LOUISIANA WILDLIFE ACTION PLAN

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EXECUTIVE SUMMARY

With extensive coastal marshes, islands, native prairies, and diverse coastal and interior forests and savannas, Louisiana provides habitat for an enormous variety of fish and wildlife. Louisiana's abundant and diverse wildlife includes 64 mussel species, 35 crawfish species, 140 species of reptiles and amphibians, 70 mammal species, 450+ bird species, and hundreds of inland and marine fishes. Louisiana provides refuge to millions of migrant landbirds on a typical spring day and five million waterfowl during an average winter. Louisiana supports approximately 200 wading bird and seabird colonies, some of which are among the largest in North America for certain species. Louisiana also supports some of the richest and most diverse fisheries in the United States, both recreational and commercial.

Despite the extensive and diverse habitat that Louisiana provides, many species are experiencing declines or are at risk. Louisiana is not alone in this regard, as the situation is similar nationwide. In recognition of this fact, the State and Tribal Wildlife Grants (SWG) Program was created by federal legislation in November 2001. The SWG Program is administered by the U.S. Fish and Wildlife Service's Division of Federal Aid, which also oversees the highly successful Wildlife and Sport Fish Restoration programs.

The SWG program was established "for the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished," with the goal of preventing species from being federally listed as threatened or endangered under the Endangered Species Act (ESA). The inclusion of species that are not hunted or fished is a crucial aspect of the SWG program, as many of these species previously had no existing source of funding. In fact, the SWG program has now become the primary federal funding source for nongame conservation nationwide. Another crucial aspect of the SWG program is the focus on proactive conservation measures designed to preclude future ESA listings. This is important because conservation is often more effective and efficient before species undergo declines sufficient to warrant ESA action.

Congress stipulated that each state fish and wildlife agency that wished to participate in the SWG program develop a Wildlife Action Plan (WAP) to guide the use of SWG funds. The Louisiana Department of Wildlife and Fisheries (LDWF) developed the 2005 Louisiana WAP, which was submitted for approval to the National Advisory Acceptance Team in October 2005 and subsequently approved in December of that year. The WAP is the roadmap for nongame conservation in Louisiana and must be reviewed and revised every ten years to ensure that it remains an effective tool for conservation planning and implementation.

The 2005 Louisiana WAP was developed by LDWF in coordination with other stakeholders of Louisiana's natural resources, and LDWF again took the lead in the 2015 revision of the Louisiana WAP. Beginning in 2012, LDWF began a comprehensive review and revision process that has culminated in this document. As with the creation of the 2005 WAP, for the 2015 revision, LDWF involved a broad base of conservation stakeholders and technical experts in the process of updating the Louisiana WAP and in reviewing the draft revised WAP prior to finalization. Although LDWF was the lead agency in developing the 2015 WAP, this document is intended to be used by all conservation stakeholders in the state.

As with the development of the 2005 WAP, the initial step in revising the WAP was a review of the status of Louisiana's fish and wildlife species. This process enabled LDWF to update the Species of Greatest Conservation Need (SGCN) list, which provides the framework on which the WAP is constructed. The 2015 revision process has yielded a list of 345 SGCN, including 123 invertebrate and 222 vertebrate species. SGCN have been added for every taxonomic group, with the largest increase in invertebrate taxa. This includes mollusks, crustaceans, and non-crustacean arthropods (e.g., insects, spiders, etc.) and reflects an effort to be more inclusive of these often-overlooked species. The 2015 SGCN include a handful of game species, although the vast majority of SGCN are nongame species. In addition to these 345 animal SGCN, a list of 350 rare plants is included in the 2015 Louisiana WAP. Although plant species are not currently eligible for SWG funding, these species are included to raise their conservation profile, as well as in the hope that a funding source for these organisms may emerge within the next ten years.

After updating the SGCN list, the next steps in the revision were to review and update (1) threats to SGCN, (2) research and survey needs for SGCN, and (3) conservation actions needed to improve the status of SGCN. Threats to SGCN were classified using the hierarchy provided by Salafsky et al. (2008), in order to improve consistency with other states. Briefly, these threats include:

- Residential and Commercial Development
- Agriculture and Aquaculture
- Energy Production and Mining
- Transportation and Service Corridors
- Biological Resource Use
- Human Intrusion and Disturbance
- Natural System Modification
- Invasive and Other Problematic Species
- Pollution
- Geological Events
- Climate Change and Severe Weather

Over 500 research and survey needs and conservation actions are identified for SGCN in the 2015 WAP. By addressing these research needs and implementing the listed conservation actions, the status of Louisiana's SGCN can be improved. These lists are not presented as the only conservation needs for our fish and wildlife, but are intended as a starting point. The conservation landscape is constantly changing, and new opportunities and priorities may arise at any time.

Also of critical importance to the implementation of the WAP, and, ultimately the improvement in the conservation status of SGCN, is habitat conservation. Accordingly, a significant portion of the 2015 WAP is dedicated to detailed descriptions of the habitats upon which SGCN depend, as well as the assessment of threats to those habitats and conservation actions needed to address said threats. Additionally, habitats that were not included in the 2005 WAP have been added during the revision process. An additional 250+ research needs and conservation actions related to habitats are also provided in this revised WAP.

One theme that will emerge to readers of the Louisiana WAP is the importance of private lands in the conservation of our fish and wildlife resources. This is due to the fact that over 90% of the state is privately owned. Clearly, successful conservation will not be achievable solely by focusing on public lands. Indeed, the cooperation of conservation-minded private citizens will be critical to effective conservation of Louisiana's natural resources. LDWF has an excellent track record in working with landowners, and such efforts will need to be expanded moving forward. The maintenance and expansion of existing partnerships will also be critical to successful implementation of the Louisiana WAP, because LDWF cannot achieve the lofty goals of the WAP acting alone. Over 50 current or potential partner organizations are mentioned in the 2015 Louisiana WAP, and meeting the conservation needs of all SGCN will require partnership and collaboration with all of these entities.

A major addition to the 2015 WAP is the identification of priority geographies for the conservation of SGCN, which are known as Conservation Opportunity Areas (COAs). We expect that designation of COAs will help focus conservation action where it is most needed and also increase coordination and cooperation between LDWF and partners in the implementation of the WAP. These COAs represent an initial effort at identifying priority areas and, with the help of Louisiana's conservation stakeholders, will be further refined in the coming years.

Monitoring the implementation of the WAP is also critically important, because the identification of conservation actions that are highly successful, along with those that are less effective, will help to improve our efforts in both the short-term and long-term. Chapter 9 provides details on how LDWF will monitor the effectiveness of the conservation actions identified in the 2015 WAP, as well as overall success of the WAP. Adaptive management will be a major component of this approach and will allow us to continually refine our conservation efforts.

The SWG Program will continue to support research, survey, and conservation efforts for SGCN and the habitats that support them. However, SWG funding is currently not guaranteed from year to year, and ongoing national efforts, though not yet successful, to secure dedicated long-term funding for nongame conservation will be crucial to the ultimate successful implementation of not only the Louisiana WAP, but all WAPs nationwide. The success of the Wildlife and Sport Fish Restoration Programs demonstrate the potential game-changing nature of such dedicated funding – the ability of wildlife and fisheries agencies across the nation to more adequately plan and execute multiyear, landscape scale conservation projects.

The 2015 Louisiana WAP will guide the conservation efforts of LDWF over the next 10 years. We expect this plan to garner increased support for the conservation of SGCN from additional state agencies, federal agencies, non-governmental organizations, academia, industry, and the public. Ultimately, the successful conservation of Louisiana's invaluable natural resources will only be achieved by all stakeholders working towards a shared goal and common vision for our future.

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Acknowledgement of all individuals who participated in revising the Louisiana Wildlife Action Plan (WAP) is practically impossible, as the creation of such a document is a truly collaborative effort. Individuals representing all of the state and federal agencies in Louisiana, conservation organizations, private industry, and academia, staff from all divisions within the Louisiana Department of Wildlife and Fisheries (LDWF), and Louisiana's public have had the opportunity to provide input. For the time and effort of all who have contributed, the authors extend our sincere gratitude.

We would like to acknowledge all of the Contributing Authors who provided valuable material for this revision. A complete list of those individuals can be found on the inside cover of this document. Included in this list are the authors of the 2005 WAP who are no longer with LDWF, and who did an admirable job when presented with the unprecedented and daunting task of writing the 2005 Louisiana WAP. As the authors of this revised WAP, we are forever indebted to Gary Lester, Stephen Sorenson, Patty Faulkner, and Inés Maxit for laying the foundation upon which this revision is built. Former WAP Coordinator Andy Ardoin took the initial steps towards the revision, and that work was continued by LeAnne Bonner.

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

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8	Documentation of broad-based public participation during the development and implementation of the strategy	Chapter 3, pg. 31-32

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LIST OF ACRONYMS

AET	Actual evapotranspiration
AFB	Air Force Base
AFWA	Association of Fish and Wildlife Agencies
AGFC	Arkansas Game and Fish Commission
ANHC	Arkansas Natural Heritage Commission
APHIS	Animal and Plant Health Inspection Service
ARMI	Amphibian and Reptile Monitoring Initiative (USGS)
ARUs	Automated Recording Units
ATV	All Terrain Vehicle
BBS	Breeding Bird Survey
BICM	Barrier Island Comprehensive Monitoring
BMP	Best Management Practice
BRAS	Baton Rouge Audubon Society
BRD	Bycatch Reduction Device
BTNEP	Barataria-Terrebonne National Estuary Program
CARA	Conservation and Reinvestment Act of 2000
CBC	Christmas Bird Count
CCB	Center for Conservation Biology
CCAA	Candidate Conservation Agreement with Assurances
CCVI	Climate Change Vulnerability Index
CO_2	Carbon Dioxide
COAs	Conservation Opportunity Areas
CP33	Conservation Practice 33 (NRCS CRP; habitat buffers for upland birds)
CPA	Conservation Planning Atlas
CPRA	Coastal Protection and Restoration Authority
CPUE	Catch Per Unit Effort
CRMS	Coastwide Reference Monitoring System
CRP	Conservation Reserve Program
CSA	Coastal Study Area
CUP	Coastal Use Permit
CWPPRA	Coastal Wetlands Planning, Protection, and Restoration Act
DDT	Dichlorodiphenyltrichloroethane
DFC	Desired Forest Condition
DOD	Department of Defense
DOI	Department of Interior
DOTD	Louisiana Department of Transportation and Development
DSCs	Desired Stand Conditions
DST	Decision Support Tool
DU	Ducks Unlimited
DW	Delta Waterfowl

EGCP	East Gulf Coastal Plain
EGCPJV	East Gulf Coastal Plain Joint Venture
EORs	Element Occurrence Records
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
EV	Extremely Vulnerable
FERC	Federal Energy Regulatory Commission
FFA	Future Farmers of America
FIA	Forest Inventory and Analysis
GCJV	Gulf Coast Joint Venture
GCM	General Circulation Models
GCP	Gulf Coast Prairie
GCPLCC	Gulf Coast Prairie Landscape Conservation Cooperative
GCPOLCC	Gulf Coastal Plains & Ozarks Landscape Conservation Cooperative
GCPM	Gulf Coast Prairies and Marshes
GCVA	Gulf Coast Vulnerability Assessment
GIS	Geographic Information System
GIWW	Gulf Intracoastal Waterway
GMEI	Gulf of Mexico Estuarine Inventory
GOMAMN	Gulf of Mexico Avian Monitoring Network
GPS	Global Positioning System
GTC	Gopher Tortoise Council
HSI	Habitat Suitability Index
HUC	Hydrologic Unit Code
HV	Highly Vulnerable
IBP	Institute for Bird Populations
ID	Identification
IPCC	Intergovernmental Panel on Climate Change
IRT	Interagency Review Team
IUCN	International Union for Conservation of Nature
JV	Joint Venture
KNF	Kisatchie National Forest
LA	Louisiana
LAMP	Louisiana Amphibian Monitoring Program
LANSTF	Louisiana Aquatic Nuisance Species Task Force
LCA	Louisiana Coastal Area
LCC	Landscape Conservation Cooperative
LCWCRTF	Louisiana Coastal Wetlands Conservation and Restoration Task Force
LDAF	Louisiana Department of Agriculture and Forestry
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries

LFA	Louisiana Forestry Association
LiDAR	Light Detection and Ranging
LMCDN	Louisiana-Mississippi Conservation Delivery Network
LMVJV	Lower Mississippi Valley Joint Venture
LNG	Liquefied Natural Gas
LNHP	Louisiana Natural Heritage Program
LNPI	Louisiana Native Plant Initiative
LOSCO	Louisiana Oil Spill Coordinator's Office
LOSL	Louisiana Office of State Lands
LOSP	Louisiana Office of State Parks
LPBF	Lake Pontchartrain Basin Foundation
LPFC	Louisiana Prescribed Fire Council
LSU	Louisiana State University
LTDS	Line Transect Distance Sampling
MAPS	Monitoring Avian Productivity and Survival
MAV	Mississippi Alluvial Valley
MBHI	Migratory Bird Habitat Initiative
MDEQ	Mississippi Department of Environmental Quality
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MOU	Memorandum of Understanding
MRAP	Mississippi River Alluvial Plain
MRGO	Mississippi River Gulf Outlet
MSL	Mean Sea Level
MV	Moderately Vulnerable
NAAMP	North American Amphibian Monitoring Program
NABCI	North American Bird Conservation Initiative
NAD83	North American Datum of 1983
NAS	National Audubon Society
NBCI	Northern Bobwhite Conservation Initiative
NFWPCAP	National Fish, Wildlife, and Plants Climate Adaptation Partnership
NGO	Non Governmental Organization
NMFS	National Marine Fisheries Service
NLCD	National Landcover Database
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	National Resources Inventory
NV	Not Vulnerable
NVCS	National Vegetation Classification System
NWR	National Wildlife Refuge
NWTF	National Wild Turkey Federation

OAS	Orleans Audubon Society
ORV	Off-road Vehicle
OSP	Louisiana Office of State Parks
PARC	Partners for Amphibian and Reptile Conservation
PBI	Prescribed Burn Initiative
PCB	polychlorinated biphenyl
PET	Potential evapotranspiration
PIF	Partners-in-Flight
PPT	Parts per Thousand
PRISM	Program for Regional and International Shorebird Monitoring
PWRC	Patuxent Wildlife Research Center
RCW	Red-cockaded Woodpecker
RIFA	Red Imported Fire Ants
ROW	Right-of-Way
RRWP	Red River Waterway Project
SARP	Southeast Aquatic Resources Partnership
SAV	Submersed Aquatic Vegetation
SEAFWA	Southeastern Association of Fish and Wildlife Agencies
SECAS	Southeastern Conservation Adaptation Strategy
SEPARC	Southeast Partners in Amphibian and Reptile Conservation
SEPIF	Southeastern Partners in Flight
SERPPAS	Southeastern Regional Partnership for Planning and Sustainability
SFI	Sustainable Forestry Initiative
SGCN	Species of Greatest Conservation Need
SIVVA	Standardized Index of Vulnerability and Value Assessment
SLAMM	Sea Level Affecting Marshes Model
SLR	Sea Level Rise
SMART	Specific, Measurable, Achievable, Relevant, and Time Bound
SMZ	Streamside Management Zone
SPC	Spill Prevention Control
SRA	Sabine River Authority
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
TIMOs	Timber Investment Management Organizations
TNC	The Nature Conservancy
TPWD	Texas Parks and Wildlife Department
TRACS	Tracking and Reporting on Actions for the Conservation of Species
UEGCP	Upper East Gulf Coastal Plain

U.S.	United States
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNVC	United States National Vegetation Classification
UWGCP	Upper West Gulf Coastal Plain
VES	Visual Encounter Surveys
VHF	Very High Frequency
WAP	Wildlife Action Plan
WGCP	West Gulf Coastal Plain
WMA	Wildlife Management Area
WNS	White Nose Syndrome
WRP	Wetland Reserve Program

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SUMMARY OF CHANGES

A. Revision of the 2005 Louisiana Wildlife Action Plan (WAP)

The Louisiana Department of Wildlife and Fisheries (LDWF) notified the United States Fish and Wildlife Service (USFWS) of our intent to comprehensively review and revise the Louisiana Wildlife Action Plan (WAP) in February of 2012. That marked the beginning of a three and a half year process that has resulted in a significant rewrite of the 2005 WAP. This section details the major changes made during the 2015 WAP revision, and, in conjunction with the Roadmap to the Eight Required Elements, will enable readers to quickly identify those areas of the WAP that have been added or updated. As required by the *2007 Guidance for Wildlife Action Plan Review and Revisions* (USFWS 2007), all of the Required Elements have been updated as deemed necessary.

B. Species of Greatest Conservation Need (SGCN) List

As the focal point of the WAP, the list of SGCN (Element 1) was the logical starting point for the review and revision of the Louisiana WAP. This was a multi-stage process, and resulted in changes to Status Ranks of SGCN, removal of SGCN from the WAP, the addition of SGCN to the WAP, changes in common and scientific names and organization as a result of taxonomic and nomenclatural revisions, and the development and application of criteria to prioritize SGCN.

1. Revision of NatureServe Conservation Status Ranks

Each native species in Louisiana, including all SGCN, are assigned a Global Status Rank (G-rank) and Sub-national Status Rank (S-rank). For explanations of these ranks, refer to Appendix M. The initial step in revising the Louisiana WAP SGCN list was a review of the S-ranks of all 2005 SGCN, as well as those species that were considered rare (S1, S2, or S3) by LDWF's Natural Heritage Program (LNHP), but not included as SGCN in the 2005 WAP. Following this process, S-ranks were updated for 140 species in Biotics, the central repository of such data, maintained by NatureServe on behalf of member programs.

2. Removal of SGCN

A total of 25 SGCN from the 2005 Louisiana WAP were removed from the updated SGCN list (Table 1). Two of the species removed, the Silverjaw Minnow and the Pascagoula Map Turtle, are no longer considered to occur in Louisiana. The Silverjaw Minnow has been split into two species that are geographically separated, with the southeastern population now known as the Longjaw Minnow (*Notropis amplamala*; Pera and Armbruster 2006). The Longjaw Minnow is therefore a newly described species that replaces the Silverjaw Minnow as a SGCN in this plan. In the case of the Pascagoula Map Turtle, genetics and morphological evidence caused populations formerly referable to this species to be split into two species, the Pascagoula Map Turtle and the newly described Pearl River Map Turtle (*Graptemys pearlensis*; Ennen et al. 2010), which occurs in Louisiana and has been added as a SGCN.

Table 1. 2005 SGCN Removed from 2015 WAP

Non-crustacean Arthropods (5)	
Common Name	**Scientific Name**
Great Southern White	*Ascia monuste*
Southern Dogface	*Colias cesonia*
Harvester	*Feniseca tarquinius*
Reakirt's Blue	*Hemiargus isola*
Neamathla Skipper	*Nastra neamathla*
Inland Fishes (1)	
Common Name	**Scientific Name**
Silverjaw Minnow*	*Ericymba buccata*
Marine Fishes (1)	
Common Name	**Scientific Name**
Longfin Mako	*Isurus paucus*
Amphibians and Reptiles (6)	
Common Name	**Scientific Name**
Oak Toad	*Anaxyrus quercicus*
Barking Treefrog	*Hyla gratiosa*
Northern Scarlet Snake	*Cemophora coccinea copei*
Pascagoula Map Turtle*	*Graptemys gibbonsi*
Scarlet Kingsnake	*Lampropeltis triangulum elapsoides*
Eastern Slender Glass Lizard	*Ophisaurus attenuatus longicaudus*
Birds (7)	
Common Name	**Scientific Name**
Ivory-billed Woodpecker	*Campephilus principalis*
Northern Harrier	*Circus cyaneus*
Yellow-billed Cuckoo	*Coccyzus americanus*
Orchard Oriole	*Icterus spurius*
Yellow-crowned Night-Heron	*Nyctanassa violacea*
Northern Parula	*Parula americana*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Mammals (5)	
Common Name	**Scientific Name**
Sei Whale	*Balaenoptera borealis*
Blue Whale	*Balaenoptera musculus*
Finback Whale	*Balaenoptera physalus*
Red Wolf	*Canis rufus*
Florida Panther	*Puma concolor coryi*

* Species no longer considered to occur in Louisiana due to changes in taxonomy. Other species in this table may be considered extirpated or extinct (see Chapter 4).

Three additional species, the Ivory Billed Woodpecker, Red Wolf, and Florida Panther were removed from the list because they are either extirpated from Louisiana, or functionally extinct. Three whales were removed as they very rarely occur in State Waters.

3. Addition of SGCN

A total of 130 SGCN were added to the 2005 SGCN list. A complete list of those SGCN can be found in Table 2. Two of these species, the Pearl River Map Turtle and Longjaw Minnow are newly described species that replace the species they were formerly referable to, as discussed above.

Table 2. SGCN added to 2015 WAP

Mollusks (10)	
Common Name	**Scientific Name**
Flamed Tigersnail	*Anguispira alternata*
Bay Scallop	*Argopecten irradians*
Half-Naked Penshell	*Atrina seminuda*
Sawtooth Penshell	*Atrina serrata*
Lightning Whelk	*Busycon sinistrum*
Channeled Whelk	*Busycotypus canaliculatus*
Texas Pigtoe	*Fusconaia askewi*
Round Pearlshell	*Glebula rotundata*
Silty Hornsnail	*Pleurocera canaliculata*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (10)	
Common Name	**Scientific Name**
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Peppermint Shrimp	*Lysmata wurdemanni*
Pontchartrain Painted Crawfish	*Orconectes hobbsi*
Flatnose Crawfish	*Procambarus planirostris*
Southwestern Creek Crawfish	*Procambarus dupratzi*
Caddo Chimney Crawfish	*Procambarus machardyi*
Pearl Blackwater Crawfish	*Procambarus penni*
Calcasieu Creek Crawfish	*Procambarus pentastylus*
Non-crustacean Arthropods (41)	
Common Name	**Scientific Name**
Spring-loving Psiloneuran Caddisfly	*Agarodes libalis*
Lace-winged Roadside Skipper	*Amblyscirtes aesculapius*
Texas Forestfly	*Amphinemura texana*
Texas Brown Tarantula	*Aphonopelma hentzi*
Saline Prairie Scarab Beetle	*Ataenius robustus*
Louisiana Eyed Silkmoth	*Automeris louisiana*

Brou’s Mallow Moth	*Bagisara brouana*
American Bumble Bee	*Bombus pensylvanicus*
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Frosted Elfin	*Callophrys irus*
Nutmeg Underwing	*Catocala atocala*
Ceraclean Caddisfly	*Ceraclea spongillovorax*
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*
Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*
Sandbar Tiger Beetle	*Cicindela blanda*
Eastern Beach Tiger Beetle	*Cicindela dorsalis venusta*
Cajun Tiger Beetle	*Cicindela pilatei*
White Sand Tiger Beetle	*Cicindela wapleri*
Pitcher Plant Spiketail	*Cordulegaster sarracenia*
Monarch	*Danaus plexippus*
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*
Six-banded Longhorn Beetle	*Dryobius sexnotatus*
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*
Mottled Duskywing	*Erynnis martialis*
Bay Skipper	*Euphyes bayensis*
Hodges’ Clubtail	*Gomphus hodgesi*
Masked Springfly	*Helopicus bogaloosa*
Meske's Skipper	*Hesperia meskei*
Molson's Microcaddisfly	*Hydroptila molsonae*
Schoolhouse Springs Purse Casemaker	*Hydroptila ouachita*
Hydroptilad Caddisfly	*Hydroptila poirrieri*
Gulf Pine Sphinx	*Lapara phaeobrachycerous*
Louisiana Needlefly	*Leuctra szczytkoi*
Strecker's Giant Skipper	*Megathymus streckeri*
Georgia Satyr	*Neonympha areolatus*
Southern Snaketail	*Ophiogomphus australis*
Florida Harvester Ant	*Pogonomyrmex badius*
Comanche Harvester Ant	*Pogonomyrmex comanche*
King's Hairstreak	*Satyrium kingi*
Texas Emerald	*Somatochlora margarita*
Southern Unstriped Scorpion	*Vaejovis carolinianus*
Inland Fishes (12)	
Common Name	**Scientific Name**
American Eel	*Anguilla rostrata*
Redspot Darter	*Etheostoma artesiae*
Gumbo Darter	*Etheostoma thompsoni*
Clear Chub	*Hybopsis winchelli*
Sturgeon Chub	*Macrhybopsis gelida*
Shoal Chub	*Macrhybopsis hyostoma*
Sicklefin Chub	*Macrhybopsis meeki*
Longjaw Minnow*	*Notropis amplamala*
Ironcolor Shiner	*Notropis chalybaeus*

Stargazing Darter	*Percina uranidea*
Saddleback Darter	*Percina vigil*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Marine Fishes (6)	
Common Name	**Scientific Name**
Frillfin Goby	*Bathygobius soporator*
Dwarf Seahorse	*Hippocampus zosterae*
Tarpon	*Megalops atlanticus*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Southern Puffer	*Sphoeroides nephelus*
Reptiles and Amphibians (12)	
Common Name	**Scientific Name**
Smooth Softshell	*Apalone mutica*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Pearl River Map Turtle*	*Graptemys pearlensis*
Eastern Hog-Nosed Snake	*Heterodon platirhinos*
Gulf Coast Waterdog	*Necturus beyeri*
Red River Mudpuppy	*Necturus louisianensis*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Texas Horned Lizard	*Phrynosoma cornutum*
Coal Skink	*Plestiodon anthracinus*
Hurter's Spadefoot	*Scaphiopus hurterii*
Pygmy Rattlesnake	*Sistrurus miliarius*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Birds (29)	
Common Name	**Scientific Name**
Upland Sandpiper	*Bartramia longicauda*
Red Knot	*Calidris canutus*
Buff-breasted Sandpiper	*Calidris subruficollis*
Crested Caracara	*Caracara cheriway*
Chimney Swift	*Chaetura pelagica*
Lark Sparrow	*Chondestes grammacus*
Marsh Wren	*Cistothorus palustris*
Common Ground-Dove	*Columbina passerina*
Little Blue Heron	*Egretta caerulea*
White-tailed Kite	*Elanus leucurus*
Peregrine Falcon	*Falco peregrinus*
Southeastern American Kestrel	*Falco sparverius paulus*
Greater Roadrunner	*Geococcyx californianus*
Least Bittern	*Ixobrychus exilis*
Hudsonian Godwit	*Limosa haemastica*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Long-billed Curlew	*Numenius americanus*

Sooty Tern	*Onychoprion fuscatus*
Osprey	*Pandion haliaetus*
Roseate Spoonbill	*Platalea ajaja*
Glossy Ibis	*Plegadis falcinellus*
Cerulean Warbler	*Setophaga cerulea*
Yellow-throated Warbler	*Setophaga dominica*
American Redstart	*Setophaga ruticilla*
White-breasted Nuthatch	*Sitta carolinensis*
Coastal Least Tern	*Sternula antillarum*
Eastern Meadowlark	*Sturnella magna*
Golden-winged Warbler	*Vermivora chrysoptera*
Warbling Vireo	*Vireo gilvus*
Mammals (10)	
Common Name	**Scientific Name**
Northern Pygmy Mouse	*Baiomys taylori*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*
Baird's Pocket Gopher	*Geomys breviceps sagittalis*
Prairie Vole	*Microtus ochrogaster*
Golden Mouse	*Ochrotomys nuttalli*
Eastern Pipistrelle	*Perimyotis subflavus*
Bachman's Fox Squirrel	*Sciurus niger bachmanii*
Eastern Chipmunk	*Tamias striatus*
Bottlenose Dolphin	*Tursiops truncatus*

* See discussion of these two SGCN above, under "Species Removed."

4. Taxonomic Updates/Common Name Changes

Seven SGCN have had changes in the common name since 2005, including the Northern Long-eared Bat (formerly Northern Myotis), Nelson's Sparrow (formerly Nelson's Sharp-tailed Sparrow), Creeper (formerly Squawfoot), Pine Hills Digger (formerly Pine Hills Crawfish), Old Prairie Digger (formerly Old Prairie Crawfish), Gulf Crawfish (formerly Plain Brown Crawfish) and Elegant Creek Crawfish (formerly Elegant Crawfish).

Taxonomic updates were made for 17 SGCN to reflect changes in taxonomy since 2005. These changes affected non-crustacean arthropod, marine fish, amphibian, reptile, and bird SGCN. Taxonomy for all species follows the authorities suggested in *Best Practices for State Wildlife Action Plans* (AFWA 2012).

5. Prioritization of SGCN

In the 2005 Louisiana WAP, no attempt was made to prioritize SGCN, beyond the priority that could be inferred from G-ranks and S-ranks. During the 2015 revision, a set of prioritization criteria were developed and used to prioritize SGCN for conservation action and funding. SGCN were placed into three tiers within each taxonomic group, with Tier 1 species being those that are considered the highest priority. More information on this framework, including the criteria, may be found in Chapter 3.

C. Revision of Threats to SGCN

The identification of threats to SGCN and their habitats (Element 3) is a key component of WAPs. For the 2015 revision, LDWF refined our approach to addressing this aspect of the WAP, as discussed below.

1. Adoption of Standard Lexicon

As recommended in the *Best Practices for State Wildlife Action Plans* (AFWA 2012) the standard lexicon of threats provided by Salafsky et al. (2008) was adopted for the 2015 Louisiana WAP revision. For more information on the process used to assess threats to habitats and SGCN, refer to Chapter 3. For the results of threats assessments and discussion of threats, refer to Chapter 4 (SGCN) and Chapter 5 (Habitats).

2. Addition of Invasive Species and Climate Change Chapters

Two of the 1st level threats identified by Salafsky et al. (2008) were given further treatment in chapters devoted to those threats. Invasive Species are comprehensively addressed in Chapter 6, and Climate Change is addressed in Chapter 7. Although invasives were treated in the 2005 WAP, a more complete treatment was desirable due to the pervasive nature of this threat. Climate Change was not addressed in the 2005 WAP, but has emerged into the forefront of conservation planning since that time and was recommended for inclusion in WAPs by AFWA (2012) in *Best Practices for State Wildlife Action Plans*.

D. Revision of Research Needs and Conservation Actions

Elements 3 and 4 of the Eight Required Elements include the description of research and survey needs necessary for the restoration and improved conservation of SGCN, as well as descriptions of conservation actions necessary to conserve SGCN. In the 2005 Louisiana WAP, this information was largely contained nested within the “Conservation Habitats” chapter. For the 2015 WAP revision, a new Chapter (Chapter 4: SGCN) was created, and this information was moved to that location to make the WAP more user-friendly and to reduce repetition. Taxonomic committees within LDWF met and revised and updated both the research and survey needs and conservation actions listed for SGCN. Many new needs and actions were identified and incorporated into the revised WAP. For more information on the processes used refer to Chapter 3, and for the updated needs and actions refer to Chapter 4.

E. SGCN Habitats

Element 2 of the Eight Required Elements concerns the description of key habitats needed for the effective conservation of SGCN. For the 2015 revision, LDWF entirely revised this section of the Louisiana WAP. This updated information may be found in Chapter 5.

1. Reorganization of Habitats

In the 2005 Louisiana WAP, the habitats were arranged alphabetically. For the 2015 revision, this information was reorganized into broad sub-categories, within which the habitats are then arranged in alphabetical order. These categories are:

- Forests
- Savannas and Woodlands
- Shrublands
- Grasslands
- Ephemeral Ponds
- Lentic Water Bodies
- Submersed Aquatic Vegetation (SAV)
- Subterranean
- Geologic Feature
- Anthropogenic Habitats
- River Basins
- Marine Habitats

Habitat treatments were also updated and restructured to provide the following information for each habitat/community:

- Rarity Ranks
- Synonyms
- Ecological Systems associated with the habitat
- General Description
- Characteristic Plant Species
- Current Extent and Status (with parish-level range map)
- Associated SGCN and Rare Plants
- Threats Assessment
- Research Needs/Conservation Actions

2. Additions to List of Habitats

Thirteen habitats/communities that were not included in the 2005 WAP are treated in the 2015 revision. These habitats include:

- Pondcypress-Blackgum Swamp
- Canebrake
- Freshwater Floating Marsh
- Louisiana Beach
- Mississippi Terrace Prairie
- West Gulf Coastal Plain Muck Bog
- Ephemeral Ponds (5 types)
- Lakes and Reservoirs
- Ponds
- Submersed Aquatic Vegetation (SAV; 5 types)
- Caves
- Rice Agriculture and Aquaculture
- Pine Plantation

For each of these new habitats, a complete habitat treatment is provided, as described above.

3. Changes in Habitat Prioritization

Unlike SGCN, habitats were prioritized in the 2005 Louisiana WAP. For the 2015 revision, we developed a new methodology for prioritizing habitats (see Chapter 3 for details), which included the development and application of ranking criteria, similar to that developed for SGCN, including the creation of three tiers.

4. Characteristic and Rare Plants Associated with Habitats

As mentioned above, a list of Characteristic Plants is provided for each habitat/community, where applicable. This information was included to aid in identification of those habitats in the field by non-specialists, as well as to provide a more complete description of each habitat. Additionally, a list of Rare Plants was included for each habitat/community and added to the end of the SGCN table for each habitat.

F. Conservation Opportunity Areas

A new section was added to the 2015 WAP which provides information on the location of priority geographies for the conservation of SGCN. As recommended in the *Best Practices for State Wildlife Action Plans* (AFWA 2012), these geographies are referred to as Conservation Opportunity Areas (COAs). For more detail on COAs, please refer to Chapter 8.

G. Research and Monitoring

Element 5 of the Eight Required Elements concerns monitoring, and requires monitoring at three levels:

1. Monitoring of SGCN and habitats
2. Monitoring the effectiveness of conservation actions and the WAP
3. Adaptive management of the WAP

All three levels of monitoring were addressed in the 2005 Louisiana WAP and have been revised for the 2015 WAP. Additional detail has been added to help improve consistency when monitoring SGCN and associated habitats to address the 1st level of monitoring. For the 2nd level of monitoring, the 2005 Louisiana WAP provided five tables of performance indicators. In the 2015 revision of the WAP, we have replaced these tables with the First and Second Level Conservation Actions and Outputs that are incorporated into Wildlife TRACS. This provides several advantages, which are discussed in Chapter 9. Tracking the effectiveness of SWG projects using the Wildlife TRACS system will also improve the adaptive management of the Louisiana WAP. For more information on LDWF's approach to Adaptive Management, refer to Chapter 9.

H. Required Elements 6, 7, and 8

Updated information on the procedure and plan for the next (2025) revision of the Louisiana WAP may be found in Chapter 3. Also, in Chapter 3 is updated information on the processes used by LDWF to coordinate with federal, state, and local agencies, as well as with Indian Tribes. This chapter also includes updated information on the public participation and review that was incorporated into the 2015 WAP.

I. General Updates to the 2005 WAP

The introductory chapters of the 2005 WAP (Introduction; State Overview) have been revised by LDWF as needed, including updating of statistics. All Appendices from the 2005 WAP were revised or replaced as deemed appropriate.

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 fish and wildlife 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. In addition, LDWF regulates 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 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 once numerous fish and wildlife species of the United States 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 Dingell-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 already on the brink, and others 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 1,500 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 and help prevent future ESA listings.

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 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 Greatest Conservation Need (SGCN) 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 for a list of projects funded through SWG to date (abstracts and final reports available upon request). 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 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 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. WAP 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 ESA 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 actions 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 actions.

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 Louisiana Natural Heritage Program (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 actions 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 of 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 Wildlife Management Areas (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 the WAP 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 actions and monitoring the results, this WAP 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 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 actions 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 needed 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 (U.S.) at the terminus of the Mississippi River. Alexandria, Baton Rouge, Lafayette, Lake Charles, Monroe, New Orleans, and Shreveport are the 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 coast 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 parts of the state are heavily agricultural, with fragmented forests, including Bottomland Hardwood Forest. The southeastern part of the state, known as the Florida Parishes, consists primarily of upland forest dominated by evergreen/mixed hardwoods, and Longleaf Pine flatwoods. The southern portion of this region is dominated by marshes and forested wetlands. Southwestern Louisiana is dominated by agriculture and improved pasture, in the historical Coastal Prairie region, and upland or wetland scrub-shrub vegetation. The coastal portion of the state is made up of Freshwater, Intermediate, Brackish, and Salt 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 example of forested wetlands in Louisiana and the largest remaining floodplain 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, and 25% of the state's surface is comprised of deposits associated with Pleistocene terraces. Tertiary Period sediments account for the other 20%, 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 offshore and fluvial 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 glaciofluvial deposits. Loess deposits up to several meters thick remain preserved in areas flanking the Mississippi River valley.

3. Coastal Zone:

Louisiana has over three 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 to Texas; and the Deltaic Plain, which extends 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 fluvio-deltaic processes created more than four million acres of coastal wetlands and gave rise to one of the most productive ecosystems in the U.S. 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 shorebirds, waterbirds, waterfowl, and other wildlife.

Coastal Louisiana has one of the highest land loss rates in the U.S. Annual losses were estimated by the U.S. Army Corps of Engineers (USACE) to be 40-50 square miles during the late 1980s (Benoit 1997, Johnston et al. 1995), with losses averaging 16.76 square miles per year from 1985-2010 (CPRA 2012). Since the 1930s, coastal Louisiana has lost over 1.2 million acres of land and may lose up to 1.2 million additional acres over the next 50 years (CPRA 2012). Historic hydromodification of the Mississippi River for navigation and flood control, dredging canals for oil and gas exploration and pipeline installation, and dredging and filling for residential and commercial development have combined 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 leeward areas less adequately buffered from wind and tidal influences, contribute to coastal wetland loss. The exploration for, 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 1930s (Barras et al. 1994, Barras et al. 2003, Dunbar et al. 1992). Currently Louisiana has 40% 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 2014).

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 1,750 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 statistics for Louisiana's Primary Energy Production for 2011. Although production is statewide, much comes from the coastal parishes.

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

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 U.S. Five of the fifteen largest ports in the U.S. are located in Louisiana (USACE 2010).

Commercial Fishing - In 2013, Louisiana commercial landings exceeded one billion pounds with a dockside value of $399 million, which 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 Species of Greatest Conservation

Need (SGCN), 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% of the state 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.

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). Agricultural lands cover 42% (11.5 million acres) of the state's land area with 73% (8.4 million acres) of those lands 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 overall parish-wide population increases. 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 Coastal Plain Ecoregion (EGCP). In contrast, many parishes in the Upper West Gulf Coastal Plain (UWGCP) and the upper portion of the Mississippi River Alluvial Plain (MRAP) show declining population trends (Fig. 2.1) Habitat fragmentation, degradation, and loss due to the continued population growth and associated development throughout Louisiana are some of the greatest threats to the state's wildlife and fisheries resources.

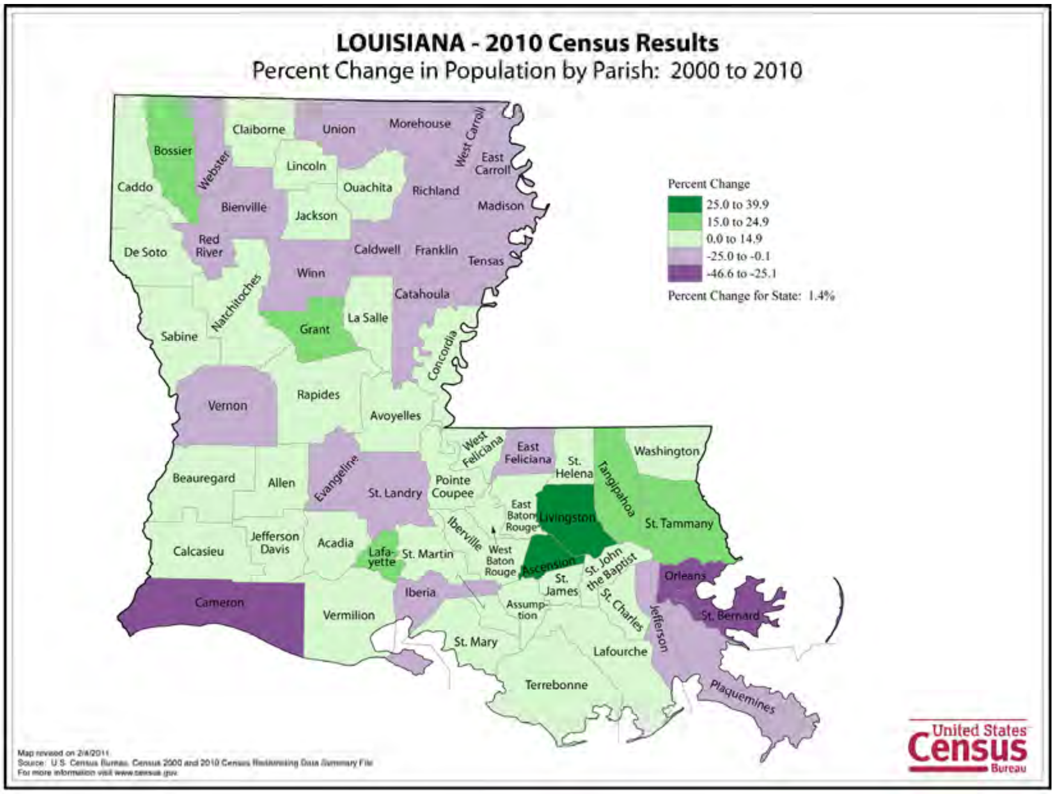

Figure 2.1. Louisiana’s population trends by parish from 2000 to 2010.

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

Sportspersons and wildlife watchers across the U.S. spend $144.7 billion annually, 1% of the Nation’s gross domestic product. In the southeastern region of the country, 16% of the population identify themselves as anglers, 7% as hunters, and 26% 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 anglers 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 people 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 26% 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 the Louisiana Department of Wildlife and Fisheries (LDWF) to facilitate the implementation of the Wildlife Action Plan (WAP) by identifying research and information needs, assessing environmental resources, determining regional conservation goals, and maximizing the limited 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 Louisiana Natural Heritage Program (LNHP) (Fig. 2.2). Below are summaries of each ecoregion and major public landowners.

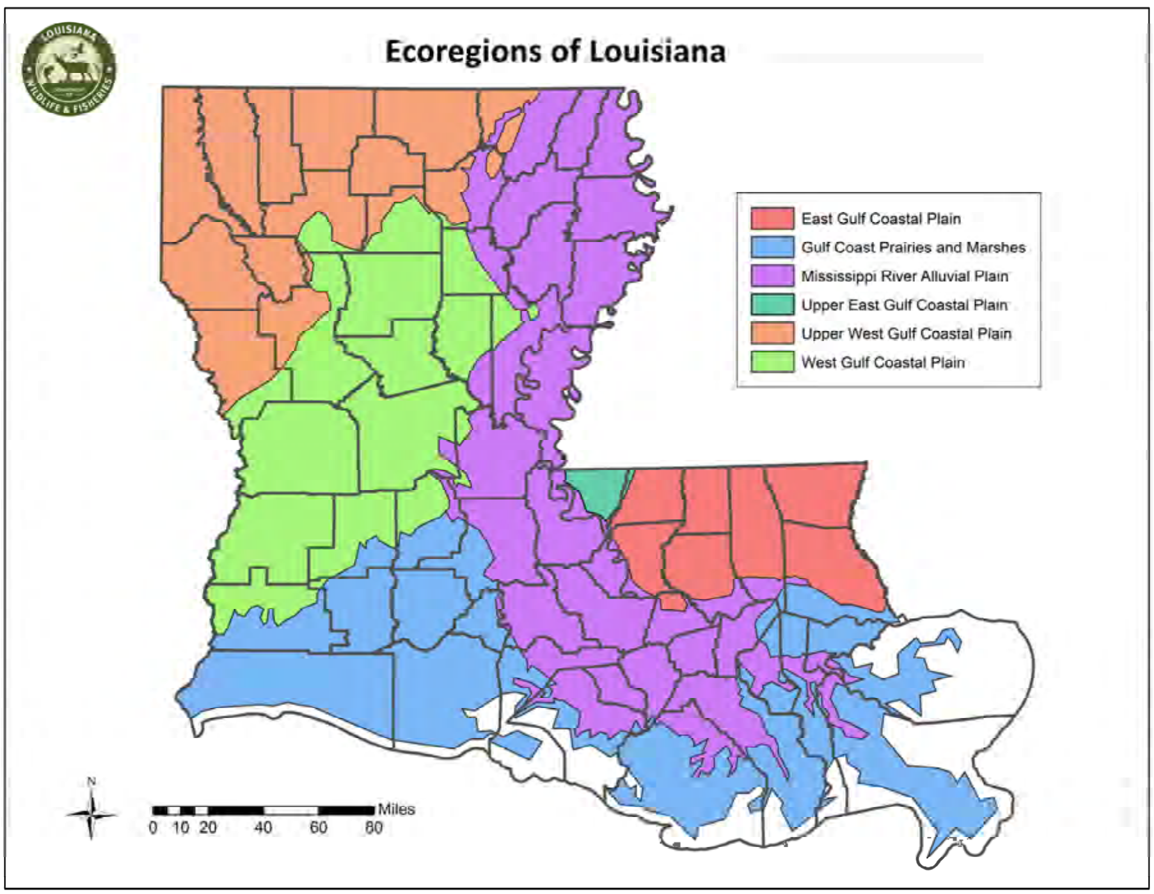

Figure 2.2 Ecoregions of Louisiana

a. East Gulf Coastal Plain

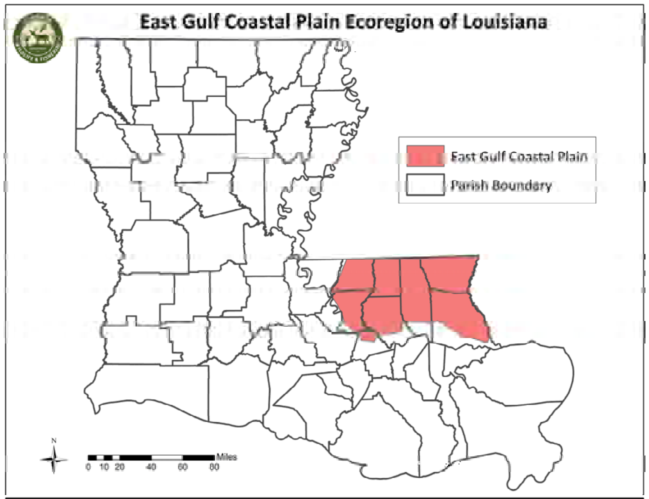

Figure 2.3. East Gulf Coastal Plain Ecoregion.

The 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. 2.3). There is a transition of natural community types across this ecoregion. The western parishes of East Baton Rouge, Livingston, and Ascension feature flat topography and fertile soils, historically supporting Hardwood Flatwoods and Spruce Pine-Hardwood Flatwoods, with Bottomland Hardwood Forests occurring in riparian areas. Eastern Longleaf Pine Flatwoods Savannas were once one of the predominant natural community types in the southeastern Florida Parishes, which have very infertile soils. Also found in the EGCP are Bayhead Swamps, Eastern Upland Longleaf Pine Woodlands, Eastern Hillside Seepage Bogs, and Slash Pine-Pondcypress-Hardwood Woodlands. Cypress-Tupelo-Blackgum Swamps and Small Stream Forests occur throughout the ecoregion. Table 2.1 lists the primary habitats of the ecoregion.

Table 2.1. Primary Habitats of the East Gulf Coastal Plain Ecoregion

Habitat
Eastern Longleaf Pine Flatwoods Savanna
Eastern Upland Longleaf Pine Woodland
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest
Shortleaf Pine/Oak-Hickory Woodland
Bottomland Hardwood Forest
Small Stream Forest
Slash Pine-Pondcypress/Hardwood Woodland
Live Oak-Pine-Magnolia Forest
Bayhead Swamp/Forested Seep
Cypress-Tupelo-Blackgum Swamp
Spruce Pine-Hardwood Flatwood
Batture
Coastal Live Oak-Hackberry Forest
Southern Mesophytic Hardwood Forest
Canebrake
EGCP Flatwoods Pond
Xeric Sandhill Woodland
Eastern Hillside Seepage Bog

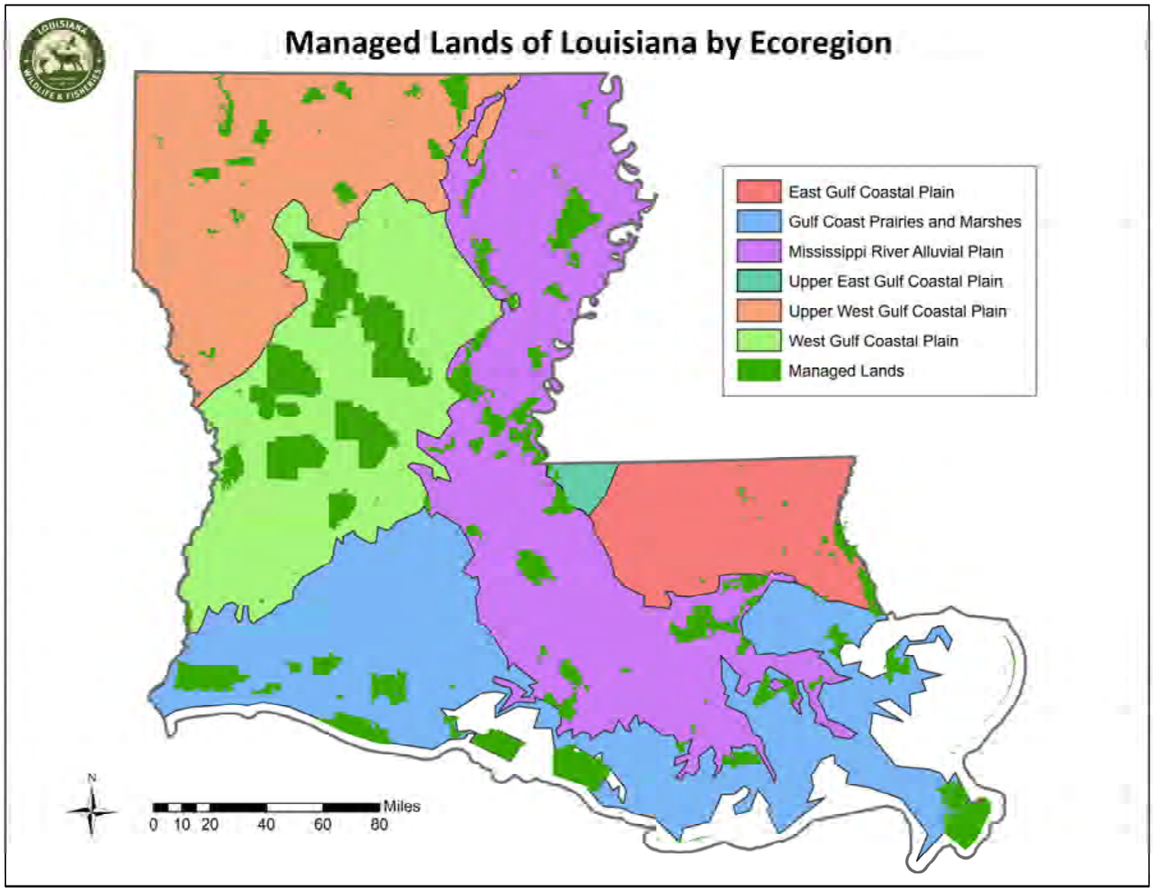

Figure 2.4. Managed areas in Louisiana by Ecoregion

Managed areas within Louisiana comprise 3.3 million acres and are found in all ecoregions of the state (Fig. 2.4). 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 (WMAs) and Refuges include Hutchinson Creek, Sandy Hollow, Waddill, Lake Ramsey, Tangipahoa Parish School Board, and Pearl River WMAs, and St Tammany Refuge. State parks include Tickfaw, Fairview-Riverside, and Fontainebleau. State historic sites include Port Hudson and Centenary.

As one of the areas of Louisiana with the greatest human population growth rate, the EGCP will continue to experience the pressures of urban expansion and this poses the challenge of balancing the needs of wildlife with those of humans.

b. Upper East Gulf Coastal Plain

The Upper East Gulf Coastal Plain (UEGCP) ecoregion includes portions of five states from western Kentucky and Tennessee south through Mississippi and Alabama and into Louisiana in West Feliciana Parish (Fig. 2.5). 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 Pine Forests. Bottomland Hardwood Forests, Small Stream Forests, and Cypress-Tupelo-Blackgum Swamps also are found in low-lying areas of this ecoregion with level to gentle topography. Table 2.2 lists the primary habitats within the ecoregion. The only state WMA in this ecoregion is Tunica Hills. Other state properties include Locust Grove and Audubon State Historic sites and Tunica Hills State Preservation Area.

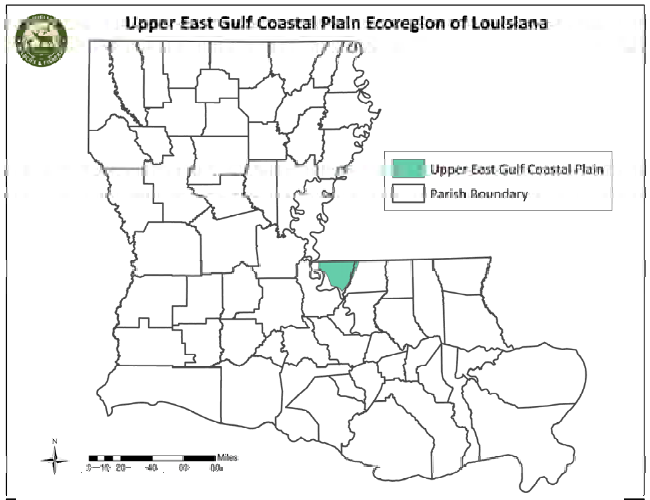

Figure 2.5. Upper East Gulf Coastal Plain Ecoregion.

Table 2.2 Primary Habitats of the Upper East Gulf Coastal Plain Ecoregion
Habitat
Southern Mesophytic Hardwood Forest
Small Stream Forest
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest
Cypress-Tupelo-Blackgum Swamp
Bottomland Hardwood Forest

c. Mississippi River Alluvial Plain

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

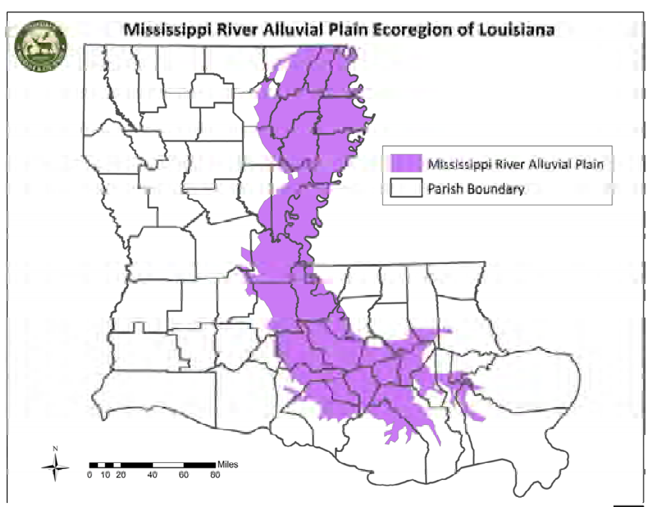

Figure 2.6. Mississippi River Alluvial Plain Ecoregion.

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. 2.6). The MRAP, rich in alluvial sediments, is known primarily for Bottomland Hardwood Forests as well as associated Cypress-Tupelo-Blackgum 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 the primary habitats within the ecoregion.

Table 2.3. Primary Habitats of the Mississippi River Alluvial Plain Ecoregion.

Habitat
Barrier Island Live Oak Forest
Bottomland Hardwood Forest
Batture
Cypress-Tupelo-Blackgum Swamp
Hardwood Flatwoods
Live Oak Natural Levee Forest
Salt Dome Hardwood Forest
Coastal Mangrove-Marsh Shrubland
Brackish Marsh
Canebrake
Freshwater Floating Marsh
Freshwater Marsh
Intermediate Marsh
Mississippi Terrace Prairie
Salt Marsh
Vegetated Pioneer Emerging Delta
Macon Ridge Green Ash Pond
River Delta Freshwater Submersed Aquatic Vegetation
Sandbar

Federal lands include Indian Bayou WMA (USACE), Black Bayou Lake, Handy Brake, 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. Poverty Point is a World Heritage site located in Pioneer, LA.

d. Upper West Gulf Coastal Plain

The UWGCP ecoregion extends from south-central and south-western Arkansas to the extreme southeastern portion of Oklahoma and south into eastern Texas east to parts of northern 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. 2.7).

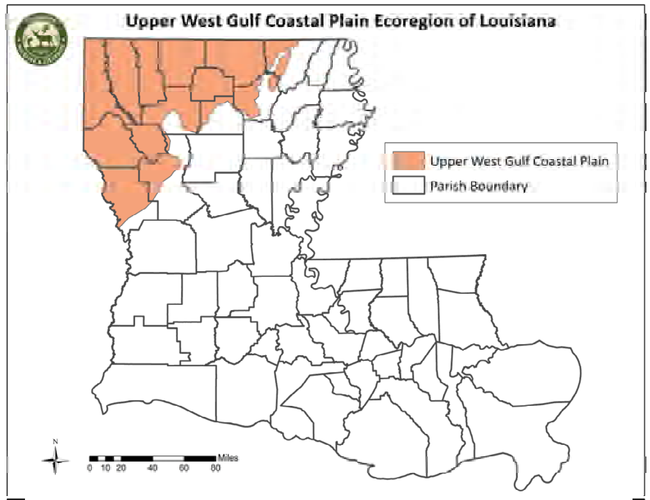

Figure 2.7. Upper West Gulf Coastal Plain Ecoregion.

The UWGCP was once recognized as the Shortleaf Pine-Oak-Hickory Woodland region of Louisiana, existing on sandy and clayey uplands north of 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 Woodland 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 soils. Wet bottomlands include natural communities such as Bayhead Swamps, Small Stream Forests, Bottomland Hardwood Forests, and Cypress-Tupelo-Blackgum Swamps. Table 2.4 lists the primary habitats within the ecoregion.

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, 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.

Table 2.4. Primary Habitats of the Upper West Gulf Coastal Plain Ecoregion.
Habitat
Shortleaf Pine/Oak-Hickory Woodland
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest
Western Upland Longleaf Pine Woodland
Small Stream Forest
Bottomland Hardwood Forest
Bayhead Swamp
Cypress-Tupelo-Blackgum Swamp
Xeric Sandhill Woodland
Hardwood Flatwoods
Calcareous Prairie
Calcareous Forest
Batture
Canebrake
Sandstone Glade/Barren
West Gulf Coastal Plain Muck Bog
Western Hillside Seepage Bog
Sparta Sand Pond
Saline Prairie

e. West Gulf Coastal Plain

The West Gulf Coastal Plain (WGCP) 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. 2.8). This ecoregion is distinguished by a wide range of natural community types but is primarily known for its Longleaf Pine woodlands. In the central portion of this ecoregion, Western Upland Longleaf Pine Woodlands are found in association with Hardwood Slope Forests, and Mixed Hardwood-Loblolly Forests. Bayhead Swamps and Western Hillside Seepage Bogs occur along slopes and at lower elevations. The WGCP 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

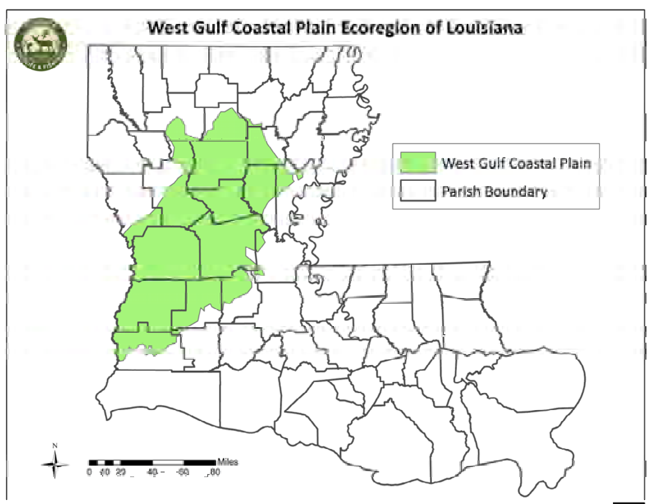

Figure 2.8. West Gulf Coastal Plain Ecoregion.

this ecoregion. The south and southwestern portions of the WGCP ecoregion in Louisiana are known for Western Longleaf Pine Flatwoods Savannas and associated Flatwoods Ponds. This portion of the ecoregion is the transition zone between Louisiana’s Coastal Prairies and Upland Longleaf Pine Woodlands. Table 2.5 lists the primary habitats within the ecoregion.

Table 2.5. Primary Habitats of the West Gulf Coastal Plain Ecoregion.

Habitat
Hardwood Flatwoods
Shortleaf Pine/Oak-Hickory Woodland
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest
Western Upland Longleaf Pine Woodland
Small Stream Forest
Bottomland Hardwood Forest
Western Longleaf Pine Flatwoods Savanna
Bayhead Swamp
Cypress-Tupelo-Blackgum Swamp
Calcareous Prairie
Xeric Sandhill Woodland
Calcareous Forest
Saline Prairie
Sandstone Glade/Barren
Canebrake
West Gulf Coastal Plain Muck Bog
Flatwoods Pond
Batture
Sparta Sand Pond
Western Hillside Seepage Bog

Federal lands include the lower portions of 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 Jimmie Davis, Chicot, South Toledo Bend, Hodges Gardens, and Sam Houston Jones.

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 north 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,

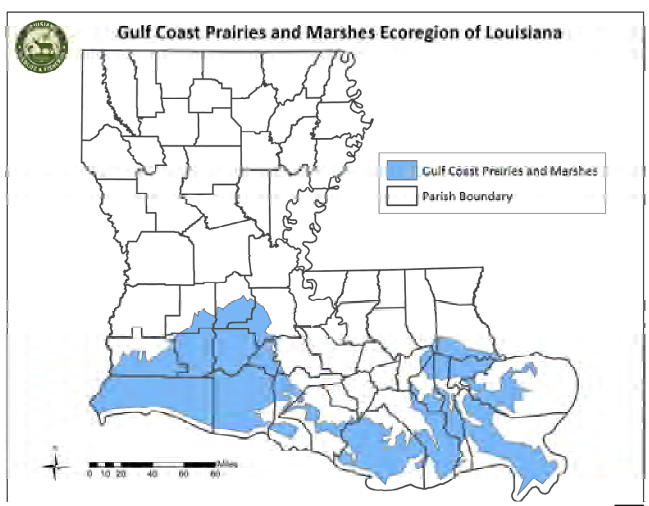

Figure 2.9. Gulf Coast Prairies and Marshes Ecoregion.

St. Landry, Evangeline, Allen, Jefferson Davis, Calcasieu, Cameron, Vermilion, Iberia, St. Mary, Terrebonne, Lafourche, St. Charles, St. John the Baptist, Jefferson, Plaquemines, St. Bernard, Orleans, St. Tammany, and Tangipahoa Parishes (Fig. 2.9).

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 3,500 acres remaining. The coastal marsh areas are comprised of Salt, Brackish, Intermediate, and Freshwater Marsh types across the coastal region. Associated natural communities include Cypress-Tupelo-Blackgum 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, Salt Dome Hardwood Forests are unique to the south-central coast occurring on salt domes in this area. Table 2.6 lists the primary habitats within the ecoregion.

Federal lands include Jean Lafitte National Historic Park and Sabine, Cameron Prairie, Lacassine, Shell Keys, Mandalay, Bayou Sauvage, Breton, and Delta NWRs. Wildlife Management Areas include, Atchafalaya Delta, Pointe-Aux-Chenes, Salvador, Timken, Wisner, Pass-A-Loutre, and Biloxi. State Wildlife Refuges include Rockefeller, State, Elmer's Island, Marsh Island, and Isle Dernieres Barrier Island. White Lake Wetlands Conservation Area is also in this ecoregion. State Parks include Bayou Segnette, Grand Isle, Palmetto Island, and St. Bernard.

Table 2.6. Primary Habitats of the Gulf Coast Prairies and Marshes Ecoregion.

Habitat
Brackish Marsh
Batture
Freshwater Marsh
Intermediate Marsh
Salt Marsh
Barrier Island
Coastal Prairie
Vegetated Pioneer Emerging Delta
Bottomland Hardwood Forest
Coastal Live Oak-Hackberry Forest
Salt Dome Hardwood Forest
Coastal Dune Grassland/Shrub Thicket
Cypress-Tupelo-Blackgum Swamp
Coastal Mangrove-Marsh Shrubland
Live Oak Natural Levee Forest
Live Oak-Pine-Magnolia Forest
Small Stream Forest
Western Longleaf Pine Flatwoods Savanna
Prairie Pothole
Freshwater Floating Marsh
Louisiana Beach
Sandbar
Barrier Island Live Oak Forest

2. Aquatic Systems:

a. Freshwater

Louisiana's abundant bayous, rivers, lakes, reservoirs, and wetlands provide virtually unlimited fishing, hunting, boating and other recreational opportunities which are major contributors to the state's economy. Today, freshwater resources are in high demand for domestic water supplies, irrigation for agriculture, and other residential and industrial uses.

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.

A vast array of levees has been constructed for flood protection and to channelize water flow in the rivers for navigation. Louisiana has more than 2,000 miles of levees as well as other flood control structures along these rivers. The present conditions of the Red and Pearl Rivers are heavily influenced by locks and dams constructed for navigation and to control water levels. The Sabine, Pearl, Atchafalaya, Ouachita and Black Rivers have all undergone alterations to their natural flow regime.

Riparian areas, found immediately adjacent to stream banks, consist of fairly narrow strips of land to broader bottoms that represent a transition between drier upland areas and streams. Forested riparian areas perform important ecological and environmental services. Riparian areas reduce the amount of sediment and nutrients that reach streams in surface runoff, provide wildlife habitat and wildlife corridors, and lower water temperatures by providing shade. Riparian zones also protect against stream bank erosion, reduce flood peaks by storing flood waters, provide a source of detritus and woody debris for aquatic and terrestrial organisms, and remove and store carbon from the atmosphere. These areas are therefore critical for maintaining healthy streams.

Man-made water bodies account for over one million surface acres of water. 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 U.S. The reservoir covers 186,000 acres and has a controlled storage capacity of 4,477,000 acre-feet (1.4 trillion gallons) at conservation pool (172.0 ft. MSL). The reservoir was formed when the Sabine River was impounded for hydroelectric purposes, water supply, and recreation. Many of the state's lakes are small natural oxbows, which are remnants of rivers cut off from the active river channel following course alterations.

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 four 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: high levels of fecal coliform bacteria, low dissolved oxygen, unsuitable levels of 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, fish and wildlife propagation, is addressed.

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)	1,077,013 (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 totaling over 3,000 miles in length (LDWF 2014) (Table 2.8, Fig. 2.10). In the early 1970's the Louisiana Natural and Scenic River Act (Act) was passed by the Louisiana State Legislature, creating the System and setting certain requirements for a river to meet for inclusion in the program. The System was developed for the purpose of preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. The Act also contains a regulatory component, and designated the LDWF Secretary to administer the System.

Six activities are prohibited on designated Natural and Scenic Rivers because of their detrimental ecological impacts on the streams. These prohibited uses include, (1) channelization, (2) clearing and snagging, (3) channel realignment, (4) reservoir construction, (5) commercial clear cutting of trees within 100 feet of the ordinary low water mark, and (6) use of a motor vehicle or other wheeled or tracked vehicle on a system stream, except for direct crossings by immediately adjacent landowners.

Scenic River Permits are required for all activities on or near System Rivers that may detrimentally impact the ecological integrity, scenic beauty, or wilderness qualities of those rivers. These permits, when granted, contain specific conditions aimed at preserving the stream's natural character and quality. 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 rivers, and percent land use of aquatic basins in Louisiana.

			Major Land Uses (%)		
Basin	**Area (miles)^2**	**Scenic Rivers**	**Forested**	**Agriculture**	**Urban**
Atchafalaya	2,374	0	19	15	1
Barataria	2,520	1	1	10	3
Calcasieu	4,270	9	51	26	3
Mermentau	4,786	0	8	57	2
Mississippi	1,886	0	20	18	3
Ouachita	7,644	11	59	29	2
Pearl	914	7	47	24	4
Pontchartrain	7,637	23	26	12	5
Red	7,500	5	54	30	3
Sabine	3,257	1	54	14	2
Terrebonne	3,979	0	11	14	2
Vermilion — Teche	47	2	16	47	4

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

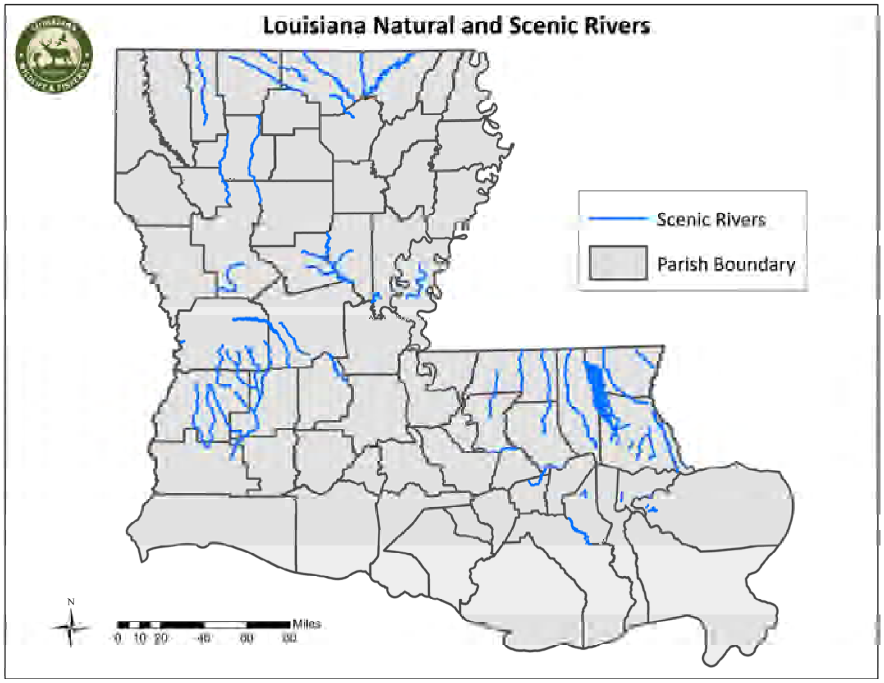

Figure 2.10. Natural and Scenic Rivers

d. Management Basins:

Louisiana has twelve water quality management basins delineated by 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 silviculture 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 and, along with the Mississippi Basin contain the highest number of SGCN (Table 2.9).

Table 2.9 Aquatic basins and associated aquatic SGCN listed by taxa.

Basin	Amphibian	Crustacean	Inland Fish	Insect	Marine Fish	Mollusk	Reptile	Total
Atchafalaya	0	1	8	0	14	2	11	36
Barataria	0	4	3	0	15	1	8	31
Calcasieu	1	8	6	2	10	7	11	45
Mermentau	1	5	3	1	10	1	11	32
Mississippi	0	5	21	0	15	13	12	66
Ouachita	1	4	17	10	0	23	5	60
Pearl	1	7	20	2	13	14	13	70
Pontchartrain	1	6	12	3	14	16	10	62
Red	1	7	15	11	0	11	5	50
Sabine	1	7	10	1	11	9	12	51
Terrebonne	0	4	2	0	15	0	10	31
Vermilion-Teche	0	5	3	0	14	4	10	36

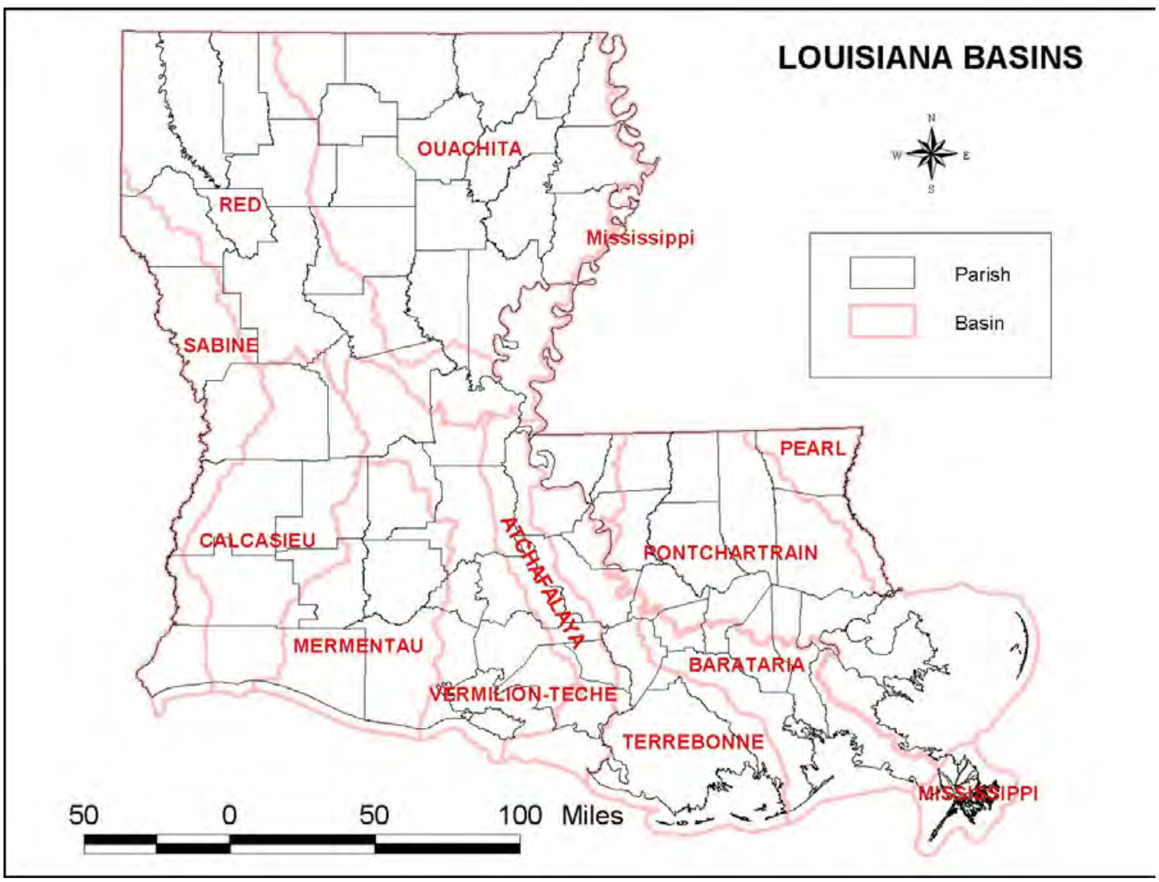

Figure 2.11. Aquatic basins in Louisiana.

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% of the combined flow of those three rivers. 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. The Atchafalaya Basin is predominantly Bottomland Hardwood Forest and Cypress-Tupelo-Blackgum Swamp, and constitutes the largest contiguous freshwater swamp in the U.S. However, the lower distributary area contains Freshwater, Intermediate, Brackish, and Salt Marsh, as well as Vegetated Pioneer Emerging Delta at the Atchafalaya and Wax Lake Deltas. These deltas represent the most significant accretion on the Louisiana coast. The beneficial use of dredge spoil resulting from the maintenance of navigation channels within these deltas has resulted in the creation of multiple islands that are utilized by colonial nesting waterbirds.

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 Hardwood Forest and Freshwater 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. This basin contains some of the most productive barrier islands in Louisiana for nesting birds, as well as the only occurrence of Barrier Island Live Oak Forest in the state. Bayou des Allemands is the only designated natural and scenic river to occur in this basin.

3. *Calcasieu Basin*

The Calcasieu River Basin is located in southwest 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. This basin encompasses a portion of the prairie region of southwest Louisiana, and Bottomland Hardwood Forest and Cypress-Tupelo-Blackgum Swamps are found along the river and its tributaries. The landscape in this basin varies from pine-wooded hills in the upper end to Brackish and Salt Marshes in the lower reaches around Calcasieu Lake. There are nine designated natural and scenic rivers found in this basin including: Barnes Creek, Beckwith Creek, Bundicks Creek, Calcasieu River, Drake's Creek, Hickory Branch, Six Mile Creek, Ten Mile Creek, and Whiskey Chitto Creek.

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 Coastal Prairie habitat remains and the dominant habitat type is agricultural land. Bottomland Hardwood Forest and Cypress-Tupelo-Blackgum Swamps occur along the Mermentau and its larger tributaries. Freshwater, Intermediate, and Brackish Marshes constitute the majority of coastal wetlands in this basin 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 Mississippi does not receive 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 by the lower Mississippi 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 birdsfoot 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 Hardwood Forests and agricultural lands. The Mississippi River delta is losing land faster than any other area in the world due to anthropogenic factors including flood control and navigational modifications.

6. *Ouachita Basin*

The Ouachita River's source is located in the Ouachita Mountains of west-central Arkansas near the Oklahoma border. Most of the basin consists of rich, alluvial plains cultivated in cotton and soybeans. Natural habitats in this basin consist primarily of Bottomland Hardwood Forests and Hardwood Flatwoods. Bayou Bartholomew contains the state's highest fish and mollusk diversity, and contains several federally listed mollusks. Eleven designated natural and scenic rivers are found in this basin, which include Bayou Bartholomew, Bayou D'Arbonne, Bayou D 'Loutre, Big Creek, Corney Bayou, Fish Creek, Little River, Middle Fork of Bayou D'Arbonne, Ouachita River, Saline Bayou (Catahoula and LaSalle parishes), and Trout Creek.

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 sea level in the northwest portion to sea level at the southern end. Correspondingly, the vegetation varies from pine forests and

Bottomland Hardwood Forest to Freshwater and Brackish Marsh.

Seven Louisiana designated natural and scenic rivers lie within the basin, including Pushepatapa Creek, the Bogue Chitto River, Holmes Bayou, Bradley Slough, Wilson Slough, Morgan River, and the West Pearl River.

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 consist of both pine and hardwood forests. The southern portions of the basin consist of Cypress-Tupelo-Blackgum Swamps, Bottomland Hardwood Forests, and Brackish and Salt Marshes. The marshes of the southeastern part of the basin constitute one of the most-rapidly eroding areas 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. This basin contains the highest number of designated natural and scenic rivers in the state, with 23. These include the Abita River, the Amite River, Bashman Bayou, Bayou Bienvenue, Bayou Cane, Bayou Chaperon, Bayou Chinchuba, Bayou Dupre, Bayou Labranche, Bayou Lacombe, Bayou Liberty, Bayou Manchac, Bayou St John, Bayou Trepagnier, Blind River, the Bogue Falaya River, the Comite River, Lake Borgne Canal, Pirogue Bayou, the Tangipahoa River, the Tchefuncte River and tributaries, Terre Beau Bayou and the Tickfaw River.

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. There are a wide variety of habitats found in this basin from Oxbow Lakes to Calcareous Prairies. Much of the area adjacent to this river and its tributaries is composed of Bottomland Hardwood Forest and Cypress-Tupelo-Blackgum Swamp. The Oxbows along the Red River were formed by the Great Raft which extended from the Arkansas state line south for 165 miles. This log jam was removed in the mid 1800s and as a result Silver, Soda and Cross Lakes were drained. A dam was installed on Cross Lake to maintain water levels. Designated natural and scenic rivers include Bayou Cocodrie (Concordia Parish), Bayou Dorcheat, Bayou Kisatchie, Black Lake Bayou, and Saline Bayou (Bienville, Winn, and Natchitoches parishes).

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10. *Sabine Basin*

The Sabine River Basin lies along the Texas-Louisiana border. The basin stretches from the Texas state line near Shreveport to Sabine Lake and the Gulf of Mexico. It is bounded on the east by the Red River Basin and Calcasieu River Basin. Elevation varies greatly along the length of the river, with areas near the coast at or near sea level. Characteristic vegetation ranges from mixed forests in the upper basin to Bottomland Hardwood Forest in the mid-section and Intermediate, Brackish and Salt Marshes in the lower end. Toledo Bend Reservoir is located in the Sabine Basin along the Louisiana-Texas border. The reservoir extends approximately 65 miles from the dam to the vicinity of Logansport. This reservoir is the 5^{th} largest in the U.S., with an average surface area of 186,000 acres. The reservoir was created to provide a water supply, hydroelectric power, and for recreation. Pearl Creek is the only designated scenic and natural river in this basin.

11. *Terrebonne Basin*

The Terrebonne Basin covers 1,712,500 acres in south-central Louisiana, 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. This basin varies in width from 18 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 consists of Freshwater, Intermediate, Brackish, and Salt Marshes, as well as Barrier Islands, including the Isles Dernieres Barrier Island Refuge and East Timbalier Island NWR. The Isle Dernieres Barrier Islands Refuge consists of a series of barrier islands, including Wine Island, East Island, Trinity Island, Whiskey Island, and Raccoon Island.

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. Water in this basin is managed primarily for agricultural uses; as a result there are sedimentation, dissolved oxygen, and turbidity issues in these river systems. The wooded uplands of the northern part of the basin consist of both upland pine and Bottomland Hardwood Forest. The central and southern portions of the basin consist largely of agricultural lands and the coastal zone is a mixture of Fresh, Intermediate, and Brackish Marshes. Designated natural and scenic rivers found in this basin include Bayou Cocodrie (Rapides and Evangeline parishes) and Spring Creek.

e. Marine

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

Coastal marshes and beaches occupy a transition zone between the open water of the Gulf of Mexico, and the upland forests and grasslands north of the immediate coast. Within this coastal zone, a variety of natural and anthropogenic processes contribute to the dynamic nature of these habitats. Louisiana's marshes are extremely productive habitats, and provide shelter for the juvenile stages of many marine species. Coastal forests provide invaluable stopover habitat for Neotropical migrant landbirds.

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 relict beach ridges with interspersed marshes. Coastal water bodies in this region are enclosed estuaries rather than the expansive open bays of the southeast. These estuaries are heavily impacted by human marsh management and navigational changes to the landscape.

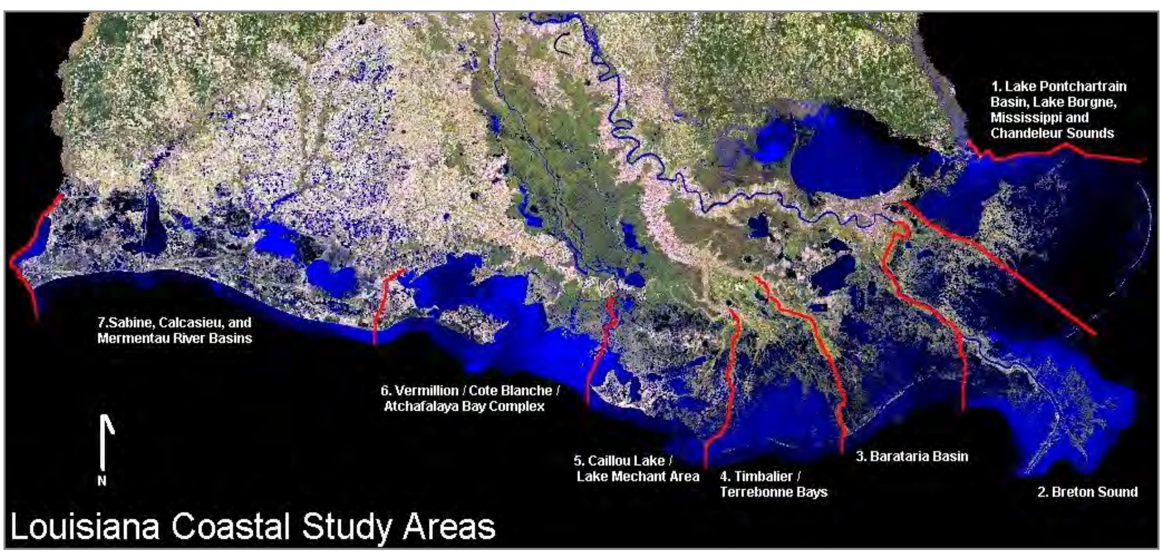

Figure 2.12. Louisiana's coastal study areas.

CHAPTER 3. APPROACH

The task of revising the Wildlife Action Plan (WAP) has been coordinated among Louisiana Department of Wildlife and Fisheries (LDWF) staff from the Office of Wildlife and Office of Fisheries. Additional input was solicited 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. This chapter presents the approach used during the 2015 revision process. For details on the approach used in the development of the WAP in 2005, refer to Appendix B.

A. Organizational Structure

1. Technical Committees

As in 2005, a core committee of LDWF staff (Appendix C) 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 provide guidance. The core committee was responsible for reviewing each chapter of the 2005 WAP to identify any aspects of the WAP that required update. Additional chapters were developed during the revision process and the core committee was 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 Species of Greatest Conservation Need (SGCN) ranking criteria discussed below.

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

2. Coordination with Other Agencies

LDWF identified 26 federal and state government agencies as stakeholders in the development and implementation of the 2015 WAP (Appendix D). 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. Partner, Tribal, and Public Involvement

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 91 non-government organizations (NGOs; Appendix D) following the same procedure as outlined above for federal and state agencies, including the same 45 day comment period. Included in these 91 organizations were the 4 federally-recognized tribes in Louisiana. Although these 4 tribes were contacted and provided the opportunity to provide input, no responses were received from them.

Additionally, 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 (www.wlf.louisiana.gov/wildlife/wildlife-action-plan) for 45 days. To inform the public about this opportunity, a press release was issued, and subsequently cross-posted onto LDWF's social media resources. After the comment period ended, comments from the public were carefully reviewed and addressed as appropriate. Despite our efforts to engage the public during the revision, very limited responses were received.

4. Cooperation with Other States

During the 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 neighboring states and will best be addressed via a regional approach. Staff from LDWF attended two national WAP summits during the revision process to facilitate coordination and consistency between all states for the 2015 WAPs.

5. Procedures for the 2025 WAP Revision

The Louisiana Department of Wildlife and Fisheries commits to a comprehensive review and revision of the 2015 WAP by October 1, 2025. In the interim, LDWF will utilize the monitoring framework described in Chapter 9, along with adaptive management practices to ensure that the 2015 WAP remains an effective tool for conservation planning.

Similar procedures as described for technical expert, government agency, NGO, and public participation during the 2015 revision will be implemented in the 2025 revision process. It is anticipated that lessons learned during the 2015 revision will be of great value during the next revision. Prior to the submission of the 2025 WAP, LDWF will utilize the Emerging Issue process to address new conservation issues that may arise.

6. Implementation Coordination with Partner Agencies, Tribes, and the Public

The importance of close coordination with LDWF's conservation partners and Louisiana's public during the implementation of the WAP will be apparent in many of the conservation actions detailed in Chapters 4, 5, 6, and 8 of the 2015 WAP. In particular, those partners that own or manage significant lands will be critically important to the implementation of the WAP and therefore the effective conservation of SGCN.

This is also true of private landowners, as the majority of Louisiana is privately owned, and therefore many SGCN and priority habitats occur on private lands.

There will also be efforts to engage the general public during implementation of the 2015 WAP, as long-term success of all conservation efforts will hinge on increased buy-in from our constituents. As staff time and other resources allow, various methods will be used to increase public awareness and participation in WAP implementation. These methods will include press releases concerning conservation efforts and successes, social media engagement, production of videos, inclusion of SGCN and WAP in school curricula, and engagement at festivals and other public events.

B. Species of Greatest Conservation Need

1. Identifying SGCN

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 C), 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 Louisiana Natural Heritage Program (LNHP) 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 actions 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 59 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, and 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. SGCN Prioritization Process

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 recognition of the need for greater prioritization of SGCN (AFWA 2011), to allow state fish and wildlife agencies to more effectively plan conservation actions and allocate limited funding. 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 two points to a maximum of 26 points. Once each SGCN had a total score, the interquartiles of the range of scores were determined and were used to separate the SGCN into three Tiers within each taxonomic group. For each taxonomic group there are Tier I, Tier II, and Tier III SGCN. Tier I SGCN should generally 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

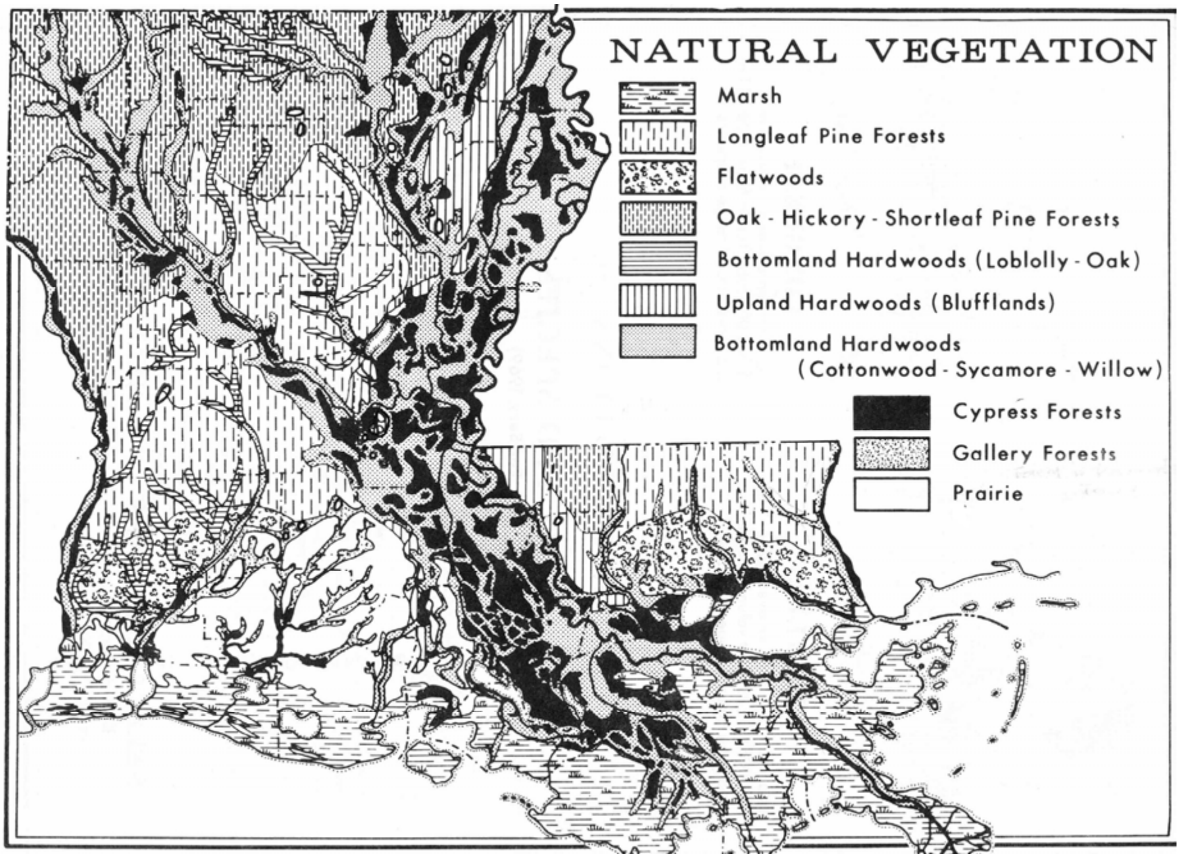

Figure 3.1. Primary natural vegetation types and presettlement distribution in Louisiana (Newton 1972).

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 C).

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. A total of 59 habitats, 12 river basins, and five marine substrate types are treated in the 2015 WAP (Appendix F).

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 actions, 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 set of habitat prioritization criteria (Table 3.2) was developed 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. Threat 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 as 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 areal 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. The results of the habitat prioritization can be found in Appendix G.

D. Threats to SGCN and Related Habitats

For the 2015 WAP Revision, it was decided that, as recommended in the AFWA Best Practices document (AFWA 2011), 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 1st level threats, are comprehensive, as are the 2nd level threats, which have a higher degree of specificity than do the 1st level threats. For a complete list of 1st and 2nd level threats, and selected 3rd level threats, presented in the standard lexicon, see Appendix H. For each habitat and basin treated in the 2015 WAP, 1st and 2nd 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 lexicon.

