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Louisiana State Wildlife Action Plan

OCTOBER 2025



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LOUISIANA STATE WILDLIFE ACTION PLAN

OCTOBER 2025

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Executive Summary

The Louisiana State Wildlife Action Plan (SWAP) is Louisiana's official blueprint for conservation of our state's fishes, wildlife, plants, and natural communities. The SWAP is a non-regulatory document that provides guidance to fish, wildlife, and habitat managers to maximize the efficacy of research and conservation efforts for Species of Greatest Conservation Need (SGCN) and their associated natural communities. As you will see in this document, many SGCN have conservation actions and research needs that still need to be addressed, resulting in significant data gaps that leave species vulnerable to a myriad of threats, many of which act synergistically. To help address these challenges, the U.S. Congress created the State and Tribal Wildlife Grant Program (SWG; Program) to aid in the conservation of SGCN, which often have no other eligible funding sources. The ultimate goal of the Program is to facilitate research and conservation actions to prevent species from being listed as threatened or endangered under the Endangered Species Act (ESA). To maintain eligibility for SWG funds, each state fish and wildlife agency is required to submit a SWAP which is mandated to undergo a comprehensive review every 10 years. This is Louisiana's third iteration of this document.

Louisiana's lands and waters provide resources for thousands of game and nongame fish and wildlife species. Each year, the state provides refuge to millions of migrating landbirds, shorebirds, and waterfowl and safe nesting sites for hundreds of wading bird and seabird colonies, some of which are among the largest in North America. It is also home to other charismatic species such as the Monarch, Gopher Tortoise, Bald Eagle, and Louisiana Black Bear. The SWAP features 428 fish and wildlife SGCN, 552 plant SGCN, and 61 Natural Communities and is the roadmap guiding conservation and restoration of these species in the state, with great success.

In March 2016, the Louisiana Black Bear was officially delisted and removed from ESA protections. The recovery of this species was the result of extensive efforts that included SWG funded academic research and partnerships with private landowners who voluntarily restored more than 485,000 acres of bottomland hardwood forest. These restoration efforts generated suitable habitat for the species and created corridors of habitat to safely enable the large-scale movements of the species.

In 2023, the Frecklebelly Madtom, a species of small catfish, was listed as federally threatened in the Coosa River system of Georgia and Tennessee due to population declines resulting from habitat degradation. However, the species was not federally listed in the Louisiana portion of its range. Field inventories funded by SWG and habitat protections provided by Louisiana's Natural and Scenic Rivers Act and State and federal lands in the Pearl and Bogue Chitto watersheds demonstrated that listing was not warranted for the Louisiana population. These species were successfully recovered or made more resilient as a result of targeted surveys and dedicated restoration efforts, neither of which would have been possible without SWG funding facilitated by the SWAP.

This document is intended to be a comprehensive conservation strategy to be used collaboratively by the Louisiana Department of Wildlife and Fisheries and our partners for the conservation of all SGCN and their habitats.

Acknowledgments

The 2025 Louisiana State Wildlife Action Plan was truly a team effort. LDWF staff from the Wildlife Diversity Program, Office of Wildlife, and the Office of Fisheries (Inland and Marine sections) invested more than 7,000 hours in the revision of this document. Ensuring the best available information was utilized, taxa team members spent numerous hours writing their respective chapters, recalculating conservation ranks, and identifying research and conservation actions. An extra thank you goes out to those members who were on multiple teams. We also thank all of our external taxa experts who provided invaluable information and expertise. Taxa Team members, Core Team members, external experts, and partners are all listed in Appendices A, B, and C. In addition, we thank the following LDWF employees who were not on a team but contributed to the revision: Nikki Anderson, Ivy Bonin, Adley Bunch, Katherine Ellis, Andy Fischer, Jason Froeba, Hannah Gonzales, Emma Guidry, John Hanks, Leigh Ann LaFrance, Melissa Longman, Christy McDonough, Jason Olszak, Eva Szyszkoski, Jon Wiebe, Matt Weigel, Amelia Wolfe, Sara Zimorski, and Zach Zuckerman.

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We are especially appreciative of the editors who reviewed and edited every chapter in this document.

We are particularly grateful to those organizations or individuals who reviewed and commented on the draft version of this document, including:

Finally, we also thank the authors, contributors, and experts who helped create previous editions of this document, which provided a solid foundation on which to build.

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The Eight Required Elements

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. Description of location 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. Descriptions of the 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 plan at intervals not to exceed 10 years.
7. Plans for coordinating, to the extent feasible, the development, implementation, review, and revision of the plan 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. Description of the necessary public participation in the development, revision, and implementation of the plan.

ROADMAP TO THE EIGHT REQUIRED ELEMENTS

Element	Chapter or Appendix	Pages
1. Distribution and Abundance of SGCN	Chapter 4: SGCN	Pages 33-99
	Chapter 10: Regional Perspective	Pages 244-266
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2. Location and Relative Condition of Key Habitats	Chapter 5: Natural Communities	Pages 100-181
	Chapter 7: COAs	Pages 190-199
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3. Problems Affecting SGCN and Research Actions	Chapter 4: SGCN	Pages 33-99
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	Chapter 8: Threats	Pages 200-215
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	Chapter 9: Monitoring	Pages 216-243
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5. Monitoring and Adaptive Management	Chapter 9: Monitoring	Pages 216-243
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7. Coordination of Review and Revision	Chapter 3: Approach	Pages 30-32
8. Public Participation	Chapter 3: Approach	Pages 30-32

Summary of Changes

The Louisiana Department of Wildlife and Fisheries (LDWF) notified the U.S. Fish and Wildlife Service (USFWS) of the intent to comprehensively review and revise the Louisiana State Wildlife Action Plan (SWAP) on 6 February 2023. This section details the major changes made during the 2025 SWAP revision, and, in conjunction with the Roadmap to the Eight Required Elements (page 12), will enable readers to quickly identify those areas that have been updated.

Prior to the official start of the SWAP revision, LDWF sent a SWAP survey to LDWF staff, partners (Appendix B), individuals from the State Wildlife Grant (SWG) distribution list, and tribal representatives. This survey was conducted in an effort to gauge how the 2015 SWAP was utilized and to acquire recommendations for the 2025 comprehensive revision. More information on the survey and results can be found in Chapter 3: Approach. The survey responses guided the decision making process for the LDWF Core Team during initial SWAP revision meetings. In an effort to reduce redundancy and make the SWAP more streamlined and easy to use, the research needs and conservation actions were combined into one list, and a table of the most commonly needed actions was added for each taxa group. In addition, the Core Team removed tiers from both the Species of Greatest Conservation Need (SGCN) and Natural Communities chapters. The Core Team and Taxa Team members (Appendix A) agreed that the designations were of limited value when prioritizing focal species for projects or management actions. However, taxa experts indicated that tiers were valuable when discussing invasive species. As such, the Invasives Team revised Tier (1- 4) definitions and added Tier 5, which serves as a watch list for species not currently found in Louisiana, but that have the potential to invade.

As in 2015, LDWF used teams of taxa experts to review all SGCN and natural communities for the 2025 SWAP; a total of 64 animal SGCN were removed (*Table 1*) and 133 were added (*Table 2*). Taxa teams updated scientific and common names, global and sub-national ranks (G- and S- ranks), and modified research needs and conservation actions, and threats. One natural community - Ouachita Sand Prairie and Woodland - was added, Cave was removed, and other communities were renamed or reorganized. In the 2015 SWAP, a full list of SGCN

was listed under each natural community type. This resulted in substantial redundancy. In an effort to minimize redundancy in the 2025 revision, only obligate or near-obligate SGCN are listed for each natural community. A comprehensive list of SGCN occurring in each natural community subtype is included in Appendix F.

The most significant change in the 2025 revision was the addition of plants to the SGCN chapter. Plant SGCN, which were included in an appendix in the 2015 SWAP, are now in the body of the SGCN chapter and include the same information as animal species. Although plants are not eligible for funding under the State Wildlife Grant Program, they are eligible through other funding sources and their importance to animals and natural communities should not be overlooked. The complete list of plants can be found in Chapter 4: SGCN.

In addition to the SGCN and Natural Community revisions, LDWF worked with the USFWS Science Applications Migratory Birds Program and the Southeast Conservation Adaptation Strategy (SECAS) to redefine the 2015 Conservation Opportunity Areas (COAs). This resulted in fewer COAs (nine instead of 30). The development of the COAs were data informed and defined, in part, by specific conservation actions. The new COA boundaries and information about the COA process are located in Chapter 7.

Other changes in the 2025 SWAP include a chapter written by SECAS staff on regional and landscape conservation (Chapter 10). This chapter has information about Regional SGCN (RSGCN) and the potential impacts of climate change on SGCN and their habitats and includes a case study provided by the Southeast Climate Adaptation Science Center. SECAS also provided a new standalone Threats chapter (Chapter 8), which details Louisiana-specific threats and actions.

TABLE 1. Previously identified Species of Greatest Conservation Need that were removed for this revision.

MOLLUSKS (8 total)	
Common Name	Scientific Name
Silty Hornsnail	<i>Pleurocera canaliculata</i>
Western Fanshell	<i>Cyprogenia aberti</i>
Round Pearlshell	<i>Glebulula rotundata</i>
Alabama Hickorynut	<i>Obovaria unicolor</i>
Channeled Whelk	<i>Busycotypus canaliculatus</i>
Lightning Whelk	<i>Busycon sinistrum</i>
Rayed Creekshell	<i>Anodontoides radiatus</i>
Pyramid Pigtoe	<i>Pleurobema rubrum</i>

CRUSTACEANS (6 total)	
Common Name	Scientific Name
Carolinian Ghost Shrimp	<i>Callichirus major</i>
Peppermint Shrimp	<i>Lysmata wurdemanni</i>
Ouachita Fencing Crawfish	<i>Faxonella creaseri</i>
Sabine Fencing Crawfish	<i>Faxonella beyeri</i>
Beach Ghost Shrimp	<i>Callichirus islagrande</i>
Estuarine Ghost Shrimp	<i>Lepidophthalmus louisianensis</i>

NON-CRUSTACEAN ARTHROPODS (8 total)	
Common Name	Scientific Name
Texas Brown Tarantula	<i>Aphonopelma hentzi</i>
Yellow Brachycercus Mayfly	<i>Brachycercus flavus</i>
Sandbar Tiger Beetle	<i>Cicindela blanda</i>
Celia's Roadside-Skipper	<i>Amblyscirtes celia</i>
Little Metalmark	<i>Calephelis virginensis</i>
Georgia Satyr	<i>Neonympha areolatus</i>
Pepper and Salt Skipper	<i>Amblyscirtes hegona</i>
Falcate Orangetip	<i>Anthocharis midea</i>

INLAND FISHES (3 total)	
Common Name	Scientific Name
Sturgeon Chub	<i>Macrhybopsis gelida</i>
Sicklefin Chub	<i>Macrhybopsis meeki</i>
Stargazing Darter	<i>Percina uranidea</i>

MARINE FISHES (3 total)	
Common Name	Scientific Name
Chain Pipefish	<i>Syngnathus louisianae</i>
Broad Flounder	<i>Paralichthys squamilentus</i>
Texas Pipefish	<i>Syngnathus texanus</i>

AMPHIBIANS AND REPTILES (5 total)	
Common Name	Scientific Name
Spotted Dusky Salamander	<i>Desmognathus conanti</i>
Texas Horned Lizard	<i>Phrynosoma cornutum</i>
Eastern Wormsnake	<i>Carphophis amoenus</i>
Common Watersnake	<i>Nerodia sipedon</i>
Eastern Coachwhip	<i>Coluber flagellum</i>

BIRDS (25 total)	
Common Name	Scientific Name
Common Ground-Dove	<i>Columbina passerina</i>
Greater Roadrunner	<i>Geococcyx californianus</i>
Sandhill Crane	<i>Antigone canadensis</i>
Dunlin	<i>Calidris alpina</i>
Caspian Tern	<i>Hydroprogne caspia</i>
American Bittern	<i>Botaurus lentiginosus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Osprey	<i>Pandion haliaetus</i>
White-tailed Kite	<i>Elanus leucurus</i>
Crested Caracara	<i>Caracara cheriway</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Bell's Vireo	<i>Vireo bellii</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
Sedge Wren	<i>Cistothorus platensis</i>
Smith's Longspur	<i>Calcarius pictus</i>
Lark Sparrow	<i>Chondestes grammacus</i>
Swainson's Warbler	<i>Limnethlypis swainsonii</i>
Hooded Warbler	<i>Setophaga citrina</i>
American Redstart	<i>Setophaga ruticilla</i>
Prairie Warbler	<i>Setophaga discolor</i>
Dickcissel	<i>Spiza americana</i>
Warbling Vireo	<i>Vireo gilvus</i>
Common Tern	<i>Sterna hirundo</i>
Sooty Tern	<i>Onychoprion fuscatus</i>

MAMMALS (5 total)	
Common Name	Scientific Name
Bottlenose Dolphin	<i>Tursiops truncatus</i>
Prairie Vole	<i>Microtus ochrogaster</i>
Baird's Pocket Gopher	<i>Geomys breviceps sagittalis</i>
Oak Ridge Pocket Gopher	<i>Geomys breviceps breviceps</i>
Ringtail	<i>Bassariscus astutus</i>

TABLE 2. Species of Greatest Conservation Need Added to the 2025 State Wildlife Action Plan.

MOLLUSKS (7 total)	
Common Name	Scientific Name
Obovaria sp.	<i>Obovaria cf. unicolor</i>
Alabama Spike	<i>Elliptio arca</i>
Cypress Floater	<i>Utterbackiana hartfieldorum</i>
Pascagoula Creekshell	<i>Strophitus pascagoulaensis</i>
Brown-band Wentletrap	<i>Gyroscala rupicola</i>
Round Pigtoe	<i>Pleurobema sintoxia</i>
Texas Lightning Whelk	<i>Sinistrofulgur pulleyi</i>

CRUSTACEANS (4 total)	
Common Name	Scientific Name
Slenderwrist Burrowing Crayfish	<i>Fallicambarus petilicarpus</i>
a crayfish	<i>Creaserinus clausus</i>
a crayfish	<i>Creaserinus crenastylus</i>
Blair's Fencing Crayfish	<i>Faxonella blairi</i>

NON-CRUSTACEAN ARTHROPODS (36 total)	
Common Name	Scientific Name
Stillwater Clubtail	<i>Arigomphus lentulus</i>
Red-veined Pennant	<i>Celithemis bertha</i>
Brown Spiketail	<i>Zoraena bilineata</i>
Southeastern Spinyleg	<i>Dromogomphus armatus</i>
Eastern Ringtail	<i>Erpetogomphus designatus</i>
Taper-tailed Darner	<i>Gomphaeschna antilope</i>
Blackwater Clubtail	<i>Gomphurus dilatatus</i>
Banner Clubtail	<i>Hylogomphus apomyius</i>
Alabama Shadowdragon	<i>Neurocordulia alabamensis</i>
Clearlake Clubtail	<i>Phanogomphus australis</i>
Fine-lined Emerald	<i>Somatochlora filosa</i>
Treetop Emerald	<i>Somatochlora provocans</i>
Clamp-tipped Emerald	<i>Somatochlora tenebrosa</i>
Riverine Clubtail	<i>Stylurus amnicola</i>
Laura's Clubtail	<i>Stylurus laurae</i>
Townes' Clubtail	<i>Stylurus townesi</i>
Phantom Darner	<i>Triacanthagyna trifida</i>
Cherry Bluet	<i>Enallagma concisum</i>
Blackwater Bluet	<i>Enallagma weewa</i>
Sphagnum Sprite	<i>Nehalennia gracilis</i>
an <i>Anillinus</i> ground beetle	<i>Anillinus felicianus</i>
Big Sand Tiger Beetle	<i>Cicindela formosa</i>
Southern Plains Bumble Bee	<i>Bombus fraternus</i>
Variable Cuckoo Bumble Bee	<i>Bombus variabilis</i>
a roadside-skipper	<i>Amblyscirtes nemoris</i>
Mather's Roadside-Skipper	<i>Amblyscirtes matheri</i>
Common Roadside-Skipper	<i>Amblyscirtes vialis</i>
Zabulon Skipper	<i>Lon zabulon</i>
Aaron's Skipper	<i>Poanes aaroni</i>
Henry's Elfin	<i>Callophrys henrici</i>
Gorgone Checkerspot	<i>Chlosyne gorgone</i>
Needleflies	<i>Leuctra species</i>
a panorpid scorpionfly	<i>Panorpa americana</i>
a panorpid scorpionfly	<i>Panorpa rupeculana</i>
a panorpid scorpionfly	<i>Panorpa vernalis</i>
Mourning Scorpionfly	<i>Panorpa lugubris</i>

INLAND FISHES (19 total)	
Common Name	Scientific Name
Gulf Chub	<i>Macrhybopsis tomellerii</i>
Alligator Gar	<i>Atractosteus spatula</i>
Cypress Minnow	<i>Hybognathus hayi</i>
Ghost Shiner	<i>Paranotropsis buchanani</i>
Goldstripe Darter	<i>Etheostoma parvipinne</i>
Highfin Carpsucker	<i>Carpiodes velifer</i>
Mooneye	<i>Hiodon tergisus</i>
Sabine Shiner	<i>Miniellus sabiniae</i>
Northern Starhead Topminnow	<i>Fundulus dispar</i>
Southern Starhead Topminnow	<i>Fundulus nottii</i>
Western Starhead Topminnow	<i>Fundulus blairae</i>
Quillback	<i>Carpiodes cyprinus</i>
Blackspot Shiner	<i>Notropis atrocaudalis</i>
Silverband Shiner	<i>Paranotropsis shumardi</i>
Goldeye	<i>Hiodon alosoides</i>
Striped Bass (Gulf Strain)	<i>Morone saxatilis</i>
River Shiner	<i>Alburnops blennius</i>
Brown Madtom	<i>Noturus phaeus</i>
River Darter	<i>Percina shumardi</i>

MARINE FISHES (31 total)	
Common Name	Scientific Name
Bigeye Thresher Shark	<i>Alopias superciliosus</i>
Dusky Shark	<i>Carcharhinus obscurus</i>
Great Hammerhead	<i>Sphyrna mokarran</i>
Longfin Mako Shark	<i>Isurus paucus</i>
Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>
Sandbar Shark	<i>Carcharhinus plumbeus</i>
Scalloped Hammerhead	<i>Sphyrna lewini</i>
Shortfin Mako Shark	<i>Isurus oxyrinchus</i>
Southern Flounder	<i>Paralichthys lethostigma</i>
Marked Goby	<i>Ctenogobius stigmaticus</i>
Lined Seahorse	<i>Hippocampus erectus</i>
Greater Amberjack	<i>Seriola dumerili</i>
Cobia	<i>Rachycentron canadum</i>
Silky Shark	<i>Carcharhinus falciformis</i>
Caribbean Reef Shark	<i>Carcharhinus perezi</i>
White Shark	<i>Carcharodon carcharias</i>
Whale Shark	<i>Rhincodon typus</i>
Yellowmouth Grouper	<i>Mycteroperca interstitialis</i>
Marbled Grouper	<i>Dermatolepis inermis</i>
Blue Marlin	<i>Makaira nigrican</i>

TABLE 2 cont.

MARINE FISHES (31 total) cont.	
Common Name	Scientific Name
Sailfish	<i>Istiophorus platypterus</i>
White Marlin	<i>Kajikia albida</i>
Longbill Spearfish	<i>Tetrapturus pfluegeri</i>
Gag Grouper	<i>Mycteroperca microlepis</i>
Tiger Shark	<i>Galeorhinus cuvier</i>
Bigeye Tuna	<i>Thunnus obesus</i>
Florida Pompano	<i>Trachinotus carolinus</i>
African Pompano	<i>Alectis ciliaris</i>
Common Snook	<i>Centropomus undecimalis</i>
King Mackerel	<i>Scomberomorus cavalla</i>
Giant Manta Ray	<i>Mobula birostris</i>

AMPHIBIANS AND REPTILES (10 total)	
Common Name	Scientific Name
Three-toed Box Turtle	<i>Terrapene triunguis</i>
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>
Southeastern Dwarf Salamander	<i>Eurycea quadridigitata</i>
Dwarf American Toad	<i>Anaxyrus americanus charlesmithi</i>
Oak Toad	<i>Anaxyrus quercicus</i>
Eastern Musk Turtle	<i>Sternotherus odoratus</i>
Mississippi Mud Turtle	<i>Kinosternon subrubrum hippocrepis</i>
Seepage Siren	<i>Siren sphagnicola</i>
Gulf Coast Smooth Softshell	<i>Apalone mutica calvata</i>
Midland Smooth Softshell	<i>Apalone mutica mutica</i>

BIRDS (18 total)	
Common Name	Scientific Name
American Golden-Plover	<i>Pluvialis dominica</i>
American Wigeon	<i>Mareca americana</i>
Black Tern	<i>Chlidonias niger</i>
Canada Warbler	<i>Cardellina canadensis</i>
Common Grackle	<i>Quiscalus quiscula</i>
Common Nighthawk	<i>Chordeiles minor</i>
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>
Northern Flicker	<i>Colaptes auratus</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>
Ruddy Turnstone	<i>Arenaria interpres</i>
Semipalmated Sandpiper	<i>Calidris pusilla</i>
Snowy Egret	<i>Egretta thula</i>
Stilt Sandpiper	<i>Calidris himantopus</i>
Tricolored Heron	<i>Egretta tricolor</i>
Whimbrel	<i>Numenius phaeopus</i>
Willet	<i>Tringa semipalmata</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>

MAMMALS (7 total)	
Common Name	Scientific Name
Plains Spotted Skunk	<i>Spilogale interrupta</i>
Alleghanian Spotted Skunk	<i>Spilogale putorius</i>
Rice's Whale	<i>Balaenoptera ricei</i>
Red Wolf	<i>Canis rufus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Northern Yellow Bat	<i>Lasiurus intermedius</i>
Common Muskrat	<i>Ondatra zibethicus</i>

LIST OF ACRONYMS

AFB - Air Force Base	MICRA - Mississippi Interstate Cooperative Resource Association
AFWA - Association of Fish and Wildlife Agencies	MOU - Memorandum of Understanding
AOAs - Action Opportunity Areas	MRAP - Mississippi River Alluvial Plain
ARUs - Autonomous Recording Units	NMFS - National Marine Fisheries Service
BBS - Breeding Bird Survey	NOAA - National Oceanic and Atmospheric Administration
BEA - Bureau of Economic Analysis	NSN - Nightjar Survey Network
BMP - Best Management Practice	NRCS - Natural Resources Conservation Service
BTNEP - Barataria-Terrebonne National Estuary Program	NVCS - National Vegetation Classification System
CBC - Christmas Bird Count	NWR - National Wildlife Refuge
CCVI - Climate Change Vulnerability Index	ORV - Off-road Vehicle
COAs - Conservation Opportunity Areas	PAD - Protected Areas Database
CIMS - Coastal Information Management System	PARC - Partners in Amphibian and Reptile Conservation
CMP - Conservation Measures Partnership	PCB - polychlorinated biphenyl
CPRA - Coastal Protection and Restoration Authority	PFA s - Per- and Polyfluoroalkyl Substances
CRMS - Coastwide Reference Monitoring System	PIT - Passive Integrated Transponder
CRP - Conservation Reserve Program	PPT - Parts Per Thousand
CSA - Coastal Study Area	ROW - Rights-of-Way
CWPPRA - Coastal Wetlands Planning, Protection, and Restoration Act	RSGCN - Regional Species of Greatest Conservation Need
DoD - Department of Defense	SARP - Southeast Aquatic Resources Partnership
DOI - Department of Interior	SAV - Submerged Aquatic Vegetation
EAB - Emerald Ash Borer	SEAFWA - Southeastern Association of Fish and Wildlife Agencies
EDRR - Early Detection Rapid Response	SECAS - Southeastern Conservation Adaptation Strategy
EGCP - East Gulf Coastal Plain	SGCN - Species of Greatest Conservation Need
EORs - Element Occurrence Records	SLR - Sea Level Rise
EPA - Environmental Protection Agency	SMART - Specific Measurable Achievable Relevant and Time Bound
EQIP - Environmental Quality Incentives Program	SMZ - Streamside Management Zone
ESA - Endangered Species Act	SRA - Sabine River Authority
FAA - Federal Aviation Administration	SWAP - State Wildlife Action Plan
GCJV - Gulf Coast Joint Venture	SSA - Species Status Assessment
GCPM - Gulf Coast Prairies and Marshes	SWG - State Wildlife Grants
GIS - Geographic Information System	TED - Turtle Exclusion Device
GMEI - Gulf of Mexico Estuarine Inventory	TNC - The Nature Conservancy
GPS - Global Positioning System	TPWD - Texas Parks and Wildlife Department
GSM - Global System for Mobile Communications	TRACS - Tracking and Reporting Actions for the Conservation of Species
HUC - Hydrologic Unit Code	UAS - Unmanned Aircraft Systems
INRMPS - Integrated Natural Resource Management Plans	U.S. - United States
IUCN - International Union for Conservation of Nature	USACE - U.S. Army Corps of Engineers
KNF - Kisatchie National Forest	USCB - U.S. Census Bureau
LA - Louisiana	USDA - U.S. Department of Agriculture
LCWCRTF - Louisiana Coastal Wetlands Conservation and Restoration Task Force	USFS - U.S. Forest Service
LDAF - Louisiana Department of Agriculture and Forestry	USFWS - U.S. Fish and Wildlife Service
LDEQ - Louisiana Department of Environmental Quality	USGS - U.S. Geological Survey
LDENR - Louisiana Department of Energy and Natural Resources	USNVC - U.S. National Vegetation Classification
LaDOTD - Louisiana Department of Transportation and Development	UWGCP - Upper West Gulf Coastal Plain
LDWF - Louisiana Department of Wildlife and Fisheries	VES - Visual Encounter Surveys
LFA - Louisiana Forestry Association	VHF - Very High Frequency
LiDAR - Light Detection and Ranging	WDP - Wildlife Diversity Program
LMVJV - Lower Mississippi Valley Joint Venture	WGCP - West Gulf Coastal Plain
LNG - Liquefied Natural Gas	WMA - Wildlife Management Area
LNHP - Louisiana Natural Heritage Program	WNS - White-nose Syndrome
LSU - Louisiana State University	WRP - Wetland Reserve Program
MAPS - Monitoring Avian Productivity and Survival	WSC - West South Central
MDWFP - Mississippi Department of Wildlife, Fisheries, and Parks	

Chapter 1: Introduction

CONSERVATION AND MANAGEMENT OF WILDLIFE AND FISHERIES RESOURCES IN LOUISIANA

The Louisiana Department of Wildlife and Fisheries (LDWF) is the government agency responsible for the conservation and management of fish and wildlife resources in the state, including aquatic and terrestrial vertebrate and invertebrate species, plant Species of Greatest Conservation Need (SGCN), and natural communities. LDWF is authorized by the State Constitution and in revised statutes under Titles 36 and 56 to execute the laws enacted for the control and supervision of programs relating to the management, protection, conservation, and replenishment of wildlife, fish, and their habitats. Responsible stewardship of the state's renewable natural resources contributes to the quality of life and the economic well-being of the state, benefiting millions of consumptive and non-consumptive users annually. LDWF incorporates the use of good science, accurate information, and cutting-edge technology in carrying out its mission and continually looks for ways to improve the management of resources to ensure their sustainability and availability for all users now and in the future.

LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES' MISSION STATEMENT

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

BACKGROUND

Early in the 20th 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 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.

As of September 2024, there were more than 1,600 species federally listed as threatened or endangered, 47 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 created the need for a complementary source of funding to support the conservation, protection, and restoration of all the fish and wildlife species in our country and help prevent future ESA listings.

CONGRESSIONAL MANDATE AND GUIDANCE

The State Wildlife Grants (SWG) Program was designed and created 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 order to participate in the SWG Program, Congress mandated that each state develops a Comprehensive Wildlife Conservation Strategy, now known as the State Wildlife Action Plan (SWAP). SWAPs are required to undergo a comprehensive revision every 10 years to ensure that they remain a relevant and effective tool for conservation planning and implementation and must address Eight Required Elements. These Eight Required Elements provide a framework for national consistency while enabling each state to determine how best to address those elements for themselves, preserving state-level authority in conservation decision making. In response, LDWF developed the *Louisiana State Wildlife Action Plan* to establish conservation needs and guide the use of SWG funds over the next 10 years. A crucial aspect of the SWAP is the identification of Species of Greatest Conservation Need (SGCN), those species most in need of conservation action as identified by the state. Coauthored by Wildlife Diversity Program staff and peer-reviewed by a diverse group of colleagues from state and

federal agencies, academia, non-governmental groups, citizen scientists, and others, the SWAP is truly a collaborative effort by subject-matter experts best positioned to positively affect conservation and restoration actions in our state. The first edition of the SWAP was submitted to the U.S. Fish and Wildlife Service (USFWS) National Advisory Acceptance Team for approval and was subsequently approved in December 2005. The current document represents the third iteration of the Louisiana SWAP, which is the roadmap for nongame conservation in Louisiana, and is a pro-active document meant to identify actions needed to conserve wildlife and their habitats before species become too rare and restoration efforts too costly. In addition to the requirement of having a SWAP, state agencies are required to provide 25% of total project costs for planning grants and 35% for implementation grants, thereby leveraging resources to bolster federal investments.

Although plants are not currently an eligible expense for SWG funding, LDWF added plant SGCN to the appendix of the 2015 SWAP. This addition highlighted the need for the conservation of at-risk plants and prepared LDWF for anticipated funding sources that would support plant-based projects. For the 2025 SWAP, the USFWS Office of Conservation Investment approved the use of SWG funds to assess and officially add plant SGCN. As such, over 700 plant species have been added and given the same consideration as the wildlife and fish SGCN.

THE SWAP IN LOUISIANA

The purpose of the SWAP is to provide a blueprint for guiding LDWF and conservation partners in the development and implementation of management actions for Louisiana's fish, wildlife, and plant species with emphasis on SGCN and associated habitats they depend upon. The SWAP has been in place for 20 years, during which time much progress has been made, and there has been a growing interest in regional, landscape level conservation efforts. As such, LDWF performed a comprehensive review of the status of all fish, wildlife, and plant species in Louisiana and completed a comprehensive review of the SWAP. For more information on the accomplishments of the SWAP and SWG since 2005, refer to: www.wlf.louisiana.gov/page/state-and-tribal-wildlife-grants.

Additionally, conservation needs and priorities are fluid, and many data gaps, research needs, threats, and conservation opportunities have emerged since the first SWAP was approved in 2005. Because the focus of the SWAP is conservation of SGCN and natural communities, entire chapters are devoted to these topics: Chapter 4: Species of Greatest Conservation Need and Chapter 5: Natural Communities. The 2025 SWAP will provide a clear directive for the future management of these species in Louisiana; address localized, statewide, and regional concerns

and implement conservation actions aimed at preventing federal listing under the ESA; and aim to recover species already listed. The SWAP will achieve this by (1) providing updated information on the current status of fish, wildlife, and plant SGCN in the state as well as important natural communities, (2) identifying threats to SGCN and natural communities and providing ways of addressing those threats, and (3) initiating new partnerships and developing existing partnerships to conserve biodiversity in Louisiana. In addition, the SWAP has identified Conservation Opportunity Areas (COA) where conservation can have the greatest impact.

By establishing a framework to measure the effectiveness of proposed conservation actions and monitoring results, this SWAP 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.

SUCCESS STORIES FROM LOUISIANA

DELISTING - LOUISIANA BLACK BEAR

The Louisiana Black Bear, the state mammal of Louisiana, became federally listed as threatened by the U.S. Fish and Wildlife Service (USFWS) in 1992. It was estimated that more than 80% of the bear's habitat had been modified or destroyed. LDWF, in conjunction with the University of Tennessee, the Black Bear Conservation Committee, and the Parish of St. Mary, implemented nine projects over the course of eight years which included a broad suite of conservation actions for the species. Reforestation, one of the delisting criteria established by USFWS, was accomplished, in part, by LDWF restoring nearly 800 acres of bottomland hardwood forest, the primary habitat of the Louisiana Black Bear. In addition, concentrated efforts toward outreach and technical assistance resulted in fewer human/bear conflicts. Over the years, approximately \$782,000 of LDWF's SWG funds and \$421,000 in state match were used to help recover and ultimately delist the species in 2016. Due to successful efforts of LDWF and its partners, the species' S-rank improved from an S2 (imperiled) to an S3 (vulnerable) in Louisiana.

LISTING PRECLUDED - FRECKLEBELLY MADTOM

The Frecklebelly Madtom, a species of small catfish, was petitioned for federal listing in 2010 due to declines across its range (Pearl and Mobile river basins). Absence from historical sites, in conjunction with low relative abundance, made it apparent that additional surveys were needed. LDWF worked with the Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP), and USFWS to sample nearly 180 sites over five years. LDWF funded four projects during this timeframe with SWG funds totaling \$230,417 and state match totaling \$84,767. Using MDWFP's sampling techniques, surveys in 2019 found over 700 Frecklebelly Madtom at 18 of 19 sampling locations in the mainstem of the Pearl River. The species was previously undocumented from the majority of these sites. This information was provided to USFWS and was used in the Species Status Assessment (SSA). Results from the SSA showed that listing the Frecklebelly Madtom as endangered or threatened throughout its entire range was not warranted. It was, however, listed as threatened for a distinct population segment in the upper Coosa River in Georgia and Tennessee.

ADDRESSING DATA GAPS - CRAYFISHES IN LOUISIANA

Lack of data or data gaps represent one of the most commonly stated challenges in nongame conservation. In many instances, especially for arthropods, it is nearly impossible to determine if a species should be included on the SGCN given information currently available. For many arthropods, data do not exist to substantiate listing as an SGCN or to show that populations are stable. A majority of the SGCN in the 2025 SWAP have research needs and conservation actions that aim to address data gaps such as (1) determine abundance, (2) determine distribution, and (3) monitor populations. State Wildlife Grants provide an excellent opportunity to fund projects with the main goal of obtaining baseline data and filling data gaps.

In the 2015 SWAP, the Crustacean Research and Survey Needs included: (1) research of life history strategies of all crayfish SGCN (2) estimate population abundance and trends, and (3) conduct drainage-wide surveys for all crayfish SGCN. Since 2015, LDWF has funded nine SWG projects focusing on crayfishes. Of the more than 1,000 crayfish Element Occurrence Records (EORs) in the WDP database, more than 950 were added since 2017. These data were invaluable during the 2025 SWAP revision process and resulted in S-rank changes for 11 species (five determined to be more imperiled, six determined to be less imperiled), and the removal of two species from the SGCN list. Through these grants, LDWF was able to focus on specific data gaps for species with a last observation date recorded more than 20 years ago, those with few EORs, and those for which no published life history studies exist (e.g., Pontchartrain Painted Crayfish, *Faxonius hobbsi*).

Examples of filled data gaps:

- Ouachita Fencing Crayfish, *Faxonella creaseri*, a species thought to be endemic to Louisiana was found in Arkansas. With this newly discovered range extent, coupled with the fact that Louisiana records were more numerous than previously expected, the species was removed from the SGCN list (Himes 2022).
- Vernal Crayfish, *Procambarus viaeviridis*, historically known from only four sites in Louisiana, was discovered at 70 new locations (Himes 2022).
- Sabine Fencing Crayfish, *Faxonella beyeri*, range extent was found to be approximately twice as large as was historically known, and the species was removed from the SGCN list (Himes 2022).
- Blair's Fencing Crayfish, *Faxonella blairi*, was only known from Arkansas, Texas, and Oklahoma until it was confirmed to occur over a large area in Louisiana (Himes 2022).

For additional SWG success stories, check out the 20th Anniversary SWG Report. www.fishwildlife.org/application/files/2616/0087/6829/STWG_2020_Report_Final.pdf

Chapter 2: State Overview

GEOGRAPHY

Louisiana is located in the south-central United States at the terminus of the Mississippi River. Alexandria, Baton Rouge, Lafayette, Lake Charles, Monroe, New Orleans, and Shreveport are the major cities in the state (Figure 2.1).

The physiographic features 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 Florida Parishes, located in the southeastern part of the state, consists primarily of upland forest dominated by evergreen/mixed hardwoods and Longleaf Pine (*Pinus palustris*) flatwoods. The southern

portion of this region is dominated by marshes and forested wetlands. Southwestern Louisiana is dominated by upland or wetland scrub-shrub vegetation and agriculture and improved pasture in the historical Coastal Prairie region. Freshwater, Intermediate, Brackish, and Salt Marshes and, increasingly, open water comprise coastal Louisiana (Hartley et al. 2000).

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



LOUISIANA FACTS

SCENARIOS AND DRIVERS

Sea level rise and subsidence have been identified as the principal drivers influencing coastal land loss. Fifty-year model predictions of two scenarios: low (moderate future environmental conditions) and high (more severe environmental conditions) estimate significant land loss (1,100 to 3,000 sq. miles). These data emphasize the importance of implementation of the Coastal Master Plan projects (CPRA 2023).

FIGURE 2.1. Major cities in Louisiana

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 America would deposit their sediments farther offshore, and fluvial deposits of sand, gravel, and silt, known as valley trains, were deposited in the lower Mississippi River 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.

COASTAL ZONE

Louisiana has over 3 million acres of coastal wetlands, which constitute about 40% (USGS 2014) of the remaining coastal marsh in the Lower 48 States. Louisiana’s coastal zone can be divided into two distinct regions: the Chenier Plain, extending west from Vermilion Bay 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 America. Over the past several thousand years, these fluvio-deltaic processes created more than 4 million acres of coastal wetlands and gave rise to one of the most productive ecosystems in the United States. The Chenier Plain contains highly productive inland lakes and wetlands behind oak-covered remnant beach ridges (Cheniers) that parallel the coast. The Deltaic Plain is characterized by a vast system of low-lying wetlands and coastal Barrier Islands (Benoit 1997). These wetland ecosystems are of regional, national, and international significance in terms of their ability to support substantive marine fisheries (commercial and recreational) and a diverse array of wildlife SGCN (Remsen et al. 2019).

As highlighted within the State’s 2023 *Coastal Master Plan* (CPRA 2023), Louisiana is in the midst of a land loss crisis. Since the 1930s, nearly 2,000 square miles of land have been lost, and without action, the state could lose up to another 3,000 square miles under the higher environmental scenario¹ over the next 50 years. The ongoing land loss crisis has been attributed to a host of natural and anthropogenic factors. Levees and floodgates have channeled the Mississippi River and its tributaries into the Gulf of America, depriving the coastal ecosystem of the fresh water and sediment it needs to survive. Dredging canals for oil and gas exploration and pipelines have resulted in the weakening of coastal marshes and have allowed salt water to spread further inland into coastal basins. In addition, sea level rise, subsidence (i.e. sinking of the land), storms, invasive species, and oil spills (with emphasis placed on the geographically-expansive *Deepwater Horizon* spill, 2010) have further stressed Louisiana’s coastal environment.

LOUISIANA FACTS

WILDLIFE WATCHING

In 2019, the economic impact of wildlife watching (e.g., bird watching) in Louisiana was associated with \$702 million in retail sales with a total economic impact of \$1.29 billion. Wildlife watching supported more than 16,000 jobs and contributed \$474.8 million in salaries and wages. It generated \$79.7 million in federal tax revenues and \$87.1 million in state and local tax revenues (Southwick Associates 2021).

LOUISIANA FACTS

ENERGY

The following are statistics for Louisiana’s primary energy production in 2023 as compared to all other states in the country. Although production is statewide, much comes from the coastal parishes (LDENR 2023).

LOCATION	CRUDE OIL	NATURAL GAS
Including Outer Continental Shelf Production	Ranks 2nd	Ranks 3rd
Excluding Outer Continental Shelf Production	Ranks 10th	Ranks 3rd

CLIMATE

The climate in Louisiana is relatively mild due to the subtropical influence of the Gulf of America and cooler, drier air from the Central Plains. Summers are hot and humid with an average high temperature of 93.3°F. Winters are mild with an average low temperature of 36.2°F. The highest temperature on record of 114°F was captured in northwest Louisiana in the town of Plain Dealing in 1936. The lowest temperature on record of -16°F was also captured in

¹ The higher environmental scenario includes +2.5’ sea level rise by Year 50, a 10% increase in average storm intensity over 50 years, higher rates of subsidence, and other factors (CPRA 2023).

northwest Louisiana in the city of Minden in 1899 (NOAA 2024). Average annual temperatures have risen by 0.5°F since the beginning of the 20th century with the warmest five-year interval occurring from 2019-2024 (Kunkel et al. 2013, Franks et al. 2022, NASA 2024).

Average annual precipitation ranges from 50 inches in the northern part of the state to 70 inches in the southeastern part of the state. The average number of extreme precipitation events (4 inches or greater), which has been above average for over 40 years, reached record highs between 2015 and 2020 (Frankson et al. 2022), including the devastating flood of 2016. Louisiana has the second-highest annual number of thunderstorms compared to other states in the contiguous United States (Frankson et al. 2022). In addition, Louisiana is vulnerable to direct impacts from hurricanes, which occur approximately every three years. The state was in the direct path of six hurricanes between 2002 and 2009, the largest number of hurricanes during a five-year period. In 2020, Louisiana was hit by three hurricanes, including Hurricane Laura, the strongest hurricane to make landfall in the state since 1856. Laura produced 150 mph winds, had a 15-foot storm surge, and resulted in massive flooding. In 2021, Louisiana was hit by Hurricane Ida, which tied Hurricane Laura in intensity as a Category 4 hurricane.

LAND OWNERSHIP

The state of Louisiana is 33.5 million acres, with 5.9 million acres covered by water and 27.6 million acres of land (U.S. Census Bureau 2010). Approximately 10% of the state is in federal or state ownership, and roughly 90% is privately owned (USGS 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.

Forestland covers approximately 14.9 million acres (~50%) of the state’s land area (LFA 2025). Private, non-industrial landowners own 9.5 million acres (64%) of the state’s forestland, 3.9 million acres is owned by the forest industry (26%), and the remaining 1.5 million (10%) is in general public lands (LFA 2022). Agricultural lands which include crop, pasture, rangelands, and other operational lands (e.g., Conservation Reserve Program) cover 8 million acres (over 25%) of the state’s land area (USDA 2022).

ECONOMY

LOUISIANA FACTS

ECONOMIC EXPORTS

Louisiana is the number one export state in the nation. The working coast annually sends more than \$120 billion in goods and services to the rest of the United States and exports \$36.2 billion internationally. Of these, Louisiana represents 20% of the nation’s annual waterborne commerce. (CPRA 2023, Barnes et al. 2017).

In addition to contributing to the conservation landscape of the Southeast, Louisiana’s lands and waters also benefit the state’s economy. The Bureau of Economic Analysis (BEA) provides Outdoor Recreation Satellite Accounts for each state. In 2023, the BEA estimated that the outdoor recreation economy generated \$9.2 billion in value for the state’s Gross Domestic Product and another \$2.8 billion in wages and salaries. In addition to recreational value, natural landscapes can support working lands such as agriculture and timber, and water resources such as commercial fisheries. According to the Louisiana Seafood Promotion and Marketing Board, it is estimated that \$2.4 billion is generated annually from the production, harvest, and sale of fish, crawfish, oyster, shrimp, crab, and alligator (2025).

POPULATION TRENDS

According to the U.S. Census Bureau (2021), Louisiana experienced a 2.7% increase in its population from 2010-2020. Nationwide, there was a 7.4% population increase with a 10.2% increase occurring in the South. As of 1 July 2024, there are 4,597,740 Louisiana residents and 107.8 persons per square mile. The median household income is \$58,229. Parishes with the greatest population decline (9% decrease or higher) include Allen, Assumption, Bienville, Cameron, Catahoula, Claiborne, Concordia, Iberville, Madison, Pointe Coupee, Red River, Tensas, Webster, West Carroll, and Winn. Parishes with the greatest population increase (9% increase or higher) include Ascension, Bossier, Calcasieu, Lafayette, Livingston, Orleans, St. Bernard, St. Tammany, Tangipahoa, and West Baton Rouge. Several of these parishes occur in the East Gulf Coastal Plain ecoregion and have experienced increased residential development resulting in habitat fragmentation, degradation, and loss.

LOUISIANA FACTS

POPULATION LIVING IN COASTAL PARISHES
In 2020, over 2 million residents, more than 50% of the state's population, lived in Louisiana's coastal parishes (USCB 2024, NOAA 2024).

RECENT TRENDS IN CONSUMPTIVE AND NON-CONSUMPTIVE RECREATIONAL USE IN LOUISIANA

Data provided by the latest National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USDOI 2022) show that in 2022, 39.9 million people participated in fishing, 14.4 million in hunting, and 148.3 million in wildlife-watching activities including observing, feeding, or photography. Sportspeople and wildlife watchers across the United States spent \$394.9 billion in 2022. Of that total amount, \$91 billion was trip related; \$179 billion was spent on equipment; and \$124.9 billion was spent on items such as licenses, land leases, and property ownership. Hunters spent \$45.2 billion on hunting; anglers spent \$99.4 billion on fishing; and wildlife watchers spent \$250.2 billion. Expenditures for wildlife watching include trip related expenses (e.g., goods, lodging, and transportation), equipment, magazine subscriptions, membership dues, contributions to conservation or wildlife-related organizations, land leasing and owning, and plantings.

The 2022 National survey divided states into nine geographic divisions. The West South Central (WSC) geographic division includes Louisiana, Arkansas, Oklahoma, and Texas. Of those who responded, 17% participated in angling (15% national average); 14% participated in hunting (6% national average); and wildlife-watching, which was split into around-the-home and away-from-home, with approximately 53% (56% national average) and 23% (28% national average), respectively. Similarly, the 2019 Addendum to the 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Birding in the United States: A Demographic and Economic Analysis divided the United States into eight regions. The South Central region, which includes Louisiana and seven other states, featured 14% of the nation’s total number of birders. The South Central region also had the highest avidity for birders at 130 days per year spent bird watching versus an average of 88 days for all regions. In 2016, nationwide birding expenditures “generated nearly \$96 billion in total industry output” (USDOI 2019).

LOUISIANA FACTS

MIGRATORY GAME BIRDS

The economic impact of migratory bird hunting in Louisiana in 2019, associated with \$308.2 million in retail sales, had a total economic impact of \$490.1 million. This economic activity supported 4,056 jobs and contributed \$162.9 million in salaries and wages. It generated \$36.8 million in federal tax revenues and \$28.7 million in state and local tax revenues (Southwick Associates 2021).

ECOLOGICAL REGIONS AND AQUATIC DRAINAGE BASINS IN THE STATE

ECOREGIONS OF LOUISIANA

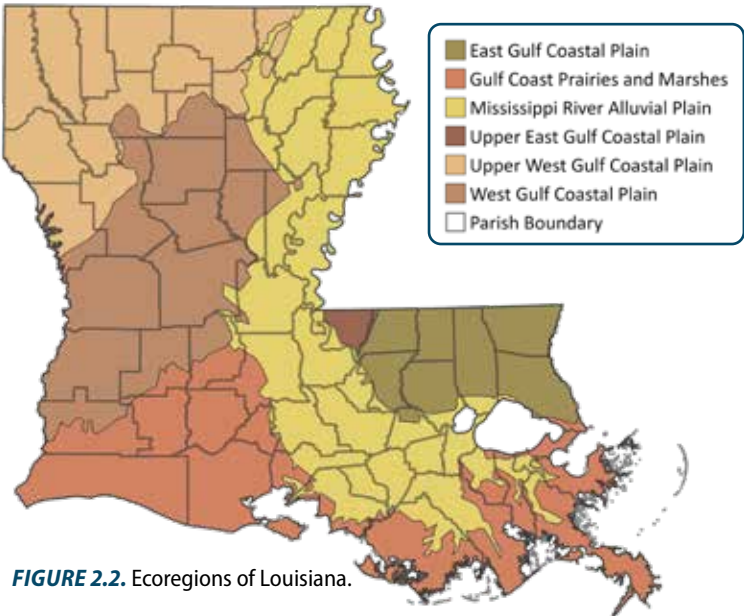


FIGURE 2.2. Ecoregions of Louisiana.

TERRESTRIAL SYSTEMS

Louisiana contains a highly diverse ecological landscape, and the physiographic distribution of species often corresponds to ecological boundaries. Areas that share similar ecological attributes such as vegetation, soils, geology, climate, hydrology, and wildlife can be classified as ecoregions. 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 Wildlife Diversity Program (WDP; Figure 2.2). Below are summaries of each ecoregion. See Figure 2.3 for a map of conservation lands within each ecoregion and Appendix G for a list of all managed areas within each ecoregion.

East Gulf Coastal Plain

The East Gulf Coastal Plan (EGCP) ecoregion extends from southwestern Georgia across western Florida, southern Alabama, and Mississippi, and into the Florida Parishes of Louisiana (Figure 2.4). The western EGCP 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 Forest occurring in riparian areas. Eastern Longleaf Pine Flatwoods Savanna and Woodland was once a predominant natural

LOUISIANA FACTS

FUR HARVEST

Hunting and trapping furbearers generates at least \$1.75 million annually for coastal communities (LDWF 2024).

CONSERVATION LANDS BY ECOREGION

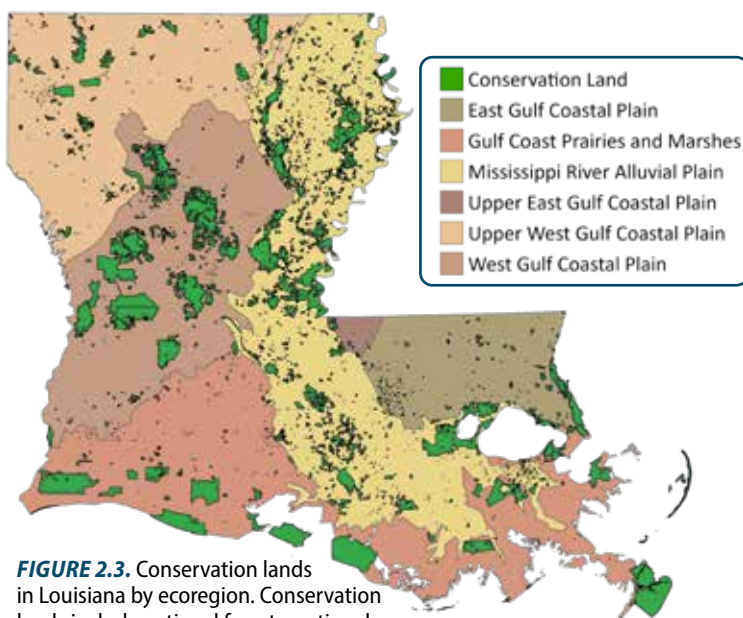


FIGURE 2.3. Conservation lands in Louisiana by ecoregion. Conservation lands include national forests; national wildlife refuges; national historical parks; State wildlife management areas, refuges, conservation areas, conservation corridors, historical sites, and parks; properties enrolled in the Louisiana Natural Areas Registry; tribal lands; and Department of Defense properties. Managed areas within Louisiana comprise 3.5 million acres and are found in all ecoregions of the state. Map data from PAD-US v4.0 (USGS 2024) and LDWF.

EAST GULF COASTAL PLAIN ECOREGION

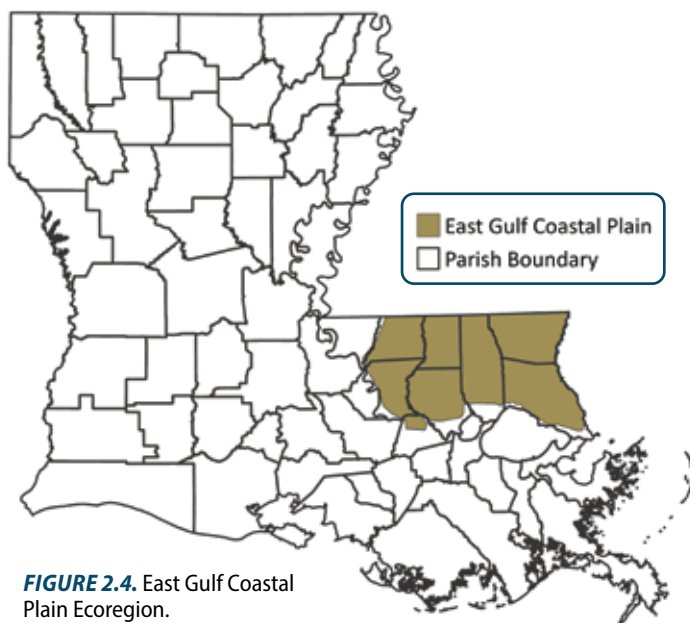


FIGURE 2.4. East Gulf Coastal Plain Ecoregion.

LOUISIANA FACTS

ALLIGATOR HARVEST

The annual economic contribution of Louisiana's American Alligator (*Alligator mississippiensis*) harvest totaled over \$200 million in 2019 (Chiessa 2021).

community type in the Florida Parishes. Other natural communities found in the EGCP are Acidic Bay Forest, Eastern Upland Longleaf Pine Savanna and Woodland, Eastern Hillside Seepage Bog, Slash Pine-Pondcypress Woodland, Baldcypress-Tupelo Swamp Forest, and Small Stream Forest.

The Florida Parishes have had one of the largest human population growth rates in the state. As this area continues to experience the pressures of urban expansion, challenges for balancing the needs of wildlife with those of humans will increase.

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 (Figure 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 Forest, Bottomland Hardwood Forest, Small Stream Forest, and Baldcypress-Tupelo Swamp Forest found in low-lying areas of this ecoregion.

Mississippi River Alluvial Plain

The Mississippi River Alluvial Plain (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 (Figure 2.6). It then continues south along the Mississippi River, terminating where bottomland forests meet coastal marshes.

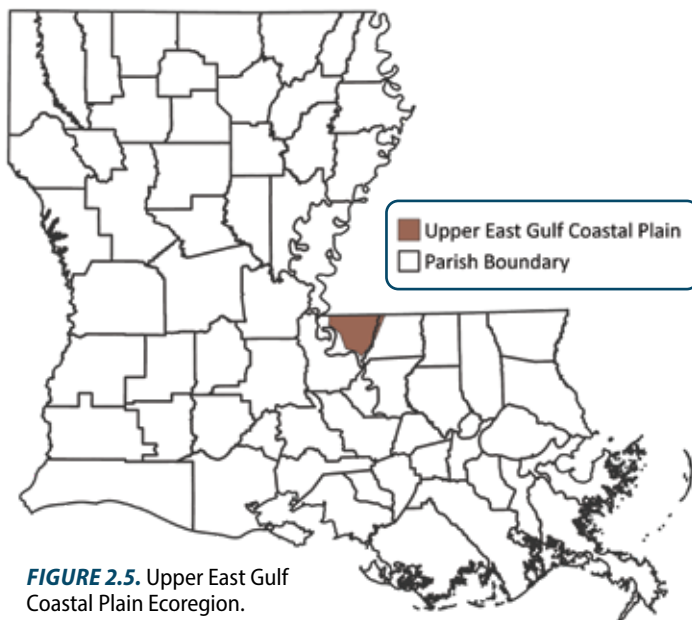
The MRAP, rich in alluvial sediments, is known primarily for Bottomland Hardwood Forest as well as associated Baldcypress-Tupelo Swamp Forest natural communities. In addition, the northeastern portion of this ecoregion contains both Wet and Mesic Hardwood Flatwoods found on Macon Ridge.

Upper West Gulf Coastal Plain

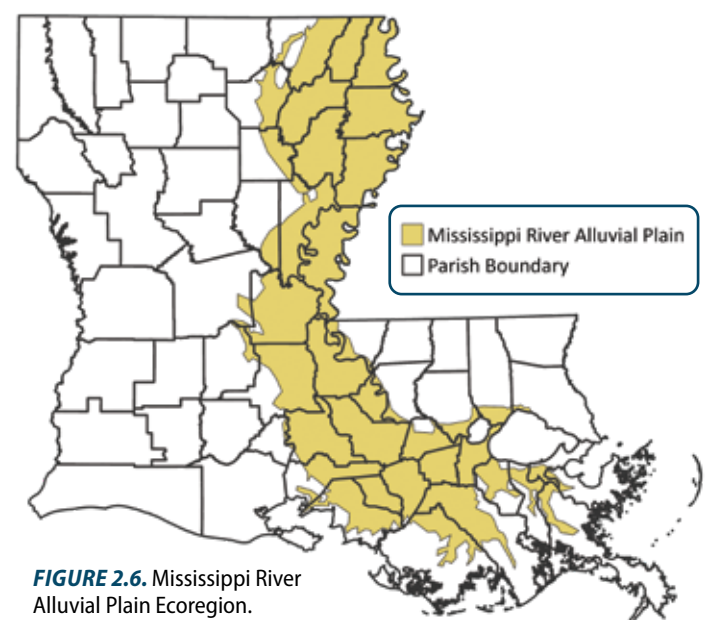
The Upper West Gulf Coastal Plain (UWGCP) ecoregion extends from south-central and southwestern Arkansas to the extreme southeastern portion of Oklahoma, south into eastern Texas, and east to parts of northern Louisiana (Figure 2.7).

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 (*Pinus echinata*) was logged and replaced, most recently, by Loblolly Pine (*Pinus taeda*) plantations. However, some natural stands of Shortleaf Pine/Oak-Hickory Woodland still exist in this ecoregion. Xeric Sandhill Woodland occurs on xeric sands in the UWGCP,

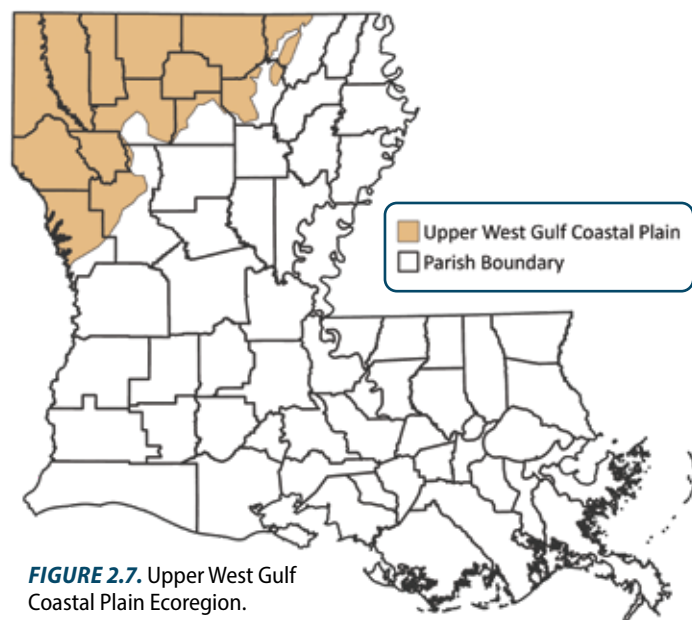
UPPER EAST GULF COASTAL PLAIN ECOREGION



MISSISSIPPI RIVER ALLUVIAL PLAIN ECOREGION



UPPER WEST GULF COASTAL PLAIN ECOREGION



while Hardwood Slope Forest develops on more mesic soils. Wet bottomlands in this ecoregion include natural communities such as Acidic Bay Forest, Small Stream Forest, Bottomland Hardwood Forest, and Baldcypress-Tupelo Swamp Forest.

West Gulf Coastal Plain

The West Gulf Coastal Plain (WGCP) ecoregion occurs from central Louisiana (*Figure 2.8*) into eastern Texas. 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 Savanna and Woodland is found in association with Hardwood Slope Forest. Acidic Bay Forest and Western Hillside Seepage Bog natural communities occur along slopes and at lower elevations. The WGCP contains unique geologic formations occurring in bands across the ecoregion from Caldwell Parish in the northeastern part of the state to Vernon Parish in the southwestern part of the state. These uplifted formations, known as the Jackson, Catahoula, Cook Mountain, and Fleming formations, present distinct soil types and conditions which influenced the development of the natural community types found along these formation bands. Depending on the formation type and degree of uplift, calcareous clays, sandstones, saline deposits, siltstones, and ironstones shaped the development of natural communities such as Calcareous Forest, Calcareous Prairie, Sodic/Alkali Barren, and Sandstone Glade/Barren. The south and southwestern portions of the WGCP ecoregion in Louisiana are known for Western Longleaf Pine Flatwoods Savanna and associated Flatwoods Pond community types. This portion of the ecoregion is the transition zone between Louisiana's Coastal Prairie and Upland Longleaf Pine Woodland.

Gulf Coast Prairies and Marshes

The Gulf Coast Prairies and Marshes (GCPM) ecoregion occupies the coastal zone of the Gulf of America and stretches from

LOUISIANA FACTS

COMMERCIAL FISHING

In 2022, Louisiana commercial landings were just under one billion pounds (912,385,645) with a dockside value of \$417 million. This accounts for approximately 42% of the total catch by weight in the Lower 48 States (NOAA 2024).

WEST GULF COASTAL PLAIN ECOREGION

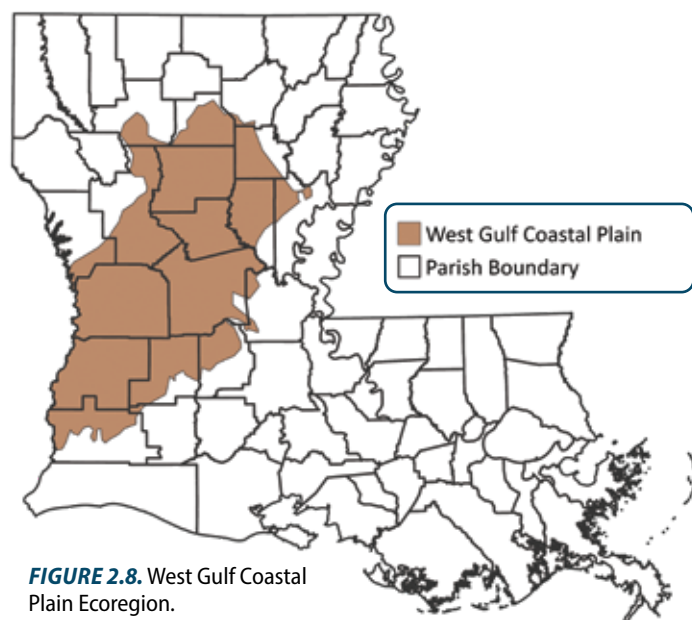


FIGURE 2.8. West Gulf Coastal Plain Ecoregion.

Mexico north through Texas and into Louisiana (*Figure 2.9*). In Louisiana, it occurs from the southwest portion of Louisiana's Coastal Prairie region and the southwest coast, extending east along the entire coast to southeast Louisiana.

As the name implies, this ecoregion's boundary is defined by Coastal Prairie and marsh natural community types. Louisiana's Coastal Prairie, once encompassing an estimated 2.5 million acres in the southwest portion of the state, is critically imperiled with approximately 3,500 acres remaining. The coastal marsh is comprised of Salt, Brackish, Intermediate, and Freshwater Marsh types across the coastal region. Associated natural communities include Baldcypress-Tupelo Swamp Forest, Coastal Live Oak-Hackberry Forest (Cheniers) along the southwest coast, Live Oak Natural Levee Forest along the southeast coast, and Bottomland Hardwood Forest. In addition, Salt Dome Hardwood Forest is unique to the south-central coast, occurring on salt domes in this area.

AQUATIC SYSTEMS

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 126,000 miles of rivers and streams. Lakes, many of which are small natural oxbows, and reservoirs comprise 1,486,650 acres of surface water. Fresh and tidal wetlands comprise 9,849,353 acres of available surface water, and 5,005 square miles are available in estuaries (LDEQ 2024). The Mississippi River and its major tributary, the Red River, along with

GULF COAST PRAIRIES AND MARSHES ECOREGION

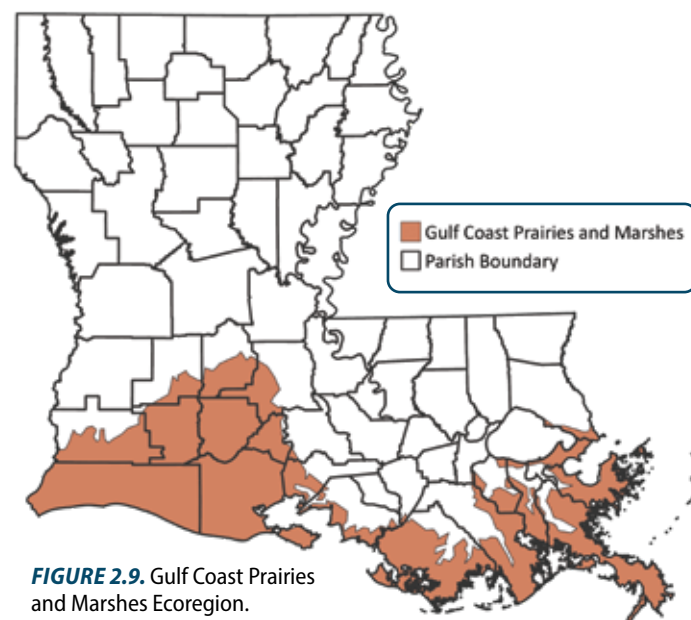


FIGURE 2.9. Gulf Coast Prairies and Marshes Ecoregion.

other major river systems including the Ouachita, Black, Calcasieu, Atchafalaya, Sabine, Pearl, Vermilion, and Mermentau, combine to incorporate more than 2,300 miles of navigable waterways.

Riparian areas, found immediately adjacent to stream banks, consist of 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 1 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 United States. 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) level. The reservoir was formed when the Sabine River was impounded for hydroelectric purposes, water supply, and recreation.

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 Sabine, Pearl, Atchafalaya, Ouachita, and Black rivers have all undergone alterations to their natural flow regime. In addition, the present conditions of the Pearl and Red rivers are heavily influenced by locks and dams constructed for navigation and to control water levels.



(LEFT) The Comite River is a designated Louisiana Scenic River, known for its natural beauty and recreational opportunities. **(ABOVE)** Cane Bayou is also a designated Louisiana Scenic River and a popular destination for kayaking, canoeing, and bird watching.

LOUISIANA'S NATURAL AND SCENIC RIVERS

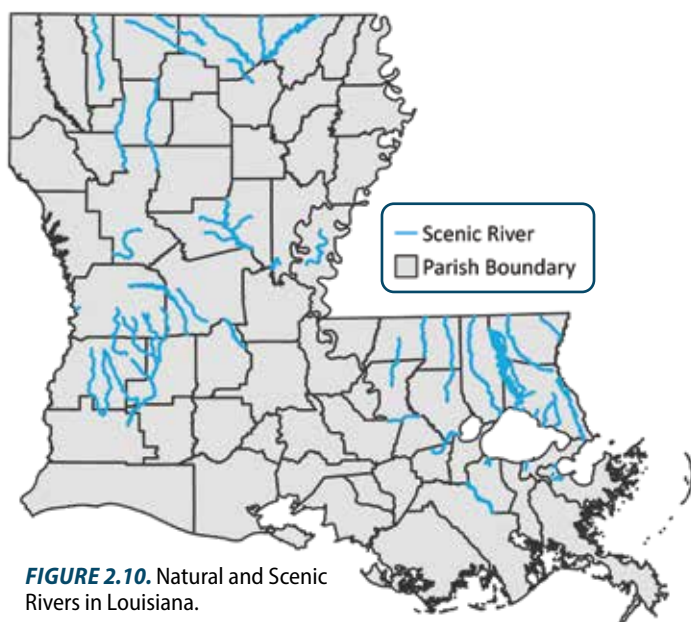


FIGURE 2.10. Natural and Scenic Rivers in Louisiana.

Water Quality Assessments

The Louisiana Department of Environmental Quality (LDEQ) completed sampling of all 12 Louisiana watershed management basins (Figure 2.11) in 2024 including a total of 487 water body management subsegments. 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. Low dissolved oxygen, which is one of the parameters used to assess water quality for fish and wildlife propagation, is the most frequently reported cause of impairment across use categories. The second and third highest causes of water quality impairment are fecal coliform and enterococcus, respectively (LDEQ 2024).

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 more than 60 streams or stream segments totaling over 3,000 miles in length (LDWF 2014) (Figure 2.10). In the early 1970s, 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 de-snagging,
3. channel realignment,
4. reservoir construction,
5. commercial clearcutting 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; bulkhead, pier, dock, and ramp construction; waste water discharges; and land development adjacent to the river.

For more information on Scenic Rivers: www.wlf.louisiana.gov/page/scenic-rivers

Management Basins

Louisiana has twelve water quality management basins delineated by the natural drainage patterns of the state's major river basins (Figure 2.11). Each water quality management basin is subdivided into stream segments in which the hydraulic and water quality characteristics are relatively constant. Land use in the basins is dominated by silviculture and agriculture, although the percentage of urban use in the Pontchartrain Basin is considerable. The Pearl and Pontchartrain basins have the highest aquatic species diversity relative to their area and, along with the Mississippi Basin, contain the highest numbers of SGCN. For more information on each basin refer to Chapter 5: Natural Communities.

Marine

Within Louisiana, marine habitats are generally seaward of the Gulf Intracoastal Waterway and extend out to the three-mile limit of the State's jurisdiction.

Coastal marshes and beaches occupy a transition zone between the open water of the Gulf of America and the upland forests and grasslands inland of the immediate coast. Louisiana's marshes are extremely productive habitats and provide shelter for juvenile stages of many marine species and nesting habitat for colonial waterbirds. Coastal forests provide invaluable stopover habitat for Neotropical-Nearctic migratory birds (Neotropical migratory birds or Neotropical migrants).

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 experiencing the highest rate of wetland loss in the nation. Coastal water bodies in the southwest region are enclosed estuaries rather than the expansive open bays of the southeast. These estuaries are heavily impacted by human marsh management and hydrological and navigational changes to the landscape.

LDWF biologists in the Marine Fisheries Section focus sampling efforts on the seven Coastal Study Areas (CSAs; Figure 2.12). The CSAs are delineated based on the major coastal basins. Sampling is standardized and focuses on shrimp, crab, oyster, and coastal finfish (e.g., Red Drum [*Sciaenops ocellatus*] and Spotted Seatrout [*Cynoscion nebulosus*]).

LOUISIANA'S BASINS

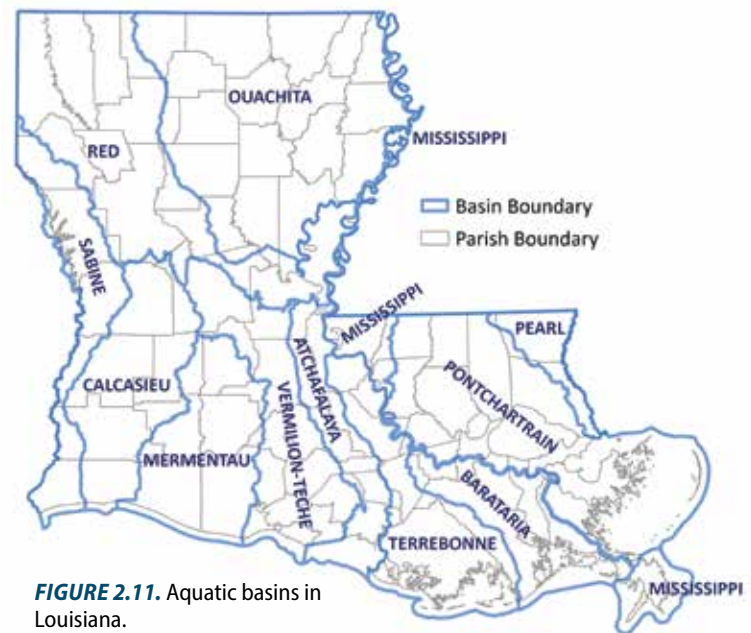


FIGURE 2.11. Aquatic basins in Louisiana.

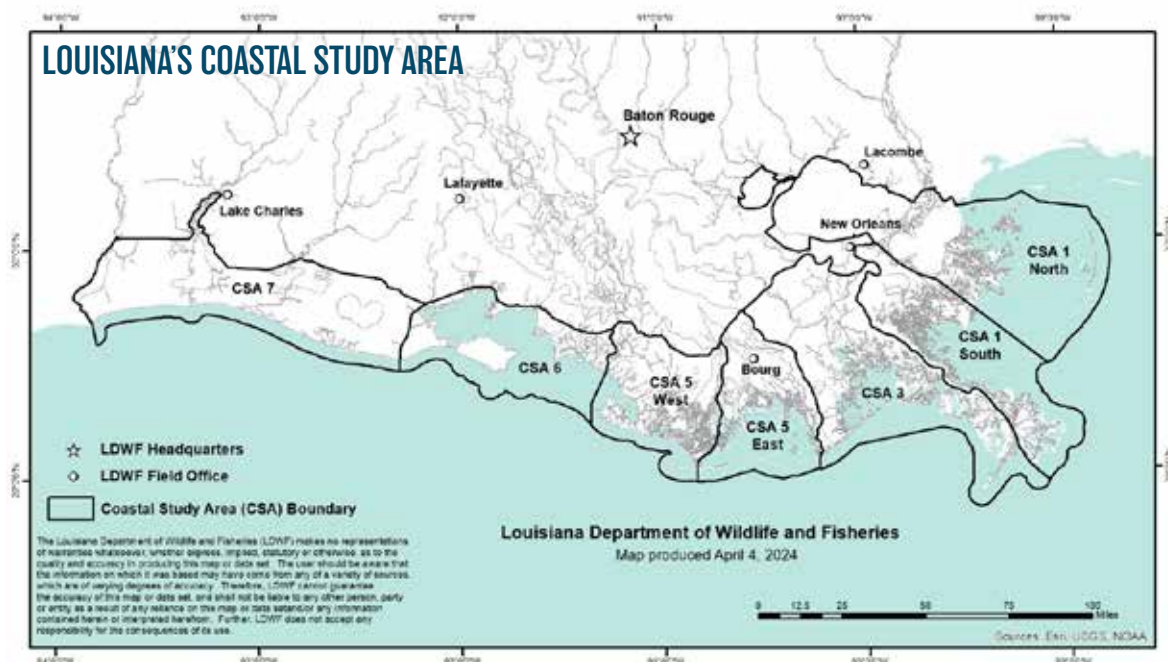


FIGURE 2.12. Coastal Study Areas.

Chapter 3: Approach

The task of revising the State Wildlife Action Plan (SWAP) was coordinated by Louisiana Department of Wildlife and Fisheries (LDWF) staff from the Office of Wildlife and the Office of Fisheries. Input was provided by LDWF taxa team experts and solicited from representatives of other state and federal agencies, universities, non-governmental and environmental organizations, corporations, industry, and the citizens of Louisiana. The revision of the SWAP would not have been possible without their feedback. This chapter presents the approach used during the 2025 revision process.

ORGANIZATIONAL STRUCTURE

A Core Team (Appendix A) was formed to oversee the revision of the SWAP. This committee included LDWF representatives from the Office of Wildlife and the Office of Fisheries. The Core Team was responsible for reviewing each section of the 2015 SWAP to identify areas in need of update and to find ways to streamline and minimize redundancy of the 2025 SWAP.

To assist with the comprehensive revision, 10 taxa teams (*Table 3*) were formed including Mollusk, Crustacean, Non-crustacean Arthropod (i.e. arachnids and insects), Inland Fish, Marine Fish, Amphibian and Reptile, Bird, Mammal, Plant, and Natural Community. All members of the Core Team and taxa teams were LDWF employees and included staff with appropriate expertise from the Wildlife Diversity Program, Wildlife, Inland Fisheries, and Marine Fisheries (Appendix A). The taxa teams were tasked with review of the Species of Greatest Conservation Need (SGCN) list from the 2015 SWAP, removal and addition of SGCN or natural communities, review and revision of research needs and conservation actions, review and update of global and state ranks (G- and S-ranks), reassessment of threats, and identification of outside technical experts. In addition, an Invasive Species Team was formed. This team assessed species from the 2015 SWAP and added or removed taxa as appropriate; team members also revised the tier definitions and placed species in their respective tiers. The total number of members for each SWAP comprehensive revision team is listed in *Table 3.1*.

In the 2015 SWAP, all research needs and conservation actions were listed in text, oftentimes repeating the same actions for multiple species. To reduce redundancy, the 2025 SWAP captures research needs and conservation actions for each taxon in tabular format (i.e. action tables), reducing space, while providing an

easy-to-read snapshot of species conservation. Research needs and conservation actions relevant to the majority of taxa were used to populate the header fields of a draft action table, upon which other action tables could be based. Taxa teams then created action tables for their respective taxa, populating the leftmost column with SGCN and then marking needs or actions applicable to each species. For consistency purposes, column headings were kept the same for each taxa group as much as possible. However, to accommodate distinct differences among taxa groups, additional headings or slight changes in wording were used. In addition, each taxa team reviewed the research needs and conservation actions in the 2015 SWAP and determined if those actions were (1) still applicable, (2) successfully completed, or (3) no longer relevant. When a need or action was selected for every SGCN in a taxa group (e.g., Promote quality habitat was selected for all mollusk SGCN), that item was removed from the action table and placed in a text section for that taxa group’s general research needs and conservation actions. When appropriate, guild specific or species specific actions were added as text under the action tables.

TABLE 3. Louisiana State Wildlife Action Plan comprehensive revision teams.

TEAM	NUMBER OF MEMBERS	TEAM	NUMBER OF MEMBERS
Core	7	Amphibian and Reptile	5
Mollusk	8	Bird	5
Crustacean	4	Mammal	5
Non-crustacean Arthropod	4	Plant	7
Inland Fish	10	Natural Community	7
Marine Fish	10	Invasive Species	9

COORDINATION WITH PARTNERS

Prior to the initiation of this comprehensive revision, a SWAP survey, similar to those used in other states, was sent to all LDWF employees (approximately 750 individuals), over 120 partners and 140 individuals from the State Wildlife Grant (SWG) distribution list, and representatives of seven native tribes (*Appendix B*). The survey investigated how LDWF staff, partners, stakeholders, and tribal representatives utilized the 2015 SWAP, and chapters or appendices that were the most frequently referenced. In addition, it sought recommendations for the 2025 revision. The survey was also used to identify those who wanted to be involved in the revision process.

LDWF received 102 responses¹. Of those responses, 62 respondents were aware of the SWAP and used the document; 21 respondents were aware of the SWAP, but never used the document; and 17 respondents were not aware of the SWAP. When asked how respondents had used the SWAP, responses included as a reference document for drafting SWG proposals (41) and non-SWG proposals (28), for conservation planning (33), to prioritize conservation planning and implementation (21), and other (10). The majority of respondents use the SWAP primarily to obtain information on SGCN or natural communities. Identifying specific research questions, understanding conservation strategies that can be implemented, and addressing specific management issues were ranked in the middle by respondents. The Species of Greatest Conservation Need (66), Habitat

Conservation (32), Conservation Opportunity Areas (23), and Research and Monitoring (24) chapters and the SGCN List (23) were the sections of the SWAP ranked as most useful.

In addition to incorporating information and feedback received from the SWAP survey, LDWF worked with partners to refine the 2015 COAs, revise the Conservation Opportunity Areas chapter, and add two new chapters including Chapter 8: Threats and Chapter 10: Louisiana: A Regional Perspective. The Conservation Opportunity Areas (*Chapter 7*) revision, led by the U.S. Fish and Wildlife Service's Science Applications Migratory Bird Program with assistance from the Southeast Conservation Adaptation Strategy (SECAS), began in 2020. The Louisiana: A Regional Perspective, spurred by a 2018 resolution from the Association of Fish and Wildlife Agencies (AFWA) to focus efforts on landscape conservation, was written by SECAS and the Southeast Climate Adaptation Science Center. This chapter, which uses the SECAS Southeast Conservation Blueprint, includes Regional Species of Greatest Conservation Need (RSGCN), Louisiana-specific climate change and climate resiliency information, a case study on a subset of Louisiana amphibians and their climate vulnerability and adaptability as well as a section on working with partners across the region. In addition, SECAS wrote Threats (*Chapter 8*), which includes Louisiana-specific information based on *Conservation Measures Partnership's Direct Threats Classification v 2.0* (2016).

SPECIES OF GREATEST CONSERVATION NEED

The Species of Greatest Conservation Need (SGCN) list from the 2015 SWAP was the starting point for the 2025 SGCN list (*Appendix D*). LDWF subject matter experts (*Appendix A*) reviewed their respective SGCN lists, and species were suggested for removal or addition. Subject matter experts outside of LDWF were identified for each taxa group (*Appendix C*) and were asked to (1) provide input on the 2015 SGCN list, including suggestions and justifications for species' removal and addition; (2) provide data that could be used for determining S-ranks; and (3) fill out Species Assessment Forms (identical to those used during the 2015 revision). LDWF taxa team subject matter experts examined all of the outside reviewer input, discussed the recommendations of those experts, and revised the SGCN list accordingly.

Considerations used to determine inclusion or removal of a species from the list were S-rank, Louisiana's responsibility (i.e. when a significant portion of a species' range or population is confined to Louisiana), known or potential threats, status and trends, and expert opinion. In many instances, a species was placed on the list due to lack of data. For an explanation of federal and state listing categories and ranks refer to *Appendix I*.

In addition to the 2015 SGCN list, taxa teams also considered lists suggested by the Southeast Association of Fish and Wildlife Agencies (SEAFWA) SWAP Standardization Sub-committee. This sub-committee recommended that each state in the Southeast consider for inclusion those species listed under the Endangered Species Act, those considered Regional SGCN, and species ranked as G1-G2 by NatureServe. Inherent overlap occurred among these lists.

A concerted effort was also made during this revision to fully incorporate plant SGCN into the 2025 SWAP. In 2015, plant SGCN were included in the SGCN list, but were not included in the body of the SWAP and were not given the same amount of consideration as animal SGCN and natural communities. Although plants are not eligible for funding under the SWG Program, state fish and wildlife agencies were allowed to use U.S. Fish and Wildlife Service SWG funds for the development of plant SGCN lists and the incorporation of plant SGCN into 2025 SWAPs. This was due, in part, to potential for new mechanisms that would allow funding for projects focused solely on plants.

¹ Note that not all categories will total 102 responses, as respondents were allowed to abstain from answering all questions, and some questions allowed multiple selections as answers.

NATURAL COMMUNITIES

As with SGCN, the list of natural communities from the 2015 SWAP was the starting point for the 2025 natural communities list (Appendix E). All natural communities were reviewed by the Plant and Natural Community taxa teams and included updates to natural community global and state ranks, status, and extent maps. The taxa teams also revised natural community associations, when needed. In addition, information on basins and marine substrates were updated by LDWF staff in the Office of Fisheries. A list of obligate or near-obligate SGCN that occur in each natural community was determined by the respective taxa teams and are featured for each natural community. For the full list of SGCN that occur in each natural community subtype, refer to Appendix F.

PUBLIC AND PARTNER INVOLVEMENT

In July 2025, a draft of the 2025 SWAP was sent to external reviewers (e.g., stakeholders; *Appendix B*) for review. External reviewers were given the opportunity to provide comments and suggested edits prior to final submission. In addition, LDWF solicited comments from the public. To alert the public of this opportunity, a press release was issued, and posts were made via LDWF social media outlets. A draft was made available on the LDWF website for 30 days, and all comments were reviewed and addressed as appropriate.

PROCEDURE FOR 2035 SWAP COMPREHENSIVE REVISION

The Louisiana Department of Wildlife and Fisheries commits to a comprehensive review and revision of the 2025 SWAP by 1 October 2035. Although it is too soon to determine the exact method for the 2035 revision, it is anticipated that an approach similar to the 2025 revision will be used. Over the next 10 years, LDWF will use the approach and monitoring framework outlined in this SWAP. During this time, if it is recognized that mid-cycle revisions are necessary, LDWF will initiate a minor revision; this will allow the SWAP to be an adaptive document that presents the best conservation measures for SGCN and their habitats. Similarly, LDWF will use the Emerging Issues process to address any new conservation issues that may arise.

Chapter 4: Species of Greatest Conservation Need

The primary focus of the Louisiana State Wildlife Action Plan (SWAP) is the recovery of Species of Greatest Conservation Need (SGCN), those wildlife or plant 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 (data gaps). The identification of SGCN is Element # 1 of the Eight Required Elements for SWAPs. This chapter also addresses Elements # 3 (threats to SGCN and 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 SGCN list during the 2025 revision, refer to *Chapter 3: Approach*. There are a total of 428 animal and 552 plant SGCN identified in this 3rd iteration

of the SWAP. A total of 64 animal SGCN were removed, and 133 were added (for details see the Summary of Changes, pages 13-16). In addition, plants were officially added to the SGCN list. Research and conservation needs and actions and threats are described for each taxonomic group below. These items are not exhaustive and are not intended as the only conservation priorities for these species.

The 2025 SWAP captures research needs and conservation actions for each taxon in tabular format. Column headings were kept the same for each taxa group as much as possible. However, to accommodate distinct differences among taxa groups, additional headings or slight changes in wording were used. When a need or action was selected for every SGCN in a taxa group, that item was removed from the action table and placed in a text section for that taxa group's general research needs and conservation actions. When appropriate, guild-specific or species-specific actions were also added to the text sections.

SGCN BY TAXONOMIC GROUP

MOLLUSKS

Good water quality starts with healthy aquatic systems. Freshwater mussels act as natural filters that help purify Louisiana's streams, bayous, and lakes. In fact, by some estimates, a single mussel may filter between 10 and 20 gallons of water per day (Kreeger et al. 2018). In areas with dense mussel aggregations, this could equal the complete filtering of a stream's daily discharge. Mussels remove suspended sediments such as dirt and debris as well as pharmaceuticals and other chemical contaminants. In addition, mussels are a valuable food source for other species (e.g., Freshwater Drum [*Aplodinotus grunniens*],

North American River Otter [*Lontra canadensis*], and Muskrat), and hold important cultural significance (e.g., food, jewelry, and button making). Despite providing valuable ecosystem services, freshwater mussels receive disproportionately less attention than more charismatic species. Currently, North American freshwater mussels are one of the world's most imperiled taxonomic groups (Master et al. 2000). Habitat destruction and alteration, whether direct (e.g., sand and gravel mining, dam construction) or indirect (e.g., altered flow regimes), often act cumulatively and cause declines.

Freshwater mussels have a unique life history, and most rely on fish to act as hosts for larval mussels, called glochidia. Some larval mussels parasitize specific species of host fish, while others use a variety of host species. In fact, mussels have developed elaborate adaptations to entice fish to approach, ensuring that the glochidia attach to the gills or fins of the hosts. Host fish provide nutrients to the developing mussel larvae for days to weeks prior to the mussels releasing into the substrate as juveniles. In addition, because fish are more mobile, this relationship ensures maximized dispersal of mussels. Louisiana mussel SGCN would not persist without their freshwater hosts.

Over 300 species from two families – Unionidae (298) and Margaritiferidae (5) – occur in the United States (FMCS 2023). Of those species, more than 90 are listed as federally threatened or endangered. The southeastern U.S. contains the greatest mussel diversity with approximately 270 species (Neves et al. 1997), 63 of which are currently known to occur in Louisiana (Vidrine 2023). Of those, 33 species of freshwater mussels are listed as Louisiana SGCN (Table 4.1) including the federally listed Rabbitsfoot (threatened), Pink Mucket (endangered), Fat Pocketbook (endangered), Inflated Heelsplitter (threatened), and Louisiana Pearlshell (threatened). The Louisiana Pearlshell is the only federally listed mussel endemic to Louisiana. In 2023, U.S. Fish and Wildlife Service (USFWS) proposed to list two additional species, the Texas Heelsplitter as endangered and the Louisiana Pigtoe as threatened.

In addition to 33 freshwater mussels, one terrestrial snail is also included on the SGCN list. Five marine mollusks are included on Louisiana’s SGCN list due to their dependence on highly restricted habitats. At least three of these marine mollusks are known only from Marine Seagrass Beds at the Chandeleur Islands. Mollusk SGCN occupy diverse habitats from small, freshwater, inland streams to the shallow waters of the Gulf of America, demonstrating the complex nature of conserving Louisiana’s mollusks.

MOLLUSK SGCN

TABLE 4.1. Mollusk Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: MOLLUSCA			
CLASS: BIVALVIA			
ORDER: PECTINIDA			
FAMILY: PECTINIDAE			
<i>Argopecten irradians</i>	Bay Scallop	G5	SU
ORDER: PTERIIDA			
FAMILY: PINNIDAE			
<i>Atrina seminuda</i>	Half-Naked Penshell	GNR	SU
<i>Atrina serrata</i>	Sawtooth Penshell	G5	SU
ORDER: UNIONIDA			
FAMILY: MARGARITIFERIDAE			
<i>Margaritifera hembeli</i>	Louisiana Pearlshell*	G1G2	S2

TABLE 4.1. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: UNIONIDAE			
<i>Ellipsaria lineolata</i>	Butterfly	G4G5	S1
<i>Elliptio arca</i>	Alabama Spike	G2G3	S1
<i>Elliptio crassidens</i>	Elephantear	G5	S3
<i>Euryntia dilatata</i>	Spike	G5	S1
<i>Fusconaia askewi</i>	Texas Pigtoe	G2?	S1
<i>Lampsilis abrupta</i>	Pink Mucket**	G1G2	S1
<i>Lampsilis cardium</i>	Plain Pocketbook	G5	S2
<i>Lampsilis ornata</i>	Southern Pocketbook	G5	S3
<i>Lampsilis satura</i>	Sandbank Pocketbook	G2?	S2
<i>Lampsilis siliquidea</i>	Fatmucket	G5	S1
<i>Lasmigona complanata</i>	White Heelsplitter	G5	S2
<i>Ligumia recta</i>	Black Sandshell	G4G5	S1
<i>Obovaria arkansasensis</i>	Southern Hickorynut	G3G4	S3
<i>Obovaria olivaria</i>	Hickorynut	G4	S1
<i>Obovaria cf. unicolor</i>	<i>Obovaria</i> sp.	G1G2	S2
<i>Ortmanniana ligamentina</i>	Mucket	G5	S1
<i>Pleurobema beadleanum</i>	Mississippi Pigtoe	G3	S2
<i>Pleurobema riddellii</i>	Louisiana Pigtoe	G1G2	S3
<i>Pleurobema sintoxia</i>	Round Pigtoe	G4?	S2
<i>Potamilus amphichaenus</i>	Texas Heelsplitter*	G1G3	S1
<i>Potamilus capax</i>	Fat Pocketbook**	G3	S1
<i>Potamilus inflatus</i>	Inflated Heelsplitter	G1G2Q	S1
<i>Pseudodontoideus subvexus</i>	Southern Creekmussel	G3	S1
<i>Ptychobranthus occidentalis</i>	Ouachita Kidneyshell	G3G4	S1
<i>Reginaia ebenus</i>	Ebonysheell	G4G5	S3
<i>Strophitus pascagoulaensis</i>	Pascagoula Creekshell	GNR	S2
<i>Strophitus undulatus</i>	Creeper	G5	S2
<i>Theliderma cylindrica</i>	Rabbitsfoot*	G3	S1
<i>Theliderma metanevra</i>	Monkeyface	GNR	S2
<i>Truncilla donaciformis</i>	Fawnsfoot	G5	S2
<i>Utterbackiana hartfieldorum</i>	Cypress Floater	G4	S3
<i>Villosa vibex</i>	Southern Rainbow	G5	S2
CLASS: GASTROPODA			
ORDER: NEOGASTROPODA			
FAMILY: BUSYCONIDAE			
<i>Sinistrofulgur pulleyi</i>	Texas Lightning Whelk	GNR	SU

TABLE 4.1. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: NEOTAENIOGLOSSA			
FAMILY: EPITONIIDAE			
<i>Gyroscala rupicola</i>	Brown-band Wentletrap	GNR	SU
ORDER: STYLOMMATOPHORA			
FAMILY: DISCIDAE			
<i>Anguispira alternata</i>	Flamed Tigersnail	G5	S3

*Federally Threatened

**Federally Endangered

MOLLUSK THREATS

Like many aquatic organisms, mollusks in Louisiana face a variety of threats, many of which are associated with habitat alterations and aquatic connectivity. Modifications to streams can have significant environmental impacts. These modifications can include the construction and operation of aquatic barriers like dams and weirs and the removal of snags and other woody debris for aesthetic reasons, flood prevention, or navigational purposes. Sand and gravel mining operations and improperly designed culverts are significant contributors to headcutting, a process that erodes and degrades streambeds. Additionally, excessive extraction of ground or surface water intensifies the degradation. All of these activities have the potential to decrease habitat quality and quantity as well as alter flow, aquatic connectivity, and water chemistry. In addition, reservoirs without constant flow mandates pose a threat to areas below dams during droughts or in seasons with lower than normal rainfall.

Anthropogenic activities such as infrastructure construction and maintenance projects, the use of off-road vehicles (ORVs), and the clearing of riparian zones can cause sedimentation. The subsequent increase in suspended solids in the water column decreases food availability, interferes with filter feeding and respiration, and impedes aspects of mussel-host fish relationships. Very high levels of sedimentation can cause smothering and mortality (Goldsmith et al. 2020). The input of household, industrial, and agricultural effluents, specifically ammonia, can be lethal to mollusks, which are extremely sensitive to changes in water quality. Organic enrichment of streams due to unnatural accumulations of decaying invasive vegetation, agricultural runoff, and wild or domestic animal feces may act in tandem with other stressors. When driven across or through stream beds, off-road vehicles may be responsible for the direct destruction of mussel. Many mussels and their host fish, already living at the upper limits of their thermal tolerances (Khan et al. 2019), are susceptible to the clearing of vegetation in riparian zones and the resultant increase in water temperatures due to shade reduction (Sullivan and Adam 1989, Rutherford et al. 2004).

Non-native animal species such as Feral Hogs (*Sus scrofa*) cause direct destruction of mussel beds, changes in microbial community composition, and increases in organic enrichment, leading to decreases in freshwater mussel diversity and abundance (Kaller et al. 2007). The Limpkin (*Aramus guarauna*),

a marsh bird specializing in gastropod predation, has rapidly expanded its range into Louisiana, presumably capitalizing on the invasion of apple snails (*Pomacea* spp.). These birds have been observed feeding upon freshwater mussels in Louisiana; however, potential impacts to local populations from this novel predator are only beginning to be investigated.

Due to their unique life history characteristics, mollusks are one of the most susceptible taxa to climate change (Halpern and Kappel 2012, Poff et al. 2012, Ingram et al. 2013). Sea level rise may result in the loss of seagrass beds associated with Barrier Islands and can increase the salinity of coastal streams, potentially reducing habitat suitability. More frequent, high intensity tropical cyclones can decimate seagrass beds, further reducing available habitat. Predicted decreases in precipitation could result in loss of habitat and increased salinity. One of the most widespread climate related threats to freshwater mussels is elevated water temperatures. Many mussel populations are already near their thermal maxima, and additional increases in temperature could cause altered metabolic rates which would decrease growth and reproduction (Ganser et al. 2015). Droughts, also expected to increase in severity, lead to reduced streamflow, which increases the risk of desiccation, but also contributes to warming water temperatures and decreased oxygen levels. The link between mussels and their host fish means that any reduction in abundance of host fish, shifts in timing of fish presence, or alteration of their distribution, could have serious consequences. Many of the threats affecting mollusks occur simultaneously, and the negative effects are cumulative.

MOLLUSK RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation actions for mollusks are listed in Table 4.2.

Mollusk General Research and Conservation Needs and 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.
- Resolve existing taxonomic questions through the use of DNA technology.
- Maintain in-stream flows at levels that will support populations of rare mussels and host fishes.
- Collaborate with partners to set water quality and flow standards that are beneficial to mussel species.
- Promote quality habitat for mollusk SGCN.
- Restrict or outlaw the use of off-road vehicles (ORVs) in streams, particularly the practice of “mudriding” through streambeds.
- Work with the LDWF Scenic Rivers Program, and other state agencies, to minimize sand and gravel mining operations and their impacts in streams that support mollusk SGCN.
- Conserve and restore the Chandeleur Islands and adjacent, shallow-water habitats such as Marine Seagrass Beds.
- Work with partners to prioritize the removal of aquatic passage barriers throughout the state to benefit mollusk

TABLE 4.2. Mollusk Action Table

COMMON NAME	SCIENTIFIC NAME	Determine Abundance	Determine Distribution	Life History (Reproduction, Movement, Survivorship, Host Fish)	Determine Habitat Needs	Population Monitoring	Develop and Promote BMPs
Bay Scallop	<i>Argopecten irradians</i>	●	●				
Half-Naked Penshell	<i>Atrina seminuda</i>	●	●				
Sawtooth Penshell	<i>Atrina serrata</i>	●	●				
Louisiana Pearlshell	<i>Margaritifera hembeli</i>					●	●
Butterfly	<i>Ellipsaria lineolata</i>	●	●	●	●	●	●
Alabama Spike	<i>Elliptio arca</i>	●	●	●	●	●	●
Elephantear	<i>Elliptio crassidens</i>	●		●	●	●	●
Spike	<i>Euryntia dilatata</i>	●	●	●	●	●	●
Texas Pigtoe	<i>Fusconaia askewi</i>	●	●	●	●	●	●
Pink Mucket	<i>Lampsilis abrupta</i>	●	●	●	●	●	●
Plain Pocketbook	<i>Lampsilis cardium</i>	●	●	●	●	●	●
Southern Pocketbook	<i>Lampsilis ornata</i>	●	●	●	●	●	●
Sandbank Pocketbook	<i>Lampsilis satura</i>	●	●	●	●	●	●
Fatmucket	<i>Lampsilis siliquioidea</i>	●	●	●	●	●	●
White Heelsplitter	<i>Lasmigona complanata</i>	●	●	●	●	●	●
Black Sandshell	<i>Ligumia recta</i>	●	●	●	●	●	●
Southern Hickorynut	<i>Obovaria arkansasensis</i>	●	●	●	●	●	●
Hickorynut	<i>Obovaria olivaria</i>	●	●	●	●	●	●
<i>Obovaria</i> sp.	<i>Obovaria cf. unicolor</i>	●		●	●	●	●
Mucket	<i>Ortmanniana ligamentina</i>	●	●	●	●	●	●
Mississippi Pigtoe	<i>Pleurobema beadleianum</i>	●		●	●	●	●
Louisiana Pigtoe	<i>Pleurobema riddellii</i>	●	●	●	●	●	●
Round Pigtoe	<i>Pleurobema sintoxia</i>	●	●	●	●	●	●
Texas Heelsplitter	<i>Potamilus amphichaenus</i>	●	●	●	●	●	●
Fat Pocketbook	<i>Potamilus capax</i>	●	●	●	●	●	●
Inflated Heelsplitter	<i>Potamilus inflatus</i>	●	●	●	●	●	●
Southern Creekmussel	<i>Pseudodontoideus subvexus</i>	●	●	●	●	●	●
Ouachita Kidneyshell	<i>Ptychobranthus occidentalis</i>	●	●	●	●	●	●
Ebonyshell	<i>Reginaia ebenus</i>	●	●	●	●	●	●
Pascagoula Creekshell	<i>Strophitus pascagoulaensis</i>	●	●	●	●	●	●
Creeper	<i>Strophitus undulatus</i>	●	●	●	●	●	●
Rabbitsfoot	<i>Theliderma cylindrica</i>	●	●	●	●	●	●
Monkeyface	<i>Theliderma metanevra</i>	●	●	●	●	●	●
Fawnsfoot	<i>Truncilla donaciformis</i>	●	●	●	●	●	●
Cypress Floater	<i>Utterbackiana hartfieldorum</i>	●	●	●	●	●	●
Southern Rainbow	<i>Villosa vibex</i>	●	●	●	●	●	●
Texas Lightning Whelk	<i>Sinistrofulgur pulleyi</i>	●	●				
Brown-band Wenteltrap	<i>Gyroscala rupicola</i>	●	●				
Flamed Tigersnail	<i>Anguispira alternata</i>	●	●	●	●	●	●

SGCN and host fish, and limit the creation of weirs, dams, and reservoirs on streams and rivers across the state.