Once all relevant 1st 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:

Table 3.2 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

- 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.

The threat impact for each of the 1st level threats, as well as the overall threat impact for each habitat and basin can be found in those treatments, as well as additional discussion of those threats.

For SGCN, it was not considered efficacious to utilize the aforementioned rank calculator to assess threats at the level of the individual species. Instead, for each broad taxonomic group (i.e. mollusks, birds, and mammals) the 1st level threats that are relevant are identified, and those threats are discussed briefly, along with relevant stresses, in some cases. A stress, as defined by Salafsky et al. (2008) is a "symptom" of a threat, such as habitat fragmentation (stress), which results from residential development (1st level threat). Two of the 11 1st level threats, invasive species and climate change, are discussed in detail in chapters devoted to those threats, due to recognition that those threats were not fully addressed in the 2005 WAP.

E. Identifying Priority Subbasins for Conservation Opportunity Areas

A prioritization method is described here for assigning scores to four-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 four-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., *Crawfishes of Louisiana*), museum collections (e.g., Tulane Museum of Ichthyology), 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 S- rank. This means that counts were made separately for S1, S2, 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 of each S-rank was multiplied by a prioritization factor. For S1 species, the total number was multiplied by three. For S2 species, the total number was multiplied by two, and for S1 species the total number was multiplied by one. 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 (COAs). For more information on the identification of COAs, see Chapter 8.

CHAPTER 4. SPECIES OF GREATEST CONSERVATION NEED

A. Species of Greatest Conservation Need

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

For details on the approach the Louisiana Department of Wildlife and Fisheries (LDWF) used to revise the 2005 SGCN list during the 2015 revision, refer to Chapter 3 (Approach). For additional information on the 2005 approach, refer to Appendix B. This Chapter contains the updated SGCN list for Louisiana, binned by taxonomic group. For a complete list of SGCN in taxonomic order, see Appendix I. Within each taxonomic group, the SGCN are divided into three tiers, with Tier I containing those species that are most in need of immediate conservation action. For detailed information on the factors and methodology used to determine these tiers, see Chapter 3. Research needs and conservation actions that have been identified for Louisiana SGCN can be found in Section C below. There are a total of 345 animal SGCN identified in this 2nd iteration of the Louisiana WAP, compared to 240 SGCN in the 2005 WAP. Ultimately, 25 SGCN identified in the 2005 WAP were removed from the list, and 130 SGCN were added (for details see the Summary of Changes). Almost half (61) of the newly identified SGCN are invertebrates, reflecting a more consistent effort to address these species.

B. Threats, Research Needs, and Conservation Actions

Threats are described briefly for each taxonomic group below. These descriptions are not comprehensive, but rather focus on major or specific threats to each group. Threats were considered at the level of the 1st level threats provided by Salafsky et al. (2008). Table 4.1 provides a summary of which threats are most pervasive in each group.

Table 4.1 1st Level Threats to SGCN

First Level Threat	Mollusks	Crustaceans	Arthropods	Inland Fishes	Marine Fishes	Herps	Birds	Mammals
Residential/Commercial Development		x	x			x	x	x
Agriculture/Aquaculture		x	x			x	x	x
Energy Production & Mining	x	x	x	x	x	x	x	x
Transportation & Service Corridors	x	x	x	x	x	x	x	x
Biological Resource Use	x		x			x	x	x
Human Intrusion/Disturbance	x	x	x	x	x	x	x	x
Natural System Modification	x	x	x	x	x	x	x	x
Invasive & other Problematic Species	x	x	x	x	x	x	x	x
Pollution	x	x	x	x	x	x	x	x
Geological Events								
Climate Change & Severe Weather	x	x	x	x	x	x	x	x

For more information on the threats posed by invasive species and climate change, refer to Chapters 6 and 7 of this WAP, respectively.

Specific research needs and conservation actions are presented below for many SGCN. However, these actions are not exhaustive and are not intended as the only conservation priorities for these species.

C. SGCN by Taxonomic Group

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). Approximately 300 species of mussels are recognized in the United States (U.S.) (Williams et al. 2008). The southeastern U.S. contains the greatest species diversity with approximately 270 species, of which at least 64 species (~ 24% of the U.S. total) are currently known to occur in Louisiana (Neves et al. 1997). Of these 64 species, 24 species are ranked as imperiled or critically imperiled in the state by the Louisiana Natural Heritage Program (LNHP 2015). Federally-listed species include Rabbitsfoot (USFWS 2013), 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, two snails, one aquatic and one terrestrial, are included on the SGCN list. Finally, five marine mollusks are included due to their dependence on highly restricted habitats within Louisiana. At least three of the five marine mollusk SGCN are currently known only from Marine 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 Penshell	*Atrina serrata*	G5	S1
Half-Naked Penshell	*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 sinistrum*	GNR	S1
Tier III			
Mucket	*Actinonaias ligamentina*	G5	S1
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. Threats to Mollusks

Sand and gravel mining operations pose a direct threat to some mussels, because such activities may result in the degradation or complete loss of habitat. Construction of infrastructure associated with transportation projects may directly impact mussel habitat or lead to reduced water quality, as may the use of off-road vehicles (ORVs) near or upstream of occurrences of SGCN. Modifications to streams, including the building and operation of dams, construction of weirs, removal of snags and woody debris for aesthetic or navigational purposes, and excessive removal of ground or surface water all have the potential to decrease habitat quality and quantity. Additionally, the clearing of riparian zones often leads to increased sedimentation, which increases turbidity and may cause the extirpation of some mollusks. Another threat to water quality is through organic enrichment and the concomitant alteration of the microbial community caused by Feral Hog activity within streams, which may also result in the direct destruction of mussel beds (Kaller et al. 2007). In addition to sediment, the input of household, industrial, and agricultural effluents into streams poses a threat to freshwater mollusks. Sea level rise (SLR) threatens freshwater mollusks in coastal streams due to increases in salinities and threatens marine mollusks through the loss of seagrass beds associated with Barrier Islands. If climate change results in decreased precipitation in our region, many freshwater mollusks may be threatened, because reductions in rainfall could lead to a reduction of in-stream flow.

c. Mollusk Research and Survey Needs

- Update historical occurrence records and obtain data on current status, distribution, and abundance of all mussel SGCN (prioritized by S-rank), particularly in the Red River, Bayou Bartholomew, Tensas River, and any areas not surveyed within the last decade.
- Determine the host fish(es) of mussel SGCN.
- Monitor mussel SGCN in streams impacted by pollution events.
- Develop and implement standardized monitoring protocols for mollusk SGCN.
- Delineate marine mollusk habitat at the Chandeleur Islands.
- Determine threats to mussel SGCN (prioritized by S-rank).

SH -Ranked Mussels (Western Fanshell, Texas Heelsplitter)

- Determine if these species are extant in Louisiana.

Louisiana Pearlshell

- Implement the recently developed standardized monitoring protocol throughout the range on both public and private lands.

Silty Hornsnail

- Determine the current status and distribution of this species.

Flamed Tigersnail

- Determine the current status and distribution of this species.

Penshells, Whelks, & Bay Scallop

- Determine the current status and distribution of these and other marine mollusks at the Chandeleur Islands.

d. Mollusk Conservation Actions

- Collaborate with the U.S. Fish and Wildlife Service (USFWS) Natchitoches National Fish Hatchery and other partners to develop propagation and restocking techniques and initiate restocking efforts where needed.
- Work with parishes, the Louisiana Department of Transportation and Development (DOTD), and other partners to install oversized culverts below grade to allow passage of host fishes and 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 water drainage.
- Work with timber companies to encourage designation of streamside management zones (SMZs) within actively managed areas.
- Maintain in-stream flows at levels that will support populations of rare mussels and host fishes.
- Conserve and restore the Chandeleur Islands and adjacent, shallow-water habitats such as Marine Seagrass Beds.
- Restrict or outlaw the use of ORVs in streams, particularly the practice of “mud-riding” through streambeds.
- Discourage the creation of weirs, dams, and reservoirs on streams and rivers supporting mollusk SGCN.
- Work with partners to remove low-water sills on the Pearl River to benefit mollusk SGCN.

- Work with the LDWF Scenic Rivers Program to minimize sand and gravel mining operations in streams that support mollusk SGCN.

Louisiana Pearlshell

- Partner with USFWS and other stakeholders to implement the recommendations and meet the recovery goals of the Louisiana Pearlshell Recovery Plan (USFWS, *In revision*) and the 5-Year Review (USFWS 2011).
- Work with landowners to implement Best Management Practices (BMPs) to improve water quality in streams inhabited by Louisiana Pearlshell.

Inflated Heelsplitter

- Work with the Scenic Rivers Program to prevent negative impacts from sand and gravel mining in the Amite River.
- Manage the Amite River to benefit Freshwater Drum (*Aplodinotus grunniens*), the host fish for this species.
- Work with partners to reduce and mitigate the impacts of urbanization adjacent to the Amite River.

2. Crustaceans

There are 338 crawfish species in the U.S., 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 rare and local, imperiled, or critically imperiled by LNHP (2015), including at least five endemic or apparently endemic taxa: 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 a few sites could also lead to their extinction (Taylor et al. 1996). In addition to crawfish, four species of marine 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 Creek 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	*Procambarus 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. Threats to Crustaceans

Loss of habitat due to development or conversion of land for agriculture may threaten some primary and secondary burrowing crawfishes, especially those that have restricted distributions. The threats posed by sand and gravel mining, transportation infrastructure, ORVs, stream modification, Feral Hogs, pollution, and climate change discussed in “Threats to Mollusks” above also apply to many stream dwelling crustaceans. The backfilling of ditches, although not a modification of a “natural” system, nonetheless negatively impacts some crawfishes, because species that utilize ephemeral wetlands sometimes are found associated with ecologically stable ditches. Furthermore, the application of herbicides to control vegetation in such waterways may also threaten some crawfishes by reducing cover and food availability or through direct mortality caused by sensitivity to the herbicide (Walls 2009). An additional potential threat to crawfish SGCN is the introduction of non-native crawfishes into Louisiana waterways.

c. Crustacean Research and Survey Needs

- Research life history strategies of all crawfish SGCN:
    - Size/age at maturity, longevity, and survivorship.
    - Habitat requirements and preferences, including microhabitat preferences.

    - Population estimates and trends.
    - Reproductive ecology [including fecundity and behavior of ovigerous (“in berry”) females].
    - Behavior, including migratory patterns, competition, and niche partitioning.
- Conduct drainage-wide surveys for all crawfish SGCN, including extensive surveys for stream dwelling species beyond bridge crossings and historical localities.
- Determine the appropriate in-stream characteristics that should be targeted during stream restoration activities (e.g., dissolved oxygen levels, depth, flow, canopy cover, submerged structure).
- Examine feasibility and efficacy of providing artificial cover in areas lacking sufficient cover.
- Determine the lethal levels of common pollutants on crawfish.
- Monitor streams and other occurrences of rare crawfishes for the presence of non-native crawfishes and emerging diseases.
- Develop standardized sampling protocols for monitoring known occurrences of rare crawfishes to track population trends and improve understanding of population dynamics.
- Evaluate current habitat threats and develop strategies to abate those threats.
- Investigate the impacts of Chinese Tallow on Ephemeral Pond dwelling rare crawfishes.

d. Crustacean Conservation Actions

- Work with parishes and DOTD to minimize negative impacts of new stream crossings and to mitigate negative impacts of existing stream crossings, including promoting placement of submerged culverts.
- Work with landowners and the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (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.
- Target degraded streams within the known range of one or more rare crawfish for experimental restoration.
- Develop education/outreach materials concerning the unique native crawfishes of Louisiana and the potential threats posed by non-native crawfishes and habitat degradation.
- Protect and restore ephemeral wetlands 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 (HSIs) for rare crawfishes.

Pine Hills Digger & Flatwoods Digger

- Protect and restore mesic/wet open pine systems.

3. Non-crustacean Arthropods

Unlike many more well-known taxa, there is no readily available number of species of non-crustacean arthropods in Louisiana. Fifty-seven insects, one spider, and one scorpion are included as SGCN. For the majority of these SGCN, the primary needs are baseline data, because this group is the most poorly known of Louisiana's fauna. To be sure, the dearth of available subject-matter experts on these taxonomic groups resulted in very limited expert input for these species. The list of butterfly SGCN from the 2005 WAP, along with the list of insects currently tracked by the LNHP, forms the backbone of the non-crustacean arthropod list. Baseline studies of these taxa to address known data gaps may lead to significant revision of this list for the next iteration of the WAP.

a. Non-crustacean Arthropod SGCN

Common Name	Scientific Name	G-Rank	S-Rank
Tier I			
Yellow Brachycercus Mayfly	*Sparbarus 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*	G2G3	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	*Habroscelimorpha dorsalis venusta*	G4T3T4	S2
Sandbar Tiger Beetle	*Ellipsoptera blanda*	G3G4	S3
Cajun Tiger Beetle	*Dromochorus 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	*Lethe creola*	G3G4	S3
Georgia Satyr	*Neonympha areolatus*	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 exilis*	G5	S1S2
Eastern Pygmy Blue	*Brephidium pseudofea*	G5	S1S2
Gulf Pine Sphinx	*Lapara phaeobrachycerous*	G3G4	S3
Brou’s Mallow Moth	*Bagisara brouana*	G3	S3
Nutmeg Underwing	*Catocala atocala*	G3G4	S1S2
Tier III			
Texas Brown Tarantula	*Aphonopelma hentzi*	GNR	S3
White Sand Tiger Beetle	*Ellipsoptera wapleri*	G3G4	S2S3
American Bumble Bee	*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*	G4	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	*Lethe appalachia*	G4	SU
Monarch	*Danaus plexippus*	G4	S4

b. Threats to Non-crustacean Arthropods

An overarching stress for many terrestrial non-crustacean arthropod SGCN is habitat destruction and alteration resulting from residential or commercial development, as well as conversion of land to agricultural use. The indiscriminate use of insecticides, particularly neonicotinoids, is also a threat to many insects, including butterflies, skippers, and native bees. Finally, although the extent of impacts on native arthropods by the Red Imported Fire Ant (RIFA) is unknown for many species, there is little doubt that negative impacts are occurring; further investigation of those impacts and the persistence of their effects on SGCN, both invertebrate and vertebrate, are warranted. For aquatic insects, many of the same threats and stressors discussed under mollusks and crustaceans pertain.

c. Non-crustacean Arthropod Research and Survey Needs

- Determine the current distribution, status, and limiting factors of all 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 designation as SGCN.
- Investigate potential negative impacts of RIFA and other invasive ant species on native arthropods, including grass-dwelling skippers.

<u>Southern Snaketail</u>

- Conduct baseline ecological studies as well as research to determine the effects of flooding and water pollution on larvae.

<u>Pitcher Plant Spiketail</u>

- Conduct baseline ecological studies including research on movements, habitat use, demography, and life history.

<u>Texas Emerald</u>

- Conduct baseline studies including research on ecology of naiads and habitat preferences.

<u>Harvester Ants</u>

- Determine threats and limiting factors for both species.

Louisiana Eyed Silkmoth

- Determine the distribution and status of this species.

d. Non-crustacean Arthropod Conservation Actions

- Include insect conservation (with emphasis on rare insects and pollinators) in public education and outreach efforts.
- Coordinate with Xerces Society and other partners to promote the conservation of non-crustacean arthropods.
- Use prescribed fire to maintain appropriate habitat.

Texas Brown Tarantula

- Maintain appropriate habitat with prescribed fire, including at Kisatchie National Forest (KNF).
- Promote the retention of woody debris by land managers.

Southern Unstriped Scorpion

- Promote the retention of woody debris by land managers.

Stream-dwelling Insects

- Work with parishes and DOTD to minimize negative impacts of new stream crossings and to mitigate negative impacts of existing stream crossings, including promoting placement of submerged culverts.
- 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 the Louisiana Department of Environmental Quality (LDEQ) to address impairments to streams that will negatively impact stream dwelling insects.

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

- Work with partners on watershed-level conservation efforts to benefit these blackwater stream species.
- Retain riparian buffers and conserve Small Stream Forest for these species.

Louisiana Needlefly & Schoolhouse Springs Net-spinning Caddisfly

- Partner with The Nature Conservancy (TNC) to conserve and monitor rare insects at Schoolhouse Springs.
- Work with TNC and other partners to monitor and address threats to these species and the Schoolhouse Springs watershed.

Pitcher Plant Spiketail

- Maintain and restore West Gulf Coastal Plain Muck Bogs and Western Hillside Seepage Bogs within known and potential range.

Sandbar Species

- Work with partners to protect/restore Sandbars in Louisiana rivers.
- Control invasive plants (e.g., Salt Cedar, Torpedo Grass, and Cogon Grass) and animals (e.g., Feral Hogs, RIFA) on Sandbars.
- Restrict or outlaw the use of ORVs on riverine Sandbars.

Saline Prairie Scarab Beetle

- Prioritize Saline Prairie conservation and management.

Six-banded Longhorn Beetle

- Conserve mature hardwood forests wherever found within the range of this species.
- Retain large over-mature trees and snags in floodplains and mesic forests.

Comanche and Florida Harvester Ants

- If RIFA are found to be a limiting factor, control RIFA near known occurrences of these species using methods that are not detrimental to Harvester Ants or other SGCN.
- Use prescribed fire to maintain open pine systems.
- Monitor and, if necessary, buffer timber harvest activities around known occurrences to reduce negative impacts from such as soil compaction from heavy machinery.

Native Bees, Butterflies, & Skippers

- Provide refugia during prescribed burning efforts by burning in sections whenever possible, and conduct research to determine impacts of various burning schemes.
- Retain and plant native plants on Rights-of-Way (ROWs).

- Develop reliable, affordable, sources of pollinator friendly native plant material and seed.
- Develop recommendations for private landowners for the seasonal timing of mowing to avoid negative impacts to butterflies and skippers, and implement those recommendations on Wildlife Management Areas (WMAs) and other LDWF properties.
- 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 and other public lands when possible.
- Restrict and remove honey bee hives from LDWF properties.

<u>Frosted Elfin, Wild Indigo Duskywing, & Strecker's Giant Skipper</u>

- Use prescribed fire to maintain open pine habitat.

<u>Creole Pearly Eye, Lace-winged Roadside Skipper, & Yucca Giant Skipper</u>

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

<u>Arogos Skipper</u>

- Expand efforts towards Coastal Prairie management and restoration.

<u>Dusky Roadside Skipper & Gulf Pine Sphinx</u>

- Expand efforts towards Longleaf Pine management and restoration.

<u>Dusted Skipper</u>

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

<u>Monarch</u>

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

Louisiana Eyed Silkmoth

- Conserve large patches of unfragmented Salt Marsh.

4. Inland Fishes

Louisiana's high diversity of inland fishes is due primarily to the complexity of aquatic habitats, which range from small streams, bayous, oxbows and backwater areas, large river systems, and estuarine areas of coastal Louisiana. At least 195 fish species have been recorded from freshwater habitats in Louisiana. Thirty-one species of inland fishes are considered rare and local, imperiled, or critically imperiled (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 1995) 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. Threats to Inland Fishes

As with crawfishes and aquatic insects, the threats posed by sand and gravel mining, transportation infrastructure, ORVs, stream modification, Feral Hogs, pollution, and climate change discussed under mollusks also apply to many inland fishes, because many inland fish SGCN occupy similar habitats to those taxa. Invasive species, in addition to aforementioned Feral Hogs, are also a major threat to many fish SGCN. Invasive species negatively impact fish SGCN in several ways, including through habitat degradation, increased competition for resources, and direct predation.

c. Inland Fishes Research and Survey Needs

- Determine trends in range and abundance of invasive fishes via sampling.
- 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.
- Resolve the impacts of in-stream flow alterations on fish SGCN.
- Determine optimal habitat conditions for fish SGCN via modeling.

- 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.
- Research habitat requirements, population trends, and distribution of all fish SGCN.
- Develop HSIs for SGCN to aid in future conservation and restoration efforts.

S1 & S2 Inland Fish SGCN

- Determine the current distribution, habitat requirements, and status, including population trend.

Paddlefish

- Determine the status of this species in coastal rivers.
- Determine spawning and nursery habitat locations within rivers.

American Eel

- Determine distribution and population status in Louisiana.

Alabama Shad & River Redhorse

- Determine if these species are still extant in the Lake Pontchartrain basin via targeted surveys.
- Determine presence/absence and status of the River Redhorse, especially in the Ouachita basin.

Suckermouth Minnow

- Determine if this species is still extant in the Red and Ouachita River systems via targeted surveys.

Blue Sucker

- Monitor this species in the Sabine River.
- Determine the current distribution, habitat requirements, and status in preferred habitat in Anacoco Creek.
- Target preferred habitat for surveys of spawning and rearing juveniles.

Frecklebelly Madtom & Freckled Darter

- Determine if these species are still extant in the Pearl River system via targeted surveys.

Gulf Pipefish

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

d. Inland Fishes Conservation Actions

- Remove non-essential dams and low-water sills in Louisiana watersheds where warranted, and discourage the building of new dams.
- Retain riparian buffers.
- Work with parishes, private landowners, and industrial interests (e.g., timber or petrochemical companies) to disseminate BMPs for SMZs.
- Develop recommendations to improve fish passage through low-head dams.
- Expand outreach/education efforts on the importance of riparian zones.
- Coordinate with LDEQ and the Louisiana Department of Natural Resources (LDNR) 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.
- Restrict or outlaw the use of ORVs in streams, particularly the practice of "mud-riding" through streambeds.
- Work with parishes and DOTD to minimize negative impacts of new stream crossings and to mitigate negative impacts of existing stream crossings, including promoting placement of submerged culverts.
- Partner with neighboring states to address conservation of shared fish resources such as the Suckermouth Minnow and the Western Sand Darter.

S1 & S2 Inland Fish SGCN

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

Gulf Sturgeon

- Implement the federal recovery plan (USFWS 1995) for Gulf Sturgeon as well as the Louisiana State Conservation Plan for Gulf Sturgeon (LDWF 2015).
- Restock this species where populations may have been negatively impacted by anthropogenic activities.

Pallid Sturgeon

- Implement the federal recovery plan (USFWS 1993 and 2014 revision) for Pallid Sturgeon.

Paddlefish

- Implement the Louisiana recovery plan (Reed 1991) for Paddlefish.
- Restock this species where populations may have been negatively impacted by anthropogenic activities.

American Eel

- Install eel ladders at dams throughout the state to aid passage.
- Remove sills from the Pearl River.

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. Presence of these species 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 further the understanding of ecological processes in these systems. The Smalltooth Sawfish is the only federally listed marine fish in Louisiana, 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 effort. Therefore, for many of these species, the collection of baseline data is high priority.

a. Marine Fish SGCN

Common Name	Scientific Name	G-Rank	S-Rank
Tier I			
Smalltooth Sawfish	*Pristis pectinata*	G1G3	S1
Saltmarsh Topminnow	*Fundulus jenkinsi*	G3	S3
Texas Pipefish	*Syngnathus texanus*	G1	SU
Goliath Grouper	*Epinephelus itajara*	G2	S1
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	SU
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. Threats to Marine Fishes

Many marine fishes utilize marshes at some point in their life, and coastal marshes are often fragmented and subsequently degraded due to canals associated with energy production and the service corridors related to those activities. Furthermore, modifications to the natural hydrology of many systems have had negative impacts on both the quantity and quality of marsh habitat. Invasive species threaten marine fishes on several fronts, from marsh loss due to Nutria herbivory to direct predation of smaller native fishes by Lionfish. As with other aquatic SGCN, pollution from multiple sources is a concern. Finally, SLR and tropical cyclones also threaten habitat that is critical to marine species.

c. Marine Fishes Research and Survey Needs

- Determine the status of little known marine fishes (Frillfin Goby, Violet Goby, Emerald Sleeper, Large-scaled Spinycheek Sleeper) and determine habitat preferences of these species via focused surveys using appropriate gear (traps, oyster trays, etc.).
- 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.
- Research habitat value of sandy shoals off of Louisiana for SGCN.

<u>Lemon Shark</u>

- Determine species distribution in Louisiana.
- Implement long-term monitoring of the Lemon Shark nursery at the Chandeleur Islands.

<u>Smalltooth Sawfish & Goliath Grouper</u>

- Determine if there are reproducing populations of either species in Louisiana.

Tarpon

- Sample blackwater habitat using appropriate gear (e.g., cast nets, stop-nets, etc.) to determine status and habitat use.
- Research conservation genetics of Tarpon in Louisiana.

Texas Pipefish and Opossum Pipefish

- Determine current status and range of this species in Louisiana.

Broad Flounder

- Determine the status of this and other small flatfishes.

Southern Puffer

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

d. Marine Fishes Conservation Actions

- Conserve and restore Barrier Islands.
- Partner with the U.S. Army Corps of Engineers (USACE) to encourage the beneficial use of dredge material.
- Work with the Coastal Protection and Restoration Authority (CPRA), Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) program, USACE Louisiana Coastal Area (LCA) program, and other partners to incorporate strategies for SGCN into future coastal restoration efforts.

Smalltooth Sawfish

- Implement Smalltooth Sawfish Recovery Plan (NMFS 2009).

Tarpon

- Conserve blackwater habitat where found to benefit juvenile Tarpon.

Saltmarsh Topminnow

- Create and maintain emergent marsh islands, including at Atchafalaya Delta WMA, to benefit this species.

Pipefishes

- Conserve and restore marsh habitat and Submersed Aquatic Vegetation (SAV) beds.

Goliath Grouper

- Construct and retain artificial reefs.

Large-scaled Spinycheek Sleeper

- Restore oyster reefs to benefit this species.

6. Amphibians and Reptiles

One hundred forty species of amphibians and reptiles occur in 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. The greatest richness is in the Florida Parishes, east of the Mississippi River. St. Tammany Parish alone is home to 102 species. A secondary area of high richness is in the dissected uplands of central Louisiana. Areas with the lowest species richness include the coastal marshes and Mississippi River floodplain.

Sixteen species of amphibians (10 salamanders, 6 frogs) and 35 species of reptiles (17 turtles, 5 lizards, 13 snakes) are considered SGCN by LNHP (2015). The Dusky Gopher Frog and the Ornate Chorus Frog are considered extirpated in Louisiana (last observed in 1967 and 1954, respectively), and follow-up surveys have been unable to relocate them at historical sites or potential sites (Siegel and Doody 1992, Thomas 1996, Leonard et al. 2003). All marine turtles occurring in Louisiana are federally and state listed: three of the five are endangered, and the Loggerhead Sea Turtle and Green Sea Turtle are 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 Black Pinesnake and Louisiana Pinesnake are candidate species for federal listing, with the Louisiana Pinesnake recently proposed for listing as threatened.

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 louisianensis*	G5	S3
Strecker's Chorus Frog	*Pseudacris streckeri*	G5	S1
Eastern Spadefoot	*Scaphiopus holbrookii*	G5	S3
Hurter's Spadefoot	*Scaphiopus hurterii*	G5	S3

Common Name	**Scientific Name**	**G-Rank**	**S-Rank**
Tier I			
Ringed Map Turtle	*Graptemys oculifera*	G2	S2
Pearl River Map Turtle	*Graptemys pearlensis*	G2G3	S3
Western Chicken Turtle	*Deirochelys reticularia miaria*	G5	S2
Ornate Box Turtle	*Terrapene ornata*	G5T5	S1
Black Pinesnake	*Pituophis melanoleucus lodingi*	G4T2T3	S1
Louisiana Pinesnake	*Pituophis ruthveni*	G2	S2
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*	G4	S1
Texas Horned Lizard	*Phrynosoma cornutum*	G4G5	SX
Tier II			
Loggerhead Sea Turtle	*Caretta caretta*	G3	S1B, S3N
Green Sea Turtle	*Chelonia mydas*	G3T3	S1N
Kemp's Ridley Sea Turtle	*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
Northern Mole Kingsnake	*Lampropeltis 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
Pygmy Rattlesnake	*Sistrurus miliarius*	G5	S2

Harlequin Coralsnake	*Micrurus fulvius*	G5	S2
Tier III			
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricata imbricata*	G3T3Q	SZ
Alligator Snapping Turtle	*Macrochelys temminckii*	G3G4	S3
Smooth Softshell	*Apalone mutica*	G5	S3
Leatherback Sea Turtle	*Dermochelys coriacea*	G2	SZ
Ouachita Map Turtle	*Graptemys 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. Threats to Amphibians and Reptiles

As with other taxa, habitat fragmentation, degradation, and conversion resulting from development, agriculture, and transportation infrastructure serve as major stressors to many reptiles and amphibians. Magnitude of impact to these species is exacerbated by their limited mobility which prevents escape to refugia. Annual movements undertaken between breeding and non-breeding habitats characteristic of some reptile and amphibian SGCN exposes individuals to vehicle strikes, Feral Cats, and other hazards. For those species associated with upland habitats, including open pine systems, incompatible habitat management practices such as fire suppression, roller-chopping, and bedding may be an issue. For coastal species, the impacts of oil spills, SLR, and tropical cyclones may be locally devastating. Amphibians are vulnerable to many of the same threats that were discussed for other aquatic species (e.g., improper riparian zone management, climate change, etc.), with species in ephemeral wetlands and smaller streams most likely to be impacted. Over-collecting for the pet trade or for food has the potential to lead to or accelerate declines of long-lived turtle species. Wanton killing of snakes may be a significant source of mortality for some uncommon species such as Eastern Diamond-backed Rattlesnakes. So called “ghost traps” (i.e., derelict crab traps) are well known as a source of mortality for terrapins in some locations, and sea turtles are vulnerable to the impacts of by-catch in the absence of turtle-excluder devices (TEDs). Sandbar-nesting riverine turtles are vulnerable to human disturbance at nesting beaches, as well as nest flooding resulting from inopportune water releases upstream of such beaches. Red Imported Fire Ants are a serious threat to many terrestrial, adult amphibians and reptiles, as well as to the eggs and hatchlings of aquatic and terrestrial turtles. Some native species, such as Raccoons and Coyotes, are also a significant source of mortality for various life stages of some SGCN.

c. Amphibian Research and Survey Needs

- Monitor for emerging diseases in Louisiana amphibian populations including, but not limited to, chytridiomycosis (via *Batrachochytrium dendrobatidis* or *B. salamandrivorans*), ranavirus, and Perkinsus-like organism.

Eastern Tiger Salamander

- Determine current status and distribution in Louisiana via intensive, targeted surveys.
- Locate new breeding ponds.
- Conduct intensive, long-term monitoring of known breeding ponds.

Four-toed Salamander

- Locate important ephemeral ponds used for breeding.

Southern Dusky Salamander

- Clarify 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

- Conduct baseline surveys to clarify distribution and abundance.
- Investigate possible causes of decline for this species and other salamanders, including new or emergent diseases.

Webster's Salamander

- Determine current population status and trend.

Louisiana Slimy Salamander

- Generate population estimate and monitor population for determination of trend.

Gulf Coast Mud Salamander & Southern Red Salamander

- Determine current distribution and status via intensive, targeted surveys.

Gulf Coast Waterdog & Red River Mudpuppy

- Determine current distribution and abundance of both *Necturus* species via intensive sampling.

Ornate Chorus Frog

- Clarify current status via intensive, targeted surveys.
- Locate suitable habitat.

Strecker's Chorus Frog

- Clarify current status in Northwest Louisiana via intensive, targeted surveys.

Eastern and Hurter's Spadefoot

- Determine breeding locations via intensive surveys.

Dusky Gopher Frog

- Locate suitable ponds for reintroduction or areas for the creation of ponds (including Bogue Chitto National Wildlife Refuge (NWR) and Lake Ramsey WMA).

Southern Crawfish Frog

- Determine current status and distribution in Louisiana via intensive, targeted surveys.
- Conduct intensive, long-term monitoring of known breeding ponds.
- Locate potential reintroduction sites and locate new breeding ponds.
- Encourage timber companies to use BMPs (including the use of prescribed fire and elimination of bedding) when managing appropriate Crawfish Frog habitat.

d. Amphibian Conservation Actions

- Implement habitat management recommendations of Partners in Amphibian and Reptile Conservation (PARC) (Bailey et al. 2006) to benefit amphibian SGCN whenever possible on LDWF managed lands, and promote the implementation of such recommendations by 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) to reduce mortality by vehicle strikes and facilitate gene flow.
- Encourage timber companies to use BMPs (including the use of prescribed fire and elimination of bedding) when managing appropriate Eastern Tiger Salamander habitat.

- Conserve and create open-canopy ponds (e.g., Flatwoods Ponds and other ephemeral wetlands).

Four-toed Salamander

- Determine important ephemeral ponds used for breeding.

Southern Red-backed Salamander

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

Webster's Salamander

- Create and disseminate BMPs for Webster's Salamander
- Conserve Webster's Salamander on WMAs as well as private property by working with landowners.

Louisiana Slimy Salamander

- Implement and promote the use of BMPs and SMZs in appropriate habitat.
- Retain snags, logs, and other woody debris in suitable habitat.

Gulf Coast Mud Salamander & Southern Red Salamander

- Implement and promote BMPs to beneficially manage habitat for these species.

Gulf Coast Waterdog & 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.
- Promote the use of SMZs to protect water quality in watersheds where these species are found.
- Retain submerged, woody debris.

Eastern Spadefoot

- 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 or remove hardwoods from existing ponds in suitable habitat for reintroduction attempts.
- Work with TNC and other partners to provide education and outreach about this species to the public, including landowners.
- Explore opportunities for propagation and reintroduction into Louisiana.

Southern Crawfish Frog

- Explore opportunities for reintroduction.
- Restrict use of bedding during silvicultural activity in suitable or historical habitat.

e. Reptile Research and Survey Needs

- Monitor for emerging diseases in Louisiana reptile populations including, but not limited to, snake fungal disease, upper respiratory tract disease (Gopher tortoise), herpesvirus, etc.

Loggerhead Sea Turtle & Kemp's Ridley Sea Turtle

- Assess beach habitat statewide for nesting suitability and prioritize areas for nesting surveys.
- Document occurrence and level of nesting activity.
- Continue to collect and update data on the distribution of these species in state waters via coordination with Marine Fisheries, and incorporate sea turtle by-catch data into the LNHP database in order to clarify status and distribution.

Alligator Snapping Turtle

- Construct life-history table.
- Monitor populations throughout the state to inform population trend calculation.
- Investigate impacts of commercial fisheries by-catch and continued recreational harvest on populations.

Riverine Turtles

- Determine the magnitude of impact of submergence of sandbars due to water releases from upstream reservoirs on productivity of riverine turtles.
- Determine peak nesting times for riverine turtles in all major rivers to support efforts to minimize negative impacts to productivity.

Ringed & Pearl River Map Turtles

- Conduct ecological studies of reproduction, nest success and recruitment.
- Generate population estimates via intensive mark-recapture (or mark-resight) surveys.

Western Chicken Turtle

- Determine occurrence, distribution, habitat preference, and nesting ecology.
- Determine habitat use, movements, and activity patterns via radio telemetry or other tracking technology.

Mississippi Diamond-Backed Terrapin

- Conduct nesting surveys and research to determine nesting ecology.
- Collect life history data necessary to construct life-history tables.
- Investigate active crab trap and ghost trap by-catch in areas known to have viable populations.
- Investigate methods to reduce capture in crab traps (i.e., By-catch Reduction Device (BRD) and/or to develop biodegradable panels to limit by-catch in ghost traps.

Ornate Box Turtle

- Determine current status by conducting intensive surveys of historical localities and suitable habitat.
- Perform life history studies on extant populations, if rediscovered.
- Determine habitat use, movements, and activity patterns via radio telemetry.

Stripe-necked Musk Turtle

- Determine current status.

Razor-backed Musk Turtle

- Clarify status and determine the effect of commercial harvest on populations via targeted surveys and long-term monitoring.

Gopher Tortoise

- Generate population estimate and determine distribution.
- Monitor reproduction and recruitment.
- Assess nest depredation, including impacts of mammalian predators and RIFA.
- Investigate the feasibility of re-stocking Gopher Tortoises.

Western Slender Glass Lizard

- Determine habitat requirements and investigate the relationship between this species and grassy swales.

Southern Prairie Skink

- Determine current status.

Coal Skink

- Determine status and habitat preferences.

Texas Horned Lizard

- Determine current status and document any extant occurrences.
- Investigate the possibility of reintroduction.

Western Worm Snake

- Determine current status and distribution via intensive surveys in historical range.

Common Rainbow Snake

- Determine current status and distribution, as well as basic ecology, via intensive surveys.
- Determine best trapping methods for this species.

Eastern Hog-nosed Snake

- Determine current status and distribution.
- Determine limiting factors and potential causes of decline.

Northern Mole Kingsnake

- Determine current status and distribution via intensive surveys

Black Pinesnake

- Determine the current status of this species via surveys of historical range.

Louisiana Pinesnake

- Determine the limits of the species' range and population size in Louisiana.
- Research nesting ecology, nest success, and other basic life-history factors.

- Determine best methods for detection and monitoring.
- Determine the extent to which ROWs are used and the condition of snakes using ROWs.
- Investigate impacts of timber harvesting on this species, particularly roller chopping.
- Investigate the effects of various land uses on this species.

Pine Woods Littersnake

- Determine status, distribution, and basic life-history traits.

Southeastern Crowned Snake

- Perform studies of basic ecology.
- Determine what factors are contributing to the range contraction observed for this species.

Harlequin Coral Snake

- Determine if this species is extant in Louisiana via intensive surveys.

Eastern Diamond-backed Rattlesnake

- Determine if viable populations of this species occur in Louisiana.

Timber Rattlesnake

- Monitor for the presence of disease in Timber Rattlesnakes.

f. Reptile Conservation Actions

- Encourage the use of wildlife friendly erosion control blankets.
- Provide education and outreach to reduce the wanton killing of snakes.
- Partner with DOTD to provide road crossings to limit road mortality.

Sea Turtles

- Promote the use of TEDs.
- Provide educational/outreach materials and services regarding sea turtles in Louisiana.
- Protect potential and documented nesting beaches in Louisiana.
- Restore and undertake stewardship activities to improve habitat quality of Louisiana beaches.
- Address potential impacts to these species during Environmental Permit reviews.
- Outlaw intentional release of helium-filled balloons.

Loggerhead Sea Turtle & Kemp's Ridley Sea Turtle

- Protect and restore Louisiana Beach habitat.
- Require mitigation measures during dredging operations near where females aggregate prior to breeding, particularly areas west of the mouth of the Mississippi River.

Alligator Snapping Turtle

- Headstart and restock to supplement local populations as needed.
- Control nest predators, including RIFA, in known nesting areas.
- Retain riparian buffers as well as emergent and submerged woody debris.
- Discourage winter drawdowns to increase hatchling survival.
- Promote a recreational harvest check system and require commercial fishermen to report by-catch landings.

Smooth Softshell & Map Turtles

- Work with partners to protect/restore sandbars in Louisiana rivers.
- Control exotic plants and animals on sandbars.
- Restrict or outlaw the use of ORVs on sandbars and in streams, particularly the practice of "mud-riding" through streambeds.
- 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.
- Retain emergent and submerged woody debris (subsidize if warranted) and provide education and outreach regarding the importance of this habitat component.
- Work with USACE, Sabine River Authority (SRA), and other appropriate partners to time the regulation of water levels to minimize impacts to nesting turtles.

Smooth Softshell & 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 and surrounding, important nesting areas.
- Incorporate adjacent uplands into wetland protection and restoration efforts.
- Implement BMPs to benefit this species, particularly the elimination of bedding during silvicultural operations.

Mississippi Diamond-backed Terrapin

- Conserve and restore Coastal Dune Grassland, Coastal Dune Shrub Thicket, and shell rake habitat to ensure availability of adequate nesting sites.
- Remove derelict crab traps from coastal waters to limit incidental mortality of Diamond-backed Terrapins.
- Promote and if possible require the use of TEDS on crab traps.

Ornate Box Turtle

- Conserve, restore, and provide and promote stewardship of Coastal Prairie.

Gopher Tortoise

- Work with landowners to manage habitat for the benefit of Gopher Tortoises.
- Provide education and outreach regarding Gopher Tortoise and the importance of leaving individuals in native habitat.
- Develop a comprehensive “waif” tortoise plan for the state.
- Maintain and restore open pine habitat, especially through the use of prescribed fire
- Translocate isolated individuals to known areas of lower concentration to bolster reproduction; provide disease screenings prior to translocations.
- Implement predator control and assess nest depredation in important areas as needed.

Western Slender Glass Lizard

- Conserve and restore Longleaf Pine habitats, Coastal Prairies, and Cheniers, including restoration and management of native grasses.

Eastern Glass Lizard

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

Northern Mole Kingsnake

- Manage and restore open-pine habitats.

Black Pinesnake

- Manage and restore open-pine habitat within the historical range of this species.
- Discourage bedding and stump removal during silvicultural operations.

Louisiana Pinesnake

- Maintain and restore open-pine habitat within the species' range especially through the use of prescribed fire.
- Continue to partner with the Louisiana Pinesnake Working Group.
- Work with zoos on reintroduction projects.
- Work with landowners to manage habitat for the benefit of Louisiana Pinesnakes.
- Develop Candidate Conservation Agreements with Assurances (CCAA) with private landowners.

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.
- Consider patch size needs of this species during development of timber prescriptions and construction of transportation infrastructure.

7. Birds

Approximately 160 species of birds occur as breeders or year-round residents in Louisiana (Wiedenfeld and Swan 2000), and more than 300 additional species are known to migrate through or spend the nonbreeding season in the state or its adjacent waters (Cardiff et al. 2014). There are 91 species on the SGCN list of which 51 species are considered rare and local, imperiled, or critically imperiled by the LNHP (2015). Recovery plans have been developed by the USFWS for federally-listed birds including the Whooping Crane, Red-Cockaded Woodpecker, Piping Plover, and Interior Least Tern (USFWS 1994, 2003, 1996, 1990). 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. The *rufa* subspecies of the Red Knot was federally-listed as threatened in 2014.

Five of the nine extant or presumed extant, federally-listed bird species are believed to be extirpated in Louisiana.[1] Despite sporadic, occasional reports of Ivory-Billed Woodpecker (*Campephilus principalis)* sightings, observers have invariably failed to document credible or compelling evidence of the persistence of this species in our state. The most recent, presumed credible report was of a pair of birds observed in Pearl River WMA in April 1999, but all subsequent attempts to document the woodpecker's presence in Louisiana were unsuccessful (Fitzpatrick 2002). With the presumed discovery of this

[1] Passenger Pigeon (*Ectopistes migratorius*) and Carolina Parakeet (*Conuropsis carolinensis*), not included in this figure, were once both commonly occurring species in Louisiana, but went extinct in the early 1900s.

species in Arkansas in 2004 (Fitzpatrick et al. 2005), LDWF made the decision to include the Ivory-billed Woodpecker on the 2005 WAP SGCN list in the event of a confirmed re-discovery here. However, the species is removed from the list of SGCN for this revision due to the lack of recent, verifiable sightings; Ivory-billed Woodpecker is no longer considered to occur in Louisiana by LDWF. Other species with historical range in Louisiana but now considered extirpated here include Attwater's Greater Prairie-Chicken, Eskimo Curlew, and Bachman's Warbler. Efforts are currently underway to reintroduce the formerly-extirpated 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	SXN
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	*Antigone 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
American Redstart	*Setophaga ruticilla*	G5	S3B
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
Eastern Meadowlark	*Sturnella magna*	G5	S4

b. Threats to Birds

Many threats discussed for other taxa also apply to birds, including habitat degradation, fragmentation, and conversion resulting from development or agriculture. For birds, habitats most in peril include Barrier Islands, threatened primarily by natural system modification, climate change, SLR and subsidence, and tropical cyclones, and coastal forests of all types (e.g., Coastal Live Oak-Hackberry Forest, Barrier Island Live Oak Forest, etc.), threatened by a number of factors, many of which overlap those of Barrier Islands. Additionally, the conversion of agricultural land from rice and crawfish aquaculture to lower wildlife value crops is of concern for many wetland dependent species. Migratory species may be threatened by habitat loss within their breeding and nonbreeding ranges, including loss of stopover sites. Disturbance of nesting birds, particularly of colonial nesting species, may greatly negatively impact productivity and should be prevented. Stewardship at beach nesting bird colonies can be extremely effective. Natural system modifications of all types, including fire suppression and hydrological modification threaten a wide range of bird species. Aforementioned habitat impacts and stressors listed below will likely exacerbate loss of birds when those impacts are combined with effects of climate change. High mobility of birds may mitigate impacts to some species, but others, particularly coastal obligates, remain at high risk due to SLR.

In addition to loss of habitat or habitat function, birds suffer direct mortality from many other anthropogenic sources including ingestion of plastics, electrocutions from power lines, fisheries' by-catch, collisions with infrastructure (e.g., communication towers, wind turbines, power lines, glass windows, etc.), vehicle strikes, poisoning from toxic releases, predation by outdoor cats, and many others. Although great strides have been made in recent decades in addressing and reducing some sources of pollution, including pesticides such as DDT, pollution of various types remains a threat to bird SGCN. Inland, nearshore, and offshore oil spills pose serious direct threats to both inland species and, particularly, coastal species, which frequently nest in high densities. Although not yet a major issue in Louisiana, concern exists regarding the potential impacts of wind farms on birds, especially in areas of high bird density (e.g., rice fields with waterfowl or wading birds) or areas utilized by large, soaring species such as vultures and eagles, which are killed disproportionately compared to other bird groups. Mortality resulting from collisions with communication towers is significant, but may be minimized, in part, by changing light schemes on these towers or even the structures themselves. Glass windows kill more birds in the U.S. than all other mortality factors except outdoor cats; more than 350 million birds are killed annually in the U.S. due to window-strikes (Loss et al. 2014). Incorporation of bird-safe or bird-friendly building design into new structures could aid in reducing this loss [see Audubon Minnesota's Bird-Safe Building Guidelines (2010) and American Bird Conservancy's Bird-friendly Building Design (2011)]. Reduction of the reflectance of existing windows and covering windows with screen (traditional or natural materials) will reduce mortality.

The most insidious threat to birds is predation by Feral Cats (including outdoor, owned cats), which are considered a Tier I invasive species in the 2015 WAP (Chapter 6). Cats kill far more birds annually in the U.S. than all other direct anthropogenic sources (Loss et al. 2013), with current estimates exceeding 2 billion birds per year. Other invasives, both plants and animals, threaten native birds as well, whether through predation, competition for nest cavities or other resources, or habitat modification. In addition, the full extent of intentional, illegal destruction of birds is unknown, but for some high profile species, it is a conspicuous source of mortality.

c. Bird Research and Survey Needs

- Use standardized monitoring protocols for birds such as the national protocol for secretive marsh birds, the U.S. Geological Survey (USGS) Breeding Bird Survey (BBS) protocol, and others.
- Participate in regionwide planning and survey efforts such as Southeast Partners in Flight (SEPIF) and the Gulf of Mexico Avian Monitoring Network (GOMAMN).
- Work with the USGS National Wildlife Health Center to monitor emerging avian diseases that have the potential to affect wildlife populations, such as Avian Influenza (H5N2 and the high pathogenicity H5N8).
- Derive population estimates and objectives for all bird SGCN.
- Validate existing and future modeling efforts.
- Update the Louisiana Breeding Bird atlas.
- Implement a statewide network of VHF receiver stations to allow tracking of birds to inform full life cycle conservation.
- Collect baseline life-history data to allow for the construction of life-history tables.

<u>Waterfowl</u>

- Evaluate the effectiveness of current coastal marsh conservation and restoration strategies at providing waterfowl habitat.
- Evaluate the importance of crawfish aquaculture for waterfowl.
- Quantify the importance of refugia from hunting pressure for winter waterfowl conservation.

<u>Mottled Duck</u>

- Research demography (e.g., nest success, brood success rates, annual recruitment, and annual survival rates), molting habitat needs, and limiting factors, including how these measures are impacted by landscape characteristics and management activities.
- Identify primary mortality sources for all life stages.

<u>Lesser Scaup</u>

- Research ecology and movements of wintering Lesser Scaup.

<u>Northern Bobwhite</u>

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

Colonial Nesting Waterbirds

- Collect baseline life-history data to allow for the construction of life-history tables.
- Conduct colony surveys to update LNHP database.
- Develop a long term monitoring framework and methodology that may be used to determine status and trends of colonial nesting waterbird populations.
- Identify foraging areas and quantify distances traveled by individual birds to reach those areas.
- Monitor disturbance and effects of disturbance at nesting colonies.
- Develop management recommendations for inclusion in coastal restoration plans.

Wood Stork

- Characterize use and availability of foraging and roosting habitat.
- Derive a population estimate and population objective for this species.

Brown Pelican

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

Reddish Egret

- Locate nesting, roosting, and foraging areas to prioritize conservation actions.
- Quantify the response of breeding birds to management activities that may impact nesting colonies.
- Implement satellite tracking of Reddish Egrets to determine stopover sites and important wintering areas.
- Conduct targeted surveys (including nesting surveys) to accurately determine population size or index.
- Determine limiting factors on reproduction.
- Ensure goals of studies align with regional goals of the Reddish Egret Working Group.

Swallow-tailed Kite

- Monitor public and private lands to fill data gaps in breeding distribution and abundance.
- Quantify magnitude of threats that may be limiting occupancy and productivity.
- Identify potential factors for observed decreases in breeding density within portions of the current breeding range in Louisiana.
- Participate in the region-wide, pre-migration roost monitoring program.

Bald Eagle

- Research stopover sites, migration routes, and threats to Bald Eagles.
- Monitor nesting and productivity by aerial surveys every five years.

Rails

- Quantify proportion of population that is resident vs. migratory.
- Expand existing surveys (including callback surveys and nest surveys) to determine population densities and distribution statewide.
- Determine population densities and distribution during the non-breeding season.
- Develop a long term collaborative monitoring framework and methodology for assessing secretive marsh bird populations that may be used to determine status and trends region wide.

Yellow Rail

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

Black Rail

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

King Rail

- Determine brood survival and other demographic measures across habitats including working wetlands.
- Validate existing and future modeling efforts.

Shorebirds

- Collect data on prey availability and habitat use including the influence of landscape scale characteristics to inform management and aid in the development of BMPs.
- Develop management recommendations for inclusion in coastal restoration plans.

Snowy Plover & Wilson’s Plover

- Monitor breeding and nonbreeding populations statewide.
- Develop management recommendations for inclusion in coastal restoration plans.

Piping Plover

- Monitor trends in abundance and distribution via long-term surveys.

American Oystercatcher

- Conduct targeted surveys (including nesting surveys) to accurately determine population size or index.
- Conduct research to assess the limiting factors on reproduction.
- Implement satellite tracking of American Oystercatchers to determine stopover sites and important wintering areas.
- Locate nesting, roosting, and foraging areas to prioritize conservation actions.
- Ensure goals of studies align with regional goals of the American Oystercatcher Working Group.

Red Knot

- Conduct satellite telemetry studies of Red Knots to determine subspecies and elucidate habitat use and migratory routes of Red Knots that winter in Louisiana to promote more efficient full life cycle conservation of this species.
- Develop management recommendations for inclusion in coastal restoration plans.

American Woodcock

- Develop protocols to monitor winter abundance of American Woodcock.
- Determine limiting factors for breeding and non-breeding birds.

Terns

- Research limiting factors for nesting terns.
- Develop management recommendations for inclusion in coastal restoration plans.
- Monitor breeding and non-breeding populations statewide.

Sooty Tern

- Develop a long term monitoring framework and methodology for assessing populations of this and other pelagic birds that may be used to determine status and trends.

Landbirds

- Participate in population monitoring programs such as USGS BBS as well as Christmas Bird Counts (CBCs).

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 (LAMP) to increase collection of data for this species, as it is not well-surveyed by other monitoring programs.
- Research 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.
- Quantify magnitude of limiting factors and threats to the population such as predation and West Nile virus.

Loggerhead Shrike

- Collect data on year-round distribution and abundance, vital rates, territory size, and availability of suitable nesting sites across habitats.
- Evaluate changes in available habitat over time.
- Initiate research into causes of decline and determine limiting factors on both residents and migrants.
- Quantify direct and indirect impacts of RIFA on breeding and wintering birds.
- Quantify proportion of population that is resident vs. migratory.
- Ensure goals of studies align with regional goals of the Loggerhead Shrike Working Group.

Neotropical Migratory Landbirds

- Implement energetics study of food resources on Cheniers and other critical stopover habitats to develop an energetics model relating habitat to refueling rates
- Determine impact of habitat characteristics and landscape scale variables on the value of stopover habitat.
- Develop and access weather radar as a tool to provide information to prioritize habitats for conservation and restoration.

- Utilize geolocators or other tracking technology to determine connectivity of breeding and nonbreeding areas.

Bell's Vireo

- 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.

Prothonotary Warbler

- Utilize geolocators or other tracking technology to determine connectivity of breeding and nonbreeding areas, including stopover sites.

Bachman's Sparrow

- Develop estimates of current distribution and population size statewide.
- Determine relationship between population size and vegetation succession on quality sites and investigate utility of management of refugia.
- Research dispersal behavior to maximize the benefits of future habitat management.
- Monitor reproductive success to determine limiting factors.

Field Sparrow

- Determine breeding and nonbreeding population abundances and assess the amount and quality of available habitat statewide.

Grasshopper Sparrow

- Determine breeding and nonbreeding population abundances and assess the amount and quality of available habitat statewide.

LeConte's Sparrow

- Determine suitable grassland patch size, species composition, structure and landscape habitat matrix needed to support nonbreeding birds.

Nelson's Sparrow

- Determine current abundance and distribution in relation to habitat changes.

Seaside Sparrow

- Estimate annual survivorship, especially during non-breeding season.
- Assess accuracy of Partners in Flight (PIF) population estimate.
- Model population response to predicted habitat changes, such as SLR.
- Determine current abundance and distribution in relation to habitat changes.

Rusty Blackbird

- Determine nonbreeding population abundance and habitat use.

d. Bird Conservation Actions

- 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.
- Develop plan to reduce impact of Feral Cats on bird populations.
- Promote the design and construction of bird-friendly buildings.
- Partner with CPRA and other coastal partners to ensure habitat restoration and creation efforts maximize benefits to wildlife.
- Develop partnerships for habitat management with Landscape Conservation Cooperatives (LCCs) and Joint Ventures (JVs).
- Manage habitat to benefit bird SGCN through the Private Lands Program.
- Utilize the East Gulf Coastal Plain Joint Venture’s (EGCPJV) Communication Strategy for Prescribed Fire and Fire Adapted Habitats to promote prescribed fire.

Waterfowl

- Create, enhance, and maintain high-quality habitat across Louisiana.
- Work with Ducks Unlimited (DU), Delta Waterfowl (DW), NRCS, and USFWS to ensure that quality habitat is distributed across the landscape.
- Encourage rice farming, rather than conversion to crops with lower wildlife value, north of coastal marshes, and promote practice of traditional rice production methods over less valuable, dry-seeded rice farming.
- Partner with DU, DW, USFWS, and other partners to conserve habitat on the northern breeding grounds.
- Work with CPRA, CWPPRA program, USACE LCA program, and other partners to incorporate strategies specifically targeting important wintering areas in all future coastal restoration efforts.
- Support efforts to replace or improve infrastructure for managing coastal marshes, such as the efforts funded through the Louisiana Waterfowl Project South.
- Support efforts to provide strategically located refugia in the agricultural landscape of southwest Louisiana, such as currently provided through the Waterfowl Rest Areas Program.

Mottled Duck

- Create and/or restore large blocks of nesting habitat in agricultural lands and coastal marshes.
- Provide brood-rearing habitat from mid-April through July in agricultural landscapes through wetland restoration and water delivery.
- Maintain low salinities (<6-8 parts per thousand) in coastal marsh through hydrologic restoration to enhance brood-rearing habitats.
- Where warranted and feasible, improve nest success by minimizing interactions with predators.

Northern Bobwhite

- Develop partnerships for habitat management with LCCs and JVs.
- Manage habitat to benefit this species through the Private Lands Program.
- Implement recommended habitat restoration actions specified by the National Bobwhite Conservation Initiative (NBCI).
- Manage habitat to benefit this species on WMAs, NWRs, National Forests, and other public lands where appropriate.

Waterbirds, including Colonial Nesting and Solitary Nesting

- Support CPRA, CWPPRA program, USACE LCA program, and other partner efforts for shoreline stabilization and habitat restoration, especially that of Barrier Islands and other coastal islands, and incorporate strategies specifically targeting important nesting and nonbreeding areas in all future coastal restoration efforts by these and other partners.
- Provide CPRA and other coastal restoration partners necessary information on colonial nesting birds to ensure habitat restoration and creation efforts maximize benefits to wildlife.
- Develop new and improve existing partnerships for protection and restoration of coastal marshes.
- Monitor colonies for impacts of predators and conduct targeted predator removal as needed.
- Provide public education regarding the importance and sensitivity 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 LCCs and JVs to implement recommendations of shorebird and wading bird conservation plans.
- Create bird nesting islands when and where feasible, and explore potential partnerships and funding mechanisms to support such construction.
- Provide artificial nest platforms to increase available nest sites where warranted.

Reddish Egret

- Apply colony-specific management actions as needed.
- Create or improve alternate colony sites.
- Improve foraging habitat within ten kilometers of existing colonies.
- Implement the Gulf Coast Joint Venture's (GCJV) Reddish Egret Conservation Plan
- Collaborate with the Reddish Egret Working Group to further goals common to the region.

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

- Coordinate with timber companies for Bald Eagle management plans.
- Implement buffers around easily accessible nest trees to minimize disturbance.

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

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

Shorebirds

- Identify, conserve, and monitor shorebird nonbreeding locations, including stopover sites.
- Partner with LCCs, JVs, USFWS, NRCS, and other interested groups to encourage landowners to manage water levels to provide habitat for shorebirds during migration; acquire and manage properties for shorebird use in underrepresented areas.
- Manage moist soil units on WMAs and refuges to provide suitable stopover habitat where appropriate.

Long-billed Curlew

- Provide inland, managed, dry to saturated habitat moderately to densely covered in short to medium height grasses (preferably native species), from July 15 to November 5.
- Provide additional acreage of similar habitat, if found to be limited on landscape, from 15 March to 31 May.

Buff-breasted Sandpiper

- Provide inland, managed short grass habitat or bare soil/water interface habitat, ideally pesticide and herbicide free, from July 15 to November 5.
- Provide additional acreage of similar habitat, if found to be limited on landscape, from 15 March to 31 May.

Short-billed Dowitcher

- Provide inland, managed habitat that is saturated to flooded (optimal flooding depths range from 2-16 cm), with sparse or no vegetation from July 15 to November 5.
- Provide additional acreage of similar habitat, if found to be limited on landscape, from 15 March to 31 May.

American Woodcock

- Develop partnerships with state and federal agencies, Non-governmental organizations (NGOs), and the private sector to implement the American Woodcock Management Plan.
- Manage habitat to benefit this species on state, federal, and private lands where appropriate.

Shorebirds & Seabirds

- Work with CPRA, USACE, and other partners to continue the beneficial use of dredge material.
- Work with the CPRA, CWPPRA program, USACE LCA program, and other partners to incorporate strategies specifically targeting important nesting and wintering areas in all future coastal restoration efforts.

Plovers and Coastal Least Tern

- Work with landowners/parishes to exclude grazing livestock from beaches.
- Control Feral Hogs on and around known nesting beaches.
- Restrict or outlaw the use of All-Terrain Vehicles (ATVs) and other ORVs from nesting areas, especially during nesting season.
- Conserve and restore mainland beach and Barrier Island habitats.

- Use signs, stewards, and symbolic fencing to protect nesting birds.
- Develop and implement a comprehensive survey methodology to determine long-term trends in populations.

Terns

- Develop partnerships to strengthen the protection and restoration of Barrier Islands.
- Use signs, stewards, and symbolic fencing to protect nesting birds.
- Develop and implement a comprehensive survey methodology to determine long-term trends in populations.

Interior Least Tern

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

Landbirds

- Utilize PIF documents for informing management decisions.
- Work with NRCS, USFWS, U.S. Forest Service (USFS), and other partners to develop and distribute outreach materials concerning the importance of early successional habitats for SGCN.
- Promote and conduct forest management practices that benefit landbirds.

Red-headed Woodpecker & Brown-headed Nuthatch

- Use prescribed fire to maintain open pine systems.
- Use the Open Pine Desired Forest Conditions (DFCs) 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

- Implement the Louisiana Statewide Red-cockaded Woodpecker (RCW) Safe Harbor Program.
- Support USFWS recovery efforts outlined in the RCW Recovery Plan (USFWS 2003).
- Establish 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.

Southeastern American Kestrel

- Develop a nest box program focusing on known or suspected nesting areas and engage the public in this program.

Loggerhead Shrike

- Conserve and acquire Coastal Prairie and other native grasslands.
- Maintain low, thick, shrubs in grasslands and pastures (3-10 shrubs or small trees per acre), where compatible with habitat restoration goals of region.
- Collaborate with the Loggerhead Shrike Working Group to prioritize goals common to partners.

Neotropical Migrant Landbirds

- Promote sustainable land-use practices on remaining Cheniers.
- Work with landowners to prevent or reduce grazing livestock access to Cheniers.
- Conserve and restore coastal forest habitats, including reforestation where appropriate.
- Acquire and manage nonbreeding habitat in Mexico, Central and South America, and the Caribbean.
- Restore and manage Bottomland Hardwood Forest within the Mississippi River Alluvial Plain (MAV).

Prothonotary Warbler

- Retain snags for nesting and supplement with nest boxes if nest sites are a limiting factor.

Grassland Birds

- Partner with NRCS and the Louisiana Native Plant Initiative (LNPI) 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.

Bachman's Sparrow & Henslow's Sparrow

- Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.
- Conserve and restore Longleaf Pine grassland habitats.

LeConte's Sparrow

- Manage native grasslands with the application of prescribed fire at appropriate fire return intervals.

Seaside Sparrow

- Create and restore Salt to Brackish marsh, preferably in blocks ≥10,000 acres, containing areas of medium and tall height Smooth Cordgrass (*Spartina alterniflora*), interspersed with ponds, tidal creeks, and bare ground areas.

9. Mammals

Seventy mammal species have been recorded in Louisiana or its adjacent waters (Lowery 1974). Thirteen species are considered rare and local, imperiled, or critically imperiled by the LNHP (2015). There are four federally-listed mammal species in Louisiana that are considered SGCN. Recovery plans for the Louisiana Black Bear (USFWS 1995b) and West Indian Manatee (USFWS 2001) have been developed by USFWS. 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 may not 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*	G1G2	S1
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*	G5	S4T1
Eastern Spotted Skunk	*Spilogale putorius*	G4	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 bachmani*	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. Threats to Mammals

Louisiana's mammal SGCN are highly diverse in ecology and habitat preference, and as such, almost all of the 1st level threats identified by Salafsky et al. (2008) apply to at least one mammal SGCN. Many of these species are subject to direct habitat loss and degradation resulting from development and agriculture, as discussed for other taxa. Marine mammals are at risk from oil spills and other toxic releases, and, as with birds, wind farms pose a potential threat to many bats. Also of concern for bat SGCN is the replacement of "bat-friendly" bridges with designs that are of lower value to these species. Some SGCN, including predators, rodents, and bats, are subject to varying degrees of human persecution. As with all SGCN, natural system modification is one of the most serious threats to many mammals. One of the most high profile threats to bats is White-nose Syndrome, which has not yet been documented in Louisiana, but has been detected in neighboring states. Whether terrestrial or aquatic, all mammal SGCN are potentially impacted by pollution. Finally, although many mammals are predicted to be fairly resilient to the impacts of climate change, there is some level of risk, particularly to range-restricted species.

c. Mammal Research and Survey Needs

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

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.

Eastern Chipmunk

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

Northern Pygmy Mouse

- Determine current abundance and distribution via targeted surveys.

Hispid Pocket Mouse

- Determine current abundance and distribution via targeted surveys.
- Research habitat requirements and basic life history.

Oak Ridge Pocket Gopher

- Determine the current status and distribution of this subspecies in Louisiana.
- Research the natural history of this subspecies in Louisiana.

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 Pinesnake.
- Investigate methods to increase colonization rates of clearcuts or restored habitat.

Prairie Vole

- Determine current status in state via intensive, targeted surveys in historical range.

Golden Mouse

- Determine current abundance and distribution via targeted surveys.
- Research habitat requirements and preferences.

Eastern Harvest Mouse

- Determine current abundance and distribution via targeted surveys.
- Research life history and habitat requirements.

Southeastern Shrew

- Determine current abundance and distribution and habitat use via targeted surveys.
- Research impacts of RIFA on this species.

Bats

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

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.

Southeastern Myotis

- Determine locations of large winter roosts via telemetry.

Northern Long-eared Bat

- Conduct surveys to determine current status, distribution, and habitat use.
- Determine habitat use and foraging ecology via telemetry.

Long-tailed Weasel

- Determine current status and distribution via intensive surveys.
- Determine habitat preferences and requirements of this species.

Eastern Spotted Skunk & Ringtail

- Determine current status in state via intensive, targeted surveys in historical range.

West Indian Manatee

- Determine habitat use, movement patterns, and behavior in Louisiana waters.
- Evaluate SAV availability and the potential need for restoration.

- Develop a database of warm water discharge locations throughout the coastal zone.

Bottlenose Dolphin

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

Sperm Whale

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

d. Mammal Conservation Actions

West Indian Manatee

- Raise public awareness of this species to increase reports of sightings to the LNHP.
- Provide educational/outreach materials about this species.
- Respond to manatee strandings and conduct necropsies when possible.

Bachman's Fox Squirrel

- Develop habitat management recommendations to benefit this subspecies.

Eastern Chipmunk

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

Hispid Pocket Mouse

- Support use of prescribed fire to maintain appropriate habitat.

Prairie Vole

- Conserve and restore Coastal Prairie.

Oak Ridge Pocket Gopher

- Promote BMPs that favor the growth of herbaceous plants where this subspecies is found.

Baird's Pocket Gopher

- Develop a HSI for pocket gophers in Louisiana.
- Promote prescribed fire and restore open pine habitat within the range of this species, and continue Coastal Prairie stewardship actions.

Golden Mouse

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

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.
- Develop BMPs for bats and disseminate to timber companies and other private landholders.

Rafinesque's Big-eared Bat & Southeastern Myotis

- Use Desired Stand Conditions (DSCs) and BMPs found in the Lower Mississippi Valley Joint Venture (LMVJV) document "Restoration, Management, and Maintenance of Forest Resources in the Mississippi Alluvial Valley (MAV)," including the retention of snags.
- Work with landowners to implement proper habitat management to benefit these species.

Louisiana Black Bear

- Increase connectivity through the establishment and maintenance of corridors.
- Partner with DOTD to provide road crossings to limit road mortality.
- Support outreach and education to increase public acceptance of bears and reduce nuisance behavior.
- Work with landowners to manage habitat to benefit this species.
- Work with USFWS and other partners to implement the recovery plan (USFWS 1995b) for this species.

Bottlenose Dolphin

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

D. 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 natural communities, thereby benefitting large numbers of SGCN. As with the conservation actions presented earlier in this chapter, this list is plastic and not comprehensive. Actions are divided into five categories: Partnerships, Education, Research and Inventory, Habitat Impact Avoidance, and Stewardship Implementation.

1. Partnerships

- Partner with NGOs, state and federal agencies, industry, and private landowners to promote conservation of natural communities.
- Partner with DOTD, particularly in planning phases, to address wildlife-vehicle strike minimization measures such as creating wildlife crossings.
- 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 (IRT) 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.
- Partner with the Southeastern Regional Partnership for Planning and Sustainability (SERPPAS) to develop and expand training opportunities for prescribed burning certification and to promote prescribed fire and conservation in the Southeast.
- Promote WAP priorities within the framework of the Southeastern Conservation Adaptation Strategy (SECAS) in order to develop regionwide conservation strategies for SGCN and their habitats.

2. 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, as well as the Board of Regents.

- 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.
- Provide information on WAP SGCN and associated habitats for teachers and other workshop participants (Future Farmers of America (FFA), Envirothon, etc.) to ensure their use in Louisiana schools.
- Develop and publish information regarding beneficial management practices and 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.
- Leverage resources such as the Teaming With Wildlife Coalition and Master Naturalist chapters to improve public awareness of conservation issues.

3. 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 species and 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.
- Continue and expand, as deemed appropriate, to investigate and quantify the effects of oil spills on SGCN via additional research and monitoring, as well as mechanisms to mitigate for such impacts.

4. 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.

5. Stewardship Implementation

- Promote the utilization of federal cost share programs (e.g., NRCS) to address habitat conservation issues such as invasive species 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, more staff certified to apply herbicides, and staff qualified to use mechanical equipment to improve habitat (e.g., brush removal in prairies).

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CHAPTER 5. HABITAT CONSERVATION

A. Introduction

This chapter provides information on the wildlife habitats of Louisiana. The information presented here is largely drawn from The Natural Communities of Louisiana (LNHP 2009), which is the latest natural community classification available for the state. Habitats are named and described based on vegetation, landscape position, soils, and ecological processes. The habitat classification employed here is not congruent with the National Vegetation Classification System (NVCS; USNVC 2015). The finest classification level in the NVCS is the Ecological Association. In some cases, habitats presented here are equivalent to an Ecological Association in the NVCS. However, most habitats in this Wildlife Action Plan (WAP) are slightly broader in concept and capture several ecological associations. Appendix J places the habitats presented in this chapter within their respective Groups and Macrogroups of the NVCS. Groups and Macrogroups are mid-level units within the NVCS hierarchy and are defined by criteria pertaining to physiognomy, biogeography, and floristics (USNVC 2015).

In addition to natural habitats, this chapter also addresses anthropogenic (man-made) habitats, which can provide value to wildlife, including Species of Greatest Conservation Need (SGCN). Habitats in this chapter are organized alphabetically within the following broader categories:

Forests **–** habitats that, in their natural state, are dominated by trees and have a canopy cover of greater than 75%. The herbaceous understory is composed of plants that 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 understory. Savannas typically have a canopy cover of less than 50%. Woodlands are more densely wooded, but are still relatively open, having 50-75% 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 – natural isolated depressions which are seasonally inundated, and often drawn-down completely during dry periods. This category includes wooded and non-wooded ponds.

Lentic Water Bodies – natural lakes (e.g., Oxbows), 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, canals, and estuarine and marine waters.

Subterranean Habitat – this category includes one habitat: Cave.

Geologic Feature – this category captures Barrier Islands, which support several natural communities.

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

River Basins – the 12 river basins within Louisiana.

Marine Habitats – categorized by substrate type, primarily.

For each habitat treatment, the name, state (S-rank) and global (G-rank) conservation ranks, and ecological system placements are given. Ecological systems are defined as groups of associations (communities) that tend to co-occur in similar ecological settings, and were defined to allow habitat mapping (Comer et al. 2003). Comer et al. (2003) identified 599 Ecological Systems occurring in the United States. These systems are described on NatureServe Explorer. Habitats presented here are, in many cases, finer scale features with narrower concepts than Ecological Systems. Many habitats fall within more than one Ecological System. In each account, the habitat is described and characteristic plants are listed. The geographic distribution of each habitat is expressed as a parish distribution map. Associated SGCN are listed for each habitat. Threats assessments were completed for each habitat using the NatureServe Conservation Status Assessments: Rank Calculator, Version 3.186. Results of threats assessments are summarized. Habitat research needs/conservation actions for each habitat are provided, although these lists are not exhaustive.

This account of habitats is not final and in many cases, knowledge is lacking. 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 because we need to understand the factors that drove the evolution of our natural communities, and that are necessary for healthy fish and wildlife populations. Following completion of this planning process and as implementation of the Wildlife Action Plan (WAP) continues, understanding of Louisiana's habitats will improve, and additional threats and needed conservation actions will become evident.

B. Habitat Accounts

1. FORESTS

a. Barrier Island Live Oak Forest

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

General Description:

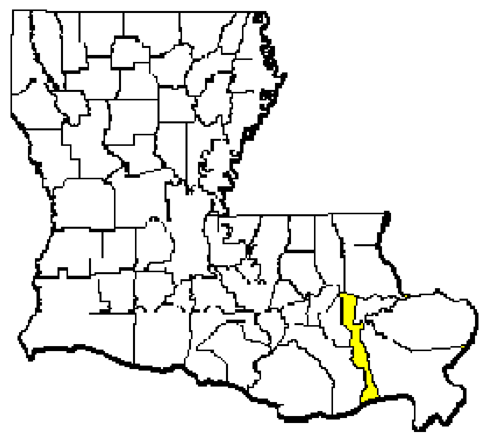
Grand Isle is Louisiana's only Barrier Island that supports a forested community. This forest is restricted to interior portions of Grand Isle, where it is sufficiently buffered from the harsh shoreline environment. Trees in Barrier Island Live Oak Forests can exhibit the effects of saltwater spray and wind, having a stunted appearance and leaning away from the prevailing wind (West 1938, Brown 1930). This community is impacted by development, invasive 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	
Live Oak	*Quercus virginiana*
Sugarberry	*Celtis laevigata*
Yaupon	*Ilex vomitoria*
Toothache Tree	*Zanthoxylum clava-herculis*

Current Extent and Status:

Barrier Island Live Oak Forest is restricted to Grand Isle where it occupies a small area (approximately 40 acres). This habitat probably occupied less than 1,000 acres, perhaps closer to 500 acres historically. Most of its historical extent has been destroyed by residential and commercial development. The Nature Conservancy's (TNC) Lafitte Woods Preserve protects approximately 40 acres of this forest type.



Barrier Island Live Oak Forest: SGCN (18)	
Non-crustacean Arthropods (1)	
Monarch	*Danaus plexippus*
Reptiles (1)	
Eastern Glass Lizard	*Ophisaurus ventralis*
Birds (16)	
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-Throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler	*Vermivora chrysoptera*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*

Hooded Warbler	*Setophaga citrina*
Cerulean Warbler	*Setophaga cerulea*
Yellow-throated Warbler	*Setophaga dominica*
Painted Bunting	*Passerina ciris*

Threats Affecting Habitat:

Historically important threats such as residential and commercial development are of minor importance now as most of the remaining acreage is protected. Remaining examples of this habitat are threatened by disturbance by humans, invasive plants, subsidence, hurricanes, and sea level rise (SLR).

Barrier Island Live Oak Forest Threats Assessment:

1st 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	Pervasive	Moderate	Medium
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Medium			

Habitat Research Needs/Conservation Actions:

1. Partner with Non-Governmental Organizations (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. Support reforestation on Grand Isle to expand this habitat type.
3. Promote propagation and planting of coastal ecotypes of Live Oak, Toothache Tree, and other native species on Grand Isle.
4. Support Coastal Protection and Restoration Authority (CPRA), Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA), Louisiana Coastal Area Program (LCA), U.S. Army Corps of Engineers (USACE), Louisiana Department of Natural Resources (LDNR), and other partner efforts for shoreline stabilization and habitat restoration.

b. 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:

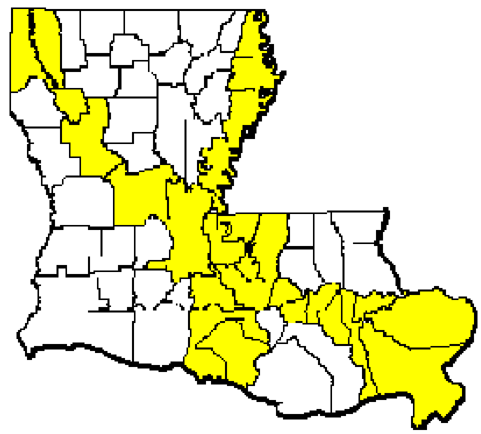
Batture Forest develops on the slope between the natural (or man-made) levee crest and major streams/rivers. Batture areas are periodically scoured when river levels rise, and depending on sediment particle size, new sediment may be deposited when river levels fall. Historically, meandering rivers naturally 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 Hardwood 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	
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 large rivers. The acreage and number of intact sites is unknown. Substantial portions of the Atchafalaya Basin may support forest that is referable to this habitat.



Batture Forest SGCN (34)	
Reptiles (6)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Ringed Map Turtle	*Graptemys oculifera*
Ouachita Map Turtle	*Graptemys ouachitensis*
Sabine Map Turtle	*Graptemys sabinensis*
Pearl River Map Turtle	*Graptemys pearlensis*
Birds (19)	
Wood Stork	*Mycteria americana*
Little Blue Heron	*Egretta caerulea*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*

American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Painted Bunting	*Passerina ciris*
Rusty Blackbird	*Euphagus carolinus*
Mammals (7)	
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Eastern Pipistrelle	*Perimyotis subflavus*
Bachman's Fox Squirrel	*Sciurus niger bachmani*
Ringtail	*Bassariscus astutus*
Long-tailed Weasel	*Mustela frenata*
Plants (2)	
Square-stem Monkeyflower	*Mimulus ringens*
Western Umbrella Sedge	*Fuirena simplex var. aristulata*

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.

Batture Forest Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Conduct inventory of this habitat type, especially in the Atchafalaya Basin.
2. Work with USACE, local levee boards, city planning commissions and local conservation groups to promote development of Batture Forest reserves to retain natural qualities and to provide education on the importance of this habitat for both resident and migratory wildlife.
3. Work with the Louisiana Department of Environmental Quality (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 USACE to minimize impacts of dredging and water discharges in Batture Forest.
5. Promote the maintenance and restoration of natural hydrologic regimes.

c. 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). In this treatment, Forested Seep is included within the concept of Bayhead Swamp. 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. Several ferns and living peat moss (*Sphagnum*) are often conspicuous in the understories of Bayhead Swamps. Landscape position can vary from broad depressions or small 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 systems and often serve as natural fire breaks. The up-slope edges of Bayhead Swamps historically experienced fire and likely support species to which a fire-frequent edge is important. These forests naturally vary from a few acres to more than 100 acres in size (Brooks et al 1993, Smith 1996).

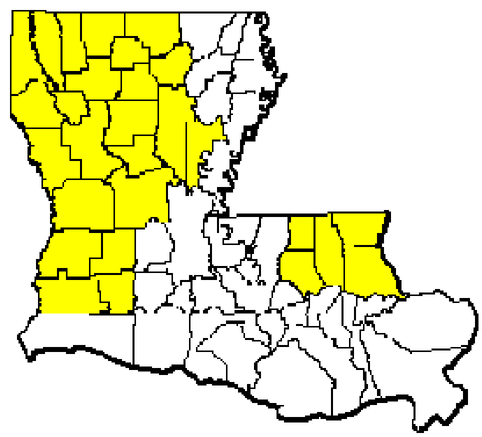
Bayhead Swamp, Schoolhouse Springs Preserve, Jackson Parish.

Bayhead Swamp: Characteristic Plants	
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 and northern portions of the West Gulf Coastal Plain, where it can occur with seepage on middle and upper slopes. Baldcypress is not a typical component of this habitat elsewhere in the state.

Current Extent and Status:

Bayhead Swamps are associated with geologically older landscapes generally supporting a pine-dominated matrix. Historically these forested wetlands are estimated to have occupied 100,000 to 500,000 acres, with 25-50% of the original cover currently remaining (Smith 1993). High-quality Bayhead Swamps are fairly easy to find on conservation areas and private lands rangewide.



Bayhead Swamp SGCN (52)	
Crustaceans (1)	
Flatnose Crawfish	*Procambarus planirostris*
Non-crustacean Arthropods (12)	
Texas Emerald	*Somatochlora margarita*
Texas Forestfly	*Amphinemura texana*

Louisiana Needlefly	*Leuctra szczytkoi*
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*
Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*
Spring-loving Psiloneuran Caddisfly	*Agarodes libalis*
Schoolhouse Springs Purse Casemaker Caddisfly	*Hydroptila ouachita*
Hydroptilad Caddisfly	*Hydroptila poirrieri*
Pepper and Salt Skipper	*Amblyscirtes hegon*
Arogos Skipper	*Atrytone arogos*
Monarch	*Danaus plexippus*
Amphibians (2)	
Southern Dusky Salamander	*Desmognathus auriculatus*
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*
Birds (9)	
American Woodcock	*Scolopax minor*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
Hooded Warbler	*Setophaga citrina*
Painted Bunting	*Passerina ciris*
Rusty Blackbird	*Euphagus carolinus*
Mammals (8)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Golden Mouse	*Ochrotomys nuttalli*
Long-tailed Weasel	*Mustela frenata*
Plants (20)	
Baygall Caric Sedge	*Carex venusta*
Birdbill Spike Grass	*Chasmanthium ornithorhynchum*
Black Titi	*Cliftonia monophylla*
Bog Moss	*Mayaca fluviatilis*
Bog Spicebush	*Lindera subcoriacea*

Canby's Bulrush	*Schoenoplectus etuberculatus*
Louisiana Quillwort	*Isoetes louisianensis*
Millet Beak Sedge	*Rhynchospora miliacea*
Myrtle Holly	*Ilex myrtifolia*
Northern Burmannia	*Burmannia biflora*
Odorless Bayberry	*Morella inodora*
Rooted Spike Sedge	*Eleocharis radicans*
Sarvis Holly	*Ilex amelanchier*
Sessile-leaf Bellwort	*Uvularia sessilifolia*
Swamp-forest Beak Sedge	*Rhynchospora decurrens*
Texas Screwstem	*Bartonia texana*
Texas Trillium	*Trillium texanum*
Threeway Sedge	*Dulichium arundinaceum*
Tussock Sedge	*Carex stricta*
Yellowroot	*Xanthorhiza simplicissima*

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. Climate change is a potential threat to this habitat, if precipitation decreases, which could lead to drying of some occurrences.

Bayhead Swamp/Forested Seep Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Encourage landowners and managers to utilize Bayhead Swamps as fire breaks and to not install fire lines around them, to expose edges to fire.

2. Provide funding for control of Feral Hogs in Bayhead Swamps, and for control of invasive plants such as Chinese Privet (*Ligustrum sinense*) and Chinese Tallow Tree (*Triadica sebifera*).

d. 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 (MRAP) ecoregion. 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 Louisiana Natural Heritage Program (LNHP) in Bottomland Hardwood Forests of Louisiana (LNHP 2009):

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

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. 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	
Water Hickory	*Carya aquatica*
Swamp Privet	*Forestiera acuminata*
Waterlocust	*Gleditsia aquatica*
Planertree	*Planera aquatica*
Overcup Oak	*Quercus lyrata*
Nuttall Oak	*Quercus texana*
Red Grape	*Vitis palmata*

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

This community occurs in floodplains of major rivers on low ridges, flats and sloughs in first bottoms (portions of floodplains nearest to rivers, immediately behind natural levees). Soils are seasonally inundated or saturated periodically for 1 to 2 months during the growing season.

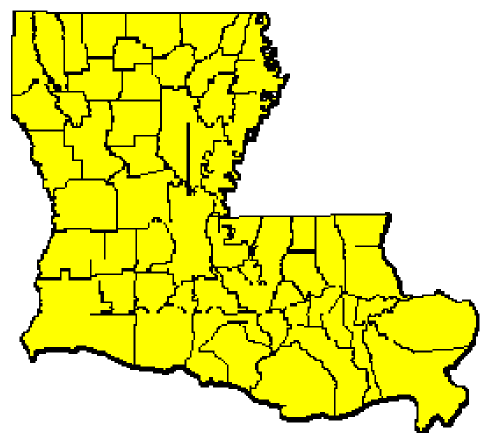
Hackberry-American Elm-Green Ash Bottomland Hardwood Forest: Characteristic Plants	
Water Hickory	*Carya aquatica*
Sugarberry (Hackberry)	*Celtis laevigata*
Green Ash	*Fraxinus pennsylvanica*
Honeylocust	*Gleditsia triacanthos*
American Elm	*Ulmus americana*

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

This is the driest Bottomland Hardwood Forest association, occurring 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	
Cherokee Caric Sedge	*Carex cherokeensis*
Caric Sedges	*Carex* spp.
Green Hawthorn	*Crataegus viridis*
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 is a large-scale habitat in Louisiana, having historically occupied an estimated 6 to 8 million acres (Smith 1993). On today's landscape, only 25 to 50% of this original acreage is thought to remain (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 USACE oversees the Atchafalaya Basin Spillway Diversion Project which is part of the largest remaining block of floodplain forest and swamp in the U.S, along with Atchafalaya National Wildlife Refuge (NWR) and Sherburne Wildlife Management Area (WMA). Louisiana's East Gulf Coastal Plain (EGCP) 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 U.S. Fish and Wildlife Service (USFWS), and Pearl River WMA, operated by the Louisiana Department of Wildlife and Fisheries (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 (61)	
Mollusks (1)	
Flamed Tigersnail	*Anguispira alternata*
Crustaceans (1)	
Javelin Crawfish	*Procambarus jaculus*
Non-crustacean Arthropods (6)	
Cajun Tiger Beetle	*Dromochorus pilatei*
Six-banded Longhorn Beetle	*Dryobius sexnotatus*
Seminole Texan Crescent	*Anthanassa texana seminole*
Creole Pearly-eye	*Lethe creola*
Lace-winged Roadside-Skipper	*Amblyscirtes aesculapius*
Nutmeg Underwing	*Catocala atocala*
Amphibians (5)	
Southern Dusky Salamander	*Desmognathus auriculatus*
Louisiana Slimy Salamander	*Plethodon kisatchie*
Strecker's Chorus Frog	*Pseudacris streckeri*
Eastern Spadefoot	*Scaphiopus holbrookii*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (4)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (20)	
Wood Stork	*Mycteria americana*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
American Woodcock	*Scolopax minor*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler	*Vermivora chrysoptera*

Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Cerulean Warbler	*Setophaga cerulea*
Painted Bunting	*Passerina ciris*
Rusty Blackbird	*Euphagus carolinus*
Mammals (10)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Northern Long-eared Bat	*Myotis septentrionalis*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Big Brown Bat	*Eptesicus fuscus*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*
Plants (14)	
Broad-leaved Spiderwort	*Tradescantia subaspera*
Bur Oak	*Quercus macrocarpa*
Climbing Bittersweet	*Celastrus scandens*
Cypress-knee Sedge	*Carex decomposita*
Fowl Manna Grass	*Glyceria striata*
Hairy Lipfern	*Cheilanthes lanosa*
Long-sepaled False Dragon Head	*Physostegia longisepala*
Low Erythrodes	*Platythelys querceticola*
Nodding Pogonia	*Triphora trianthophora*
Pondberry	*Lindera melissifolia*
Sink-hole Fern	*Blechnum occidentale*
Snow Melanthera	*Melanthera nivea*
Southern Shield Woodfern	*Dryopteris ludoviciana*
Swamp Thistle	*Cirsium muticum*

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. As with other forested wetlands, potential impacts of climate change related to reduced precipitation are of concern.

Bottomland Hardwood Forest Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Promote use of appropriate silvicultural techniques and Best Management Practices (BMPs) (e.g., the Lower Mississippi Valley Joint Venture (LMVJV) desired forest conditions (DFCs) report, *Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat*) to restore and manage Bottomland Hardwood Forests for wildlife.
2. Work with adjoining states to address water management issues that affect Bottomland Hardwood Forest habitat in Louisiana.
3. Continue to work with partners to promote corridors of Bottomland Hardwood Forests for wildlife species.
4. Work with the Natural Resources Conservation Service (NRCS) to incorporate long-term planning for reforested Conservation Reserve Program (CRP) and Wetland Reserve Program (WRP) sites.
5. Implement floodplain reintroductions and diversions to restore natural hydrology to Bottomland Hardwood Forests.

e. 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

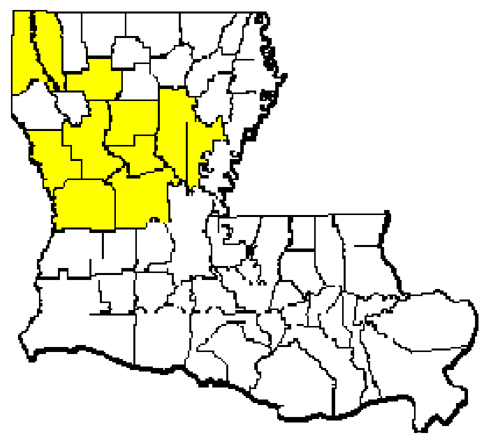
General Description.

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 woodlands, where dry site conditions and fire maintained a more 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	
Cherokee Caric Sedge	*Carex cherokeensis*
Nutmeg Hickory	*Carya myristiciformis*
Eastern Redbud	*Cercis canadensis*
White Ash	*Fraxinus americana*
Tuberous Puccoon	*Lithospermum tuberosum*
Chinquapin Oak	*Quercus muehlenbergii*
Shumard Oak	*Quercus shumardii*
Post Oak	*Quercus stellata*
Aromatic Sumac	*Rhus aromatica*
Rusty Blackhaw	*Viburnum rufidulum*

***Current Extent and Status*:**



It is estimated that 50,000 to 100,000 acres of Calcareous Forest occurred in Louisiana in pre-settlement times, and that 25 to 50 percent of the original cover remain today (Smith 1993). There are several high quality occurrences on conservation areas such as Kisatchie National Forest (KNF; particularly the Winn Ranger District), Barksdale Air Force Base (AFB), Bodcau WMA, and TNC's Copenhagen Hills Preserve. Additional field survey work is needed to more accurately determine the status and extent of Calcareous Forest.

Calcareous Forest SGCN (45)	
Non-crustacean Arthropods (4)	
Six-banded Longhorn Beetle	*Dryobius sexnotatus*
Frosted Elfin	*Callophrys irus*
Wild Indigo Duskywing	*Erynnis baptisiae*
Nutmeg Underwing	*Catocala atocala*
Reptiles (2)	
Western Wormsnake	*Carphophis vermis*
Timber Rattlesnake	*Crotalus horridus*
Birds (9)	
American Woodcock	*Scolopax minor*
Greater Roadrunner	*Geococcyx californianus*

Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Wood Thrush	*Hylocichla mustelina*
Yellow-throated Vireo	*Vireo flavifrons*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Mammals (11)	
Northern Long-eared Bat	*Myotis septentrionalis*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Silver-haired Bat	*Lasionycteris noctivagans*
Southeastern Myotis	*Myotis austroriparius*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Golden Mouse	*Ochrotomys nuttalli*
Northern Pygmy Mouse	*Baiomys taylori*
Ringtail	*Bassariscus astutus*
Long-tailed Weasel	*Mustela frenata*
Plants (19)	
Atlantic Camas	*Camassia scilloides*
Downy Yellow Violet	*Viola pubescens*
Durand Oak	*Quercus sinuata var. sinuata*
Lanceleaved Buckthorn	*Rhamnus lanceolata*
Northern Prickly-ash	*Zanthoxylum americanum*
Northern Red Oak	*Quercus rubra*
Nuttall's Deathcamas	*Zigadenus nuttallii*
Oglethorpe's Oak	*Quercus oglethorpensis*
Purple Boneset	*Eupatorium purpureum*
Purple Milkweed	*Asclepias purpurascens*
Stiff Tickseed	*Coreopsis palmata*
Tall Bellflower	*Campanulastrum americanum*
Three-flowered Hawthorn	*Crataegus triflora*
Three-lobed Coneflower	*Rudbeckia triloba*
Virginia Strawberry	*Fragaria virginiana*
Wahoo	*Euonymus atropurpureus*
Whiteleaf Leatherflower	*Clematis glaucophylla*
Yellow Pimpernel	*Taenidia integerrima*
Yellow-wood	*Cladrastis kentukea*

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:

1st 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
Overall Calculated Threat Impact: High			

Habitat Research Needs/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 prescribed fire as management tool for Calcareous Forests occuring on higher landscape positions.

f. 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

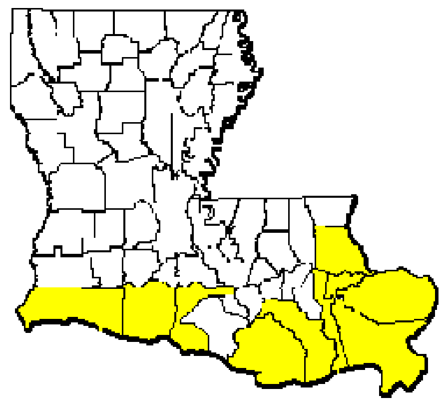
General Description:

Coastal Live Oak-Hackberry Forests, also known as Cheniers (French for "place of oaks"), occur on abandoned beach ridges defining the Chenier Plain of southwest Louisiana and adjacent Texas. Cheniers occur on the Deltaic Plain as well, but are rare there. 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 typically 4-5 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 and foraging habitat for migrating birds (Mueller 1990). Hundreds of thousands of birds (around 100 species) use Cheniers annually as stopover points during migration. Native American shell middens also support this habitat type, which is considered a distinct habitat by NatureServe (2015) called 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	
Sugarberry (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 expansion. 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, or 1-5% of pre-settlement extent, are thought to remain today (Smith 1993). True remaining extent is likely much closer to the lower end of this range.