- Prioritize work on mollusk SGCN by S-rank and ESA status.
- Address data gaps by prioritizing projects in the Red Basin, particularly Bayou Pierre, and the Atchafalaya basin.
- Assess how Limpkin are affecting native mussel SGCN.

Mollusk Species-specific Research and Conservation Needs and Actions

Louisiana Pearlshell

- Implement the federal recovery plan (USFWS 2019 and in revision) and the 5-year Review (USFWS 2011) for Louisiana Pearlshell.
- Investigate juvenile habitat use of interstitial space and substrate columns.

Pink Mucket

- Implement the federal recovery plan (USFWS 1985) for Pink Mucket.

Louisiana Pigtoe

- Implement the federal recovery plan (USFWS draft) for Louisiana Pigtoe.

Texas Heelsplitter

- Implement the federal recovery plan (USFWS in review) for Texas Heelsplitter.
- Conduct surveys in the upper portion of the Toledo Bend Reservoir and the upstream portion of the Sabine River in Louisiana.

Fat Pocketbook

- Implement the federal recovery plan (USFWS 1989 and revised 2019) for Fat Pocketbook.

Inflated Heelsplitter

- Implement the federal recovery plan (USFWS 1993) for Inflated Heelsplitter.

Rabbitsfoot

- Implement the federal recovery plan (USFWS 2023) for Rabbitsfoot.



Fawnsfoot (*Truncilla donaciformis*)



Louisiana Pearlshell (*Margaritifera hembeli*)



Inflated Heelsplitter (*Potamilus inflatus*)



Louisiana Pigtoe (*Pleurobema riddellii*)

CRUSTACEANS

Although Louisiana is well known for its substantial crawfish consumption and its associated annual \$250 million annual industry (LSU AgCenter 2023), few are aware of the diversity in crawfish species that exists within its borders. Thirty-nine species of crawfish, or in scientific terms, crayfish, are known to occur in Louisiana (Walls 2009, Johnson et al. 2021, USFWS 2024, Himes 2022). More than half of these taxa (22) are considered SGCN by the Wildlife Diversity Program, including at least two endemic or apparently endemic crayfishes: the Teche Painted Crayfish and the Calcasieu Creek Crayfish (Table 4.3). The population viability of many of these rare crayfishes is threatened because of their small ranges; habitat degradation severe enough to cause the extirpation of these species at a single site or even a few sites could also lead to their extinction (Taylor et al. 1996).

Crayfishes are considered one of the most imperiled taxonomic groups in the United States, second only to freshwater mussels (Master 1990). The Slenderwrist Burrowing Crayfish, the Kisatchie Painted Crayfish, and the Calcasieu Painted Crayfish (a subspecies of the Louisiana Painted Crayfish), have been petitioned for federal listing as threatened or endangered under the ESA. Due to their popularity as a food source, Louisiana’s two commercial crayfish species have been the subject of intense research. However, the remaining native species have received comparably little attention despite the fundamental role they play in nutrient cycling by facilitating detrital decomposition and by serving as prey items for aquatic and terrestrial vertebrates (Reynolds et al. 2013, Taylor et al. 2019). In addition, crayfishes are often used as indicators of habitat or water quality, and the burrows they construct not only provide refugia for other organisms, but also assist with soil integration and aeration (Reynolds et al. 2013, Taylor et al. 2019).

Much has been accomplished regarding the geographic distribution of several crayfish SGCN since the publication of Louisiana’s 2015 SWAP. Primarily through State Wildlife Grants, various researchers conducted extensive field inventories for several crayfish SGCN. In most cases, these surveys resulted in larger ranges of crayfish SGCN than previously thought, and S-ranks improved for some of these species. In addition, during this time period, four new species were added to the list of Louisiana crayfish fauna: the Slenderwrist Burrowing Crayfish, Blair’s Fencing Crayfish, and two recently described species in the genus *Creaserinus*, for which common names have yet to be assigned (Johnson et al. 2021). While this progress is encouraging, the discovery of several new species in the state only highlights the data gaps that remain to be addressed.

CRUSTACEAN SGCN

TABLE 4.3. Crustacean Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: ARTHROPODA			
CLASS: MALACOSTRACA			
ORDER: DECAPODA			
FAMILY: CAMBARIDAE			
<i>Creaserinus clausus</i>	a crayfish	GNR	SU
<i>Creaserinus crenastylus</i>	a crayfish	GNR	SU
<i>Creaserinus oryktes</i>	Flatwoods Digger	G4	S1
<i>Fallicambarus dissitus</i>	Pine Hills Digger	G3	S3
<i>Fallicambarus macneesei</i>	Old Prairie Digger	G3	S2
<i>Fallicambarus petilicarpus</i>	Slenderwrist Burrowing Crayfish	G3	SU
<i>Faxonella blairi</i>	Blair's Fencing Crayfish	G4G5	S3
<i>Faxonius hathawayi blacki</i>	Calcasieu Painted Crayfish	G3T2T3	S3
<i>Faxonius hathawayi hathawayi</i>	Teche Painted Crayfish	G3T3	S3
<i>Faxonius hobbsi</i>	Pontchartrain Painted Crayfish	G4Q	S2
<i>Faxonius maletae</i>	Kisatchie Painted Crayfish	G3?	S2
<i>Procambarus bivittatus</i>	Ribbon Crayfish	G5	S1
<i>Procambarus dupratzi</i>	Southwestern Creek Crayfish	G5	S3
<i>Procambarus elegans</i>	Elegant Creek Crayfish	G3	S3
<i>Procambarus geminus</i>	Twin Crayfish	G3	S3
<i>Procambarus jaculus</i>	Javelin Crayfish	G4	S3
<i>Procambarus machardy</i>	Caddo Chimney Crayfish	G1G2	S2
<i>Procambarus penni</i>	Pearl Blackwater Crayfish	G3	S2
<i>Procambarus pentastylus</i>	Calcasieu Creek Crayfish	G3	S3
<i>Procambarus planirostris</i>	Flatnose Crayfish	G4	S2
<i>Procambarus shermani</i>	Gulf Crayfish	G4	S1
<i>Procambarus viaeviridis</i>	Vernal Crayfish	G5	S2

CRUSTACEAN THREATS

Freshwater taxa are at a greater risk of extinction than many other groups, and crayfishes are no exception (Darwall et al. 2011, Riccardi and Ramsussen 1999). Habitat loss, habitat degradation, invasive species, climate change, severe weather, and over-harvesting all pose threats to native crayfish species (Reynolds et al. 2013, Sibley et al. 2011, Taylor et al. 2007). In addition to these, Richman and colleagues (2015) note urban development, pollution, damming, and water management as problems in North America.

Anthropogenic activities such as infrastructure construction and maintenance projects, sand and gravel mining, the use of ORVs, and clearing of riparian zones all cause siltation. Siltation can be problematic for all crayfishes but can be especially challenging for stream dwelling species that may not be adapted to tolerate increased turbidity. The suspended particles make respiration challenging, and the resulting stress makes crayfishes more susceptible to parasites and other threats (Rosewarne et al. 2014). Clearing of vegetation, especially shade trees, along waterways can negatively impact crayfishes by increasing water temperature and reducing available dissolved oxygen; this is especially problematic for species that are adapted to cooler (<78°F) water (Walls 2009). Furthermore, application of herbicides to control vegetation in waterways and along roadsides may also threaten some crayfishes by reducing cover, food availability, and through direct mortality caused by sensitivity to herbicides (Walls 2009). Some crayfish species may use ditches as alternative habitat when higher quality, more preferred habitat, such as ephemeral wetlands, is limited. When crayfish colonize anthropogenic habitats such as ditches, maintenance of these waterways, especially sediment removal, may cause significant negative effects. In addition, improperly designed culverts can produce higher velocities benefiting certain non-native species better adapted to traveling upstream in fast-flowing environments than slower moving native crayfishes. Limitations to dispersal of native crayfishes could limit population size, reduce migration between populations, decrease gene flow, and increase competition with non-natives (Foster and Keller 2011).

Invasive species such as Feral Hogs can directly prey upon native crayfishes and indirectly affect them by modifying habitat (Wood and Roark 1980). Many researchers consider non-native crayfishes to be the greatest threat to native crayfishes via direct competition and through their influence on the abundance of native vegetation (Lodge et al. 2000, Walls 2009). Introduction of non-native crayfishes could occur through the pet-trade, bait-bucket dumping, and hitchhiking on fish-hatchery shipments. Potential non-native invaders include the Rusty Crayfish (*Faxonius rusticus*), Virile Crayfish (*Faxonius virilis*), Calico Crayfish (*Faxonius immunis*), and Australian Red Claw Crayfish (*Cherax quadricarinatus*) (Walls 2009, Pedraza-Lara et al. 2023). In addition to non-native crayfishes, native crayfishes introduced from a neighboring drainage could have catastrophic results for the naturally occurring crayfish species in that drainage (Walls 2009).

A large number of crayfishes in the southeastern United States are vulnerable to climate change (Hossain et al. 2018). Many species are well adapted to survive infrequent rainfall or minor droughts; however, prolonged periods of drought or consecutive yearly droughts have the potential to greatly reduce reproductive output and locally extirpate species (Walls 2009). In addition, crayfish species occurring near the coast have likely evolved adaptations to handle infrequent, temporary salinity increases caused by tropical cyclones. Combined with the persistent threat of saltwater intrusion, as tropical cyclones becomes more frequent, it is possible that the near-coastal species will reach the limit of what they are biologically able to tolerate. Unlike near-coastal species, no evidence exists that non-coastal species can tolerate even the slightest increase in salinity (Walls 2009). Richman and colleagues (2015) found that these and other threats to crayfishes are likely to increase in both magnitude and extent, emphasizing a need to develop crayfish conservation plans.

CRUSTACEAN GENERAL RESEARCH NEEDS AND CONSERVATION ACTIONS

- Determine life history characteristics including those related to habitat needs, population dynamics, movement, and reproduction.
- Determine the influence of road crossings on life history characteristics.
- Develop population monitoring techniques and protocols for crayfish SGCN.
- Determine effects of extreme drought on crayfish SGCN.
- Investigate impacts of Chinese Tallow Tree (*Triadica sebifera*) on Ephemeral Pond dwelling crayfish SGCN.
- Work with parishes and Louisiana Department of Transportation and Development (LaDOTD) to minimize negative impacts of new stream crossings and to mitigate negative impacts of existing stream crossings, including promoting placement of submerged and oversized culverts.
- Maintain in-stream flows and water depths at levels that will support populations of crayfish SGCN.
- Develop Best Management Practices and create quality habitat for crayfish SGCN.
- Target degraded streams and ephemeral wetlands within the known range of one or more crayfish SGCN for experimental restoration.
- Determine effects of water quality on crayfish SGCN, including lethal levels of pollutants.
- Monitor impacts of emerging diseases on crayfish SGCN.
- Encourage researchers to collect tissue samples for future genetic research on crayfish SGCN.
- Promote awareness about the potential introduction of non-native crayfish species such as the Rusty Crayfish, Virile Crayfish, Calico Crayfish, and Australian Red Claw Crayfish.
- Conduct outreach and education on the consequences of transport and release (bait dumping) of native crayfish between drainages.
- Conduct genetic analysis of the Digger Crayfish (*Creaserinus fodiens sensu lato*) species complex within Louisiana to identify unknown species.

- Determine distribution and range extent for primary burrowing crayfish species.
- Delineate edges of range extent for Kisatchie Painted Crayfish, Javelin Crayfish, Pontchartrain Painted Crayfish, and Southern Creek Crayfish.
- Determine distribution and range extent for Ribbon Crayfish, Pearl Blackwater Crayfish, Flatnose Crayfish, Gulf Crayfish, and Vernal Crayfish.

CRUSTACEAN SPECIES-SPECIFIC RESEARCH NEEDS AND CONSERVATION ACTIONS

Teche Painted Crayfish

- Determine if the Gray Speckled Crayfish (*Faxonius palmeri palmeri*) is expanding its native range and if it poses a threat to Teche Painted Crayfish.

Twin Crayfish

- Investigate sustainability of existing recreational harvest.



Calcasieu Creek Crayfish (*Procambarus pentastylus*)



Twin Crayfish (*Procambarus geminus*)



Blair's Fencing Crayfish (*Faxonella blairi*)



Teche Painted Crayfish (*Faxonius hathawayi hathawayi*)

NON-CRUSTACEAN ARTHROPODS

Despite their substantial contributions to food webs and ecosystem services, non-crustacean arthropods remain poorly known (Noriega et al. 2018). In fact, Louisiana's list of non-crustacean arthropod SGCN, in part, reflects this lack of information, as several species have yet to be assigned an S-rank. Louisiana's non-crustacean arthropod SGCN include one species of scorpion and >80 species of insects (*Table 4.4*); the list includes obscure taxa like the Little Dubiraphian Riffle Beetle and the Schoolhouse Springs Purse Casemaker Caddisfly, but also some of our most recognizable species such as the Monarch and the American Bumble Bee. The importance of arthropods to life on Earth is indisputably clear; terrestrial

arthropods make up >150 million tons of the Earth's carbon, on par with the biomass of all terrestrial vertebrates combined (Bar-On et al. 2018, Eggleton 2020, Rosenberg et al. 2023).

Whether from lack of funding, disdain as pests, or through general apathy, insect conservation has only recently been recognized as a critical need. Indeed, the proportion of refereed journal articles published on the *decline of insects* vs. simply *insects* has dramatically increased since the publication of Louisiana's 2015 SWAP (Eggleton 2020). Reports of the magnitude of declines have varied widely from those suggesting impending global collapse to those of more moderate and measured concern (Hallman

et al. 2017, Cardoso et al. 2019, Seibold et al. 2019, Wagner 2020, Daskalova et al. 2021, Sanchez-Bayo and Wyckhuys 2021). However, little doubt remains that many insects and other non-crustacean arthropods are experiencing observable population declines. Determining the scope and severity of those declines is exceptionally challenging (Eggleton 2020, Jactel et al. 2020, Wagner 2020), particularly given the complexity and diversity of arthropods and the lack of even the most basic information.

Regardless of the existing data gaps, conservationists agree that proactive measures should be taken immediately to help minimize the loss of non-crustacean arthropods (Forister et al. 2019, Jactel et al. 2020, Wagner et al. 2021). Otherwise, negative impacts from the loss of these species – already linked to population declines of insectivorous birds (Manning and Sullivan 2021, Tallamy and Shriver 2021) and shifts in plant abundance and phenology (Ulrich et al. 2020) – will likely extend to that of human civilization. The ecosystem services provided by native insects, as pollinators, predators, decomposers, and more, amount to >\$55 billion annually in the United States (Losey and Vaughan 2006).

NON-CRUSTACEAN ARTHROPOD SGCN

TABLE 4.4. Non-Crustacean Arthropod Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: ARTHROPODA			
CLASS: ARACHNIDA			
ORDER: SCORPIONES			
FAMILY: VAEJOVIDAE			
<i>Vaejovis carolinianus</i>	Southern Unstriped Scorpion	G5	S2
CLASS: INSECTA			
ORDER: COLEOPTERA			
FAMILY: CARABIDAE			
<i>Anillinus felicianus</i>	an Anillinus ground beetle	GNR	S1
FAMILY: CERAMBYCIDAE			
<i>Dryobius sexnotatus</i>	Six-banded Longhorn Beetle	GNR	S2
FAMILY: CICINDELIDAE			
<i>Cicindela formosa</i>	Big Sand Tiger Beetle	G5	S2
<i>Dromochorus pilatei</i>	Cajun Tiger Beetle	G4	S3
<i>Ellipsiptera wapleri</i>	White Sand Tiger Beetle	G3G4	S3
<i>Habroscelimorpha dorsalis venusta</i>	Gulf Beach Tiger Beetle	G3T3	S2
FAMILY: ELMIDAE			
<i>Dubiraphia parva</i>	Little Dubiraphian Riffle Beetle	G2	S1
FAMILY: SCARABAEIDAE			
<i>Ataenius robustus</i>	Saline Prairie Scarab Beetle	GNR	S1

TABLE 4.4. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: HYMENOPTERA			
FAMILY: APIDAE			
<i>Bombus fraternus</i>	Southern Plains Bumble Bee	G3G4	S2
<i>Bombus pensylvanicus</i>	American Bumble Bee	G3G4	S3
<i>Bombus variabilis</i>	Variable Cuckoo Bumble Bee	G1G2	SU
FAMILY: FORMICIDAE			
<i>Pogonomyrmex badius</i>	Florida Harvester Ant	G5	S1
<i>Pogonomyrmex comanche</i>	Comanche Harvester Ant	G2G3	S2
ORDER: LEPIDOPTERA			
SUPERFAMILY: BOMBYCOIDEA			
FAMILY: SATURNIIDAE			
<i>Automeris louisiana</i>	Louisiana Eyed Silkmoth	G1G3	S2
FAMILY: SPHINGIDAE			
<i>Lapara phaeobrachycerous</i>	Gulf Pine Sphinx	G3G4	S1
SUPERFAMILY: NOCTUOIDEA			
FAMILY: EREBIDAE			
<i>Catocala atocala</i>	Brou's Underwing	G3G4	SU
FAMILY: NOCTUIDAE			
<i>Bagisara brouana</i>	Brou's Mallow Moth	G3	SU
SUPERFAMILY: PAPILIONOIDEA			
FAMILY: HESPERIIDAE			
<i>Amblyscirtes aesculapius</i>	Lace-winged Roadside-Skipper	G4	S3
<i>Amblyscirtes alternata</i>	Dusky Roadside-Skipper	G3G4	S2
<i>Amblyscirtes matheri</i>	Mather's Roadside-Skipper	GNR	SU
<i>Amblyscirtes nemoris</i>	a roadside-skipper	GNR	S2
<i>Amblyscirtes vialis</i>	Common Roadside-Skipper	G5	S3
<i>Atrytone arogos</i>	Arogos Skipper	G2G3	S1
<i>Atrytonopsis hianna</i>	Dusted Skipper	G4G5	S3
<i>Erynnis baptisiae</i>	Wild Indigo Duskywing	G5	S2
<i>Erynnis martialis</i>	Mottled Duskywing	G3	S2
<i>Euphyes bayensis</i>	Bay Skipper	G2G3	S2
<i>Euphyes dion</i>	Dion Skipper	G5	S2
<i>Euphyes pilatka</i>	Palatka Skipper	G3	S1
<i>Hesperia meskei</i>	Meske's Skipper	G3G4	S1
<i>Hesperia metea</i>	Cobweb Skipper	G4	SH
<i>Lon zabulon</i>	Zabulon Skipper	G5	S3
<i>Megathymus streckeri</i>	Strecker's Giant-Skipper	G5	S1
<i>Megathymus yuccae</i>	Yucca Giant-Skipper	G5	S1
<i>Panoquina panoquinoides</i>	Obscure Skipper	G5?	S2
<i>Poanes aaroni</i>	Aaron's Skipper	G4	S2

TABLE 4.4. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: LYCAENIDAE			
<i>Brephidium exilis</i>	Western Pygmy Blue	G4G5	S2
<i>Brephidium pseudofea</i>	Eastern Pygmy Blue	G4	S2
<i>Callophrys henrici</i>	Henry's Elfin	G5	S3
<i>Callophrys irus</i>	Frosted Elfin	G3	S3
<i>Satyrrium kingi</i>	King's Hairstreak	G3G4	S3
FAMILY: NYMPHALIDAE			
<i>Anthanassa texana seminole</i>	Seminole Texan Crescent	G5T3T4	S3
<i>Chlosyne gorgone</i>	Gorgone Checkerspot	G5	SU
<i>Danaus plexippus</i>	Monarch	G4	S4
<i>Lethe appalachia</i>	Appalachian Brown	G5	S3
<i>Lethe creola</i>	Creole Pearly-eye	G4	S3
ORDER: MECOPTERA			
FAMILY: PANORPIDAE			
<i>Panorpa americana</i>	a panorpid scorpionfly	GNR	S1
<i>Panorpa lugubris</i>	Mourning Scorpionfly	GNR	S1
<i>Panorpa rupeculana</i>	a panorpid scorpionfly	GNR	S1
<i>Panorpa vernalis</i>	a panorpid scorpionfly	GNR	S2
ORDER: ODONATA			
SUBORDER: ANISOPTERA			
FAMILY: AESHNIDAE			
<i>Gomphaeschna antilope</i>	Taper-tailed Darner	G4	S1
<i>Triacanthagyna trifida</i>	Phantom Darner	G5	S1
FAMILY: CORDULEGASTRIDAE			
<i>Zoraena bilineata</i>	Brown Spiketail	G5	S1
<i>Zoraena sarracenia</i>	Pitcher Plant Spiketail	G3	S2
FAMILY: CORDULIIDAE			
<i>Neurocordulia alabamensis</i>	Alabama Shadowdragon	G5	SU
<i>Somatochlora filosa</i>	Fine-lined Emerald	G5	S1
<i>Somatochlora margarita</i>	Texas Emerald	G2G3	S1
<i>Somatochlora provocans</i>	Treetop Emerald	G4	S1
<i>Somatochlora tenebrosa</i>	Clamp-tipped Emerald	G5	S1
FAMILY: GOMPHIDAE			
<i>Arigomphus lentulus</i>	Stillwater Clubtail	G5	S3
<i>Dromogomphus armatus</i>	Southeastern Spinyleg	G4	S1
<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5	S1
<i>Gomphurus dilatatus</i>	Blackwater Clubtail	G5	S1
<i>Hylogomphus apomyius</i>	Banner Clubtail	G3G4	S2

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: GOMPHIDAE (cont.)			
<i>Ophiogomphus australis</i>	Southern Snaketail	G1G2	S1
<i>Phanogomphus australis</i>	Clearlake Clubtail	G4	S1
<i>Phanogomphus hodgesi</i>	Hodges' Clubtail	G3	S1
<i>Stylurus amnicola</i>	Riverine Clubtail	G4	S1
<i>Stylurus laurae</i>	Laura's Clubtail	G4	S2
<i>Stylurus townesi</i>	Townes' Clubtail	G3	S1
FAMILY: LIBELLULIDAE			
<i>Celithemis bertha</i>	Red-veined Pennant	G5	S1
SUBORDER: ZYGOPTERA			
FAMILY: COENAGRIONIDAE			
<i>Enallagma concisum</i>	Cherry Bluet	G4	S1
<i>Enallagma weewa</i>	Blackwater Bluet	G5	S1
<i>Nehalennia gracilis</i>	Sphagnum Sprite	G5	S1
ORDER: PLECOPTERA			
FAMILY: LEUCTRIDAE			
<i>Leuctra szczytkoi</i>	Louisiana Needlefly	G1	S1
<i>Leuctra species</i>	needleflies	N/A	N/A
FAMILY: NEMOURIDAE			
<i>Amphinemura texana</i>	Texas Forestfly	G3	S1
FAMILY: PERLODIDAE			
<i>Helopicus bogaloosa</i>	Masked Springfly	G3G4	SU
ORDER: TRICHOPTERA			
FAMILY: HYDROPSYCHIDAE			
<i>Cheumatopsyche morsei</i>	Morse's Net-spinning Caddisfly	G1G3	SU
<i>Diplectrona rossi</i>	Schoolhouse Springs Net-spinning Caddisfly	G1	S1
FAMILY: HYDROPTILLIDAE			
<i>Hydroptila molsonae</i>	Molson's Microcaddisfly	G2	SU
<i>Hydroptila ouachita</i>	Schoolhouse Springs Purse Casemaker Caddisfly	G1G2	S1
<i>Hydroptila poirrieri</i>	a purse casemaker caddisfly	G2	S1
FAMILY: LEPTOCERIDAE			
<i>Ceraclea spongillovorax</i>	a longhorned caddisfly	G3G4	SU
FAMILY: PHILOPOTAMIDAE			
<i>Chimarra holzenthali</i>	Holzenthals Philopotamid Caddisfly	G1G2	S1
FAMILY: SERICOSTOMATIDAE			
<i>Agarodes libalis</i>	Spring-loving Psiloneuran Caddisfly	G3	SU

NON-CRUSTACEAN ARTHROPOD THREATS

Louisiana's non-crustacean arthropods are threatened by a variety of elements, most of which are directly related to human activities. Unlike most other SGCN, this taxa group contains aquatic and terrestrial organisms, and some species are obligates to both. Of the 86 at-risk species of non-crustacean arthropods in this plan, 50 species are terrestrial (e.g., most beetles, bees, butterflies, and others), and 36 are aquatic for at least a portion of their lives (e.g., dragonflies, damselflies, stoneflies, caddisflies, and others). The great diversity and complexity of their life histories magnify the level of conservation challenges. Likely, as is shared with most SGCN, the greatest threat to these species is an increase in urban and agricultural development, which reduces the quality and quantity of available habitat. An increase in agricultural intensification brings more opportunity to reduce plant diversity and introduce pesticides and other pollutants into the environment. Chemical waste and sedimentation runoff from agricultural, industrial, and residential developments decreases water quality. Light pollution negatively affects insects' abilities to navigate and communicate (Cardoso et al. 2020) and can lead to collision mortality. Introduction of exotic animal species such as Red Imported Fire Ant (*Solenopsis invicta*) or those released as biocontrol agents can depredate, outcompete, and displace other species (Wagner and Driesche 2010). When exotic plants become established, some insects (e.g., butterflies, moths, etc.) may lose appropriate host plants for their larvae or food plants for adults. The movement to essentially sanitize neighborhoods by promotion of lawns and exotic plants has been extremely detrimental; even a small patch of native plants can make a positive measurable difference (Eggleton 2020, Harvey et al. 2022, Donkersley et al. 2023).

Predicted alterations to ecosystems from climate change, - increased weather extremes (e.g., increased rainfall and increased drought), increased magnitude and duration of maximum temperatures, and other effects, will alter the distribution, richness, and abundance of non-crustacean arthropods. Impacts may include desiccation and stressors to physiological systems, changes in plant distribution and flowering phenology, altered stream flows, expansion of invasive species, and more (Harvey et al. 2020, Ulrich et al. 2020, Harvey et al. 2022, Prather et al. 2023). Finally, another emerging threat may be development of renewable energy; one study suggests that a single wind turbine, for example, may kill 40 million insects each year (Trieb 2018, Voigt 2020). The loss of Louisiana's non-crustacean arthropods will require targeted research and conservation actions for effective solutions.

Non-crustacean Arthropod General Research Needs and Conservation Actions

- Determine the current distribution, life history, status, habitat needs, and limiting factors of all SGCN to fill knowledge gaps for Louisiana and provide baseline data for future assessments.
- Determine impacts of host switching to non-native plants.
- Conduct surveys and other studies to determine potential future designation as SGCN.

- Include insect conservation (with emphasis on rare insects and pollinators) in public education and outreach efforts.
- Investigate reasons for major declines.
- Promote quality habitat (e.g., retention of woody debris).
- Develop and promote Best Management Practices and Streamside Management Zones for non-crustacean arthropod SGCN.
- Investigate the impacts of competition with invasive non-crustacean arthropods.
- Coordinate with Xerces Society and other partners to promote the conservation of non-crustacean arthropods.
- Restrict or outlaw the use of off-road vehicles (ORVs) in streams, particularly the practice of "mudriding" through streambeds and adjacent habitats.
- Address the impacts of light pollution on non-crustacean arthropods.

Non-crustacean Arthropod Guild and Species-specific Research Needs and Conservation Actions

Monarch

- Implement the federal recovery plan if Monarch becomes federally listed.
- Plant native milkweed species in landscaping, mitigation, and habitat restoration efforts.
- Monitor for emerging diseases such as *Ophryocystis elektroscirrha* in Monarchs.
- Facilitate cooperation with the Monarch Joint Venture to maximize efficacy of Monarch conservation.
- Investigate impacts of wind turbines on Monarchs and their migration.
- Promote the use of the Conservation Benefit Agreements (formerly Candidate Conservation Agreement with Assurances) to create beneficial habitat for Monarchs.
- Conduct outreach highlighting the negative impacts of broad spectrum pesticides and herbicides on Monarchs.

Pollinators

- 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 (ROW).
- Develop reliable, affordable, and genotypically appropriate 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 pollinators and implement those recommendations on Wildlife Management Areas (WMAs) and other LDWF properties.

Aquatic Insect Guild

- Determine and prioritize where to retain and/or reconnect aquatic habitat connectivity.
- Work with parishes and the LaDOTD 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 to address impairments to streams that will negatively impact stream dwelling insects.
- Conserve, monitor, and address threats to rare insects at Schoolhouse Springs and blackwater stream species.



American Bumblebee (*Bombus pensylvanicus*).



Comanche Harvester Ants (*Pogonomyrmex comanche*).



(LEFT) Southern Unstriped Scorpion (*Vaejovis carolinianus*) under longwave ultraviolet light. (RIGHT) Monarch caterpillar (*Danaus plexippus*).

INLAND FISHES

Louisiana’s great diversity of inland fishes is largely attributed to the state’s dynamic biogeographical landscape, which encompasses the East and West Gulf Coastal Plains, the Mississippi Basin, and a variety of aquatic habitats. These habitats range from small streams, bayous, oxbows, and backwater areas to coastal rivers, large river systems, and estuaries. The substrates in these environments vary from gravels to fine silts, with a few notable rock formations. Most of the state averages 50 to 65 inches of rain annually but is prone to drought or extremely high levels of rainfall in any given year. Drought and precipitation across the Mississippi Basin directly impacts Louisiana’s water levels, resulting in variable and often harsh natural conditions for fish, especially when coupled with high average and extreme temperatures. Many spring-fed systems, however, offer stability in volume and temperature during periods of low rainfall.

Globally, freshwater ecosystems make up only 0.009% of Earth’s water but hold 43% of fish biodiversity (Nelson 2006, Helfman 2007). Jelks and colleagues (2008) reported that North America is home to 700 imperiled freshwater and diadromous (fish that migrate between fresh and salt water at various stages of their life cycle to spawn) species of fishes, a number that is likely significantly higher today due to taxonomic changes and the general negative trend in the status of freshwater species. Freshwater migratory fishes are estimated to have declined worldwide by 81% between 1970 and 2020. However, based on a 1970 baseline, North American populations seem relatively stable (Deinet et al. 2025). This is likely due to most North American dam construction taking place from the 1930s to the 1950s, and an already-shifted baseline having been achieved by 1970. It can be inferred that similar declines have happened in North America, just earlier than less developed areas that are currently in a dam-building phase.

The diversity of fishes in Louisiana is rich with 196 primarily freshwater, euryhaline (fish that can tolerate a wide range of salinity), and diadromous fish species recorded in Louisiana (Doosey et al. 2021). These species range from the smallest fish in North America, the Least Killifish (*Heterandria formosa*), to the giant Alligator Gar and Gulf Sturgeon. Fifty-five species are considered SGCN (Table 4.5), with 19 added and three removed in this update. Inland fish SGCN are found in all freshwater habitats of the state, with many specializing in big river and headwater stream habitats.

Fish are excellent indicators of aquatic health, which directly influences human health and quality of life. However, the life histories and ecological niches of many fish SGCN remain poorly understood. To improve their ecosystem management and conservation, more research is needed to better understand the complex habits, needs, and interactions of freshwater fishes in Louisiana. This understanding is essential for maintaining both biodiversity and the health of aquatic environments on which humans depend.

INLAND FISH SGCN

TABLE 4.5. Inland Fish Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: CHORDATA			
CLASS: ACTINOPTERYGII			
ORDER: ACIPENSERIFORMES			
FAMILY: ACIPENSERIDAE			
<i>Acipenser oxyrinchus desotoi</i>	Gulf Sturgeon*	G2G3T2T3	S1
<i>Scaphirhynchus albus</i>	Pallid Sturgeon**	G2	S1
<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon	G4	S3
FAMILY: POLYDONTIDAE			
<i>Polyodon spathula</i>	Paddlefish	G4	S4
ORDER: ANGUILLIFORMES			
FAMILY: ANGUILLIDAE			
<i>Anguilla rostrata</i>	American Eel	G4	S4
ORDER: CLUPEIFORMES			
FAMILY: ALOSIDAE			
<i>Alosa alabamae</i>	Alabama Shad	G2?	S1M
ORDER: CYPRINIFORMES			
FAMILY: CATASTOMIDAE			
<i>Carpiodes cyprinus</i>	Quillback	G5	S3
<i>Carpiodes velifer</i>	Highfin Carpsucker	G4G5	S3
<i>Cycleptus elongatus</i>	Blue Sucker	G3G4	S3
<i>Cycleptus meridionalis</i>	Southeastern Blue Sucker	G3G4	S1
<i>Moxostoma carinatum</i>	River Redhorse	G4	S1
FAMILY: LEUCISCIDAE			
<i>Alburnops blennioides</i>	River Shiner	G5	S3
<i>Alburnops chalybaeus</i>	Ironcolor Shiner	G4	S3
<i>Alburnops potteri</i>	Chub Shiner	G4	S3
<i>Camptostoma anomalum</i>	Central Stoneroller	G5	S1
<i>Cyprinella camura</i>	Bluntnose Shiner	G5	S2
<i>Cyprinella whipplei</i>	Steelcolor Shiner	G5	SH
<i>Ericymba amplamala</i>	Longjaw Minnow	G5	S2
<i>Hybognathus hayi</i>	Cypress Minnow	G4G5	S3
<i>Hybopsis winchelli</i>	Clear Chub	G5	S4
<i>Macrhybopsis hyostoma</i>	Shoal Chub	G5	S3
<i>Macrhybopsis tomellerii</i>	Gulf Chub	GNR	S2
<i>Miniellus boops</i>	Bigeye Shiner	G5	S3
<i>Miniellus sabinae</i>	Sabine Shiner	G4	S3
<i>Notropis atrocaudalis</i>	Blackspot Shiner	G4	S2
<i>Paranotopis bichanani</i>	Ghost Shiner	G5	S3
<i>Paranotopis shumardi</i>	Silverband Shiner	G5	S3
<i>Phenacobius mirabilis</i>	Suckermouth Minnow	G5	S1

TABLE 4.5. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: LEUCISCIDAE (cont.)			
<i>Pteronotrops hubbsi</i>	Bluehead Shiner	G3	S2
<i>Pteronotrops signipinnis</i>	Flagfin Shiner	G5	S2
<i>Pteronotrops welaka</i>	Bluenose Shiner	G3G4	S1
ORDER: CYPRINODONTIFORMES			
FAMILY: FUNDULIDAE			
<i>Fundulus blairae</i>	Western Starhead Topminnow	G4	S3
<i>Fundulus dispar</i>	Northern Starhead Topminnow	G4	S3
<i>Fundulus euryzonus</i>	Broadstripe Topminnow	G3	S2
<i>Fundulus nottii</i>	Southern Starhead Topminnow	G5	S3
ORDER: HIODONTIFORMES			
FAMILY: HIODONTIDAE			
<i>Hiodon alosoides</i>	Goldeye	G5	S4
<i>Hiodon tergisus</i>	Mooneye	G5	S3
ORDER: LEPISTOSTEIFORMES			
FAMILY: LEPISTOSTEIDAE			
<i>Atractosteus spatula</i>	Alligator Gar	G3G4	S5
ORDER: MORONIFORMES			
FAMILY: MORONIDAE			
<i>Morone saxatilis</i>	Striped Bass (Gulf Strain)	G5	S1
ORDER: PERCIFORMES			
FAMILY: PERCIDAE			
<i>Ammocrypta clara</i>	Western Sand Darter	G3	S1
<i>Crystallaria asprella</i>	Crystal Darter	G3	S2
<i>Etheostoma artesiae</i>	Redspot Darter	G5	S3
<i>Etheostoma caeruleum</i>	Rainbow Darter	G5	S2
<i>Etheostoma parvipinne</i>	Goldstripe Darter	G4G5	S4
<i>Etheostoma thompsoni</i>	Gumbo Darter	G3	S2
<i>Percina aurora</i>	Pearl Darter*	G1	SH
<i>Percina copelandi</i>	Channel Darter	G4	S1
<i>Percina lenticula</i>	Freckled Darter	G3	S1
<i>Percina macrolepida</i>	Bigscale Logperch	G5	S2
<i>Percina shumardi</i>	River Darter	G5	S3
<i>Percina suttkusi</i>	Gulf Logperch	G5	S3
<i>Percina vigil</i>	Saddleback Darter	G5	S3
ORDER: SILURIFORMES			
FAMILY: ICTALURIDAE			
<i>Noturus munitus</i>	Frecklebelly Madtom	G3	S3
<i>Noturus phaeus</i>	Brown Madtom	G4	S2
ORDER: SYNGNATHIFORMES			
FAMILY: SYNGNATHIDAE			
<i>Syngnathus scovelli</i>	Gulf Pipefish (Inland Populations)	G5	S3

*Federally Threatened

**Federally Endangered

INLAND FISH THREATS

Louisiana has the aquatic habitat diversity and productivity to support many abundant and resilient populations of inland fishes. Hot climate, combined with sluggish waters, extreme rainfall events, periods of extended flooding, periodic droughts, and high nutrient and organic loading, lead to low dissolved oxygen being a seasonal issue in much of the state. The state's aquatic systems, when healthy, are resilient to these periodic stressors, and rely on them, to an extent, to remain diverse and abundant. However, anthropogenic impacts can alter systems in such a way that they become out of balance and less resilient to the state's natural conditions.

Like many other freshwater organisms, inland fishes in Louisiana face a variety of anthropogenic threats including sand and gravel mining, increased sedimentation and nutrient loading from agriculture, transportation infrastructure (e.g., undersized culverts), ORV use in streams, stream modification, de-snagging and clearing of riparian cover, decreased lateral and longitudinal connectivity (e.g., dams and flood control levees, respectively), unnaturally high connectivity (e.g., man-made canals), water withdrawals and diversions, invasive species, abandoned fishing gear, pollution, and compounding impacts from extreme weather events and climate change. Magnitude and timing of threats can cause varying impacts, and threats are often compounded by natural and man-made conditions.

A notable feature of Louisiana is its susceptibility to flooding due to a number of natural conditions including a high potential for extreme rainfall, a low-relief landscape, and its location at the mouth of the Mississippi Basin. Fish populations in the state have evolved to not only rebound from, but depend on, periodic high water events and seasonal fluctuations. However, humans have altered the landscape to reduce flood risk, resulting in many intended and unintended consequences. Many of the ecological consequences of past flood control measures, such as declining species and shifting aquatic communities, have become apparent in the 20th and 21st centuries. With advancing technologies and methods, Louisiana has the opportunity to not only mediate past watershed alterations, but to plan for more sustainable and ecologically beneficial methods such as nature-based solutions and green infrastructure through organizations like the Louisiana Watershed Initiative. Watershed-scale planning and implementation of beneficial projects could greatly relieve stresses and threats to many of our fish SGCN.

INLAND FISH RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation actions for inland fishes are listed in Table 4.6.

TABLE 4.6. Inland Fish Action Table.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Determine Habitat Needs	Restore Historic Habitat and Reintroduce Populations	Remove the Sills from the Pearl and Bogue Chitto Rivers	Determine Impacts of Locks and Dams on Movement and Spawning Success on Red River
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>				•	
Pallid Sturgeon	<i>Scaphirhynchus albus</i>					•
Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>					•
Paddlefish	<i>Polyodon spathula</i>				•	•
American Eel	<i>Anguilla rostrata</i>				•	•
Alabama Shad	<i>Alosa alabamae</i>	•	•		•	•
Quillback	<i>Carpionodes cyprinus</i>				•	
Highfin Carpsucker	<i>Carpionodes velifer</i>				•	
Blue Sucker	<i>Cycleptus elongatus</i>					•
Southeastern Blue Sucker	<i>Cycleptus meridionalis</i>				•	
River Redhorse	<i>Moxostoma carinatum</i>	•	•		•	
River Shiner	<i>Alburnops blennius</i>					•
Ironcolor Shiner	<i>Alburnops chalybaeus</i>	•				
Chub Shiner	<i>Alburnops potteri</i>					•
Central Stoneroller	<i>Campostoma anomalum</i>					
Bluntnose Shiner	<i>Cyprinella camura</i>	•	•			
Steelcolor Shiner	<i>Cyprinella whipplei</i>	•	•			
Longjaw Minnow	<i>Ericymba amplamala</i>	•	•			
Cypress Minnow	<i>Hybognathus hayi</i>	•	•		•	
Clear Chub	<i>Hybopsis winchelli</i>				•	
Shoal Chub	<i>Macrhybopsis hyostoma</i>	•				•
Gulf Chub	<i>Macrhybopsis tomellerii</i>	•	•		•	
Bigeye Shiner	<i>Miniellus boops</i>	•				
Sabine Shiner	<i>Miniellus sabiniae</i>					•
Blackspot Shiner	<i>Notropis atrocaudalis</i>					
Ghost Shiner	<i>Paranotropis buechanani</i>	•	•			•
Silverband Shiner	<i>Paranotropis shumardi</i>				•	•
Suckermouth Minnow	<i>Phenacobius mirabilis</i>					
Bluehead Shiner	<i>Pteronotropis hubbsi</i>	•	•	•		
Flagfin Shiner	<i>Pteronotropis signipinnis</i>	•				
Bluenose Shiner	<i>Pteronotropis welaka</i>			•		
Western Starhead Topminnow	<i>Fundulus blairae</i>	•				
Northern Starhead Topminnow	<i>Fundulus dispar</i>	•				
Broadstripe Topminnow	<i>Fundulus euryzonus</i>	•	•			
Southern Starhead Topminnow	<i>Fundulus nottii</i>	•				
Goldeye	<i>Hiodon alosoides</i>					•
Mooneye	<i>Hiodon tergisus</i>				•	•
Alligator Gar	<i>Atractosteus spatula</i>					•
Striped Bass (Gulf Strain)	<i>Morone saxatilis</i>	•		•	•	
Western Sand Darter	<i>Ammocrypta clara</i>	•		•		
Crystal Darter	<i>Crystallaria asprella</i>	•			•	
Redspot Darter	<i>Etheostoma artesiae</i>	•				
Rainbow Darter	<i>Etheostoma caeruleum</i>	•				
Goldstripe Darter	<i>Etheostoma parvipinne</i>					

TABLE 4.6. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Determine Habitat Needs	Restore Historic Habitat and Reintroduce Populations	Remove the Sills from the Pearl and Bogue Chitto Rivers	Determine Impacts of Locks and Dams on Movement and Spawning Success on Red River
Gumbo Darter	<i>Etheostoma thompsoni</i>					
Pearl Darter	<i>Percina aurora</i>	●		●	●	
Channel Darter	<i>Percina copelandi</i>	●	●			
Freckled Darter	<i>Percina lenticula</i>	●			●	
Bigscale Logperch	<i>Percina macrolepida</i>	●				
River Darter	<i>Percina shumardi</i>				●	●
Gulf Logperch	<i>Percina suttkusi</i>				●	
Saddleback Darter	<i>Percina vigil</i>				●	
Frecklebelly Madtom	<i>Noturus munitus</i>				●	
Brown Madtom	<i>Noturus phaeus</i>					
Gulf Pipefish (Inland Populations)	<i>Syngnathus scovelli</i>					

Inland Fish General Research Needs and Conservation Actions

- Research habitat requirements, population trends, and distribution of all fish SGCN.
- Implement or continue, where applicable, long-term monitoring of all fish SGCN.
- Develop Habitat Suitability Indices (HSIs) for fish SGCN to aid in future conservation and restoration efforts.
- Determine ranges of new species determined by taxonomic splits and confirm with genetic analysis.
- Compile all historical data on fish SGCN.
- Determine current and historical relative abundance of fish SGCN and their communities.
- Investigate the life history of fish SGCN including reproduction, movements, and survivorship.
- Conduct population monitoring of fish SGCN.
- Resolve the impacts of in-stream flow alterations on fish SGCN.
- Determine the impacts of land use on fish community structure.
- Determine which habitat characteristics are most important for restoration activities.
- Develop and promote Best Management Practices and Streamside Management Zones for fish SGCN.
- Retain riparian buffers.
- Work with parishes, private landowners, and industrial interests (e.g., timber or petrochemical companies) to disseminate Best Management Practices and Streamside Management Zones.
- Promote quality habitat for all fish SGCN.
- Restrict or outlaw the use of off-road vehicles (ORVs) in streams, particularly the practice of “mud-riding” through streambeds.
- Protect instream habitat during post-storm de-snagging and stream clearing efforts.
- Determine and prioritize where to retain and/or reconnect aquatic habitat connectivity.
- Remove non-essential dams and low-water sills in Louisiana watersheds where warranted and discourage the building of new dams.
- Develop recommendations to improve fish passage through low-head dams through fish ladders, bypasses, or removal.
- Work with parishes and LaDOTD to minimize negative impacts of new stream crossings and to mitigate negative impacts of existing stream crossings, including promoting placement of submerged and oversized culverts.
- Continue the efforts of the Louisiana Aquatic Connectivity Team to improve fish passage through culverts, dams, and other anthropogenic barriers across the state.
- Investigate the impacts of barrier removal on all fish SGCN including surveys before and after removal (e.g., culverts, dams, and Pearl River sills).
- Coordinate with other agencies and organizations to conserve and restore aquatic habitat.
- Partner with neighboring states to address conservation of shared fish resources.
- Conduct outreach and increase awareness about the importance of biodiversity and fish SGCN.
- Expand outreach/education efforts on the importance of habitat including riparian zones, fish passage corridors, instream habitat, and anthropogenic impacts.
- Determine specific threats and their impacts to fish SGCN.
- Coordinate with partners 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.

Inland Fish Species-specific Research Needs 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).

Pallid Sturgeon

- Conduct genetic analysis to determine degree of hybridization.
- Implement the federal recovery plan (USFWS 1993 and 2014 revision) for Pallid Sturgeon.

Paddlefish

- Continue to participate in the Mississippi Interstate Cooperative Resource Association (MICRA) Paddlefish and Sturgeon Committee for interstate species management.
- Implement the Louisiana recovery plan (Reed 1991) for Paddlefish.

American Eel

- Install eel ladders at dams throughout the state to aid passage.
- Determine timing and locations of glass eel and elver movement in coastal areas.
- Conduct coastal surveys to determine the location of male American Eels.
- Research impacts of the nematode *Anguillicoloides crassus* on inland and migratory eels.
- Determine timing and success of out-migrating silver eels across the state

Alabama Shad

- Conduct research in connection with efforts in Arkansas in the Ouachita River system to determine population statistics and migration timing in Louisiana waters.
- Determine status in the Pontchartrain and Pearl River watersheds.

Ironcolor Shiner

- Conserve headwater stream habitat where they occur.

Sucker Species

- Research flow requirements to verify impacts of specific flood mitigation techniques on life history and/or population viability.

Alligator Gar

- Compare inland and coastal populations.
- Determine impacts of recreational and commercial fishing on various populations in the state.
- Identify and reconnect spawning and nursery habitat.

Western Sand Darter

- Determine if extirpated in the state.

Brown Madtom

- Confirm population declines and determine the cause of those declines in the Kisatchie Bayou drainage.

Gulf Pipefish

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



Redspot Darter (*Etheostoma artesiae*)



Alligator Gar (*Atractosteus spatula*)



Blackspot Shiner (*Notropis atrocaudalis*)



Bluenose Shiner
(*Pteronotropis welaka*)

MARINE FISHES

Marine fishes occur in a wide range of habitats from Louisiana’s marshes and estuaries to open-ocean pelagic environments. Due to the productivity of coastal wetlands and bays, most of Louisiana’s recreational and commercial harvest comes from species that are estuarine-dependent for some portion of their life cycle. That being said, the vast majority of the species present in Louisiana’s coastal and estuarine environments are not recreationally or commercially exploited, and three species of marine fishes are federally listed in Louisiana: Giant Manta Ray (threatened), Oceanic Whitetip Shark (threatened), and Smalltooth Sawfish (endangered). Forty-six species of marine fishes have been identified as SGCN (Table 4.7) and play crucial roles in balancing the overall health and biodiversity of marine habitats. Due to a lack of targeted sampling effort and limited funding for marine SGCN, there are insufficient data on the life history, abundance, and habitat ranges and requirements for many of these species. Further understanding the spatial distribution and abundance of these under-studied species could be achieved through additional surveys. Data from commercial bycatch, targeted sampling regimes, and possible citizen science collaboration could provide valuable information on these poorly studied marine fishes. For many of these species, the collection of baseline data and life history information is high priority.

MARINE FISH SGCN

TABLE 4.7. Marine Fish Species of Greatest Conservation Need

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: CHORDATA			
CLASS: ACTINOPTERYGII			
ORDER: CARANGIFORMES			
FAMILY: CARANGIDAE			
<i>Alectis ciliaris</i>	African Pompano	GNR	S4
<i>Seriola dumerili</i>	Greater Amberjack	GNR	S4
<i>Trachinotus carolinus</i>	Florida Pompano	G5	S4
FAMILY: RACHYCENTRIDAE			
<i>Rachycentron canadum</i>	Cobia	GNR	S4
ORDER: CYPRINODONTIFORMES			
FAMILY: FUNDULIDAE			
<i>Adinia xenica</i>	Diamond Killifish	G5	S4
<i>Fundulus jenkinsi</i>	Saltmarsh Topminnow	G3	S3
<i>Fundulus pulvereus</i>	Bayou Killifish	G5	S4
ORDER: ELOPIFORMES			
FAMILY: MEGALOPIDAE			
<i>Megalops atlanticus</i>	Tarpon	G5	S3

TABLE 4.7. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: GOBIIFORMES			
FAMILY: ELEOTRIDAE			
<i>Eleotris amblyopsis</i>	Large-scaled Spinycheek Sleeper	G5	SU
<i>Erotelis smaragdus</i>	Emerald Sleeper	GNR	SU
FAMILY: GOBIIDAE			
<i>Bathygobius soporator</i>	Frillfin Goby	GNR	SU
<i>Ctenogobius stigmaticus</i>	Marked Goby	GNR	S3
FAMILY: OXUDERCIDAE			
<i>Gobioides broussonetii</i>	Violet Goby	G5	SU
ORDER: ISTIOPHORIFORMES			
FAMILY: ISTIOPHORIDAE			
<i>Istiophorus platypterus</i>	Sailfish	GNR	S3
<i>Kajikia albida</i>	White Marlin	GNR	S3
<i>Makaira nigricans</i>	Blue Marlin	GNR	S3
<i>Tetrapturus pfluegeri</i>	Longbill Spearfish	GNR	S3
ORDER: OPHIDIIFORMES			
FAMILY: BYTHITIDAE			
<i>Gunterichthys longipenis</i>	Gold Brotula	GNR	SU
ORDER: PERCIFORMES			
FAMILY: CENTROPOMIDAE			
<i>Centropomus undecimalis</i>	Common Snook	G5	S4M
FAMILY: SERRANIDAE			
<i>Dermatolepis inermis</i>	Marbled Grouper	GNR	S3
<i>Epinephelus itajara</i>	Goliath Grouper	G3	S1
<i>Mycteroperca interstitialis</i>	Yellowmouth Grouper	GNR	S3
<i>Mycteroperca microlepis</i>	Gag Grouper	GNR	S3
ORDER: PLEURONECTIFORMES			
FAMILY: PARALICHTHYIDAE			
<i>Paralichthys lethostigma</i>	Southern Flounder	G5	S3
ORDER: RHINOPRISTIFORMES			
FAMILY: PRISTIDAE			
<i>Pristis pectinata</i>	Smalltooth Sawfish**	G1G3	S1

TABLE 4.7. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: SCOMBRIFORMES			
FAMILY: SCOMBRIDAE			
<i>Scomberomorus cavalla</i>	King Mackerel	GNR	S4
<i>Thunnus obesus</i>	Bigeye Tuna	GNR	S3
ORDER: SYNGNATHIFORMES			
FAMILY: SYNGNATHIDAE			
<i>Hippocampus erectus</i>	Lined Seahorse	GNR	S3
<i>Hippocampus zosterae</i>	Dwarf Seahorse	GNR	SU
<i>Microphis lineatus</i>	Opossum Pipefish	G4G5	SU
ORDER: TETRAODONTIFORMES			
FAMILY: TETRAODONTIDAE			
<i>Sphoeroides nephelus</i>	Southern Puffer	G5	SU
CLASS: CHONDRICHTHYES			
ORDER: CARCHARHINIFORMES			
FAMILY: CARCHARHINIDAE			
<i>Carcharhinus falciformis</i>	Silky Shark	G3	S3
<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark*	GNR	S3
<i>Carcharhinus obscurus</i>	Dusky Shark	G3	S3
<i>Carcharhinus perezi</i>	Caribbean Reef Shark	G4	S3
<i>Carcharhinus plumbeus</i>	Sandbar Shark	G4	S3
<i>Carcharodon carcharias</i>	White Shark	G2	S4M
<i>Negaprion brevirostris</i>	Lemon Shark	G3G4	S3
FAMILY: GALEOCERDONIDAE			
<i>Galeocerdo cuvier</i>	Tiger Shark	G4	S3
FAMILY: SPHYRNIDAE			
<i>Sphyrna lewini</i>	Scalloped Hammerhead	G4	S3
<i>Sphyrna mokarran</i>	Great Hammerhead	G3G4	S3
ORDER: LAMIFORMES			
FAMILY: ALOPIIDAE			
<i>Alopias superciliosus</i>	Bigeye Thresher Shark	G3	S3
FAMILY: LAMNIDAE			
<i>Isurus oxyrinchus</i>	Shortfin Mako Shark	GNR	S3
<i>Isurus paucus</i>	Longfin Mako Shark	G2G3	S3
ORDER: MYLIOBATIFORMES			
FAMILY: MOBULIDAE			
<i>Mobula birostris</i>	Giant Manta Ray*	G3G4	SU
ORDER: ORECTOLOBIFORMES			
FAMILY: RHINCODONTIDAE			
<i>Rhincodon typus</i>	Whale Shark	G4G5	S3

*Federally Threatened

**Federally Endangered

MARINE FISH THREATS

Many marine fish species use Louisiana's diverse estuarine habitats throughout their life cycles. In fact, estuaries, transition zones where freshwater rivers meet the sea, are among the most productive of all habitats. The associated freshwater marshes (utilized by marine species such as Southern Flounder), as well as brackish and saline marshes, comprise a substantial portion of Louisiana's coastal environments. Unfortunately, despite their critical roles in providing storm buffers and nursery habitat for aquatic life, Louisiana's coastal marshes are becoming increasingly fragmented and degraded due to human activity and natural processes. Human activities like the creation of canals, levees, spillways, locks and dams, and other aquatic barriers can have significant negative impacts to natural hydrology, limiting movement of organisms, and, potentially, causing increases in salinity in previously freshwater-dominated systems. Increases in salinity can kill less salt-tolerant vegetation, exacerbating marsh loss. Man-made levees and locks and dams restrict the natural flow of sediments to the Gulf of America and its coastal marshes. Historically, seasonal flood pulses would deposit nutrient-laden sediment in these habitats, overtopping natural levees and nourishing and rebuilding Louisiana's marshes. Instead, much of this sediment is functionally "lost" offshore. The inappropriate diversion of sediments and the loss of sediment-trapping vegetation further magnify habitat loss caused by coastal subsidence, which may occur naturally or through anthropogenic means. Whether natural or man-made, changes in Louisiana's hydrology patterns influence the quality, quantity, and distribution of marine habitats, altering the availability of suitable habitat important to the survival and reproduction of marine species.

Predicted alterations to ecosystems from climate change such as sea level rise, an increase in intensity and frequency of severe weather events, ocean acidification, alterations to ocean currents, and changes in environmental conditions can directly influence habitat availability (Pershing et al. 2018). When combined with subsidence and sea level rise, the impacts of tropical cyclones on coastal habitats can be immediate, severe, and long term. Alterations to ocean temperatures and currents can lead to changes in the distribution of marine life, greatly altering food webs.

Negative impacts from the run-off of pollution such as pesticides, herbicides, pharmaceutical and industrial contaminants, and micro-plastics may directly and indirectly affect water quality and the health of marine fishes. Nutrient run-off also increases the occurrence of hypoxic events along the coast and have been shown to increase the size of the Gulf of America Dead Zone, an annually forming area of hypoxic water off the coast of Louisiana. Hypoxia can lead to mass mortality events as well as alterations in fish distribution.

The rise of economic and cultural globalization has increased the potential spread of non-native species across the globe. In Louisiana, non-native species threaten marine fishes on several fronts. Each year, herbivory by Nutria (*Myocastor coypus*) further decreases the acreage of coastal marshes. Non-native plants may outcompete natives and change the structure of habitats and the resources within. Non-native fishes can

displace or outcompete native species, can alter vegetation through herbivory, and can consume the eggs, larvae, and adults of native aquatic organisms. Efforts to minimize the introduction of non-native species is paramount, as is the development of effective measures to minimize, mitigate, or eliminate the impacts of established non-natives. Surveillance monitoring, increased awareness, and enforcement must act in concert to address the threat of non-natives.

Additional threats to Marine Fishes include illegal, unreported, and unregulated fishing. Some examples of these activities include fishing without a license, failing to report catches or making false reports, keeping undersized fish or fish that are protected by regulations, fishing during closed seasons, and using prohibited fishing gear (NOAA 2025a). These actions may threaten the ability of LDWF to manage marine fisheries in a sustainable manner, further complicating the conservation of Louisiana’s marine fishes.

MARINE FISH RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation actions for marine fishes are listed in Table 4.8.

Marine Fish General Research Needs and Conservation Actions

- Determine abundance and distribution of all Marine SGCN.
- Develop and test methods to evaluate species distributions, environmental influences on diversity, evenness, and richness of communities, and identify and evaluate further research needs on critical juvenile recruitment habitat that influences changes in offshore fish communities.
- Research habitat value of sandy shoals off Louisiana for Marine SGCN.
- Research, conserve, and restore Barrier Island habitat off Louisiana for Marine SGCN.

TABLE 4.8. Marine Fish Action Table.

COMMON NAME	SCIENTIFIC NAME	Life History (Reproduction, Movement, Survivorship)	Determine Habitat Needs	Population Monitoring	Develop and Promote BMPs (Addressing Bycatch)	Promote Quality Habitat	Outreach and Increase Awareness
African Pompano	<i>Alectis ciliaris</i>	●		●			●
Greater Amberjack	<i>Seriola dumerili</i>	●		●			
Florida Pompano	<i>Trachinotus carolinus</i>	●		●			●
Cobia	<i>Rachycentron canadum</i>	●		●			
Diamond Killifish	<i>Adinia xenica</i>					●	●
Saltmarsh Topminnow	<i>Fundulus jenkinsi</i>	●		●		●	●
Bayou Killifish	<i>Fundulus pulvereus</i>					●	●
Tarpon	<i>Megalops atlanticus</i>	●	●	●		●	
Large-scaled Spinycheek Sleeper	<i>Eleotris amblyopsis</i>	●	●			●	●
Emerald Sleeper	<i>Erotelis smaragdus</i>	●				●	●
Frillfin Goby	<i>Bathygobius soporator</i>	●				●	●
Marked Goby	<i>Ctenogobius stigmaticus</i>	●				●	●
Violet Goby	<i>Gobioides broussonetii</i>	●				●	●
Sailfish	<i>Istiophorus platypterus</i>	●		●			
White Marlin	<i>Kajikia albida</i>	●		●			
Blue Marlin	<i>Makaira nigricans</i>	●		●			

- Work with education and outreach organizations to provide anglers and baitfish distributors with resources to distinguish between commonly used baitfish and Marine SGCNs.
- Monitor habitat changes (e.g., loss of grass, rocking/bulkhead installation/dredging etc.) near historical sampling sites, possibly change or add sites with more natural shorelines.
- Incorporate findings regarding water quality changes such as PFAs, industrial spills, algae blooms, pharmaceuticals and other detrimental contaminants found in inshore environments.
- Partner with the U.S. Army Corps of Engineers (USACE) to encourage the beneficial use of dredge material.
- Work with partners to incorporate strategies for Marine SGCN into future coastal restoration efforts.
- Continue efforts to characterize bycatch within Louisiana commercial fisheries.

Marine Fish Species-specific Research Needs and Conservation Actions

Oceanic Whitetip Shark

- Implement Oceanic Whitetip Shark Recovery Plan (NMFS 2024).

Tarpon

- Conserve backwater habitat to benefit juvenile Tarpon.

Giant Manta Ray

- Implement Giant Manta Ray Recovery Plan (NMFS 2019).

Southern Flounder

- Incorporate monitoring of commercial fisheries industries' bycatch rate and bycatch release mortality on SGCN sportfish species of interest such as Southern Flounder.

Smalltooth Sawfish

- Implement Smalltooth Sawfish Recovery Plan (NMFS 2009).

TABLE 4.8. cont.

COMMON NAME	SCIENTIFIC NAME	Life History (Reproduction, Movement, Survivorship)	Determine Habitat Needs	Population Monitoring	Develop and Promote BMPs (Addressing Bycatch)	Promote Quality Habitat	Outreach and Increase Awareness
Longbill Spearfish	<i>Tetrapturus pfluegeri</i>	•		•			
Gold Brotula	<i>Gunterichthys longipenis</i>		•			•	
Common Snook	<i>Centropomus undecimalis</i>	•		•			•
Marbled Grouper	<i>Dermatolepis inermis</i>	•		•			•
Goliath Grouper	<i>Epinephelus itajara</i>			•	•	•	
Yellowmouth Grouper	<i>Mycteroperca interstitialis</i>	•		•			•
Gag Grouper	<i>Mycteroperca microlepis</i>	•		•			
Southern Flounder	<i>Paralichthys lethostigma</i>	•	•	•		•	
Smalltooth Sawfish	<i>Pristis pectinata</i>	•				•	•
King Mackerel	<i>Scomberomorus cavalla</i>	•		•			•
Bigeye Tuna	<i>Thunnus obesus</i>	•		•			
Lined Seahorse	<i>Hippocampus erectus</i>	•	•			•	
Dwarf Seahorse	<i>Hippocampus zosterae</i>					•	
Opossum Pipefish	<i>Microphis lineatus</i>	•	•	•		•	
Southern Puffer	<i>Sphoeroides nephelus</i>	•	•			•	
Silky Shark	<i>Carcharhinus falciformis</i>	•		•			•
Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>			•	•		•
Dusky Shark	<i>Carcharhinus obscurus</i>			•	•		•
Caribbean Reef Shark	<i>Carcharhinus perezi</i>	•		•			•
Sandbar Shark	<i>Carcharhinus plumbeus</i>			•	•		•
White Shark	<i>Carcharodon carcharias</i>	•		•			•
Lemon Shark	<i>Negaprion brevirostris</i>			•	•		•
Tiger shark	<i>Galeocerdo cuvier</i>	•		•			•
Scalloped Hammerhead	<i>Sphyrna lewini</i>			•	•		•
Great Hammerhead	<i>Sphyrna mokarran</i>			•	•		•
Bigeye Thresher Shark	<i>Alopias superciliosus</i>			•	•		•
Shortfin Mako Shark	<i>Isurus oxyrinchus</i>			•	•		•
Longfin Mako Shark	<i>Isurus paucus</i>			•	•		•
Giant Manta Ray	<i>Mobula birostris</i>	•		•			•
Whale Shark	<i>Rhincodon typus</i>	•		•			•

Tiger Shark (*Galeocerdo cuvier*)Great Hammerhead Shark
(*Sphyrna mokarran*)

AMPHIBIANS AND REPTILES

Amphibians and reptiles, also referred to as herpetofauna, are integral components of terrestrial and aquatic ecosystems and provide beneficial services that directly and indirectly affect human well-being (Valencia-Aguilar et al. 2013). Many species consume rodents and invertebrates, several of which are pests or disease vectors, and help to control populations of these prey species and may prevent outbreaks. Several snake species feed on fish, particularly injured or diseased fish, which helps keep fish populations healthy. All life stages of amphibians and reptiles serve as prey for other species such as fishes, birds, and mammals, including humans. In fact, the American Bullfrog (*Lithobates catesbeianus*), Pig Frog (*L. grylio*), snapping turtles (*Chelydra serpentina* and *Macrochelys temminckii*), softshell turtles (*Apalone* spp.), Red-eared Slider (*Trachemys scripta elegans*), and others have been sought as food sources by Louisianans for centuries. In addition, amphibians and reptiles or their derivatives (e.g., snake venom) have been instrumental in the development of medicinal treatments for various human ailments including asthma, skin conditions, cardiovascular diseases such as high blood pressure and congestive heart failure, and more (Valencia-Aguilar et al. 2013, Hocking and Babbitt 2014, Li et al. 2018, Offor and Piater 2023).

Some beneficial services may not be as apparent but are, nevertheless, critical to ecosystem function and resilience. For example, the Gopher Tortoise not only serves as a seed disperser of native groundcover plants, it is also a keystone species, providing shelter for over 360 vertebrate and invertebrate species in its extensive subterranean burrows (Eisenberg 1983). In addition to acting as ecosystem engineers, some species can be part of a comprehensive approach to environmental contaminant surveillance. Amphibians function as biological indicators of ecosystem health due to their permeable eggs, gills, and skin and ensuing sensitivity to environmental changes (Vitt et al. 1990, Stebbins and Cohen 1995, Oloo 2024). Monitoring the health of aquatic amphibians can provide valuable insight into overall water quality (Gibbons et al. 2000, Rouse et al. 1999). Similarly, increases in pollution may be indicated by declines in the health of terrestrial amphibians and reptiles (Brühl et al. 2011, French et al. 2018).

More than 150 native species and subspecies of amphibians and reptiles inhabit Louisiana’s diverse landscape (Boundy and Carr 2017, Means et al. 2017, Pyron and Beamer 2023), with the greatest species richness in the Florida Parishes. Louisiana is unique among the states with high herpetofaunal diversity in that it has no endemic species. Twenty-five species and subspecies of native amphibians (15 salamanders and 10 frogs) and 47 species and subspecies of native reptiles (24 turtles, 5 lizards, and 18 snakes) are SGCN in Louisiana (Table 4.9). The Dusky Gopher Frog, Ornate Chorus Frog, Ornate Box Turtle, Eastern Pinesnake, Harlequin Coralsnake, and Eastern Diamond-backed Rattlesnake may be extirpated from the state; recent surveys have been unable to detect these species at historical sites or new sites with suitable habitat (Siegel and

Doody 1992, Thomas 1996, Leonard et al. 2003, Pechmann et al. 2006, Buhlmann 2007, Lejeune et al. 2021). In fact, most of these species have not been observed in the state for >40 years.

All marine turtles occurring in Louisiana are federally and state listed: three of the five are endangered (Kemp’s Ridley Sea Turtle, Hawksbill Sea Turtle, and Leatherback Sea Turtle); and the Loggerhead Sea Turtle and Green Sea Turtle are threatened. U.S. Fish and Wildlife Service recovery plans have been developed for each species. Other federally and state listed species include the Dusky Gopher Frog, Gopher Tortoise, Ringed Map Turtle, Eastern Pinesnake, and Louisiana Pinesnake. In August 2024, the Pearl River Map Turtle became the species most recently added to the federally threatened list.

AMPHIBIAN AND REPTILE SGCN

TABLE 4.9. Amphibian and Reptile Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: CHORDATA			
CLASS: AMPHIBIA			
ORDER: ANURA			
FAMILY: BUFONIDAE			
<i>Anaxyrus americanus charlesmithi</i>	Dwarf American Toad	G5T5	S3
<i>Anaxyrus quercicus</i>	Oak Toad	G5	S2
<i>Anaxyrus terrestris</i>	Southern Toad	G5	S3
FAMILY: HYLIDAE			
<i>Dryophytes versicolor</i>	Gray Treefrog	G5	S3
<i>Pseudacris ornata</i>	Ornate Chorus Frog	G4	SH
<i>Pseudacris streckeri</i>	Strecker's Chorus Frog	G5	SH
FAMILY: RANIDAE			
<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	G4T4	S1
<i>Lithobates sevosus</i>	Dusky Gopher Frog**	G1	SH
FAMILY: SCAPHIOPODIDAE			
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	G5	S2
<i>Scaphiopus hurterii</i>	Hurter's Spadefoot	G5	S2
ORDER: CAUDATA			
FAMILY: AMBYSTOMATIDAE			
<i>Ambystoma texanum</i>	Small-mouthed Salamander	G5	S3
<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander	G5	S1

TABLE 4.9. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: PLETHODONTIDAE			
<i>Desmognathus valentinei</i>	Valentine's Southern Dusky Salamander	GNR	S2
<i>Eurycea cirrigera</i>	Southern Two-lined Salamander	G5	S3
<i>Eurycea guttolineata</i>	Three-lined Salamander	G5	S3
<i>Eurycea quadridigitata</i>	Southeastern Dwarf Salamander	G5	SU
<i>Hemidactylium scutatum</i>	Four-toed Salamander	G5	S1
<i>Plethodon kisatchie</i>	Louisiana Slimy Salamander	G3G4	S2
<i>Plethodon serratus</i>	Southern Red-backed Salamander	G5	S1
<i>Plethodon websteri</i>	Webster's Salamander	G3G4	S1
<i>Pseudotriton montanus flavissimus</i>	Gulf Coast Mud Salamander	G5T4	S1
<i>Pseudotriton ruber vioscai</i>	Southern Red Salamander	G5T4T5	S1
FAMILY: PROTEIDAE			
<i>Necturus beyeri</i>	Gulf Coast Waterdog	GNR	S3
<i>Necturus louisianensis</i>	Red River Mudpuppy	G4	S2
FAMILY: SIRENIDAE			
<i>Siren sphagnicola</i>	Seepage Siren	GNR	SU
CLASS: REPTILIA			
ORDER: SQUAMATA			
FAMILY: ANGUIDAE			
<i>Ophisaurus attenuatus</i>	Western Slender Glass Lizard	G5T5	S3
<i>Ophisaurus ventralis</i>	Eastern Glass Lizard	G5	S2
FAMILY: COLUBRIDAE			
<i>Carphophis vermis</i>	Western Wormsnake	G5	S1
<i>Cemophora coccinea</i>	Common Scarletsnake	G5	S3
<i>Lampropeltis elapsoides</i>	Scarlet Kingsnake	G5	S2
<i>Lampropeltis rhombomaculata</i>	Northern Mole Kingsnake	G5	SH
<i>Lampropeltis triangulum</i>	Eastern Milksnake	G5	S2
<i>Pituophis melanoleucus</i>	Eastern Pinesnake*	G4	SH
<i>Pituophis ruthveni</i>	Louisiana Pinesnake*	G1G2	S1
<i>Tantilla coronata</i>	Southeastern Crowned Snake	G5	S1
<i>Tantilla gracilis</i>	Flat-headed Snake	G5	S3
<i>Thamnophis saurita</i>	Eastern Ribbonsnake	G5	S3

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: CROTALIDAE			
<i>Crotalus adamanteus</i>	Eastern Diamond-backed Rattlesnake	G3	S1
<i>Crotalus horridus</i>	Timber Rattlesnake	G4	S3
<i>Sistrurus miliarius streckeri</i>	Western Pygmy Rattlesnake	G5T5	S2
FAMILY: DIPSADIDAE			
<i>Farancia erythrogramma erythrogramma</i>	Common Rainbow Snake	G4T4	S1
<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake	G5	S3
<i>Rhadinaea flavilata</i>	Pine Woods Littersnake	G4	S1
FAMILY: ELAPIDAE			
<i>Micrurus fulvius</i>	Harlequin Coralsnake	G5	SH
FAMILY: NATRICIDAE			
<i>Nerodia clarkii clarkii</i>	Gulf Saltmarsh Snake	G4T3	S3
FAMILY: SCINCIDAE			
<i>Plestiodon anthracinus</i>	Coal Skink	G5	S2
<i>Plestiodon septentrionalis obtusirostris</i>	Southern Prairie Skink	G5T5	S1
FAMILY: TEIIDAE			
<i>Aspidoscelis sexlineatus</i>	Six-lined Racerunner	G5	S4
ORDER: TESTUDINES			
FAMILY: CHELONIIDAE			
<i>Caretta caretta</i>	Loggerhead Sea Turtle*	G2G4	S1
<i>Chelonia mydas</i>	Green Sea Turtle*	G3	S1
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle**	G3	SNA
<i>Lepidochelys kempii</i>	Kemp's Ridley Sea Turtle**	G1	S1
FAMILY: CHELYDRIDAE			
<i>Macrochelys temminckii</i>	Western Alligator Snapping Turtle	G3	S2
FAMILY: DERMOCHELYIDAE			
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle**	G2	SNA
FAMILY: EMYDIDAE			
<i>Chrysemys dorsalis</i>	Southern Painted Turtle	G5	S3
<i>Deirochelys reticularia miaria</i>	Western Chicken Turtle	G5T5	S1
<i>Deirochelys reticularia reticularia</i>	Eastern Chicken Turtle	G5T5	S1
<i>Graptemys oculifera</i>	Ringed Map Turtle*	G2	S1
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	G5	S3
<i>Graptemys pearlensis</i>	Pearl River Map Turtle*	G2G3	S1
<i>Graptemys sabinensis</i>	Sabine Map Turtle	G5	S3
<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin	G4T3	S3
<i>Terrapene carolina major</i>	Gulf Coast Box Turtle	G5T4	S3
<i>Terrapene ornata</i>	Ornate Box Turtle	G4G5	SH
<i>Terrapene triunguis</i>	Three-toed Box Turtle	GNR	S4

TABLE 4.9. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: KINOSTERNIDAE			
<i>Kinosternon subrubrum hippocrepis</i>	Mississippi Mud Turtle	G5T5	S4
<i>Sternotherus carinatus</i>	Razor-backed Musk Turtle	G5	S4
<i>Sternotherus odoratus</i>	Eastern Musk Turtle	G5	S4
<i>Sternotherus peltifer</i>	Stripe-necked Musk Turtle	GNR	S1
FAMILY: TESTUDINIDAE			
<i>Gopherus polyphemus</i>	Gopher Tortoise*	G3	S1
FAMILY: TRIONYCHIDAE			
<i>Apalone mutica calvata</i>	Gulf Coast Smooth Softshell	G5T5	S2
<i>Apalone mutica mutica</i>	Midland Smooth Softshell	G5T5	S3

*Federally Threatened

**Federally Endangered

AMPHIBIAN AND REPTILE THREATS

Louisiana's native amphibian and reptile species face a variety of challenges that affect long-term viability and persistence in a rapidly changing human-impacted environment. Habitat loss and habitat degradation from urban development, transportation corridors, unsustainable forestry and agricultural practices, and coastal land loss are the primary threats affecting Louisiana's amphibian and reptile populations. Other threats include sand and gravel mining, pollution, road mortality, invasive species, diseases, unsustainable and illegal collection, and climate change.

In addition to complete loss of habitats, urbanization can cause habitat fragmentation, which reduces the amount of contiguous habitat available. This may bisect and isolate populations, reducing species' population size, which may lead to inbreeding (Schlaepfer et al. 2018). The increased necessity for installation of transportation corridors in response to urban growth also leads to increased habitat fragmentation and further isolation of ephemeral wetlands, which some species require for successful reproduction and recruitment (Gibbons et al. 2000, Mitchell and Gibbons 2010). Fragmentation disrupts a species' ability to access resources for survival, reproduction, and migration, and increases the risk of vehicular strikes. Louisiana's East Gulf Coastal Plain Ecoregion, which holds the highest herpetofaunal diversity in the state, has experienced rapid human population growth in recent years and, thus, an increase in urban development. Like the need for transportation corridors, the requirement of energy can increase with urbanization, which can also affect native wildlife and their habitats. Large-scale energy development, such as renewable energy, is rapidly expanding in the state creating the potential for multiple taxa, including threatened and endangered species and SGCN, to suffer significant habitat loss, disruption, and declines in populations (Lovich and Ennen 2011).

Land conversion and inappropriate habitat management practices serve as major stressors to many amphibian and reptile species. Along with development, upland habitats are often targeted for silviculture. Roller-chopping and bedding, used for site preparation of pine plantations, are detrimental to upland species like the federally threatened Gopher Tortoise and species that rely on ephemeral ponds like the imperiled Eastern Tiger Salamander. Fire suppression in fire-adapted communities changes the vegetation structure and causes a build-up of woody shrubs and ground fuels, which significantly degrades the habitat and increases the risk of severe wildfire (USDA 2018). Additional anthropogenic impacts include filling for development, dredging, ditching, draining, and installation of levees and water control structures.

Chemical and physical alterations of streams and associated riparian habitat also negatively affect amphibians and reptiles (Koehnken et al. 2020). Chemical waste and sedimentation runoff from agricultural, industrial, and residential developments pollute streams, removing oxygen and increasing ammonia. The resulting decrease in water quality negatively impacts herpetofauna directly and can be particularly detrimental to turtles that feed on mollusks, which are sensitive to poor water quality. Sand and gravel mining degrades aquatic systems through siltation, increased turbidity, and surface water pollution (Bailey 2006). Riverine turtle species appear to be most impacted by sand and gravel mining, likely because of their dependency on impacted habitats as well as their biological constraints around nesting (e.g., nesting requires sandbars; Lovich et al. 2009, Selman and Qualls 2009). In addition, nesting success of sandbar-nesting riverine turtles can be substantially reduced by other human disturbance, particularly ORV usage on sandbars. The removal of woody debris and neglecting Best Management Practices (BMPs) for riparian areas are detrimental to freshwater turtle species that utilize the woody debris for basking and shelter and to aquatic salamanders that rely on the debris for nesting and shelter (Bailey et al. 2006, Glorioso et al. 2021).

Invasive non-native species and problematic native species can greatly impact populations of amphibians and reptiles. As human development expands, populations of predators such as Raccoon (*Procyon lotor*), Opossum (*Didelphis virginiana*), foxes (*Vulpes* spp.), skunks (*Mephitis* spp., *Spilogale* spp.), North American River Otter, and crows (*Corvus* spp.) also increase in some areas (Bailey et al. 2006). Raccoons and crows are a significant source of mortality for various life stages of some herpetofaunal SGCN, particularly turtle eggs and hatchlings (Buhlmann 2017). The Red Imported Fire Ant (*Solenopsis invicta*) is a serious threat to many adult terrestrial amphibians and reptiles as well as to the eggs and hatchlings of aquatic and terrestrial turtles (Allen et al. 2004). Feral Hogs destroy sensitive habitats and prey upon amphibians and reptiles. Outdoor cats (*Felis catus*) are estimated to kill approximately 350 million to more than 1 billion amphibians and reptiles per year in the United States (Loss et al. 2013). Non-native amphibian and reptile species can also affect native species through the transmission of diseases through anthropogenic movement (Daszak et al. 2000). Ranaviruses have been associated with

mass mortality events of amphibians and turtles and can occur asymptotically within individuals in the same population (Johnson et al. 2008, Currylow et al. 2014).

Many of Louisiana's SGCN will be impacted by climate change, a long-term threat that is not easily addressed. The predicted increases in the magnitude and frequency of tropical cyclones, the increase in sea level rise, and the exacerbation of salt water intrusion will be particularly injurious to coastal species, especially when those impacts are combined with erosion, subsidence, and overwash. However, climate change will not only impact coastal species but also herpetofauna across the state. Climate change is expected to be detrimental to amphibians and reptiles by reducing habitat availability, altering precipitation patterns, and causing increases and shifts in temperatures. Turtles may be particularly vulnerable; long generation times, low hatchling survival, low dispersal rates, and temperature-dependent sex determination make them ill-adapted to climate change (Gibbons et al. 2000, Ihlw et al. 2012, Butler 2019). In fact, even minor temperature changes can greatly affect sex ratios of nestling turtles (Janzen 1994, Wright et al. 2012, Olson and Saenz 2013). Warming temperatures resulting from climate change may facilitate the spread and establishment of non-native species, which can increase competition with native species (Hitt et al. 2016). In addition, climate change has the potential to reduce the effectiveness of traditional management strategies, and land managers must remain vigilant and adaptive in their approach to conservation.

In Louisiana, recreational and commercial collection of native amphibians and reptiles has been largely unregulated with minimal reporting requirements. Lack of monitoring data and regulatory oversight heightens the potential for unsustainable legal collection and illegal poaching. North American turtles are particularly vulnerable, as there is great interest and increasing demand for them for use in food, as pets, and in traditional medicines (Gibbons et al. 2000, Mali et al. 2015). Unsustainable and illegal collection combined with the myriad of aforementioned threats could result in serious impacts to amphibian and reptile populations statewide. Wanton killing of snakes may be a significant source of mortality for some imperiled species such as Eastern Diamond-backed Rattlesnake. However, take from the wild does not have to be intentional for populations to be impacted; "ghost traps" (e.g., derelict crab traps) are a source of mortality for terrapins in some locations, and sea turtles are vulnerable as bycatch in the absence of turtle-excluder devices (TEDs) in trawling gear. With very limited collection information on native amphibians and reptiles, it is difficult to determine how populations are affected and emphasizes the importance of monitoring collection and harvest levels, addressing illegal poaching, and minimizing adverse impacts that take could have on native herpetofaunal populations.

Herpetofaunal species are among the most imperiled taxa in the world due to the multitude of threats challenging their persistence. The unique life history traits of this group make them particularly vulnerable to anthropogenic and

environmental changes. Thus, it is imperative that threats to reptile and amphibian populations be minimized to the greatest extent possible to prevent further population declines.

AMPHIBIAN AND REPTILE RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation actions for amphibians and reptiles are listed in *Table 4.10*.

Amphibian and Reptile General Research Needs and Conservation Actions

- Maximize habitat quality and quantity for amphibian and reptile SGCN.
- Monitor for emerging diseases in Louisiana amphibian and reptile populations including, but not limited to, chytridiomycosis, ranavirus, Perkinsea, and snake fungal disease.
- Implement biosecurity protocols for prevention of disease spread in wetland and aquatic habitats.
- Encourage the use of wildlife friendly erosion control blankets.
- Partner with LaDOTD to implement the construction of road crossings and placement of road signs to limit road mortality.
- Conduct research (e.g., genetic analysis, health screenings) to inform potential repatriations of confiscated or relinquished individuals.
- Promote existing Best Management Practices for amphibian and reptile SGCN.
- Promote connectivity among populations by restoring stream networks and terrestrial habitat corridors.
- Limit or exclude livestock access to stream, spring, and seepage habitats.
- Work with the Scenic Rivers Program and other partners to minimize the impacts of gravel mining and promote adequate water quality measures.
- Utilize the *Louisiana Turtle Conservation Plan* to identify conservation strategies and actions to contribute to viable native turtle populations.
- Assess nest depredation, including impacts of mammalian predators, avian predators, and Red Imported Fire Ant, and implement control measures as necessary.
- Implement reporting for recreational collection and commercial fishing bycatch landings of native turtles.

Amphibian Species-specific Research Needs and Conservation Actions

Gray Treefrog

- Collect DNA samples from unidentified gray treefrogs to determine geographical boundaries for Gray Treefrog.

Ornate Chorus Frog

- Implement the Ornate Chorus Frog Conservation Action Plan (Burrow 2022).

TABLE 4.10. Amphibian and Reptile Action Table.

COMMON NAME	SCIENTIFIC NAME	Determine Presence or Probable Absence	Determine Abundance	Determine Distribution	Life History (Reproduction, Movement, Survivorship)	Determine Habitat Needs	Population Monitoring	Investigate Impacts of Harvest	Develop BMPs and SMZs for Management and Restoration	Outreach
Dwarf American Toad	<i>Anaxyrus americanus charlesmithi</i>		•	•	•	•	•		•	
Oak Toad	<i>Anaxyrus quercicus</i>		•	•	•	•	•		•	
Southern Toad	<i>Anaxyrus terrestris</i>		•	•	•		•		•	
Gray Treefrog	<i>Dryophytes versicolor</i>		•	•	•		•		•	
Ornate Chorus Frog	<i>Pseudacris ornata</i>	•	•	•			•		•	
Strecker's Chorus Frog	<i>Pseudacris streckeri</i>	•	•	•			•		•	
Southern Crawfish Frog	<i>Lithobates areolatus areolatus</i>	•	•	•	•	•	•		•	•
Dusky Gopher Frog	<i>Lithobates sevosus</i>									•
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>		•	•	•		•		•	
Hurter's Spadefoot	<i>Scaphiopus hurterii</i>		•	•	•		•		•	
Small-mouthed Salamander	<i>Ambystoma texanum</i>		•	•	•	•	•		•	
Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>		•	•	•	•	•		•	
Valentine's Southern Dusky Salamander	<i>Desmognathus valentinei</i>		•	•	•	•	•		•	
Southern Two-lined Salamander	<i>Eurycea cirrigera</i>		•	•	•	•	•		•	
Three-lined Salamander	<i>Eurycea guttolineata</i>		•	•	•	•	•		•	
Southeastern Dwarf Salamander	<i>Eurycea quadridigitata</i>		•	•	•	•	•		•	
Four-toed Salamander	<i>Hemidactylum scutatum</i>		•	•	•	•	•		•	
Louisiana Slimy Salamander	<i>Plethodon kisatchie</i>		•	•	•	•	•		•	
Southern Red-backed Salamander	<i>Plethodon serratus</i>		•	•	•	•	•		•	
Webster's Salamander	<i>Plethodon websteri</i>		•	•	•	•	•		•	
Gulf Coast Mud Salamander	<i>Pseudotriton montanus flavissimus</i>		•	•	•	•	•		•	
Southern Red Salamander	<i>Pseudotriton ruber vioscai</i>		•	•	•	•	•		•	
Gulf Coast Waterdog	<i>Necturus beyeri</i>				•		•		•	•
Red River Mudpuppy	<i>Necturus louisianensis</i>		•	•	•	•	•		•	•
Seepage Siren	<i>Siren sphagnicola</i>	•	•	•	•	•	•		•	
Western Slender Glass Lizard	<i>Ophisaurus attenuatus attenuatus</i>		•	•	•	•	•		•	
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>		•	•	•	•	•		•	
Western Wormsnake	<i>Carphophis vermis</i>		•	•	•	•	•		•	
Common Scarletsnake	<i>Cemophora coccinea</i>		•	•	•		•		•	
Scarlet Kingsnake	<i>Lampropeltis elapsoides</i>		•	•	•		•		•	
Northern Mole Kingsnake	<i>Lampropeltis rhombomaculata</i>	•	•	•			•		•	
Eastern Milksnake	<i>Lampropeltis triangulum</i>		•	•	•	•	•		•	
Eastern Pinesnake	<i>Pituophis melanoleucus</i>	•	•	•			•			•
Louisiana Pinesnake	<i>Pituophis ruthveni</i>		•	•	•		•			•
Southeastern Crowned Snake	<i>Tantilla coronata</i>	•	•	•			•		•	
Flat-headed Snake	<i>Tantilla gracilis</i>		•	•	•	•	•		•	

TABLE 4.10. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Presence or Probable Absence	Determine Abundance	Determine Distribution	Life History (Reproduction, Movement, Survivorship)	Determine Habitat Needs	Population Monitoring	Investigate Impacts of Harvest	Develop BMPs and SMZs for Management and Restoration	Outreach
Eastern Ribbonsnake	<i>Thamnophis saurita</i>		●	●	●	●	●		●	
Eastern Diamond-backed Rattlesnake	<i>Crotalus adamanteus</i>	●	●	●	●	●	●		●	●
Timber Rattlesnake	<i>Crotalus horridus</i>		●	●	●		●			●
Western Pygmy Rattlesnake	<i>Sistrurus miliarius streckeri</i>		●	●	●	●	●		●	●
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>		●	●	●	●	●		●	
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>		●	●	●		●		●	
Pine Woods Littersnake	<i>Rhadinaea flavilata</i>		●	●	●	●	●		●	
Harlequin Coralsnake	<i>Micrurus fulvius</i>	●	●	●			●		●	●
Gulf Saltmarsh Snake	<i>Nerodia clarkii clarkii</i>		●		●		●		●	
Coal Skink	<i>Plestiodon anthracinus</i>		●	●	●	●	●		●	
Southern Prairie Skink	<i>Plestiodon septentrionalis obtusirostris</i>	●	●	●	●	●	●		●	
Six-lined Racerunner	<i>Aspidoscelis sexlineatus</i>		●	●	●		●		●	
Loggerhead Sea Turtle	<i>Caretta caretta</i>		●	●	●	●	●			●
Green Sea Turtle	<i>Chelonia mydas</i>		●	●	●	●				●
Hawksbill Sea Turtle	<i>Eretmochelys imbricata</i>									●
Kemp's Ridley Sea Turtle	<i>Lepidochelys kempii</i>		●	●	●	●	●			●
Western Alligator Snapping Turtle	<i>Macrochelys temminckii</i>		●	●			●	●		●
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>									●
Southern Painted Turtle	<i>Chrysemys dorsalis</i>		●	●	●	●	●	●	●	
Western Chicken Turtle	<i>Deirochelys reticularia miaria</i>		●	●	●	●	●	●	●	●
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>		●	●	●	●	●	●	●	
Ringed Map Turtle	<i>Graptemys oculifera</i>		●	●	●		●			●
Ouachita Map Turtle	<i>Graptemys ouachitensis</i>		●	●	●		●	●	●	
Pearl River Map Turtle	<i>Graptemys pearlensis</i>		●	●	●		●		●	●
Sabine Map Turtle	<i>Graptemys sabinensis</i>		●		●		●	●	●	
Mississippi Diamondback Terrapin	<i>Malaclemys terrapin pileata</i>		●		●		●			●
Gulf Coast Box Turtle	<i>Terrapene carolina major</i>		●		●		●	●	●	●
Ornate Box Turtle	<i>Terrapene ornata</i>	●		●			●		●	●
Three-toed Box Turtle	<i>Terrapene triunguis</i>		●		●		●	●	●	●
Mississippi Mud Turtle	<i>Kinosternon subrubrum hippocrepis</i>		●				●	●		
Razor-backed Musk Turtle	<i>Sternotherus carinatus</i>		●	●	●	●	●	●	●	
Eastern Musk Turtle	<i>Sternotherus odoratus</i>		●				●	●		
Stripe-necked Musk Turtle	<i>Sternotherus peltifer</i>		●	●	●	●	●	●	●	
Gopher Tortoise	<i>Gopherus polyphemus</i>		●		●		●			●
Gulf Coast Smooth Softshell	<i>Apalone mutica calvata</i>		●	●	●		●	●	●	
Midland Smooth Softshell	<i>Apalone mutica mutica</i>		●	●	●		●	●	●	

Southern Crawfish Frog

- Investigate steps for potential augmentation or reintroduction of Southern Crawfish Frog.
- Locate suitable breeding ponds.
- Conduct restoration and maintenance of existing breeding ponds or creation of breeding ponds in suitable habitat.
- Conduct restoration and maintenance of upland open canopy habitat surrounding breeding ponds.
- Explore opportunities with partners for propagation and reintroduction.
- Conduct post-reintroduction/augmentation monitoring.
- Work with land managers and private landowners to conserve this species and suitable habitat.

Dusky Gopher Frog

- Investigate steps for potential reintroduction of Dusky Gopher Frog.
- Locate suitable breeding ponds.
- Conduct restoration and maintenance of existing breeding ponds or creation of breeding ponds in suitable habitat.
- Conduct restoration and maintenance of upland open canopy habitat surrounding breeding ponds.
- Explore opportunities with partners for propagation and reintroduction.
- Conduct post-reintroduction monitoring.
- Work with landowners and facilitate agreements to restore and manage habitat for the benefit of Dusky Gopher Frog.
- Implement the federal recovery plan (USFWS 2015 and 2019) for Dusky Gopher Frog.

Dusky Salamander Complex

- Conduct additional genetic analysis to assess boundaries between conspecifics and further evaluate intergrade zones.

Reptile Species-specific Research Needs and Conservation Actions

Scarlet Kingsnake, Common Scarletsnake, Flat-headed Snake, Southeastern Crowned Snake

- Determine best methods for detection and monitoring.

Eastern Milksnake

- Conduct additional genetic analysis to assess boundaries between conspecifics and further evaluate intergrade zones with Western Milksnakes.

Eastern Pinesnake

- Implement the federal recovery plan (USFWS 2023) for Eastern Pinesnake.

Louisiana Pinesnake

- Work with landowners and facilitate agreements to restore and manage habitat for the benefit of Louisiana Pinesnakes.
- Continue to investigate improved methods for detection and monitoring.
- Determine the extent to which ROW are used.

- Continue to partner with the Louisiana Pinesnake Working Group to monitor populations and facilitate reintroduction efforts.
- Implement the federal recovery plan (USFWS draft 2023) for Louisiana Pinesnake.

Timber Rattlesnake

- Implement the Timber Rattlesnake Conservation Action Plan (PARC 2021).

Sea Turtles

- Assess beach habitat statewide for nesting suitability and prioritize areas for nesting surveys for Loggerhead Sea Turtle, Kemp's Ridley Sea Turtle, and potentially Green Sea Turtle.
- Assess use and availability of vegetative habitat in coastal waters and near restored lands for Loggerhead Sea Turtle, Kemp's Ridley Sea Turtle, and Green Sea Turtle.
- Promote the use of Turtle Excluder Devices (TEDs).
- Advocate against the intentional release of helium-filled balloons.
- Promote the use of sea turtle-friendly lighting during the nesting season.
- Implement the federal recovery plan (USFWS 1998) for Green Sea Turtle.
- Implement the federal recovery plan (USFWS 1998) for Hawksbill Sea Turtle.
- Implement the federal recovery plan (USFWS 1992) for Kemp's Ridley Sea Turtle.
- Implement the federal recovery plan (USFWS 1998) for Leatherback Sea Turtle.
- Implement the federal recovery plan (USFWS 1991) for Loggerhead Sea Turtle.

Freshwater Turtles

- Determine the impact of water releases from upstream reservoirs on productivity of turtles utilizing sandbars for nesting.
- Work with entities to maintain in-stream flows to minimize impacts to nesting turtles.
- Implement measures to restore and maintain sandbars for nesting success.
- Restrict or outlaw the use of off-road vehicles (ORVs) on sandbars and in streams, particularly the practice of "mud-riding" through streambeds.
- Work with partners to reduce the impacts of dredging, channelization, and vegetation modification on freshwater turtles.
- Investigate prevalence of Western Alligator Snapping Turtle as bycatch in commercial fisheries.
- Implement the federal recovery plan (USFWS in review) for Pearl River Map Turtle.
- Implement the federal recovery plan (USFWS 1988) for Ringed Map Turtle.

Mississippi Diamondback Terrapin

- Investigate the degree of impact of active crab traps and implement bycatch reduction measures.

- Investigate the degree of impact of ghost traps (i.e. derelict or abandoned).

Box Turtles

- Obtain DNA samples from Gulf Coast Box Turtles to compare species' taxonomic status with Three-toed Box Turtles.

Gopher Tortoise

- Relocate isolated individuals to contribute to Primary or Secondary Support Populations in an effort to create Minimum Viable Populations.
- Work with landowners and facilitate agreements to restore and manage habitat for the benefit of Gopher Tortoises.
- Work with permitted partners to implement a headstart program on public and private lands.
- Develop a Gopher Tortoise Management Plan for Louisiana.
- Implement the federal recovery plan (USFWS 1990 and 2007) for Gopher Tortoise.



(LEFT) Hurter's Spadefoot (*Scaphiopus hurterii*) (RIGHT) Ornate Chorus Frog (*Pseudacris ornata*)



(LEFT) Common Scarletsnake (*Cemophora coccinea*) (RIGHT) Louisiana Pinesnake (*Pituophis ruthveni*)



(LEFT) Western Alligator Snapping Turtle (*Macrochelys temminckii*) (CENTER) Gulf Coast Waterdog (*Necturus beyeri*) (RIGHT) Louisiana Slimy Salamander (*Plethodon kisatchie*)



(LEFT) Western Chicken Turtle (*Deirochelys reticularia miaria*) (RIGHT) Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

BIRDS

Louisiana hosts a remarkable diversity of birds, with 493 species documented within the state’s boundaries and adjacent waters (Conover and Dittmann 2025), including over 160 breeding species (Wiedenfeld and Swan 2000, Brady 2017). The state provides important habitat for a number of threatened and endangered bird species, including Longleaf Pine savanna for Red-cockaded Woodpecker, coastal high marsh for Eastern Black Rail, and coastal intertidal habitats for Piping Plover and rufa Red Knot (USFWS 2001, 2019a, 2019b, 2020). Importantly, Louisiana’s coast represents the most significant nesting area in the northern Gulf of America for a long list of SGCN (Table 4.11), including Clapper Rail, Sandwich and Forster’s terns, and Seaside Sparrow (Remsen et al. 2019).

Unlike many taxonomic groups, distribution and population status and trends are relatively well understood for North American birds (Fink et al. 2023, Sauer et al. 2019). Unfortunately, these data resources are revealing potentially catastrophic declines in North American breeding bird populations (Rosenberg et al. 2019). Although Louisiana has already lost a number of species, including Greater Prairie-Chicken (*Tympanuchus cupido*) and Bachman’s Warbler (*Vermivora bachmanii*) among others, successful recovery of Brown Pelican and Bald Eagle populations are shining examples of conservation success stories. Efforts to reintroduce the formerly extirpated Whooping Crane are currently underway. Successful implementation of similar conservation efforts, as outlined here, will be critical in preventing the continued decline of Louisiana’s imperiled bird species and the need for their listing under the Endangered Species Act.

Although some species are permanent residents and occur in Louisiana year-round, the vast majority of Louisiana birds are migratory (approximately 85%), with different species dependent on the state’s habitats to meet resource needs at different times of the year. The survival and fitness of migratory species depends on individuals’ success during each stage of the annual cycle, wherever that may occur. Thus, successful conservation of Louisiana birds will hinge on research and monitoring to inform appropriate conservation actions when and where populations are most limited.

BIRD SGCN

TABLE 4.11. Bird Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
KINGDOM: ANIMALIA			
PHYLUM: CHORDATA			
CLASS: AVES			
ORDER: ACCIPITRIFORMES			
FAMILY: ACCIPITRIDAE			
<i>Elanoides forficatus</i>	Swallow-tailed Kite	G5	S2S3B
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G5	S4

TABLE 4.11. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: ANSERIFORMES			
FAMILY: ANATIDAE			
<i>Anas acuta</i>	Northern Pintail	G5	S4N
<i>Anas fulvigula</i>	Mottled Duck	G4	S4
<i>Aythya affinis</i>	Lesser Scaup	G5	S3S4N
<i>Aythya americana</i>	Redhead	G5	S4N
<i>Aythya valisineria</i>	Canvasback	G5	S4N
<i>Mareca americana</i>	American Wigeon	G5	S3S4N
ORDER: APODIFORMES			
FAMILY: APODIDAE			
<i>Chaetura pelagica</i>	Chimney Swift	G4G5	S3B
ORDER: CAPRIMULGIFORMES			
FAMILY: CAPRIMULGIDAE			
<i>Antrostomus carolinensis</i>	Chuck-will's-widow	G5	S4B
<i>Antrostomus vociferus</i>	Eastern Whip-poor-will	G5	S3M
<i>Chordeiles minor</i>	Common Nighthawk	G5	S4B
ORDER: CHARADRIIFORMES			
FAMILY: CHARADRIIDAE			
<i>Anarhynchus nivosus</i>	Snowy Plover	G3	S1
<i>Anarhynchus wilsonia</i>	Wilson's Plover	G5	S2
<i>Charadrius melodus</i>	Piping Plover*	G3	S2N
<i>Pluvialis dominica</i>	American Golden-Plover	G5	S3M
FAMILY: HAEMATOPODIDAE			
<i>Haematopus palliatus</i>	American Oystercatcher	G5	S1
FAMILY: LARIDAE			
<i>Chlidonias niger</i>	Black Tern	G4G5	S3M
<i>Gelochelidon nilotica</i>	Gull-billed Tern	G5	S3
<i>Rynchops niger</i>	Black Skimmer	G5	S3
<i>Sterna forsteri</i>	Forster's Tern	G5	S4
<i>Sternula antillarum antillarum</i>	Coastal Least Tern	G4TNRQ	S3B
<i>Sternula antillarum athalassos</i>	Interior Least Tern	G4T3Q	S1B
<i>Thalasseus maximus</i>	Royal Tern	G5	S5
<i>Thalasseus sandvicensis</i>	Sandwich Tern	G5	S4B
FAMILY: SCOLOPACIDAE			
<i>Arenaria interpres</i>	Ruddy Turnstone	G5	S2?N
<i>Bartramia longicauda</i>	Upland Sandpiper	G5	S2M
<i>Calidris canutus</i>	Red Knot*	G4	S2N
<i>Calidris himantopus</i>	Stilt Sandpiper	G5	S4N
<i>Calidris melanotos</i>	Pectoral Sandpiper	G5	S4S5M

TABLE 4.11. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: SCOLOPACIDAE (cont.)			
<i>Calidris pusilla</i>	Semipalmated Sandpiper	G5	S3S4M
<i>Calidris subruficollis</i>	Buff-breasted Sandpiper	G4	S3M
<i>Limnodromus griseus</i>	Short-billed Dowitcher	G3	S3N
<i>Limosa fedoa</i>	Marbled Godwit	G5	S4N
<i>Limosa haemastica</i>	Hudsonian Godwit	G4	S3M
<i>Numenius americanus</i>	Long-billed Curlew	G4	S3N
<i>Numenius phaeopus</i>	Whimbrel	G5	S3M
<i>Scolopax minor</i>	American Woodcock	G5	S1B, S5N
<i>Tringa flavipes</i>	Lesser Yellowlegs	G5	S5N
<i>Tringa semipalmata</i>	Willet	G5	S3
ORDER: CICONIIFORMES			
FAMILY: CICONIIDAE			
<i>Mycteria americana</i>	Wood Stork	G4	S3N
ORDER: CUCULIFORMES			
FAMILY: CUCULIDAE			
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	G5	S4B
ORDER: FALCONIFORMES			
FAMILY: FALCONIDAE			
<i>Falco sparverius paulus</i>	Southeastern American Kestrel	G5T4	S2
ORDER: GALLIFORMES			
FAMILY: ODONTOPHORIDAE			
<i>Colinus virginianus</i>	Northern Bobwhite	G4G5	S3
ORDER: GRUIFORMES			
FAMILY: GRUIDAE			
<i>Grus americana</i>	Whooping Crane**	G1	S1
FAMILY: RALLIDAE			
<i>Coturnicops noveboracensis</i>	Yellow Rail	G4	S3S4N
<i>Laterallus jamaicensis jamaicensis</i>	Eastern Black Rail*	G3T1	S1
<i>Rallus crepitans</i>	Clapper Rail	G5	S4
<i>Rallus elegans</i>	King Rail	G4	S3
ORDER: PASSERIFORMES			
FAMILY: CARDINALIDAE			
<i>Passerina ciris</i>	Painted Bunting	G5	S5B
FAMILY: ICTERIDAE			
<i>Euphagus carolinus</i>	Rusty Blackbird	G4	S3N
<i>Quiscalus quiscula</i>	Common Grackle	G5	S4S5
<i>Sturnella magna</i>	Eastern Meadowlark	G5	S3B, S4N
FAMILY: LANIIDAE			
<i>Lanius ludovicianus</i>	Loggerhead Shrike	G4	S3S4

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: MOTACILLIDAE			
<i>Anthus spragueii</i>	Sprague's Pipit	G3G4	S2N
FAMILY: PARULIDAE			
<i>Cardellina canadensis</i>	Canada Warbler	G5	S3M
<i>Geothlypis formosa</i>	Kentucky Warbler	G5	S4B
<i>Helmitheros vermivorum</i>	Worm-eating Warbler	G4G5	S3B
<i>Parkesia motacilla</i>	Louisiana Waterthrush	G5	S3B
<i>Protonotaria citrea</i>	Prothonotary Warbler	G5	S5B
<i>Setophaga cerulea</i>	Cerulean Warbler	G4	S2M
<i>Setophaga dominica</i>	Yellow-throated Warbler	G5	S4B
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4	S2S3M
FAMILY: PASSERELLIDAE			
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S1B, S3N
<i>Ammospiza leconteii</i>	LeConte's Sparrow	G5	S4N
<i>Ammospiza maritima</i>	Seaside Sparrow	G4	S4
<i>Ammospiza nelsoni</i>	Nelson's Sparrow	G5	S3S4N
<i>Centronyx henslowii</i>	Henslow's Sparrow	G4	S3N
<i>Peucaea aestivalis</i>	Bachman's Sparrow	G3	S3
<i>Spizella pusilla</i>	Field Sparrow	G5	S3?
FAMILY: SITTIDAE			
<i>Sitta pusilla</i>	Brown-headed Nuthatch	G4	S4
FAMILY: TROGLODYTIDAE			
<i>Cistothorus palustris marianae</i>	Marian's Marsh Wren	G5T3	S3
FAMILY: TURDIDAE			
<i>Hylocichla mustelina</i>	Wood Thrush	G4	S4B
ORDER: PELECANIFORMES			
FAMILY: ARDEIDAE			
<i>Botaurus exilis</i>	Least Bittern	G4	S4B
<i>Egretta caerulea</i>	Little Blue Heron	G5	S3N, S4B
<i>Egretta rufescens</i>	Reddish Egret	G4	S1
<i>Egretta thula</i>	Snowy Egret	G5	S4N, S5B
<i>Egretta tricolor</i>	Tricolored Heron	G5	S5B
FAMILY: PELECANIDAE			
<i>Pelecanus occidentalis</i>	Brown Pelican	G4	S3?
FAMILY: THRESKIORNITHIDAE			
<i>Platalea ajaja</i>	Roseate Spoonbill	G5	S4
ORDER: PICIFORMES			
FAMILY: PICIDAE			
<i>Colaptes auratus</i>	Northern Flicker	G5	S4
<i>Dryobates borealis</i>	Red-cockaded Woodpecker*	G3	S2
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	G5	S4

TABLE 4.11. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: STRIGIFORMES			
FAMILY: STRIGIDAE			
<i>Asio flammeus</i>	Short-eared Owl	G5	S2N
ORDER: ANIMAL ASSEMBLAGE			
FAMILY: ANIMAL ASSEMBLAGE			
Migratory Stopover Site	Migratory Stopover Site	GNR	SNRM
Waterbird Nesting Colony	Waterbird Nesting Colony	GNR	SNRB

*Federally Threatened
**Federally Endangered

BIRD THREATS

Threats to Louisiana birds include those widely recognized as significant at the continental scale, with habitat loss and degradation being the greatest of these threats. Migratory species may be threatened by habitat loss within either or both their breeding and nonbreeding ranges, including loss of migratory stopover sites between breeding and nonbreeding sites. Primary drivers of habitat loss and degradation (including fragmentation) include industrial, commercial, and residential development; conversion of natural areas to agriculture; intensification of agricultural practices; and changing forest conditions (e.g., due to fire suppression). Coastal disturbance and land loss represent particularly important threats in Louisiana, given the regional, and in some cases continental or global, importance of the state’s coastal habitats as breeding sites for many state and regional bird SGCN. Indeed, among Louisiana’s most imperiled bird habitats are Barrier Islands and coastal forests (e.g., Coastal Live Oak-Hackberry Forest, Barrier Island Live Oak Forest, etc.), all of which are threatened primarily by natural system modification, sea level rise, subsidence, tropical cyclones, and development. The high mobility of birds may mitigate impacts to some species, but the risk to coastal obligates is exacerbated by effects of climate change.

In addition to loss of habitat or habitat function, birds are threatened by direct anthropogenic mortality in the form of predation by outdoor cats (*Felis catus*), collisions with infrastructure (e.g., buildings, communication towers, power lines, wind turbines) and vehicles, ingestion of plastics, electrocutions from power lines, fisheries’ bycatch (e.g., entanglement in fishing gear), and other factors. Predation by cats (including outdoor, owned cats) is the most significant source of anthropogenic mortality, likely exceeding 2 billion (and up to 4 billion) bird deaths per year in the United States (Loss et al. 2013, 2015), followed by collisions with buildings, particularly glass windows, which result in over 1 billion bird deaths per year in the United States (Kornreich et al. 2024). Unlike habitat loss and other forms of anthropogenic mortality, straightforward practices readily available to the general public may be implemented to reduce these impacts (e.g., keeping cats indoors, covering windows with screens or applying treatments to reduce reflectance). Artificial light at night further increases risk of collision with lighted infrastructure by nocturnal migrants (the majority of migratory songbirds migrate

at night and may be disoriented by or attracted to artificial light). Nocturnal collisions may be reduced by turning off unnecessary interior and exterior lights during migration, utilizing motion-detecting security lighting, and favoring downward-pointing exterior lights. Nocturnal collisions with communication towers and other structures may be reduced by using flashing lights rather than steady-burning lights. In addition, offshore wind energy development poses complex risks to several guilds of birds, including risk of wind turbine collision by migratory birds and other species as well as displacement and avoidance of foraging habitat for coastal colonial waterbirds. Information gaps currently limit our understanding of these risks and how to implement offshore wind energy while minimizing its potential negative impacts. Finally, human disturbance of nesting birds, especially of colonial nesting species, may significantly reduce nest success and productivity. Stewardship at beach-nesting bird colonies such as symbolic fencing and education and outreach efforts can be extremely effective in minimizing human-related disturbance. In addition, the full extent of intentional, illegal destruction of birds is unknown but represents a conspicuous source of mortality for some high profile species.

Additional threats to birds include contaminants, invasive species, and disease. Despite improvements in regulating some sources of pollution, harmful pesticides and pollution of various types remain threats 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 in spill-prone areas. In addition, such contaminant spills can reduce quantity and quality of food resources and can kill vegetation, further exacerbating coastal habitat loss (e.g., a reduction of nesting habitats). Trash, including fishing gear and other marine debris, can cause entanglements resulting in mortality and may be used as nesting material with potentially harmful consequences (e.g., ingestion of plastics, exposure to toxins, and entanglement). Neonicotinoid insecticides have pervasive negative direct and indirect effects on birds, with population-scale implications, yet their use remains widespread and inadequately regulated. Invasive species threaten native birds through predation, competition for nest sites or other resources, or habitat-related interactions. Lastly, emerging avian diseases (e.g., highly pathogenic avian influenza), which may be spread or otherwise exacerbated by human-wildlife interactions, may negatively impact bird populations already stressed by aforementioned threats.

BIRD RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation actions for birds are listed in Table 4.12.

Bird General Research Needs and Conservation Actions

- Inventory at-risk bird populations using standardized monitoring protocols (e.g., North American Marsh Bird Monitoring protocol, Breeding Bird Survey [BBS] protocol, Christmas Bird Count [CBC] protocol, etc.) to inform population estimates, population trends, and distribution throughout Louisiana.

TABLE 4.12. Bird Action Table.

COMMON NAME	SCIENTIFIC NAME	Movement	Life History (Reproduction and Survivorship)	Determine Habitat Needs	Develop BMPs for Management and Restoration	Outreach and Increase Awareness
Swallow-tailed Kite	<i>Elanoides forficatus</i>	•	•		•	•
Bald Eagle	<i>Haliaeetus leucocephalus</i>					
Northern Pintail	<i>Anas acuta</i>	•				
Mottled Duck	<i>Anas fulvigula</i>	•	•	•	•	
Lesser Scaup	<i>Aythya affinis</i>					
Redhead	<i>Aythya americana</i>		•			
Canvasback	<i>Aythya valisineria</i>		•			
American Wigeon	<i>Mareca americana</i>		•			
Chimney Swift	<i>Chaetura pelagica</i>	•	•	•	•	•
Chuck-will's-widow	<i>Antrostomus carolinensis</i>	•	•	•	•	•
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	•	•			•
Common Nighthawk	<i>Chordeiles minor</i>	•	•	•		•
Snowy Plover	<i>Anarhynchus nivosus</i>	•	•		•	•
Wilson's Plover	<i>Anarhynchus wilsonia</i>	•	•		•	•
Piping Plover	<i>Charadrius melodus</i>	•	•		•	•
American Golden-Plover	<i>Pluvialis dominica</i>	•	•	•	•	
American Oystercatcher	<i>Haematopus palliatus</i>	•	•		•	•
Black Tern	<i>Chlidonias niger</i>	•				
Gull-billed Tern	<i>Gelochelidon nilotica</i>	•	•		•	
Black Skimmer	<i>Rynchops niger</i>	•	•		•	•
Forster's Tern	<i>Sterna forsteri</i>	•	•		•	
Coastal Least Tern	<i>Sternula antillarum antillarum</i>	•	•		•	•
Interior Least Tern	<i>Sternula antillarum athalassos</i>	•	•		•	•
Royal Tern	<i>Thalasseus maximus</i>	•	•		•	
Sandwich Tern	<i>Thalasseus sandvicensis</i>	•	•		•	
Ruddy Turnstone	<i>Arenaria interpres</i>	•	•			
Upland Sandpiper	<i>Bartramia longicauda</i>	•	•		•	
Red Knot	<i>Calidris canutus</i>	•	•		•	•
Stilt Sandpiper	<i>Calidris himantopus</i>	•	•		•	
Pectoral Sandpiper	<i>Calidris melanotos</i>	•	•		•	
Semipalmated Sandpiper	<i>Calidris pusilla</i>	•	•		•	
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	•	•	•	•	
Short-billed Dowitcher	<i>Limnodromus griseus</i>	•	•			
Marbled Godwit	<i>Limosa fedoa</i>	•	•			
Hudsonian Godwit	<i>Limosa haemastica</i>	•	•		•	
Long-billed Curlew	<i>Numenius americanus</i>	•	•		•	
Whimbrel	<i>Numenius phaeopus</i>	•	•		•	
American Woodcock	<i>Scolopax minor</i>	•	•	•	•	•
Lesser Yellowlegs	<i>Tringa flavipes</i>	•	•		•	
Willet	<i>Tringa semipalmata</i>	•	•			
Wood Stork	<i>Mycteria americana</i>	•	•			
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	•	•			•
Southeastern American Kestrel	<i>Falco sparverius paulus</i>	•	•		•	•
Northern Bobwhite	<i>Colinus virginianus</i>		•	•	•	•
Whooping Crane	<i>Grus americana</i>	•	•		•	•
Yellow Rail	<i>Coturnicops noveboracensis</i>	•	•	•	•	•
Eastern Black Rail	<i>Laterallus jamaicensis jamaicensis</i>	•	•	•	•	•

TABLE 4.12. cont.

COMMON NAME	SCIENTIFIC NAME	Movement	Life History (Reproduction and Survivorship)	Determine Habitat Needs	Develop BMPs for Management and Restoration	Outreach and Increase Awareness
Clapper Rail	<i>Rallus crepitans</i>	●	●			●
King Rail	<i>Rallus elegans</i>	●	●		●	●
Painted Bunting	<i>Passerina ciris</i>	●	●			●
Rusty Blackbird	<i>Euphagus carolinus</i>	●	●		●	●
Common Grackle	<i>Quiscalus quiscula</i>	●	●			●
Eastern Meadowlark	<i>Sturnella magna</i>	●	●		●	●
Loggerhead Shrike	<i>Lanius ludovicianus</i>	●	●		●	
Sprague's Pipit	<i>Anthus spragueii</i>	●	●	●	●	
Canada Warbler	<i>Cardellina canadensis</i>	●	●			●
Kentucky Warbler	<i>Geothlypis formosa</i>	●	●		●	●
Worm-eating Warbler	<i>Helmitheros vermivorum</i>	●	●		●	●
Louisiana Waterthrush	<i>Parkesia motacilla</i>	●	●		●	●
Prothonotary Warbler	<i>Protonotaria citrea</i>	●	●		●	●
Cerulean Warbler	<i>Setophaga cerulea</i>	●	●			●
Yellow-throated Warbler	<i>Setophaga dominica</i>	●	●		●	●
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	●	●			●
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	●	●		●	●
LeConte's Sparrow	<i>Ammospiza leconteii</i>	●	●			●
Seaside Sparrow	<i>Ammospiza maritima</i>	●	●		●	
Nelson's Sparrow	<i>Ammospiza nelsoni</i>	●	●			●
Henslow's Sparrow	<i>Centronyx henslowii</i>	●	●		●	●
Bachman's Sparrow	<i>Peucaea aestivalis</i>		●		●	
Field Sparrow	<i>Spizella pusilla</i>	●	●	●	●	●
Brown-headed Nuthatch	<i>Sitta pusilla</i>		●		●	
Marian's Marsh Wren	<i>Cistothorus palustris marianae</i>		●			
Wood Thrush	<i>Hylocichla mustelina</i>	●	●		●	●
Least Bittern	<i>Botaurus exilis</i>	●				
Little Blue Heron	<i>Egretta caerulea</i>		●		●	
Reddish Egret	<i>Egretta rufescens</i>	●	●		●	●
Snowy Egret	<i>Egretta thula</i>				●	
Tricolored Heron	<i>Egretta tricolor</i>		●		●	
Brown Pelican	<i>Pelecanus occidentalis</i>	●			●	●
Roseate Spoonbill	<i>Platalea ajaja</i>		●		●	
Northern Flicker	<i>Colaptes auratus</i>	●	●			
Red-cockaded Woodpecker	<i>Dryobates borealis</i>					●
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	●	●	●	●	●
Short-eared Owl	<i>Asio flammeus</i>	●		●		
Waterbird Nesting Colony	Waterbird Nesting Colony	●	●		●	●
Migratory Stopover Site	Migratory Stopover Site				●	●

- Improve inventory efforts in little-surveyed areas of the state to improve statewide status and distribution information.
- Improve inventory efforts for birds on LDWF and other state properties to inform and improve management of habitats where avian SGCN are located.
- Support research examining avian demographic parameters that are vital for identifying factors limiting population growth and for implementing appropriate conservation actions.
- Promote measures that create, maintain, or enhance high-quality habitat based on current and/or historical distribution of bird SGCN in Louisiana, considering recolonization potential given suitable habitat availability.
- Work with partners to identify and implement actions to support full annual cycle conservation (e.g., improving habitat quality at migratory stopover sites).
- Support full annual cycle bird conservation efforts outside of Louisiana by participating in regional, national, and international partnerships (e.g., Southern Wings, Fall Flights).
- Monitor emerging avian diseases that have the potential to affect wildlife populations.
- Update the *Louisiana Breeding Bird Atlas*.
- Maintain a statewide network of telemetry receiver stations to facilitate range-wide tracking of tagged birds to help inform full annual cycle conservation.
- Work with partners and industry to fill information gaps, provide tools to assess risk, and identify mechanisms to avoid, minimize, or mitigate impacts of energy development.
- Conduct education and outreach on the negative impacts of anthropogenic sources of bird mortality (e.g., outdoor cats, collisions) and promote Best Management Practices to minimize those threats.
- Work with partners to ensure that coastal restoration efforts maximize benefits to wildlife (e.g., via Guidance for Coastal Ecosystem Restoration and Monitoring to Create or Improve Bird-nesting Habitat (DWH Louisiana TIG 2023)).
- Promote biodiversity and conservation awareness by engaging the general public through citizen/community science platforms (e.g., iNaturalist, eBird).
- Partner with eBird to facilitate crowdsourced data acquisition and quality control and to generate updated, state-specific status and trend science products.
- Prioritize acquisition of property as a primary conservation action to limit conversion and fragmentation of natural areas and to allow for habitat management consistent with LDWF goals and objectives.
- Encourage rice farming (e.g., through incentive programs) to discourage conversion to crops with lower wildlife value and work with partners to promote and maintain rice and crawfish farming techniques that provide suitable habitat for waterfowl, marsh birds, and shorebirds.

Bird Guild or Species-specific Research Needs and Conservation Actions

Waterfowl

- Evaluate the effectiveness of current coastal marsh conservation and restoration strategies as well as the importance of working wetlands for providing waterfowl habitat and satisfying foraging needs and energetic demands.
- Quantify the importance of refugia from hunting pressure for winter waterfowl conservation.
- Work with partners to conserve habitat on the northern breeding grounds.
- Continue to investigate the effects of short- and long-term exposure to modern lead concentrations on vital rates (e.g., Mottled Duck).
- Provide surface water with salinity levels <9 ppt from mid-February through July in coastal and agricultural landscapes through wetland restoration or hydrologic manipulation to enhance nesting and brooding-rearing habitats for Mottled Duck.

Waterbirds

Colonial nesting waterbirds

- Monitor impacts of predators, invasive species, and human disturbance at colonies and implement mitigation measures (e.g., predator control, Feral Hog control) as needed.
- Support periodic coast-wide aerial nest photography survey efforts to monitor coastal colonial waterbird populations (see: <https://avianmonitoring.com>).
- Support movement ecology research to understand spatial and foraging ecology of birds associated with nesting colonies (e.g., to inform threat mitigation associated with development in coastal waters).
- Support bird nesting island initiatives by coordinating with partners on beneficial use of dredged materials.
- Support and assist in implementation of conservation goals and strategies outlined in the Reddish Egret International Working Group's *Conservation Action Plan for the Reddish Egret*.
- Implement updated inland survey effort of long-legged wading bird nesting rookeries.

Marsh birds

- Maintain 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.
- Quantify proportion of the King Rail population that is resident vs. migratory.
- Investigate Yellow Rail use of rice fields produced using different farming practices (e.g., water seeding vs. drill seeding), pre- and post-harvest.
- Examine the response of Eastern Black Rails and other rail species to the effects of various land-use practices (e.g., prescribed fire, grazing).
- Support and promote conservation programs that acquire, conserve, and restore or enhance critical Eastern Black Rail habitats.

- Support efforts to restore high marsh habitat and specific Eastern Black Rail habitat features within large-scale marsh creation and restoration projects.
- Support research to understand relationships between marsh restoration techniques, restored marsh habitat structure, and marsh bird population response.
- Implement the federal recovery plan (USFWS 2021) for Eastern Black Rail.

Whooping Crane

- Support continued efforts to re-establish a resident, nonmigratory population of Whooping Crane in Louisiana.
- Raise awareness of illegal shootings and support organizations that advocate for increased fines and penalties of cases brought to prosecution.
- Coordinate with utility companies to deploy a variety of line marking devices on power lines in important flight paths to minimize collision deaths.
- Support research to facilitate increased Whooping Crane hatching and fledging rates.
- Support private landowner incentives to maintain water on fields for late season nesting attempts by Whooping Crane.
- Implement the federal recovery plan (USFWS 2007) for Whooping Crane.

Shorebirds

- Evaluate solitary nesting shorebird species' nesting habitat preferences and monitor response to coastal restoration efforts to refine *Guidance for Coastal Ecosystem Restoration and Monitoring to Create or Improve Bird-nesting Habitat*.
- Evaluate nonbreeding shorebird species' habitat use, foraging success, and demographic factors (e.g., survival) in response to coastal restoration efforts (e.g., those on barrier islands, headlands, mainland beaches).
- Support stewardship efforts (e.g., signage, fencing, outreach) and regulation of motorized vehicles on publicly accessible beaches to minimize disturbance and mortality of beach-nesting species.
- Support movement ecology research on Red Knot and other coastal shorebird SGCN to evaluate importance of critical habitats in Louisiana and to inform risk of interaction with coastal and nearshore development (e.g., renewable energy and oil and gas infrastructure, commercial and residential beach development).
- Identify, monitor, and conserve coastal and inland localities important for migratory shorebird stopover, staging, and foraging.
- Work with partners to identify and implement actions to provide habitat and improve habitat quality for shorebirds throughout the annual cycle (e.g., water management on working wetlands).
- Manage moist soil units on WMAs and state refuges to provide suitable stopover and nonbreeding shorebird habitat.
- Support implementation of actions to achieve objectives identified by the *U.S. Shorebird Conservation Plan* and the *Midcontinent Shorebird Conservation Initiative Framework*.

- Ensure that research, management, and conservation goals align with those of species-specific working groups associated with Louisiana SGCN (e.g., *American Woodcock Conservation Plan*).
- Implement the federal recovery plan (USFWS 1988 and draft 2015) for Piping Plover.
- Implement the federal recovery plan (USFWS 2023) for rufa Red Knot.

Interior Least Tern

- Work with partners to protect sandbars in Louisiana rivers (e.g., limit use of off-road vehicles (ORVs) on sandbars during nesting season).
- Work with partners to reduce negative impacts of dredging/channelization on sandbars and to regulate water levels to minimize inundation of sandbars during nesting season.
- Work with LDWF's Scenic Rivers Program and partners to minimize the impacts of gravel mining on sandbar habitat availability.

Landbirds

- Promote and conduct forest management practices that benefit landbirds (e.g., utilize prescribed fire where appropriate, utilize group and single-tree selection harvest methods, maximize the number of snags retained, maintain Streamside Management Zones).
- Conserve and restore coastal forests (including reforestation and land acquisition) to improve coastal stopover habitat availability and habitat quality.
- Support partners' efforts to implement conservation actions in nonbreeding habitats in Mexico, Central and South America, and the Caribbean.
- Support implementation of the East Gulf Coastal Plain Joint Venture's communications strategy: *A Burning Issue: Prescribed Fire and Fire-adapted Habitats of the East Gulf Coastal Plain*.
- Participate in the national Nightjar Survey Network program to monitor nightjar population trends.
- Support and expand remote sensing techniques as tools to inventory SGCN and prioritize habitats and areas (e.g., WMAs) for management and restoration.

Raptors

- Participate in species-specific monitoring efforts for Swallow-tailed Kite and Bald Eagle.
- Protect Swallow-tailed Kite roost sites and Bald Eagle nest sites.
- Provide recommendations to minimize disturbance near Bald Eagle nests, consistent with federal guidelines.
- Provide recommendations to minimize forestry impacts on nesting or roosting raptors, including the importance of retaining large canopy and super-emergent trees as well as timing timber harvest activities to avoid critical periods.
- Implement nest box program for Southeastern American Kestrel where nest cavity availability may limit population growth.

Grassland and Open Pine Birds

- Promote and conduct management practices that benefit landbirds in grassland and open pine systems (e.g., promote establishment of native grasses and forbs, utilize prescribed fire to maximize native grass and forb recruitment and to manage understory vegetation in managed pine systems, maintain open canopy conditions in managed pine systems).
- Implement habitat management actions recommended by the National Bobwhite Conservation Initiative's range-wide strategic plan and by LDWF's *Louisiana Bobwhite Recovery Plan*.
- Contribute to fulfilling conservation and management objectives identified by the Loggerhead Shrike Working Group.
- Determine suitable grassland patch size, species composition, structure, and landscape habitat matrix needed to support grassland bird SGCN (e.g., LeConte's Sparrow, Henslow's Sparrow).
- Maintain the statewide Red-cockaded Woodpecker Safe Harbor Program.
- Implement the federal recovery plan (USFWS 1985 and 2003) for Red-cockaded Woodpecker.



(LEFT) Loggerhead Shrike (*Lanius ludovicianus*) (RIGHT) Seaside Sparrow (*Ammodramus maritima*)



Red Knot (*Calidris canutus*), with Willet (*Tringa semipalmata*) (back-right) and Sanderling (*Calidris alba*) (front-right)



(LEFT) Reddish Egret (*Egretta rufescens*) (CENTER) Common Nighthawk (RIGHT) American Kestrel (*Falco sparverius*)



(LEFT) Royal Tern (*Thalasseus maximus*) (RIGHT) Roseate Spoonbill (*Platalea ajaja*)

MAMMALS

Mammals are some of the most charismatic and recognizable animals with 83 species occurring in Louisiana and its adjacent waters. Mammals play many integral roles in ecosystems, including pollination, seed dispersal, nutrient cycling, and natural disturbance of habitat through burrowing, tunneling, herbivory, and other means (Lacher et al. 2019). Relative to ectothermic taxa groups, mammals require vast amounts of energy to sustain themselves, having profound impacts on food webs through consumption of natural resources. For instance, a shrew may consume up to three times its body weight per day to meet its energetic needs (Wilson and Ruff 1999), and an individual Long-tailed Weasel can eat up to three rodents per night (Svendson 2003). In addition, many rodents consume large quantities of seeds or cache them for later consumption. The act of caching unintentionally results in seed dispersal and is overall beneficial for plant communities (Lacher et al. 2019), accounting for >95% of plant biomass in some systems (Vander Wall 2008). Furthermore, rodents and other mammals serve as key prey items for numerous taxa groups (Lowery 1974).

The value of mammals is not limited to the benefits they provide to ecosystems. Many species benefit humans by consuming vast quantities of pest insects. Ammerman and colleagues (2012) estimated that Brazilian Free-tailed Bats (*Tadarida brasiliensis*), which preferentially prey upon crop insects, consume up to 4 billion Corn Earworm Moths (*Helicoverpa zea*) each night in Texas. Whitby and colleagues (2020) found agricultural pests in more than 90% of Eastern Red Bat (*Lasiurus borealis*) and Big Brown Bat guano samples examined. Estimates suggest that the annual value of bats to United States agriculture could be as high as \$53 billion (Boyles et al. 2011). Additionally, species like the Tricolored Bat eat large quantities of biting insects such as mosquitos and midges each night (Ammerman et al. 2012).

Historically, attention has focused on mammalian game species that directly benefit humans through subsistence uses (e.g., meat and clothing; Feldhamer et al. 2003) or financial gains (e.g., fur bearers). Only within the past few decades have mesocarnivores such as the Plains Spotted Skunk and Long-tailed Weasel received more focused attention making management agencies aware of their steep declines (Gompper and Hackett 2005, Jachowski et al. 2021). Other nongame mammals have received even less consideration, and unfortunately, many native species, such as mice and moles, are considered pests; however, the most problematic are not native and include species such as the House Mouse (*Mus musculus*), Norway Rat (*Rattus norvegicus*), Black Rat (*Rattus rattus*), and Nutria (Whitaker and Hamilton 1998). Similarly, bats are often viewed with superstition or as direct threats to human health and safety. Fortunately, public opinion of bats has recently shifted in a more positive direction (Fagan et al. 2018) as a result of increased education and outreach on the beneficial ecosystem services they provide. These benefits, along with those provided by other mammal species, are diverse and their

loss would have cascading impacts felt across ecosystems and, ultimately, human civilization. A list of the mammal Species of Greatest Conservation Need can be found in *Table 4.13*.

MAMMAL SGCN

TABLE 4.13. Mammal Species of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: CHORDATA			
CLASS: MAMMALIA			
ORDER: ARTIODACTYLA			
FAMILY: BALAENOPTERIDAE			
<i>Balaenoptera ricei</i>	Rice's Whale**	G1	S1
FAMILY: PHYSETERIDAE			
<i>Physeter macrocephalus</i>	Sperm Whale**	G3G4	SNA
ORDER: CARNIVORA			
FAMILY: CANIDAE			
<i>Canis rufus</i>	Red Wolf**	G1	SX
FAMILY: MEPHITIDAE			
<i>Spilogale interrupta</i>	Plains Spotted Skunk	G3	SH
<i>Spilogale putorius</i>	Alleghanian Spotted Skunk	G4	S1
FAMILY: MUSTELIDAE			
<i>Neogale frenata</i>	Long-tailed Weasel	G5	S2
FAMILY: URSIDAE			
<i>Ursus americanus luteolus</i>	Louisiana Black Bear	G5T2	S3
ORDER: CHIROPTERA			
FAMILY: VESPERTILIONIDAE			
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat	G3G4	S3
<i>Eptesicus fuscus</i>	Big Brown Bat	G5	S3
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	G3G4	S2M
<i>Lasiurus cinereus</i>	Hoary Bat	G3G4	S2M
<i>Lasiurus intermedius</i>	Northern Yellow Bat	G5	S4
<i>Myotis austroriparius</i>	Southeastern Myotis	G4	S3
<i>Myotis septentrionalis</i>	Northern Long-eared Bat**	G2G3	S1
<i>Perimyotis subflavus</i>	Tricolored Bat	G3G4	S3
ORDER: EULIPTYPHILA			
FAMILY: SORICIDAE			
<i>Sorex longirostris</i>	Southeastern Shrew	G5	S1

TABLE 4.13. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: RODENTIA			
FAMILY: CRICETIDAE			
<i>Baiomys taylori</i>	Northern Pygmy Mouse	G4G5	SU
<i>Ochrotomys nuttalli</i>	Golden Mouse	G5	SU
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse	G5	SU
<i>Ondatra zibethicus</i>	Common Muskrat	G5	S4
FAMILY: HETEROMYIDAE			
<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse	G5	S2
FAMILY: SCIURIDAE			
<i>Sciurus niger bachmani</i>	Bachman's Fox Squirrel	G5TNR	S3
<i>Tamias striatus</i>	Eastern Chipmunk	G5	S3
ORDER: SIRENIA			
FAMILY: TRICHECHIDAE			
<i>Trichechus manatus</i>	West Indian Manatee*	G2G3	S2

*Federally Threatened

**Federally Endangered

MAMMAL THREATS

Much like other taxa, the main threat to mammals is habitat loss and modification, affecting 40% of mammals worldwide (Visconti et al. 2011). Louisiana's largest native terrestrial species, the Louisiana Black Bear, requires substantial tracts of land to persist, and Black Bear home ranges can vary considerably between 1,705 to 78,579 acres (Feldhamer et al. 2003). Home ranges of female Louisiana Black Bears have been estimated at 2,965 acres for the Tensas basin population in Louisiana (Benson and Chamberlain 2007). Because of habitat loss, Black Bear have trouble finding resources (e.g., food, mates, denning sites, etc.) within their home range and may be forced into urban areas, often resulting in conflicts with humans. Small mammals can also require large spaces to survive; home range size for the Alleghanian Spotted Skunk can be up to 2,139 acres (Lesmeister et al. 2009). Used by bats for roosting and foraging, forests are essential for bats' survival but are often overlooked and subjected to logging and urban development (Mickleburgh et al. 2002, Frick et al. 2020). Additionally, maintaining connectivity between territories and populations will continue to be a challenge as habitats become increasingly fragmented by roads and urban development.

Direct and indirect mortality from anthropogenic activities is a leading cause of population decline in mammals (Avila et al. 2018). Some SGCN, including large predators, rodents, and bats, are subject to varying degrees of human persecution that arise from human-wildlife conflicts. An additional concern for many bat species is the replacement of "bat-friendly" bridges with designs that are of lower value to these animals (Wilson et al. 2023). For other mammalian terrestrial species, roads are a prominent feature across the landscape and often fragment habitats. Roads inhibit habitat connectivity and limit animal movement through avoidance (McGregor et al. 2008)

or by vehicle collision that can cause mortality (Kreling et al. 2019). Similar to roadways, in waterways, boat collisions, are an overwhelming threat to manatees (Bonde et al. 2004). In addition, marine mammals can become entangled in fishing gear or other marine debris causing unintended mortality.

Non-native, invasive species can have significant impacts to native mammals and their habitats. For example, Nutria likely outcompete Muskrat, while simultaneously destroying their critical habitat and limiting their dispersal. Non-native diseases also pose a serious threat to many mammal SGCN. Although disease outbreaks are rarely the sole cause of large-scale declines in mammals, they can further tax already imperiled populations (Smith et al. 2006). Additionally, the movement of diseases between wild and domesticated mammals and humans is of growing concern (Choisy and Rohani 2006). For example, Canine distemper (*Morbillivirus canis*) is native to America but now occurs throughout Louisiana. This virus is known to cause mortality in many mustelids, including spotted skunks (Harris et al. 2021). The effects of White-nose Syndrome (WNS) in bats is well studied, and research suggests it is one of the greatest threats to many bat species (Frick et al. 2020). The fungus *Pseudogymnoascus destructans* (Pd), which causes WNS, was first documented in Louisiana, in 2020. Although WNS has not been observed in Louisiana, it has been documented in neighboring states.

Energy development, industrial and residential waste, and other pollutants are additional threats to mammals. Marine mammals are at risk from noise pollution, oil spills, and other toxic releases that may result in mortality or decreased fitness (Avila et al. 2018). Brevetoxins produced by the red tide (*Karenia brevis*) have caused mass mortality events in manatees (Bonde et al. 2004). In terrestrial habitats, discarded bottles can cause mortality in small mammals like shrews by acting as passive traps (Brannon and Bargelt 2013). Rodenticides, used to control the non-native House Mouse or Norway Rat, can lead to primary exposure through incidental consumption by native rodent species. Secondary exposure to rodenticides has been documented in carnivores with diets high in rodents (Smith and Mengak 2022, Erickson and Urban 2004). As with birds, wind farms pose a potential threat to many bats through collisions, and the construction of wind and solar farms can exacerbate habitat loss (Frick et al. 2020).

MAMMAL RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation needs and actions for mammals are listed in Table 4.14.

Mammal General Research Needs and Conservation Actions

- Increase connectivity through the establishment and maintenance of corridors.

Mammal Species-specific Research Needs and Conservation Actions

Spotted Skunks and Long-tailed Weasel

- Develop techniques to detect species.

TABLE 4.14. Mammal Action Table.

COMMON NAME	SCIENTIFIC NAME	Determine Abundance	Determine Distribution	Life History (Reproduction, Movement, Survivorship)	Determine Habitat Needs	Population Monitoring	Develop and Promote BMPs	Promote Quality Habitat	Outreach and Increase Awareness
Rice's Whale	<i>Balaenoptera ricei</i>								●
Sperm Whale	<i>Physeter macrocephalus</i>	n/a	n/a	n/a	n/a	n/a	n/a	n/a	●
Red Wolf	<i>Canis rufus</i>								●
Plains Spotted Skunk	<i>Spilogale interrupta</i>								●
Alleghanian Spotted Skunk	<i>Spilogale putorius</i>	●	●	●	●	●	●	●	●
Long-tailed Weasel	<i>Neogale frenata</i>	●	●	●	●	●	●	●	●
Louisiana Black Bear	<i>Ursus americanus luteolus</i>					●	●	●	●
Rafinesque's Big-eared Bat	<i>Corynorhinus rafinesquii</i>	●		●		●	●	●	●
Big Brown Bat	<i>Eptesicus fuscus</i>	●	●	●		●			●
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	●	●	●	●				●
Hoary Bat	<i>Lasiurus cinereus</i>	●	●	●	●				●
Northern Yellow Bat	<i>Lasiurus intermedius</i>	●	●	●	●	●	●	●	●
Southeastern Myotis	<i>Myotis austroriparius</i>					●	●	●	●
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	●	●	●	●	●	●	●	●
Tricolored Bat	<i>Perimyotis subflavus</i>	●	●	●	●	●	●	●	●
Southeastern Shrew	<i>Sorex longirostris</i>	●	●	●	●	●	●	●	
Northern Pygmy Mouse	<i>Baiomys taylori</i>	●	●	●	●	●	●	●	
Eastern Harvest Mouse	<i>Reithrodontomys humulis</i>	●	●	●	●	●	●	●	
Golden Mouse	<i>Ochrotomys nuttalli</i>	●	●	●	●	●	●	●	
Common Muskrat	<i>Ondatra zibethicus</i>	●	●			●	●	●	
Hispid Pocket Mouse	<i>Chaetodipus hispidus</i>	●	●	●		●	●	●	
Bachman's Fox Squirrel	<i>Sciurus niger bachmani</i>					●		●	
Eastern Chipmunk	<i>Tamias striatus</i>	●	●	●	●	●	●	●	
West Indian Manatee	<i>Trichechus manatus</i>			●					●

Black Bear

- Partner with LaDOTD to implement the construction of road crossings and placement of road signs to limit road mortality.

Bats

- Monitor impacts of emergent diseases, specifically WNS.
- Partner with LaDOTD to implement the use of bat-friendly bridges during bridge replacements.
- Investigate potential impacts of wind and solar farms.
- Implement the federal recovery plan (USFWS, in development) and Survey Guidelines (2024) for Northern Long-eared Bat.
- Implement the federal recovery plan (USFWS, in development) for Tricolored Bat.

Southeastern Shrew

- Research impacts of Red Imported Fire Ant (*Solenopsis invicta*) on this species.

West Indian Manatee

- Develop a database of warm water discharge locations throughout the coastal zone.
- Implement the federal recovery plan (USFWS 1996) for West Indian Manatee.



Long-tailed Weasel (*Neogale frenata*)



Hispid Pocket Mouse (*Chaetodipus hispidus*)

PLANTS

As humans have transitioned from a traditional hunter-gatherer existence to a technology driven lifestyle, a variety of connections have been lost with the natural world. Whether it is the ability to navigate using the constellations or the ability to locate valuable resources by reading the landscape and weather, vast segments of the human population can no longer conduct these basic tasks that were once essential to human existence. This is nowhere more evident than in our relationship with plants. Wandersee and Schussler (1998) coined the term plant blindness and defined it as: “(a) the inability to see or notice the plants in one’s environment; (b) the inability to recognize the importance of plants in the biosphere and in human affairs; (c) the inability to appreciate the aesthetic and unique biological features of the life forms that belong to the Plant Kingdom; and (d) the misguided anthropocentric ranking of plants as inferior to animals and thus, as unworthy of consideration.” Undoubtedly, plant blindness has contributed significantly to the lack of consideration given to plants in the conservation arena.

From carnivorous sundews to ethereal orchids, Louisiana supports approximately 2,500 native plant species and approximately 1,000 non-native plant species. This remarkable number may be attributed to the state’s unique geographical features including its position relative to the Mississippi River Delta and the Gulf of America, coupled with its favorable climatic conditions. Approximately 550 native plants (22%) and three lichens are listed as SGCN in Louisiana (Table 4.15). While not all are showy, charismatic species, their ecological significance is undeniable and deserves to be celebrated.

Due to their ability to transform solar energy into the carbon-based fuel essential for life, plants are a fundamental part of the food chain. As primary producers, plants provide sustenance for herbivores, which in turn supports higher trophic levels. In many cases, these relationships are mutually beneficial, such as the symbiotic bond between plants and pollinators. In these relationships, plants offer vital resources to pollinators such as nectar and pollen, while pollinators facilitate plant reproduction and seed dispersal, which ultimately aids in maintaining and creating healthy ecosystems (Nicolson and Wright 2017). From hollow trees to aquatic root systems, plants also serve as shelter and nesting sites for various taxa. For example, foliar cover from trees and shrubs can provide many organisms with protection from predators, excessive heat, and harsh weather conditions.

Plants also provide a multitude of ecosystem services that are important to mitigating the impacts of climate change. Through photosynthesis, plants are able to reduce the presence of greenhouse gases in the atmosphere by sequestering carbon and storing it as biomass (Kumar et al. 2006). Many plants have intricate root systems that slow down the movement of surface water, facilitate the penetration of groundwater, and anchor soil, improving soil structure which reduces flooding and erosion leading to cleaner water in natural and

urban systems (Phillips and Marden 2006). Plants enhance substrate stability, particularly in areas with highly erodible soils like coastal marshes, southern mesophytic forests, and xeric sandhills, increasing the resilience and health of these natural communities across the state. Plants can also be used to assess habitat quality as certain species may persist exclusively in exemplary natural communities. Plants found regularly in particular habitats, but absent elsewhere, can also aid in identifying existing or historical natural communities. For example, the presence of White-Leaf Prairie Hibiscus (*Hibiscus leucophyllus*) along a transportation corridor may indicate the presence of a remnant coastal prairie.

It is for these reasons that state agencies have begun to incorporate plants into State Wildlife Action Plans. This not only elevates the profiles of rare, threatened, and endangered plant species but also highlights the critical roles plants play as primary producers and providers of ecosystem services to wildlife and humans. Whether it is the importance plants play in preventing the loss of coastal habitats, sequestering carbon, or providing critical habitat, maintaining healthy plant populations is vital to the conservation of all species.

PLANT SGCN

TABLE 4.15. Plant and Lichen of Greatest Conservation Need.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: ASCOMYCOTA			
CLASS: ASCOMYCETES			
ORDER: OPEGRAPHALES			
FAMILY: OPEGRAPHACEAE			
<i>Fouragea filicina</i>	a lichen	GNR	SNR
ORDER: OSTROPALES			
FAMILY: GRAPHIDACEAE			
<i>Helminthocarpon leprevostii</i>	a lichen	GNR	SNR
CLASS: LECANOROMYCETES			
ORDER: LECANORALES			
FAMILY: BACIDIACEAE			
<i>Phyllopsora halei</i>	a lichen	GNR	SNR
PHYLUM: ANTHOPHYTA			
CLASS: DICOTYLEDONEAE			
ORDER: APIALES			
FAMILY: APIACEAE			
<i>Eryngium hookeri</i>	Hooker's Eryngo	G4G5	S3
<i>Perideridia americana</i>	Eastern Yampah	G4	S1
<i>Polytaenia nuttallii</i>	Prairie Parsley	G5	S2
<i>Ptilimnium texense</i>	Texas Bishopweed	G3	S3

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
PHYLUM: ANTHOPHYTA (cont.)			
CLASS: DICOTYLEDONEAE			
ORDER: APIALES			
FAMILY: APIACEAE			
<i>Sanicula marilandica</i>	Maryland Black Snakeroot	G5	SH
<i>Sanicula odorata</i>	Clustered Black Snakeroot	G5	S3
<i>Sium suave</i>	Hemlock Water-parsnip	G5	S1S2
<i>Taenidia integerrima</i>	Yellow Pimpernel	G5	S2
<i>Thaspium chapmanii</i>	Meadowparsnip	GNR	S1
FAMILY: ARALIACEAE			
<i>Panax quinquefolius</i>	American Ginseng	G3G4	S1
ORDER: ARISTOLOCHIALES			
FAMILY: ARISTOLOCHIACEAE			
<i>Asarum canadense</i>	Canada Wild Ginger	G5	S1
ORDER: ASTERALES			
FAMILY: ASTERACEAE			
<i>Antennaria solitaria</i>	Single-head Pussytoes	G5	S1
<i>Baccharis dioica</i>	Broom-bush Baccharis	G4G5	S1
<i>Boltonia apalachicolaensis</i>	Apalachicola Doll's-daisy	G2	S1
<i>Chaetopappa asteroides</i>	Arkansas Leastdaisy	G5	S1
<i>Chrysopsis hyssopifolia</i>	Cottony Goldenaster	G5T3T5	S1
<i>Cirsium lecontei</i>	Le Conte's Thistle	G3	S2
<i>Cirsium muticum</i>	Swamp Thistle	G5	SU
<i>Coreopsis intermedia</i>	Golden-wave Tickseed	G3	S2
<i>Coreopsis major</i>	Wood Tickseed	G5	S3
<i>Coreopsis nudata</i>	Georgia Tickseed	G3?	S2
<i>Coreopsis palmata</i>	Stiff Tickseed	G5	S2
<i>Diaperia verna</i>	Cotton-rose	G5	S1
<i>Echinacea angustifolia</i>	Narrow-Leaved Purple Coneflower	G5	S1
<i>Echinacea purpurea</i>	Purple Coneflower	G5	S2
<i>Eupatorium lancifolium</i>	Lance-Leaf Thoroughwort	G3?	S2
<i>Eupatorium mohrii</i>	Mohr's Thoroughwort	G4?	S2
<i>Eupatorium sullivaniae</i>	Sullivan's Thoroughwort	GNR	S1
<i>Eutrochium purpureum</i>	Sweet Joe-pyeweed	G5	S1
<i>Grindelia lanceolata</i>	Narrowleaf Gumweed	G3G5	S1
<i>Helenium brevifolium</i>	Shortleaf Sneezeweed	G4	S1
<i>Helenium camppestre</i>	Old Field Sneezeweed	G4	S1
<i>Helianthus floridanus</i>	Florida Sunflower	G3G4	SH

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: ASTERALES (cont.)			
FAMILY: ASTERACEAE			
<i>Helianthus silphoides</i>	Rosinweed Sunflower	G4	S2
<i>Heliopsis gracilis</i>	Smooth Oxeye	G5T5?	S2
<i>Hieracium longipilum</i>	Hairy Hawkweed	G4G5	S1
<i>Iva imbricata</i>	Seacoast Marsh-elder	G5	S3
<i>Krigia wrightii</i>	Wright's Dwarf-dandelion	G3G4	S1
<i>Liatris punctata</i>	Dotted Gayfeather	G5	S1
<i>Liatris tenuis</i>	Slender Gayfeather	G3	S1
<i>Lindheimera texana</i>	Texas Yellowstar	G5	S1
<i>Marshallia trinervia</i>	Broadleaf Barbaras-buttons	G3	S1
<i>Melanthera nivea</i>	Snow Melanthera	G5	S2
<i>Nabalus altissimus</i>	Tall Rattlesnake-root	G5	S3
<i>Nabalus asper</i>	Rough Rattlesnake-root	G4?	SH
<i>Nabalus barbatus</i>	Barbed Rattlesnake-root	G3	S2
<i>Packera anonyma</i>	Appalachian Ragwort	G5	S2
<i>Packera obovata</i>	Roundleaf Ragwort	G5	S3
<i>Palafoxia callosa</i>	Small Palafoxia	G4G5	SH
<i>Palafoxia texana</i> var. <i>ambigua</i>	Texas Palafoxia	G3G5TNR	S1
<i>Pterocaulon virgatum</i>	Wand Blackroot	G5	S3
<i>Ratibida peduncularis</i>	Mexican Hat	G4G5	S2
<i>Ratibida pinnata</i>	Gray-head Prairie Coneflower	G5	S2
<i>Rudbeckia grandiflora</i>	Largeflower Rudbeckia	G5	S1
<i>Rudbeckia missouriensis</i>	Missouri Coneflower	G4G5	S2
<i>Rudbeckia scabrifolia</i>	Sabine Coneflower	G3G4	S3
<i>Rudbeckia texana</i>	Texas Coneflower	G4	S3
<i>Rudbeckia triloba</i>	Three-lobed Coneflower	G5	S3
<i>Sclerolepis uniflora</i>	Pink Bog Button	G3	S1
<i>Senecio ampullaceus</i>	Texas Ragwort	G4	S1S2
<i>Sericocarpus linifolius</i>	Narrowleaf Whitetop Aster	G5	S2
<i>Silphium perfoliatum</i>	Cup-plant	G5	SH
<i>Solidago discoidea</i>	Rayless Mock-goldenrod	G4G5	S3
<i>Solidago flexicaulis</i>	Zigzag Goldenrod	G5	S1
<i>Solidago juncea</i>	Early Goldenrod	G5	S1
<i>Symphyotrichum attenuatum</i>	Gulf Coast Smooth Aster	GNR	S3
<i>Symphyotrichum elliottii</i>	Elliott's Aster	G4	S1

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: ASTERALES (cont.)			
FAMILY: ASTERACEAE			
<i>Symphyotrichum puniceum</i> var. <i>scabriceale</i>	Pineland Purple-stem Aster	G5T2	SH
<i>Tetragonotheca ludoviciana</i>	Louisiana Squarehead	G4	S3
<i>Thelesperma filifolium</i>	Stiff Greenthread	G4G5	S1
<i>Thelesperma flavodiscum</i>	East Texas Greenthread	G4	S1
<i>Vernonia baldwinii</i>	West Ironweed	G5	S2
ORDER: BORAGINALES			
FAMILY: HELIOTROPIACEAE			
<i>Euploca tenella</i>	Slender Heliotrope	G5	S2
<i>Euploca convolvulacea</i>	Bindweed Heliotrope	G5	S1
ORDER: BRASSICALES			
FAMILY: CLEOMACEAE			
<i>Polanisia erosa</i>	Large Clammyweed	G5	S2
ORDER: CAMPANULALES			
FAMILY: CAMPANULACEAE			
<i>Campanulastrum americanum</i>	Tall Bellflower	G5	S1
<i>Lobelia elongata</i>	Elongated Lobelia	G4G5	SH
<i>Lobelia flaccidifolia</i>	Coastal Plain Lobelia	G5	S3
<i>Lobelia inflata</i>	Indian-tobacco	G5	S2
<i>Lobelia rogersii</i>	McVaugh's Lobelia	G3G4	S1
<i>Lobelia siphilitica</i>	Great Blue Lobelia	G5	S3
<i>Triodanis lamprosperma</i>	Prairie Venus's Looking-glass	G5?	S2
FAMILY: GOODENIACEAE			
<i>Scaevola plumieri</i>	Gullfeed	G5	SH
ORDER: CAPPARALES			
FAMILY: BRASSICACEAE			
<i>Borodinia canadensis</i>	Mustard Sicklepod	G5	S1
<i>Cakile harperi</i>	Harper's Searocket	G5	S1
<i>Cardamine concatenata</i>	Cutleaf Toothwort	G5	S3
<i>Physaria gracilis</i>	Spreading Bladderpod	G5	SH
<i>Rorippa aquatica</i>	North American Lake-Cress	G4?	SH
<i>Streptanthus hyacinthoides</i>	Smooth Twistflower	G3	S2
<i>Tomostima cuneifolia</i>	Wedgeleaf Whitlow-grass	G5	S1

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: CARYOPHYLLALES			
FAMILY: AMARANTHACEAE			
<i>Amaranthus greggii</i>	Gregg's Amaranth	G4?	S2
<i>Blutaparon vermiculare</i>	Silverhead	G5	S3
<i>Gossypianthus lanuginosus</i>	Woolly Cotton-flower	G5	S1
<i>Tidestromia lanuginosa</i>	Woolly Honeysweet	G5	S1
FAMILY: CARYOPHYLLACEAE			
<i>Geocarpon minimum</i>	Earth-fruit*	G2	S1
<i>Geocarpon nuttallii</i>	Drummond's Sandwort	G5	S1
<i>Loeflingia squarrosa</i>	Spreading Pygmyleaf	G5	S1
<i>Paronychia drummondii</i>	Drummond's Nailwort	G4G5	S2
<i>Sabulina muscorum</i>	Dixie Stitchwort	GNR	S3
<i>Silene stellata</i>	Starry Campion	G5	S2
<i>Silene subciliata</i>	Scarlet Catchfly	G3	S2
<i>Silene virginica</i>	Fire Pink	G5	S2
<i>Stipulicida setacea</i>	Pineland Scaly-pink	G4G5	S1
FAMILY: MONTIACEAE			
<i>Phemeranthus parviflorus</i>	Small-flower Fameflower	G5	S3
<i>Phemeranthus rugospermus</i>	Prairie Fameflower	G3G4	S1
FAMILY: NYCTAGINACEAE			
<i>Mirabilis albidia</i>	Pale Umbrella-wort	G5	S1
ORDER: CELASTRALES			
FAMILY: AQUIFOLIACEAE			
<i>Ilex amelanchier</i>	Sarvis Holly	G4	S2
<i>Ilex myrtifolia</i>	Myrtle Holly	G5?	S2
FAMILY: CELASTRACEAE			
<i>Celastrus scandens</i>	Climbing Bittersweet	G5	S1
<i>Euonymus atropurpureus</i>	Wahoo	G5	S1
<i>Parnassia grandifolia</i>	Large-leaved Grass-of-Parnassus	G3G4	S1
ORDER: DIPSACALES			
FAMILY: CAPRIFOLIACEAE			
<i>Triosteum angustifolium</i>	Yellowleaf Tinker's-weed	G5	S2
<i>Triosteum perfoliatum</i>	Perfoliate Tinker's-weed	G5	SH
ORDER: EBENALES			
FAMILY: SAPOTACEAE			
<i>Sideroxylon reclinatum</i>	Florida Bully	G4G5	SH

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: ERICALES			
FAMILY: CYRILLACEAE			
<i>Cliftonia monophylla</i>	Black Titi	G4G5	S1
FAMILY: ERICACEAE			
<i>Kalmia latifolia</i>	Mountain Laurel	G5	S2
<i>Lyonia mariana</i>	Staggerbush	G5	S1
<i>Monotropa hypopithys</i>	American Pinesap	G5	S2
<i>Vaccinium ashei</i>	Rabbit-eye Blueberry	GNR	SH
ORDER: EUPHORBIALES			
FAMILY: BUXACEAE			
<i>Pachysandra procumbens</i>	Allegheny-spurge	G4G5	S2
FAMILY: EUPHORBIACEAE			
<i>Cnidoscolus stimulosus</i>	Risky Tread-softly	G5	S3
<i>Croton argyranthemus</i>	Silver Croton	G5	S1
<i>Euphorbia bombensis</i>	Sand Dune Spurge	G4G5	S1
<i>Euphorbia discoidalis</i>	Summer Spurge	G4	S2
<i>Euphorbia meganaesos</i>	Glabrous Spotted Spurge	G2	S1
<i>Euphorbia tetrapora</i>	Weak Spurge	G4	S2
ORDER: FABALES			
FAMILY: FABACEAE			
<i>Acaciella hirta</i>	Prairie Acacia	G5	S3
<i>Acmispon americanus</i>	American Bird's-foot-trefoil	G5	S2
<i>Amorpha laevigata</i>	Smooth Indigo-bush	G3?	SH
<i>Amorpha nitens</i>	Shining False Indigo	G4	SH
<i>Amorpha paniculata</i>	Panicled Indigo-bush	G3	S2
<i>Astragalus crassicaupus</i>	Berliander's Ground-Plum	G5	S2
<i>Astragalus nuttallianus</i>	Nuttall's Milkvetch	G5	S2
<i>Astragalus soxmaniorum</i>	Soxman's Milkvetch	G3	S2
<i>Astragalus trichocalyx</i>	Ground-plum	G5T5?	S1
<i>Cladrastis kentukea</i>	Yellow-wood	G4	S1
<i>Crotalaria purshii</i>	Pursh's Rattlebox	G5	S2
<i>Dalea compacta</i> var. <i>pubescens</i>	Compact Prairie-clover	G5T5	S1
<i>Dalea emarginata</i>	Wedgeleaf Prairie-clover	G5	S2
<i>Dalea grisea</i>	Silky Prairie-clover	G5T4	S2
<i>Dalea lanata</i>	Downy Prairie-clover	G5	S1
<i>Dalea phleoides</i>	Slimspike Prairie-clover	G4	S1
<i>Dalea pinnata</i> var. <i>trifoliata</i>	Summer Farewell	G5T3T4	SH
<i>Desmodium nuttallii</i>	Nuttall's Tick-trefoil	G5	S1
<i>Indigofera miniata</i>	Coast Indigo	G5	S1

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: FABALES (cont.)			
FAMILY: FABACEAE			
<i>Lathyrus pusillus</i>	Tiny Pea	G5?	S3
<i>Lathyrus venosus</i>	Forest Pea	G5	S3
<i>Lupinus villosus</i>	Lady Lupine	G4	S2
<i>Pedimelum digitatum</i>	Palm-leaf Scurfpea	G5	S1
<i>Pedimelum hypogaeum</i> var. <i>subulatum</i>	Awl-shaped Scurfpea	G5T4	S2
<i>Pedimelum rhombifolium</i>	Roundleaf Scurfpea	G5	S2
<i>Tephrosia florida</i>	Florida Hoary-pea	G4G5	S2
<i>Tephrosia hispida</i>	Sprawling Hoary-pea	G4G5	S2?
<i>Trifolium amphianthum</i>	Peanut Clover	GNR	SH
<i>Trifolium bejariense</i>	Bejar Clover	G4	S1
<i>Trifolium carolinianum</i>	Carolina Clover	G5	S3
<i>Trifolium reflexum</i>	Buffalo Clover	G3G4	S3
<i>Zornia bracteata</i>	Viperina	G5?	S2
ORDER: FAGALES			
FAMILY: BETULACEAE			
<i>Corylus americana</i>	American Hazelnut	G5	S1
FAMILY: FAGACEAE			
<i>Castanea ozarkensis</i>	Ozark Chinquapin	GNR	S1
<i>Quercus arkansana</i>	Arkansas Oak	G3	S2
<i>Quercus coccinea</i>	Scarlet Oak	G5	S1
<i>Quercus imbricaria</i>	Shingle Oak	G5	S1
<i>Quercus laevis</i>	Turkey Oak	G5	S1
<i>Quercus macrocarpa</i>	Bur Oak	G5	S1
<i>Quercus oglethorpensis</i>	Oglethorpe's Oak	G3	S1
<i>Quercus rubra</i>	Northern Red Oak	G5	S2
<i>Quercus durandii</i>	Durand Oak	G4G5	S1
ORDER: GENTIANALES			
FAMILY: APOCYNACEAE			
<i>Amsonia ludoviciana</i>	Louisiana Bluestar	G3	S3
<i>Asclepias humistrata</i>	Pinewoods Milkweed	G4G5	SH
<i>Asclepias incarnata</i>	Swamp Milkweed	G5	S2
<i>Asclepias michauxii</i>	Michaux's Milkweed	G4G5	S2
<i>Asclepias purpurascens</i>	Purple Milkweed	G4G5	S1
<i>Asclepias rubra</i>	Red Milkweed	G4G5	S3
<i>Asclepias stenophylla</i>	Narrow-leaved Milkweed	G4G5	SH
<i>Matelea cynanchoides</i>	Prairie Milkvine	G4G5	S1
FAMILY: GELSEMIACEAE			
<i>Gelsemium rankinii</i>	Rankin's Trumpet-flower	G5	S2

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: GENTIANACEAE			
<i>Bartonia paniculata</i> ssp. <i>texana</i>	Texas Screwstem	G2G3	S1
<i>Bartonia verna</i>	White Screwstem	G5?	S3
<i>Gentiana villosa</i>	Striped Gentian	G4	S2
<i>Obolaria virginica</i>	Virginia Pennywort	G5	S2
<i>Sabatia arenicola</i>	Sand Rose-gentian	G3G5	S1
ORDER: GERANIALES			
FAMILY: GERANIACEAE			
<i>Geranium maculatum</i>	Wild Crane's-bill	G5	S1
ORDER: HALORAGALES			
FAMILY: HALORAGACEAE			
<i>Myriophyllum laxum</i>	Loose-flowered Water-milfoil	G3	S1
ORDER: ILLICIALES			
FAMILY: SCHISANDRACEAE			
<i>Schisandra glabra</i>	Bay Starvine	G3	S3
ORDER: JUGLANDALES			
FAMILY: JUGLANDACEAE			
<i>Carya pallida</i>	Sand Hickory	G5	S1
ORDER: LAMIALES			
FAMILY: BORAGINACEAE			
<i>Hackelia virginiana</i>	Virginia Stickseed	G5	S3
<i>Lithospermum canescens</i>	Hoary Puccoon	G5	S1
<i>Lithospermum incisum</i>	Narrowleaved Puccoon	G5	S1
FAMILY: LAMIACEAE			
<i>Clinopodium georgianum</i>	Georgia Savory	G4	S2
<i>Collinsonia canadensis</i>	Canada Horsebalm	G5	S2?
<i>Collinsonia punctata</i>	Florida Horsebalm	G3?	S1
<i>Monarda lindheimeri</i>	Lindheimer's Beebalm	G4	S1
<i>Physostegia correllii</i>	Correll's False Dragonhead	G2	S1
<i>Physostegia longisepala</i>	Long-sepaled False Dragonhead	G2G3	S3
<i>Scutellaria cardiophylla</i>	Heartleaf Skullcap	G4?	S2
<i>Scutellaria thieretii</i>	Thieret's Skullcap	G2Q	S2
FAMILY: PHRYMACEAE			
<i>Mimulus ringens</i>	Square-stem Monkeyflower	G5	S2
ORDER: LAURALES			
FAMILY: LAURACEAE			
<i>Lindera melissifolia</i>	Pondberry**	G3	SH
<i>Lindera subcoriacea</i>	Bog Spicebush	G3	S1
<i>Litsea aestivalis</i>	Pondspice	G3	SH

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: LINALES			
FAMILY: LINACEAE			
<i>Linum floridanum</i> var. <i>chrysocarpum</i>	Florida Yellow Flax	G5?T3?	S1
<i>Linum macrocarpum</i>	Spring Hill Flax	G2	S1
<i>Linum sulcatum</i>	Grooved Yellow Flax	G5	S1
ORDER: MAGNOLIALES			
FAMILY: MAGNOLIACEAE			
<i>Magnolia pyramidata</i>	Pyramid Magnolia	G4	S2
ORDER: MALPIGHIALES			
FAMILY: HYPERICACEAE			
<i>Hypericum brachyphyllum</i>	Coastal Plain St. John's Wort	G5	S3
<i>Hypericum pseudomaculatum</i>	Large Spotted St. John's Wort	G5?	S1
<i>Hypericum sphaerocarpum</i>	Round-seed St. John's Wort	G5	S2
<i>Hypericum stragulum</i>	Straggling St. John's Wort	G5	SH
<i>Hypericum suffruticosum</i>	Pineland St. John's Wort	G4G5	SH
<i>Hypericum virgatum</i>	Coppery St. John's Wort	G4?	SH
ORDER: MALVALES			
FAMILY: MALVACEAE			
<i>Callirhoe alcaeoides</i>	Clustered Poppy-mallow	G5?	S1
<i>Callirhoe digitata</i>	Fringed Poppy-mallow	G4	S1
<i>Callirhoe involucrata</i>	Purple Poppy-mallow	G5	SH
<i>Hibiscus leucophyllus</i>	White-Leaf Prairie Hibiscus	GNR	S1
<i>Sida elliotii</i>	Elliott's Sida	G4G5	SH
ORDER: MYRICALES			
FAMILY: MYRICACEAE			
<i>Morella inodora</i>	Odorless Bayberry	G4	S2
ORDER: MYRTALES			
FAMILY: LYTHRACEAE			
<i>Didiplis diandra</i>	Water-purslane	G3G4	S1
FAMILY: MELASTOMATACEAE			
<i>Rhexia nashii</i>	Nash's Meadow-beauty	G5	S2
FAMILY: ONAGRACEAE			
<i>Circaea canadensis</i>	Canada Enchanter's-nightshade	G5	S2
<i>Ludwigia alata</i>	Winged Seedbox	G3G5	S1
<i>Ludwigia microcarpa</i>	Small-fruit Seedbox	G5	S1
<i>Ludwigia sphaerocarpa</i>	Grapefruit Primrose-willow	G4	S1
<i>Oenothera heterophylla</i>	Sandhill Evening-primrose	G4	S3

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: ONAGRACEAE (cont.)			
<i>Oenothera rhombipetala</i>	Four-point Evening Primrose	G4G5	S1
<i>Oenothera sessilis</i>	Prairie Evening Primrose	G2	S1
<i>Oenothera spachiana</i>	Spach's Evening-primrose	G5	S3
FAMILY: THYMELAEACEAE			
<i>Dirca palustris</i>	Eastern Leatherwood	G5	S1
ORDER: NEPENTHALES			
FAMILY: DROSERACEAE			
<i>Drosera intermedia</i>	Spoonleaf Sundew	G5	S2
<i>Drosera tracyi</i>	Tracy's Sundew	G3G4	SH
FAMILY: SARRACENIACEAE			
<i>Sarracenia psittacina</i>	Parrot Pitcher Plant	G4	S3
<i>Sarracenia rosea</i>	Rosy Pitcher Plant	G3	SH
ORDER: PAPAVERALES			
FAMILY: PAPAVERACEAE			
<i>Corydalis flavula</i>	Yellow Fumewort	G5	S2
<i>Sanguinaria canadensis</i>	Bloodroot	G5	S2
ORDER: PLANTAGINALES			
FAMILY: PLANTAGINACEAE			
<i>Collinsia violacea</i>	Violet Blue-eyed Mary	G4	SH
<i>Gratiola floridana</i>	Florida Hedge-hyssop	G4	SH
<i>Gratiola ramosa</i>	Branched Hedge-hyssop	G4G5	S1
<i>Gratiola torreyi</i>	Yellow Hedge-hyssop	G3	S1
<i>Penstemon murrayanus</i>	Cupleaf Beardtongue	G4	S1
<i>Plantago patagonica</i>	Woolly Plantain	G5	S2
<i>Veronicastrum virginicum</i>	Culver's-root	G4	SH
ORDER: PODOSTEMALES			
FAMILY: PODOSTEMACEAE			
<i>Podostemum ceratophyllum</i>	Riverweed	G4	S1
ORDER: POLYGALALES			
FAMILY: POLYGALACEAE			
<i>Asemeia grandiflora</i>	Showy Milkwort	G5?	S2
<i>Polygala boykinii</i>	Boykin's Milkwort	G4	S1
<i>Polygala brevifolia</i>	Littleleaf Milkwort	G4G5	S1
<i>Polygala chapmanii</i>	Chapman's Milkwort	G3G5	S1
<i>Polygala crenata</i>	Scalloped Milkwort	G4?	S2
<i>Polygala hookeri</i>	Hooker's Milkwort	G3	S1

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: POLYGONALES			
FAMILY: POLYGONACEAE			
<i>Eriogonum longifolium</i>	Longleaved Wild-buckwheat	G4	S2
<i>Eriogonum multiflorum</i>	Many-flowered Wild-buckwheat	G5	S3
<i>Polygonella americana</i>	American Jointweed	G5	S2
<i>Polygonella polygama</i>	October-flower	G4	S1
ORDER: PRIMULELES			
FAMILY: PRIMULACEAE			
<i>Primula meadia</i>	Eastern Shooting Star	G5	S2
<i>Samolus ebracteatus</i> var. <i>alysoides</i>	Limewater Brookweed	G4G5T2T4	S1
ORDER: RANUNCULALES			
FAMILY: RANUNCULACEAE			
<i>Actaea pachypoda</i>	White Baneberry	G5	S2
<i>Anemone berlandieri</i>	Southern Thimbleweed	G4G5	S2
<i>Anemone virginiana</i>	Virginia Anemone	G5	S1
<i>Clematis arenicola</i>	West Gulf Leatherflower	GNR	S2
<i>Clematis catesbyana</i>	Satin-curls	G5	S1
<i>Clematis glaucophylla</i>	Whiteleaf Leatherflower	G4?	S1
<i>Ranunculus flabellaris</i>	Yellow Water-crowfoot	G5	S1
<i>Ranunculus hispidus</i>	Hairy Buttercup	G5	SH
<i>Thalictrum amphibolum</i>	Waxyleaf Meadowrue	G5	S1
<i>Xanthorhiza simplicissima</i>	Yellowroot	G5	S1
ORDER: RHAMNALES			
FAMILY: RHAMNACEAE			
<i>Ceanothus herbaceus</i>	Prairie Redroot	G5	S1
<i>Endotropis lanceolata</i>	Lanceleaved Buckthorn	G5	SH
ORDER: ROSALES			
FAMILY: CHRYSOBALANACEAE			
<i>Geobalanus oblongifolius</i>	Gopher-apple	G4G5	SH
FAMILY: CRASSULACEAE			
<i>Sedum nuttallii</i>	Yellow Stonecrop	G5	S1
FAMILY: GROSSULARIACEAE			
<i>Ribes curvatum</i>	Granite Gooseberry	G4	S2
FAMILY: HYDRANGEACEAE			
<i>Hydrangea arborescens</i>	Wild Hydrangea	G5	S2

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: ROSACEAE			
<i>Agrimonia incisa</i>	Incised Groovebur	G3G4	S1
<i>Crataegus ashei</i>	Ashe Hawthorn	G2	SH
<i>Crataegus brachyacantha</i>	Blueberry Hawthorn	G4	S3
<i>Crataegus florens</i>	Mississippi Hawthorn	GNR	SH
<i>Crataegus mendosa</i>	Albertville Hawthorn	G3Q	SH
<i>Crataegus pruinosa</i>	Frosted Hawthorn	G5T5	S2
<i>Crataegus pulcherrima</i>	Beautiful Hawthorn	G2G4	S1
<i>Crataegus triflora</i>	Three-flowered Hawthorn	G2G3	S1
<i>Crataegus uniflora</i>	Dwarf Hawthorn	G5	S3
<i>Gillenia stipulata</i>	American Ipecac	G5	S3
<i>Prunus gracilis</i>	Oklahoma Plum	G4G5	S2
<i>Prunus munsoniana</i>	Wild Goose Plum	G5	S3
<i>Rosa setigera</i>	Climbing Prairie Rose	G5	S2
FAMILY: SAXIFRAGACEAE			
<i>Heuchera americana</i>	American Alumroot	G5	S2
<i>Micranthes texana</i>	Texas Saxifrage	G4	S1
<i>Micranthes virginianensis</i>	Virginia Saxifrage	G5	SH
ORDER: RUBIALES			
FAMILY: RUBIACEAE			
<i>Galium circaezans</i>	Forest Bedstraw	G5	S3
<i>Galium bermudense</i>	Coastal Bedstraw	G5	S2
<i>Galium orizabense</i> ssp. <i>laevicaule</i>	Smoothstem Bedstraw	G5?T4?	S1
<i>Galium virgatum</i>	Southwestern Bedstraw	G4G5	S2
<i>Houstonia lanceolata</i>	Purple Bluet	G5	S2
<i>Houstonia procumbens</i>	Roundleaf Bluet	G5	S2
ORDER: SALICALES			
FAMILY: SALICACEAE			
<i>Salix caroliniana</i>	Carolina Willow	G5	SH
<i>Salix humilis</i> var. <i>humilis</i>	Prairie Willow	G5T5	S1
<i>Salix occidentalis</i>	Dwarf Prairie Willow	G5	S2
ORDER: SAPINDALES			
FAMILY: RUTACEAE			
<i>Zanthoxylum americanum</i>	Northern Prickly-ash	G5	S1
FAMILY: SAPINDACEAE			
<i>Acer leucoderme</i>	Chalk Maple	G5	S2
FAMILY: STAPHYLEACEAE			
<i>Staphylea trifolia</i>	American Bladdernut	G5	SH

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: SCROPHULARIALES			
FAMILY: ACANTHACEAE			
<i>Justicia americana</i>	American Water-willow	G5	S2
<i>Ruellia noctiflora</i>	Night-flowering Wild-petunia	G3?	S1
<i>Ruellia pinetorum</i>	Pineland Wild-petunia	G5	S1
FAMILY: LENTIBULARIACEAE			
<i>Pinguicula lutea</i>	Yellow Butterwort	G4G5	S2
<i>Utricularia juncea</i>	Southern Bladderwort	G5	S3
<i>Utricularia purpurea</i>	Purple Bladderwort	G5	S2
FAMILY: OLEACEAE			
<i>Forestiera ligustrina</i>	Upland Swamp Privet	G4G5	S3
FAMILY: OROBANCHACEAE			
<i>Agalinis aphylla</i>	Coastal Plain False Foxglove	G3G4	S1
<i>Agalinis caddoensis</i>	Caddo Parish Agalinis	GH	SX
<i>Agalinis filicaulis</i>	Thread-stem False Foxglove	G3	S2
<i>Agalinis linifolia</i>	Flax-leaf False Foxglove	G4?	S2
<i>Agalinis skinneriana</i>	Pale False Foxglove	G3G4	S1
<i>Aphyllon uniflorum</i>	One-flowered Broomrape	G5	S1
<i>Castilleja coccinea</i>	Scarlet Indian-paintbrush	G5	SH
<i>Dasistoma macrophyllum</i>	Mullein Foxglove	G4	SH
<i>Macranthera flammea</i>	Bog Flame Flower	G3	S2
<i>Schwalbea americana</i>	American Chaffseed**	G2	S1
ORDER: SOLANALES			
FAMILY: CONVULVACEAE			
<i>Stylisma patens</i>	Coastal Plain Dawnflower	G5	S1
<i>Stylisma villosa</i>	Hairy Dawnflower	G4	S1
FAMILY: HYDROPHYLLACEAE			
<i>Phacelia glabra</i>	Smooth Scorpionweed	G4	S2
<i>Phacelia strictiflora</i> var. <i>robinsonii</i>	Sandhills Scorpionweed	G5T4	S2
FAMILY: MENYANTHACEAE			
<i>Nymphoides cordata</i>	Little Floatingheart	G5	SH
FAMILY: POLEMONIACEAE			
<i>Phlox pilosa</i> ssp. <i>pulcherrima</i>	Lundell's Phlox	G5TNR	S1

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: SOLANACEAE			
<i>Calliphysalis carpenteri</i>	Carpenter's Ground-cherry	G3	S1
<i>Physalis angustifolia</i>	Coastal Ground-cherry	G3G4	S1
<i>Physalis macrocarpa</i>	Large-seed Ground-cherry	G2G3	S1
<i>Solanum dimidiatum</i>	Western Horse-nettle	G5	S2S3
<i>Solanum pseudogracile</i>	Glowing Nightshade	G4	S1
ORDER: THEALES			
FAMILY: THEACEAE			
<i>Stewartia malacodendron</i>	Silky Camellia	G4	S2
ORDER: URTICALES			
FAMILY: URTICACEAE			
<i>Parietaria praetermissa</i>	Clustered Pellitory	G3G4	S1
ORDER: VIOLALES			
FAMILY: CISTACEAE			
<i>Crocanthemum rosmarinifolium</i>	Rosemary Rockrose	G4	S2
<i>Lechea minor</i>	Thymeleaf Pinweed	G5	S2
<i>Lechea san-sabeana</i>	San Saba Pinweed	G4	S1
<i>Lechea pulchella</i> var. <i>ramosissima</i>	Leggett's Pinweed	G5	S1
FAMILY: VIOLACEAE			
<i>Viola pubescens</i>	Downy Yellow Violet	G5	S1
CLASS: MONOCOTYLEDONEAE			
ORDER: ALISMATALES			
FAMILY: ALISMATACEAE			
<i>Helanthium tenellum</i>	Dwarf Burhead	G5?	SH
<i>Sagittaria chapmanii</i>	Chapman's Arrowhead	G3?	SH
FAMILY: TOFIELDIACEAE			
<i>Triantha racemosa</i>	Coastal False Asphodel	G5	S2S3
ORDER: ARALES			
FAMILY: ARACEAE			
<i>Peltandra sagittifolia</i>	Spoon-flower	G3G4	S1
ORDER: ARECALES			
FAMILY: ARECACEAE			
<i>Serenoa repens</i>	Saw Palmetto	G4G5	S1
ORDER: ASPARAGALES			
FAMILY: AMARYLLIDACEAE			
<i>Zephyranthes chlorosolen</i>	Evening Rainlily	G5	S2

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: ASPARAGACEAE			
<i>Camassia scilloides</i>	Atlantic Camas	G5	S3
<i>Maianthemum racemosum</i>	Solomon's-plume	G5	SH
<i>Schoenolirion wrightii</i>	Texas Sunnybell	G3	S2
<i>Yucca cernua</i>	Nodding Yucca	G2	S1
FAMILY: HYPOXIDACEAE			
<i>Hypoxis curtissii</i>	Swamp Stargrass	G4?	S2
ORDER: COMMELINALES			
FAMILY: COMMELINACEAE			
<i>Tradescantia reverchonii</i>	Reverchon's Spiderwort	G4	S3
<i>Tradescantia subaspera</i>	Broad-leaved Spiderwort	G5	S1
FAMILY: MAYACACEAE			
<i>Mayaca fluviatilis</i>	Bog Moss	G5	S2
FAMILY: XYRIDACEAE			
<i>Xyris fimbriata</i>	Fringed Yellow-eyed-grass	G5	S3
<i>Xyris louisianica</i>	Kral's Yellow-eyed-grass	G2G3	S2
<i>Xyris platylepis</i>	Tall Yellow-eyed-grass	G5	S2
<i>Xyris scabrifolia</i>	Harper's Yellow-eyed-grass	G3	S2
<i>Xyris serotina</i>	Acid-swamp Yellow-eyed-grass	G3G4	S1
<i>Xyris smalliana</i>	Small's Yellow-eyed-grass	G4G5	S1
<i>Xyris stricta</i>	Pineland Yellow-eyed-grass	G4	S2
<i>Xyris torta</i>	Twisted Yellow-eyed-grass	G5	S2
ORDER: CYPERALES			
FAMILY: CYPERACEAE			
<i>Carex arkansana</i>	Arkansas Caric Sedge	G4	S1
<i>Carex bushii</i>	Bush's Sedge	G5	S2
<i>Carex decomposita</i>	Cypress-knee Sedge	G3G4	S3
<i>Carex fissa</i> var. <i>aristata</i>	Hammock Sedge	G4?T4?	S1T1
<i>Carex granularis</i>	Limestone Meadow Sedge	G5	S2
<i>Carex hirsutella</i>	Hairy Green Sedge	G5	S1
<i>Carex meadii</i>	Mead's Sedge	G5	S3
<i>Carex microdonta</i>	Small-toothed Caric Sedge	G4	S3
<i>Carex oblita</i>	Southern Dark-green Sedge	G4	S1
<i>Carex ozarkana</i>	Ozark Sedge	G4	S1
<i>Carex stricta</i>	Tussock Sedge	G5	SH
<i>Carex styloflexa</i>	Bent Sedge	G5?	S3
<i>Carex tenax</i>	Wire Sedge	G4	S3

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: CYPERALES (cont.)			
FAMILY: CYPERACEAE			
<i>Carex turgescens</i>	Swollen Sedge	G4G5	S1
<i>Cyperus cephalanthus</i>	Cryptic Flatsedge	G2?	S2
<i>Cyperus distinctus</i>	Marshland Flatsedge	G4	S1
<i>Cyperus grayoides</i>	Illinois Flatsedge	G3G4	S3
<i>Cyperus subsquarrosus</i>	Dwarf Bulrush	G5	S1
<i>Dulichium arundinaceum</i>	Threeway Sedge	G5	S2
<i>Eleocharis ambigens</i>	Ambiguous Spikerush	G4G5	S2
<i>Eleocharis atropurpurea</i>	Purple Spikerush	G4G5	S1
<i>Eleocharis bicolor</i>	Two-tone Spikerush	GNR	S1
<i>Eleocharis compressa</i>	Flat-Stem Spikesedge	G5	SH
<i>Eleocharis elongata</i>	Slim Spikesedge	G5?	S2
<i>Eleocharis engelmannii</i>	Engelmann's Spikerush	G5	S1
<i>Eleocharis geniculata</i>	Canada Spikesedge	G5	S1
<i>Eleocharis lanceolata</i>	Ozark Spikesedge	G4G5	S1
<i>Eleocharis melanocarpa</i>	Black-fruited Spikesedge	G4	S1
<i>Eleocharis minima</i>	Small Spikesedge	GNR	SH
<i>Eleocharis radicans</i>	Rooted Spikesedge	G5	S1
<i>Eleocharis rostellata</i>	Walking Spikesedge	G5	S1
<i>Fuirena scirpoidea</i>	Southern Umbrella-sedge	G5	S1
<i>Fuirena simplex</i> var. <i>aristulata</i>	Western Umbrella-sedge	G5T4	S1
<i>Rhynchospora baldwinii</i>	Baldwin's Beaksedge	G4	S1
<i>Rhynchospora capitellata</i>	Brownish Beaksedge	G5	S1
<i>Rhynchospora chalarocephala</i>	Loose-head Beaksedge	G5	S2
<i>Rhynchospora chapmanii</i>	Chapman's Beaksedge	G4	S3
<i>Rhynchospora ciliaris</i>	Ciliate Beaksedge	G4	S3
<i>Rhynchospora compressa</i>	Flat-fruit Beaksedge	G4	S2
<i>Rhynchospora debilis</i>	Savanna Beaksedge	G4?	S1
<i>Rhynchospora decurrens</i>	Swamp-forest Beaksedge	G3G4	SH
<i>Rhynchospora divergens</i>	Spreading Beaksedge	G4	S1
<i>Rhynchospora inundata</i>	Narrow-fruit Horned Beaksedge	G4	S1
<i>Rhynchospora leptocarpa</i>	Slender-fruit Beaksedge	G3	S1
<i>Rhynchospora macra</i>	Large Beaksedge	G3G4	S3

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: CYPERALES (cont.)			
FAMILY: CYPERACEAE			
<i>Rhynchospora microcarpa</i>	Southern Beaksedge	G5	S3
<i>Rhynchospora microcephala</i>	Small-headed Beaksedge	G5T5	S2
<i>Rhynchospora nitens</i>	Short-beak Beaksedge	G4	S3
<i>Rhynchospora scirpoides</i>	Long-beak Beaksedge	G4	S3
<i>Rhynchospora stenophylla</i>	Coastal Plain Beaksedge	G4	S1
<i>Rhynchospora tracyi</i>	Tracy's Beaksedge	G4	S1
<i>Rhynchospora pinetorum</i>	Small's Beaksedge	G3G4	S1
<i>Schoenoplectus deltarum</i>	Delta Bulrush	G3G4	S3
<i>Schoenoplectus etuberculatus</i>	Canby's Bulrush	G3G4	S1
<i>Scirpus divaricatus</i>	Spreading Bulrush	G4	S2
<i>Scleria bellii</i>	Smooth-seed Hairy Nutrush	G3	S1
<i>Scleria nitida</i>	Shining Nutrush	G4	SH
<i>Scleria verticillata</i>	Low Nutsedge	G5	S1
FAMILY: POACEAE			
<i>Andropogon cretaceus</i>	Purple Bluestem	G3G5	S1
<i>Andropogon mohrii</i>	Mohr's Bluestem	G4?	S1
<i>Andropogon perangustatus</i>	Narrowleaf Bluestem	G4	S2
<i>Anthenantia texana</i>	Texas Silkyscale	G3G4	S1
<i>Aristida palustris</i>	Longleaf Three-awn	G4	S2
<i>Bouteloua curtipendula</i>	Sideoats Grama	G5	S1
<i>Bouteloua rigidiseta</i>	Texas Grama	G5	S1
<i>Bromus pubescens</i>	Common Eastern Brome	G5	S2
<i>Cenchrus myosuroides</i>	Big Sandbur	G4	S1
<i>Cenchrus tribuloides</i>	Dune Sandbur	G5	S2
<i>Chasmanthium ornithorhynchum</i>	Birdbill Spike Grass	G4	S2
<i>Coelorachis tessellata</i>	Lattion Jointgrass	G5?	S2
<i>Coleataenia tenera</i>	Southern Narrow Panic Grass	G4	S2
<i>Danthonia sericea</i>	Silky Oatgrass	G5?	S2
<i>Dichanthelium caeruleum</i>	Blue Witchgrass	G3	S1
<i>Dichanthelium chamaelonche</i>	Carpet Witchgrass	GNR	S1
<i>Dichanthelium clandestinum</i>	Deer-tongue Witchgrass	G5	S2

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: POACEAE (cont.)			
<i>Dichanthelium fusiforme</i>	Spindle-fruited Witchgrass	G5?	S1
<i>Dichanthelium linearifolium</i>	Slender Leaf Witchgrass	G5	S2
<i>Dichanthelium strigosum</i> var. <i>glabrescens</i>	Hairless Witchgrass	G5T4T5	S1
<i>Dichanthelium strigosum</i> var. <i>leucoblepharis</i>	Dwarf Witchgrass	G5T3T5	S1
<i>Distichlis littoralis</i>	Key Grass	G4G5	S1
<i>Echinochloa polystachya</i>	River Grass	G5	S2
<i>Eragrostis curtipedicellata</i>	Gummy Lovegrass	G5	S3
<i>Erianthus brevibarbis</i>	Short-beard Plumegrass	G3G5	S1
<i>Eriochloa punctata</i>	Louisiana Cupgrass	G5	S2
<i>Festuca paradoxa</i>	Cluster Fescue	G5	S3
<i>Glyceria arkansana</i>	Arkansas Mannagrass	G4	S3
<i>Glyceria septentrionalis</i>	Floating Mannagrass	G5	S1
<i>Glyceria striata</i>	Fowl Mannagrass	G5	S1
<i>Koeleria macrantha</i>	June Grass	G5	S1
<i>Muhlenbergia sericea</i>	Southern Hairgrass	G5?	S1
<i>Muhlenbergia paniculata</i>	Tumble Grass	G5	S1
<i>Panicum flexile</i>	Wiry Witch Grass	G5	S2
<i>Panicum filipes</i>	Hall's Panic Grass	G5T5	S1
<i>Paspalum monostachyum</i>	Gulfdune Paspalum	G4?	S2
<i>Poa sylvestris</i>	Woodland Bluegrass	G5	S1
<i>Schizachyrium maritimum</i>	Gulf Bluestem	G3G4Q	S1
<i>Spartina pectinata</i>	Prairie Cord Grass	G5	S2
<i>Sporobolus neglectus</i>	Small Dropseed	G5	S1
<i>Sporobolus silveanus</i>	Silveus Dropseed	G4	S1
<i>Tridens carolinianus</i>	Carolina Fluff Grass	G3G4	S2
<i>Triplasis americana</i>	Perennial Sand Grass	G5	S1
<i>Uniola paniculata</i>	Sea Oats	G5	S2
ORDER: DIOSCOREALES			
FAMILY: NARTHECIACEAE			
<i>Lophiola aurea</i>	Goldcrest	G4	S2S3
ORDER: ERIOCAULALES			
FAMILY: ERIOCAULACEAE			
<i>Eriocaulon texense</i>	Texas Pipewort	G4	S3
<i>Lachnocaulon digynum</i>	Pineland Bogbutton	G3G4	S3

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: HYDROCHARITALES			
FAMILY: HYDROCHARITACEAE			
<i>Halophila engelmannii</i>	Engelmann's Sea-grass	G3G5	S1
<i>Thalassia testudinum</i>	Turtle-grass	G4G5	S2?
ORDER: JUNCALES			
FAMILY: JUNCACEAE			
<i>Juncus longii</i>	Long's Rush	G3Q	S1
<i>Juncus paludosus</i>	Swamp Rush	G3G4	S1
<i>Luzula acuminata</i> var. <i>carolinae</i>	Southern Hairy Woodrush	G5T5?	S1
ORDER: LILIALES			
FAMILY: COLCHICACEAE			
<i>Uvularia perfoliata</i>	Perfoliate Bellwort	G5	S2
<i>Uvularia sessilifolia</i>	Sessile-leaf Bellwort	G5	S2
FAMILY: HAEMODORACEAE			
<i>Lachnanthes caroliniana</i>	Carolina Redroot	G5	S3
FAMILY: IRIDACEAE			
<i>Herbertia lahue</i>	Prairie-nymph	G4G5	S1
<i>Iris nelsonii</i>	Abbeville Red Iris	G1Q	S1
<i>Nemastylis geminiflora</i>	Prairie Pleatleaf	G4	S2
FAMILY: LILIACEAE			
<i>Erythronium albidum</i>	White Trout Lily	G5	S2
<i>Lilium michauxii</i>	Carolina Lily	G4G5	S3
<i>Lilium superbum</i>	Turk's-cap Lily	G5	S1
<i>Lilium catesbaei</i>	Southern Red Lily	G4	S1
<i>Medeola virginiana</i>	Indian Cucumber-root	G5	S1
FAMILY: MELANTHIACEAE			
<i>Amianthium muscitoxicum</i>	Fly-poison	G4G5	SH
<i>Chamaelirium luteum</i>	Devil's-bit	G4G5	S2S3
<i>Stenanthium leimanthoides</i>	Pine Barren Death-camas	G2	S1
<i>Stenanthium texanum</i>	Black Death-camas	G3	S1
<i>Toxicoscordion nuttallii</i>	Nuttall's Poison Camas	G5	S1
<i>Trillium gracile</i>	Sabine River Wakerobin	G2G3	S3
<i>Trillium recurvatum</i>	Reflexed Trillium	G5	S2
<i>Trillium texanum</i>	Texas Trillium	G2	S1
FAMILY: PONTEDERIACEAE			
<i>Heteranthera missouriensis</i>	Missouri Mud-Plantain	G5?	S1
FAMILY: SMILACACEAE			
<i>Smilax auriculata</i>	Earleaf Greenbrier	G4?	S1

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: STEMONACEAE			
<i>Croomia pauciflora</i>	Croomia	G3	SH
ORDER: NAJADALES			
FAMILY: CYMODOCEACEAE			
<i>Halodule wrightii</i>	Shoal-grass	G5	S1
<i>Syringodium filiforme</i>	Manatee-grass	G4	SU
FAMILY: JUNCAGINACEAE			
<i>Triglochin striata</i>	Arrow-grass	G5	S1
FAMILY: POTAMOGETONACEAE			
<i>Potamogeton epihydrus</i>	Nuttall's Pondweed	G5	SH
<i>Potamogeton perfoliatus</i>	Claspingleaf Pondweed	G5	S1
ORDER: ORCHIDALES			
FAMILY: BURMANNIACEAE			
<i>Burmannia biflora</i>	Northern Burmannia	G4G5	S2
FAMILY: ORCHIDACEAE			
<i>Aspidogyne querceticola</i>	Little Jug Orchid	G4	S1
<i>Calopogon barbatus</i>	Bearded Grass-pink	G4?	S1
<i>Calopogon multiflorus</i>	Many-flowered Grass-pink	G3	S1
<i>Calopogon oklahomensis</i>	Oklahoma Grass-pink	G2	S1
<i>Calopogon pallidus</i>	Pale Grass-pink	G4	S2
<i>Cleisteslopsis oricamporum</i>	Spreading Pogonia	G3?	S1
<i>Corallorhiza odontorhiza</i>	Autumn Coralroot	G5	S1
<i>Cypripedium kentuckiense</i>	Southern Lady's-slipper	G3	S1
<i>Habenaria quinqueseta</i>	Long-horned Habenaria	G4G5	S1
<i>Hexalectris spicata</i>	Crested Coralroot	G5	S2
<i>Isotria verticillata</i>	Large Whorled Pogonia	G5	S2
<i>Orthochilus ecristatus</i>	Giant orchid	G4	S2
<i>Platanthera integra</i>	Yellow Fringeless Orchid	G3G4	S3
<i>Platanthera lacera</i>	Green Fringed Orchid	G5	S1
<i>Platanthera conspicua</i>	Large White Fringed Orchid	G4	S1
<i>Ponthieva racemosa</i>	Shadow-witch Orchid	G5	S2
<i>Spiranthes breviflora</i>	Texas Ladies'-tresses	G1G2	SNR
<i>Spiranthes eatonii</i>	Eaton's Ladies'-tresses	G3Q	SNR
<i>Spiranthes floridana</i>	Florida Ladies'-tresses	G1	SH
<i>Spiranthes longilabris</i>	Giant-spiral Ladies'-tresses	G3	SNR
<i>Spiranthes magnicamporum</i>	Great Plains Ladies'-tresses	G3G4	S2
<i>Spiranthes ovalis</i> var. <i>ovalis</i>	October Ladies'-tresses	G5?T3T4	S3
<i>Triphora trianthophora</i>	Nodding Pogonia	G4?	S2

Scientific Name	Common Name	G-Rank	S-Rank
ORDER: ZINGIBERALES			
FAMILY: CANNACEAE			
<i>Canna flaccida</i>	Golden Canna	G4?	S3
FAMILY: MARANTACEAE			
<i>Thalia dealbata</i>	Powdery Thalia	G4	S2
PHYLUM: BRYOPHYTA			
CLASS: BRYOPSIDA			
ORDER: ARCHIDIALES			
FAMILY: ARCHIDIACEAE			
<i>Archidium minus</i>	Small Archidium Moss	G2?	SH
ORDER: DICRANALES			
FAMILY: DICRANACEAE			
<i>Campylopus angustiretis</i>	Campylopus Moss	G2?	SNR
FAMILY: HYMENOPHYLLACEAE			
<i>Didymoglossum petersii</i>	Dwarf Filmy Fern	G4	S2
ORDER: FISSIDENTALES			
FAMILY: FISSIDENTACEAE			
<i>Fissidens amoenus</i>	Hall's Pocket Moss	G3	SH
<i>Fissidens leptophyllus</i>	Reese's Fissidens Moss	G2?	SH
<i>Fissidens scalaris</i>	Neon Fissidens Moss	G2?	SH
<i>Fissidens submarginatus</i>	Koch's Pocket Moss	G1G2	SH
ORDER: FUNARIALES			
FAMILY: EPHEMERACEAE			
<i>Micromitrium wrightii</i>	Wright's Millimetre Moss	G2?	SH
ORDER: HOOKERIALES			
FAMILY: PILOTRICHACEAE			
<i>Trachypodium hypnaceum</i>	a moss	G2?	SH
PHYLUM: FILICINOPHYTA			
CLASS: FILICOPSIDA			
ORDER: FILICALES			
FAMILY: BLECHNACEAE			
<i>Blechnum occidentale</i>	Sink-hole Fern	GNR	SH
FAMILY: DRYOPTERIDACEAE			
<i>Ctenitis submarginalis</i>	Brown-hair Comb Fern	G5	S1
<i>Dryopteris australis</i>	Southern Woodfern	GNA	SH
<i>Dryopteris celsa</i>	Log Fern	G4	S1
<i>Dryopteris ludoviciana</i>	Southern Shield Woodfern	G5	S2

TABLE 4.15. cont.

Scientific Name	Common Name	G-Rank	S-Rank
FAMILY: PTERIDACEAE			
<i>Adiantum pedatum</i>	Northern Maidenhair Fern	G5	S3
<i>Ceratopteris pteridoides</i>	Floating Antler Fern	G5?	S2
<i>Cheilanthes alabamensis</i>	Alabama Lipfern	G5	SH
<i>Myriopteris lanosa</i>	Hairy Lipfern	G5	S1
FAMILY: THELYPTERIDACEAE			
<i>Amauropelta noveboracensis</i>	New York Fern	G5	S1
<i>Cyclosorus interruptus</i>	Willdenow's Maiden Fern	G5?	S1
ORDER: POLYPODIALES			
FAMILY: ATHYRIACEAE			
<i>Deparia acrostichoides</i>	Silver False Spleenwort	G5	S2
<i>Diplazopsis pycnocarpa</i>	Glade Fern	G5	S2
<i>Diplazium lonchophyllum</i>	Lanceleaved Glade Fern	G3G5	S1
FAMILY: CYSTOPTERIDACEAE			
<i>Cystopteris protrusa</i>	Lowland Bladderfern	G5	S3
CLASS: OPHIOGLOSSOPSIDA			
ORDER: OPHIOGLOSSALES			
FAMILY: OPHIOGLOSSACEAE			
<i>Sceptridium jenmanii</i>	Alabama Grape Fern	G3G4	S2
PHYLUM: HEPATOPHYTA			
CLASS: JUNGERMANNIOPSIDA			
ORDER: JUNGERMANNIALES			
FAMILY: LEJEUNAECEAE			
<i>Cololejeunea setiloba</i>	a liverwort	G2?	SNR
PHYLUM: LYCOPHYTA			
CLASS: ISOETOPSIDA			
ORDER: ISOETALES			
FAMILY: ISOETACEAE			
<i>Isoetes louisianensis</i>	Louisiana Quillwort**	G2G3	S2
ORDER: SELAGINELLALES			
FAMILY: SELAGINELLACEAE			
<i>Bryodesma corallinum</i>	Sand Spikemoss	G4	S3
<i>Selaginella ludoviciana</i>	Gulf Spikemoss	G3G4	S1
CLASS: LYCOPODIOPSIDA			
ORDER: LYCOPODIALES			
FAMILY: LYCOPODIACEAE			
<i>Palhinhaea cernua</i>	Staghorn Clubmoss	G5	S2

*Federally Threatened

**Federally Endangered

PLANT THREATS

Protection of Louisiana's native plant species is essential for preserving the integrity of natural communities that support habitats and resources for all living things. Plant SGCN are perpetually threatened by anthropogenic factors both directly and indirectly.

Habitat loss, destruction, and alteration are the greatest threats to plant SGCN. Conversion of natural areas into urban and suburban developments continues to reduce or eliminate populations of imperiled species. Agricultural practices can also reduce persistence of rare plants through eutrophication (i.e. increased nutrient loads), non-selective herbicide use, and overgrazing. In addition, some commercial forestry practices (e.g., site conversion to pine plantation) and site preparation practices (e.g., bedding and herbicide) can reduce herbaceous undergrowth resulting in decreased biodiversity. Restoration of agricultural land to its historical state is often very difficult due to land-leveling and tilling, which alter the natural hydrology and topography, cause soil degradation, and cause the loss of microbiota as well as the seedbank (Kraut-Cohen et al. 2020). Several plant SGCN occur in communities that are dependent on fire. However, with European settlement came fire suppression, which disrupted natural burn regimes and, consequently, reduced grassland and other open habitats and plant populations (Fowler and Konopik 2007). Efforts are underway to return fire to the landscape, but inadequate burning and inappropriate restoration practices (e.g., use of incorrect ecotypes) and out-of-kind compensatory mitigation can hinder recovery of imperiled fire-driven systems (e.g., prairies, savannas, woodlands), which covered nearly half of Louisiana prior to European settlement.