Few examples of this habitat are protected. TNC protects Hollister Chenier Preserve (ca. 50 acres) in Cameron Parish and the Baton Rouge Audubon Society (BRAS) owns and maintains the approximately 40 acre Peveto Woods Sanctuary, also in Cameron Parish. Although privately owned, the Evariste Nunez Woods and Bird Sanctuary (~ 42 acres) is maintained by LDWF through a lease agreement. Establishment of this habitat on an artificial ridge near Fourchon is being carried out by the Barataria-Terrebonne National Estuary Program (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)	
Non-crustacean Arthropods (2)	
Celia's Roadside-Skipper	*Amblyscirtes celia*
Falcate Orangetip	*Anthocharis midea*
Reptiles (3)	
Ornate Box Turtle	*Terrapene ornata*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Timber Rattlesnake	*Crotalus horridus*

Birds (16)	
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler	*Vermivora chrysoptera*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Cerulean Warbler	*Setophaga cerulea*
Yellow-throated Warbler	*Setophaga dominica*
Painted Bunting	*Passerina ciris*
Plants (3)	
Narrowleaved Puccoon	*Lithospermum incisum*
Saw Palmetto	*Serenoa repens*
Wedgeleaf Whitlow-grass	*Draba cuneifolia*

*Saw Palmetto occurs on several relict Barrier Islands on the Deltaic Plain of southeast Louisiana and on the North Shore of Lake Pontchartrain. The islands predate the formation of the St. Bernard Delta.

Importance to Neotropical Migratory Landbirds:

It should 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 600 miles 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, which move 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.

Coastal Live Oak-Hackberry Forest Threats Assessment:

1st 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	Pervasive	Slight	Low
Climate Change & Severe Weather	Large	Moderate	Medium
Overall Calculated Threat Impact: Medium			

Habitat Research Needs/Conservation Actions:

1. Partner with state and federal agencies, NGOs, private landowners, and other stakeholders to restore Cheniers.
2. Support CPRA, CWPPRA, LCA, LDNR, USACE, and other partner efforts for shoreline stabilization and habitat restoration.
3. Work with USACE 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.
5. Develop methods to encourage landowners to remove cattle from Cheniers or promote rotational grazing and manage the land for wildlife conservation.
6. Support protection of high quality examples of this habitat that have the potential for long term sustainability through cooperative agreements or purchase from willing sellers.
7. Construct coastal hammocks by partnering with CPRA, USACE, and other partners to use sediment pipeline delivery or other sediment delivery methods to build land sufficient to support Coastal Live Oak-Hackberry Forests in both the Chenier and Deltaic Plains.
8. 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.
9. Support invasive plant and animal control on all expressions of Coastal Live Oak-Hackberry Forest by providing funding for direct control of these species.

g. Cypress-Tupelo-Blackgum Swamp

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), 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.

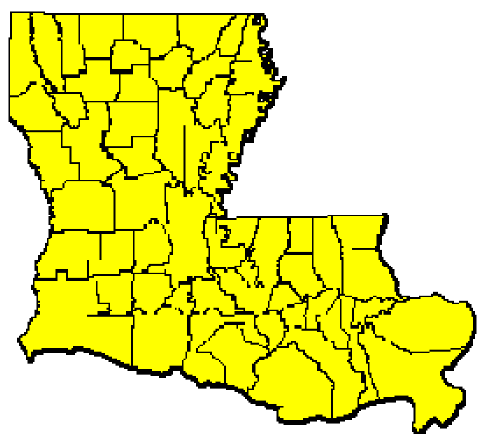
Cypress-Tupelo-Blackgum Swamps are forested, alluvial swamps occurring on intermittently exposed soils, most commonly along rivers and streams but also in backswamp depressions and swales. The soils are inundated or saturated by surface water or ground water on a nearly permanent basis throughout the growing season, except during periods of drought. Even deep-water 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 Tupelo seeds germinate underwater, nor can young seedlings of these trees survive long submergence. Seedling recruitment can only occur during draw-down periods.

Baldcypress Swamp, Caddo Parish

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 infrequently. Near-permanent impoundment of Cypress-Tupelo-Blackgum Swamps is a major threat affecting sustainability of these forests. Those areas dominated by Tupelo and Blackgum are also alluvial but occur on higher topographic positions than Baldcypress dominated swamps.

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*
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. Of the original 2 to 4 million acres, 500,000 to 1 million acres are thought to remain today (50–75% loss). While old individual Baldcypress trees are not that difficult to find, old-growth examples of Cypress-Tupelo-Blackgum Swamps 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 Cypress-Tupelo-Blackgum 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 commercial interests; however, the swamps of the lower MRAP 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 (37)	
Non-crustacean Arthropods (4)	
Creole Pearly-eye	*Lethe creola*
Seminole Texan Crescent	*Anthanassa texana seminole*
King's Hairstreak	*Satyrium kingi*
Appalachian Brown	*Lethe appalachia*
Amphibians (3)	
Four-toed Salamander	*Hemidactylium scutatum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Ornate Chorus Frog	*Pseudacris ornata*
Reptiles (3)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Birds (9)	
Wood Stork	*Mycteria americana*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Prothonotary Warbler	*Protonotaria citrea*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (6)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Plants (12)	
Abbeville Red Iris	*Iris X nelsonii*
Apalachicola Doll's-daisy	*Boltonia apalachicolensis*
Cypress-knee Sedge	*Carex decomposita*
Floating Antler Fern	*Ceratopteris pteridoides*

Fowl Manna Grass	*Glyceria striata*
Hall's Pocket Moss	*Fissidens hallii*
Hemlock Water-parsnip	*Sium suave*
Little Floatingheart	*Nymphoides cordata*
Log Fern	*Dryopteris celsa*
Pondspice	*Litsea aestivalis*
Willdenow's Maiden Fern	*Thelypteris interrupta*
Yellow Water-crowfoot	*Ranunculus flabellaris*

Threats Affecting Habitat:

Cypress-Tupelo-Blackgum 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.

Cypress-Tupelo-Blackgum Swamp Threats Assessment:

1st 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	Restricted	Moderate	Low
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Medium			

Habitat Research Needs/Conservation Actions:

1. Establish and maintain long-term monitoring sites within coastal wetland forests.
2. Promote use of LMVJV DFCs to restore/manage swamps for wildlife.
3. Continue to work with Louisiana Purchase 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. Work with USACE to manage water levels in the Atchafalaya Basin to benefit this habitat type.

h. Hardwood Flatwoods

Rarity Ranks: Mesic Hardwood Flatwoods: S2S3/G2G3
Wet Hardwood Flatwoods: S2S3G2G3
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:

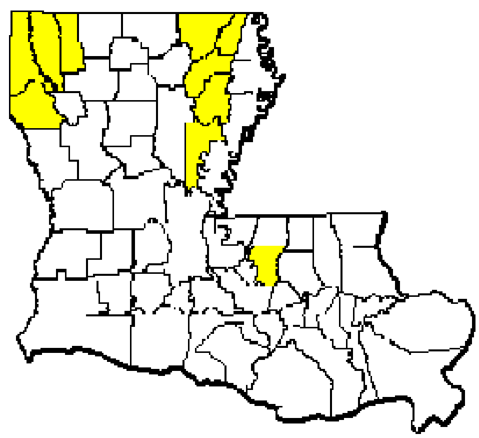
Wet Hardwood Flatwoods and Mesic Hardwood Flatwoods are described as two distinct communities in the LNHP community classification system but are combined here. Also included in this habitat is Prairie Terrace Loess Forest, a mesic flatwoods type which is restricted to East Baton Rouge Parish.

Hardwood Flatwoods 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.

Hardwood Flatwoods on Macon Ridge, northeast Louisiana.

Hardwood Flatwoods: Characteristic Plants (* wet, ** mesic, + both)	
Devil's Walking Stick	*Aralia spinosa* **
Giant Cane	*Arundinaria gigantea* **
Cherokee Caric Sedge	*Carex cherokeensis* **
Mockernut Hickory	*Carya alba* **
Shagbark hickory	*Carya ovata* *
Sugarberry	*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. The historical extent of all types of Hardwood Flatwoods is not known. Prairie Terrace Loess Forest is estimated to have occupied 500,000 to 1,000,000 acres historically, with 1-5 % remaining today (Smith 1993). Ecology of Hardwood Flatwoods is a major knowledge gap in Louisiana.

Hardwood Flatwoods SGCN (38)	
Non-crustacean Arthropods (2)	
Monarch	*Danaus plexippus*
Nutmeg Underwing	*Catocala atocala*
Amphibians (2)	
Southern Dusky Salamander	*Desmognathus auriculatus*
Eastern Spadefoot	*Scaphiopus holbrookii*
Reptiles (4)	
Western Wormsnake	*Carphophis vermis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (10)	
American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Painted Bunting	*Passerina ciris*
Mammals (11)	
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Southeastern Myotis	*Myotis austroriparius*
Eastern Chipmunk	*Tamias striatus*
Golden Mouse	*Ochrotomys nuttalli*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*
Plants (9)	

Arkansas Caric Sedge	*Carex arkansana*
Canada Enchanter's-nightshade	*Circaea lutetiana ssp. canadensis*
Floating Manna Grass	*Glyceria septentrionalis*
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*
Three-lobed Coneflower	*Rudbeckia triloba*
Upland Swamp Privet	*Forestiera ligustrina*
Virginia Anemone	*Anemone virginiana*
Wolf's Spike Sedge	*Eleocharis wolfii*
Yellowleaf Tinker's-weed	*Triosteum angustifolium*

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 threaten this habitat.

Hardwood Flatwoods Threats Assessment:

1st 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 Research Needs/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 conservation easements and land acquisition.

i. Live Oak Natural Levee Forest

Rarity Rank: S1/G2
Synonyms: Natural Levee Forest, Frontland Forest
Ecological Systems: CES203.190 Mississippi River Riparian Forest
CES203.196 Mississippi River High Floodplain (Bottomland) Forest

General Description:

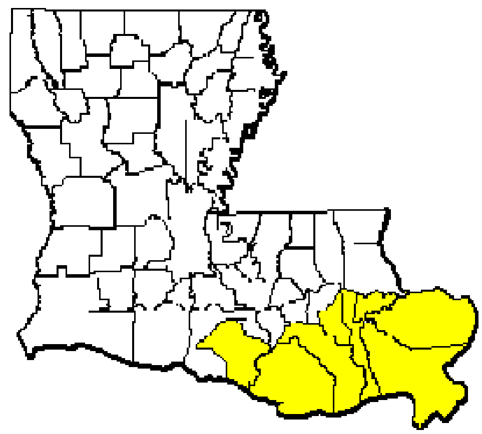
This community occurs principally in southeastern Louisiana on natural levees or frontlands and on islands within marshes and swamps. It is similar in some respects to Coastal Live Oak-Hackberry Forest in that both develop on natural ridges in the coastal zone and overstory dominants are comparable. Palmetto is usually the most conspicuous midstory and understory shrub, often attaining heights of over 13 feet, 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, Chinaberry (*Melia azedarach*), and Japanese Honeysuckle (*Lonicera japonica*).

Live Oak Natural Levee Forest, Plaquemines Parish

Live Oak Natural Levee Forest: Characteristic Plants	
Sugarberry	*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 among the first areas to be cleared for agriculture and residential development. Of the original 500,000 to 1,000,000 acres in Louisiana, currently, only 10,000 to 50,000 acres remain, which is 1-5% of pre-settlement extent (Smith 1993). The majority of Live Oak 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 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 referable to this type.

Live Oak Natural Levee Forest SGCN (28)	
Reptiles (5)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (18)	
Wood Stork	*Mycteria americana*
Roseate Spoonbill	*Platalea ajaja*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
American Woodcock	*Scolopax minor*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler	*Vermivora chrysoptera*

Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Cerulean Warbler	*Setophaga cerulea*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (5)	
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Long-tailed Weasel	*Mustela frenata*

Threats Affecting Habitat:

The majority of remnant Live Oak Natural Levee Forests are altered and fragmented, and destruction and habitat disturbance 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:			
1st 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	Pervasive	Moderate	Medium
Climate Change & Severe Weather	Pervasive	Serious	High
Overall Calculated Threat Impact: Medium			

Habitat Research Needs/Conservation Actions:

1. Support CPRA, CWPPRA, LCA, LDNR, USACE, and other partner efforts for shoreline stabilization and habitat restoration.
2. Work with LCA, LDNR and CPRA to broaden coastal restoration priorities to include Live Oak Natural Levee Forests.
3. Work with local parish planning commissions and LDNR to change zoning classifications to reduce development within this habitat type.
4. Make this community type a priority for land acquisition, 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 invasive 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).

j. 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:

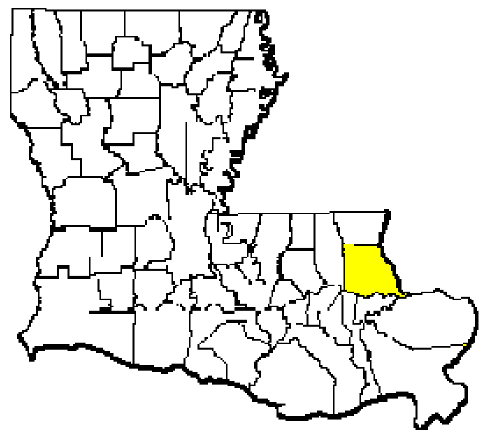
This community is known in Louisiana from southern St. Tammany Parish within 2 miles of Lake Pontchartrain where the Pleistocene Prairie Terrace meets the lake. Soils typically are sandy and are apparently relatively fertile. The community may exhibit site-to-site variation in species composition and physiognomy depending on soil moisture regime, time since canopy disturbance (e.g., from tropical storms), fire history, 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 transitional type between mesic Mixed Hardwood-Loblolly Forest and/or Beech-Magnolia Forest and more typical maritime forests that occur in coastal states east of Louisiana. 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	
Live Oak	*Quercus virginiana*
Yaupon	*Ilex vomitoria*
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. Estimated pre-settlement of this habitat type is from 10,000 to 50,000 acres, with only 10-25% of the original extent remaining today (Smith 1993). Small examples of this habitat are protected at Big Branch Marsh NWR, Fontainebleau State Park, and Northlake Nature Center.



Live Oak-Pine-Magnolia Forest SGCN (27)	
Crustaceans (2)	
Flatwoods Digger	*Fallicambarus oryktes*
Flatnose Crawfish	*Procambarus planirostris*
Reptiles (7)	
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Pine Woods Littersnake	*Rhadinaea flavilata*
Southeastern Crowned Snake	*Tantilla coronata*
Harlequin Coralsnake	*Micrurus fulvius*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (9)	
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*

Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Rusty Blackbird	*Euphagus carolinus*
Mammals (7)	
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Bachman's Fox Squirrel	*Sciurus niger bachmani*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (2)	
Gulf Spikemoss	*Selaginella ludoviciana*
Silky Camellia	*Stewartia malacodendron*

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 may also threaten this habitat.

Live Oak-Pine-Magnolia Forest Threats Assessment:			
1st 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 Research Needs/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.

k. 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

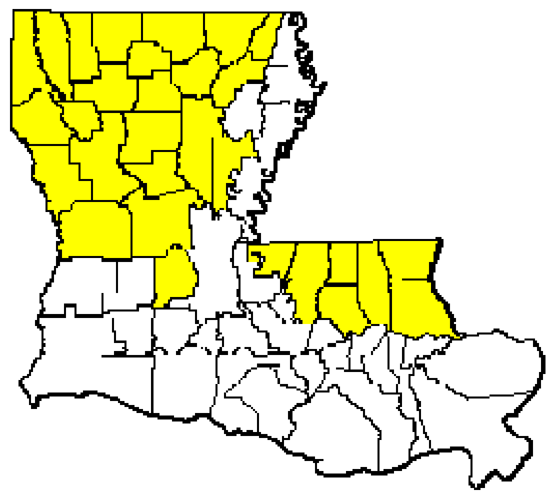
General Description:

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 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% 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 Spruce Pine (*Pinus glabra*) is an occasional associate in the Florida Parishes.

Hardwood Slope Forest, Vernon Parish

Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest: Characteristic Plants	
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 have occupied 500,000 to 1,000,000 acres historically, with an estimated 25-50% still remaining (Smith 1993). Hardwood Slope Forest is estimated to have occupied 100,000 to 500,000 acres historically, with 25-50% estimated to remain today (Smith 1993). Occurrences are scattered in the West Gulf Coastal Plain (WGCP) of central Louisiana and EGCP in the eastern Florida Parishes. There are a few occurrences known from Macon Ridge in the MRAP. Mixed Hardwood-Loblolly Pine Forest was probably historically more extensive on the Macon Ridge. A number of occurrences are protected on KNF and Fort Polk Military Reservation and WMA. Hardwood Slope Forests are sometimes completely contained within streamside management zones (SMZs) on industrial forest lands.

Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest SGCN (86)	
Non-crustacean Arthropods (1)	
Lace-winged Roadside-Skipper	*Amblyscirtes aesculapius*
Amphibians (4)	
Louisiana Slimy Salamander	*Plethodon kisatchie*

Southern Red-backed Salamander	*Plethodon serratus*
Southern Red Salamander	*Pseudotriton ruber vioscai*
Eastern Spadefoot	*Scaphiopus holbrookii*
Reptiles (7)	
Coal Skink	*Plestiodon anthracinus*
Western Wormsnake	*Carphophis vermis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Harlequin Coralsnake	*Micrurus fulvius*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (18)	
American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Swallow-tailed Kite	*Elanoides forficatus*
Bell's Vireo	*Vireo bellii*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Prairie Warbler	*Setophaga discolor*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (12)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Northern Long-eared Bat	*Myotis septentrionalis*
Big Brown Bat	*Eptesicus fuscus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Eastern Chipmunk	*Tamias striatus*
Golden Mouse	*Ochrotomys nuttalli*

Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*
Plants (44)	
American Alumroot	*Heuchera americana*
American Hazelnut	*Corylus americana*
American Pinesap	*Monotropa hypopithys*
Autumn Coralroot	*Corallorhiza odontorhiza*
Barbed Rattlesnake-root	*Prenanthes barbata*
Bay Starvine	*Schisandra glabra*
Bloodroot	*Sanguinaria canadensis*
Canada Enchanter's-nightshade	*Circaea lutetiana ssp. canadensis*
Canada Horse-balm	*Collinsonia canadensis*
Carpenter's Ground-cherry	*Physalis carpenteri*
Common Shootingstar	*Dodecatheon meadia*
Crested Coralroot	*Hexalectris spicata*
Devil's-bit	*Chamaelirium luteum*
Downy Yellow Violet	*Viola pubescens*
Eastern Leatherwood	*Dirca palustris*
Fire Pink	*Silene virginica*
Granite Gooseberry	*Ribes curvatum*
Green-fringe Orchid	*Platanthera lacera*
Indian Cucumber-root	*Medeola virginiana*
Long-horned Habenaria	*Habenaria quinqueseta*
Louisiana Bluestar	*Amsonia ludoviciana*
Mullein Foxglove	*Dasistoma macrophylla*
Northern Red Oak	*Quercus rubra*
Ozark Chinquapin	*Castanea pumila var. ozarkensis*
Panicled Indigobush	*Amorpha paniculata*
Perfoliate Tinker's-weed	*Triosteum perfoliatum*
Purple Boneset	*Eupatorium purpureum*
Reflexed Trillium	*Trillium recurvatum*
Shadow-witch Orchid	*Ponthieva racemosa*
Sicklepod	*Arabis canadensis*
Silky Camellia	*Stewartia malacodendron*
Single-head Pussytoes	*Antennaria solitaria*
Solomon's-plume	*Maianthemum racemosum ssp. racemosum*
Southern Hairy Woodrush	*Luzula acuminata var. carolinae*
Southern Horse-balm	*Collinsonia serotina*
Southern Lady's-slipper	*Cypripedium kentuckiense*

Staggerbush	*Lyonia mariana*
Starry Campion	*Silene stellata*
Turk's-Cap Lily	*Lilium superbum*
Upland Swamp Privet	*Forestiera ligustrina*
Virginia Saxifrage	*Saxifraga virginiensis*
White Trout-lily	*Erythronium albidum*
Wild Crane's-bill	*Geranium maculatum*
Zigzag Goldenrod	*Solidago flexicaulis*

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:

1st 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:

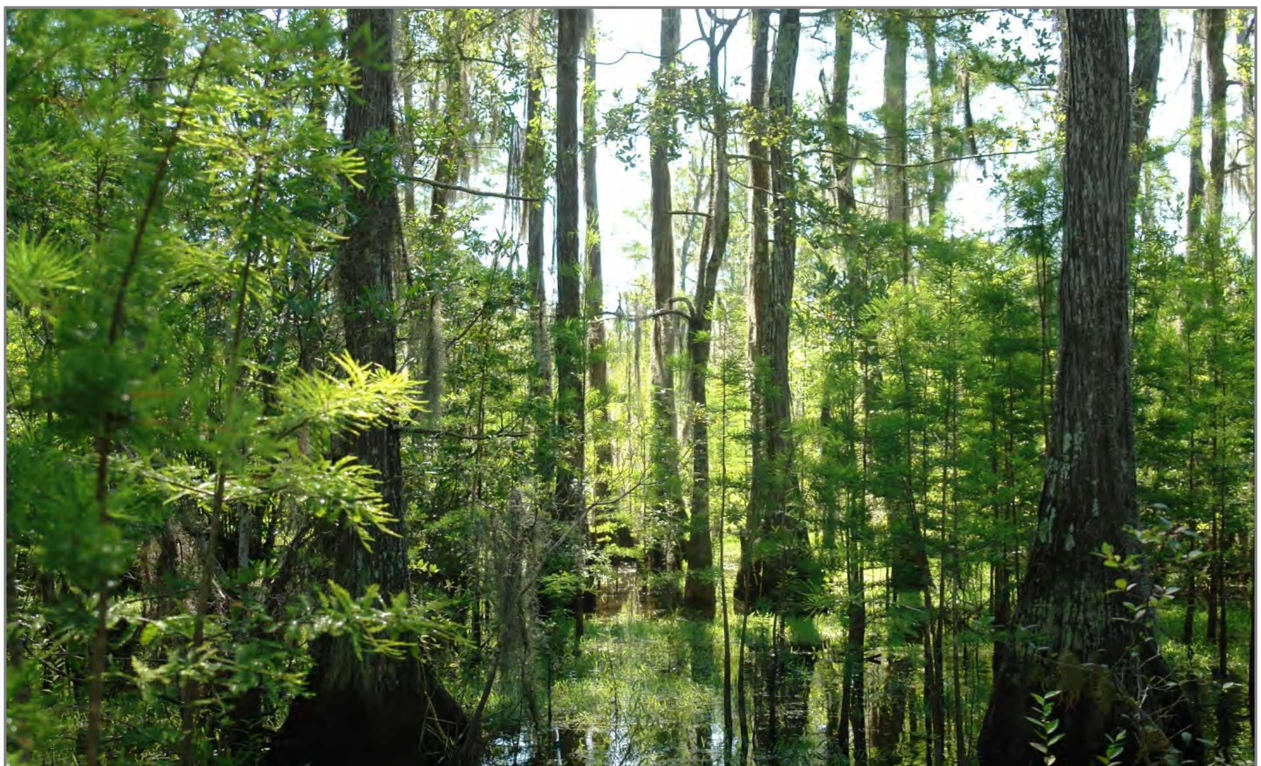
1st Level Threat	Scope	Severity	Impact
Residential/Commercial Development	N/A	N/A	N/A
Agriculture/Aquaculture	Small	Extreme	Low
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	Small	Moderate	Low
Biological Resource Use	Restricted	Serious	Medium
Human Intrusion/Disturbance	N/A	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 Research Needs/Conservation Actions:

1. Develop and implement DFCs for restoration of these habitat types including appropriate herbicide treatments.
2. Encourage use of broader SMZs to protect these habitats.
3. Promote use of fire in Mixed Hardwood-Loblolly Pine Forests, to include discouraging the practice of placing fire lines along stream valleys, allowing prescribed fire to burn into riparian habitats.

l. Pondcypress-Blackgum Swamp
Rarity Rank: S1/G1?
Synonyms: Pondcypress Flooded Woodland
Ecological Systems: CES203.489 East Gulf Coastal Plain Large River Floodplain Forest

Pondcypress-Blackgum Swamps occupy the backwater portions of larger swamplands, in places well removed from active stream channels. This habitat can also occupy isolated depressions in EGCP flatwoods embedded within a matrix of Eastern Longleaf Pine Flatwoods Savanna. This swamp type may grade into Baldcypress-Tupelo-Blackgum Swamps which are more influenced by river flooding. Pondcypress-Blackgum Swamps are acidic and nutrient poor. Floristic diversity is higher than that of Cypress-Tupelo-Blackgum swamps.



Pondcypress-Blackgum Swamp, St. Tammany Parish.

Pondcypress-Blackgum Swamp: Characteristic Plants	
Carolina Ash	*Fraxinus caroliniana*
Drummond Red Maple	*Acer rubrum* var. *drummondii*
Fringed Yellow-eyed-grass	*Xyris fimbriata*
Lizard’s Tail	*Saururus cernuus*
Marsh St. John’s Wort	*Triadenum walteri*
Pondcypress	*Taxodium ascendens*
Purple Bladderwort	*Utricularia purpurea*
Royal Fern	*Osmunda regalis var. spectabilis*
Swamp Blackgum	*Nyssa biflora*
Virginia-willow	*Itea virginica*
Walter’s Greenbrier	*Smilax walteri*
White Titi	*Cyrilla racemiflora*

Current Extent and Status:
Pondcypress-Blackgum Swamps are restricted in Louisiana to the eastern Florida Parishes. No estimates of historical areal extent have been made.

Pondcypress-Blackgum Swamp SGCN (30)	
Non-crustacean Arthropods (4)	
Creole Pearly-eye	*Lethe creola*
Seminole Texan Crescent	*Anthanassa texana seminole*
King's Hairstreak	*Satyrium kingi*
Appalachian Brown	*Lethe appalachia*
Amphibians (3)	

Four-toed Salamander	*Hemidactylium scutatum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Ornate Chorus Frog	*Pseudacris ornata*
Reptiles (3)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Birds (9)	
Wood Stork	*Mycteria americana*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Swallow-tailed Kite	*Elanoides forficatus*
Bald Eagle	*Haliaeetus leucocephalus*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Prothonotary Warbler	*Protonotaria citrea*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (6)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Plants (5)	
Cypress-knee Sedge	*Carex decomposita*
Pondspice	*Litsea aestivalis*
Bog Moss	*Mayaca fluviatilis*
Sarvis Holly	*Ilex amelanchier*
Myrtle Holly	*Ilex myrtifolia*

Threats Assessment:

Pondcypress-Blackgum Swamps are threatened by introduction of excessive nutrients, which alters species composition of this acidic and oligotrophic habitat.

Pondcypress-Blackgum Swamp Threats Assessment:

1st Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	N/A	N/A	N/A
Energy Production & Mining	N/A	N/A	N/A
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	Small	Moderate	Low
Human Intrusion/Disturbance	N/A	N/A	N/A
Natural System Modification	Small	Moderate	Low
Invasive & other Problematic Species	Large	Slight	Low
Pollution	Large	Moderate	Medium
Geological Events	N/A	N/A	N/A
Climate Change & Severe Weather	Pervasive	Slight	Low
Overall Calculated Threat Impact: Low			

Habitat Research Needs/Conservation Actions:

1. Conduct field inventories to gain a better understanding of the conservation status of and variation within this habitat.
2. Discourage introduction of partially treated municipal waste water into Pondcypress-Blackgum Swamps; this swamp type is acidic and oligotrophic and can be degraded by nutrient input.

m. 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:

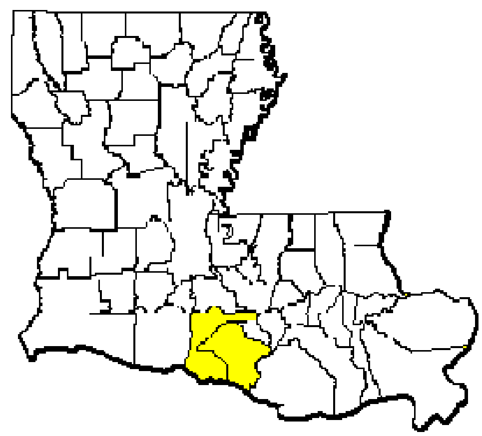
In the Mississippi Interior Salt Basin, salt domes occur where large, underground salt deposits (deposited by evaporating seas in the Jurassic Period) have risen to or near to the surface (Stern et. al. 2011). Louisiana contains approximately 425 salt domes on the mainland and offshore, varying in depth 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	
Pawpaw	*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:

Salt Dome Hardwood Forests are only known from five salt domes having surface expression which are located in Iberia and St. Mary parishes. The "Five Islands" are situated in a line extending northwest to southeast. Currently, Cote Blanche and Weeks Islands 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 issues with exotic invasive species. Remaining forest on Avery Island is in need of survey and evaluation.



Salt Dome Hardwood Forest SGCN (35)	
Non-crustacean Arthropods (2)	
Celia's Roadside-Skipper	*Amblyscirtes celia*
Wild Indigo Duskywing	*Erynnis baptisiae*
Reptiles (3)	
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (18)	
Bald Eagle	*Haliaeetus leucocephalus*

American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Golden-winged Warbler	*Vermivora chrysoptera*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Cerulean Warbler	*Setophaga cerulea*
Yellow-throated Warbler	*Setophaga dominica*
Painted Bunting	*Passerina ciris*
Mammals (3)	
Southeastern Myotis	*Myotis austroriparius*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Louisiana Black Bear	*Ursus americanus luteolus*
Plants (9)	
Bay Starvine	*Schisandra glabra*
Broad-leaved Spiderwort	*Tradescantia subaspera*
Climbing Bittersweet	*Celastrus scandens*
Croomia	*Croomia pauciflora*
Lanceleaved Glade Fern	*Diplazium lonchophyllum*
Snow Melanthera	*Melanthera nivea*
Southern Shield Woodfern	*Dryopteris ludoviciana*
Three-lobed Coneflower	*Rudbeckia triloba*
Woodland Bluegrass	*Poa sylvestris*

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 intrusion are also of concern.

Salt Dome Hardwood Forest Threats Assessment:			
1st 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 Research Needs/Conservation Actions:

1. Continue field inventory work for this habitat.
2. Establish conservation servitudes protecting Salt Dome Hardwood Forest.
3. Support aggressive control of invasive species in this habitat, including problematic plants and Feral Hogs.

n. Small Stream Forest

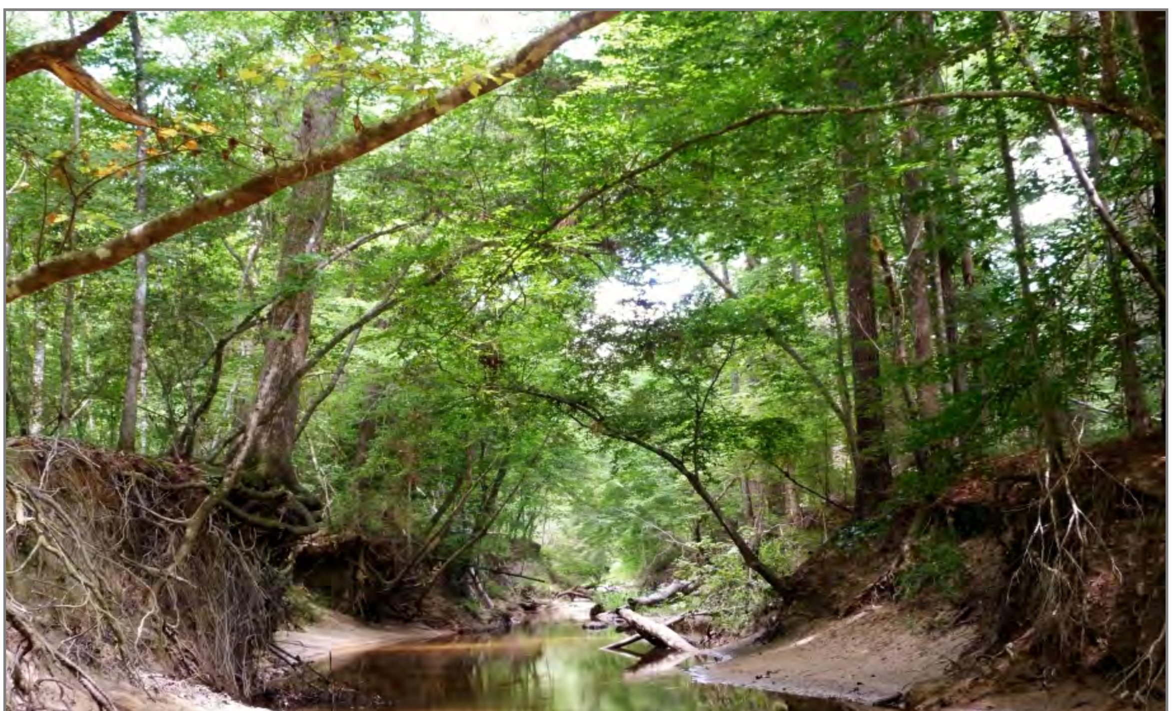
Rarity Rank: S2/G3

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 occasional associates statewide.

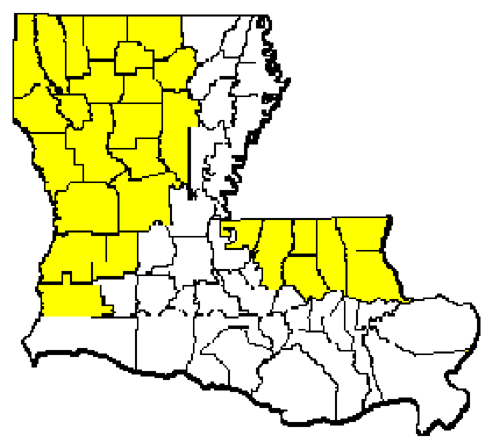


Small Stream Forest, Fort Polk Military Reservation and WMA, Vernon Parish

Small Stream Forest: Characteristic Plants	
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	*Sebastiania fruticosa*

Current Extent and Status:

Small Stream Forests are widely distributed in broad uplands. An estimated 25 to 50% of Louisiana's original Small Stream Forest, which is estimated to have been 1 to 2 million acres, is thought to remain intact (Smith 1993). A number of high-quality occurrences are captured by KNF and Fort Polk Military Reservation and WMA.



Small Stream Forest SGCN (100)	
Mollusks (8)	
Rayed Creekshell	*Anodontoides radiatus*
White Heelsplitter	*Lasmigona complanata*
Louisiana Pearlshell	*Margaritifera hembeli*
Southern Hickorynut	*Obovaria jacksoniana*
Louisiana Pigtoe	*Pleurobema riddellii*
Southern Creekmussel	*Strophitus subvexus*
Creeper	*Strophitus undulatus*
Southern Rainbow	*Villosa vibex*
Crustaceans (10)	

Teche Painted Crawfish	*Orconectes hathawayi*
Calcasieu Painted Crawfish	*Orconectes blacki*
Kisatchie Painted Crawfish	*Orconectes maletae*
Ribbon Crawfish	*Procambarus bivittatus*
Twin Crawfish	*Procambarus geminus*
Ouachita Fencing Crawfish	*Faxonella creaseri*
Caddo Chimney Crawfish	*Procambarus machardyi*
Pearl Blackwater Crawfish	*Procambarus penni*
Calcasieu Creek Crawfish	*Procambarus pentastylus*
Southwestern Creek Crawfish	*Procambarus dupratzi*
Non-crustacean Arthropods (9)	
Yellow Brachycercus Mayfly	*Sparbarus flavus*
Hodges' Clubtail	*Gomphus hodgesi*
Southern Snaketail	*Ophiogomphus australis*
Cajun Tiger Beetle	*Dromochorus pilatei*
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*
Masked Springfly	*Helopicus bogaloosa*
Ceraclean Caddisfly	*Ceraclea spongillovorax*
Molson's Microcaddisfly	*Hydroptila molsonae*
Pepper and Salt Skipper	*Amblyscirtes hegon*
Inland Fishes (11)	
American Eel	*Anguilla rostrata*
Central Stoneroller	*Campostoma anomalum*
Ironcolor Shiner	*Notropis chalybaeus*
Bluenose Shiner	*Pteronotropis welaka*
Flagfin Shiner	*Pteronotropis signipinnis*
Bluehead Shiner	*Pteronotropis hubbsi*
Rainbow Darter	*Etheostoma caeruleum*
Gumbo Darter	*Etheostoma thompsoni*
Channel Darter	*Percina copelandi*
Redspot Darter	*Etheostoma artesiae*
Clear Chub	*Hybopsis winchelli*
Amphibians (6)	
Southern Dusky Salamander	*Desmognathus auriculatus*
Southern Red-backed Salamander	*Plethodon serratus*
Webster's Salamander	*Plethodon websteri*
Louisiana Slimy Salamander	*Plethodon kisatchie*
Red River Mudpuppy	*Necturus louisianensis*
Eastern Spadefoot	*Scaphiopus holbrookii*

Reptiles (10)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Coal Skink	*Plestiodon anthracinus*
Western Wormsnake	*Carphophis vermis*
Common Rainbow Snake	*Farancia erytrogramma erytrogramma*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Harlequin Coralsnake	*Micrurus fulvius*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (16)	
American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Bell's Vireo	*Vireo bellii*
Yellow-throated Vireo	*Vireo flavifrons*
Warbling Vireo	*Vireo gilvus*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Yellow-throated Warbler	*Setophaga dominica*
Rusty Blackbird	*Euphagus carolinus*
Mammals (13)	
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Silver-haired Bat	*Lasionycteris noctivagans*
Southeastern Myotis	*Myotis austroriparius*
Northern Long-eared Bat	*Myotis septentrionalis*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Eastern Chipmunk	*Tamias striatus*
Golden Mouse	*Ochrotomys nuttalli*

Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*
Plants (17)	
American Bladdernut	*Staphylea trifolia*
Broadleaf Barbaras-buttons	*Marshallia trinervia*
Canby's Bulrush	*Schoenoplectus etuberculatus*
Dwarf Filmy Fern	*Trichomanes petersii*
Florida Hedge-hyssop	*Gratiola floridana*
Green-fringe Orchid	*Platanthera lacera*
Indian Cucumber-root	*Medeola virginiana*
Louisiana Bluestar	*Amsonia ludoviciana*
Louisiana Quillwort	*Isoetes louisianensis*
Mountain Laurel	*Kalmia latifolia*
New York Fern	*Thelypteris noveboracensis*
Nodding Pogonia	*Triphora trianthophora*
Pyramid Magnolia	*Magnolia pyramidata*
Riverweed	*Podostemum ceratophyllum*
White Trout-lily	*Erythronium albidum*
Waxyleaf Meadowrue	*Thalictrum revolutum*
Yellowroot	*Xanthorhiza simplicissima*

Threats Affecting Habitat:

The most impactful threat to this habitat is invasive species. Smaller-scale threats include impoundment of streams for reservoirs as well as natural system modification.

Small Stream Forest Threats Assessment:			
1st 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 Research Needs/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. Support 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.

o. 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:

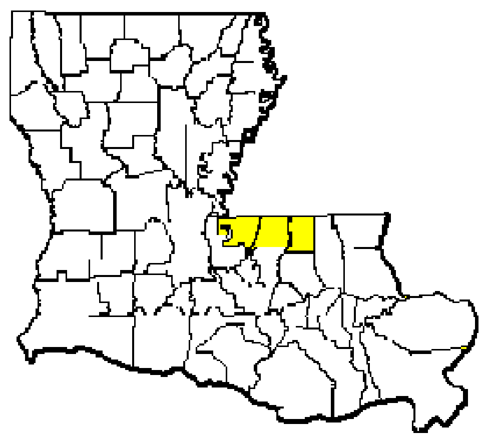
Southern Mesophytic Hardwood Forest is currently recognized in Louisiana only in the northwestern Florida Parishes, primarily in the Tunica Hills area. This hardwood forest develops on deep, fertile, circum-neutral to slightly alkaline loessial deposits that have eroded over thousands of years to form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

Ravine in Tunica Hills, West Feliciana Parish.

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

Current Extent and Status:

Currently only about 25-50% of Louisiana's original 100,000 to 500,000 acres of Southern Mesophytic Forests is thought to remain intact (Smith 1993). Clearing for agriculture, forest type conversion, and development in West Feliciana Parish brought about loss, degradation, and fragmentation of these forests. Southern Mesophytic Forest is extremely susceptible to soil damage, particularly 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 is found on Tunica Hills WMA which is 5,231 acres.



Southern Mesophytic Hardwood Forest SGCN (50)	
Non-crustacean Arthropods (3)	
Southern Unstriped Scorpion	*Vaejovis carolinianus*
Yellow Brachycercus Mayfly	*Sparbarus flavus*
Yucca Giant-Skipper	*Megathymus yuccae*
Amphibians (2)	
Webster's Salamander	*Plethodon websteri*
Eastern Spadefoot	*Scaphiopus holbrookii*
Reptiles (4)	

Coal Skink	*Plestiodon anthracinus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (12)	
American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (11)	
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Southeastern Myotis	*Myotis austroriparius*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Eastern Chipmunk	*Tamias striatus*
Golden Mouse	*Ochrotomys nuttalli*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (18)	
Allegheny-spurge	*Pachysandra procumbens*
American Alumroot	*Heuchera americana*
American Ginseng	*Panax quinquefolius*
Bay Starvine	*Schisandra glabra*
Canada Enchanter's-nightshade	*Circaea lutetiana ssp. canadensis*
Canada Wild Ginger	*Asarum canadense*
Carolina Gentian	*Frasera caroliniensis*
Carpenter's Ground-cherry	*Physalis carpenteri*
Climbing Bittersweet	*Celastrus scandens*

Crested Coralroot	*Hexalectris spicata*
Glade Fern	*Diplazium pycnocarpon*
Low Erythrodes	*Platythelys querceticola*
Pyramid Magnolia	*Magnolia pyramidata*
Shadow-witch Orchid	*Ponthieva racemosa*
Silver False Spleenwort	*Deparia acrostichoides*
Virginia Saxifrage	*Saxifraga virginiensis*
White Baneberry	*Actaea pachypoda*
Woodland Bluegrass	*Poa sylvestris*

Threats Affecting Habitat:

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

Southern Mesophytic Forest Threats Assessment:

1st 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 Research Needs/Conservation Actions:

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

p. 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:

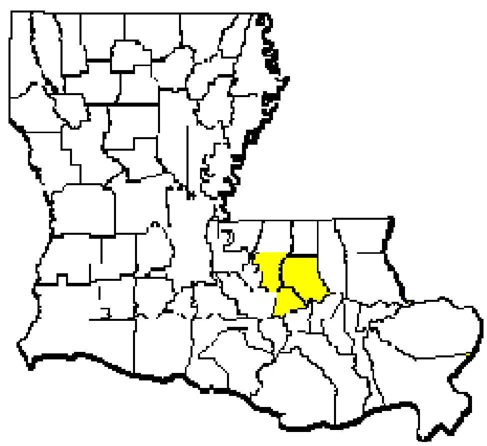
This flatwoods type is a natural mixed forest community endemic to the western Florida Parishes. A wetland variant of this community occupies poorly drained flats, depressional areas and small drainages (sometimes called "slashes") that occur in a mosaic with higher, non-wetland areas. Such higher areas support a mesic Spruce Pine-Hardwood Flatwood forest. Both variants are distinguished by the prevalence of Spruce Pine (*Pinus glabra*) 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 Longleaf Pine (*Pinus palustris*) communities occupying similar hydrologic settings in the eastern Florida Parishes (Smith 1996). This edaphic factor may have precluded Longleaf Pine 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	
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 to have been 50,000 to 100,000 acres, with 10-25% currently remaining (Smith 1993). Protected occurrences of this habitat occur on Tickfaw State Park and Frenchtown Road Conservation Area.



Spruce Pine-Hardwood Flatwoods SGCN (29)	
Crustaceans (1)	
Flatnose Crawfish	*Procambarus planirostris*
Amphibians (3)	
Four-toed Salamander	*Hemidactylium scutatum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*
Reptiles (5)	
Coal Skink	*Plestiodon anthracinus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Pine Woods Littersnake	*Rhadinaea flavilata*
Timber Rattlesnake	*Crotalus horridus*

Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (11)	
American Woodcock	*Scolopax minor*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Wood Thrush	*Hylocichla mustelina*
Prothonotary Warbler	*Protonotaria citrea*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Rusty Blackbird	*Euphagus carolinus*
Mammals (9)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Bachman's Fox Squirrel	*Sciurus niger bachmani*
Golden Mouse	*Ochrotomys nuttalli*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*

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 Flatwoods Threats Assessment:			
1st 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 Research Needs/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 conservation servitudes and land acquisition.
3. Provide resources to public and private landowners for invasive species control in this habitat (especially for Chinese Tallow Tree and Chinese Privet).
4. Support production of Spruce Pine seedlings for distribution to landowners interested in restoring this habitat type.

2 . SAVANNAS AND WOODLANDS

a. Eastern Longleaf Pine Flatwoods 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:

Eastern 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 in the understory, 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).

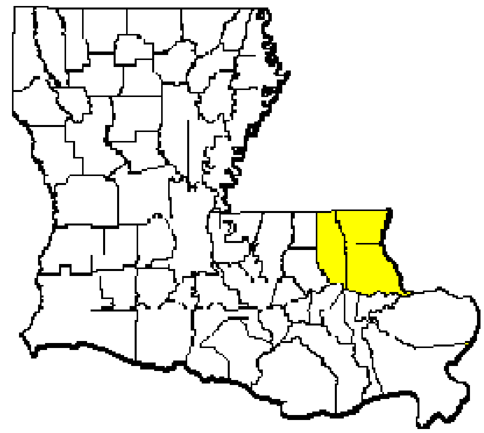
Pine Savannas are found naturally on broad "flats" occupying poorly drained and seasonally saturated/flooded depressional areas. These communities are subject to a highly fluctuating water table, from surface saturation and shallow flooding in late fall/winter/early spring to growing-season drought. In the EGCP, Pine Savannas are commonly associated with mesic upland 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 Pine Flatwoods 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 subsoil.

Fire, soil conditions, and a seasonally high water table work in concert to control community structure in Eastern Longleaf Pine Flatwood Savannas; however 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 Flatwoods Savanna: Characteristic Plants	
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:



Today, Eastern Longleaf Pine Flatwoods Savanna remnants are limited in size compared to the broad expanses that once existed. Historically, the eastern Florida Parishes of Louisiana were dominated by extensive stands of this habitat. Now barely 1% of the original estimated 100,000 to 500,000 acres of Eastern Longleaf Pine Flatwoods Savanna 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 Eastern Longleaf Pine Flatwoods Savanna on portions of their Abita Creek, Lake Ramsey and Talisheek Pine Wetlands Preserves. LDWF owns and manages Lake Ramsey WMA with 796 acres of savanna. This WMA is adjacent to TNC's Lake Ramsey Preserve. Big Branch NWR, Bogue Chitto NWR, and Pearl River WMA collectively contain "pine flatwoods" with remnants of savanna herbaceous flora, 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 Eastern Longleaf Pine Flatwoods Savannas. Several mitigation banks located in close proximity to TNC preserves are protecting and restoring this habitat.

Eastern Longleaf Pine Flatwoods Savanna SGCN (83)	
Crustaceans (3)	
Gulf Crawfish	*Procambarus shermani*
Flatwoods Digger	*Fallicambarus oryktes*
Flatnose Crawfish	*Procambarus planirostris*
Non-crustacean Arthropods (9)	
American Bumble Bee	*Bombus pensylvanicus*
Little Metalmark	*Calephelis virginiensis*
Georgia Satyr	*Neonympha areolatus*
Lace-winged Roadside-Skipper	*Amblyscirtes aesculapius*
Arogos Skipper	*Atrytone arogos*
Yucca Giant-Skipper	*Megathymus yuccae*
Monarch	*Danaus plexippus*
Gulf Pine Sphinx	*Lapara phaeobrachycerous*
Brou's Mallow Moth	*Bagisara brouana*
Amphibians (6)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Four-toed Salamander	*Hemidactylium scutatum*

Southern Dusky Salamander	*Desmognathus auriculatus*
Ornate Chorus Frog	*Pseudacris ornata*
Eastern Spadefoot	*Scaphiopus holbrookii*
Dusky Gopher Frog	*Lithobates sevosus*
Reptiles (6)	
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*
Pine Woods Littersnake	*Rhadinaea flavilata*
Southeastern Crowned Snake	*Tantilla coronata*
Harlequin Coralsnake	*Micrurus fulvius*
Birds (18)	
Northern Bobwhite	*Colinus virginianus*
Yellow Rail	*Coturnicops noveboracensis*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
Southeastern American Kestrel	*Falco sparverius paulus*
Loggerhead Shrike	*Lanius ludovicianus*
Brown-headed Nuthatch	*Sitta pusilla*
Sedge Wren	*Cistothorus platensis*
Prairie Warbler	*Setophaga discolor*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Mammals (5)	
Southeastern Shrew	*Sorex longirostris*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Eastern Harvest Mouse	*Reithrodontomys humulis*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (36)	
Bog Flame Flower	*Macranthera flammea*

Boykin's Milkwort	*Polygala boykinii*
Branched Hedge-hyssop	*Gratiola ramosa*
Chapman's Beak Sedge	*Rhynchospora chapmanii*
Chapman's Milkwort	*Polygala chapmanii*
Ciliate Beak Sedge	*Rhynchospora ciliaris*
Coastal False Asphodel	*Triantha racemosa*
Coastal Plain False Foxglove	*Agalinis aphylla*
Death Camas	*Zigadenus leimanthoides*
Flat-fruit Beak Sedge	*Rhynchospora compressa*
Flax-leaf False Foxglove	*Agalinis linifolia*
Goldencrest	*Lophiola aurea*
Hooker's Milkwort	*Polygala hookeri*
Le Conte's Thistle	*Cirsium lecontei*
Leggett's Pinweed	*Lechea pulchella*
Littleleaf Milkwort	*Polygala brevifolia*
Low Nut Sedge	*Scleria verticillata*
Many-flowered Grass-pink	*Calopogon multiflorus*
Michaux's Milkweed	*Asclepias michauxii*
Night-flowering Wild Petunia	*Ruellia noctiflora*
Pale Grass-pink	*Calopogon pallidus*
Parrot Pitcher Plant	*Sarracenia psittacina*
Rough-hair Witchgrass	*Dichanthelium strigosum var. glabrescens*
Savanna Beak Sedge	*Rhynchospora debilis*
Scalloped Milkwort	*Polygala crenata*
Short-beard Plumegrass	*Saccharum brevibarbe var. brevibarbe*
Shortleaf Sneezeweed	*Helenium brevifolium*
Southern Red Lily	*Lilium catesbaei*
Sprawling Hoary-pea	*Tephrosia hispidula*
Spreading Pogonia	*Cleistes bifaria*
Spring Hill Flax	*Linum macrocarpum*
Staghorn Clubmoss	*Lycopodiella cernua var. cernua*
Thread-stem False Foxglove	*Agalinis filicaulis*
Tracy's Sundew	*Drosera tracyi*
Yellow Butterwort	*Pinguicula lutea*
Yellow Fringeless Orchid	*Platanthera integra*

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 Flatwoods Savanna Threats Assessment:			
1st 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 Research Needs/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.
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".

b. 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

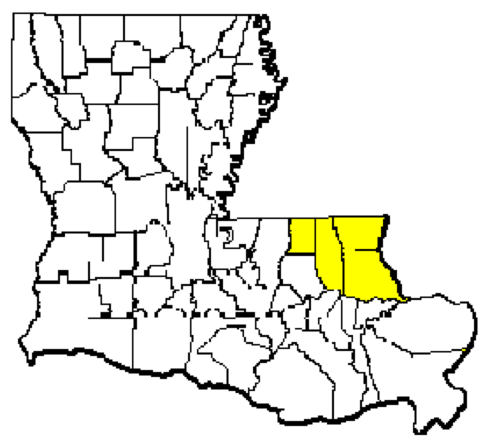
General Description:

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 acidic 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 cover. 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	
Split-Beard Bluestem	*Andropogon ternarius*
Arrowfeather Threeawn	*Aristida purpurascens* var. *virgata*
Roundhead Lespedeza	*Lespedeza capitata*
Blazing Stars	*Liatris* spp.
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*
Pineywoods Dropseed	*Sporobolus junceus*
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 1-5% of the original estimated 1 to 2 million acres of Eastern 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 Pine Woodland remaining in Louisiana. LDWF also manages an Eastern Upland 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 (LSU) 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 (59)	
Crustaceans (1)	
Flatwoods Digger	*Fallicambarus oryktes*
Non-crustacean Arthropods (6)	
Florida Harvester Ant	*Pogonomyrmex badius*
American Bumble Bee	*Bombus pensylvanicus*
Mottled Duskywing	*Erynnis martialis*
Dusky Roadside-Skipper	*Amblyscirtes alternata*
Yucca Giant-Skipper	*Megathymus yuccae*
Monarch	*Danaus plexippus*
Amphibians (3)	
Ornate Chorus Frog	*Pseudacris ornata*
Eastern Spadefoot	*Scaphiopus holbrookii*
Dusky Gopher Frog	*Lithobates sevosus*
Reptiles (9)	
Gopher Tortoise	*Gopherus polyphemus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*
Black Pinesnake	*Pituophis melanoleucus lodingi*
Southeastern Crowned Snake	*Tantilla coronata*
Harlequin Coralsnake	*Micrurus fulvius*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (18)	
Northern Bobwhite	*Colinus virginianus*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
Southeastern American Kestrel	*Falco sparverius paulus*
Loggerhead Shrike	*Lanius ludovicianus*
Brown-headed Nuthatch	*Sitta pusilla*
Sedge Wren	*Cistothorus platensis*
Prairie Warbler	*Setophaga discolor*

Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Eastern Meadowlark	*Sturnella magna*
Mammals (6)	
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (16)	
Alabama Grape Fern	*Botrychium jenmanii*
Boykin's Milkwort	*Polygala boykinii*
Carolina Fluff Grass	*Tridens carolinianus*
Dwarf Gray Willow	*Salix humilis var. tristis*
Fly-poison	*Amianthium muscitoxicum*
Illinois Pinweed	*Lechea racemulosa*
Incised Groovebur	*Agrimonia incisa*
Lady Lupine	*Lupinus villosus*
Michaux's Milkweed	*Asclepias michauxii*
Narrowleaf Whitetop Aster	*Sericocarpus linifolius*
One-flowered Broomrape	*Orobanche uniflora*
Rough-hair Witch Grass	*Dichanthelium strigosum var. leucoblepharis*
Sand Hickory	*Carya pallida*
Scarlet Oak	*Quercus coccinea*
Thymeleaf Pinweed	*Lechea minor*
Wild Coco Orchid	*Pteroglossaspis ecristata*

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:

1st 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 Research Needs/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 Prescribed Burn Initiatives (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".

c. 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:

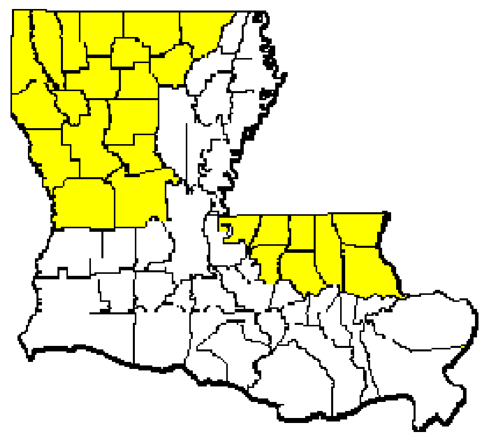
The Shortleaf Pine/Oak-Hickory Woodland community occurs on dry hills, principally in central and northern Louisiana, as well as in the Florida Parishes. In the Upper West Gulf Coastal Plain (UWGCP), this was the most prevalent habitat on the landscape (i.e., it was the matrix community). The overstory 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 found in Longleaf Pine grasslands. Fire is an important process in this community, and 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	
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 4-6 million acres of Shortleaf Pine/Oak-Hickory Forest in Louisiana and, of this original extent, 5-10% 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 (50)	
Crustaceans (2)	
Flatwoods Digger	*Fallicambarus oryktes*
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (1)	
Lace-winged Roadside-Skipper	*Amblyscirtes aesculapius*
Amphibians (4)	
Southern Red-backed Salamander	*Plethodon serratus*
Louisiana Slimy Salamander	*Plethodon kisatchie*
Strecker's Chorus Frog	*Pseudacris streckeri*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (9)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*

Eastern Glass Lizard	*Ophisaurus ventralis*
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*
Coal Skink	*Plestiodon anthracinus*
Western Wormsnake	*Carphophis vermis*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (21)	
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
Yellow-throated Vireo	*Vireo flavifrons*
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*
Wood Thrush	*Hylocichla mustelina*
Worm-eating Warbler	*Helmitheros vermivorum*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
Hooded Warbler	*Setophaga citrina*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Painted Bunting	*Passerina ciris*
Rusty Blackbird	*Euphagus carolinus*
Mammals (13)	
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Eastern Chipmunk	*Tamias striatus*
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Golden Mouse	*Ochrotomys nuttalli*

Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*

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:

1st 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 Research Needs/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 the U.S. Forest Service (USFS), Department of Defense (DOD), and Office of State Lands (LOSL) 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 restored by aggressive harvesting of off-site pine species, replanting of Shortleaf Pine, and prescribed burning.

d. 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” Eastern 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 Bayhead Swamps. 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, hydrology, and fire regimes (LNHP 2009; Teague et al. 1995). Existing examples of this habitat encompass 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.

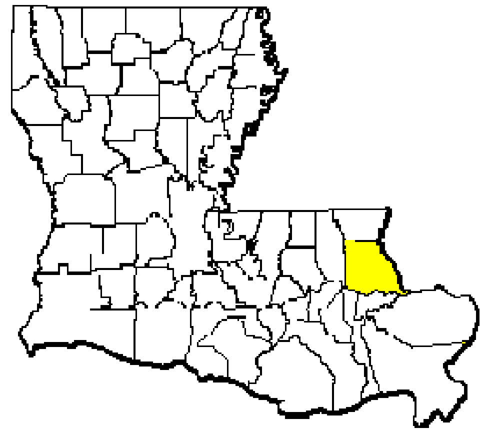
Slash Pine-Pondcypress/Hardwood Woodlands evolved with recurrent lightning-season ground fires, and regular light surface fire appears critical in maintaining this community. Both Slash Pine and Pondcypress are fire-adapted species and can survive fires once they attain a certain size; however, neither 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 averaged 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	
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*
Fringed Yellow-eyed-grass	*Xyris fimbriata*
Pineland Yellow-eyed-grass	*Xyris stricta* var. *stricta*

Current Extent and Status:

In the EGCP of Louisiana, 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 10-25% currently remaining (Smith 1993, Smith 1999). Protected examples occur on TNC's Talisheek Pine Wetlands and Abita Creek Flatwoods Preserves, as well as several nearby mitigation banks.



Slash Pine-Pondcypress-Hardwood Woodland SGCN (41)	
Crustaceans (1)	
Flatnose Crawfish	*Procambarus planirostris*
Non-crustacean Arthropods (2)	
Arogos Skipper	*Atrytone arogos*
Brou's Mallow Moth	*Bagisara brouana*
Amphibians (7)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Four-toed Salamander	*Hemidactylium scutatum*
Southern Dusky Salamander	*Desmognathus auriculatus*
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*
Ornate Chorus Frog	*Pseudacris ornata*
Eastern Spadefoot	*Scaphiopus holbrookii*
Dusky Gopher Frog	*Lithobates sevosus*
Reptiles (6)	
Eastern Glass Lizard	*Ophisaurus ventralis*
Coal Skink	*Plestiodon anthracinus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Pine Woods Littersnake	*Rhadinaea flavilata*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (10)	
Swallow-tailed Kite	*Elanoides forficatus*
American Woodcock	*Scolopax minor*

Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Yellow-throated Vireo	*Vireo flavifrons*
Prothonotary Warbler	*Protonotaria citrea*
Kentucky Warbler	*Geothlypis formosa*
American Redstart	*Setophaga ruticilla*
Hooded Warbler	*Setophaga citrina*
Yellow-throated Warbler	*Setophaga dominica*
Mammals (9)	
Southeastern Shrew	*Sorex longirostris*
Southeastern Myotis	*Myotis austroriparius*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*
Bachman’s Fox Squirrel	*Sciurus niger bachmani*
Golden Mouse	*Ochrotomys nuttalli*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (6)	
Acid-swamp Yellow-eyed-grass	*Xyris serotina*
Georgia Tickseed	*Coreopsis nudata*
Parrot Pitcher Plant	*Sarracenia psittacina*
Pineland Yellow-eyed-grass	*Xyris stricta var. stricta*
Pink Bog Button	*Sclerolepis uniflora*
Spoonleaf Sundew	*Drosera intermedia*

Threats Affecting Habitat:

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:			
1st 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 Research Needs/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 affect 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.

e. 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*:**

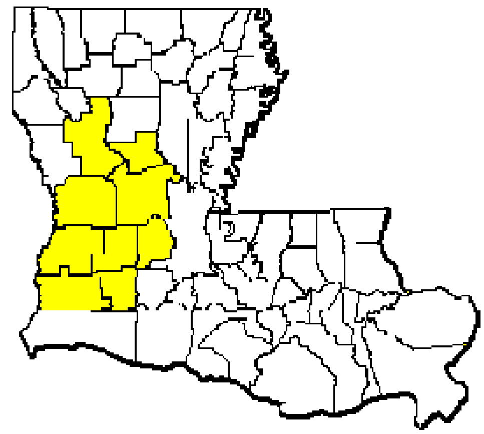
Western Longleaf Pine Flatwoods Savanna includes both acidic (S1S2) and saline (sodic) types (S1). Saline Western Longleaf Pine Flatwoods Savannas occur mainly on Brimstone Silt Loam, which is a sodic or alkali soil. Pine savannas are floristically rich, herb-dominated wetlands that are naturally sparsely 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, Western 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 through which air and water move slowly.

The only known extant Louisiana occurrences of *Schwalbea americana* (American Chaffseed), which is federally-listed as endangered, are found on pimple mounds in Western 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 eventually eliminate the herbaceous flora.

Western Longleaf Pine Flatwoods Savanna, Beauregard Parish

Western Longleaf Pine Flatwoods Savanna: Characteristic Plants	
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/Alkali)	
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 1-5% remaining (Smith 1993).

Most extant Western Longleaf Pine Flatwoods 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. Recovery potential in degraded examples varies depending on the site history. In some cases, much of the diverse herbaceous ground cover has returned with reintroduction of fire.

Western Longleaf Pine Flatwoods Savanna SGCN (54)	
Crustaceans (1)	
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (5)	
Texas Brown Tarantula	*Aphonopelma hentzi*
American Bumble Bee	*Bombus pensylvanicus*
Little Metalmark	*Calephelis virginiensis*
Monarch	*Danaus plexippus*
Gulf Pine Sphinx	*Lapara phaeobrachycerous*
Amphibians (2)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (3)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Birds (18)	
Northern Bobwhite	*Colinus virginianus*
Yellow Rail	*Coturnicops noveboracensis*

American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Chuck-will's-widow	*Antrostomus carolinensis*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*
Sedge Wren	*Cistothorus platensis*
Loggerhead Shrike	*Lanius ludovicianus*
Prairie Warbler	*Setophaga discolor*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Mammals (3)	
Eastern Harvest Mouse	*Reithrodontomys humulis*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (22)	
American Chaffseed	*Schwalbea americana*
Arkansas Leastdaisy	*Chaetopappa asteroides*
Boykin's Milkwort	*Polygala boykinii*
Chapman's Milkwort	*Polygala chapmanii*
Coastal Plain Lobelia	*Lobelia flaccidifolia*
Dotted Gayfeather	*Liatris punctata*
Flat-fruit Beak Sedge	*Rhynchospora compressa*
Rough-hair Witch Grass	*Dichanthelium strigosum var. leucoblepharis*
Branched Hedge-hyssop	*Gratiola ramosa*
Oklahoma Grass-pink	*Calopogon oklahomensis*
Thread-stem False Foxglove	*Agalinis filicaulis*
Rosinweed Sunflower	*Helianthus silphioides*
Rough-hair Witch Grass	*Dichanthelium strigosum var. leucoblepharis*
Savanna Beak Sedge	*Rhynchospora debilis*
Scalloped Milkwort	*Polygala crenata*
Silveus Dropseed	*Sporobolus silveanus*
Pale False Foxglove	*Agalinis skinneriana*
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*
Small-fruit Seedbox	*Ludwigia microcarpa*

Spreading Beak Sedge	*Rhynchospora divergens*
Wand Blackroot	*Pterocaulon virgatum*
Wild Coco Orchid	*Pteroglossaspis ecristata*

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:

1st 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
Overall Calculated Threat Impact: Very High			

Habitat Research Needs/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.
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.

f. 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:

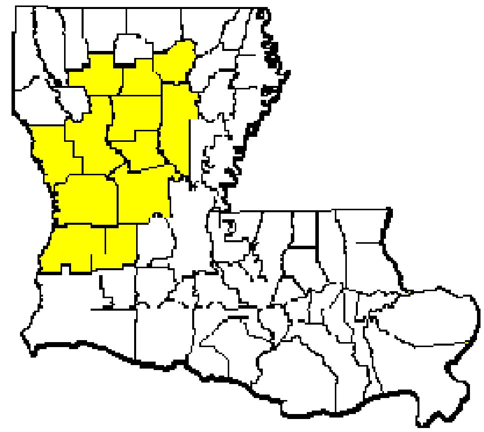
This habitat occurs in the hilly uplands in western and central Louisiana. It occurs on acidic sandy loams to acidic clays associated with Pleistocene or Tertiary formations. Soil moisture regimes range from dry-mesic to xeric. The community is characteristically dissected by small to large creek bottoms. 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 occurred. 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	
Dry-Mesic	
Big Bluestem	*Andropogon gerardii*
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*
Pineywoods Dropseed	*Sporobolus junceus*
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 West Gulf Coastal Plain (WGCP). 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 acres with an estimated 10-25% remaining (Smith 1993). Currently, the largest tracts of this community are found on KNF and Fort Polk Military Reservation and WMA.



Western Upland Longleaf Pine Woodland SGCN (72)	
Crustaceans (1)	
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (17)	
Texas Brown Tarantula	*Aphonopelma hentzi*
American Bumble Bee	*Bombus pensylvanicus*
Little Metalmark	*Calephelis virginiensis*
Monarch	*Danaus plexippus*
Texas Emerald	*Somatochlora margarita*
Comanche Harvester Ant	*Pogonomyrmex comanche*
Frosted Elfin	*Callophrys irus*
Little Metalmark	*Calephelis virginiensis*
Georgia Satyr	*Neonympha areolatus*
Mottled Duskywing	*Erynnis martialis*
Wild Indigo Duskywing	*Erynnis baptisiae*
Dusky Roadside-Skipper	*Amblyscirtes alternata*
Dusted Skipper	*Atrytonopsis hianna*
Meske's Skipper	*Hesperia meskei*
Yucca Giant-Skipper	*Megathymus yuccae*
Strecker's Giant-Skipper	*Megathymus streckeri*
Falcate Orangetip	*Anthocharis midea*
Amphibians (4)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Southern Red-backed Salamander	*Plethodon serratus*
Hurter's Spadefoot	*Scaphiopus hurterii*

Reptiles (6)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Coal Skink	*Plestiodon anthracinus*
Louisiana Pinesnake	*Pituophis ruthveni*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (17)	
Northern Bobwhite	*Colinus virginianus*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
White-breasted Nuthatch	*Sitta carolinensis*
Brown-headed Nuthatch	*Sitta pusilla*
Sedge Wren	*Cistothorus platensis*
Loggerhead Shrike	*Lanius ludovicianus*
Prairie Warbler	*Setophaga discolor*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Eastern Meadowlark	*Sturnella magna*
Mammals (8)	
Northern Long-eared Bat	*Myotis septentrionalis*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Hispid Pocket Mouse	*Chaetodipus hispidus*
Golden Mouse	*Ochrotomys nuttalli*
Ringtail	*Bassariscus astutus*
Long-tailed Weasel	*Mustela frenata*
Plants (19)	
American Chaffseed	*Schwalbea americana*
American Jointweed	*Polygonella americana*
Culver's-root	*Veronicastrum virginicum*
Dwarf Gray Willow	*Salix humilis var. tristis*

Illinois Flat Sedge	*Cyperus grayoides*
Louisiana Squarehead	*Tetragonotheca ludoviciana*
Many-flowered Wild-buckwheat	*Eriogonum multiflorum*
October-flower	*Polygonella polygama*
Oklahoma Grass-pink	*Calopogon oklahomensis*
One-flowered Broomrape	*Orobanche uniflora*
Pale False Foxglove	*Agalinis skinneriana*
Rosinweed Sunflower	*Helianthus silphioides*
Sand Spikemoss	*Selaginella arenicola ssp. riddellii*
Silver Croton	*Croton argyranthemus*
Slender Gayfeather	*Liatris tenuis*
Smooth Twistflower	*Streptanthus hyacinthoides*
Soxman's Milkvetch	*Astragalus soxmaniorum*
Thymeleaf Pinweed	*Lechea minor*
Wild Coco Orchid	*Pteroglossaspis ecristata*

Threats Affecting Habitat:

Most of the historical acreage of this habitat now supports 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:

1st 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 Research Needs/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, protection (e.g., conservation 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”.

g. 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:

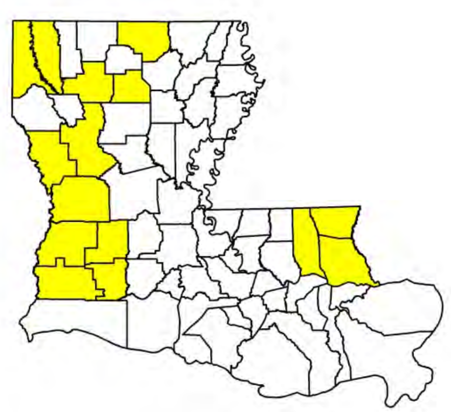
Xeric Sandhill Woodlands develop on deep sandy soils on Tertiary uplands and Pleistocene stream terraces. Most occurrences are in the latter setting. Soils are nutrient-poor, excessively well-drained loamy fine sands. Fire may be an important process maintaining some examples of this community. However, 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	
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*
Shortleaf Pine (UWGCP)	*Pinus echinata*
Prickly Pear	*Opuntia* sp.
Bluejack Oak	*Quercus incana*
Sand Post Oak	*Quercus margaretta*
Gray's Beak Sedge	*Rhynchospora grayi*
Louisiana Squarehead	*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). Pre-settlement extent of Xeric Sandhill Woodland habitat west of the Mississippi River is estimated to have been 50,000 to 100,000 acres, with 10-25% remaining today (Smith 1993). Most remaining Xeric Sandhill Woodlands in the WGCP are highly degraded (MacRoberts and MacRoberts 1995). East of the Mississippi River, Xeric Sandhill Woodland is thought to have occupied 2,000 to 10,000 acres, with 5-10 % remaining. A handful of protected occurrences are captured by Ft. Polk, KNF, and TNC's Caddo Black Bayou Preserve, all located in western Louisiana.



Xeric Sandhill Woodland SGCN (80)	
Crustaceans (1)	
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (6)	
Florida Harvester Ant	*Pogonomyrmex badius*

Comanche Harvester Ant	*Pogonomyrmex comanche*
American Bumble Bee	*Bombus pensylvanicus*
Cobweb Skipper	*Hesperia metea*
Monarch	*Danaus plexippus*
Texas Brown Tarantula	*Aphonopelma hentzi*
Amphibians (2)	
Strecker's Chorus Frog	*Pseudacris streckeri*
Hurter's Spadefoot	*Scaphiopus hurterii*
Reptiles (8)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*
Coal Skink	*Plestiodon anthracinus*
Texas Horned Lizard	*Phrynosoma cornutum*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Louisiana Pinesnake	*Pituophis ruthveni*
Timber Rattlesnake	*Crotalus horridus*
Pygmy Rattlesnake	*Sistrurus miliarius*
Birds (12)	
Northern Bobwhite	*Colinus virginianus*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Loggerhead Shrike	*Lanius ludovicianus*
Bell's Vireo	*Vireo bellii*
Prairie Warbler	*Setophaga discolor*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Painted Bunting	*Passerina ciris*
Eastern Meadowlark	*Sturnella magna*
Mammals (7)	
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Hispid Pocket Mouse	*Chaetodipus hispidus*
Golden Mouse	*Ochrotomys nuttalli*
Ringtail	*Bassariscus astutus*
Long-tailed Weasel	*Mustela frenata*

Plants (44)	
American Jointweed	*Polygonella americana*
Arkansas Oak	*Quercus arkansana*
Awl-shaped Scurfpea	*Pediomelum hypogaeum var. subulatum*
Cottony Goldenaster	*Chrysopsis gossypina ssp. hyssopifolia*
Culver's-root	*Veronicastrum virginicum*
Cupleaf Beardtongue	*Penstemon murrayanus*
Drummond's Nailwort	*Paronychia drummondii*
Earleaf Greenbrier	*Smilax auriculata*
Early Goldenrod	*Solidago juncea*
East Texas Greenthread	*Thelesperma flavodiscum*
Golden-wave Tickseed	*Coreopsis intermedia*
Gopher-apple	*Licania michauxii*
Heartleaf Skullcap	*Scutellaria cardiophylla*
Illinois Flat Sedge	*Cyperus grayoides*
Large Clammyweed	*Polanisia erosa*
Longleaved Wild-buckwheat	*Eriogonum longifolium*
Louisiana Squarehead	*Tetragonotheca ludoviciana*
Many-flowered Wild-buckwheat	*Eriogonum multiflorum*
October-flower	*Polygonella polygama*
Oklahoma Plum	*Prunus gracilis*
Pale Umbrella-wort	*Mirabilis albida*
Palm-leaf Scurfpea	*Pediomelum digitatum*
Perennial Sand Grass	*Triplasis americana*
Pineland Scaly-pink	*Stipulicida setacea*
Pinewoods Milkweed	*Asclepias humistrata*
Prairie Fameflower	*Phemeranthus rugospermus*
Prairie Milkvine	*Matelea cynanchoides*
Purple Poppy-mallow	*Callirhoe involucrata*
Sand Spikemoss	*Selaginella arenicola ssp. riddellii*
Sandhills Scorpionweed	*Phacelia strictiflora*
Scarlet Catchfly	*Silene subciliata*
Silky Prairie-clover	*Dalea villosa var. grisea*
Silver Croton	*Croton argyranthemus*
Slimspike Prairie-clover	*Dalea phleoides*
Smooth Twistflower	*Streptanthus hyacinthoides*
Soxman's Milkvetch	*Astragalus soxmaniorum*
Spreading Pygmyleaf	*Loeflingia squarrosa*
Summer Farewell	*Dalea pinnata*
Texas Palafoxia	*Palafoxia texana var. ambigua*
Texas Ragwort	*Senecio ampullaceus*

Turkey Oak	*Quercus laevis*
Viperina	*Zornia bracteata*
Wedgeleaf Whitlow-grass	*Draba cuneifolia*
Woolly Plantain	*Plantago patagonica*

Threats Affecting Habitat:

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

<u>Xeric Sandhill Woodland Threats Assessment:</u>

1st 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 Research Needs/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. <u>SHRUBLANDS</u>

a. 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). American Bison, Louisiana Black Bear, Wild Turkey, White-tailed Deer, Cougar, 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 have accounted for the largest and most extensive Canebrakes (Noss 2013, Brantley and Platt 2001). It is hypothesized that the Passenger Pigeon (now extinct) 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	
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. This habitat is now extirpated in Louisiana.

Canebrake SGCN (12)	
Non-crustacean Arthropods (2)	
Creole Pearly-eye	*Lethe creola*
Lace-winged Roadside Skipper	*Amblyscirtes aesculapius*
Reptiles (1)	
Timber Rattlesnake	*Crotalus horridus*
Birds (5)	
Worm-eating Warbler	*Helmitheros vermivorum*
Louisiana Waterthrush	*Parkesia motacilla*
Swainson's Warbler	*Limnothlypis swainsonii*
Kentucky Warbler	*Geothlypis formosa*
Hooded Warbler	*Setophaga citrina*
Mammals (4)	
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Golden Mouse	*Ochrotomys nuttalli*

Habitat Research Needs/Conservation Actions:

1) Identify historical occurrences of Canebrakes using General Land Office land survey records and plat maps; concentrate search within the MRAP in areas that are currently captured by conservation lands.

2) Initiate an experimental habitat restoration project on at least one site on an existing conservation area known to have been a Canebrake based on historical evidence and where Giant Cane is still present.
3) Document response by Giant Cane and responses of wildlife species to overstory removal and prescribed fire.

b. 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

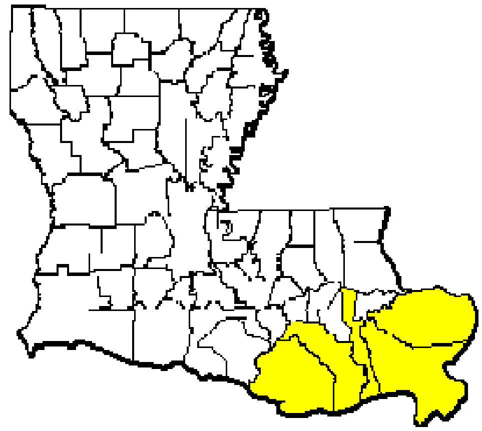
General Description:

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 mangroves for nesting.

Coastal Mangrove-Marsh Shrubland, Lafourche Parish

Coastal Mangrove-Marsh Shrubland: Characteristic Plant Species	
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 acres. 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 Barrier Islands Refuge and Breton NWR.

Coastal Mangrove-Marsh Shrubland SGCN (13)	
Non-crustacean Arthropods (2)	
Western Pygmy Blue	*Brephidium exilis*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Reptiles (2)	
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Birds (9)	
Brown Pelican	*Pelecanus occidentalis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Clapper Rail	*Rallus crepitans*
Marsh Wren	*Cistothorus palustris*
Nelson's Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*

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:			
1st 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 Research Needs/Conservation Actions:

1. Promote the continued planting of mangrove as a soil stabilizer in habitat restoration projects.
2. Support CPRA, CWPPRA, LCA, LDNR, USACE, and other partner efforts for shoreline stabilization and habitat restoration.
3. Work with CPRA and LCA to support coastal restoration projects, specifically targeting important nesting habitat for SGCN.

4. GRASSLANDS

a. 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 exerts a major influence in the configuration of the various marsh types.

Brackish Marsh, Jefferson Parish

Brackish Marsh: Characteristic Plant Species	
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 50-75% 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 LDWF properties containing Brackish Marsh include Pointe-aux-Chenes WMA and Rockefeller State Wildlife Refuge. Paul J. Rainey Sanctuary, owned by the 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)	
Crustaceans (1)	
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (5)	
Bay Skipper	*Euphyes bayensis*
Palatka Skipper	*Euphyes pilatka*
Western Pygmy Blue	*Brephidium exilis*
Eastern Pygmy Blue	*Brephidium pseudofea*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Marine Fish (7)	

Diamond Killifish	*Adinia xenica*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Texas Pipefish	*Syngnathus texanus*
Emerald Sleeper	*Erotelis smaragdus*
Violet Goby	*Gobioides broussonnetii*
Reptiles (2)	
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Birds (36)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Yellow Rail	*Coturnicops noveboracensis*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus crepitans*
King Rail	*Rallus elegans*
Whooping Crane	*Grus americana*
Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Coastal Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*

Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Short-eared Owl	*Asio flammeus*
Loggerhead Shrike	*Lanius ludovicianus*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (1)	
Arrow-grass	*Triglochin striata*

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:

1st 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 Research Needs/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, CWPPRA, USACE, LCA, and other organizations to support coastal restoration projects, specifically targeting important waterbird nesting areas and SGCN.
3. Work with USACE and state agencies to ensure 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.

b. 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

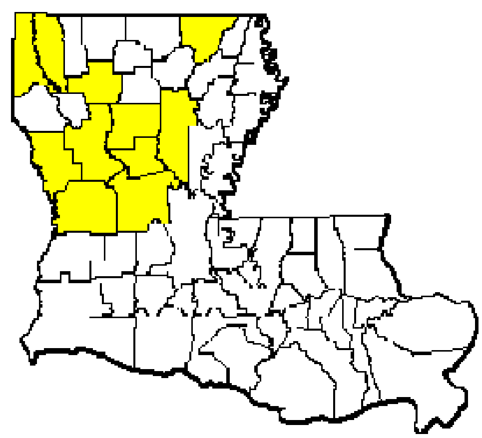
General Description:

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, alkaline soil, extreme physical soil properties, and drought stress to 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	
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 5 to 10% of the original extent is thought to remain today (Smith 1993). Currently, protected Calcareous Prairies occur on each formation.

There are 12 known Morse Clay Prairies in Bienville, Bossier, and Caddo Parishes. Two of these prairies are captured by Bodcau WMA (owned by USACE and leased by LDWF), and Barksdale AFB. Most of the prairie acreage on Bodcau WMA was at one time plowed and planted in food plots. Currently, management involves fire and brush control, and the prairies are expected to improve in quality in the future. On Barksdale AFB, 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. The Morse Clay Prairie in Bienville Parish is on private land and is being improved through stewardship by the landowner. Fleming Calcareous Prairies are scattered in Vernon, Rapides, and Natchitoches Parishes. Several occurrences are on Ft. Polk and KNF. 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 to their former extent.

Most Calcareous Prairies are on private land and are likely degraded. Given the small scale, 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 the forest industry to improve examples of this habitat are expected in the future.

Calcareous Prairie SGCN (55)	
Non-crustacean Arthropods (5)	
American Bumble Bee	*Bombus pensylvanicus*
Frosted Elfin	*Callophrys irus*
Wild Indigo Duskywing	*Erynnis baptisiae*
Dusted Skipper	*Atrytonopsis hianna*
Monarch	*Danaus plexippus*
Amphibians (2)	
Strecker's Chorus Frog	*Pseudacris streckeri*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (2)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Birds (12)	
Northern Bobwhite	*Colinus virginianus*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Loggerhead Shrike	*Lanius ludovicianus*
Smith's Longspur	*Calcarius pictus*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Eastern Meadowlark	*Sturnella magna*
Mammals (2)	
Eastern Harvest Mouse	*Reithrodontomys humulis*
Long-tailed Weasel	*Mustela frenata*

Plants (32)	
Atlantic Camas	*Camassia scilloides*
Barbara's Buttons	*Marshallia caespitosa var. signata*
Coast Indigo	*Indigofera miniata*
Compact Prairie-clover	*Dalea compacta var. pubescens*
Evening Rainlily	*Cooperia drummondii*
Fringed Poppy-mallow	*Callirhoe digitata*
Great Plains Ladies'-tresses	*Spiranthes magnicamporum*
Grooved Yellow Flax	*Linum sulcatum*
Ground-plum	*Astragalus crassicarpus var. trichocalyx*
June Grass	*Koeleria macrantha*
Meadowparsnip	*Thaspium chapmanii*
Mead's Sedge	*Carex meadii*
Missouri Coneflower	*Rudbeckia missouriensis*
Narrow-leaved Milkweed	*Asclepias stenophylla*
Narrowleaved Puccoon	*Lithospermum incisum*
Nuttall's Deathcamas	*Zigadenus nuttallii*
Pale Umbrella-wort	*Mirabilis albida*
Prairie Pleatleaf	*Nemastylis geminiflora*
Prairie Redroot	*Ceanothus herbaceus*
Purple Bluet	*Houstonia purpurea var. calycosa*
Purple Coneflower	*Echinacea purpurea*
Sideoats Grama	*Bouteloua curtipendula*
Slender Heliotrope	*Heliotropium tenellum*
Small-toothed Caric Sedge	*Carex microdonta*
Southern Thimbleweed	*Anemone berlandieri*
Spreading Bladderpod	*Lesquerella gracilis*
Stiff Tickseed	*Coreopsis palmata*
Texas Grama	*Bouteloua rigidiseta*
Texas Yellowstar	*Lindheimera texana*
Tumble Grass	*Schedonnardus paniculatus*
Wedgeleaf Whitlow-grass	*Draba cuneifolia*
Wiry Witch Grass	*Panicum flexile*

Threats Affecting Habitat:

This naturally open habitat is 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:

1st 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 Research Needs/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. Work closely with KNF on stewardship (including supplemental prescribed burning) of the Keiffer Prairie Complex, which is enrolled in LDWF’s Natural Areas Registry.

c. 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 habitat 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 successional relationship. Coastal Dune Grassland occurs on beach dunes and relatively elevated backshore areas (ridges) above intertidal beaches. 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, since they are elevated above the highest flood mark (except during hurricanes) and substrates are sandy and excessively well-drained. 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 plants. 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 and beach ridges on Barrier Islands and the mainland coast. Coastal Dune Shrub Thickets are of very limited extent in Louisiana due to relatively poor 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 vine species. This community may be destroyed by sand dune migration or erosion and may be replaced by Coastal Dune Grassland.

Coastal Dune Shrub Thicket, Jefferson Parish

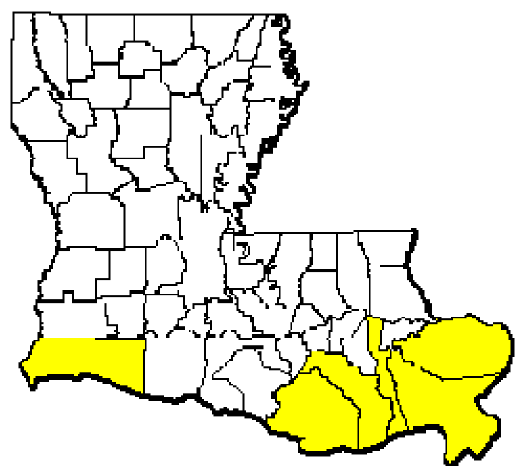
Coastal Dune Grassland, Cameron Parish

Coastal Dune Grassland: Characteristic Plant Species	
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	
Coastal Scrub Wattle	*Acacia farnesiana*
Marine Vine	*Cissus incisa*
Spotted Bee Balm	*Monarda punctata*
Waxmyrtle	*Myrica cerifera*
Rattlebox	*Sesbania drummondii*
Toothache Tree	*Zanthoxylum clava-herculis*

Current Extent and Status:

Coastal Dune Grasslands and Coastal Dune Shrub Thickets are each estimated to have occupied less than 2,000 acres in pre-settlement times, with 50-75% 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 (24)	
Non-crustacean Arthropods (2)	
Monarch	*Danaus plexippus*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Reptiles (3)	

Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Birds (13)	
Brown Pelican	*Pelecanus occidentalis*
White-tailed Kite	*Elanus leucurus*
Wilson's Plover	*Charadrius wilsonia*
Long-billed Curlew	*Numenius americanus*
Common Ground-Dove	*Columbina passerina*
Short-eared Owl	*Asio flammeus*
Crested Caracara	*Caracara cheriway*
Peregrine Falcon	*Falco peregrinus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Grasshopper Sparrow	*Ammodramus savannarum*
Nelson's Sparrow	*Ammodramus nelsoni*
Plants (6)	
Gulf Bluestem	*Schizachyrium maritimum*
Mexican Hat	*Ratibida peduncularis*
Nuttall's Milkvetch	*Astragalus nuttallianus*
Roundleaf Scurfpea	*Pediomelum rhombifolium*
Sea Oats	*Uniola paniculata*
Wedgeleaf Prairie-clover	*Dalea emarginata*

Threats Affecting Habitat:

Both Coastal Dune Grasslands and Shrub Thickets are threatened by several sources of habitat disturbance, 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. Sand supply is limited by the relatively sediment-impoverished Mississippi River and impediments to longshore deposition of sediments.

Coastal Dune Grassland Threats Assessment:			
1st 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:			
1st 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 Research Needs/Conservation Actions:

1. Support CPRA, CWPPRA, LCA, LDNR, USACE, and other partner efforts for shoreline stabilization and habitat restoration. Work with local governments to recommend limits on off-road vehicle (ORV) use in this habitat.
2. Work with NRCS Plant Materials Center and BTNEP to develop viable cultivars for coastal dune restoration efforts.

3. Review and research the effects of cattle grazing on sand dunes and encourage grazing practices that preserve the integrity of these habitats.
4. Work with partners to acquire and restore existing and historical occurrences of this community, as well as identify and acquire areas where such habitats could be created as SLR impacts existing areas.
5. Control the invasive exotic Salt Cedars (*Tamarix* spp.), which pose a serious threat to this habitat.

d. 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

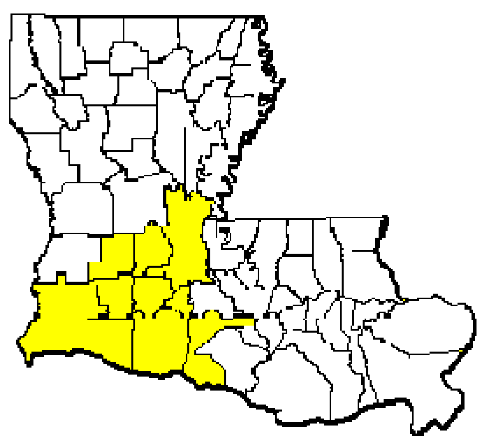
General Description:

Coastal Prairie is an extension of the tall-grass prairie of the eastern Great Plains, and is characterized by a diverse flora consisting of tall grasses and forbs. A combination of historical dry climate intervals, 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 prairies 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 (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 Coastal Prairie landscape.