Climate change exacerbates existing threats and increases the vulnerability of plant SGCN and their habitats. An expected increase in the frequency and intensity of extreme weather events will likely destroy habitats, displacing or severely impacting sensitive species. In addition, these events can contribute to erosion, sedimentation, and salinity changes which can negatively affect plants and natural communities (Fagherazzi 2019). As the climate changes, organisms with mutualistic relationships with native species may decline as well, impacting pollination and seed dispersal for many plant species (Fontúrbel et al. 2021). A warming climate will also likely increase potential for invasive species to colonize new areas and to reach saturation levels in existing infestations.

Louisiana is particularly susceptible to invasive species due to the state's subtropical climate with abundant rainfall and mild winters, favorable conditions for many non-native plants. Without proper control, invasive plants often outcompete native plants for resources and disrupt ecological functions within natural communities. Non-native species in the horticultural trade such as Chinese Tallow Tree, Chinese Privet (*Ligustrum sinense*), and Coral Ardisia (*Ardisia crenata*) can readily spread to natural areas, resulting in a loss of diversity. The movement of firewood and other plant materials (e.g., nursery stock) can also spread pests

such as the Emerald Ash Borer (EAB; *Agrilus planipennis*), an exotic beetle that destroys ash trees (*Fraxinus* spp.), and the Redbay Ambrosia Beetle (*Xyleborus glabratus*), a prolific vector of Laurel Wilt disease (*Raffaelea lauricola*). The transportation of hay has also led to the spread of invasive plants such as Cogon Grass (*Imperata cylindrica*) and Johnson Grass (*Sorghum halepense*). Invasive mammals such as Nutria and Feral Hogs are also injurious to sensitive plant populations and can decimate natural communities.

Public apathy and failure to recognize the ecological value of plants, also known as plant blindness (Wandersee and Schussler 1998), can cause reduced efforts for plant conservation. For example, charismatic organisms are often prioritized, and, consequently, plants, especially those lacking noticeable aesthetic forms, are often neglected. Those plant species that are not neglected may suffer from over-collection in the wild by well-intentioned members of the public. Such action, in an effort to “conserve” imperiled plants, will likely result in failure due to a lack of fully understanding the specific conditions needed for these species to survive. In addition, the overharvesting of native plants can cause deleterious impacts to sensitive populations, and unsustainable foraging practices should also be discouraged. Development of informational materials and outreach programs that address the crucial and influential roles native plants have on natural community health and ecological functions is critically important for the conservation of plant species. In addition, promoting responsible conservation practices and encouraging cooperation with partners and the public are essential to ensure the survival and persistence of plant SGCN.

PLANT RESEARCH NEEDS AND CONSERVATION ACTIONS

Research needs and conservation needs and actions for plants are listed in *Table 4.16*.

Plant General Research Needs and Conservation Actions

- Estimate current and historical extent of natural communities supporting each plant SGCN.

- Promote, restore, and expand quality habitat for all plant SGCN.
- Conduct population monitoring on all plant SGCN prioritizing State Historical (SH), S1 species, and SGCN with imminent threats to local populations.
- Identify reintroduction sites for all federally listed, State Historical (SH), and S1 plant SGCN.
- Work with partners to develop seed banks and seed supply with emphasis on plant SGCN located within imperiled or critically imperiled natural communities.
- Work with partners to minimize the introduction and spread of pests, emerging diseases, and invasive species detrimental to SGCN and natural communities.
- Promote monitoring for pests such as EAB and emerging diseases such as Laurel Wilt (*Harringtonia lauricola*) in plant SGCN populations.
- Promote the development of outreach materials for identification of pests, diseases, and invasive species impacting plant SGCN.
- Encourage the reporting of pests, diseases, and invasive species through online reporting, citizen science programs, and others.
- Develop plant rescue protocols to ensure rescued materials are sent to appropriate end users such as ethical propagators, research facilities, and scientific collectors; when relocations are warranted, rescued plant materials should be used at approved relocation sites.
- Promote the education of sustainable harvest and use of native plants.
- Support efforts to incorporate native vegetation in gardens and landscaping at all scales (e.g., residential, commercial, municipal, etc.)
- Encourage the passage of legislation that allows additional protection for native vegetation and natural communities.
- Encourage the acquisition of properties for conservation of plant SGCN and natural communities.
- Incentivize the use of native plants on the landscape.
- Encourage the use of appropriate genotypes in restoration projects.



(LEFT) Texas Coneflower (*Rudbeckia texana*) (RIGHT) Purple Coneflower (*Echinacea purpurea*)

Plant Species-specific Research Needs and Conservation Actions

American Chaffseed

- Implement the federal recovery plan (USFWS 2015 and 2019).

Earth Fruit

- Implement the federal recovery plan (USFWS 1993).

Pondberry

- Implement the federal recovery plan (USFWS 1993).

Louisiana Quillwort

- Implement the federal recovery plan (USFWS 1996).



Texas Trillium
(*Trillium texanum*)



Hairy Lipfern (*Myriopteris lanosa*)

TABLE 4.16. Plant Action Table

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
a lichen	<i>Fouragea filicina</i>	●	●	●	●	●			
a lichen	<i>Helminthocarpon leprevostii</i>	●	●	●	●	●			
a lichen	<i>Phyllopsora halei</i>	●	●	●	●	●			
Hooker's Eryngo	<i>Eryngium hookeri</i>	●	●	●	●	●	●	●	
Eastern Yampah	<i>Perideridia americana</i>	●		●	●	●	●	●	
Prairie Parsley	<i>Polytaenia nuttallii</i>	●				●	●		
Texas Bishopweed	<i>Ptilimnium texense</i>	●		●		●	●		
Maryland Black Snakeroot	<i>Sanicula marilandica</i>	●		●		●			
Clustered Black Snakeroot	<i>Sanicula odorata</i>	●	●	●		●			
Hemlock Water-parsnip	<i>Sium suave</i>	●		●		●			
Yellow Pimpernel	<i>Taenidia integerrima</i>	●				●			
Meadowparsnip	<i>Thaspium chapmanii</i>	●		●			●	●	

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
American Ginseng	<i>Panax quinquefolius</i>	•	•	•		•			•
Canada Wild Ginger	<i>Asarum canadense</i>	•	•	•	•	•			
Single-head Pussytoes	<i>Antennaria solitaria</i>	•		•		•			
Broom-bush Baccharis	<i>Baccharis dioica</i>	•	•	•	•	•			
Apalachicola Doll's-daisy	<i>Boltonia apalachicolensis</i>	•	•	•	•	•			
Arkansas Leastdaisy	<i>Chaetopappa asteroides</i>	•	•	•	•		•	•	
Cottony Goldenaster	<i>Chrysopsis hyssopifolia</i>	•	•	•			•		
Le Conte's Thistle	<i>Cirsium lecontei</i>	•		•	•		•		
Swamp Thistle	<i>Cirsium muticum</i>	•		•			•	•	
Golden-wave Tickseed	<i>Coreopsis intermedia</i>	•		•	•	•	•		
Wood Tickseed	<i>Coreopsis major</i>	•			•	•	•		
Georgia Tickseed	<i>Coreopsis nudata</i>	•		•		•	•		
Stiff Tickseed	<i>Coreopsis palmata</i>	•		•			•		
Cotton-rose	<i>Diaperia verna</i>		•	•			•	•	
Narrow-Leaved Purple Coneflower	<i>Echinacea angustifolia</i>	•		•		•	•		
Purple Coneflower	<i>Echinacea purpurea</i>	•		•			•	•	
Lance-Leaf Thoroughwort	<i>Eupatorium lancifolium</i>	•		•	•	•	•		
Mohr's Thoroughwort	<i>Eupatorium mohrii</i>	•		•	•		•	n/a	n/a
Sullivan's Thoroughwort	<i>Eupatorium sullivaniae</i>	•		•	•	•	•		
Sweet Joe-pyeweed	<i>Eutrochium purpureum</i>	•	n/a	n/a	n/a	•			
Narrowleaf Gumweed	<i>Grindelia lanceolata</i>	•		•		•	•	•	
Shortleaf Sneezeweed	<i>Helenium brevifolium</i>	•		•			•	•	
Old Field Sneezeweed	<i>Helenium campentre</i>	•		•			•		
Florida Sunflower	<i>Helianthus floridanus</i>	•		•		•	•		
Rosinweed Sunflower	<i>Helianthus silphioides</i>	•		•	•		•	•	
Smooth Oxeye	<i>Heliopsis gracilis</i>	•		•		•			
Hairy Hawkweed	<i>Hieracium longipilum</i>	•		•	•	•	•	•	
Seacoast Marsh-elder	<i>Iva imbricata</i>	•				•			
Wright's Dwarf-dandelion	<i>Krigia wrightii</i>	•		•	•		•	•	
Dotted Gayfeather	<i>Liatris punctata</i>	•	•	•	•		•		
Slender Gayfeather	<i>Liatris tenuis</i>	•		•	•		•		
Texas Yellowstar	<i>Lindheimera texana</i>	•		•			•		
Broadleaf Barbaras-buttons	<i>Marshallia trinervia</i>	•	•	•					
Snow Melanthera	<i>Melanthera nivea</i>	•		•		•	•		•
Tall Rattlesnake-root	<i>Nabalus altissimus</i>	•		•	•	•			
Rough Rattlesnake-root	<i>Nabalus asper</i>	•		•		•	•	n/a	n/a
Barbed Rattlesnake-root	<i>Nabalus barbatus</i>	•	•	•	•	•	•	•	
Appalachian Ragwort	<i>Packera anonyma</i>	•	•	•	•	•	•	•	
Roundleaf Ragwort	<i>Packera obovata</i>	•		•		•	•	•	
Small Palafoxia	<i>Palafoxia callosa</i>	•		•			•		
Texas Palafoxia	<i>Palafoxia texana</i> var. <i>ambigua</i>	•		•		•		•	
Wand Blackroot	<i>Pterocaulon virgatum</i>	•					•		
Mexican Hat	<i>Ratibida peduncularis</i>	•		•		•	•		
Gray-head Prairie Coneflower	<i>Ratibida pinnata</i>	•					•	•	

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Largeflower Rudbeckia	<i>Rudbeckia grandiflora</i>	•		•	•	•	•	•	
Missouri Coneflower	<i>Rudbeckia missouriensis</i>	•		•			•	•	
Sabine Coneflower	<i>Rudbeckia scabrifolia</i>	•		•			•		
Texas Coneflower	<i>Rudbeckia texana</i>	•					•		
Three-lobed Coneflower	<i>Rudbeckia triloba</i>	•		•		•	•	•	
Pink Bog Button	<i>Sclerolepis uniflora</i>			•			•		
Texas Ragwort	<i>Senecio ampullaceus</i>	•		•				•	
Narrowleaf Whitetop Aster	<i>Sericocarpus linifolius</i>	•		•		•	•		
Cup-plant	<i>Silphium perfoliatum</i>	•				•		•	
Rayless Mock-goldenrod	<i>Solidago discoidea</i>	•		•	•	•			
Zigzag Goldenrod	<i>Solidago flexicaulis</i>	•				•			
Early Goldenrod	<i>Solidago juncea</i>	•		•	•	•		•	
Gulf Coast Smooth Aster	<i>Symphotrichum attenuatum</i>	•		•		•	•		
Elliott's Aster	<i>Symphotrichum elliotii</i>	•		•		•		•	
Pineland Purple-stem Aster	<i>Symphotrichum puniceum</i> var. <i>scabricaule</i>	•		•	•	•	•		
Louisiana Squarehead	<i>Tetragonotheca ludoviciana</i>	•		•	•	•	•		
Stiff Greenthread	<i>Thelesperma filifolium</i>	•					•	•	
East Texas Greenthread	<i>Thelesperma flavodiscum</i>	•		•		•	•		
West Ironweed	<i>Vernonia baldwinii</i>	•		•	•	•	•		
Slender Heliotrope	<i>Euploca tenella</i>	•		•			•		
Bindweed Heliotrope	<i>Euploca convolvulacea</i>	•	•	•				•	
Large Clammyweed	<i>Polanisia erosa</i>	•		•			•		
Tall Bellflower	<i>Campanulastrum americanum</i>	•		•		•			
Elongated Lobelia	<i>Lobelia elongata</i>	•		•	•	•	•		
Coastal Plain Lobelia	<i>Lobelia flaccidifolia</i>	•	•	•			•		
Indian-tobacco	<i>Lobelia inflata</i>	•		•	•	•	•		
McVaugh's Lobelia	<i>Lobelia rogersii</i>	•		•		•	•		
Great Blue Lobelia	<i>Lobelia siphilitica</i>	•		•	•	•			
Prairie Venus's Looking-glass	<i>Triodanis lamprosperma</i>	•		•	•		•	•	
Gullfeed	<i>Scaevola plumieri</i>	•		•		•			
Mustard Sicklepod	<i>Borodinia canadensis</i>	•		•		•			
Harper's Searocket	<i>Cakile harperi</i>	•	•	•	•	•			
Cutleaf Toothwort	<i>Cardamine concatenata</i>	•	•	•		•			
Spreading Bladderpod	<i>Physaria gracilis</i>	•		•	•	•	•		
North American Lake-Cress	<i>Rorippa aquatica</i>	•		•		•			
Smooth Twistflower	<i>Streptanthus hyacinthoides</i>	•		•			•	•	
Wedgeleaf Whitlow-grass	<i>Tomostima cuneifolia</i>	•						•	
Gregg's Amaranth	<i>Amaranthus greggii</i>			•		•			
Silverhead	<i>Blutaparon vermiculare</i>	•		•		•			
Woolly Cotton-flower	<i>Gossypianthus lanuginosus</i>	•		•	•	•	•	•	
Woolly Honeysweet	<i>Tidestromia lanuginosa</i>	•				•			
Earth-fruit	<i>Geocarpon minimum</i>	•	•	•		•	•	•	
Drummond's Sandwort	<i>Geocarpon nuttallii</i>	•	•	•	•	•	•		
Spreading Pygmyleaf	<i>Loeflingia squarrosa</i>	•		•	•			•	

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Drummond's Nailwort	<i>Paronychia drummondii</i>		•	•			•		
Dixie Stitchwort	<i>Sabulina muscorum</i>	•	•	•				•	
Starry Campion	<i>Silene stellata</i>	•		•		•			
Scarlet Catchfly	<i>Silene subciliata</i>	•		•		•	•		
Fire Pink	<i>Silene virginica</i>			•		•			
Pineland Scaly-pink	<i>Stipulicida setacea</i>	•		•			•		
Small-flower Fameflower	<i>Phemeranthus parviflorus</i>	•		•			•	•	
Prairie Fameflower	<i>Phemeranthus rugospermus</i>	•		•		•	•	•	
Pale Umbrella-wort	<i>Mirabilis albida</i>			•			•		
Sarvis Holly	<i>Ilex amelanchier</i>	•		•		•			•
Myrtle Holly	<i>Ilex myrtifolia</i>	•		•		•			
Climbing Bittersweet	<i>Celastrus scandens</i>	•	•	•		•			
Wahoo	<i>Euonymus atropurpureus</i>	•		•	•	•			
Large-leaved Grass-of-Parnassus	<i>Parnassia grandifolia</i>			•		•	•		
Yellowleaf Tinker's-weed	<i>Triosteum angustifolium</i>	•		•					
Perfoliate Tinker's-weed	<i>Triosteum perfoliatum</i>	•		•					
Florida Bully	<i>Sideroxylon reclinatum</i>	•		•	•	•			
Black Titi	<i>Cliftonia monophylla</i>	•	•	•		•	•		
Mountain Laurel	<i>Kalmia latifolia</i>	•		•					
Staggerbush	<i>Lyonia mariana</i>	•		•			•		
American Pinesap	<i>Monotropa hypopithys</i>	•	•	•	•	•			•
Rabbit-eye Blueberry	<i>Vaccinium ashei</i>	•		•	•	•			
Allegheny-spurge	<i>Pachysandra procumbens</i>		•	•		•			
Risky Tread-softly	<i>Cnidioscolus stimulosus</i>	•					•		
Silver Croton	<i>Croton argyranthemus</i>	•		•			•		
Sand Dune Spurge	<i>Euphorbia bombensis</i>	•		•		•			
Summer Spurge	<i>Euphorbia discoidalis</i>	•					•		
Glabrous Spotted Spurge	<i>Euphorbia meganaesos</i>	•		•		•	•	•	
Weak Spurge	<i>Euphorbia tetrapora</i>	•			•	•	•	•	
Prairie Acacia	<i>Acaciella hirta</i>	•					•	•	
American Bird's-foot-trefoil	<i>Acmispon americanus</i>	•	•	•	•	•	•		
Smooth Indigo-bush	<i>Amorpha laevigata</i>	•	•	•	•	•	•	•	
Shining False Indigo	<i>Amorpha nitens</i>	•		•	•	•		•	
Panicked Indigo-bush	<i>Amorpha paniculata</i>	•		•		•		•	
Berliander's Ground-plum	<i>Astragalus crassicaulus</i>	•	•	•	•	•	•		
Nuttall's Milkvetch	<i>Astragalus nuttallianus</i>	•		•	•	•	•	•	
Soxman's Milkvetch	<i>Astragalus soxmaniorum</i>	•		•			•		
Ground-plum	<i>Astragalus trichocalyx</i>			•			•		
Yellow-wood	<i>Cladrastis kentukea</i>	•		•		•			
Pursh's Rattlebox	<i>Crotalaria purshii</i>	•					•		
Compact Prairie-clover	<i>Dalea compacta</i> var. <i>pubescens</i>	•	•	•		•	•		
Wedgeleaf Prairie-clover	<i>Dalea emarginata</i>	•				•			
Silky Prairie-clover	<i>Dalea grisea</i>	•		•			•		
Downy Prairie-clover	<i>Dalea lanata</i>	•	•	•	•	•		•	

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Slimspike Prairie-clover	<i>Dalea phleoides</i>	•		•		•	•	•	
Summer Farewell	<i>Dalea pinnata</i> var. <i>trifoliata</i>			•			•		
Nuttall's Tick-trefoil	<i>Desmodium nuttallii</i>	•		•	•		•	•	
Coast Indigo	<i>Indigofera miniata</i>	•	•	•		•		•	
Tiny Pea	<i>Lathyrus pusillus</i>	•		•		•		•	
Forest Pea	<i>Lathyrus venosus</i>	•		•		•			
Lady Lupine	<i>Lupinus villosus</i>	•		•			•		
Palm-leaf Scurfpea	<i>Pedimelum digitatum</i>						•		
Awl-shaped Scurfpea	<i>Pedimelum hypogaeum</i> var. <i>subulatum</i>	•	•	•	•	•	•		
Roundleaf Scurfpea	<i>Pedimelum rhombifolium</i>	•		•					
Florida Hoary-pea	<i>Tephrosia florida</i>	•		•			•		
Sprawling Hoary-pea	<i>Tephrosia hispidula</i>	•		•			•		
Peanut Clover	<i>Trifolium amphianthum</i>	•		•	•	•	•		
Bejar Clover	<i>Trifolium bejariense</i>	•				•	•		
Carolina Clover	<i>Trifolium carolinianum</i>	•	•	•	•	•	•	•	
Buffalo Clover	<i>Trifolium reflexum</i>	•	•	•	•	•	•	•	•
Viperina	<i>Zornia bracteata</i>	•		•		•	•	•	
American Hazelnut	<i>Corylus americana</i>		•	•	•				
Ozark Chinquapin	<i>Castanea ozarkensis</i>	•	•	•	•	•	•	•	•
Arkansas Oak	<i>Quercus arkansana</i>		•	•		•			
Scarlet Oak	<i>Quercus coccinea</i>	•		•		•	•		
Shingle Oak	<i>Quercus imbricaria</i>	•		•	•	•			
Turkey Oak	<i>Quercus laevis</i>	•		•		•	•		
Bur Oak	<i>Quercus macrocarpa</i>	•	•	•		•			
Oglethorpe's Oak	<i>Quercus oglethorpensis</i>	•		•	•	•			
Northern Red Oak	<i>Quercus rubra</i>	•		•					
Durand Oak	<i>Quercus durandii</i>	•	•	•	•	•			
Louisiana Bluestar	<i>Amsonia ludoviciana</i>	•		•	•	•			
Pinewoods Milkweed	<i>Asclepias humistrata</i>	•		•	•		•		•
Swamp Milkweed	<i>Asclepias incarnata</i>	•		•	•	•			
Michaux's Milkweed	<i>Asclepias michauxii</i>	•		•			•		
Purple Milkweed	<i>Asclepias purpurascens</i>	•		•		•	•	•	
Red Milkweed	<i>Asclepias rubra</i>	•		•			•		
Narrow-leaved Milkweed	<i>Asclepias stenophylla</i>	•		•			•	•	
Prairie Milkvine	<i>Matelea cynanchoides</i>	•		•			•	•	
Rankin's Trumpet-flower	<i>Gelsemium rankinii</i>								
Texas Screwstem	<i>Bartonia paniculata</i> ssp. <i>texana</i>	•	•	•	•	•			•
White Screwstem	<i>Bartonia verna</i>	•					•		
Striped Gentian	<i>Gentiana villosa</i>	•							
Virginia Pennywort	<i>Obolaria virginica</i>	•		•	•	•			
Sand Rose-gentian	<i>Sabatia arenicola</i>	•		•					
Wild Crane's-bill	<i>Geranium maculatum</i>	•			•				
Loose-flowered Water-milfoil	<i>Myriophyllum laxum</i>	•		•	•	•			
Bay Starvine	<i>Schisandra glabra</i>	•	•	•		•			

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Sand Hickory	<i>Carya pallida</i>	•		•	•		•		
Virginia Stickseed	<i>Hackelia virginiana</i>	•		•					
Hoary Puccoon	<i>Lithospermum canescens</i>	•		•	•	•		•	
Narrowleaved Puccoon	<i>Lithospermum incisum</i>	•		•			•		
Georgia Savory	<i>Clinopodium georgianum</i>	•		•			•		
Canada Horsebalm	<i>Collinsonia canadensis</i>		•	•		•			
Florida Horsebalm	<i>Collinsonia punctata</i>	•		•	•	•			
Lindheimer's Beebalm	<i>Monarda lindheimeri</i>	•		•			•		
Correll's False Dragonhead	<i>Physostegia correllii</i>	•	•	•	•	•	•	•	•
Long-sepaled False Dragonhead	<i>Physostegia longisepala</i>	•		•			•		
Heartleaf Skullcap	<i>Scutellaria cardiophylla</i>			•			•		
Thieret's Skullcap	<i>Scutellaria thieretii</i>			•		•			
Square-stem Monkeyflower	<i>Mimulus ringens</i>	•		•		•		•	
Pondberry	<i>Lindera melissifolia</i>	•		•	•	•			•
Bog Spicebush	<i>Lindera subcoriacea</i>	•	•	•		•			•
Pondspice	<i>Litsea aestivalis</i>	•		•	•				
Florida Yellow Flax	<i>Linum floridanum</i> var. <i>chrysocarpum</i>	•		•		•	•	•	
Spring Hill Flax	<i>Linum macrocarpum</i>	•		•			•		
Grooved Yellow Flax	<i>Linum sulcatum</i>	•		•			•		
Pyramid Magnolia	<i>Magnolia pyramidata</i>	•		•		•			
Coastal Plain St. John's Wort	<i>Hypericum brachyphyllum</i>	•	•	•		•	•		
Large Spotted St. John's Wort	<i>Hypericum pseudomaculatum</i>	•		•	•	•			
Round-seed St. John's Wort	<i>Hypericum sphaerocarpum</i>	•		•		•	•		
Straggling St. John's Wort	<i>Hypericum stragulum</i>	•		•	•		•		
Pineland St. John's Wort	<i>Hypericum suffruticosum</i>	•		•			•		
Coppery St. John's Wort	<i>Hypericum virgatum</i>	•	•	•			•		
Clustered Poppy-mallow	<i>Callirhoe alcaeoides</i>	•				•	•	•	
Fringed Poppy-mallow	<i>Callirhoe digitata</i>	•		•			•		
Purple Poppy-mallow	<i>Callirhoe involucrata</i>	•		•			•		
White-Leaf Prairie Hibiscus	<i>Hibiscus leucophyllus</i>	•	•	•	•	•	•		
Elliott's Sida	<i>Sida elliotii</i>	•		•	•	•		•	
Odorless Bayberry	<i>Morella inodora</i>	•		•		•	•		
Water-purslane	<i>Didiplis diandra</i>	•			•	•			
Nash's Meadow-beauty	<i>Rhexia nashii</i>	•		•	•	•	•		
Canada Enchanter's-nightshade	<i>Circaea canadensis</i>		•	•		•			
Winged Seedbox	<i>Ludwigia alata</i>	•		•		•		•	
Small-fruit Seedbox	<i>Ludwigia microcarpa</i>	•		•			•	•	
Grapefruit Primrose-willow	<i>Ludwigia sphaerocarpa</i>	•	•	•		•		•	
Sandhill Evening-primrose	<i>Oenothera heterophylla</i>	•		•	•	•	•		
Four-point Evening Primrose	<i>Oenothera rhombipetala</i>	•		•			•	•	
Prairie Evening Primrose	<i>Oenothera sessilis</i>	•		•	•	•	•		
Spach's Evening-primrose	<i>Oenothera spachiana</i>	•		•	•		•	•	
Eastern Leatherwood	<i>Dirca palustris</i>	•	•	•		•			
Spoonleaf Sundew	<i>Drosera intermedia</i>	•		•		•	•		

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Tracy's Sundew	<i>Drosera tracyi</i>	•		•	•	•	•		
Parrot Pitcher Plant	<i>Sarracenia psittacina</i>	•		•			•		
Rosy Pitcher Plant	<i>Sarracenia rosea</i>	•		•	•	•	•		•
Blue Water-lily	<i>Nymphaea elegans</i>		•	•		•		•	
Yellow Fumewort	<i>Corydalis flavula</i>	•				•			
Bloodroot	<i>Sanguinaria canadensis</i>		•	•		•			
Violet Blue-eyed Mary	<i>Collinsia violacea</i>	•	•	•	•	•	•	•	
Florida Hedge-hyssop	<i>Gratiola floridana</i>	•		•		•			
Branched Hedge-hyssop	<i>Gratiola ramosa</i>		•	•		•	•		
Yellow Hedge-hyssop	<i>Gratiola torreyi</i>	•					•	•	
Cupleaf Beardtongue	<i>Penstemon murrayanus</i>	•	•	•		•	•	•	
Woolly Plantain	<i>Plantago patagonica</i>	•		•		•	•	•	
Culver's-root	<i>Veronicastrum virginicum</i>	•	•	•				•	
Riverweed	<i>Podostemum ceratophyllum</i>	•		•		•			
Showy Milkwort	<i>Asemeia grandiflora</i>	•			•		•		
Boykin's Milkwort	<i>Polygala boykinii</i>	•	•	•			•		
Littleleaf Milkwort	<i>Polygala brevifolia</i>	•		•			•		
Chapman's Milkwort	<i>Polygala chapmanii</i>	•	•	•		•	•		
Scalloped Milkwort	<i>Polygala crenata</i>	•		•			•		
Hooker's Milkwort	<i>Polygala hookeri</i>			•	•		•		
Longleaved Wild-buckwheat	<i>Eriogonum longifolium</i>			•			•	•	
Many-flowered Wild-buckwheat	<i>Eriogonum multiflorum</i>	•		•		•	•	•	
American Jointweed	<i>Polygonella americana</i>		•	•		•	•	•	
October-flower	<i>Polygonella polygama</i>	•		•			•		
Eastern Shooting Star	<i>Primula meadia</i>	•	•	•		•			
Limewater Brookweed	<i>Samolus ebracteatus</i> var. <i>alyssoides</i>	•		•	•		•		
White Baneberry	<i>Actaea pachypoda</i>	•				•			
Southern Thimbleweed	<i>Anemone berlandieri</i>	•		•			•	•	
Virginia Anemone	<i>Anemone virginiana</i>	•		•					
West Gulf Leatherflower	<i>Clematis arenicola</i>	•		•	•	•	•		
Satin-curles	<i>Clematis catesbyana</i>	•		•		•		•	
Whiteleaf Leatherflower	<i>Clematis glaucophylla</i>	•			•	•		•	
Yellow Water-crowfoot	<i>Ranunculus flabellaris</i>	•	•			•			
Hairy Buttercup	<i>Ranunculus hispidus</i>	•		•	•	•			
Waxyleaf Meadowrue	<i>Thalictrum amphibolum</i>						•	•	
Yellowroot	<i>Xanthorhiza simplicissima</i>	•		•		•			
Prairie Redroot	<i>Ceanothus herbaceus</i>	•		•			•	•	
Lanceleaved Buckthorn	<i>Endotropis lanceolata</i>	•		•		•			
Gopher-apple	<i>Geobalanus oblongifolius</i>	•		•	•	•	•		•
Yellow Stonecrop	<i>Sedum nuttallii</i>	•		•	•	•		•	
Granite Gooseberry	<i>Ribes curvatum</i>	•		•			•		
Wild Hydrangea	<i>Hydrangea arborescens</i>	•				•			
Incised Groovebur	<i>Agrimonia incisa</i>	•		•	•	•	•		
Ashe Hawthorn	<i>Crataegus ashei</i>	•	•	•	•	•		•	

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Blueberry Hawthorn	<i>Crataegus brachyacantha</i>		•	•		•			
Mississippi Hawthorn	<i>Crataegus florens</i>	•		•	•	•		•	
Albertville Hawthorn	<i>Crataegus mendosa</i>	•	•	•	•	•		•	
Frosted Hawthorn	<i>Crataegus pruinosa</i>	•		•	•	•			
Beautiful Hawthorn	<i>Crataegus pulcherrima</i>	•	•	•	•	•			
Three-flowered Hawthorn	<i>Crataegus triflora</i>	•		•			•		
Dwarf Hawthorn	<i>Crataegus uniflora</i>	•	•	•	•	•	•	•	
American Ipecac	<i>Gillenia stipulata</i>	•	•	•	•	•			
Oklahoma Plum	<i>Prunus gracilis</i>	•		•		•	•	•	
Wild Goose Plum	<i>Prunus munsoniana</i>	•		•	•	•		•	
Climbing Prairie Rose	<i>Rosa setigera</i>	•	•	•	•	•		•	
American Alumroot	<i>Heuchera americana</i>	•	•	•		•			
Texas Saxifrage	<i>Micranthes texana</i>	•		•			•	•	
Virginia Saxifrage	<i>Micranthes virginensis</i>	•		•		•			
Forest Bedstraw	<i>Galium circaezans</i>	•		•					
Coastal Bedstraw	<i>Galium bermudense</i>	•				•	•		
Smoothstem Bedstraw	<i>Galium orizabense</i> ssp. <i>laevicaule</i>	•		•	•	•	•		
Southwestern Bedstraw	<i>Galium virgatum</i>	•		•	•		•	•	
Purple Bluet	<i>Houstonia lanceolata</i>	•		•			•	•	
Roundleaf Bluet	<i>Houstonia procumbens</i>	•		•		•	•	•	
Carolina Willow	<i>Salix caroliniana</i>	•		•		•			
Prairie Willow	<i>Salix humilis</i> var. <i>humilis</i>	•		•	•		•	•	
Dwarf Prairie Willow	<i>Salix occidentalis</i>	•		•		•	•		
Northern Prickly-ash	<i>Zanthoxylum americanum</i>	•		•		•	•	•	
Chalk Maple	<i>Acer leucoderme</i>	•		•	•	•			•
American Bladdernut	<i>Staphylea trifolia</i>	•	•	•					
American Water-willow	<i>Justicia americana</i>	•	•	•		•		•	
Night-flowering Wild-petunia	<i>Ruellia noctiflora</i>	•		•		•	•		
Pineland Wild-petunia	<i>Ruellia pinetorum</i>	•		•	•	•	•		
Yellow Butterwort	<i>Pinguicula lutea</i>	•					•		
Southern Bladderwort	<i>Utricularia juncea</i>	•		•		•	•		
Purple Bladderwort	<i>Utricularia purpurea</i>	•		•		•			
Upland Swamp Privet	<i>Forestiera ligustrina</i>	•		•		•			
Coastal Plain False Foxglove	<i>Agalinis aphylla</i>	•	•	•		•	•		
Caddo Parish Agalinis	<i>Agalinis caddoensis</i>	•	•	•	•	•			•
Thread-stem False Foxglove	<i>Agalinis filicaulis</i>	•		•			•		
Flax-leaf False Foxglove	<i>Agalinis linifolia</i>	•		•			•		
Pale False Foxglove	<i>Agalinis skinneriana</i>	•		•			•		
One-flowered Broomrape	<i>Aphyllon uniflorum</i>	•	•	•	•	•	•		
Scarlet Indian-paintbrush	<i>Castilleja coccinea</i>	•		•	•	•	•		
Mullein Foxglove	<i>Dasistoma macrophyllum</i>	•		•		•		•	
Bog Flame Flower	<i>Macranthera flammea</i>		•	•		•	•		
American Chaffseed	<i>Schwalbea americana</i>	•	•	•		•	•		•
Coastal Plain Dawnflower	<i>Stylisma patens</i>	•	•	•	•		•		
Hairy Dawnflower	<i>Stylisma villosa</i>	•		•	•		•		

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Smooth Scorpionweed	<i>Phacelia glabra</i>	•		•			•		
Sandhills Scorpionweed	<i>Phacelia strictiflora</i> var. <i>robbinsonii</i>	•		•		•	•	•	
Little Floatingheart	<i>Nymphoides cordata</i>	•		•	•				
Lundell's Phlox	<i>Phlox pilosa</i> ssp. <i>pulcherrima</i>	•		•	•	•	•		
Carpenter's Ground-cherry	<i>Calliphysalis carpenteri</i>	•	•	•	•	•			
Coastal Ground-cherry	<i>Physalis angustifolia</i>	•	•	•			•	•	
Large-seed Ground-cherry	<i>Physalis macrocarpa</i>	•		•	•	•	•	•	
Western Horse-nettle	<i>Solanum dimidiatum</i>	•				•	•		
Glowing Nightshade	<i>Solanum pseudogracile</i>	•		•		•			
Silky Camellia	<i>Stewartia malacodendron</i>	•		•		•			
Clustered Pellitory	<i>Parietaria praetermissa</i>	•	•	•		•			
Rosemary Rockrose	<i>Crocanthemum rosmarinifolium</i>	•		•			•		
Thymeleaf Pinweed	<i>Lechea minor</i>	•		•			•		
San Saba Pinweed	<i>Lechea san-sabeana</i>	•		•			•		
Leggett's Pinweed	<i>Lechea pulchella</i> var. <i>ramosissima</i>	•		•			•		
Downy Yellow Violet	<i>Viola pubescens</i>	•	•	•					
Dwarf Burhead	<i>Helanthium tenellum</i>	•	•	•		•		•	
Chapman's Arrowhead	<i>Sagittaria chapmanii</i>	•	•	•	•	•	•	•	
Coastal False Asphodel	<i>Triantha racemosa</i>	•	•	•		•	•		
Spoon-flower	<i>Peltandra sagittifolia</i>	•		•	•	•			
Saw Palmetto	<i>Serenoa repens</i>	•		•	•	•	•		
Evening Rainlily	<i>Zephyranthes chlorosolen</i>	•		•			•		
Atlantic Camas	<i>Camassia scilloides</i>		•	•		•			
Solomon's-plume	<i>Maianthemum racemosum</i>	•		•	•	•			
Texas Sunnysbell	<i>Schoenolirion wrightii</i>	•		•			•	•	
Nodding Yucca	<i>Yucca cernua</i>	•		•	•	•	•	•	•
Swamp Stargrass	<i>Hypoxis curtissii</i>	•		•	•	•	•		
Reverchon's Spiderwort	<i>Tradescantia reverchonii</i>	•					•	•	
Broad-leaved Spiderwort	<i>Tradescantia subaspera</i>	•	•	•	•	•			
Bog Moss	<i>Mayaca fluviatilis</i>	•	•	•		•			
Fringed Yellow-eyed-grass	<i>Xyris fimbriata</i>	•		•		•	•	•	
Kral's Yellow-eyed-grass	<i>Xyris louisianica</i>	•		•			•		
Tall Yellow-eyed-grass	<i>Xyris platylepis</i>	•			•	•	•	•	
Harper's Yellow-eyed-grass	<i>Xyris scabrifolia</i>			•			•		
Acid-swamp Yellow-eyed-grass	<i>Xyris serotina</i>		•	•			•		
Small's Yellow-eyed-grass	<i>Xyris smalliana</i>	•		•		•	•		
Pineland Yellow-eyed-grass	<i>Xyris stricta</i>	•		•			•		
Twisted Yellow-eyed-grass	<i>Xyris torta</i>	•		•	•	•	•	•	
Arkansas Caric Sedge	<i>Carex arkansana</i>	•	•	•				•	
Bush's Sedge	<i>Carex bushii</i>	•	•	•	•	•	•		
Cypress-knee Sedge	<i>Carex decomposita</i>	•	•	•		•			
Hammock Sedge	<i>Carex fissa</i> var. <i>aristata</i>	•		•	•	•		•	
Limestone Meadow Sedge	<i>Carex granularis</i>	•		•					
Hairy Green Sedge	<i>Carex hirsutella</i>	•		•	•	•	•		

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Mead's Sedge	<i>Carex meadii</i>			•			•		
Small-toothed Caric Sedge	<i>Carex microdonta</i>	•		•			•	•	
Southern Dark-green Sedge	<i>Carex oblita</i>	•		•		•			
Ozark Sedge	<i>Carex ozarkana</i>	•		•	•	•			
Tussock Sedge	<i>Carex stricta</i>	•		•		•			
Bent Sedge	<i>Carex styloflexa</i>	•	•	•	•	•			
Wire Sedge	<i>Carex tenax</i>	•					•		
Swollen Sedge	<i>Carex turgescens</i>	•				•			
Cryptic Flatsedge	<i>Cyperus cephalanthus</i>		•	•			•		
Marshland Flatsedge	<i>Cyperus distinctus</i>	•		•	•	•	•	•	
Illinois Flatsedge	<i>Cyperus grayoides</i>			•			•		
Dwarf Bulrush	<i>Cyperus subsquarrosus</i>	•	•	•		•		•	
Threeway Sedge	<i>Dulichium arundinaceum</i>	•		•		•		•	
Ambiguous Spikerush	<i>Eleocharis ambigens</i>	•	•	•	•	•		•	
Purple Spikerush	<i>Eleocharis atropurpurea</i>	•		•	•	•	•	•	
Two-tone Spikerush	<i>Eleocharis bicolor</i>	•		•	•	•	•		
Flat-Stem Spikesedge	<i>Eleocharis compressa</i>	•		•	•	•		•	
Slim Spikesedge	<i>Eleocharis elongata</i>	•		•		•			
Engelmann's Spikerush	<i>Eleocharis engelmannii</i>	•		•	•	•		•	
Canada Spikesedge	<i>Eleocharis geniculata</i>	•	•	•		•	•	•	
Ozark Spikesedge	<i>Eleocharis lanceolata</i>	•		•	•	•		•	
Black-fruited Spikesedge	<i>Eleocharis melanocarpa</i>	•	•	•		•	•	•	
Small Spikesedge	<i>Eleocharis minima</i>	•		•	•	•			
Rooted Spikesedge	<i>Eleocharis radicans</i>	•		•		•		•	
Walking Spikesedge	<i>Eleocharis rostellata</i>	•				•			
Southern Umbrella-sedge	<i>Fuirena scirpoidea</i>	•		•			•	•	
Western Umbrella-sedge	<i>Fuirena simplex</i> var. <i>aristulata</i>	•				•			
Baldwin's Beaksedge	<i>Rhynchospora baldwinii</i>	•	•	•	•	•	•		
Brownish Beaksedge	<i>Rhynchospora capitellata</i>	•	•	•	•	•	•	•	
Loose-head Beaksedge	<i>Rhynchospora chalarocephala</i>	•			•	•	•		
Chapman's Beaksedge	<i>Rhynchospora chapmanii</i>		•	•		•	•	•	
Ciliate Beaksedge	<i>Rhynchospora ciliaris</i>		•	•			•		
Flat-fruit Beaksedge	<i>Rhynchospora compressa</i>	•		•	•		•		
Savanna Beaksedge	<i>Rhynchospora debilis</i>	•		•			•		
Swamp-forest Beaksedge	<i>Rhynchospora decurrens</i>	•		•		•	•	•	
Spreading Beaksedge	<i>Rhynchospora divergens</i>	•		•			•		
Narrow-fruit Horned Beaksedge	<i>Rhynchospora inundata</i>	•		•		•	•	•	
Slender-fruit Beaksedge	<i>Rhynchospora leptocarpa</i>	•		•	•	•	•		
Large Beaksedge	<i>Rhynchospora macra</i>			•			•		
Southern Beaksedge	<i>Rhynchospora microcarpa</i>	•		•		•	•	•	
Small-headed Beaksedge	<i>Rhynchospora microcephala</i>	•		•	•	•	•		
Short-beak Beaksedge	<i>Rhynchospora nitens</i>	•		•			•		
Long-beak Beaksedge	<i>Rhynchospora scirpoides</i>	•		•	•	•	•	•	
Coastal Plain Beaksedge	<i>Rhynchospora stenophylla</i>	•	•	•		•	•		

TABLE 4.16. cont.

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Tracy's Beaksedge	<i>Rhynchospora tracyi</i>	•		•	•		•	•	
Small's Beaksedge	<i>Rhynchospora pinetorum</i>	•		•			•		
Delta Bulrush	<i>Schoenoplectus deltarum</i>	•	•	•	•				
Canby's Bulrush	<i>Schoenoplectus etuberculatus</i>	•	•	•	•	•			
Spreading Bulrush	<i>Scirpus divaricatus</i>	•		•					
Smooth-seed Hairy Nutrush	<i>Scleria bellii</i>	•		•	•	•	•		
Shining Nutrush	<i>Scleria nitida</i>	•		•	•	•			
Low Nut Sedge	<i>Scleria verticillata</i>	•		•		•	•		
Purple Bluestem	<i>Andropogon cretaceus</i>	•	•	•			•		
Mohr's Bluestem	<i>Andropogon mohrii</i>	•					•		
Narrowleaf Bluestem	<i>Andropogon perangustatus</i>	•		•			•		
Texas Silkyscale	<i>Anthenantia texana</i>	•		•	•	•	•		
Longleaf Three-awn	<i>Aristida palustris</i>	•		•			•		
Sideoats Grama	<i>Bouteloua curtipendula</i>	•		•			•	•	
Texas Grama	<i>Bouteloua rigidiseta</i>	•		•			•		
Common Eastern Brome	<i>Bromus pubescens</i>	•	•	•					
Big Sandbur	<i>Cenchrus myosuroides</i>	•	•	•		•			
Dune Sandbur	<i>Cenchrus tribuloides</i>	•	•	•		•			
Birdbill Spike Grass	<i>Chasmanthium ornithorhynchum</i>		•	•		•			
Lattion Jointgrass	<i>Coelorachis tessellata</i>	•			•	•	•		
Southern Narrow Panic Grass	<i>Coleataenia tenera</i>	•		•		•	•		
Silky Oatgrass	<i>Danthonia sericea</i>	•		•			•	•	
Blue Witchgrass	<i>Dichanthelium caeruleum</i>	•	•	•	•	•	•		
Carpet Witchgrass	<i>Dichanthelium chamaelonche</i>	•	•	•	•	•	•		
Deer-tongue Witchgrass	<i>Dichanthelium clandestinum</i>	•	•	•	•	•			
Spindle-fruited Witchgrass	<i>Dichanthelium fusiforme</i>	•		•	•	•	•		
Slender Leaf Witchgrass	<i>Dichanthelium linearifolium</i>	•		•		•	•	•	
Hairless Witchgrass	<i>Dichanthelium strigosum</i> var. <i>glabrescens</i>	•		•		•	•		
Dwarf Witchgrass	<i>Dichanthelium strigosum</i> var. <i>leucoblepharis</i>	•		•		•	•		
Key Grass	<i>Distichlis littoralis</i>			•				•	
River Grass	<i>Echinochloa polystachya</i>	•		•	•				
Gummy Lovegrass	<i>Eragrostis curtipedicellata</i>	•		•	•	•	•		
Short-beard Plumegrass	<i>Erianthus brevibarbis</i>	•		•		•	•		
Louisiana Cupgrass	<i>Eriochloa punctata</i>	•		•	•	•		•	
Cluster Fescue	<i>Festuca paradoxa</i>	•	•	•		•			
Arkansas Mannagrass	<i>Glyceria arkansana</i>	•	•	•	•	•		•	
Floating Mannagrass	<i>Glyceria septentrionalis</i>	•		•					
Fowl Mannagrass	<i>Glyceria striata</i>	•		•					
June Grass	<i>Koeleria macrantha</i>	•		•	•		•		
Southern Hairgrass	<i>Muhlenbergia sericea</i>	•		•	•				
Tumble Grass	<i>Muhlenbergia paniculata</i>	•			•		•	•	
Wiry Witch Grass	<i>Panicum flexile</i>	•			•		•		
Hall's Panic Grass	<i>Panicum filipes</i>			•	•		•		

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Gulfdune Paspalum	<i>Paspalum monostachyum</i>	•				•			
Woodland Bluegrass	<i>Poa sylvestris</i>	•			•	•			
Gulf Bluestem	<i>Schizachyrium maritimum</i>	•		•		•			
Prairie Cord Grass	<i>Spartina pectinata</i>	•		•				•	
Small Dropseed	<i>Sporobolus neglectus</i>	•		•	•	•	•	•	
Silveus Dropseed	<i>Sporobolus silveanus</i>	•		•			•		
Carolina Fluff Grass	<i>Tridens carolinianus</i>	•	•	•	•	•	•		
Perennial Sand Grass	<i>Triplasis americana</i>			•			•	•	
Sea Oats	<i>Uniola paniculata</i>	•		•		•			•
Goldencrest	<i>Lophiola aurea</i>	•		•			•		
Texas Pipewort	<i>Eriocaulon texense</i>	•				•	•	•	
Pineland Bogbutton	<i>Lachnocaulon digynum</i>	•		•			•		
Engelmann's Sea-grass	<i>Halophila engelmannii</i>	•		•	•	•			
Turtle-grass	<i>Thalassia testudinum</i>	•		•		•			•
Long's Rush	<i>Juncus longii</i>	•		•	•	•	•		
Swamp Rush	<i>Juncus paludosus</i>	•		•	•	•			
Southern Hairy Woodrush	<i>Luzula acuminata</i> var. <i>carolinae</i>	•		•	•	•			
Perfoliate Bellwort	<i>Uvularia perfoliata</i>	•		•	•	•			
Sessile-leaf Bellwort	<i>Uvularia sessilifolia</i>	•		•		•			
Carolina Redroot	<i>Lachnanthes caroliniana</i>	•					•	•	
Prairie-nymph	<i>Herbertia lahue</i>	•		•		•	•		
Abbeville Red Iris	<i>Iris nelsonii</i>		•	•		•			•
Prairie Pleatleaf	<i>Nemastylis geminiflora</i>	•		•		•	•	•	
White Trout Lily	<i>Erythronium albidum</i>	•				•			
Carolina Lily	<i>Lilium michauxii</i>	•				•			
Turk's-cap Lily	<i>Lilium superbum</i>	•		•		•			
Southern Red Lily	<i>Lilium catesbaei</i>	•		•			•		
Indian Cucumber-root	<i>Medeola virginiana</i>	•		•					
Fly-poison	<i>Amianthium muscitoxicum</i>	•		•		•	•		
Devil's-bit	<i>Chamaelirium luteum</i>	•	•	•		•			
Pine Barren Death-camas	<i>Stenanthium leimanthoides</i>	•		•		•	•		
Black Death-camas	<i>Stenanthium texanum</i>	•	•	•			•		
Nuttall's Poison Camas	<i>Toxicoscordion nuttallii</i>	•		•		•	•		
Sabine River Wakerobin	<i>Trillium gracile</i>	•	•	•		•			
Reflexed Trillium	<i>Trillium recurvatum</i>	•		•		•			
Texas Trillium	<i>Trillium texanum</i>	•	•	•		•			
Missouri Mud-Plantain	<i>Heteranthera missouriensis</i>	•		•	•	•			
Earleaf Greenbrier	<i>Smilax auriculata</i>	•		•		•	•	•	
Croomia	<i>Croomia pauciflora</i>	•	•	•	•	•			
Shoal-grass	<i>Halodule wrightii</i>	•		•		•			
Manatee-grass	<i>Syringodium filiforme</i>	•		•		•			
Arrow-grass	<i>Triglochin striata</i>	•	•	•		•	•	•	
Nuttall's Pondweed	<i>Potamogeton epihydrus</i>	•		•		•			
Claspingleaf Pondweed	<i>Potamogeton perfoliatus</i>	•	•	•		•			

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
Northern Burmannia	<i>Burmannia biflora</i>	•		•			•		
Little Jug Orchid	<i>Aspidogyne quercetica</i>	•		•	•	•			
Bearded Grass-pink	<i>Calopogon barbatus</i>	•	•	•		•	•		
Many-flowered Grass-pink	<i>Calopogon multiflorus</i>	•		•		•	•		
Oklahoma Grass-pink	<i>Calopogon oklahomensis</i>	•		•			•		
Pale Grass-pink	<i>Calopogon pallidus</i>			•			•		
Spreading Pogonia	<i>Cleisteslopsis oricamporum</i>	•		•			•		
Autumn Coralroot	<i>Corallorhiza odontorhiza</i>	•	•	•	•	•			
Southern Lady's-slipper	<i>Cypripedium kentuckiense</i>	•		•	•	•			•
Long-horned Habenaria	<i>Habenaria quinqueseta</i>	•		•			•		
Crested Coralroot	<i>Hexalectris spicata</i>	•	•	•					
Large Whorled Pogonia	<i>Isotria verticillata</i>	•				•			
Giant Orchid	<i>Orthochilus ecristatus</i>	•	•	•			•		
Yellow Fringeless Orchid	<i>Platanthera integra</i>	•				•	•		
Green Fringed Orchid	<i>Platanthera lacera</i>	•		•			•		
Large White Fringed Orchid	<i>Platanthera conspicua</i>	•		•			•		
Shadow-witch Orchid	<i>Ponthieva racemosa</i>	•		•		•			
Texas Ladies'-tresses	<i>Spiranthes brevilabris</i>	•		•	•	•	•		
Eaton's Ladies'-tresses	<i>Spiranthes eatonii</i>	•		•		•	•		
Florida Ladies'-tresses	<i>Spiranthes floridana</i>	•		•	•	•	•		
Giant-spiral Ladies'-tresses	<i>Spiranthes longilabris</i>	•		•			•		
Great Plains Ladies'-tresses	<i>Spiranthes magnicamporum</i>	•		•			•		
October Ladies'-tresses	<i>Spiranthes ovalis</i> var. <i>ovalis</i>	•	•	•	•	•			
Nodding Pogonia	<i>Triphora trianthophora</i>	•		•		•			
Golden Canna	<i>Canna flaccida</i>	•		•		•	•		
Powdery Thalia	<i>Thalia dealbata</i>	•			•	•	•	•	
Small Archidium Moss	<i>Archidium minus</i>	•		•	•	•			
Campylopus Moss	<i>Campylopus angustiretis</i>	•	•	•	•	•			
Dwarf Filmy Fern	<i>Didymoglossum petersii</i>	•	•	•		•			
Hall's Pocket Moss	<i>Fissidens amoenus</i>	•		•	•	•			
Reese's Fissidens Moss	<i>Fissidens leptophyllus</i>	•		•	•	•			
Neon Fissidens Moss	<i>Fissidens scalaris</i>	•		•	•	•			
Koch's Pocket Moss	<i>Fissidens submarginatus</i>	•		•	•	•			
Wright's Millimetre Moss	<i>Micromitrium wrightii</i>	•	•	•	•	•			
A moss	<i>Trachypodium hypnaceum</i>	•	•	•	•	•			
Sink-hole Fern	<i>Blechnum occidentale</i>			•					
Brown-hair Comb Fern	<i>Ctenitis submarginalis</i>	•	•	•		•			
Southern Woodfern	<i>Dryopteris australis</i>	•		•	•	•			
Log Fern	<i>Dryopteris celsa</i>	•		•					
Southern Shield Woodfern	<i>Dryopteris ludoviciana</i>	•		•		•			
Northern Maidenhair Fern	<i>Adiantum pedatum</i>					•			
Floating Antler Fern	<i>Ceratopteris pteridoides</i>	•		•					
Alabama Lipfern	<i>Cheilanthes alabamensis</i>	•	•	•	•			•	
Hairy Lipfern	<i>Myriopteris lanosa</i>	•		•		•	•		

TABLE 4.16. cont.

COMMON NAME	SCIENTIFIC NAME	Determine Distribution	Life History (Reproduction, Dispersal, and Survivorship)	Determine Habitat Needs	Identify Natural Community Associations	Develop and Promote BMPs	Maintain Open Habitat with Fire	Maintain Open Habitat Other Methods	Outreach and Increase Awareness
New York Fern	<i>Amauropelta noveboracensis</i>	•		•					
Willdenow's Maiden Fern	<i>Cyclosorus interruptus</i>	•				•			
Silver False Spleenwort	<i>Deparia acrostichoides</i>	•		•		•			
Glade Fern	<i>Diplaziopsis pycnocarpa</i>	•		•		•			
Lanceleaved Glade Fern	<i>Diplazium lonchophyllum</i>			•		•			
Lowland Bladderfern	<i>Cystopteris protrusa</i>	•		•		•			
Alabama Grape Fern	<i>Sceptridium jenmanii</i>	•	•	•	•	•			•
A liverwort	<i>Cololejeunea setiloba</i>	•	•	•	•	•			
Louisiana Quillwort	<i>Isoetes louisianensis</i>	•	•	•	•	•		•	
Sand Spikemoss	<i>Bryodesma corallinum</i>	•		•			•	•	
Gulf Spikemoss	<i>Selaginella ludoviciana</i>			•		•			
Staghorn Clubmoss	<i>Palhinhaea cernua</i>	•	•	•	•	•	•	•	

*Maintain Open Habitat with Fire = Species predominantly occurs in a fire-maintained system, but can occur in similar systems maintained to be open by other methods.

Chapter 5: Natural Communities

This chapter provides an overview of the natural communities of Louisiana based on the United States National Vegetation Classification (USNVC) system (USNVC 2025). The version of the natural community classification presented here is a simplified representation and may not fully align with the USNVC system.

The finest classification level in the USNVC system is the Ecological Association. In some cases, natural communities presented here are equivalent to a single Ecological Association in the USNVC system. However, most natural communities in this State Wildlife Action Plan (SWAP) are slightly broader in concept and capture several ecological associations or broader classification units within the USNVC. Appendix H contains a cross-reference of natural communities discussed in this chapter to the Groups and Macrogroups within the USNVC system. Groups and Macrogroups are intermediate classification units within the USNVC system hierarchy and are defined by criteria pertaining to physiognomy, biogeography, and floristics (USNVC 2025). In addition to vegetated natural communities, this chapter also addresses unvegetated and anthropogenic habitats.

Below, natural communities are organized into five archetypes:

1. Forests
2. Savannas and Woodlands
3. Non-forested Grasslands and Open Terrain
4. Inland and Marine Waters
5. Anthropogenic Habitats

The terrestrial archetypes are classified primarily on vegetative structure, including factors such as canopy cover, the presence and dominance of heliophytic (light-loving) understory vegetation, and the degree of naturalness or human influence. In contrast, Inland and Marine Waters are categorized by physical characteristics such as size, flow regime, salinity, and

substrate type. Together, these archetypes represent the diverse ecological tapestry of the region, shaped by the interplay of climate, topography, hydrology, and disturbance history.

Forests in Louisiana are widespread habitats characterized by a dominance of trees and a canopy cover often ranging from 75% to 100% under natural conditions. However, the exact threshold for what constitutes a forest can vary significantly depending on forest type and successional stage. Canopy density, as well as the structure of the mid-story and understory, is influenced by numerous environmental factors including soil type, moisture availability, disturbance history, and light penetration. The mid-story, composed of smaller trees and shrubs, can range from sparse to dense. The understory may be limited in herbaceous growth due to low light levels, or it may support a suite of shade-tolerant to shade-dependent plant species. Natural communities of the forest archetype are grouped according to the primary physiographic plain in which the natural community is associated and includes Alluvial Plain Forests, Coastal Plain Forests (Deltaic and Chenier), Interior Southern Plains Forests (Eastern and Western Gulf coastal plains), and Loess Plain Forests subtypes.

Savannas and Woodlands are naturally wooded habitats characterized by an open tree canopy that allows ample sunlight to reach the ground, supporting a rich and diverse herbaceous understory dominated by grasses and other light-loving plants. These ecosystems exist along a continuum of canopy cover, with savannas typically featuring 5% to 50% canopy closure, while woodlands are somewhat more densely wooded, generally exhibiting 50% to 75% canopy cover. The exact structure varies depending on the specific natural community characteristics such as type, age, fire frequency, fire intensity, and edaphic characteristics. These landscapes support high levels of plant and animal biodiversity and are shaped by a suite

of natural processes, with fire playing a particularly crucial role. Historically, frequent fires helped maintain an open structure, limit encroachment by dense woody vegetation, and promote the persistence of fire-adapted species. The dynamic interplay between canopy openness, fire, and herbaceous diversity makes savannas and woodlands some of the most ecologically rich and visually distinctive habitats in the region. In Louisiana, savannas and woodlands are primarily found inland across the Interior Southern Plains and includes Eastern Gulf Coastal Plain Savanna and Woodland, Western Gulf Coastal Plain Savanna and Woodland, and Interior Southern Plains Savanna and Woodland subtypes.

Non-forested Grasslands and Open Terrain refer to habitats that are naturally treeless with a rich diversity of herbaceous vegetation or terrain that is naturally unvegetated. Natural communities of this archetype are grouped into three subtypes: (1) Prairies, (2) Marshes, and (3) Barrier Islands, Beaches, and Sandbars. Prairies are dominated by grasses, grass-like plants, and forbs, forming extensive vegetative cover that supports a diverse array of plant and wildlife species. Fire and edaphic characteristics play a particularly crucial role in shaping prairie natural communities. Marshes, though often wet or seasonally inundated, share this non-forested characteristic and are populated by herbaceous wetland species adapted to saturated conditions. Barrier islands, beaches, and sandbars, found along coastlines and river systems, also fall within this category when they support sparse vegetation, including specialized grasses and shrubs adapted to shifting, sandy substrates. In some areas, particularly in coastal dune systems, low-growing shrubs may become more prominent, adding structural complexity while maintaining the open character of the landscape. Collectively, these habitats are crucial for biodiversity, water filtration, erosion control, and as transitional zones between aquatic and upland ecosystems.

Inland and Marine Waters encompass a variety of water bodies and vegetated habitats, which can be broadly categorized into three subtypes: (1) Lentic Water Bodies, (2) Lotic Water Bodies, and (3) Marine and Estuarine Water Bodies. Lentic Water Bodies refer to still or slow-moving systems such as natural lakes (e.g., oxbows), reservoirs, and both natural and man-made ponds. These areas often support submerged aquatic vegetation (SAV). Lotic Water Bodies, in contrast, are characterized by flowing water and include river systems and deltas. These dynamic environments also support freshwater SAV, contributing to ecological diversity and aquatic habitat complexity. Marine waters include estuarine and marine environments (e.g., Estuarine and Marine Submerged Aquatic Vegetations) and other coastal systems. Habitats in this system are often classified based on substrate type (e.g., sand, mud, or shell hash), which influences the distribution and composition of marine organisms. Together, these aquatic systems play critical roles in biodiversity, water quality, and habitat provisioning.

Anthropogenic Habitats are environments that have elements of nature but do not constitute a *natural community*. These

habitats have been significantly altered or created directly or indirectly by human activities. Agriculture and Improved Pasture, Rice Agriculture and Aquaculture, and Pine Plantation and Contemporary Forest are included in this anthropogenic category. These landscapes often consist of degraded habitats, largely fire-suppressed habitats, or second-growth forests that have regenerated with a preponderance of weedy or ruderal species and often contain an abundance of invasive species or invasive species cover. Unlike natural, old-growth forests, savannas, woodlands, or grasslands, these anthropogenic habitats typically have simplified structures, reduced biodiversity, and altered ecological processes. Pine plantations, for example, are usually composed of single-species stands, typically, Loblolly Pine (*Pinus taeda*) or Slash Pine (*P. elliotii*) planted in rows and harvested on short rotations. Both pine plantations and contemporary forests are markedly different from the diverse and dynamic ecosystems they replaced. While they provide some economic value and habitat for certain types of wildlife, these forests represent a departure from the complex, high functioning, mixed-species habitats that once dominated the region.

Unnatural pastures are often seeded with non-native grasses and are regularly manipulated through mowing, fertilization, and grazing regimes to support livestock, resulting in reduced plant diversity and altered soil and hydrological conditions. Rice fields and aquaculture ponds, many of which are integrated into rice farming systems, may resemble natural wetlands during parts of the year, but they are flooded, drained, and cultivated in cycles that are artificial. While these habitats provide economic value and can support certain wildlife species, especially waterbirds, they differ significantly from the native ecosystems they replaced, offering only a subset of the ecological functions and biodiversity of natural systems.

For each natural community, the name, state (S-rank) and global (G-rank) conservation ranks, and synonym(s) 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). The NVC identified 30 Macrogroups, 50 Groups with 53 Community Ecological System (CES) codes, 115 Alliances, and 338 Associations as occurring in Louisiana (USNVC 2025). These systems are described on NatureServe Explorer (explorer.natureserve.org), and their correlation to the natural communities are presented in Appendix I. Natural communities presented here are, in many cases, finer scale features with narrower concepts than Ecological Systems. Many natural communities fall within more than one Ecological System. In each account, the natural community is described and representative obligate or near-obligate SGCN are listed. For the full list of SGCN occurring in each subtype refer to Appendix F. General natural community research needs, conservation actions, and threats for each habitat are provided. In many cases, knowledge on Louisiana's natural communities is lacking. However, continued inventory and research of these natural communities will further refine our understanding, influence management actions, and inform future iterations of this Plan.

FOREST SYSTEMS

ALLUVIAL PLAIN FORESTS



Baldcypress-Tupelo Swamp Forest, Caddo Parish

BALDCYPRESS-TUPELO SWAMP FOREST

Rarity Rank: G3G5/S4
Synonyms: Freshwater Swamp, Brake, Swamp Forest

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.

Baldcypress-Tupelo Swamp Forest is forested, alluvial swamp occurring on intermittently exposed soils, most commonly along rivers and streams but also in backchannel depressions and swales. The soils are inundated or saturated by surface water or groundwater 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 Swamp generally occurs on mucks and clays but also on silts and sands with underlying clay layers (Conner and Buford 1998). Baldcypress-Tupelo Swamp Forest has 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 (*Taxodium distichum*) nor Tupelo (*Nyssa sylvatica*) seeds germinate underwater, nor can young seedlings of these trees survive long submergence. Seedling recruitment can only occur during draw-down periods.

This probably explains why these species tend to occur in even-aged stands since the environmental conditions favorable for germination and establishment of saplings occur infrequently. Near-permanent impoundment of Baldcypress-Tupelo Swamp Forest is a major threat affecting sustainability of these forests. Those areas dominated by Tupelo are also alluvial but may occur on higher topographic positions than Baldcypress-dominated swamps.

BALDCYPRESS-TUPELO SWAMP FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Setophaga dominica</i>	Yellow-throated Warbler
	<i>Protonotaria citrea</i>	Prothonotary Warbler
Non-crustacean Arthropods	<i>Satyrium kingi</i>	King's Hairstreak
	<i>Anguilla rostrata</i>	American Eel
Inland Fishes	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Fundulus</i> spp.	Starhead Topminnow complex
	<i>Iris nelsonii</i>	Abbeville Red Iris
Plants	<i>Carex decomposita</i>	Cypress-knee Sedge
	<i>Dryopteris celsa</i>	Log Fern

Extent and Status

Baldcypress-Tupelo Swamp Forest may be found throughout Louisiana. Of the original 2 million to 4 million acres, 25% to 50% (approximately 500,000 to 1 million acres) remain. Although old individual Baldcypress trees are not that difficult to find, old-growth examples of Baldcypress-Tupelo Swamp Forest are very rare (Smith 1993, TNC 2004). The Atchafalaya Basin Floodway contains the greatest remaining contiguous acreage in the United States with an estimated 595,000 acres of collective Baldcypress-Tupelo Swamp Forest and Bottomland Hardwood Forest. Large tracts can also be found in the East Gulf Coastal Plain (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).

EXTENT OF BALDCYPRESS-TUPELO SWAMP FOREST

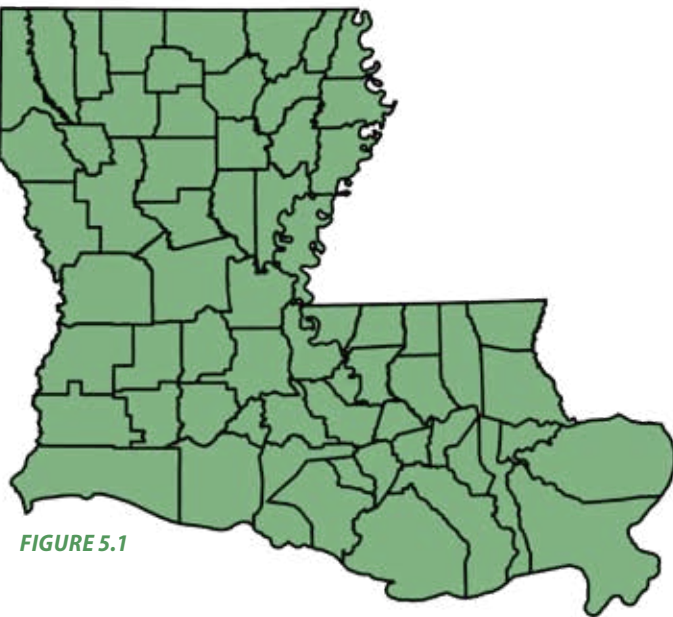


FIGURE 5.1

Threats

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

Research Needs and Conservation Actions

1. Establish and maintain long-term monitoring sites within coastal wetland forests.
2. Promote use of Lower Mississippi Valley Joint Venture (LMJVJ) Desired Future Conditions to restore/manage swamps for fish and wildlife.
3. Continue to work with partners to identify old-growth areas where conservation actions can be implemented.
4. Work with adjoining states to address water management issues that affect Baldcypress-Tupelo Swamp Forests in Louisiana.
5. Work with U.S. Army Corps of Engineers (USACE) to manage water levels in the Atchafalaya Basin to benefit this habitat type.

BATTURE FOREST

Rarity Rank: G4G5/S4

Synonyms: Riverfront Pioneer Forest, Cottonwood-Willow Forest

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: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Plants	<i>Mimulus ringens</i>	Square-stem Monkey Flower

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 are unknown. Portions of the Atchafalaya Basin may support forest of this type.

Threats

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.

EXTENT OF BATTURE FOREST

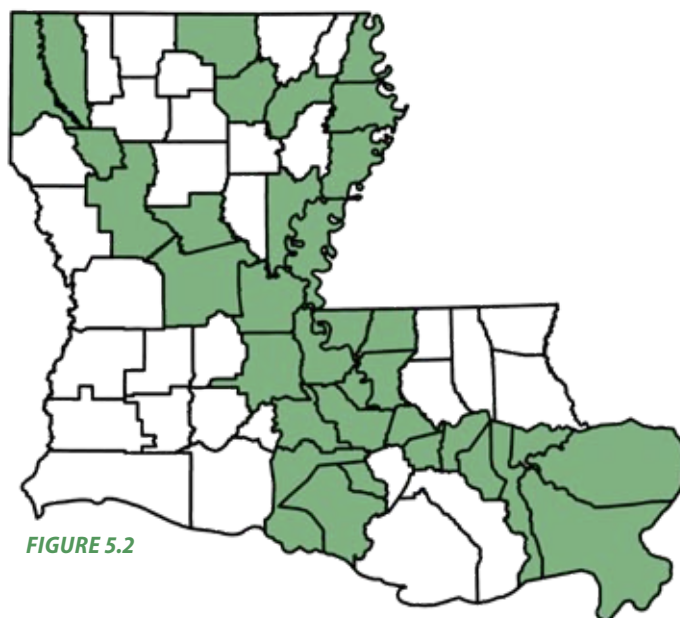


FIGURE 5.2



Batture Forest along the Mississippi River, West Feliciana Parish

Research Needs and Conservation Actions

1. Conduct inventory of this habitat type, especially in the Atchafalaya Basin.
2. Work with partners 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 fish and wildlife.
3. Work with partners to fill data gaps concerning ecological system processes and water quality/discharge impacts on this habitat.
4. Work with partners to minimize impacts of dredging and water discharges in Batture Forest.
5. Promote the maintenance and restoration of natural hydrologic regimes.

BOTTOMLAND HARDWOOD FOREST

Rarity Rank: G4G5/S4
Synonyms: Mixed Bottomland Hardwood, Broad Stream Margin, Hardwood Bottom

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 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, TNC 2004).

The following are three associations recognized by the Wildlife Diversity Program in Bottomland Hardwood Forests of Louisiana (LNHP 2009):

- 1. 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 one to two months during the growing season.
- 2. Overcup Oak-Water Hickory Bottomland Hardwood Forest
Overcup Oak (*Quercus lyrata*) and Water Hickory (*Carya aquatica*) are codominants of this floodplain forest which occurs on low-lying poorly drained flats, sloughs in backwater



Bottomland Hardwood Forest, Big Lake WMA, Tensas Parish

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.

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.

BOTTOMLAND HARDWOOD FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Crustaceans	<i>Procambarus</i> <i>viaeviridis</i>	Vernal Crayfish
	<i>Geothlypis formosa</i>	Kentucky Warbler
Birds	<i>Protonotaria citrea</i>	Prothonotary Warbler
	<i>Euphagus carolinus</i>	Rusty Blackbird
Amphibians	<i>Ambystoma texanum</i>	Small-mouthed Salamander
Plants	<i>Lindera melissifolia</i>	Pondberry
	<i>Catocala atocala</i>	Brou's Underwing
Non-crustacean Arthropods	<i>Dryobius sexnotatus</i>	Six-banded Longhorn Beetle

Extent and Status

Bottomland Hardwood Forest is a significant habitat in Louisiana, having historically occupied an estimated 6 million to 8 million acres (Smith 1993). Substantial acreage of this habitat type remains on the landscape today; however, much that remains has been hydrologically altered. Pristine, old-growth examples are very rare, with most extant examples being second or third growth stands. 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, particularly within the USACE Atchafalaya Basin Spillway Diversion Project, the Atchafalaya National Wildlife Refuge (NWR), and Sherburne WMA; together these lands protect more than 43,000 acres of wildlife habitat. In fact the Atchafalaya Basin contains the largest remaining block of floodplain forest and swamp in the U.S. Louisiana’s East Gulf Coastal Plain (EGCP) still contains extensive areas of Bottomland Hardwood Forest primarily along the Pearl and lower Bogue Chitto rivers in St. Tammany and Washington parishes. Much of this acreage is contained within the Bogue Chitto NWR and Pearl River WMA. Although 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 major challenges to reforestation efforts but are essential to providing adequate wildlife habitat in alluvial settings.

Threats

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. Ash (*Fraxinus* spp.) trees

EXTENT OF BOTTOMLAND HARDWOOD FOREST

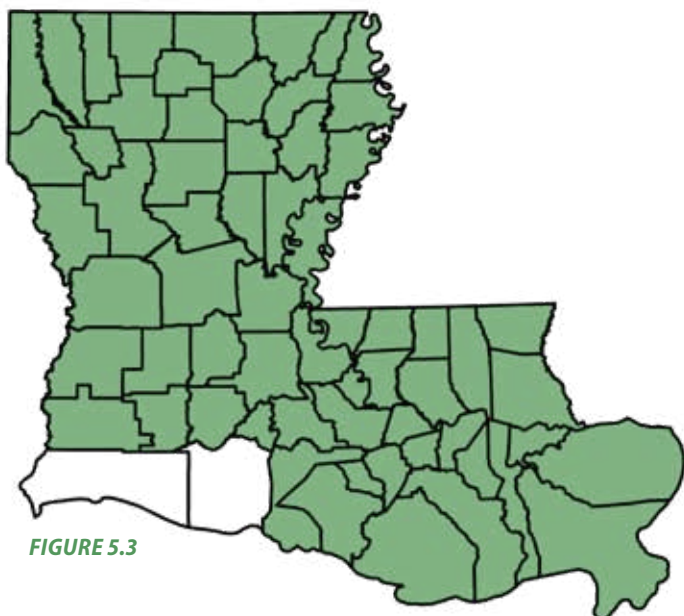


FIGURE 5.3

are critical parts of many Bottomland Hardwood Forests and are threatened by the Emerald Ash Borer (EAB; *Agrilus planipennis*), a destructive, wood-boring beetle native to Asia. As with other forested wetlands, potential impacts of climate change related to reduced precipitation are of concern.

Research Needs and Conservation Actions

1. Promote use of appropriate silvicultural techniques and Best Management Practices (BMPs) 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.
6. Establish and maintain long-term monitoring sites within reforested Bottomland Hardwood Forests.

CANEBRAKE

Rarity Rank: G2?/SX

Synonyms: Giant Cane Shrubland

Canebrake is a dense, monotypic thicket 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 (*Bison bison*), Louisiana Black Bear, Wild Turkey (*Meleagris gallopavo*), White-tailed Deer (*Odocoileus virginianus*), Cougar



Canebrake

(*Puma concolor*), and other wildlife used Canebrake for shelter and food. Giant Cane was used extensively by Native Americans for building materials and as a food source. Native Americans also managed Canebrake 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 Canebrake habitat (Noss 2013, Brantley and Platt 2001). It is hypothesized that the extinct Passenger Pigeon (*Ectopistes migratorius*) also contributed to the establishment and expansion of Canebrake. 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). Canebrake began to decline rapidly after European settlement and, by the early 1900s, had nearly disappeared throughout the southeastern United States. 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).

Extent and Status

Canebrake likely occurred statewide on rich alluvial soil in large and small floodplains and was probably most extensive in the Mississippi and Red river valleys. This habitat is now extirpated in Louisiana.

Research Needs and Conservation Actions

1. Identify historical occurrences of Canebrake 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. Establish research projects that explore enhancing existing patches of Giant Cane and monitoring sites where storms have opened canopy gaps.
4. Document response by Giant Cane and responses of wildlife species to overstory removal and prescribed fire.

HARDWOOD FLATWOODS

Rarity Ranks: Mesic Hardwood Flatwoods: G1G2?/S2S3
 Wet Hardwood Flatwoods: G2G3/S2S3
 Prairie Terrace Loess Forest: G2/S1

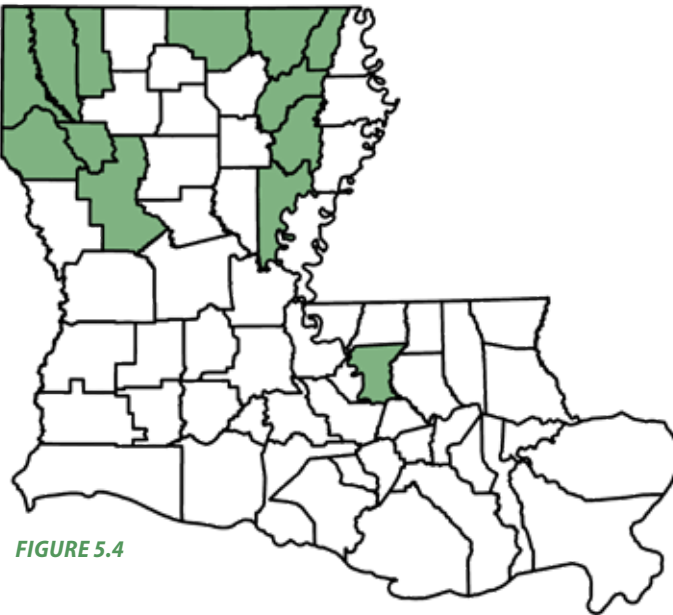
Synonyms: Willow Oak Flat, Pin Oak Flat

Wet Hardwood Flatwoods and Mesic Hardwood Flatwoods are sometimes described as two distinct communities but are combined here. Also included in this habitat are Pleistocene Terrace Flatwoods and Prairie Terrace Loess Forest, a mesic flatwoods type restricted to East Baton Rouge Parish.

Wet 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 FOREST: OBLIGATE OR NEAR-OBLIGATE SPECIES		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Catocala atocala</i>	Brou's Underwing
	<i>Triosteum angustifolium</i>	Yellowleaf Tinker's-weed
Plants	<i>Carex arkansana</i>	Arkansas Caric Sedge
	<i>Forestiera ligustrina</i>	Upland Swamp Privet

EXTENT OF HARDWOOD FLATWOODS



Hardwood Flatwoods on Macon Ridge, northeast Louisiana

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 million acres historically, with 1% to 5% remaining today (Smith 1993). Ecology of Hardwood Flatwoods is a major knowledge gap in Louisiana.

Threats

This habitat faces potential residential and commercial development and conversion to anthropogenic habitat types. Forestry practices, particularly site preparation methods such as bedding, negatively impact the hydrology, soil, and vegetation composition of Hardwood Flatwoods. Disturbance associated with increased human interface and invasive plants and animals also threaten this habitat.

Research Needs and Conservation Actions

1. Implement research on ecology, classification, and extent of this habitat type.
2. Conduct better mapping of this habitat, particularly on Pleistocene terraces. This can be done to some degree with high-resolution LiDAR.
3. Designate this habitat as a high priority for inventory.
4. Seek habitat protection opportunities through conservation easements and land acquisition.

MACON RIDGE GREEN ASH POND

Rarity Rank: G2?/S1
Synonyms: Spicewood Pond, Spicewood Brake

Macon Ridge Green Ash Pond, a wooded, ephemeral pond type, is restricted to Macon Ridge in northeastern Louisiana. Macon Ridge Green Ash Ponds are embedded in what was historically

Hardwood Flatwoods and, possibly, other forest types on higher elevations of the Macon Ridge. On today's landscape, they are often surrounded by agricultural fields. General Land Office survey records sometimes referred to Macon Ridge Green Ash Ponds as spicewood ponds or spicewood brakes, a possible reference to the aromatic shrub Pondberry, which is federally endangered.

MACON RIDGE GREEN ASH POND: OBLIGATE OR NEAR-OBLIGATE SPECIES		
	Scientific Name	Common Name
Plants	<i>Lindera melissifolia</i>	Pondberry

Extent and Status

Macon Ridge Green Ash Pond was apparently abundant in pre-settlement times. Many ponds were lost to agriculture; faint outlines of these extirpated ponds in cultivated fields are sometimes evident on aerial imagery. However, many ponds were likely spared, because they were too wet to farm. Some of these extant ponds are now embedded in agricultural fields.

EXTENT OF MACON RIDGE GREEN ASH POND

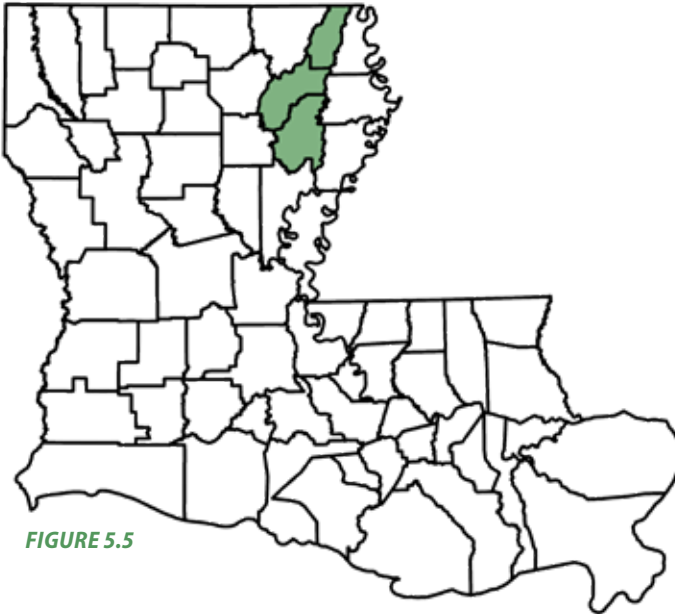


FIGURE 5.5



Macon Ridge Green Ash Pond, Franklin Parish

Threats

Macon Ridge Green Ash Ponds are threatened by invasive species (particularly EAB), basin alteration and disturbance, and input of agricultural chemicals from adjacent fields.

Research Needs and 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 partners to develop conservation initiatives for this ephemeral pond type.
5. Conduct floristic surveys, especially for Pondberry, in Macon Ridge Green Ash Ponds.

COASTAL PLAIN FORESTS



Barrier Island Live Oak Forest on Grand Isle, Jefferson Parish

BARRIER ISLAND LIVE OAK FOREST

Rarity Ranks: G1/S1
Synonyms: Maritime Forest

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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds		Neotropical-Nearctic migrants

Extent and Status

Barrier Island Live Oak Forest is restricted to Grand Isle where it occupies a small geographic area. 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 several tracts totaling approximately 40 acres of this forest type.

Threats

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

EXTENT OF BARRIER ISLAND LIVE OAK FOREST



FIGURE 5.6

Research Needs and Conservation Actions

- 1. Work with partners 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 (*Quercus virginiana*), Toothache Tree (*Zanthoxylum clava-herculis*), and other native species on Grand Isle.
- 4. Support partner efforts for shoreline stabilization and habitat restoration.

COASTAL LIVE OAK-HACKBERRY FOREST

Rarity Rank: G2/S1
Synonyms: Chenier, Maritime Forest, Chenier Maritime Forest

Coastal Live Oak-Hackberry Forest, also known as Chenier (French for “place of oaks”), occurs on abandoned beach ridges defining the Chenier Plain of southwest Louisiana and adjacent Texas. Coastal Live Oak-Hackberry Forest occurs on the Deltaic Plain as well (on substrate of different geological origins) but is rare in this region. 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 to 5 feet above sea level. This forest is an important storm barrier limiting saltwater intrusion into marshes. Typically, marshes landward of Chenier is fresher than those Gulf-ward. This community also provides important wildlife habitat and serves as vital resting and foraging habitat for migrating birds (Barrow et al. 2000). Hundreds of thousands of birds (around 100 species) use Coastal Live Oak-Hackberry Forest 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: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Birds		Neotropical-Nearctic migrants

Extent and Status

Coastal Live Oak-Hackberry Forest occurs in the Chenier Plain from Iberia Parish westward across Vermilion and Cameron parishes and on a few ridges in the Deltaic Plain. This habitat also occurs on Native American shell middens, many of which have been mined for fill material. Because this forest type is found on elevated sites, most examples were developed or highly altered relatively early during European expansion. Of the original 100,000 to 500,000 acres of Coastal Live-Oak Hackberry Forest in Louisiana, only 2,000 to 10,000 acres (1% to 5%) of pre-settlement extent are thought to remain today (Smith 1993). The true remaining extent is likely much closer to the lower end of this range.

Few examples of this habitat are protected. In Cameron Parish, TNC protects Hollister Chenier Preserve (approximately 50 acres), and the Baton Rouge Audubon Society owns and maintains the Peveto Woods Sanctuary (approximately 40 acres). Although privately owned, the Evariste Nunez Woods and Bird Sanctuary (approximately 42 acres) is maintained by LDWF through a lease agreement. Several Native American shell middens are protected on Jean Lafitte National Historical Park and Preserve.

EXTENT OF COASTAL LIVE OAK-HACKBERRY FOREST

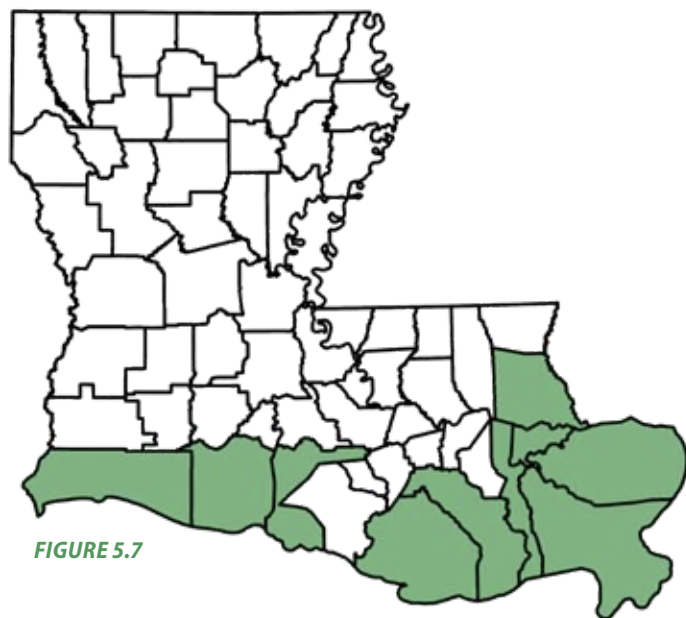


FIGURE 5.7



Coastal Live Oak-Hackberry Forest (Cameron Parish)

Importance to Neotropical Migratory Birds

Coastal Live Oak-Hackberry Forest is extremely important as stopover habitat for Neotropical migratory birds during spring and fall migration. The majority of migrants fly nonstop for more than 600 miles to cross the Gulf of America 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, Coastal Live Oak-Hackberry Forest provides 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 America on their journey to Central and South America.

Threats

Coastal Live Oak-Hackberry Forest is threatened by overgrazing from livestock, 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.

Research Needs and Conservation Actions

1. Work with partners to restore Coastal Live Oak-Hackberry Forest.
2. Support partner efforts for shoreline stabilization and habitat restoration.
3. Work with partners 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 Chenier 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 Chenier 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. Work with partners and construct coastal hammocks to use sediment pipeline delivery or other sediment delivery

- methods to build land sufficient to support Coastal Live Oak-Hackberry Forest 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.

SALT DOME HARDWOOD FOREST

Rarity Rank: G1/S1
Synonyms: None

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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Plants	<i>Diplazium lonchophyllum</i>	Lanceleaved Glade Fern
	<i>Croomia pauciflora</i>	Croomia
	<i>Poa sylvestris</i>	Woodland Bluegrass



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

EXTENT OF SALT DOME HARDWOOD FOREST

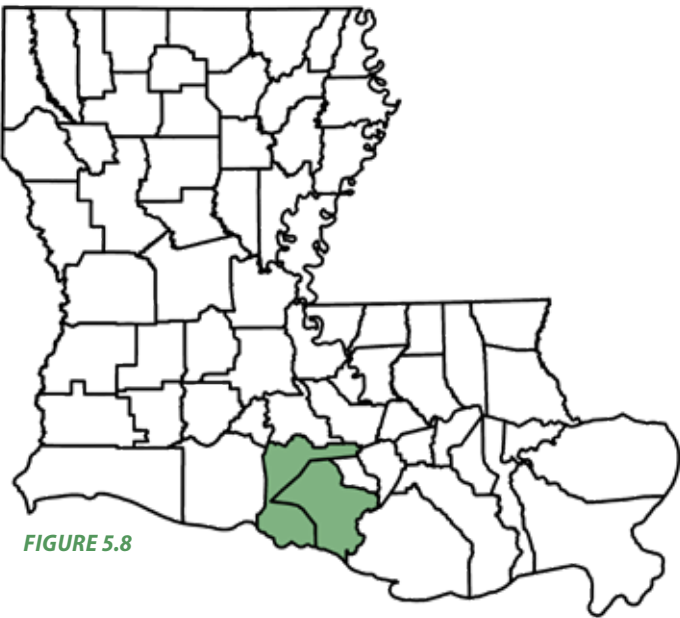


FIGURE 5.8

Extent and Status

Salt Dome Hardwood Forest is 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 Island and Weeks Island support high quality forest. Belle Isle is much smaller with less topographic variation. Habitat on Belle Isle is intact but is not comparable to forest on the other islands. Only a small tract of forest remains on Jefferson Island. Avery Island has lost much of its forest habitat and has issues with exotic invasive species. Remaining forest on Avery Island is in need of survey and evaluation.

Threats

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.

Research Needs and Conservation Actions

1. Continue field inventory work for this habitat, especially on Avery Island.
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.

LIVE OAK NATURAL LEVEE FOREST

Rarity Rank: G3G4/S1
Synonyms: Natural Levee Forest, Frontland Forest

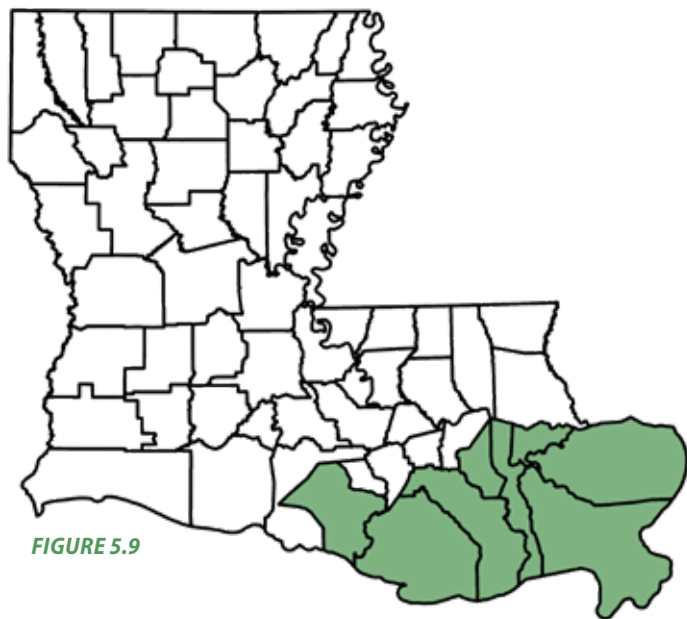
This community occurs principally in southeastern Louisiana on natural levees or frontlands and on islands within marshes and swamps. It is similar in some respects to Coastal Live Oak-Hackberry Forest in that both develop on natural ridges in the coastal zone and overstory dominants are comparable. Palmetto (*Sabal minor*) 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*).

Extent and Status

Louisiana's Live Oak Natural Levee Forest occurs 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, it was among the first habitats to be cleared for agriculture and residential development. The original extent of this natural community in Louisiana is unknown; however, very little remains. The majority of Live Oak Natural Levee Forest is 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 loosely referable to this type.

EXTENT OF LIVE OAK NATURAL LEVEE FOREST



Threats

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

Research Needs and Conservation Actions

1. Support partner efforts for shoreline stabilization and habitat restoration.
2. Work with partners to broaden coastal restoration priorities to include Live Oak Natural Levee Forests.
3. Work with local parish planning commissions and other partners 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 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).

LIVE OAK-PINE-MAGNOLIA FOREST

Rarity Rank: G2G3/S1
Synonyms: Maritime Forest, Maritime Mesophytic Forest

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 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 hardwood forest types 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.

Extent and Status

This community is very restricted in Louisiana, known only from St. Tammany Parish along the northshore of Lake Pontchartrain. Estimated pre-settlement extent of this habitat type is 10,000 to 50,000 acres, with only 10% to 25% of the original extent remaining (Smith 1993). Small tracts of this habitat are protected at Big Branch Marsh NWR, Fontainebleau State Park, and Northlake Nature Center.

EXTENT OF LIVE OAK PINE MAGNOLIA FOREST

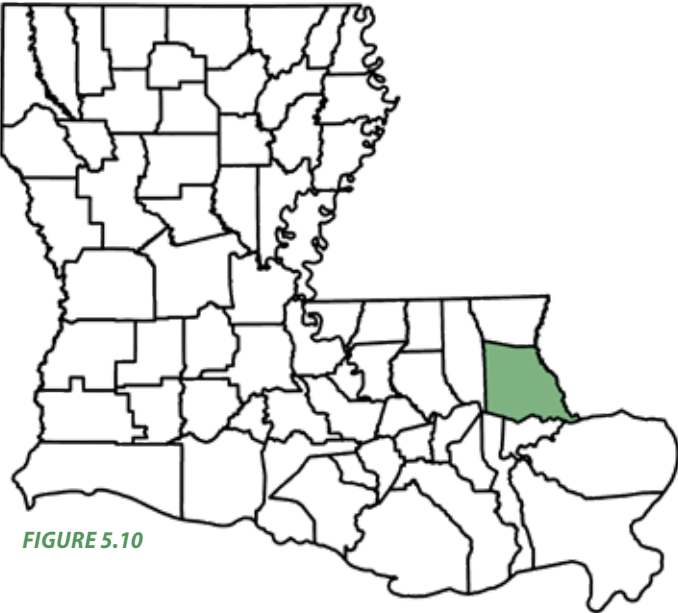


FIGURE 5.10



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

Threats

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

Research Needs and 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.

INTERIOR SOUTHERN PLAINS FORESTS (EASTERN/WESTERN)



Acidic Bay Forest, Schoolhouse Springs Preserve, Jackson Parish



Acidic Bay Forest

ACIDIC BAY FOREST

Rarity Rank: G3?/S2

Synonyms: Reed Brake, Acidic Seep Forest, Spring-Head, Green-Head, Bayhead Swamp, Baygall, Bayhead

In this treatment, Forested Seep and Bayhead Swamp are included within the concept of Acidic Bay Forest. Acidic Bay Forest is forested wetland occupying acidic, often seepage-influenced, areas embedded in pine woodlands and savannas of the Interior Southern Plains subtype. Soils are often saturated and spongy even during dry periods. The flora of

Acidic Bay Forest includes several broad-leaved evergreen trees and shrubs such as Sweetbay Magnolia (*Magnolia virginiana*) and Red Bay (*Persea palustris*). Baldcypress is characteristic of this community in the Upper West Gulf Coastal Plain (UWGCP) and northern portions of the West Gulf Coastal Plain (WGCP), where it can occur with seepage on middle and upper slopes. Baldcypress is not a typical component of this habitat elsewhere in the state. Several ferns and living peat moss (*Sphagnum* spp.) are often conspicuous in the understories of Acidic Bay Forest. 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. Acidic Bay Forest was historically shaped by natural fire and is typically flanked by fire-dependent pine systems. Acidic Bay Forest receives frequent fire along its edges and only occasionally burns through; therefore, it often serves as a natural fire break. The up-slope edges of Acidic Bay Forest 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).

ACIDIC BAY FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Somatochlora margarita</i>	Texas Emerald
Amphibians	<i>Desmognathus valentinei</i>	Valentine's Southern Dusky Salamander
	<i>Pseudotriton montanus flavissimus</i>	Gulf Coast Mud Salamander
Plants	<i>Trillium texanum</i>	Texas Trillium
	<i>Ilex myrtifolia</i>	Myrtle Holly
	<i>Lindera subcoriacea</i>	Bog Spicebush

EXTENT OF ACIDIC BAY FOREST

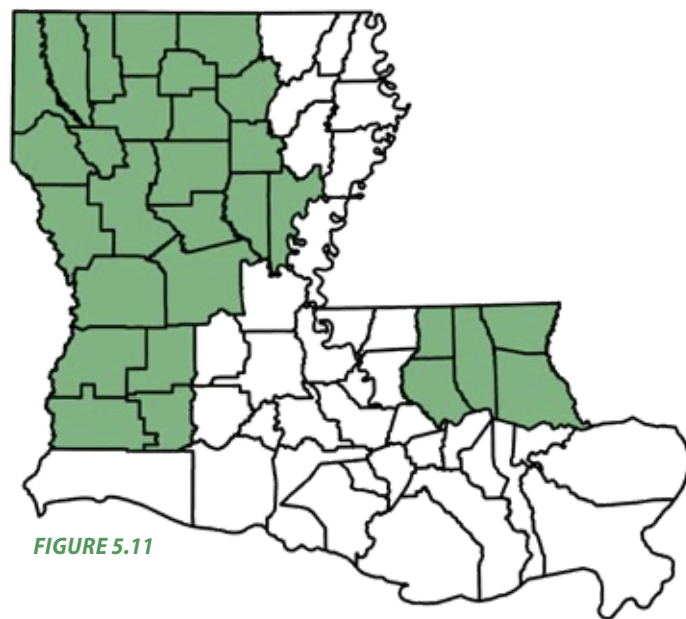


FIGURE 5.11

Extent and Status

Acidic Bay Forest is associated with geologically older landscapes generally supporting a pine-dominated matrix. Historically, this forested wetland type was estimated to have occupied 100,000 to 500,000 acres, but only 25% to 50% of the original cover currently remains (Smith 1993). High-quality Bayhead Swamp can be found on conservation areas and private lands rangewide.

Threats

Soil and canopy disturbances associated with timber harvesting, mineral extraction, and other sources occasionally affect this habitat. Laurel Wilt, a disease affecting woody plants in the laurel family, threatens Red Bay, a characteristic plant of Bayhead Swamps. 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.

Research Needs and 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. Support control of Feral Hogs and invasive plants such as Chinese Privet and Chinese Tallow Tree in Acidic Bay Forests.

CALCAREOUS FOREST

Rarity Rank: G2?Q/S2

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

This community occurs on calcareous soils in the uplands or upper floodplains 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



Calcareous Forest, Bodcau WMA, Bossier Parish

valleys often having a closed canopy. Calcareous Forest on upper slopes and ridge tops was likely woodland, 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 and, typically, have an alkaline horizon at or within the upper 30 inches of the soil profile (Kelley and Bordelon 2024, Smith et al. 1989).

CALCAREOUS FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Catocala atocala</i>	Brou's Underwing
	<i>Baiomys taylori</i>	Northern Pygmy Mouse
Mammals	<i>Lasionycteris noctivagans</i>	Silver-haired Bat
	<i>Quercus durandii</i>	Durand Oak
Plants	<i>Acer leucoderme</i>	Chalk Maple
	<i>Cladrastis kentukea</i>	Yellow-wood

Extent and Status

Calcareous Forest was estimated to occupy 50,000 to 100,000 acres in Louisiana in pre-settlement times, but only 25% to 50% of the original cover remains today (Smith 1993). Several high-quality occurrences exist on conservation areas such as the Kisatchie National Forest (KNF; particularly the Winn Ranger District), Barksdale Air Force Base (AFB), Bodcau WMA, and TNC's Copenhagen Hills Preserve. Additional field surveys are needed to more accurately determine the status and extent of this habitat type.

EXTENT OF CALCAREOUS FOREST

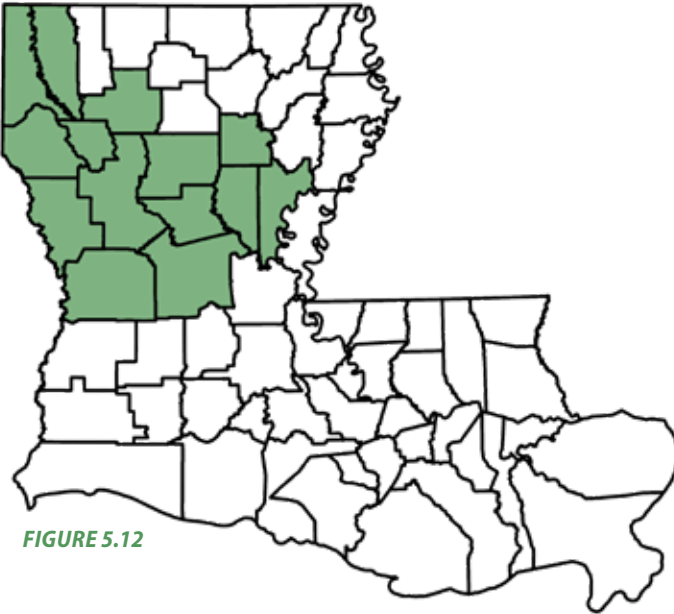


FIGURE 5.12

Threats

This habitat is threatened mainly by disturbance associated with timber harvesting and oil and gas extraction (including roads and infrastructure). Ash trees are critical parts of Calcareous Forests and are threatened by the EAB. Inadequate fire threatens Calcareous Forests on upper slopes and ridge tops.

Research Needs and 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 a management tool for Calcareous Forests occurring on higher landscape positions.
5. Monitor impacts of EAB on calcareous woodlands, especially those adjacent to Keiffer prairies where EAB has already been detected.
6. Target occurrences of Calcareous Forest in Louisiana for permanent protection via servitudes or land acquisition.

HARDWOOD SLOPE FOREST

Rarity Rank: G2G3/S3

Synonyms: Mixed Pine Hardwood, Beech-Magnolia Forest, Mixed Hardwood Forest, Mixed Mesic Hardwood Forest

Hardwood Slope Forest occurs on slopes (often steep) rising out of stream floodplains. Fire may have occurred very rarely in Hardwood Slope Forest but is not a process required to maintain this community. In Hardwood Slope Forest, American Beech (*Fagus grandifolia*) and Southern Magnolia (*Magnolia grandiflora*) 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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Amphibians	<i>Plethodon kisatchie</i>	Louisiana Slimy Salamander
Birds	<i>Helmitheros vermivorum</i>	Worm-eating Warbler
Plants	<i>Ribes curvatum</i>	Granite Gooseberry

Extent and Status

Hardwood Slope Forest once occupied 100,000 to 500,000 acres historically, with an estimated 25% to 50% still remaining (Smith 1993). Occurrences are scattered in the WGCP of central Louisiana and in the EGCP in the Florida Parishes. There are a few occurrences known from Macon Ridge in the MRAP, and a number of occurrences are protected on KNF and Fort Polk-Vernon WMA. Hardwood Slope Forest is sometimes completely contained within Streamside Management Zones (SMZs) on industrial forest lands.



Hardwood Slope Forest

EXTENT OF HARDWOOD SLOPE FOREST

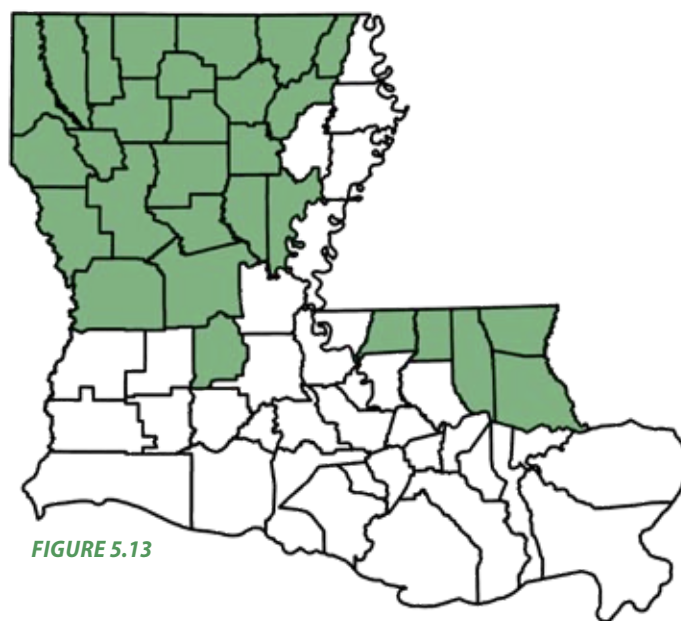


FIGURE 5.13

Threats

Conversion to other forest types and agriculture, disturbance from human activities, and invasive plants and animals pose substantial threats to this habitat.

Research Needs and Conservation Actions

1. Develop and implement Desired Future Conditions for restoration of these habitat types including appropriate herbicide treatments.
2. Maintain SMZs and encourage use of broader SMZs to protect these habitats.
3. Promote use of fire in Hardwood Slope Forests, to include discouraging the practice of placing fire lines along stream valleys, allowing prescribed fire to burn into riparian habitats.

POND Cypress-SWAMP TUPELO FOREST

Rarity Rank: G3/S1
Synonyms: Pondcypress Flooded Woodland

Pondcypress-Swamp Tupelo Forest is strongly associated with blackwater streams and floodplains. It occupies the backwater portions of larger swamplands in places well removed from active stream channels. This habitat can also occupy isolated depressions in East Gulf Coastal Plain flatwoods embedded within a matrix of Eastern Longleaf Pine Flatwoods Savanna. This swamp type may grade into Baldcypress-Tupelo-Swamp Forest which is more influenced by river flooding. Pondcypress-Swamp Tupelo Forest is acidic and nutrient poor. Floristic diversity is significantly higher than that of Baldcypress-Tupelo Swamp Forest. Fire may play a role in the stand density and species distribution of Pondcypress-Swamp Tupelo Forest, which can have a fairly open to dense canopy.

POND Cypress-SWAMP TUPELO FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Satyrium kingi</i>	King's Hairstreak
Plants	<i>Carex decomposita</i>	Cypress-knee Sedge
	<i>Ilex amelanchier</i>	Sarvis Holly



Pondcypress-Swamp Tupelo Forest, Joyce WMA, Tangipahoa Parish

EXTENT OF POND Cypress-SWAMP TUPELO FOREST

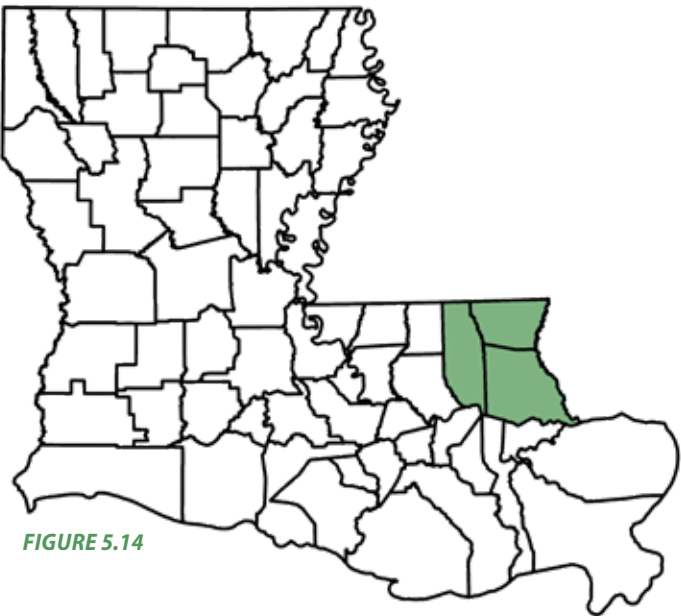


FIGURE 5.14

Extent and Status
In Louisiana, Pondcypress-Swamp Tupelo Forest is restricted to the eastern Florida Parishes. No estimates of historical areal extent have been made.

Threats Assessment
Pondcypress-Swamp Tupelo Forest is threatened by introduction of excessive nutrients, which alters species composition of this acidic and oligotrophic habitat.

- Research Needs and 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-Swamp Tupelo Forest; this swamp type is acidic and oligotrophic and can be degraded by nutrient input.

SMALL STREAM FOREST

Rarity Rank: G3/S3
Synonyms: Riparian Forest, Small Stream Floodplain Forest, Creek Bottom Forest, Sandy Branch Bottom, Upland Stream Forest, Hammock

Small Stream Forest is relatively narrow wetland forest occurring along small rivers and streams in central, western, southeastern, and northern Louisiana. This forest is seasonally flooded for brief periods. Small Stream Forest typically occurs higher up in the floodplain. The percentage of sand, silt, calcareous clay, acidic clay, and organic material in the soil is highly variable (depending on local geology) which results in a wide-ranging species composition for this habitat. Soils usually have a significant sand fraction but are typically classified as silt loams. This forest has fewer major geomorphic floodplain features than those typically associated with larger rivers or Bottomland Hardwood Forest. At times, this community is quite similar in species composition to Hardwood Slope Forest

(Beech-Magnolia Forest). This forested wetland is a critical component of the landscape, filtering surface and subsurface flows, improving water quality, and storing sediment and nutrients (Rummer 2004). Spruce Pine is a common associate in the Florida Parishes, and Baldcypress and Loblolly Pine are occasional associates statewide. Historically, this system was intermingled with Canebrake. Mild, low, surface fires largely restricted to the duff layer, would occur in this system; however, the fire intensity and frequency would not alter species composition or structure.

SMALL STREAM FOREST: OBLIGATE OR NEAR-OBLIGATE SPECIES

	Scientific Name	Common Name
Mollusks	<i>Margaritifera hembeli</i>	Louisiana Pearlshell
Crustaceans	<i>Faxonius maletae</i>	Kisatchie Painted Crayfish
	<i>Faxonius hathawayi blacki</i>	Calcasieu Painted Crayfish
	<i>Faxonius hobbsi</i>	Pontchartrain Painted Crayfish
Birds	<i>Parkesia motacilla</i>	Louisiana Waterthrush
	<i>Leuctra szczytkoi</i>	Louisiana Needlefly
Non-crustacean Arthropods	<i>Dubiraphia parva</i>	Little Dubiraphian Riffle Beetle
	<i>Diplectrona rossi</i>	Schoolhouse Springs Net-spinning Caddisfly
Amphibians	<i>Eurycea guttolineata</i>	Three-lined Salamander
Reptiles	<i>Farancia erytrogramma erytrogramma</i>	Common Rainbow Snake
	<i>Sternotherus peltifer</i>	Stripe-necked Musk Turtle
Inland Fishes	<i>Pteronotropis signipinnis</i>	Flagfin Shiner
		Starhead Topminnow complex
	<i>Alburnops chalybaeus</i>	Ironcolor Shiner
Mammals	<i>Lasionycteris noctivagans</i>	Silver-haired Bat
	<i>Marshallia trinervia</i>	Broadleaf Barbaras-buttons
Plants	<i>Magnolia pyramidata</i>	Pyramid Magnolia
	<i>Gratiola floridana</i>	Florida Hedge-hyssop



Small Stream Forest, Fort Polk, Vernon Parish

EXTENT OF SMALL STREAM FOREST

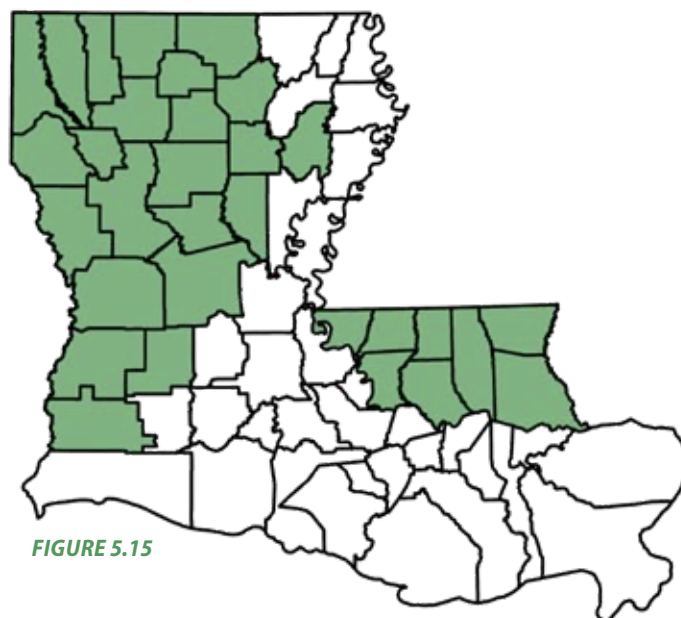


FIGURE 5.15

Extent and Status

Small Stream Forest is widely distributed in broad uplands. An estimated 25% to 50% of Louisiana's original Small Stream Forest, which is estimated to have been 1 million to 2 million acres, is thought to remain intact (Smith 1993). A number of high-quality examples occur on KNF, Fort Polk-Vernon WMA, and Fort Polk North WMA.

Threats

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.

Research Needs and 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. Conduct studies that help us better differentiate between this habitat and other similar habitat types.
3. Work with partners to develop guidelines and funding mechanisms for restoration of abandoned gravel mines.
4. Form a committee to develop BMPs for current and proposed gravel mines to prevent or reduce the impacts to streams and the surrounding forest habitat.
5. Support control of invasive species in this community type.
6. Discourage reservoirs with footprints that would destroy this habitat type, especially those that would affect high-quality streams.

LOESS PLAIN FORESTS



Southern Mesophytic Hardwood Forest, Tunica Hills WMA, West Feliciana Parish

SOUTHERN MESOPHYTIC HARDWOOD FOREST

Rarity Rank: G1G2/S2
Synonyms: Relict Northern Hardwood Forest, Bluffland Forest, Beech-Magnolia Forest, Upland Hardwood Forest, Mixed Mesophytic Forest

Southern Mesophytic Hardwood Forest is currently recognized in Louisiana only in the northwestern Florida Parishes and Catahoula Parish. 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.

SOUTHERN MESOPHYTIC HARDWOOD FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Vaejovis carolinianus</i>	Southern Unstriped Scorpion
	<i>Anillinus felicianus</i>	an <i>Anillinus</i> ground beetle
Amphibians	<i>Plethodon websteri</i>	Webster's Salamander
	<i>Plethodon serratus</i>	Southern Red-backed Salamander
Birds	<i>Helmitheros vermivorum</i>	Worm-eating Warbler
Mammals	<i>Tamias striatus</i>	Eastern Chipmunk
Plants	<i>Pachysandra procumbens</i>	Allegheny Spurge
	<i>Stewartia malacodendron</i>	Silky Camellia
	<i>Asarum canadense</i>	Canada Wild Ginger

EXTENT OF SOUTHERN MESOPHYTIC FOREST

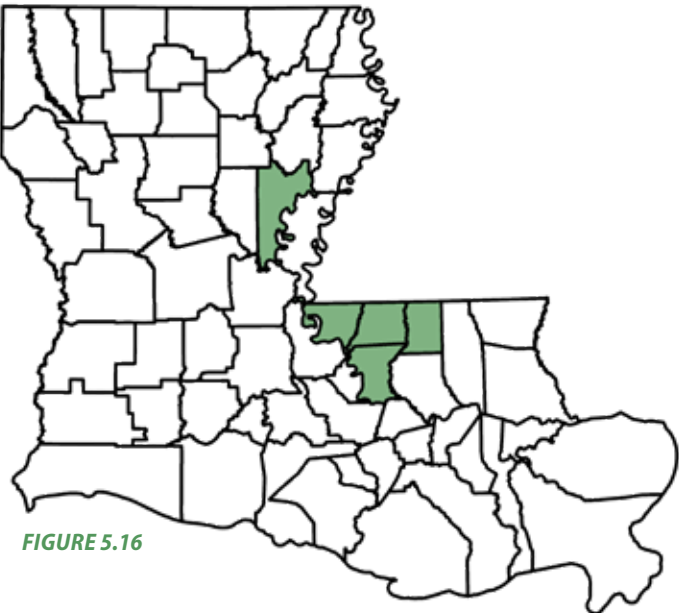


FIGURE 5.16

Extent and Status

Currently, only 25% to 50% of Louisiana's original 100,000 to 500,000 acres of Southern Mesophytic Hardwood Forest is thought to remain intact (Smith 1993). Clearing for agriculture, forest conversion, and development in West Feliciana and Catahoula parishes has brought about loss, degradation, and fragmentation of this forest. Southern Mesophytic Hardwood Forest is extremely susceptible to soil damage, particularly erosion stemming from 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 tracts of this habitat are found on Tunica Hills WMA which is 6,440 acres and J.C. "Sonny" Gilbert WMA (Sicily Island) which is 7,524 acres.

Threats

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

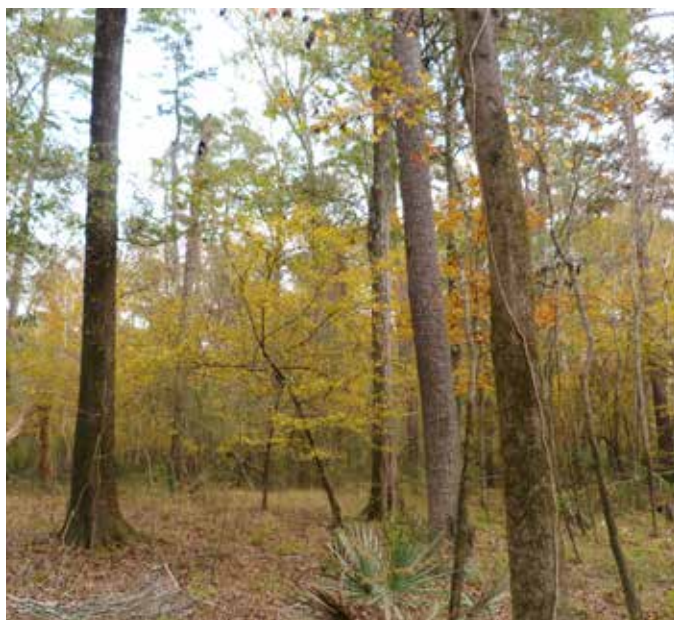
Research Needs and Conservation Actions

1. Invest in protection of this habitat through land acquisition and conservation servitudes.
2. Provide funding for the control of invasive species in this habitat type.
3. Work with WMA staff to conduct invasive species control on the two WMAs that have this community type.

SPRUCE PINE-HARDWOOD FLATWOODS FOREST

Rarity Rank: G1G2/S1
Synonyms: Pine-Hardwood Flatwoods

This flatwoods type is a natural mixed forest community endemic to the Loess Plain of the western Florida Parishes. A



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

wetland variant of this community occupies poorly drained flats, depressional areas, and small drainages that occur in a mosaic with higher, non-wetland areas. Such higher areas support a mesic Spruce Pine-Hardwood Flatwoods Forest. Both variants are distinguished by the prevalence of Spruce Pine over Loblolly Pine, 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 occurrence 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 Forest typically has a dense canopy resulting in heavy shading and, usually, a sparse understory. Palmetto is often an understory dominant.

SPRUCE PINE HARDWOODS FLATWOODS FOREST: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Amphibians	<i>Hemidactylium scutatum</i>	Four-toed Salamander

Extent and Status

Spruce Pine-Hardwood Flatwoods Forest is restricted to Louisiana, occupying a narrow range in Livingston, East Baton Rouge and, potentially, Ascension parishes. Pre-settlement acreage is estimated at 50,000 to 100,000 acres, with 10% to 25% currently remaining (Smith 1993). Protected occurrences of this habitat occur on Tickfaw State Park and on BREC's Frenchtown Conservation Area and Palomino Park.

EXTENT OF SPRUCE PINE-HARDWOOD FLATWOODS FOREST

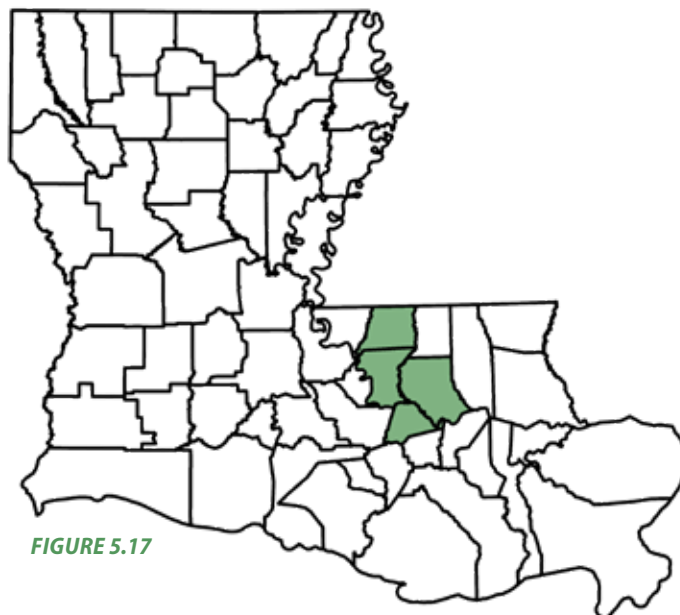


FIGURE 5.17

Threats

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.

Research Needs and 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.

SAVANNAS AND WOODLANDS

EASTERN GULF COASTAL PLAIN SAVANNAS AND WOODLANDS



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

EASTERN HILLSIDE SEEPAGE BOG

Rarity Rank: G2/S1

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

Eastern Hillside Seepage Bog is an open, mostly treeless, herb-dominated natural wetland of hilly uplands historically dominated by Longleaf Pine in the EGCP of Louisiana. In the EGCP, this bog occurs 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).

This bog type is generally persistently wet from seepage and is variable in size, typically less than one acre and rarely exceeding 10 acres. EGCP bog is underlain by an impervious clay 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 many kinds of unique forbs, including carnivorous plants (e.g., pitcher plants [*Sarracenia* spp.]) and a variety of orchid species. Because Eastern Hillside Seepage Bog is embedded in Eastern Upland Longleaf Pine Savanna and Woodland, it is a fire-driven system 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). This habitat type is extremely sensitive to surrounding land management activities and is easily degraded or destroyed by activities that alter natural hydrologic regimes.

EASTERN HILLSIDE SEEPAGE BOG: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Bagisara brouana</i>	Brou's Mallow Moth
	<i>Sarracenia rosea</i>	Rosy Pitcher Plant
Plants	<i>Macranthera flammea</i>	Bog Flame Flower
	<i>Lilium catesbaei</i>	Southern Red Lily

Extent and Status

Eastern Hillside Seepage Bog is a habitat type that is naturally small in size. Pre-settlement extent of seepage bogs in the EGCP of Louisiana was estimated to be less than 2,000 acres with only 10% to 25% remaining in St. Tammany and Washington parishes (Smith 1993). In recent years, surveys conducted by LDWF staff have revealed additional loss of this habitat to development. As a result of this loss, coupled with the lack of new occurrences, staff estimate that the current extent is far less than 10%. The remaining bogs are most often surrounded by commercial timberlands and are degraded. Only minimal protection exists for remaining bogs. TNC's Abita Creek Flatwoods Preserve in St. Tammany Parish contains a seepage bog of approximately eight acres. No bogs are known from federal or state public lands in the EGCP.

EXTENT OF EASTERN HILLSIDE SEEPAGE BOG

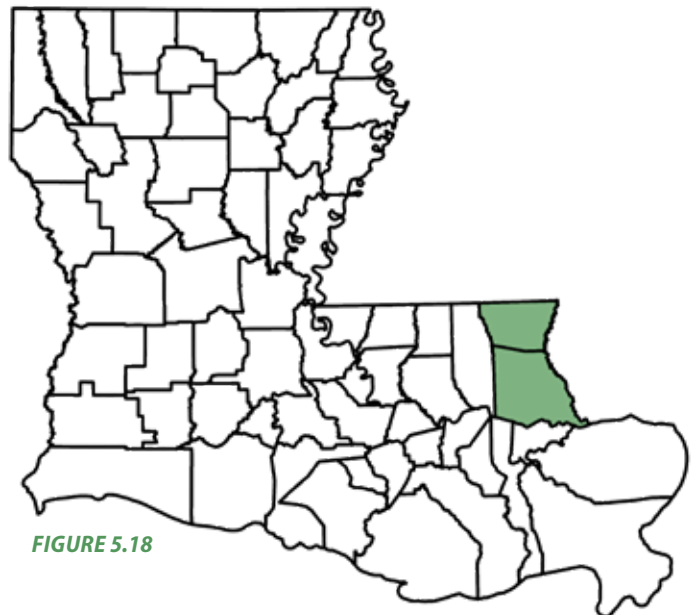


FIGURE 5.18

Threats

Eastern Hillside Seepage Bog is a very rare natural community 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 at rapid rates, replacing bogs or is occurring in close proximity to bogs, impeding proper management. Invasive species, especially Feral Hogs, pose serious threats to the remaining bogs in this region.

Research Needs and Conservation Actions

1. Prioritize surveys for this habitat type to determine extent and condition 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 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.
5. Provide landowner assistance with Feral Hog control in this habitat; disturbance by hogs is a particular threat.

EASTERN LONGLEAF PINE FLATWOODS SAVANNA

Rarity Rank: G1/S1

Synonyms: Open Savanna, Pine Savanna, Pine Flatwoods, Grass-Sedge Bog, Pitcher-Plant Prairie, Coastal Meadow, Pine Meadow, Pine Barren, Pitcher-Plant Meadow, Pitcher-Plant Bog, Herbaceous Bog, Flatwoods Bog



Eastern Longleaf Pine Flatwoods Savanna

Eastern Longleaf Pine Flatwoods Savanna 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, showy orchids, lilies, and many other types of wildflowers. 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, and 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 Pondcypress-Swamp Tupelo Forest, Acidic Bay Forest, or Small Stream Forest. Soils in Eastern Longleaf Pine Flatwoods Savanna 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 regulate community structure in Eastern Longleaf Pine Flatwoods Savanna; however, fire is considered the critical element in its maintenance. All of the species indigenous to pine savannas have evolved over millennia within a regime of frequent (once every one to three 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 FLATWOODS SAVANNA: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Crustaceans	<i>Creaserinus oryktes</i>	Flatwoods Digger
	<i>Dryobates borealis</i>	Red-cockaded Woodpecker
Birds	<i>Peucaea aestivalis</i>	Bachman's Sparrow
	<i>Centronyx henslowii</i>	Henslow's Sparrow
Non-crustacean Arthropods	<i>Atrytone arogos</i>	Arogos Skipper
	<i>Panorpa lugubris</i>	Mourning Scorpionfly
	<i>Enallagma concisum</i>	Cherry Bluet
Reptiles	<i>Rhadinaea flavilata</i>	Pine Woods Littersnake
	<i>Plestiodon anthracinus</i>	Coal Skink
Plants	<i>Calopogon multiflorus</i>	Many-flowered Grass-pink
	<i>Lobelia rogersii</i>	McVaugh's Lobelia
	<i>Sarracenia psittacina</i>	Parrot Pitcher Plant

EXTENT OF EASTERN LONGLEAF PINE FLATWOODS SAVANNA

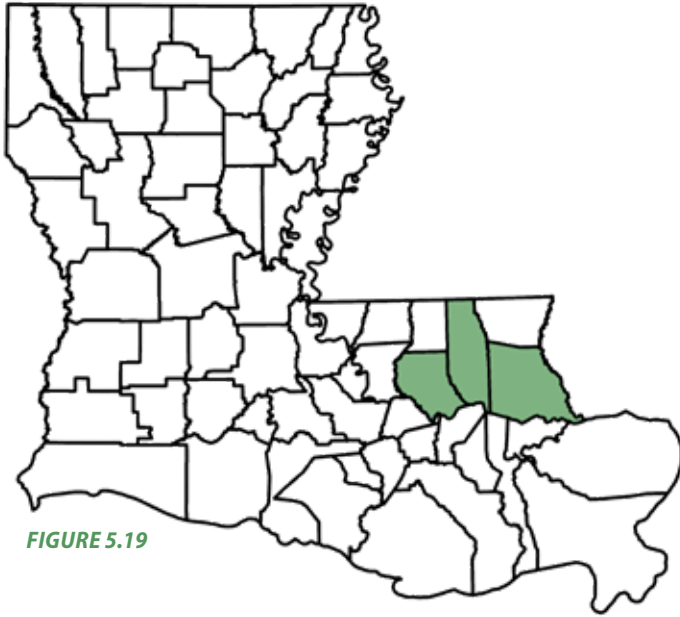


FIGURE 5.19

Extent and Status

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; 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 Flatwoods, Lake Ramsay Savannah, and Talisheek Pine Wetlands preserves. LDWF owns and manages Lake Ramsay WMA (796 acres of savanna) which is adjacent to TNC's Lake Ramsay Preserve. Big Branch NWR, Bogue Chitto NWR, and Pearl River WMA contain "pine flatwoods" with remnants of herbaceous savanna 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.

Threats

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.

Research Needs and 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 partners to incorporate 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.

EASTERN UPLAND LONGLEAF PINE SAVANNA AND WOODLAND

Rarity Rank: G1G2/S1

Synonyms: Sandhill Pine Forest

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, and a dense midstory and understory brush layer develop. 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, a federally threatened species, which depends on the sandy soils and open herbaceous understory for survival.

EASTERN UPLAND LONGLEAF PINE SAVANNA AND WOODLAND: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Birds	<i>Peucaea aestivalis</i>	Bachman's Sparrow
	<i>Dryobates borealis</i>	Red-cockaded Woodpecker
	<i>Centronyx henslowii</i>	Henslow's Sparrow
Non-crustacean Arthropods	<i>Amblyscirtes alternata</i>	Dusky Roadside-Skipper
	<i>Pogonomyrmex badius</i>	Florida Harvester Ant
	<i>Lapara phaeobrachyceros</i>	Gulf Pine Sphinx
Reptiles	<i>Tantilla coronata</i>	Southeastern Crowned Snake
	<i>Gopherus polyphemus</i>	Gopher Tortoise
	<i>Crotalus adamanteus</i>	Eastern Diamond-backed Rattlesnake
Plants	<i>Tridens carolinianus</i>	Carolina Fluff Grass
	<i>Tephrosia florida</i>	Florida Hoary-pea
	<i>Lupinus villosus</i>	Lady Lupine



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

EXTENT OF EASTERN UPLAND LONGLEAF PINE SAVANNA AND WOODLAND

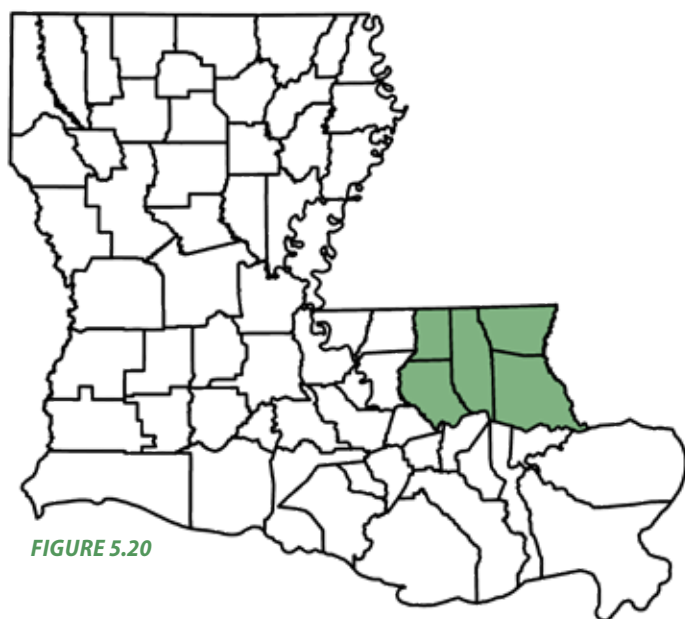


FIGURE 5.20

Extent and Status

Historically, the eastern Florida Parishes of Louisiana were dominated by extensive stands of Longleaf Pine. Now only 1% to 5% of the original estimated 1 million to 2 million acres of Eastern Upland Longleaf Pine Savanna and Woodland remains (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 Savanna and Woodland remaining in Louisiana. Louisiana State University's (LSU) Lee Memorial Forest located in Washington Parish also contains high-quality Eastern Upland Longleaf Pine Savanna and Woodland. There are several tracts of restorable habitat on private lands 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.

Threats

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.

Research Needs and 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 partners to incorporate 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.

SLASH PINE-POND CYPRESS WOODLAND

Rarity Rank: G2?/S1

Synonyms: Slash Pine Flatwoods, Wet pine-Pondcypress Savanna

This wetland habitat is restricted to the wet, acidic flatwoods on the far eastern Pleistocene Prairie Terrace of Louisiana's EGCP. Slash Pine-Pondcypress Woodland is situated in wetter depressions of Eastern Longleaf Pine Flatwoods Savanna. This community is characterized by a diverse understory, similar in species composition to those found in wet Longleaf Pine savannas, though it is more closely associated with more hydric site conditions. It features an open to semi-open canopy savanna to woodland structure with a species-rich ground layer and depends on fire to maintain its ecological balance. Its structure and species composition can vary significantly from site to site, influenced by subtle differences in topography, soil characteristics, hydrology, and fire history (Teague et al. 1995).

Soils of the Slash Pine-Pondcypress Woodland are hydric, strongly acidic, and nutrient poor silt loams and fine sandy loams. 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.

Slash Pine-Pondcypress Woodland evolved with recurrent lightning-season ground fires, and regular, light, surface fire appears critical in maintaining this community. Both Slash Pine and Pondcypress (*Taxodium ascendens*) are fire-adapted



Slash Pine-Pondcypress Woodland, St. Tammany Parish

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 short (two to three years) and similar to adjacent Longleaf Pine savannas, though fires in this community were likely less intense and less effective on the wetter expressions of this community type. This allowed for uneven encroachment and regeneration of Slash Pine and Pondcypress, at times, as well as precluded complete dominance of the site by Slash Pine, Pondcypress, and hardwoods.

SLASH PINE-POND Cypress WOODLAND: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Plants	<i>Coreopsis nudata</i>	Georgia Tickseed
	<i>Xyris serotina</i>	Acid-swamp Yellow-eyed-grass
	<i>Sarracenia psittacina</i>	Parrot Pitcher Plant

EXTENT OF SLASH PINE-POND Cypress WOODLAND

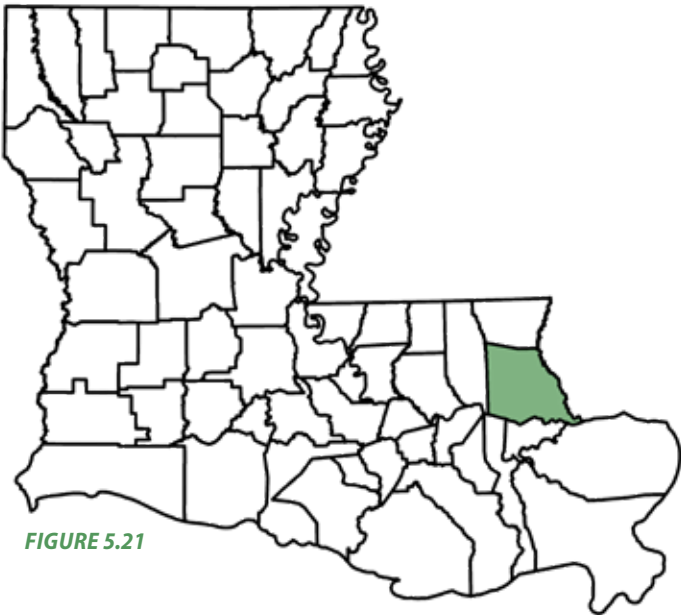


FIGURE 5.21

Extent and Status

In the EGCP of Louisiana, Slash Pine-Pondcypress Woodland is primarily associated with flatwoods ponds, Eastern Longleaf Pine Flatwoods Savanna, and Acidic Bay Forest. Protected examples occur on TNC’s Talisheek Pine Wetlands and Abita Creek Flatwoods preserves. In Louisiana, this system is restricted to southern portions of St. Tammany Parish and possibly a portion of southern Tangipahoa Parish.

Threats

Conversion to anthropogenic habitats has affected this habitat and is expected to continue, along with fire exclusion and disturbance from human activities.

Research Needs and 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 maximum ecological value of this habitat.
4. Work with timber companies to ensure they can recognize this plant community and apply appropriate management techniques and buffers when warranted.
5. Create opportunities for acquisition and stewardship of this habitat type, including targeting occurrences that are degraded but recoverable with timber harvesting and prescribed fire.

WESTERN GULF COASTAL PLAIN SAVANNAS AND WOODLANDS



Ouachita Sand Prairie



Ouachita Sand Prairie

OUACHITA SAND PRAIRIE AND WOODLAND

Rarity Rank: GNR/S1

Synonyms: West Gulf Coastal Plain Lowland Sand Prairie, Coastal Plain Sandy Terrace Grassland

Ouachita Sand Prairie and Woodland is a unique ecological assemblage imbedded in Bottomland Hardwood Forest and Hardwood Flatwoods floodplains restricted to the Ouachita River watershed spanning northern Louisiana and southern Arkansas. Historically, this community formed as dunes and splay delta ridges on the periphery of Paleolake Monroe during the Pleistocene Epoch (Washington 2001). This community may be inundated under 10 to 30 feet of water for prolonged periods (several months). The substrate consists largely of silty sands with high metal concentrations including copper, zinc, and, particularly, aluminum. Due to the community's unique edaphic and hydrological profile, it supports a diverse variety of wetland and upland plant species. Some of the common plants observed at Louisiana occurrences are Switchgrass (*Panicum virgatum*), Little Bluestem (*Schizachyrium scoparium*), Poorjoe (*Hexasepalum teres*), Sandyland Goat's-rue (*Tephrosia*

onobrychoides), Plumegrass (*Erianthus* sp.), Thin-paspalum (*Paspalum setaceum*), Sparkleberry (*Vaccinium arboreum*), Glade Rushfoil (*Croton willdenowii*), Woolly Croton (*Croton lindheimerii*), Redtop Panic Grass (*Coleataenia rigidula*), Water Dawnflower (*Stylisma aquatica*), Yaupon Holly (*Ilex vomitoria*), Wax-myrtle (*Morella cerifera*), and Black Tupelo (LDWF 2025). Some examples of this community are prairie-like with little to no canopy and dense herbaceous understories, while others appear to take on brushy woodland characteristics. Notably, Pondberry has been reported in a Lowland Sand Prairie within the Coffee Prairie Natural Area in southern Arkansas and may be associated with Ouachita Sand Prairie and Woodland habitat in northern Louisiana.

Extent and Status

Additional field survey work is needed in order to accurately determine the status and extent of Ouachita Sand Prairie and Woodland.

EXTENT OF OUACHITA SAND PRAIRIE AND WOODLAND

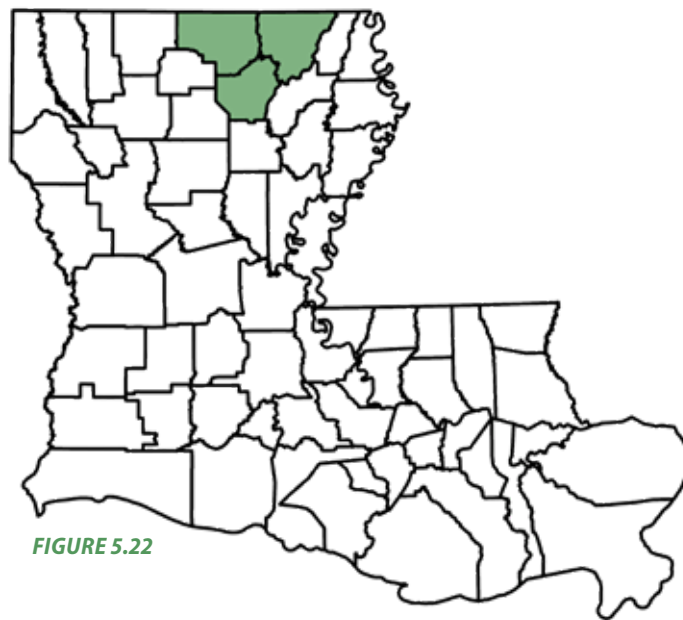


FIGURE 5.22

Threats

Examples of Ouachita Sand Prairie and Woodland have been mostly found in an impaired or degraded state. In some of these areas, this may be due to failed conversions to Loblolly Pine plantations, which are now mostly covered with Chinese Tallow Tree and excessive brush. The historical role fire played in this community is yet to be determined, but fire suppression may be a threat.

Research Needs and Conservation Actions

1. Prioritize surveys for Ouachita Sand Prairie and Woodland to determine history, extent, and status.
2. Create a management plan to control brush and invasive species (particularly Chinese Tallow Tree) while considering the historical role of fire in this community.



Sandstone Glade, Kisatchie National Forest, Natchitoches Parish

SANDSTONE GLADE/BARREN

Rarity Rank: G1G2/S2
Synonyms: Catahoula Barren, Sandstone Outcrop

Sandstone Glade/Barren is an open area in an otherwise wooded landscape that exists due to the presence of rock at or near the surface. Sandstone Glade/Barren is associated with the Catahoula Formation, which extends as a belt across central Louisiana. Sandstone Glade/Barren is embedded in Western Upland Longleaf Pine Savanna and Woodland habitats. Soil depth determines development of vegetation. Many glades have portions where rock is at the surface and areas with very shallow soil. These 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 Savanna and Woodland, Sandstone Glade/Barren habitats 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/BARREN: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Hesperia metea</i>	Cobweb Skipper
	<i>Phemeranthus parviflorus</i>	Small-flower Fameflower
Plants	<i>Sedum nuttalli</i>	Yellow Stonecrop
	<i>Bryodesma corallinum</i>	Sand Spikemoss

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.

Threats

This habitat is threatened by disturbance and the resulting soil erosion. Glades with deeper soil are fire-dependent and are degraded by woody encroachment without adequate fire.

EXTENT OF SANDSTONE GLADE

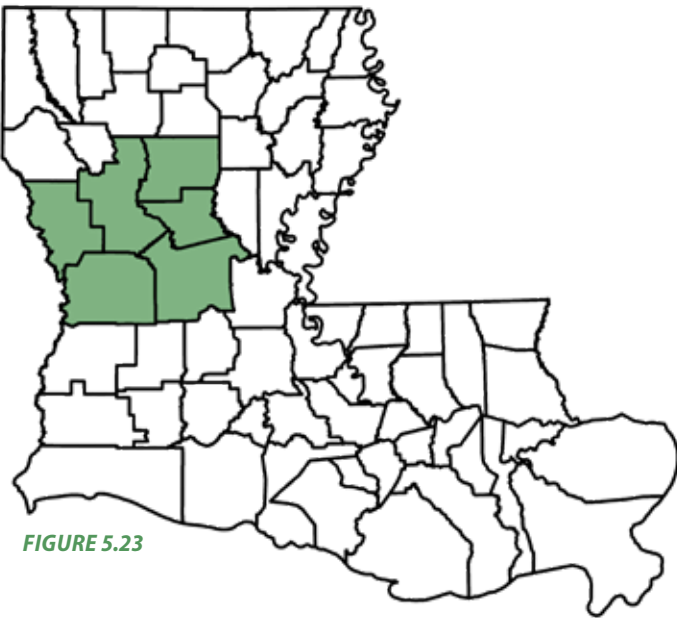


FIGURE 5.23

Research Needs and 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 Glade/Barren.
- 2. Encourage and fund the use of prescribed fire and chemical and mechanical brush control as management tools.
- 3. Work with timber companies to ensure they can recognize this plant community and apply appropriate management techniques and buffers when warranted.

SPARTA SAND POND

Rarity Rank: GNR/S1
Synonyms: none

Sparta 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 that 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 Spikesedge is a sand pond specialist, and its presence at one Louisiana Sparta Sand Pond is strong evidence that it is a natural feature.

SPARTA SAND POND: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Plants	<i>Eleocharis melanocarpa</i>	Black-fruited Spikesedge

Extent and Status

Sparta Sand Pond is 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 and likely occupy less than 100 acres.

Threats

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



Sparta Sand Pond, Bienville Parish

EXTENT OF SPARTA SAND POND

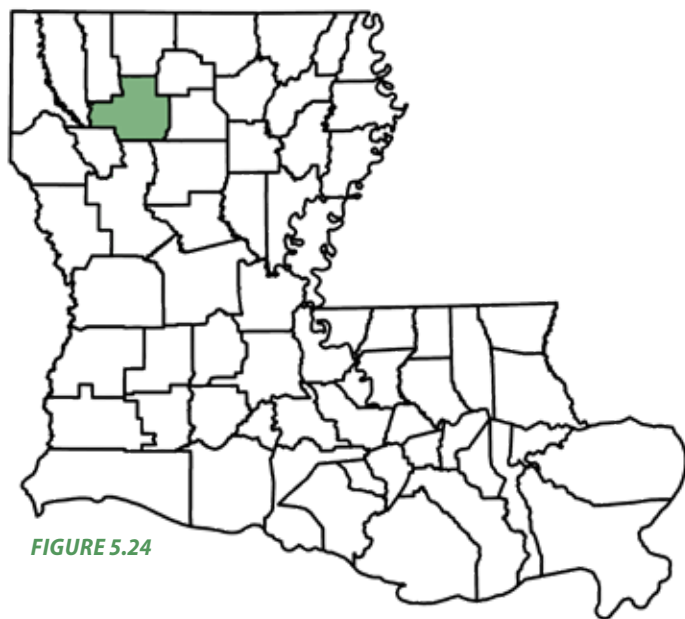


FIGURE 5.24

planted or volunteering pines. This encroachment may have been prevented by frequent fires burning into the edges of Sparta Sand Ponds from adjacent Western Upland Longleaf Pine Savanna and Woodland.

Research Needs and Conservation Actions

1. Continue surveys to determine the extent and condition of this habitat type.
2. Encourage stewardship and BMPs of Sparta Sand Ponds.

WEST GULF COASTAL PLAIN MUCK BOG

Rarity Ranks: G1/S1

Synonyms: Stream Valley Bog

West Gulf Coastal Plain Muck Bog 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 or well developed and cannot support the weight of a person,

unlike coastal Freshwater Floating Marsh. The vegetation mat apparently floats during summer months and is submerged 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 Smooth Sawgrass (*Cladium mariscoides*). Louisiana muck bogs are hypothesized to be younger than some of the muck bogs in the Post Oak Savanna of Texas. However, the formation of West Gulf Coastal Plain Muck Bog seems similar in Louisiana as in Texas. Surrounding, deep sandy soils efficiently capture and transmit precipitation as groundwater, which converges on stream valleys. Small streams become impeded by Beaver (*Castor canadensis*), and constant saturation from seepage leads to peat accumulation.

The substrate of West Gulf Coastal Plain Muck Bog in Texas is acidic, with a pH of 4.3 to 4.8 (MacRoberts and MacRoberts 1998), and Louisiana West Gulf Coastal Plain Muck Bog is almost certainly acidic as well. Summer fires sweeping off 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: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Somatochlora margarita</i>	Texas Emerald
Plants	<i>Eleocharis melanocarpa</i>	Black-fruited Spikesedge
	<i>Dulichium arundinaceum</i>	Threeway Sedge

Extent and Status

In Louisiana, this habitat is only known from the xeric, sandy, upland Longleaf Pine Woodland on the Sparta Formation in Bienville Parish and likely occupies less than 100 acres.

Threats

Little is known about this habitat in Louisiana, and this lack of knowledge is itself a threat. Inadequate fire, invasive plants and animals, and conversion of land for energy production appear to pose the greatest threats to this habitat.



West Gulf Coastal Plain Muck Bog, Bienville Parish

EXTENT OF WEST GULF COASTAL PLAIN MUCK BOG

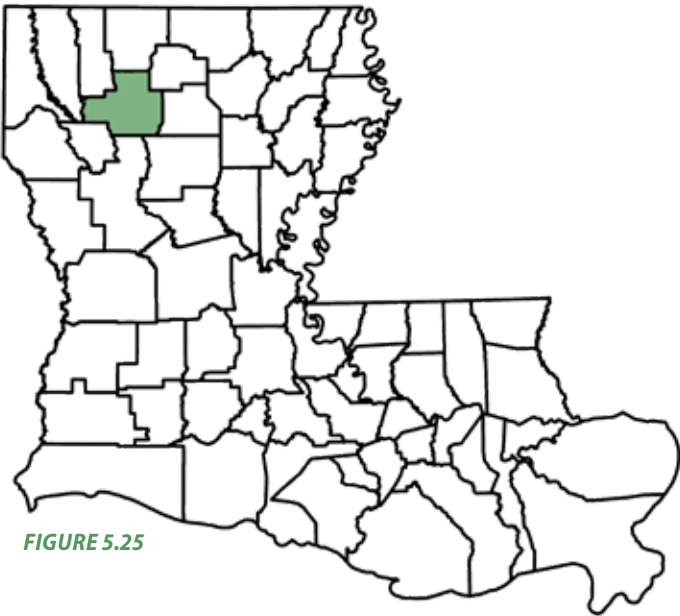


FIGURE 5.25

Research Needs and 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. Conduct targeted surveys for this habitat.
4. Promote summer and fall prescribed fires (the floating mat is submerged during the dormant season).
5. Continue efforts to control invasive species, particularly Feral Hogs.

WESTERN HILLSIDE SEEPAGE BOG

Rarity Rank: G2G3/S2

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

Western Hillside Seepage Bog is an open, mostly treeless, herb-dominated natural wetland of hilly, sandy uplands historically dominated by Longleaf Pine. In the WGCP, this bog type occurs on the Pleistocene high and intermediate terraces and on Tertiary uplands (Catahoula, Fleming, and Sparta formations). It occurs commonly on mid- to lower slopes on saturated, strongly acidic (pH ca. 4.5 to 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 limited acreage in the state (Smith 1996). This bog is generally persistently wet from seepage and is variable in size being most often less than one acre, but rarely exceeding 10 acres. Western Hillside Seepage Bog is 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 Plant and a variety of orchid species. Many species are restricted to this habitat and the

closely allied Western 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. Western Hillside Seepage Bog is embedded in what is now, or historically was, Western Upland Longleaf Pine Savanna and Woodland, which is a fire-driven system. This bog type, 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 evapotranspiration and through surface and subsurface 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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Zoraena sarracenia</i>	Pitcher Plant Spiketail
	<i>Somatochlora margarita</i>	Texas Emerald
Plants	<i>Xyris scabrifolia</i>	Harper's Yellow-eyed-grass
	<i>Calopogon barbatus</i>	Bearded Grass-pink
	<i>Rudbeckia scabrifolia</i>	Sabine Coneflower

Extent and Status

This habitat occurs as small patches and is historically thought to have occupied less than 2,000 acres with an estimated 50% to 75% remaining today. In the WGCP, Hillside Seepage Bog is found from Calcasieu north to Natchitoches and Winn parishes. Most known occurrences are in Vernon and Natchitoches parishes on KNF and Fort Polk-Vernon WMA, and there are possibly many more bogs within this geography (e.g., few biological inventories have occurred in Beauregard Parish).



Western Hillside Seepage Bog, Fort Polk, Vernon Parish

EXTENT OF WESTERN HILLSIDE SEEPAGE BOG

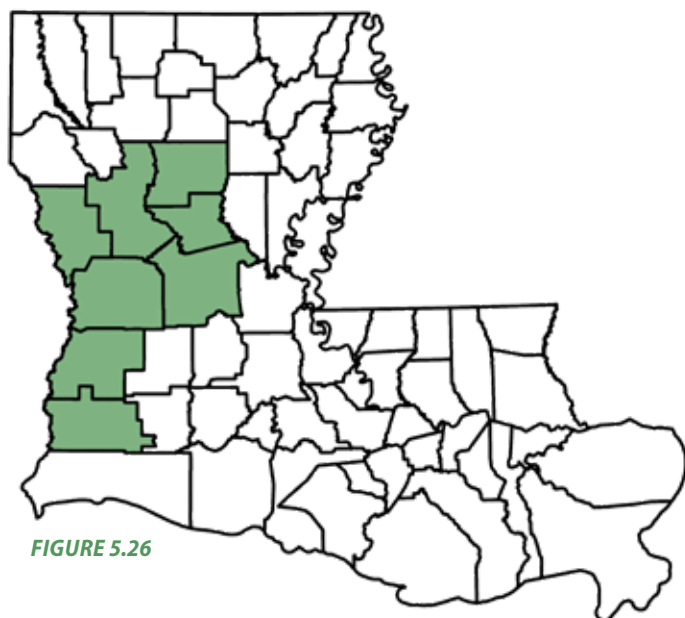


FIGURE 5.26

Threats

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

Research Needs and Conservation Actions

1. Continue surveys to determine the extent and condition of this habitat type.
2. Work with staff of KNF and Ft. Polk to implement appropriate management, including optimal fire timing and frequency.
3. Encourage landowners to include this community type in prescribed burning plans and discourage the placement of firebreaks around bogs.
4. Provide additional cost-share funds for landowners to reduce or eliminate the costs associated with conducting prescribed burns on their property.
5. Include the presence of embedded Western Hillside Seepage Bog as a criterion when scoring properties for LDWF PBIs.
6. Support control of Feral Hogs within and near this habitat type.

WESTERN LONGLEAF PINE FLATWOODS SAVANNA

Rarity Rank: Acidic: G2G3/S2

Saline: G1/S1

Synonyms: Open Savanna, Pine Savanna, Pine Flatwoods, Grass-Sedge Bog, Pitcher-Plant Prairie, Coastal Meadow, Pine Meadow, Pine Barren, Pitcher-Plant Meadow, Pitcher-Plant Bog, Herbaceous Bog, Flatwoods Bog

Western Longleaf Pine Flatwoods 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, showy orchids, lilies, and many other types of wildflowers. Club-mosses (*Lycopodium* spp.) and peat mosses are often conspicuous. One essential difference between Western and Eastern Longleaf Pine Flatwoods Savannas is that the western expression of this



Western Longleaf Pine Flatwoods Savanna - Saline



Western Longleaf Pine Flatwoods Savanna - Acidic

system is typically associated with pimple-mounded topography, generating a complex matrix of upland and wetland plant communities. The only known extant Louisiana occurrences of American Chaffseed (*Schwalbea americana*), which is federally endangered, are found on pimple mounds in Western Longleaf Pine Flatwoods Savanna in Allen and Beauregard parishes. Pine savannas historically dominated the Gulf Coastal Plain flatwoods regions of southeast and southwest Louisiana (Smith 1996).

Two types of Western Longleaf Pine Flatwoods Savanna are recognized: Acidic (S2) and Saline (sodic/alkali; S1). Western Acidic Longleaf Pine Flatwoods Savanna occurs on a variety of soils, while Western Saline Longleaf Pine Flatwoods Savanna is restricted to mainly Brimstone Silt Loam and possibly other sodic or alkali soil types.

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. Pine savannas experience a highly fluctuating water table, ranging from surface saturation/shallow flooding in late

fall, winter, and 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 western and eastern types may be underlain by slowly permeable subsoil through which air and water move slowly.

Frequent fire is a major factor controlling species occurrence and community structure. All of the species indigenous to pine savannas have evolved over millennia within a regime of frequent (once every one to three 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. 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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Peucaea aestivalis</i>	Bachman's Sparrow
	<i>Dryobates borealis</i>	Red-cockaded Woodpecker
	<i>Centronyx henslowii</i>	Henslow's Sparrow
Reptiles	<i>Plestiodon anthracinus</i>	Coal Skink
Plants	<i>Schwalbea americana</i>	American Chaffseed
	<i>Polygala boykinii</i>	Boykin's Milkwort
	<i>Rhynchospora debilis</i>	Savanna Beaksedge

Extent and Status

Western Longleaf Pine Flatwoods Savanna and embedded habitats are highly threatened and much reduced from their original extent. This habitat is estimated to have occupied 1 million to 2 million acres in pre-settlement times with an estimated 1% to 5% remaining (Smith 1993).

Most extant Western Longleaf Pine Flatwoods Savanna occur on private land, although one of the largest tracts occurs on the southwestern portion of KNF Vernon Unit. A combination of factors has favored their continued existence during the last 100 years, including their utilization as rangeland (involving frequent burning). Several examples are captured by the newly acquired LDWF Flatwoods Savanna WMA and conservation lands owned by TNC. When science-based criteria and standards are employed, wetland mitigation banking can be a key tool for conservation of this habitat. Recovery potential in degraded examples varies depending on the site history. In some cases, much of the diverse herbaceous ground cover has returned with the reintroduction of fire.

Threats

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

EXTENT OF WESTERN LONGLEAF PINE FLATWOODS SAVANNA

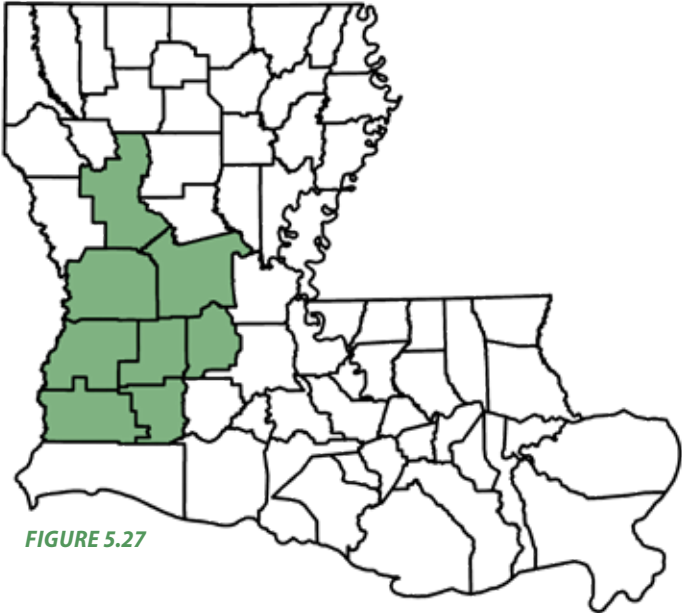


FIGURE 5.27

Research Needs and 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.
- 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 maximum ecological value of this habitat. This includes discouraging establishment of inappropriate vegetation types on the flatwoods landscape such as Bottomland Hardwood Forest.

WESTERN UPLAND LONGLEAF PINE SAVANNA AND WOODLAND

Rarity Rank: G2G3/S3
Synonyms: Sandhill Pine Forest, Clayhill Pine Forest

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 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 species

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 SAVANNA AND WOODLAND: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Birds	<i>Peucaea aestivalis</i>	Bachman's Sparrow
	<i>Dryobates borealis</i>	Red-cockaded Woodpecker
	<i>Centronyx henslowii</i>	Henslow's Sparrow
Non-crustacean Arthropods	<i>Amblyscirtes alternata</i>	Dusky Roadside-Skipper
	<i>Megathymus streckeri</i>	Strecker's Giant-Skipper
	<i>Pogonomyrmex comanche</i>	Comanche Harvester Ant
Reptiles	<i>Tantilla gracilis</i>	Flat-headed Snake
	<i>Pituophis ruthveni</i>	Louisiana Pinesnake
	<i>Plestiodon anthracinus</i>	Coal Skink
Mammals	<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse
	<i>Liatis tenuis</i>	Slender Gayfeather
Plants	<i>Orobanch uniflorum</i>	One-flowered Broomrape
	<i>Orthochilus ecristatus</i>	Giant Orchid

Extent and Status

Western Upland Longleaf Pine Savanna and Woodland historically dominated large areas in the WGCP. However, much of this area has been developed or converted to other forest types. The estimated pre-settlement acreage of this habitat is 2 million to 4 million acres with an estimated 10% to 25% remaining (Smith 1993). Currently, the largest tracts of this community are found on KNF and Fort Polk Joint Readiness Training Center (Fort Polk), which fully encompasses Fort Polk-Vernon and Fort Polk North WMAs.

EXTENT OF WESTERN UPLAND LONGLEAF PINE SAVANNA AND WOODLAND

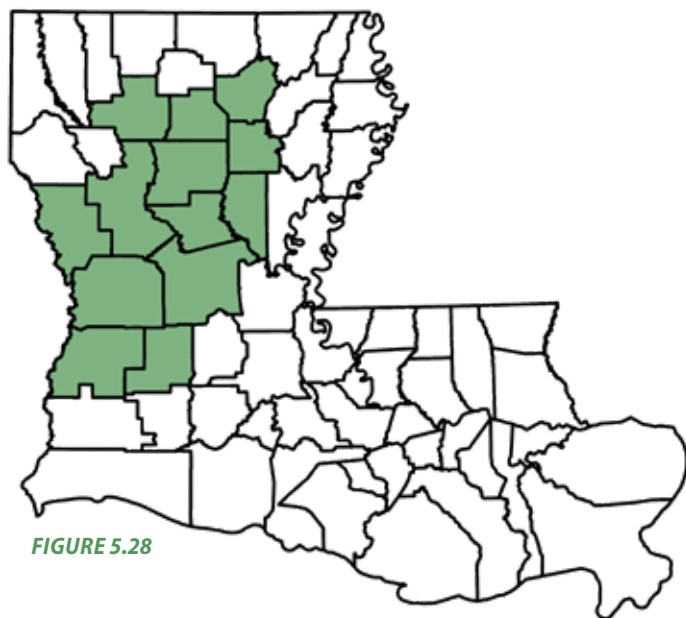


FIGURE 5.28



Western Upland Longleaf Pine Savanna and Woodland, Fort Polk, Vernon Parish.

Threats

Most of the historical acreage of this habitat now supports anthropogenic forests. Due to rarity and limited opportunity, additional habitat conversion is expected to be infrequent but to have severe consequences where it does occur. This habitat is mainly threatened by inadequate fire. Climate change, with its projected increase in severe weather, threatens this habitat. Several sources of human disturbance also degrade this habitat.

Research Needs and 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.

INTERIOR SOUTHERN PLAINS SAVANNAS AND WOODLANDS

FLATWOODS POND

Rarity Ranks: East Gulf Coastal Plain: G2Q/S1
West Gulf Coastal Plain: G2Q/S1

Synonyms: none

Flatwoods Pond is a habitat type embedded in Eastern and Western Longleaf Pine Flatwoods Savannas and occupy swales and depressions remaining from ancient Pleistocene eolian deflations or undeveloped stream channels. Flatwoods Ponds are often circular or elliptical to linear in shape. Ponds may range from just a few inches deep relative to the surrounding landscape, to approximately 5 feet deep in larger ponds. Generally treeless, Flatwoods 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, areas of 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 occurring according to their relative tolerance or competitive adaptations to flooding and saturated soil conditions. The Flatwoods Pond natural communities 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. These communities provide important breeding habitat for many amphibians, including several SGCN.

FLATWOODS POND (EAST GULF COASTAL PLAIN): OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Enallagma concisum</i>	Cherry Bluet
Amphibians	<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander
Reptiles	<i>Deirochelys reticularia reticularia</i>	Eastern Chicken Turtle
	<i>Lithobates sevosus</i>	Dusky Gopher Frog
Plants	<i>Helanthium tenellum</i>	Dwarf Burhead
	<i>Xyris stricta</i>	Pineland Yellow-eyed-grass

FLATWOODS POND (WEST GULF COASTAL PLAIN): OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Amphibians	<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander
	<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog
Reptiles	<i>Deirochelys reticularia miaria</i>	Western Chicken Turtle
Plants	<i>Lobelia flaccidifolia</i>	Coastal Plain Lobelia
	<i>Xyris stricta</i>	Pineland Yellow-eyed-grass
	<i>Platanthera integra</i>	Yellow Fringeless Orchid



West Gulf Coastal Plain Flatwoods Pond, Beauregard Parish

Extent and Status

Smith (1993) estimated that Flatwoods Pond habitat occupied 2,000 to 10,000 acres historically. Bridges (1988) surveyed the WGCP of Louisiana extensively for this community and estimated that less than 100 Flatwoods Ponds remain and determined that less than 20 were still of high-quality. Based on recent surveys by LDWF staff, it is estimated that less than 80 Flatwoods Ponds remain in Louisiana and that approximately 12 to 15 remain in a high-quality state. It is not clear if Smith's estimate is for all Flatwoods Pond habitat or simply those in the WGCP. However, these features are significantly more prolific in the WGCP than the EGCP. Examples of high quality Flatwoods Ponds can be observed at the newly acquired LDWF Flatwoods Savanna WMA in Allen Parish.

EXTENT OF FLATWOODS POND (EAST GULF COASTAL PLAIN)

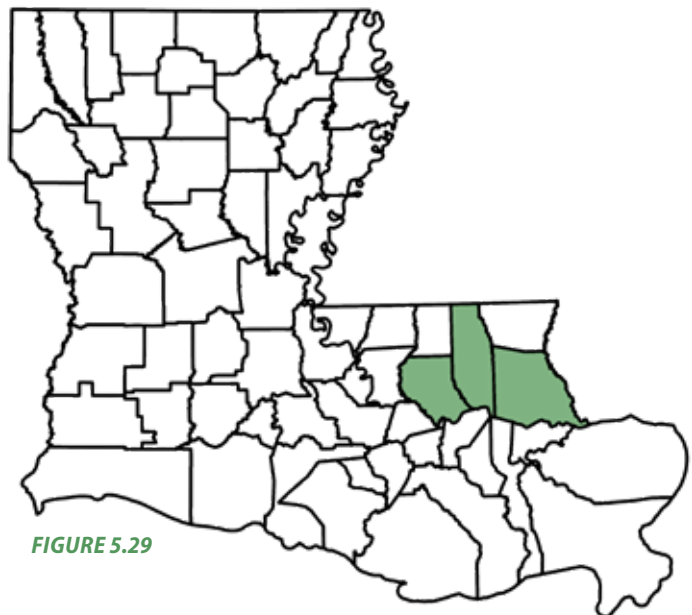


FIGURE 5.29

EXTENT OF FLATWOODS POND (WEST GULF COASTAL PLAIN)

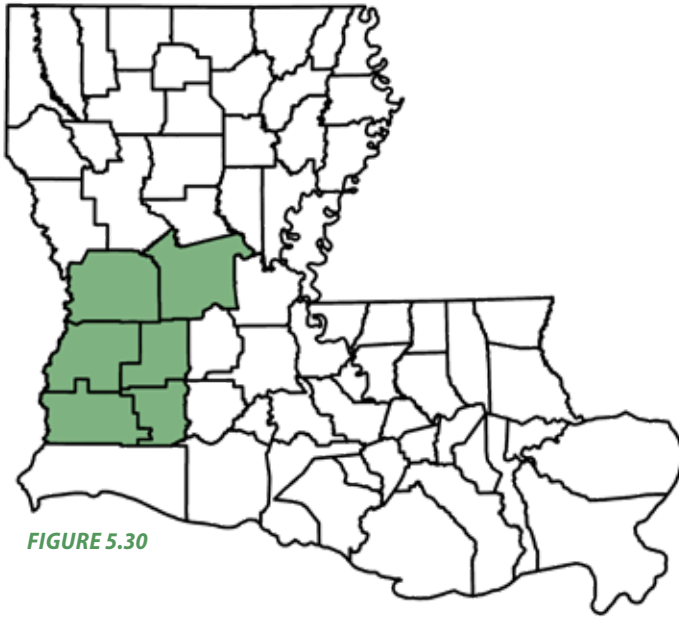


FIGURE 5.30

Threats

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, especially Feral Hogs.

Research Needs and 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 if East Gulf Coastal Plain Flatwoods Pond was historically wooded or open.
3. Support restoration of Flatwoods Ponds that have been converted to Acidic Bay Forest 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, discourage placement of fire lines around ponds, and discourage modification of pond basins.
6. Include the presence of embedded Flatwoods Ponds as a criterion when scoring properties for the LDWF PBIs.
7. Support control of Feral Hogs and other invasive species within and near this habitat type.

SHORTLEAF PINE/OAK-HICKORY WOODLAND

Rarity Rank: G2G3/S1

Synonyms: Shortleaf Pine-Oak, Oak-Hickory Forest

The Shortleaf Pine/Oak-Hickory Woodland community occurs on dry hills, principally in north-central and northwestern Louisiana as well as in the Florida Parishes. In the UWGCP, this was the most prevalent habitat on the landscape (i.e. it was the matrix community). Small pockets of this community type also occur in the Longleaf Pine region of the WGCP. The overstory is composed of a combination of Shortleaf Pine (*Pinus echinata*) and various dry-sited hardwood species, predominantly oaks and hickories. The herbaceous component of this community is just as much, if not more, important than the canopy component. The ground cover was historically grassy and similar to that of Longleaf Pine systems. However, the ground cover in Shortleaf Pine/Oak-Hickory Woodland was likely variable and possessed some shaded areas with associated shade-loving plants, in contrast to large continuous stands of sun-loving plants found in Longleaf Pine grasslands. Some expressions of this community have a calcareous component and, thus, are similar to calcareous woodland and forest types. 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) or more frequently but with very low intensities and restricted to the duff layer, especially for Shortleaf Pine/Oak-Hickory Woodland embedded within other pyrogenic communities.

Extent and Status

There was an estimated 4 million to 6 million acres of Shortleaf Pine/Oak-Hickory Woodland in Louisiana (Smith 1993) and, of this original extent, less than 5% is thought to remain today. Most



Shortleaf Pine/Oak-Hickory Woodland

EXTENT OF SHORLEAF PINE/OAK-HICKORY WOODLAND

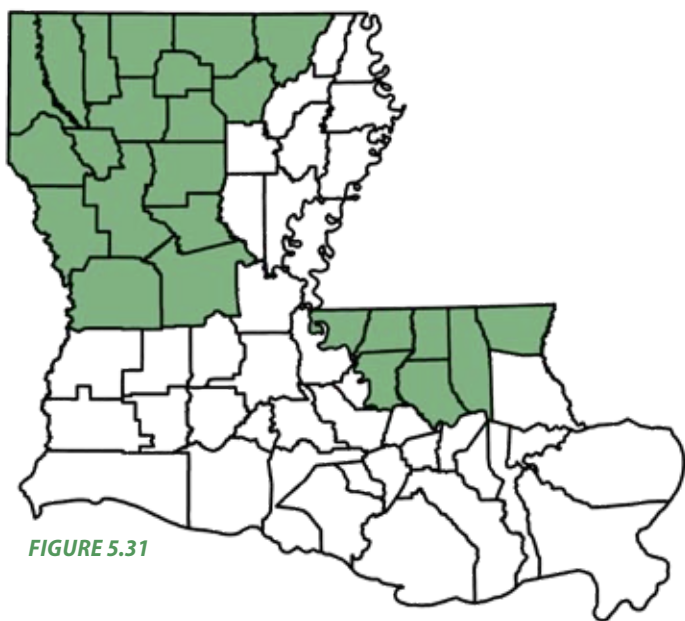


FIGURE 5.31

of the remaining acreage is in northwestern Louisiana in the UWGCP. Extant examples of Shortleaf Pine/Oak-Hickory Forest that possess both the characteristic overstory and herbaceous ground cover are extremely rare.

Threats

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

Research Needs and Conservation Actions

1. Continue surveys to determine the current extent and condition of this habitat type.
2. Develop Desired Future Conditions for restoration of this habitat type including appropriate fire regimes and herbicide uses.
3. Work with partners 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 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.



Xeric Sandhill Woodland, Caddo Parish

XERIC SANDHILL WOODLAND

Rarity Rank: G2G3/S1

Synonyms: Oak-Farkleberry Sandy Land

Xeric Sandhill Woodland develops 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 Woodland overlaps considerably with that of upland Longleaf Pine savanna and woodland communities that occur on deep, xeric sandy soils. However, vegetation structure often differs between these two habitats; Xeric Sandhill Woodland features plants that often have severely stunted growth and sometimes have a sandhill scrub-shrub structural appearance. Xeric Sandhill Woodland tends to be small-scale, inclusional habitats, while the xeric phase of upland Longleaf Pine savanna and woodland is typically more expansive.

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: OBLIGATE OR NEAR-OBLIGATE SPECIES

	Scientific Name	Common Name
Non-crustacean Arthropods	<i>Pogonomyrmex comanche</i>	Comanche Harvester Ant
	<i>Pogonomyrmex badius</i>	Florida Harvester Ant
	<i>Hesperia metea</i>	Cobweb Skipper
Reptiles	<i>Gopherus polyphemus</i>	Gopher Tortoise
	<i>Tantilla coronata</i>	Southeastern Crowned Snake
	<i>Pituophis ruthveni</i>	Louisiana Pinesnake
Mammals	<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse
Plants	<i>Cyperus grayoides</i>	Illinois Flat Sedge
	<i>Tetragonotheca ludoviciana</i>	Louisiana Squarehead
	<i>Asclepias humistrata</i>	Pinewoods Milkweed

EXTENT OF XERIC SANDHILL WOODLAND

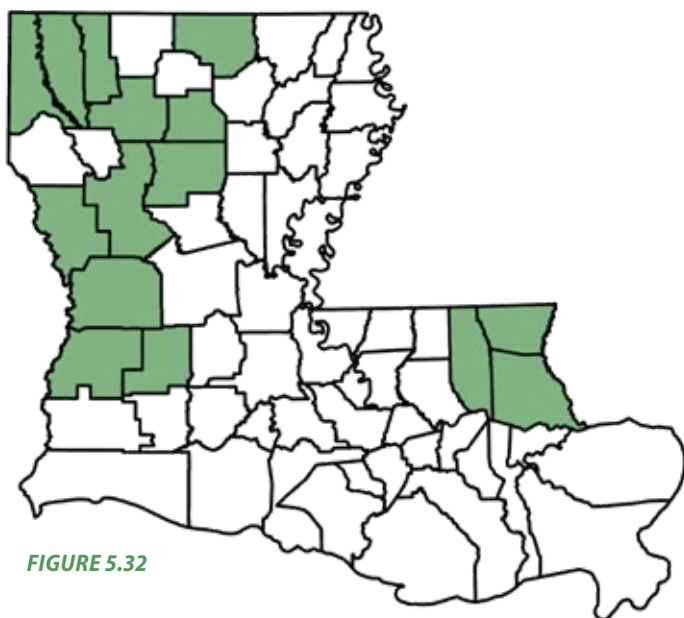


FIGURE 5.32

Threats

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

Research Needs and 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, particularly in the EGCP, including cooperative agreements with landowners and land acquisition.

NON-FORESTED GRASSLANDS AND OPEN TERRAIN

MARSHES



Brackish Marsh in southwest Louisiana

BRACKISH MARSH

Rarity Rank: G4?/S3

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

Brackish Marsh is usually found between Salt Marsh and Intermediate Marsh, although it may occasionally lie adjacent to the Gulf of America. 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 (*Spartina patens*). 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, and Menhaden (*Brevoortia tyrannus*). 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 via numerous waterways exerts a major influence in the configuration of the various marsh types.

BRACKISH MARSH: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Birds	<i>Ammospiza nelsoni</i>	Nelson's Sparrow
	<i>Cistothorus palustris marianae</i>	Marian's Marsh Wren
	<i>Ammospiza maritima</i>	Seaside Sparrow
Non-crustacean Arthropods	<i>Euphyes bayensis</i>	Bay Skipper
	<i>Euphyes pilatka</i>	Palatka Skipper
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Inland Fishes	<i>Anguilla rostrata</i>	American Eel
	<i>Atractosteus spatula</i>	Alligator Gar
Marine Fishes	<i>Fundulus jenkinsi</i>	Saltmarsh Topminnow
	<i>Adinia xenica</i>	Diamond Killifish
Plants	<i>Triglochin striata</i>	Arrow-grass

Extent and Status

Coastal marshes are highly dynamic systems; thus, the acreage of each marsh type has varied greatly across time. Pre-settlement, Louisiana coastal marshes covered approximately 4.5 million acres (Smith 1993). Based on surveys conducted in 2021, the remaining total coastal marsh extent in Louisiana is 3.62 million acres (Nyman et al. 2022), which is approximately 80% of the estimated pre-settlement extent. Statewide coastal marsh surveys conducted in 2021 estimated that approximately 565,000 acres are Brackish Marsh (Nyman et al. 2022).

Federal conservation areas that support Brackish Marsh include Bayou Sauvage, Delta, and Sabine NWRs. Marsh Island and State Wildlife Refuges, as well as Biloxi WMA, all managed by LDWF, contain large areas of Brackish Marsh. Other LDWF properties containing Brackish Marsh include Pointe-aux-Chenes WMA and Rockefeller 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 and sediment diversions to abate marsh deterioration, and prescribed burning to improve habitat and food quality for wildlife.

EXTENT OF BRACKISH MARSH

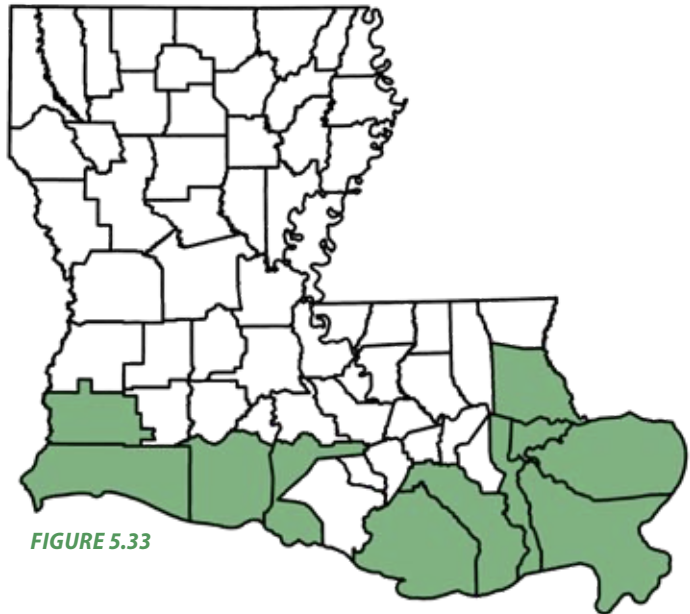


FIGURE 5.33

Threats

The main threats to this habitat include subsidence, SLR, and the effects of potential increases in storm frequency and intensity associated with climate change.

Research Needs and Conservation Actions

1. Develop methods to encourage landowners to utilize rotational grazing in Brackish Marsh and manage the land for wildlife conservation.
2. Work with partners to support coastal restoration projects, specifically targeting habitat and habitat features important for 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 partners to develop viable cultivars for marsh restoration efforts.

COASTAL MANGROVE-MARSH SHRUBLAND

Rarity Rank: G2?/S2

Synonyms: Intertidal Saltwater Swamp, Saltwater Swamp, Mangrove Swamp

Coastal Mangrove-Marsh Shrublands are estuarine communities dominated by Black Mangrove (*Avicennia germinans*). Although sometimes termed a swamp, the physiognomy of the community in Louisiana more closely resembles a shrub thicket or marsh scrub-shrub matrix. 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.

Extent and Status

Coastal Mangrove-Marsh Shrubland in Louisiana is 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



Coastal Mangrove-Marsh and Shrubland, Lafourche Parish

EXTENT OF COASTAL MANGROVE-MARSH AND SHRUBLAND

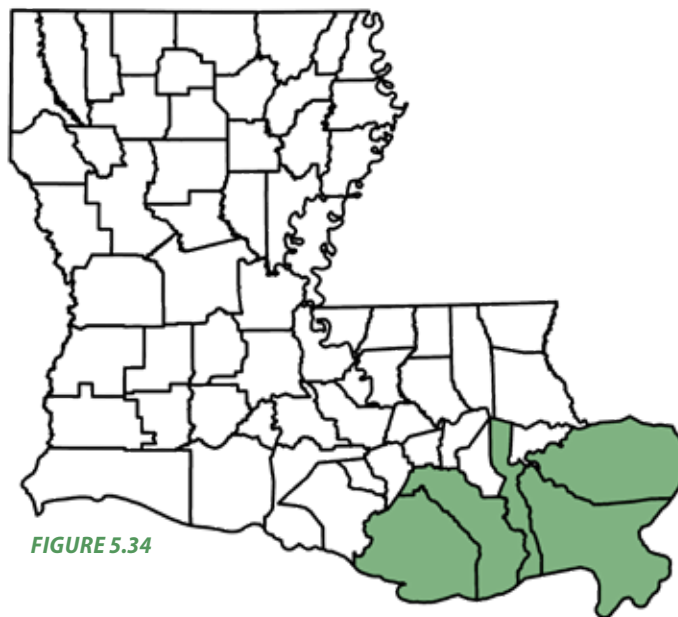


FIGURE 5.34

make estimating acreage problematic. Giri and colleagues (2011) estimated that mangrove shrubland covered approximately 5,386 acres in 1983. After a severe winter freeze in 1983/1984, acreage was reduced to approximately 539 acres. Mostly mild winters over the following decades allowed expansion of this natural community in southeastern Louisiana with mangrove coverage estimated to be approximately 1,072 acres in 2010 (Giri et al. 2011). Giri and colleagues (2023) estimated that mangrove shrubland covered approximately 3,946 acres in 2020.

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 1983/1984 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 Louisiana 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 Elmer's Island Wildlife Refuge, Isles Dernieres Barrier Islands Refuge, and Breton NWR.

Threats

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

Research Needs and Conservation Actions

1. Promote the continued planting of mangrove as a soil stabilizer in habitat restoration projects.
2. Support partner efforts for shoreline stabilization and habitat restoration.
3. Work with partners to support coastal restoration projects, specifically targeting habitat and habitat features important for SGCN.



Freshwater Floating Marsh, southeast Louisiana

FRESHWATER FLOATING MARSH

Rarity Rank: GNR/S2
Synonyms: Flotant, Peat Marsh, Prairie Tremblant

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 (*Hymenachne hemitoma*) 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 Marsh is buoyant year-round, whereas thick-mat Freshwater Floating Marsh dominated by Bulltongue (*Sagittaria lancifolia*) is only seasonally buoyant (Swarzenski et al. 1991). Freshwater Floating Marsh of the type described here is typically rainfall, rather than floodwater-driven (Swarzenski et al. 2005), and the pH is usually acidic (C. Swarzenski, personal communication). Peat mosses (*Sphagnum* spp.) are 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 Marsh is readily colonized by the shrub Wax-myrtle. Fire is required to prevent conversion of emergent herbaceous marsh to shrub thicket.

The Maidencane Freshwater Floating Marsh is restricted to freshwater 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 Marsh 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 fresh water 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.

Colonization of stands of free-floating plants by emergent marsh vegetation can happen. For example, free-floating invasives such as Water Hyacinth (*Eichhornia crassipes*) 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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Eleocharis rostellata</i>	Walking Spikesedge
	<i>Ludwigia alata</i>	Winged Seedbox

Extent and Status

The majority of floating marsh in Louisiana is associated with the Deltaic Plain. However, a unique form of freshwater floating marsh was described by O’Neal (1949) from the eastern portion of the Chenier Plain. 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. Because almost all low-salinity marshes in the Mississippi River Deltaic Plain are peat-based, with only a subset truly floating, accurate estimates are difficult to obtain. Conservation areas protecting Freshwater Floating Marsh in the Deltaic Plain include Salvador and Lake Boeuf WMAs, Jean Lafitte National Historical Park and Preserve, and Mandalay NWR. White Lake Wetlands Conservation Area and Lacassine NWR are the only localities within the Chenier Plain known to support Freshwater Floating Marsh.

Threats

Freshwater Floating Marsh is threatened by input of nutrients and salinity, which is hastened by human activities associated with placement of canals and diversions as well as other habitat alteration to the marsh landscape. Inadequate fire is also an issue for some occurrences, which allows shrub dominance. Because this marsh type is highly buoyant, it has some resilience to subsidence; however, increases in salinity associated with subsidence of surrounding rooted marshes poses a serious threat to this habitat. Aerial overspray from herbicide applications or excessive herbicide use may have prolonged negative impacts and cause floating mash collapse.

EXTENT OF FRESHWATER FLOATING MARSH

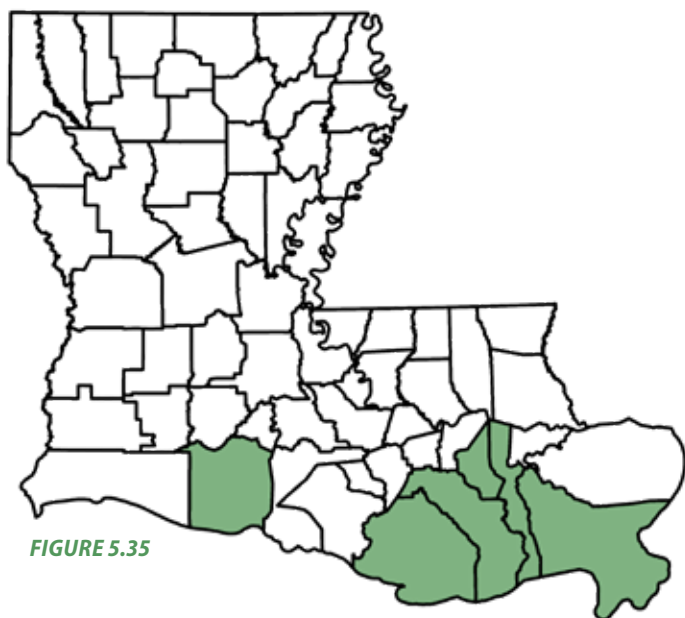


FIGURE 5.35

Research Needs and Conservation Actions

1. Accurately assess the amount and condition of Freshwater Floating Marshes (with Maidencane as the dominant).
2. Assess the status of Freshwater Floating Marsh on the Chenier Plain and work with staff at White Lake Wetlands Conservation Area and neighboring landowners to protect this marsh type.
3. Conduct vegetation and floristic inventories of reference sites including the collection of voucher specimens.
4. Conduct zoological inventories of this habitat.
5. 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).
6. Work with coastal restoration organizations to prevent degradation of this habitat through nutrient and sediment input and to prioritize habitat and habitat features important to SGCM.
7. Work within LDWF and with partners to apply appropriate management, specifically prescribed burning.
8. Develop outreach materials to increase public awareness of this unique habitat.

FRESHWATER MARSH

Rarity Rank: G3G4/S2

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

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



Freshwater Marsh, southeast Louisiana

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 to 1 ppt. A significant portion of Louisiana's Freshwater Marsh is Freshwater Floating Marsh which primarily occurs in the Deltaic Plain of Louisiana. Freshwater Floating Marsh is treated as a separate habitat due to its 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 (*Micropogonias undulatus*), Spotted Seatrout (*Cynoscion nebulosus*), Black Drum (*Pogonias cromis*), and flounder (*Paralichthys* spp.). This community may change to a more saline marsh type due to saltwater intrusion or may become open water due to subsidence.

FRESHWATER MARSH: OBLIGATE OR NEAR-OBLIGATE SGCM

	Scientific Name	Common Name
Birds	<i>Rallus elegans</i>	King Rail
	<i>Botaurus exilis</i>	Least Bittern
Non-crustacean Arthropods	<i>Euphyes dion</i>	Dion Skipper
	<i>Euphyes pilatka</i>	Palatka Skipper
Inland Fishes	<i>Anguilla rostrata</i>	American Eel
	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Fundulus</i> spp.	Starhead Topminnow complex
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Symphyotrichum elliottii</i>	Elliott's Aster
	<i>Canna flaccida</i>	Golden Canna
	<i>Ludwigia sphaerocarpa</i>	Grapefruit Primrose-willow

NON-FORESTED PARASITIC AND OPEN TERPAIN

Extent and Status

Coastal marshes are highly dynamic systems; thus, the acreage of each marsh type has varied greatly across time. Pre-settlement, Louisiana coastal marshes covered approximately 4.5 million acres (Smith 1993). Based on surveys conducted in 2021, the remaining total coastal marsh extent in Louisiana is 3.62 million acres (Nyman et al. 2022), which is approximately 80% of the estimate pre-settlement extent. Statewide coastal marsh surveys conducted in 2021, estimated that approximately 992,000 acres are Freshwater Marsh (Nyman et al. 2022).

Freshwater Marsh has undergone the largest reduction in acreage of any of the marsh types over the past 30 years, due mainly to saltwater intrusion; canal dredging; and commercial, industrial and residential development. The largest contiguous tracts of Freshwater Marsh occur in Terrebonne, St. Mary, Vermilion, Cameron, Lafourche, and St. Charles parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, federal lands containing Freshwater Marsh 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 include the Atchafalaya Delta, Salvador, Timken, Pass-a-Loutre, and Pearl River WMAs, 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 Marsh, and Mandalay NWRs.

EXTENT OF FRESHWATER MARSH

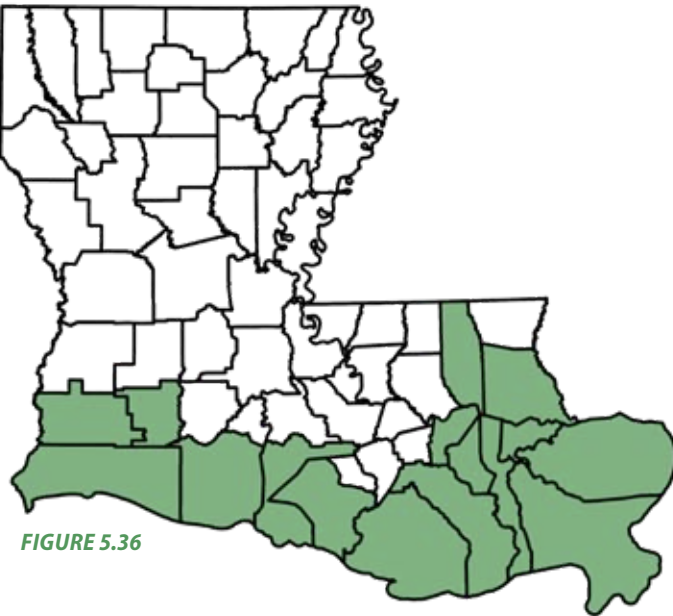


FIGURE 5.36

Threats

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

Research Needs and 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 partners to broaden coastal restoration projects to include Freshwater Marsh and to prioritize habitat features important for SGCN.
- 4. Utilize sediment pipeline delivery to create Freshwater Marsh.
- 5. Provide landowner assistance with Feral Hog control in this habitat; disturbance by hogs is a particular threat.

INTERMEDIATE MARSH

Rarity Rank: G4?/S3

Synonyms: Oligohaline Marsh

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 America. 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, bulltongues (*Sagittaria* spp.) and bulldredges (*Schoenoplectus* spp.). 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: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Botaurus exilis</i>	Least Bittern
Non-crustacean Arthropods	<i>Euphyes dion</i>	Dion Skipper
	<i>Euphyes pilatka</i>	Palatka Skipper
Inland Fishes	<i>Anguilla rostrata</i>	American Eel
	<i>Atractosteus spatula</i>	Alligator Gar
Reptiles	<i>Nerodia clarkii clarkii</i>	Gulf Saltmarsh Snake
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Eleocharis rostellata</i>	Walking Spikesedge



Intermediate Marsh, St. Tammany Parish

Extent and Status

Coastal marshes are highly dynamic systems; thus, the acreage of each marsh type has varied greatly across time. Pre-settlement, Louisiana coastal marshes covered approximately 4.5 million acres (Smith 1993). Based on surveys conducted in 2021, the remaining total coastal marsh extent in Louisiana is 3.62 million acres (Nyman et al. 2022), which is approximately 80% of the estimate pre-settlement extent. Statewide coastal marsh surveys conducted in 2021, estimated that approximately 1.26 million acres are Intermediate Marsh (Nyman et al. 2022). The largest contiguous tracts of Intermediate Marsh occur in Cameron, Vermilion, Terrebonne, and Lafourche parishes (Hartley et al. 2000). In the Chenier Plain of southwestern Louisiana, Rockefeller Wildlife Refuge and Sabine NWR contain Intermediate Marsh. 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 Marsh NWRs, and Jean Lafitte National Historical Park and Preserve.

EXTENT OF INTERMEDIATE MARSH

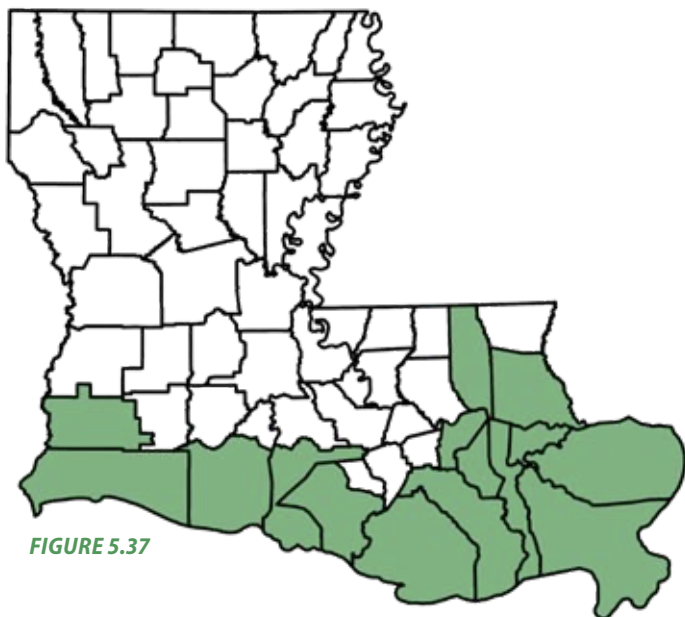


FIGURE 5.37

Threats

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

Research Needs and 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 partners to develop BMPs for livestock production in this habitat.
4. Work with partners for protection and restoration of Intermediate Marsh and shoreline stabilization as well as to expand coastal restoration projects to include this habitat, prioritizing features important for SGCN.
5. Provide landowner assistance with Feral Hog control in this habitat; disturbance by hogs is a particular threat.

SALT MARSH

Rarity Rank: G5/S4

Synonyms: Smooth Cord Grass Marsh, Saltgrass Marsh, Saline Marsh

Typically, Salt Marsh is the marsh area closest to the beach rim of the Gulf of America and, in general, varies from 1 to 15 miles in width. This marsh is a regularly tidally flooded, flat, polyhaline area dominated by salt-tolerant grasses and 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 (*Spartina alterniflora*). Two other major groups of autotrophs found in Salt Marsh are microscopic algae located on the surface of the vascular plants and benthic algae (usually diatoms) living on or in 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 saltwater intrusion resulting in shifts in marsh salinity levels. Salt Marsh provides nursery areas



Salt Marsh, St. Bernard Parish

NON-FORESTED PARASITIC AND OPEN TERN



Salt Marsh, Barataria Basin

for larval forms of many species such as shrimp, crabs, Red Drum, Spotted Seatrout, and Menhaden, and greatly enhances the production of such marine organisms due to the enormous primary productivity of the Salt Marsh vegetation. Factors that 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, subsidence, and erosion.

Salt Marsh also functions as a nitrogen and phosphorus sink (at least seasonally), thereby improving the quality of water that passes through it. In addition, Salt Marsh can alleviate the effects of storms and flooding farther inland 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 maritima*) is endemic to Salt Marsh, one of only five such Salt Marsh-obligate vertebrate species on Earth (Greenberg et al. 2006).

SALT MARSH: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Ammodramus nelsoni</i>	Nelson's Sparrow
	<i>Rallus crepitans</i>	Clapper Rail
	<i>Ammodramus maritima</i>	Seaside Sparrow
Non-crustacean Arthropods	<i>Brephidium pseudofea</i>	Eastern Pygmy Blue
	<i>Euphyes bayensis</i>	Bay Skipper
	<i>Automeris louisiana</i>	Louisiana Eyed Silkmoth
Inland Fishes	<i>Anguilla rostrata</i>	American Eel
	<i>Atractosteus spatula</i>	Alligator Gar
Reptiles	<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin
	<i>Nerodia clarkii clarkii</i>	Gulf Saltmarsh Snake
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Distichlis littoralis</i>	Key Grass

Extent and Status

Coastal marshes are highly dynamic systems; thus, the acreage of each marsh type has varied greatly across time. Pre-settlement, Louisiana coastal marshes covered approximately 4.5 million acres (Smith 1993). Based on surveys conducted in 2021, the remaining total coastal marsh extent in Louisiana is 3.62 million acres (Nyman et al. 2022), which is approximately 80% of the estimate pre-settlement extent. Statewide coastal marsh surveys conducted in 2021, estimated that 805,650 acres are Salt Marsh (Nyman et al. 2022). Salt Marsh is most extensive on the Deltaic Plain of southeastern Louisiana. The area of Salt Marsh is currently increasing, likely due to saltwater intrusion resulting in shifts in marsh salinity levels.

EXTENT OF SALT MARSH

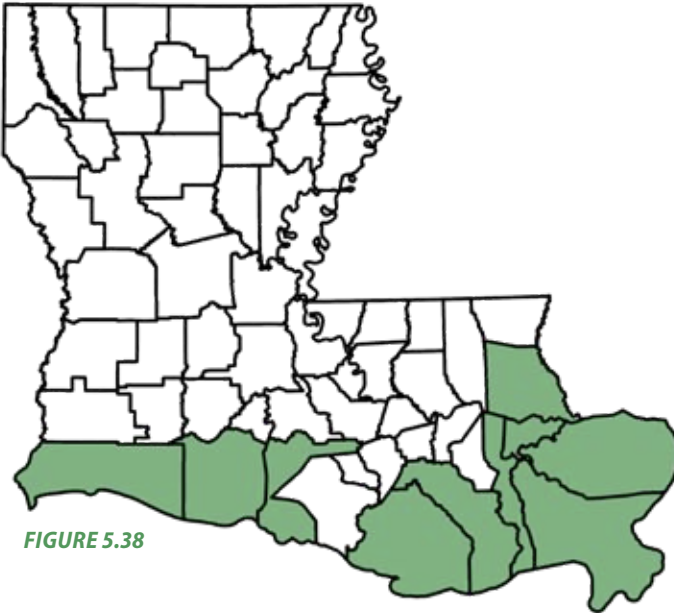


FIGURE 5.38

Threats

Salt Marsh is threatened by disturbance from several human sources, subsidence, SLR, and potentially by increased tropical cyclone 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 are the impacts caused by Feral Hogs and Nutria.

Research Needs and Conservation Actions

- 1. Support partner efforts for shoreline stabilization and habitat restoration.
- 2. Work with partners to support coastal restoration projects, specifically targeting habitat and habitat features important for 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 Feral Hogs and Nutria, in Salt Marsh.



Vegetated Pioneer Emerging Delta, St. Mary Parish

VEGETATED PIONEER EMERGING DELTA

Rarity Rank: G3G4/S3

Synonyms: Delta Flats, Emergent Islands

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*) 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.

Extent and Status

According to Smith (1993), there was an estimated 2,000 to 10,000 acres of Vegetated Pioneer Emerging Delta in pre-settlement times; an estimated 75% to 100% of this amount is present today. Two areas of the Louisiana coast support 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.

Threats

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

EXTENT OF VEGETATED PIONEER EMERGING DELTA

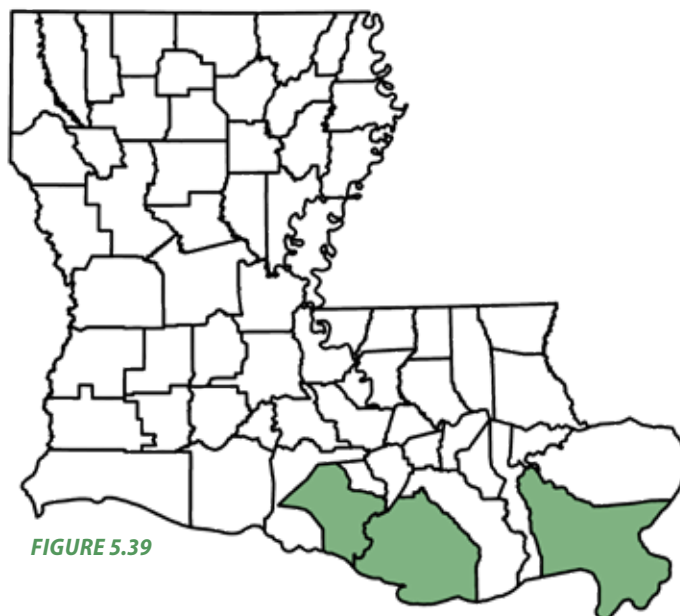


FIGURE 5.39

Research Needs and 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 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 partners to incorporate management objectives for the protection and restoration of emerging delta habitat into future coastal restoration efforts.
5. Continue efforts to control invasive species, particularly Torpedo Grass, Feral Hogs, and Nutria.

NON-FORESTED PARASITIC AND OPEN TERN

BEACHES, BARRIER ISLANDS, SANDBARS



Raccoon Island, Terrebonne Parish

BARRIER ISLAND

Rarity Rank: S1
Synonyms: None

Barrier Islands in Louisiana are old shorelines of abandoned, eroding deltas of the Mississippi River. Louisiana's Barrier Islands are important foraging, loafing, 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 Grassland and Coastal Dune Shrub Thicket, Coastal Mangrove-Marsh and Shrubland, Barrier Island Live Oak Forest, Salt Marsh, and Louisiana Beach. Marine Aquatic Submerged Vegetation also occurs in Chandeleur Sound immediately behind the Chandeleur Islands. Plant species distribution is determined by elevational gradients and exposure to saltwater spray or tidal overwash. Generally, succulent species and vines are found on the beachfronts, Marshhay Cord Grass on the highest dunes, and Black Mangrove and Smooth Cord Grass in the sheltered bayside areas.

Extent and Status

Since deltaic processes have been altered due to the 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 onto beaches and dunes, creating back barrier marsh platforms, and the use of sand fencing and vegetative planting to anchor sand and stabilize the substrate.