Coastal Prairie, Calcasieu Parish

Coastal Prairie: Characteristic Plants	
Indian-plantain	*Arnoglossum ovatum*
False Indigos	*Baptisia alba, B. bracteata, 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 1% 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 NWR and White Lake Wetlands Conservation Area support this wet prairie type. Six confirmed 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 approximately 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 (60)	
Crustaceans (1)	
Old Prairie Digger	*Fallicambarus macneesei*
Non-crustacean Arthropods (3)	
American Bumble Bee	*Bombus pensylvanicus*
Celia's Roadside-Skipper	*Amblyscirtes celia*
Monarch	*Danaus plexippus*
Amphibians (1)	
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (4)	
Western Chicken Turtle	*Deirochelys reticularia miaria*
Ornate Box Turtle	*Terrapene ornata*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Birds (27)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Northern Bobwhite	*Colinus virginianus*
American Bittern	*Botaurus lentiginosus*
Little Blue Heron	*Egretta caerulea*
White-tailed Kite	*Elanus leucurus*
Yellow Rail	*Coturnicops noveboracensis*
Black Rail	*Laterallus jamaicensis*
Sandhill Crane	*Antigone canadensis*
Whooping Crane	*Grus americana*
Upland Sandpiper	*Bartramia longicauda*
Long-billed Curlew	*Numenius americanus*
Buff-breasted Sandpiper	*Calidris subruficollis*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Short-eared Owl	*Asio flammeus*
Crested Caracara	*Caracara cheriway*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Sprague's Pipit	*Anthus spragueii*
Field Sparrow	*Spizella pusilla*

Grasshopper Sparrow	*Ammodramus savannarum*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Dickcissel	*Spiza americana*
Eastern Meadowlark	*Sturnella magna*
Mammals (4)	
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Eastern Harvest Mouse	*Reithrodontomys humulis*
Prairie Vole	*Microtus ochrogaster ludovicianus*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (20)	
Berg's Panic Grass	*Panicum bergii*
Coastal Plain Lobelia	*Lobelia flaccidifolia*
Cryptic Flat Sedge	*Cyperus cephalanthus*
Evening Rainlily	*Cooperia drummondii*
Limewater Brookweed	*Samolus ebracteatus*
Lindheimer's Beebalm	*Monarda lindheimeri*
Low Nut Sedge	*Scleria verticillata*
Mead's Sedge	*Carex meadii*
Oklahoma Grass-pink	*Calopogon oklahomensis*
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*
Scarlet Indian-paintbrush	*Castilleja coccinea*
Small-fruit Seedbox	*Ludwigia microcarpa*
Small Palafoxia	*Palafoxia callosa*
Small's Beak Sedge	*Rhynchospora globularis var. pinetorum*
Small-toothed Caric Sedge	*Carex microdonta*
Texas Grama	*Bouteloua rigidiseta*
Tracy’s Beak Sedge	*Rhynchospora tracyi*
Wand Blackroot	*Pterocaulon virgatum*
Western Horse-nettle	*Solanum dimidiatum*
Wild Coco Orchid	*Pteroglossaspis ecristata*

Threats Affecting Habitat:

Remaining occurrences of this very rare habitat are threatened by inadequate 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. Invasive species such as Chinese Tallow Tree and Feral Hogs threaten prairie remnants. Feral Hogs are particularly destructive in wetter prairies.

Coastal Prairie Threats Assessment:			
1st 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 Research Needs/Conservation Actions:

1. Partner with NGOs, state and federal agencies, private landowners, etc. to promote protection, restoration, and expansion of Coastal Prairie habitat.
2. Partner with the Gulf Coast Prairie Landscape Conservation Cooperative (GCPLCC) and other stakeholders to develop a conservation strategy map to facilitate functional Coastal Prairie restoration and conservation.
3. Promote fire as an essential management tool by providing funding for prescribed burning on prairie remnants and prairie-like grasslands within the historical range of Coastal Prairie.
4. Support initiatives to develop plant materials to facilitate re-establishment of Coastal Prairies, and help develop partnerships to secure long-term funding for plant materials centers.
5. Support research to determine prairie-compatible grazing schemes on Coastal Prairie rangeland and incorporate the outcomes of that research into BMPs.
6. Continue stewardship actions on Coastal Prairie on White Lake Wetlands Conservation Area.
7. Continue to fund and carry out stewardship actions such as brush control and prescribed fire on private rangelands located within the historical Coastal Prairie region.
8. Support and encourage aggressive Feral Hog control measures on Sabine NWR, which supports marsh-fringing Coastal Prairie.
9. Work with USFWS at Cameron Prairie NWR to move forward with re-establishment of Coastal Prairie and to initiate an aggressive prescribed burning program.
10. Partner with railroad companies to protect and properly manage railroad prairie remnants.
11. Locate opportunities to purchase agricultural lands on the historical prairie landscape from willing sellers for grassland conservation.

12. Work with NRCS to accomplish stewardship actions such as brush control and prescribed fire on sites enrolled in grassland CRP within the historical Coastal Prairie range.
13. Pursue long-term protection of Coastal Prairie remnants through cooperative agreements with landowners (e.g., leases, servitudes) or through land acquisition.
14. Identify minimum patch size and connectivity needed to achieve a fully functional Coastal Prairie landscape.
15. Use LiDAR or other high quality, high precision elevation data to evaluate habitat suitability for SGCN that are sensitive to vertical stratification, and use this information to inform conservation and restoration activities.

e. 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:

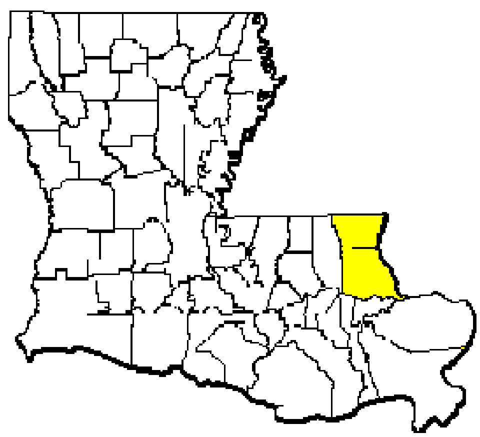
Hillside Seepage Bogs are open, mostly treeless, herb-dominated natural wetlands of hilly uplands historically dominated by Longleaf Pine in the EGCP and WGCP of Louisiana. In the EGCP, these bogs occur on the Pleistocene high terraces in Washington and St. Tammany Parishes, arising commonly on mid- 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 Seepage Bogs are embedded in Longleaf Pine woodlands, 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

Eastern Hillside Seepage Bog: Characteristic Plants	
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:



Eastern Hillside Seepage Bogs 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 10-25% currently remaining in St. Tammany and Washington Parishes (Smith 1993). The actual remaining acreage is probably less than 10%. These present day bogs are most often found surrounded by commercial timberlands and are degraded. 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 Flatwoods 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 (30)	
Crustaceans (2)	
Flatwoods Digger	*Fallicambarus oryktes*
Flatnose Crawfish	*Procambarus planirostris*
Non-crustacean Arthropods (2)	
Arogos Skipper	*Atrytone arogos*
Brou's Mallow Moth	*Bagisara brouana*

Amphibians (2)	
Gulf Coast Mud Salamander	*Pseudotriton montanus flavissimus*
Southern Red Salamander	*Pseudotriton ruber vioscai*
Birds (5)	
Sedge Wren	*Cistothorus platensis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Mammals (3)	
Southeastern Shrew	*Sorex longirostris*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Plants (16)	
Bog Flame Flower	*Macranthera flammea*
Chapman's Beak Sedge	*Rhynchospora chapmanii*
Coastal False Asphodel	*Triantha racemosa*
Coastal Plain Beak Sedge	*Rhynchospora stenophylla*
Harper's Yellow-eyed-grass	*Xyris scabrifolia*
Large White Fringed Orchid	*Platanthera blephariglottis var. conspicua*
Pale Grass-pink	*Calopogon pallidus*
Parrot Pitcher Plant	*Sarracenia psittacina*
Pineland Bogbutton	*Lachnocaulon digynum*
Purple Pitcher Plant	*Sarracenia purpurea*
Southern Red Lily	*Lilium catesbaei*
Spoonleaf Sundew	*Drosera intermedia*
Spring Hill Flax	*Linum macrocarpum*
Staghorn Clubmoss	*Lycopodiella cernua var. cernua*
Tracy's Sundew	*Drosera tracyi*
Yellow Butterwort	*Pinguicula lutea*

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 as such development is occurring in close proximity to several bogs.

Eastern Hillside Seepage Bog Threats Assessment:

1st 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 Research Needs/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. 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.

f. 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 Freshwater 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 Freshwater Floating Marshes are buoyant year-round, whereas thick-mat Freshwater Floating Marshes dominated by Bulltongue (*Sagittaria lancifolia*) are only seasonally buoyant (Swarzenski et al. 1991). Freshwater 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, personal communication). 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 shrub thicket.

The Maidencane Freshwater Floating Marshes are restricted to fresh water environments. State transitions can occur with environmental changes, such as increases in 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 Freshwater 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 Freshwater 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 Freshwater Floating Marsh if the mat is affected.

Colonization of stands of free-floating plants by emergent marsh vegetation can happen. For example, the free-floating invasives Water Hyacinth (*Eichhornia crassipies*) and Common and Giant Salvinia (*Salvinia minima* and S. *molesta*, respectively) 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 Freshwater 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	
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*

C*urrent Extent and Status:*

Floating marshes of all types are estimated to occupy 375,000 acres (Evers et al. 1996; Sasser et al. 1996) but the current extent of Freshwater Floating Marsh as treated here is unknown. Accurate assessments are confounded because almost all low-salinity marshes in the Mississippi River Deltaic 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 NWR.

Freshwater Floating Marsh SGCN (18)	
Non-crustacean Arthropods (1)	
Dion Skipper	*Euphyes dion*
Reptiles (1)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Birds (13)	
Wood Stork	*Mycteria americana*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
King Rail	*Rallus elegans*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Forster's Tern	*Sterna forsteri*
Loggerhead Shrike	*Lanius ludovicianus*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (2)	

Bog Moss	*Mayaca fluviatilis*
Winged Seedbox	*Ludwigia alata*

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, diversions, and other 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:

1st 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	Pervasive	Moderate	Medium
Climate Change & Severe Weather	Pervasive	Extreme	Very High
Overall Calculated Threat Impact: Very High			

Habitat Research Needs/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 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 the National Park Service (NPS) and USFWS to apply appropriate management in this habitat, specifically prescribed burning.

7. Develop outreach materials to increase public awareness of this unique habitat.

g. 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:

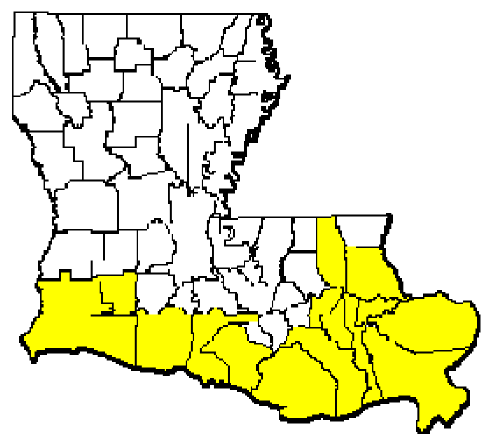
Freshwater Marsh is normally located adjacent to Intermediate Marsh along the northern most extent of the coastal marshes, although it may occur beside coastal bays where freshwater enters (e.g., Atchafalaya Bay). Small pools or ponds may be scattered. The floristic composition of these sites is quite 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 plant 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 Freshwater Floating Marsh 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 this habitat supports high numbers of wintering waterfowl. As with the other marsh types, Freshwater Marsh acts as an important nursery area 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 due to subsidence.

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

Freshwater Marsh: Characteristic Plants	
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 to 25-50% 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 to a lesser extent Joyce and Maurepas Swamp WMAs. Federal lands with Freshwater Marsh in the Deltaic Plain include Delta, Bayou Sauvage, Big Branch, and Mandalay NWRs.

Freshwater Marsh SGCN (48)	
Non-crustacean Arthropods (1)	
Dion Skipper	*Euphyes dion*
Marine Fish (4)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Chain Pipefish	*Syngnathus louisianae*
Reptiles (2)	
Alligator Snapping Turtle	*Macrochelys temminckii*

Western Chicken Turtle	*Deirochelys reticularia miaria*
Birds (32)	
Wood Stork	*Mycteria americana*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Yellow Rail	*Coturnicops noveboracensis*
Black Rail	*Laterallus jamaicensis*
King Rail	*Rallus elegans*
Sandhill Crane	*Antigone canadensis*
Whooping Crane	*Grus americana*
Hudsonian Godwit	*Limosa haemastica*
Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Short-eared Owl	*Asio flammeus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (8)	
Blue Water-lily	*Nymphaea elegans*
Golden Canna	*Canna flaccida*

Grapefruit Primrose-willow	*Ludwigia sphaerocarpa*
Hemlock Water-parsnip	*Sium suave*
Narrow-fruit Horned Beak Sedge	*Rhynchospora inundata*
Rooted Spike Sedge	*Eleocharis radicans*
Slim Spikerush	*Eleocharis elongata*
Swamp Milkweed	*Asclepias incarnata*

Threats Affecting Habitat:

Threats to this habitat include subsidence, salinity input, and invasive species (especially Feral Hogs and Nutria). Increased storm frequency and intensity associated with climate change would subject Freshwater Marshes to greater disturbance and potentially result in higher incidences of salt water intrusion, in concert with SLR.

<u>Freshwater Marsh Threats Assessment:</u>

1st 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 Research Needs/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 for mitigation.
2. Continue to work with USACE 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, LCA, CWPPRA, USACE, and other stakeholders to broaden coastal restoration projects to include Freshwater Marsh.
4. Utilize sediment pipeline delivery to create Freshwater Marsh.

h. 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

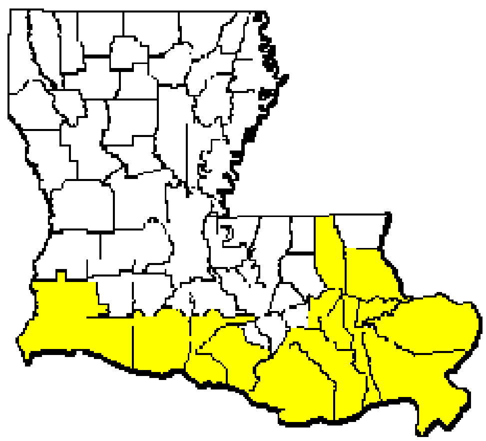
General Description:

Intermediate Marsh is fresh most of the time, but is occasionally affected by saltwater inputs associated with tropical storm surges. This marsh type typically lies between Brackish Marsh and Freshwater Marsh and in estuaries, although it infrequently may be adjacent to the Gulf of Mexico. Intermediate Marsh has an irregular tidal regime and is oligohaline (salinity of 3-10 ppt). Small pools or ponds may be scattered throughout the marsh. 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. Intermediate Marsh 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 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	
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 to 50-75% of this original extent (Smith 1993). The largest contiguous tracts of Intermediate Marsh occur in Cameron, Vermilion, Terrebonne, and Lafourche Parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Rockefeller State Wildlife Refuge and Sabine NWR contain Intermediate to Brackish Marshes. In the Deltaic Plain, Intermediate Marsh can be found on Pointe-aux-Chenes, Pass-a-Loutre, Pearl River, Biloxi, and Manchac WMAs as well as Bayou Sauvage and Big Branch NWRs, and Jean Lafitte National Park and Preserve.

Intermediate Marsh SGCN (47)	
Non-crustacean Arthropods (1)	
Dion Skipper	*Euphyes dion*
Marine Fish (8)	
Gold Brotula	*Gunterichthys lonigpenis*
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Emerald Sleeper	*Erotelis smaragdus*
Violet Goby	*Gobioides broussonnetii*

Birds (37)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus crepitans*
King Rail	*Rallus elegans*
Sandhill Crane	*Antigone canadensis*
Whooping Crane	*Grus americana*
American Oystercatcher	*Haematopus palliatus*
Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Coastal Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Short-eared Owl	*Asio flammeus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*

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, Brackish Marsh, or Salt Marsh.

Intermediate Marsh Threats Assessment:

1st 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
Overall Calculated Threat Impact: High			

Habitat Research Needs/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 USACE and state agencies to ensure water control structures provide the maximum benefit to Intermediate Marsh.
3. Work with landowners and NRCS to develop BMPs for livestock production in this habitat.
4. Work with CPRA, LCA, CWPPRA, USACE and other stakeholders for protection and restoration of Intermediate Marsh and shoreline stabilization as well as to expand coastal restoration projects to include this habitat.

i. Louisiana Beach

***Rarity Ranks**:* S2
Synonyms: none
Ecological System: CES203.469 Louisiana Beach

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. These beaches are usually composed of fine sands, and are generally less well-developed than beaches along other parts of the Gulf Coast. Beaches composed of shell fragments are found primarily along the low-energy shorelines in the central portion of the Louisiana coast. A distinctive feature of Louisiana Beaches is the replacement of Sea Oats (*Uniola paniculata*), a grass much more characteristic of beaches (especially) to the east, by Marshhay Cord Grass (*Spartina patens*) (Barbour et al. 1987). This habitat includes several ecological associations (NatureServe 2015).

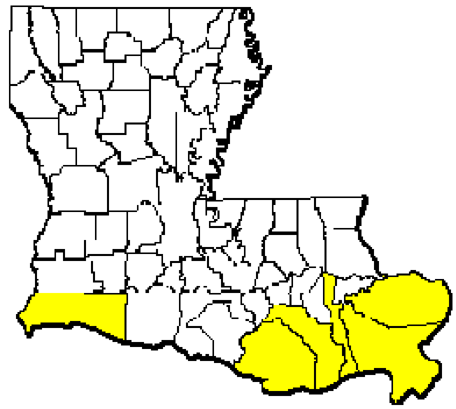
Louisiana Beach, Elmer's Island Wildlife Refuge, Jefferson Parish

Louisiana Beach, Isle Dernieres Barrier Islands Refuge, Terrebonne Parish

Louisiana Beach: Characteristic Plants	
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. Shell beaches are found mainly on the central part of the coast in Vermilion and Iberia Parishes. 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 Louisiana Beach habitat. Exemplary Louisiana Beach habitat occurs on Trinity and Timbalier Islands in the Isle Dernieres Barrier Islands Refuge, on Grand 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. Louisiana Beach habitat can also be found on Breton NWR.



Louisiana Beach SGCN (43)	
Crustaceans (3)	
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Non-crustacean Arthropods (3)	
Eastern Beach Tiger Beetle	*Habroscelimorpha dorsalis venusta*
Bay Skipper	*Euphyes bayensis*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Reptiles (3)	
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Loggerhead Sea Turtle	*Caretta caretta*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Birds (22)	
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*
Reddish Egret	*Egretta rufescens*
Snowy Plover	*Charadrius nivosus*
Wilson's Plover	*Charadrius wilsonia*
Piping Plover	*Charadrius melodus*
American Oystercatcher	*Haematopus palliatus*

Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Red Knot	*Calidris canutus*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Sooty Tern	*Onychoprion fuscatus*
Coastal Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Peregrine Falcon	*Falco peregrinus*
Plants (12)	
Big Sandbur	*Cenchrus myosuroides*
Canada Spike Sedge	*Eleocharis geniculata*
Coastal Ground-cherry	*Physalis angustifolia*
Dune Sandbur	*Cenchrus tribuloides*
Gregg's Amaranth	*Amaranthus greggii*
Gulf Bluestem	*Schizachyrium maritimum*
Inkberry	*Scaevola plumieri*
Sand Dune Spurge	*Chamaesyce bombensis*
Sand Rose-gentian	*Sabatia arenicola*
Sea Oats	*Uniola paniculata*
Southern Hairgrass	*Muhlenbergia capillaris var. filipes*
Woolly Honeysweet	*Tidestromia lanuginosa*

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 reduced coarse sediment in 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, in concert with inundation resulting from SLR.

Louisiana Beach Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Provide general guidelines for prohibited activities on beaches to be used as a standard by local municipalities and work with local enforcement groups to enforce rules.
2. Close beaches to vehicle traffic by installing signs and vehicle barriers.
3. Assure designated parking areas are available at all beach access points. Advise local municipalities on where to 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. Conduct research to determine impacts of cattle grazing to Louisiana Beach habitat and associated wildlife.

j. 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 found on Pleistocene terraces within the MRAP floodplain. These prairies may have been similar to the Grand Prairie of eastern Arkansas. Frequent fire and soil type would have prevented invasion of woody species. 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 in Louisiana.

Mississippi Terrace Prairie: Characteristic Plants	
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:

Mississippi Terrace Prairie historically occupied less than 2,000 acres (Smith 1993). This habitat was historically known from the MRAP ecoregion in northeast Louisiana. This community was converted primarily to agriculture, but some areas were also converted for housing development. No known examples remain today.

Mississippi Terrace Prairie SGCN (23)	
Non-crustacean Arthropods (3)	
American Bumble Bee	*Bombus pensylvanicus*
Monarch	*Danaus plexippus*
Nutmeg Underwing	*Catocala atocala*

Amphibians (1)	
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (4)	
Western Chicken Turtle	*Deirochelys reticularia miaria*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Birds (13)	
Northern Bobwhite	*Colinus virginianus*
Short-eared Owl	*Asio flammeus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Sprague's Pipit	*Anthus spragueii*
Field Sparrow	*Spizella pusilla*
Lark Sparrow	*Chondestes grammacus*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Eastern Meadowlark	*Sturnella magna*
Mammals (2)	
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*

Habitat Research Needs/Conservation Actions:

1. Conduct field surveys within and near areas that historically supported Mississippi 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.

k. 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:

Saline Prairies are small-scale grasslands, often occurring 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 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 sometimes transition upslope into dry-mesic Saline Prairies.

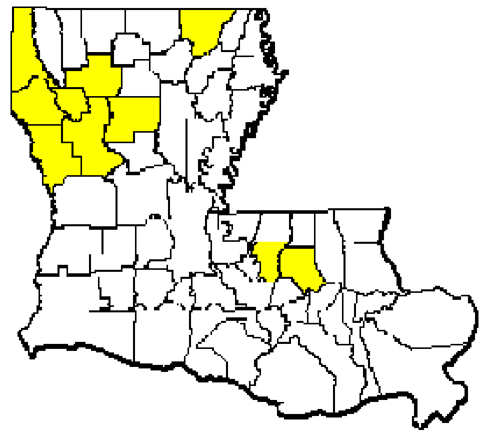
Upland Saline Prairie soils have high levels of exchangeable sodium and sometimes magnesium in the subsoil and near the surface horizons which create extreme conditions for plant growth. Such conditions include relatively high alkalinity, very poor movement of water and air in the soil, resistance to 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 resistant to root penetration. The principal soils supporting this community in the UWGCP and EGCP are the Bonn and Lafe series. Occurrences in the WGCP 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 Saline 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 are ephemeral, 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 prairies 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.

Wet Saline Prairie, Winn Parish

Upland Saline Prairie, De Soto Parish

Saline Prairie: Characteristic Plants	
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:



Saline Prairie is estimated to have occupied less than 2,000 acres historically (Smith 1993). It is unclear whether this estimate includes both upland and wet variants. 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 sodic/alkali soils.

Saline Prairie SGCN (47)	
Non-crustacean Arthropods (4)	
Saline Prairie Scarab Beetle	*Ataenius robustus*
Comanche Harvester Ant	*Pogonomyrmex comanche*
American Bumble Bee	*Bombus pensylvanicus*
Monarch	*Danaus plexippus*
Reptiles (5)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Texas Horned Lizard	*Phrynosoma cornutum*
Southern Prairie Skink	*Plestiodon septentrionalis obtusirostris*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Birds (10)	
Northern Bobwhite	*Colinus virginianus*
American Woodcock	*Scolopax minor*
Loggerhead Shrike	*Lanius ludovicianus*
Sprague's Pipit	*Anthus spragueii*
Smith's Longspur	*Calcarius pictus*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Eastern Meadowlark	*Sturnella magna*
Mammals (5)	
Eastern Harvest Mouse	*Reithrodontomys humulis*

Northern Pygmy Mouse	*Baiomys taylori*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*
Long-tailed Weasel	*Mustela frenata*
Plants (23)	
American Bird's-foot-trefoil	*Lotus unifoliolatus*
Arkansas Caric Sedge	*Carex arkansana*
Cotton-rose	*Evax verna*
Dixie Stitchwort	*Minuartia muscorum*
Drummond's Sandwort	*Minuartia drummondii*
Earth-fruit	*Geocarpon minimum*
Elliott's Sida	*Sida elliottii*
Evening Rainlily	*Cooperia drummondii*
Flame Hedgehyssop	*Gratiola flava*
Hall's Panic Grass	*Panicum hallii var. filipes*
Narrowleaf Gumweed	*Grindelia lanceolata var. lanceolata*
Pale Umbrella-wort	*Mirabilis albida*
Prairie Cord Grass	*Spartina pectinata*
Rosemary Rockrose	*Helianthemum rosmarinifolium*
San Saba Pinweed	*Lechea san-sabeana*
Small-flower Flameflower	*Phemeranthus parviflorus*
Smooth Scorpionweed	*Phacelia glabra*
Texas Saxifrage	*Saxifraga texana*
Texas Sunnybell	*Schoenolirion wrightii*
Tumble Grass	*Schedonnardus paniculatus*
Upland Swamp Privet	*Forestiera ligustrina*
Wand Blackroot	*Pterocaulon virgatum*
Wolf's Spike Sedge	*Eleocharis wolfii*

Threats Affecting Habitat:

Saline Prairies are threatened by disturbance associated with mineral extraction, roads and service corridors, as well as afforestation attempts. Feral Hogs pose a serious threat to Saline Prairies.

Saline Prairie Threats Assessment:			
1st 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 Research Needs/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 invertebrate assemblages on Saline Prairies.
4. Provide assistance with Feral Hog control in this habitat to landowners; disturbance by hogs is a particular threat.
5. Target occurrences of Saline Prairie in northwest Louisiana for permanent protection via servitudes or land acquisition.

l. 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 strongly 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 provides nursery areas for larval forms of many species such as shrimp, crabs, Red Drum, Spotted Seatrout, and Gulf Menhaden, and greatly enhances the production of such marine organisms due to the enormous primary productivity of the Salt 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. Factors negatively impacting Salt Marsh include prolonged periods of inundation (whether caused by winds, tides, rain, or hurricanes), subsidence, and erosion.

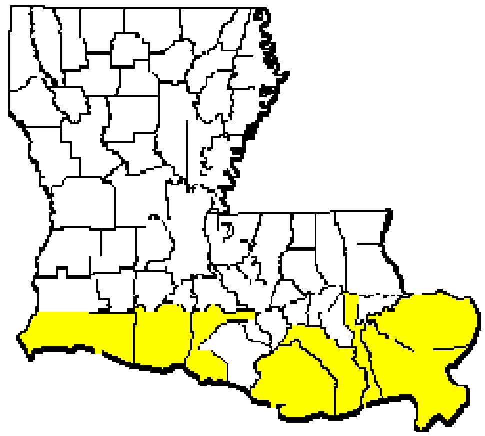
Salt Marsh, St. Bernard Parish

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, Salt Marsh 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 overall, 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: Characteristic Plants	
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 50-75% remaining (Smith 1993). Salt Marsh is most extensive on the deltaic plain of southeast Louisiana. The area of Salt Marsh is currently increasing, apparently due to salt water intrusion resulting in shifts in marsh salinity levels (LNHP 2009). However, coastal erosion and subsidence are threats because they act to convert marsh to open, shallow water.



Salt Marsh SGCN (49)	
Crustaceans (1)	
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (5)	
Bay Skipper	*Euphyes bayensis*
Obscure Skipper	*Panoquina panoquinoides*
Western Pygmy Blue	*Brephidium exilis*
Eastern Pygmy Blue	*Brephidium pseudofea*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Marine Fish (3)	
Diamond Killifish	*Adinia xenica*
Bayou Killifish	*Fundulus pulvereus*
Texas Pipefish	*Syngnathus texanus*
Reptiles (3)	
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Birds (35)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*

American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
Black Rail	*Laterallus jamaicensis*
Clapper Rail	*Rallus crepitans*
Whooping Crane	*Grus americana*
American Oystercatcher	*Haematopus palliatus*
Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Coastal Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Short-eared Owl	*Asio flammeus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Nelson's Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (1)	
Key Grass	*Monanthochloe littoralis*

Threats Affecting Habitat:

Salt Marshes are threatened by disturbance from several human sources, subsidence, and potentially by increased tropical storm frequency and intensity associated with climate change. All of these threats act to reduce the extent of Salt Marsh by converting marsh to open water. Of particular concern in this regard are the impacts caused by Feral Hogs and Nutria.

Salt Marsh Threats Assessment:			
1st 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 Research Needs/Conservation Actions:

1. Support CPRA, CWPPRA, LCA, LDNR, USACE, and other partner efforts for shoreline stabilization and habitat restoration.
2. Work with LCA, CPRA, USACE, CWPPRA, and other groups to support coastal restoration projects, specifically targeting important bird nesting areas and SGCN.
3. Work with USACE and state agencies to ensure water control structures provide the maximum benefit to Salt Marsh.
4. Continue efforts to control invasive species, particularly Nutria and Feral Hogs, in Salt Marsh.

m. 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 coarse 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 invasive plant species (NatureServe 2015). Sandbars are critical nesting areas for the federally-listed endangered Interior Least Tern (*Sternulla antillarum athalassos*), as well as for many riverine turtles.

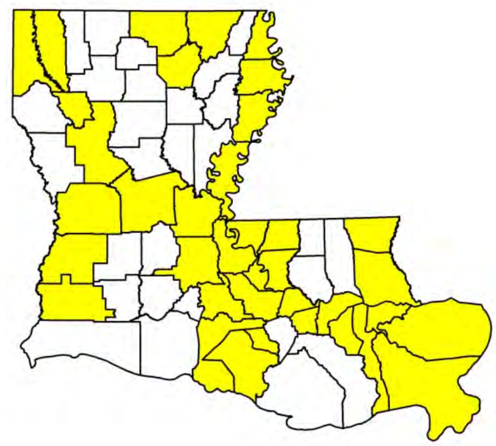
Mississippi River Sandbar, West Feliciana Parish

Expansive Sandbar on Red River, Bossier Parish

Sandbar: Characteristic Plants	
Roughfruit Amaranth	*Amaranthus tuberculatus*
Valley Redstem	*Ammannia coccinea*
Winged Pigweed	*Cycloloma atriplicifolium*
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 primarily 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% 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 2015).



Sandbar SGCN (20)	
Non-crustacean Arthropods (3)	
White Sand Tiger Beetle	*Ellipsoptera wapleri*
Sandbar Tiger Beetle	*Ellipsoptera blanda*
Comanche Harvester Ant	*Pogonomyrmex comanche*
Reptiles (6)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Ringed Map Turtle	*Graptemys oculifera*
Ouachita Map Turtle	*Graptemys ouachitensis*
Sabine Map Turtle	*Graptemys sabinensis*
Pearl River Map Turtle	*Graptemys pearlensis*
Birds (7)	
Piping Plover	*Charadrius melodus*
Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Gull-billed Tern	*Gelochelidon nilotica*
Interior Least Tern	*Sternula antillarum athalassos*
Black Skimmer	*Rynchops niger*
Plants (4)	
Bindweed Heliotrope	*Heliotropium convolvulaceum*
Downy Prairie-clover	*Dalea lanata*
Dwarf Bulrush	*Lipocarpha micrantha*
Square-stem Monkeyflower	*Mimulus ringens*

Threats Affecting Habitat:

Sandbars are subject to frequent human intrusion resulting in disturbance and trampling. Large rivers are engineered waterways, and operation of locks and dams as well as levees interrupt the natural development and maintenance of Sandbars. Invasive plants and animals threaten this habitat as well, with Feral Hogs being of particular concern.

Sandbar Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Determine ownership/management authority for Sandbars in Louisiana rivers.
2. Work with USACE to develop a Memorandum Of Understanding (MOU) regarding Sandbar management.
3. Work with landowners to develop limits on ORV use of this habitat and to protect Sandbars from negative impacts of cattle.
4. Support and commission a study into the need and economic impact of existing dams on Louisiana rivers.
5. Remove low-impact (unnecessary) structures, particularly on the Red and Ouachita Rivers, to restore natural flow of these rivers.
6. Implement control of invasive species on Sandbars.

n. Sandstone Glade/Barren

Rarity Rank: S1S2/G1G2

Synonyms: Catahoula Barren, Sandstone Outcrop

Ecological Systems: CES203.364 West Gulf Coastal Plain Catahoula Barrens

General Description:

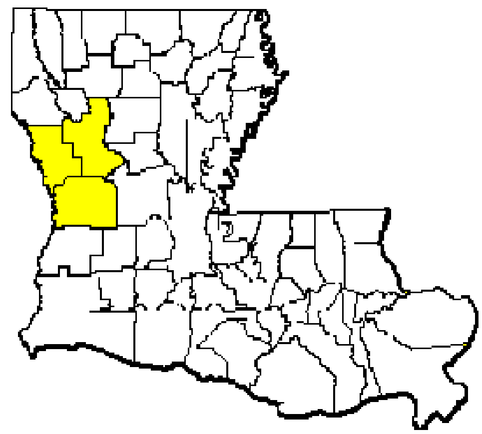
A glade is an open area in an otherwise wooded landscape that exists due to the presence of rock at or near the surface. Sandstone Glades are associated with the Catahoula Formation, which extends as a belt across central Louisiana. Sandstone Glades are embedded in Western Upland Longleaf Pine Woodlands. 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 herbaceous plants, as well as trees such as Longleaf Pine. Being embedded in Western 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	
Nuttall's Rayless Goldenrod	*Bigelowia nuttallii*
Silver Dwarf Morning-Glory	*Evolvulus sericeus*
Slender Bluestem	*Schizachyrium tenerum*
Texas Sunnybell	*Schoenolirion wrightii*
Sand Spikemoss	*Selaginella arenicola* ssp. *riddellii*
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 50-75% 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 (17)	
Non-crustacean Arthropods (4)	
Texas Brown Tarantula	*Aphonopelma hentzi*
American Bumble Bee	*Bombus pensylvanicus*
Cobweb Skipper	*Hesperia metea*
Monarch	*Danaus plexippus*
Amphibians (1)	
Southern Red-backed Salamander	*Plethodon serratus*
Reptiles (4)	
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Coal Skink	*Plestiodon anthracinus*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Timber Rattlesnake	*Crotalus horridus*
Birds (4)	
Northern Bobwhite	*Colinus virginianus*
Greater Roadrunner	*Geococcyx californianus*

Chuck-will's-widow	*Antrostomus carolinensis*
Field Sparrow	*Spizella pusilla*
Plants (4)	
Hairy Lipfern	*Cheilanthes lanosa*
Sand Spikemoss	*Selaginella arenicola ssp. riddellii*
Small-flower Flameflower	*Phemeranthus parviflorus*
Texas Sunnybell	*Schoenolirion wrightii*

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.

Sandstone Glade/Barren Threats Assessment:

1st 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 Research Needs/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.

o. 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 Sandbars and delta of the Mississippi River, whereas the pioneer marsh vegetation is similar to that of Freshwater Marsh. This community can be floristically diverse, containing many species also found on Sandbars. Rapid invasion by the invasive Torpedo Grass (*Panicum repens*) apparently reduces plant species richness, particularly on higher sandy deposits. 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	
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 75-100% of this amount 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 (31)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Bald Eagle	*Haliaeetus leucocephalus*
Clapper Rail	*Rallus crepitans*
Whooping Crane	*Grus americana*
Snowy Plover	*Charadrius nivosus*
Wilson's Plover	*Charadrius wilsonia*
Piping Plover	*Charadrius melodus*
Red Knot	*Calidris canutus*
Long-billed Curlew	*Numenius americanus*

Marbled Godwit	*Limosa fedoa*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Nelson's Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (2)	
Dwarf Bulrush	*Lipocarpha micrantha*
Square-stem Monkeyflower	*Mimulus ringens*

Threats Affecting Habitat:

The greatest threat to this habitat is invasive species, primarily Feral Hogs and Nutria which denude newly created delta habitat via rooting and wallowing behavior and direct herbivory, respectively.

Vegetated Pioneer Emerging Delta Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Identify and protect sensitive delta areas from disturbances, such as by boats or other motorized vehicles.
2. Work with USACE to develop better strategies for the placement of dredge materials as a restoration method for this habitat type and promote appropriate use of dredge spoil to develop new areas for bird nesting and stopover sites and to enhance aquatic species habitat.
3. Work with USACE and others to manage water control to create more high quality habitat and benefit existing delta habitat.
4. Work with LCA, CPRA, CWPPRA, USACE, and NRCS to incorporate management objectives for the protection and restoration of emerging delta habitat into future coastal restoration efforts.

p. 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 an herbaceous marsh that occupies the valleys of impeded streams embedded within the sandy uplands of the Sparta Formation. Substrates are high in organic matter (e.g., peat). In some examples, the vegetation appears to form a mat that floats above or rests on top of a layer of organic slurry. 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 vegetation mat apparently floats during summer months, and is submersed during winter and spring.

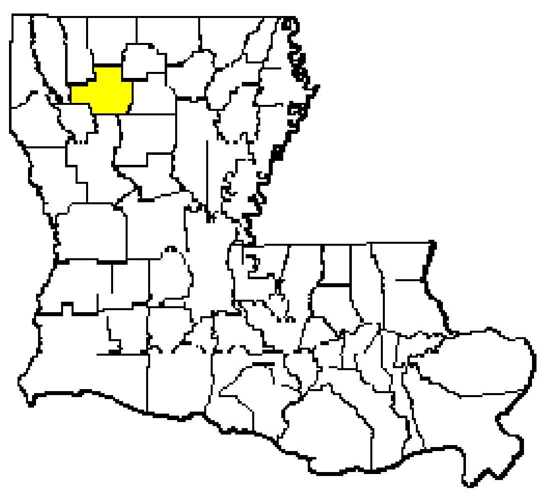
Some West Gulf Coastal Plain Muck Bogs in Texas are very old, on the order of thousands of years (MacRoberts and MacRoberts 1998) and have several plant species not present in the Louisiana examples, notably Yellow Trumpet Pitcher Plant (*Sarracenia alata*) and Saw Grass (*Cladium mariscoides*). Louisiana's muck bogs are hypothesized to be younger than some of the muck bogs in the Post Oak Savanna of Texas. The formation of WGCP Muck Bogs seems similar in Louisiana as in Texas, however. Surrounding deep sandy soils efficiently capture and transmit precipitation as ground water, which converges on stream valleys. Small streams become impeded by Beaver, and constant saturation from seepage leads to peat accumulation.

West Gulf Coastal Plain Muck Bog, Bienville Parish

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 may have historically controlled woody plant growth and prevented conversion to a wooded habitat. Little is known about this habitat in Louisiana.

West Gulf Coastal Plain Muck Bog: Characteristic Plants	
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	*Habenaria 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 habitat is only known in Louisiana from the xeric sandy Upland Longleaf Pine Woodlands on the Sparta Formation in Bienville Parish.



West Gulf Coastal Plain Muck Bog SGCN (12)	
Non-crustacean Arthropods (6)	
Arogos Skipper	*Atrytone arogos*
Little Metalmark	*Calephelis virginiensis*
Georgia Satyr	*Neonympha areolatus*
Pitcher Plant Spiketail	*Cordulegaster sarracenia*
Texas Emerald	*Somatochlora margarita*
Monarch	*Danaus plexippus*
Birds (5)	
American Woodcock	*Scolopax minor*
Sedge Wren	*Cistothorus platensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Plants (1)	
Threeway Sedge	*Dulichium arundinaceum*

Threats Affecting Habitat:

At this point little is known about this habitat in Louisiana and this lack of knowledge is itself a threat. Despite this overall lack of knowledge, inadequate fire and invasive plants and animals appear to pose the greatest threat to this habitat.

West Gulf Coastal Plain Muck Bog Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Conduct basic botanical and zoological studies, including analyses of substrate and characterization of the floating mat.
2. Address questions regarding development, peat age, and buoyancy of floating mats in this habitat.
3. Document new occurrences of this habitat.
4. Promote fire in this habitat – since the floating mat is submersed during the dormant season, summer or fall burning is necessary.

q. 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:

Hillside Seepage Bogs are open, mostly treeless, herb-dominated natural wetlands of hilly, sandy uplands historically dominated by Longleaf Pine (*Pinus palustris*). This community can be found in the EGCP and WGCP 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). 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 Yellow Trumpet Pitcher Plants (*Sarracenia alata*) and a variety of orchid species. Many species are restricted to this habitat and closely allied Longleaf Pine Flatwoods Savanna. Patches of shrubs are often present within bogs and can become more prevalent, possibly degrading the habitat, if fire is excluded from the system. This is due to the fact that hillside bogs are embedded in what are now, or historically were, Longleaf Pine Woodlands, which are fire-driven systems. These bogs therefore 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).

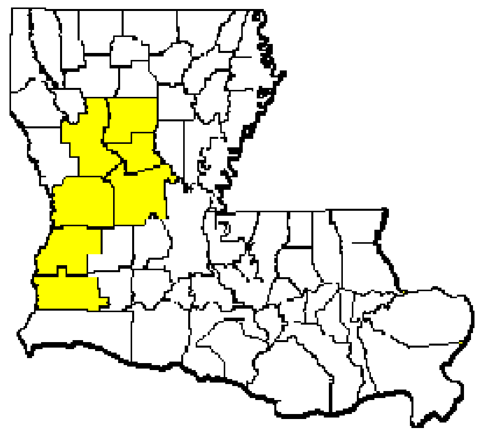
The degree to which a bog remains wet throughout the year depends on the size of the watershed, the soil infiltration rate upslope, the rate of saturated flow in the soil, the topographic position of the bog, the bog's water storage capacity, and the rate of water leaving the bog from evapo-transpiration 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, Fort Polk, Vernon Parish

Western Hillside Seepage Bog: Characteristic Plants	
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 Trumpet Pitcher Plant	*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:

This is a small-scale habitat, historically thought to have occupied less than 2,000 acres, with an estimated 50-75% remaining today. 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 Military Reservation and WMA. There are possibly many more unknown bogs in these parishes and Beauregard Parish. Beauregard Parish has received relatively little biological inventory.



Western Hillside Seepage Bog SGCN (25)	
Non-crustacean Arthropods (4)	
Pitcher Plant Spiketail	*Cordulegaster sarracenia*
Texas Emerald	*Somatochlora margarita*
Georgia Satyr	*Neonympha areolatus*
Monarch	*Danaus plexippus*
Birds (6)	
Yellow Rail	*Coturnicops noveboracensis*
Sedge Wren	*Cistothorus platensis*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Mammals (1)	
Long-tailed Weasel	*Mustela frenata*
Plants (14)	
Bearded Grass-pink	*Calopogon barbatus*
Black Snakeroot	*Zigadenus densus*
Drummond's Yellow-eyed-grass	*Xyris drummondii*
Harper's Yellow-eyed-grass	*Xyris scabrifolia*
Large Beak Sedge	*Rhynchospora macra*
Large-leaved Grass-of-Parnassus	*Parnassia grandifolia*
Large White Fringed Orchid	*Platanthera blephariglottis var. conspicua*
One-flowered Broomrape	*Orobanche uniflora*

Pineland Bogbutton	*Lachnocaulon digynum*
Red Milkweed	*Asclepias rubra*
Sabine Coneflower	*Rudbeckia scabrifolia*
Staghorn Clubmoss	*Lycopodiella cernua var. cernua*
Swamp Thistle	*Cirsium muticum*
Yellow Fringeless Orchid	*Platanthera integra*

Threats Affecting Habitat:

Fire exclusion or inadequate fire, and invasive species (especially Feral Hogs) are the main threats to this habitat.

Western Hillside Seepage Bog Threats Assessment:

1st 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 Research Needs/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 to lack of awareness.
3. Work with staff of KNF 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.
6. Include the presence of embedded Western Hillside Seepage Bogs as a criterion when scoring properties for LDWF PBIs.
7. 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 below the general descriptions. SGCN are listed for all combined ephemeral pond types in a single table at the end of this section.

a. 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 Eastern and Western Longleaf Pine Flatwoods Savannas and are believed to occupy swales and depressions remaining from ancient Pleistocene stream channels. They are often linear in shape, although circular and elliptical ponds do occur. Where surrounding soils are coarser, wind deflation during historical droughts is a potential source of origin. Flatwoods Ponds may range from just a few inches deep relative to the surrounding landscape, 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 Savannas every few years. Such fires burned into the ponds during the late 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.

WGCP Flatwoods Pond, Beauregard Parish

EGCP Flatwoods Pond: Characteristic Plants	
Southern Waxy Sedge	*Carex glaucescens*
White Titi	*Cyrilla racemiflora*
Myrtle Holly	*Ilex myrtifolia*
Fetterbush	*Lyonia lucida*
Swamp Blackgum	*Nyssa biflora*

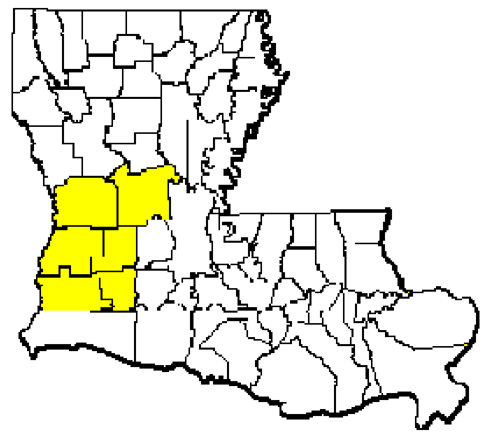
WGCP Flatwoods Pond: Characteristic Plants	
Longleaf Three-Awn	*Aristida palustris*
Mayhaw	*Crataegus opaca*
Swamp Blackgum	*Nyssa biflora*
White-top Sedge	*Rhynchospora latifolia*
Baldwin's Nut Sedge	*Scleria baldwinii*
American Snowbell	*Styrax americanus*
Iris-leaf Yellow-eyed-grass	*Xyris laxifolia* var. *iridifolia*
Pineland Yellow-eyed-grass	*Xyris stricta* var. *stricta*

Current Extent and Status:

Smith (1993) estimated Flatwoods Ponds to have occupied 2,000 to 10,000 acres historically, and that 10 to 25% of the original extent remains today. It is not clear if Smith's estimate is for all Flatwoods Ponds or just those in the WGCP.

EGCP Current Extent:

WGCP Current Extent:



Threats Affecting Habitat:

Flatwoods Ponds in both the EGCP and WGCP are threatened by various sources of disturbance. The most impactful threats to both are inadequate fire and invasive plants and animals.

EGCP Flatwoods Pond Threats Assessment:

1st 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			

WGCP Flatwoods Pond Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type in both the 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 of woody vegetation 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 PBIs.

b. Prairie Pothole

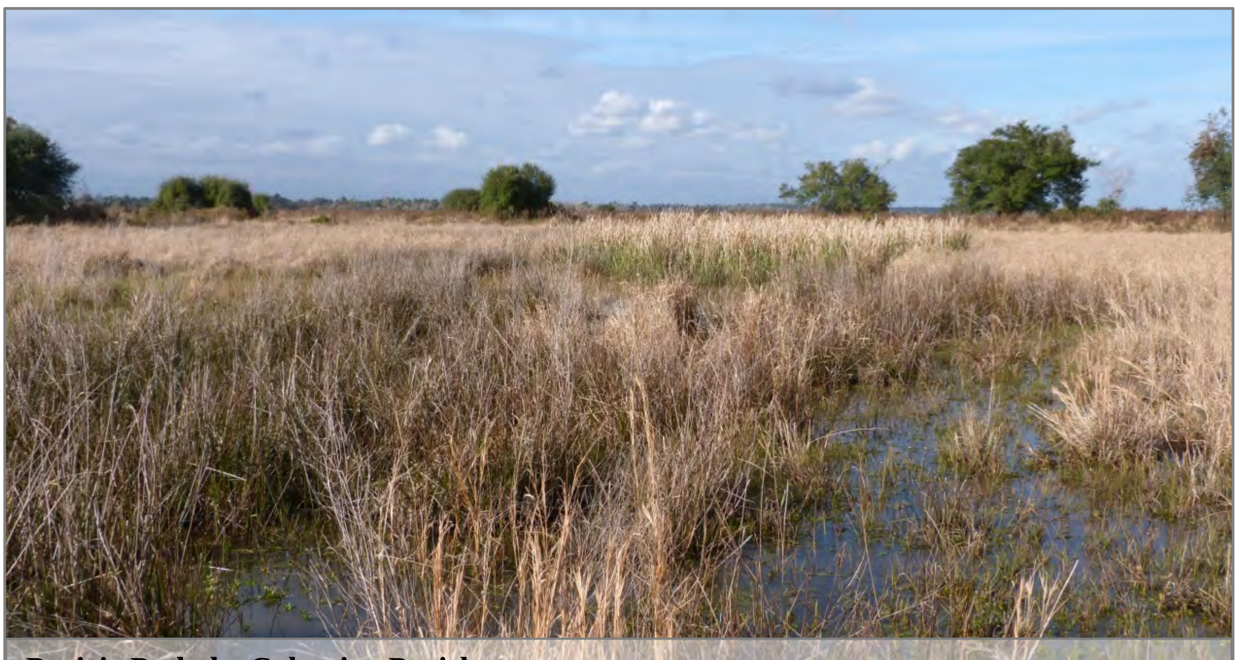
Rarity Rank: S1

Synonyms: Buffalo Wallow

Ecological Systems: none

General Description:

This ephemeral pond type occurs on the Coastal Prairie landscape in southwest Louisiana. Prairie Potholes are small (often < 1 acre) and circular, elliptical, 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 American Bison (*Bos 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 Prairie Potholes support Freshwater Marsh vegetation, with the grass Maidencane (*Panicum hemitomon*) dominating, while others are rich in sedges and rushes.

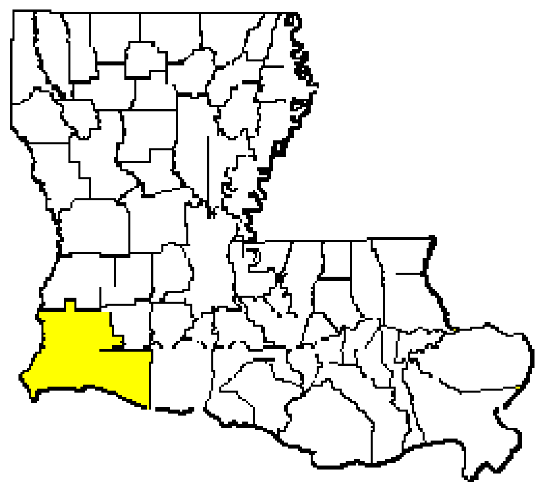


Prairie Pothole, Calcasieu Parish

Prairie Pothole: Characteristic Plants	
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:

Nearly all of the historical Coastal Prairie has been land-leveled and plowed. Prairie Potholes are very rare on today's 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:

1st 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 Research Needs/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.

c. Sparta Sand Pond

Rarity Rank: S1
Synonyms: none
Ecological Systems: none

General Description:

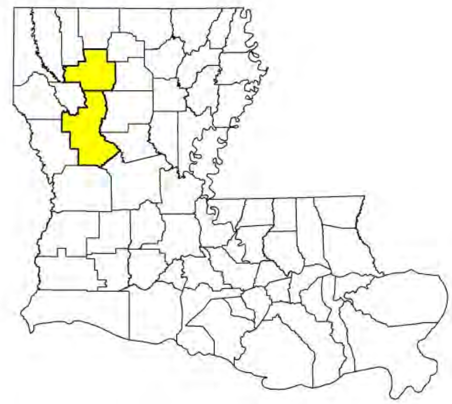
Sand ponds are extremely rare in Louisiana, with only a few known records on the Sparta Formation in Bienville Parish. Sparta Sand Ponds may be ancient inter-dune depressions which formed in dry shifting sands during historical dry climate intervals. Known examples are mostly wooded, but it is possible 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

Sparta Sand Pond: Characteristic Plants	
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 industrial forest lands.



Threats Affecting Habitat:

Sparta Sand Ponds are apparently naturally rare in Louisiana. 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:

1st 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 Research Needs/Conservation Actions:

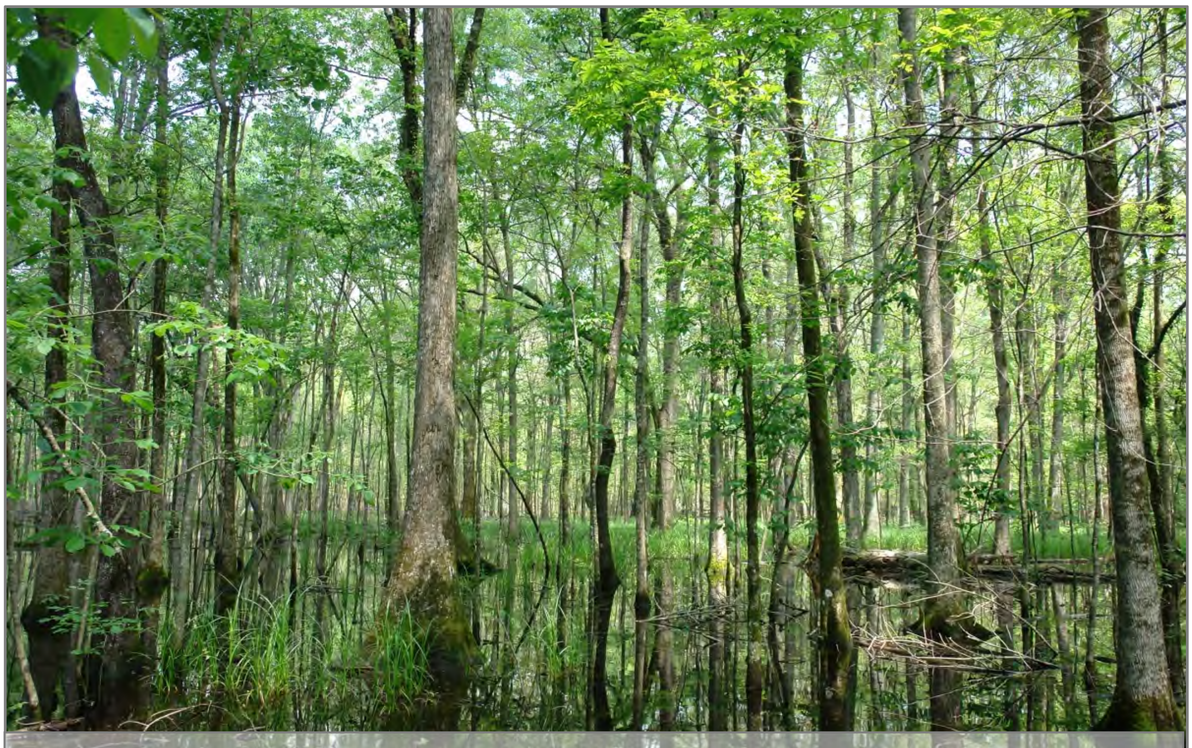
1. Continue surveys to determine the extent and condition of this habitat type.
2. Encourage stewardship of sand ponds; beneficial management practices include mechanical or hand removal of woody vegetation on pond margins (especially pines, whose needles acidify the water), and prescribed burning, allowing fires to burn into drawn-down pond edges.

d. Macon Ridge Green Ash Pond

Rarity Rank: S1/G2?
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 Hardwood-Loblolly Pine Forest on higher elevations. On today's landscape, they are often surrounded by agricultural fields. On General Land Office survey records, Macon Ridge Green Ash 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.

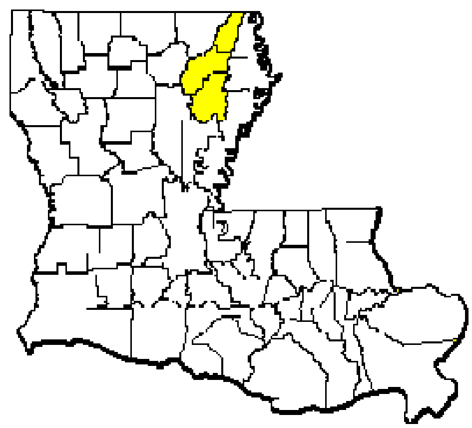


Macon Ridge Green Ash Pond, Franklin Parish

Macon Ridge Green Ash Pond: Characteristic Plants	
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:			
1st 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 Research Needs/Conservation Actions:

1. Continue surveys to determine the extent and condition of this habitat type.
2. Conduct zoological inventories for this habitat.
3. Develop BMPs for this habitat type, such as the use of 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 (33)	
Crustaceans (11)	
Javelin Crawfish	*Procambarus jaculus*
Flatnose Crawfish	*Procambarus planirostris*
Vernal Crawfish	*Procambarus viaeviridis*
Twin Crawfish	*Procambarus geminus*
Gulf Crawfish	*Procambarus shermani*
Flatwoods Digger	*Fallicambarus oryktes*
Pine Hills Digger	*Fallicambarus dissitus*
Old Prairie Digger	*Fallicambarus macneesei*
Sabine Fencing Crawfish	*Faxonella beyeri*
Ouachita Fencing Crawfish	*Faxonella creaseri*
Caddo Chimney Crawfish	*Procambarus machardyi*
Non-crustacean Arthropods (1)	
Creole Pearly-eye	*Lethe creola*
Birds (1)	
Whooping Crane	*Grus americana*
Amphibians (8)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Four-toed Salamander	*Hemidactylium scutatum*
Ornate Chorus Frog	*Pseudacris ornata*
Strecker's Chorus Frog	*Pseudacris streckeri*
Eastern Spadefoot	*Scaphiopus holbrookii*
Hurter's Spadefoot	*Scaphiopus hurterii*
Dusky Gopher Frog	*Lithobates sevosus*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (1)	
Western Chicken Turtle	*Deirochelys reticularia miaria*
Plants (11)	
Black-fruited Spike Sedge	*Eleocharis melanocarpa*
Coastal Plain Lobelia	*Lobelia flaccidifolia*
Cypress-knee Sedge	*Carex decomposita*
Dwarf Burhead	*Echinodorus tenellus*
Myrtle Holly	*Ilex myrtifolia*
Pineland Yellow-eyed-grass	*Xyris stricta var. stricta*
Pondberry	*Lindera melissifolia*

Sarvis Holly	*Ilex amelanchier*
Small's Yellow-eyed-grass	*Xyris smalliana*
Tracy's Beak Sedge	*Rhynchospora tracyi*
Water-purslane	*Didiplis diandra*

6. LENTIC WATER BODIES

a. 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 a free-standing water body; as a result, Oxbows are typically U-shaped. Oxbows and other naturally occurring lakes provide valuable fish and wildlife habitat.

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 19th 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 (17)	
Mollusks (1)	
Fat Pocketbook	*Potamilus capax*
Crustaceans (1)	
Teche Painted Crawfish	*Orconectes hathawayi*
Inland Fishes (3)	
Gulf Pipefish	*Syngnathus scovelli*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Amphibians (2)	
Gulf Coast Waterdog	*Necturus beyeri*
Red River Mudpuppy	*Necturus louisianensis*

Reptiles (3)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Birds (5)	
Wood Stork	*Mycteria americana*
Little Blue Heron	*Egretta caerulea*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Plants (2)	
Cypress-knee Sedge	*Carex decomposita*
Water-purslane	*Didiplis diandra*

Threats Affecting Habitat:

Lakes and Reservoirs are threatened by residential and commercial development, contamination by agricultural, municipal and industrial effluents, trash dumping, and invasive exotic species such as Giant Salvinia and Hydrilla.

Lakes and Reservoirs Threats Assessment:

1st 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 Research Needs/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 non-native carp.
4. Partner with LDEQ to promote practices such as requiring updated sewage systems in communities around lakes
5. Promote retention of riparian buffers, native vegetation mats, and submerged woody debris for fish and wildlife species.

b. 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.

Devil's Lake in Sabine Parish

Current Extent and Status:

Farm and recreational ponds are scattered across the state probably in the thousands. Beaver ponds are generally common on the landscape, 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)	
Non-crustacean Arthropods (1)	
Creole Pearly-eye	*Lethe creola*
Amphibians (4)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Strecker's Chorus Frog	*Pseudacris streckeri*
Eastern Spadefoot	*Scaphiopus holbrookii*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (1)	
Western Chicken Turtle	*Deirochelys reticularia miaria*
Plants (5)	
Canby's Bulrush	*Schoenoplectus etuberculatus*
Cypress-knee Sedge	*Carex decomposita*
Narrow-fruit Horned Beak Sedge	*Rhynchospora inundata*
Threeway Sedge	*Dulichium arundinaceum*
Water-purslane	*Didiplis diandra*

Threats Affecting Habitat:

Most threats affecting ponds are local in nature, and include modification of natural ponds (removal of Beavers, alteration of basin geometry, etc.) and disturbance and pollution from human sources. Invasive exotic species threaten ponds on a larger scale.

<u>Ponds Threats Assessment:</u>

1st 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 Research Needs/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.

a. 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 underestimated. 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 deposition of suspended particulate matter.

Marine Seagrass Bed: Characteristic Plants	
Manatee-grass	*Cymodocea filiformis*
Shoal-grass	*Halodule beaudettei*
Sea-grass	*Halophila engelmannii*
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 low, long-term survival depends on having adequate protection from the Chandeleur Islands, which have degraded in recent decades. Damage to seagrass beds by outboard motors may also threaten this community.

Marine SAV Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Determine areal extent of, and map marine SAV at Chandeleur Islands.
2. Conduct inventory and monitoring to determine changes in condition and extent over time and to identify emerging threats.
3. Support incorporation of the Chandeleur Islands into the CPRA Coastal Master Plan; these islands are biologically valuable and should be a priority for protection.
4. Work with CPRA and other agencies to implement measures to nourish the Chandeleur Islands, such as augmenting sand supply.

b. 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. These beds lack widespread distribution due to the general turbidity of most of the estuaries in Louisiana.

Estuarine Submersed Aquatic Vegetation, Lake Pontchartrain

Estuarine Submersed Aquatic Vegetation: Characteristic Plants	
Eurasian Watermilfoil	*Myriophyllum spicatum* (exotic)
Southern Naiad	*Najas guadalupensis*
Widgeon-Grass	*Ruppia maritima*
Eelgrass	*Vallisneria americana*
Horned Pondweed	*Zannichellia palustris*

Current Extent and Status:

Historical extent of this SAV type is unknown (Smith 1993). 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. Activities which increase the turbidity in the waters surrounding SAV beds threaten the viability of Estuarine SAV. Alteration to salinity levels due to marsh loss also threatens this habitat.

Estuarine SAV Threats Assessment:

1st 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 Research Needs/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.

c. River Delta Freshwater Submersed Aquatic Vegetation

Rarity Rank: S3S4
Synonyms: none
Ecological System: CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:

Louisiana's two active deltas, the Mississippi 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	
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 as well, particularly if native species are excluded. Possible increase in frequency and intensity of tropical storms associated with climate change may impact this habitat. Increased salinity due to altered hydrology, marsh loss, and SLR also threaten this community.

River Delta Freshwater SAV Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Conduct studies to determine the areal extent of this SAV type, and address basic ecological questions regarding its development and maintenance.
2. Reduce human disturbance of this habitat type on public and private lands.

d. Coastal Marsh and Bayou Freshwater Submersed Aquatic Vegetation

Rarity Ranks: S3S4

Synonyms: none

Ecological Systems Classification: CES203.467 Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
CES203.470 Mississippi Delta Fresh and Oligohaline Tidal Marsh

General Description:

Ponds embedded within Freshwater Marsh and bayous and canals that traverse Freshwater Marsh can all have well-developed SAV beds. There is some species overlap in this type of SAV with SAV in 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-Blackgum 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, and Delta NWR.

Coastal Marsh and Bayou Freshwater Submersed Aquatic Vegetation: Characteristic Plants	
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 increases in tropical storm frequency and intensity and SLR, potentially threaten this habitat.

<u>Coastal Marsh and Bayou SAV Threats Assessment:</u>			
1st 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 Research Needs/Conservation Actions:

1. Continue biological inventory and research for this SAV type.
2. In impounded marshes, encourage water management regimes that benefit this SAV type and prevent invasion by emergent plant species and conversion to marsh.
3. Protect this SAV type from threats posed by boat traffic and development of oil and gas infrastructure.

e. Interior Freshwater Submersed Aquatic Vegetation

Rarity Ranks: S2S4
Synonyms: none
Ecological Systems Classification: 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. Older, better developed, and species rich SAV beds containing native species are of particular interest for conservation and protection.

Interior Freshwater Submersed Aquatic Vegetation: Characteristic Plants	
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.

Threats Affecting Habitat:

Interior Freshwater SAV is threatened in some cases by habitat instability, and by invasive plants. Climate change poses an additional threat, especially if there are reductions in precipitation.

Interior Freshwater SAV Threats Assessment:			
1st 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 Research Needs/Conservation Actions:

1. Continue surveys to document and describe exemplary occurrences of this SAV type.
2. Produce literature presenting information on the identification of aquatic plants and explaining the benefits of SAV.
3. Produce and distribute a poster series highlighting Interior Freshwater SAV habitat and associated native and exotic 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)	
Mollusks (5)	
Bay Scallop	*Argopecten irradians*
Sawtooth Penshell	*Atrina serrata*
Half-Naked Penshell	*Atrina seminuda*
Channeled Whelk	*Busycotypus canaliculatus*
Lightning Whelk	*Busycon sinistrum*
Inland Fish (1)	
Gulf Pipefish	*Syngnathus scovelli*
Marine Fish (4)	
Dwarf Seahorse	*Hippocampus zosterae*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Texas Pipefish	*Syngnathus texanus*
Reptiles (5)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Birds (5)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Mammals (1)	
West Indian Manatee	*Trichechus manatus*
Plants (11)	
Marine SAV (4)	
Engelmann's Sea-grass	*Halophila engelmannii*
Manatee-grass	*Syringodium filiforme*
Shoal-grass	*Halodule wrightii*
Turtle-grass	*Thalassia testudinum*

Estuarine SAV (1)	
Claspingleaf Pondweed	*Potamogeton perfoliatus*
Freshwater SAV (6)	
Blue Water-lily	*Nymphaea elegans*
Loose-flowered Water-milfoil	*Myriophyllum laxum*
Nuttall's Pondweed	*Potamogeton epihydrus*
Slim Spikerush	*Eleocharis elongata*
Water-purslane	*Didiplis diandra*
Yellow Water-crowfoot	*Ranunculus flabellaris*

8. SUBTERRANEAN HABITAT

a. Cave

Rarity Rank: S1
Synonyms: none
Ecological Systems: none

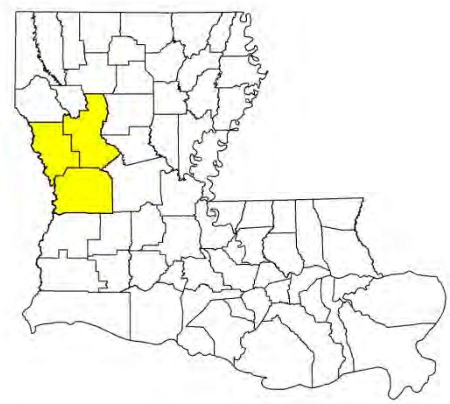
General Description:

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 and Cook Formations. Louisiana's caves appear to have been formed through the process of water erosion whereby water is able to penetrate a layer of sandstone and slowly erode a softer layer directly beneath. In their natural state they are very poorly developed and of limited extent, however the majority have been modified or enlarged by humans. In their current state, even the modified caves likely provide similar habitat for SGCN as do natural caves.

Wolf Cave, KNF, Natchitoches Parish, LA

Current Extent and Status:

There are six known natural caves in Louisiana, three of which are found on KNF. Sabine parish also contains Murrell's Caves, which may be natural in origin.



Cave SGCN (2)	
Mammals (2)	
Eastern Pipistrelle	*Perimyotis subflavus*
Northern Long-eared Bat	*Myotis septentrionalis*

Threats Affecting Habitat:

Caves are threatened by vandalism and by human disturbance.

<u>Caves Threats Assessment:</u>

1st 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 Research Needs/Conservation Actions:

1. Close caves to the public and install gates if warranted
2. Conduct zoological surveys of Louisiana caves, especially for bats and invertebrates.
3. Conduct surveys to determine the extent of Louisiana caves.

9. GEOLOGIC FEATURE

a. Barrier Island

Rarity Rank: S1/N/A

Synonyms: None

Ecological Systems: CES203.469 Louisiana Beach
CES203.513 Mississippi Delta Maritime Forest
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, Barrier Island Live Oak Forest, Salt Marsh, and Louisiana Beach. Marine Seagrass Bed also occurs in Chandeleur Sound immediately behind the Chandeleur Islands. Plant 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, Marshhay Cord Grass on highest dunes, and Black Mangrove and Smooth Cord Grass on the sheltered bayside areas.

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 and retain sediment, 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 Terre Islands, Timbalier Islands, and the Isle Dernieres. Much of the Chandeleur chain is captured by Breton NWR, and the remainder is owned as State Lands and managed by USFWS. East Timbalier Island NWR is managed by USFWS. 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, but some extremely valuable habitat remains.

Raccoon Island in the Isle Dernieres

Brown Pelicans nesting among Black Mangrove on Raccoon Island.

Barrier Island SGCN (61)	
Mollusks (5)	
Bay Scallop	*Argopecten irradians*
Sawtooth Penshell	*Atrina serrata*
Half-Naked Penshell	*Atrina seminuda*
Channeled Whelk	*Busycotypus canaliculatus*
Lightning Whelk	*Busycon sinistrum*
Crustaceans (2)	
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Non-crustacean Arthropods (5)	
Eastern Beach Tiger Beetle	*Habroscelimorpha dorsalis venusta*
Obscure Skipper	*Panoquina panoquinoides*
Eastern Pygmy Blue	*Brephidium pseudofea*
Monarch	*Danaus plexippus*
Louisiana Eyed Silkmoth	*Automeris louisiana*
Reptiles (8)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Leatherback Sea Turtle	*Dermochelys coriacea*

Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Eastern Glass Lizard	*Ophisaurus ventralis*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*
Birds (33)	
Mottled Duck	*Anas fulvigula*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Brown Pelican	*Pelecanus occidentalis*
Little Blue Heron	*Egretta caerulea*
Reddish Egret	*Egretta rufescens*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Clapper Rail	*Rallus crepitans*
Snowy Plover	*Charadrius nivosus*
Wilson's Plover	*Charadrius wilsonia*
Piping Plover	*Charadrius melodus*
American Oystercatcher	*Haematopus palliatus*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Red Knot	*Calidris canutus*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Sooty Tern	*Onychoprion fuscatus*
Interior Least Tern	*Sternula antillarum athalassos*
Coastal Least Tern	*Sternula antillarum*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Royal Tern	*Thalasseus maximus*
Sandwich Tern	*Thalasseus sandvicensis*
Black Skimmer	*Rynchops niger*
Short-eared Owl	*Asio flammeus*
Peregrine Falcon	*Falco peregrinus*
Marsh Wren	*Cistothorus palustris*
Nelson's Sparrow	*Ammodramus nelsoni*
Seaside Sparrow	*Ammodramus maritimus*
Plants (8)	
Canada Spike Sedge	*Eleocharis geniculata*
Earleaf Greenbrier	*Smilax auriculata*

Inkberry	*Scaevola plumieri*
Sand Dune Spurge	*Chamaesyce bombensis*
Sand Rose-gentian	*Sabatia arenicola*
Saw Palmetto	*Serenoa repens*
Sea Oats	*Uniola paniculata*
Southern Hairgrass	*Muhlenbergia capillaris var. filipes*

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:

1st 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	Pervasive	Slight	Low
Climate Change & Severe Weather	Pervasive	Moderate	Medium
Overall Calculated Threat Impact: Very High			

Habitat Research Needs/Conservation Actions:

1. Partner with state and federal agencies, NGOs, private landowners, and other partners to implement the Coastal Master Plan and to promote the protection and restoration of barrier islands (including Isle Dernieres Barrier Islands Refuge and the Chandeleur Islands) to benefit SGCN.
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 and other stakeholders to provide native ecotypes for barrier island restoration efforts.
4. Support efforts by CPRA, CWPPRA, LCA, LDNR, USACE, and other partners for shoreline stabilization and habitat restoration.

10. ANTHROPOGENIC HABITATS

a. 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 typically are dominated by non-native species. Anthropogenic habitats occur in every ecoregion throughout the state. The land cover types may include all or some of the following:

- Scattered woody and herbaceous vegetation such as orchards (pecan, citrus, etc.), vineyards, experimental plots, plant nurseries, residential areas, 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 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 both resident and migratory grassland species such as Northern Bobwhite, Eastern Bluebird, Dickcissel, Loggerhead Shrike, and many species of sparrows. 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 as well as other insects that are major constituents of food webs that support SGCN.

Within this habitat type, there may be patches of "natural" habitat such as vegetated streamsides, embedded wetlands, and small blocks of forest which can serve as important breeding, dispersal, and travel corridors for various wildlife species. Farm Bill programs such as CRP and WRP have paid landowners to set aside or retire portions of farmlands from active production. 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 historically indigenous. Young re-planted Bottomland Hardwood Forest (early successional) is heavily used by grassland Neotropical migrants and later by American Woodcock. Although no SGCN are fully dependent upon these habitats for survival, these systems often support high 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.

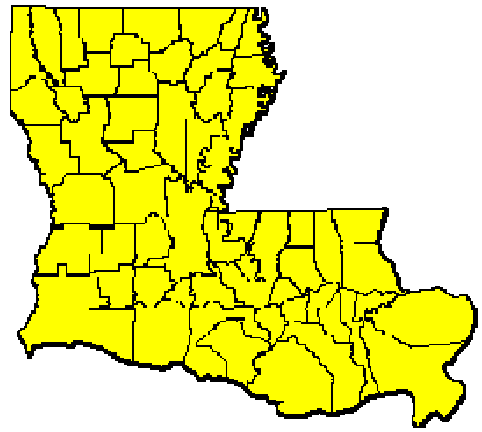
Grain crops can support SGCN such as Northern Bobwhite and wintering sparrows when appropriate field borders are incorporated into farming operations. Rain-flooded (harvested or unharvested) grain fields also provide valuable foraging habitat for wintering waterfowl. Post-harvested or tilled grain fields, where flooded shallowly, are valuable habitat for a variety of shorebirds. Dry harvested fields are primary feeding areas for wintering geese and are also used by SGCN including Sandhill Cranes and several species of raptors.

In fragmented habitats, conservation features on agricultural lands may serve to connect patches of natural habitat. Irrigation ditches are heavily used by birds, mammals, and crustaceans. Fencerows serve as breeding sites for some birds and impaling substrates for Loggerhead Shrikes. Wooded drainages can serve as travel corridors for birds and mammals, especially highly mobile species such as Louisiana Black Bear and Neotropical migratory landbirds.

Cotton field, Rapides Parish

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 for fish and wildlife value with proper planning. The USDA administered Farm Bill programs offer some of the greatest opportunities for these enhancements to occur, because of the sheer magnitude of funding associated with farm bill programs. Programs such as CRP, WRP, and the Environmental Quality Incentives Program (EQIP) provide cost-share, incentive payments, or both to qualified participants.



Agriculture and Improved Pasture (excluding rice) SGCN (71)	
Crustaceans (10)	
Sabine Fencing Crawfish	*Faxonella beyeri*
Ouachita Fencing Crawfish	*Faxonella creaseri*
Caddo Chimney Crawfish	*Procambarus machardyi*
Gulf Crawfish	*Procambarus shermani*
Twin Crawfish	*Procambarus geminus*
Javelin Crawfish	*Procambarus jaculus*
Flatnose Crawfish	*Procambarus planirostris*
Vernal Crawfish	*Procambarus viaeviridis*
Flatwoods Digger	*Fallicambarus oryktes*
Old Prairie Digger	*Fallicambarus macneesei*
Non-crustacean Arthropods (13)	
Texas Brown Tarantula	*Aphonopelma hentzi*
Florida Harvester Ant	*Pogonomyrmex badius*
Comanche Harvester Ant	*Pogonomyrmex comanche*
American Bumble Bee	*Bombus pensylvanicus*
Wild Indigo Duskywing	*Erynnis baptisiae*
Cobweb Skipper	*Hesperia metea*
Dusted Skipper	*Atrytonopsis hianna*
Yucca Giant-Skipper	*Megathymus yuccae*
Monarch	*Danaus plexippus*
Brou's Mallow Moth	*Bagisara brouana*
Falcate Orangetip	*Anthocharis midea*
Little Metalmark	*Calephelis virginiensis*
Creole Pearly-eye	*Lethe creola*
Amphibians (2)	

Strecker's Chorus Frog	*Pseudacris streckeri*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (6)	
Gopher Tortoise	*Gopherus polyphemus*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Western Wormsnake	*Carphophis vermis*
Common Rainbow Snake	*Farancia erytrogramma erytrogramma*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Louisiana Pinesnake	*Pituophis ruthveni*
Birds (25)	
Northern Bobwhite	*Colinus virginianus*
Swallow-tailed Kite	*Elanoides forficatus*
White-tailed Kite	*Elanus leucurus*
Sandhill Crane	*Antigone canadensis*
Whooping Crane	*Grus americana*
Upland Sandpiper	*Bartramia longicauda*
Buff-breasted Sandpiper	*Calidris subruficollis*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Short-eared Owl	*Asio flammeus*
Crested Caracara	*Caracara cheriway*
Southeastern American Kestrel	*Falco sparverius paulus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Sprague's Pipit	*Anthus spragueii*
Smith’s Longspur	*Calcarius pictus*
Field Sparrow	*Spizella pusilla*
Lark Sparrow	*Chondestes grammacus*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow’s Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Rusty Blackbird	*Euphagus carolinus*
Mammals (15)	
Southeastern Shrew	*Sorex longirostris*
Big Brown Bat	*Eptesicus fuscus*
Eastern Pipistrelle	*Perimyotis subflavus*

Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*
Southeastern Myotis	*Myotis austroriparius*
Northern Long-eared Bat	*Myotis septentrionalis*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Bachman's Fox Squirrel	*Sciurus niger bachmani*
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Golden Mouse	*Ochrotomys nuttalli*
Eastern Harvest Mouse	*Reithrodontomys humulis*
Northern Pygmy Mouse	*Baiomys taylori*

Habitat Research Needs/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 woody vegetation, where appropriate.
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 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. Support and encourage prescribed burning as a routine rangeland management tool.
8. Work with farmers, state (LDEQ, LDNR) and federal (NRCS, U.S. Geological Survey (USGS)) agencies, university extension services, local and parish governments, and the legislature to develop a comprehensive statewide water rights/use plan.
9. Provide landowners with information on federal/state incentive programs through LDWF programs, and NRCS, to promote best management practices on working lands.
10. Continue to coordinate with NRCS on development of practices via the Farm Bill that are beneficial for SGCN.
11. Continue to participate in NRCS State Technical Advisory Committee (TAC) as well as annual meetings with NRCS.

b. Rice Agriculture and Aquaculture

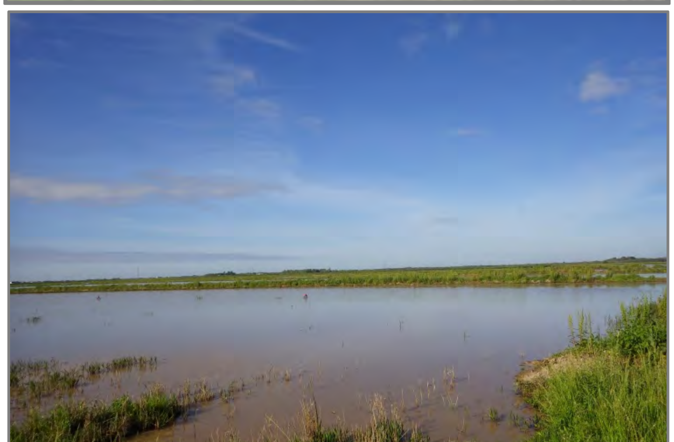
Rarity Rank: N/A

Synonyms: None

Ecological Systems: None

General Description:

Rice field, Cameron Parish



Crawfish Pond, Vermilion Parish

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 drawn-down 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, shorebirds, and other waterbirds. These birds feed on aquatic invertebrates, rice and weed seed, 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 Rails, Least Bittern, Purple Gallinule, Common Gallinule), and shorebirds (Black-necked Stilt). Flooded rice fields and crawfish ponds are extremely important to shorebirds, wading birds, and waterfowl and are integral components of the LMVJV and Gulf Coast Joint Venture (GCJV) plans for meeting the present and future nutritional needs of these avian guilds. 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" crop which is harvested later. Preparation for this ratoon crop, most often mid-July – early August, including manipulation of harvested stubble and re-flooding, provides valuable habitat for waterbirds as most other water is removed from the landscape. Ratooned crops also increase food available for wintering waterfowl by as much as 15% compared to fields that are not ratooned. 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. Bald Eagle, Peregrine Falcon, 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 and migrant shorebirds. These summer drawdowns concentrate aquatic prey into shallow pools that persist due to elevation differences and waterbirds including Roseate Spoonbills, Wood Storks, and other species of wading birds exploit this foraging opportunity. 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, as well as over 100,000 acres of ratoon crop rice. Louisiana has about 120,000 acres of crawfish ponds.

Rice Agriculture and Aquaculture SGCN (42)	
Amphibians (1)	
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Reptiles (1)	
Western Chicken Turtle	*Deirochelys reticularia miaria*
Birds (40)	
Mottled Duck	*Anas fulvigula*
Northern Pintail	*Anas acuta*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Lesser Scaup	*Aythya affinis*
Wood Stork	*Mycteria americana*
American Bittern	*Botaurus lentiginosus*
Least Bittern	*Ixobrychus exilis*
Little Blue Heron	*Egretta caerulea*
Glossy Ibis	*Plegadis falcinellus*
Roseate Spoonbill	*Platalea ajaja*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
White-tailed Kite	*Elanus leucurus*

Yellow Rail	*Coturnicops noveboracensis*
King Rail	*Rallus elegans*
Sandhill Crane	*Antigone canadensis*
Whooping Crane	*Grus americana*
Upland Sandpiper	*Bartramia longicauda*
Hudsonian Godwit	*Limosa haemastica*
Dunlin	*Calidris alpina*
Buff-breasted Sandpiper	*Calidris subruficollis*
Short-billed Dowitcher	*Limnodromus griseus*
Interior Least Tern	*Sternula antillarum athalassos*
Gull-billed Tern	*Gelochelidon nilotica*
Caspian Tern	*Hydroprogne caspia*
Forster's Tern	*Sterna forsteri*
Common Ground-Dove	*Columbina passerina*
Short-eared Owl	*Asio flammeus*
Crested Caracara	*Caracara cheriway*
Peregrine Falcon	*Falco peregrinus*
Loggerhead Shrike	*Lanius ludovicianus*
Sedge Wren	*Cistothorus platensis*
Marsh Wren	*Cistothorus palustris*
Sprague's Pipit	*Anthus spragueii*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Dickcissel	*Spiza americana*

Habitat Research Needs/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 of rice and crawfish aquaculture from willing sellers within the coastal prairie region, including abandoned or unproductive land, for re-establishment of native grassland/wetland complexes.
5. Assist rice/crawfish producers in replacement of degraded 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 period of time in late summer (July-September) for 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; these activities may be conducted using NRCS programs such as the Migratory Bird Habitat Initiative (MBHI), EQIP, and Conservation Stewardship Program (CSP).

7. Work with partners to promote the continued presence of rice acreage on the landscape to benefit native birds, including the use of incentive programs where available.
8. Promote the use of traditional rice production methods over dry-seeding techniques.

c. Pine Plantation

Rarity Rank: N/A

Synonyms: Loblolly Pine Plantation, Slash Pine Plantation

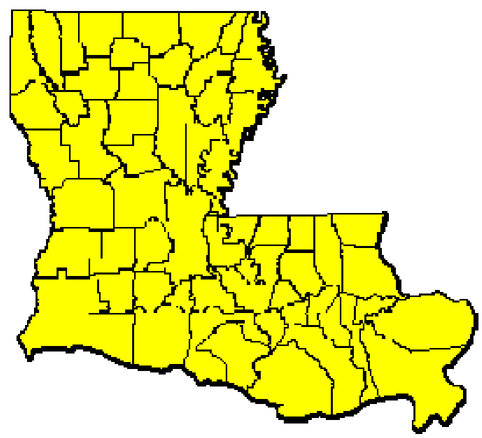
Ecological Systems: None

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 WGCP and EGCP 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 Pine 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 CRP have incentivized the establishment of 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 pine plantations for private landowners.

Pine Plantation SGCN (80)*	
Crustaceans (2)	
Flatwoods Digger	*Fallicambarus oryktes*
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (21)	
Texas Brown Tarantula	*Aphonopelma hentzi*
American Bumble Bee	*Bombus pensylvanicus*
Florida Harvester Ant	*Pogonomyrmex badius*

Comanche Harvester Ant	*Pogonomyrmex comanche*
Wild Indigo Duskywing	*Erynnis baptisiae*
Cobweb Skipper	*Hesperia metea*
Dusted Skipper	*Atrytonopsis hianna*
Meske's Skipper	*Hesperia meskei*
Yucca Giant-Skipper	*Megathymus yuccae*
Strecker's Giant-Skipper	*Megathymus streckeri*
Falcate Orangetip	*Anthocharis midea*
Monarch	*Danaus plexippus*
Brou’s Mallow Moth	*Bagisara brouana*
Little Metalmark	*Calephelis virginiensis*
Creole Pearly-eye	*Lethe creola*
Yellow Brachycercus Mayfly	*Sparbarus flavus*
Texas Emerald	*Somatochlora margarita*
Frosted Elfin	*Callophrys irus*
Georgia Satyr	*Neonympha areolatus*
Mottled Duskywing	*Erynnis martialis*
Dusky Roadside-Skipper	*Amblyscirtes alternata*
Amphibians (7)	
Eastern Tiger Salamander	*Ambystoma tigrinum tigrinum*
Ornate Chorus Frog	*Pseudacris ornata*
Strecker's Chorus Frog	*Pseudacris streckeri*
Southern Crawfish Frog	*Lithobates areolatus areolatus*
Eastern Spadefoot	*Scaphiopus holbrookii*
Hurter's Spadefoot	*Scaphiopus hurterii*
Dusky Gopher Frog	*Lithobates sevosus*
Reptiles (14)	
Gopher Tortoise	*Gopherus polyphemus*
Western Slender Glass Lizard	*Ophisaurus attenuatus attenuatus*
Eastern Glass Lizard	*Ophisaurus ventralis*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Eastern Diamond-backed Rattlesnake	*Crotalus adamanteus*
Coal Skink	*Plestiodon anthracinus*
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*
Black Pinesnake	*Pituophis melanoleucus lodingi*
Louisiana Pinesnake	*Pituophis ruthveni*
Pine Woods Littersnake	*Rhadinaea flavilata*
Southeastern Crowned Snake	*Tantilla coronata*
Harlequin Coralsnake	*Micrurus fulvius*
Eastern Hog-nosed Snake	*Heterodon platirhinos*

Timber Rattlesnake	*Crotalus horridus*
Birds (26)	
Northern Bobwhite	*Colinus virginianus*
Swallow-tailed Kite	*Elanoides forficatus*
White-tailed Kite	*Elanus leucurus*
Bald Eagle	*Haliaeetus leucocephalus*
American Woodcock	*Scolopax minor*
Common Ground-Dove	*Columbina passerina*
Greater Roadrunner	*Geococcyx californianus*
Chuck-will's-widow	*Antrostomus carolinensis*
Chimney Swift	*Chaetura pelagica*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Red-cockaded Woodpecker	*Picoides borealis*
Southeastern American Kestrel	*Falco sparverius paulus*
Loggerhead Shrike	*Lanius ludovicianus*
Brown-headed Nuthatch	*Sitta pusilla*
Sedge Wren	*Cistothorus platensis*
Prairie Warbler	*Setophaga discolor*
Bachman's Sparrow	*Peucaea aestivalis*
Field Sparrow	*Spizella pusilla*
Lark Sparrow	*Chondestes grammacus*
Grasshopper Sparrow	*Ammodramus savannarum*
Henslow's Sparrow	*Ammodramus henslowii*
Le Conte's Sparrow	*Ammodramus leconteii*
Nelson's Sparrow	*Ammodramus nelsoni*
Painted Bunting	*Passerina ciris*
Dickcissel	*Spiza americana*
Rusty Blackbird	*Euphagus carolinus*
Mammals (10)	
Southeastern Shrew	*Sorex longirostris*
Bachman's Fox Squirrel	*Sciurus niger bachmani*
Oak Ridge Pocket Gopher	*Geomys breviceps breviceps*
Baird's Pocket Gopher	*Geomys breviceps sagittatus*
Golden Mouse	*Ochrotomys nuttalli*
Eastern Harvest Mouse	*Reithrodontomys humulis*
Louisiana Black Bear	*Ursus americanus luteolus*
Long-tailed Weasel	*Mustela frenata*
Eastern Spotted Skunk	*Spilogale putorius*
Ringtail	*Bassariscus astutus*

*This SGCN list includes many species that would only be expected in high-quality, well-managed examples of Pine Plantation

Habitat Research Needs/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 fire within these habitat types.
5. Promote federal/state incentive programs such as EQIP, CRP, CSP, 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 of urban development with conservation easements to maintain these areas in working forestlands.

11. River Basins

Louisiana has over 66,000 miles of rivers and streams, which support diverse assemblages of crustaceans, mussels, fishes, turtles, and other wildlife, including many SGCN. Many of Louisiana's most diverse and productive wildlife habitats are associated with, or maintained by, these waterbodies. Rivers and streams are also important for agriculture, transportation and stormwater drainage, and they provide a livelihood for trappers and fishermen. Many streams are used for recreation, including fishing, hunting, paddling, boating, swimming, wildlife watching and wildlife photography.

However, in our water-rich state, we sometimes take streams for granted. According to the EPA, 76% of Louisiana's rivers and streams are impaired, meaning that because of poor water quality, the streams do not support all of their intended uses. Designated uses may include recreation (e.g., swimming and boating), fish and wildlife propagation (e.g., fishing and fish consumption), drinking water supply, and irrigation. Furthermore, impaired water quality is a significant threat to fish and wildlife populations and their supporting habitats.

Figure 5.1. Major waterbodies and river basins of Louisiana

***Threats to River Basins*:**

Threats to rivers and streams are similar between basins and include ten of the eleven 1st level threats identified by Salafsky et al. (2008). Detailed accounts of which threats apply to each basin and to what extent, are presented in the individual basin treatments below. A brief discussion of each of the applicable 1st level threats is given here, as this information will be similar across basins.

- Residential/Commercial Development – this includes direct impacts to riparian areas and wetlands by clearing, draining, and filling.
- Agriculture/Aquaculture –silvicultural activities that do not follow BMPs may directly impact riparian areas, and clearing or draining and filling of riparian or wetland areas may also directly impact river basins.
- Energy Production & Mining – sand and gravel mining within river floodplains and within streambeds poses a direct threat to habitat for many SGCN, and can alter ecosystems.
- Transportation & Service Corridors – clearing of land for such corridors may have watershed level impacts and may also lead to increased sedimentation of waterbodies, resulting in reduced water quality.
- Human Intrusion & Disturbance – this includes the use of ORVs within streams, which negatively impacts habitats, water quality, and SGCN.
- Natural System Modification – one of the biggest threats to our rivers and streams is hydromodification (e.g., dredging, forced drainage, flow alterations, sediment re-suspension, and water withdrawals).
- Invasive Species – the introduction and proliferation of numerous invasive plant and animal species has had negative impacts within most aquatic systems in Louisiana.
- Pollution – as illustrated by the water quality information presented for each basin, pollution of rivers and streams affects all systems in the state and comes from many sources. These sources include but are not limited to: wastewater from residential and industrial sources, anthropogenic mercury, litter and illegal dumping, and sedimentation resulting from numerous human activities.
- Geological Events – subsidence can lead to shifts in salinities within the coastal reaches of rivers and streams, in turn causing habitat shifts and reducing habitat suitability for SGCN.
- Climate Change & Severe Weather – decreases in precipitation may result in reductions in freshwater input. Changes in the frequency and intensity of tropical storms may also lead to shifts in salinities and habitat composition within coastal portions of river basins.

Many of these threats result in reduced water quality. In turn, poor water quality adversely affects fish and other aquatic life inhabiting streams and rivers and also limits opportunities to enjoy these diverse natural resources.