BARRIER ISLAND: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Egretta rufescens</i>	Reddish Egret
	<i>Pelecanus occidentalis</i>	Brown Pelican
	<i>Thalasseus maximus</i>	Royal Tern
Non-crustacean Arthropods	<i>Habroscelimorpha dorsalis venusta</i>	Gulf Beach Tiger Beetle
	<i>Caretta caretta</i>	Loggerhead Sea Turtle
Reptiles	<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin
	<i>Lepidochelys kempii</i>	Kemp's Ridley Sea Turtle
Plants	<i>Baccharis dioica</i>	Broom-bush Baccharis
	<i>Amaranthus greggii</i>	Gregg's Amaranth
	<i>Blutaparon vermiculare</i>	Silverhead

EXTENT OF BARRIER ISLAND

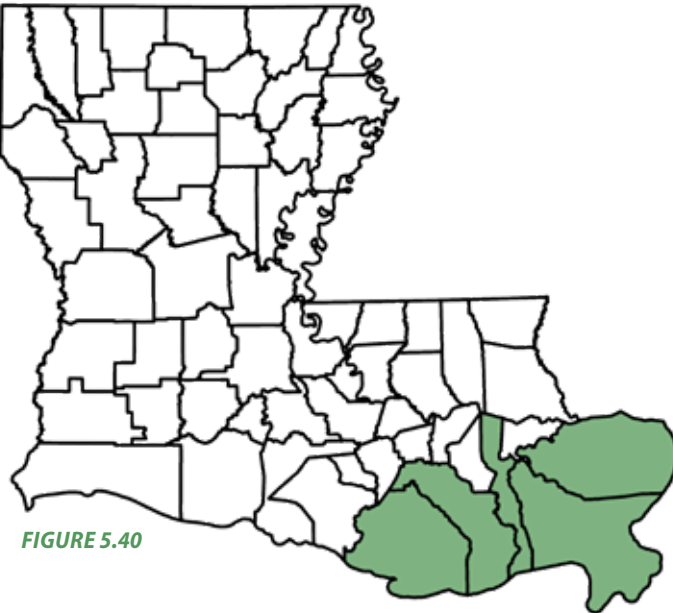


FIGURE 5.40

The major barrier islands include the Chandeleur Islands chain, Grand Isle, the Grand Terre Islands, Timbalier Island, and the Isle Dernieres. Much of the Chandeleur Islands chain is captured by Breton NWR, and the remainder is owned by State Lands and managed by the U.S. Fish and Wildlife Service (USFWS). Isle Dernieres Barrier Islands Refuge, managed by LDWF, includes Wine (almost completely submerged), Whiskey, Trinity/East, and Raccoon islands. Grand Isle is the only inhabited Barrier Island, and, as a result, much of the natural habitat has been destroyed; however, extremely valuable habitat remains and should be conserved.

Threats

Barrier Islands are threatened by habitat destruction and disturbance by humans, trash and marine debris accumulation, subsidence, SLR, hydrologic alterations, inadequate sand supply, and increased frequency and intensity of tropical cyclones.

Research Needs and Conservation Actions

1. Work with partners to implement *Louisiana's Comprehensive Master Plan for a Sustainable Coast* 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 partners for shoreline stabilization and habitat restoration, prioritizing inclusion of habitat features important for SGCN.

COASTAL DUNE GRASSLAND AND COASTAL DUNE SHRUB THICKET

Rarity Rank: G2G3/S1

Synonyms: Maritime Grassland, Dune Meadow, Dune Grass

Coastal Dune Grassland and Coastal Dune Shrub Thicket are distinct communities but 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 tropical cyclones and storms and because of a limited amount of eolian sand. The sites are normally xeric because they are elevated above the highest flood mark (except during tropical cyclones) and substrates are sandy and excessively well-drained. These sites are exposed to moderate to high amounts of salt spray. In addition,



Coastal Dune Grassland, Cameron Parish



Coastal Dune Shrub Thicket, Grand Isle, Jefferson Parish

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 Thicket is formed. This community occurs on established sand dunes and beach ridges on Barrier Islands and the mainland coast. Coastal Dune Shrub Thicket is 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 habitat type may be destroyed by sand dune migration or erosion and may be replaced by Coastal Dune Grassland.

COASTAL DUNE GRASSLAND/COASTAL DUNE SHRUB THICKET: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Plants	<i>Dalea emarginata</i>	Wedgeleaf Prairie-clover
	<i>Pedimelum rhombifolium</i>	Roundleaf Scurfpea
	<i>Schizachyrium maritimum</i>	Gulf Bluestem

Extent and Status

Coastal Dune Grassland and Coastal Dune Shrub Thicket are each estimated to have occupied less than 2,000 acres in pre-settlement times with 50% to 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 Coastal Dune Shrub Thicket, specifically on the east and west ends of the island. A considerable portion of this habitat is captured by Grand Isle State Park.

EXTENT OF COASTAL DUNE GRASSLAND AND COASTAL DUNE SHRUB THICKET

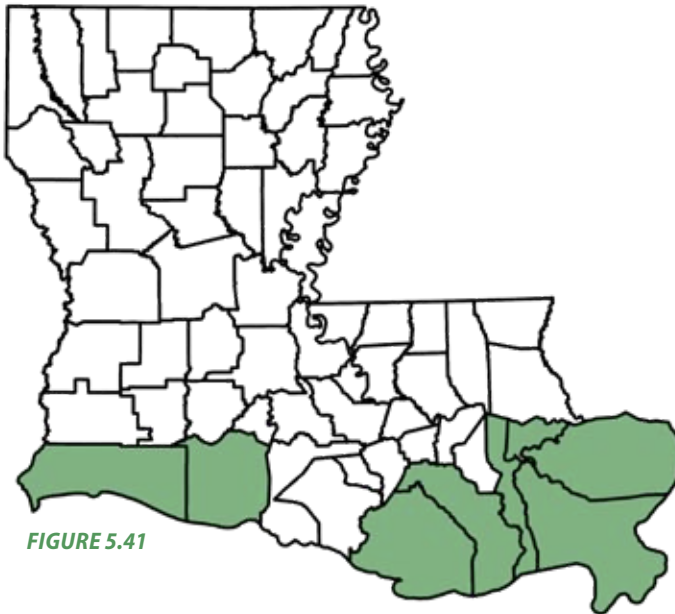


FIGURE 5.41

Threats

Both Coastal Dune Grassland and Coastal Dune Shrub Thicket habitats are threatened by several sources of disturbance and may face increased tropical cyclone frequency and intensity 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-impovertished Mississippi River and impediments to longshore deposition of sediments.

Research Needs and Conservation Actions

- 1. Support partner efforts for shoreline stabilization and habitat restoration. Work with local governments to recommend limits on off-road vehicles (ORV) use in this habitat.
- 2. Work with partners 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 saltcedars (*Tamarix* spp.), which pose a serious threat to this habitat.

LOUISIANA BEACH

Rarity Ranks: S2
Synonyms: none

Louisiana’s coastal sediments are derived from the Mississippi River. Louisiana Beach forms along the Gulf-facing shoreline and is low in elevation. Louisiana Beach is usually composed of fine sands and shell hash and is generally less well-developed than beaches along other parts of the Gulf Coast. Louisiana Beach composed of shell fragments is found primarily along the low-energy shorelines in the western portion of the Louisiana coast and the Barrier Islands in eastern Louisiana. A distinct feature of Louisiana Beach is the replacement of Sea Oats (*Uniola paniculata*), a grass characteristic of beaches (especially) to the east, by Marshhay Cord Grass (*Spartina patens*) (Barbour et al. 1987).

LOUISIANA BEACH: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Anarhynchus wilsonia</i>	Wilson's Plover
	<i>Charadrius melodus</i>	Piping Plover
	<i>Sternula antillarum antillarum</i>	Coastal Least Tern
Non-crustacean Arthropods	<i>Habroscelimorpha dorsalis venusta</i>	Gulf Beach Tiger Beetle
	<i>Caretta caretta</i>	Loggerhead Sea Turtle
Reptiles	<i>Lepidochelys kempii</i>	Kemp's Ridley Sea Turtle
	<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin
Plants	<i>Amaranthus greggii</i>	Gregg's Amaranth
	<i>Cenchrus myosuroides</i>	Big Sandbur
	<i>Tidestromia lanuginosa</i>	Woolly Honeysweet

Extent and Status

Well-developed Louisiana Beach occurs on the Chenier Plain in Cameron Parish in the Oak Grove area west nearly to Sabine Pass. Shell beaches are found mainly on the central part of the coast in Cameron, 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/ East Island in the Isle Dernieres Barrier Islands Refuge, Timbalier Island, West Grand Terre Island, along the coast from Elmer’s Island Wildlife Refuge through 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.

EXTENT OF LOUISIANA BEACH

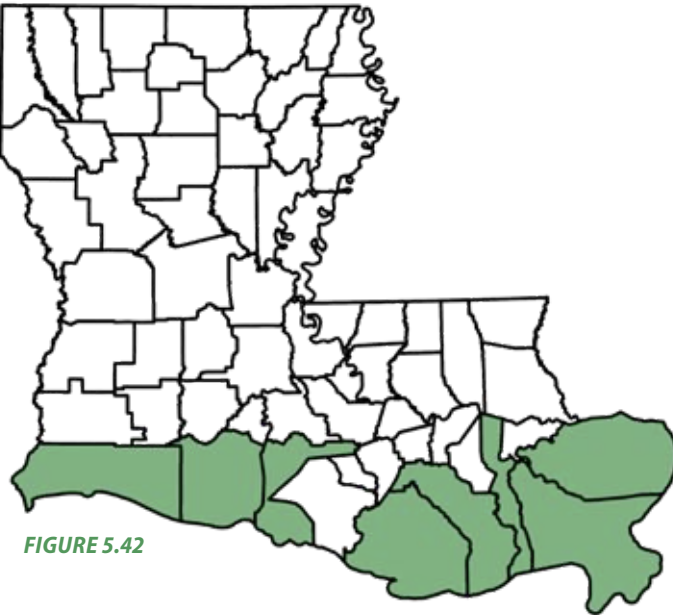


FIGURE 5.42

Threats

Many Louisiana Beach occurrences are impacted by vehicle traffic and trash accumulation. The maintenance of Louisiana Beach 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



Louisiana Beach Restoration, Lafourche Parish

frequency and intensity of tropical cyclones associated with climate change may also threaten this habitat, in concert with inundation resulting from SLR.

Research Needs and 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. Ensure designated parking areas are available at all beach access points. Advise local municipalities on potential funding sources that could provide additional designated parking; advise on how to install while minimizing impacts 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. Develop seed sources to be used for restoration efforts.
6. Conduct research to determine impacts of cattle grazing to Louisiana Beach habitat and associated wildlife.

SANDBAR

Rarity Rank: G4G5/S4

Synonyms: River Sandbar

Sandbar is a sand/gravel deposit in or adjacent to permanently flowing freshwater contained within a natural channel. Sandbar is 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 Sandbar is not scoured and re-worked. Due to the early successional nature of this community type, it can be invaded by invasive plant species (NatureServe 2015). Sandbar is a critical nesting area for Interior Least Tern (*Sternula antillarum athalassos*) and many riverine turtles.

SANDBAR: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Sternula antillarum athalassos</i>	Interior Least Tern
Non-crustacean Arthropods	<i>Ellipsoptera wapleri</i>	White Sand Tiger Beetle
	<i>Graptemys pearlensis</i>	Pearl River Map Turtle
Reptiles	<i>Graptemys oculifera</i>	Ringed Map Turtle
	<i>Apalone mutica calvata</i>	Gulf Coast Smooth Softshell
Inland Fishes	<i>Ammocrypta clara</i>	Western Sand Darter
Plants	<i>Euploca convolvulacea</i>	Bindweed Heliotrope

Extent and Status

Sandbar habitat occurs primarily along the major rivers such as the Mississippi, Red, Pearl, Sabine, and Ouachita rivers. This habitat found within the Mississippi River has shown a general decline over the past 60 years; the USACE 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).

EXTENT OF SANDBAR

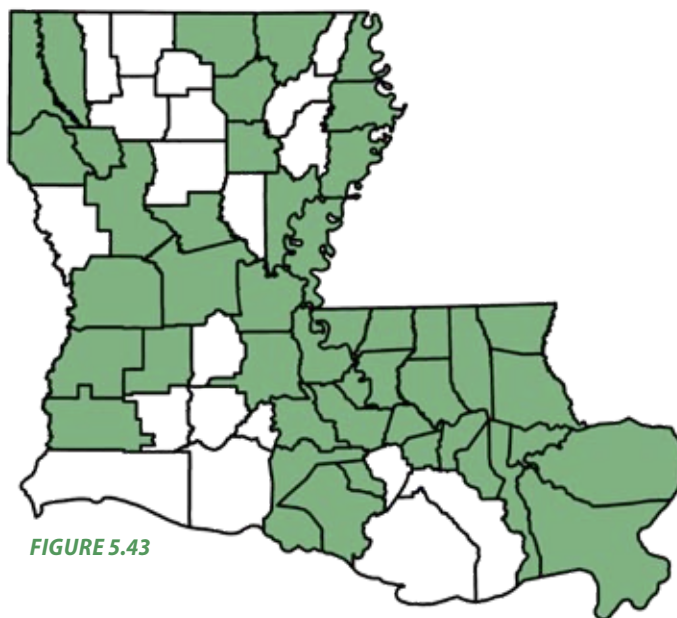


FIGURE 5.43

Threats

Sandbars are subject to frequent human disturbance. Large rivers are often engineered waterways; the operation of locks and dams, barge traffic, and 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.

Research Needs and Conservation Actions

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



Sandbar

PRAIRIES

CALCAREOUS PRAIRIE

Rarity Rank: G1/S1
Synonyms: Barren, Calcareous Barren, Calcareous Clay Prairie, Keiffer Prairie, Jackson Prairie, Morse Clay Prairie, Anacoco Prairie, Blackland Prairie, Fleming Calcareous Prairie, Calcareous Glade

Calcareous Prairie is typically a small, naturally treeless area occurring on calcareous substrata in the uplands of central, western, and northwestern Louisiana. Prairie communities can range in size from less than one acre to 100 or more acres and occur in a mosaic with Calcareous Forests (Smith et al. 1989). Calcareous Prairie has been identified in association with four geological formations: (1) Intermediate Terraces (Pleistocene) associated with old Red River deposits in northwestern Louisiana (Morse Clay Prairies), (2) the Fleming Formation (Tertiary-Miocene) in central-western Louisiana, (3) the Jackson Group (Tertiary-Eocene) in central Louisiana, and (4) the Cook Mountain Formation (Tertiary-Eocene) in central and western Louisiana. Although these prairies are grouped together, each site possesses distinct characteristics, sometimes serving as the sole habitat for specific plant SGCN. Soils are stiff calcareous clays with high shrink-swell characteristics and range in color from red to olive-tan to gray-black. The surface soil pH of these systems varies from slightly acidic to alkaline (pH 6.5 to 8.0); however, they typically have an alkaline horizon at or within the upper 30 inches of the soil profile (Kelley and Bordelon 2024, Smith et al. 1989). 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.

CALCAREOUS PRAIRIE: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Ammodramus savannarum</i>	Grasshopper Sparrow
Plants	<i>Rudbeckia missouriensis</i>	Missouri Coneflower
	<i>Echinacea purpurea</i>	Purple Coneflower
	<i>Carex microdonta</i>	Small-toothed Caric Sedge

Extent and Status

Historically, approximately 40,000 to 50,000 acres of Calcareous Prairie occurred statewide (MacRoberts and MacRoberts 1997). This conservative estimate is based on historical land surveys. At the time of these early surveys, European settlement had already greatly removed much of this landscape, and smaller prairies under 40 acres would likely have not been captured (MacRoberts and MacRoberts 1997). Only about 1% of the original extent is thought to be intact (MacRoberts and MacRoberts 1997). Currently, remnants of Calcareous Prairies occur on each geologic formation in the state.

EXTENT OF CALCAREOUS PRAIRIE

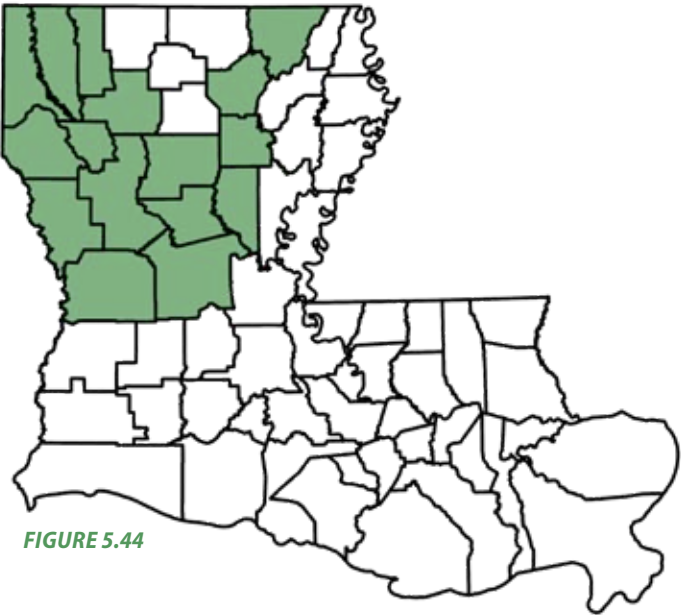


FIGURE 5.44

There are 15 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. Current management involves fire and brush control, which is expected to improve the quality of these prairies over time. On Barksdale AFB, most of the prairies are of high quality (McInnis 1997). The Barksdale prairies are intrinsically important, 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 Fort 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 (e.g., Keiffer Prairies). The USFS has been working to remove invading woody vegetation and expand these prairies to their former extent.



Morse Clay Calcareous Prairie, Bienville Parish

Threats

This naturally open habitat is threatened by mineral extraction and associated infrastructure. Development, habitat conversion, afforestation attempts, disturbance by other human activities, inadequate fire, excessive use of broad-spectrum herbicides by local and state transportation departments, and invasive species all pose additional threats.

Research Needs and Conservation Actions

1. Continue status surveys to determine the extent and condition of this habitat type.
2. Partner with the Louisiana LaDOTD and other rights-of-way (ROW) holders such as energy and utility companies to protect and properly manage railroad prairie remnants, including minimizing the use of herbicides on ROW containing Calcareous Prairie.
3. Work with land managers, hunting clubs, extension agents, etc. to discourage the placement of food plots within this habitat type.
4. 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.
5. Work closely with KNF on stewardship of the Keiffer Prairie Complex, which is enrolled in LDWF's Natural Areas Registry.
6. Provide landowner assistance with Feral Hog control in this habitat; disturbance by hogs is a particular threat.
7. Target occurrences of Calcareous Prairie in Louisiana for permanent protection via servitudes or land acquisition.

COASTAL PRAIRIE

Rarity Rank: G2Q/S1

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

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 can be found in Coastal Prairie. These mounds were formed by eolian deposition during historical harsh droughts (Siefert et al. 2009) and, possibly, fluvial deposition during periods with higher than



Coastal Prairie

normal precipitation (Wilcox et al. 2011). Pimple mounds and embedded marshes and ponds (e.g., Prairie Pothole) add to the habitat diversity of the Coastal Prairie landscape.

COASTAL PRAIRIE: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Crustaceans	<i>Fallicambarus macneesei</i>	Old Prairie Digger
Birds	<i>Coturnicops noveboracensis</i>	Yellow Rail
	<i>Anthus spragueii</i>	Sprague's Pipit
	<i>Ammodramus leconteii</i>	LeConte's Sparrow
Reptiles	<i>Terrapene ornata</i>	Ornate Box Turtle
Mammals	<i>Baiomys taylori</i>	Northern Pygmy Mouse
Plants	<i>Hibiscus leucophyllus</i>	White-Leaf Prairie Hibiscus
	<i>Cyperus cephalanthus</i>	Cryptic Flat Sedge
	<i>Rhynchospora tracyi</i>	Tracy's Beaksedge

Extent and Status

Coastal Prairie historically occupied about 2.22 million acres in southwest Louisiana (Grace et al. 2000). About 0.02% (4,000 to 5,000 acres) of the original Coastal Prairie remains today (Early et al. 2024). The marsh-fringing prairie type is represented by several remnants and totals about 1,015 acres. White Lake Wetlands Conservation Area supports the largest and best examples of this wet prairie type, while small highly degraded examples are captured by Sabine NWR and Cameron Prairie NWR. Wet-mesic prairie occupies approximately 3,015 acres. 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 and within pimple-mounded areas imbedded in wet-mesic sites. Less than 300 acres of dry-mesic prairie likely remain. All the railroad remnants are in various states of degradation due to woody encroachment, soil disturbance, and prolonged fire suppression.

EXTENT OF COASTAL PRAIRIE

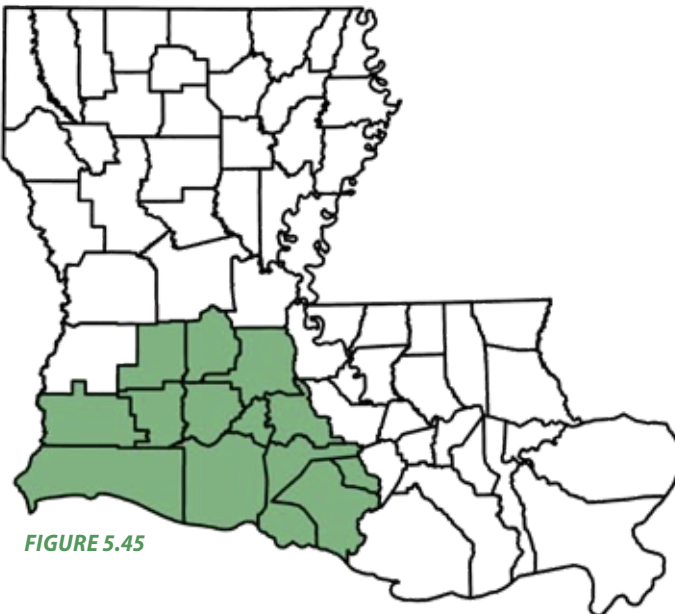


FIGURE 5.45

Threats

Remaining occurrences of this very rare habitat are threatened by inadequate fire, incompatible grazing management, improper mitigation banking practices, and disturbance from human activities as well as invasive species. 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. More than half of the Coastal Prairie remnants, including the six largest Coastal Prairie remnants, and over 75% of the remaining Coastal Prairie acreage in Louisiana are restricted to Cameron and Calcasieu parishes (Early 2025).

A rising threat to Coastal Prairie in Louisiana comes from unsound mitigation practices and permitting. The largest known, contemporary, single loss of Coastal Prairie acreage (approximately 31 acres) resulted from an improperly permitted mitigation bank, which allowed the conversion of a wetland Coastal Prairie remnant to a forested mitigation bank (Early 2025). In recent years, approximately 5,770 acres on Coastal Prairie-classified soils have been converted to “Bottomland Hardwood Forest” mitigation types, while only 0.11 acres of this area was actually classified as potential Bottomland Hardwood Forest soil (Early 2025). In addition, three coastal prairie remnants have been completely surrounded by several “Bottomland Hardwood Forest” mitigation banks, further fragmenting and isolating these Coastal Prairie remnants from other grassland types and potential reconnections or expansions via restoration efforts (Early 2025).

Research Needs and Conservation Actions

1. Collaborate with partners to promote protection, restoration, and expansion of Coastal Prairie habitat.
2. Collaborate with partners and 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. Collaborate with the USACE and the Interagency Review Team to develop science-based approaches and guidelines for mitigation banking in the Coastal Prairie regions that foster and facilitate more Coastal Prairie preservation, restoration, and reestablishment in the region.
5. Continue to work with USACE, other mitigation bank regulatory bodies, and mitigation bank sponsors to ensure correct identification and maximum ecological value of this habitat. This includes discouraging establishment of inappropriate vegetation types on the flatwoods landscape such as Bottomland Hardwood Forest.
6. 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.

7. Support research to determine prairie-compatible grazing schemes on Coastal Prairie rangeland and incorporate the outcomes of that research into BMPs.
8. Continue stewardship actions on Coastal Prairie on White Lake Wetlands Conservation Area.
9. 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.
10. Support and encourage aggressive Feral Hog control measures throughout the Coastal Prairie region especially on public lands that support Coastal Prairie remnants and Coastal Prairie reestablishment projects.
11. Work with USFWS at Cameron Prairie NWR to move forward with re-establishment of Coastal Prairie and to initiate an aggressive prescribed burning program.
12. Partner with railroad companies and LaDOTD to protect and properly manage railroad prairie remnants.
13. Locate opportunities to purchase agricultural lands on the historical prairie landscape from willing sellers for grassland conservation.
14. 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.
15. Pursue long-term protection of Coastal Prairie remnants through cooperative agreements with landowners (e.g., leases, servitudes) or through land acquisition.
16. Identify minimum patch size and connectivity needed to achieve a fully functional Coastal Prairie landscape.
17. 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.
18. Provide landowner assistance with Feral Hog control in this habitat; disturbance by hogs is a particular threat.

MISSISSIPPI TERRACE PRAIRIE

Rarity Ranks: G2/SX

Synonyms: Macon Ridge Prairie

Mississippi Terrace Prairie was a tall-grass prairie type of northeastern Louisiana found on Pleistocene terraces within the MRAP floodplain. This prairie 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 Prairie in northeastern Louisiana such as the Boeuf Prairie in Franklin Parish. This habitat is now considered extirpated in Louisiana.

Extent and Status

Mississippi Terrace Prairie historically occupied less than 2,000 acres in the MRAP ecoregion in northeast Louisiana (Smith 1993). This community was converted primarily to agriculture, but some areas were also converted for housing development. No known examples remain today. However, several small remnants of a calcareous or other unknown prairie type occur in the region, which appear to be similar to Mississippi Terrace Prairie.

EXTENT OF MISSISSIPPI TERRACE PRAIRIE

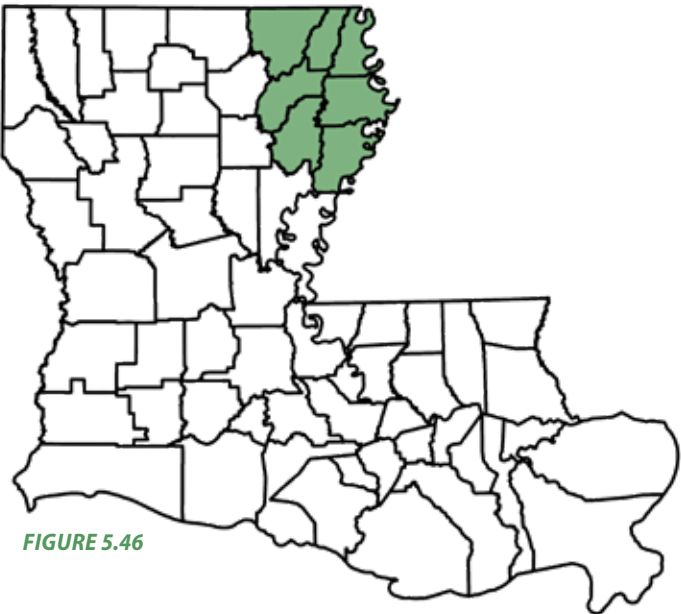


FIGURE 5.46

Research Needs and 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.

PRAIRIE POTHOLE

Rarity Rank: GNR/S1

Synonyms: Marais

Prairie Pothole, an ephemeral pond type, occurs on the Coastal Prairie landscape in southwestern Louisiana. Prairie Potholes occupy swales and depressions remaining from ancient Pleistocene eolian deflations or undeveloped stream channels. These features are small (often < 1 to 2 acres) and circular, elliptical, or sinuous when occupying relict drainage channels winding through a prairie. Prairie Potholes may be well-defined and distinct from the surrounding prairie. Pothole depth 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 Maidencane being the dominant species, while other potholes are rich in sedges and rushes. Although the hydro-geomorphology of Prairie Potholes and Flatwoods Ponds is the same, these systems differ drastically in species richness, diversity, and composition for unknown reasons.

PRAIRIE POTHOLE: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Crustaceans	<i>Fallicambarus macneesei</i>	Old Prairie Digger
Plants	<i>Cyperus cephalanthus</i>	Cryptic Flat Sedge



Prairie Pothole, Calcasieu Parish

Extent and Status

Because nearly all of the historical Coastal Prairie has been land-leveled and plowed, Prairie Potholes are very rare on today’s landscape. Extensive surveys by LDWF staff, performed between 2018 and 2024, concluded that approximately 15 Prairie Pothole occurrences remain, all of which are located on ranglands in Cameron and Calcasieu parishes.

EXTENT OF PRAIRIE POTHOLE

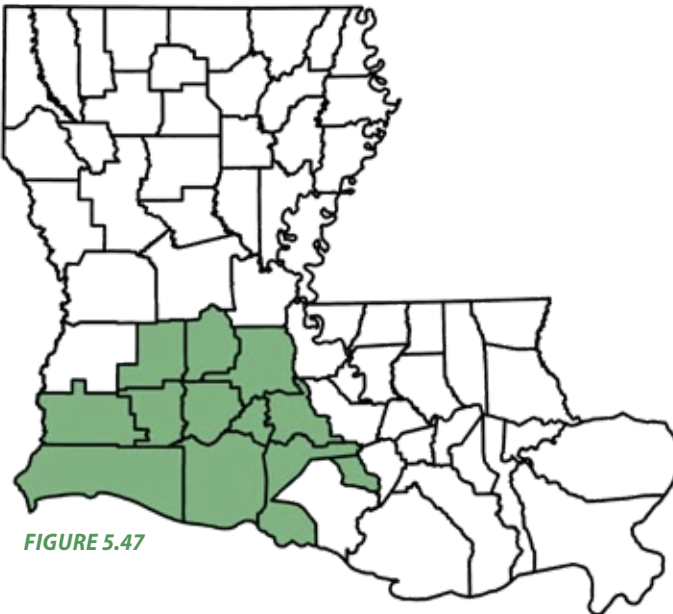


FIGURE 5.47

Threats

Prairie Potholes are threatened by disturbance from several human sources as well as by invasive species, most notably Feral Hogs.

Research Needs and 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 and management, especially prescribed fire, on Coastal Prairie ranglands.
4. Support control of Feral Hogs and other invasive species within and near this habitat type.

NON-FORESTED PARASITIC AND OPEN TEPAL

SODIC/ALKALI BARRENS (FORMERLY SALINE PRAIRIE)

Rarity Rank: G1G2/S1

Synonyms: Alkali Flat, Barrens, Salt Barren, Slick, Saline Prairie

Sodic/Alkali Barren is a small-scale grassland, often occurring in complexes of small openings. Sodic/Alkali Barren habitat ranges from less than one acre to about 30 acres in size. There are two types of Sodic/Alkali Barren classified by hydrology and landscape position: dry-mesic (upland) and wet. Dry-mesic Sodic/Alkali Barren occurs on fluvial terraces adjacent to active small stream floodplains, and its soils formed in Pleistocene alluvium. Wet Sodic/Alkali Barren occurs in stream valleys subject to regular flooding. Wet expressions of this community sometimes transition upslope into dry-mesic Sodic/Alkali Barren. Some areas of these systems contain exposed or sparsely vegetated soil known as “slicks,” which support “cryptogamic lips” dominated by algae, mosses, lichens, and very small flowering plants (Pittman 1988, Reid et al. 2010, Baker and Witsell 2013).



Wet Sodic/Alkali Barren, Winn Parish



Dry-mesic Sodic/Alkali Barren

Upland Sodic/Alkali Barren 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 associated with Sodic/Alkali Barren natural communities are Bonn, Brimstone, and Lafe soil series (Reid et al. 2010). However, Guyton soils or soil map units containing the Guyton soils series are the primary mapped soil units at some Sodic/Alkali Barrens (Reid et al. 2010). A detailed study of the flora and edaphics of several upland Sodic/Alkali Barrens by Reid and colleagues (2010) revealed that the soils of these barrens are not truly saline but are sodic (i.e. natric, alkali). The flora of the barrens studied by Reid and colleagues (2010) had very few typical salt-tolerant plants and supported plants that are ephemeral. The upland Sodic/Alkali Barren flora has substantial overlap with the flora of Sandstone Glade/Barren (MacRoberts et al. 2009, Reid et al. 2010). Wet Sodic/Alkali Barren occurs on lower landscape positions than upland prairie and is seasonally flooded. The flora of wet Sodic/Alkali Barren is entirely different from that of upland prairie and includes several plants that also occur in coastal saline habitats. Wet expressions of this system also feature large barren patches and are in need of more detailed floristic edaphic studies.

SODIC/ALKALI BARRENS: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Birds	<i>Ammodramus savannarum</i>	Grasshopper Sparrow
Non-crustacean Arthropods	<i>Ataenius robustus</i>	Saline Prairie Scarab Beetle
Mammals	<i>Baiomys taylori</i>	Northern Pygmy Mouse
	<i>Geocarpon minimum</i>	Earth-fruit
	<i>Geocarpon nuttalli</i>	Drummond's Sandwort
Plants	<i>Micranthes texana</i>	Texas saxifrage

Extent and Status

Sodic/Alkali Barren was 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 from 2006 to 2008 to locate Sodic/Alkali Barrens in northwestern Louisiana. This work was very successful, revealing about 10 new records and expanding the range of the Sodic/Alkali Barren to include three additional parishes (Reid et al. 2010). Sodic/Alkali Barren 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.

EXTENT OF SODIC/ALKALI BARRENS

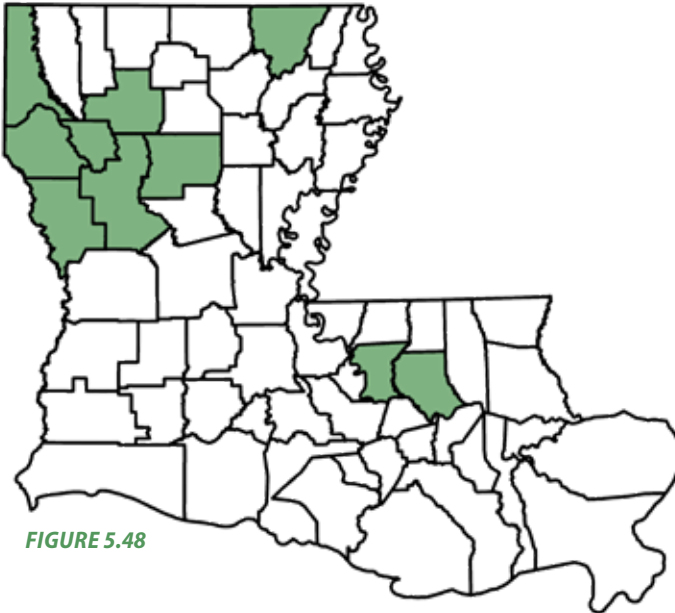


FIGURE 5.48

Threats

Sodic/Alkali Barren is threatened by disturbance associated with mineral extraction and roads and service corridors as well as afforestation attempts. Several recently rediscovered Sodic/Alkali Barrens are under threat of commercial and residential development as they are not protected. Feral Hogs pose a serious threat to Sodic/Alkali Barren communities.

Research Needs and Conservation Actions

1. Continue surveys to monitor the current extent and condition of this habitat type.
2. Conduct detailed studies of flora and edaphic conditions of Wet Sodic/Alkali Barren habitat types.
3. Conduct surveys to determine invertebrate assemblages of Sodic/Alkali Barren.
4. Provide assistance with Feral Hog control in this habitat to landowners.
5. Target occurrences of Sodic/Alkali Barren in northwest Louisiana for permanent protection via servitudes or land acquisition.
6. Work with land managers, hunting clubs, extension agents, and others to discourage the placement of food plots within or near this habitat type.

INLAND AND MARINE

LENTIC WATER BODIES



Coastal Freshwater Submerged Aquatic Vegetation

COASTAL FRESHWATER SUBMERGED AQUATIC VEGETATION

Rarity Ranks: G4/S3S4
Synonyms: none

Well-developed Freshwater Submerged Aquatic Vegetation (SAV) beds often occur in lentic water bodies within the coastal plain. Typically, this natural community consists primarily of freshwater but may include pulses or short durations of higher salinities ranging from 0 to 5 ppt salinity. Species found within the Coastal Freshwater Submerged Aquatic Vegetation natural community can overlap those found in other SAV types such as Interior Freshwater Submerged Aquatic Vegetation and Estuarine Submerged Aquatic Vegetation communities. Floating-leaved aquatics such as water-lilies (*Nymphaea* spp.) are often conspicuous in Coastal Freshwater Submerged Aquatic Vegetation. This habitat occurs throughout coastal Freshwater Marsh and the interface of Baldcypress-Tupelo Swamp Forest. This SAV type develops in natural and man-made water bodies.

COASTAL FRESHWATER SUBMERGED AQUATIC VEGETATION: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Inland Fishes	<i>Atractosteus spatula</i>	Alligator Gar
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Marine Fishes	<i>Fundulus pulvereus</i>	Bayou Killifish
	<i>Fundulus jenkinsi</i>	Saltmarsh Topminnow
	<i>Eleotris amblyopsis</i>	Large-scaled Spinycheek Sleeper

Extent and Status

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. The historical extent is unknown, and current acreage has not been estimated.

Threats

Disturbance, invasive species, and possible effects of climate change, including increases in tropical cyclone frequency and intensity and SLR, can threaten this habitat.

Research Needs and Conservation Actions

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

INTERIOR FRESHWATER SUBMERGED AQUATIC VEGETATION

Rarity Ranks: G4/S5
Synonyms: none

Interior Freshwater Submerged Aquatic Vegetation is highly variable and can occupy swamps, lakes (e.g., oxbows), reservoirs (especially upper ends), sluggish bayous, Beaver ponds, and small farm ponds. Water turbidity, temperature, substrate, wave action, nutrient loads, and light penetration are key factors in determining the composition of the flora and fauna of SAV beds. 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. The magnitude of benefits may vary based on the quantity and quality of habitat. For example, floodplain lakes can support abundant SAV consisting of multiple species. Aquatic plants have good dispersal abilities and can be quickly recruited in a water body lacking aquatic vegetation if the water quality remains conducive to such recruitment and hospitable throughout the species' life cycle. Older, better developed, and species-rich SAV beds containing native species are of particular interest for conservation and protection.

INTERIOR FRESHWATER SUBMERGED AQUATIC VEGETATION: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Inland Fishes	<i>Pteronotropis welaka</i>	Bluenose Shiner
	<i>Fundulus</i> spp.	Starhead Topminnow complex
	<i>Syngnathus scovelli</i>	Gulf Pipefish (Inland Populations)
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Potamogeton perfoliatus</i>	Nuttall's Pondweed
	<i>Myriophyllum laxum</i>	Loose-flowered Water-milfoil



Interior Freshwater Submerged Aquatic Vegetation, Sabine Parish

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

Interior Freshwater Submerged Aquatic Vegetation is threatened in some cases by habitat instability, turbidity, and by invasive plants. Climate change poses an additional threat, especially if there are reductions in precipitation. Invasive species such as Water Hyacinth, Giant Salvinia and Hydrilla (*Hydrilla verticillata*) also threaten this natural community.

Research Needs and 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 Submerged Aquatic Vegetation habitat and associated native and exotic aquatic plants.
4. Continue to invest in cleaning stations at boat ramps to limit the spread of invasive aquatic plants.

LAKES AND RESERVOIRS

Rarity Rank: S5

Synonyms: none

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. Other natural lakes occur in coastal Barataria, Calcasieu, Mermentau, and Terrebonne basins. Natural 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 Great Raft in the 19th century, water levels in these lakes fluctuated greatly until control structures were installed to maintain these lakes as reservoirs. Although reservoirs can provide habitat that is utilized by native species, including some SGCN, it is always desirable to remove impoundments and restore natural hydrology and habitat connectivity.

LAKES AND RESERVOIRS: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Inland Fishes	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Syngnathus scovelli</i>	Gulf Pipefish
	<i>Anguilla rostrata</i>	American Eel
Birds	<i>Haliaeetus leucocephalus</i>	Bald Eagle
Plants	<i>Carex decomposita</i>	Cypress-knee Sedge
	<i>Rorippa aquatica</i>	North American Lake-Cress
	<i>Didiplis diandra</i>	Water Purselane

Extent and Status

Lakes and reservoirs are common on the landscape. Reservoirs of varying sizes are distributed among all of Louisiana’s ecoregions with Toledo Bend Reservoir, one of the largest man-made lakes in the United States, found along the western border at the Louisiana-Texas state line.

Threats

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



Oxbow Lake associated with Tensas River, Concordia Parish

Research Needs and Conservation Actions

- 1. Work with partners to minimize human impacts such as nutrient loading, sedimentation, 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.

PONDS

Rarity Rank: S5
Synonyms: none

Ponds are very frequent on the Louisiana landscape and are often artificially created by impounding streams or excavating earth. The typical recreational or farm pond is relatively “sterile,” as it is surrounded by anthropogenic habitats such as lawn or pasture. Beaver ponds are small, natural ponds that can support open swamp vegetation and recruit freshwater 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. Putatively natural ponds that originated from wind deflation (i.e. removal of loose sediments by wind) or some other natural process are apparently rare in Louisiana, but knowledge is greatly lacking.

PONDS: OBLIGATE OR NEAR-OBLIGATE SGCN		
Scientific Name		Common Name
Plants	<i>Rhynchospora inundata</i>	Narrow-fruit Horned Beaksedge
	<i>Nymphaea elegans</i>	Blue Water-lily
	<i>Utricularia juncea</i>	Southern Bladderwort



Bass pond at Woodworth Outdoor Education Center, Rapides Parish

Extent and Status

Farm and recreational ponds are scattered across the state and likely number in the thousands. Beaver ponds are generally common on the landscape, though age and degree of development vary greatly.

Threats

Most threats affecting ponds are local in nature, and include modification of natural ponds (removal of Beavers, alteration of basin geometry, etc.), sedimentation, and disturbance and pollution from humans, agriculture, and Feral Hogs. Invasive plant species such as Water Hyacinth, Giant Salvinia, and Hydrilla threaten Ponds on a larger scale.

Research Needs and 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.

LOTIC WATER BODIES



River Delta Freshwater Submerged Aquatic Vegetation, Atchafalaya Delta WMA, St. Mary Parish

RIVER DELTA FRESHWATER SUBMERGED AQUATIC VEGETATION

Rarity Rank: G3G5/SNR

Synonyms: none

Louisiana’s two active deltas, the Mississippi and Atchafalaya deltas, support extensive SAV beds in shallow water areas. Water turbidity, temperature, salinity, substrate, wave action, nutrient loads, and light penetration are key factors in determining the composition of the flora and fauna of SAV beds. River Delta Freshwater Submerged Aquatic Vegetation beds can consist of both submerged species and floating-leaved species. As sediments accumulate, this SAV type gives way to the Vegetated Pioneer Emerging Delta habitat. Salinities for this community typically range from 0 to 5 ppt.

RIVER DELTA FRESHWATER SUBMERGED AQUATIC VEGETATION: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Inland Fishes	<i>Anguilla rostrata</i>	American Eel
	<i>Atractosteus spatula</i>	Alligator Gar

Extent and Status

River Delta Freshwater Submerged Aquatic Vegetation beds are associated with the Mississippi and Atchafalaya river deltas. This community can be found on Atchafalaya Delta and Pass-a-Loutre WMAs as well as Delta NWR.

Threats

River Delta Freshwater Submerged Aquatic Vegetation is threatened by disturbance associated with mineral extraction, canals, utility corridors, and damage from outboard motors. Invasive species and the possible increase in frequency and intensity of tropical cyclones associated with climate change may impact this habitat. Increased salinity due to altered hydrology, marsh loss, and SLR also threaten this community.

Research Needs and 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.

RIVERS, STREAMS, CREEKS, AND BAYOUS

Rarity Rank: GNR/SNR

Synonyms: None

River, stream, and creek are interchangeable terms for flowing water, with no technical definition (USGS 2018). In general, rivers are typically considered the largest of the three, with streams intermediate in size and creeks the smallest. These water bodies are formed when water moves from an area of higher elevation to an area of lower elevation due to gravity. Water comes from direct precipitation but also as runoff from the surrounding land surface. Land surfaces that drain water into rivers, streams, and creeks are known as basins; for more information on the basins in Louisiana, see pages 167-181.

Bayous are slow-moving, typically shallow, water bodies, found in flat areas where water pools. They can consist of fresh, brackish, or salt water and often have abundant vegetation. Some bayous, like Bayou Bartholomew, have high biological diversity and are critical habitat for mussel SGCN.

RIVERS, STREAMS, CREEKS, AND BAYOUS: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Mollusks		All mussels
	<i>Procambarus pentastylus</i>	Calcasieu Creek Crayfish
Crustaceans	<i>Faxonius hobbsi</i>	Pontchartrain Painted Crayfish
	<i>Faxonius maletae</i>	Kisatchie Painted Crayfish
Marine Fishes	<i>Eleotris amblyopsis</i>	Large-scaled Spinycheek Sleeper
Inland Fishes		All Inland Fishes
Amphibians	<i>Siren sphagnicola</i>	Seepage Siren
	<i>Necturus louisianensis</i>	Red River Mudpuppy
	<i>Necturus beyeri</i>	Gulf Coast Waterdog
Reptiles	<i>Graptemys pearlensis</i>	Pearl River Map Turtle
	<i>Apalone mutica mutica</i>	Midland Smooth Softshell
	<i>Sternotherus carinatus</i>	Razor-backed Musk Turtle
Birds	<i>Chlidonias niger</i>	Black Tern
	<i>Rynchops niger</i>	Black Skimmer
	<i>Anas fulvigula</i>	Mottled Duck
Mammals	<i>Ondatra zibethicus</i>	Common Muskrat
	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Isoetes louisianensis</i>	Louisiana Quillwort
	<i>Podostemum ceratophyllum</i>	Riverweed

Extent and Status

Louisiana contains over 120,000 miles of rivers, streams, creeks, and bayous throughout the state (XU 2004). The Mississippi River, the second longest river in the United States at approximately 2,300 miles long, is a major transportation artery that empties into the Gulf of America (NPS 2025). Bayou Bartholomew, the longest bayou in the world, flows for approximately 364 miles through Arkansas and Louisiana, before converging with the Ouachita River (LDEQ 2025).

Threats

Rivers are threatened by residential and commercial development; commerce and transportation; contamination by agricultural, municipal, and industrial effluents; loss of riparian habitat; instream and gravel mining; loss of instream and lateral connectivity; flow alteration; and invasive species such as bigheaded carps (*Xenocypridae*) and Giant Salvinia. Streams, creeks, and bayous face many of the same challenges as rivers but on a more localized scale.



Pearl River



Aerial view of Cane Bayou

Research Needs and Conservation Actions

1. Investigate the impacts of impediments to aquatic organism passage and mitigate impacts with fish ladders, bypasses, conservation locking, and barrier removal, where appropriate.
2. Utilize green infrastructure, BMPs, and habitat restoration to minimize pollution and sedimentation inputs.
3. Restore natural flows and connections to floodplains to encourage resilient and healthy ecosystems.
4. Partner with LDEQ to promote practices such as requiring updated sewage systems in communities around lakes.
5. Inventory, prioritize, and mitigate barriers to aquatic organism passage at road/stream crossings.
6. Measure flood reduction effectiveness and ecological impacts of post-storm debris removal on aquatic ecosystems and work with policymakers, agencies, and stakeholders to minimize unnecessary ecological impacts.
7. Restore riparian zones and floodplain habitat to improve water quality and ecosystem resilience.
8. Conduct fish, mussel, crayfish, and macroinvertebrate SGCM studies in streams, creeks, and bayous to better understand population status and life history needs.

MARINE AND ESTUARINE WATER BODIES



Estuarine Submerged Aquatic Vegetation

ESTUARINE SUBMERGED AQUATIC VEGETATION

Rarity Rank: G4/S1

Synonyms: none

The Estuarine Submerged Aquatic Vegetation brackish water community consists of submerged, rooted vascular plants growing in shallow, protected waters with low turbidity. Water temperature, salinity (5 to 10 ppt), substrate, wave action, nutrient loads, and light penetration are key factors in determining the composition of the flora and fauna of SAV beds. The substrate is often predominantly sand, but other substrates such as other minerals or Soft Mud Bottom can occur. 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 species. The presence of SAV provides additional structure, shelter, and food to the animals dependent upon these habitats. Estuarine Submerged Aquatic Vegetation is more likely to be abundant in smaller, sheltered areas of Soft Mud Bottom and less likely to be present or abundant in areas where wave action or other factors causing turbulence and turbidity are persistent. 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 fishes and shellfish. In addition, 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 SUBMERGED AQUATIC VEGETATION: OBLIGATE OR NEAR-OBLIGATE SGCN

	Scientific Name	Common Name
Marine Fishes	<i>Fundulus pulvereus</i>	Bayou Killifish
	<i>Fundulus jenkinsi</i>	Saltmarsh Topminnow
	<i>Adinia xenica</i>	Diamond Killifish
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
Plants	<i>Potamogeton perfoliatus</i>	Claspingleaf Pondweed

Extent and Status

Historical extent of this SAV type is unknown (Smith 1993). This SAV occurs in waters subject to occasional salinity pulses like those in Lake Pontchartrain and several lakes in the Barataria Basin such as Lake Salvador.

EXTENT OF ESTUARINE SUBMERGED AQUATIC VEGETATION

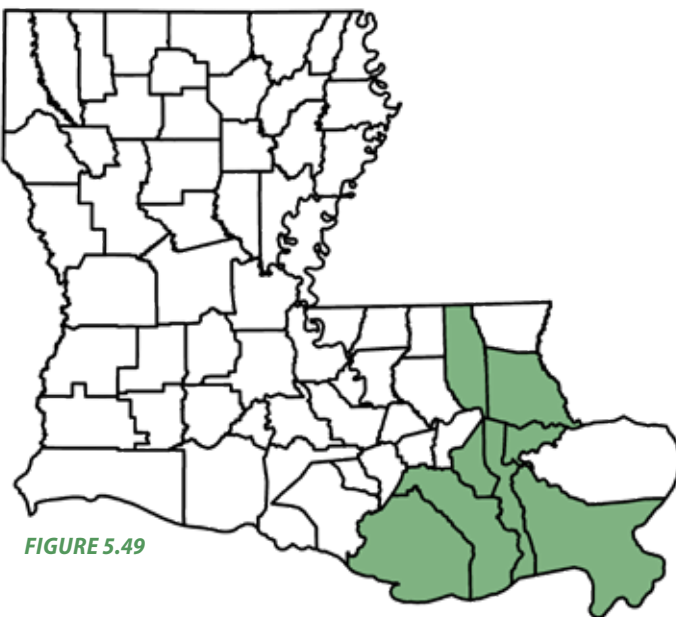


FIGURE 5.49

Threats

Estuarine Submerged Aquatic Vegetation faces threats from various sources of human disturbance, including damage from outboard motors. Activities that increase the turbidity in the waters surrounding SAV beds threaten the viability of this community. Alteration to salinity levels due to marsh loss, tropical cyclones, and SLR also threaten this habitat.

Research Needs and Conservation Actions

1. Continue surveys to determine the extent and condition of this habitat type; revisit and evaluate existing occurrences in the Wildlife Diversity Program database.
2. Recommend a maximum vessel speed, vessel draft, and engine draft when boating in particularly sensitive areas such as shallow SAV beds and provide education about methods for boaters to reduce negative, unintentional impacts.
3. Protect this SAV type from damage resulting from boat traffic and development of oil and gas infrastructure.
4. Generate greater public awareness of the importance of SAV.

MARINE SUBMERGED AQUATIC VEGETATION

Rarity Rank: G4?/S1

Synonyms: Temperate Grass Flat, Seagrass Bed, Tropical Marine Meadow, Turtlegrass Bed

The Marine Submerged Aquatic Vegetation 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



Turtle Grass (*Thalassia testudinum*), from the Chandeleur Islands

bottoms. Wave action, currents, temperature, salinity, substrate characteristics, and light penetration affected by turbidity determine species assemblage. Violent storms may drastically disrupt or alter community structure. Although this grass bed is a relatively small part of the ecosystem in coastal Louisiana, it is believed they play an extremely important role. The actual ecological value of this benthic grass community is poorly understood and may be underestimated. This is an extremely productive community often as productive as Salt Marsh. It provides food for a number of animals and acts as a nursery area and refuge for the young of many fishes and invertebrates. It can support a diverse epiphytic biota, including algae, fungi, bacteria, protozoans, bryozoans, and hydrozoans, thus creating a unique environment that allows for the existence of indigenous grass bed species. It supplies detrital material and nutrients to the water, adds oxygen via photosynthesis, and stabilizes bottom sediments by increasing deposition of suspended particulate matter.

MARINE SUBMERGED AQUATIC VEGETATION: OBLIGATE OR NEAR-OBLIGATE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Argopecten irradians</i>	Bay Scallop
	<i>Gobioides broussonetii</i>	Violet Goby
Marine Fishes	<i>Erotelis smaragdus</i>	Emerald Sleeper
	<i>Microphis lineatus</i>	Opossum Pipefish
Birds	<i>Aythya americana</i>	Redhead
Mammals	<i>Trichechus manatus</i>	West Indian Manatee
	<i>Halophila engelmannii</i>	Engelmann's Sea-grass
Plants	<i>Thalassia testudinum</i>	Turtle-grass
	<i>Syringodium filiforme</i>	Manatee-grass

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

Long-term survival of the Marine Submerged Aquatic Vegetation natural community depends on having adequate protection from the Chandeleur Islands, which have degraded in recent decades. Impacts to seagrass beds by tropical cyclones, SLR, and outboard motors threaten this community.

EXTENT OF MARINE SUBMERGED AQUATIC VEGETATION

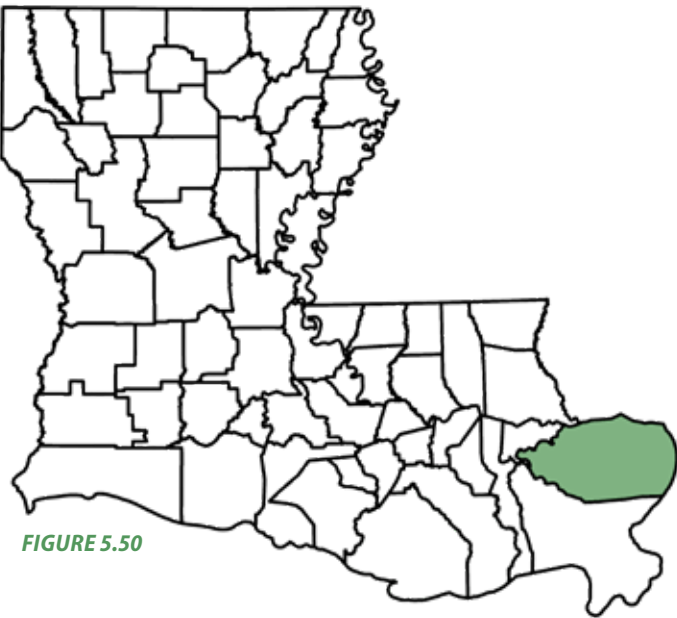


FIGURE 5.50

Research Needs and Conservation Actions

- 1. Determine areal extent of, and map Marine Submerged Aquatic Vegetation at Chandeleur Islands.
- 2. Conduct inventory and monitoring to determine changes in condition and extent over time and to identify emerging threats.
- 3. Work with CPRA and other agencies to implement measures to nourish the Chandeleur Islands, such as augmenting sand supply.

MARINE SUBSTRATE HABITATS

Rarity Rank: SNA

Synonyms: None

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.

► Hard Mud/Clay Bottom

Rarity Rank: SNA

Synonyms: None

Hard Mud and Clay Bottom is an estuarine and seawater bottom dominated by fine or coarse sediments, often relatively low in organic matter. This habitat type is widely represented in larger lakes and bays, particularly in areas where the sediments of the surrounding marshes are dominated by mineral materials. Hard Mud and Clay Bottom is typically a remnant of eroded or submerged shorelines. Productivity in this area tends to be derived from terrestrial (e.g., marshland) allochthonous¹ sources and phytoplankton.

¹ Allochthonous sediments are those found in a location different from the location of origin.

Threats

Hard Mud and Clay Bottom habitat, like other estuarine environments, faces threats from subsidence, erosion, and altered hydrology, which disrupt sediment accretion and salinity (CPRA 2023). Another major issue is hypoxia, which makes the lower water column less suitable for fishes and invertebrates (Rabalais et al. 2002). In addition, dredging, fishing activities, pollution, and invasive species further threaten the health of this habitat (Galloway et al. 2000).

Research Needs and Conservation Actions

1. Document miles of Hard Mud and Clay Bottom habitat that can be impacted by proposed Coastal Use Permit project activities and coordinate with partners to ensure proper mitigation.
2. Determine the use of this substrate type by marine fish SGCN.

> Sandy Bottom

Rarity Rank: SNA

Synonyms: None

Sandy Bottom is an estuarine and seawater bottom dominated by coarse sediments, often low in organic matter. This habitat is usually maintained by high energy influences (e.g., waves and currents) 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 bottom is limited to the foreshore environments of barrier islands and, to a lesser extent, beaches of the Chenier Plain. High energy beaches are nursery areas for a unique suite of marine organisms, including the Florida Pompano, Gulf Kingfish (*Menticirrhus littoralis*), and Broad Flounder (*Paralichthys squamilentus*), and are often found in association with the Marine Submerged Aquatic Vegetation natural community type at the Chandeleur Islands. Other types of sandy bottoms may be found in submerged sandbars, remnants of former barrier islands, and offshore shoals.

Threats

Sandy Bottom habitats adjacent to barrier islands exhibit a high susceptibility to erosion from continuous exposure to wave action and storm surge and limited sources of sand for replenishment (CPRA 2023). Offshore sandy shoals face threats from dredging activities, which are generally conducted for beach nourishment and construction (Pickens and Taylor 2014). Additional threats to these habitats include SLR, hypoxia, invasive species, and ocean acidification (Mickey et al. 2015, Reed et al. 2012).

Research Needs and Conservation Actions

1. Promote barrier shoreline restoration projects through partnerships with coastal restoration organizations.

> Shell/Shell Hash Bottom

Rarity Rank: SNA

Synonyms: None

Shell and Shell Hash Bottom is an estuarine water bottom that contains a significant amounts of crushed mollusk shells. This bottom has great potential for settlement of oysters, barnacles, or other invertebrate larvae that require hard substrates and serves as a shelter for many fish species, including several SGCN. This relatively hard substrate may reduce shoreline erosion along shallow, sloped shorelines, providing physical protection for the adjacent marshlands. It may also cause changes in currents, creating environments that are beneficial for many species of fishes and invertebrates. In very low-salinity environments, fewer species utilize shell as a settlement substrate, but the other values of the habitat remain.

Eastern Oyster (*Crassostrea virginica*) provides the majority of the shell substrate in Louisiana. Mussels, barnacles, worms, fishes, and a variety of other animals are either found in increasing abundance around oyster reefs or are dependent upon this type of bottom 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 estuaries of the Vermilion-Teche Basin, Atchafalaya Basin, and in upper areas of 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 Bottom tends to be more resistant to erosion than mud bottoms. It creates relief to the bottom and modifies tidal currents, especially near passes.

Fishery managers in the Gulf of America suspect that estuarine hard bottoms support more diverse, complex communities than adjacent soft bottoms, prompting an increase in low profile artificial reefs.

SHELL/SHELL HASH: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Marine Fishes	<i>Bathygobius soporator</i>	Frillfin Goby

Threats

Shell and Shell Hash Bottom habitats are affected by variability in temperature and salinity levels that are a result of climate change, coastal restoration projects, and management practices that disrupt natural hydrology. These hydrological fluctuations, combined with overharvesting, nutrient loading, erosion, and invasive species, can alter ecosystem functions and undermine the resilience of mollusk populations (Banks et al. 2016).

Research Needs and Conservation Actions

1. Limit resource extraction and intensive infrastructure maintenance near oyster reef habitats during times of stressful environmental conditions to minimize impacts to reefs and inhabitants.

- 2. Review Coastal Use Permits and provide comments regarding impacts to resources.
- 3. Identify issues and possible stressor periods on projects occurring near shell habitats and work with companies during pre-applicaton meetings to address potential issues.
- 4. Evaluate and update current shell budget models to help better manage the volume of oyster shell removed during commercial harvest activities.
- 5. Evaluate historical sampling data on shell reefs to acquire a better understanding of the species diversity on hard bottom habitats and determine long-term trends of aquatic species richness versus habitat quality.

► **Soft Mud Bottom**

Rarity Rank: SNA
Synonyms: None

Soft Mud Bottom is an estuarine water bottom dominated by fine, relatively unconsolidated sediments. Typically high in organic matter, Soft Mud Bottom also forms a substrate that is suitable for easy burrowing. Animals may use this substrate as a refuge from predators and as a food source. Productivity of animal biomass may be related to allochthonous or autochthonous² sources, depending upon the productivity of SAV, adjacent marshes, and phytoplankton.

Soft Mud Bottom habitat of coastal open lakes, bayous, and bays tends to have greater densities of large vertebrate and invertebrate predatory species than do the more cryptic habitats of the Soft Mud Bottom of small ponds, marsh creeks, or other similar habitats. As a result, Soft Mud Bottom usually provides suitable nursery grounds for postlarval or young juveniles. Predation within this cryptic habitat occurs more from terrestrial sources (e.g., wading birds, shorebirds, and mammals) as compared to Soft Mud Bottom in open-water habitats. The loss of this cryptic habitat is a major issue associated with the ongoing changes to the geomorphology in the coastal zone. As water bodies expand and merge into larger areas, there is a reduction in suitable nursery habitat, which could lead to a decrease in abundance and biodiversity.

SOFT MUD BOTTOM: OBLIGATE OR NEAR-OBLIGATE SGCN		
Scientific Name		Common Name
Marine Fishes	<i>Erotelis smaragdus</i>	Emerald Sleeper
	<i>Gobioides broussonetii</i>	Violet Goby

Threats

Soft Mud Bottom faces significant threats from subsidence, erosion, and altered hydrology, which disrupts sediment accretion and salinity (CPRA 2023). In addition, agricultural runoff introduces excess nutrients, which can lead to hypoxic conditions and a decline in biodiversity (Rabalais et al. 2002). Further habitat disturbances arise from dredging, fishing activities, pollution, and invasive species (Galloway et al. 2000).

Research Needs and Conservation Actions

- 1. Adopt coastal restoration strategies when available.
- 2. Establish marked channels or no wake zones in sensitive areas.
- 3. Improve zoning laws on the Northshore of Lake Pontchartrain to address water quality issues.

► **State Territorial Open Water**

Rarity Rank: SNA
Synonyms: None

State Territorial Open Water includes all open water from the beach shoreline to the end of State jurisdiction, approximately three nautical miles off the coast. Habitats range from sandy beaches and shoals in relatively high energy environments to Soft Mud Bottom habitat in low energy environments. Oyster reef environments are found 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 can be found near the mouth of the Mississippi River and very shallow slopes can be found between Vermilion Bay and Caillou Bay.

Salinity in State Territorial Open Water can vary widely by location and season. Near-freshwater conditions may be found near the mouths of the major rivers in high-water conditions, especially during the spring. Salinity above 30 ppt may regularly be found in the waters along the Chandeleur and Timbalier islands. Other areas of the state may have a similarly high salinity during years with drier conditions.

Threats

Louisiana’s State Territorial Open Water habitat is under significant threat from coastal erosion and hydrological alterations (CPRA 2023). Activities such as dredging and pollution, coupled with the impacts from changes in climate, are intensifying habitat degradation (Reed et al. 2012). Threats to biological communities stem from direct fishing pressures, bycatch mortality, and the presence of invasive species (Galloway et al. 2000).

Research Needs and Conservation Actions

- 1. Expand monitoring to better categorize and quantify habitat use by animal and plant species in existing open water habitat.
- 2. Conduct research into impacts from mariculture, energy development (e.g., liquid natural gas [LNG], offshore wind), and other industrial activities.
- 3. Continue coastal research and monitoring to increase our understanding of processes that result in hypoxia (insufficient oxygen) and anoxia (complete lack of oxygen); research the effects of hypoxia and anoxia on vertebrate and invertebrate species’ populations and movements.

² Autochthonous sediments are those that are found in their place of origin or a location nearby.

ANTHROPOGENIC HABITATS

AGRICULTURE AND IMPROVED PASTURE (EXCLUDING RICE)

Rarity Rank: SNA

Synonyms: None

Agriculture and Improved Pasture encompasses diverse land cover and land use features of altered habitats resulting from human activity. These areas typically are dominated by non-native species and 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 (e.g., pecan and citrus), vineyards, experimental plots, and plant nurseries
- Row and cover crops (e.g., grain, cotton, sweet potatoes, soybeans, and sugarcane)
- Tilled or untilled fields containing exposed or partially exposed soil
- Fallow fields or areas that have been left idle during the growing season
- Pastures dominated by turf grasses 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 habitat diversity for 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. Negative effects of this shift are particularly apparent for grassland bird species such as Northern Bobwhite, 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 these habitat types, there may be patches of “natural” habitat such as vegetated streambanks, 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 Conservation Reserve Program and Wetlands Reserve Program 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. Young, replanted Bottomland Hardwood Forest (early successional) is heavily used by grassland and scrub-shrub Neotropical migratory birds and American Woodcock. Although no SGCN are fully dependent upon these habitats for survival, these



Soybean field



Cotton field, Rapides Parish



Sugarcane

systems often support high concentrations of resident and migratory species and will likely become increasingly important for these animals as changes in climate 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 habitats for a variety of shorebirds. Dry harvested fields are primary feeding areas for wintering geese and are also used by several SGCN.

In fragmented habitats, conservation features on agricultural and pastoral 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 as impaling substrates for Loggerhead Shrike. Wooded drainages can serve as travel corridors for birds and mammals, especially highly mobile species such as Neotropical migratory birds and Louisiana Black Bear.

AGRICULTURE AND IMPROVED PASTURE: OBLIGATE OR NEAR-OBLIGATE SGCN		
	Scientific Name	Common Name
Crustaceans	<i>Fallicambarus macneesei</i>	Old Prairie Digger
Mammals	<i>Baiomys taylori</i>	Northern Pygmy Mouse

Extent and Status

There are approximately 8 million acres of farm land in Louisiana (USDA NASS 2025). 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 these programs. Programs such as CRP, WRP, and the Environmental Quality Incentives Program (EQIP) provide cost-share, incentive payments, or both to qualified participants.

EXTENT OF AGRICULTURE AND IMPROVED PASTURE

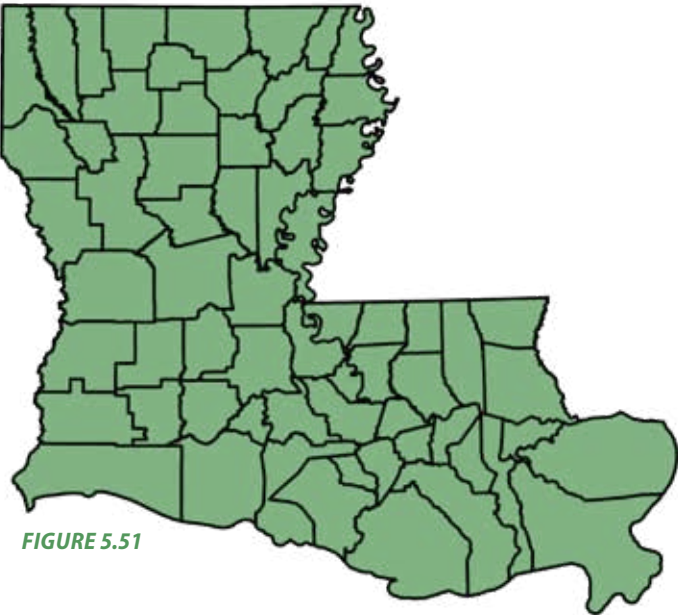


FIGURE 5.51

Research Needs and Conservation Actions

- 1. Encourage planting of native species along field borders and filter strips to create habitat and improve connectivity for wildlife species.
- 2. Encourage the development of “soft or feathered” edges on the agricultural landscape through natural succession and the planting of native grasses, legumes and forbs, and small shrubs (e.g., plum thickets and blackberry), 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.
- 5. Encourage management for and planting of native grasses and forbs and proper timing of mowing and haying to prevent destruction of burrows and nests in grasslands.
- 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 partners and legislators to develop a comprehensive statewide water rights/use plan.
- 9. Provide landowners with information on federal and state incentive programs to promote BMPs on working lands.
- 10. Continue to coordinate with NRCS on the development of practices via the Farm Bill that are beneficial for SGCN.
- 11. Promote BMPs to minimize soil erosion and runoff.

PINE PLANTATION AND CONTEMPORARY FOREST

Rarity Rank: SNA
Synonyms: Loblolly Pine Plantation, Slash Pine Plantation

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 and Slash Pine (*Pinus elliotii*) plantations are common, depending on geographic location. Loblolly Pine is most often planted for timber production by industrial and non-industrial private landowners because of its productivity and adaptability to a wide range of site conditions found throughout the West Gulf Coastal Plain and East Gulf Coastal Plain. Timber production for Slash Pine, which was introduced to southwest Louisiana, typically occurs in this region. Most pine plantations are managed similarly for production of various wood products, including many types of paper and packing products, fuel wood pellets, utility poles and pilings, structural lumber, and engineered wood products. Demand for these products over the last several decades has 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 clearcutting and replanting at a rotation age of 25 to 30 years.

Although some species of wildlife utilize Pine Plantation, overall, this habitat type is of significantly lower quality when compared to natural 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. Often, these and other higher quality community types are replaced by Pine Plantation. Pine Plantation has less plant species diversity in both the forest canopy and understory as a result of single species planting, high stocking (i.e. dense shading), more intensive use of herbicides, and exclusion of prescribed fire. However, habitat quality can be improved greatly with 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.



Pine Plantation

Thinning at regular intervals and implementing prescribed burning programs on many of these sites will provide improved understory conditions for many wildlife species.

Currently, a significant portion of forest on the Louisiana landscape is classified as an anthropogenically driven Contemporary Forest. This forest type has been cut and is two or more growth cycles removed from an old-growth stand. This regrown stand will typically have an abundance of weedy, fast-growing species and will be frequently overrun by invasive plants. Unlike the region's original old-growth forests, savannas, woodlands, or grasslands, this modern forest generally features simpler structures, lower biodiversity, and disrupted ecological processes. As a result, it is a stark contrast to the rich, dynamic ecosystem it has replaced. Although it still offers some economic benefits and serves as habitat for certain wildlife, Contemporary Forest is a poor replacement for the complex, ecologically rich, mixed-species habitat that once occupied the area. Afforestation (e.g., creation of a Contemporary Forest), especially through out-of-kind mitigation, is one of the major threats to grassland systems in southwest Louisiana (Early 2025).

Extent and Status

Pine Plantation can be found throughout the Gulf Coastal Plain of Louisiana. Although properly managed Pine Plantation can provide limited benefits to wildlife, many plantations, particularly those that are densely planted, are of little tangible wildlife value. 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. Pine Plantation covers approximately 3.5 million acres of Louisiana's landscape (Zhang and Polyakov 2010). Contemporary Forest is found throughout the state. Incentives have led to a proliferation of these anthropogenic habitats in lieu of natural communities.

Research Needs and Conservation Actions

1. Promote multi-use management (wildlife and timber) within this habitat type.
2. Provide education and outreach opportunities to landowners on the benefits and methods needed to manage these habitat types for wildlife.

EXTENT OF PINE PLANTATION AND CONTEMPORARY FOREST

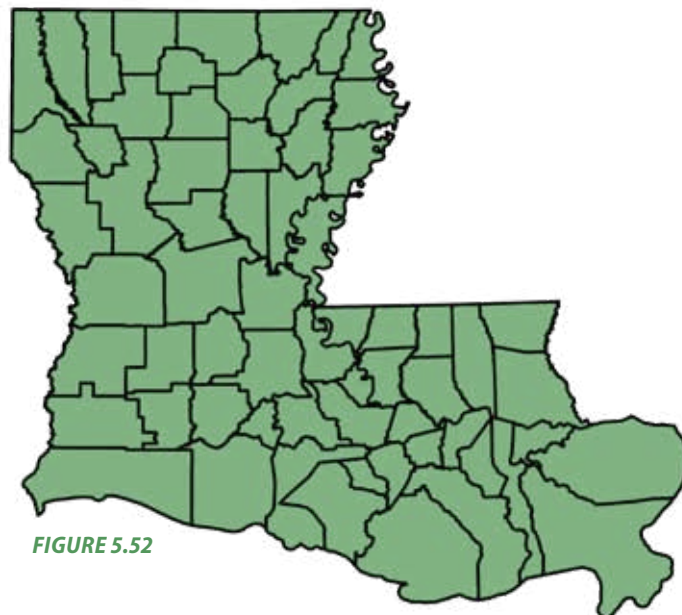


FIGURE 5.52

3. Work with landowners and other stakeholders to promote sound mitigation and prevent active or passive afforestation of grassland habitats in Louisiana.
4. 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.
5. Promote thinning at regular intervals followed by application of prescribed fire within these habitat types.
6. Promote incentive programs that provide cost-share assistance for management activities that mimic natural disturbance in Pine Plantation.
7. Target areas at high risk of urbanization for the development of conservation easements.
8. Implement research exploring how industrial forestry practices impact native flora and fauna.
9. Promote BMPs to minimize soil erosion and runoff.

RICE AGRICULTURE AND AQUACULTURE

Rarity Rank: SNA

Synonyms: None

Rice Agriculture and Aquaculture habitats encompass rice fields, 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 seeds, and green shoots. Fields with growing rice are then flooded, which can provide nesting and brood rearing cover for resident waterfowl (e.g., Mottled Duck, Black-bellied Whistling-Duck [*Dendrocygna autumnalis*], and Fulvous Whistling-Duck [*Dendrocygna bicolor*]) and secretive marsh birds (e.g., King Rail and Least Bittern). Flooded rice fields and crawfish

ponds are extremely important to shorebirds, wading birds, and waterfowl and are integral components of the LMJVJ and Gulf Coast Joint Venture plans for meeting the present and future nutritional needs of these avian guilds. The fields are drained in summer for harvest, at which point they are 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 flooded again to grow a second “ratoon” crop. Preparation for this ratoon crop, most often mid-July to early August, including manipulation of harvested stubble and re-flooding, provides valuable habitat for waterbirds, as most other water is removed from the landscape. Ratoon 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 waterbirds. Bald Eagle, Peregrine Falcon (*Falco peregrinus*), and other raptors are often associated with rice agriculture and crawfish aquaculture due to the abundance of potential prey. Crawfish ponds typically retain water until harvest ends in June, at which point, water is drawn down for summer management and planting. The resulting mudflats are used extensively by resident and migratory shorebirds. These summer drawdowns concentrate aquatic prey into shallow pools that persist due to elevational differences, and waterbirds including Roseate Spoonbill, Wood Stork, and other species of wading birds exploit this foraging opportunity. The expansion of sugarcane into the rice region of southwest Louisiana, formerly dominated by Coastal Prairie, has greatly reduced the agricultural lands’ benefits for wildlife, particularly waterbirds.

Extent and Status

In 2024, Louisiana had 473,000 acres of rice (USDA NASS 2025). Louisiana has approximately 359,000 acres of crawfish ponds currently in operation (Ag MRC 2025).

Research Needs and Conservation Actions

1. Encourage planting of native prairie species along field borders and filter strips to create habitat and improve connectivity for wildlife species.



(LEFT) Aerial view of rice fields. (CENTER) Whooping Cranes at a crawfish farm. (RIGHT) A Hudsonian Godwit in a rice field.

2. Encourage management of ditches and canals associated with Rice Agriculture 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 agriculture and crawfish aquaculture from willing sellers within the Coastal Prairie region, including abandoned or unproductive lands, for re-establishment of native grassland and wetland complexes.
5. Assist rice and crawfish producers in replacement of degraded infrastructure (e.g., levee and water control structures) to ensure working wetlands persist, as opposed to being converted to dry land row crops (e.g., sugarcane).
6. Encourage provision of mudflat habitat and aquaculture farms for migrating shorebirds.
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.
8. Promote the use of traditional rice production methods over dry-seeding techniques and implement research exploring how these practices impact native flora and fauna.
9. Promote BMPs to minimize soil erosion and runoff.



White-faced Ibis, White Ibis, and Little Blue Heron use a crawfish farm



White-faced Ibis, White Ibis, and Great Egret flying over a rice field



BASINS

MAJOR WATER BODIES AND RIVER BASINS OF LOUISIANA

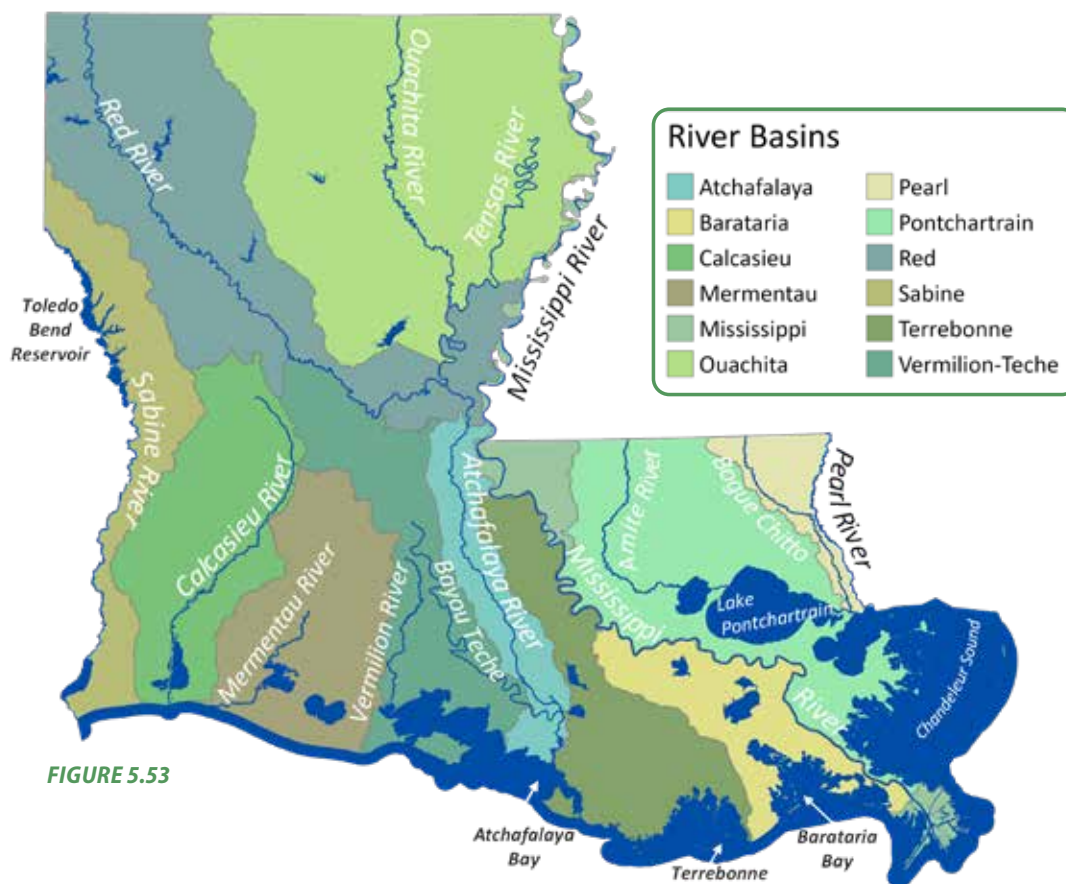


FIGURE 5.53

Louisiana has over 120,000 miles of rivers and streams (Figure 5.55), 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 water bodies. Rivers and streams are also important for agriculture, transportation, and stormwater drainage. Many streams are used for recreation including fishing, hunting, paddling, boating, swimming, wildlife watching, and wildlife photography.

Unfortunately, according to the U.S. Environmental Protection Agency (EPA), many of Louisiana's rivers and streams are impaired, meaning that the streams are of poor water quality and 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.

Similar factors impact most basins across the state, but vary by scale and magnitude due to the source of the threats and the diverse geography of the state. The main threats to aquatic systems across Louisiana include residential and commercial development, agriculture and aquaculture, energy production and mining, transportation and service corridors, biological resource

use, human intrusion and disturbance, water withdrawals and diversions, natural system modification, invasive and problematic species, pollution, geological events (subsidence), and changes in climate and severe weather. One factor that is unique to coastal drainages is saltwater intrusion from the Gulf of America. Notable threats to each basin will be highlighted below.

ATCHAFALAYA BASIN

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 Baldcypress-Tupelo Swamp Forest (Figure 5.56). Located in south-central Louisiana, the system stretches from the river's origin near Simmesport to its terminus at the Atchafalaya Bay. This basin 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 flow of the Red and Mississippi rivers 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 use of dredge material resulting from the maintenance of navigation channels. Much of this newly created land is contained within the 136,200 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, ecotourism, 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 Forest 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).

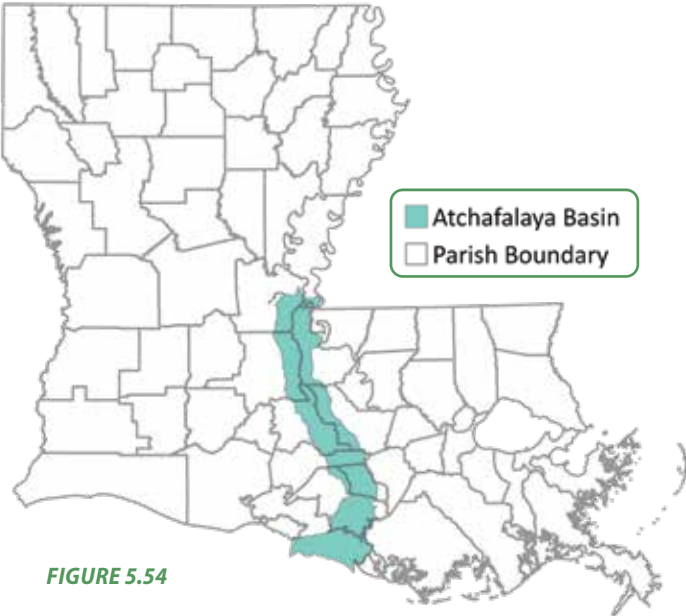
There are approximately 100 species of freshwater fishes (W. Kelso, personal communication), 19 species of mussels (Vidrine 1993, 2019), and nine species of crayfishes (Walls 2009) found within the Atchafalaya Basin. For more information about this basin, see the LDWF Inland Fisheries Management plan for the Atchafalaya Basin (www.wlf.louisiana.gov/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

ATCHAFALAYA BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Inland Fishes	<i>Polyodon spathula</i>	Paddlefish
	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Cyprinus elongatus</i>	Blue Sucker

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 50% of the 12 waterbody subsegments within the basin fully supported their designated use for fish and wildlife propagation. The suspected causes of poor water quality in the subsegments include fecal coliform bacteria, suspended solids, mercury, turbidity, non-native aquatic invasive plants, and low concentration of dissolved oxygen. The suspected sources of poor water quality include home sewage systems, agriculture, and stormwater runoff.

EXTENT OF THE ATCHAFALAYA BASIN



Baldcypress-Tupelo Swamp Forest

Threats

The primary threat in the Atchafalaya Basin is natural system modification, which is largely related to changes in natural hydrology and floodplain connectivity (CWPPRA 2025). In addition, invasive plants such as the non-native Water Hyacinth and Giant Salvinia and invasive fishes such as non-native carp have negative impacts to habitat and wildlife in this basin. Agricultural runoff also impacts the basin with increased sediment and nutrient loads.

Research Needs and Conservation Actions

- 1. Work with USACE and CPRA to improve environmental flows in the Atchafalaya Basin.
- 2. Work with partners to increase monitoring of nutrient inputs, sedimentation, hypoxia, and overall water quality.
- 3. Coordinate with partners to address threats to this basin.
- 4. Complete a comprehensive survey of oyster reef/hard bottom habitat acreage within the system.
- 5. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
- 6. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

BARATARIA BASIN

The upper Barataria Basin was formed approximately 3,500 to 4,000 years ago as part of the Lafourche Delta complex. Encompassing approximately 1,565,000 acres, this basin is bordered on the north and east by the levees of the Mississippi River, which were constructed after the Great Mississippi Flood of 1927 (CWPPRA 2025) (Figure 5.57). The basin is bordered on the west by Bayou Lafourche and on the south by the Gulf of America. The basin is primarily comprised of the following terrestrial habitat types: agriculture/improved pasture (mostly sugarcane), Bottomland Hardwood Forest, Baldcypress-Tupelo Swamp Forest, and all coastal marsh types ranging from freshwater 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 Gulf Intracoastal Waterway (LaCoast 2005), and fresh water diverted from the Mississippi River at sites such as the Davis Pond and the Naomi freshwater diversions. Wetland loss due to coastal erosion is a major environmental issue affecting the

EXTENT OF THE BARATARIA BASIN

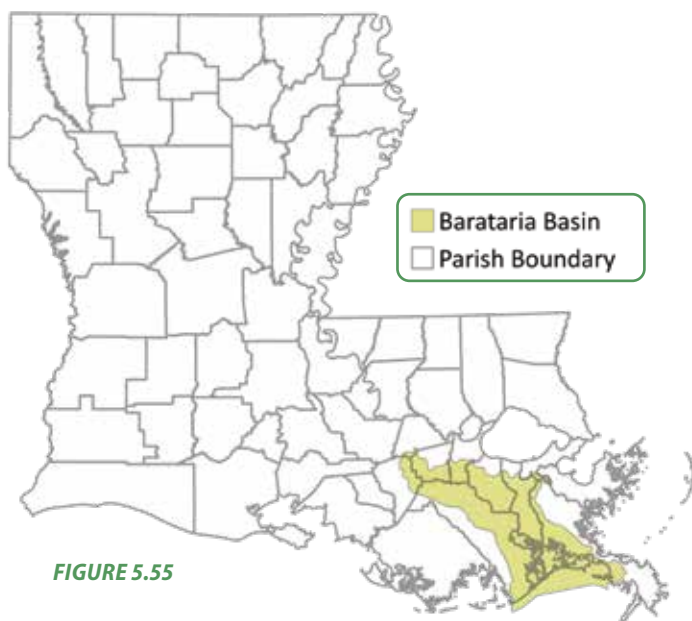


FIGURE 5.55

basin. In response, many coastal restoration projects have been developed to address land loss in the area (CPRA 2023). LDWF properties in this basin include Pointe-aux-Chenes and Salvador WMAs and Elmer's Island and Queen Bess Island Wildlife Refuges. These sites are composed of Freshwater, Freshwater Floating, Intermediate, Brackish, and Salt marshes that are threatened by subsidence and erosion from storms. The barrier islands (e.g., Grand Isle) and the coastal islands in this basin are highly productive sites for colonial nesting waterbirds.

Approximately 60 species of freshwater fishes (W. Kelso, personal communication) and nine species of crayfishes (Walls 2009) 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 areas in the state 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/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

BARATARIA BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Inland Fishes	<i>Polyodon spathula</i>	Paddlefish
	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Anguilla rostrata</i>	American Eel



Colony of Forster's Tern in the Barataria Basin

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that 56% of the 27 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality 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 poor water quality include crop production, pastureland, urban runoff, septic tanks, spills, minor industrial point sources, petroleum activities, highway runoff, hydromodification, and dredging.

Threats

The primary threat to this basin includes the alteration of the natural hydrology of the system (CWPPRA 2025). The loss of historic connectivity to the Mississippi Basin, along with current efforts to reconnect the basins, presents unique challenges for the Barataria Basin. Invasive plants including Water Hyacinth and Giant Salvinia have substantial impacts on this system. Due to the location and nature of this basin, severe weather and other climate related impacts are significant. Subsidence, which leads to increased saltwater intrusion, is also a threat to this basin.

Research Needs and Conservation Actions

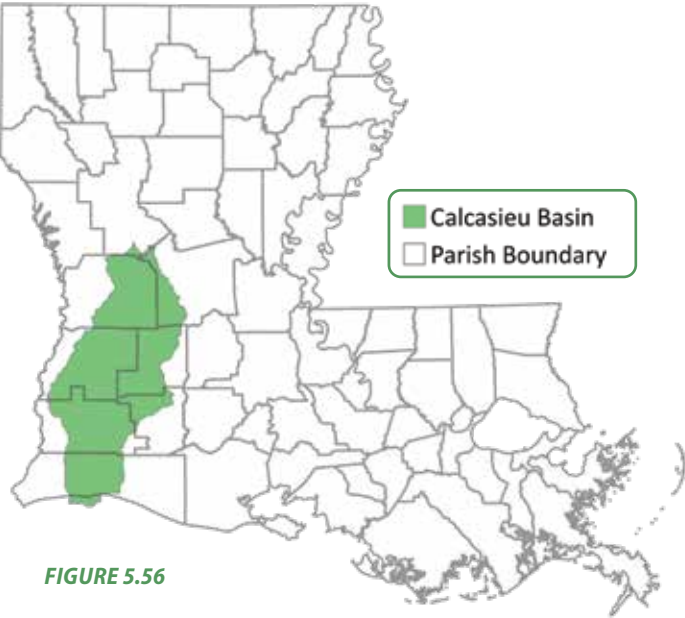
1. Maintain existing freshwater diversion canals from the Mississippi River into the Barataria Basin.
2. Monitor impacts of extreme weather events and impacts from changes in climate conditions.
3. Inform other agencies and the public about the uniqueness of Freshwater Floating Marsh; protect such marshes from disturbance caused from canal development and from input of nutrients and sediment.
4. Work with partners to abate threats to this basin.
5. Promote coastal restoration and protection initiatives to maintain or enhance coastal marsh and Barrier Island habitat critical to SGCN.
6. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
7. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

CALCASIEU BASIN

The Calcasieu Basin, located in southwest Louisiana, comprises approximately 4,400 square miles (Calcasieu Parish 2025) of drainage area and represents 8% of the area of the state (Figure 5.58). Headwaters of the Calcasieu River are found in the hills west of Alexandria, Louisiana, and flow in a southerly direction for about 215 miles. From the upland hills where elevations range from 260 feet to 400 feet above mean sea level, the river flows through the Coastal Prairie and coastal marshes, which have an elevation ranging from 1 foot to 2 feet above mean sea level. The floodplains of this basin are extremely flat, averaging 2 feet to 3 feet above mean sea level. The lower Calcasieu River flows through Prien Lake, Moss Lake, and Calcasieu Lake (all natural lakes) before emptying into the Gulf of America approximately 30 miles east of the Louisiana-Texas state line. Dominant features of this basin include oxbow lakes, natural levees, and the surrounding Pleistocene Uplands (Weston 1974). The middle and upper Calcasieu Basin are sparsely populated. The city of Lake Charles lies in the southern portion of the basin and is an area that 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 America. Flows in the upper basin can range from a high of 180,000 cubic feet per second in downstream portions to zero cubic feet per second in the uppermost portions 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 mouth of the river and 0.7 foot at Lake Charles. The upper Calcasieu River is largely unaltered and free-flowing. An existing saltwater barrier across the Calcasieu River at Lake Charles divides the basin into an upper and lower basin and prevents saltwater intrusion from degrading this major source of irrigation for rice production. Navigation improvements have also modified the river from its mouth to approximately 52.6 river miles inland (Weston 1974).

EXTENT OF THE CALCASIEU BASIN



Approximately 90 species of freshwater fishes (Maxwell 2012, LDWF unpublished data, B. Reed, personal communication), 29 species of mussels (Vidrine 1993, 2019), and 17 species of crayfishes (Walls 2009) 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. For more information about this basin, see the LDWF Inland Fisheries management plan for the Calcasieu River (www.wlf.louisiana.gov/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 24% of the 40 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. The suspected causes of poor water quality 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 poor water quality include home sewage systems, agriculture, silviculture, urban stormwater runoff, and dredging.

CALCASIEU BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Lampsilis satura</i>	Sandbank Pocketbook
	<i>Pleurobema riddellii</i>	Louisiana Pigtoe
Crustaceans	<i>Procambarus pentastylus</i>	Calcasieu Creek Crayfish
	<i>Faxonius hathawayi blacki</i>	Calcasieu Painted Crayfish
Inland Fishes	<i>Fundulus blairae</i>	Western Starhead Topminnow
	<i>Etheostoma thompsoni</i>	Gumbo Darter
	<i>Percina macrolepida</i>	Bigscale Logperch
Reptiles	<i>Graptemys sabinensis</i>	Sabine Map Turtle

Threats

The Calcasieu Basin is largely delineated by the saltwater barrier north of Lake Charles, with differing impacts above and below it. Primary threats to the upper basin include natural system modification, agricultural and silvicultural runoff, and the removal of woody debris from waterways. The lower basin faces a larger number and greater magnitude of threats than the upper basin. Dominant threats to the lower basin include natural system modification, pollution, transportation corridors, and severe weather and other climate related events (CWPPRA 2025). Invasive species such as Feral Hog (*Sus scrofa*) are significant threats to water quality, habitat, and SGCN of the region.

Saltwater intrusion and coastal land loss are also significant threats to the southern portion of this basin, most notably the Brackish Marsh surrounding Calcasieu Lake. The straightening and dredging of the Calcasieu Ship Channel is the likely source behind a general increase in salinity 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



Brackish Marsh in the Calcasieu Basin

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 2023).

Research Needs and Conservation Actions

1. Support current initiatives, develop new programs, and encourage BMPs that help reduce siltation and sedimentation throughout the Calcasieu Basin.
2. Determine impacts of weirs on fish passage and mussel distributions.
3. 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.
4. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
5. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

MERMENTAU BASIN

The Mermentau Basin is in the southwestern part of the state and drains an area of approximately 6,730 square miles (*Figure 5.59*). 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 water from surrounding estuarine waters and the Gulf of America (USACE 1998).

The basin is composed of three different and distinctive land forms which are arranged in broad bands from north to south. The upper part of the basin is a flatwoods area which gives way to an undulating landscape extending northward into the Calcasieu and Red basins. To the south of the flatwoods area lies the Coastal Prairie region which extends from Vinton, Louisiana (located in the Calcasieu Basin in the western part of the state), east to Bayou Teche. This region is characterized by large expanses of flat grassland dissected by numerous tributaries 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 America and its bays (Domingue, Szabo & Assoc. Inc. 1975).

The lower portion of the basin is bound on the east by Freshwater Bayou Channel, on the south by the Gulf of America, on the west by Louisiana Highway 27, and on the north by the Gulf Intracoastal Waterway. In 1932, the coastal portion of the Mermentau Basin was made up of 2,482 square miles of wetlands. By 2016, the basin had 1,994 square miles of wetlands remaining, after experiencing a conversion of 20% of the area’s land to open water (Couvillion et al. 2017).

Approximately 75 species of freshwater fishes (Tulane 2008, LDWF unpublished data), 19 species of mussels (Vidrine 1993, 2019), and 14 species of crayfishes (Walls 2009) are found within the Mermentau Basin.

MERMENTAU BASIN: OBLIGATE OR REPRESENTATIVE SPECIES

	Scientific Name	Common Name
Crustaceans	<i>Faxonius hathawayi hathawayi</i>	Teche Painted Crayfish
Inland Fishes	<i>Polyodon spathula</i>	Paddlefish
	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Anguilla rostrata</i>	American Eel
Reptiles	<i>Graptemys sabinensis</i>	Sabine Map Turtle

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 6% of the 18 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality 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 poor water quality include home sewage systems, agriculture, silviculture, urban stormwater runoff, and dredging.



Coastal Prairie in the Mermentau Basin

EXTENT OF THE MERMENTAU BASIN

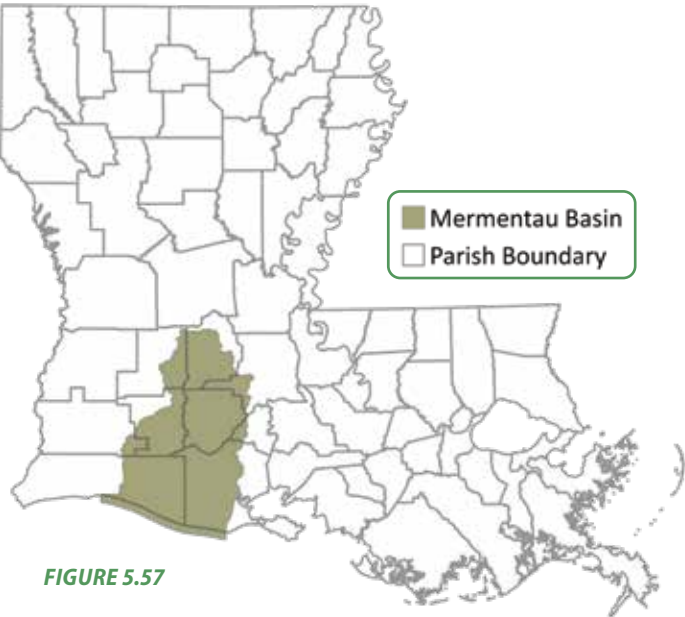


FIGURE 5.57

Threats

The Mermentau Basin faces some of the most impactful threats in the state. The most significant threats include agriculture and natural system modification (CWPPRA 2025), as the natural landscape of this watershed is almost completely altered. Pollution poses a threat from toxins and heavy metals left by historical industry and from runoff including nutrient loading and suspended solids. Invasive species, primarily Water Hyacinth and Giant Salvinia, also pose threats to the system.

Research Needs and Conservation Actions

- 1. Work with partners to improve water quality through conservation practices on working lands.
- 2. Partner with and support the Mississippi River Basin Initiative (www.nrcs.usda.gov/programs-initiatives/mississippi-river-basin-healthy-watersheds-initiative) to address the causes of habitat impairment within the Mermentau Basin.
- 3. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

MISSISSIPPI BASIN

The portion of the Mississippi River that occurs in Louisiana is part of the Lower Mississippi Drainage Basin, which extends from Cairo, Illinois, to Head-of-Passes at the Gulf of America (Figure 5.60). Within Louisiana, the Mississippi Basin is composed of the Mississippi River, 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 Forest, and Sandbar. This basin also contains nearly all of the Southern Mesophytic Hardwood Forest found in Louisiana, much of which occurs in Tunica Hills WMA. 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 Basin contains approximately 375 species of freshwater fishes which comprise 45-50% of all freshwater fish species in North America (Brosse et al. 2013). Approximately 50 species of freshwater fishes (W. Kelso, personal communication), 34 species of mussels (Vidrine 1993, 2019, Jones et al. 2019), and nine species of crayfishes (Walls 2009) are found within the Mississippi Basin in Louisiana.

MISSISSIPPI BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Lampsilis cardium</i>	Plain Pocketbook
	<i>Lampsilis siliquoidea</i>	Fatmucket
	<i>Potamilus capax</i>	Fat Pocketbook
Inland Fishes	<i>Scaphirhynchus albus</i>	Pallid Sturgeon
	<i>Cyprinella camura</i>	Bluntface Shiner
	<i>Syngnathus scovelli</i>	Gulf Pipefish (Inland Populations)

Water Quality

The 2024 Water Quality Inventory Report (LDEQ 2024) indicates that only 43% of the 14 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality 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 poor water quality include home sewage systems, agriculture, silviculture, urban stormwater runoff, and dredging.

EXTENT OF THE MISSISSIPPI BASIN

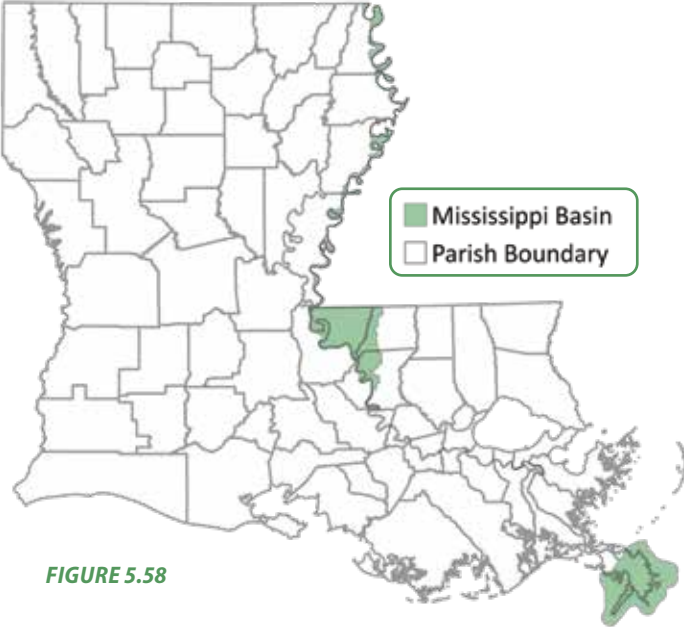


FIGURE 5.58



Southern Mesophytic Hardwood Forest in the Mississippi Basin

Threats

The Mississippi Basin drains approximately 1.25 million square miles (over 41% of the contiguous United States), and threats from across this large geographic area accumulate as they converge on the lower Mississippi River in Louisiana (USACE 2025). Primary threats to this basin include natural system modification, agriculture, industrialization, and pollution (CWPPRA 2025). The Mississippi River and its tributaries act as major transportation corridors. Due to the size of the basin, changes in climate and severe weather directly impacting states as far away as Montana, Minnesota, or Pennsylvania can pose threats to this highly altered system in Louisiana. The compounded threats and disturbances in this basin also provide ample opportunities for invasive species to thrive, further threatening the wildlife and habitats of the region.

Basin Research Needs and 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 through the use of controlled diversions in order to restore the natural hydrology of forested wetlands.
3. Enhance connectivity and habitat in batture to support floodplain-dependent species.
4. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

OUACHITA BASIN

The Ouachita River system is the principal drainage for south Arkansas and northeast Louisiana, draining an area of approximately 26,000 square miles (Figure 5.61). 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 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 with Bayou Bartholomew being home to one of the most diverse assemblages of freshwater mussels and fishes in the United States.

There are two sets of locks and dams on the Ouachita River in Louisiana. The Jonesville and Columbia locks 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 and shorebirds (USACE 1998).

Approximately 120 species of freshwater fishes (W. Kelso, personal communication), 45 species of mussels (Vidrine 1993, 2019), and 20 species of crayfishes (Walls 2009) are found within the Ouachita Basin.

OUACHITA BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Theliderma cylindrica</i>	Rabbitsfoot
	<i>Lampsilis abrupta</i>	Pink Mucket
	<i>Ellipsaria lineolata</i>	Butterfly
Crustaceans	<i>Procambarus elegans</i>	Elegant Creek Crayfish
Inland Fishes	<i>Miniellus boops</i>	Bigeye Shiner
	<i>Fundulus dispar</i>	Northern Starhead Topminnow
	<i>Percina copelandi</i>	Channel Darter

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 15% of the 61 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality include metals, pesticides, nutrients, fecal coliform bacteria, organic enrichment and low concentration of dissolved oxygen, oil and grease, non-native aquatic plants, sedimentation and siltation, and turbidity. The suspected sources of poor water quality include home sewage systems, agriculture, silviculture, urban storm water runoff, surface mining, and dredging.

Threats

Primary threats to the Ouachita Basin include natural system modification, agricultural water withdrawals and runoff, and

EXTENT OF THE OUACHITA BASIN

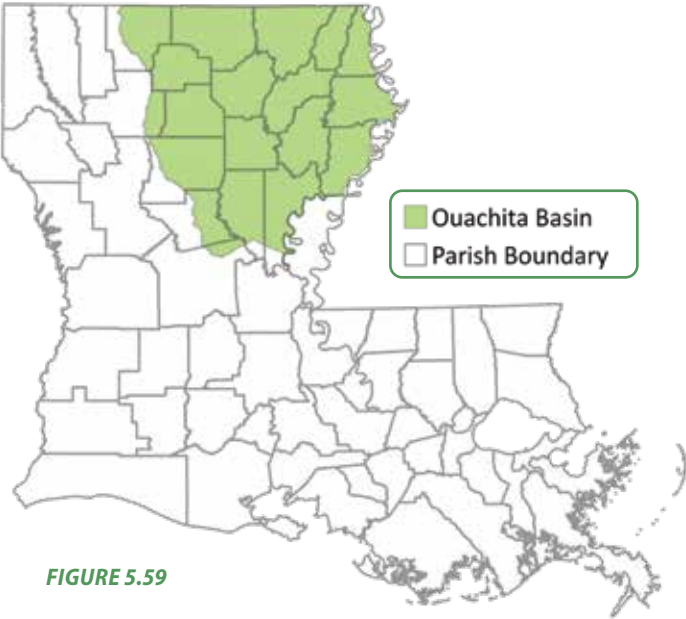


FIGURE 5.59

industrial pollution. The natural system modifications that most affect this basin include deforestation and channelization. The impact of invasive species, including several species of carp and Giant and Common Salvinia, is one of the most pressing threats to this basin. Protection of the state’s most diverse mussel assemblage will require amelioration of these threats in the region.

Research Needs and Conservation Actions

1. Improve partnerships 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 and the Boeuf River.
3. Address the impacts of adjacent agricultural practices on SGCN in Bayou Bartholomew.
4. Address the impacts of habitat alteration and development on Bayou DeSiard.
5. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.



Bayou Bartholomew in the Ouachita Basin

6. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

PEARL BASIN

The Pearl Basin’s drainage area covers approximately 7,800 square miles (Storm 2005) and lies within two states – Mississippi and Louisiana (Figure 5.62). 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.

Draining an area of 8,760 square miles in Louisiana and Mississippi, the East Pearl River is one of the principal rivers in the region. The East Pearl 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 Farris Slough and forms the boundary between Mississippi and Louisiana. The East Pearl River drains into Lake Borgne and eventually into the Mississippi Sound.

The Pearl 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 the creation of reservoirs. The headwater dam (Ross Barnett Reservoir) at Jackson, Mississippi, has changed normal historical 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, resulting in unknown impacts to coastal species within the Lake Borgne and Mississippi Sound receiving waters. Degradation of other habitats (e.g., 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. Historical mining practices on the Pearl and Bogue Chitto rivers may have interfered with the spawning cycle of the Alabama Shad, as removal of sand and gravel has greatly reduced the available substrate necessary for this fish’s reproduction.

The USACE project *Pearl River Navigation Channel* completed in the 1950s 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 has altered the historical migration routes and the overall life cycle 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 1970s, maintenance dredging was suspended, and the locks were placed in caretaker status. A request to reevaluate the economic and environmental feasibility of maintaining the locks and navigation channel



Pearl River Map Turtle from the Pearl Basin

was submitted to the USACE in the 1980s by local business interests in Slidell and Bogalusa. Dredging of the river returned in 1989. However, dredging was temporarily discontinued due to environmental concerns, before being resumed in the Navigation Canal in 2023.

Construction of U.S. Interstate 10 (I-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 which has altered the natural hydrology and has substantially increased sedimentation in many areas, including within Pearl River WMA.

Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 39 species of mussels (Vidrine 1993, 2019; Jones et al. 2019), and 15 species of crayfishes (Walls 2009) 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/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

PEARL BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Elliptio crassidens</i>	Elephantear
	<i>Villosa vibex</i>	Southern Rainbow
	<i>Utterbackiana hartfieldorum</i>	Cypress Floater
Crustaceans	<i>Procambarus penni</i>	Pearl Blackwater Crayfish
	<i>Procambarus bivittatus</i>	Ribbon Crayfish
Inland Fishes	<i>Acipenser oxyrinchus desotoi</i>	Gulf Sturgeon
	<i>Cycleptus meridionalis</i>	Southeastern Blue Sucker
	<i>Noturus munitus</i>	Frecklebelly Madtom
Reptiles	<i>Graptemys pearlensis</i>	Pearl River Map Turtle
	<i>Graptemys oculifera</i>	Ringed Map Turtle
	<i>Farancia erythrogramma erythrogramma</i>	Common Rainbow Snake

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 35% of the 23 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality include metals, nutrients, fecal coliform bacteria, organic enrichment and low concentration of dissolved oxygen, low pH levels, and

EXTENT OF THE PEARL BASIN

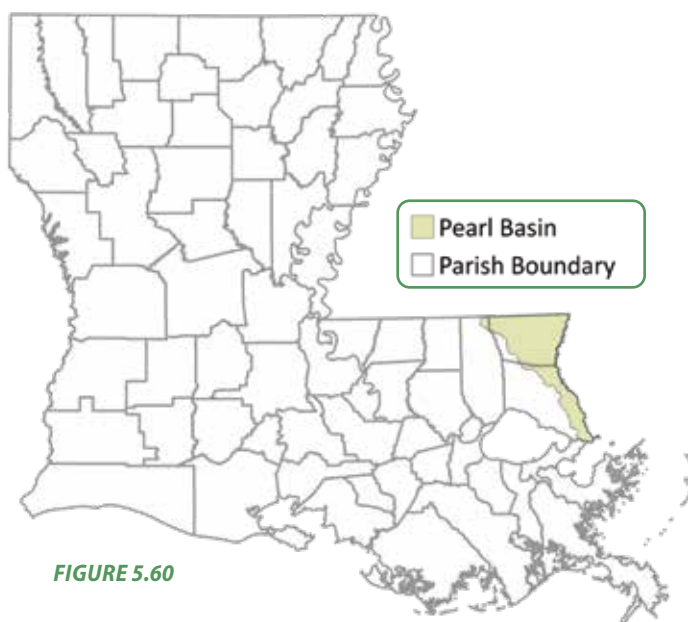


FIGURE 5.60

turbidity. The suspected sources of poor water quality include home sewage systems, agriculture (particularly pasturelands), silviculture, urban stormwater runoff, and surface mining.

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 modification of the natural flow regime described above. Sedimentation associated with transportation infrastructure construction has also impacted water quality within this basin. Invasive species like Feral Hog are significant threats to water quality, habitat, and SGCN of the region.

Research Needs and Conservation Actions

1. Coordinate with partners to develop a comprehensive management strategy for the entire Pearl Basin, to include plans for restoring, to the extent possible, historical flow patterns in the lower Pearl River.
2. Work with partners to address water quality issues.
3. Support establishing levee breaks or set-backs to develop or replenish backwater areas.
4. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin including the removal of the Pools Bluff and Bogue Chitto sills.
5. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

PONTCHARTRAIN BASIN

The Pontchartrain Basin is a 4,700 square mile watershed in southeast Louisiana and southwest Mississippi (Figure 5.63). The topography of the basin ranges from more than 300 feet above sea level in the rolling hills along the Louisiana-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 contains all or portions of seven of the eight Florida parishes: East Baton Rouge, East Feliciana, Livingston, St. Helena, St. Tammany, Tangipahoa, and Washington. Many rivers drain the Florida Parishes, introducing fresh water into Lakes Maurepas, Pontchartrain, and Borgne. The largest of these, the Pearl and Amite rivers, have headwaters in Mississippi. The rivers of this basin have eroded and incised the uplands to form distinct river valleys. Lakes Maurepas, Pontchartrain, and Borgne form a shallow brackish receiving basin for 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 America 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, Isaac, and Ida. These islands are of critical importance to a number of SGCN, including sea turtles and many species of shorebirds and colonial nesting waterbirds.

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 Lake Pontchartrain Basin Foundation released a comprehensive management plan for the basin that details management strategies to address sewage and agricultural runoff, stormwater runoff, saltwater intrusion, and 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 2023).

The Pontchartrain Basin contains some of the greatest aquatic species diversity in the state. Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 36 species of mussels (Vidrine 1993, 2019), and 15 species of crayfishes (Walls 2009) are found within the Pontchartrain Basin. Additionally, the Chandeleur Islands likely provide the



Colonial nesting waterbirds at Breton National Wildlife Refuge in the Pontchartrain Basin

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 Scallop may be extirpated from Louisiana waters. For more information on this basin, see the LDWF Inland Fisheries management plan for the lower Pontchartrain Basin (www.wlf.louisiana.gov/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

PONTCHARTRAIN BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Potamilus inflatus</i>	Inflated Heelspliter
	<i>Villosa vibex</i>	Southern Rainbow
	<i>Utterbackiana hartfieldorum</i>	Cypress Floater
Inland Fishes	<i>Fundulus euryzonus</i>	Broadstripe Topminnow
	<i>Etheostoma caeruleum</i>	Rainbow Darter
	<i>Percina suttkusi</i>	Gulf Logperch
Reptiles	<i>Graptemys oculifera</i>	Ringed Map Turtle
	<i>Farancia erytrogramma erytrogramma</i>	Common Rainbow Snake

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 34% of the 105 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. The suspected causes of poor water quality 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 and siltation, elevated water temperatures, and turbidity. The suspected sources of poor water quality include home sewage systems, agriculture (particularly pasturelands), silviculture, urban development, urban stormwater runoff, industry, and sand and gravel mining.

EXTENT OF THE PONTCHARTRAIN BASIN

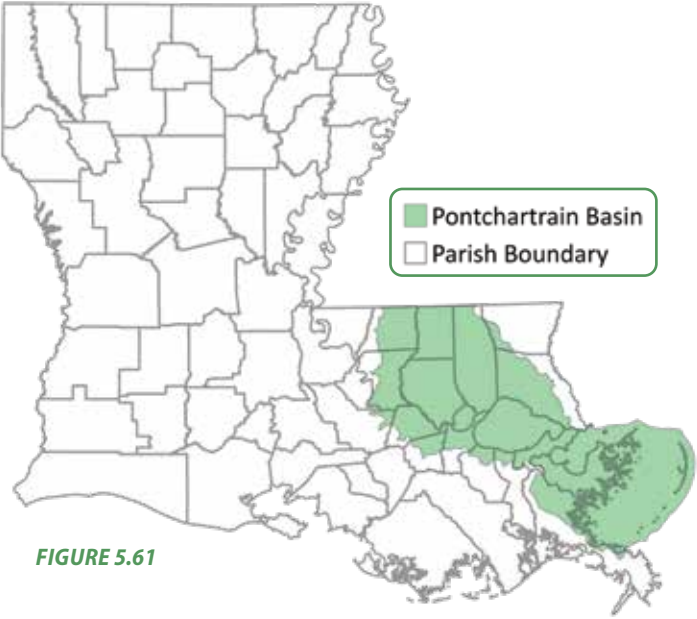


FIGURE 5.61

Threats

Primary threats to the Pontchartrain Basin include natural system modification, urbanization, energy production and mining, and changes in climate and severe weather. Flood control tactics (e.g., channelization, levees, and removal of woody debris) that do not maximize the use of nature-based solutions pose major threats to drainages in the Pontchartrain Basin. Invasive species, particularly Water Hyacinth, are threats to this system. With the intense urbanization of the basin, various associated threats will likely increase in the future.

Research Needs and Conservation Actions

1. Develop a comprehensive stream survey methodology for the Pontchartrain Basin.
2. Work with partners to promote conservation efforts within this basin and address water quality issues.
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.
5. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
6. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

RED BASIN

The headwaters of the Red River begin in Curry County, New Mexico, and the river ends 1,360 miles downstream at the Mississippi River (Figure 5.64). 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 10 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 periods of flooding. Much of the basin is wooded, and significant agricultural lands are located within the Red River’s historical floodplain.

Navigational improvements on the Red River began in the early part of the 19th century. The most recent improvements, part of the \$1.9 billion Red River Waterway Project (RRWP) authorized by Congress with the Rivers and Harbors Act of 1968, consisted of dredging a channel 9 feet deep and 200 feet wide and adding a series of five lock and dam complexes to improve navigation from the Mississippi River to Shreveport. Other improvements within the RRWP consisted of developing a comprehensive plan for bank stabilization from the Denison Dam on the Texas-Oklahoma border to the Mississippi River.

Approximately 100 species of freshwater fishes (W. Kelso, personal communication), 35 species of mussels (Vidrine 1993, 2019), and 22 species of crayfishes (Walls 2009) are found within the Red Basin.

RED BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Margaritifera hembeli</i>	Louisiana Pearlshell
	<i>Pleurobema sintoxia</i>	Round Pigtoe
Crustaceans	<i>Procambarus machardy</i>	Caddo Chimney Crayfish
	<i>Faxonius maletae</i>	Kisatchie Painted Crayfish
Inland Fishes	<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon
	<i>Alburnops potteri</i>	Chub Shiner
	<i>Pteronotropis hubbsi</i>	Bluehead Shiner

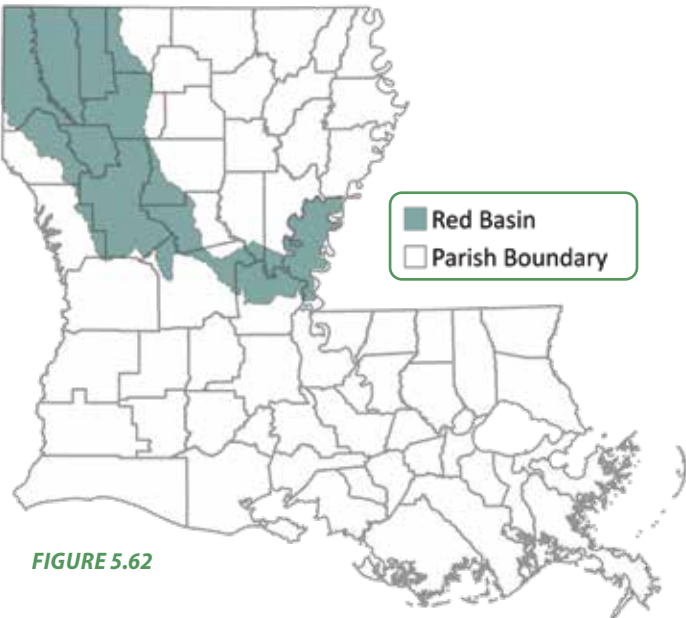
Water Quality

The 2024 Water Quality Inventory Report (LDEQ 2024) indicates that only 29% of the 70 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality include metals, nutrients, PCBs, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, low pH levels, sedimentation and siltation, and turbidity. The suspected sources of poor water quality include silvicultural activities, crop production, pasturelands, home sewage systems, land development, urban runoff, channelization and dredging of streams, removal of riparian vegetation, and road construction.



A Louisiana Pearlshell Mussel Bed in the Red Basin

EXTENT OF THE RED BASIN



Threats

The primary threats to the Red Basin include extensive agriculture and silviculture leading to sedimentation and runoff, natural system modification, transportation and service corridors, energy production, and mining. The locks and dams pose threats to fish passage and lead to increased siltation. Hydropower is proposed on dams on the Red River and, if constructed, would add a new threat to the system. Invasive species, including extensive Giant Salvinia infestations, also threaten many water bodies within the system.

Research Needs and 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. Determine impacts of the locks and dams on fish passage.
4. Implement education, outreach, and cost-share programs with USDA NRCS and other partners to reduce sediments and nutrient loading within the basin.
5. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

SABINE BASIN

The Sabine River starts in north-central Texas and flows in an easterly direction to the Texas-Louisiana state line near Logansport, Louisiana (Figure 5.65). The Sabine River flows as boundary waters between the two states for some 270 river miles to the Gulf of America, 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 relicensing process in 2013, several new requirements were incorporated into plant operations. Intended to benefit fish and wildlife in the system, the new operating license requirements included the elimination of hypolimnetic releases (i.e. releases of a mixture of upper and lower water strata) and changes to generating schedules that will reduce impacts to fishes. The elimination of hypolimnetic releases will enable passage of the migratory American Eel past the dam.

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 10 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 and restoration advocates in Louisiana have pushed strongly for the continued prohibition of commercial harvest. In 2018, harvest of oysters was prohibited in Sabine Lake by act of the Louisiana Legislature (SB451).

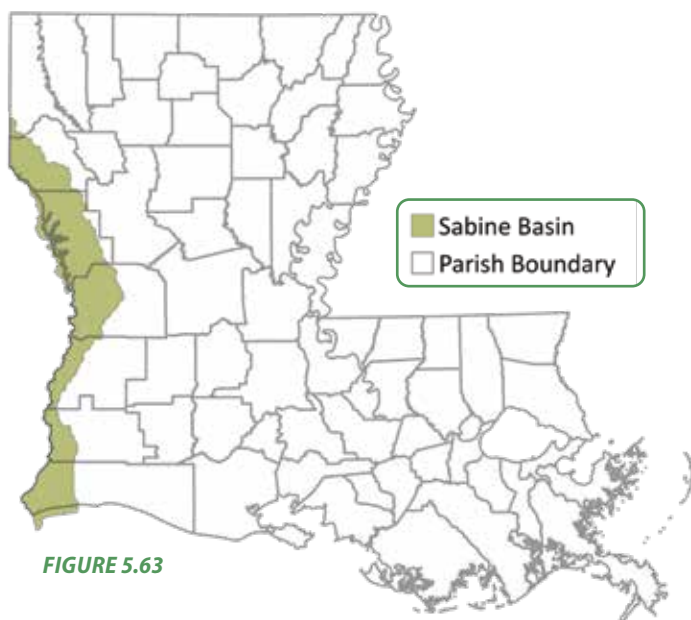
Approximately 100 species of freshwater fishes (Texas State University 2013), 31 species of mussels (Vidrine 1993, 2019), and 19 species of crayfishes (Walls 2009) are found within the Sabine Basin. For more information on this basin, see the LDWF Inland Fisheries management plan for the Sabine River (www.wlf.louisiana.gov/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

SABINE BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Fusconaia askewi</i>	Texas Pigtoe
	<i>Potamilus amphichaenus</i>	Texas Heelsplitter
	<i>Lampsilis satura</i>	Sandbank Pocketbook
Crustaceans	<i>Procambarus machardy</i>	Caddo Chimney Crayfish
	<i>Procambarus dupratzi</i>	Southwestern Creek Crayfish
	<i>Miniellus sabinae</i>	Sabine Shiner
Inland Fishes	<i>Phenacobius mirabilis</i>	Suckermouth Minnow
	<i>Ammocrypta clara</i>	Western Sand Darter
Reptiles	<i>Graptemys sabinensis</i>	Sabine Map Turtle

Water Quality

The 2024 Water Quality Inventory Report (LDEQ 2024) indicates that 68% of the 19 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality include mercury, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, and turbidity. The suspected sources of poor water quality include major industrial point sources, silvicultural activities, surface mining, agriculture, and urban runoff.

EXTENT OF THE SABINE BASIN



Sabine Map Turtles from Sam Houston Jones State Park in the Sabine Basin

Threats

The primary threats to the lower Sabine Basin in Louisiana are natural system modification and the related energy production by the Toledo Bend Dam. Historically, there have been negative impacts from operation of the dam, but recent changes in flow requirements may reduce those impacts. Toledo Bend Dam is also the most significant barrier to fish passage in the state. Silvicultural runoff and related pollution are substantial threats to the lower Sabine. As with many other systems in Louisiana, invasive species and changes to the natural hydrology pose great threats within this basin.

Research Needs and Conservation Actions

1. Support initiatives and programs that help reduce siltation and sedimentation throughout the Sabine Basin.
2. Continue to provide input to the Sabine River Authority in regard to reducing impacts of power generation on fish and wildlife above and below Toledo Bend Dam.
3. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
4. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

TERREBONNE BASIN

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 America to the south (Figure 5.66). 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 historical floodplains of the Mississippi River and Bayou Lafourche. The western half of the basin consists of Bottomland Hardwood Forest and Baldcypress-Tupelo Swamp Forest. 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 implemented to address the issue (CPRA 2023). 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 America 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, are critically important for multiple bird SGCN, which makes maintenance and restoration of these areas of the utmost importance. Many of these islands, including Racoon, Whiskey, Trinity/East, and Timbalier, have received restoration and nourishment through state and federal projects but will continue to need attention to remain subaerial. In addition to these islands providing vital habitat for colonial nesting waterbirds, the islands buffer mainland marshes from the tidal processes of the Gulf and help protect the coastline from tropical cyclones. 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.



Freshwater Marsh in Terrebonne Basin

Approximately 60 species of freshwater fishes (W. Kelso, personal communication), 19 species of mussels (Vidrine 1993, 2019), and 10 species of crayfishes (Walls 2009) are found within the Terrebonne Basin. For more information on this basin, see the LDWF Inland Fisheries management plan for water bodies within Terrebonne Basin (www.wlf.louisiana.gov/resources/category/freshwater-inland-fish/inland-waterbody-management-plans).

TERREBONNE BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Inland Fishes	<i>Polyodon spathula</i>	Paddlefish
	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Anguilla rostrata</i>	American Eel

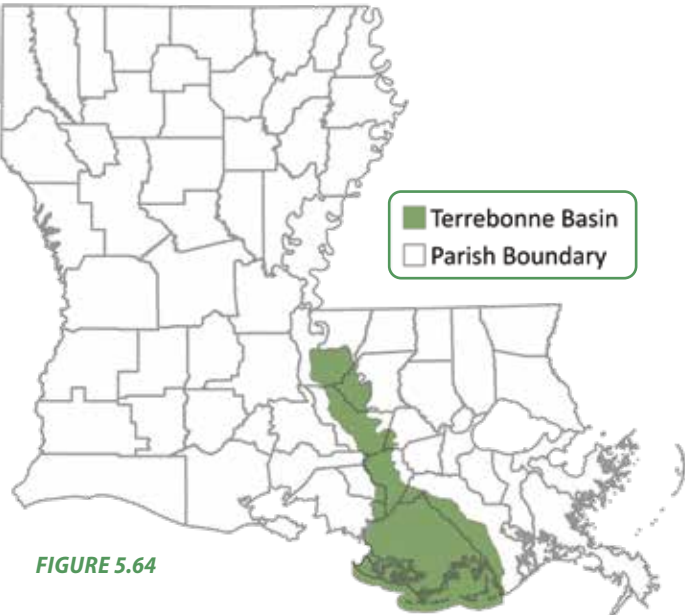
Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 48% of the 56 waterbody subsegments within this basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality 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 and siltation, and turbidity. The suspected sources of poor water quality include non-irrigated crop production, pastureland, urban runoff, hydromodification, combined sewers and unsewered areas, surface runoff, and chemical spills.

Threats

Subsidence, SLR, and the potential increase in frequency and magnitude of tropical cyclones are major threats to this basin and are of particular concern for the 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.

EXTENT OF THE TERREBONNE BASIN



Research Needs and Conservation Actions

1. Restore historical flow regimes within the Terrebonne Basin.
2. Work with partners to increase monitoring of nutrient inputs and overall water quality within the basin.
3. Coordinate with BTNEP to abate identified threats from invasive flora and fauna.
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. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
7. Work with the Louisiana Watershed Initiative on flood mitigation projects to encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

VERMILION-TECHE BASIN

The Vermilion-Teche Basin’s drainage area covers approximately 4,047 square miles (*Figure 5.67*). 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 portions of the basin. The coastal zone is primarily Freshwater Marsh from Bayou Cypremort east to Louisiana Hwy. 317. Intermediate and Brackish marshes occupy all of the coastal zone west of Bayou Cypremort with small areas of Salt Marsh on Marsh Island WMA and National Audubon Society’s 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 fresh water is distributed among Bayou Teche, the Vermilion River, and the west side borrow pit along the Atchafalaya Basin protection levee for municipal, industrial, irrigation, and water-quality control uses (USACE 1998).



Approximately 60 species of freshwater fishes (W. Kelso, personal communication), 28 species of mussels (Vidrine 1993, 2019), and 14 species of crayfishes (Walls 2009) 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 harvest of crabs, shrimp, and oysters occurs within the coastal bay system and in waters offshore of Marsh Island.

VERMILION-TECHE BASIN: OBLIGATE OR REPRESENTATIVE SPECIES		
	Scientific Name	Common Name
Mollusks	<i>Margaritifera hembeli</i>	Louisiana Pearlshell
Crustaceans	<i>Faxonius hathawayi hathawayi</i>	Teche Painted Crayfish
	<i>Polyodon spathula</i>	Paddlefish
Inland Fishes	<i>Atractosteus spatula</i>	Alligator Gar
	<i>Anguilla rostrata</i>	American Eel

Water Quality

The 2024 *Water Quality Inventory Report* (LDEQ 2024) indicates that only 15% of the 42 waterbody subsegments within the basin fully supported their designated use for fish and wildlife propagation. Causes of poor water quality include metals, pesticides, nutrients, fecal coliform bacteria, non-native aquatic plants, organic enrichment and low concentration of dissolved oxygen, dissolved and suspended solids, sedimentation and siltation, and turbidity. The suspected sources of poor water quality include crop production, aquaculture, urban runoff, petroleum activities, hydromodification, surface mining, construction, and dredging.

Threats

Coastal land loss is a significant threat, most notably on Marsh Island, and numerous projects have been proposed to address this issue (CPRA 2023). Additional primary threats to the Vermilion-Teche Basin, which are similar to those of neighboring basins, include natural system modifications, invasive plants such as Hydrilla and Common Salvinia, and sedimentation from agricultural lands.



Intermediate Marsh in the Vermilion-Teche Basin

EXTENT OF THE VERMILION-TECHE BASIN

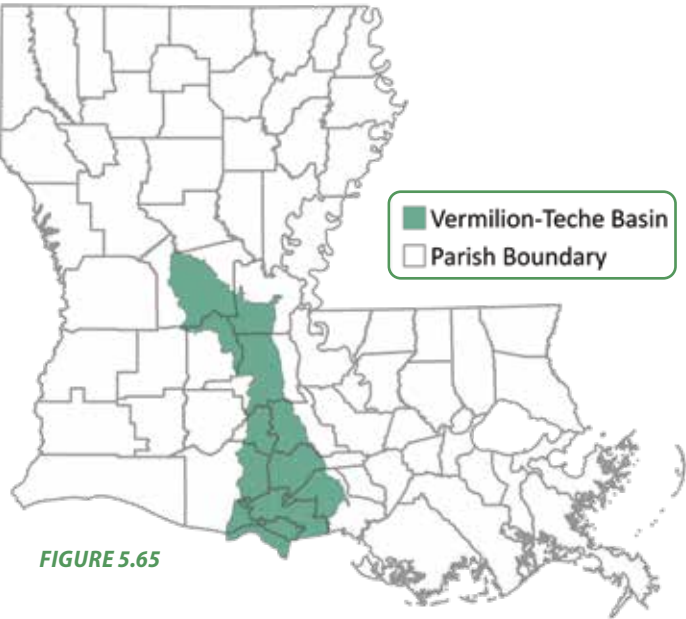


FIGURE 5.65

Research Needs and Conservation Actions

1. Develop a comprehensive stream survey methodology for the Vermilion-Teche Basin.
2. Conduct a detailed inventory 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 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.
7. Restore aquatic connectivity to enhance aquatic organism passage throughout the basin.
8. Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.

Chapter 6: Invasive Species

Invasive species are "probably the single greatest threat in our country to our native wildlife."

- Sam Hamilton, former director of the U.S. Fish and Wildlife Service

Invasive species are one of the most widespread and serious threats to Species of Greatest Conservation Need (SGCN) and their habitats in Louisiana. The scope of this threat continues to expand, and it may be one of the few threats that private landowners and managers can actively mitigate through concerted efforts. This chapter provides a list of invasive species that are known to occur in Louisiana or have the potential to occur within the next decade (*Table 6.1*).

Important distinctions must be made between two closely related and oftentimes confusing terms in invasion biology, namely *non-native* and *invasive*. These terms are discussed in detail in Mack and colleagues (2000) but will be defined in general terms here. *Non-native* species are sometimes referred to as alien, introduced, exotic, or naturalized species. These terms all have different connotations and meanings across various disciplines, but are encapsulated in this section under the term *non-native*. *Non-native* species are those species transferred to a new geographic location previously unoccupied by that species. *Invasive*¹ species are non-native species that have become established in an area, causing negative impacts to native species and their environment. Invasive species often have life history traits that allow them to outcompete 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 (Mack et al. 2000). Additionally, invasive species frequently thrive in new habitats because they lack natural controls (e.g., reproductive limitations, predators, diseases, and competitors) that would normally regulate their populations in their native range, further enhancing their ability to spread, consume resources, alter habitats, and dominate other species. Louisiana's humid subtropical climate makes it especially vulnerable to the introduction and establishment of invasive species. Long, hot summers and short, mild winters, along with high precipitation levels, provide favorable conditions for a plethora of invasive species to survive year-round. The negative impact of these species on native wildlife and natural communities is profound, often resulting in diminished food availability, reduced habitat quality, decreased species diversity,

increased habitat fragmentation, and weakened ecosystem resilience. For SGCN, the threat of invasive species is a perpetual and escalating challenge that compounds pressures already faced by vulnerable native species and natural communities.

In addition to ecological impacts, invasive species also have far reaching negative economic consequences to industrial, agricultural, commercial, and private business sectors. Thousands of invasive species have become established in the United States. Although the precise economic costs are difficult to quantify, Pimentel and colleagues (2000) estimated damages caused by invasive species to be as much as \$137 billion (or \$257 billion in 2025, adjusted for inflation) annually. To limit the spread of invasive species, federal and state governments have passed laws regulating the transport and possession of non-native species and have created legal consequences for violators. 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.

Efforts to control invasive species often rely on methods such as trapping, shooting, and utilization of herbicides and pesticides. However, the rate at which invasive species spread is frequently faster than the rate at which these removal techniques can be effectively implemented. This lag in response time is in part due to insufficient invasive species removal resources for land managers and state agencies. If more substantial efforts are not made to seriously and proactively address the spread of invasive species, they will continue to pose a major threat to our nation's resources and natural heritage. To minimize and mitigate these injurious impacts, it is essential to enhance funding for more effective invasive species management programs and for addressing gaps in invasive species legislation. In addition, education plays a crucial role in ensuring individuals understand the risks of invasive species on the environment and the impacts to the economy. Teaching the public to be mindful of intentional or unintentional transport or release of invasive species may be the best chance of preventing further introductions. The combination of robust management (including restoration of natural processes such as fire and seasonal flows), legislative action, and public awareness will be critical for minimizing the damage caused by invasive species and protecting Louisiana's native wildlife and habitats.

¹ In this document, invasive is reserved for non-native species only; we recognize that problematic native species may also be referred to as invasive by some authorities.

ADDITIONAL SOURCES OF INFORMATION ON INVASIVE SPECIES

LAWS AND REGULATIONS

- United States laws and regulations (www.fws.gov/program/invasive-species)
- Lacey Act information (www.fws.gov/law/lacey-act)
- Louisiana regulations Title 56 (www.legis.la.gov/legis/Law.aspx?p=y&d=104844)
- Louisiana regulations Title 76 (<https://doa.louisiana.gov/media/dw0asdgl/76.pdf>)

GENERAL INVASIVE SPECIES INFORMATION

- Louisiana invasive species (<http://is.cbr.tulane.edu/index.html>)
- Invasive species introduction pathways (www.invasivespeciesinfo.gov/subject/pathways)
- Invasive species distribution and mapping (www.eddmaps.org)
- Invasive species reporting (<http://pest.ceris.purdue.edu/state.php?code=LA>)
- Southeast Exotic Pest Plant Council (www.se-eppc.org/index.cfm)
- Aquatic Nuisance Species Taskforce (www.fws.gov/program/aquatic-nuisance-species-task-force)
- USDA APHIS (www.aphis.usda.gov)
- USDA Invasive Species (www.usda.gov/topics/invasive-species)
- USGS Aquatic Invasives Database (<http://nas.er.usgs.gov/>)
- BTNEP Invasive Species Website (<https://invasivespecies.btnep.org>)
- USFWS Aquatic Nuisance Species (www.fws.gov/initiative/invasive-species/aquatic-nuisance-species)
- ISSG Global Invasive Species Database (www.iucngisd.org/gisd)
- National Invasive Species Information Center- Louisiana (www.invasivespeciesinfo.gov/us/louisiana)
- North American Invasive Species Management Association (<https://naisma.org/about-naisma/>)
- Southeast Regional Invasive Species and Climate Change (RISCC) Management Network (<https://southeastriscc.org>)
- National Invasive Species Council (www.doi.gov/invasivespecies)
- USGS Invasive Species (www.usgs.gov/programs/biological-threats-and-invasive-species-research-program/science/invasive-species)

IDENTIFICATION AND CONTROL OF INVASIVE SPECIES

- A Field Guide for the Identification of Invasive Plants in Southern Forests (www.fs.usda.gov/research/treesearch/35292)
- A Management Guide for Invasive Plants in Southern Forests (www.fs.usda.gov/research/treesearch/36915)
- Invasive Plant Responses to Silvicultural Practices in the South (www.invasive.org/silvicsforinvasives.pdf)
- USDA plant pests and invasive species (www.ldaf.la.gov/plants/pests)
- USDA National Invasive Species Information Center- Best Management Practices (www.invasivespeciesinfo.gov/subject/best-management-practices)



From top to bottom: Bighead Carp (*Hypophthalmichthys nobilis*), Silver Carp (*Hypophthalmichthys molitrix*), Grass Carp (*Ctenopharyngodon idella*), Black Carp (*Mylopharyngodon piceus*)



Nutria (*Myocastor coypus*)



Greenhouse Frog (*Eleutherodactylus planirostris*)



Rio Grand Cichlid (*Herichthys cyanoguttatus*)



Zebra Mussel (*Dreissena polymorpha*)



Giant Salvinia (*Salvinia molesta*)

LOUISIANA INVASIVE SPECIES LIST

The following list includes definitions of tier categories used to classify threat levels of non-native species currently known to occur in Louisiana (Tiers 1-4) and Watchlist species (Tier 5) that pose a reasonable threat of invasion in the near future.

> TIER 1

This tier is reserved for species currently having severe or widespread negative impacts on native wildlife or natural communities in Louisiana. This tier may include species that have a limited distribution in the state but that have severe impacts where found.

> TIER 2

This tier is reserved for species currently having moderately negative impacts on native wildlife or natural communities in Louisiana. This tier may include species exhibiting severe impacts in other states but that have not reached Tier 1 status in Louisiana.

> TIER 3

This tier is reserved for species currently having limited negative impacts or likely to have limited negative impacts on native wildlife or natural communities in Louisiana. This tier may also include species for which impacts to native wildlife or natural communities are poorly known as well as species for which negative impacts to native wildlife or natural communities might quickly escalate due to ongoing range expansion or population increases.

> TIER 4

This tier is reserved for species currently having very limited or minimal negative impacts on native wildlife or natural communities in Louisiana. This tier includes well established non-native species that are unlikely to ever have measurable negative impacts in Louisiana.

> TIER 5 (WATCHLIST)

This tier is reserved for species not currently found in Louisiana but that have the potential to invade in the next 10 years, some with potentially severe negative impacts.

TABLE 6.1. Invasive Species List.

TIER 1	
Plants	
Common Name	Scientific Name
Alligatorweed	<i>Alternanthera philoxeroides</i>
Coral Ardisia	<i>Ardisia crenata</i>
King Ranch Bluestem	<i>Bothriochloa ischaemum</i> var. <i>songarica</i>
Bushkiller	<i>Cayratia japonica</i>
Camphor Tree	<i>Cinnamomum camphora</i>
Elephant Ear	<i>Colocasia esculenta</i>
Bermuda Grass	<i>Cynodon dactylon</i>
Japanese Twin-Sorus Fern	<i>Deparia petersenii</i>
Air Yam	<i>Dioscorea alata</i> & <i>D. bulbifera</i>
Brazilian Waterweed	<i>Egeria densa</i>
Water Hyacinth	<i>Eichhornia crassipes</i>
Chinese Parasol Tree	<i>Firmiana simplex</i>
Hydrilla or Waterthyme	<i>Hydrilla verticillata</i>
Cogon Grass	<i>Imperata cylindrica</i>
Yellow Flag Iris	<i>Iris pseudacorus</i>
Japanese Privet	<i>Ligustrum japonicum</i>
Glossy Privet	<i>Ligustrum lucidum</i>
Chinese Privet	<i>Ligustrum sinense</i>
Common Privet	<i>Ligustrum vulgare</i>
Japanese Honeysuckle	<i>Lonicera japonica</i>
Peruvian Water Grass	<i>Luziola peruviana</i>
Japanese Climbing Fern	<i>Lygodium japonicum</i>
Cuban Bulrush	<i>Cyperus blepharoleptos</i>
Torpedo Grass	<i>Panicum repens</i>
Holmwood Grass	<i>Paspalum modestum</i> (= <i>P. hydrophyllum</i>)
Vasey Grass	<i>Paspalum urvillei</i>
Kudzu	<i>Pueraria montana</i> var. <i>lobata</i>
Bradford Pear	<i>Pyrus calleryana</i>
McCartney Rose	<i>Rosa bracteata</i>
Cherokee Rose	<i>Rosa laevigata</i>
Itch Grass	<i>Rottboellia cochinchinensis</i>
Common Salvinia (Water Spangles)	<i>Salvinia minima</i>
Giant Salvinia	<i>Salvinia molesta</i>
Johnson Grass	<i>Sorghum halepense</i>
Smut Grass	<i>Sporobolus indicus</i>
Chinese Tallow Tree	<i>Triadica sebifera</i>
Tungoil Tree	<i>Vernicia fordii</i>
Japanese Ardisia	<i>Ardisia japonica</i>
TIER 1	
Fungi	
Common Name	Scientific Name
Chestnut Blight	<i>Cryphonectria parasitica</i>
Laurel Wilt	<i>Raffaelea lauricola</i>

TIER 1	
Animals	
Common Name	Scientific Name
Island Apple Snail or Maculata Apple Snail	<i>Pomacea maculata</i>
Argentine Ant	<i>Linepithema humile</i>
Red Imported Fire Ant	<i>Solenopsis invicta</i>
Grass Carp	<i>Ctenopharyngodon idella</i>
Common Carp	<i>Cyprinus carpio</i>
Silver Carp	<i>Hypophthalmichthys molitrix</i>
Bighead Carp	<i>Hypophthalmichthys nobilis</i>
Black Carp	<i>Mylopharyngodon piceus</i>
House Sparrow	<i>Passer domesticus</i>
European Starling	<i>Sturnus vulgaris</i>
Feral/Domestic Cat	<i>Felis catus</i>
Nutria	<i>Myocastor coypus</i>
Norway Rat	<i>Rattus norvegicus</i>
Black Rat	<i>Rattus rattus</i>
Feral Hog	<i>Sus scrofa</i>
TIER 2	
Plants	
Common Name	Scientific Name
Tree-of-Heaven	<i>Ailanthus altissima</i>
Mimosa	<i>Albizia julibrissin</i>
Chaff-Weed	<i>Alternanthera sessilis</i>
Australian Bluestem	<i>Bothriochloa bladhii</i>
Paper Mulberry	<i>Broussonetia papyrifera</i>
Deep-rooted Sedge	<i>Cyperus enterianus</i>
Fuzzy Flatsedge	<i>Cyperus pilosus</i>
Purple Nutsedge	<i>Cyperus rotundus</i>
Smooth Crabgrass	<i>Digitaria ischaemum</i>
Hairy Crabgrass	<i>Digitaria sanguinalis</i>
Junglerice	<i>Echinochloa colona</i>
Barnyardgrass	<i>Echinochloa crus-galli</i>
Elodea	<i>Elodea canadensis</i>
Uruguay Seedbox	<i>Ludwigia hexapetala</i>
Mariana Maiden Fern	<i>Macrothelypteris torresiana</i>
Chinaberry	<i>Melia azedarach</i>
White Mulberry	<i>Morus alba</i>
Asian Spiderwort	<i>Murdannia keisak</i>
Parrotfeather	<i>Myriophyllum aquaticum</i>
Eurasian Watermilfoil (Spike Milfoil)	<i>Myriophyllum spicatum</i>
Nandina	<i>Nandina domestica</i>
Crested Floating Hearts	<i>Nymphoides cristata</i>
Yellow Floating Heart	<i>Nymphoides peltata</i>
Duck Lettuce	<i>Ottelia alismoides</i>
Dallis Grass	<i>Paspalum dilatatum</i>
Common Bahia Grass	<i>Paspalum notatum</i>

TABLE 6.1. cont.

TIER 2	
Plants (cont.)	
Common Name	Scientific Name
Golden Bamboo	<i>Phyllostachys aurea</i>
Trifoliate Orange	<i>Poncirus trifoliata</i>
Curly Dock	<i>Rumex crispus</i>
Thin-Spike Bristle Grass	<i>Setaria pumila</i>
Paraguayan Windmill Grass	<i>Stapfochloa canterae</i>
African Salt Cedar	<i>Tamarix africana</i>
Canary Island Salt Cedar	<i>Tamarix canariensis</i>
French Tamarisk	<i>Tamarix gallica</i>
Salt Cedar	<i>Tamarix ramosissima</i>
Small-Leaf Spiderwort	<i>Tradescantia fluminensis</i>
Brazilian Vervain	<i>Verbena brasiliensis</i>
Common Vetch	<i>Vicia sativa</i>
Smooth Vetch	<i>Vicia tetrasperma</i>
Vetch	<i>Vicia villosa</i>
Chinese Wisteria	<i>Wisteria sinensis</i>
Bradford Pear	<i>Pyrus calleryana</i>
TIER 2	
Fungi	
Common Name	Scientific Name
White Nose Syndrome Fungus	<i>Pseudogymnoascus destructans</i>
Snake Fungal Disease	<i>Ophidiomyces ophiodiicola</i>
TIER 2	
Animals	
Common Name	Scientific Name
Eel Swimbladder Nematode	<i>Anguillicolloides crassus</i>
Asian Clam	<i>Corbicula fluminea</i>
Zebra Mussel	<i>Dreissena polymorpha</i>
Brown Widow	<i>Latrodectus geometricus</i>
Yellow Fever Mosquito	<i>Aedes aegypti</i>
Asian Tiger Mosquito	<i>Aedes albopictus</i>
Emerald Ash Borer	<i>Agrilus planipennis</i>
European Honeybee	<i>Apis mellifera</i>
Formosan Termite	<i>Coptotermes formosanus</i>
Red-bay Ambrosia Beetle	<i>Xyleborus glabratus</i>
Pearlscale Cichlid	<i>Herichthys carpintis</i>
Rio Grande Cichlid	<i>Herichthys cyanoguttatus</i>
Tilapia	<i>Oreochromis</i> spp., <i>Sarotherodon</i> spp., <i>Tilapia</i> spp.
Lionfish	<i>Pterois volitans</i> & <i>P. miles</i>
Cuban Treefrog	<i>Osteopilus septentrionalis</i>
Brown Anole	<i>Anolis sagrei</i>
Rock Pigeon	<i>Columba livia</i>
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>
African Collared-Dove	<i>Streptopelia roseogrisea</i>
Feral/Domestic Dog	<i>Canis familiaris</i>
House Mouse	<i>Mus musculus</i>

TIER 3	
Plants	
Common Name	Scientific Name
Giant Water Sensitive Plant	<i>Aeschynomene fluitans</i>
Giant Reed	<i>Arundo donax</i>
Brazilian Water-hyssop	<i>Bacopa egensis</i>
Blyxa	<i>Blyxa aubertii</i>
Balloon Vine	<i>Cardiospermum halicacabum</i>
Nodding Thistle	<i>Carduus nutans</i>
Bull Thistle	<i>Cirsium vulgare</i>
Ethiopian Rattlebox	<i>Crotalaria ochroleuca</i>
Rattleweed	<i>Crotalaria retusa</i>
Showy Rattle	<i>Crotalaria spectabilis</i>
Ricefield Flatsedge	<i>Cyperus iria</i>
Fortune's Net-veined Holly Fern	<i>Cyrtomium fortunei</i>
Kleberg Bluestem	<i>Dichanthium annulatum</i>
Catclaw Vine	<i>Dolichandra unguis-cati</i>
Dopatrium	<i>Dopatrium junceum</i>
Thorny Olive	<i>Elaeagnus pungens</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Large-Head Horseweed	<i>Erigeron bonariensis</i>
Eucalyptus	<i>Eucalyptus</i> spp.
Chinese Holly	<i>Ilex cornuta</i>
Japanese Holly	<i>Ilex crenata</i>
Japanese Lespedeza	<i>Kummerowia striata</i>
West India Camara	<i>Lantana camara</i>
Shrubby Lespedeza	<i>Lespedeza bicolor</i>
Indian Marshweed	<i>Limnophila indica</i>
Asian Marshweed	<i>Limnophila sessiliflora</i>
Marshweed	<i>Limnophila x ludoviciana</i>
Monkeygrass	<i>Liriope muscari</i>
Reed Fescue	<i>Lolium arundinacea</i>
Perennial Ryegrass	<i>Lolium perenne</i>
Japanese Yellow Loosestrife	<i>Lysimachia japonica</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Wild Bushbean	<i>Macroptilium lathyroides</i>
Brittle Naiad (Brittle Waternymph)	<i>Najas minor</i>
Watercress	<i>Nasturtium officinale</i>
Stinkvine	<i>Paederia foetida</i>
Beefsteak Plant	<i>Perilla frutescens</i>
Timothy Grass	<i>Phleum pratense</i>
Water Lettuce	<i>Pistia stratiotes</i>
Japanese Knotweed	<i>Polygonum cuspidatum</i>
Spider Brake Fern	<i>Pteris multifida</i>
Sawtooth Oak	<i>Quercus acutissima</i>
Castor-Bean	<i>Ricinus communis</i>
Multiflora Rose	<i>Rosa multiflora</i>

TABLE 6.1. cont.

TIER 3	
Plants (cont.)	
Common Name	Scientific Name
Indian Toothcup	<i>Rotala indica</i>
Britton's Wild Petunia	<i>Ruellia simplex</i>
Indian Cupscale	<i>Sacciolepis indica</i>
Guyana Arrowhead	<i>Sagittaria guyanensis</i>
Brazilian Rattlebox	<i>Sesbania punicea</i>
Jerusalem Cherry	<i>Solanum pseudocapsicum</i>
Tropical Soda Apple	<i>Solanum viarum</i>
Confederate Jasmine	<i>Trachelospermum jasminoides</i>
Chinese Elm	<i>Ulmus parvifolia</i>
Siberian Elm	<i>Ulmus pumila</i>
Para Grass	<i>Urochloa mutica</i>
TIER 3	
Fungi	
Common Name	Scientific Name
Amphibian Chytrid Fungus	<i>Batrachochytrium dendrobatidis</i>
TIER 3	
Animals	
Common Name	Scientific Name
Asian Tramp Snail	<i>Bradybaena similaris</i>
Chinese Mystery Snail	<i>Cipangopaludina chinensis</i>
Japanese Mystery Snail	<i>Cipangopaludina japonica</i>
Garden Snail	<i>Cornu aspersum</i>
Red-Rim Melania	<i>Melanoides tuberculata</i>
Draparnaud's Glass Snail	<i>Oxychilus draparnaudi</i>
A Water Flea	<i>Daphnia lumholzi</i>
Asian Tiger Shrimp	<i>Penaeus monodon</i>
Southeast Asian Cellar Spider	<i>Crossopriza lyoni</i>
Caribbean Huntsman Spider	<i>Heteropoda venatoria</i>
South American Toothed Hacklemesh Spider	<i>Metaltella simoni</i>
Pantropical Jumping Spider	<i>Plexippus paykulli</i>
Red-streaked Leafhopper	<i>Balclutha rubrostriata</i>
Cactus Moth	<i>Cactoblastis cactorum</i>
Metallic Bluish-green Cuckoo Wasp	<i>Chrysis angolensis</i>
Seven-spotted Lady Beetle	<i>Coccinella septempunctata</i>
Southern House Mosquito	<i>Culex quinquefasciatus</i>
Asian Oak Weevil	<i>Cyrtopistomus castaneus</i>
Diaprepes Root Weevil	<i>Diaprepes abbreviatus</i>
Gazelle Scarab	<i>Digitonthophagus gazella</i>
Spotted Wing Drosophila	<i>Drosophila suzukii</i>
Mexican Rice Borer	<i>Eoreuma loftini</i>
Greater Wax Moth	<i>Galleria mellonella</i>
Asian Lady Beetle	<i>Harmonia axyridis</i>
Sculptured Resin Bee	<i>Megachile sculpturalis</i>
Tawny Crazy Ant	<i>Nylanderia fulva</i>
Exotic Big-headed Ants	<i>Pheidole</i> spp.
Japanese Beetle	<i>Popillia japonica</i>

TIER 3	
Animals (cont.)	
Common Name	Scientific Name
Two-spotted Leafhopper	<i>Sophonia orientalis</i>
Chinese Mantis	<i>Tenodera sinensis</i>
Bicolored Pennant Ant	<i>Tetramorium bicarinatum</i>
Japanese Burrowing Cricket	<i>Velarifictorus micado</i>
Northern Snakehead	<i>Channa argus</i>
Tessellated Blenny	<i>Hypsoblennius invemar</i>
Cuchia	<i>Ophichthys cuchia</i>
Rio Grande Chirping Frog	<i>Eleutherodactylus cystignathoides</i>
Greenhouse Frog	<i>Eleutherodactylus planirostris</i>
Florida Softshell	<i>Apalone ferox</i>
Brown Basilisk	<i>Basiliscus vittatus</i>
Boa Constrictor	<i>Boa constrictor</i>
Sri Lankan Spotted House Gecko	<i>Hemidactylus parvimaclatus</i>
Mediterranean Gecko	<i>Hemidactylus turcicus</i>
Green Iguana	<i>Iguana iguana</i>
Reticulated Python	<i>Malayopython reticulatus</i>
Burmese Python	<i>Python bivittatus</i>
Ball Python	<i>Python regius</i>
Argentine Black and White Tegu	<i>Salvator merianae</i>
Savannah Monitor	<i>Varanus exanthematicus</i>
Nile Monitor	<i>Varanus niloticus</i>
Canada Goose (Feral only)	<i>Branta canadensis</i>
Muscovy Duck (Feral only)	<i>Cairina moschata</i>
Mute Swan	<i>Cygnus olor</i>
Scaly-breasted Munia	<i>Lonchura punctulata</i>
Monk Parakeet	<i>Myiopsitta monachus</i>
TIER 4	
Plants	
Common Name	Scientific Name
Little Quaking Grass	<i>Briza minor</i>
Water Sprite	<i>Ceratopteris thalictroides</i>
Rooting Water Hyacinth	<i>Eichhornia azurea</i>
Centipedegrass	<i>Eremochloa ophiuroides</i>
Groundivy	<i>Glechoma hederacea</i>
English Ivy	<i>Hedera helix</i>
West Indian Marshgrass	<i>Hymenachne amplexicaulis</i>
Moon Vine	<i>Ipomoea alba</i>
Mile-a-Minute Vine	<i>Ipomoea cairica</i>
Cypress Vine	<i>Ipomoea quamoclit</i>
Weeping Lantana	<i>Lantana montevidensis</i>
Matrimony Vine	<i>Lycium barbarum</i>
Creeping Jenny	<i>Lysimachia nummularia</i>
Big-foot Water Clover	<i>Marsilea macropoda</i>
Big-foot Water Clover	<i>Marsilea macropoda</i>

TABLE 6.1. cont.

TIER 4	
Plants (cont.)	
Common Name	Scientific Name
Guinea Grass	<i>Megathyrsus maxima</i>
Sacred Lotus	<i>Nelumbo nucifera</i>
White Egyptian Lotus	<i>Nymphaea lotus</i>
Curly Pondweed	<i>Potamogeton crispus</i>
Crownvetch	<i>Securigera varia</i>
Japanese Hawksbeard	<i>Youngia japonica</i>

TIER 4	
Animals	
Common Name	Scientific Name
Freshwater Jellyfish	<i>Craspedacusta sowerbyi</i>
Spotted Jellyfish	<i>Phyllorhiza punctata</i>
Chinese Mitten Crab	<i>Eriocheir sinensis</i>
Oleander Aphid	<i>Aphis nerii</i>
Two-spined Trap-jaw Ant	<i>Odontomachus haematodus</i>
Rough-node Trap-Jaw Ant	<i>Odontomachus ruginodis</i>
Longhorn Crazy Ant	<i>Paratrechina longicornis</i>
Ghost Ant	<i>Tapinoma melanocephalum</i>
Goldfish	<i>Carassius auratus</i>
Paradisefish	<i>Macropodus opercularis</i>
Oriental Weatherfish	<i>Misgurnus anguillicaudatus</i>
Green Swordtail	<i>Xiphophorus hellerii</i>
Southern Platyfish	<i>Xiphophorus maculatus</i>
Brahminy Blindsnake	<i>Indotyphlops braminus</i>
Capybara	<i>Hydrochoerus hydrochaeris</i>

TIER 5	
Bacteria	
Common Name	Scientific Name
Cylindro	<i>Cylindrospermopsis raciborskii</i>

TIER 5	
Plants	
Common Name	Scientific Name
Australian Pine	<i>Casuarina</i> spp.
Lanceleaf Rattlebox	<i>Crotalaria lanceolata</i>
Indian Swampweed	<i>Hygrophila polysperma</i>
Water Spinach	<i>Ipomoea aquatica</i>
African Elodea	<i>Lagarosiphon major</i> & <i>muscoides</i> ; <i>Elodea crispata</i>
Old World Climbing Fern	<i>Lygodium microphyllum</i>
Water Clovers	<i>Marsilea minuta</i> & <i>M. mutica</i>
Punktree	<i>Melaleuca quinquenervia</i>
Little Floating Hearts	<i>Nymphoides indica</i>
Aquatic Soda Apple	<i>Solanum tampicense</i>
Mosquito Fern	<i>Azolla pinnata</i>
Hybrid Eelgrass	<i>Vallisneria spiralis</i> + <i>denseserrulata</i>

TIER 5	
Fungi	
Common Name	Scientific Name
Salamander Chytrid Fungus	<i>Batrachochytrium salmandrivorans</i>

TIER 5	
Animals	
Common Name	Scientific Name
Channeled Apple Snail	<i>Pomacea canaliculata</i>
Giant African Land Snails	<i>Achatina</i> spp., <i>Archachatina</i> spp., <i>Limicolaria</i> spp.
Asian Oyster	<i>Crassostrea ariakensis</i>
Pacific Oyster	<i>Crassostrea gigas</i>
Brown (Mexihalo) Mussel	<i>Perna perna</i>
(Asian) Green Mussel	<i>Perna viridis</i>
Green Crab	<i>Carcinus maenas</i>
Golden Mussel	<i>Limnoperna fortunei</i>
Papershell Crayfish	<i>Orconectes immunis</i>
Rusty Crayfish	<i>Orconectes rusticus</i>
Virile Crayfish	<i>Orconectes virilis</i>
Pentastome Snake Parasite	<i>Raillietiella orientalis</i>
Asian Longhorn Beetle	<i>Anoplophora glabripennis</i>
Africanized Honeybee	<i>Apis mellifera scutellata</i>
Spotted Lanternfly	<i>Lycorma delicatula</i>
Spongy Moth	<i>Lymantria dispar</i>
Snakeheads (excluding Northern Snakehead)	<i>Channidae</i>
Asian Swamp Eel family (excluding Cuchia)	<i>Synbranchidae</i>
Southern African Python	<i>Python natalensis</i>
Northern African Python	<i>Python sebae</i>
Red Tegu	<i>Salvator rufescens</i>
Gold Tegu	<i>Tupinambis teguixin</i>
Asian Water Monitor	<i>Varanus salvator</i>

GENERAL INVASIVE SPECIES MANAGEMENT ACTIONS

The following management actions apply to many or all invasive species and should be considered priority conservation strategies. Implementation of these actions will benefit multiple natural communities and SGCN. Although not exhaustive, their implementation will support broader ecological health and resilience.

- Encourage the development and implementation of an Early Detection Rapid Response (EDRR) protocol to prevent the establishment of non-native species.
- Promote existing occurrence databases for emerging invasives (e.g., iMapInvasives, USGS Nonindigenous Aquatic Species, etc.), including rigorous documentation of newly discovered individuals or populations of such species.
- Document current range extent and expansion of invasive species, enabling more effective landscape-level management and targeted interventions.
- Educate and encourage the public to report sightings of invasives to the appropriate source, fostering and utilizing community involvement for early detection and response.
- Work with partners to verify and eradicate newly detected non-native wildlife and plant species.
- Promote education on the identification of invasive species, highlighting their negative impacts on natural communities, and methods for control or eradication.
- Restore natural flow regimes and connectivity in aquatic systems to encourage seasonal cycles and health of native plants and animals, supporting ecosystem resilience.
- Promote the utilization of federal cost-share programs (e.g., Natural Resource Conservation Service Farm Bill programs) to help landowners and land managers address invasive species problems on private lands.
- Provide technical assistance and encourage landowners to control invasive species to benefit SGCN and natural communities.
- Control invasive species (Nutria, Feral Hogs, Giant Salvinia, etc.) as appropriate, particularly when the species is documented to have negative impacts on SGCN or natural communities.
- Pursue the creation, implementation, and enforcement of laws and regulations prohibiting the possession and commercial sale of potentially invasive and invasive non-native plants and animals that are not currently covered by existing regulations.
- Increase awareness about the potential risk of using non-native plant species that are commonly used as ornamentals and promote the use of native species for landscaping.
- Educate the public on preventative measures to curb the spread of invasive plants such as 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 trailheads, boat launches, and parking lots in parks and recreation areas.
- Promote the use of disinfection and quarantine protocols by researchers, managers, and hobbyists for field sampling and recreational gear and equipment to prevent the spread of non-native pathogens.
- Develop Best Management Practices for invasive species control.
- Collaborate with partners to develop native-based seed mixes to replace those containing non-native species.



House Sparrow (*Passer domesticus*)



Eurasian Collared-Dove (*Streptopelia decaocto*)



Bighead Carp (*Hypophthalmichthys nobilis*)

CHAPTER 7: Conservation Opportunity Areas

CONSERVATION OPPORTUNITY AREAS NEED AND OVERVIEW

There are 428 animals and 552 plants that have been identified as Species of Greatest Conservation Need (SGCN)¹ in Louisiana. Given the finite time and resources available for the conservation of SGCN and their habitats, a growing need exists to focus conservation actions where they can have the greatest impact. For that reason, the 2025 State Wildlife Action Plan (SWAP) defined priority conservation areas for Louisiana's SGCN. These areas were primarily developed using SGCN richness and habitat condition and are known as Conservation Opportunity Areas.

Conservation Opportunity Areas (COAs) 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 Bird Habitat Joint Ventures. COAs vary greatly in size and landscape composition, and each may have specific threats, conservation needs, and conservation actions.

The COAs identified in this SWAP 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 SWAP, 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.

IDENTIFYING COAs

For the 2015 SWAP, LDWF staff used a multi-tiered Geographic Information System (GIS) based approach in which multiple data layers were overlaid to determine SGCN hot spots. These data included layers representing the predicted distribution of all S1, S2, and S3 SGCN, predicted distribution of S1, S2, and

S3 natural communities, the location of existing conservation lands and Louisiana Natural and Scenic Rivers, and the location of stream segments that are of very high quality for fish and wildlife propagation. This process resulted in 38 potential COAs, which were then refined to a final set of 30. However,

¹ These numbers represent the 2025 SGCN list, but all analyses conducted throughout this chapter used the SGCN and natural communities in the 2015 SWAP. All global ranks, state ranks, and natural community names are reflective of the 2015 SWAP.

due to the large number of COAs and the number of acres encompassed within each COA, LDWF still found it difficult to target conservation resources and actions.

The 2015 SWAP recognized the need for future iterations of COA development to narrow the broad focus towards more targeted conservation opportunities. In 2020, LDWF partnered with U.S. Fish and Wildlife Service (USFWS) staff supporting the Southeast Conservation Adaptation Strategy to better target acquisition and management projects. This occurred by refining the 2015 approach and redefining COA boundaries. The resulting methodology refined the original approach by focusing on information needs to support specific actions in the SWAP, and data available within the SE Conservation Blueprint (SECAS 2021) could help address these information needs. This process produced data-informed priority areas that are easier to communicate, replicate, and defend (i.e. increased transparency of purpose and process results in more defensible decisions). Further, it achieved the LDWF objectives of reducing the number of COAs (nine instead of 30), and creating high priority focal areas defined by a specific set of priority actions. Full details of the methods can be found in the final project report available on USGS ScienceBase (www.sciencebase.gov/catalog/item/650efc46d34e823a0275500f).

Briefly, LDWF and USFWS staff (hereafter, the COA Team) developed a six step, data-informed process to identify COAs for Louisiana.

1. Identifying Focal Priority Actions
2. Identifying Species Priority Areas
3. Identifying Action Opportunity Areas (AOAs)
4. Prioritizing Action Opportunity Areas
5. Identifying Conservation Opportunity Areas
6. Reviewing and Refining Conservation Opportunity Areas

STEP 1: IDENTIFYING FOCAL PRIORITY ACTIONS

The COA Team compiled a full list of priority actions outlined in the 2015 SWAP and compared them to Blueprint indicators. Throughout the SWAP, priority actions were identified by habitats or groups of habitats (e.g., forests). This approach often resulted in specific priority actions occurring in a subset of the state's six primary ecoregions. To simplify the analysis, the COA Team defined focal "ecosystems" as either a habitat group or an important sub-group. The final targeted list of ecosystems included (1) Freshwater Streams and Rivers, (2) Pine Forests and Woodlands, and (3) Floodplain Forests and Woody Wetlands.

For the Freshwater Streams and Rivers ecosystem, the COA Team focused on actions that would improve linear and lateral connectivity. Other potential actions were deferred for a later assessment due to a lack of adequate ecosystem condition data (e.g., water quality) or because LDWF does not have significant and direct influence over the priority action (e.g., sandbar creation and management in big rivers). For the Pine

Forests and Woodlands ecosystem and the Floodplain Forests and Woody Wetlands ecosystem, the COA Team focused on restoration and protection. Priority actions related to the application of fire in upland forest ecosystems were considered a necessary component of both restoration and protection and, therefore, were not analyzed separately. Marine ecosystems (i.e. Island and Seagrass) were not included in this analysis. The relevant indicators in the 2019-2021 versions of the Southeast Conservation Blueprint did not provide adequate coverage for Louisiana. Similarly, Prairies/Grasslands, Coastal Prairies, and Chenier ecosystems were not considered due to the lack of adequate ecosystem condition information. The Chenier ecosystem also lacks a specific set of focal species and, thus, did not fit well in this analysis framework. Given the presence of partner-vetted COAs focused on Coastal Prairies, Cheniers, Islands, and Seagrass in the 2015 SWAP, the COA Team retained the original five COAs targeting these ecosystems (i.e. Cajun Prairie², Sabine Prairie, Chenier-Coastal Prairie³, Barataria-Terrebonne, and the Chandeleurs) without further refinement.

STEP 2: IDENTIFYING SPECIES PRIORITY AREAS

The COA Team identified areas within the state with high concentrations of SGCN that could benefit from the focal priority action. The methodology used to determine SGCN distribution in this revision is the same subbasin-level distribution predictions that were used for the 2015 SWAP. For the restoration and protection action items in the Pine Forests and Woodlands and the Floodplain Forests and Woody Wetlands ecosystems, SGCN data were first filtered to those species dependent on the relevant ecosystem for the priority action. Unfortunately, species-specific distributions were not available for aquatics species. Thus, summary ranking data for fishes, crustaceans, and mollusks were used to identify hotspots for Freshwater Streams and Rivers ecosystem actions. For all three ecosystems, the pool of relevant subbasins was ranked based on a SGCN Index score (i.e. predicted presence of each species, weighted by S-ranks) and categorized into three bins: top 20%, top 20-50%, and bottom 50%. These categories approximate the categories used by the Southeast Conservation Blueprint to define High, Moderate, and Low priority for conservation actions. Further, earlier prototypes that defined the top category using a 5% threshold were deemed too restrictive by LDWF staff. For the Pine Forests and Woodlands ecosystem, subbasins were only ranked in the coastal plain ecoregions where that ecosystem occurs. For the Freshwater Streams and Rivers and Floodplain Forests and Woody Wetlands ecosystems, all subbasins in the state were included in the analysis, because the ecosystems are distributed statewide.

STEP 3: IDENTIFYING ACTION OPPORTUNITY AREAS (AOAs)

For purposes of this project, AOAs are defined as those areas within species priority areas (identified in Step 2) that also have abundant and leverageable ecological opportunities to enact focal priority actions. Spatial data characterizing the amount and

² Cajun Prairie was known as Calcasieu Prairie in the 2015 SWAP.

³ Chenier-Coastal Prairie was known as Chenier in the 2015 SWAP.

distribution of ecological opportunity for a particular action were based on relevant measured or modeled ecosystem condition indicators in the Blueprint and were presented to LDWF staff as map overlays within the prioritized subbasins (identified in Step 2). LDWF staff provided expert judgement, prioritizing target actions in a particular area by selecting or creating polygons. These polygons were created around concentrations of the action opportunity depicted by the Blueprint. The staff's expert judgement represented the values of the Louisiana SWAP and, by proxy, the statewide conservation community in general, contextualized with their understanding of both tangible and intangible information (e.g., history of efforts in an area, social opportunities for the focal action, and emerging trends).

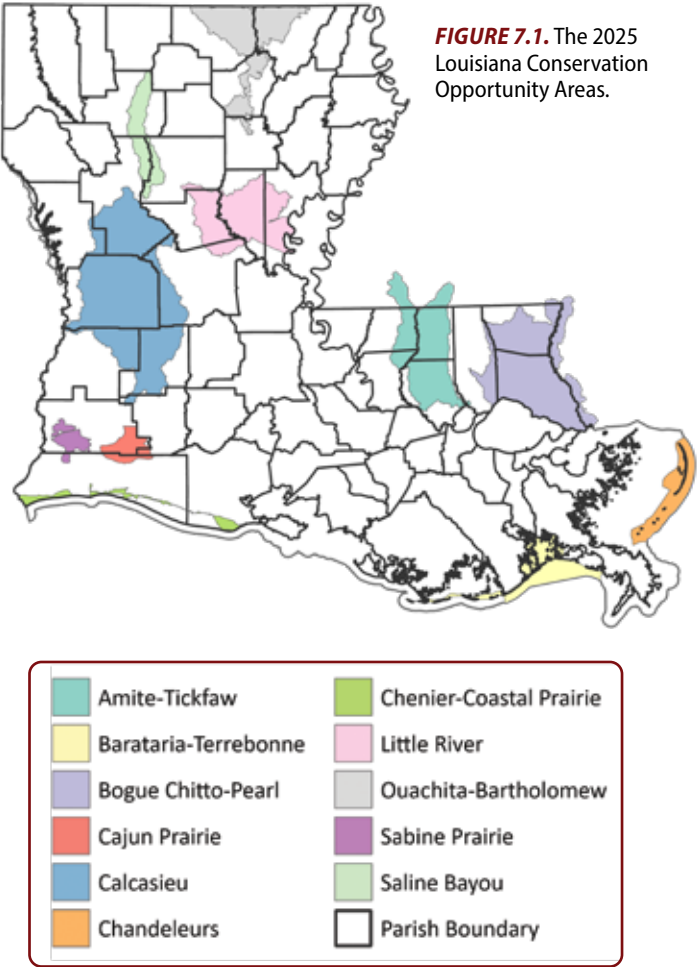
STEP 4: PRIORITIZING ACTION OPPORTUNITY AREAS

The COA Team identified a total of 76 potential AOAs across the three sets of focal priority actions (Pine Protection and Restoration = 8; Forested Wetland Protection and Restoration = 26; Freshwater Aquatic Connectivity Restoration = 42). These AOAs were ranked using a suite of values or desired conditions that helped define Conservation Opportunity Areas (COAs) for the Louisiana SWAP, including ancillary data on known SGCN and priority natural community locations, the protection status of the focal ecosystem, partner leverage opportunities, and overlap with AOAs for other priority actions. Expert judgement by LDWF staff determined that AOAs ranked as the Top 20% within each of the three sets of actions (Pine Protection and Restoration, Forested Wetland Protection and Restoration, and Freshwater Aquatic Connectivity Restoration) should move forward to Step 5. Additionally, LDWF staff elevated the priority of subbasins encompassing Bayou Bartholomew in northeast Louisiana due to its importance as a stronghold of imperiled aquatic biodiversity and, therefore, a priority landscape for restoration efforts.

STEP 5: IDENTIFYING CONSERVATION OPPORTUNITY AREAS

Once priority AOAs were identified (Step 3) and ranked (Step 4), LDWF staff identified six draft COA boundaries by examining the spatial overlap of highly ranked AOAs for each of the three sets of actions (Pine Protection and Restoration, Forested Wetland Protection and Restoration, and Freshwater Aquatic Connectivity Restoration). For most ecoregions of the state (Figure 2.2), determining the draft COA boundaries was straightforward; there was minimal overlap of the sets of actions, and most of the boundaries closely conformed to watershed boundaries. In the East Gulf Coastal Plain, however, there was considerable overlap of Pine, Forested Wetland, and Aquatic AOAs and less congruency with watershed boundaries. In this ecoregion, LDWF staff elected to identify two draft COAs based on HUC 10 boundaries, including areas across the border in Mississippi. These boundaries include areas not highlighted as important by the six step process, but actions in those areas are likely to impact sustainability of aquatic organisms downstream.

CONSERVATION OPPORTUNITY AREAS



STEP 6: REVIEWING AND REFINING CONSERVATION OPPORTUNITY AREAS

The COA Team summarized a variety of data on known SGCN and priority natural community locations to identify critical gaps in the draft COA network (e.g., whether or not small-patch grassland communities like saline prairie were captured or represented in the network). As expected, the draft COAs showed great variability in coverage of locations for individual SGCN species and priority natural communities, ranging from 0% to 100% of known locations. In a few cases, LDWF staff adjusted draft COA boundaries as needed, but largely accepted the six draft boundaries. These six COAs, plus the five 2015 COAs encompassing ecosystems not covered by this analysis (i.e. Cajun Prairie, Sabine Prairie, Chenier-Coastal Prairie, Barataria-Terrebonne, and the Chandeleurs), represent the final COAs for 2025 (Figure 7.1).

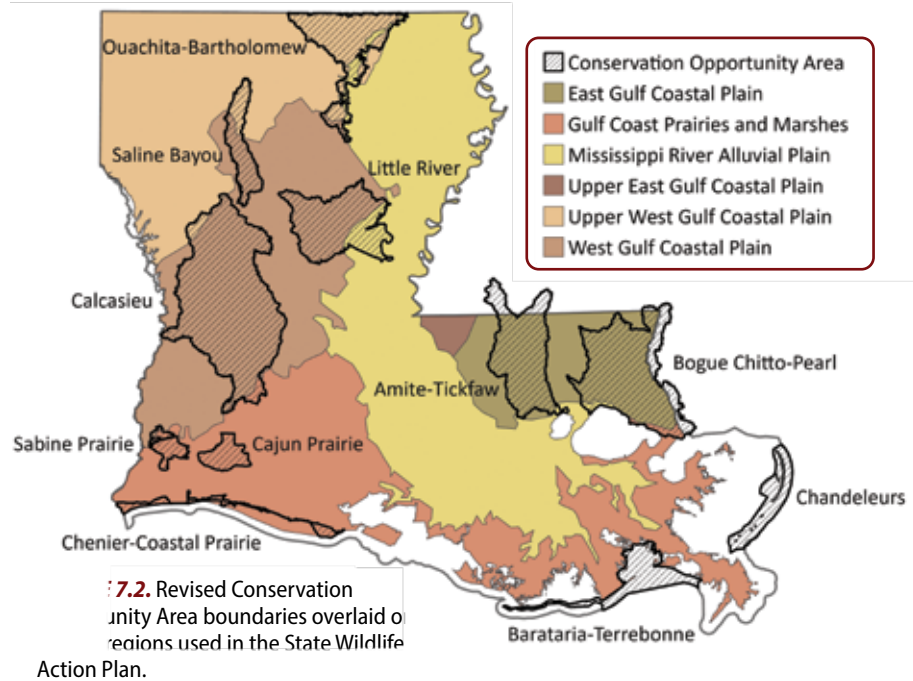
LOUISIANA COAs

The desired outcome of the COA update effort was to catalyze implementation of the Louisiana SWAP by better targeting research, management, and acquisition. The process used here promotes those outcomes by ensuring COAs focus on priority ecosystems and the highest diversity areas within the distribution of those ecosystems. Further, by using standardized and best available information on the relative condition of ecosystems from Blueprint Indicators, this process will support setting and achieving conservation targets within COAs and promote collaborations within Louisiana and with neighboring states. *Figure 7.2* illustrates the COA boundaries overlaid on the ecoregions, and *Figure 7.3* illustrates the COA boundaries along with other lands managed for conservation in the state. For a list of managed areas by ecoregion, see *Appendix G*.

The COA Team identified 11 COAs through this process that covers a broad spectrum of SGCN and priority natural communities (*Tables 7.1, 7.2, and 7.3*), thus, reducing the overall number of COAs and the percent of the state the COAs cover. However, this process did not appreciably reduce the range of sizes of the COAs, largely due to the size of the subbasins used to represent species distributions in both the original and update processes. Subsetting the species information by ecosystem helped better target COA placement for maintenance and protection of upland pine and floodplain forest ecosystems. Further improvements in the resolution and reliability of species distribution (e.g., occupancy) and population status (e.g., demographics) information will help further target actions and refine overall objectives. Despite the coarse resolution of the species data, this iteration of COAs is targeted to areas for specific actions that will more explicitly focus on the health, function, and connectivity of ecosystems. As such, COAs provide a laboratory for linking response of SGCN to suites of conservation actions at landscape scales, information that will in turn help refine mapping and better target actions.

In the sections that follow, a very brief overview of each COA is provided with summary tables of natural communities likely to be found within its borders. Additional information about each COA and associated SGCN can be found in Blueprint Reports and the Landscape Assessment Report provided in the supplemental materials on ScienceBase (www.sciencebase.gov/catalog/item/650efc46d34e823a0275500f).

CONSERVATION OPPORTUNITY AREAS AND ECOREGIONS



CONSERVATION OPPORTUNITY AREAS AND CONSERVATION LANDS

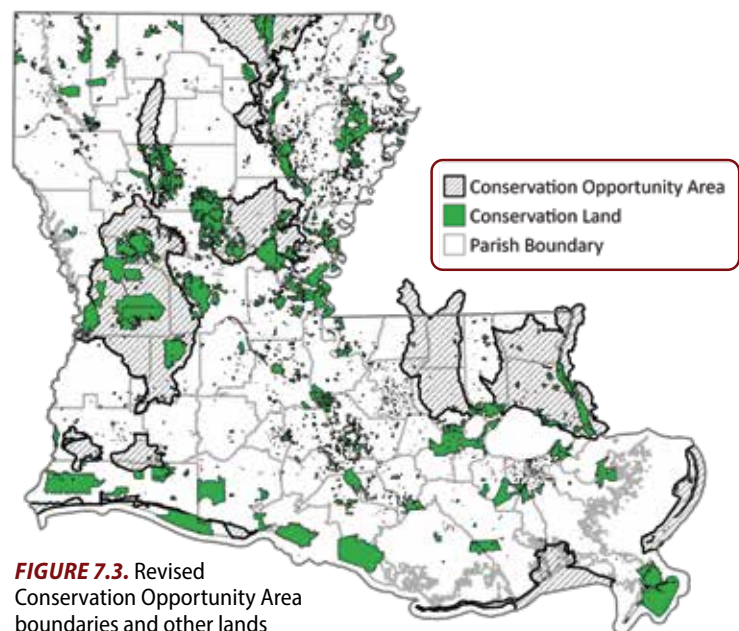


FIGURE 7.3. Revised Conservation Opportunity Area boundaries and other lands managed for conservation.

TABLE 7.1. Overview of 2025 Conservation Opportunity Areas. Opportunities for restoration (R) and protection (P) are noted when an ecosystem was a primary driver of the COA boundary. A small 'x' indicates that COA encompasses highly-ranked ecological opportunity for the action and, thus, could be considered a secondary focus of the COA.

COA Name	Area in LA (1000 Acres)	Pine Forest and Woodland	Floodplain Forest and Woody Wetlands	Freshwater Connectivity		Prairies and Chenier	Barrier Islands and Seagrass
				Linear	Lateral		
Amite-Tickfaw	642	P, R	P, R	R	x		
Bogue Chitto-Pearl	979	P, R	P, R	P, R	P		
Cajun Prairie	148	n/a		x	R	P, R	
Calcasieu	1,909	P, R	P, R	R	P, R	x	
Chenier-Coastal Prairie	103			x	x	P, R	
Little River	751	x	P, R	R	R	x	
Ouachita-Bartholomew	626	x	P, R	R	x	x	
Sabine Prairie	108			x	x	P, R	
Saline Bayou	281	x	P, R	x	P	x	
Barataria-Terrebonne	360						P, R
Chandeleurs	275						P, R

TABLE 7.2. The count of terrestrial Species of Greatest Conservation Need (SGCN) from LDWF data by taxa group overlapping each Conservation Opportunity Area (COA). Numbers in parentheses indicate the number of species considered narrow-range endemics. SGCN records that overlap a COA are counted as both in network and out (i.e. "Rest of the State").

COA Name	Terrestrial Taxa Groups							Totals
	Arachnid	Bird	Crustacean	Herp	Insect	Mammal	Plant	
Amite-Tickfaw	0 (0)	5 (0)	0 (0)	7 (0)	8 (0)	3 (0)	3 (0)	26 (0)
Bogue Chitto-Pearl	0 (0)	7 (0)	1 (0)	15 (0)	6 (0)	5 (1)	13 (2)	47 (3)
Cajun Prairie	0 (0)	5 (0)	0 (0)	2 (0)	1 (0)	1 (0)	1 (1)	10 (1)
Calcasieu	0 (0)	10 (0)	0 (0)	8 (1)	8 (0)	4 (0)	14 (4)	44 (5)
Chenier-Coastal Prairie	0 (0)	7 (0)	0 (0)	0 (0)	2 (0)	1 (0)	0 (0)	10 (0)
Little River	0 (0)	6 (0)	0 (0)	5 (2)	2 (0)	2 (0)	4 (1)	19 (3)
Ouachita-Bartholomew	0 (0)	4 (0)	0 (0)	5 (1)	0 (0)	2 (0)	2 (0)	13 (1)
Sabine Prairie	0 (0)	3 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0)
Saline Bayou	1 (0)	4 (0)	0 (0)	5 (1)	0 (0)	1 (0)	4 (1)	15 (2)
Rest of the State	0 (0)	35 (0)	0 (0)	25 (2)	12 (0)	9 (0)	26 (7)	107 (9)
Totals	1 (0)	37 (0)	1 (0)	27 (2)	16 (0)	10 (1)	35 (7)	127 (10)

TABLE 7.3. The count of aquatic Species of Greatest Conservation Need (SGCN) from LDWF data by taxa group overlapping each Conservation Opportunity Area (COA). Numbers in parentheses indicate the number of species considered narrow-range endemics. SGCN records that overlap a COA are counted as both in network and out (i.e. "Rest of the State").

COA Name	Aquatic Taxa Groups								Totals
	Bivalve	Crustacean	Fish	Gastropod	Herp	Insect	Mammal	Plant	
Amite-Tickfaw	7 (0)	0 (0)	8 (1)	0 (0)	4 (4)	0 (0)	0 (0)	0 (0)	19 (1)
Bogue Chitto-Pearl	9 (0)	2 (0)	18 (2)	0 (0)	9 (8)	0 (0)	1 (0)	3 (0)	42 (4)
Cajun Prairie	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Calcasieu	4 (0)	4 (3)	6 (1)	0 (0)	5 (2)	3 (3)	0 (0)	0 (0)	22 (7)
Chenier-Coastal Prairie	0 (0)	0 (0)	0 (0)	0 (0)	2 (1)	0 (0)	1 (0)	0 (0)	3 (0)
Little River	1 (1)	3 (3)	4 (0)	0 (0)	3 (2)	0 (0)	0 (0)	0 (0)	11 (4)
Ouachita-Bartholomew	12 (0)	3 (2)	12 (0)	1 (0)	4 (1)	0 (0)	0 (0)	0 (0)	32 (2)
Sabine Prairie	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Saline Bayou	0 (0)	2 (2)	1 (0)	0 (0)	2 (0)	1 (1)	0 (0)	0 (0)	6 (3)
Rest of the State	25 (1)	14 (11)	32 (3)	2 (0)	12 (7)	7 (7)	1 (0)	1 (1)	94 (24)
Totals	30 (1)	15 (11)	33 (3)	2 (0)	13 (2)	8 (8)	1 (0)	4 (1)	106 (26)

1. AMITE-TICKFAW

The Amite-Tickfaw COA was delineated to capture priority areas for protection and restoration actions in the Pine Forests and Woodlands ecosystem and the Floodplain Forests and Woody Wetlands ecosystem as well as restoration of linear connectivity (*Table 7.4*). Compared to the rest of the state, this area has somewhat lower terrestrial resilience to changes in climate. Further, as of 2021, 7.1% of the acres in this COA has been identified as urban with an additional 24.8% considered to have at least a moderate probability for urbanization by 2060, which is higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.4. Focal Habitats known or expected to occur within the Amite-Tickfaw Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Upland Hardwoods	Hardwood Slope Forest	S3	-
	Mixed Forest and Woodland	Mixed Hardwood-Loblolly Pine Forest	S3	-
		Spruce Pine-Hardwood Flatwoods	S2	Yes
	Pine Forest and Woodland	Eastern Upland Longleaf Pine Woodland	S1	-
	Riparian Forest and Woody Wetland	Bottomland Hardwood Forest	S4	-
		Cypress-Tupelo-Blackgum Swamp	S4	-
		Small Stream Forest	S2	-

2. BOGUE CHITTO-PEARL

The Bogue Chitto-Pearl COA was delineated to capture priority areas for protection and restoration actions in the Pine Forests and Woodlands ecosystem and the Floodplain Forests and Woody Wetlands ecosystem and linear connectivity, well as restoration of connectivity to the floodplain (*Table 7.5*). Compared to the rest of the state, this area has somewhat lower terrestrial resilience to changes in climate. Further, as of 2021, 12.8% of the acres in this COA has been identified as urban with an additional 34.8% considered to have at least a moderate probability for urbanization by 2060, which is higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.5. Focal Habitats known or expected to occur within the Bogue Chitto-Pearl Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Coastal	Coastal Live Oak-Hackberry Forest	S1	-
	Pine Forest and Woodland	Eastern Longleaf Pine Flatwoods Savanna	S1	-
		Eastern Upland Longleaf Pine Woodland	S1	-
	Mixed Forest and Woodland	Mixed Hardwood-Loblolly Pine Forest	S3	-
		Shortleaf Pine/Oak Hickory Woodland	S1	-
	Riparian Forest and Woody Wetland	Bayhead Swamp	S3	-
		Bottomland Hardwood Forest	S4	-
		Cypress-Tupelo-Blackgum Swamp	S4	-
		Eastern Hillside Seepage Bog	S1	-
		Pondcypress-Blackgum Swamp	S1	-
		Slash Pine-Pondcypress/Hardwood Woodland	S2	Yes
		Small Stream Forest	S2	-
	Upland Hardwood Forest and Woodland	Hardwood Slope Forest	S3	-
Transitional	Coastal Wetland	Intermediate Marsh	S3	-
	Herbaceous Wetland	Freshwater Marsh	S2	-

3. CAJUN PRAIRIE

The Cajun Prairie COA⁴ was delineated in 2015 to capture priority areas for protection and restoration actions of grassland ecosystems (*Table 7.6*). This update captured those actions and also identified opportunities to restore the lateral and linear connectivity of streams and rivers. Compared to the rest of the state, this area has somewhat lower terrestrial resilience to changes in climate, but higher coastal resilience to sea level rise. Further, as of 2021, 4.1% of the acres in this COA has been identified as urban with an additional 51.5% considered to have at least a moderate probability for urbanization by 2060, which is higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.6. Focal Habitats known or expected to occur within the Cajun Prairie Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Transitional	Coastal Wetland	Coastal Prairie	S1	Yes
	Herbaceous Wetland	Prairie Pothole	S1	Yes

4. CALCASIEU

The Calcasieu COA was primarily delineated to capture priority areas for protection and restoration actions in the Freshwater Streams and Rivers ecosystem, but has significant overlap with protection and restoration priorities for Pine Forests and Woodlands ecosystem and the Floodplain Forests and Woody Wetlands ecosystem (*Table 7.7*). In addition, the COA encompasses prairie restoration opportunities. Compared to the rest of the state, this area has high terrestrial resilience to changes in climate. Further, as of 2021, 6.2% of the acres in this COA has been identified as urban with an additional 1.3% considered to have at least a moderate probability for urbanization by 2060, which is lower than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.7. Focal Habitats known or expected to occur within the Calcasieu Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Freshwater	Lentic	Flatwoods Pond	S2	-
Forest	Pine Forest and Woodland	Western Longleaf Pine Savanna (Acidic)	S2	Yes
		Western Upland Longleaf Pine Woodland	S3	Yes
	Mixed Forest and Woodland	Mixed Hardwood-Loblolly Pine Forest	S3	-
		Shortleaf Pine/Oak Hickory Woodland	S1	-
		Xeric Sandhill Woodland	S1	-
	Riparian Forest and Woody Wetland	Bayhead Swamp	S3	-
		Bottomland Hardwood Forest	S4	-
		Cypress-Tupelo-Blackgum Swamp	S4	-
		Forested Seep	S3	-
		Small Stream Forest	S2	-
		Western Hillside Seepage Bog	S1	Yes
	Upland Hardwood Forest and Woodland	Hardwood Slope Forest	S3	-
Grassland	Glade	Sandstone Glade	S2	Yes
	Prairie	Coastal Prairie	S1	Yes
		Calcareous Prairie	S1	-
Subterranean	Cave	Cave	S1	-

⁴ Cajun Prairie was known as Calcasieu Prairie in the 2015 SWAP.

5. CHENIER-COASTAL PRAIRIE

The Chenier-Coastal Prairie COA (labeled Chenier COA in the 2015 SWAP) was delineated in 2015 to capture priority areas for protection and restoration actions in coastal prairie and chenier ecosystems (*Table 7.8*). This update also identified opportunities to restore the lateral and linear connectivity of streams and rivers. Compared to the rest of the state, this area has somewhat higher coastal resilience to sea level rise. Further, as of 2021, 4.7% of the acres in this COA has been identified as urban with an additional 9.7% considered to have at least a moderate probability for urbanization by 2060, which is higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.8. Focal Habitats known or expected to occur within the Chenier-Coastal Prairie Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Coastal	Coastal Live Oak-Hackberry Forest	S1	-
Grassland	Coastal	Coastal Dune Grassland	S1	-

6. LITTLE RIVER

The Little River COA was primarily delineated to capture priority areas for protection and restoration actions in the Floodplain Forests and Woody Wetlands ecosystem as well as restoration of linear and lateral connectivity (*Table 7.9*). This analysis also identified some action opportunities for pine forest and grasslands. Compared to the rest of the state, this area has higher terrestrial resilience to changes in climate. Further, as of 2021, 5.9% of the acres in this COA has been identified as urban with an additional 2% considered to have at least a moderate probability for urbanization by 2060, which is lower than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.9. Focal Habitats known or expected to occur within the Little River Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Pine Forest and Woodland	Western Upland Longleaf Pine Woodland	S3	Yes
		Calcareous Forest	S2	-
	Mixed Forest and Woodland	Mixed Hardwood-Loblolly Pine Forest	S3	-
		Shortleaf Pine/Oak Hickory Woodland	S1	-
		Bottomland Hardwood Forest	S4	-
	Riparian Forest and Woody Wetland	Cypress-Tupelo-Blackgum Swamp	S4	-
		Forested Seep	S3	-
		Small Stream Forest	S2	-
		Western Hillside Seepage Bog	S1	Yes
	Upland Hardwood Forest and Woodland	Hardwood Slope Forest	S3	-
Grassland	Prairie	Calcareous Prairie	S1	-

7. OUACHITA-BARTHOLOMEW

The Ouachita-Bartholomew COA was primarily delineated to capture priority areas for protection and restoration actions in the Floodplain Forests and Woody Wetlands ecosystem as well as restoration of linear connectivity (*Table 7.10*). This analysis also identified some action opportunities for pine forest, grasslands, and lateral connectivity. Compared to the rest of the state, this area has similar terrestrial resilience to changes in climate. Further, as of 2021, 7.5% of the acres in this COA has been identified as urban with an additional 8.9% considered to have at least a moderate probability for urbanization by 2060, which is slightly higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.10. Focal Habitats known or expected to occur within the Ouachita-Bartholomew Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Mixed Forest and Woodland	Mixed Hardwood-Loblolly Pine Forest	S3	-
	Riparian Forest and Woody Wetland	Bottomland Hardwood Forest	S4	-
		Wet Hardwood Flatwoods	S2S3	-
	Upland Hardwood Forest and Woodland	Hardwood Slope Forest	S3	-
Grassland	Prairie	Ouachita Sand Prairie	S1	-

8. SABINE PRAIRIE

The Sabine Prairie COA was delineated in 2015 to capture priority areas for protection and restoration actions of grassland ecosystems (*Table 7.11*). This update also identified opportunities to restore the lateral and linear connectivity of streams and rivers. Compared to the rest of the state, this area has lower terrestrial resilience to changes in climate, and somewhat higher coastal resilience to sea level rise. Further, as of 2021, 4% of the acres in this COA has been identified as urban with an additional 64% considered to have at least a moderate probability for urbanization by 2060, which is much higher than the state as a whole (statewide urban increase of 7.5% by 2060).

TABLE 7.11. Focal Habitats known or expected to occur within the Sabine Prairie Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Grassland	Coastal	Coastal Prairie	S1	Yes

9. SALINE BAYOU

The Saline Bayou COA was primarily delineated to capture priority areas for protection and restoration actions in the Floodplain Forests and Woody Wetlands ecosystem as well as protection of existing lateral connectivity (*Table 7.12*). This analysis also identified some action opportunities for pine forest, grassland, and linear connectivity. Compared to the rest of the state, this area has slightly higher terrestrial resilience to changes in climate. Further, as of 2021, 5.3% of the acres in this COA has been identified as urban with a very low probability for additional urbanization by 2060.

TABLE 7.12. Focal Habitats known or expected to occur within the Saline Bayou Conservation Opportunity Area based on Louisiana Department of Wildlife and Fisheries data.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Pine Forest and Woodland	Western Upland Longleaf Pine Woodland	S3	Yes
	Mixed Forest and Woodland	Calcareous Forest	S2	-
		Mixed Hardwood-Loblolly Pine Forest	S3	-
		Shortleaf Pine/Oak Hickory Woodland	S1	-
		Xeric Sandhill Woodland	S1	-
	Riparian Forest and Woody Wetland	Bayhead Swamp	S3	-
		Cypress-Tupelo-Blackgum Swamp	S4	-
		Small Stream Forest	S2	-
		Western Hillside Seepage Bog	S1	Yes
Grassland	Prairie	Saline Prairie	S1S2	-
		Calcareous Prairie	S1	-

10. BARATARIA-TERREBONNE

The Barataria-Terrebonne COA was delineated in 2015 to capture priority areas for protection and restoration actions of seagrass and barrier island ecosystems (*Table 7.13*). This COA was included in the 2025 set without further analysis. However, the 2023 Blueprint Report (see supplemental materials) identified that only 17% of seagrass and barrier island ecosystems in this part of the state scored in fair to good or better coastal condition. Further, the assessment found about 50% of the area to be important for sea turtles and 41% of the acreage to be important for marine mammals, ranking both above the 70th percentile. However, NOAA sea level rise inundation data indicates nearly all the island acres evaluated would be affected by a 2.7' sea level rise by 2060.

TABLE 7.13. Focal Habitats known or expected to occur within the Barataria-Terrebonne Conservation Opportunity Area as reported in the 2015 State Wildlife Action Plan.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Coastal	Barrier Island Live Oak Forest	S1	Yes
		Coastal Live Oak-Hackberry Forest	S1	-
		Coastal Mangrove-Marsh Shrubland	S2	-
Grassland	Coastal	Salt Marsh	S3S4	-
		Coastal Dune Grassland	S1	-
Beach and Dune	Beach	Louisiana Beach		-
		Barrier Island		-
	Dune	Coastal Dune Shrub Thicket	S1	-
Marine	Seagrass	Marine Seagrass Bed	S1S2	-

11. CHANDELEURS

The Chandeleurs COA was delineated in 2015 to capture priority areas for protection and restoration actions of seagrass and barrier island ecosystems (*Table 7.14*). This COA was included in the 2025 set without further analysis. However, the 2023 Blueprint Report (see supplemental materials) identified only 18% of seagrass and barrier island ecosystems in this part of the state that scored in fair to good or better coastal condition. Further, the assessment found 2,211 acres with seagrasses present and 97% of the acreage ranked above the 70th percentile for sea turtle habitat. The area also showed about 15% being above the 70th percentile for marine mammals. However, NOAA sea level rise inundation data indicates nearly all the island acres evaluated would be affected by a 2' sea level rise by 2060.

TABLE 7.14. Focal Habitats known or expected to occur within the Chandeleurs Conservation Opportunity Area as reported in the 2015 State Wildlife Action Plan.

BIOME	ECOSYSTEM GROUP	NATURAL COMMUNITY	S-RANK	ENDEMIC
Forest	Coastal	Coastal Mangrove-Marsh Shrubland	S2	-
Grassland	Coastal	Coastal Dune Grassland	S1	-
Beach and Dune	Beach	Louisiana Beach		-
		Barrier Island		-
Marine	Seagrass	Marine Seagrass Bed	S1S2	-

Chapter 8: Threats

INTRODUCTION

Louisiana is home to a multitude of unique ecosystems with habitats that support a rich diversity of species, some of which can be found nowhere else in the world. Many of the species that Louisiana has identified as Species of Greatest Conservation Need (SGCN) depend on these ecosystems to exist. It is important to recognize potential threats to these ecological communities to better manage and conserve habitat to preserve these key species.

Much of Louisiana has been altered from its original state by human expansion and development resulting in the reduction and impairment of suitable habitat for SGCN. State Wildlife Action Plans are required to identify threats that may adversely affect SGCN and the habitats that support them. This chapter focuses on 12 threat categories with applicable subcomponents, which are mostly based on the *Conservation Measures Partnership's Direct Threats Classification, 2.0* (CMP 2016). In many instances, the definitions associated with each threat have been pulled directly from the original source document. The exception is Data Gaps, which LDWF included as an additional threat to those officially listed in the threats classification document.

RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Threats posed by human settlements and other nonagricultural land uses with a substantial footprint can be further broken down into three subcategories: residential, commercial, and associated development. Despite much of the landscape remaining relatively sparsely populated, development is a primary threat to SGCN.

HOUSING AND URBAN AREAS

According to the 2020 U.S. Census Bureau, Louisiana is the 33rd largest state by area but the 25th most densely populated state, with over 4.6 million residents occupying roughly 52,419 square miles or 33.5 million acres, of which 9,168 square miles or 5.9 million acres is water.

Intensive development destroys natural habitats and can alter local hydrology and facilitates the introduction of invasive species (whether intentional or inadvertent) and cause considerable disruption to the environment. Urbanization, road construction, and forest fragmentation can also increase impacts to the environment by hindering the dispersal and migration of forest plants and animals.

Cities and towns, including non-housing development associated with housing, occupy an increasingly large area of former wildlife habitat. Louisiana's overall recent population growth has not been dramatic, with an overall increase of 2.7% from the 2010 to the 2020 census (*Figure 8.1*).

POPULATION CHANGE BY PARISH FROM 2010 TO 2020

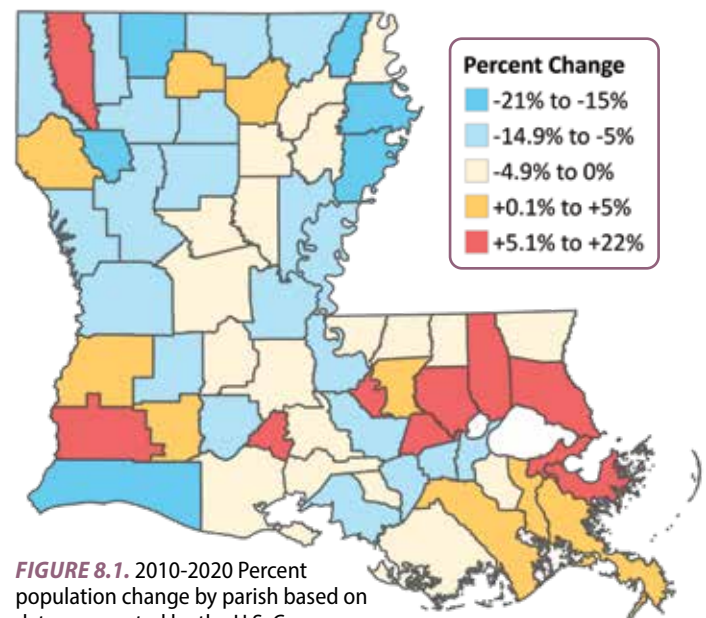


FIGURE 8.1. 2010-2020 Percent population change by parish based on data as reported by the U.S. Census.