General Research Needs/Conservation Actions:

The Louisiana Wildlife Action Plan identifies the following actions for the conservation of riverine and riparian systems, including those contained within the Natural and Scenic Rivers System:

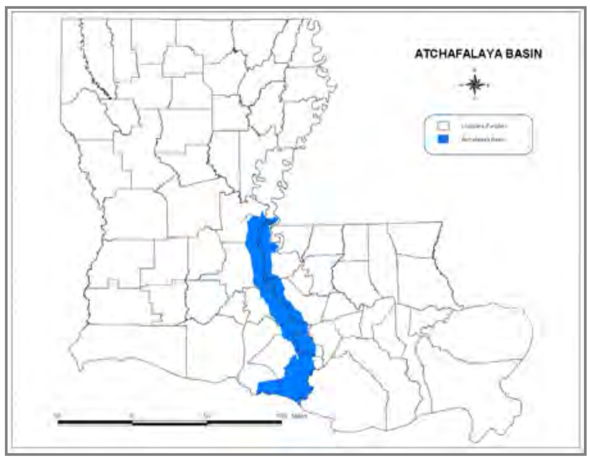
1. Provide technical assistance to federal, state and local regulatory agencies, private landowners, and commercial/residential developers for the purposes of conserving stream habitat, riparian corridors and SGCN, as well as improving stream water quality and quantity.
2. Consult with federal, state, and local government and NGOs in the development and/or revision of BMPs for sand and gravel mining, water withdrawals, timber harvesting, stream bank stabilization, pesticide application, general construction, and stormwater runoff.
3. Collaborate with Southeast Aquatic Resources Partnership (SARP) to conserve aquatic resources.
4. Investigate the possibility of providing incentives to protect and restore riparian forest to provide habitat for SGCN and improve water quality.
5. Promote existing funding programs (e.g., USDA NRCS Farm Bill programs) that support re-establishment of forested/vegetated SMZs.
6. Continue efforts to conserve aquatic habitat and improve water quality through educational outreach and enforcement of Scenic Rivers laws and regulations.
7. Coordinate with enforcement agencies at all levels to prevent or ameliorate damage to aquatic systems, including Scenic Rivers.
8. Support and strengthen LDWF's Scenic Rivers program by conducting regular monitoring and surveying of system streams as well as contributing data, expertise, and, if appropriate, State Wildlife Grant funding for the development of Scenic River Management Plans and regulatory programs.
9. Preserve and restore riparian corridors for SGCN on existing conservation lands and private lands.
10. Conduct scientifically defensible stream assessments that characterize water quality, gradient, in-stream flow, substrate composition, in-stream habitat, and stressors to inform management and regulatory decisions by federal and state regulators, including the Scenic Rivers Program.
11. Partner in efforts to eradicate or control invasive exotic species known to adversely affect native flora and fauna, including SGCN.
12. Address non-point source pollution and loss of riparian habitat through collaboration with state and federal agencies, NGOs, and the public.
13. Use GIS to analyze information such as stream migration patterns, land use changes, broad scale stressors, climate variability, species and habitat distributions, and water quality and quantity to inform management and regulatory decision-making.
14. Promote oil spill prevention (Spill Prevention Control, SPC) regulations and natural resource response mechanisms (Natural Resource Damage Assessments, NRDA).

15. Work with the Louisiana Aquatic Nuisance Species Task Force (LANSTF) to identify and address threats related to invasive species.
16. Develop partnerships with regulatory agencies to share data on habitat threats and to ensure compliance with existing regulations.
17. Continue LDWF involvement in the environmental review process of all river related projects. Identify potential impacts and recommend appropriate mitigation.
18. Prepare educational material on potential impacts of invasive species to the aquatic basins.
19. Develop programs to eliminate entanglement gear in all basins.
20. Encourage alternative bridge and culvert designs to lessen impacts to aquatic habitats and organisms.
21. 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.

a. Atchafalaya Basin

General Description:

The Atchafalaya Basin, at approximately 1 million acres, is the nation's largest river-swamp system (Demas et al. 2001), consisting primarily of Bottomland Hardwood Forest and Cypress-Tupelo-Blackgum Swamp. Located in south-central Louisiana, the system stretches from the river's origin near Simmesport to its terminus at 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, which 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 to the Atchafalaya and Wax Lake Deltas, which currently have the most significant accretion of land on the Louisiana coast (LCWCRTF 1993). Also contributing to land formation is the beneficial use of dredge material resulting from maintaining navigation channels. Much of this newly created land is contained within the 137,000 acre Atchafalaya Delta WMA, which consists primarily of tidal riverine Freshwater Marsh.



The Atchafalaya Basin has many commercial uses including fishing, trapping, logging, oil and gas exploration and production, nature tours, and limited shipping. Recreational activities include fishing, hunting, camping, bird watching, swimming, and boating. The Atchafalaya Basin contains a diversity of habitats, from Bottomland Hardwood Forests in the upper basin to coastal marshes, oyster reefs, and Vegetated Pioneer Emerging Delta in the lower portions of the basin. Much of the Atchafalaya Basin consists of public lands, including Sherburne WMA, Atchafalaya NWR, and multiple USACE properties (e.g., Bayou des Ourses and Indian Bayou).

There are roughly 100 species of freshwater fishes (W. Kelso, personal communication), 22 species of mussels (Vidrine 1993), and ten species of crawfish (J. Walls, personal communication) found within the Atchafalaya Basin. For more information about this basin see the LDWF Inland Fisheries Management plan for the Atchafalaya Basin (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that only 50% of the 12 waterbody subsegments within the basin were fully supporting their designated use for fish and wildlife propagation. The causes of water quality issues in the other 50% of subsegments include: fecal coliform bacteria, suspended solids, mercury, turbidity, non-native aquatic invasive plants, and low concentration of dissolved oxygen.

Atchafalaya Basin SGCN (36)	
Mollusks (2)	
Round Pearlshell	*Glebula rotundata*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (1)	
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (8)	
Pallid Sturgeon	*Scaphirhynchus albus*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Shoal Chub	*Macrhybopsis hyostoma*
Bluehead Shiner	*Pteronotropis hubbsi*
Blue Sucker	*Cycleptus elongatus*
Saddleback Darter	*Percina vigil*
Marine Fish (14)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Emerald Sleeper	*Erotelis smaragdus*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Reptiles (11)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Leatherback Sea Turtle	*Dermochelys coriacea*

Western Chicken Turtle	*Deirochelys reticularia miaria*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Atchafalaya Basin and the scope and severity of those threats. Primary threats to this basin include natural system modification, which is largely related to changes in natural hydrology, as well as the negative impacts of invasive plants such as Common and Giant Salvinia.

Atchafalaya Basin Threats Assessment:			
1st 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 Research Needs /Conservation Actions:

1. Restore historical flow regimes within the Atchafalaya Basin.
2. Work with LDEQ and USGS to increase monitoring of nutrient inputs and overall water quality within the Atchafalaya Basin.
3. Coordinate with Atchafalaya Basin Program (LDNR) and BTNEP to address threats to this basin.
4. Complete a comprehensive survey of oyster reef/hard bottom habitat acreage within the system.

b. Barataria Basin

General Description:

The upper Barataria Basin was formed approximately 3,500-4,000 years ago as part of the Lafourche Delta complex. Encompassing approximately 300,000 acres, this basin 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 the south by the Gulf of Mexico. The basin is mainly comprised of the following four terrestrial habitat types: agriculture/improved pasture (primarily sugarcane), Bottomland Hardwood Forests, Cypress-Tupelo-Blackgum Swamps, and coastal marshes which range from fresh to saltwater. Freshwater Floating Marsh is known from this basin and may occupy a substantial area. Freshwater input sources include local precipitation, minor inflow from the Greater Intracoastal Waterway (LaCoast 2005), and when possible, freshwater diverted from the Mississippi River at sites such as Davis Pond and Naomi freshwater diversions. 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). LDWF properties in this basin include Pointe-aux-Chenes and Salvador WMAs and Elmer's Island Refuge. These sites are composed of Freshwater, Freshwater Floating, Intermediate, and Brackish Marshes that are threatened by subsidence and erosion from storms. This basin also includes Grand Isle, Elmer's Island, and Queen Bess Island, which is a highly productive island for colonial nesting waterbirds.

Approximately 60 species of freshwater fishes (W. Kelso, personal communication) and nine species of crawfish (J. Walls, personal communication) are 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.

For more information about this basin, see the LDWF Inland Fisheries management plan for the Barataria Basin (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 11% of the 27 water body subsegments within the basin fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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 these water quality problems include: crop production, pastureland, urban runoff, septic tanks, spills, minor industrial point sources, petroleum activities, highway runoff, hydromodification, and dredging.

Barataria Basin SGCN (31)	
Mollusks (1)	
Round Pearlshell	*Glebula rotundata*
Crustaceans (4)	
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (3)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Alabama Shad	*Alosa alabamae*
Marine Fish (15)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Dwarf Seahorse	*Hippocampus zosterae*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Emerald Sleeper	*Erotelis smaragdus*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Reptiles (8)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*

Alligator Snapping Turtle	*Macrochelys temminckii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Barataria Basin and the scope and severity of those threats. Primary threats to this basin include changes to the natural hydrology of the system, negative impacts of invasive plants, and subsidence.

Barataria Basin Threats Assessment:

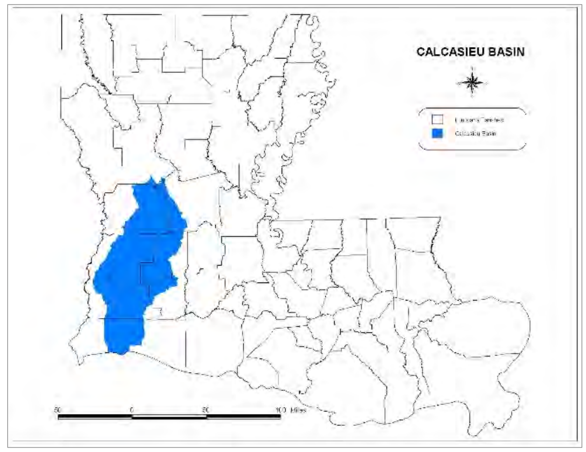
1st Level Threat	Scope	Severity	Impact
Residential/Commercial Development	Restricted	Moderate	Low
Agriculture/Aquaculture	Restricted	Moderate	Low
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Moderate	Low
Biological Resource Use	N/A	N/A	N/A
Human Intrusion/Disturbance	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 Research Needs/Conservation Actions:

1. Maintain existing freshwater diversion canals from the Mississippi River into the Barataria Basin.
2. Inform other agencies (e.g., CPRA) and the public about the uniqueness of Freshwater Floating Marsh; protect such marshes from disturbance from canal development, and from input of nutrients and sediment.
3. Work with BTNEP and other partners to abate threats to this basin.
4. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh and Barrier Island habitat critical to SGCN.

c. Calcasieu Basin

General Description:



The Calcasieu Basin, located in southwest Louisiana, comprises approximately 4,105 square miles of drainage area and represents 8% 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 ranging from 260-400 feet above mean sea level, the river flows through the Coastal Prairie and coastal marshes, which have an elevation ranging from one to two feet above mean sea level. The flood plains are extremely flat with little relief and average two to three feet above mean sea level. The river flows through the following major lakes: 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 of Mexico. 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 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 for rice production. Navigation improvements have modified the Calcasieu from its mouth to approximately 52.6 river miles inland (Weston 1974).

Similar to other basins, saltwater intrusion and coastal land loss are significant threats 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. 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 an attempt to address this threat (CPRA 2012).

Approximately 90 species of freshwater fishes (Maxwell 2012, LDWF unpublished data, B. Reed, personal communication), 30 species of mussels (Vidrine 1993), and 16 species of crawfish (J. Walls, personal communication) are 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. For more information about this basin, see the LDWF Inland Fisheries management plan for the Calcasieu River (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 31% of the 39 waterbody subsegments within the basin fully support their designated use for fish and wildlife propagation. The suspected causes for 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 (45)	
Mollusks (7)	
Texas Pigtoe	*Fusconaia askewi*
Round Pearlshell	*Glebula rotundata*
Sandbank Pocketbook	*Lampsilis satura*
Southern Hickorynut	*Obovaria jacksoniana*
Louisiana Pigtoe	*Pleurobema riddellii*
Southern Creekmussel	*Strophitus subvexus*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (8)	
Calcasieu Painted Crawfish	*Orconectes blacki*
Pine Hills Digger	*Fallicambarus dissitus*
Old Prairie Digger	*Fallicambarus macneesei*
Calcasieu Creek Crawfish	*Procambarus pentastylus*
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (2)	
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Pitcher Plant Spiketail	*Cordulegaster sarracenia*

Inland Fish (6)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Shoal Chub	*Macrhybopsis hyostoma*
Redspot Darter	*Etheostoma artesiae*
Gumbo Darter	*Etheostoma thompsoni*
Bigscale Logperch	*Percina macrolepida*
Marine Fish (10)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Amphibians (1)	
Gulf Coast Waterdog	*Necturus beyeri*
Reptiles (11)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Sabine Map Turtle	*Graptemys sabinensis*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Calcasieu Basin and the scope and severity of those threats. Among the primary threats to this basin are changes in the natural hydrology of the Calcasieu River, invasive plants, and pollution of many water bodies from multiple sources, including run-off from extensive agricultural lands.

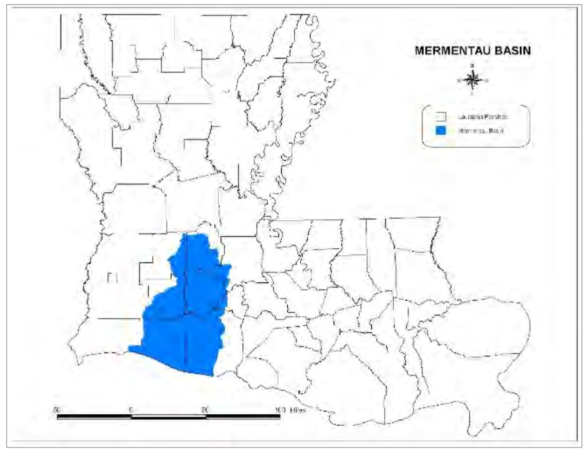
Calcasieu Basin Threats Assessment:			
1st Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Restricted	Serious	Medium
Agriculture/Aquaculture	Large	Serious	High
Energy Production & Mining	Restricted	Serious	Medium
Transportation & Service Corridors	Restricted	Serious	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 Research Needs/Conservation Actions:

1. Support current initiatives and develop new programs that help reduce siltation and sedimentation, including the use of BMPs, throughout the Calcasieu Basin.
2. Support practical initiatives that will help address saltwater intrusion into and erosion of coastal marshes surrounding Calcasieu Lake while also allowing for adequate connectivity between the lake and marsh habitats.

d. Mermentau Basin

General Description:



The Mermentau Basin is located in the southwestern part of Louisiana and drains an area of approximately 6,730 square miles. This basin, located between the Vermilion-Teche and Calcasieu Basins, comprises a controlled system for the drainage of the 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 three 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 the Coastal Prairie region which extends from west, near Vinton, Louisiana (located in the Calcasieu Basin), to east, ending at Bayou Teche. This region 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 Coastal Prairie region, which is extensively cultivated, gives way to a band of marshland which extends along Louisiana’s entire coastline. This marsh region is further subdivided into Freshwater Marsh, which borders the Coastal Prairie to the north, Intermediate and Brackish Marshes, and finally 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 Intracoastal 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 converted to open water from 1932-2005, a loss of 19% of the historical wetlands in Mermentau Basin. This represents 9% of wetland loss in Louisiana over that time period (LaCoast 2005).

Approximately 75 species of freshwater fishes (Tulane 2008, LDWF unpublished data), 22 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) are 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 fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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 stormwater runoff, and dredging.

Mermentau Basin SGCN (32)	
Mollusks (1)	
Round Pearlshell	*Glebula rotundata*
Crustaceans (5)	
Teche Painted Crawfish	*Orconectes hathawayi*
Old Prairie Digger	*Fallicambarus macneesei*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (1)	
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Inland Fish (3)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Gumbo Darter	*Etheostoma thompsoni*
Marine Fish (10)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Amphibians (1)	
Gulf Coast Waterdog	*Necturus beyeri*

Reptiles (11)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Sabine Map Turtle	*Graptemys sabinensis*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Mermentau Basin and the scope and severity of those threats. As with the neighboring Calcasieu Basin, two of the primary threats to this basin are invasive plants (e.g., Common and Giant Salvinia, Water Hyacinth, Hydrilla) and alterations to the natural hydrology of the system.

Mermentau Basin Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Partner with USDA NRCS to develop an initiative to improve water quality through conservation practices on working lands.

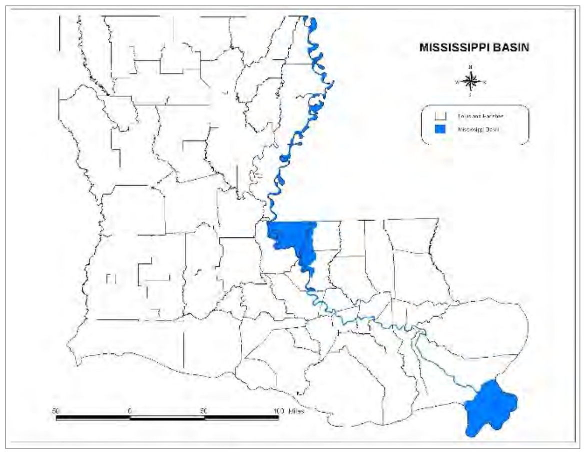
2. Partner with and support the Mississippi River Basin Initiative (www.la.nrcs.usda.gov/programs/MRBI/index.html) and the Gulf of Mexico Initiative (www.la.nrcs.usda.gov/programs/GOMI/index.html) to address the causes of habitat impairment within the Mermentau Basin.

e. Mississippi Basin

General Description:

The portion of the Mississippi River which occurs in Louisiana is part of the Lower Mississippi Drainage Basin, which extends from Cairo, Illinois to Head-of-Passes at 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 Mississippi River delta. The river is completely leveed on its western side from the Arkansas line to Venice, Louisiana and on its eastern side from Baton Rouge to Venice.

The primary habitat types within the basin are Batture, Bottomland Hardwood Forests, and Sandbars. This basin also contains nearly 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 species of fish which comprises 25% of all fish species in North America (NPS 2004). Approximately 50 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) are found within the Mississippi Basin in Louisiana.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 43% of the 17 waterbody subsegments within the basin support their designated use for fish and wildlife propagation. Causes of water quality issues include: metals, nutrients, polychlorinated biphenyls (PCBs), hexachlorobenzene, fecal coliform bacteria, 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 (66)	
Mollusks (13)	
Butterfly	*Ellipsaria lineolata*
Elephant-ear	*Elliptio crassidens*

Ebonyshell	*Fusconaia ebena*
Round Pearlshell	*Glebula rotundata*
Plain Pocketbook	*Lampsilis cardium*
Fatmucket	*Lampsilis siliquoidea*
White Heelsplitter	*Lasmigona complanata*
Southern Hickorynut	*Obovaria jacksoniana*
Pyramid Pigtoe	*Pleurobema rubrum*
Fat Pocketbook	*Potamilus capax*
Rabbitsfoot	*Quadrula cylindrica*
Southern Creekmussel	*Strophitus subvexus*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (5)	
Vernal Crawfish	*Procambarus viaeviridis*
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (21)	
Pallid Sturgeon	*Scaphirhynchus albus*
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Alabama Shad	*Alosa alabamae*
Central Stoneroller	*Campostoma anomalum*
Bluntface Shiner	*Cyprinella camura*
Steelcolor Shiner	*Cyprinella whipplei*
Sturgeon Chub	*Macrhybopsis gelida*
Shoal Chub	*Macrhybopsis hyostoma*
Sicklefin Chub	*Macrhybopsis meeki*
Bigeye Shiner	*Notropis boops*
Longjaw Minnow	*Notropis amplamala*
Ironcolor Shiner	*Notropis chalybaeus*
Chub Shiner	*Notropis potteri*
Blue Sucker	*Cycleptus elongatus*
Gulf Pipefish	*Syngnathus scovelli*
Redspot Darter	*Etheostoma artesiae*
Rainbow Darter	*Etheostoma caeruleum*
Bigscale Logperch	*Percina macrolepida*
Saddleback Darter	*Percina vigil*

Marine Fish (15)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Goliath Grouper	*Epinephelus itajara*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Dwarf Seahorse	*Hippocampus zosterae*
Reptiles (12)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Leatherback Sea Turtle	*Dermochelys coriacea*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Mississippi Basin and the scope and severity of those threats. Among the most serious threats to this basin are the impacts of invasive plants and animals, as well as modifications to the natural hydrology of the Mississippi River. Due to the high level of commercial use of the river, pollution is also a serious threat to water quality.

Mississippi Basin Threats Assessment:			
1st 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			

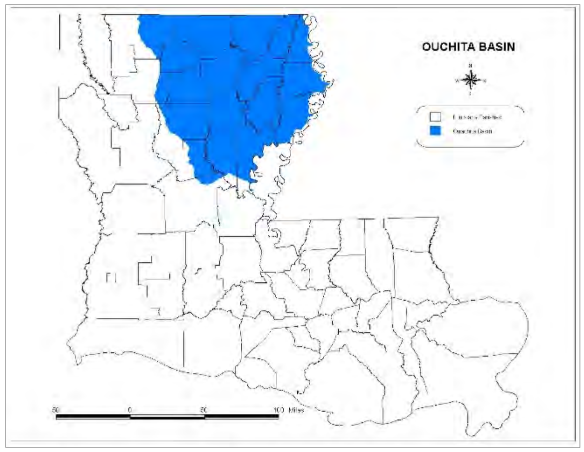
Basin Research Needs/Conservation Actions:

1. Develop a comprehensive biological survey methodology for the Mississippi River and its tributaries.
2. Explore the possibility of reconnecting the Mississippi River with portions of its floodplain by using controlled diversions, in order to restore the natural hydrology of forested wetlands.

f. Ouachita Basin

General Description:

The Ouachita River system is the principal drainage for south Arkansas and northeast Louisiana, draining an approximate area of 26,000 square miles. The source of the river is 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 cultivated in Loblolly Pine plantations. Bayou Bartholomew and Bayou D'Arbonne are the major tributaries of the Ouachita River. Bayou Bartholomew is home to one of the most diverse assemblages of freshwater mussels and fishes in Louisiana.



There are two lock and dams on the Ouachita River 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. The Catahoula Diversion Channel and Control Structure and the Little River Closure Dam 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).

Approximately 120 species of freshwater fishes (W. Kelso, personal communication), 49 species of mussels (Vidrine 1993), and 19 species of crawfish (J. Walls, personal communication) are 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 fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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 (60)	
Mollusks (23)	
Mucket	*Actinonaias ligamentina*
Western Fanshell	*Cyprogenia aberti*
Round Pearlshell	*Glebula rotundata*
Butterfly	*Ellipsaria lineolata*
Spike	*Elliptio dilatata*
Ebonyshell	*Fusconaia ebena*
Pink Mucket	*Lampsilis abrupta*
Sandbank Pocketbook	*Lampsilis satura*
Plain Pocketbook	*Lampsilis cardium*
Southern Pocketbook	*Lampsilis ornata*
Fatmucket	*Lampsilis siliquoidea*
White Heelsplitter	*Lasmigona complanata*
Black Sandshell	*Ligumia recta*
Southern Hickorynut	*Obovaria jacksoniana*
Hickorynut	*Obovaria olivaria*
Pyramid Pigtoe	*Pleurobema rubrum*
Fat Pocketbook	*Potamilus capax*
Ouachita Kidneyshell	*Ptychobranchus occidentalis*
Rabbitsfoot	*Quadrula cylindrica*
Monkeyface	*Quadrula metanevra*
Creeper	*Strophitus undulatus*
Fawnsfoot	*Truncilla donaciformis*
Silty Hornsnail	*Pleurocera canaliculata*
Crustaceans (4)	
Vernal Crawfish	*Procambarus viaeviridis*
Elegant Creek Crawfish	*Procambarus elegans*
Ouachita Fencing Crawfish	*Faxonella creaseri*
Pine Hills Digger	*Fallicambarus dissitus*
Non-crustacean Arthropods (10)	
Texas Emerald	*Somatochlora margarita*
Texas Forestfly	*Amphinemura texana*
Louisiana Needlefly	*Leuctra szczytkoi*
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*

Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*
Ceraclean Caddisfly	*Ceraclea spongillovorax*
Schoolhouse Springs Purse Casemaker Caddisfly	*Hydroptila ouachita*
Inland Fish (17)	
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Central Stoneroller	*Campostoma anomalum*
Steelcolor Shiner	*Cyprinella whipplei*
Shoal Chub	*Macrhybopsis hyostoma*
Bigeye Shiner	*Notropis boops*
Ironcolor Shiner	*Notropis chalybaeus*
Bluehead Shiner	*Pteronotropis hubbsi*
Blue Sucker	*Cycleptus elongatus*
River Redhorse	*Moxostoma carinatum*
Western Sand Darter	*Ammocrypta clara*
Crystal Darter	*Crystallaria asprella*
Redspot Darter	*Etheostoma artesiae*
Channel Darter	*Percina copelandi*
Stargazing Darter	*Percina uranidea*
Saddleback Darter	*Percina vigil*
Amphibians (1)	
Red River Mudpuppy	*Necturus louisianensis*
Reptiles (5)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Razor-backed Musk Turtle	*Sternotherus carinatus*

Threats Affecting Basin:

The following table illustrates the threats identified for the Ouachita Basin and the scope and severity of those threats. Invasive species, including carp of several species and Common Salvinia, are one of the most pressing threats to this basin. As with most river systems in Louisiana, changes to natural hydrological regimes within this basin are of concern. Finally, due to the large amount of agricultural land within this basin, sedimentation and agricultural runoff impact many waterbodies.

Ouachita Basin Threats Assessment:			
1st 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			

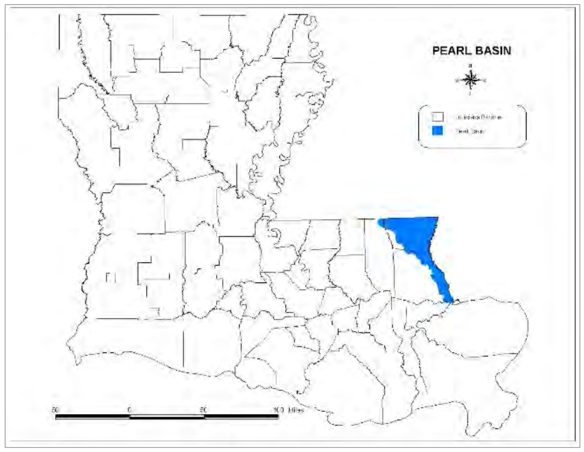
Basin Research Needs/Conservation Actions:

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. Partner with USDA NRCS to reduce impacts from agriculture sediments within the Ouachita Basin, particularly in Bayou Bonne Idee.
3. Address the impacts of adjacent agricultural practices on Bayou Bartholomew SGCN.
4. Address the impacts of habitat alteration and development on Bayou DeSiard.

g. Pearl Basin

General Description:

The Pearl 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, including industrial timberland. Urbanization is steadily increasing as residents from the metropolitan area of New Orleans continue to immigrate into St. Tammany and Washington Parishes.



The East Pearl River system is one of Louisiana and Mississippi's principal rivers, draining an area of 8,760 square miles. The river divides into two 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 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 Basin is among the most unaltered of all the state's basins; however, future development pressures and changes in land use practices could seriously degrade habitat in this basin. Main channel and side channel habitats throughout the basin are threatened by the operation of dams and creation of reservoirs. The headwater dam (Ross Barnett Reservoir) at Jackson, Mississippi has changed normal historic flow patterns in the lower Pearl Basin. Future proposals for new or expanded reservoirs could further compound the interruption of normal flow patterns to the river below such reservoirs, with unknown impacts to coastal species within the Lake Borgne/Mississippi Sound receiving waters. Degradation of other habitats (tributaries, backwaters, and swamps) has been less severe, primarily due to a lack of accessibility to most of these areas. Erosion and sedimentation, exacerbated by agricultural practices, are the prime contributors to non-point source pollution. Historic mining practices on the Pearl and Bogue Chitto Rivers have interfered with the spawning cycle of the Alabama Shad, as removal of sand and gravel has greatly reduced the available substrate necessary for 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 two low water sills and three navigation locks on the Pearl River have altered the historic migration routes and the overall life cycles of the Gulf Sturgeon. Other species affected include the Alabama Shad, which has experienced significant declines in the last century due to these structures blocking spawning routes, and the Paddlefish, whose spawning and rearing areas have been altered.

With the decline of commercial traffic in the 1970'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 1980'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 had an impact on the forested wetlands 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 have substantially increased sedimentation in many areas, including within Pearl River WMA.

Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 20 species of mussels (Vidrine 1993), and 15 species of crawfish (J. Walls, personal communication) are found within the Pearl Basin. For more information about this basin, see the LDWF Inland Fisheries management plan for the Pearl River (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 26% of the 23 water body subsegments within the basin fully support their designated use for fish and wildlife propagation. Causes of water quality issues include: metals, nutrients, fecal coliform bacteria, 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 stormwater runoff, and surface mining.

Pearl Basin SGCN (70)	
Mollusks (14)	
Rayed Creekshell	*Anodontoides radiatus*
Elephant-ear	*Elliptio crassidens*
Ebonyshell	*Fusconaia ebena*
Round Pearlshell	*Glebula rotundata*
Southern Pocketbook	*Lampsilis ornata*
White Heelsplitter	*Lasmigona complanata*
Black Sandshell	*Ligumia recta*
Southern Hickorynut	*Obovaria jacksoniana*
Alabama Hickorynut	*Obovaria unicolor*
Mississippi Pigtoe	*Pleurobema beadleianum*
Inflated Heelsplitter	*Potamilus inflatus*
Southern Creekmussel	*Strophitus subvexus*
Fawnsfoot	*Truncilla donaciformis*

Southern Rainbow	*Villosa vibex*
Crustaceans (7)	
Flatnose Crawfish	*Procambarus planirostris*
Pearl Blackwater Crawfish	*Procambarus penni*
Pontchartrain Painted Crawfish	*Orconectes hobbsi*
Gulf Crawfish	*Procambarus shermani*
Ribbon Crawfish	*Procambarus bivittatus*
Flatwoods Digger	*Fallicambarus oryktes*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (2)	
Molson's Microcaddisfly	*Hydroptila molsonae*
Southern Snaketail	*Ophiogomphus australis*
Inland Fish (20)	
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Alabama Shad	*Alosa alabamae*
Clear Chub	*Hybopsis winchelli*
Shoal Chub	*Macrhybopsis hyostoma*
Longjaw Minnow	*Notropis amplamala*
Ironcolor Shiner	*Notropis chalybaeus*
Flagfin Shiner	*Pteronotropis signipinnis*
Bluenose Shiner	*Pteronotropis welaka*
Southeastern Blue Sucker	*Cycleptus meridionalis*
River Redhorse	*Moxostoma carinatum*
Frecklebelly Madtom	*Noturus munitus*
Crystal Darter	*Crystallaria asprella*
Redspot Darter	*Etheostoma artesiae*
Pearl Darter	*Percina aurora*
Channel Darter	*Percina copelandi*
Freckled Darter	*Percina lenticula*
Gulf Logperch	*Percina suttkusi*
Saddleback Darter	*Percina vigil*
Marine Fish (13)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*

Chain Pipefish	*Syngnathus louisianae*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Amphibians (1)	
Gulf Coast Waterdog	*Necturus beyeri*
Reptiles (13)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Leatherback Sea Turtle	*Dermochelys coriacea*
Ringed Map Turtle	*Graptemys oculifera*
Pearl River Map Turtle	*Graptemys pearlensis*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Pearl Basin and the scope and severity of those threats. Although this basin is not as threatened as many other systems in Louisiana, there are still threats that need to be addressed. One of the primary threats to the Pearl Basin is the modification of the natural flow regime described above. Sedimentation associated with transportation infrastructure construction has also impacted water quality within this basin.

Pearl Basin Threats Assessment:			
1st 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			

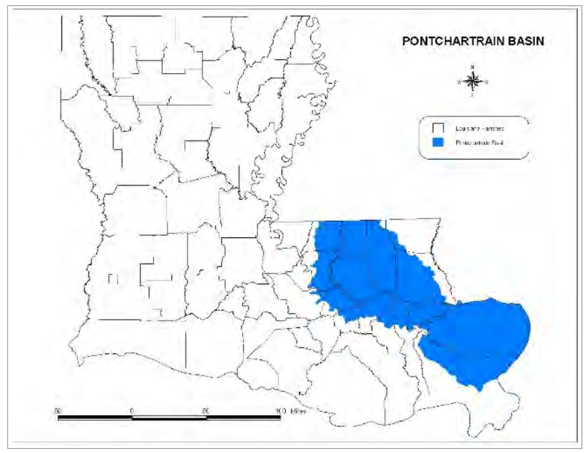
Basin Research Needs/Conservation Actions:

1. Coordinate with USACE, Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP), Mississippi Department of Environmental Quality (MDEQ), LDEQ, USDA NRCS, TNC, and others to develop a comprehensive management strategy for the entire Pearl Basin, to include plans for restoring, to the extent possible, historic flow patterns in the lower Pearl River.
2. Work with LDEQ, the Lake Pontchartrain Basin Foundation (LPBF), TNC, and other partners to address water quality issues in the Pearl Basin.
3. Support establishing levee breaks or set-backs to develop or replenish backwater areas.

h. Pontchartrain Basin

General Description:

The 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 contains all or portions of seven parishes: East Baton Rouge, East Feliciana, Livingston, St. Helena, St. Tammany, Tangipahoa, and Washington. Many rivers drain the Florida Parishes, introducing freshwater 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 freshwater from the Amite, Tickfaw, Blind, Tangipahoa, Tchefuncte, and Pearl Rivers, as well as Bayou Lacombe and Bayou Bonfouca. Freshwater is also introduced through regional drainage and diversion canals, whereas salt water enters these lakes from the Gulf of Mexico via the Mississippi Sound, Mississippi River Gulf Outlet (MRGO), Chef Menteur 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 remnants 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. These islands are of critical importance to a number of SGCN, including many species of birds.

Land use within this basin is varied, ranging from high-density urban areas that drain metropolitan Baton Rouge and New Orleans to rural pastures 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 contains some of the greatest aquatic species diversity in the state. Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 35 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) are found within the Pontchartrain Basin. Additionally, the Chandeleur Islands likely provide the only existing habitat in Louisiana for certain species of saltwater invertebrates and seagrasses. If erosion continues and the islands are lost, SGCN such as Bay Scallops may be extirpated from Louisiana waters. For more information on this basin, see the LDWF Inland Fisheries management plan for the lower Ponchartrain Basin (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 31% of the 86 waterbody subsegments within the basin fully support their designated use for fish and wildlife propagation. The suspected causes of water quality issues 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 (62)	
Mollusks (16)	
Rayed Creekshell	*Anodontoides radiatus*
Elephant-ear	*Elliptio crassidens*
Round Pearlshell	*Glebula rotundata*
Southern Pocketbook	*Lampsilis ornata*
Southern Hickorynut	*Obovaria jacksoniana*
Alabama Hickorynut	*Obovaria unicolor*
Mississippi Pigtoe	*Pleurobema beadleianum*
Inflated Heelsplitter	*Potamilus inflatus*
Southern Creekmussel	*Strophitus subvexus*
Fawnsfoot	*Truncilla donaciformis*
Southern Rainbow	*Villosa vibex*
Bay Scallop	*Argopecten irradians*
Sawtooth Penshell	*Atrina serrata*
Half-Naked Penshell	*Atrina seminuda*
Channeled Whelk	*Busycotypus canaliculatus*
Lightning Whelk	*Busycon sinistrum*
Crustaceans (6)	
Flatnose Crawfish	*Procambarus planirostris*

Gulf Crawfish	*Procambarus shermani*
Ribbon Crawfish	*Procambarus bivittatus*
Pontchartrain Painted Crawfish	*Orconectes hobbsi*
Flatwoods Digger	*Fallicambarus oryktes*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (3)	
Hodges' Clubtail	*Gomphus hodgesi*
Southern Snaketail	*Ophiogomphus australis*
Molson's Microcaddisfly	*Hydroptila molsonae*
Inland Fish (12)	
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Alabama Shad	*Alosa alabamae*
Clear Chub	*Hybopsis winchelli*
Longjaw Minnow	*Notropis amplamala*
Ironcolor Shiner	*Notropis chalybaeus*
Flagfin Shiner	*Pteronotropis signipinnis*
River Redhorse	*Moxostoma carinatum*
Broadstripe Topminnow	*Fundulus euryzonus*
Gulf Logperch	*Percina suttkusi*
Saddleback Darter	*Percina vigil*
Marine Fish (14)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Dwarf Seahorse	*Hippocampus zosterae*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*

Tarpon	*Megalops atlanticus*
Amphibians (1)	
Gulf Coast Waterdog	*Necturus beyeri*
Reptiles (10)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Leatherback Sea Turtle	*Dermochelys coriacea*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Pontchartrain Basin and the scope and severity of those threats.

Pontchartrain Basin Threats Assessment:

1st 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 Research Needs/Conservation Actions:

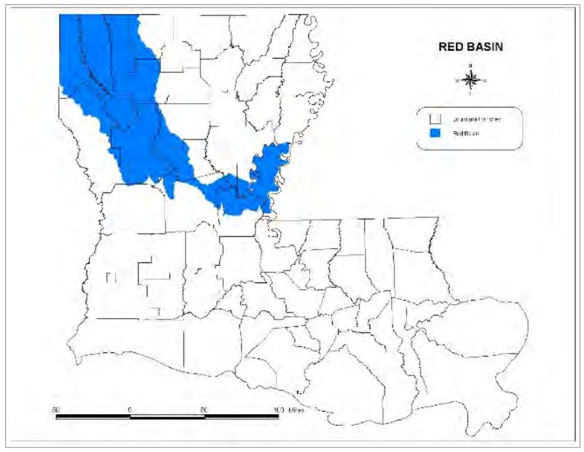
1. Develop a comprehensive stream survey methodology for the Pontchartrain Basin.

2. Work with LPBF and NRCS to promote conservation efforts within this basin and address water quality issues. Implement habitat conservation strategies presented in LPBF plan.
3. Complete a comprehensive inventory of marine invertebrates at the Chandeleur Islands.
4. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh and Barrier Island habitat critical to SGCN.

i. Red Basin

General Description:

The headwaters of the Red River begin in Curry County, New Mexico, and the river 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 five 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 corner of the state and follows a southeasterly course, passing through or forming the boundary of ten parishes, until it reaches its terminus 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 wooded, and significant agricultural lands are 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 nine 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 border to the Mississippi River.

Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 36 species of mussels (Vidrine 1993), and 18 species of crawfish (J. Walls, personal communication) are found within the Red Basin.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 23% of the 70 waterbody subsegments within the basin fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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: silvicultural 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 (50)	
Mollusks (11)	
Spike	*Elliptio dilatata*
Texas Pigtoe	*Fusconaia askewi*
Ebonyshell	*Fusconaia ebena*
Round Pearlshell	*Glebula rotundata*
Louisiana Pearlshell	*Margaritifera hembeli*
Southern Hickorynut	*Obovaria jacksoniana*
Pyramid Pigtoe	*Pleurobema rubrum*
Louisiana Pigtoe	*Pleurobema riddellii*
Southern Creekmussel	*Strophitus subvexus*
Creeper	*Strophitus undulatus*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (7)	
Kisatchie Painted Crawfish	*Orconectes maletae*
Twin Crawfish	*Procambarus geminus*
Javelin Crawfish	*Procambarus jaculus*
Pine Hills Digger	*Fallicambarus dissitus*
Sabine Fencing Crawfish	*Faxonella beyeri*
Ouachita Fencing Crawfish	*Faxonella creaseri*
Caddo Chimney Crawfish	*Procambarus machardyi*
Non-crustacean Arthropods (11)	
Texas Emerald	*Somatochlora margarita*
Texas Forestfly	*Amphinemura texana*
Louisiana Needlefly	*Leuctra szczytkoi*
Little Dubiraphian Riffle Beetle	*Dubiraphia parva*
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Pitcher Plant Spiketail	*Cordulegaster sarracenia*
Schoolhouse Springs Net-spinning Caddisfly	*Diplectrona rossi*
Morse's Net-spinning Caddisfly	*Cheumatopsyche morsei*
Holzenthal's Philopotamid Caddisfly	*Chimarra holzenthali*
Ceraclean Caddisfly	*Ceraclea spongillovorax*
Schoolhouse Springs Purse Casemaker Caddisfly	*Hydroptila ouachita*
Inland Fish (15)	
Pallid Sturgeon	*Scaphirhynchus albus*

Shovelnose Sturgeon	*Scaphirhynchus platorynchus*
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Shoal Chub	*Macrhybopsis hyostoma*
Ironcolor Shiner	*Notropis chalybaeus*
Chub Shiner	*Notropis potteri*
Suckermouth Minnow	*Phenacobius mirabilis*
Bluehead Shiner	*Pteronotropis hubbsi*
Blue Sucker	*Cycleptus elongatus*
River Redhorse	*Moxostoma carinatum*
Western Sand Darter	*Ammocrypta clara*
Crystal Darter	*Crystallaria asprella*
Redspot Darter	*Etheostoma artesiae*
Saddleback Darter	*Percina vigil*
Amphibians (1)	
Red River Mudpuppy	*Necturus louisianensis*
Reptiles (5)	
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Ouachita Map Turtle	*Graptemys ouachitensis ouachitensis*
Razor-backed Musk Turtle	*Sternotherus carinatus*

Threats Affecting Basin:

The following table illustrates the threats identified for the Red Basin and the scope and severity of those threats. As with several other basins in Louisiana, invasive plants such as Hydrilla and Common Salvinia threaten the Red Basin in several ways. Also, the presence of significant agricultural lands within this basin has led to sedimentation issues within some waterbodies. Finally, changes to the natural flow regime of the Red River have caused impacts to both the system and SGCN that utilize it.

Red Basin Threats Assessment:			
1st 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			

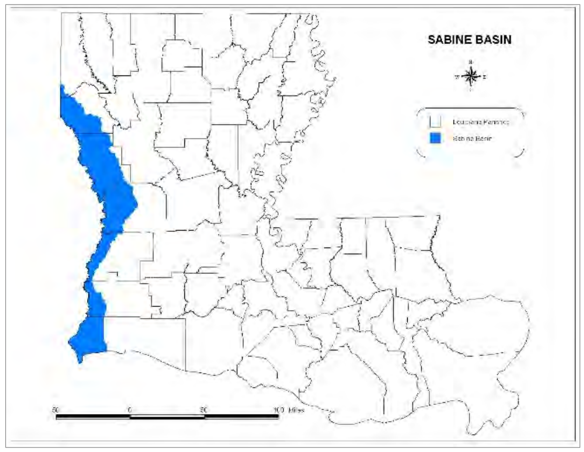
Basin Research Needs/Conservation Actions:

1. Develop a comprehensive biological stream survey methodology for the Red Basin.
2. Conduct a detailed inventory of the Red River above Shreveport that focuses on habitats and SGCN.
3. Implement education, outreach, and cost-share programs with USDA NRCS and other partners to reduce sediments and nutrient loading within the Red Basin.

j. Sabine Basin

General Description:

The Sabine River arises in northern Hunt County and eastern Collin and Rockwall counties in north central Texas, and flows in an easterly direction to the Texas and Louisiana boundary near Logansport, Louisiana. The Sabine flows as boundary waters between the two states for some 270 river miles to the Gulf of Mexico, and drains an area of approximately 9,700 square miles, 7,190 square miles of which 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 1960s and became operational in 1969. Operation of a hydroelectric plant on the Sabine River has affected water flows on the lower portions of the river since that time. However, as part of the Federal Energy Regulatory Commission (FERC) relicensing process in 2013, several new requirements were incorporated into plant operations. Intended to benefit fish and wildlife in the system, those new operating license requirements included eliminating hypo-limnetic releases, enabling passage of American Eels past the dam, and changes to generating schedules that will reduce impacts to fishes.



The northern and central portions of the basin are primarily wooded with scattered agricultural lands throughout. Most of the basin supports cultivated and ruderal pinelands, with the majority of hardwoods located along principle drainages. Along the coastal zone, almost all 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 unharvested oyster reefs in the world exists, estimated at ten square kilometers (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.

Approximately 100 species of freshwater fishes (Texas State University 2013), 33 species of mussels (Vidrine 1993), and 13 species of crawfish (J. Walls, personal communication) are found within the Sabine Basin. For more information on this basin, see the LDWF Inland Fisheries management plan for the Sabine River (www.wlf.louisiana.gov/fishing/waterbody-management-plans-inland).

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 63% of the 19 waterbody subsegments support their designated use for fish and wildlife propagation. Causes of water quality issues 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, silvicultural activities, surface mining, agriculture, and urban runoff.

Sabine Basin SGCN (51)	
Mollusks (9)	
Texas Pigtoe	*Fusconaia askewi*
Round Pearlshell	*Glebula rotundata*
Sandbank Pocketbook	*Lampsilis satura*
Southern Hickorynut	*Obovaria jacksoniana*
Louisiana Pigtoe	*Pleurobema riddellii*
Texas Heelsplitter	*Potamilus amphichaenus*
Southern Creekmussel	*Strophitus subvexus*
Creeper	*Strophitus undulatus*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (7)	
Calcasieu Painted Crawfish	*Orconectes blacki*
Southwestern Creek Crawfish	*Procambarus dupratzi*
Pine Hills Digger	*Fallicambarus dissitus*
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Non-crustacean Arthropods (1)	
Yellow Brachycercus Mayfly	*Brachycercus flavus*
Inland Fish (10)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Shoal Chub	*Macrhybopsis hyostoma*
Ironcolor Shiner	*Notropis chalybaeus*
Suckermouth Minnow	*Phenacobius mirabilis*
Blue Sucker	*Cycleptus elongatus*
Western Sand Darter	*Ammocrypta clara*
Redspot Darter	*Etheostoma artesiae*
Gumbo Darter	*Etheostoma thompsoni*

Bigscale Logperch	*Percina macrolepida*
Marine Fish (11)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Texas Pipefish	*Syngnathus texanus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Amphibians (1)	
Gulf Coast Waterdog	*Necturus beyeri*
Reptiles (12)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Leatherback Sea Turtle	*Dermochelys coriacea*
Western Chicken Turtle	*Deirochelys reticularia miaria*
Sabine Map Turtle	*Graptemys sabinensis*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Sabine Basin and the scope and severity of those threats. As with many other systems in Louisiana, invasive species and changes to the natural hydrology pose the greatest threats within this basin. Also, as discussed above, historically there have been negative impacts from operation of the Toledo Bend dam, but recent changes in requirements may reduce those impacts.

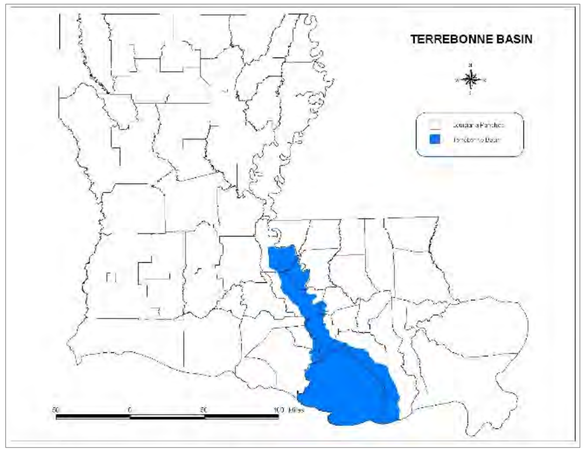
Sabine Basin Threats Assessment:			
1st Level Threat	**Scope**	**Severity**	**Impact**
Residential/Commercial Development	Small	Slight	Low
Agriculture/Aquaculture	Large	Moderate	Medium
Energy Production & Mining	Large	Serious	High
Transportation & Service Corridors	Restricted	Moderate	Low
Biological 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 Research Needs/Conservation Actions:

1. Support initiatives and programs that help reduce siltation and sedimentation throughout the Sabine Basin.
2. Continue LDWF participation in Sabine River Aquatic Resource Working Group to provide input to the Sabine River Authority (SRA) in regard to reducing impacts of power generation on fish and wildlife below Toledo Bend Dam.

k. Terrebonne Basin

General Description:



The Terrebonne Basin covers approximately 1,712,500 acres in south-central Louisiana (LCWRCTF 1993), bordered by Bayou Lafourche to the east, the Atchafalaya Basin floodway to the west, the Mississippi River to the north, and the Gulf of Mexico to the south. It includes all of Terrebonne Parish and parts of Lafourche, Assumption, St. Martin, St. Mary, Iberville, and Ascension Parishes.

The extreme northern portion of the basin is primarily agricultural 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 Freshwater, Freshwater Floating, and Intermediate Marshes inland, and Brackish and Salt Marshes 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. These islands, including the Isle Dernieres Barrier Islands Refuge and East Timbalier Island NWR, are critically important for multiple bird SGCN, which makes maintenance and restoration of these areas of the utmost importance. Many of these islands have received restoration/nourishment through state and federal projects, but will continue to need attention 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.

Approximately 60 species of freshwater fishes (W. Kelso, personal communication), 12 species of mussels (Vidrine 1993), and ten species of crawfish (J. Walls, personal communication) are found within the Terrebonne Basin.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 22% of the 58 waterbody subsegments within the basin fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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 (31)	
Crustaceans (4)	
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (2)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Marine Fish (15)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Dwarf Seahorse	*Hippocampus zosterae*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Emerald Sleeper	*Erotelis smaragdus*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Reptiles (10)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*

Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Smooth Softshell	*Apalone mutica*
Leatherback Sea Turtle	*Dermochelys coriacea*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Terrebonne Basin and the scope and severity of those threats. Subsidence is a major threat to this basin, and is of particular concern with regard to the important islands contained within Terrebonne Bay. As with many other basins, changes in natural hydrology and negative impacts of invasive plants are also among the primary threats.

Terrebonne Basin Threats Assessment:

1st 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			

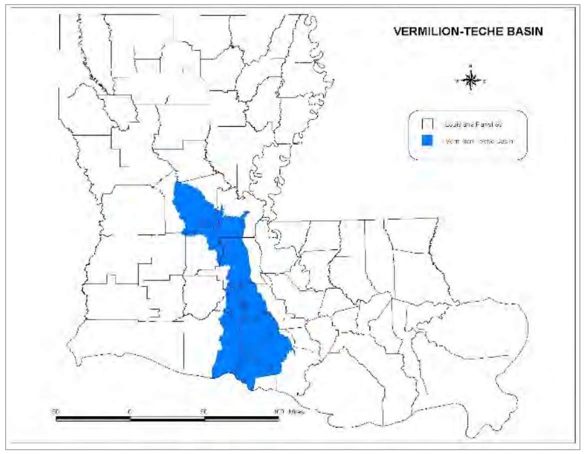
Basin Research Needs/Conservation Actions:

1. Restore historical flow regimes within the Terrebonne Basin.
2. Work with LDEQ and USGS to increase monitoring of nutrient inputs and overall water quality within the Terrebonne Basin.
3. Coordinate with the Atchafalaya Basin Program (LDNR) and BTNEP to abate identified threats from invasive flora and fauna to this basin.
4. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh and Barrier Island habitat critical to SGCN.

5. Conduct field inventory to determine the amount and condition of Freshwater Floating Marsh in this basin; publish results and educate agencies and the public about this unique marsh type.
6. Discourage river diversion projects that would introduce nutrients and sediment into Freshwater Floating Marshes.

l. Vermilion-Teche Basin

General Description:



The Vermilion-Teche Basin's drainage area covers approximately 4,047 square miles. Land-cover within the basin ranges from upland pine woodlands northwest of Alexandria and corn and soybean agriculture in the northern portion of the basin to rice and sugarcane in the central and southern basin. The coastal zone is primarily 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.

Authorized by the Flood Control Act of 1966, supplemental freshwater from the Atchafalaya River upstream of Krotz Springs is diverted to the head of Bayou Teche at Port Barre. The supplemental freshwater 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).

Approximately 60 species of freshwater fishes (W. Kelso, personal communication), 30 species of mussels (Vidrine 1993), and 17 species of crawfish (J. Walls, personal communication) are found within the Vermilion-Teche Basin. Many marine fish 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 and in waters offshore of Marsh Island.

Water Quality:

The 2012 Water Quality Inventory Report (LDEQ 2012) indicated that 11% of the 44 waterbody subsegments within the basin fully support their designated use for fish and wildlife propagation. Causes of water quality issues 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 (36)	
Mollusks (4)	
Round Pearlshell	*Glebula rotundata*
Louisiana Pearlshell	*Margaritifera hembeli*
Louisiana Pigtoe	*Pleurobema riddellii*
Fawnsfoot	*Truncilla donaciformis*
Crustaceans (5)	
Teche Painted Crawfish	*Orconectes hathawayi*
Javelin Crawfish	*Procambarus jaculus*
Old Prairie Digger	*Fallicambarus macneesei*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (3)	
Paddlefish	*Polyodon spathula*
American Eel	*Anguilla rostrata*
Redspot Darter	*Etheostoma artesiae*
Marine Fish (14)	
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Opossum Pipefish	*Microphis brachyurus*
Chain Pipefish	*Syngnathus louisianae*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Emerald Sleeper	*Erotelis smaragdus*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Reptiles (10)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Alligator Snapping Turtle	*Macrochelys temminckii*
Leatherback Sea Turtle	*Dermochelys coriacea*

Western Chicken Turtle	*Deirochelys reticularia miaria*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Razor-backed Musk Turtle	*Sternotherus carinatus*
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*

Threats Affecting Basin:

The following table illustrates the threats identified for the Vermilion-Teche Basin and the scope and severity of those threats. Primary threats to the Vermilion-Teche Basin are similar to those of neighboring basins and include natural system modifications, invasive plants (e.g., Hydrilla and Common Salvinia), and sedimentation from agricultural lands.

Vermilion-Teche Basin Threats Assessment:

1st 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 Research Needs/Conservation Actions:

1. Develop a comprehensive stream survey methodology for the Vermillion-Teche Basin.
2. Conduct a detailed inventory of the Vermillion-Teche Basin that focuses on habitats and SGCN.
3. Work with USDA 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. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh habitat critical to marine SGCN.
6. 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.

SGCN:

The table below lists SGCN for all of the following marine habitats combined.

Marine SGCN (39; All substrate types and open water)	
Mollusks (5)	
Bay Scallop	*Argopecten irradians*
Sawtooth Penshell	*Atrina serrata*
Half-Naked Penshell	*Atrina seminuda*
Channeled Whelk	*Busycotypus canaliculatus*
Lightning Whelk	*Busycon sinistrum*
Crustaceans (4)	
Beach Ghost Shrimp	*Callichirus islagrande*
Carolinian Ghost Shrimp	*Callichirus major*
Peppermint Shrimp	*Lysmata wurdemanni*
Estuarine Ghost Shrimp	*Lepidophthalmus louisianensis*
Inland Fish (2)	
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*
American Eel	*Anguilla rostrata*
Marine Fish (18)	
Lemon Shark	*Negaprion brevirostris*
Smalltooth Sawfish	*Pristis pectinata*
Tarpon	*Megalops atlanticus*
Gold Brotula	*Gunterichthys lonigpenis*
Diamond Killifish	*Adinia xenica*
Saltmarsh Topminnow	*Fundulus jenkinsi*
Bayou Killifish	*Fundulus pulvereus*
Dwarf Seahorse	*Hippocampus zosterae*
Opossum Pipefish	*Microphis brachyurus*

Chain Pipefish	*Syngnathus louisianae*
Texas Pipefish	*Syngnathus texanus*
Goliath Grouper	*Epinephelus itajara*
Large-scaled Spinycheek Sleeper	*Eleotris amblyopsis*
Emerald Sleeper	*Erotelis smaragdus*
Frillfin Goby	*Bathygobius soporator*
Violet Goby	*Gobioides broussonnetii*
Broad Flounder	*Paralichthys squamilentus*
Southern Puffer	*Sphoeroides nephelus*
Reptiles (7)	
Loggerhead Sea Turtle	*Caretta caretta*
Green Sea Turtle	*Chelonia mydas*
Hawksbill Sea Turtle	*Eretmochelys imbricata*
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*
Leatherback Sea Turtle	*Dermochelys coriacea*
Mississippi Diamond-backed Terrapin	*Malaclemys terrapin pileata*
Gulf Saltmarsh Snake	*Nerodia clarkii*
Mammals (3)	
West Indian Manatee	*Trichechus manatus*
Bottlenose Dolphin	*Tursiops truncatus*
Sperm Whale	*Physeter macrocephalus*

Threats Affecting Habitats:

Marsh loss and associated changes in wetland, estuarine, and marine habitats have 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 transportation, industry, commercial and recreational harvest of natural resources, and other uses, increased and new stresses will be placed on these environments.

General Marine Habitat Research Needs/Conservation Actions:

1. Initiate new research and monitoring projects for all marine habitats to identify their locations, assess their current condition and extent, and develop management recommendations.
2. Develop conservation plans for all marine habitats and incorporate BMPs for restoration activities into such plans.
3. Conduct additional research and monitoring to rigorously assess impacts of navigation and access canals.
4. Map distribution and community composition of SAV of all types to inform conservation and restoration.

5. Conduct 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. Include additional monitoring before and after implementation of projects involving hydrological modifications. Those monitoring efforts should extend for an adequate duration to 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. Optimize the statistical power of current biological and environmental sampling designs.
9. 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, and develop a species ID guide to marine SGCN to supplement these efforts.
10. 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.
11. Evaluate existing data to identify surrogate species for monitoring secretive species.
12. Work with university researchers to verify and monitor status of secretive species.
13. Use existing project review process to minimize impacts to marine habitats and SGCN, and require mitigation where applicable.
14. Through the authority of the Fish and Wildlife Coordination Act, LDWF 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.
15. Review pre-permitted marsh management plans to determine their impacts and coordinate with LDNR and USFWS refuges to allow for tidal exchange.
16. Review proposed structures that require Coastal Use Permit (CUP) and USACE permits.
17. Support installation of low sill, raised berm, or other structure development on channel bottoms to slow salinity encroachment in estuarine areas where hypoxia is exacerbated by stratification.
18. Continue to work with state coastal zone regulators, as outlined in a 2005 MOU between LDNR and LDWF, to ensure that proposed water control structures are designed and operated in a manner that provide adequate aquatic organism ingress and egress.
19. Promote upstream BMPs in riparian zones to reduce nutrient loading and sedimentation in coastal waters.

20. Manage man-made structures to mimic natural hydrologic systems. Conduct a review of established structures to ensure they are meeting permit requirements. Recommend appropriate changes as needed.
21. LDWF will continue to coordinate with federal and state regulators (i.e., USACE and LDNR) 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.
22. In areas where there are local zoning laws, coordinate with local governments to identify alternative means of shoreline stabilization.
23. Support appropriate river diversion projects where sediment deposition in coastal marshes can be achieved and/or where there is a high likelihood of increase in coastal marsh biomass.
24. Support research to identify alternative diversion techniques where needed.
25. 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.
26. Support development of methods to reduce discharge of excess nutrients into waters off coastal Louisiana, including floodplain management, freshwater diversions through wetlands, and regulatory measures for fertilizer users.

a. Soft Mud Bottom

General Description:

Soft Mud Bottoms are estuarine water bottoms dominated by fine, relatively unconsolidated sediments. In lower salinity regimes, these bottoms may be vegetated by Water Milfoils (*Myriophyllum* spp.), Bladderworts (*Utricularia* spp.), Widgeon Grass (*Ruppia maritima)*, Southern Naiad (*Najas guadalupensis*), and other SAV. The presence of SAV provides additional structure, shelter, and food sources to the animals dependent upon these habitats. SAV is more likely to be abundant in smaller, sheltered areas of soft mud bottoms and less likely to be present or abundant in areas where wave action or other factors causing turbulence and turbidity are persistent.

Typically high in organic matter, soft mud bottoms also form a substrate that is suitable for easy burrowing. Animals may use this substrate both as a refuge from predators and as a food source. Productivity of animal biomass may be related to allochthonous or autochthonous sources, depending upon the productivity of SAV, adjacent marshes, and phytoplankton.

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. Such habitats therefore provide a more suitable area as nursery grounds for postlarval or young juveniles. Predation within these cryptic habitats tends to be more from terrestrial sources (e.g., wading birds, shorebirds, and mammals) than in 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 waterbodies expand and merge into larger areas less suitable for nursery habitat.

Habitat Research Needs/Conservation Actions:

1. Adopt coastal restoration strategies when developed/finalized.
2. Recommend maximum boat horsepower uses in particularly sensitive areas such as shallow SAV beds, and provide education about methods for boaters to reduce negative, unintentional impacts.
3. Establish marked channels or no wake zones in sensitive areas.
4. Improve zoning laws on the Northshore of Lake Pontchartrain to address water quality issues.
5. Generate greater public awareness of the importance of SAV.

b. Shell/Shell Hash Bottom

General Description:

Shell/Shell Hash Bottoms are estuarine water bottoms with significant coverage of mollusk shells. These bottoms have high potential for settlement of oysters, barnacles, or other invertebrate larvae that require hard substrates and also serve as shelter for many fish species, including several SGCN. 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 fewer species utilize shell as a settlement substrate, but the other values of the habitat remain.

Eastern Oysters (*Crassostrea 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 (*Rangia cuneata*) and mixed shell hash. Extensive Rangia beds are found in Lakes Maurepas and Pontchartrain, 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. They create relief to the bottom and modify 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 prompted an increase in low profile artificial reefs.

Habitat Research Needs/Conservation Actions:

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. Develop shell budget models to help better manage the volume of shell removed during commercial harvest activities.
3. Prior to large investments and efforts to create and restore historical shell reefs, acquire a better understanding of the real value and functionality of these hard bottom habitats to aquatic species.

c. Hard Mud/Clay Bottom

General Description:

Hard Mud/Clay Bottoms are estuarine and territorial seawater 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 shorelines. Productivity in these areas tends to be derived from terrestrial (marshland) allochthonous sources and phytoplankton.

Habitat Research Needs/Conservation Actions:

1. Use existing project review process to document miles of Hard Mud/Clay Bottoms impacted, and coordinate with partners to assure proper mitigation.
2. Determine the value of this substrate type to marine SGCN fishes.

d. Sandy Bottom

General Description:

Sandy Bottoms are estuarine and seawater bottoms dominated by coarse sediments, often relatively low in organic matter. These habitats are usually maintained by relatively high energy influences (waves, currents, etc.) that remove or prevent the deposition of finer sediment fractions. As such, there is a continuum of sediment types ranging from nearly pure sand to silt or clay bottoms with a relatively small fraction of sand. High energy sand bottoms are limited to the foreshore environments of Barrier Islands, and to a lesser extent, to beaches of the Chenier plain. They are also often found in association with Marine Seagrass Beds at the Chandeleur Islands. Other sandy bottoms may be found in submerged sandbars, 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 (*Menticirrhus littoralis*) and Broad Flounder (*Paralichthys squamilentus*).

Habitat Research Needs/Conservation Actions:

1. Support the Barrier Island Comprehensive Monitoring program (BICM) with CPRA and promote barrier shoreline restoration projects through partnerships with CWWPRA and other coastal restoration organizations.

e. State Territorial Open Water

General Description:

This comprises all open waters from the beach shoreline to the limit of state jurisdiction. 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 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 during the spring, whereas salinities above 30 ppt may be regularly found in the waters along the Chandeleur and Timbalier Islands. Other areas of the state may have similarly high salinities in years with drier conditions.

Habitat Research Needs/Conservation Actions:

1. Fill data gaps regarding status of species and habitats in existing open water areas.
2. Develop a better understanding of potential future impacts of mariculture, Liquid Natural Gas (LNG) development, and other industrial impacts in this habitat.
3. 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.

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CHAPTER 6. INVASIVE SPECIES

Invasive species are one of the most widespread and serious threats to Species of Greatest Conservation Need (SGCN) and their habitats in Louisiana. Furthermore, the threat of invasive species continues to expand, and is perhaps the single threat that can best be addressed by private landowners and managers. Therefore, during the revision of the Louisiana Wildlife Action Plan (WAP), a more comprehensive approach to this issue was taken. It is our hope that this chapter will raise public awareness of this pervasive threat to Louisiana's wildlife resources, and spur increased action. This chapter contains a list of invasive species that are known to occur or have the potential to occur within the next 10 years in Louisiana. 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 non-native species, are simply those transferred to a new geographic location previously unoccupied by that species. Such transfer might occur through natural means (e.g., high winds, flooding, etc) or through anthropogenic means (e.g., movement of nursery stock, intentional stocking, etc.). No matter the means, exotic species that are introduced have a roughly 10% chance of success in their new range (Mack et al. 2000). A clear dichotomy exists between exotic species intentionally introduced and those accidentally introduced. The vast majority of vertebrates, especially fish, mammals, and birds, have been intentionally introduced, usually for game or aesthetic reasons, 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 native species and natural communities. Invasive exotic species often have life history traits that allow them to outcompete other species, particularly native species. 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. Only 1% 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*), which has become much more abundant in the United States 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. Invasive species are not exclusively non-native therefore, however, the majority of problematic invasives are 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 increases the potential for those introductions to lead to established populations. Long, hot summers and short, mild winters, along with high precipitation levels, allow for a plethora of invasive species to survive year-round in Louisiana. Once established, these species can cause significant negative impacts to the invaded environment such as decreased food availability and 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 U.S. cause major environmental damage and losses of approximately $137 billion annually (Pimentel et al. 2000). Those species that cause economic losses or become nuisances to humans are deemed “pests,” a term, like “invasive,” that may be applied to native or exotic organisms. 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 difficult to comprehend, the greatest damages may come in the unknown extent 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 in response 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 more effective management programs for invasive species. Addressing gaps in invasive species legislation, along with properly educating the public about owning and safe-handling of known or potentially invasive species, may be the best chance of preventing further introductions and may help focus resources on addressing damage done thus far to our native wildlife and habitats.

B. Additional Sources of Information on Invasive Species

1. Laws and Regulations

- U.S. 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 (http://is.cbr.tulane.edu/index.html)
- Invasive species introduction pathways (www.invasivespeciesinfo.gov/docs/toolkit/pathways.doc)
- Invasive species distribution and mapping (http://www.eddmaps.org)
- Invasive species reporting (http://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)
- ISSG Global Invasive Species Database (http://www.issg.org/database/species/search.asp?st=100ss&fr=1&str=&lang=EN)

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

The list that follows 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 such species that have the potential to invade within the next 10 years. This list is divided into four Tiers:

- Tier I – 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 II – 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 III – Currently occurring (or have occurred recently), but that have no known or anticipated significant impacts on wildlife or natural communities in Louisiana.
- Tier IV – 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.

Common Name	**Scientific Name**
TIER I	
Channeled Apple Snail	*Pomacea canaliculata* & *Pomacea maculata*
Argentine Ant	*Linepithema humile*
Red Imported Fire Ant	*Solenopsis invicta*
Rio Grande Cichlid	*Herichthys cyanoguttatus*
Grass Carp	*Ctenopharyngodon idella*
Common Carp	*Cyprinus carpio*
Silver Carp	*Hypophthalmichthys molitrix*
Bighead Carp	*Hypophthalmichthys nobilis*
Black Carp	*Mylopharyngodon piceus*
Lionfish	*Pterois volitans* & *P. miles*
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*
Coral Ardisia	*Ardisia crenata*
Camphor Tree	*Cinnamomum camphora*
Elephant Ear	*Colocasia esculenta*
Bermuda Grass	*Cynodon dactylon*
Japanese Twin-Sorus Fern	*Deparia petersenii*
Air Yam	*Dioscorea alata & D. bulbifera*
Brazilian Waterweed	*Egeria densa*
Water Hyacinth	*Eichhornia crassipes*
Chinese Parasol Tree	*Firmiana simplex*
Hydrilla or Waterthyme	*Hydrilla verticillata*
Cogon Grass	*Imperata cylindrica*
Yellow Flag Iris	*Iris pseudacorus*
Chinese Privet	*Ligustrum sinense*
Japanese Climbing Fern	*Lygodium japonicum*
Torpedo Grass	*Panicum repens*
Holmwood Grass	*Paspalum modestum (=P. hydrophyllum)*
Vasey Grass	*Paspalum urvillei*
Trifoliate Orange	*Poncirus trifoliata*
Kudzu	*Pueraria montana*
McCartney Rose	*Rosa bracteata*
Cherokee Rose	*Rosa laevigata*
Common Salvinia (Water Spangles)	*Salvinia minima*
Giant Salvinia	*Salvinia molesta*
Smut Grass	*Sporobolus indicus*
Chinese Tallow Tree	*Triadica sebifera*
Tungoil Tree	*Vernicia fordii*
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*
Tawny 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*
Giant Water Sensitive Plant	*Aeschynomene fluitans*
Tree-of-Heaven	*Ailanthus altissima*
Mimosa	*Albizia julibrissin*
Alligatorweed	*Alternanthera philoxeroides*
Chaff-Weed	*Alternanthera sessilis*
Giant Reed	*Arundo donax*
Mosquito Fern	*Azolla pinatta*
Australian Bluestem	*Bothriochloa bladhii*
King Ranch Bluestem	*Bothriochloa ischaemum* var. *songarica*
Little Quaking Grass	*Briza minor*
Paper Mulberry	*Broussonetia papyrifera*
Balloon Vine	*Cardiospermum halicacabum*
Nodding Thistle	*Carduus nutans*
Bushkiller	*Cayratia japonica*
Water Sprite	*Ceratopteris thalictroides*
Paraguayan Windmill Grass	*Chloris canterai*
Bull Thistle	*Cirsium vulgare*
Large-Head Horseweed	*Conyza bonariensis*
Deep-rooted Sedge	*Cyperus entrerianus*
Ricefield Flatsedge	*Cyperus iria*
Fuzzy Flatsedge	*Cyperus pilosus*
Purple Nutsedge	*Cyperus rotundus*
Fortune’s Net-veined Holly Fern	*Cyrtomium fortunei*
Kleberg Bluestem	*Dichanthium annulatum*
Smooth Crabgrass	*Digitaria ischaemum*
Hairy Crabgrass	*Digitaria sanguinalis*
Dopatrium	*Dopatrium junceum*
Junglerice	*Echinochloa colona*
Barnyardgrass	*Echinochloa crus-galli*
Thorny Olive	*Elaeagnus pungens*
Autumn Olive	*Elaeagnus umbellata*
Elodea	*Elodea canadensis*
Centipedegrass	*Eremochloa ophiuroides*

Reed Fescue	*Festuca arundinacea*
Groundivy	*Glechoma hederacea*
English Ivy	*Hedera helix*
West Indian Marshgrass	*Hymenachne amplexicaulis*
Moon Vine	*Ipomoea alba*
Mile-a-Minute Vine	*Ipomoea cairica*
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*
Indian Marshweed	*Limnophila indica*
Marshweed	*Limnophila x ludoviciana*
Asian Marshweed	*Limnophila sessiliflora*
Monkeygrass	*Liriope muscari*
Perennial Ryegrass	*Lolium perenne*
Japanese Honeysuckle	*Lonicera japonica*
Uruguay Seedbox	*Ludwigia hexapetala*
Peruvian Water Grass	*Luziola peruviana*
Catclaw Vine	*Macfadyena unguis-cati*
Big-foot Water Clover	*Marsilea macropoda*
Chinaberry	*Melia azedarach*
Parrotfeather	*Myriophyllum aquaticum*
Eurasian Watermilfoil (Spike Milfoil)	*Myriophyllum spicatum*
Brittle Naiad (Brittle Waternymph)	*Najas minor*
Nandina	*Nandina domestica*
Watercress	*Nasturtium officinale*
Sacred Lotus	*Nelumbo nucifera*
White Egyptian Lotus	*Nymphaea lotus*
Sacred Lotus	*Nelumbo nucifera*
Crested Floating Hearts	*Nymphoides cristata*
Duck Lettuce	*Ottelia alismoides*
Cuban Bulrush	*Oxycaryum cubense*
Stinkvine	*Paederia foetida*
Dallis Grass	*Paspalum dilatatum*
Common Bahia Grass	*Paspalum notatum*

Beefsteak Plant	*Perilla frutescens*
Timothy Grass	*Phleum pratense*
Golden Bamboo	*Phyllostachys aurea*
Water Lettuce	*Pistia stratiotes*
Japanese Knotweed	*Polygonum cuspidatum*
Curly Pondweed	*Potamogeton crispus*
Spider Brake Fern	*Pteris multifida*
Bradford Pear	*Pyrus calleryana*
Sawtooth Oak	*Quercus acutissima*
Castor-Bean	*Ricinus communis*
Multiflora Rose	*Rosa multiflora*
Indian Toothcup	*Rotala indica*
Itch Grass	*Rottboellia cochinchinensis*
Britton’s Wild Petunia	*Ruellia brittoniana*
Curly Dock	*Rumex crispus*
Indian Cupscale	*Sacciolepis indica*
Guyana Arrowhead	*Sagittaria guyanensis*
Brazilian Rattlebox	*Sesbania punicea*
Thin-Spike Bristle Grass	*Setaria pumila* ssp. *pallidefusca*
Jerusalem Cherry	*Solanum pseudocapsicum*
Tropical Soda Apple	*Solanum viarum*
Johnson Grass	*Sorghum halepense*
African Salt Cedar	*Tamarix africana*
Canary Island Salt Cedar	*Tamarix canariensis*
French Tamarisk	*Tamarix gallica*
Salt Cedar	*Tamarix ramosissima*
Mariana Maiden Fern	*Thelypteris torresiana*
Guinea Grass	*Urochloa maxima*
Para Grass	*Urochloa mutica*
Brazilian Vervain	*Verbena brasiliensis*
Vetch	*Vicia villosa*
Chinese Wisteria	*Wisteria sinensis*
Japanese Hawksbeard	*Youngia japonica*
TIER III	
Chinese Mystery Snail	*Cipangopaludina 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	*Eoreuma loftini*
Red-streaked Leafhopper	*Balclutha rubrostriata*
Red-bay Ambrosia Beetle	*Xyleborus glabratus*
Caribbean Huntsman Spider	*Heteropoda venatoria*
Southeast Asian Cellar Spider	*Crossopriza lyoni*
Pantropical Jumping Spider	*Plexippus paykulli*
Oscar	*Astronotus ocellatus*
Goldfish	*Carassius auratus*
Convict Cichlid	*Archocentrus nigrofasciatus*
Red-bellied Pacu	*Piaractus brachypomus*
Tessellated Blenny	*Hypsoblennius invemar*
Suckermouth Catfish	*Hypostomus sp.*
Paradisefish	*Macropodus opercularis*
Oriental Weatherfish	*Misgurnus anguillicaudatus*
Tilapia	*Oreochromis* sp., *Sarotherodon* sp., *Tilapia* sp.
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*
Brazilian Water-hyssop	*Bacopa egensis*
Blyxa	*Blyxa aubertii*
Ethiopian Rattlebox	*Crotalaria brevidens* var. *intermedia*
Lanceleaf Rattlebox	*Crotalaria lanceolata*
Rattleweed	*Crotalaria retusa*
Showy Rattle	*Crotalaria spectabilis*
Eucalyptus	*Eucalyptus* spp.
Asian Spiderwort	*Murdannia keisak*
Crownvetch	*Securigera varia*
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 Snails	*Achatina* sp., *Archachtina* sp., *Limicolaria* sp.

Chinese Mitten Crab	*Eriocheir sinensis*
Green Crab	*Carcinus maenas*
Rusty Crawfish	*Orconectes rusticus*
Virile Crawfish	*Orconectes virilis*
Papershell Crawfish	*Orconectes immunis*
Emerald Ash Borer	*Agrilus planipennis*
Asian Longhorn Beetle	*Anoplophora glabripennis*
Africanized Honeybee	*Apis mellifera scutellata*
Gypsy Moth	*Lymantria dispar*
Purple Loosestrife	*Lythrum salicaria*
Snakehead family	*Channidae*
Walking Catfish family	*Clariidae*
Freshwater Electric Eel	*Electrophorus* spp.
Asian Swamp Eel family	*Synbranchidae*
Pencil Catfish family	*Trichomycteridae*
Tench	*Tinca tinca*
Cuban Treefrog	*Osteopilus septentrionalis*
Argentine Giant Tegu	*Salvator merianae*
Boa Constrictor	*Boa constrictor*
Burmese Python	*Python molurus*
Pythons	*Python* sp.
Brown Tree Snake	*Boiga irregularis*
Australian Pine	*Casuarina spp.*
"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*
Old World Climbing Fern	*Lygodium microphyllum*
Water Clovers	*Marsilea minuta* & *M. mutica*
Punktree	*Melaleuca quinquenervia*
False Pickerelweeds	*Monochoria hastata* & *M. vaginalis*
Marine Naiad	*Najas marina*
Little Floating Hearts	*Nymphoides indica*
Yellow Floating Heart	*Nymphoides peltata*
Roundleaf Toothcup	*Rotala rotundifolia*
Brazilian Peppertree	*Schinus terebinthifolius*
Aquatic Soda Apple	*Solanum tampicense*
Water Chestnut	*Trapa natans*

D. General Invasive Species Management Actions

The following management actions apply to many or all invasive species. Implementation of these actions will benefit multiple natural communities and SGCN. This list represents actions that were identified by the Louisiana Department of Wildlife and Fisheries (LDWF) WAP revision invasive species committee during the 2015 WAP revision, and should not be considered exhaustive. Given the extreme threat posed by invasives to SGCN, any and all opportunities for control and removal should be seized.

- Establish and maintain an occurrence database for emerging invasives, including rigorous documentation of newly discovered populations of such species.
- 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 for control or eradication.
- Promote the utilization of federal cost share programs (e.g., Natural Resource Conservation Service (NRCS) Farm Bill programs) to address invasive species problems.
- Encourage landowners to control invasive species whenever possible to benefit SGCN and natural communities.
- Control invasive species (Nutria, Feral Hogs, etc.) as appropriate, particularly when the species is documented to have specific negative impacts on SGCN or natural communities.
- Pursue the creation, implementation, and enforcement of regulations prohibiting the commercial sale of invasive exotic plants and animals that are not currently covered by existing regulations, in conjunction with increasing awareness about such species that are commonly used as ornamentals and promoting the use of native species for landscaping.
- Educate the public on preventative measures to curb the spread of invasive plants; Examples include cleaning protocols for equipment, vehicles, and clothing, mowing and/or hand removing invasive plants before seed production, targeting invasive plants along roadsides to prevent spread, and providing wash stations at trail heads, boat launches, and parking lots in parks and recreation areas.
- Conduct research into temperature and salinity tolerance of Tier I invasive 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 the Louisiana Department of Transportation and Development (DOTD), to develop native-based seed mixes to replace existing seed mixes that contain exotics.

E. Tier I Species Accounts

This section presents species accounts for each of the Tier I invasive species. These accounts include the following information:

- General information about the species
- Distribution in Louisiana
- Communities/SGCN Impacted
- Research Needs and Management Actions

1. Apple Snail *(Pomacea canaliculata* and ***Pomacea maculata):*** 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 out-compete 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 enhance their ability to outcompete native aquatic species. These snails may be introduced either accidentally or intentionally from aquaria, including via the improper disposal of aquatic plants infested with eggs or juvenile snails. Apple Snails 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.

Communities/Species Impacted:

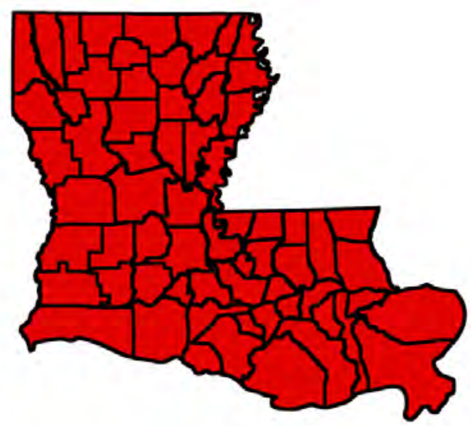
All freshwater aquatic systems throughout the state are potentially vulnerable to invasion by Apple Snails. Although exact impacts remain unknown, all native aquatic species are potentially at risk.

Research Needs & Management Actions:

- Quantify impacts to native aquatic species and communities due to competition or herbivory, including identifying which plant species Apple Snails 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.
- Engage local stakeholders in documentation of Apple Snail occurrence and active control of egg masses.
- Develop integrated pest control recommendations for Apple Snails, especially for smaller isolated water bodies where infestations can potentially be contained.

2. Argentine Ant (*Linepithema humile*): Introduced to the U.S. through the Port of New Orleans in the late 1800's, this 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, primarily near water bodies. The shoreline of Toledo Bend Reservoir is densely infested.



Communities/Species Impacted:

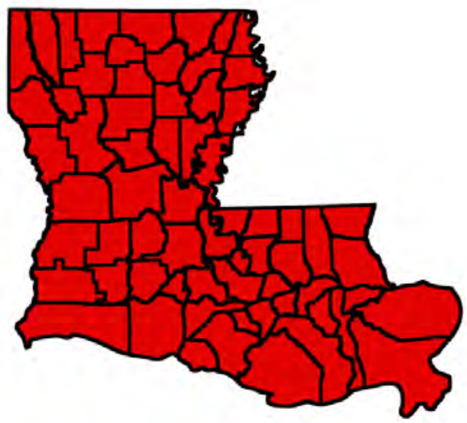
All terrestrial communities, with the greatest likelihood of occurrence in open, disturbed habitats near water. Terrestrial vertebrate and invertebrate species are at greatest risk, particularly those found near water, including species that occur in riparian zones.

Research Needs & Management Actions:

- Quantify impacts to ecosystem function and native wildlife, particularly nesting birds and reptiles.
- 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.

3. 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 out-competes 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, is altering ecosystems.

Distribution: Statewide.



Communities/Species Impacted:

All terrestrial communities, including Barrier Islands, are impacted. The greatest likelihood of occurrence is in open, disturbed habitats near water, grasslands and open pine systems; rarely found in areas with dense canopy cover. Terrestrial vertebrates (including ground nesting birds and turtles) and invertebrate species.

Research Needs & Management Actions:

- 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 and important Mottled Duck nest sites such as islands at Atchafalaya Delta WMA.
- 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 native species.

4. Rio Grande Cichlid *(Herichthys cyanoguttatus):* The Rio Grande Cichlid is native to south Texas and Mexico, but has spread through the aquarium trade to other parts of the U.S. 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 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 and 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.

Communities/Species Impacted:

Native fish species are at greatest risk. All freshwater aquatic habitats in the southern half of the state are potentially at risk for invasion.

Research Needs & Management Actions:

- 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.

5. Carp: Five species of non-native carp are currently found in Louisiana, 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.

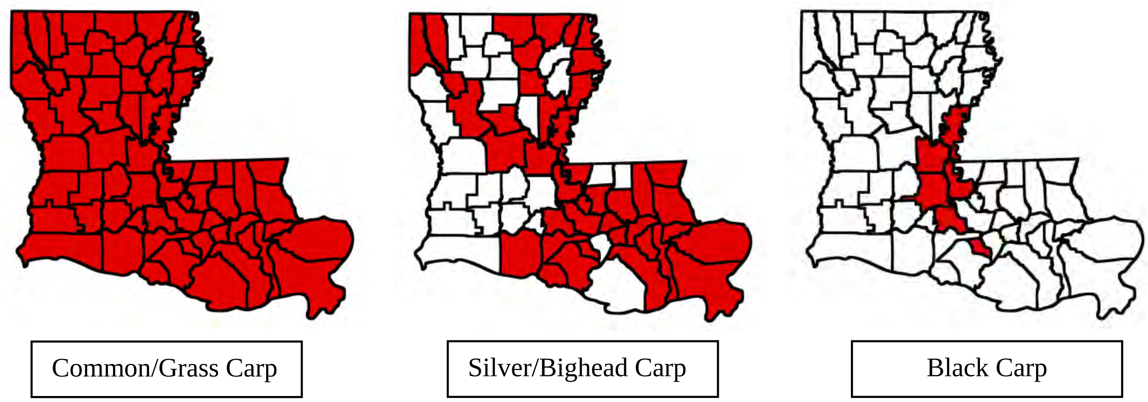
a. Common Carp (*Cyprinus carpio*): Common Carp were introduced from Europe into the U.S. in the late 1800s. Deliberate releases as a food fish and accidental releases from fish farms have aided in this species becoming so widespread that it is often mistaken as a native. Koi are a variety of Common Carp sometimes kept as ornamental fish in water gardens. Common Carp are omnivores that consume both phytoplankton and zooplankton which may include fish eggs and larvae. Common Carp increase turbidity by disturbing rooted vegetation while searching for food.

b. 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 submersed aquatic vegetation can change the phytoplankton community composition which could alter the food web of the water body.

c. 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 biological control agent for snails in the 1980s. The only known release of this carp to native waters occurred in 1994 when an aquaculture facility near the Missouri River was flooded, resulting in escape of Black Carp. At this time it is not known if Black Carp have established reproducing populations.

d. Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*Hypophthalmichthys nobilis*): Silver Carp and Bighead Carp were first introduced into the U.S. 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:



Communities/Species Impacted:

Many native aquatic species may be negatively impacted by Common and Grass Carp, through direct competition for resources or habitat degradation. Silver and Bighead Carp may cause negative impacts to native filter-feeding planktivores, such as Paddlefish and native mussels. Black Carp may consume native aquatic crustaceans and mollusks, including SGCN. Additionally, these species may harbor parasites and diseases that could spread to native fishes, including SGCN.

Research Needs and Management Actions:

- 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 dense concentrations.
- Conduct research into the parasites and diseases carried by non-native carp and the potential impacts on native species.

6. Lionfish (*Pterois volitans and P. miles*): Lionfish are predatory marine fish native to the Pacific Ocean that became established in the Atlantic Ocean 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: Throughout the Gulf of Mexico, usually associated with hard structures such as oil rigs, wrecks, reefs and rock outcroppings.

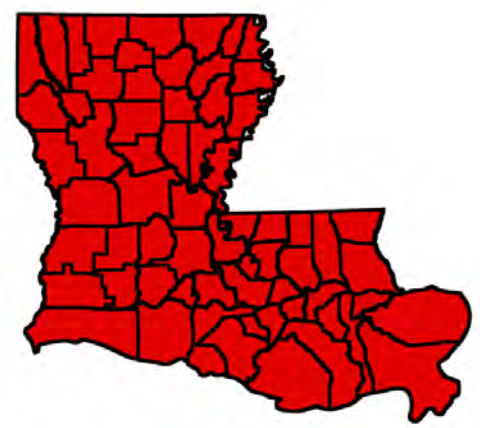
Communities/Species Impacted:

Native marine species associated with hard structure, including SGCN.

Research Needs & Management Actions:
- 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 these species, as well as the potential invasive qualities of other closely related species.

7. 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. Although potentially beneficial in some agricultural settings (e.g., removal of insect pests), this 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 native species, particularly cavity nesters.

Distribution: Statewide, particularly near agricultural or urban areas; less commonly encountered in heavily forested regions.



Communities/Species Impacted:

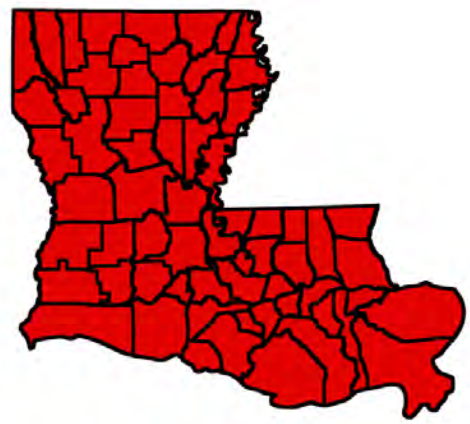
Terrestrial communities, particularly near agricultural and urban areas. Unlikely to be a major threat to any undisturbed, natural community. Cavity-nesting birds, such as woodpeckers (including Red-headed Woodpecker), and secondary cavity-nesting birds, such as Eastern Bluebird and Purple Martin, are most likely to be negatively affected.

Research Needs & Management Actions:

- Quantify impacts to ecosystem function and native wildlife, particularly cavity-nesting birds.
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species.

8. 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. Successful eradication is not likely given the species' current geographic extent and abundance.

Distribution: Statewide, particularly near agricultural or urban areas; rarely encountered in heavily forested regions.



Communities/Species Impacted:

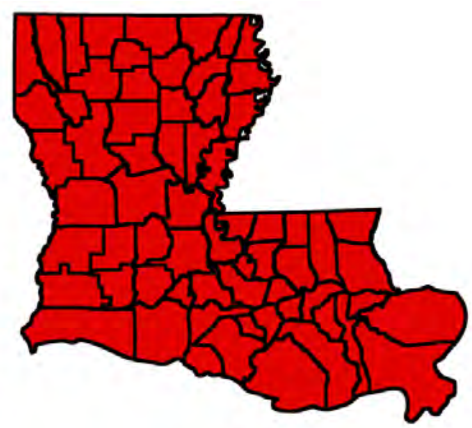
Terrestrial communities, particularly near agricultural and urban areas. Highly unlikely to be major threat to any undisturbed, natural community. Cavity-nesting birds, such as woodpeckers (including Red-headed Woodpecker), and secondary cavity-nesting birds, such as Eastern Bluebird and Purple Martin, are most likely to be affected by House Sparrows.

Research Needs & Management Actions:

- Quantify impacts to ecosystem function and native wildlife, particularly cavity-nesting birds.
- Prioritize control efforts to target areas of highest density or areas of greatest potential impact to native species.

9. Norway Rat (*Rattus norvegicus*) and Black Rat (*Rattus rattus)*: 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, 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 (Chapman 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 per year (Jackson 1982), with up to 12 young per litter.

Distribution: Statewide.



Communities/Species Impacted:

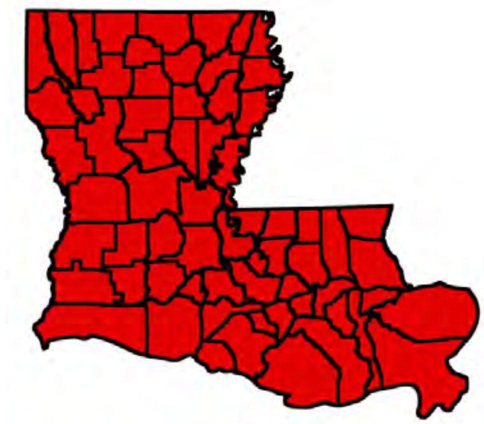
Barrier Islands are especially vulnerable to invasion by these species. Invertebrates, reptiles, amphibians, mammals and ground nesting birds, including colonial waterbirds, are most at risk of direct predation.

Research Needs & Management Actions:

- 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.

10. 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 in other 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 in fresh, brackish, and saltwater.



Communities/Species Impacted:

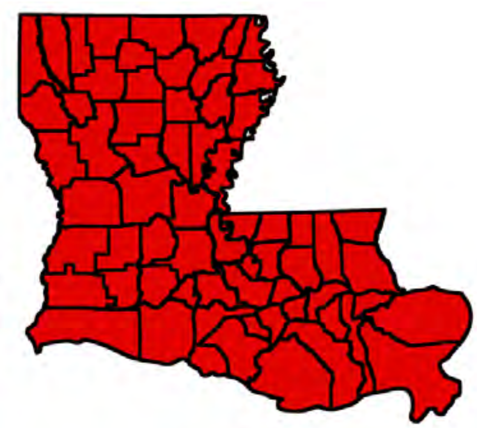
Aquatic communities, particularly Fresh, Intermediate, Brackish, and Salt Marsh, via herbivory, accelerated land loss, and direct destruction through burrow construction. Potentially all native species, including SGCN, that depend on marsh. Recent observations on a Louisiana Barrier Island implicate nutria as a nest predator (Furfey, personal communication).

Research Needs & Management Actions:

- Determine the role of Nutria as predators in colonies of beach-nesting birds.
- Continue to support the Coastwide Nutria Control Program.

11. 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 2.4 billion birds, more than 12 billion mammals, and more than 700 million reptiles and amphibians annually (Loss *et al.* 2013). Cats also spread infectious diseases and parasites such as rabies, toxoplasmosis and hookworms to native wildlife and humans. Few invasive species have been as thoroughly proven by science to cause significant impacts to native species, yet largely ignored.

Distribution: Statewide, typically with greater concentrations near urban centers.



Communities/Species Impacted:

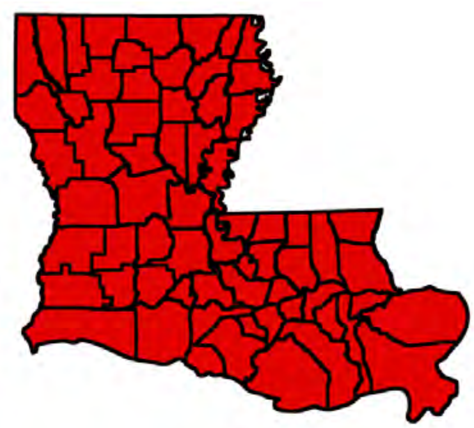
All terrestrial communities, including Barrier Islands. Terrestrial and, rarely, aquatic vertebrate and invertebrate species may be affected. Most prey targeted is <3.5 ounces, but items >1 pound may be taken.

Research Needs & Management Actions:

- 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.

12. Feral Hogs (*Sus scrofa*): Feral hogs, which are also commonly referred to as feral swine, wild hogs, wild boar, and Russian boar, 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 six and eight months of age and is capable of producing two litters of piglets per year. The average litter size is six 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 and reptiles. 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 coli*.

Distribution: Statewide.



Communities/Species Impacted:

All communities are at risk, including marshes of all types, prairies, bogs, forested wetlands, and Barrier Islands. Terrestrial mammals, ground-nesting birds, reptiles, amphibians, and invertebrates may be affected. Additionally, native plants are consumed and otherwise destroyed. Watershed ecology may be significantly impacted.

Research Needs & Management Actions:

- 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.

- Promote control through hunting, trapping, and snaring.

13. 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 U.S. as an ornamental and is still used in landscaping. The presence of Coral Ardisia can significantly decrease native plant species richness, as 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 and is tolerant of deep shade.

Distribution: Scattered throughout central and southern Louisiana. The true distribution is doubtless under reported.

Distribution from Thomas and Allen (1998) and field observations

Communities/Species Impacted:

Bottomland Hardwood Forest, Mixed Hardwood-Loblolly Pine Forest, Salt Dome Hardwood Forest, Small Stream Forest, Southern Mesophytic Forest. Native plants may be negatively impacted, as well as any animal species that depend on those plant species.

Research Needs & Management Actions:

- Establish a Coral Ardisia occurrence database; rigorously document newly discovered populations.
- Conduct outreach to inform the public of the threat of Coral Ardisia and discourage its use in landscaping.
- Support control of Coral Ardisia; methods could include hand-pulling and/or herbicide application.

1**4. 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)

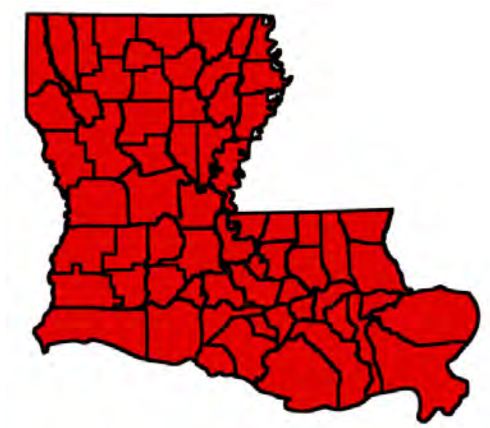
Communities/Species Impacted:

Natural communities impacted include: Bottomland Hardwood Forest, Live Oak Natural Levee Forest, and Salt Dome Hardwood Forest.

Research Needs & Management Actions:
- Support site-level control of this species.
- Document response and recovery of native species following control of Camphor Tree.
- Provide education regarding the invasive nature of this species, with the goal of eliminating use as an ornamental plant.

15. 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 spreads vegetatively by 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 exotic species that competes well in Saline Prairies. This species can also be a weed of Calcareous Prairie and Coastal Prairie, and can dominate Sandbars.

Distribution: Statewide.



Distribution from Thomas and Allen (1993)

Communities/Species Impacted:

Calcareous Prairie, Coastal Prairie, Louisiana Beach, Saline Prairie, and Sandbars (can be dominant here). SGCN that utilize native grasslands, such as Northern Bobwhite, may be most impacted by Bermuda Grass.

Research Needs & Management Actions:

- Support control of local infestations in natural areas with either grass-selective or broad spectrum herbicides.
- Conduct research on the effectiveness of rest from grazing and prescribed fire on the persistence of Bermuda Grass.
- Discourage use of this species where native bunch grasses are a viable alternative.

16. Air Yam (*Dioscorea bulbifera*): Air Yam is an aggressive twining herbaceous vine native to either Asia or Africa, with morphological differences between plants from these 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 eight 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 in Florida following Hurricane Andrew, Air Yam was found to impede regeneration of trees following canopy disturbance (Horvitz et al. 1998).

Distribution: Scattered, most frequent in southern Louisiana.

Distribution from USDA, NRCS (2013) and other reports

Communities/Species Impacted:

Barrier Island Live Oak Forest, Bottomland Hardwood Forest, Natural Levee Live Oak Forest, Salt Dome Hardwood Forest. SGCN that depend on the impacted natural communities, including Neotropical migrant birds which may be negatively impacted by decreased quality of stopover habitat associated with heavy infestations.

Research Needs & Management Actions:

- Conduct outreach to educate the public and land managers on the identification and negative impacts of this species, as well as on the options available for control.
- Support and organize efforts to control this species.

17. 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 among native ferns in rich woods, ravines, riparian forests, and wooded seeps (Nelson 2000). The distribution of this species in Louisiana is certainly under-reported.

Distribution: Eastern Florida Parishes, Weeks Island and possibly other salt domes.

Distribution based on specimens housed at LSU Herbarium

Communities/Species Impacted:

Bayhead Swamp, Hardwood Slope Forest, Salt Dome Hardwood Forest, Small Stream Forest, and Southern Mesophytic Hardwood Forest.

Research Needs & Management Actions:

- Conduct field surveys involving collection of voucher specimens to better determine distribution and abundance in Louisiana.
- Conduct research to determine the ecological impact of this fern on native species in Louisiana.

18. Chinese Parasol Tree (*Firmiana simplex*): This species is extremely fast growing, and in Louisiana has demonstrated the ability to aggressively invade mesic forests. Chinese Parasol Tree is self-fertile and produces large amounts of seed (Servis 2013). These characteristics, coupled with a fast growth rate, make it a serious threat. 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, degrading habitat quality.

Distribution: Widely scattered. Well established colonies exist in the Tunica Hills in West Feliciana parish.

Distribution from Thomas and Allen (1998)

Communities/Species Impacted:

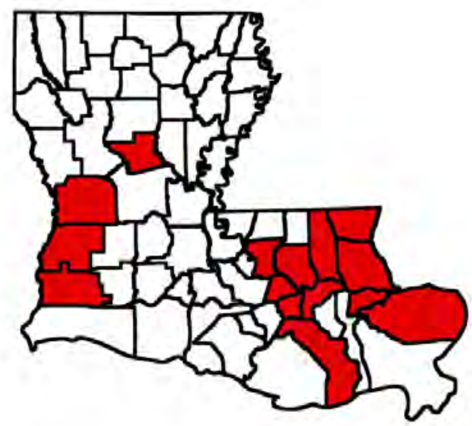
Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, and Southern Mesophytic Hardwood Forest.

Research Needs & Management Actions:

- Produce and distribute educational materials to raise awareness of this lesser-known invasive.
- Pursue regulations prohibiting the commercial sale of this species.
- Conduct research into control methods and document habitat change following implementation of control.

19. 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 is beneficial to this plant. These attributes make Cogon Grass a formidable weed. Cogon Grass ranges from one foot to several feet in height. The midrib of the leaf blade is noticeably off-centered and 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, but with several reports west of the Mississippi River.



Distribution from Kartesz 2014

Communities/Species Impacted:

Eastern and Western Longleaf Pine Flatwoods Savannas, Eastern and Western Upland Longleaf Pine Woodlands, and Sandbars (particularly in the Florida Parishes). Many SGCN, including Gopher Tortoise and turtles nesting on Sandbars may be negatively impacted due to reductions in forage plants and suitable nesting sites, respectively, by heavy infestations of Cogon Grass.

Research Needs & Management Actions:

- Encourage diligent cleaning of highway mowing equipment after use.
- Conduct field surveys for timely detection of new occurrences, especially those outside the known range of Cogon Grass.
- Intensive control of existing occurrences.
- Target landowners and the public for education and outreach.
- Support additional research on the control of Cogon Grass, and research documenting habitat recovery where control efforts have been implemented.

20. 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, reduce ground layer species cover, and alter 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 through root suckers, making this species difficult to eradicate from an area.

Distribution: Statewide**.**

Distribution from Thomas and Allen (1998)

Communities/Species Impacted:

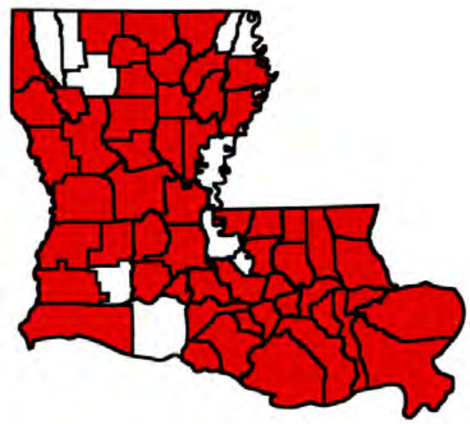
Bottomland Hardwood Forest, Coastal Prairie, Eastern and Western Upland Longleaf Pine Woodland, Hardwood Slope Forest, Mixed Hardwood-Loblolly Pine Forest, Small Stream Forest, and Southern Mesophytic Hardwood Forest.

Research Needs & Management Actions:

- Promote control measures such as mechanical removal, prescribed burning, and herbicide application, where appropriate.
- Synthesize and publish information pertaining to chemical control of Chinese Privet for use by land managers and owners.
- Provide education regarding the threats posed by this species and discourage its use as an ornamental.

21. 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, that climbs on trees and over understory shrubs and herbs, preventing sunlight from reaching native species. Additionally, the climbing fronds are ladder fuels, enabling fire to reach the forest canopy. While this species can invade relatively undisturbed forests, Japanese Climbing Fern is usually much more abundant in disturbed forest, along forest edges in utility corridors, and along roadsides.

Distribution: Essentially statewide.



Distribution from Thomas and Allen (1993)

Communities/Species 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, Eastern and Western Upland Longleaf Pine Woodlands.

Research Needs & Management Actions:

- Synthesize and publish information pertaining to chemical and other methods and combinations of treatments to control Japanese Climbing Fern, for use by land managers and owners.

22. 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 rice country of southwestern Louisiana. 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, corresponding to Louisiana's main rice-growing region.

Distribution from Allen et al. (2004)

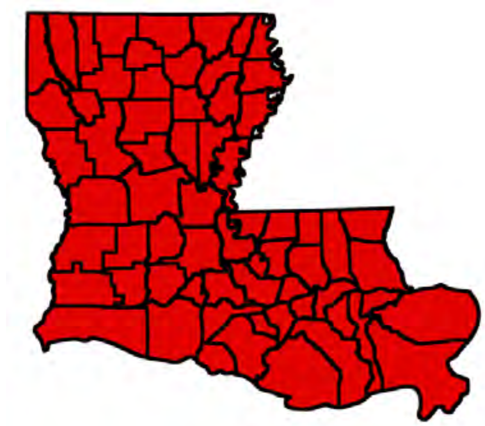
Communities/Species Impacted:

Coastal Prairie and Western Longleaf Pine Flatwoods Savanna.

Research Needs & Management Actions:
- 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.

23. 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 neglected 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 rangeland and pasture. 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 regularly disturbed, this species poses a threat to habitats that are valuable though slightly degraded.

Distribution: Statewide.



Distribution from Thomas and Allen (1993)

Communities/Species Impacted:

Calcareous Prairie, Coastal Prairie, Eastern and Western Longleaf Pine Flatwoods Savanna. Vasey Grass can also be found in disturbed areas throughout the state.

Research Needs & Management Actions:

- Conduct research to determine the effects of resting land from grazing combined with prescribed fire on the abundance and persistence of Vasey Grass.

24. Trifoliate Orange (*Poncirus trifoliata*): Trifoliate Orange is native to China, and was introduced as an ornamental and hedge plant. This species, a member of the citrus family, is also used as stock to graft commercial citrus, which may afford an additional opportunity for escape. Trifoliate Orange occurs in mesic forests where it can form extensive thickets, outcompeting native species. A notable trait of this shrub is the presence of large thorns.

Distribution: Nearly statewide.

Distribution from Thomas and Allen (1998)

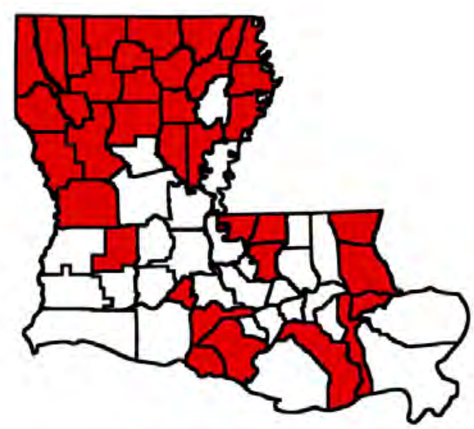
Communities/SGCN Impacted:

Bottomland Hardwood Forest, Hardwood Flatwoods, Hardwood Slope Forest, and Southern Mesophytic Forest.

Research Needs & Management Actions:
- Support chemical control of this species.
- Conduct research to document habitat recovery following control of Trifoliate Orange, especially where dense thickets were eliminated.

25. Kudzu (*Pueraria montana*): Kudzu is a fast growing deciduous legume that spreads by twining, blanketing large expanses if left uncontrolled. These monospecific expanses may suppress 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.



Distribution from Thomas and Allen (1998)

Communities/Species Impacted:

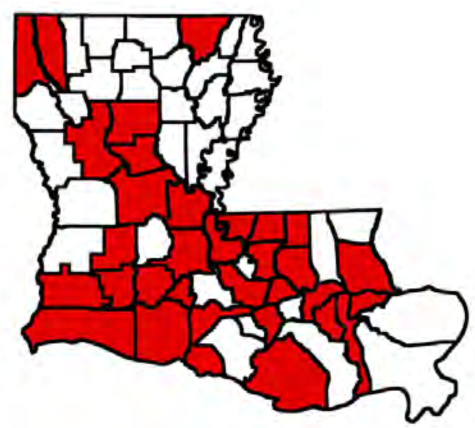
Southern Mesophytic Hardwood Forest, Bottomland Hardwood Forest, and Batture. This species requires disturbance, such as a canopy gap, to gain a foothold. In Louisiana, it typically dominates disturbed waste areas such as roadsides or eroded slopes.

Research Needs &Management Actions:

- Support control of this species using a variety of techniques (e.g., herbicide application, mechanical control, prescribed burning, and grazing) as appropriate for the affected habitat.
- Document habitat responses following control efforts.

26. McCartney Rose (*Rosa bracteata*): McCartney Rose is a densely prickly evergreen shrub that grows in clumps, and produces arching and climbing stems or canes. If left uncontrolled, this plant can reach up to 11.5 feet in height (Global Invasive Species Database 2005). McCartney 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). McCartney Rose thrives in open sun in frequently disturbed areas and is drought and fire tolerant. This species is often very conspicuous on excessively grazed rangelands and pastures and persists when cultivated and then abandoned. McCartney Rose forms dense thickets that suppress native, 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: Widely distributed.



Distribution from Thomas and Allen (1998)

Communities/Species Impacted:

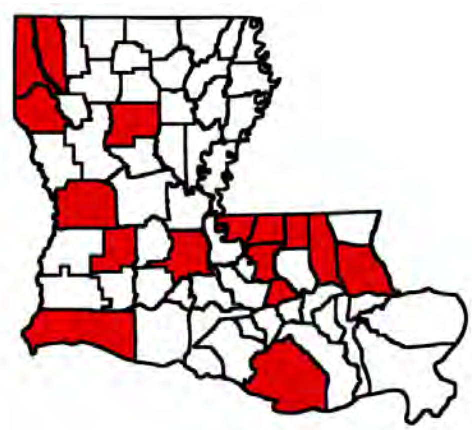
Coastal Prairie, Eastern and Western Longleaf Pine Flatwoods Savanna, and Eastern and Western Upland Longleaf Pine Woodland. McCartney Rose requires disturbance for establishment and does not readily invade high quality habitat.

Research Needs & Management Actions:

- Conduct research to determine the combined effects of herbicide application and prescribed fire on McCartney Rose.
- Encourage grazing schemes that limit invasion by McCartney Rose and other weeds, and that sustainably utilize native grass forage.

27. Cherokee Rose (*Rosa laevigata*): Cherokee Rose is native to China, and like many non-native plants, was brought to the U.S. as an ornamental. Cherokee Rose is a prickly evergreen sprawling shrub or high climbing vine. Cherokee Rose can be found in sunny disturbed areas along edges of forests, savannas, 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 possibly hinder forest regeneration.

Distribution: Widely scattered. Well established and frequent in West Feliciana Parish in the Tunica Hills.



Distribution from Thomas and Allen (1998)

Communities/Species Impacted:

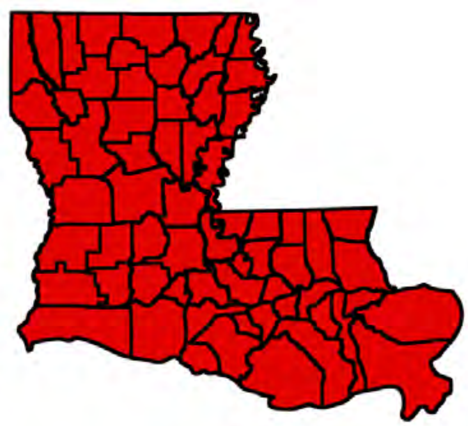
Southern Mesophytic Forest, Small Stream Forest, Eastern and Western Longleaf Pine Flatwoods Savannas.

Research Needs & Management Actions:

- Conduct research on control of this species and document habitat response following control of large infestations.

28. Chinese Tallow Tree (*Triadica sebifera*): Chinese Tallow (a.k.a. Chicken Tree or Popcorn Tree) is one of our most serious invasive species of mesic and wet forests and grasslands. Native to East Asia, it has been present in the southeastern U.S. 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 forest interiors. In the historical range of Coastal Prairie, it is a major weed of old fields, pastures, and rangeland. Neglected fields can be dominated by Chinese Tallow Tree. Shallow wetlands such as Flatwoods Ponds, especially in the absence of frequent prescribed fire, can also become tallow thickets.

Distribution: Statewide



Distribution from Thomas and Allen (1996) and additional field observations.

Communities/Species Impacted:

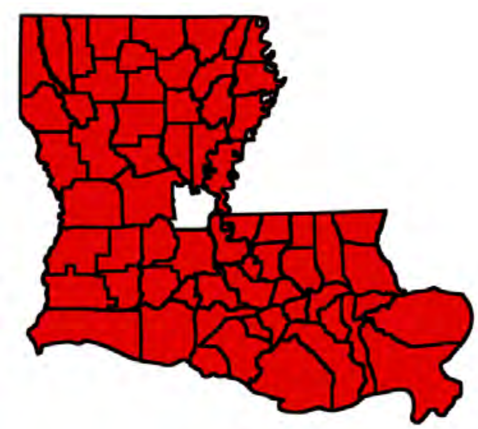
Bottomland Hardwood Forest, Coastal Prairie, Cypress-Tupelo-Blackgum Swamp, Ephemeral Pond, Live Oak Natural Levee Forest, Eastern and Western Longleaf Pine Flatwoods Savanna, and Small Stream Forest.

Research Need & Management Actions:

- Encourage use of prescribed fire in rangeland and pasture management to limit recruitment of Chinese Tallow Tree in these grasslands.

29. 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 nearly three feet 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 dense clumps, excluding native vegetation and decreasing diversity. The presence of Smut Grass on pasture and rangeland indicates excessive grazing, 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 survive in soil for more than 2 years (Davy et. al. 2012). Its prolific seed production, seed size, and lifespan contribute to its success as an invasive.

Distribution: Essentially statewide. Particularly common in excessively grazed pasture and rangelands.



Distribution from Allen et al. (2004)

Communities/Species Impacted:

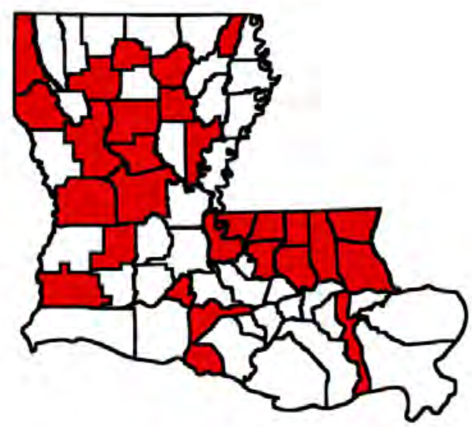
Coastal Prairie, Saline Prairie, and Calcareous Prairie. This species indicates disturbance, and does not readily invade high quality grasslands.

Research Needs & Management Actions:

- Work with landowners to establish grazing schemes that avoid overgrazing high quality native grasses, precluding the establishment of vigorous stands of Smut Grass.
- Conduct research examining the effects of resting grazing lands and employing prescribed fire on the abundance and persistence of Smut Grass.

30. Tungoil Tree (*Vernicia fordii*): Tungoil 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 Tungoil Tree stands may represent abandoned plantations. A distinctive feature is the presence of two red glands located on the petiole (leaf stalk) at the junction with the leaf blade. All parts of the plant are toxic, especially the fruits and seeds.

Distribution: Widely distributed. Tungoil Tree occurs in mesic soils and is most prevalent in the Florida Parishes.



Distribution from Thomas and Allen (1996)

Communities/Species Impacted:

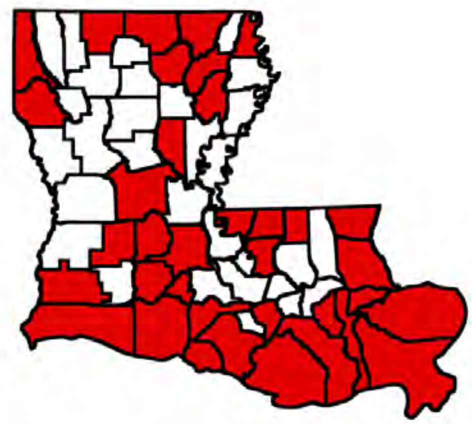
Eastern Upland Longleaf Pine Woodland, Mixed Hardwood-Loblolly Pine Forest, Shortleaf Pine-Oak-Hickory Woodland, Southern Mesophytic Hardwood Forest, and Small Stream Forest.

Research Needs & Management Actions:

- Support site-level control of Tungoil Tree and document habitat responses following control efforts.
- Educate the public regarding the negative impacts of using this species as an ornamental.

31. Elephant Ear (*Colocasia esculenta*): Elephant Ear, also called Wild Taro, 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-Blackgum 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)

Communities/Species Impacted:

All freshwater wetland habitats, including Cypress-Tupelo-Blackgum Swamp. Shorelines of sluggish waterways throughout the state.

Research Needs & Management Actions:

- Discourage use of this species as an ornamental.
- Control local infestations with a combination of digging corms from soil and application of glyphosate plus surfactant (MacDonald et al. 2008).
- Conduct research to determine habitat responses following implementation of control efforts.

32. Brazilian Waterweed (*Egeria densa*): This species is also known as Common Waterweed or Brazilian Elodea and prefers slow-moving waters of sluggish streams, ponds, and lakes. Establishment in natural ecosystems is likely due to dumping from aquaria. However, this species has also been intentionally introduced, as it was once thought to aid in the control of 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, smothering 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.

Distribution from field observations by LDWF Fisheries Staff.

Communities/Species Impacted:

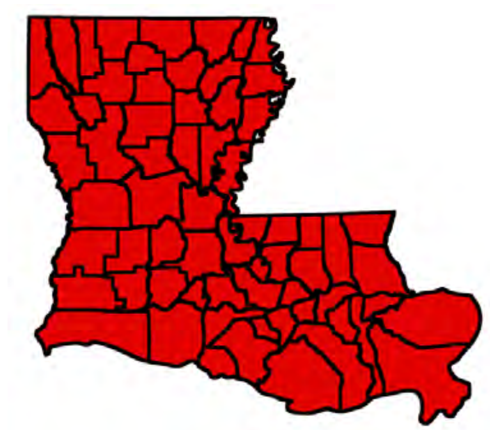
Cypress-Tupelo-Blackgum Swamp, other lentic water bodies, and slow-moving waterways throughout the state.

Research Needs & Management Actions:

- Control with herbicides that are known to be effective against Brazilian Waterweed.
- Support research into temperature and salinity tolerance of this species.
- Conduct research to determine more cost effective methods of control, including alternative herbicides and the use of additional biological controls.

33. Water Hyacinth (*Eichhornia crassipes*): Native to South America, Water Hyacinth was first introduced into the U.S. 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 sunlight to native submersed aquatic vegetation (SAV) which degrades water quality and harms wildlife. Decomposition of Water Hyacinth lowers dissolved oxygen levels, thus negatively affecting aquatic wildlife.

Distribution: Statewide.



Distribution from field observations by LDWF Fisheries Staff.

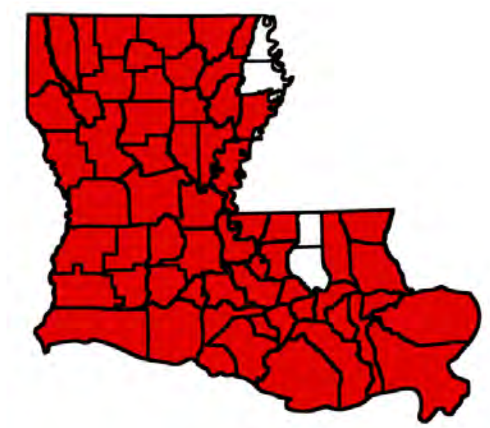
Communities/Species Impacted:

Native fauna and all native freshwater communities are negatively impacted. Additionally, those species that require a substantial open water habitat component are negatively impacted by the dense mats formed by this species.

Research Needs & Management Actions:
- 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 this plant.
- Fund research to investigate Water Hyacinth as a potential component of biofuels.
- Conduct research on new herbicides to determine the efficacy and cost effectiveness versus current options.
- Conduct research into the long term effectiveness of biological control agents, and promote the use of such control when appropriate.
- Continue efforts to educate the public regarding the threats this species poses.

34. 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 dense mats. Hydrilla can adversely affect water quality by shading out native vegetation and lowering dissolved oxygen concentrations, which may lead to fish kills. Hydrilla was likely introduced via dumping from aquaria or intentional planting. This species spreads easily between water bodies via boats and trailers.

Distribution: Essentially statewide.



Distribution from field observations by LDWF Fisheries Staff.

Communities/Species Impacted:

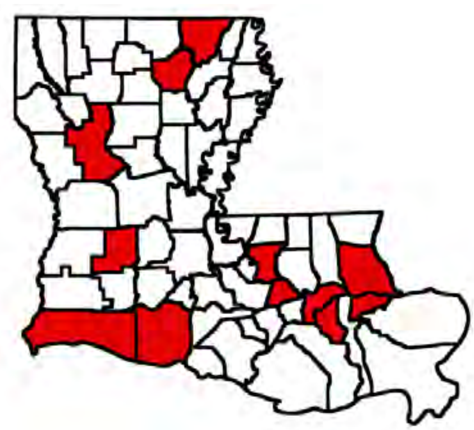
All freshwater habitats, particularly those with slow-moving water, such as Oxbows and Cypress-Tupelo-Blackgum Swamps. Hydrilla can exclude native aquatic plants, and lead to low levels of dissolved oxygen, causing negative impacts to native invertebrates and fishes.

Research Needs & Management Actions:

- Control using herbicides, drawdowns, and other known effective methods.
- Conduct research to identify new herbicides which would be more cost effective than current options.
- Conduct research into the long term effectiveness of biological controls.
- Continue efforts to educate the public about the threats this species poses.

35. Yellow Flag Iris (*Iris pseudacorus*): Yellow Flag Iris is an exotic invasive mainly found in wetland habitats, typically growing on edges of lakes, ponds, 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 Iris 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 stands. Introduction to new areas may occur if rhizome fragments or seed are carried downstream or by a storm event (Ramey and Peichel 2001).

Distribution: Infrequent and scattered.



Distribution from Thomas and Allen (1993)

Communities/Species Impacted:

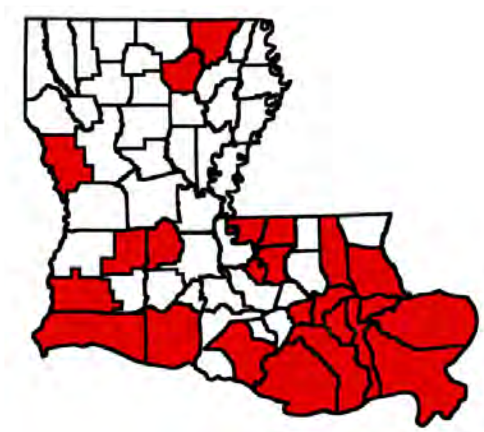
Cypress-Tupelo-Blackgum Swamp and Freshwater Marsh.

Research Needs & Management Actions:

- Increase awareness of the potential negative effects of this species when used as an ornamental, and promote the use of native irises as an alternative.

36. Torpedo Grass (*Panicum repens*): Torpedo Grass superficially resembles a much larger version of Bermuda Grass (*Cynodon dactlyon*). Torpedo Grass is invasive due to its rapid growth by torpedo-like rhizomes. This species can form dense stands in a variety of habitats, from sandy Gulf beaches to river, lake, and pond shorelines. In the latter settings, Torpedo Grass can dominate and actually grow out into the water. Torpedo Grass can rapidly invade and dominate disturbed sandy soils, including dredge spoil islands.

Distribution: Primarily the southern part of Louisiana, with scattered records elsewhere.



Distribution from Allen et al. (2004) and specimens housed at LSU Herbarium.

Communities/Species Impacted:

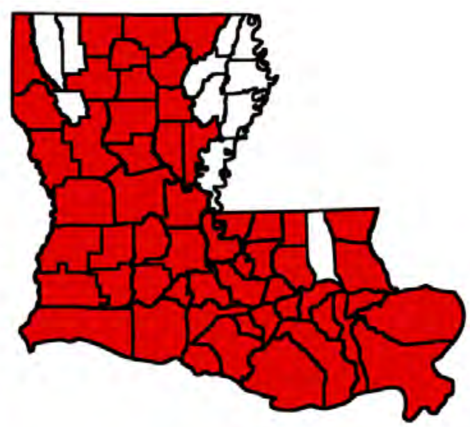
Barrier Island, Coastal Dune Grassland, Lakes, Ponds, Louisiana Beach, Vegetated Pioneer Emerging Delta, and Sandbars.

Research Needs & Management Actions:

- Conduct research to determine alternative herbicides that may be effective in controlling this species with minimal impact to non-target species.

37. 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 U.S. since the 1880s for water gardens, where it was likely accidentally introduced into the wild. 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.



Distribution from field observations by LDWF Fisheries Staff.

Communities/Species Impacted:

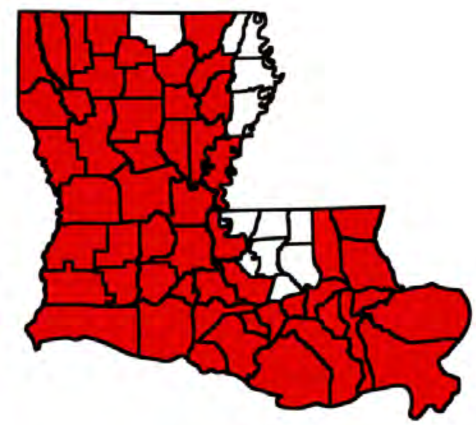
All aquatic systems, including Lakes and Ponds, Cypress-Tupelo-Blackgum Swamps, and Freshwater Marsh.

Research Needs & Management Actions:

- 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 herbicide and surfactant mixtures. 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 methods of control, including alternative herbicides and additional biological control agents.

38. Giant Salvinia (*Salvinia molesta*): Giant Salvinia was likely brought to the U.S. as an aquarium plant, and subsequently 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-Blackgum 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.



Distribution from field observations by LDWF Fisheries Staff.

Communities/Species Impacted:

All aquatic systems, including Cypress-Tupelo-Blackgum Swamp, Lakes and Ponds, and Freshwater Marsh.

Research Needs & Management Actions:
- 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 fluctuations have 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.

CHAPTER 7. CLIMATE CHANGE

Climate change has recently moved to the forefront of conservation planning in the United States. In 2009 legislation proposed by the U.S. House of Representatives required the incorporation of a climate change strategy into each state's Wildlife Action Plan (WAP; AFWA 2009). Although this legislation was not passed by the U.S. Senate, an Executive Order (Executive Order No. 13653) was later issued in 2013 to increase the responsibility of federal agencies, including the U.S. Fish and Wildlife Service (USFWS), in addressing climate change. Therefore, the Louisiana Department of Wildlife and Fisheries (LDWF), is addressing climate change during the WAP revision process, to ensure that the WAP remains consistent with current and future policies and is eligible for any associated funding opportunities to conserve Species of Greatest Conservation Need (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 and habitats, (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 applies 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 (CO_2; 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 the implications of those changes.

Whereas it is true that climate change projections are only likely future scenarios, it is also true that these projections are based on fundamental principles of the physical sciences and that earlier projections have ultimately been confirmed by observed changes in climatic conditions (Melillo et al. 2014). Although uncertainty still exists regarding the exact rate of change and effects on regional 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 some 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 Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES, 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 in precipitation 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 and increasing evapotranspiration will more than offset any increase in precipitation.

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.

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. Some species will be negatively impacted while other species benefit (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 even to fire-dependent communities.

4. Which species are most at-risk?

The International Union for Conservation of Nature (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. That is, any negative impacts to that particular species would necessarily impact the species that relies on it, even if the dependent 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 climatic 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) in the 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 7.1.

Table 7.1. 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 7.2 and Figure 7.1 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 7.3 and Figure 7.2 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 one 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 7.2. 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 PRISM historic average from 1970-2000.

	PRISM	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 7.3. 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 PRISM historic average from 1970-2000.

	PRISM	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

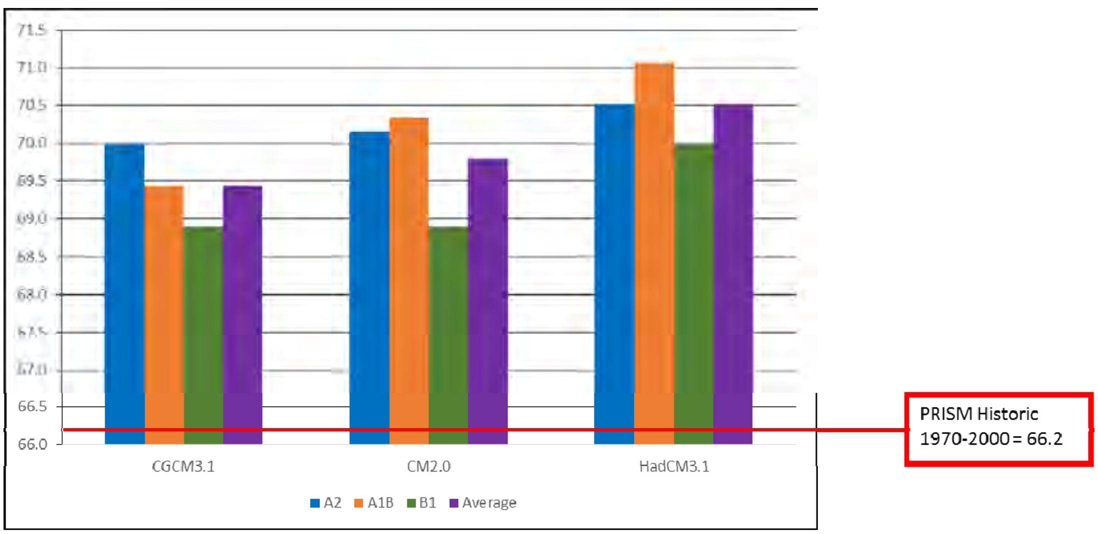


Figure 7.1. Graphical representation of projected average monthly temperature (°F) for Louisiana for the period 2009-2099, with historic average (PRISM Climate Group 2004) for the period 1970-2000 shown in red.

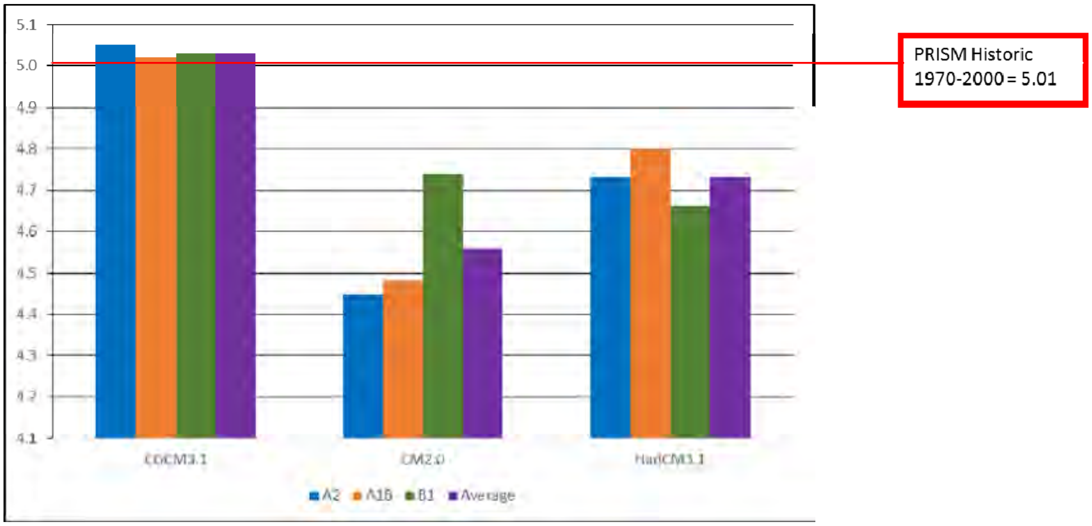


Figure 7.2. Projected average monthly precipitation (inches) for Louisiana for the period 2009-2099, with historic average for the period 1970-2000 (PRISM Climate Group 2004) shown in red.

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 7.3 shows the projected change in temperature for a 16-general circulation model (GCM) ensemble average under IPCC SRES high emissions scenario (A2). Figure 7.4 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.

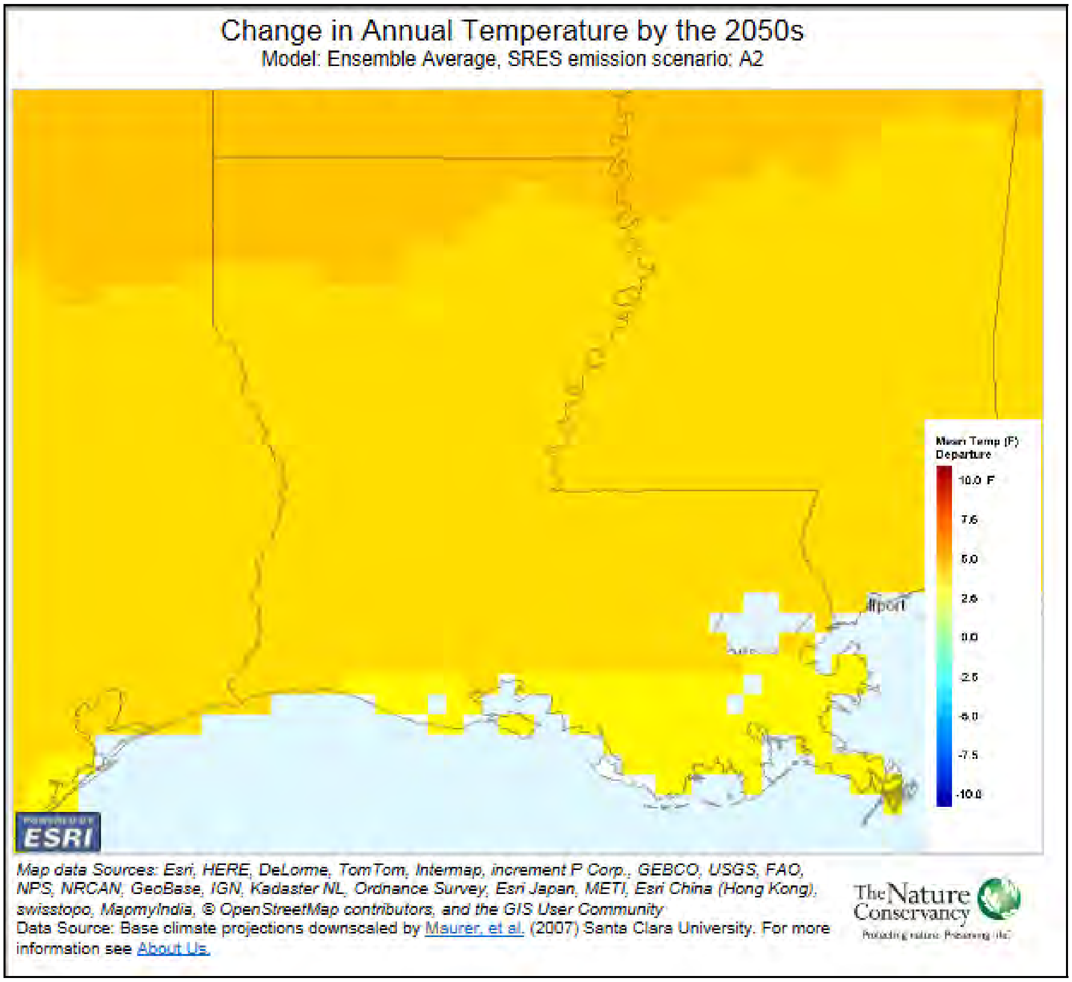


Figure 7.3. ClimateWizard projected temperature change for mid-century based on the Ensemble Average of 16 GCMs under the high (A2) emissions scenario.

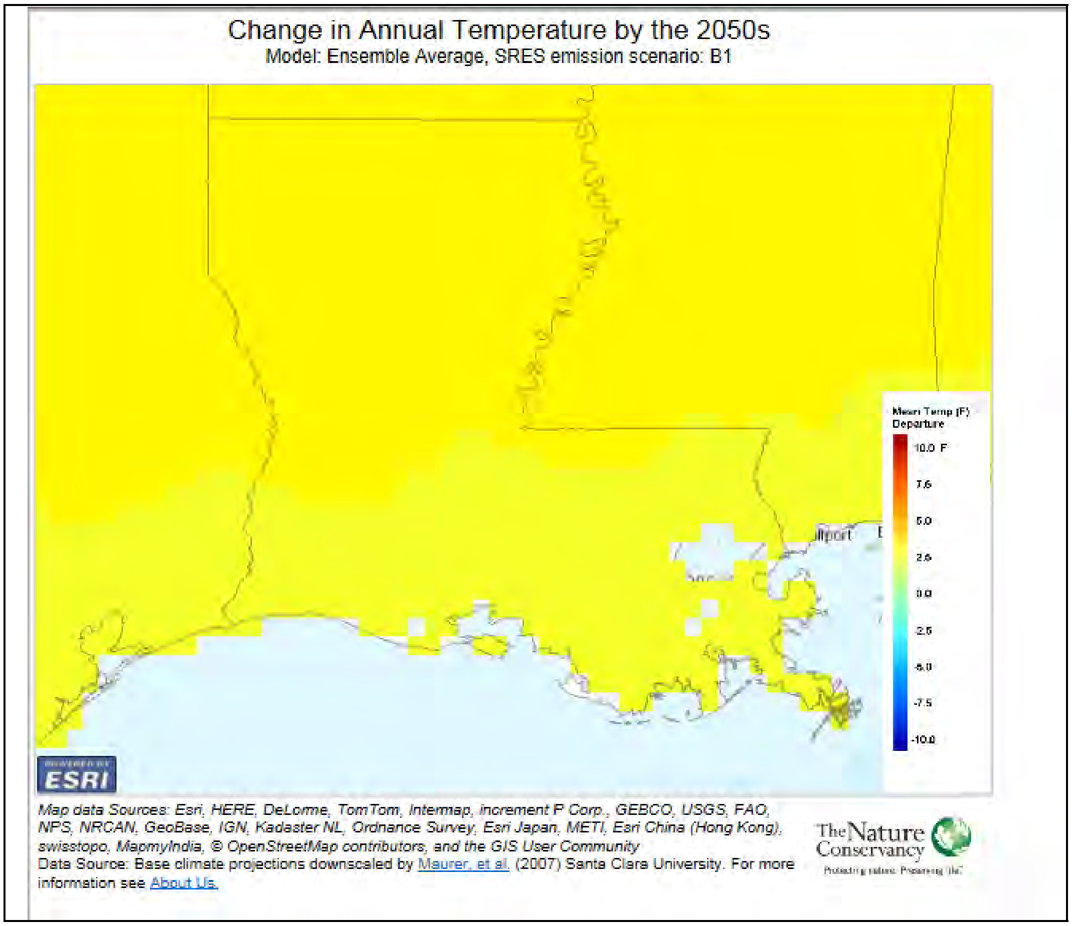


Figure 7.4. ClimateWizard projected temperature change for mid-century based on the Ensemble Average of 16 GCMs under the low (B1) emissions scenario.

Figures 7.5, 7.6, 7.7, and 7.8 show ClimateWizard projections of precipitation changes (% change from historical levels) for Louisiana by mid-century. Figures 7.5 and 7.6 show the highest and lowest projected precipitation change, respectively, for the high-emissions scenario (A2). Figures 7.7 and 7.8 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, personal communication). 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 7.5).

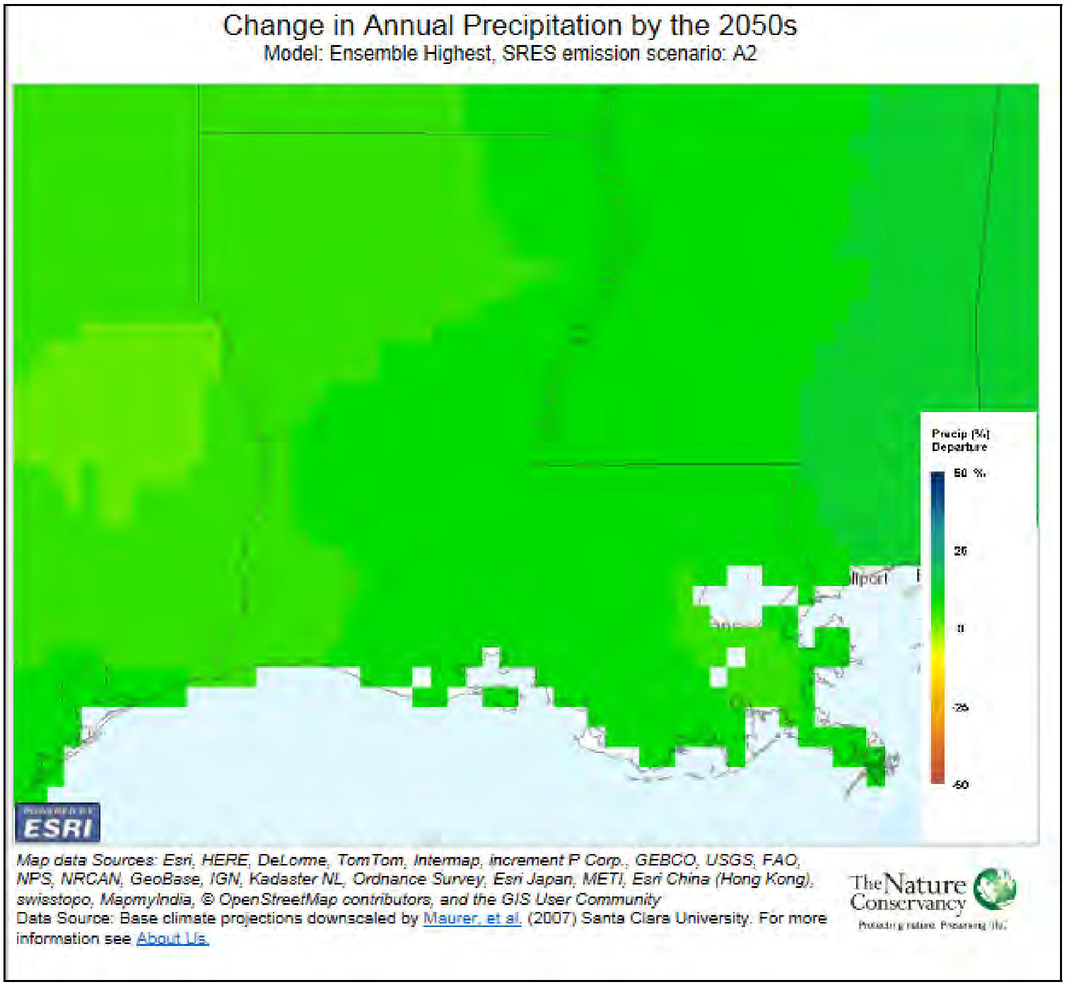


Figure 7.5. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Highest of 16 GCMs under the high (A2) emissions scenario.

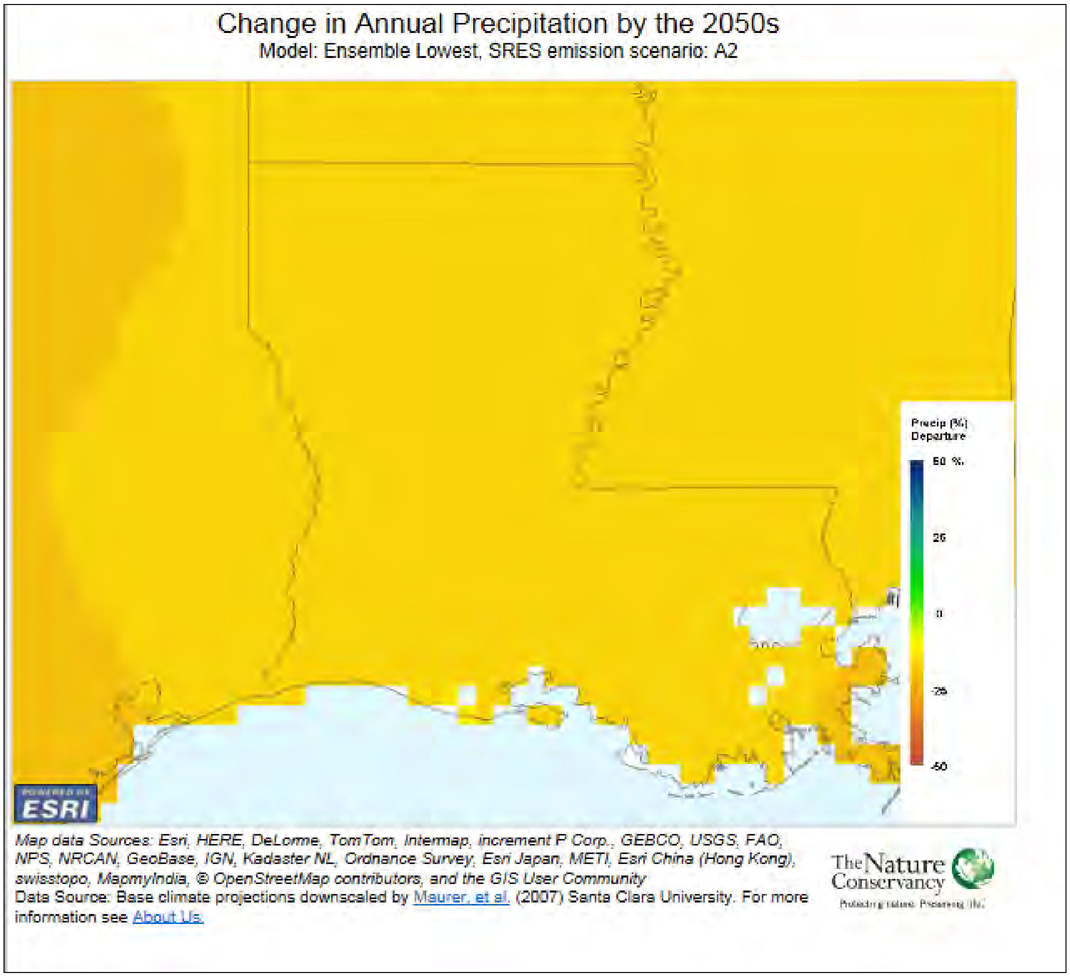


Figure 7.6. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Lowest of 16 GCMs under the high (A2) emissions scenario.

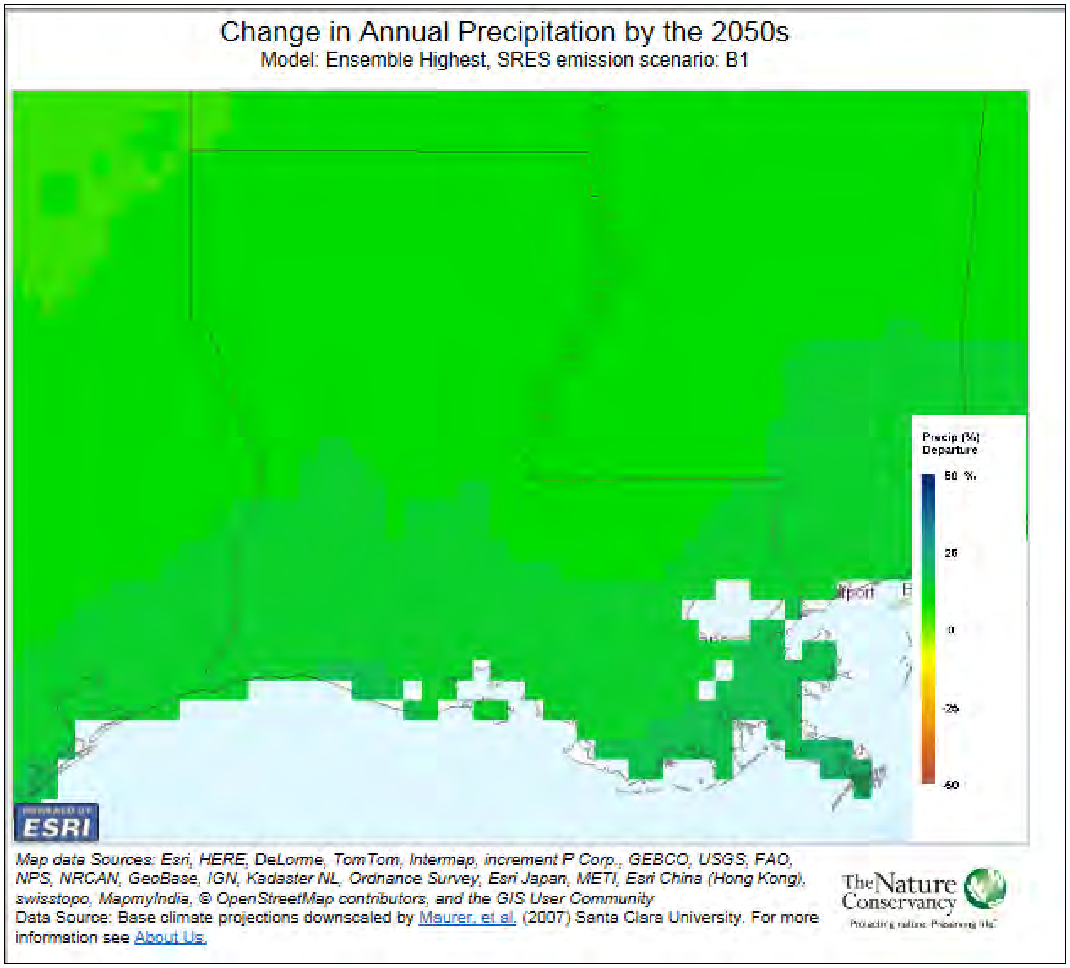


Figure 7.7. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Highest of 16 GCMs under the low (B1) emissions scenario.

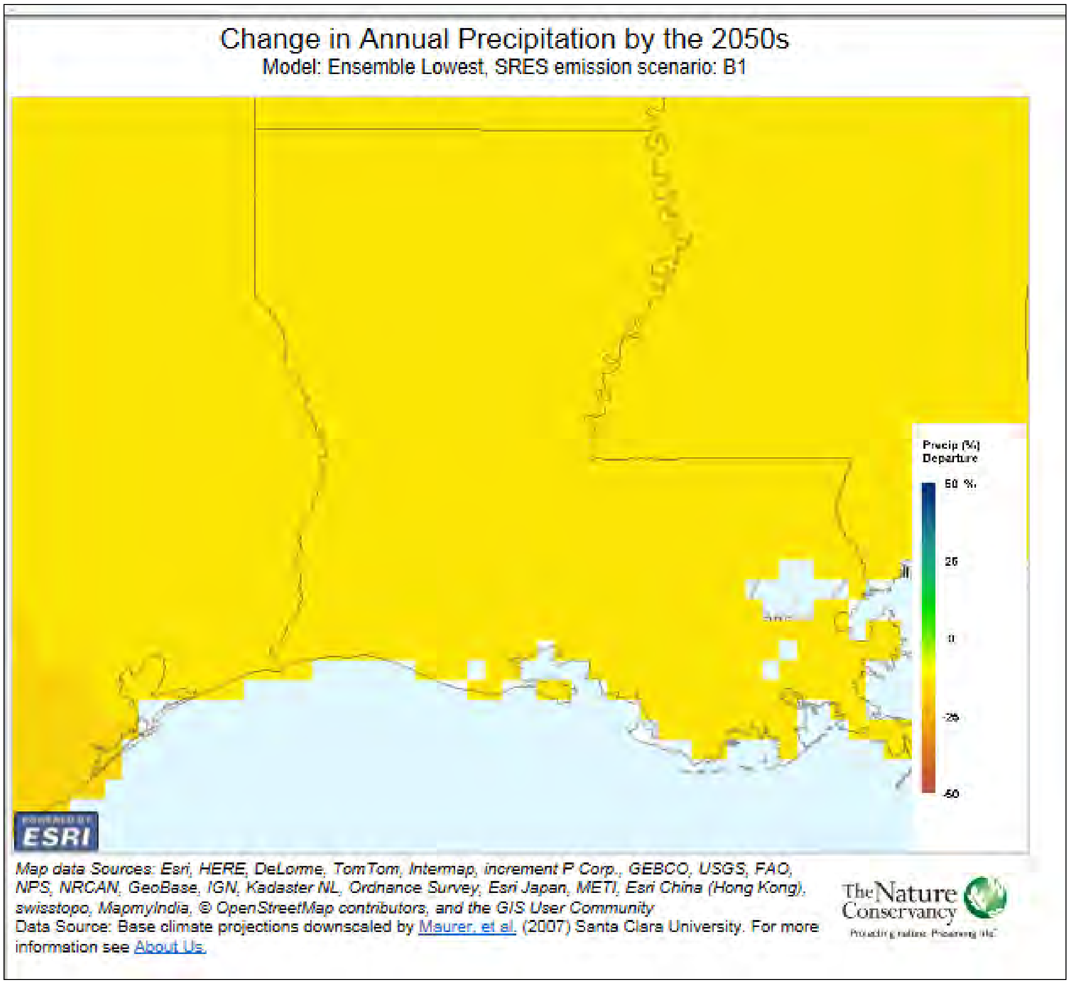


Figure 7.8. ClimateWizard projected percent precipitation change for mid-century based on the Ensemble Lowest of 16 GCMs under the low (B1) emissions scenario.

Detailed information on ClimateWizard projected temperature and percent precipitation changes for Louisiana's major cities under both emissions scenarios are reported in Tables 7.4 and 7.5. 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 7.4: 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 7.5: ClimateWizard projections for percent 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. 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). We have elected to follow the recommendations of modeling conducted by the Coastal Protection and Restoration Authority of Louisiana (CPRA) 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. 7.9). 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). 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. 7.10) 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. 7.11), 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. 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 elevated drier lands subside into lowlands. More discussion of the broader Gulf-wide impacts of SLR on land cover and focal species is presented in the summary of the Evaluation of Regional SLAMM Project.

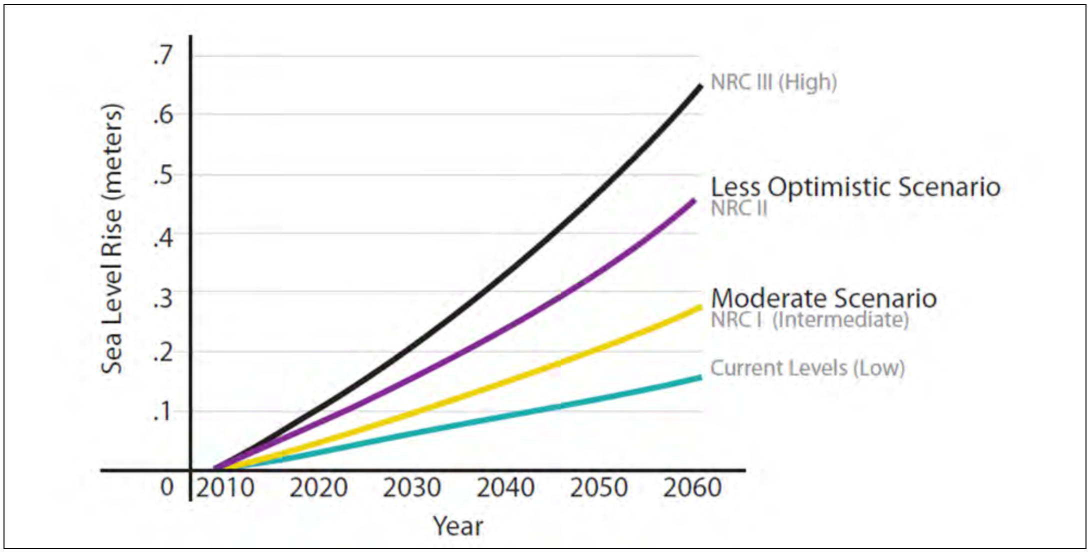


Figure 7.9: Projected SLR by mid-century, based on 3 different scenarios from the National Research Council (NRC). (CPRA 2012a).

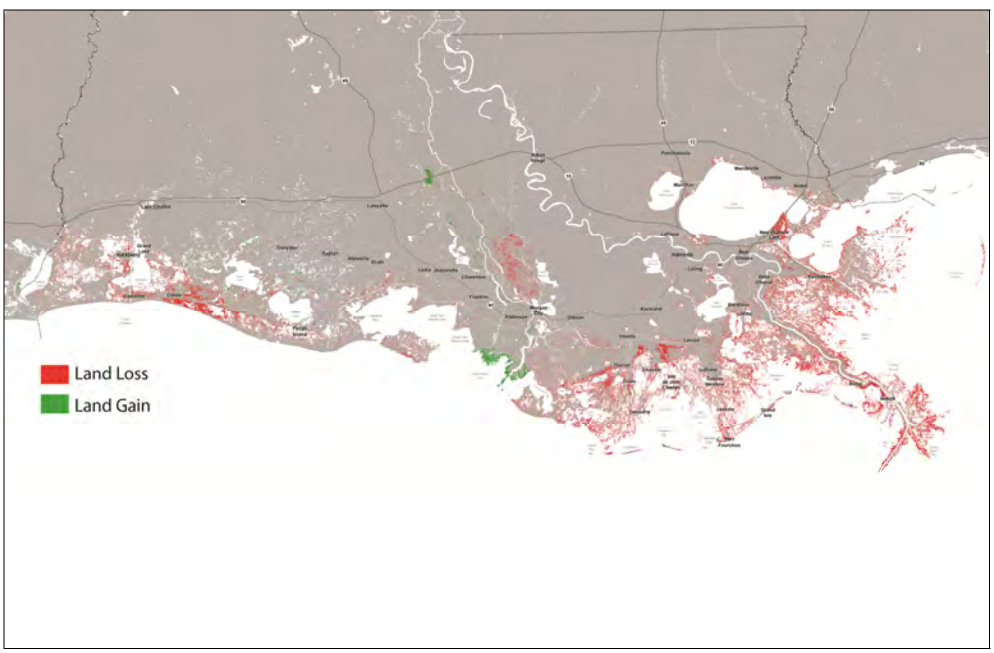


Figure 7.10: More optimistic land-loss scenario for coastal Louisiana (CPRA 2012a).

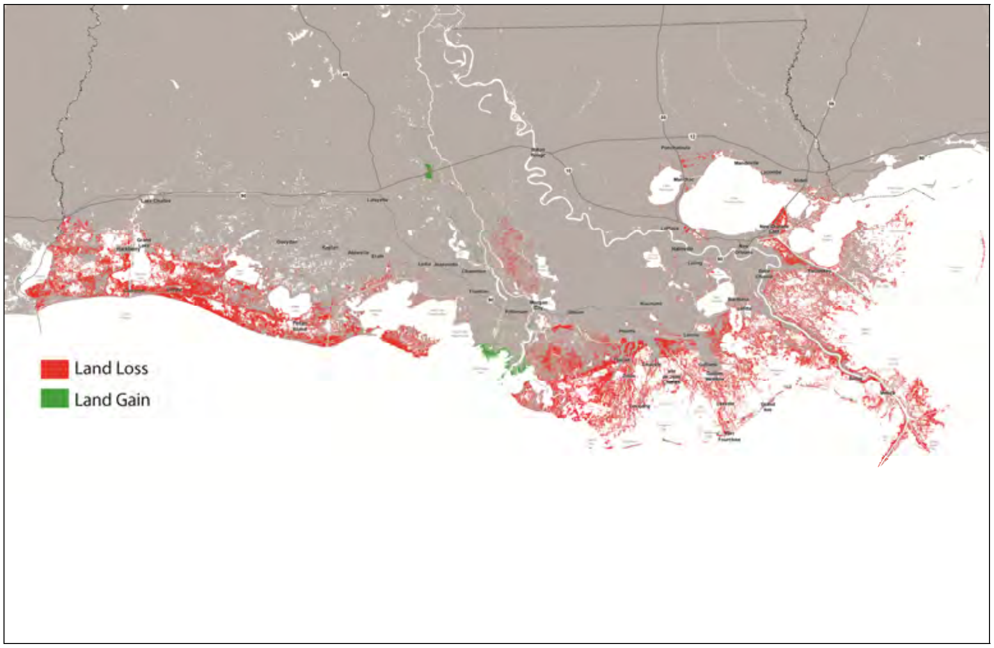


Figure 7.11: Less optimistic land-loss scenario for coastal Louisiana (CPRA 2012a).

C. 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 solely to prioritize conservation actions for Louisiana SGCN or natural communities. However, the results of these vulnerability assessments provide an additional factor that can be taken into consideration when prioritizing SGCN, natural communities, or conservation actions. Climate change vulnerability was 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. NatureServe Climate Change Vulnerability Index:

a. Overview of NatureServe CCVI

The NatureServe CCVI (Release 2.1) integrates projected exposure to climate change (Table 7.6) with three categories of sensitivity factors: (1) indirect exposure to climate change (Table 7.7), (2) species-specific factors (Table 7.8), and (3) documented responses to climate change (Table 7.9). 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 7.10).

Table 7.6. 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 7.7. 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 7.8. 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 a 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	This pertains to a species' response to specific disturbance regimes

specific disturbance regime likely to be affected by climate change	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 range wide 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 7.9. 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 7.10. 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.

b. 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 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 (based on expert opinion; Appendix I). Of the 70 species assessed, the distribution of climate change vulnerability scores can be seen in Table 7.11. For the purposes of the Louisiana WAP, Not Vulnerable/Presumed Stable and Not Vulnerable/Increase Likely were lumped into the category Not Vulnerable.

Table 7.11. 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 SGCN	34	22	12	2
% of SGCN 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 non-marine SGCN. The distribution of vulnerability scores by taxonomic group for all non-marine SGCN can be seen in Figure 7.12. 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.

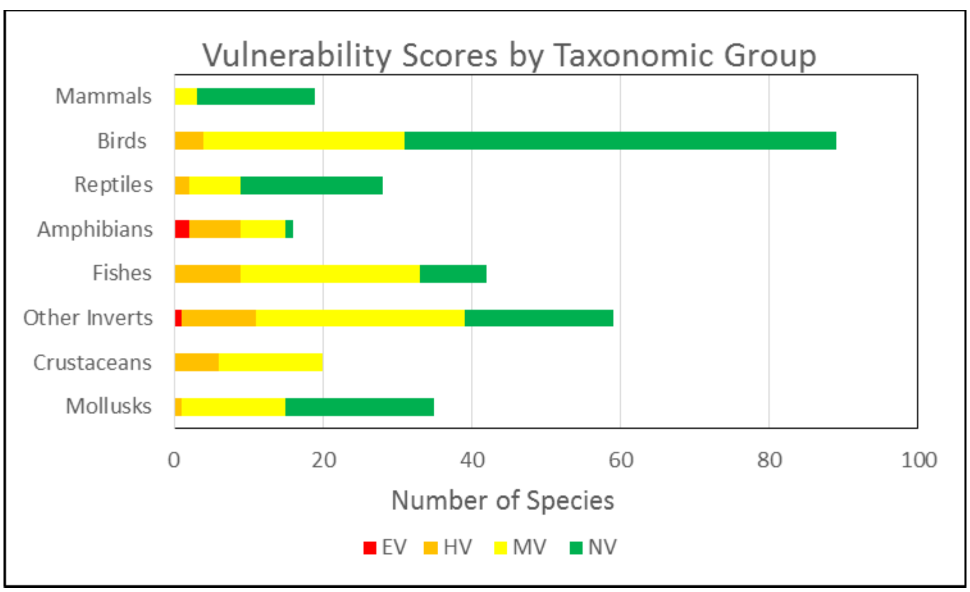


Figure 7.12. Distribution of Climate Change Vulnerability ranks for Louisiana SGCN, using the results of the 70 CCVI-assessed species to assign ranks to all non-marine SGCN.

1. 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 to climate change shown by amphibians (Fig. 7.13) include (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 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 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.

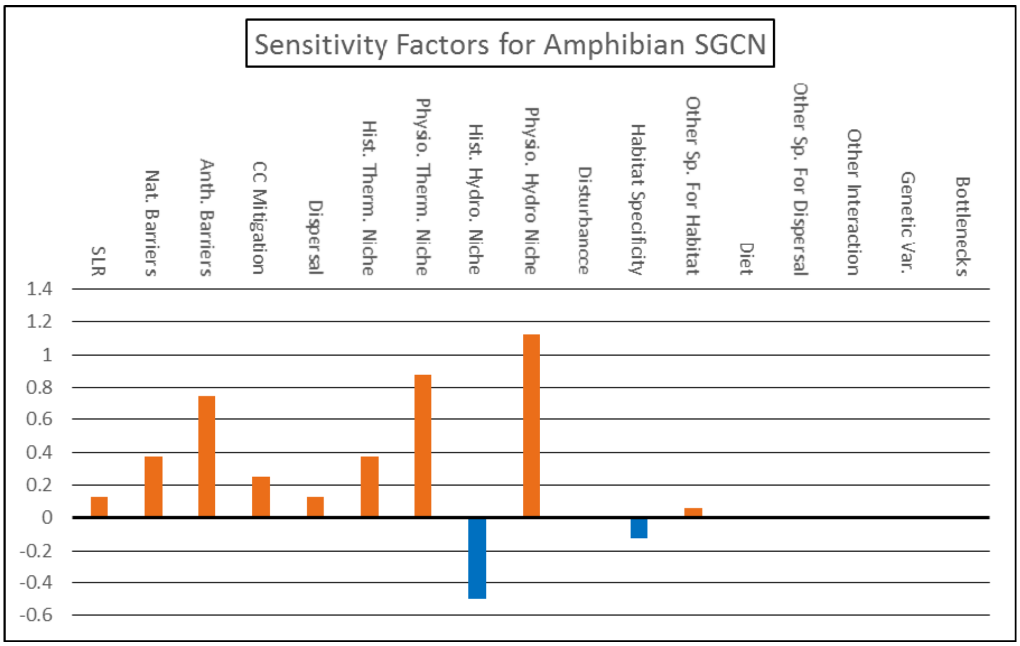


Figure 7.13. Factors affecting climate change vulnerability for amphibian SGCN.

2. 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. 7.14). Similar to amphibians, the three 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 is the fact that crawfishes have a generalized diet, as highly specific diets tend to increase vulnerability.

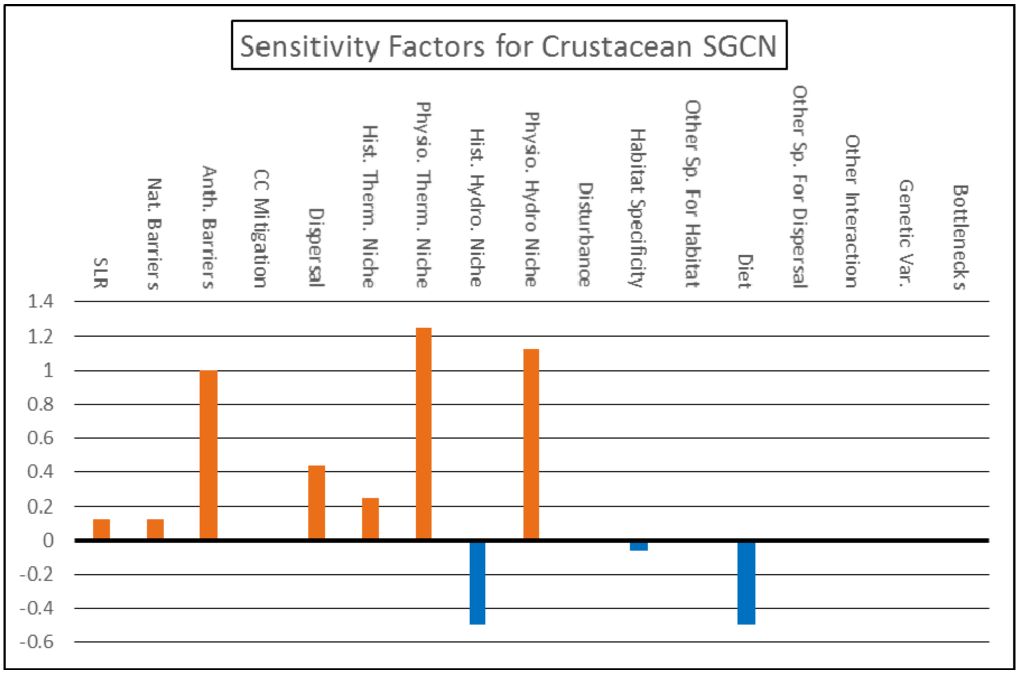


Figure 7.14. Factors affecting climate change vulnerability for crustacean SGCN.

3. 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 7.15). 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 served to counteract 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 more susceptible to drying. Due to potential negative impacts of SLR, species in the Florida Parishes are potentially more at risk, overall. Mollusks in the northwestern part of Louisiana are also at higher risk than species in most 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.

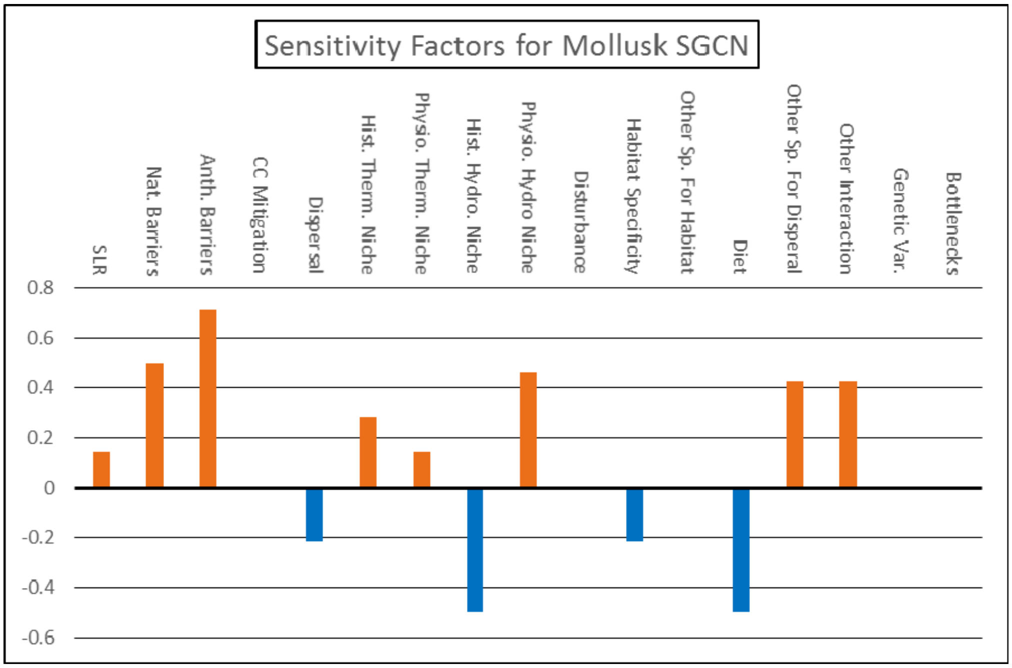


Figure 7.15. Factors affecting climate change vulnerability for mollusk SGCN.

4. Non-crustacean Arthropods

A number of different sensitivity factors contributed to high vulnerability to climate change in this group (66% of SGCN at least moderately vulnerable). The two factors that weighed most heavily were historical thermal niche and physiological hydrological niche (Fig. 7.16). 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. Such specialization could be a detriment under changing climatic conditions, particularly if the host plant or prey species becomes reduced due to such changes. Serving to mitigate climate change vulnerability for this group is the relatively high dispersal capability of most insects, as well as the past variation in precipitation patterns that has been found in Louisiana, which should provide some level of resilience to such changes in the future.

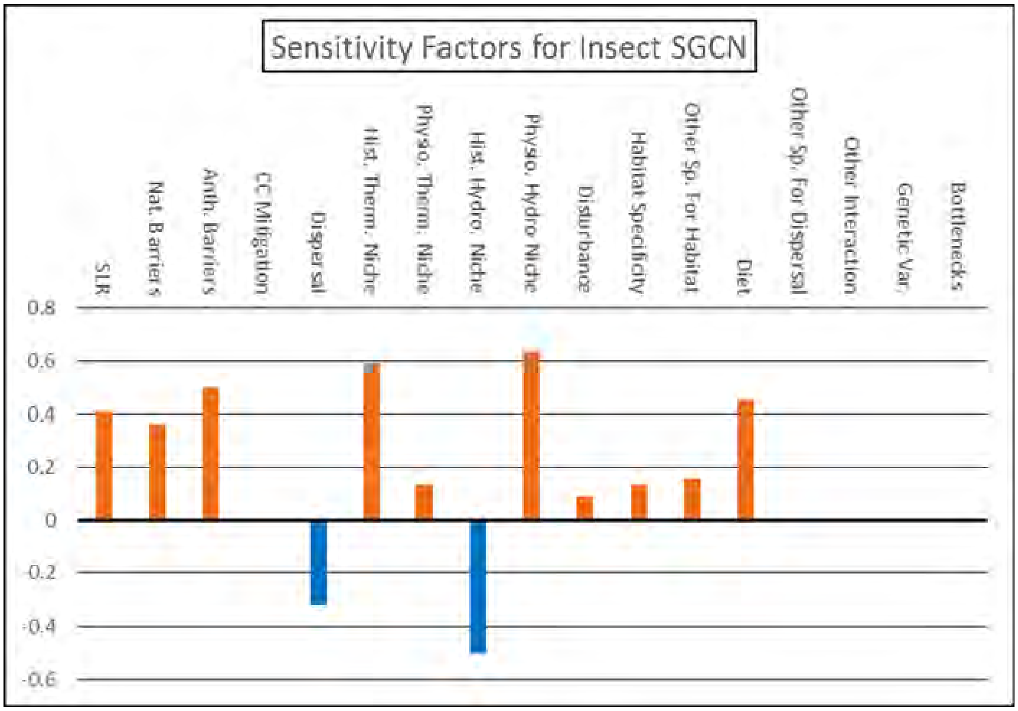


Figure 7.16. Factors affecting climate change vulnerability for non-crustacean arthropod SGCN

5. Inland Fishes

Fishes were determined to be among the most vulnerable taxonomic groups to climate change. Seventy-nine percent 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. 7.17). 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, is that, in the absence of man-made barriers, many fishes have good dispersal capability within stream systems, as well as the significant variation in precipitation patterns historically in Louisiana.

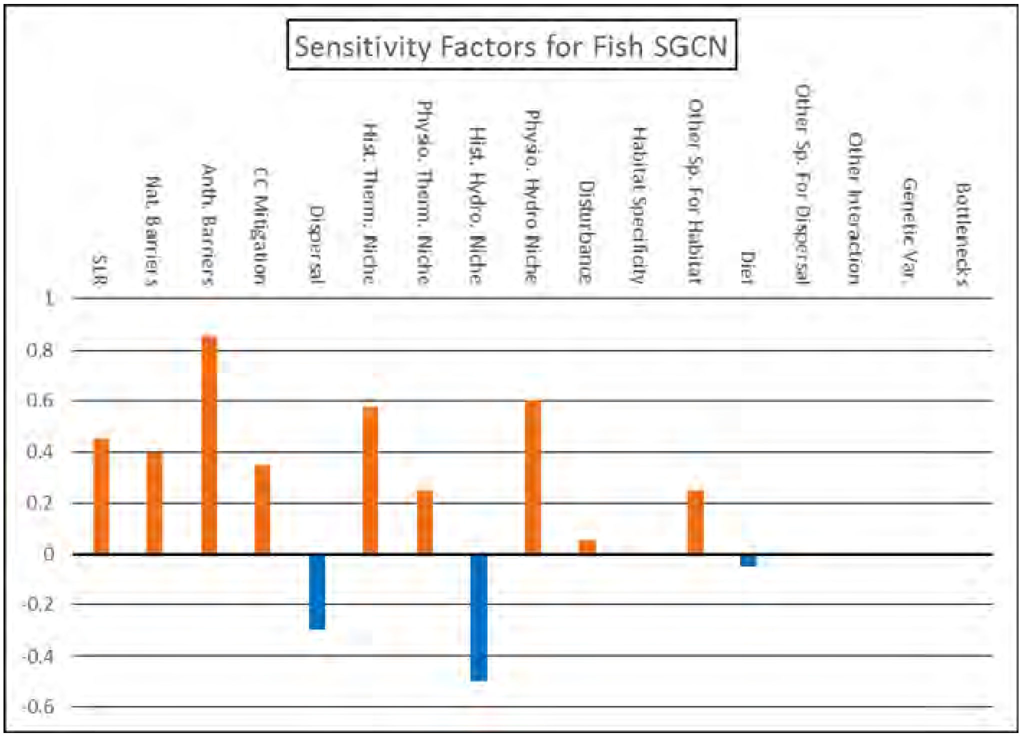


Figure 7.17. Factors affecting climate change vulnerability for fish SGCN.

6. Birds

It is not surprising that birds were among the least sensitive groups evaluated, 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. 7.18) 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 those habitats are very likely to be negatively impacted by SLR and associated increased storm surge. SLR was found to be one of the two 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.

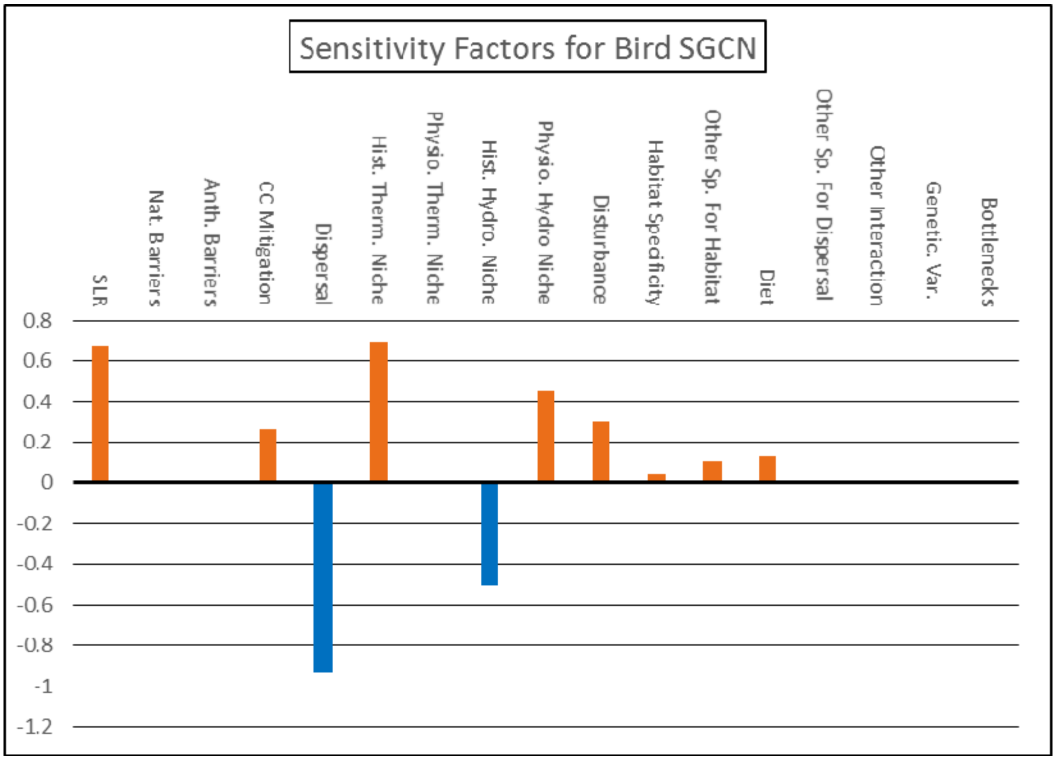


Figure 7.18. Factors affecting climate change vulnerability for bird SGCN.

7. 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. 7.19) was one of the primary factors that contributed to the observed low level of vulnerability. 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 mammal SGCN.

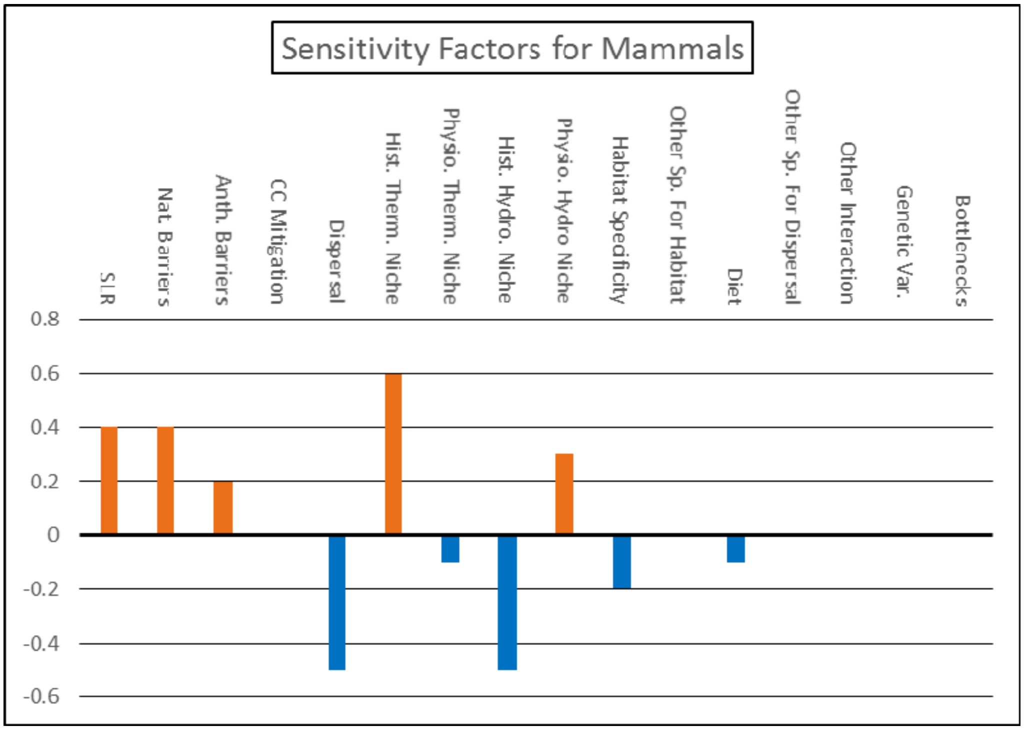


Figure 7.19. Factors affecting climate change vulnerability for mammal SGCN.

8. Reptiles

Ranking behind only mammals in terms of Low Vulnerability to climate change, 32% of reptile SGCN were projected to be vulnerable at some level, and 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 elevated levels of mortality during road crossings, which could prevent some reptile SGCN from utilizing their ability to disperse in order to track preferred climatic conditions.

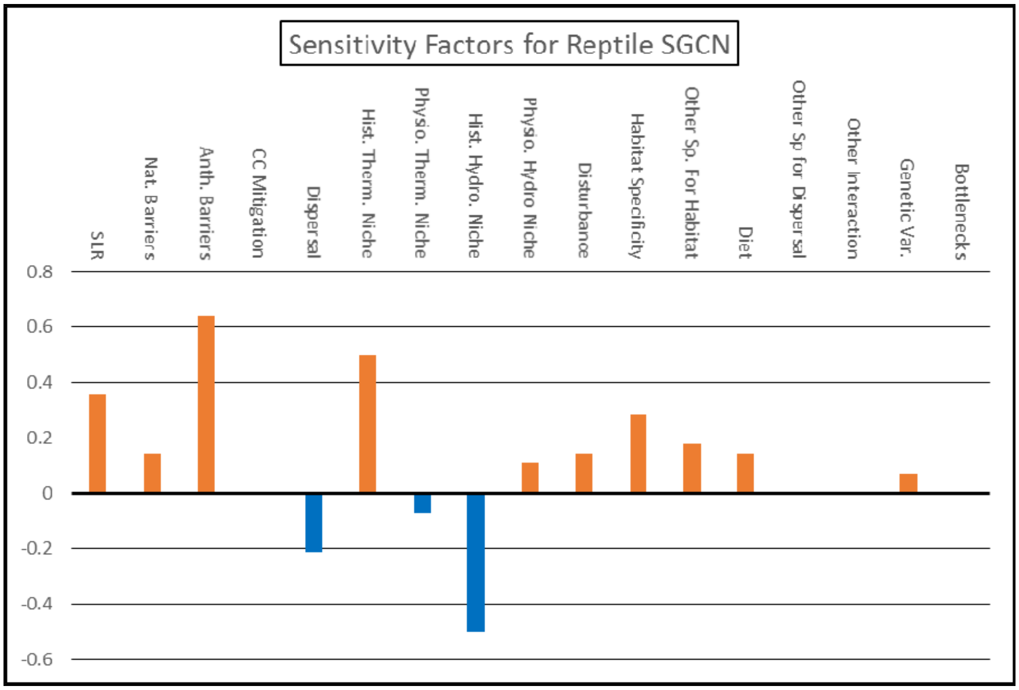


Figure 7.20. Factors affecting climate change vulnerability for reptile SGCN.

9. 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 SLR in the U.S. and continued SLR will fragment or inundate additional coastal habitats (NABCI 2010). These impacts will 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, dispersal ability might be of reduced value for birds that nest on Barrier Islands, as there may be no suitable nesting habitat to disperse to following SLR.

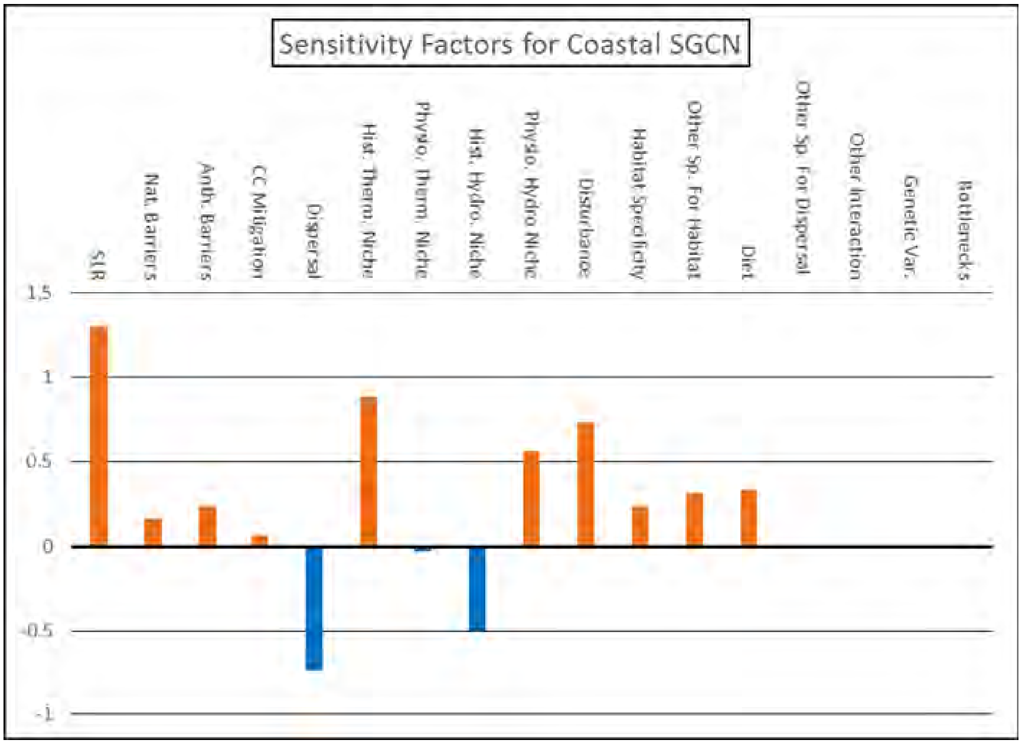


Figure 7.21. Factors affecting climate change vulnerability for coastal SGCN.

3. Gulf Coast Vulnerability Assessment

a. Overview

The Gulf Coast Vulnerability Assessment (GCVA) was initiated by the four LCCs that cover the Gulf of Mexico, the National Oceanic and Atmospheric Administration (NOAA), the Northern Gulf Institute, CPRA, and USGS to assess the relative vulnerability of four key ecosystems and associated species across the Gulf Coast region, including Louisiana.

The Core Planning Team used the Standardized Index of Vulnerability and Value Assessment (SIVVA, Reece and Noss 2014), an expert-opinion approach, to assess vulnerability. This tool enables both the assessment of relative vulnerability and the identification of factors that most influence that vulnerability. More than 50 individual managers, scientists, administrators, and others participated. These individuals assigned vulnerability scores to the species and ecosystems using their best professional opinions and empirical data that were readily available.

Following Glick et al. (2011), for purposes of the GCVA, vulnerability refers to potential impact (estimated exposure and sensitivity) to ecosystems and species of potential threats, coupled with adaptive capacity (ability or lack thereof to adapt to ecosystem changes).

The four ecosystems assessed in the GCVA were mangroves (i.e. Mangrove Marsh Shrublands), tidal emergent marsh (i.e. Freshwater to Salt Marsh), oyster reefs, and Barrier Islands. The assessment estimated the vulnerability of these ecosystems to potential threats. Threats included climate change and associated SLR, hypoxia, wetland loss, quality and quantity of freshwater inflows, invasive species, urbanization, and range shift constraints.

b. Results for Ecosystems

Three of the four ecosystems were determined to be highly vulnerable throughout or in parts of Louisiana. Following is a brief discussion of each of these three highly vulnerable ecosystems (Watson et al. 2015).

1. Tidal emergent marsh (Fig. 7.22)

Tidal emergent marsh was highly vulnerable across Louisiana. The most serious threats are SLR, fragmentation of habitat, altered hydrology, and constraints on range shifts.

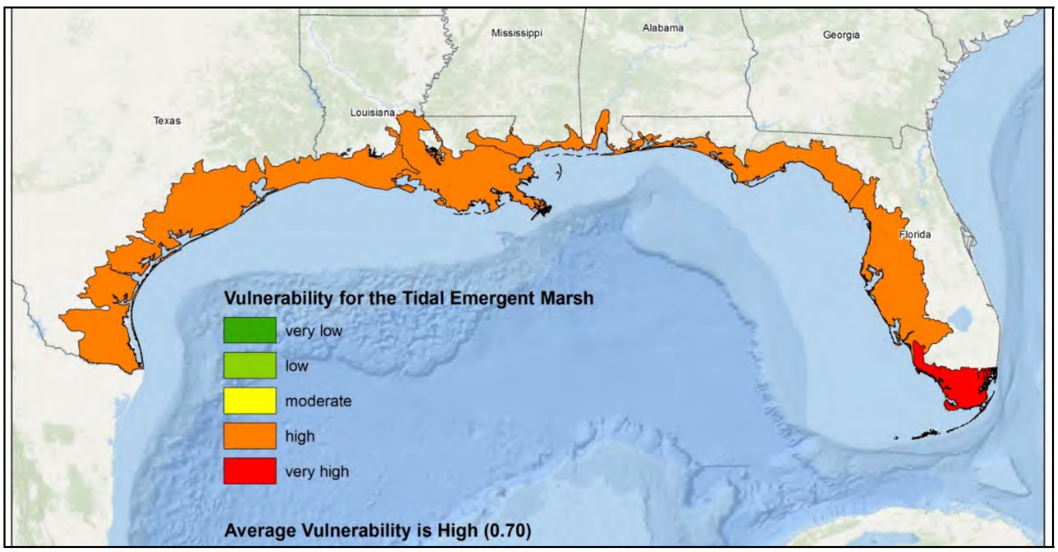


Figure 7.22. Vulnerability of Tidal Emergent Marsh from GCVA

2. Oyster reefs (Fig 7.23)

Oyster reef was highly vulnerable across Louisiana, except for the Southern Coastal Plain in the eastern part of the state. The most serious threats to oyster reef were altered hydrology and the inability of the physical structure to migrate away from threats.

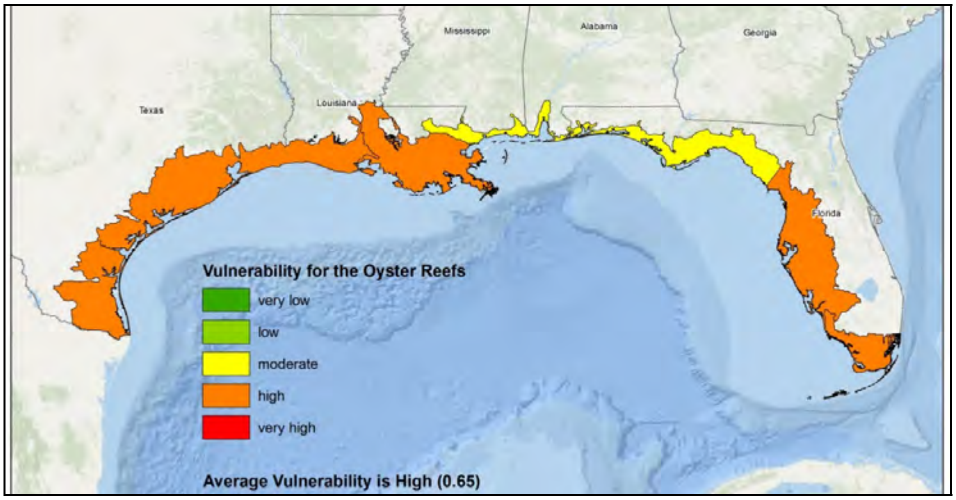


Figure 7.23. Vulnerability of Oyster Reef from GCVA

3. Barrier Islands (Fig 7.24)

Barrier Islands were highly vulnerable across Louisiana. The most serious threat was determined to be SLR.

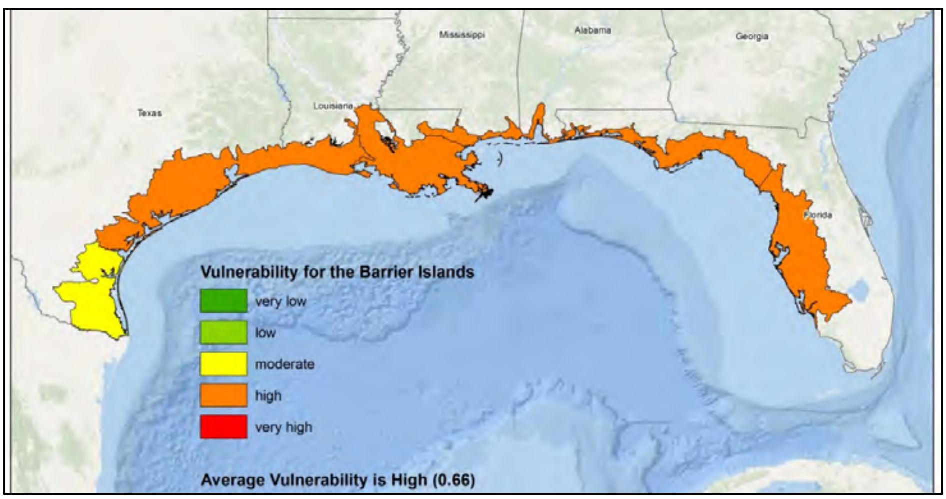


Figure 7.24. Vulnerability of Barrier Islands from GCVA

c. Results for Species

The GCVA assessed eleven species. Those species, and their associated ecosystems, were as follows:

- Roseate Spoonbill (mangroves)
- Mottled Duck (tidal emergent marsh)
- Spotted Seatrout (tidal emergent marsh)
- Blue Crab (tidal emergent marsh)

- Clapper Rail (tidal emergent marsh)
- Eastern Oyster (oyster reefs)
- American Oystercatcher (oyster reefs)
- Red Drum (oyster reefs)
- Black Skimmer (Barrier Islands)
- Wilson's Plover (Barrier Islands)
- Kemp's Ridley Sea Turtle (Barrier Islands)

The species were chosen because "they are widely distributed across the Gulf, are recognized as conservation targets by at least one LCC, and are representative of how other species may be impacted by projected changes" (Watson et al. 2015). Of the eleven species assessed, four were determined to be "highly vulnerable" throughout or in parts of Louisiana, all of which are SGCN. Following is a brief discussion of each of the four highly vulnerable SGCN (Watson et al. 2015).

1. Roseate Spoonbill (Fig. 7.25)

Roseate Spoonbills were judged to be highly vulnerable in the Southern Coastal Plain of eastern Louisiana. The most serious threats were increased coastal development, changes to biotic interactions (specifically prey), loss of habitat to SLR and erosion, storm surge, and low adaptive capacity.

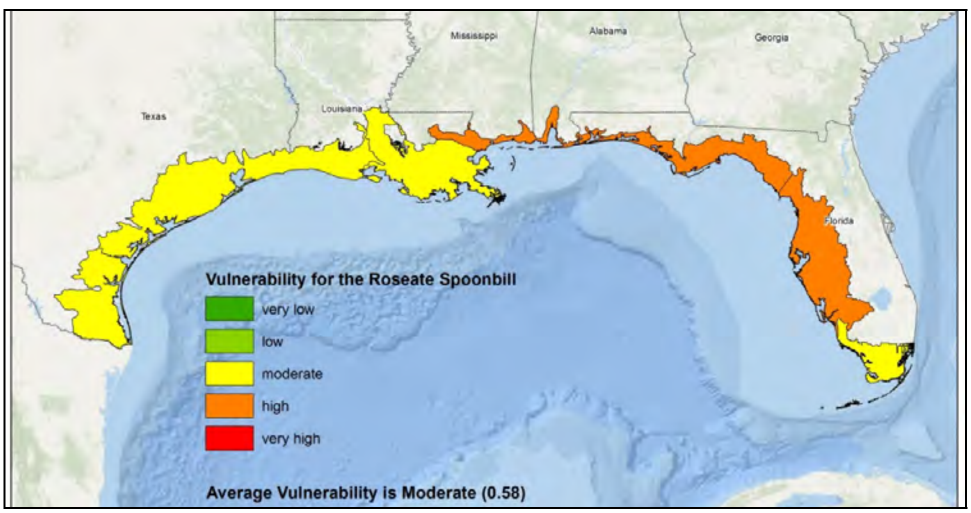


Figure 7.25. Vulnerability of Roseate Spoonbill

2. American Oystercatcher (Fig. 7.26)

American Oystercatchers were judged to be highly vulnerable in the Southern Coastal Plain of eastern Louisiana. The most serious threats were judged to be barriers to dispersal such as coastal development, loss of nesting habitat, SLR, and "synergistic effects of climate change, SLR and urbanization" (Watson et al. 2015).

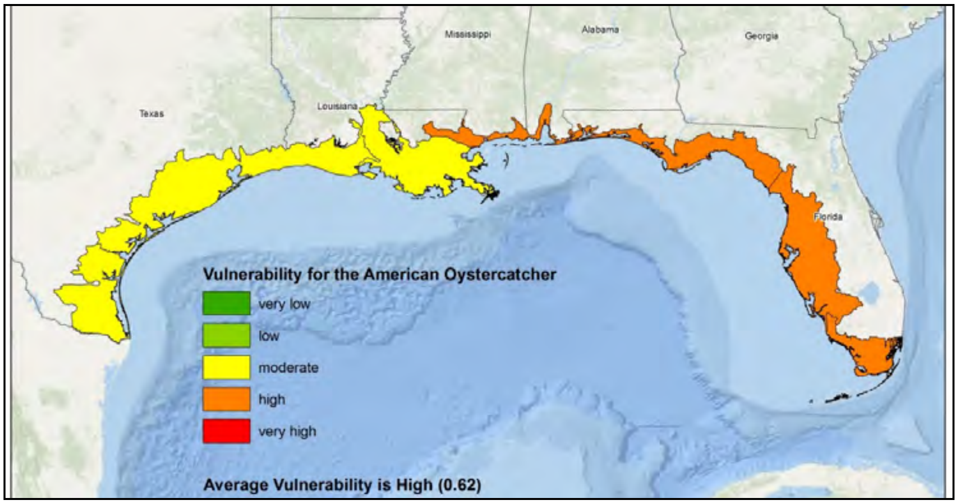


Figure 7.26. Vulnerability of American Oystercatcher

3. Black Skimmer (Fig. 7.27)

Black Skimmers were judged to be highly vulnerable in the Southern Coastal Plain of eastern Louisiana. The most serious threats were low adaptive capacity, SLR, storm surge and runoff, synergistic effects of climate change, SLR and urbanization, and changes to the natural disturbance regime.

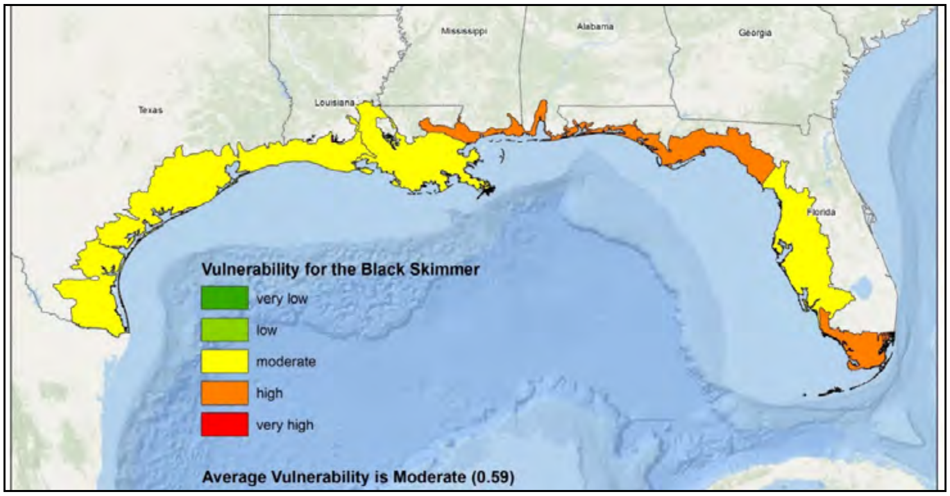


Figure 7.27. Vulnerability of Black Skimmer

4. Wilson's Plover (Fig. 7.28)

Wilson's Plovers were judged to be highly vulnerable in the Southern Coastal Plain of eastern Louisiana. The most serious threats were judged to be loss of habitat to SLR, impacts from storm surge and runoff, synergistic effects of climate change, SLR and urbanization, and changes to the natural disturbance regime.

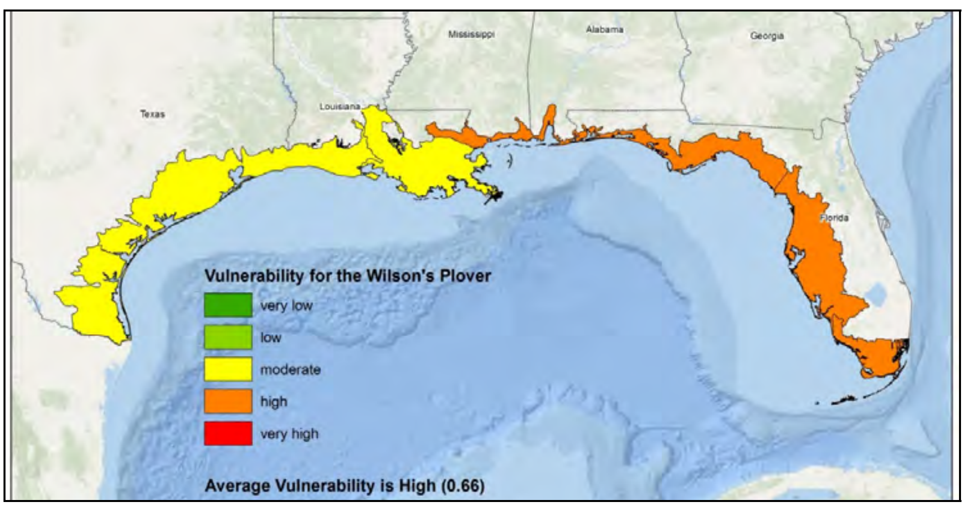


Figure 7.28. Vulnerability of Wilson's Plover

d. Intended Use of the GCVA

The GCVA was intended to be used in the following ways:

- Allow for regional coordination of adaptive management plans with the potential to maximize the efficacy of limited conservation funding;

- Focus management actions to address the most vulnerable species and ecosystems and identify the threats to such species and ecosystems;
- Inform state actions (e.g., WAPs) and link state action with regional conservation efforts;
- Identify research gaps.

4. Evaluation of Regional Sea Level Affecting Marshes Model (SLAMM)

The Gulf Coast Prairie Landscape Conservation Cooperative (GCPLCC) funded the Evaluation of Regional Sea Level Affecting Marshes Model (SLAMM) project. The main objectives were to generate a "seamless set of landcover projections for the Gulf of Mexico coast using SLAMM" and to conduct a focal species analysis using SLAMM results (Clough 2015). The principle investigator was Jonathan Clough of Warren Pinnacle Consulting, Inc.

a. Gulf-Wide SLAMM Summary

The project was comprised of 25 study areas across the Gulf of Mexico. Louisiana-specific model results were derived for two study areas, the Mississippi and Eastern Louisiana study area and the Louisiana Chenier Plain study area. SLAMM results were presented as Gulf-wide percent change in each land cover category (i.e., habitat type) over time and for each SLR scenario (0.5m, 1.0m, 1.2m, 1.5m, and 2.0m).

SLAMM predictions for irregularly-flooded marsh (i.e., high marsh) and estuarine beach indicated that these habitats were extremely vulnerable, with significant losses predicted by the year 2100 under all SLR scenarios (Clough 2015).

b. Focal Species Results

1. Seaside Sparrow

The Seaside Sparrow's habitat was considered to be regularly flooded marsh and irregularly flooded marsh areas with patches that were 10,000 acres or more in areal extent. Gulf-wide, the total combined habitat patch area dramatically decreases (~50%) by 2100 for all but the 0.5m SLR scenario (Fig. 7.29, Clough 2015).

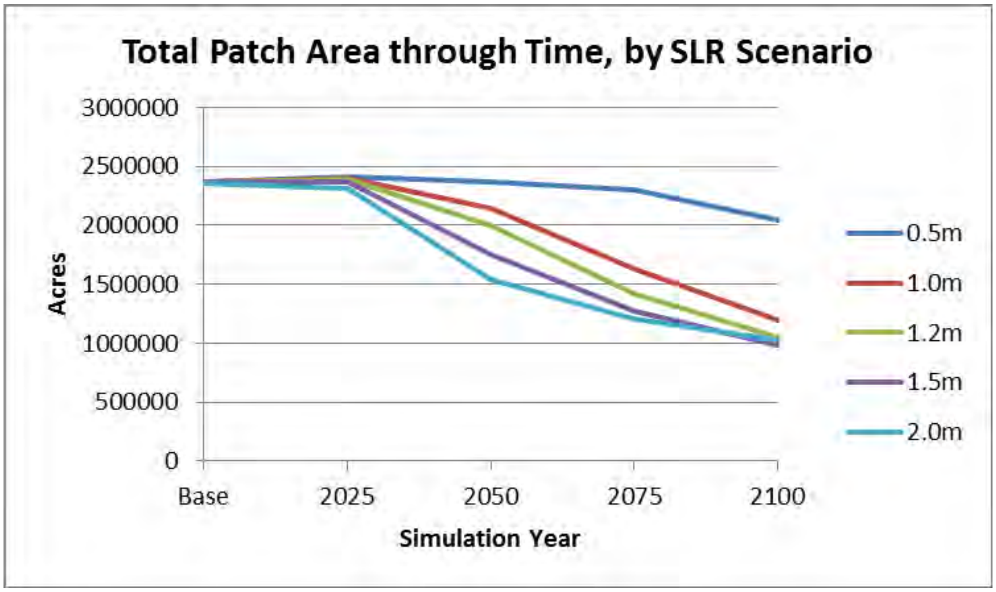


Figure 7.29. Trends in total area of all Seaside Sparrow habitat patches through time, by SLR scenario.

2. Mottled Duck

Mottled Duck habitat was considered to be inland fresh marsh, inland open water, non-salt estuarine marsh (comprising tidal fresh marsh, transitional marsh / scrub shrub, and irregularly flooded marsh areas), and estuarine open water. Mottled Duck habitat analyses were restricted to tidally-influenced classes so as to detect impacts from SLR. For the states of Texas, Louisiana, Mississippi and Alabama, the total patch area of non-salt estuarine marsh dramatically decreases (~50%) by 2100 for all but the 0.5m SLR scenario (Clough 2015). Conversely, the total patch area of estuarine open water showed moderate increases of 14-41% by 2100 depending on scenario (Clough 2015). The increases in open water habitat were attributed to the loss of estuarine beach, tidal flat and tidal marsh at lower elevations (Fig. 7.30, Clough 2015).

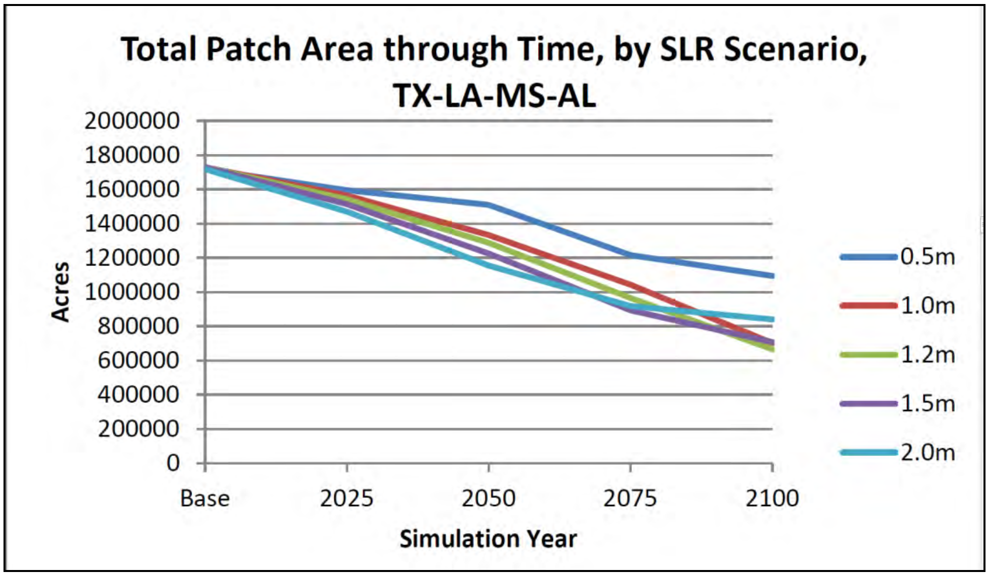


Figure 7.30. Trends in total area of Mottled Duck non-salt estuarine marsh habitat patches in the TX-LA-MS-AL region through time, by SLR scenario.

3. Black Skimmer

The Black Skimmer's habitat was considered to be estuarine beach and ocean beach areas. Gulf-wide, the trends in total patch area through time were "all negative and substantial," and corresponded in magnitude with the amount of SLR (Clough 2015). Habitat losses by 2100 ranged from 34-84% depending on the scenario (Fig. 7.31, Clough 2015).

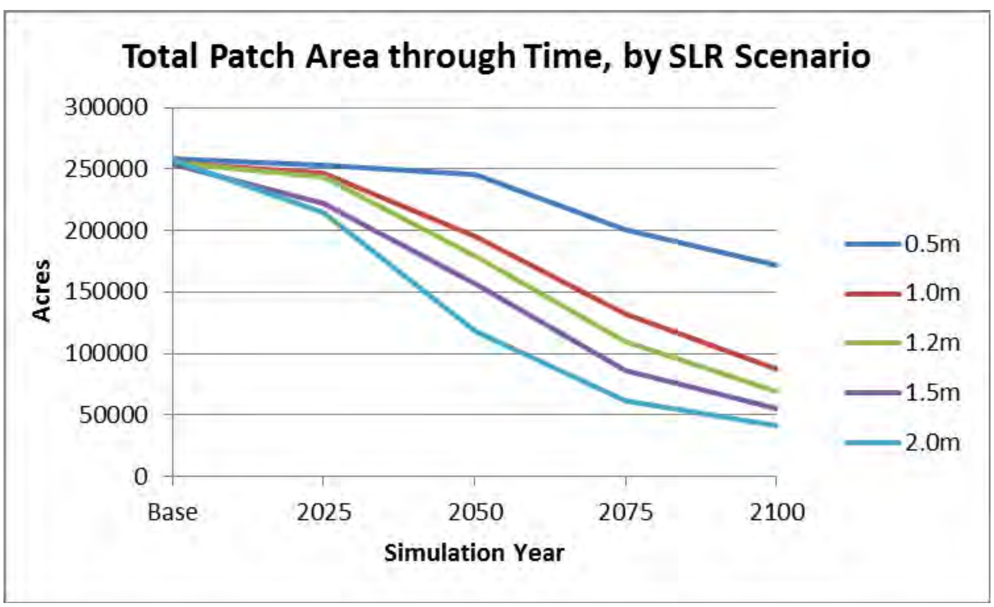


Figure 7.31. Trends in total area of all Black Skimmer beach habitat patches through time, by SLR scenario.

c. Intended Uses

The Evaluation of Regional SLAMM project is intended to provide a Gulf-wide perspective. The model predictions, such as marsh loss and conversion, may be used by state and federal policymakers and planners to determine proper adaptation strategies and to inform conservation efforts and land-use management.

D. 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 discussed, the GCVA found tidal emergent marsh, oyster reef and Barrier Islands highly vulnerable across Louisiana (Watson et al. 2015). Furthermore, SLAMM modeling reported that irregularly-flooded marsh (i.e., high marsh) and estuarine beach habitats were extremely vulnerable Gulf-wide (Clough 2015). Other sources have found that 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 SLR, 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-Blackgum 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 Flatwoods 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 earlier, 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 of 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 and associated habitats such as Cypress-Tupelo-Blackgum Swamps. Such intrusion can lead to significant mortality of freshwater-adapted vegetation and greatly reduce the value of such habitats to fish and wildlife.

E. Louisiana’s Climate Change Adaptation Strategy for SGCN and 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 which 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 major goals for climate change adaptation (Table 7.12), which will provide a framework for Louisiana’s adaptation strategy. Each of these seven goals is consistent with the overall goals and objectives of the Louisiana WAP. Below is a brief discussion of each of the seven goals from the *Strategy*, including how each goal fits into the overall purpose of the WAP. It should be noted that each of the seven 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 7.12. Crosswalk between the seven 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

Goal 1. Conserve habitat to support healthy, fish, wildlife, and plant populations and ecosystem functions in a changing climate:

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 and refinement 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.

Goal 2. Manage species and habitats to protect ecosystem functions and provide sustainable cultural, subsistence, recreational, and commercial use in a changing climate.

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 and 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. Furthermore, the climate change vulnerability scores may be used to prioritize SGCN in the future, as those that are more vulnerable to the impacts of climate change may require earlier or more substantial efforts to prevent population declines.

Goal 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 Joint Ventures (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 expanded upon.

Goal 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 (DSTs) will help with developing adaptive management strategies to adjust to changing conditions. The continuation and expansion of current wildlife monitoring programs (e.g., United States Geological Survey (USGS) Breeding Bird Surveys (BBS), Louisiana Amphibian Monitoring Program (LAMP), etc.) will be valuable in detecting any changes that may occur due to climate change. The development and use of DSTs, such as the East Gulf Coastal Plain JV (EGCPJV) Open

Pine DST, and the GCPLCC Mottled Duck DST 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 DSTs and other decision making processes. Finally, the success or failure of all conservation actions and planning efforts should be used to inform future actions.

Goal 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.

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 LCCs and JVs.

Goal 7. Reduce non-climate stressors to help fish, wildlife, plants, and ecosystems adapt to a changing climate.

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 or have identified as needs in Louisiana to benefit SGCN and their habitats (see Chapters 4 and 5 for detailed lists of such needs). 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. Programs such as those administered by the Natural Resource Conservation

Service (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 to assist resource managers in attaining each of the seven goals. As many of those actions are consistent with the habitat and species conservation actions presented earlier in the WAP, similar detail will not be presented here. Also, implementing those actions in Chapters 4 and 5 of the Louisiana WAP will be of great benefit to Louisiana SGCN and their habitats, even if climate change does not occur at the rate or in the manner in which it is currently projected.

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CHAPTER 8. CONSERVATION OPPORTUNITY AREAS

A. Conservation Opportunity Areas Need and Overview

With 345 animal Species of Greatest Conservation Need (SGCN) in Louisiana and finite time and resources for the conservation of SGCN and the habitats they require, a growing need exists to focus conservation action where it can have the greatest impact. For that reason, the 2015 Wildlife Action Plan (WAP) identifies priority areas for the conservation of Louisiana's SGCN based primarily on SGCN richness and habitat diversity. These exceptionally diverse areas are known as Conservation Opportunity Areas (COAs).

Conservation Opportunity Areas are geographies within Louisiana that have been identified as uniquely important for the conservation of SGCN. Conservation actions within these COAs will benefit many SGCN, often across taxa and habitats. The COAs presented in this chapter represent those areas where, all else being equal, conservation funding and other resources should be allocated to have the most significant impact on SGCN. COAS are an addition to, rather than a replacement of, other landscape-scale conservation planning efforts such as those undertaken by Joint Ventures (JVs) and Landscape Conservation Cooperatives (LCCs). The COA approach adds a unique layer to such efforts: a focus on SGCN as identified in the WAP. COAs vary greatly in size and landscape composition, and each may have specific threats, conservation needs, and conservation actions.

The COAs identified in this WAP afford the Louisiana Department of Wildlife and Fisheries (LDWF) and partners some of the best opportunities for SGCN conservation, research, and monitoring. However, conservation actions carried out in other areas of the state are not devalued by this methodology. In fact, not all SGCN and associated habitats are represented by these COAs, and for those that are, actions within COA boundaries alone may not be sufficient to ensure their persistence. Therefore, to fully meet the objectives of the Louisiana WAP, a degree of flexibility and opportunism must be retained, along with a willingness to modify priorities as new threats, issues, and opportunities arise. No regulatory aspect exists for COAs, and all conservation actions by private landowners or other partners are strictly voluntary. Land use or other activities will not be altered or restricted as a result of COA designation.

B. Identifying COAs

As COAs are intended to enhance our ability to conserve SGCN and their habitats, the distribution of SGCN was the primary factor used in the identification of COAs. Distribution was mapped using Louisiana Department of Environmental Quality (LDEQ) subbasins.

The process of identifying COAs was a multi-tiered Geographic Information System (GIS) based approach in which multiple data layers were compiled and considered by an LDWF committee tasked with the initial delineation of COAs. The layers used to produce a draft layer of COAs were:

1) Priority Level 1[1] subbasins based on the predicted distribution of all S1, S2, and S3 SGCN.

2) Priority Level 1 + Priority Level 2 subbasins based on predicted distribution of S1, S2, and S3 SGCN.

3) Priority Level 1 + Priority Level 2 + Priority Level 3 subbasins based on predicted distribution of S1, S2, and S3 SGCN.

4) Priority Level 1 subbasins based on the distribution of all S1, S2, and S3 natural communities.

5) Priority Level 1 + Priority Level 2 subbasins based on predicted distribution of S1, S2, and S3 natural communities.

6) Priority Level 1 + Priority Level 2 + Priority Level 3 subbasins based on predicted distribution of S1, S2, and S3 natural communities.

7) Location of existing conservation lands and Louisiana Natural & Scenic Rivers.

8) Stream segments that are of very high quality for fish and wildlife propagation based on Louisiana Department of Environmental Quality (LDEQ) water quality data (LDEQ 2012).

These layers were each set to 90% transparency and overlain on each other in a GIS. Those areas where the most layers overlapped (i.e., greatest color density) were delineated and polygons created. These polygons were then assigned to one of five levels, based on visual classification of relative color density. Using the 2011 National Landcover Database (NLCD), heavily urbanized areas were removed from these polygons, as such areas are not of current value to SGCN, and are unlikely to be cost effective targets for restoration activity.

Thirty-eight potential COAs were identified using the aforementioned approach. These 38 potential COAs were placed into two Tiers, with those areas in the three highest color density levels comprising Tier 1, and the next two levels placed in Tier 2. Those COAs in Tier 1 are of higher priority for conservation action than are Tier 2 COAs, all else being equal.

This list of potential COAs was then refined by the committee, to a final list of 30 draft COAs (Table 8.1). Other factors considered while refining the list of draft COAs included predicted increases in urbanization as well as Sea Level Rise (SLR) projections. Future iterations of Louisiana COAs will endeavor to narrow the focus beyond this initial effort and refine the COAs further based on additional factors such as land use and

[1] For the predicted distribution of SGCN, Element Occurrence Records (EORs), historical distribution information, and expert opinion were used to create range maps, using LDEQ sub-basins, which are similar in scale to HUC 10s.
For more information on subbasin level distribution modelling of SGCN, including a description of the different Priority Levels that were used, see Chapter 3.

current vegetative cover. For adjacent areas that were within the same Tier, biological similarity was used to lump or split the areas. Based on the Sorenson-Dice Coefficient, areas showing 75% or greater similarity in SGCN were lumped.

The conservation needs and actions listed for each subset of COAs were developed by LDWF and reviewed by conservation partners. However, priority conservation needs and actions may change or emerge over time.

Another important factor in identifying and planning for COAs is the presence of existing or potential conservation partners. The Louisiana WAP is intended to be a blueprint for the conservation of SGCN and their habitats, and the ambitious goals of the WAP cannot be achieved by LDWF alone. Conservation Opportunity Areas provide another tool for resource managers to determine new opportunities for conservation or to add value to already planned or existing efforts.

C. Louisiana COAs

The 30 COAs detailed below cover a broad range of habitats and span the state. Each ecoregion in the state contains multiple COAs, and the ecoregions are used to group the COAs for discussion below. For each ecoregion, priority conservation actions are identified, as well as current or potential key conservation partners[2]. Lists of priority habitats and SGCN are provided for each COA below. For SGCN, these lists are not exhaustive, but represent those species for which a COA is of particular importance (e.g., a species with a limited distribution) as well as SGCN that will serve as “umbrella” species (i.e., actions to benefit that species will benefit many others). An exception to this methodology was the identification of priority bird SGCN. Birds presented a set of unique challenges, and an alternate methodology was developed. This was a two-step process, where (1) a list of priority SGCN was developed for each ecoregion, and (2) those species were listed for each COA as deemed appropriate.

These conservation actions, habitats and SGCN represent a snapshot of priorities as identified by LDWF and partners during the revision process, and it is expected that priorities will evolve over the next ten years. The LDWF COA Committee greatly appreciates input on conservation needs and welcomes comment from Louisiana conservation stakeholders. For additional detail on research needs and conservation actions for SGCN and the priority habitats listed below, refer to Chapters 4 and 5, respectively.

[2] Note that the lists of key partners for each ecoregion’s COAs include only those partners that are specific to that ecoregion. Partners that LDWF works with on a statewide level are not necessarily listed, unless there is a particular emphasis on partnering with that entity in that ecoregion.

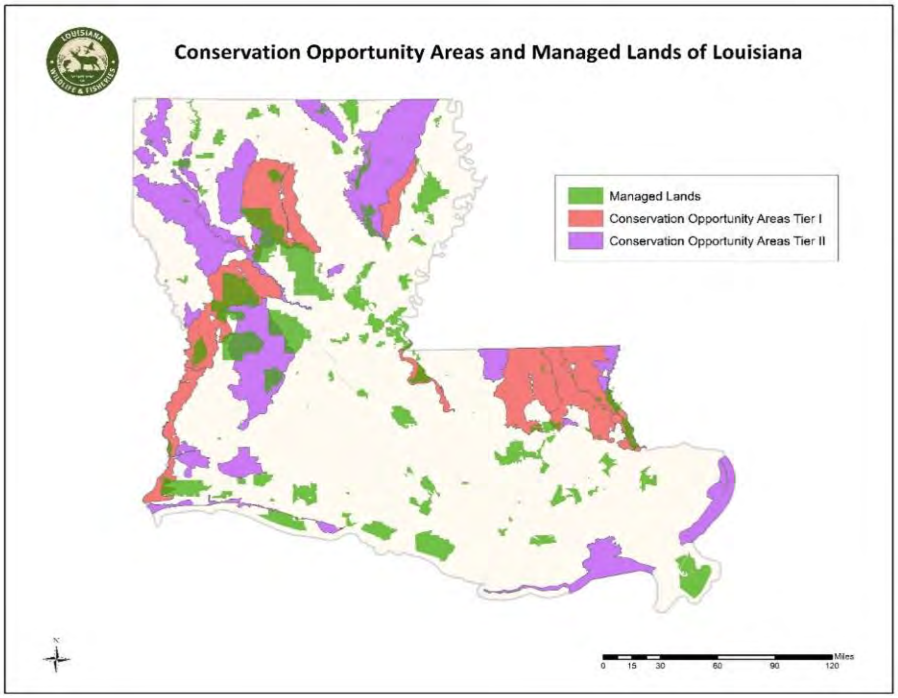

Figure 8.1 – COAs by Tier, along with managed lands located throughout Louisiana. The managed lands include LDWF WMAs and Refuges, Louisiana State Parks, USFWS Wildlife Refuges, USFS property, DOD lands, and TNC properties.

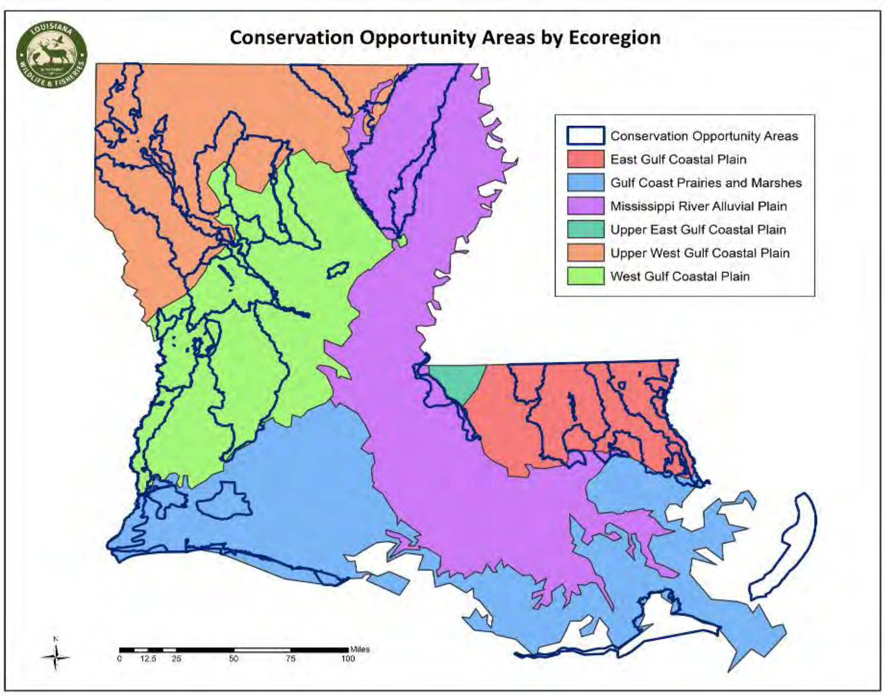

Figure 8.2 – Overview of Louisiana COA distribution relative to ecoregions

Table 8.1 – Louisiana COAs by Ecoregion and Tier, with acreage.

COA	Tier	Ecoregion	Acreage
Bogue Chitto	1	EGCP	365,896
Holmes Bayou	1	EGCP	48,230
Tchefuncte River-Northshore	1	EGCP	429,658
Tickfaw-Tangipahoa	1	EGCP	644,396
Madisonville Marsh	2	EGCP	12,569
Pearl River	2	EGCP	93,941
Upper Amite River	2	EGCP	131,095
Little Lake	1	GCPM	6,674
Barataria-Terrebonne	2	GCPM	360,298
Calcasieu Prairie	2	GCPM	147,783
Chandeleurs	2	GCPM	276,048
Chenier	2	GCPM	102,424
Sabine Prairie	2	GCPM	108,407
Richland-Franklin	1	MRAP	178,969
Tunica	1	MRAP	110,934
Ouachita	2	MRAP	1,079,020
Bodcau	2	UWGCP	58,586
Boggy Bayou	2	UWGCP	626,300
Caddo-Bossier	2	UWGCP	220,678
Kepler	2	UWGCP	333,722
Red River	2	UWGCP	166,300
Union	2	UWGCP	160,725
Dugdemona River	1	WGCP	758,240
Kisatchie Bayou-Anacoco	1	WGCP	786,638
Sabine River	1	WGCP	319,652
St. Maurice	1	WGCP	32,451
Bayou Toro	2	WGCP	38,047
Calcasieu River	2	WGCP	937,997
LaSalle	2	WGCP	20,822
Saline Lake	2	WGCP	68,956

1. **East Gulf Coastal Plain Ecoregion COAs**

Seven COAs are located in the East Gulf Coastal Plain ecoregion (EGCP, Fig. 8.3), the second highest number in any of Louisiana's ecoregions. This reflects the large number of rare species in the EGCP, many of which are found nowhere else in the state. Consequently, four of the COAs in the EGCP are Tier 1 COAs (Table 8.1). Little overlap exists between the COAs in this ecoregion and existing conservation lands, and consequently the acquisition of land from willing sellers as well as habitat management on private lands are critical needs for these COAs.

Priority Conservation Needs/Actions

- Land protection/acquisition/management, particularly of Longleaf Pine habitat
- Prescribed burning initiatives, with an emphasis on private lands
- Streamside zone management, including retention of riparian buffers
- Longleaf Pine restoration and management
- Stream and river conservation, including sandbar protection and retention of woody debris and snags in-stream
- Maintenance of in-stream flow at adequate levels for aquatic SGCN
- Hydrological restoration of forested wetlands

Key Conservation Partners

- East Gulf Coastal Plain Joint Venture (EGCPJV)
- Gulf Coastal Plains & Ozarks Landscape Conservation Cooperative (GCPOLCC)
- Gopher Tortoise Council (GTC)
- Lake Pontchartrain Basin Foundation (LPBF)
- Longleaf Alliance
- Louisiana Department of Agriculture and Forestry (LDAF)
- Louisiana Department of Natural Resources (LDNR)
- Louisiana Department of Environmental Quality (LDEQ)
- Louisiana Forestry Association (LFA)
- Louisiana Office of State Parks (LOSP)
- Louisiana Prescribed Fire Council (LPFC)
- Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP)
- National Wild Turkey Federation (NWTF)
- Parish Governments
- The Nature Conservancy (TNC)
- Timber Investment Management Organizations (TIMOs)
- U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS)
- United States Army Corps of Engineers (USACE)
- United States Fish and Wildlife Service (USFWS)
- Wetland Mitigation Bank Sponsors & Interagency Review Team (IRT)

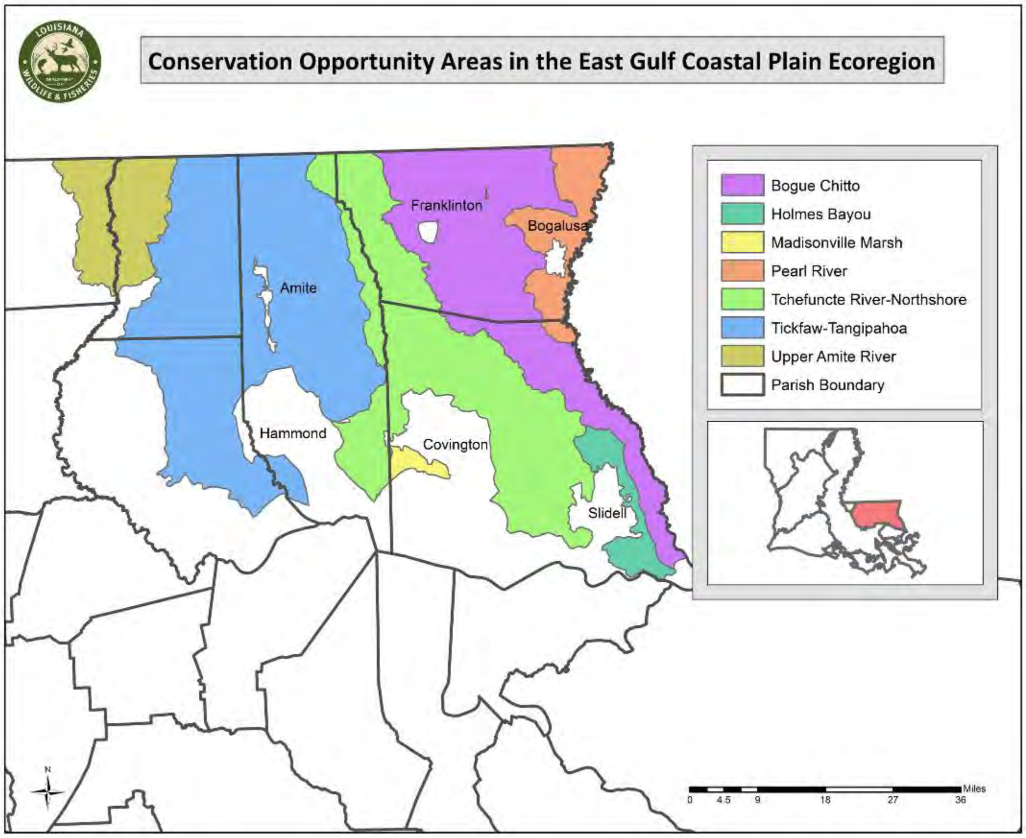

Figure 8.3 – COAs in the EGCP Ecoregion

a. Bogue Chitto COA

1. Focal Habitats

Bayhead Swamp	Eastern Upland Longleaf Pine Woodland
Bottomland Hardwood Forest	Xeric Sandhill Woodland
Cypress-Tupelo-Blackgum Swamp	Eastern Hillside Seepage Bog
Small Stream Forest	Sandbars
Eastern Longleaf Pine Flatwoods Savanna	

2. Focal SGCN

Gulf Crawfish	Pearl River Map Turtle
Ribbon Crawfish	Stripe-necked Musk Turtle
Pearl Blackwater Crawfish	Gopher Tortoise
Flatwoods Digger	Northern Bobwhite
Gulf Sturgeon	Swallow-tailed Kite
Longjaw Minnow	Common Ground-Dove
Flagfin Shiner	Red-cockaded Woodpecker
Bluenose Shiner	Southeastern American Kestrel
Southeastern Blue Sucker	Worm-eating Warbler
River Redhorse	Louisiana Waterthrush
Frecklebelly Madtom	Prothonotary Warbler
Channel Darter	Swainson’s Warbler

Freckled Darter	Bachman's Sparrow
Dusky Gopher Frog	Henslow's Sparrow
Ringed Map Turtle	

b. Holmes Bayou COA

1. *Focal Habitats*

Cypress-Tupelo-Blackgum Swamp	Intermediate Marsh

2. *Focal SGCN*

Gulf Crawfish	Southeastern Blue Sucker
Flatwoods Digger	River Redhorse
Gulf Sturgeon	Frecklebelly Madtom
Flagfin Shiner	Swallow-tailed Kite
Bluenose Shiner	West Indian Manatee

c. Madisonville Marsh COA

1. *Focal Habitats*

Cypress-Tupelo-Blackgum Swamp	Estuarine Submersed Aquatic Vegetation
Intermediate Marsh	

2. *Focal SGCN*

Gulf Sturgeon	West Indian Manatee

d. Pearl River COA

1. *Focal Habitats*

Bayhead Swamp	Eastern Upland Longleaf Pine Woodland
Bottomland Hardwood Forest	Xeric Sandhill Woodland
Cypress-Tupelo-Blackgum Swamp	Eastern Hillside Seepage Bog
Small Stream Forest	Sandbar
Eastern Longleaf Pine Flatwoods Savanna	

2. *Focal SGCN*

White Heelsplitter	Ringed Map Turtle
Black Sandshell	Pearl River Map Turtle
Ribbon Crawfish	Stripe-necked Musk Turtle
Pearl Blackwater Crawfish	Gopher Tortoise

Gulf Sturgeon	Northern Bobwhite
Paddlefish	Swallow-tailed Kite
Longjaw Minnow	Common Ground-Dove
Flagfin Shiner	Red-cockaded Woodpecker
Bluenose Shiner	Southeastern American Kestrel
Southeastern Blue Sucker	Prothonotary Warbler
River Redhorse	Swainson's Warbler
Frecklebelly Madtom	Bachman's Sparrow
Channel Darter	Henslow's Sparrow
Freckled Darter	

e. Tchefuncte River-Northshore COA

1. Focal Habitats

Bayhead Swamp	Eastern Upland Longleaf Pine Woodland
Bottomland Hardwood Forest	Slash Pine-Pondcypress-Hardwood Woodland
Cypress-Tupelo-Blackgum Swamp	Eastern Hillside Seepage Bog
Small Stream Forest	Intermediate Marsh
Eastern Longleaf Pine Flatwoods Savanna	Sandbars

2. Focal SGCN

Elephant-Ear	Common Ground-Dove
Gulf Crawfish	Red-cockaded Woodpecker
Flatwoods Digger	Southeastern American Kestrel
Gulf Sturgeon	Prothonotary Warbler
Flagfin Shiner	Swainson's Warbler
Dusky Gopher Frog	Bachman's Sparrow
Gopher Tortoise	Henslow's Sparrow
Northern Bobwhite	West Indian Manatee
Swallow-tailed Kite	

f. Tickfaw-Tangipahoa COA

1. Focal Habitats

Cypress-Tupelo-Blackgum Swamp	Eastern Longleaf Pine Flatwoods Savanna
Small Stream Forest	Eastern Upland Longleaf Pine Woodland
Spruce-Pine Hardwood Flatwoods	Shortleaf Pine-Oak-Hickory Woodland

2. *Focal SGCN*

Florida Harvester Ant	Red-cockaded Woodpecker
Gulf Sturgeon	Southeastern American Kestrel
Broadstripe Topminnow	Prothonotary Warbler
Gopher Tortoise	Swainson's Warbler
Northern Bobwhite	Bachman's Sparrow
Common Ground-Dove	

g. Upper Amite River COA

1. Focal Habitats

Bottomland Hardwood Forest	Southern Mesophytic Forest
Small Stream Forest	Shortleaf Pine-Oak-Hickory Woodland

2. *Focal SGCN*

Inflated Heelsplitter	Common Rainbow Snake
Flagfin Shiner	Northern Bobwhite
Gulf Logperch	Worm-eating Warbler
Four-toed Salamander	Louisiana Waterthrush
Eastern Spadefoot	

2. **Gulf Coast Prairies and Marshes Ecoregion COAs**

There are six COAs in the Gulf Coast Prairies and Marshes ecoregion (GCPM, Fig. 8.4 and 8.5), one of which is a Tier 1 COA. The majority of the COAs in this ecoregion include a unique or restricted habitat and are critical for the conservation of that habitat. This ecoregion's COAs include some of Louisiana's most unique and valuable natural communities, despite the fact that most are Tier 2. Among the most critical conservation needs in this ecoregion is the protection and restoration of rare and restricted habitats such as Barrier Islands, Coastal Prairies, and Cheniers.

Priority Conservation Needs/Actions

- Land protection/acquisition/management, particularly of Coastal Prairie and Cheniers
- Coastal Prairie restoration
- Barrier Island restoration
- Chenier restoration/creation
- Beneficial use of dredge material
- Marine Seagrass Bed conservation/restoration

Key Conservation Partners

- Barataria-Terrebonne National Estuary Program (BTNEP)
- Coastal Plain Conservancy
- Coastal Prairie Partnership
- Coastal Protection and Restoration Authority (CPRA)
- Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA)
- Ducks Unlimited (DU)
- U.S. Environmental Protection Agency (EPA)
- Gulf Coast Joint Venture (GCJV)
- Gulf Coast Prairie Landscape Conservation Cooperative (GCPLCC)
- Longleaf Alliance
- LDNR
- Louisiana Environmental Research Center
- Louisiana Native Plant Society (LNPS)
- National Audubon Society/Louisiana Audubon
- TNC
- USACE
- USFWS
- USGS
- Wetland Mitigation Bank Sponsors & IRT

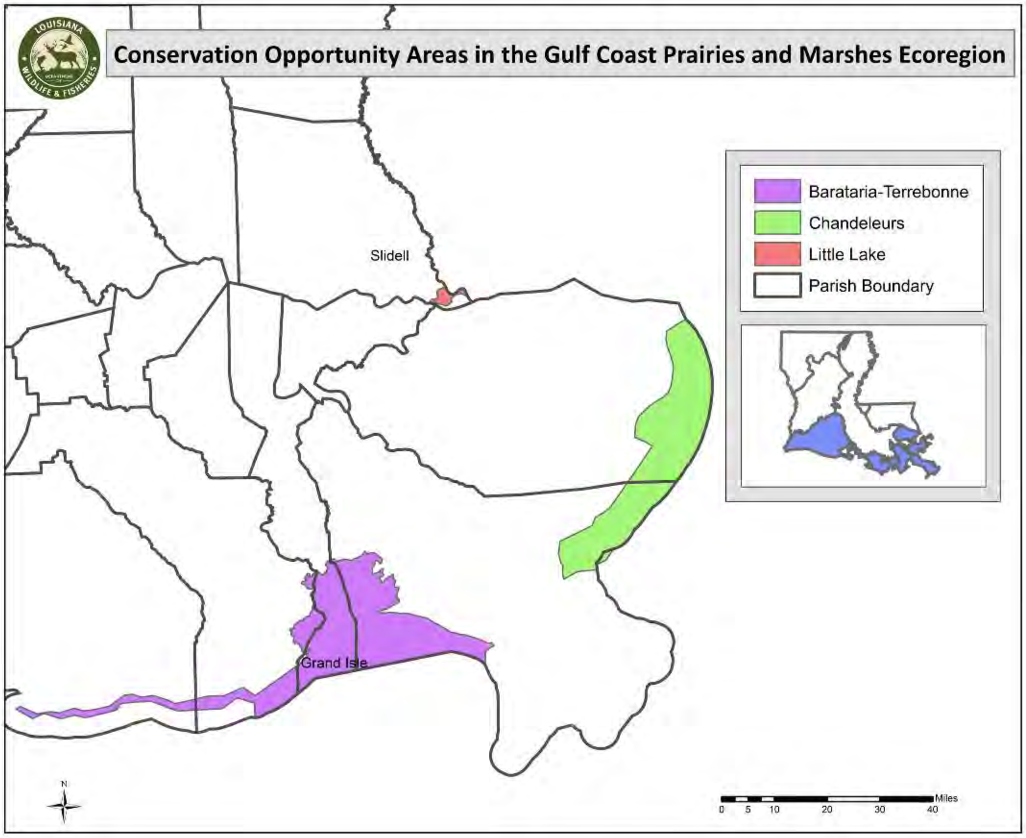

Figure 8.4 – COAs in the Eastern GCPM Ecoregion

a. Barataria-Terrebonne COA

1. Focal Habitats

Barrier Island Live Oak Forest	Louisiana Beach
Coastal Live Oak-Hackberry Forest	Salt Marsh
Coastal Mangrove-Marsh-Shrubland	Barrier Island
Coastal Dune Shrub Thicket	

2. Focal SGCN

Louisiana Eyed Silkmoth	Black Skimmer
Diamond Killifish	Chuck-will's-widow
Bayou Killifish	Yellow-throated Vireo
Kemp's Ridley Sea Turtle	Warbling Vireo
Mississippi Diamond-backed Terrapin	Wood Thrush
Eastern Glass Lizard	Worm-eating Warbler
Gulf Saltmarsh Snake	Louisiana Waterthrush
Mottled Duck	Golden-winged Warbler
Brown Pelican	Prothonotary Warbler
Reddish Egret	Swainson's Warbler
Snowy Plover	Kentucky Warbler
Wilson's Plover	Hooded Warbler
Piping Plover	Cerulean Warbler

American Oystercatcher	Prairie Warbler
Red Knot	Yellow-throated Warbler
Coastal Least Tern	Nelson’s Sparrow
Forster’s Tern	Seaside Sparrow
Royal Tern	Painted Bunting
Sandwich Tern	Dickcissel

b. Chandeleurs COA

1. Focal Habitats

Coastal Mangrove-Marsh-Shrublands	Marine Seagrass Bed
Louisiana Beach	Barrier Island

2. *Focal SGCN*

Bay Scallop	Snowy Plover
Sawtooth Penshell	Wilson’s Plover
Half-naked Penshell	Piping Plover
Channeled Whelk	American Oystercatcher
Lightning Whelk	Red Knot
Gulf Sturgeon	Sooty Tern
Lemon Shark	Gull-billed Tern
Loggerhead Sea Turtle	Caspian Tern
Kemp’s Ridley Sea Turtle	Common Tern
Redhead	Black Skimmer
Brown Pelican	West Indian Manatee
Reddish Egret	

c. Little Lake COA

1. Focal Habitats

Intermediate Marsh	Salt Marsh

2. Focal SGCN

Saltmarsh Topminnow	Seaside Sparrow
Mottled Duck	West Indian Manatee
Nelson’s Sparrow	

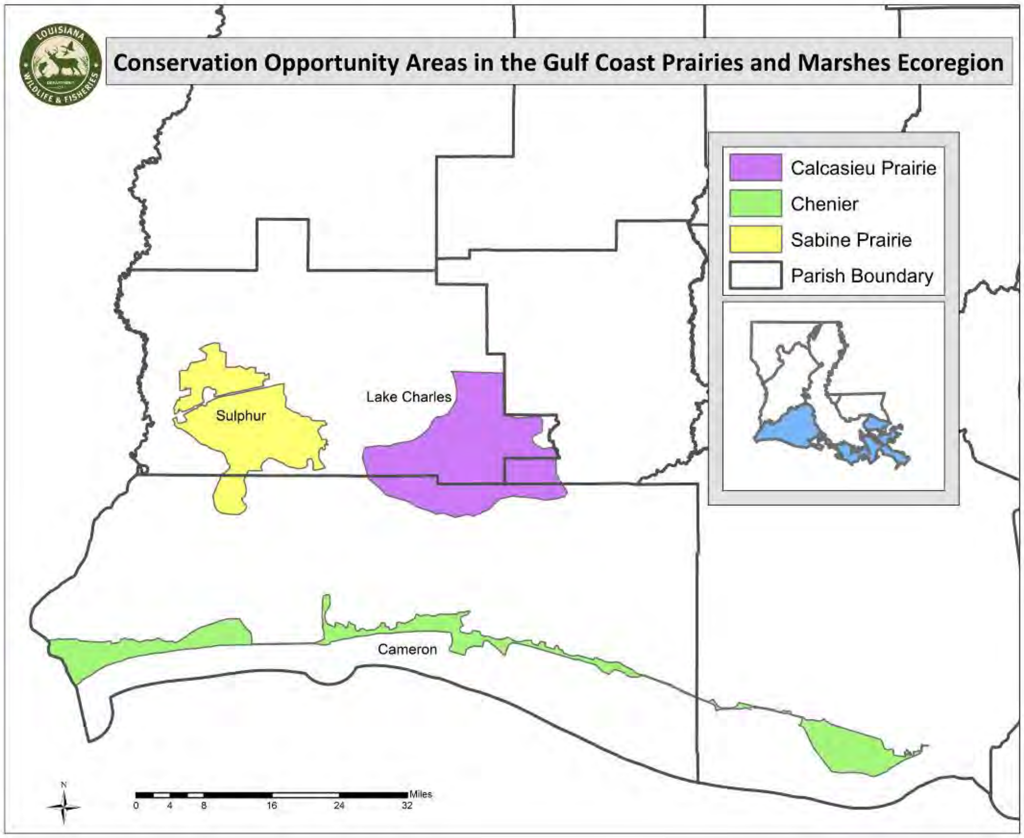

Figure 8.5 – COAs in the Western GCPM Ecoregion

d. Calcasieu Prairie & Sabine Prairie COAs

1. Focal Habitat

Coastal Prairie	Prairie Pothole

2. Focal SGCN

Celia's Roadside Skipper	Hudsonian Godwit
Old Prairie Digger	Buff-breasted Sandpiper
Southern Crawfish Frog	Short-eared Owl
Ornate Box Turtle	Crested Caracara
Mottled Duck	Loggerhead Shrike
Northern Bobwhite	Sprague's Pipit
American Bittern	Grasshopper Sparrow
White-tailed Kite	Le Conte's Sparrow
Yellow Rail	Nelson's Sparrow
King Rail	Dickcissel
Sandhill Crane	Eastern Spotted Skunk
Upland Sandpiper	

e. Chenier COA

1. Focal Habitat

Coastal Live Oak-Hackberry Forest	

2. Focal SGCN

Celia’s Roadside Skipper	Prothonotary Warbler
Falcate Orangetip	Swainson’s Warbler
Western Slender Glass Lizard	Kentucky Warbler
Chuck-Will’s-Widow	Hooded Warbler
Yellow-throated Vireo	Cerulean Warbler
Warbling Vireo	Prairie Warbler
Wood Thrush	Yellow-throated Warbler
Worm-eating Warbler	Painted Bunting
Louisiana Waterthrush	Dickcissel
Golden-winged Warbler	

3. **West Gulf Coastal Plain Ecoregion COAs**

There are eight COAs in the West Gulf Coastal Plain ecoregion (WGCP, Fig. 8.6), four of which are Tier 1 COAs. Many of the COAs in this ecoregion have a large open-pine habitat component and are important for some of the most critically imperiled SGCN in the state, such as the Louisiana Pinesnake and Red-cockaded Woodpecker. Proper management of Longleaf Pine habitats, including the appropriately timed application of prescribed fire, is vital to the conservation of SGCN in this ecoregion.

Priority Conservation Needs/Actions

- Land protection/acquisition/management, particularly of Longleaf and Shortleaf Pine habitats
- Prescribed burning initiatives for private and public lands
- Sandbar conservation and restoration
- Maintenance of in-stream flow at adequate levels for aquatic SGCN
- Streamside zone management and riparian habitat restoration
- Longleaf and Shortleaf Pine restoration and management

Key Conservation Partners

- Coastal Plain Conservancy
- Department of Defense (DOD - Ft. Polk)
- GCPOLCC
- Longleaf Alliance
- LDAF
- LDEQ
- LFA
- LOSP
- Lower Mississippi Valley Joint Venture (LMVJV)
- NWTF
- Sabine River Authority (SRA)
- Texas-Louisiana Longleaf Taskforce
- Texas Parks and Wildlife Department (TPWD)
- TNC
- TIMOs
- United States Forest Service (USFS)
- USFWS
- West Gulf Coast Longleaf Ecosystem Partnership
- Wetland Mitigation Bank Sponsors and IRT

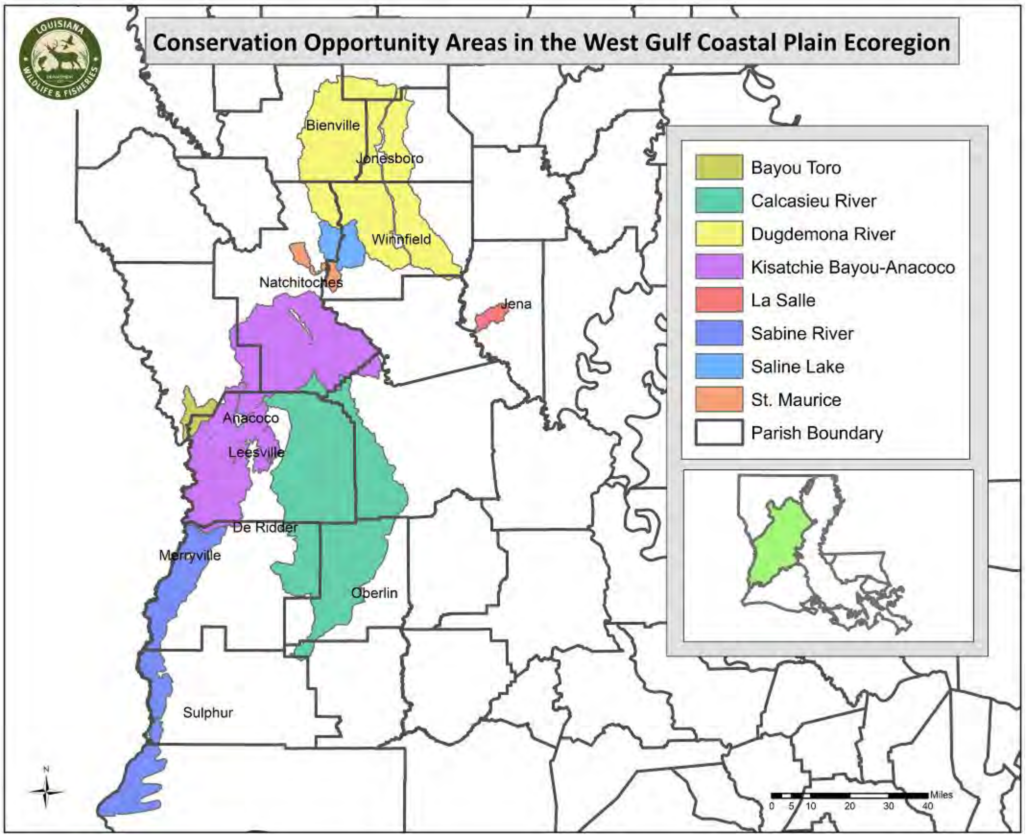

Figure 8.6 – COAs in the WGCP Ecoregion

a. Bayou Toro COA

1. Focal Habitats

Bayhead Swamp	Hardwood Slope Forest
Western Upland Longleaf Pine Woodland	Xeric Sandhill Woodland

2. Focal SGCN

Texas Heelsplitter	Bigscale Logperch
Texas Brown Tarantula	Northern Bobwhite
Southwestern Creek Crawfish	Chuck-will's-widow
Suckermouth Minnow	Bachman's Sparrow
Western Sand Darter	Hispid Pocket Mouse

b. Calcasieu River COA

1. Focal Habitats

Bayhead Swamp	Western Upland Longleaf Pine Woodland
Hardwood Slope Forest	Western Hillside Seepage Bog

Small Stream Forest	WGCP Flatwoods Pond
Western Longleaf Pine Flatwoods Savanna	

2. Focal SGCN

Yellow Brachycercus Mayfly	Red-cockaded Woodpecker
Calcasieu Painted Crawfish	White-breasted Nuthatch
Gumbo Darter	Worm-eating Warbler
Bigscale Logperch	Louisiana Waterthrush
Louisiana Pinesnake	Prairie Warbler
Northern Bobwhite	Bachman’s Sparrow
Greater Roadrunner	Henslow’s Sparrow
Chuck-will’s-Widow	Hispid Pocket Mouse

c. Dugdemona River COA

1. Focal Habitats

Bayhead Swamp	Xeric Sandhill Woodland
Calcareous Forest	Calcareous Prairie
Shortleaf Pine-Oak-Hickory Woodland	Saline Prairie
Western Upland Longleaf Pine Woodland	

2. Focal SGCN

Texas Brown Tarantula	White-breasted Nuthatch
Comanche Harvester Ant	Worm-eating Warbler
Ouachita Fencing Crawfish	Louisiana Waterthrush
Pine Hills Digger	Prairie Warbler
Louisiana Pinesnake	Lark Sparrow
Northern Bobwhite	Bachman’s Sparrow
Greater Roadrunner	Northern Long-eared Bat
Chuck-will’s-widow	Ringtail
Red-cockaded Woodpecker	

d. Kisatchie Bayou – Anacoco COA

1. *Focal Habitats*

Calcareous Forest	Xeric Sandhill Woodland
Bayhead Swamp	Calcareous Prairie
Hardwood Slope Forest	Sandstone Glade
Mixed Hardwood-Loblolly Pine Forest	Western Hillside Seepage Bog
Western Upland Longleaf Pine Woodland	

2. Focal SGCN

Texas Heelsplitter	Chuck-will’s-widow
Kisatchie Painted Crawfish	Red-cockaded Woodpecker

Pitcher Plant Spiketail	Greater Roadrunner
Shovelnose Sturgeon	White-breasted Nuthatch
Suckermouth Minnow	Worm-eating Warbler
Gumbo Darter	Louisiana Waterthrush
Bigscale Logperch	Prothonotary Warbler
Eastern Tiger Salamander	Swainson’s Warbler
Southern Red-backed Salamander	Prairie Warbler
Southern Crawfish Frog	Bachman’s Sparrow
Louisiana Pinesnake	Henslow’s Sparrow
Northern Bobwhite	Hispid Pocket Mouse

e. LaSalle COA

1. Focal Habitats

Mixed Hardwood-Loblolly Pine Forest	Western Upland Longleaf Pine Woodland
Small Stream Forest	Sandstone Glade

2. Focal SGCN

Ouachita Fencing Crawfish	Chuck-will’s-widow
Redspot Darter	Bachman’s Sparrow
Red-cockaded Woodpecker	Henslow’s Sparrow
Northern Bobwhite	Northern Long-eared Bat

f. Sabine River COA

1. Focal Habitats

Bottomland Hardwood Forest	Western Upland Longleaf Pine Woodland
Cypress-Tupelo-Blackgum Swamp	Western Hillside Seepage Bog
Western Longleaf Pine Flatwoods Savanna	WGCP Flatwoods Pond

2. Focal SGCN

Southwestern Creek Crawfish	Sabine Map Turtle
Pine Hills Digger	Northern Bobwhite
Paddlefish	Swallow-tailed Kite
Suckermouth Minnow	Greater Roadrunner
Gumbo Darter	Prothonotary Warbler
Bigscale Logperch	Swainson’s Warbler

g. Saline Lake COA

1. Focal Habitats

Calcareous Forest	Xeric Sandhill Woodland
Cypress-Tupelo-Blackgum Swamp	Calcareous Prairie

Mixed Hardwood-Loblolly Pine Woodland	Saline Prairie
Western Upland Longleaf Pine Woodland	

2. Focal SGCN

Texas Brown Tarantula	White-breasted Nuthatch
Texas Emerald	Bachman's Sparrow
Strecker's Giant Skipper	Grasshopper Sparrow
Northern Bobwhite	Henslow's Sparrow
Chuck-will's-widow	Northern Long-eared Bat
Red-cockaded Woodpecker	

<u>h. St. Maurice COA</u>

1. Focal Habitats

Bottomland Hardwood Forest	Western Upland Longleaf Pine Woodland
Mixed-Hardwood Loblolly Pine Woodland	

2. Focal SGCN

Texas Emerald	Northern Bobwhite
Yucca Giant Skipper	Chuck-will's-widow
Redspot Darter	Bachman's Sparrow
Pine Hills Digger	Henslow's Sparrow

4. **Upper West Gulf Coastal Plain Ecoregion COAs**

There are 6 COAs within the Upper West Gulf Coastal Plain ecoregion (UWGCP, Fig. 8.7), all of which are Tier 2. Despite the lack of Tier 1 COAs, this area of Louisiana is of great importance to many SGCN, including such restricted distribution species as Louisiana Pinesnake, Smith's Longspur, Grasshopper Sparrow, Bell's Vireo, Interior Least Tern, and Southern Crawfish Frog. Additionally, Saline Prairie, which is a critically imperiled natural community, is found largely within this ecoregion. Primary threats to SGCN and natural communities in this ecoregion include urbanization and industrial development.

<u>Priority Conservation Needs/Actions</u>

- Streamside management zones and riparian restoration and conservation
- Maintenance of in-stream flow at adequate levels for aquatic SGCN
- Prescribed burning initiatives for public and private lands
- Land protection/acquisition/management, including Saline Prairie, Calcareous Prairie, and Longleaf and Shortleaf Pine habitats
- Sandbar conservation and restoration
- Grassland restoration and management

<u>Key Conservation Partners</u>

- Arkansas Game and Fish Commission (AGFC)
- Arkansas Natural Heritage Commission (ANHC)
- DOD
- GCPOLCC
- Longleaf Alliance
- LDAF
- LDEQ
- LFA
- Louisiana National Guard
- LMVJV
- NWTF
- Texas-Louisiana Longleaf Taskforce
- TNC
- TPWD
- TIMOs
- USACE
- USFS
- USFWS

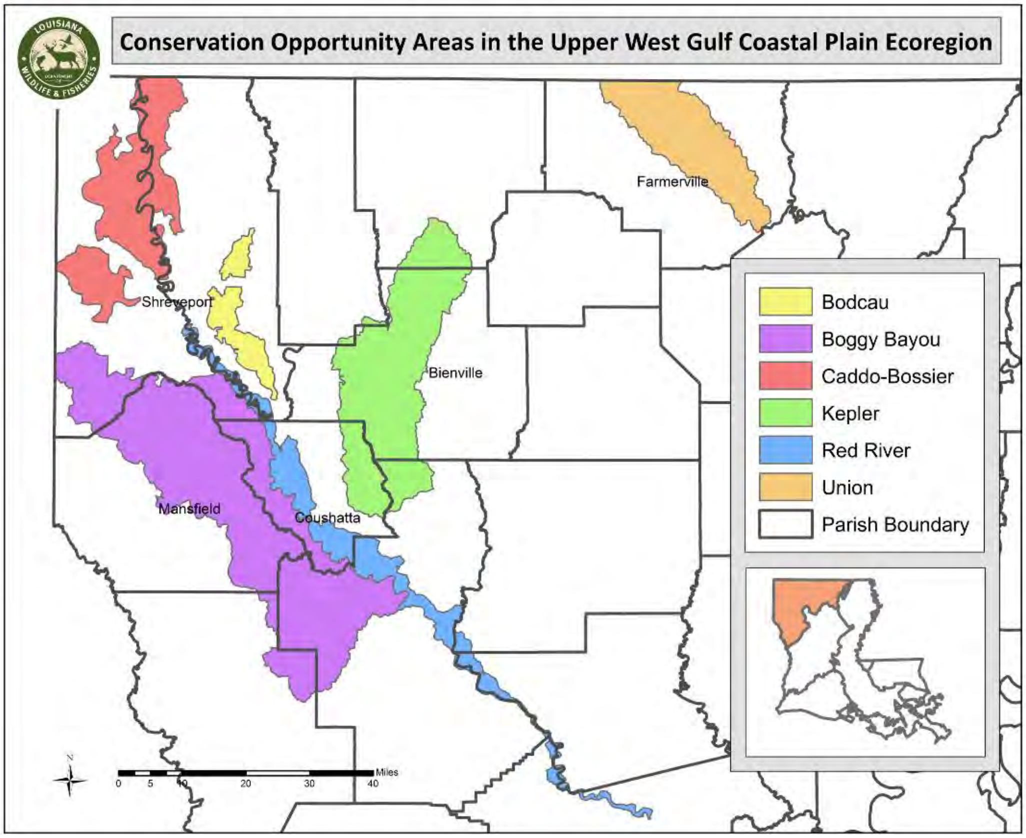

Figure 8.7 – COAs in the UWGCP Ecoregion

a. Bodcau COA

1. Focal Habitats

Bayhead Swamp	Hardwood Flatwoods
Bottomland Hardwood Forest	Shortleaf Pine-Oak-Hickory Woodland
Calcareous Forest	Calcareous Prairie
Cypress-Tupelo-Blackgum Swamp	

2. Focal SGCN

Comanche Harvester Ant	Chuck-will's-widow
Southern Crawfish Frog	Red-cockaded Woodpecker
Alligator Snapping Turtle	Lark Sparrow
Northern Bobwhite	Bachman's Sparrow
Greater Roadrunner	Henslow's Sparrow

b. Boggy Bayou COA

1. Focal Habitats

Hardwood Flatwoods	Small Stream Forest
Hardwood Slope Forest	Shortleaf Pine-Oak-Hickory Woodland
Mixed Hardwood-Loblolly Pine Forest	Saline Prairie

2. Focal SGCN

Sabine Fencing Crawfish	Chuck-will's-widow
Western Sand Darter	Lark Sparrow
Greater Roadrunner	Ringtail

c. Caddo-Bossier COA

1. Focal Habitats

Batture	Small Stream Forest
Bottomland Hardwood Forest	Shortleaf Pine-Oak-HickoryWoodland
Cypress-Tupelo-Blackgum Swamp	Sandbar
Hardwood Slope Forest	Oxbow
Mixed Hardwood-Loblolly Pine Forest	

2. Focal SGCN

Caddo Chimney Crawfish	Greater Roadrunner
Shovelnose Sturgeon	Chuck-will's-widow
Chub Shiner	Bell's Vireo
Bluehead Shiner	Warbling Vireo
Blue Sucker	Sprague's Pipit
Strecker's Chorus Frog	Smith's Longspur
Southern Crawfish Frog	Lark Sparrow
Southern Prairie Skink	Grasshopper Sparrow

d. Kepler COA

1. Focal Habitats

Bayhead Swamp	Shortleaf Pine-Oak-Hickory Woodland
Bottomland Hardwood Forest	Western Upland Longleaf Pine Woodland (especially xeric phase)
Cypress-Tupelo-Blackgum Swamp	Saline Prairie
Hardwood Flatwoods	West Gulf Coastal Plain Muck Bog

2. Focal SGCN

Louisiana Pinesnake	Bachman's Sparrow

Northern Bobwhite	Lark Sparrow
Greater Roadrunner	Henslow's Sparrow
Chuck-will's-widow	Ringtail
Red-cockaded Woodpecker	

e. Red River COA

1. Focal Habitats

Batture	Sandbar
Bottomland Hardwood Forest	Oxbow
Cypress-Tupelo-Blackgum Swamp	

2. Focal SGCN

Pallid Sturgeon	Bell's Vireo
Shovelnose Sturgeon	Warbling Vireo
Interior Least Tern	

f. Union COA

1. Focal Habitats

Bayhead Swamp	Shortleaf Pine-Oak-Hickory Woodland
Bottomland Hardwood Forest	Xeric Sandhill Woodland
Cypress-Tupelo-Blackgum Swamp	

2. Focal SGCN

Vernal Crawfish	Greater Roadrunner
Elegant Creek Crawfish	Chuck-will's-widow
Pine Hills Digger	Red-cockaded Woodpecker
Steelcolor Shiner	Bachman's Sparrow
Northern Bobwhite	Henslow's Sparrow

5. **Mississippi River Alluvial Plain Ecoregion COAs**

There are three COAs within the Mississippi River Alluvial Plain ecoregion (MRAP, Fig. 8.8 and 8.9), two of which are Tier 1 COAs. Many SGCN, particularly freshwater mussels, are found only in this ecoregion. Conservation priorities in this area are largely focused on aquatic systems and species. A large portion of the landscape in this ecoregion has been converted for agriculture and therefore habitat restoration and soil conservation are of high priority.

Priority Conservation Needs/Actions

- Land protection/acquisition/management (including Hardwood Flatwoods)
- Soil conservation practices
- Streamside zone management and riparian habitat restoration
- Hydrological restoration of forested wetlands
- Maintenance of in-stream flow at adequate levels for aquatic SGCN

Key Conservation Partners

- AGFC
- ANHC
- DU
- GCPOLCC
- LDAF
- LDEQ
- LFA
- LOSP
- Louisiana-Mississippi Conservation Delivery Network (LMCDN)
- LMVJV
- MDWFP
- TNC
- USACE
- USDA NRCS
- USFWS

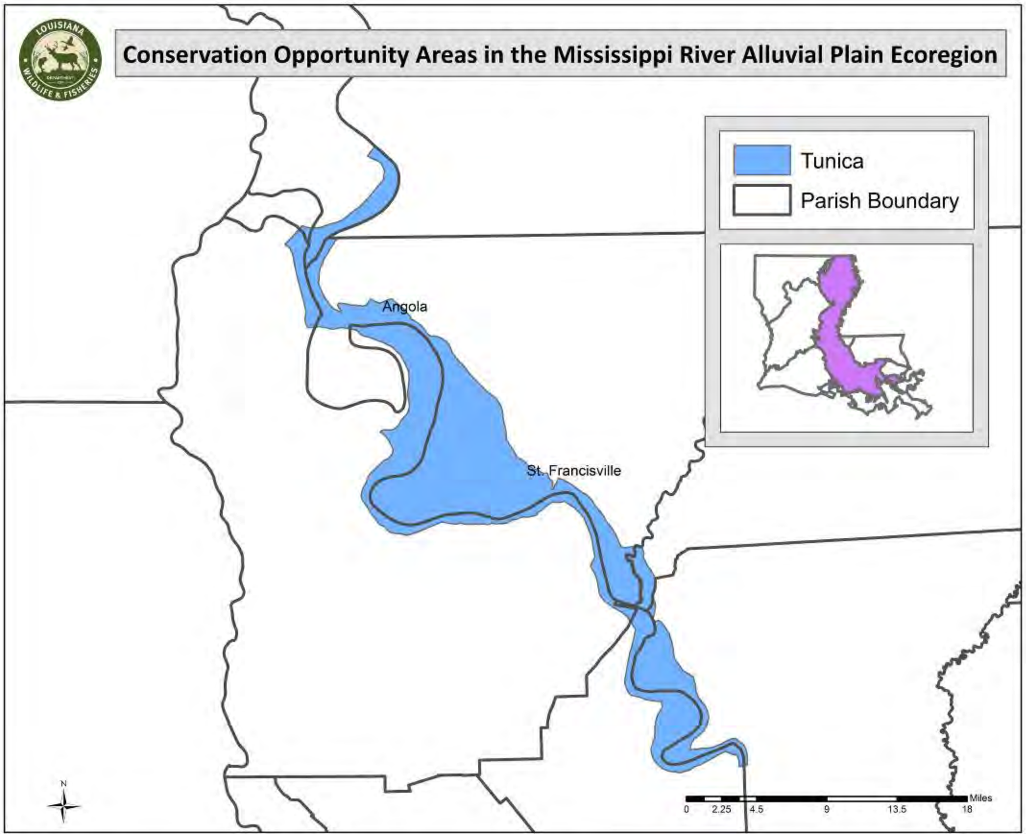

Figure 8.8 – COAs in the Southern MRAP Ecoregion

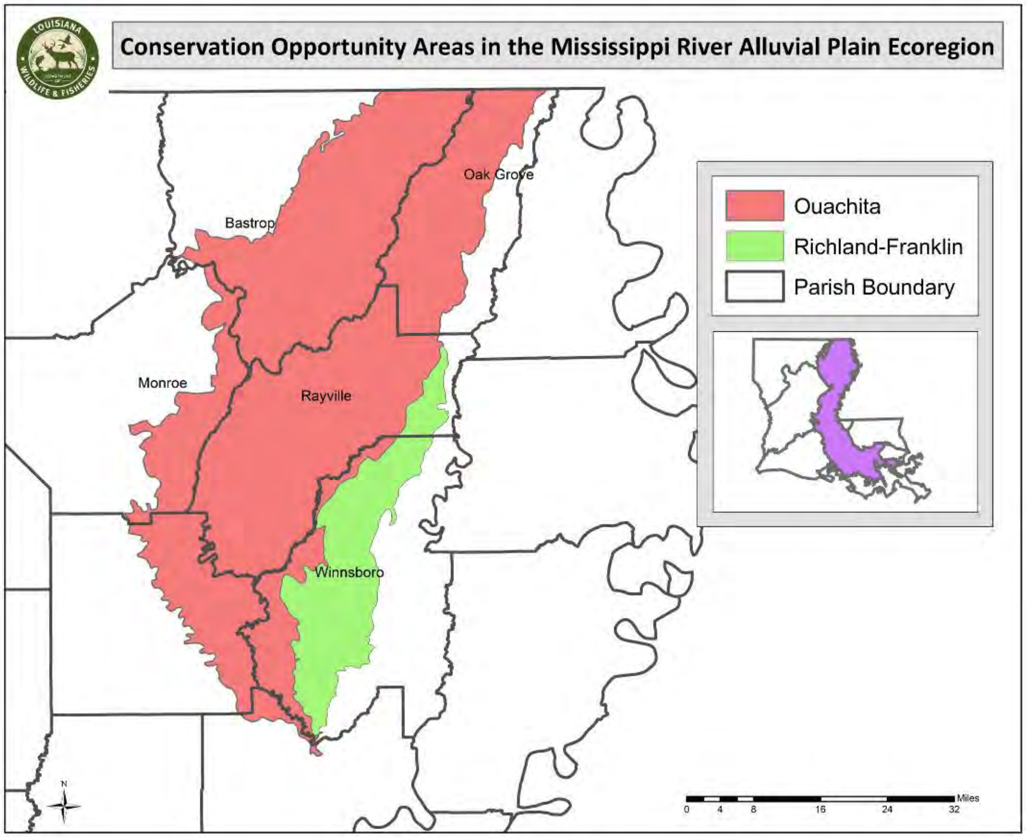

Figure 8.9 – COAs in the Northern MRAP Ecoregion

a. Tunica COA

1. Focal Habitats

Batture	Southern Mesophytic Forest
Bottomland Hardwood Forest	Sandbar
Cypress-Tupelo-Blackgum Swamp	

2. Focal SGCN

Southern Unstriped Scorpion	Rainbow Darter
Pallid Sturgeon	Interior Least Tern
Shovelnose Sturgeon	Worm-eating Warbler
Central Stoneroller	Louisiana Waterthrush
Bluntface Shiner	Prothonotary Warbler
Sturgeon Chub	Swainson’s Warbler
Sicklefin Chub	Rusty Blackbird
Chub Shiner	Eastern Chipmunk

b. Ouachita COA

1. Focal Habitats

Bottomland Hardwood Forest	Mixed Hardwood-Loblolly Pine Forest
Cypress-Tupelo-Blackgum Swamp	Macon Ridge Green Ash Pond
Hardwood Flatwoods	

2. Focal SGCN

Butterfly	Bluehead Shiner
Spike	Channel Darter
Ebonyshell	Alligator Snapping Turtle
Pink Mucket	Ouachita Map Turtle
Plain Pocketbook	Western Chicken Turtle
Fatmucket	American Woodcock
Black Sandshell	Chuck-will’s-widow
Hickorynut	Chimney Swift
Pyramid Pigtoe	Red-cockaded Woodpecker
Ouachita Kidneyshell	Prothonotary Warbler
Rabbitsfoot	Swainson’s Warbler
Monkeyface	Dickcissel
Vernal Crawfish	Rusty Blackbird
Elegant Creek Crawfish	Oak Ridge Pocket Gopher
Shovelnose Sturgeon	
Central Stoneroller	

c. Richland-Franklin COA

1. Focal Habitats

Bottomland Hardwood Forest	Mixed Hardwood-Loblolly Pine Forest
Cypress-Tupelo-Blackgum Swamp	Macon Ridge Green Ash Pond
Hardwood Flatwoods	

2. Focal SGCN

Alligator Snapping Turtle	Prothonotary Warbler
American Woodcock	Swainson’s Warbler
Chimney Swift	Rusty Blackbird

CHAPTER 9. RESEARCH AND MONITORING

Research is an integral part of Wildlife Action Plan (WAP) implementation, as filling data gaps will allow the Louisiana Department of Wildlife and Fisheries (LDWF) and conservation partners to refine conservation priorities and better target conservation actions. 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 State Wildlife Grants (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 WAP. Tier 3 Monitoring is described in Section D below.

A. Research

The WAP contains 59 habitat types, 12 aquatic basins, and five 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 a complete list, and 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, non-governmental organizations (NGOs), 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 obtained via 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 all stakeholders on the conservation needs of Louisiana SGCN.

2. Database Needs

Currently, no single data management system exists 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 increasingly common to meet regional, national, and international conservation needs, resources such as the Louisiana Natural Heritage Program (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 managers for providing data in a myriad of formats for various specific projects. Utilization of national databases (e.g., eBird, 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). Another data management tool that may prove valuable in sharing data and coordinating efforts in the implementation of the WAP is the Gulf Coast Prairie Landscape Conservation Cooperative (GCPLCC) Conservation Planning Atlas (CPA).

As important as establishing a data clearinghouse may be, it is just as important to understand how 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 two 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 to habitat is critical for the assessment of the effectiveness of the WAP for improving the status of SGCN. 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 classification may be less important than the structural composition of that habitat. Sources of habitat data include the LNHP Biotics database, U.S. Forest Service (USFS) Inventory and Analysis (FIA), and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (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, U.S. Fish and Wildlife Service (USFWS), the Louisiana Coastal Protection and Restoration Authority (CPRA), and the Louisiana Department of Agriculture and Forestry (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. Managers and restoration ecologists 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 increasing, 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 LNHP is the primary organization conducting habitat inventory in Louisiana and has been operating for approximately 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. In fact, 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, project, and available time and resources. 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 qualified biologist (usually a botanist or plant ecologist) will inspect the site prior to and during the course of management implementation. This biologist can observe the treatment effects from site visits and determine 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 for each species falling within the sampling area. Frequency of a species is defined as the number of samples across a study site containing that species. Percent cover (the amount of area shaded by plants if the sun was directly overhead) is an often-used measure of dominance for herbaceous plants, small shrubs, and woody vines. Basal area is often used to record dominance for trees and larger shrubs. Density can also be recorded, but is often not practical in densely vegetated habitats due to time constraints or the fact that it can be difficult to separate individual plants (e.g., rhizomatous grasses and sedges). Often, relative values of frequency, density, and percent cover/basal area are summed to obtain an importance value for each species sampled in a study 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. 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 data than do the experimental treatments, 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 U.S. Geological Survey (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 Joint Ventures (JVs). All bird monitoring, or, at least, as close to all bird monitoring as is feasible such as BBS and National Audubon Society's (NAS) Christmas Bird Counts (CBCs), may be relatively simple and inexpensive. However, 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 four routes per degree block in Louisiana for a total of 67 currently active routes. These data, along with data collected throughout the U.S., 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 completed 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. A continued, concerted effort will be made to recruit enough personnel 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 Counts

Both NAS and private 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: NAS 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 (MAPS)

Developed in 1989, IBP's MAPS program has become the standard for the collection of demographic data utilizing constant-effort mist netting. The MAPS program 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 limitations. Particularly, land managers and biologists should recognize that placing mist nests in extremely different forest types or treatment types, frequently, does 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 are not available for publication in 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 (DFCs) are met, which would benefit multiple SGCN. The main advantage of utilization of surrogates is that it does not require personnel 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 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 species. 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

Waterfowl Surveys- One of the most important tools LDWF uses to monitor populations and distributions of waterfowl is an aerial survey conducted from September through January. The survey consists of 27 north-south transect lines from the Gulf northward to U.S. Highway 90 that are one-quarter mile in width and vary in length from eight to 48 miles. Survey lines are spaced at 7.5 mile intervals in the southwest and at 15 miles in the southeast resulting in 3% and 1.5% sampling rates in the two areas, respectively. A fixed wing aircraft is used for this inventory from an altitude of 125 feet flying at approximately 100 mph. The number and type of waterfowl species are recorded by habitat type on each survey line. Total censuses of waterfowl, rather than transects, are recorded for Catahoula Lake and for 30 selected survey areas in central and northeast Louisiana. A transect survey is done to estimate the number of Scaup on Lakes Pontchartrain and Borgne in December and January of each year, and in April, a visibility-corrected transect survey is conducted in the coastal zone to estimate the number of breeding Mottled Ducks. The Mottled Duck survey consists of 42 north-south transect lines with randomly-selected five-mile segments re-surveyed with a low-flying zig-zagging helicopter to generate a visibility correction factor. Inventories are used to develop an index of waterfowl populations for measuring relative changes in abundance and distribution. Information on current habitat conditions for waterfowl, weather patterns, and migrations are also recorded during surveys. Survey data aid in predicting and evaluating waterfowl hunter success and are most helpful when discussing waterfowl issues with concerned citizens, outdoor writers, and wetland specialists from around the country.

Waterbird Nesting Colonies – Perhaps no group of birds better represents Louisiana than waterbirds. To be sure, for a few species, a high proportion of the 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. 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 LNHP during permit reviews, whereas a different framework may not detect known or new colonies; and (3) population indices are acceptable to determine trends, 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. Conducting 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 collaborative effort; federal and state agencies (particularly Barataria-Terrebonne National Estuary Program, BTNEP), academia, nonprofit groups, private citizens and others have provided an invaluable service in assisting LDWF in keeping these records current. More recent efforts by LDWF 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 those 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 of each species 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.

<u>Swallow-tailed Kite Surveys</u> – The Swallow-tailed Kite Conservation Alliance identified obtaining a robust estimate of the U.S. population size (Zimmerman 2009) as one of two immediate priorities. The SWG program, the Orleans Audubon Society (OAS), and LDWF provided funds for roost surveys from 2008 to 2012. Surveys were concentrated in three major river basins – the Pearl, the Atchafalaya, and the Sabine – using a technique based on Meyer (1998, 2004). Survey dates coincided with those in Florida, where the largest roosts gather (Meyer 1998, 2004), to avoid double counting and to bracket the period when the Florida roosts contain the largest numbers of kites. Three of these years (2009–2011) involved Louisiana's participation in the first region-wide, simultaneous pre-migration roost survey project. Fixed wing aircraft were used to survey river systems from sunrise until roosts began to disperse (ca. 9:00 a.m.). Larger roosts were photographed to assist enumeration. The region-wide, simultaneous pre-migration roost surveys are planned to be repeated approximately every five years for three consecutive years (recommendations are pending the project final report). Louisiana's participation is advisable and the project should allow the development of a population index and an estimate of population trend.

The second immediate priority identified by the Swallow-tailed Kite Conservation Alliance was to determine the relative importance of limiting factors to the U.S. population (Zimmerman 2009). Accomplishing this goal will require estimating vital rates and conducting population viability and sensitivity analyses.

<u>Bald Eagle Surveys</u> – Removed from the federal list of threatened and endangered species in 2007 due to population recovery, Louisiana's Bald Eagle population continues to increase. 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, eight to ten 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 Global Positioning System (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., one to two weeks old, three to four 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.

<u>Secretive Marsh Bird Callback Surveys</u> – 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 (PWRC) to discuss the need for 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 even the most basic knowledge gaps 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* dominated 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, personal communication) – 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 BBS has collected and made available invaluable data on many species of birds. Some birds, however, are not well-surveyed by the BBS including wading birds, seabirds, nocturnal species and others. The Center for Conservation Biology's (CCB) 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 the route 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 (SEPIF) *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 Avian Monitoring Network (GOMAMN), is (as of September 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 in the region. LDWF's continued commitment to this working group and others like SEPIF 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. These species 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) (Graeter et al. 2013), and the USGS 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 projects as well as other efforts 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 to increase detection.

- Artificial cover of various materials including plywood, carpet sections, and sheet metal, placed in systematic arrays within selected sites, is 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 units (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 can be used for species that readily bask, but are difficult to capture using other techniques. One design adapted for high flow riverine systems uses existing basking structures (e.g., logs, branches) to which open-topped, crawfish wire basking traps are attached just below the water's surface with twine and nails. Basking turtles fall into the traps as they attempt to escape from the researchers approaching by boat. The turtles can easily escape from these traps so researchers must collect the turtles immediately. Free floating basking traps can be used successfully in lentic systems where basking structures are lacking. These are difficult to escape from if properly designed and do not require monitoring as frequently.

- Basking surveys use spotting scopes and binoculars to monitor basking turtle populations in locations where structures suitable for basking can be found. It is possible to identify species, sex, and age class using this technique. If turtles have been previously marked using a highly visible method (such as waterproof spray paint), density estimates can also be calculated.

- 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 often used to capture snake species for presence/absence and for mark-recapture of specific species, such as the Louisiana Pinesnake, 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 which can then be sampled 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.

- Call surveys are used to quantify nocturnal breeding activity of anurans. For each species, chorus sizes are assigned values based on intensity.

d. Mammal Monitoring

Mammal monitoring faces many of the same challenges as amphibian and reptile monitoring in 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.

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 traps 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) deposits a print on an appropriate medium.

- When placed in a 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 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 on arthropod distribution is lacking. 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 these species so 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. Aquatic Habitats and Species

a. Freshwater

Due to the diverse nature of freshwater ecosystems and the lack of recent fish population data on many SGCN, 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 includes 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 the Mississippi Department of Wildlife, Fisheries, and Parks (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, 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 9.1.

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 and for determining what degree of impact invasives have on native species.

For systems that are highly altered, such as the Red and Sabine Rivers, surveys may also provide information about the population-level impacts of such alterations. 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 Freshwater Diversion and the Caernarvon Freshwater 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 the Louisiana Department of Environmental Quality (LDEQ) and USDA 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 these species may be some of the first 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 set for the various habitats and fish and invertebrate species in Louisiana coastal habitats.

Many marine and estuarine species are understudied, and long-term trends in their abundance are seldom known. It will be necessary to identify methods to monitor and verify the status of cryptic species by documenting presence, habitat use, and life history characteristics. 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 impact of these actions on both the terrestrial and aquatic ecosystems impacted by 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.

c. Coastal Restoration

Created in 2005, the Louisiana Coastal Protection and Restoration Authority (CPRA) is responsible for oversight of hurricane protection and coastal restoration activities. CPRA Board Members include Secretaries of several Louisiana natural resource agencies including LDWF, LDEQ, and the Louisiana Department of Natural Resources (LDNR). The group was tasked with producing the Comprehensive Master Plan for a Sustainable Coast, which outlines the State’s sound science approach to ensuring longevity of our coastal communities and habitats; the current Master Plan (CPRA 2012) may be viewed at http://coastal.la.gov/a-common-vision/2012-coastal-master-plan/ and is currently under revision.

As of April 2015, CPRA and its partners have “used more than 95-million cubic yards of dredged sediment, benefitted more than 26,000 acres of land, improved 256 miles of levees, and constructed 45 miles of barrier islands and berms (CPRA 2015). Whereas the primary goal of a portion of those projects is protection of the Louisiana coast through land building, where possible, projects benefit both humans and the ecosystem by taking the needs of both interests into account during design and construction. For example, Whiskey Island, in the Isles Dernieres Barrier Island Refuge, in Terrebonne Parish, provides protection from storm surge. The island gained significant subaerial land in 2009 due to restoration efforts by the State; approximately 319 acres of marsh and dune habitat were created and planted, acreage that both increases the island’s usefulness as a storm buffer and its value as bird habitat.

Funding for these projects, which involve diverse methodologies for achieving the desired goals, comes from a variety of sources including the Coastal Wetlands Planning Protection and Restoration Act (CWPPRA) and the State of Louisiana Wetlands Trust Fund. A complete list of funding sources, collaborators, and projects including cost, size, and type can be found in CPRA’s Annual Plans. Frequently, projects result in a change in habitat type (open water to marsh, Salt Marsh to Intermediate Marsh, non-vegetated area to vegetated (planted) area, etc.). Careful monitoring of restoration and enhancement activities, particularly comparisons of utilization by fish and wildlife before and after project implementation and completion, is especially vital for determining if project goals are actually met.

Concerns regarding habitat and fish and wildlife resources are resolved during both the engineering and design phase and the construction phase. Through CPRA's ecological review process, presumed ecological benefits and potential negative impacts can be assessed during the design phase of a project. By having engineers work with ecologists in the project design phase, the likelihood of a project successfully achieving its intended ecological goals is greatly improved. Throughout the process, the National Marine Fisheries Service (NMFS) will oversee project impacts on essential fish habitat, whereas the USFWS will address project impacts on other fish and wildlife. Concerns may include disruption of nutrient and water flow through tidal marshes, temporary displacement of foraging shorebirds, or hazards to sea turtles or other aquatic organisms near dredging operations. During construction, CPRA is careful to request consultation should SGCN be detected in the project footprint.

In 2003, CPRA (known at that time as the Office of Coastal Protection and Restoration) and USGS received funding from CWPPRA to develop a monitoring system and metrics to determine success of individual CWPPRA projects as well as their cumulative impacts on the landscape. The result is an overwhelmingly successful monitoring framework known as the Coastwide Reference Monitoring System (CRMS). Since 2005, 390 CRMS stations have been placed throughout coastal Louisiana. Stations (all or a subset) collect hydrographic data (continuous hourly salinity, temperature, and water level). Information on soil properties, soil porewater salinity, herbaceous and woody vegetation, and vertical accretion and surface elevation are collected by staff at varying intervals at these sites (additional information may be obtained from https://lacoast.gov/crms2/Home.aspx). Such an existing framework with continuous data could provide a tremendously beneficial backdrop for biological monitoring in the Coastal Zone.

Table 9.1 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
Monitor population trends 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 SGCN
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 identified during the revision process. These actions present explicit and concise approaches to addressing the identified threats to Louisiana's SGCN and 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 Tracking and Reporting on Actions for the Conservation of Species (Wildlife TRACS). 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 L). 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. To facilitate monitoring of WAP implementation and to maximize the utility of Wildlife TRACS outputs in reporting on SWG effectiveness, SMART (Specific, Measurable, Achievable, Relevant, and Time Bound) objectives will be developed for all future internal SWG projects and required for all external proposals as well.

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 combined 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 impact 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 or the 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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APPENDIX A. PAST AND CURRENT LOUISIANA SWG PROJECTS

T-1	SWG Surveys and Research
T-2	SWG Implementation
T-3	Avian and Herpetofaunal Surveys of Buckhorn, Sicily Island Hills, Russell Sage, and Ouachita WMAs
T-4	Effects of Forest Management on Wood Thrushes
T-5	Associations of Avian and Herpetofaunal Communities with Forest Management at Multiple Spatial Scales
T-6	Amphibian, Reptile, and Breeding Bird Communities of Bottomland Forests on Four WMAs
T-7	SWG Coordination
T-8	Gulf Sturgeon Winter Habitat Study
T-9	Identifying Swallow-tailed Kite Activity Centers
T-10	Statewide S1/S2/S3 Species Inventories
T-11	Statewide Wading Bird and Seabird Nesting Inventory
T-12	Database for Tracking S1-S2-S3 Species
T-13	Breeding Bird Survey Improvements
T-14	Louisiana Marine Animal Stranding Network
T-15	Statewide Red-cockaded Woodpecker Safe Harbor Agreement
T-16	Natural Areas Registry Program for S1-S2-S3 Vertebrates
T-17	Effects of Habitat Management Practices on Avian and Herpetofaunal Communities
T-18	Breeding Waterbird Use of Rice Fields
T-19	Fisheries Inventory of Major Rivers
T-20	Identification of Potential Habitat Sites for the Ornate Box Turtle, Crested Caracara, and Burrowing Owl using GIS
T-21	Natural Heritage Statewide Workshop
T-22	Henslow's Sparrow Ecology, Foraging, and Survival
T-23	Effects of Insectivorous Birds on Tree Growth in the Maurepas Swamp
T-24	Herpetofaunal Inventory of Three WMA's in North LA
T-25	Effect of Habitat Management Practices on Avian Communities in NW LA
T-26	Biodiversity Studies of Bayou Macon and Boeuf WMA's
T-27	Identifying, Prioritizing, and Conserving Important Birds Areas in LA
T-28	Survey for S1 Amphibians in St. Tammany Parish
T-29	Alligator Snapping Turtle Movements and Reproduction at Black Bayou Lake NWR
T-30	Productivity and Survivorship of Landbirds and Their Response to Forest / Habitat Alteration in Bottomland Hardwoods
T-31	Management of Shorebird Habitat for Fall Migration in Key WMA's
T-32	Assessment of Henslow's Sparrow Abundance and Condition in Managed Savannas across Louisiana
T-35	Native Warm Season Grass Drills
T-36	Effects of Forest Management and Silvicultural Activities on Abundance and Distribution of Songbirds and Herpetofauna
T-37	Status Re-survey of the Alligator Snapping Turtle
T-38	Using GIS to Identify Potential Habitat Sites for the Western Slender Glass Lizard and Louisiana Pine Snake
T-39	Xeric Sandylands of the West Gulf Coastal Plain
T-40	Population Dynamics and Repatriation of Black Bears

T-41	Distribution and Habitat Associations of Breeding Secretive Marsh Birds
T-44	Development of a Prototype Information System for Conservation
T-45	Inflated Heelsplitter and Best Management Practices in the Amite River
T-46	Morse Clay Prairie Inventory
T-47	Conservation Planning for the Coastal Prairie Region
T-48	Advancing Restoration of Coastal Prairie, Longleaf Pinelands, and other Habitats for Bird Species of Concern
T-49	A Survey of Fishes Inhabiting the Pearl, Tchefuncte, and Tangipahoa River Systems in LA
T-50	A Study of Fish Fauna of Louisiana's Barrier Islands
T-51	Habitat Measures Associated with Fishery SGCN in Natural and Managed SAV and Marsh Edge Habitats
T-52	Prairie Restoration on Ouachita WMA to Enhance Mottled Duck Nesting
T-53	Forest Breeding Bird Monitoring Program: Assessment of Forest Management Activities
T-54	Nuisance Bear Conflict Prevention and Response
T-55	Whooping Crane Habitat Evaluation
T-56	Bottomland Hardwood Forest Corridors for Black Bears
T-57	Alligator Snapping Turtle Ecology and Reproduction at Black Bayou Lake NWR
T-58	Insect Assemblages on Rare Saline Prairies
T-59	An Inventory of Spiders in Northwest Louisiana
T-60	Integrated Waterbird Use of Moist Soil Areas on WMA's
T-61	Predicting the Diversity and Risk of Extinction of Freshwater Mussels
T-62	Impacts of Freshwater Diversion Projects on Non-Fishery Aquatic Organisms: Development of Nekton Indicators
T-63	Avian Monitoring and Swainson's Warbler Nesting Study in the Pearl River Basin
T-65	Understanding the use of Barrier Islands as Nesting Habitat for LA Birds of Special Concern
T-66	Promotion of Prescribed Burning as a Management Tool on Selected habitat Types within the LA West Gulf Coastal Plain
T-67	LA Breeding Bird Survey Stipends
T-68	LA Participation in a Region-wide Count of Swallow-tailed Kite Pre-migration Roosts
T-69	Assessment of Population Status and Habitat Use of the Eastern Spotted Skunk in LA
T-70	A Survey of Fishes and Mussels Inhabiting the Calcasieu, Mermentau, Vermilion, and Sabine River Systems in LA
T-71	Patterns in Fish Community Structure and Environment Requirements of Current and Future SGCN in LA Estuaries
T-72	Bear Conflict Management Program
T-73	Southwest Louisiana Grassland Restoration Initiative
T-74	Habitat Suitability and Condition Assessment of Longleaf Pine Flatwood Savannah Habitat for SGCN
T-75	Fish Assemblages in the Amite, Tangipahoa, Tickfaw, and Tchefuncte Rivers
T-76	Nongame Winter Bird Projects
T-77	Coastal Prairie Condition Assessment and Grassland Bird Habitat Restoration
T-78	Aquatic Herpetofaunal Surveys on Boeuf WMA
T-79	Population Demographics of LA Black Bears
T-80	Preparation for Eventual WAP Revision
T-81	RCW Demographic Monitoring and Management
T-83	Promotion of Prescribed Burning in the EGCP
T-84	Scenic Rivers Inventory of SGCN and Habitats

T-85	Louisiana Herpetofaunal Surveys
T-86	Natural Community Inventory and Enhancement
T-87	Southwest Louisiana Grassland Prescribed Burning Initiative
T-88	Succession of Two Newly Constructed Barrier Island Marshes and their Efficacy for Providing Fish Habitat
T-89	Assessing the Impact of Low-Head Dams on Genetic Structure of Etheostomatine Darters in the Pearl River Basin
T-90	Effects of Habitat Edges and Nest Patch Characteristics on the Nesting Success of Painted Buntings
T-91	Assessment of Fish Assemblages on Northern Gulf of Mexico Manmade Structures
T-92	Abundance, Age Distribution, and Host Fish of Inflated Heelsplitter in the Amite River
T-93	Reintroduction of Whooping Cranes to SW Louisiana
T-94	Surveys of the Aquatic Turtle Fauna in Southwestern Louisiana, with Emphasis on Three Louisiana SGCN
T-95	Coastal Bird Monitoring: Colonial Nesters and Secretive Marsh Birds
T-96	Salt Dome Hardwood Forest Breeding Bird Point Counts
T-97	Examining Species Diversity and Relative Abundance of a Butterfly Community Visiting *Iris nelsonii*
T-98	Migration, Home Range, and Habitat Use of Bald Eagles
T-99	Telemetric Study of Feral Hogs in Mixed Hardwood-Loblolly Pine Forests
T-100	Spoil Island Management at the Atchafalaya Delta: Adaptive Management for Nesting Mottled Ducks and Seabirds
T-101	WAP Revision
T-102	Bat Surveys in Louisiana with an Emphasis on Three Species of Greatest Conservation Need
T-103	Ringgold Morse Clay Prairie Restoration
T-104	Distribution and Population Characteristics of Calcasieu Painted Crawfish
T-105	Effective Population Size and Genetic Connectivity of Seaside Sparrows
T-106	Status of the Alligator Snapping Turtle in Southeast Louisiana
T-107	Evaluation of Diamondback Terrapin *(Malaclemys terrapin*) Nesting Habitat and Reproductive Productivity
T-108	Rare, Threatened, and Endangered (RTE) Species and Natural Communities Located on Louisiana WMAs and Refuges
T-109	Influence of Barrier Island Loss and Local Translocations on Distribution and Survival of Brown Pelicans
T-110	Using Time-Lapse Photography to Monitor Colonial Waterbird Reproductive Productivity
T-111	Wildlife Habitat in a 25-Year-Old Restored Bottomland Hardwood Forest in Response to Three Silvicultural Treatments
T-172	A Comparative Survey of Native Bee and Butterfly Communities in Tier 1 Conservation Habitats of the EGCP
T-286	Prescribed Burning as a Management Tool on Selected Habitat Types within the Louisiana West Gulf Coastal Plain
T-287	Rare Species Detection Using Environmental DNA
T-288	Alligator Snapping Turtle Propagation
T-305	Status of the Alligator Snapping Turtle in Central Louisiana based on Trapping Data
T-307	A Survey of Crayfishes, Aquatic Insects and Benthic Fishes in the Sabine, Red, and Calcasieu River Systems
T-319	Distribution, Abundance and Use of Artificial Roosts by Critically Imperiled Bat Species in Louisiana
T-320	Coastal Prairie Research and Stewardship
T-726	Surveys for the Northern Long-eared Bat (*Myotis septentrionalis*) in Louisiana
T-766	Coastal Prairie Stewardship on White Lake Wetlands Conservation Area
T-767	Alligator Snapping Turtle Headstart Program
T-772	Bald Eagle Nesting Surveys
T-777	Develop and Publish Management Plans for Five Louisiana Designated Natural and Scenic Rivers

T-792	Overwinter Survival of Henslow’s Sparrows in Louisiana
T-795	Colonial Waterbird Response to Predator Removal on Barrier Islands
T-808	Prescribed Burning as a Management Tool on Selected Habitat Types within the Louisiana East Gulf Coastal Plain
T-822	Comprehensive Survey of Marine Bivalves and Gastropods in Near-shore Waters of the Chandeleur Islands, Louisiana
T-824	The Impact of Off-road Vehicle Traffic on Turtle Nests and Populations in the Comite River, a Scenic Rivers Area
T-2-R	Chinese Privet Impacts on SGCN

APPENDIX B. 2005 APPROACH

A. Organizational Structure

1. Technical Committees

A core committee of LDWF staff from CNR, Inland Fisheries, Marine Fisheries, and Wildlife Divisions and Public Information Section, was formed to develop the WAP (Appendix C). 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 C). 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.

2. Coordination with Other Government Agencies

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 may be found in Appendix D.

3. Public Involvement and Partnerships

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

Public meetings were held across the state 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 D).

4. Cooperation with Other States

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. Species of Greatest Conservation Need

1. Identifying SGCN

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 E) based on the following factors:

- Estimated number of Element Occurrences (EOs)
- Estimated state abundance
- State range
- Adequately protected EOs
- Threat of destruction

- Ecological fragility

NatureServe, 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.

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.

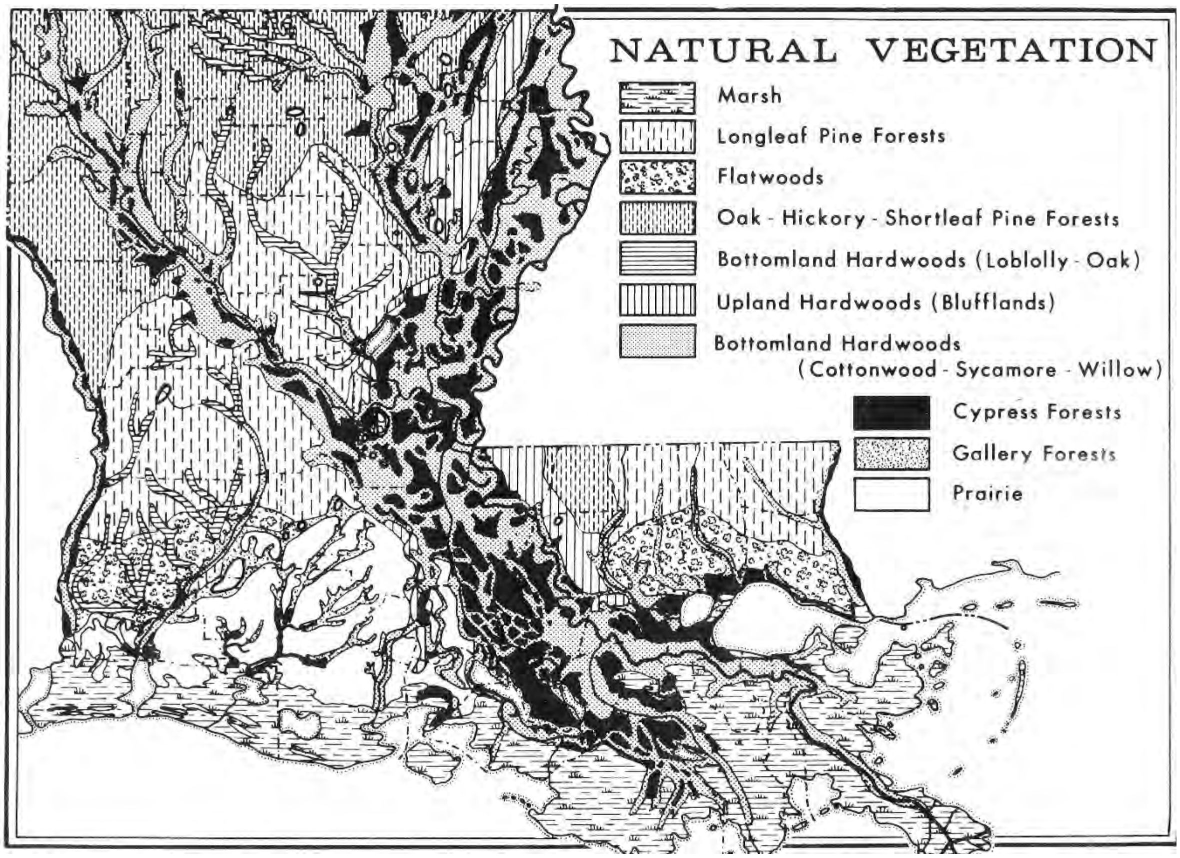

Figure 3.1. Primary natural vegetation types and presettlement distribution in Louisiana (Newton 1972).

2. Prioritizing Habitats Important for SGCN Conservation

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.

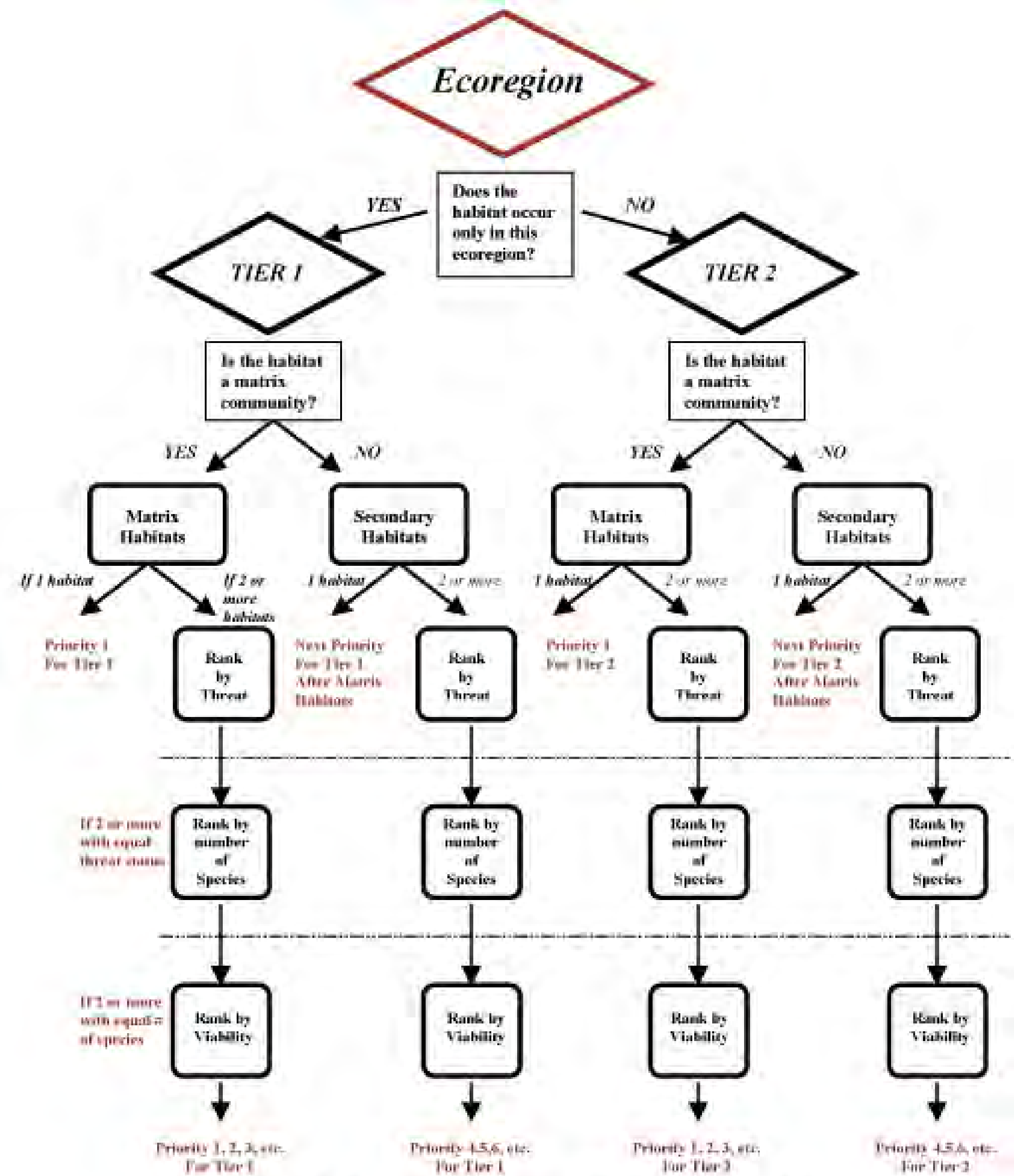

Chart 3.1 Terrestrial habitat prioritization process flowchart.

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.

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

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 savannas in the East Gulf Coastal Plain. Tremendous population growth has occurred in this ecoregion (20-30% increase from 1990-2000) and is expected to continue at a high level over the next decade (Fig. 2.1). This threat was given a "Very High" rating in both severity and scope due to the sources of the habitat conversion threat, namely residential development. The combined ratings for severity and scope resulted in a stress rating of "Very High". The contribution of residential development to eastern longleaf pine savanna 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 effects 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

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APPENDIX C. 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

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Jeff Duguay	Office of Wildlife – Wildlife Division
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Sam Holcomb	Office of Wildlife - CNR

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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

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Tommy Tuma	Office of Wildlife – Wildlife Division

Technical Committee - Herps

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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
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Glenn Thomas	Office of Fisheries
Robby Maxwell	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR

Technical Committee – Insects

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Michael Seymour	Office of Wildlife - CNR
Sam Holcomb	Office of Wildlife - CNR

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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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Scott Durham	Office of Wildlife – Wildlife Division

Technical Committee – Marine Fishes

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Glenn Thomas	Office of Fisheries
Jason Adriance	Office of Fisheries
Sam Holcomb	Office of Wildlife - CNR
Sean Jackson	Office of Fisheries

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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 D. EXTERNAL PARTNERS LIST

GOVERNMENT:

2015 WAP Revision

Arkansas Game and Fish Commission
Arkansas Natural Heritage Commission
Barataria-Terrebonne National Estuary Program
BREC (Recreation and Park Commission for the Parish of East Baton Rouge)
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 – Jean Lafitte National Historical Park
Southeastern Climate Science Center, US Geological Survey
Texas Parks and Wildlife Department
U.S. Army Corps of Engineers New Orleans
U.S. Army Corps of Engineers Vicksburg
U.S. Department of Agriculture, Natural Resource Conservation Service
U.S. Department of Army, Fort Polk
U.S. Fish and Wildlife Service, Ecological Services- Lafayette
U.S. Forest Service, Kisatchie National Forest
U.S. 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)
U.S. Army Corps of Engineers, Atchafalaya Basin (Neil LaLonde)
U.S. Army Corps of Engineers, Bodcau (Susanne Odom)
U.S. Army Corps of Engineers, New Orleans (Chris Brantley)
U.S. Army Corps of Engineers, New Orleans (Nathan S. Dayan)
U.S. Army Corps of Engineers, New Orleans Planning (Barton Rogers)
U.S. Army Corps of Engineers, Vicksburg (Dan Twedt)
U.S. Department of Agriculture (John Pitre)
U.S. Department of Agriculture (Marty Floyd)
U.S. Department of Army, Fort Polk (Danny Hudson)
U.S. Fish and Wildlife Service (Bill Vermillion)
U.S. Fish and Wildlife Service (Debbie Fuller)
U.S. Forest Service, Kisatchie National Forest (Ken Dancak)
U.S. Geological Survey, National Wetlands Research Center (Carroll Cordes)

NGOs:

2015 WAP Revision:

Acadiana Park Nature Station
American Bird Conservancy
American Fisheries Society-Louisiana Chapter
America's Wetland
Atchafalaya Basinkeeper
Atchafalaya National Heritage Area
Audubon Council
Audubon Louisiana
Audubon Nature Institute
Band of Choctaw Indians – Baton Rouge Area
Baton Rouge Audubon Society
Bird Study Group
Black Bear Conservation Coalition
Boise Cascade
Chitimacha Tribe of Louisiana
Coalition to Restore Coastal Louisiana
Coastal Conservation Association
Coastal Plain Conservancy
Coastal Prairie Partnership
Coushatta Tribe of Louisiana

Crowell Lumber Industries
Delta Waterfowl
Ducks Unlimited
East Gulf Coastal Plain Joint Venture
Farm Bureau Federation
Gulf Coast Bird Observatory
Gulf Coast Joint Venture
Gulf Coast Prairie Landscape Conservation Cooperative
Gulf Coastal Plain and Ozarks Landscape Conservation Cooperative
Gulf of Mexico Fisheries Management Council
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 Management
National Audubon Society
National Fish and Wildlife Foundation
National Wild Turkey Federation (Louisiana Chapter)
National Bobwhite Conservation Initiative
Northlake Nature Center
Orleans Audubon Society
Ouachita River Foundation
Ouachita Riverkeeper
Plum Creek
Resource Management Service
Roy O. Martin
Shortleaf Initiative
Sierra Club, Delta Chapter
Society for Ecological Restoration Southeast
Southeast Partners in Flight
Southeast Partners in 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

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APPENDIX E. TECHNICAL EXPERTS

AMPHIBIANS/REPTILES	
Avery Williams	Louisiana State University - Eunice
Brad Glorioso	U.S. Geological Survey - National Wetlands Research Center
Brad Moon	University of Louisiana at Lafayette
Brian Crother	Southeastern Louisiana University
Craig Rudolph	U.S. Forest Service - Southern Research Station
Hardin Waddle	U.S. Geological Survey - National Wetlands Research Center
John Carr	University of Louisiana at Monroe
Mac Hardy	Louisiana State University - Shreveport
Steve Shively	U.S. Forest Service - Kisatchie National Forest
BIRDS	
Aaron Pierce	Nicholls State University
Bill Vermillion	Gulf Coast Joint Venture
Blain Cerame	Louisiana State University
Dean Demarest	U.S. Fish and Wildlife Service
Emma DeLeon	Louisiana State University
Kathryn Heyden	Kentucky Department of Fish and Wildlife Resources
Mac Hardy	Louisiana State University - Shreveport
Paul Leberg	University of Louisiana at Lafayette
Phil Stouffer	Louisiana State University
CRUSTACEANS	
Jerry Walls	Louisiana State University - Alexandria
Mac Hardy	Louisiana State University - Shreveport
Steve Shively	U.S. Forest Service - Kisatchie National Forest
FISHES	
Bill Kelso	Louisiana State University
David Byrd	U.S. Forest Service - Kisatchie National Forest
Frank Jordan	Loyola University New Orleans
Gary Peterson	Louisiana State University
Hank Bart	Tulane University
John Carlson	National Oceanic and Atmospheric Administration
Margaret Miller	National Marine Fisheries Service
Martin O'Connell	University of New Orleans
Mike Kaller	Louisiana State University
Neil Douglas	University of Louisiana - Monroe

Prosanta Chakrabarty	Louisiana State University
INSECTS	
Chris Carlton	Louisiana State Arthropod Museum, LSU
Craig Marks	
Dorothy Prowell	Louisiana State University
Janice Bossart	Southeastern Louisiana University
Paul Hartfield	U.S. Fish and Wildlife Service
Noland Martin	Texas State University
Steve Shively	U.S. Forest Service - Kisatchie National Forest
Vernon Brou	
INVASIVE SPECIES	
Chris Carlton	Louisiana State Arthropod Museum, LSU
Zack Lemann	Audubon Nature Institute
Tom Lorenz	
Michael Massimi	Barataria-Terrebonne National Estuary Program
Dorothy Prowell	Louisiana State University
Martin O'Connell	University of New Orleans
MAMMALS	
Gypsy Hanks	U.S. Fish and Wildlife Service
Justin Hoffman	McNeese State University
Patricia Rosel	National Marine Fisheries Service
Paul Leberg	University of Louisiana at Lafayette
Richard Stevens	Texas Tech University
MOLLUSKS	
Allyse Ferrara	Nicholls State University
Bill Font	Southeastern Louisiana University
Bill Kelso	Louisiana State University
Ken Brown	Louisiana State University
Mike Poirrier	University of New Orleans
Paul Hartfield	U.S. Fish and Wildlife Service
Raynie Harlan	Louisiana State University
Wesley Daniel	Louisiana State University

APPENDIX F. LOUISIANA HABITAT LIST

Habitat	G-Rank	S-Rank
Forests		
Barrier Island Live Oak Forest (Maritime Forest)	G1Q	S1
Batture	G4G5	S3
Bayhead Swamp/Forested Seep	G3?	S3
Bottomland Hardwood Forest	G4G5	S4
Calcareous Forest	G2?Q	S2
Coastal Live Oak-Hackberry Forest	G2	S1
Cypress-Tupelo-Blackgum Swamp	G3G5	S4
Hardwood Flatwoods		
Mesic Hardwood Flatwoods	G2G3	S2S3
Wet Hardwood Flatwoods	G2G3	S2S3
Prairie Terrace Loess Forest	G2?	S1
Live Oak Natural Levee Forest	G2	S1
Live Oak-Pine-Magnolia Forest	G2G3	S1
Mixed Hardwood-Loblolly Pine/Hardwood Slope Forest		
Mixed Hardwood-Loblolly Pine Forest	G3G4	S3
Hardwood Slope Forest	G2G3	S3
Pondcypress-Blackgum Swamp	G1?	S1
Salt Dome Hardwood Forest	G1	S1
Small Stream Forest	G3	S2
Southern Mesophytic Hardwood Forest	G1G2	S2
Spruce Pine-Hardwood Flatwoods	G1G2	S1
Savannas and Woodlands		
Eastern Longleaf Pine Flatwoods Savanna	G1	S1
Eastern Upland Longleaf Pine Woodland	G1G2	S1
Shortleaf Pine/Oak Hickory Woodland	G2G3	S1
Slash Pine-Pondcypress/Hardwood Woodland	G2?	S2
Western Longleaf Pine Flatwoods Savanna		
Acidic	G2G3	S2
Saline	G1	S1
Western Upland Longleaf Pine Woodland	G2G3	S3
Xeric Sandhill Woodland	G2G3	S1
Shrublands		
Canebrake	G2?	SX
Coastal Mangrove-Marsh Shrubland	G2?	S2
Grasslands		
Brackish Marsh	G4?	S3
Calcareous Prairie	G1	S1
Coastal Dune Grassland/Coastal Dune Shrub Thicket	G2G3	S1
Coastal Prairie	G2Q	S1

Eastern Hillside Seepage Bog	G2	S1
Freshwater Floating Marsh	G2G3	S2S3
Freshwater Marsh	G3G4	S2
Intermediate Marsh	G4	S3
Louisiana Beach	N/A	S2
Mississippi Terrace Prairie	G2	SX
Saline Prairie	G1G2	S1S2
Salt Marsh	G5	S3S4
Sandbar	G4	S2
Sandstone Glade/Barren	G1G2	S1S2
Vegetated Pioneer Emerging Delta	G3G4	S2
West Gulf Coastal Plain Muck Bog	G1	S1
Western Hillside Seepage Bog	G2G3	S1
Ephemeral Ponds		
Flatwoods Pond		
EGCP Flatwoods Pond		S1
WGCP Flatwoods Pond		S2
Prairie Pothole		S1
Sparta Sand Pond		S1
Macon Ridge Green Ash Pond		S1
Lentic Water Bodies		
Lakes and Reservoirs		S3S4
Ponds		
Submersed Aquatic Vegetation		
Marine Seagrass Bed		S1
Estuarine Submersed Aquatic Vegetation	G3G5	S1S2
River Delta Freshwater Submersed Aquatic Vegetation		S3S4
Coastal Marsh and Bayou Freshwater SAV		S3S4
Interior Freshwater Submersed Aquatic Vegetation		S2S4
Subterranean Habitat		
Cave		S1
Geologic Feature		
Barrier Island	N/A	S1
Anthropogenic Habitats		
Agriculture and Improved Pasture	N/A	N/A
Rice Agriculture and Aquaculture	N/A	N/A
Pine Plantation	N/A	N/A

APPENDIX G. HABITATS ARRANGED IN TIERS ACCORDING TO PRIORITIZATION SCORE*

TIER 1	**Total Score**
Xeric Sandhill Woodland	28
Eastern Longleaf Pine Flatwoods Savanna	27
Coastal Prairie	26
Prairie Terrace Loess Forest	25
Eastern Upland Longleaf Pine Woodland	25
Shortleaf Pine/Oak Hickory Woodland	25
Western Longleaf Pine Flatwoods Savanna (Saline)	25
Prairie Pothole	25
Mesic Hardwood Flatwoods	24
Western Longleaf Pine Flatwoods Savanna (Acidic)	24
Calcareous Prairie	24
Barrier Island Live Oak Forest	23
Live Oak Natural Levee Forest	23
Eastern Hillside Seepage Bog	23
Mississippi Terrace Prairie	23
EGCP Flatwoods Pond	23
Barrier Island	23
TIER 2	
Live Oak-Pine-Magnolia Forest	22
Spruce Pine-Hardwood Flatwoods	22
Slash Pine-Pondcypress/Hardwood Woodland	22
Canebrake	22
Macon Ridge Green Ash Pond	22
Calcareous Forest	21
Coastal Live Oak-Hackberry Forest	21
Wet Hardwood Flatwoods	21
Salt Dome Hardwood Forest	21
Small Stream Forest	21
Louisiana Beach	21

WGCP Flatwoods Pond	21
Mixed Hardwood-Loblolly Pine Forest	20
Western Upland Longleaf Pine Woodland	20
Freshwater Floating Marsh	20
Saline Prairie	20
Sparta Sand Pond	20
TIER 3	
Hardwood Slope Forest	19
West Gulf Coastal Plain Muck Bog	19
Western Hillside Seepage Bog	19
Interior Freshwater Submersed Aquatic Vegetation	19
Pondcypress-Blackgum Swamp	19
Coastal Dune Grassland/Coastal Dune Shrub Thicket	18
Sandbar	18
Bottomland Hardwood Forest	17
Southern Mesophytic Hardwood Forest	17
Coastal Mangrove-Marsh Shrubland	17
Vegetated Pioneer Emerging Delta	17
Marine Seagrass Bed	17
Estuarine Submersed Aquatic Vegetation	17
TIER 4	
Batture	16
Brackish Marsh	16
Freshwater Marsh	16
Sandstone Glade/Barren	16
Coastal Marsh and Bayou Freshwater Submersed Aquatic Vegetation	16
Intermediate Marsh	15
River Delta Freshwater Submersed Aquatic Vegetation	15
Cave	15
Bayhead Swamp/Forested Seep	14

Salt Marsh	14
Cypress-Tupelo-Blackgum Swamps	13

* The habitat prioritization tool was not applied to anthropogenic habitats, or habitats which are represented mainly by anthropogenic examples, such as Lakes and Reservoirs, and Ponds.

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APPENDIX H. 1st, 2nd and SELECTED 3rd 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

APPENDIX I. SGCN LIST

Mollusks				
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**	**Federal Status**
Mucket	*Actinonaias ligamentina*	G5	S1	
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	
Texas Pigtoe	*Fusconaia askewi*	G2G3	S3	
Ebonyshell	*Fusconaia ebena*	G4G5	S3	
Round Pearlshell	*Glebula rotundata*	G4G5	S4	
Pink Mucket	*Lampsilis abrupta*	G2	S1	Endangered
Plain Pocketbook	*Lampsilis cardium*	G5	S1	
Southern Pocketbook	*Lampsilis ornata*	G5	S3	
Sandbank Pocketbook	*Lampsilis satura*	G2	S2	
Fatmucket	*Lampsilis siliquoidea*	G5	S2	
White Heelsplitter	*Lasmigona complanata*	G5	S1	
Black Sandshell	*Ligumia recta*	G4G5	S1	
Louisiana Pearlshell	*Margaritifera hembeli*	G1	S1	Threatened
Southern Hickorynut	*Obovaria jacksoniana*	G2	S1S2	
Hickorynut	*Obovaria olivaria*	G4	S1	
Alabama Hickorynut	*Obovaria unicolor*	G3	S1	
Mississippi Pigtoe	*Pleurobema beadleianum*	G3	S2	
Louisiana Pigtoe	*Pleurobema riddellii*	G1G2	S1S2	
Pyramid Pigtoe	*Pleurobema rubrum*	G2G3	S2	
Texas Heelsplitter	*Potamilus amphichaenus*	G1G2	SH	
Fat Pocketbook	*Potamilus capax*	G2	S1	Endangered
Inflated Heelsplitter	*Potamilus inflatus*	G1G2Q	S1	Threatened
Ouachita Kidneyshell	*Ptychobranchus occidentalis*	G3G4	S1	
Rabbitsfoot	*Quadrula cylindrica*	G3G4	S1	Threatened
Monkeyface	*Quadrula metanevra*	G4	S1	
Southern Creekmussel	*Strophitus subvexus*	G3	S1	
Creeper	*Strophitus undulatus*	G5	S2	
Fawnsfoot	*Truncilla donaciformis*	G5	S3	
Southern Rainbow	*Villosa vibex*	G5Q	S2	
Silty Hornsnail	*Pleurocera canaliculata*	G5	S2	
Flamed Tigersnail	*Anguispira alternata*	G5	S1	
Bay Scallop	*Argopecten irradians*	G5	S1	
Sawtooth Penshell	*Atrina serrata*	G5	S1	

Half-Naked Penshell	*Atrina seminude*	GNR	S1	
Channeled Whelk	*Busycotypus canaliculatus*	GNR	S1	
Lightning Whelk	*Busycon sinistrum*	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	
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	*Procambarus planirostris*	G4	S3	
Vernal Crawfish	*Procambarus viaeviridis*	G5	S1	
Southwestern Creek Crawfish	*Procambarus dupratzi*	G5	S2	
Elegant Creek 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	
Non-crustacean Arthropods				
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	*Sparbarus flavus*	G4Q	S2	
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	*Habroscelimorpha dorsalis venusta*	G3G4T3T4	S2	
White Sand Tiger Beetle	*Ellipsoptera wapleri*	G3G4	S2S3	
Sandbar Tiger Beetle	*Ellipsoptera blanda*	G3G4	S3	
Cajun Tiger Beetle	*Dromochorus 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*	G2G3	S2	
American Bumble Bee	*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	*Lethe creola*	G3G4	S3	
Georgia Satyr	*Neonympha areolatus*	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*	G2G3	S1	
Palatka Skipper	*Euphyes pilatka*	G3G4	S1	
Dion Skipper	*Euphyes dion*	G4	SU	
Cobweb Skipper	*Hesperia metea*	G4	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*	G4	S4	

Western Pygmy Blue	*Brephidium exilis*	G5	S1S2	
Eastern Pygmy Blue	*Brephidium pseudofea*	G5	S1S2	
Seminole Texan Crescent	*Anthanassa texana seminole*	G5T3T4	S3	
King's Hairstreak	*Satyrium kingi*	G3G4	SU	
Appalachian Brown	*Lethe appalachia*	G4	SU	
Gulf Pine Sphinx	*Lapara phaeobrachycerous*	G3G4	S3	
Louisiana Eyed Silkmoth	*Automeris louisiana*	G1G3	S1	
Brou's Mallow Moth	*Bagisara brouana*	G3	S3	
Nutmeg Underwing	*Catocala atocala*	G3G4	S1S2	
Inland Fishes				
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**	
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	G3T2	S1	Threatened
Pallid Sturgeon	*Scaphirhynchus albus*	G2	S1	Endangered
Shovelnose Sturgeon	*Scaphirhynchus platorynchus*	G4	S4	Threatened (S/A)
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	Proposed Threatened
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	S1	Endangered
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	S1	
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	
Amphibians and Reptiles				
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*	G5T4	S1	
Southern Red Salamander	*Pseudotriton ruber vioscai*	G5T4T5	S2	
Gulf Coast Waterdog	*Necturus beyeri*	G4	S3	
Red River Mudpuppy	*Necturus louisianensis*	G5T4	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	S3	
Dusky Gopher Frog	*Lithobates sevosus*	G1	SH	Endangered
Southern Crawfish Frog	*Lithobates areolatus areolatus*	G4	S1	
Loggerhead Sea Turtle	*Caretta caretta*	G3	S1B, S3N	Threatened
Green Sea Turtle	*Chelonia mydas*	G3	S1N	Threatened
Hawksbill Sea Turtle	*Eretmochelys imbricata*	G3T3Q	SZ	Endangered
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	G1	S1B, S3N	Endangered
Alligator Snapping Turtle	*Macrochelys temminckii*	G3G4	S3	
Smooth Softshell	*Apalone mutica*	G5	S3	
Leatherback Sea Turtle	*Dermochelys coriacea*	G2	SZ	Endangered
Ringed Map Turtle	*Graptemys oculifera*	G2	S2	Threatened
Ouachita Map Turtle	*Graptemys ouachitensis*	G5	S3	
Sabine Map Turtle	*Graptemys sabinensis*	G5T5	S3	
Pearl River 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*	G5	S1	
Stripe-necked Musk Turtle	*Sternotherus minor peltifer*	G5	S1	
Razor-backed Musk Turtle	*Sternotherus carinatus*	G5	S4	
Gopher Tortoise	*Gopherus polyphemus*	G3	S1	Threatened
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 Wormsnake	*Carphophis vermis*	G5	S1	
Common Rainbow Snake	*Farancia erytrogramma erytrogramma*	G4	S2	
Eastern Hog-nosed Snake	*Heterodon platirhinos*	G5	S3	
Northern Mole Kingsnake	*Lampropeltis rhombomaculata*	G5T5	S1S2	
Gulf Saltmarsh Snake	*Nerodia clarkii clarkii*	G4	S3S4	
Black Pinesnake	*Pituophis melanoleucus lodingi*	G4T2T3	S1	Threatened
Louisiana Pinesnake	*Pituophis ruthveni*	G2	S2	Proposed Threatened
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	
Pygmy Rattlesnake	*Sistrurus miliarius*	G5	S2	

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*	G3G4	S2N, S1B	
Clapper Rail	*Rallus crepitans*	G5	S5	
King Rail	*Rallus elegans*	G4	S3B, S4N	
Sandhill Crane	*Antigone canadensis*	G5	S2N	
Whooping Crane	*Grus americana*	G1	SXN	Endangered
Snowy Plover	*Charadrius nivosus*	G3	S1B,S2N	
Wilson's Plover	*Charadrius wilsonia*	G5	S2B, S1N	
Piping Plover	*Charadrius melodus*	G3	S2N	Threatened
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	Threatened
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	Endangered

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	Endangered
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	
American Redstart	*Setophaga ruticilla*	G5	S3B	
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	S4B,S5N	
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	
Eastern Meadowlark	*Sturnella magna*	G5	S4	
Rusty Blackbird	*Euphagus carolinus*	G4	S3N	
Mammals				
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**	
West Indian Manatee	*Trichechus manatus*	G2	S1N	Endangered
Bachman’s Fox Squirrel	*Sciurus niger bachmani*	G5	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 sagittalis*	G5	S4	
Prairie Vole	*Microtus ochrogaster*	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*	G3G4	S4	
Rafinesque’s Big-eared Bat	*Corynorhinus rafinesquii*	G3G4	S4	
Silver-haired Bat	*Lasionycteris noctivagans*	G4	SZ	
Southeastern Myotis	*Myotis austroriparius*	G3G4	S4	
Northern Long-eared Bat	*Myotis septentrionalis*	G1G2	S1	Threatened
Louisiana Black Bear	*Ursus americanus luteolus*	G5T2	S3	
Long-tailed Weasel	*Mustela frenata*	G5	S3	
Eastern Spotted Skunk	*Spilogale putorius*	G4	S1	
Ringtail	*Bassariscus astutus*	G5	S1	
Bottlenose Dolphin	*Tursiops truncatus*	G5	S5	
Sperm Whale	*Physeter macrocephalus*	G3G4	SZ	Endangered
Plants				
Common Name	**Scientific Name**	**G-Rank**	**S-Rank**	
Abbeville Red Iris	*Iris X nelsonii*	GNA	S1	
Acid-swamp Yellow-eyed-grass	*Xyris serotina*	G3G4	S1	
Alabama Grape Fern	*Botrychium jenmanii*	G3G4	S2	

Allegheny-spurge	*Pachysandra procumbens*	G4G5	S2	
American Alumroot	*Heuchera americana*	G5	S2	
American Bird's-foot-trefoil	*Lotus unifoliolatus*	G5	S2	
American Bladdernut	*Staphylea trifolia*	G5	SH	
American Chaffseed	*Schwalbea americana*	G2G3	S1	Endangered
American Ginseng	*Panax quinquefolius*	G3G4	S1	
American Hazelnut	*Corylus americana*	G5	S1	
American Jointweed	*Polygonella americana*	G5	S2	
American Pinesap	*Monotropa hypopithys*	G5	S2	
Apalachicola Doll's-daisy	*Boltonia apalachicolensis*	G2Q	S1	
Arkansas Caric Sedge	*Carex arkansana*	G4	S1	
Arkansas Leastdaisy	*Chaetopappa asteroides*	G5	S1	
Arkansas Oak	*Quercus arkansana*	G3	S2	
Arrow-grass	*Triglochin striata*	G5	S1	
Atlantic Camas	*Camassia scilloides*	G4G5	S3	
Autumn Coralroot	*Corallorhiza odontorhiza*	G5	S1	
Awl-shaped Scurfpea	*Pediomelum hypogaeum var. subulatum*	G5T4	S2	
Barbara's Buttons	*Marshallia caespitosa var. signata*	G4T4	S1	
Barbed Rattlesnake-root	*Prenanthes barbata*	G3	S2	
Bay Starvine	*Schisandra glabra*	G3	S3	
Baygall Caric Sedge	*Carex venusta*	G4	S1	
Bearded Grass-pink	*Calopogon barbatus*	G4?	S1	
Berg's Panic Grass	*Panicum bergii*	GNR	S1	
Big Sandbur	*Cenchrus myosuroides*	G4	S1	
Bindweed Heliotrope	*Heliotropium convolvulaceum*	G5	S1	
Birdbill Spike Grass	*Chasmanthium ornithorhynchum*	G4	S2	
Black Snakeroot	*Zigadenus densus*	G5	S2	
Black Titi	*Cliftonia monophylla*	G4G5	S1	
Black-fruited Spike Sedge	*Eleocharis melanocarpa*	G4	S1	
Bloodroot	*Sanguinaria canadensis*	G5	S2	
Blue Water-lily	*Nymphaea elegans*	G4?	S2S4	
Bog Flame Flower	*Macranthera flammea*	G3	S2	
Bog Moss	*Mayaca fluviatilis*	G5	S2	
Bog Spicebush	*Lindera subcoriacea*	G2G3	S1	
Boykin's Milkwort	*Polygala boykinii*	G4	S1	
Branched Hedge-hyssop	*Gratiola ramosa*	G4G5	S1S2	
Broadleaf Barbaras-buttons	*Marshallia trinervia*	G3	S1	
Broad-leaved Spiderwort	*Tradescantia subaspera*	G5	S2	
Brown-hair Comb Fern	*Ctenitis submarginalis*	G5	S1	
Bur Oak	*Quercus macrocarpa*	G5	S1	
Canada Enchanter's-nightshade	*Circaea lutetiana ssp. canadensis*	G5T5	S2	

Canada Horse-balm	*Collinsonia canadensis*	G5	S2?	
Canada Spike Sedge	*Eleocharis geniculata*	G5	S1?	
Canada Wild Ginger	*Asarum canadense*	G5	S1	
Canby's Bulrush	*Schoenoplectus etuberculatus*	G3G4	S1	
Carolina Fluff Grass	*Tridens carolinianus*	G3G4	S2	
Carolina Gentian	*Frasera caroliniensis*	G5	SH	
Carpenter's Ground-cherry	*Physalis carpenteri*	G3	S1	
Chapman's Beak Sedge	*Rhynchospora chapmanii*	G4	S3	
Chapman's Milkwort	*Polygala chapmanii*	G3G5	S1	
Ciliate Beak Sedge	*Rhynchospora ciliaris*	G4	S3	
Claspingleaf Pondweed	*Potamogeton perfoliatus*	G5	SH	
Climbing Bittersweet	*Celastrus scandens*	G5	S1	
Coast Indigo	*Indigofera miniata*	G5	S1	
Coastal False Asphodel	*Triantha racemosa*	G5	S2S3	
Coastal Ground-cherry	*Physalis angustifolia*	G3G4	S1?	
Coastal Plain Beak Sedge	*Rhynchospora stenophylla*	G4	S1	
Coastal Plain False Foxglove	*Agalinis aphylla*	G3G4	S1	
Coastal Plain Lobelia	*Lobelia flaccidifolia*	G5	S3	
Common Shootingstar	*Dodecatheon meadia*	G5	S2	
Compact Prairie-clover	*Dalea compacta var. pubescens*	G5T5	S1	
Cotton-rose	*Evax verna*	G5	S1	
Cottony Goldenaster	*Chrysopsis gossypina ssp. hyssopifolia*	G5T3T5	S1	
Crested Coralroot	*Hexalectris spicata*	G5	S2	
Croomia	*Croomia pauciflora*	G3	SH	
Cryptic Flat Sedge	*Cyperus cephalanthus*	G3?Q	S2	
Culver's-root	*Veronicastrum virginicum*	G4	SH	
Cupleaf Beardtongue	*Penstemon murrayanus*	G4	S1	
Cypress-knee Sedge	*Carex decomposita*	G3G4	S3	
Death Camas	*Zigadenus leimanthoides*	G4Q	S1	
Devil's-bit	*Chamaelirium luteum*	G5	S2S3	
Dixie Stitchwort	*Minuartia muscorum*	G4	S3	
Dotted Gayfeather	*Liatris punctata*	G5	S1	
Downy Prairie-clover	*Dalea lanata*	G5	S1	
Downy Yellow Violet	*Viola pubescens*	G5	S1	
Drummond's Nailwort	*Paronychia drummondii*	G4G5	S2	
Drummond's Sandwort	*Minuartia drummondii*	G5	S2	
Drummond's Yellow-eyed-grass	*Xyris drummondii*	G3	S3	
Dune Sandbur	*Cenchrus tribuloides*	G5	S2	
Durand Oak	*Quercus sinuata var. sinuata*	G4G5T4	S1	
Dwarf Bulrush	*Lipocarpha micrantha*	G5	S1	
Dwarf Burhead	*Echinodorus tenellus*	G5?	SH	

Dwarf Filmy Fern	*Trichomanes petersii*	G4G5	S2	
Dwarf Gray Willow	*Salix humilis var. tristis*	G5T4T5	S2	
Earleaf Greenbrier	*Smilax auriculata*	G4?	S2	
Early Goldenrod	*Solidago juncea*	G5	S1	
Earth-fruit	*Geocarpon minimum*	G2	S2	Threatened
East Texas Greenthread	*Thelesperma flavodiscum*	G4	S1	
Eastern Leatherwood	*Dirca palustris*	G4	S1	
Elliott's Sida	*Sida elliottii*	G4G5	SH	
Engelmann's Sea-grass	*Halophila engelmannii*	G3G5	S1	
Evening Rainlily	*Cooperia drummondii*	G5	S2	
Fire Pink	*Silene virginica*	G5	S2	
Flame Hedgehyssop	*Gratiola flava*	G4	S1	
Flat-fruit Beak Sedge	*Rhynchospora compressa*	G4	S3	
Flax-leaf False-foxglove	*Agalinis linifolia*	G4?	S2	
Floating Antler Fern	*Ceratopteris pteridoides*	G5?	S2	
Floating Manna Grass	*Glyceria septentrionalis*	G5	S1	
Florida Hedge-hyssop	*Gratiola floridana*	G4	SH	
Fly-poison	*Amianthium muscitoxicum*	G4G5	SH	
Four-point Evening Primrose	*Oenothera rhombipetala*	G4G5	S1?	
Fowl Manna Grass	*Glyceria striata*	G5	S1	
Fringed Poppy-mallow	*Callirhoe digitata*	G4	S1	
Georgia Tickseed	*Coreopsis nudata*	G3?	S2	
Glade Fern	*Diplazium pycnocarpon*	G5	S2	
Golden Canna	*Canna flaccida*	G4?	S4?	
Goldencrest	*Lophiola aurea*	G4	S2S3	
Golden-wave Tickseed	*Coreopsis intermedia*	G3	S2	
Gopher-apple	*Licania michauxii*	G4G5	SH	
Granite Gooseberry	*Ribes curvatum*	G4	S2	
Grapefruit Primrose-willow	*Ludwigia sphaerocarpa*	G5	S2	
Great Plains Ladies'-tresses	*Spiranthes magnicamporum*	G4	S2	
Green-fringe Orchid	*Platanthera lacera*	G5	S1	
Gregg's Amaranth	*Amaranthus greggii*	G4?	S3	
Grooved Yellow Flax	*Linum sulcatum*	G5	S1	
Ground-plum	*Astragalus crassicarpus var. trichocalyx*	G5T5?	S1	
Gulf Bluestem	*Schizachyrium maritimum*	G3G4Q	S1	
Gulf Spikemoss	*Selaginella ludoviciana*	G3G4	S1	
Hairy Lipfern	*Cheilanthes lanosa*	G5	S1	
Hall's Panic Grass	*Panicum hallii var. filipes*	G5T5	S1	
Hall's Pocket Moss	*Fissidens hallii*	G2	S1	
Harper's Yellow-eyed-grass	*Xyris scabrifolia*	G3	S2	
Heartleaf Skullcap	*Scutellaria cardiophylla*	G4?	S2	

Hemlock Water-parsnip	*Sium suave*	G5	S1S2	
Hooker's Milkwort	*Polygala hookeri*	G3	S1	
Illinois Flat Sedge	*Cyperus grayoides*	G3	S3	
Illinois Pinweed	*Lechea racemulosa*	G5	SU	
Incised Groovebur	*Agrimonia incisa*	G3	S1	
Indian Cucumber-root	*Medeola virginiana*	G5	S1	
Inkberry	*Scaevola plumieri*	G5	SH	
June Grass	*Koeleria macrantha*	G5	S1	
Key Grass	*Monanthochloe littoralis*	G4G5	S1	
Lady Lupine	*Lupinus villosus*	G5	S2	
Lanceleaved Buckthorn	*Rhamnus lanceolata*	G5	SH	
Lanceleaved Glade Fern	*Diplazium lonchophyllum*	G3G5	S1	
Large Beak Sedge	*Rhynchospora macra*	G3	S3	
Large Clammyweed	*Polanisia erosa*	G5	S2	
Large White Fringed Orchid	*Platanthera blephariglottis var. conspicua*	G4G5T3T4	S1	
Large-leaved Grass-of-Parnassus	*Parnassia grandifolia*	G3	S1	
Le Conte's Thistle	*Cirsium lecontei*	G2G3	S2	
Leggett's Pinweed	*Lechea pulchella*	G5	S1S2	
Limewater Brookweed	*Samolus ebracteatus*	G4G5	S1	
Lindheimer's Beebalm	*Monarda lindheimeri*	G4	S1	
Little Floatingheart	*Nymphoides cordata*	G5	SH	
Littleleaf Milkwort	*Polygala brevifolia*	G4G5	S1	
Log Fern	*Dryopteris celsa*	G4	S1	
Long-horned Habenaria	*Habenaria quinqueseta*	G4G5	S1	
Longleaved Wild-buckwheat	*Eriogonum longifolium*	G4	S2	
Long-sepaled False Dragon Head	*Physostegia longisepala*	G2G3	S2S3	
Loose-flowered Water-milfoil	*Myriophyllum laxum*	G3	S1	
Louisiana Bluestar	*Amsonia ludoviciana*	G3	S3	
Louisiana Quillwort	*Isoetes louisianensis*	G2G3	S2	Endangered
Louisiana Squarehead	*Tetragonotheca ludoviciana*	G4	S3	
Low Erythrodes	*Platythelys querceticola*	G3G5	S1	
Low Nut Sedge	*Scleria verticillata*	G5	S1	
Manatee-grass	*Syringodium filiforme*	G4	SU	
Many-flowered Grass-pink	*Calopogon multiflorus*	G2G3	S1	
Many-flowered Wild-buckwheat	*Eriogonum multiflorum*	G5	S3	
Meadowparsnip	*Thaspium chapmanii*	GNR	S1	
Mead's Sedge	*Carex meadii*	G4G5	S3	
Mexican Hat	*Ratibida peduncularis*	G4G5	S2S3	
Michaux's Milkweed	*Asclepias michauxii*	G4G5	S2	
Millet Beak Sedge	*Rhynchospora miliacea*	G5	S2	
Missouri Coneflower	*Rudbeckia missouriensis*	G4G5	S2	

Mountain Laurel	*Kalmia latifolia*	G5	S3	
Mullein Foxglove	*Dasistoma macrophylla*	G4	SH	
Myrtle Holly	*Ilex myrtifolia*	G5?	S2	
Narrow-fruit Horned Beak Sedge	*Rhynchospora inundata*	G4?	S1	
Narrowleaf Gumweed	*Grindelia lanceolata var. lanceolata*	G3G5T3T5	S1	
Narrowleaf Whitetop Aster	*Sericocarpus linifolius*	G5	S2	
Narrow-leaved Milkweed	*Asclepias stenophylla*	G4G5	S1	
Narrowleaved Puccoon	*Lithospermum incisum*	G5	S1	
New York Fern	*Thelypteris noveboracensis*	G5	S1	
Night-flowering Wild Petunia	*Ruellia noctiflora*	G2	S1	
Nodding Pogonia	*Triphora trianthophora*	G3G4	S2	
Northern Burmannia	*Burmannia biflora*	G4G5	S3	
Northern Prickly-ash	*Zanthoxylum americanum*	G5	S1	
Northern Red Oak	*Quercus rubra*	G5	S1S3	
Nuttall's Deathcamas	*Zigadenus nuttallii*	G5	S1	
Nuttall's Milkvetch	*Astragalus nuttallianus*	G5	S2S3	
Nuttall's Pondweed	*Potamogeton epihydrus*	G5	SH	
October-flower	*Polygonella polygama*	G4	S2	
Odorless Bayberry	*Morella inodora*	G4	S2	
Oglethorpe's Oak	*Quercus oglethorpensis*	G3	S1	
Oklahoma Grass-pink	*Calopogon oklahomensis*	G3	S1	
Oklahoma Plum	*Prunus gracilis*	G4G5	S2	
One-flowered Broomrape	*Orobanche uniflora*	G5	S1	
Ozark Chinquapin	*Castanea pumila var. ozarkensis*	G5T3	S1	
Pale False Foxglove	*Agalinis skinneriana*	G3G4	S1S2	
Pale Grass-pink	*Calopogon pallidus*	G4G5	S2	
Pale Umbrella-wort	*Mirabilis albida*	G5	S2	
Palm-leaf Scurfpea	*Pediomelum digitatum*	G5	S1	
Panicled Indigobush	*Amorpha paniculata*	G2G3	S2	
Parrot Pitcher Plant	*Sarracenia psittacina*	G4	S3	
Perennial Sand Grass	*Triplasis americana*	G5	S1	
Perfoliate Tinker's-weed	*Triosteum perfoliatum*	G5	SH	
Pineland Bogbutton	*Lachnocaulon digynum*	G3	S3	
Pineland Scaly-pink	*Stipulicida setacea*	G4G5	S1	
Pineland Yellow-eyed-grass	*Xyris stricta var. stricta*	G4	S2	
Pinewoods Milkweed	*Asclepias humistrata*	G4G5	SH	
Pink Bog Button	*Sclerolepis uniflora*	G4	S1	
Pondberry	*Lindera melissifolia*	G2G3	SH	
Pondspice	*Litsea aestivalis*	G3?	SR	
Prairie Cord Grass	*Spartina pectinata*	S2	G5	
Prairie Evening Primrose	*Oenothera pilosella ssp. sessilis*	G5T2	S1?	

Prairie Fameflower	*Phemeranthus rugospermus*	G3G4	S1	
Prairie Milkvine	*Matelea cynanchoides*	G4G5	S1	
Prairie Pleatleaf	*Nemastylis geminiflora*	G4	S2S3	
Prairie Redroot	*Ceanothus herbaceus*	G5	S1	
Purple Bluet	*Houstonia purpurea var. calycosa*	G5T5	S2	
Purple Boneset	*Eupatorium purpureum*	G5	S1	
Purple Coneflower	*Echinacea purpurea*	G4	S2	
Purple Milkweed	*Asclepias purpurascens*	G5?	S1	
Purple Pitcher Plant	*Sarracenia purpurea*	G5	SH	
Purple Poppy-mallow	*Callirhoe involucrata*	G5	SH	
Pyramid Magnolia	*Magnolia pyramidata*	G4	S2	
Red Milkweed	*Asclepias rubra*	G4G5	S3	
Reflexed Trillium	*Trillium recurvatum*	G5	S2	
Riverweed	*Podostemum ceratophyllum*	G5	S1	
Rooted Spike Sedge	*Eleocharis radicans*	G5	S1?	
Rosemary Rockrose	*Helianthemum rosmarinifolium*	G4	S2	
Rosinweed Sunflower	*Helianthus silphioides*	G4	S3S4	
Rough-hair Witch Grass	*Dichanthelium strigosum var. leucoblepharis*	G5T3T5	SH	
Rough-hair Witchgrass	*Dichanthelium strigosum var. glabrescens*	G5T4T5	S1	
Roundleaf Scurfpea	*Pediomelum rhombifolium*	G5	S2S3	
Sabine Coneflower	*Rudbeckia scabrifolia*	G3G4	S3	
San Saba Pinweed	*Lechea san-sabeana*	G4	S1	
Sand Dune Spurge	*Chamaesyce bombensis*	G4G5	S1	
Sand Hickory	*Carya pallida*	G5	S2	
Sand Rose-gentian	*Sabatia arenicola*	G3G5	S1	
Sand Spikemoss	*Selaginella arenicola ssp. riddellii*	G4T4	S3	
Sandhills Scorpionweed	*Phacelia strictiflora*	G5	S2	
Sarvis Holly	*Ilex amelanchier*	G4	S2	
Savanna Beak Sedge	*Rhynchospora debilis*	G4?	S3	
Saw Palmetto	*Serenoa repens*	G4G5	S1	
Scalloped Milkwort	*Polygala crenata*	G4?	S2	
Scarlet Catchfly	*Silene subciliata*	G3	S2	
Scarlet Indian -paintbrush	*Castilleja coccinea*	G5	SH	
Scarlet Oak	*Quercus coccinea*	G5	S2S3	
Sea Oats	*Uniola paniculata*	G5	S2	
Sessile-leaf Bellwort	*Uvularia sessilifolia*	G5	S2	
Shadow-witch Orchid	*Ponthieva racemosa*	G4G5	S2	
Shoal-grass	*Halodule wrightii*	G5	S1S2	
Short-beard Plumegrass	*Saccharum brevibarbe var. brevibarbe*	G3G5	S1	
Shortleaf Sneezeweed	*Helenium brevifolium*	G4	S1	

Southern Shield Woodfern	*Dryopteris ludoviciana*	G4	S2	
Sicklepod	*Arabis canadensis*	G5	S1	
Sideoats Grama	*Bouteloua curtipendula*	G5	S1	
Silky Camellia	*Stewartia malacodendron*	G4	S2S3	
Silky Prairie-clover	*Dalea villosa var. grisea*	G5T4	S2	
Silver Croton	*Croton argyranthemus*	G5	S2	
Silver False Spleenwort	*Deparia acrostichoides*	G5	S2	
Silveus Dropseed	*Sporobolus silveanus*	G4	S2	
Single-head Pussytoes	*Antennaria solitaria*	G5	S2	
Sink-hole Fern	*Blechnum occidentale*	G5	SH	
Slender Gayfeather	*Liatris tenuis*	G3	S1	
Slender Heliotrope	*Heliotropium tenellum*	G5	S2	
Slim Spikerush	*Eleocharis elongata*	G5?	S3	
Slimspike Prairie-clover	*Dalea phleoides*	G4	S1	
Small Palafoxia	*Palafoxia callosa*	G4G5	SH	
Small-flower Flameflower	*Phemeranthus parviflorus*	G5	S3	
Small-fruit Seedbox	*Ludwigia microcarpa*	G5	S1	
Small's Beak Sedge	*Rhynchospora globularis var. pinetorum*	G5?T3?	S1	
Small's Yellow-eyed-grass	*Xyris smalliana*	G5	S1	
Small-toothed Caric Sedge	*Carex microdonta*	G4	S3	
Smooth Twistflower	*Streptanthus hyacinthoides*	G4	S2	
Smooth Scorpionweed	*Phacelia glabra*	G4	S2	
Snow Melanthera	*Melanthera nivea*	G5	S2	
Solomon's-plume	*Maianthemum racemosum ssp. racemosum*	G5T5	SH	
Southern Hairgrass	*Muhlenbergia capillaris var. filipes*	G5T5?	S1	
Southern Hairy Woodrush	*Luzula acuminata var. carolinae*	G5T4T5	S1	
Southern Horse-balm	*Collinsonia serotina*	G3G4	S1	
Southern Lady's-slipper	*Cypripedium kentuckiense*	G3	S1	
Southern Red Lily	*Lilium catesbaei*	G4	S1	
Southern Thimbleweed	*Anemone berlandieri*	G4?	S2	
Southwestern Bedstraw	*Galium virgatum*	G4G5	S2	
Soxman's Milkvetch	*Astragalus soxmaniorum*	G3	S2	
Spoonleaf Sundew	*Drosera intermedia*	G5	S2	
Sprawling Hoary-pea	*Tephrosia hispidula*	G4G5	S2?	
Spreading Beak Sedge	*Rhynchospora divergens*	G4	S1	
Spreading Bladderpod	*Lesquerella gracilis*	G5	SH	
Spreading Pogonia	*Cleistes bifaria*	G4?	S1	
Spreading Pygmyleaf	*Loeflingia squarrosa*	G5	S1	
Spring Hill Flax	*Linum macrocarpum*	G2	S1	
Square-stem Monkeyflower	*Mimulus ringens*	G5	S2	
Staggerbush	*Lyonia mariana*	G5	S1	

Staghorn Clubmoss	*Lycopodiella cernua var. cernua*	G5T5	S2	
Starry Campion	*Silene stellata*	G5	S2	
Stiff Tickseed	*Coreopsis palmata*	G5	S2	
Summer Farewell	*Dalea pinnata*	G5	S1	
Swamp Milkweed	*Asclepias incarnata*	G5	S2	
Swamp Thistle	*Cirsium muticum*	G5	SU	
Swamp-forest Beak Sedge	*Rhynchospora decurrens*	G3G4	SH	
Tall Bellflower	*Campanulastrum americanum*	G5	S1	
Texas Grama	*Bouteloua rigidiseta*	G5	S1	
Texas Palafoxia	*Palafoxia texana var. ambigua*	G3G5TNR	S1	
Texas Ragwort	*Senecio ampullaceus*	G4	S1S2	
Texas Saxifrage	*Saxifraga texana*	G4	S1	
Texas Screwstem	*Bartonia texana*	G2	S1	
Texas Sunnybell	*Schoenolirion wrightii*	G3	S2	
Texas Trillium	*Trillium texanum*	G2	S1	
Texas Yellowstar	*Lindheimera texana*	G5	S1	
Thread-stem False Foxglove	*Agalinis filicaulis*	G3G4	S2	
Three-flowered Hawthorn	*Crataegus triflora*	G2G3	S1	
Three-lobed Coneflower	*Rudbeckia triloba*	G5	S3	
Threeway Sedge	*Dulichium arundinaceum*	G5	S2	
Thymeleaf Pinweed	*Lechea minor*	G5	S2	
Tracy's Beak Sedge	*Rhynchospora tracyi*	G4	S1	
Tracy's Sundew	*Drosera tracyi*	G3G4	SH	
Tumble Grass	*Schedonnardus paniculatus*	G5	S1	
Turkey Oak	*Quercus laevis*	G5	S1	
Turk's-Cap Lily	*Lilium superbum*	G5	S1	
Turtle-grass	*Thalassia testudinum*	G4G5	S2?	
Tussock Sedge	*Carex stricta*	G5	SH	
Upland Swamp Privet	*Forestiera ligustrina*	G4G5	S3	
Viperina	*Zornia bracteata*	G5?	S2	
Virginia Anemone	*Anemone virginiana*	G5	S1	
Virginia saxifrage	*Saxifraga virginiensis*	G5	SH	
Virginia Strawberry	*Fragaria virginiana*	G5	S1	
Wahoo	*Euonymus atropurpureus*	G5	S1	
Wand Blackroot	*Pterocaulon virgatum*	G5	S3	
Water-purslane	*Didiplis diandra*	G5	S2?	
Waxyleaf Meadowrue	*Thalictrum revolutum*	G5	S1	
Wedgeleaf Prairie-clover	*Dalea emarginata*	G5	S2	
Wedgeleaf Whitlow-grass	*Draba cuneifolia*	G5	S1	
Western Horse-nettle	*Solanum dimidiatum*	G5	S2S3	
Western Umbrella Sedge	*Fuirena simplex var. aristulata*	G5T4	S1	

White Baneberry	*Actaea pachypoda*	G5	S2	
White Trout-lily	*Erythronium albidum*	G5	S2	
Whiteleaf Leatherflower	*Clematis glaucophylla*	G4?	S1	
Wild Coco Orchid	*Pteroglossaspis ecristata*	G2G3	S2	
Wild Crane's-bill	*Geranium maculatum*	G5	S1	
Willdenow's Maiden Fern	*Thelypteris interrupta*	G5?	S1	
Winged Seedbox	*Ludwigia alata*	G3G5	S1	
Wiry Witch Grass	*Panicum flexile*	G5	S2	
Wolf's Spike Sedge	*Eleocharis wolfii*	G3G5	S3	
Woodland Bluegrass	*Poa sylvestris*	G5	S1	
Woolly Honeysweet	*Tidestromia lanuginosa*	G5	S1	
Woolly Plantain	*Plantago patagonica*	G5	S2	
Yellow Butterwort	*Pinguicula lutea*	G4G5	S2	
Yellow Fringeless Orchid	*Platanthera integra*	G3G4	S3	
Yellow Pimpernel	*Taenidia integerrima*	G5	S2	
Yellow Water-crowfoot	*Ranunculus flabellaris*	G5	S1	
Yellowleaf Tinker's-weed	*Triosteum angustifolium*	G5	S2	
Yellowroot	*Xanthorhiza simplicissima*	G5	S1	
Yellow-wood	*Cladrastis kentukea*	G4	S1	
Zigzag Goldenrod	*Solidago flexicaulis*	G5	S1	

APPENDIX J. HABITAT CROSSWALK WITH MACROGROUPS AND GROUPS OF THE NATIONAL VEGETATION CLASSIFICATION SYSTEM (NVCS).

Macrogroup Code	Macrogroup Name	Group Code	Group Name	WAP Habitats
M066	**Atlantic & Gulf Coastal Freshwater & Oligohaline Tidal Marsh**	**G110**	**Atlantic & Gulf Coastal Plain Freshwater & Oligohaline Tidal Marsh**	**Estuarine Submersed Aquatic Vegetation**
				Freshwater Floating Marsh
				Freshwater Marsh
				Intermediate Marsh
				Vegetated Pioneer Emerging Delta
M065	**Atlantic & Gulf Coastal Plain Bog & Fen**	**G186**	**Southeastern Coastal Plain Pocosin & Shrub Bog**	**Bayhead Swamp/Forested Seep**
M067	**Atlantic & Gulf Coastal Plain Wet Prairie & Marsh**	**G777**	**Atlantic & Gulf Coastal Interdunal Marsh & Prairie**	**Coastal Dune Grassland/Coastal Dune Shrub Thicket (herbaceous marsh occupying interdune wet swale)**
				Freshwater Marsh
		G111	**Atlantic & Gulf Coastal Plain Pondshore & Wet Prairie**	**EGCP Flatwoods Pond**
				Prairie Pothole
				Sparta Sand Pond
				WGCP Flatwoods Pond
		G187	**Southeastern Coastal Plain Seepage Wetland**	**Eastern Hillside Seepage Bog**
				West Gulf Coastal Plain Muck Bog
				Western Hillside Seepage Bog
M029	**Central & Appalachian Floodplain Forest**	**G673**	**Silver Maple - Sugarberry - Sweetgum Floodplain Forest**	**Bottomland Hardwood Forest**
M508	**Central Interior Calcareous Scrub & Grassland**	**G174**	**South-Central Patch Prairie**	**Mississippi Terrace Prairie**
M186	**Ditchgrass Saline Aquatic Vegetation**	**G383**	**Widgeongrass**	**Estuarine Submersed Aquatic Vegetation**
M060	**Eastern North American Coastal Beach & Rocky Shore**	**G661**	**South Atlantic & Gulf Coastal Beach**	**Louisiana Beach**
M057	**Eastern North American Dune & Coastal Grassland & Shrubland**	**G494**	**South Atlantic & Gulf Shrub & Grass Coast & Dune**	**Coastal Dune Grassland/Coastal Dune Shrub Thicket**
M108	**Eastern North American Freshwater Aquatic Vegetation**	**G114**	**Eastern North American Freshwater Aquatic Vegetation**	**Coastal Marsh and Bayou Freshwater SAV**
				Interior Freshwater Submersed Aquatic Vegetation
				River Delta Freshwater Submersed Aquatic Vegetation
M880	**Eastern North America Wet Shoreline Vegetation**	**G755**	**Central Riverine Wetland Vegetation**	**Sandbar**
M302	**Eastern North American Ruderal Flooded & Swamp Forest**	**G552**	**Northern & Central Native Ruderal Flooded & Swamp Forest**	**Bottomland Hardwood Forest (on basis of boxelder (*Acer negundo*) ruderal forest association: CEGL005033)**

M069	**Eastern North American Wet Meadow & Marsh**	**G167**	**Northern & Central Shrub Swamp**	**Canebrake**
M054	**Great Plains Tallgrass Prairie**	**G335**	**South-Central Plains & Coastal Prairie**	**Coastal Prairie**
M180	**Indo-Pacific & Caribbean Seagrass Vegetation**	**G376**	**Caribbean Seagrass**	**Marine Seagrass Bed**
M007	**Longleaf Pine Woodland**	**G009**	**Dry-Mesic Loamy Longleaf Pine Woodland**	**Eastern Upland Longleaf Pine Woodland**
				Western Longleaf Pine Flatwoods Savanna - Acidic
				Western Longleaf Pine Flatwoods Savanna - Saline
				Western Upland Longleaf Pine Woodland
		G190	**Wet-Mesic Longleaf Pine Woodland**	**Eastern Longleaf Pine Savanna**
				Slash Pine-Pondcypress/Hardwood Woodland
				Western Longleaf Pine Flatwoods Savanna - Acidic
				Western Longleaf Pine Flatwoods Savanna - Saline
		G154	**Xeric Longleaf Pine Woodland**	**Eastern Upland Longleaf Pine Woodland**
				Western Upland Longleaf Pine Woodland
				Xeric Sandhill Woodland
M079	**North American Atlantic & Gulf Coast Salt Marsh**	**G120**	**Atlantic & Gulf Coast Brackish Tidal Marsh**	**Brackish Marsh**
		G121	**Atlantic & Gulf Coast High Salt Marsh**	**Brackish Marsh**
		G122	**Atlantic & Gulf Coast Low Salt Marsh**	**Coastal Mangrove-Marsh Shrubland**
				Salt Marsh
M161	**Pond-cypress Basin Swamp**	**G036**	**Pond-cypress Basin Swamp**	**Slash Pine-Pondcypress/Hardwood Woodland**
				Pondcypress-Blackgum Swamps
M885	**Southeastern Coastal Plain Evergreen Oak & Mixed Hardwood Forest**	**G798**	**Coastal Live Oak - Hickory - Palmetto Forest**	**Barrier Island Live Oak Forest (Maritime Forest)**
				Coastal Dune Grassland/Coastal Dune Shrub Thicket
				Coastal Live Oak-Hackberry Forest
				Live Oak-Pine-Magnolia Forest
				Salt Dome Hardwood Forest
M309	**Southeastern Coastal Plain Patch Prairie**	**G175**	**Southeastern Coastal Plain Patch Prairie**	**Calcareous Prairie**
M310	**Southeastern North American Ruderal Flooded & Swamp Forest**	**G553**	**Southeastern Native Ruderal Flooded & Swamp Forest**	**Eastern Longleaf Pine Savanna**
				Western Longleaf Pine Flatwoods Savanna - Acidic

				(These habitats are included on the basis of fire-suppressed examples possessing thick woody vegetation, as opposed to open grassy high-quality examples)
M305	**Southeastern North American Ruderal Forest**	**G031**	**Southeastern Native Ruderal Forest**	**Mixed Hardwood-Loblolly Pine Forest**
M016	**Southern & South-Central Oak - Hickory - Pine Forest**	**G601**	**Chinquapin Oak - Shumard Oak - Blue Ash Alkaline Forest**	**Calcareous Forest**
		G013	**Western Gulf Coastal Plain Pine - Oak Forest & Woodland**	**Calcareous Forest**
				Mixed Hardwood-Loblolly Pine Forest
				Shortleaf Pine/Oak Hickory Woodland
				Xeric Sandhill Woodland
M308	**Southern Barrens & Glade**	**G584**	**Southeastern Coastal Plain Barrens & Glade**	**Saline Prairie**
				Sandstone Glade/Barren
M033	**Southern Coastal Plain Basin Swamp & Flatwoods**	**G038**	**Coastal Plain Hardwood Basin Swamp**	**Cypress-Tupelo-Blackgum Swamps**
				Macon Ridge Green Ash Pond
		G130	**Hardwood & Loblolly Pine Nonriverine Wet Flatwoods**	**Mixed Hardwood-Loblolly Pine Forest**
				Spruce Pine-Hardwood Flatwoods
				Mesic Hardwood Flatwoods
				Wet Hardwood Flatwoods
M032	**Southern Coastal Plain Evergreen Hardwood & Conifer Swamp**	**G037**	**Coastal Plain Mixed Evergreen Swamp**	**Bayhead Swamp/Forested Seep**
				Slash Pine-Pondcypress/Hardwood Woodland
M031	**Southern Coastal Plain Floodplain Forest**	**G033**	**Bald-cypress - Tupelo Floodplain Forest**	**Bottomland Hardwood Forest (included on the basis of a very wet-sited associations, waterlocust (*Gleditsia aquatica*)-water hickory (Carya aquatica) forest - CEGL007426; planertree (*Planera aquatica*) forest - CEGL007394**
				Cypress-Tupelo-Blackgum Swamps
		G034	**Oak - Sweetgum Floodplain Forest**	**Bayhead Swamp/Forested Seep**
				Bottomland Hardwood Forest
				Cypress-Tupelo-Blackgum Swamp
				Live Oak Natural Levee Forest
				Small Stream Forest
		G759	**Southern Ash - Elm - Willow Floodplain Forest**	**Batture**
				Bottomland Hardwood Forest
M008	**Southern Mesic Mixed Broadleaf Forest**	**G007**	**Southern Mesic Beech - Magnolia - Oak Forest**	**Hardwood Slope Forest**
				Mixed Hardwood-Loblolly Pine Forest

				Prairie Terrace Loess Forest (Placement here follows National Vegetation Classification; perhaps better placed in M033/G130 with other flatwoods habitats)
				Small Stream Forest
				Southern Mesophytic Hardwood Forest
		G166	**Southern Mesic Beech - Oak - Mixed Deciduous Forest**	**Calcareous Forest**
				Hardwood Slope Forest
				Mixed Hardwood-Loblolly Pine Forest
				Small Stream Forest

APPENDIX K. CCVI SCORES FOR REPRESENTATIVE SGCN

Southern Pocketbook	NV
Louisiana Pearlshell	HV
Southern Hickorynut	MV
Hickorynut	NV
Inflated Heelsplitter	MV
Rabbitsfoot	MV
Creeper	NV
Calcasieu Painted Crawfish	HV
Caddo Chimney Crawfish	HV
Flatwoods Digger	MV
Vernal Crawfish	MV
Pitcher Plant Spiketail	MV
Louisiana Needlefly	MV
Cajun Tiger Beetle	NV
American Bumble Bee	NV
Molson's Microcaddisfly	MV
Creole Pearly-Eye	MV
Arogos Skipper	HV
Dusted Skipper	NV
Palatka Skipper	HV
Louisiana Eyed Silkmoth	EV
Nutmeg Underwing	NV
Gulf Sturgeon	NV
Bluehead Shiner	MV
Bluenose Shiner	HV
River Redhorse	MV
Frecklebelly Madtom	MV
Western Sand Darter	NV
Crystal Darter	MV
Gulf Logperch	MV
Saltmarsh Topminnow	HV
Louisiana Slimy Salamander	EV
Gulf Coast Mud Salamander	HV
Red River Mudpuppy	NV
Southern Crawfish Frog	HV
Alligator Snapping Turtle	NV
Smooth Softshell	NV
Mississippi Diamond-backed Terrapin	HV

Gopher Tortoise	NV
Eastern Hog-nosed Snake	NV
Louisiana Pinesnake	MV
Southeastern Crowned Snake	NV
Redhead	NV
Northern Bobwhite	NV
Brown Pelican	MV
Glossy Ibis	NV
Clapper Rail	HV
King Rail	MV
Wilson's Plover	MV
Dunlin	NV
Buff-breasted Sandpiper	NV
Royal Tern	MV
Black Skimmer	MV
Short-eared Owl	NV
Chuck-will's-widow	NV
Chimney Swift	NV
Red-headed Woodpecker	NV
Louisiana Waterthrush	NV
Golden-winged Warbler	NV
Swainson's Warbler	NV
Henslow's Sparrow	NV
Seaside Sparrow	HV
Dickcissel	NV
Rusty Blackbird	NV
West Indian Manatee	NV
Baird's Pocket Gopher	MV
Eastern Chipmunk	NV
Rafinesque's Big-eared Bat	NV
Louisiana Black Bear	NV

APPENDIX L. WILDLIFE TRACS 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 Categories	**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, anaerobic 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)
		In stream 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
			Stream bank stabilization	Miles	Stabilization of stream banks (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		Interventions	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		Interventions	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 in stream 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 in stream 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 in stream 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

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APPENDIX M. EXPLANATION OF CONSERVATION STATUS AND THREATS 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 M. 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)

STATE ELEMENT RANKS:

S1 = critically imperiled in Louisiana because of extreme rarity (5 or fewer known extant populations) or because of some factor(s) making it especially vulnerable to extirpation

S2 = imperiled in Louisiana because of rarity (6 to 20 known extant populations) or because of some factor(s) making it very vulnerable to extirpation

S3 = rare and local throughout the state or found locally (even abundantly at some of its locations) in a restricted region of the state, or because of other factors making it vulnerable to extirpation (21 to 100 known extant populations)

S4 = apparently secure in Louisiana with many occurrences (100 to 1000 known extant populations)

S5 = demonstrably secure in Louisiana (1000+ known extant populations)

(B or N may be used as qualifier of numeric ranks and indicating whether the occurrence is breeding or nonbreeding)

SA = accidental in Louisiana, including species (usually birds or butterflies) recorded once or twice or only at great intervals hundreds or even thousands of miles outside their usual range

SH = of historical occurrence in Louisiana, but no recent records verified within the last 20 years; formerly part of the established biota, possibly still persisting

SR = reported from Louisiana, but without conclusive evidence to accept or reject the report

SU = possibly in peril in Louisiana, but status uncertain; need more information

SX = believed to be extirpated from Louisiana

SZ = transient species in which no specific consistent area of occurrence is identifiable

NATURESERVE THREAT RANKING DEFINITIONS:

Scope of Threat:

Pervasive – Affects all or most (71-100%) of the total population or occurrences
Large – Affects much (31-70%) of the total population or occurrences
Restricted – Affects some (11-30%) of the total population or occurrences
Small – Affects a small (1-10%) proportion of the total population or occurrences

Severity of Threat:

Extreme – Within the scope, the Threat is likely to destroy or eliminate the occurrences of an ecological community, system, or species, or reduce the species population by 71-100%
Serious – Within the scope, the Threat is likely to seriously degrade/reduce the effected occurrences or habitat, or, for species, to reduce the species population by 31-70%
Moderate - Within the scope, the Threat is likely to moderately degrade/reduce the effected occurrences or habitat, or, for species, to reduce the species population by 11-30%
Slight - Within the scope, the Threat is likely to only slightly degrade/reduce the effected occurrences or habitat, or, for species, to reduce the species population by 1-10%