Generally, human expansion focuses development around areas of higher populations (i.e. urban sprawl). The amount of land conversion associated with urban growth varies across the state but is correlated with these population centers.

- **Action Strategy:** Work with partners to reduce and mitigate the impacts of urbanization.
- **Action Strategy:** Minimize habitat fragmentation by utilizing habitat corridors and maximize retention of large unfragmented patches of high-quality habitats.
- **Action Strategy:** Manage stormwater runoff utilizing ecosystem services and green infrastructure.
- **Action Strategy:** Increase support for landowner outreach and citizen-based voluntary conservation initiatives such as the Louisiana Natural Areas Registry Program, Certified Native Habitat Program, and other habitat certification initiatives.
- **Action Strategy:** 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.

COMMERCIAL AND INDUSTRIAL AREAS

In addition to housing and population expansion, it is important to consider other aspects of development that can have a large impact to habitat through land fragmentation and conversion. Commercial development consumes large amounts of space, providing retail opportunities, distribution centers, business centers, and entertainment opportunities that attract supporting economies and often results in population growth. These areas change the surrounding landscape and can drastically alter local ecology.

AGRICULTURE AND AQUACULTURE

Agricultural and aquacultural threats can be subdivided into multiple categories, each with its own unique set of challenges that can affect the surrounding landscape and natural communities.

ANNUAL AND PERENNIAL NON-TIMBER CROPS

Non-timber crops are cultivated in farms, plantations, orchards, vineyards, and mixed agroforestry systems for purposes such as food, fodder, fiber, fuel, and other uses. Agricultural production and development serve as vital economic engines, significantly influencing communities, local and national food supplies, and individual livelihoods. The USDA\NASS 2024 State Agriculture Overview for Louisiana identifies soybeans, rice, and corn as the three leading annual crop commodities, with harvested areas measuring 1,060,000 acres for soybeans, 459,000 acres for rice, and 443,000 acres for corn. However, these activities can also negatively affect habitats, species ecology, and habitat continuity.

- **Action Strategy:** Work with the legislature to develop tax incentives for landowners to encourage conservation of priority natural communities.
- **Action Strategy:** Provide educational information on natural communities and the importance of SGCN to landowners and managers through participation in outreach events, presentations, workshops, and online resources.
- **Action Strategy:** Use citizen science programs to monitor natural communities and the impacts of commercial developments.

TOURISM AND RECREATION AREAS

Expanding population densities create additional industry opportunities for entertainment and leisure activities. Construction of facilities such as resorts, golf courses, and marinas can have a substantial footprint that further alters habitat and can affect local ecology through increased human presence and activity.

- **Action Strategy:** Promote responsible siting of commercial developments.
- **Action Strategy:** Prioritize land acquisition for conservation and associated non-consumptive wildlife recreation opportunities.
- **Action Strategy:** Invest in education and outreach tools promoting non-consumptive wildlife recreation opportunities available on municipal, state, and federal properties.
- **Action Strategy:** Promote planting of native species (local community specific) and incorporation of natural habitats adjacent to or within facilities.
- **Action Strategy:** Encourage minimal use of fertilizers to maintain local water quality.
- **Action Strategy:** Promote nature exploration such as hiking, biking, kayaking, bird watching, and other low impact nature-based activities in urban areas.

- **Action Strategy:** Encourage the use of farming practices and plant varieties that provide ecosystem services and minimize the impacts to native wildlife.

WOOD AND PULP PLANTATIONS

Most of Louisiana's terrestrial wildlife species occur in forested habitats. Louisiana hosts almost 15 million acres of forestland and, as of 2025, approximately 8 million acres of that land was in private, non-industrial ownership (LDAF 2025). Tracts planted as monocultures such as most pine plantations provide little tangible habitat for species. However, proper management of these areas can, in some cases, provide limited benefits.

- **Action Strategy:** Encourage silvicultural practices that promote natural disturbance regimes.
- **Action Strategy:** Promote the use of Longleaf Pine and tree spacing configurations that allow herbaceous understory development.



Cattle grazing on a beach in Cameron Parish.

LIVESTOCK FARMING AND RANCHING

Livestock operations, if not managed responsibly, can have unintended consequences on the landscape. Activities related to cattle ranches, dairies, hog farms, and poultry operations can contribute to increased nutrient runoff and erosion, both of which are known to degrade water quality and damage habitats.

- **Action Strategy:** Work with landowners to prevent over grazing of sensitive habitat and to minimize livestock access to flowing waters.
- **Action Strategy:** Work with landowners to conduct operations aimed at minimizing runoff of animal waste through responsible drain design and buffers.
- **Action Strategy:** Restore riparian areas adjacent to livestock operations to maintain bank stability and improve water quality.
- **Action Strategy:** Promote and incentivize native grassland restoration and compatible grazing.

- **Action Strategy:** Promote the use of prescribed fire to ranching communities as a rangeland and pastureland management tool.
- **Action Strategy:** Promote conservation grazing in historical prairie and savanna regions.

MARINE AND FRESHWATER AQUACULTURE

Aquaculture in Louisiana is a multimillion dollar industry with over 800 operations contributing to the state’s agricultural economy (USDA 2024). Water quality, operational controls, and site containment strategies are key in supporting these types of operations and minimizing their potential ecological impacts.

- **Action Strategy:** Discourage the use of non-native species in aquaculture operations.
- **Action Strategy:** Implement and promote the use of BMPs and SMZs in appropriate habitat and promote the creation of Hazard Analysis Control Point (HACP) plans for potential aquaculture releases.

ENERGY PRODUCTION AND MINING

Threats from production of non-biological resources can be direct and indirect. This section discusses the potential issues surrounding energy production and mineral extraction.

OIL AND GAS DRILLING

The exploration, development, and production of petroleum and other hydrocarbons in the form of oil and gas wells can negatively affect SGCN and their habitats. According to the U.S. Energy Information Administration, Louisiana currently ranks 6th in the country for energy production. Louisiana accounts for approximately 10% of the nation’s natural gas production (Figure 8.2) and is among the top 10 states for crude oil reserves and production (Figure 8.3). Construction of access roads to these sites impacts species and further contributes to habitat fragmentation (Figure 8.4). In addition, catastrophic oil releases at well sites can cause acute and chronic impacts to wildlife and their habitats.

- **Action Strategy:** Implement and promote the use of BMPs during exploration, production, and de-commissioning of energy production infrastructure.
- **Action Strategy:** Provide information to oil, gas, and seismic companies and encourage resource survey and mining techniques that avoid or minimize impacts to SGCN and their habitats.

MINING AND QUARRYING

The exploration, development, and production of minerals and rocks in the form of mines, quarries, and sand and gravel pits can negatively affect SGCN and their habitats. These activities can include those that not only alter habitat but can also result in terraforming that converts the entire area from its natural state. These operations can result in additional land fracturing, chemical seepage, and sediment loss, which can further degrade habitat over time.

LOUISIANA'S OIL WELLS

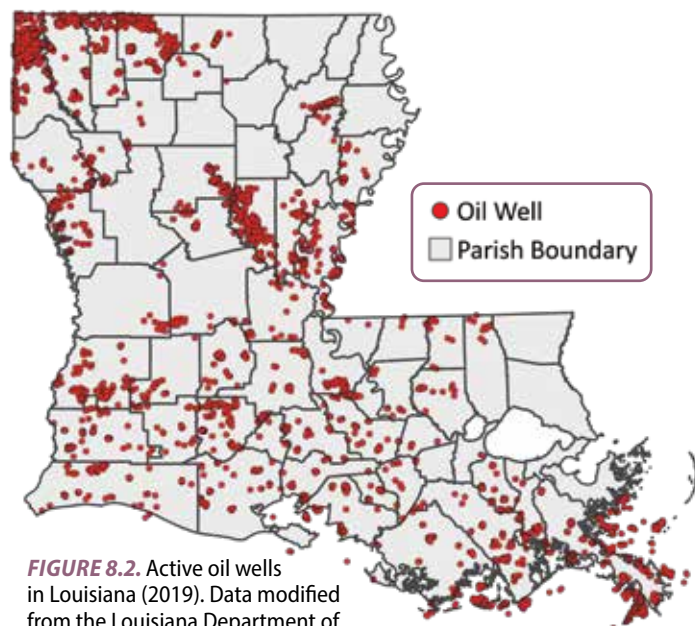


FIGURE 8.2. Active oil wells in Louisiana (2019). Data modified from the Louisiana Department of Energy and Natural Resources, Office of Conservation's locations of oil and gas wells in Louisiana as of 2019.

LOUISIANA'S NATURAL GAS WELLS

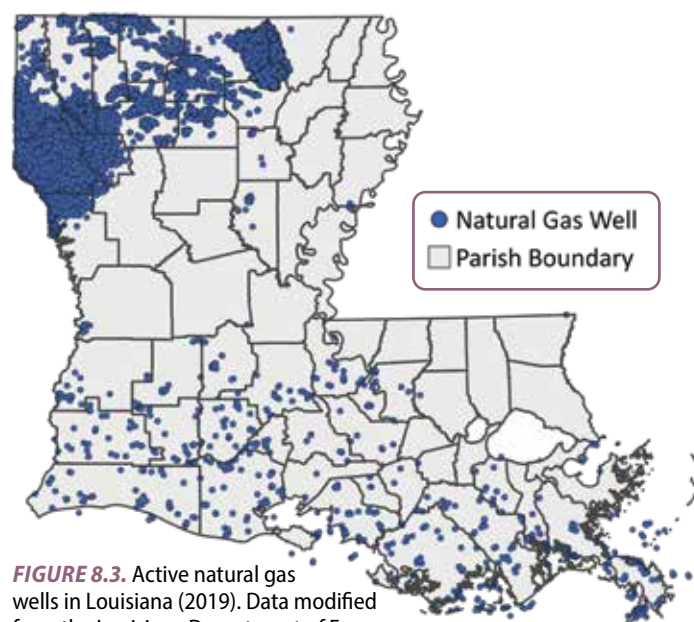


FIGURE 8.3. Active natural gas wells in Louisiana (2019). Data modified from the Louisiana Department of Energy and Natural Resources, Office of Conservation's locations of oil and gas wells in Louisiana as of 2019.



FIGURE 8.4. Satellite image of well pads (small pale rectangles) for natural resource extraction in Bossier Parish, Louisiana. More than 350 well pads are in this image, with up to eight pads per square-mile. Image from Google Earth, January 2024, at eye altitude ca. 25,000'.



(LEFT) Breton Island after an oil spill. **(BELOW LEFT)** A coastal marsh after an oil spill. **(BELOW RIGHT)** A Brown Pelican at Queen Bess Island covered in oil after an oil spill.



- **Action Strategy:** Encourage protection of natural sediments of sand and gravel bars by working with the LDWF Scenic Rivers Program and partners.

RENEWABLE ENERGY

The exploration, development, and production of renewable energy through solar and wind farms can pose risks to SGCN and their habitats. Often such projects require large footprints, destroying habitat and displacing wildlife. Birds and bats face direct mortality from collisions with wind turbines, and Louisiana's location within the Mississippi Flyway and the trans-Gulf migration corridor may heighten the collision risks for migratory birds. In addition to collisions, wind energy development may displace birds from otherwise high quality habitat, leading to functional habitat loss. It is essential to take precautions during all project phases to minimize or mitigate negative impacts. Careful consideration of the timing, location, and scale of these projects can help minimize their environmental effects.

In addition, large-scale solar farms covering extensive contiguous areas can permanently displace species like the Gopher Tortoise. If these projects are not properly designed and maintained, they may also lead to further issues related to erosion and habitat fragmentation.

- **Action Strategy:** Ensure renewable energy facilities are sited to minimize negative impacts to SGCN and associated habitats.
- **Action Strategy:** Research the impacts of renewable energy on SGCN and associated habitats.
- **Action Strategy:** Promote the use of wildlife-friendly erosion control blankets.
- **Action Strategy:** Promote native grassland plantings for solar farms.
- **Action Strategy:** Promote wildlife-friendly lighting on wind turbines to reduce collision risk.

TRANSPORTATION AND SERVICE CORRIDORS

Threats from long, narrow transportation and service corridors include habitat fragmentation and wildlife mortality from vehicular strikes.

ROADS AND RAILROADS

Surface transport on roadways and dedicated tracks includes highways, secondary roads, logging roads, bridges and causeways, and railroads. Fencing associated with roads is included with this threat. Additional roadways and improvements to heavily trafficked areas can provide additional access and opportunities for local human populations. However, these travel corridors can be barriers to local wildlife if not properly sited and constructed. Although pollution from roadways is a concern for local biodiversity, it is addressed in the Pollution section of this chapter.

- **Action Strategy:** Work with partners to promote the use of bridges and culverts designed for wildlife and fish passage such as the installation of oversized culverts below grade. In addition, minimize impacts of road, bridge, and culvert construction and replacement on stream quality.
- **Action Strategy:** Work with partners, particularly in planning phases, to address wildlife-vehicle strike minimization measures such as creating wildlife crossings.
- **Action Strategy:** Coordinate with partners to implement the use of bat-friendly bridges and culverts at stream crossings.
- **Action Strategy:** Work with partners to improve connectivity between breeding ponds to reduce mortality of species (e.g., amphibians and turtles) by vehicle strikes and to facilitate gene flow.
- **Action Strategy:** Promote the use of wildlife-friendly erosion control blankets.

UTILITY AND SERVICE LINES

Transport of energy and resources includes electrical and phone wires, aqueducts, and oil and gas pipelines. Fragmentation of interior forest occurs when new rights-of-way (ROW) are cleared. Transmission lines and pipelines can often act as corridors for invasive plant species. In addition, overhead power lines can act as barriers for bats and birds, increasing the likelihood of collisions. Although much of the infrastructure is already in place, proper management practices for these areas

and additional consideration to minimize impact to SGCN during the planning phase of future projects can aid in minimizing and mitigating some of the unintended impacts.

- **Action Strategy:** Promote the use of wildlife-friendly erosion control blankets.
- **Action Strategy:** Retain and plant native species on rights-of-way.
- **Action Strategy:** Bury utility lines to minimize risks of animal collisions.
- **Action Strategy:** Encourage the use of USFWS' *Recommended Best Practices for Communication Towers* (2021).

SHIPPING LANES

In order to maintain shipping lanes for transport in freshwater and coastal waterways, dredging of stream bottoms is necessary. However, dredging degrades habitat for many fish and mollusk SGCN. Wakes from cargo ships and barges damage shorelines, which can further degrade habitat and cause a variety of issues affecting sedimentation and water quality. In addition, commercial and recreational boats may strike and critically injure or kill wildlife.

- **Action Strategy:** Encourage and maximize the beneficial use of dredge material.
- **Action Strategy:** Promote no wake zones in areas critical for wildlife.
- **Action Strategy:** Post signage in work areas and at boat launches of water bodies where manatee may occur to reduce strike risk.

FLIGHT PATHS

Air transport may result in noise disturbance and bird strikes. Most bird-aircraft strikes take place at or near airports, generally occurring during take-off or landing. This potential threat is not unique to Louisiana, and these strikes account for a relatively small amount of bird deaths per year (USFWS 2024). This can, however, compromise air travel safety; therefore, bird movements should be considered by airports and air crew.

- **Action Strategy:** Work with partners to incorporate language into airport hazard mitigation plans that benefits wildlife.

BIOLOGICAL RESOURCE USE

Threats associated with the consumptive use of “wild” biological resources encompass both intentional and unintentional consequences of harvesting. These impacts can affect both target and nontarget species as well as their habitats. This includes the persecution and control of specific species as well as nontargets that may be injured as bycatch.

HUNTING AND COLLECTING TERRESTRIAL ANIMALS

This subcategory includes the killing or trapping of terrestrial wild animals for commercial or recreational use, subsistence, research, cultural purposes, or for predator control/persecution reasons. It also includes accidental mortality of nontarget species.

The Louisiana Wildlife and Fisheries Commission is tasked with the control and oversight of all terrestrial wildlife in the state. It receives and reviews biological, socioeconomic, and other technical data as well as management recommendations from LDWF staff. Combining these data with public input, the Commission votes on actions for long term management and sustainability of the resource. These regulations include, but are not limited to, hunting seasons and harvest limits.

- **Action Strategy:** Ensure management plans include considerations for SGCN.

LOGGING AND WOOD HARVESTING

Forest harvesting activities are typically associated with the removal of trees for timber, wood pulp, fiber, or energy. These activities commonly remove entire forest stands, which can severely alter habitat, ecological passage, and soil retention capabilities. Proper planning and management is critical for reducing long term effects when performing forest harvesting activities. For specific site planning and management, the Louisiana Department of Agriculture and Forestry has established a *Recommended Forestry Best Management Practices for Louisiana* (LDAF 2022) field manual that provides additional guidance to reduce the impacts of these forest related activities.

- **Action Strategy:** Discourage bedding and stump removal during silvicultural operations.
- **Action Strategy:** Work with timber companies to implement BMPs in appropriate habitats.
- **Action Strategy:** Retain snags, logs, over-mature trees, and other woody debris in suitable habitat.

HUMAN INTRUSION AND DISTURBANCE

Human activities related to various non-consumptive uses can modify and disturb habitats. While these threats typically do not result in permanent habitat destruction, the potential effects from human disturbance can be significant to many SGCN and their habitats, with certain species being especially vulnerable. Non-consumptive use refers to activities where the resource remains intact and can be enjoyed by multiple user groups.

RECREATIONAL ACTIVITIES

People spending time in nature or traveling in vehicles outside of established transportation corridors for recreational purposes may affect SGCN. This category includes off-road vehicles, motorboats, personal watercraft, mountain bikes, hikers, birders, pets in recreation areas, and temporary campsites, among others. This section does not include permanent recreation facilities or permanent transport corridors, which have been previously covered in this chapter.

- **Action Strategy:** Monitor and, if necessary, buffer timber harvest activities around known SGCN occurrences to reduce negative impacts from activities such as soil compaction from heavy machinery.
- **Action Strategy:** Work with the legislature to develop tax incentives for landowners to encourage conservation of priority natural communities.
- **Action Strategy:** Promote tree harvest that mimics natural disturbance.
- **Action Strategy:** Work with landowners to encourage use of BMPs for prescribed fire management and timber harvesting techniques to improve habitat quality.

FISHING AND HARVESTING AQUATIC RESOURCES

Like with terrestrial wildlife, the Louisiana Wildlife and Fisheries Commission is tasked with the control and oversight of all aquatic wildlife in the state. These regulations include, but are not limited to, fishing seasons, creel limits, and the collection and sale of amphibians and reptiles.

The harvest of aquatic wild animals for commercial or recreational use, subsistence, research, cultural purposes, or for control/persecution reasons may include accidental mortality and trawling bycatch. Abandoned traps and fishing gear allowed to remain in place while not in use (e.g., derelict crab traps) can result in the continued catch and kill of species and pose a strike hazard to watercraft.

- **Action Strategy:** Remove passive fishing gear that are not in use, including derelict crab traps, in order to minimize mortality of wildlife and fish species.
- **Action Strategy:** Promote harvest of invasive species (e.g., Silver Carp [*Hypophthalmichthys molitrix*]) in place of native species for bait and other purposes.

LDWF manages over 1.6 million acres of land and waterways designated as wildlife management areas, refuges, and conservation areas. These spaces are vital for numerous species that rely on diverse habitats. However, these lands are not just protecting Louisiana's natural resources, they are also offering various outdoor recreational opportunities to the public.

Camping sites, if not properly kept, can result in habitat disturbance that can disrupt and harm vulnerable species. The accumulation of human rubbish in an area, when not properly disposed of, can be an attractant to nuisance species, which may also prey on at-risk species in the area. Pets, particularly dogs, can also harass local wildlife, leading to unnecessary mortality.

The use of all-terrain vehicles is a popular pastime, but without proper knowledge and care, these activities can result in negative impacts to sensitive habitats such as wetlands,

sandbars, beaches, and more. These activities can not only disrupt or destroy wildlife nesting areas, they can cause direct mortality of adults and active nests. Off-roading can also result in large ruts that can destabilize stream banks, leading to additional habitat degradation.

To ensure the long-term sustainability of these areas, Louisiana is dedicated to collaborating with conservation partners and the public. This includes helping to identify sensitive regions and their habitats, raising awareness, and minimizing the negative effects that recreational activities may have on these environments.

- **Action Strategy:** Work with partners to minimize the impacts of recreational activities, including ORV use, in sensitive areas.
- **Action Strategy:** Promote conservation compatible land use.
- **Action Strategy:** Use signs, stewards, and symbolic fencing to protect nesting areas.
- **Action Strategy:** Support outreach and education aimed at minimizing human impacts to SGCN and priority habitats.
- **Action Strategy:** Educate the public on the impacts of domestic and feral animals (e.g., dogs, cats, and hogs).
- **Action Strategy:** Promote legislation to prevent the intentional release of helium-filled balloons.

NATURAL SYSTEM MODIFICATIONS

This category is defined as "threats from actions that convert or degrade habitat in service of 'managing' natural or semi-natural systems, often to improve human welfare" (CMP 2016). Modifications are frequently implemented in an attempt to address or mitigate effects of disturbances and natural processes. However, these management efforts have the potential to adversely impact or eliminate natural processes essential to ecological communities if not planned carefully.

FIRE AND FIRE SUPPRESSION

In the southeastern United States, low level fires play a crucial role in maintaining various ecosystems, particularly pine savannas and prairies. Longleaf Pine-dominated communities have evolved with frequent low-intensity fires and provide critical habitat for many SGCN.

Various factors such as habitat fracturing and fire suppression can lead to a reduction of fire on these landscapes. If left without fire, these systems will begin to transition into a mixed hardwood system, shifting the competitive advantage away from a pine savanna system. This shift will reduce ground level forest fuels and create a positive feedback loop that further suppresses fire (Loudermilk et al. 2011) while also reducing fire resiliency.

Fire caused by lightning strike is a natural and necessary part of Longleaf Pine ecosystems. However, allowing fuels to accumulate while awaiting this ignition source can result in

MILITARY ACTIVITIES

Military exercises and training activities have the potential to impact SGCN and their habitats. Beyond the facilities and bases, the military also conducts training exercises that covers a large physical footprint across the state.

An important means of collaboration between Louisiana and the U.S. Department of Defense (DoD) is through Integrated Natural Resource Management Plans (INRMPs). INRMPs serve as management plans for the highly diverse habitats for which the DoD is responsible.

These plans are installation-specific and designed to balance conservation and military activities to satisfy environmental legal requirements without compromising the capability of installation lands to support the military's mission. INRMPs are mandatory for all installations, including state-owned National Guard installations, that have significant natural resources. INRMPs must be prepared in cooperation with the U.S. Fish and Wildlife Service (USFWS) and appropriate state fish and wildlife agencies and are intended to reflect the mutual agreement of the agencies concerning the conservation, protection, and management of fish and wildlife resources.

- **Action Strategy:** Continue to work with military installations to minimize the impacts of activities, training exercises, and ranges.

larger, more uncontrollable fires. These larger fires have greater potential to cause damage to property and loss of life than more frequent low-intensity fires in the same area. The regular use of fire is an efficient management tool that can reduce competition and fuel levels to maintain the overall health of these systems and minimize the risk of catastrophic wildfires.

- **Action Strategy:** Support use of prescribed fire to maintain appropriate habitat.
- **Action Strategy:** Reintroduce fire to remnant prairie, marsh, and savanna habitats.
- **Action Strategy:** Assist federal agencies with prescribed fire management on federal lands in fire-dependent ecosystems by providing tools and manpower, as available.



Prescribed fire on a Coastal Prairie.



LDWF biologists conduct a prescribed burn during a prescribed burn workshop.

- **Action Strategy:** Establish and promote Prescribed Burn Associations in all parishes throughout the state that have fire-dependent ecosystems.

DAMS AND WATER MANAGEMENT/USE

Altering water flow patterns beyond their natural range of variation, whether intentionally or unintentionally, can have substantial impacts.

Human activities have significantly disrupted the natural hydrology of Louisiana. Actions such as dam construction and operation; sediment management; alterations to saltwater regimes, saltwater diversion levee, dike, and weir construction; groundwater extraction; channelization; and the creation of artificial lakes have drastically changed natural water flow in the state. These changes frequently reduce the quality and quantity of habitats available to SGCN. Hydrological obstructions, for example, can also lead to increased saltwater intrusion during times of drought by restricting natural flows. Increased saltwater can damage important habitat and affect drinking water. The alteration of flow patterns from human activities should be managed, where possible.

The timing, frequency, magnitude and duration of flows and connectivity are vital components of aquatic systems and provide critical habitat needed for species to survive. In addition, a well-connected network of water allows species to access additional areas, promoting a healthy and resilient ecosystem with migration opportunities.

- **Action Strategy:** Work with partners to review materials (e.g., as fill or bank stabilization) permitted as beneficial use in streams.
- **Action Strategy:** Promote aquatic species passage by establishment and conservation of connectivity through the removal of aquatic barriers and discourage creation of new aquatic barriers.
- **Action Strategy:** Promote instream flows at levels that will support populations of SGCN.

- **Action Strategy:** Minimize and mitigate the impacts and occurrence of saltwater intrusion.

OTHER ECOSYSTEM MODIFICATIONS

Other actions that convert or degrade habitat in service of “managing” natural systems to improve human welfare include land reclamation projects, abandonment of managed lands, mowing grass, beach construction, the removal of snags from streams, and the addition of riprap on shorelines.

- **Action Strategy:** Retain emergent and submerged woody debris (subsidize if warranted) and provide education and outreach regarding the importance of this habitat component.
- **Action Strategy:** Create or restore bird nesting islands when and where feasible and explore potential partnerships and funding mechanisms to support such construction.
- **Action Strategy:** Promote the use of BMPs for mowing.
- **Action Strategy:** Retain overhanging vegetation in waterways to provide thermal refugia and to minimize adverse temperature fluctuations.

REMOVING/REDUCING HUMAN MAINTENANCE

This threat includes the absence or reduction of current or historical maintenance regimes (e.g., supplemental feeding, mowing, and controlled burns) for important key ecological attributes. These regimes are typically maintained by protected area staff, farmers and ranchers, indigenous peoples, private landowners, and other resource managers.

- **Action Strategy:** Support use of prescribed fire to maintain appropriate habitat.
- **Action Strategy:** Promote conservation grazing in historical prairie and savanna regions.
- **Action Strategy:** Reconnect hydrology and reintroduce natural flow regimes to reduce invasive species and promote native flora and fauna.
- **Action Strategy:** Promote planting of resilient native flora with local genetics.

INVASIVE AND PROBLEMATIC SPECIES, PATHOGENS, AND GENES

This threat includes non-native and problematic native plants, animals, pathogens and microbes, and genetic materials that have (or are predicted to have) harmful effects on biodiversity following their introduction, spread, or increase in abundance or virulence. This section gives a brief overview on the potential ecological impacts that these elements may pose and suggests some potential mitigation strategies. Additional information on invasive species can be found in Chapter 6.

INVASIVE NON-NATIVE/ALIEN PLANTS AND ANIMALS

Harmful plants, animals, pathogens, and other microbes introduced and spread by human activities into areas in which they were not originally found can negatively impact native habitat and species.

The subtropical environment of Louisiana provides suitable habitat for species from many parts of the world. Non-native organisms present a major threat to SGCN. Once introduced, they can rapidly multiply and spread, exploiting habitat and food resources vital for native species. Impacts to habitat can be particularly noticeable in plant communities; where non-native species take over, plant communities can be reshaped, leading to a decline in native diversity and the degradation of habitat quality over time. Invasive terrestrial animals also destroy sensitive habitats as well as agricultural lands. According to the LSU AgCenter, Feral Hogs cause an estimated economic loss of \$91.1 million annually in Louisiana (Salassi et al. 2022).

Numerous invasive and non-native aquatic plants and animals have been documented in Louisiana waters. Aquatic invasions, though occasionally less detectable than those on land, are no less impactful to habitat and wildlife. In addition to posing a threat to SGCN, they can also impact recreational activities by replacing or reducing populations of local sport fish or by clogging waterways with unabated, vegetative growth.

- **Action Strategy:** Promote compliance with lists of banned, invasive, and potentially invasive species of plants and animals.

- **Action Strategy:** Work with agencies and nurseries to discourage the sale of invasive plants.
- **Action Strategy:** Create and maintain hazard analysis and critical control points plans.
- **Action Strategy:** Promote education and outreach regarding the hazards and impacts (e.g., disease, human safety, competition with natives, and ecosystem health) of releasing native and non-native captive animals.
- **Action Strategy:** Inform the public on proper control measures and eradication techniques of invasive plants and animals.
- **Action Strategy:** Restore ecosystem function to promote resilience to mitigate impacts to native species.
- **Action Strategy:** Investigate novel methods of invasive species control.

PROBLEMATIC NATIVE PLANTS AND ANIMALS

Native plants and animals, when their populations become "out of balance," usually through human influence, can become problematic species. Examples include overabundant deer populations, excessive vegetation due to the loss of foraging species, improper stocking rates, and more.

- **Action Strategy:** Promote BMPs and control measures for problematic native species.

INTRODUCED GENETIC MATERIAL

Human-altered organisms or genes include pesticide-resistant crops, genetically modified insects for biocontrol, genetically modified fishes, and genetically modified trees and crops. Modified introduced species have the potential to hybridize with local populations and pass their genetic material to local communities.

Genetically engineered crops may also pose a risk to nontarget species. In addition, consistent pesticide application on crops that are herbicide resistant may facilitate the development of resistant weeds and plants, which could lead to a cycle of increased pesticide use.



Apple snail infestation; note the bubblegum pink egg masses.

- **Action Strategy:** Use integrated pest management for the control of invasive and problematic native plants and animals.
- **Action Strategy:** Maintain unique genetic trajectories and genetic diversity of local native populations.

PATHOGENS AND MICROBES

Harmful native and non-native agents including bacteria, viruses, prions, fungi, and other microorganisms can cause illness to a host. These agents can be detrimental to SGCN by affecting the species directly or indirectly and can spread rapidly if left unchecked.

Wildlife health¹ is a complex, dynamic topic that can be difficult to define and measure. It is more than just the presence or absence of disease caused by pathogens or contaminants; rather, it can be defined by a population's ability to withstand challenges, which may include climate change, habitat loss, or the introduction of a disease-causing agent. Thus, health is the result of interacting biological, social, and environmental determinants (Stephen 2014). Diseases can have significant impacts on wildlife populations. The development of disease depends on factors related to the host organism, its environment, and the disease-causing agent. Pathogens (e.g., bacteria, viruses, parasites, and prions) and contaminants are normally present in wildlife populations, with disease typically occurring at low levels, but becoming more prevalent when hosts are stressed. An emerging disease is defined as "one that has recently been discovered; has recently increased in incidence, geography, or host range; or is newly evolved" (Rachowicz et al. 2005). Two hypotheses can apply to an emerging disease: the novel pathogen hypothesis states that the disease has recently spread into new geographic areas, whereas the endemic pathogen hypothesis suggests that it has been present in the environment but recently has affected new hosts or increased in its ability to cause disease (Rachowicz et al. 2005). For example, in North America, chytridiomycosis, caused

by the fungus *Batrachochytrium dendrobatidis*, and white-nose syndrome, caused by the fungus *Pseudogymnoascus destructans*, have emerged following pathogen introduction and have had devastating impacts on amphibian and bat populations, respectively. Disease can have direct impacts, such as mortality, or can have indirect impacts, such as reproductive failure; both types of impacts can lead to population declines. As some species disappear from the landscape, others can proliferate, causing an imbalance in predator-prey relationships or overuse of resources. Sometimes these diseases are zoonotic and threaten human health as well. According to the World Health Organization, 70% to 80% of emerging infectious diseases are zoonotic in origin. Wildlife health is a critical component of One Health, which is the intersection of human health, animal health, and environmental health. Therefore, discussions of wildlife health must consider connections with humans, domestic animals, and ecosystems. Such connections may include game species as a food source for humans, pathogens that can be transmitted between wildlife and humans or domestic animals, and the habitats needed to support wildlife populations. In addition, healthy ecosystems provide a variety of ecosystem services for humans, including agricultural production and recreation.

- **Action Strategy:** Monitor disease levels for emerging pathogens.
- **Action Strategy:** Promote BMPs for feeding stations to reduce pathogen transmission.
- **Action Strategy:** Work with partners to address emerging diseases through surveillance and research.
- **Action Strategy:** Promote communication and collaboration among partners to address emerging fish and wildlife health issues more effectively.
- **Action Strategy:** Promote BMPs and protocols for disinfection of field equipment and gear to reduce pathogen transmission.

POLLUTION

Introduction of exotic and excess materials or energy from point and nonpoint sources can have dramatic effects on local species, habitats, and the environment. Damage is generally manifested by reduced air, soil, and water quality, which can directly affect plant, wildlife, fish, and human populations.

Waste and effluents originating from urban populations, municipalities, households, and industry can significantly degrade environmental conditions, affecting SGCN and their habitats. Pollutants can dramatically change aquatic systems by altering water chemistry and can damage important terrestrial systems through contamination of soil and water. It is important to consider these potential effects and the actions required to minimize these impacts.

HOUSEHOLD SEWAGE AND URBAN WASTE WATER

This threat includes water-borne sewage and nonpoint runoff of nutrients, sediments, and toxic chemicals (including pharmaceutical contaminants) from housing and urban areas. This threat also includes discharge from municipal waste treatment, leaking septic systems, untreated sewage, outhouses, oil and sediment from roads as well as fertilizers and pesticides from lawns and golf courses.

- **Action Strategy:** Protect aquatic species from anthropogenic threats including release of treated and untreated waste water, nonpoint surface runoff, and water withdrawals for public and industrial water supplies.

¹ The following paragraph was provided by Dr. Ellen Hayes, SEAFWA Regional Wildlife Health Coordinator.



Balloons on a beach.

INDUSTRIAL AND MILITARY EFFLUENTS

This threat includes water-borne pollution from industrial and military sources such as mining, energy production, and resource extraction industries. These contaminants are typically in the form of nutrients, sediments, and toxic chemicals resulting from illegal dumping of chemicals, mine tailings (waste material created from mining activities), leakage from fuel tanks, oil spills from pipelines, and polychlorinated biphenyls (PCBs) in river sediments. Pollution can cause negative impacts even when the source is not located near the affected aquatic system. Some pollutants may only impact these systems once bioaccumulation occurs in the food chain.

The Clean Water Act requires the Louisiana Department of Environmental Quality (LDEQ) to protect waters of the state as it relates to aquatic life, ecological condition, and human health concerns. LDEQ assesses watersheds within the state on a four-year rotation, releasing an updated integrated report every two years. This report details support or non-support for designated uses in each subsegment based on water quality. *Figure 8.5* displays data based on the results of the 2020 integrated report for assessed waters' ability to support fish and wildlife propagation.

According to the Environmental Protection Agency's (EPA) 303(d) 2024 list status, Louisiana has a disproportionately high number of freshwater streams that are categorized as impaired in terms of supporting fish and wildlife propagation. Out of 9,712 miles of streams and rivers assessed, 6,375 (66%) miles were found to have some degree of impairment for this designated use. The primary causes for this impairment include low oxygen, mercury, murky water (also known as turbidity), salts, and pesticides.

ASSESSED FLOWLINES FOR FISH AND WILDLIFE PROPAGATION

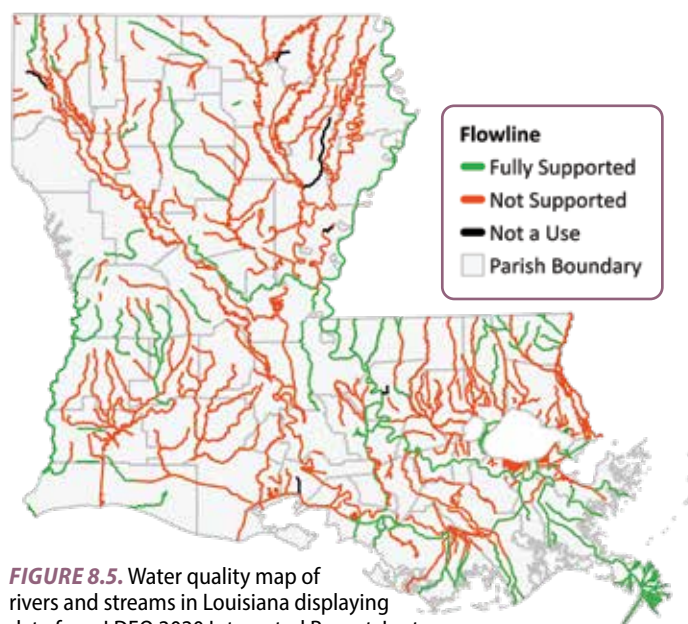


FIGURE 8.5. Water quality map of rivers and streams in Louisiana displaying data from LDEQ 2020 Integrated Report. Last updated 01 Dec 2023.

The EPA's evaluation of lakes and reservoirs in Louisiana indicated that of 581,446 acres assessed, 517,018 acres (89%) were deemed as impaired for fish and wildlife propagation, with the same top five causes contributing to this impaired status as streams and rivers.

In their wetland assessment, which evaluated 941,389 acres, the EPA found that only 75,219 acres (8%) were considered in good condition (i.e. they fully supported fish and wildlife propagation). The primary reasons for impairments are listed as low oxygen, mercury, murky water, and salts.

Lastly, the EPA's assessment of coastal waters within Louisiana found that 3,353 square miles (56%) of the 6,015 square miles were in good condition to support fish and wildlife propagation. The leading causes of impairment in these coastal areas include mercury, low oxygen, pesticides, PCBs, and dioxins.

- **Action Strategy:** Minimize the occurrence and impacts of oil spills and other chemical releases.

AGRICULTURAL AND FORESTRY EFFLUENTS

This threat includes water-borne pollutants from agricultural, silvicultural, and aquacultural systems that include nutrients, toxic chemicals, and sediments. The effects of these contaminants can be seen on and off the sites where they were applied, generated, or stored. Improper handling or application often results in increased discharge of fertilizer and pesticide through runoff, and soil erosion also contributes to off-site pollution.

- **Action Strategy:** Encourage the proper application of pesticides.
- **Action Strategy:** Encourage the use of sediment barriers and reduce soil erosion.

GARBAGE AND SOLID WASTE

Rubbish and other solid materials can entangle or otherwise harm wildlife. This material includes municipal waste, litter from cars and boats, construction and demolition debris, and waste that can trap wildlife such as open bottles, discarded fishing lines, and six-pack rings.

Wildlife entanglement is not the only threat associated with these items. The accumulation of harmful chemicals that can naturally leach out of these items poses an additional risk to ecological systems.

- **Action Strategy:** Ensure alternative garbage and solid waste use policies consider negative impacts to ecosystems.
- **Action Strategy:** Promote recycling of used fishing line.
- **Action Strategy:** Investigate and minimize the impacts of microplastics.

GEOLOGICAL EVENTS

This IUCN category was not addressed when considering threats and action strategies, because landslide and seismic activity is negligible in Louisiana, and there is no volcanic activity.

AIRBORNE POLLUTANTS

Atmospheric pollutants from point and nonpoint sources include acid rain, smog from vehicle emissions, excess smoke, excess nitrogen deposition, radioactive fallout, wind-dispersed pollutants from farm fields, and airborne particulate matter that can cause significant damage to organisms and their environments. These types of pollutants do not often stay in the atmosphere and, after a time, will condense and precipitate or deposit into other systems causing additional impacts over a larger area.

- **Action Strategy:** Promote use of no-till farming practices and other BMPs to reduce airborne particulates and pollutants.

EXCESS ENERGY

Inputs of heat, sound, and light that may disrupt wildlife or ecosystems include noise from highways or aircraft, heated water from power plants, floodlights and other outdoor lighting, and atmospheric radiation resulting from ozone gaps. Manatees have been lured to heated water discharge from power or chemical plants; such conditions may cause these individuals to attempt to overwinter, causing mortality of this threatened species. Attraction to lights can greatly impact insect behavior, possibly affecting reproductive events. Lighting also disorients migratory animals and may increase likelihood of collisions with buildings and communication towers. In addition, improperly sited lights near beaches can cause hatchling sea turtles to travel inland instead of to the water.

- **Action Strategy:** Promote education and outreach to reduce the impacts of light pollution.
- **Action Strategy:** Promote wildlife-friendly lighting to reduce collision risk.

CLIMATE CHANGE

Changes in climate patterns and weather events that occur outside of the natural range of variation can be devastating to vulnerable species or habitats. Severe weather events may be increasing in frequency and expanding outside their historical range due to human influences. It is critical to take actions that minimize and mitigate the effects of these threats. See *Chapter 10: Louisiana: A Regional Perspective* for a more in depth consideration of this topic.

ECOSYSTEM ENCROACHMENT

The impacts of displaced ecosystems encroaching upon the habitats of other species can have far-reaching consequences. The migration of an ecosystem is regarded as a form of stress to the ecosystem and its component species. This movement also creates additional pressure on neighboring systems and the species that inhabit them. Consequently, this may pose a threat to those adjacent systems, and mitigation should be considered.

Resilient sites offer diversity in microhabitat and niche types to support biodiversity while remaining connected to other sites to facilitate migration opportunities. Typically, these sites feature minimal barriers to migration and limited habitat fragmentation, which further enhances species diversity and overall ecosystem function. *Figure 8.6* depicts a map of terrestrial resiliency in Louisiana using the Southeast Conservation Blueprint's *Resilient Terrestrial Sites* indicator. The indicator originates from The Nature Conservancy's (TNC) Resilient Land data and measures two factors that influence resilience. The first, *landscape diversity*, reflects the number of microhabitats and climatic gradients created by topography, elevation, and hydrology. The second, *local connectedness*, reflects the degree of habitat fragmentation and strength of barriers to species movement. Highly resilient sites contain many different habitat niches that support biodiversity and allow species to move freely through the landscape to find suitable microclimates as the climate changes.

Coastal areas of Louisiana are particularly vulnerable to sea level rise, which can disproportionately affect lowland coastal systems and their ability to adapt and provide ecosystem services. *Figure 8.7* depicts a map of coastal resiliency for southern Louisiana using the Southeast Conservation Blueprint's *Resilient Coastal Sites* indicator. This indicator originates from TNC's Resilient Coastal Sites project and depicts the capacity for coastal habitats to migrate to adjacent lowlands and sustain biodiversity and natural services under increasing inundation from sea level rise. It is based on the characteristics of current tidal complexes, their predicted migration space, and surrounding buffer areas. These characteristics include marsh complex size, shared edge with migration space, sediment balance, water quality, natural land cover, landform diversity, and more.

RESILIENT TERRESTRIAL SITES

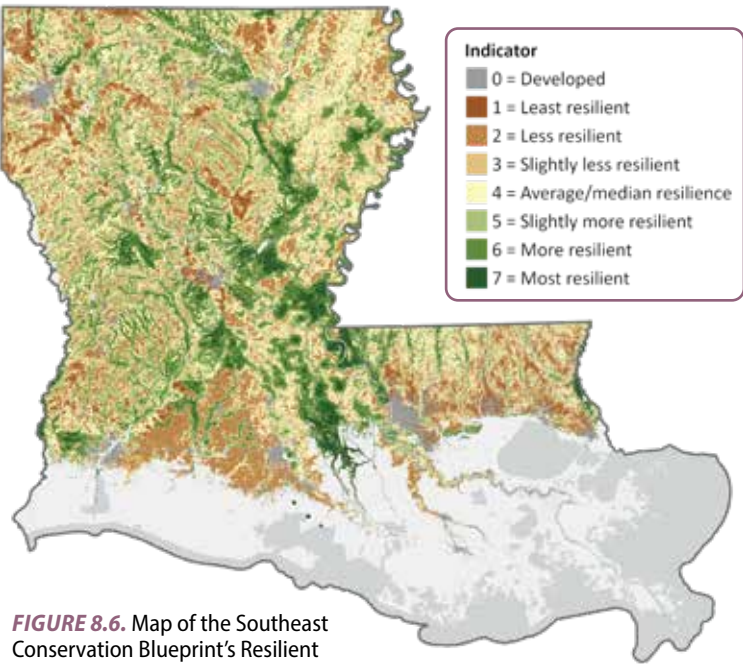


FIGURE 8.6. Map of the Southeast Conservation Blueprint's Resilient Terrestrial Sites indicator.

RESILIENT COASTAL SITES

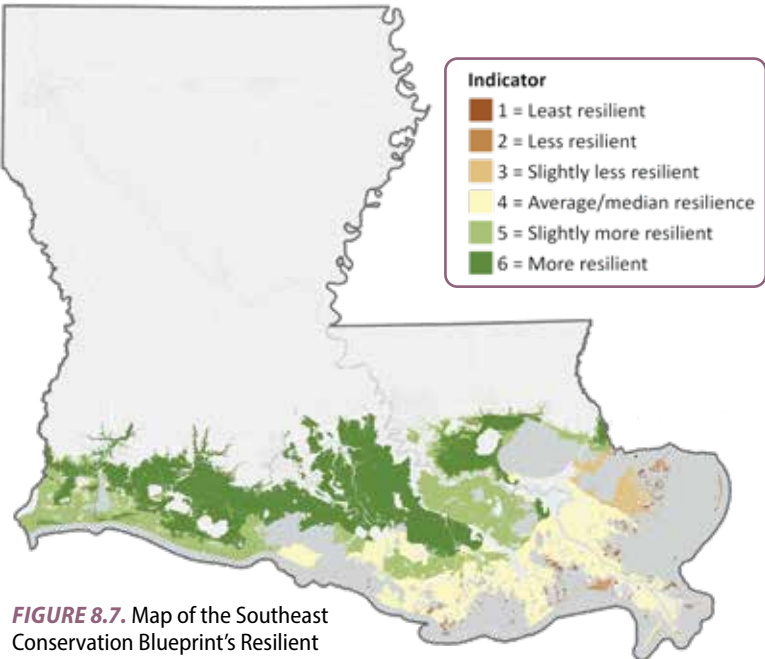


FIGURE 8.7. Map of the Southeast Conservation Blueprint's Resilient Coastal Sites indicator.

- **Action Strategy:** Establish and protect habitat corridors to provide critical habitat for SGCN to mitigate impacts from climactic shifts.
- **Action Strategy:** Acquire property to increase and support critical habitat to mitigate future impacts from climate change.
- **Action Strategy:** Promote restoration of natural barriers to minimize storm impacts including restoration of barrier islands, mainland beaches, and coastal marshes.
- **Action Strategy:** Protect upslope environments to provide critical habitat for SGCN to mitigate impacts from sea level rise.

CHANGES IN GEOCHEMICAL REGIMES

The overall shift in the chemical composition in a geologic environment can be brought on by multiple causes which can be natural or human-induced and can have differing effects on habitats and systems depending on the severity of the shift. Changes in geochemical conditions can result in changes to atmospheric CO₂, sedimentation, nutrient and metal content, and fluctuations in pH. These changes may have broad-scale effects to sensitive species or degraded ecosystems that may already be at increased risk and may not be able to cope with these shifts. In addition, subsidence (i.e. sinking of the land) can act in combination with sea level rise, decreasing available land in low lying areas.

- **Action Strategy:** Restore hydrology of the major rivers to allow sediment recharge into coastal environments.
- **Action Strategy:** Promote restoration of natural barriers to minimize subsidence including restoration of barrier islands, mainland beaches, and coastal marshes.

CHANGES IN TEMPERATURE REGIMES

Widespread variation in normal temperatures (i.e. based on historical observations) can impact species and habitats across regions. These are typically observed as heatwaves, cold spells, and changes in oceanic temperature. Deviations from established temperature norms can result in atypical weather conditions. These fluctuations can impact an area's ability to support ecosystem functions, thereby influencing species distributions and overall biodiversity.

- **Action Strategy:** Promote planting of resilient native flora with local genetics.
- **Action Strategy:** Restore and maintain riparian areas to insulate waterways from heat and cold.
- **Action Strategy:** Leave leaf litter and woody debris undisturbed.
- **Action Strategy:** Promote and increase native seed programs to ensure local eco-types of native seed are available for farmers and restoration practitioners to enhance the success of restoration and conservation efforts and ensure a resilient landscape under varied climatic conditions.

CHANGES IN PRECIPITATION AND HYDROLOGICAL REGIMES

According to projections from the South-Central and Southeast Climate Adaptation Centers, annual precipitation levels are anticipated to remain stable. However, there will likely be changes in the timing and intensity of major rainfall events. An increase in the severity of major rainfall events is expected to heighten flood risks, particularly in low lying areas, which can adversely affect aquatic systems and pose threats to human life and property.

In parallel to major precipitation events that may increase in intensity, the length of time between rainfall events is also projected to increase, potentially leading to drought-like conditions. Longer periods without precipitation will disrupt normal hydrological and terrestrial systems and persistent dry conditions will result in decreased plant productivity and increased fire risk.

Diminished rainfall and hydrological flow will likely reduce water availability. These conditions may lead to small permanent streams becoming ephemeral, which will reduce availability of sustained habitat. In addition, saltwater intrusion from the Gulf of America may be exacerbated, potentially causing further harm to freshwater systems.

Figure 8.8 displays resiliency of freshwater systems and networks in Louisiana by utilizing TNC's data on freshwater resilience and connectivity. This figure assesses the functionality of freshwater systems while also identifying potential impairments based on a variety of factors such as connectivity, natural condition, modifications to flow and hydrology, habitat availability, and water quality.

FRESHWATER RESILIENCE AND CONNECTIVITY

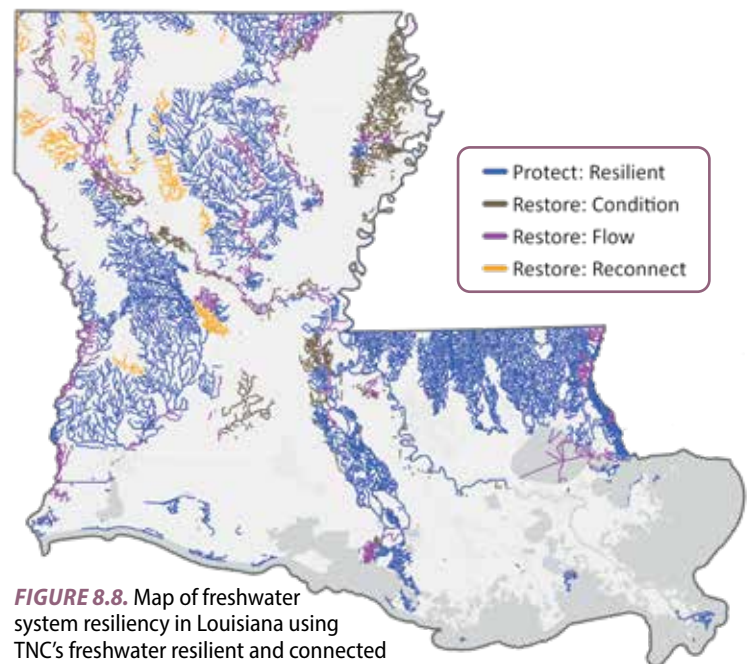


FIGURE 8.8. Map of freshwater system resiliency in Louisiana using TNC's freshwater resilient and connected network data.

Mitigative steps to reduce the impact of these scenarios would benefit system resiliency and increase habitat adaptability.

- **Action Strategy:** Reestablish natural hydrology to minimize impacts of saltwater intrusion.
- **Action Strategy:** Increase use of prescribed burns to minimize wildfire risks.
- **Action Strategy:** Encourage the use of nature-based solutions and other environmentally beneficial approaches in floodwater mitigation projects.
- **Action Strategy:** Encourage the use of green infrastructure to build resiliency in urban environments.

SEVERE AND EXTREME WEATHER EVENTS

Extreme weather events in Louisiana are generally seen in the form of tornadoes, hurricanes, and tropical storms. These extreme weather events can be very destructive, having the

potential to produce high winds, storm surge, and heavy rainfall over a short period of time. Even though these events occur naturally in Louisiana, they are predicted to increase in frequency and intensity, weakening viable ecosystems or devastating already vulnerable systems such as low lying areas in the coastal zone (e.g., beaches, barrier and coastal islands, and marshes). In addition, extreme weather has been documented to cause high mortality events.

- **Action Strategy:** Monitor fish kills, wildlife impacts, and habitat impacts due to extreme weather events.
- **Action Strategy:** Promote genetic diversity and local ecotypes to promote population resiliency to extreme weather events.
- **Action Strategy:** Promote use of living shorelines and other natural shorelines to protect against the impacts of tropical cyclones.

DATA GAPS

Understanding SGCN, their habitats, and their interactions to external stimuli is an evolving process. Currently, there are limited occurrence and distribution data for many species. In addition, limited information is available on the response of species to changing environments and to the impacts of these changes.

Data can be procured from a variety of sources including public, private, commercial, and academic sources. Engaging and collaborating with all willing partners is crucial for enhancing our knowledge and incorporating landscape scale conservation efforts in the state. With vetting by professional biologists, crowdsourced information from community science platforms like iNaturalist has immense potential to inform occurrence and

distribution data gaps and should be encouraged and utilized. These efforts could also significantly contribute to conservation management systems designed to protect important species and their habitats.

Addressing these information gaps can be achieved through research, analysis, and monitoring and provides the opportunity to obtain new insights and develop tools that will aid in deepening our understanding of these dynamics.

- **Action Strategy:** Engage the public in documenting and reporting species and habitat occurrences through citizen science initiatives.
- **Action Strategy:** Work with partners to acquire new or emerging data and tools to aid in monitoring and management efforts.

Chapter 9: Monitoring

Monitoring is one of the Eight Required Elements of a State Wildlife Action Plan (SWAP). Within each SWAP, a state must describe how it will monitor Species of Greatest Conservation Need (SGCN) and their habitats, identify how it will gauge the effectiveness of conservation actions, and provide an outline of adaptive management strategies that may be incorporated as conditions change and as new information and technologies emerge. Monitoring is critical to ensure that the goals of the SWAP are met, to demonstrate the success of the SWAP and the State Wildlife Grants (SWG) Program, and to provide vital information to inform management efforts to conserve SGCN and their habitats.

Monitoring provides crucial data for documenting the status of habitats and species and evaluating the efficacy of conservation actions. Consistent, repeated monitoring provides the necessary data for adaptive management, which refines management actions based on the evolving needs of the target resource and its progress towards conservation goals (Ringold et al. 1996). Monitoring can also provide the foresight necessary to identify emerging threats so that proactive intervention can take place (Beever 2006).

Monitoring programs should be developed based on quantifiable indicators that can assess the implementation of management actions towards desired conservation goals (Dalton et al. 2023). To be most effective, monitoring programs should also address how ecological processes may impact the conservation target.

Techniques for monitoring vary considerably across and within all taxa groups, but all methods should be reliable, standardized, and repeatable so results can be compared over time and across regions. Species monitoring typically involves the collection of population metrics including species richness, abundance, and health (Dalton et al. 2023), whereas habitat monitoring requires a more complex assessment of biotic and abiotic factors (e.g., canopy cover, soils, hydrology, etc.: Rowland and Vojta 2013). The techniques outlined in this plan are not exhaustive but include commonly used and widely accepted practices for each taxa group.

In Chapter 4: Species of Greatest Conservation Need, each taxa group has an action table that includes research and monitoring needs for each species. Column headings include research and monitoring efforts most commonly required for that taxon and are categorized in the table as determine abundance, implement population monitoring, study life history, determine habitat needs, and others. For Crustaceans and Non-crustacean Arthropods, the data gaps and research needs are so extensive that a table would not have been informative; instead, the needs are listed within the General and Species-specific Research Actions and Needs section. Although many of the needs are similar among the taxa groups, monitoring approaches may vary among species. In some instances, a standardized monitoring protocol does not exist, and research into appropriate and effective techniques or gear types may be necessary. Below is a description of the monitoring techniques used by LDWF.

MONITORING SPECIES OF GREATEST CONSERVATION NEED AND NATURAL COMMUNITIES

DATABASE NEEDS

Sound biological data are the building blocks of all conservation planning efforts. Data can inform when and where conservation actions are most warranted and, with proper study design, can suggest successful management strategies. These data can also be used to review plans for construction activities and development projects, enabling staff to provide recommendations to minimize or eliminate threats to SGCN and natural communities.

Maximizing the utility of data relies on standardized protocols utilizing robust techniques, but it also requires that data be accessible, ideally stored within a secure, centralized database.

Given the exceptionally complicated and voluminous information collected by field biologists during projects, including SWG projects¹, such a database – one that captures raw data,

¹ For a list of Louisiana's SWG projects, visit: www.wlf.louisiana.gov/page/completed-and-ongoing-louisiana-swg-projects

protocols, treatments, etc. – does not currently exist for all taxa. However, several entities have developed substantial database frameworks for certain taxa (e.g., the Avian Knowledge Network, www.avianknowledge.net; LDWF Fisheries' Data Management System) or for projects (e.g., NOAA's Data Integration Exploration and Reporting Explorer [DIVER], www.diver.orr.noaa.gov). Nevertheless, the majority of data reside in personal databases or, in best case scenarios, duplicated on shared servers (i.e. redundancy reduces the risk of data loss). Migration of those data sets, as well as associated metadata including protocols and other relevant information, to a centralized, taxa-specific or similar database would be laborious but should be prioritized as acceptable databases are developed.

The Wildlife Diversity Program (WDP) enters most of Louisiana's SGCN² and natural community data into the Biotics 5 database (LWDP 2024). Biotics 5 (developed by NatureServe) is a centralized, "web-enabled biodiversity information management system" that is utilized by wildlife diversity and natural heritage programs throughout the United States and Canada (NatureServe 2024). In addition to WDP staff field reports, data are generated

by SWG projects, herbarium and museum specimens, reports from contractors, Scientific Research and Collecting Permit holders, citizen scientists, and others. Once data are vetted by staff biologists, verified data are entered as Source Features, records linked to an observer, a locality, and a date. Source Features are aggregated (based on separation distance and other factors) into Element Occurrences. As of November 2024, approximately 17,000 Source Features comprised almost 12,000 Element Occurrences in the Louisiana Biotics database; more than 775 types of elements (e.g., species, natural communities, waterbird nesting colonies, etc.) are included spanning from 1832 to present-day. These geospatial data are used by WDP staff to inform field surveys and management actions and assess conservation status ranks. In addition, data are used by staff to determine potential negative impacts of development projects on imperiled species and habitats, allowing staff to provide recommendations to prevent, minimize, or mitigate such impacts. Members of academia regularly request Element Occurrence data to inform research projects, and governmental and non-governmental entities use these data for conservation planning and species assessments.

MOLLUSKS AND CRUSTACEANS

Although far from complete, researchers have expended considerable effort in recent years on aquatic mollusk and crustacean inventories in order to better understand their distribution and status. As regulatory agencies identify significant areas for SGCN conservation, it is important that these populations are subject to regular monitoring, both for detection of declines and validation of conservation actions that have been implemented.

In recent years, environmental DNA (eDNA) projects have assisted with aquatic mollusk and crustacean inventories in Louisiana. This technique involves searching for DNA discarded by the targeted species in water samples collected from various locations within a water body. This can be especially useful for confirming the presence of rare or cryptic species and guiding focused survey efforts.

MOLLUSKS

Detailed information on study design and standard methods for sampling freshwater mussels can be found in Strayer and Smith (2003), and many of these can be used for marine mollusks as well. Below are examples of recommended sampling techniques that researchers have successfully used in Louisiana.

Time-Constrained Tactile Search

This is a type of qualitative survey and generally accepted to be the most efficient method for detecting rare species. For this technique, a surveyor moves their hands across and through substrate for a specified amount of time, collecting any mussels located during the process (Dunn 2000). The surveyor may employ a snorkel or SCUBA to access deeper water. The total

amount of time spent in a given area is typically 1 to 1.5 person-hours (Dinkins et al. 2022, Pezold et al. 2002, Brown and Banks 2001, Brown et al. 2010); however, these time intervals are likely too short to detect the majority of rare species present (Garig 2023, Metcalfe-Smith et al. 2000).

Transect Tactile Search

This is a type of quantitative survey that is useful for covering large areas systematically. Transects are run from bank to bank, perpendicular to flow. Surveyors tactilely search a specified area along the transect, usually one meter wide, at a rate usually 0.5 min/m² for homogeneous substrates and 0.75 min/m² for heterogeneous substrates (USFWS and TPWD 2023).



Transect Tactile Search: LDWF staff sorting mussels after a survey.

² Only "tracked" species of SGCN are entered into Biotics 5; those SGCN that are not tracked are typically watch list species.



(ABOVE AND BELOW) Visual Search: LDWF biologists survey for Louisiana Pearlshell using a transparent-bottomed bucket.



Traps: Traps used for capturing crayfish.

Sediment Collection and Sieving

Although time consuming, this methodology is recommended when accurate mussel densities or juvenile data are required. Surveyors excavate randomly distributed quadrats, usually 0.25 m², to a depth of 10- 15 cm and strain collected material through a wire mesh. Researchers often couple this technique with tactile searches in order to obtain a more complete picture of the mussel community (Dinkins et al. 2022, Dunn 2000).

Visual Search

This type of survey is most useful in clear, shallow creeks (<1 meter in depth). Monitoring agencies have utilized this tool to survey for Louisiana Pearlshell since the 1980s. This labor-intensive technique involves the surveyor traversing the length of the clear, headwater streams where this mussel occurs, scanning the entire creek bottom through a transparent-bottomed bucket, and counting the individual Louisiana Pearlshells observed. Due to observed statistical limitations and the substantial time commitment required, monitoring agencies developed a statistically rigorous protocol in 2014. This protocol focuses solely on delineating and counting mussels in the dense aggregations formed by this species, thereby eliminating the need to travel the entire length of the creek. For more detailed information, see Quantitative Ecological Services, Inc. (2014).

CRUSTACEANS

Techniques for sampling crustaceans vary widely with habitat type and targeted species. Researchers have used various trap designs, electroshocking, seines, dip nets, and burrow excavations to study the distribution of these organisms, primarily crayfish, in Louisiana. The following information provides additional details on these techniques.

Traps

Minnow traps, pillow traps, and pyramid traps can be effective for sampling crayfishes in Louisiana, especially in habitats where other techniques are not feasible. Multi-day trap-soak times are generally required to achieve sufficient capture rates. Traps tend to disproportionately capture large males (Dorn et al. 2005), arguably a benefit, as large males are sometimes required for species identification. Researchers can add various baits to traps to lure crayfishes; however, information on the efficacy of this is mostly limited to commercial species and baiting may not affect capture rates of non-commercial species.

Backpack Electrofishing

This technique is an effective means of sampling for crayfishes, especially when researchers desire high capture rates, but is limited to relatively clear, shallow water with sufficient conductivity. A crew of two to three individuals is preferred; one crew member is needed to wear the backpack and move the anode across areas likely to contain crayfishes, and one or two crew members are needed as dip net operators to capture stunned crayfishes. However, it is possible for a single individual to conduct surveys using this technique (Budnick et al. 2018). Surveyors should receive safety and technique training for this gear type, which is available free of cost from the U.S. Fish and Wildlife Service (USFWS) (www.fws.gov/course/principles-and-techniques-electrofishing-online).

Seine

This tool consists of a net extended between two poles that users pull through water while keeping the lower edge of the net in contact with the substrate. For crayfish sampling, a net length of 10 feet or less is recommended and works best in areas devoid of underwater obstructions. In streams with a swift current, users can hold seines stationary while surveyors upstream operate a backpack electrofishing unit. In addition, surveyors can disturb the substrate or vegetation using their feet, flushing hidden individuals into the seine net downstream.

D-frame Net

A robust version of a dip net with at least one flat side, this tool is used for skimming streambed substrates to capture crayfishes. Net bags are typically canvas with mesh in the bottom and are often attached to the frame via hog rings. This configuration is especially useful for sampling streams, because crayfishes in these habitats are often located among roots and under rocks and woody debris. In addition, these

nets are effective for sampling ephemeral pools and ditches. When compared to backpack electrofishing, this cost effective and widely used technique typically results in fewer individual crayfishes captured per unit of time but yields similar species richness estimates (Budnick et al. 2018).

Burrow Excavation

This is one of a limited number of options researchers have to sample crayfishes that spend most of the year in burrows (i.e. primary burrowers). Using a shovel or hand trowel, surveyors excavate a burrow featuring a recently constructed chimney. Inserting a piece of flexible tubing down the burrow beforehand will help surveyors determine the burrow path during excavation. Surveyors should search any side tunnels encountered, as the target crayfish may be in one of them.

Further details on crustacean sampling techniques can be found in Walls (2009) and Zale et al. (2012).

NON-CRUSTACEAN ARTHROPODS

The techniques for sampling non-crustacean 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). In fact, as insects may undergo complete metamorphosis, survey techniques can also vary by life stage, adding further complexity to monitoring. Active techniques include visual encounter surveys, aerial netting, sweep netting, aquatic netting, collection by beat sheets, and more. Passive techniques can include pan traps, pitfall traps, flight intercept traps, emergence traps, and others. Depending on the target species, the effectiveness of traps can be improved by adding baits, pheromones, or light sources to lure individuals to the traps. Those species less likely to be trapped (e.g., cryptic, soil-dwelling invertebrates) can often be procured using a Berlese-Tullgren funnel.

Regardless of sampling technique employed, monitoring requires repeated surveys in order to gauge changes in abundance, richness, etc. Standardization of these techniques is key to making appropriate comparisons across studies. Montgomery and colleagues (2021) present an excellent synopsis of several insect sampling methods, the suggested metadata to be collected with each, and what methods are most appropriate for several taxa. Ferro and Summerlin (2019) provide language to define collection methodology. Coordination of insect data collection and analysis, as well as identification and amelioration of threats to insects, are goals of the Status of Insects: An International Research Coordination Network (<https://statusofinsects.github.io/>).

Despite forward progress in standardization, significant challenges remain, and standardization is still lacking for most survey techniques and taxa. Although surveyors may readily

learn proper setting and collection of traps and active sampling and collection methods, identification of most arthropods, especially to family, genus, or species, is time consuming and requires special expertise, and often, specialized equipment. In fact, for these reasons, researchers often do not identify many arthropods to species level during projects. Because of the scarcity of these data, even baseline information on arthropod distribution is lacking, which often hampers conservation efforts of SGCN in Louisiana. To address this knowledge gap, LDWF collects data on arthropod SGCN both through in-house efforts as well as partnering with experts. Surveys of imperiled species are vital to determine the distribution and abundance of these species so that management or conservation actions can be successfully implemented. Due to their high fecundity and short generation times, arthropods often respond rapidly to habitat manipulation and may be early indicators of habitat management effectiveness.

Examples of recommended sampling techniques for non-crustacean arthropods include:

ACTIVE TECHNIQUES

Aspirators

Aspirators are invaluable tools used to capture terrestrial arthropods, most often using a vacuum created by the user's own lungs. Aspirators are usually made with a vial, a rubber stopper with two short pieces of metal tubing embedded in it, one short length of rubber tubing, and a piece of very fine mesh. The mesh attaches to one end of a piece of metal tube on the vial side of the rubber stopper (i.e. inside of the vial); the rubber tubing attaches to the opposite end (i.e. outside of the vial) of the metal tube that has the mesh attached. The other metal



(LEFT) Aerial Nets: A researcher capturing insects with a net. **(RIGHT) Visual Encounter Surveys (VES):** A Southern Unstriped Scorpion fluorescing under longwave ultraviolet light during surveys.

tube, the collection tube, is often gently bent ($<90^\circ$) outside the vial to assist in reach. When users inhale (ideally, only into the mouth) through the rubber tubing, the arthropod is quickly sucked into the vial via the collection tube and prevented from entering the user's mouth via the mesh. A small, plastic, in-line gasoline filter attached to the rubber tubing adds protection (Singh et al. 2024). Size of target arthropods is limited by the diameter of the collection tube.

Aerial Nets

Aerial nets are used specifically for capturing flying insects like mayflies, dragonflies, flies, bees, wasps, butterflies, and moths. An aerial net typically consists of a soft, fragile mesh bag attached to a wire loop affixed to a long handle.

Sweep Nets

Sweep nets are used for capturing terrestrial arthropods typically found on live or dead vegetation. Unlike aerial nets, sweep nets are more robust with short, strong handles and with hoops adorned with very fine mesh bags reinforced with strong fabric or with full canvas bags. Sweep nets can be swept through vegetation to dislodge and capture virtually all sizes of insects, most of which can then be quickly collected via aspirator. Sweep net effort "can be 'quantified' by maintaining a constant area swept per sweep and a consistent number of sweeps per sample" (Singh et al. 2024).

Aquatic Nets

Aquatic nets, like sweep nets, are robust and made to sustain the rigors of use, in this case, striking underwater hazards like submerged debris. Aquatic nets have sturdy handles and hoops with at least one flat side (e.g., D-shaped) meant to skim streambed substrates (e.g., submerged leaf litter) to capture aquatic or semi-aquatic arthropods. Net bags are typically canvas with mesh in the bottom and are often attached to the hoops via hog rings.

Hess Samplers

Hess samplers can be used to actively collect aquatic invertebrates in shallow, lotic waters. A Hess sampler is made from an open, upright, metal cylinder with a mesh screen on one side (upstream) to allow water flow and a collection net on the opposite side (downstream). Once the cylinder is positioned upright on the substrate, the user agitates the substrate to dislodge invertebrates, which water flow carries into the collection net. Having a fixed sampling area, Hess samplers can be used for quantitative studies. See Gibbs and colleagues for a comparison of Hess samplers with other methods (Gibbs et al. 2023).

Beat Sheets

Beat sheets are similar to sweep nets in that they are efficient for collecting terrestrial arthropods from live or dead vegetation. A beat sheet is typically a canvas sheet reinforced with two crisscrossed dowel rods with their ends inserted into pockets in the four corners of the sheet (i.e. similar to a homemade kite). When the beat sheet is held by the dowels, the canvas sags into a very shallow "net." With the beat sheet held under vegetation, the user then vigorously strikes the vegetation with a stick; insects are dislodged and fall into the beat sheet where they are collected, usually via aspirator.

Visual Encounter Surveys (VES)

The use of VES in arthropod monitoring is limited to especially showy groups of day-flying insects like dragonflies and butterflies that can be readily identified in the field using binoculars. One rare example of nighttime VES includes the use of longwave ultraviolet (UV) flashlights for the detection of scorpions; the WDP documented almost 500 Southern Unstriped Scorpions along transects through Southern Mesophytic Hardwood Forest in just five nights using UV flashlights. VES may be combined with other techniques such as aerial netting to assist in species identification (Montgomery et al. 2021).

PASSIVE TECHNIQUES

Pan Traps

Pan traps can be created using brightly colored, plastic plates or shallow bowls filled with soapy water. Pan traps target small bees and wasps, which are attracted by the bright colors and become trapped in the soapy water. Like other techniques, recording the number of active traps and the amount of time the traps are active is vital for comparison studies. This type of trap should be checked at least once per day (Singh et al. 2024).

Pitfall Traps

Pitfall traps are often made by nesting two containers of similar size and shape in a hole in the ground with the lip of the inner container flush with the ground surface. Using nested containers allows the collector to more easily remove the inner container, in which specimens are trapped, while leaving the outer container in the substrate for easier redeployment of the trap. Usually each trap is covered with a roof to prevent filling from rain and disturbance by curious animals. Pitfall traps may be deployed dry or partly filled with alcohol or other killing/preserving agents; trap-checking intervals can vary among types. These traps are effective for capturing ground-dwelling arthropods in many different habitats, but, typically, require a settling in period to avoid disturbance effects from trap installation (Montgomery et al. 2021). Hohbein and Conway (2018) provide a thorough review of pitfall trap-related studies, and Brown and Matthews (2016) propose pitfall trap standardization methods.

Flight-Intercept Traps

Flight-intercept traps block the flight-path of insects, forcing insects to either fly over the barrier, typically a vertical wall of very fine mesh, to escape or drop into a liquid-filled collection tray beneath the barrier. Collection trays, often trough-shaped, are partly filled with killing/preserving agents, the type of which will determine how often traps must be checked. Plastic tarps are frequently hung over the tops of these traps to prevent inundation of collection trays by rain (Singh et al. 2024).



Light Traps: Researcher setting up a black light trap to capture non-crustacean arthropods (LEFT), and an example of a light trap used to trap insects (RIGHT).

Malaise Traps

Malaise traps are also used for capturing insects in flight, particularly those species that fly upward when confronted with an obstacle. The open, tent-shaped Malaise trap uses a vertical wall of very fine mesh to funnel flying insects into a collection container at the top (ceiling) of the tent. These traps, which are modified flight-intercept traps, can also be combined with the traditional flight-intercept trap design by adding collection trays beneath (Montgomery et al. 2021).

Light Traps

Light traps capitalize on the positive phototactic (i.e. being attracted to light) behavior of many insects. Trap designs are extremely variable from a light suspended in front of a white bed sheet to specialized traps for aquatic insects. Passive light traps typically include a collection container affixed below a funnel and/or radiating vanes situated below a light source (Montgomery et al. 2021). Light sources also vary with light-emitting diodes (LED) and Mercury vapor, UV, black light, and metal halide bulbs as options (Ferro and Summerlin 2019).

Emergence Traps

Emergence traps are used to capture insects as they transition from immature stages to adults. These traps are often open-bottomed, tent-shaped structures composed of fine mesh or other material and can be floated atop water for aquatic insect capture or placed over soil for terrestrial species. Modified versions may be built in-situ around vegetation and tree trunks (Grootaert et al. 2010). Most types also include a collection container situated at the top of the trap.

Hester-Dendy Samplers

Hester-Dendy samplers are aquatic samplers composed of several stacked plates with stacked washers to vary the spacing between plates. These samplers may be deployed at different depths including lying on the streambed. Typically, samplers are suspended in the water column by floats and anchors for a few to several weeks to allow colonization by aquatic invertebrates.

Upon retrieval, users collect the entire sampler to ensure minimal loss of invertebrates. Later, the trap is rinsed into a collection container to isolate invertebrates from the sampler. The Florida Department of Environmental Protection produced the *Methods of Hester-Dendy Multiplate Sampler Deployment* (2006), which provides helpful suggestions on sampler design and deployment.

Burlese-Tullgren Funnels

Burlese-Tullgren funnels provide an efficient method for extracting small arthropods from soil/leaf litter samples. Each sample should be stored in the field in separate breathable bags. The sample can be sieved to remove coarse debris such as leaves, sticks, and rocks during field collection or later. The sample is then placed on a screen at the bottom of a funnel which leads to a collection container filled with alcohol. A heat-producing light source placed above the funnel creates a temperature and desiccation gradient in the sample, which drives soil invertebrates from the sample into the collection container. Junod and colleagues (2023) offer an interesting alternative pitfall design that may outperform Burlese-Tullgren funnels in some instances.

Acoustic Monitoring

Acoustic monitoring has a limited use in arthropod surveys. Grasshoppers, crickets, and cicadas, which have loud species-specific mating calls, are the most appropriate arthropod targets for acoustic monitoring (Montgomery et al. 2021). Use of autonomous recording units for data collection can minimize field time for personnel, but identification of species from recordings is extremely time-consuming. Increased efficacy may be obtained through machine learning but requires reference audio for training (Montgomery et al. 2021).

INLAND FISHES

Although freshwater fish SGCN research and monitoring in Louisiana have made great strides in recent years, there are still data gaps in occurrence, distribution, abundance, habitat preference, habitat availability, movement patterns, and life history. In addition to focused research projects, regular monitoring is necessary, as aquatic habitats face many disturbances and threats, with significant impacts from changes in hydrology, land use, connectivity, and climate patterns (see the Inland Fish Threats section). Hypoxia, amplified by heat, drought, and storms, is prevalent in south Louisiana, and monitoring the impacts to and recovery of fish populations is required for effective management. Up-to-date freshwater fish SGCN data are necessary for targeted conservation and restoration efforts, determining impacts of proposed infrastructure projects, aiding in Species Status Assessments for federally petitioned species, and other applications. In addition to fish data, water quality and other physical data of waters across the state must be monitored to inform the health of aquatic systems.

Metabarcoding

Metabarcoding of eDNA shows significant promise in biodiversity monitoring of insects and other arthropods (Ruppert et al. 2019, Van Klink et al. 2022, Leandro et al. 2024, van Klink et al. 2024). Environmental DNA can be collected from samples of water, air, soil, vegetation, and several other substrates (Thomsen and Sigsgaard 2019, Uchida et al. 2020, Campbell et al. 2022, Roger et al. 2022). Once extracted, the resulting DNA is “amplified, sequenced, and categorized based on its sequence” (Ruppert et al. 2019). Such analyses can yield identifications of taxa based on libraries of known DNA barcodes; species representation in these libraries varies widely among taxa and remains a challenge in metabarcoding studies (Leandro et al. 2024). In addition, metabarcoding, although useful for determining species presence, is not especially helpful for determining species abundance, nor can it provide sex ratios or body condition (Ruppert et al. 2019). Nevertheless, metabarcoding remains a valuable tool for arthropod monitoring, particularly for “detecting the first occurrences of invasive species, the continued presence of native species thought to be extinct or otherwise threatened, and other elusive species occurring in low densities that would be difficult to detect by traditional means” (Ruppert et al. 2019). Metabarcoding is one type of eDNA method that can be used for non-crustacean arthropods. Other methods are available and may be used depending on research questions and data needs. When using eDNA techniques, users should consider the various factors that can degrade eDNA, cause contamination, or affect abundance in the environment such as ultraviolet radiation, temperature, turbidity, microbial activity, eDNA shed rate, and water chemistries (Eichmiller et al. 2016, Jo et al. 2020, Seymour et al. 2018).

Patterns in threats to aquatic habitats and fish SGCN can be found across the state; however, there are differences in magnitude and scale in different types of water bodies. Research is especially needed in large river systems to determine impacts of impoundments, navigation, and flood control projects. Headwater streams are sensitive habitats, and monitoring the effectiveness of conservation actions and impacts of flood control projects is needed. Coastal basins face unique threats from saltwater intrusion and diversions, and monitoring changes in species composition over time is critical in these dynamic environments. Researching the impacts of fish passage barriers across all habitats, with the aid of the Southeast Aquatic Resources Partnership’s online support tools, is necessary to reconnect habitats and populations for more resilient aquatic communities.

LDWF conducts regular sport fish and water quality monitoring across the state, and SGCN data are recorded as they are caught, either during community sampling or as bycatch. Inland

Fisheries districts are encouraged to pursue independent research projects, which may focus on SGCN; however, research needs for freshwater fish SGCN are vast and can only be addressed with the combined efforts of state and federal agencies, universities, river authorities, and other research institutions. In addition to collaborating with these entities, LDWF will continue to participate in partnerships such as the Mississippi Interstate Cooperative Resource Association, the Lower Mississippi River Conservation Committee, the Southeast Aquatic Resources Partnership, and the Louisiana Watershed Initiative to better research and monitor freshwater fish SGCN. Staff members are also involved with the American Fisheries Society at all levels, which aids in collaboration and awareness of the leading edge of fisheries science.

Fisheries science is ever-improving, but has a suite of well-developed field methods for sampling and monitoring with origins going back to the Paleolithic Era, originally in the pursuit of food. Modern materials and technologies have expanded and improved on many of these techniques, but many gear types have changed relatively little in hundreds or thousands of years. Because of the diversity of aquatic habitats and fish morphology and habits, many techniques require modifications to best catch target species such as using a backpack electrofisher combined with a riffle kick to capture fish in a seine set downstream or adding wings and leads to a hoop net.

Recent improvements in many techniques developed in the twentieth century have greatly expanded opportunities in freshwater fish research. Electrofishing has become more precise, with improved abilities to set power and digitally track various aspects of a sampling run. Fish movement monitoring has made great strides from radio telemetry to acoustic telemetry, which allows for greater geographic coverage, detection, precision, and data sharing. With digital data storage and sharing, fisheries data from museums, agencies, and universities from across the world can be easily accessed from a personal computer.

Genetic studies are now largely performed by analyzing single nucleotide polymorphisms (SNPs), leading to much higher resolution genetic detail than was previously available. In



Hoop Nets: LDWF staff use lead nets to survey for inland fishes.

addition to advances in genetic techniques used on individual fish and populations, genetic metabarcoding techniques can aid in determining stomach contents and species presence in a water sample using eDNA. Genetic metabarcoding techniques are strong tools, but are not foolproof, and should be used in conjunction with, or to guide, more traditional fisheries sampling techniques.

Most fisheries methods are versatile and can be used for a wide variety of target species and habitats. Knowledge of species' habits, habitats, gear options, intended uses, and inherent biases are necessary for effective fish sampling. Detailed fisheries sampling methods can be found in Zale and colleagues (2012) and Bonar and colleagues (2024). A few methods commonly used in Louisiana are listed below.

Seine Nets

Seine nets have a number of applications, based on target species, habitat features, size of net, and technique, and are intended to be used in wadeable waters. They are an active gear type and generally range in size from 10 to 50 feet long, with various mesh sizes, with or without a "bag," and come untreated or treated with net coating. Seine nets are typically pulled with the current but can be set downstream of riffles to perform a "riffle kick" or used as a block net while fish are flushed from holes or cut-banks. A seine net is one of the oldest and most versatile pieces of fishing equipment.

Gill Nets

Gill nets are passive gear used to entangle fish from a set position. Modern gill nets are usually made of nylon monofilament, which comes in various strengths and can be twisted with multiple strands for added strength. Nylon multifilament (similar to twine) nets, also known as "gar nets," provide the most strength but are not suitable for most species. Gill nets can be set for an extended period (e.g., overnight), checked periodically (e.g., every two hours), or run as strike nets that are picked up quickly after herding fish into them with a boat. Trammel nets are gill nets with extra layers of webbing, adding increased opportunity for entanglement. Gill nets come in a variety of lengths, depths, webbing sizes, and float and weight configurations. The proper gill nets should be selected based on habitat, target species, and sampling methods.

Hoop Nets

Hoop nets are a passive gear type consisting of a series of hoops, often made of fiberglass or steel, wrapped in a synthetic or metal net with a throat or series of throats at one end. They are fished horizontally pointing downstream, facing open water in lentic environments, or can be fished vertically in calm waters. Hoop nets can be fished with or without bait. This gear type is typically used to target catfish, but it is effective on a number of other types of benthic fishes, including suckers. There are also small hoop nets to target minnows and other small fish. Hoop nets can be modified with leads and walls to make lead nets and fyke nets, which can increase effectiveness.



Electrofishing: LDWF staff use a backpack electroshocker (ABOVE) and electroshocking from a boat (BELOW) to survey for inland fishes.



Electrofishing

Electrofishing is an active technique that usually targets small to medium sized fish, typically using direct current (DC), with a current flowing between a cathode (metal boat or “rat tail” on a backpack) and an anode (prod pole with metal ring or booms) to stun fish for capture. Modern electrofishing equipment offers multiple settings options to maximize effectiveness in different water conductivities on different types of fish. Most electrofishing in Louisiana is conducted from a boat-mounted or backpack unit, but other methods of electrofishing include shore shocking, tow barges, and prepositioned grids. Safety and technique training for this gear type is and available free of cost from the USFWS (www.fws.gov/course/principles-and-techniques-electrofishing-online).

Hook and Line

Hook and line sampling can be active or passive and is an acceptable method in certain circumstances. Hook and line sampling can take place in the form of rod and reel, set line, trotline, or yo-yo. Successful hook and line sampling requires a fish to find and attempt to consume bait. This method can be less effective than nets, traps, and electricity, but in certain circumstances, like catching sturgeon in deep flowing water, it may be the best option.

Traps

There are also a number of traps designed for different species such as eel pots, minnow traps, and bream traps that can be used in a number of applications.

Trawling

Trawling is an active netting method conducted from a boat. Trawls are only recommended in large inland waters where the possibility of snagging on submerged debris is minimal (e.g., in the Mississippi River). This can be an effective method of catching fish in fresh waters that are difficult to sample with the above methods.

Collection of Habitat Data

Habitat data are critical to fisheries research and monitoring. Water quality, physical habitat, flow, and other habitat data are vital for understanding biotic conditions and should accompany biological research and monitoring. There are numerous approaches to taking habitat data including in-person readings, continuous monitoring gauges and probes, satellite data, and land use data that may be appropriate depending on the focus of the research.

MARINE FISHES

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. In response, LDWF Office of Fisheries prioritizes these habitat and has a habitat focused approach rather than a species focused approach. Data collected through this process provides indices of community structure within and across habitats and can show trends in population abundances by habitat type.

Fixed-location stations, stratified by habitat type, are established in each Coastal Study Area (CSA), and fishing gear appropriate to that station is used to collect physical, chemical, and biological data, as appropriate. Sampling gear is deployed and data are 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). The GMEI was further



LDWF staff use a seine to sample for marine fishes.

refined with the implementation of the watershed-based CSA management system for penaeid shrimp (White and Boudreaux 1977), which was adapted for finfish monitoring in 1985. The general system for data collection established in 1968 has been used continuously since that time. Full details on the sampling protocol used and the updated inventory are available in the *Louisiana Estuarine, Coastal, and Offshore Marine Species Inventory* (Fischer et al. 2023). Projects rely on sampling with standardized gear over a range of habitats to characterize biological and environmental conditions. The focus of the GMEI and CSA projects is primarily to document and monitor the importance of Louisiana's estuaries as contributors to Gulf of America recreational and commercial fisheries. As a result, these projects have established long-term data sets for the various habitats and fish and invertebrate species in Louisiana's 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 standard monitoring used for more well-known species to validate trends of cryptic species.

Many conservation efforts are underway to protect, enhance, or modify coastal wetlands. These efforts will also affect the aquatic habitats and fauna associated with these coastal habitats, sometimes in ways that are not predicted or fully understood. Special purpose assessment and monitoring projects must be developed and maintained to assess the impact of these conservation efforts on both the terrestrial and aquatic ecosystems impacted.

Areas may be identified for habitat conservation or restoration 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.



(ABOVE) LDWF staff deploy flounder nets on Grand Isle.

(BELOW) LDWF staff use a trammel net to sample for marine fishes.



AMPHIBIANS AND REPTILES

Various survey methodologies exist for studying amphibian and reptile populations. It is important to select the sampling design and techniques that are best suited for the target species and can address the desired question, while considering cost, equipment needs, seasonal activity, weather patterns, habitat characteristics, and other variables (Graeter 2013a). Regardless of the design, surveys should be standardized throughout the project duration and should be repeated as feasible. Repeated surveys can aid in determining species' life history characteristics and can help address the variability in detections caused by seasonality, time of day, and weather conditions. By utilizing survey constraints and standardization guidelines, survey results can be compared both within and among projects utilizing a similar design (Graeter 2013a).

The methods listed below are recommended, standard practices for monitoring amphibian and reptile populations.

SAMPLING DESIGN

Time-Constrained Designs

Time-constrained designs standardize the duration of a survey, typically in the form of surveying for a predetermined amount of time (Todd 2013a). Survey effort can be calculated by multiplying the predetermined amount of time by the number of surveyors. The number of species or the number of individuals per species can then be divided by the calculated survey effort; this will provide the number of species and/or relative abundance per person-hours. The survey effort should only include search time; any time taken to process individuals (e.g., photographing and measuring specimens) should be excluded from calculations. Time-constrained designs, however, may limit the thoroughness in which an area is surveyed; it can require a significant amount of time to adequately survey an area, and there is a potential for observer bias when using certain sampling methods. It is also important to note that in order to effectively compare survey results, the same techniques must be utilized in all subsequent surveys (Todd 2013a).

Area-Constrained Designs

Area-constrained designs standardize the size of the survey area; surveys conclude when the entire area has been surveyed completely (Todd 2013b). The predetermined size of the survey area is primarily dependent on the habitat and the focal species. Survey areas can be designed to fit a desired time commitment but should be standardized throughout a particular project and between habitat types. The area-constrained design allows for estimations of species' densities and relative abundances per unit area as well as species' presence or absence. Similar to time-constrained designs, abiotic factors can greatly influence the results of area-constrained designs, and survey replication is required to provide the most valuable data. In addition, surveys should be conducted at multiple locations of the same habitat type within the project area. This helps ensure that survey results are representative of that habitat type. The

area-constrained design also has limitations in that the survey areas must be searched thoroughly and with equal effort across multiple surveys (Todd 2013b).

Transect Designs

Transect designs, which can be viewed as a type of area-constraint, standardize a specific survey path (Fedewa 2013). Transects can be conducted via straight lines or adapted, as necessary, to follow suitable habitat of target species (e.g., river shoreline). Surveyors are restricted to a specified path and are expected to search a standardized buffer zone that extends from the centerline of the transect path. This design can determine species' relative presence/absence, abundance, and densities across habitat types. Transect designs are particularly useful in assessing differences between habitat types (e.g., comparing upland to bottomland habitats) and determining the parameters that influence species' occupancy (Fedewa 2013).

ACTIVE SAMPLING TECHNIQUES

Active sampling involves actively searching for target species and may be aided by tools that increase detection success. Common practice includes utilizing multiple active sampling techniques within a single survey effort to increase detection rates. It is important to record abiotic factors (e.g., temperature, time, relative humidity) during survey efforts to evaluate how these parameters influence species' presence and aid in comparisons among survey results.

Visual Encounter Survey

Visual Encounter Surveys (VES) involve visually searching for species via randomized-walk, quadrat, or transect methods and can be time-constrained and/or area-constrained (Glaudias 2013a). Efficacy varies depending on the target species and its associated habitat type. Species that regularly elude capture by passive techniques may be detected more readily with VES; however, for species that utilize dense vegetation or areas that make detection more difficult, other techniques may be needed to adequately assess their status. VES are used to determine species richness and abundance, but comparisons between VES can be challenging, which make survey replication and collection of abiotic information critical.

Environmental DNA Surveys

Environmental DNA (eDNA) sampling is a time-efficient method to gather presence data on rare, threatened, and endangered species, specifically species that are difficult to detect with traditional techniques. These surveys are also useful in the early detection of invasive and non-native species and facilitation of invasive species management (NISC 2022). This sampling tool has been used primarily for aquatic species, including herpetofauna, to examine biodiversity in aquatic habitats (Takahashi et al. 2023). In recent years, this technique has been applied to species inhabiting terrestrial habitats, particularly for rare upland snakes (Katz et al. 2020). Sampling should occur during the active season for target species due to the seasonal fluctuations in eDNA release (Huang et al. 2022).

Dip-Netting

Dip-nets can be used during VES to enhance a surveyor's ability to catch species in aquatic habitats (Todd 2013c). This tool may be used opportunistically or as part of a structured survey of habitats. (Teschke and Hodges 2015). To improve detection and capture success of some species, surveyors may conduct dip-netting at night, with a spotlight. When sampling similar sites, researchers should keep a tally of the number of net sweeps so that effort can be compared to other areas sampled in a similar manner (Lagler 1943).

Basking Surveys and Basking Traps

Basking surveys are conducted using optical equipment to scan the environment for turtles that regularly use basking structures (Lindeman 1996, Buhlmann 2013). Spotting scopes provide a greater viewing distance than binoculars, allowing for identification with less risk of flushing basking turtles back into the water. Basking surveys can be conducted on foot or by canoe or other suitable watercraft. This technique is particularly useful to assess species presence in water bodies where it may not be feasible to employ other survey techniques due to water flow, water depth, limited site accessibility, or life history traits incompatible with other techniques. Data on turtle species, number of turtles, age class (adult, juvenile), and sex can be recorded. If turtles have been previously marked using a highly visible method (e.g., waterproof spray paint), density estimates can also be calculated.

Basking traps are useful in areas where the water column is too deep for other trapping methods and for basking turtles that cannot be captured by baited traps. These traps are open-topped and constructed of mesh material (e.g., crayfish trap wire) in the shape of a small, medium, or large basket to fit various sizes of basking logs. Traps can be attached to basking logs with nails and twine or fitted with floats along the top portion of the basket and then attached to basking logs. Traps are then placed just under the water surface and adjacent to or underneath known or potential basking structures. Surveyors return to the site after a few minutes of settling time to prompt basking turtles to retreat into the traps; surveyors can then collect trapped turtles (Buhlmann 2013).

Presence of basking sites is necessary to perform either survey technique; however, it is important to note that although a lack of basking sites may be detrimental for some species, it is not an indicator of the absence of those species (Lindeman 1999).

Detection Dogs

Detection dogs have assisted with wildlife research and management for centuries; there is renewed interest in the use of these dogs, especially for cryptic amphibians and reptiles. Limitations to this technique include length of time to train, lifespan of the dog, personality of the dog, ability to secure an appropriate number of scent samples for training, lack of standardized protocols, and lack of understanding regarding degradation of scent in the wild. Despite the difficulties of training detection dogs, this technique can be vastly superior to some more traditional techniques. Kapfer and colleagues (2012)

detected more individuals of Eastern Box Turtle (*Terrapene carolina carolina*) in nine hours with detection dogs than hundreds of hours of VES. Although there may be uncertainty concerning the detection of subterranean species, trained dogs have been shown to detect Eastern Indigo Snake (*Drymarchon couperi*) deep within Gopher Tortoise burrows in Georgia and Florida (Stevenson et al. 2010). Cablk and Heaton (2006) found that trained dogs were effective at detecting Desert Tortoise (*Gopherus agassizii*) and were also able to detect much smaller tortoises compared to human observers in similar studies. This technique shows great promise at detecting difficult-to-trap species and age classes.

Mark-Recapture and Mark-Resight Surveys

Mark-recapture surveys involve uniquely marking captured individuals with the intent to recapture those marked individuals at a later time. Biologists can gather information on species' life history data such as growth rates, maturity rates, and age from recaptured individuals. This method, which may be paired with other survey techniques, can provide relative population abundance and population density as well as estimates of population size and structure (Winne 2013). Commonly used marking methods include but are not limited to, scute drilling and notching, paint marking, scale clipping and cauterizing, Passive Integrated Transponder (PIT) tags, and Visible Implant Elastomer (VIE) tags.

Mark-resight surveys have been used to estimate abundance and population size of basking freshwater turtles. Captured turtles are marked via a non-toxic, tree-marking spray paint on the 2nd and 3rd vertebral scutes of the carapace and released at the point of capture (Selman 2024). Basking resight surveys are conducted within two weeks of marking turtles (Selman 2024). Surveyors must capture an adequate number of turtles to use this survey method. Both mark-recapture and mark-resight surveys may be repeated to gather population data and assess trends in population size and demographics.

Radio Tracking

Radio tracking can provide data on movement patterns and survival over a longer timeframe than typical survey-based projects (Mullican 1988). For turtles, transmitters may be attached to the carapace via marine epoxy or bolted to the edge of the carapace. Harnesses can be used to attach transmitters to frogs, toads, and lizards. Some transmitters may be surgically implanted in other herpetofaunal species such as snakes. Using a receiver and antenna, the location of the transmitter, and thus the individual, can be determined. The closer the receiver is to the transmitter, the louder the "chirp" detected by the receiver. Certain implanted transmitter types can record body temperature of individuals, with the temperature of the transmitter reflected by the frequency of "chirps" (White and Garrott 1990, Carter et al. 1999).

When using tracking techniques, the potential impact of the attached tracking device on the individual should be considered. If the attachment weighs too much or greatly increases visibility, the device may impede normal movement or behavior, both of

which can increase the likelihood of predation and bias data collected. In addition, it is also possible for an attachment to become entangled with environmental objects or impact the ability of individuals to reproduce (Graeter 2013b).

Road Cruising Surveys

Road cruising involves surveying in a transect design where target species are known or presumed to occur (Andrews 2013). Detected individuals are often reported as Alive on Road (AOR) or Dead on Road (DOR; Smith and Dodd 2003). Habitat type, time of year, weather conditions, and other variables influence the species detected during these surveys (Andrews 2013). Therefore, it is beneficial to review available natural history information for the target species and baseline site data prior to conducting a road cruising survey (Tsaliagos 2013). These surveys are most effective at detecting target species during peak activity times such as breeding season. Number of observers present and distance traveled should be recorded to determine effort and compare survey results with other similar surveys. This technique has several limitations (Case 1978). Larger roads can present more of an obstacle to species and may reduce the likelihood that crossing attempts will be made. In addition, traffic and road presence can alter the behavior of target species by attracting them for thermoregulation or deterring them because of noise (Boarman and Sazaki 1996, Langen et al. 2015). This technique is not adequate for population sampling; therefore, it is best suited for determining species presence (Andrews 2013).

Aerial Surveys

Aerial surveys that utilize Unmanned Aircraft Systems (UAS) such as drones to document basking and nesting sites in or near aquatic habitats is a relatively novel technique. This method is most applicable in areas that are visually open such as grasslands, sandbars, and Longleaf Pine savannas (Glaudas 2013b). Transects are the most appropriate survey design for this technique with flight altitude, speed, and width of area sampled (including field of view of camera) remaining constant to allow for comparability (Caughley 1974). UAS should remain in view of the observers at all times. Observer bias may have a large impact on detection probability, and although this technique is inadequate at estimating population size, it can assist in determining the need for further sampling using more standard techniques (Caughley 1974, Glaudas 2013b). In addition, the use of UAS is heavily regulated by the Federal Aviation Administration (FAA). Those wishing to use this technique should review current FAA regulations.

Fixed-wing aerial surveys are useful for locating evidence of nesting sea turtles, particularly for remote beaches and barrier islands that are inaccessible by foot or land vehicle (Schroeder and Murphy 1999). This survey method can be standardized to evaluate trends in nesting activity, which would provide insight for management and coastal restoration activities (Lamont et al. 2023). A seaplane flies the length of the survey area at a low altitude to allow surveyors to detect sea turtle crawls as well as capture photographs to subsequently confirm species identification and nesting activity (e.g., presence of body pits).

If feasible, the seaplane lands nearshore to allow surveyor(s) to gather measurements for each crawl and body pit as well as distance to high tide line and vegetation (Lamont et al. 2023). Sea turtles typically nest during nighttime hours, therefore, surveys are conducted during early morning while crawls are still intact and less likely affected by weather events.

PASSIVE SAMPLING TECHNIQUES

Monitoring methods such as the active techniques above are effective means of evaluating population status but require considerable effort to implement. With passive technology, it is feasible to gather quality data that will inform the status and trends of various SGCN in Louisiana while reducing the demand on staff. Passive sampling involves techniques that trap or passively detect amphibians and reptiles. Some techniques collect and store data that can be processed at a time more convenient for the researcher. Passive sampling techniques can be easily standardized, minimizing potential bias, and are ideal for long-term monitoring. Results can yield species' relative abundance and, when paired with mark-recapture studies, can inform population demographics (Willson 2013). Steps should be taken to minimize negative impacts to bycatch, or nontarget animals.

Automated Recording Units

Automated Recording Units (ARUs) are commonly used to determine the presence and distribution of vocal taxa such as frogs. ARUs are installed within or on the periphery of wetlands to capture the calls of breeding amphibians. Surveys are conducted during the breeding season when individuals can be identified by their unique vocalizations. Data are analyzed by manually listening to audio files to identify species or via bioacoustics software. This software uses machine learning to assist in identification of species by their unique vocalizations.



Automated Recording Units: An automated recording unit (ARU) used to record calling frogs.



Aquatic Funnel Traps: Hoop nets used to survey for aquatic turtles.

PVC Pipe Surveys

A polyvinyl chloride (PVC) pipe can be placed vertically in the ground or attached to standing structures (e.g., trees) to act as artificial refugia for frogs and lizards. Researchers can later remove and process individuals that seek refuge within the pipes. This inexpensive and easily implemented technique is useful for determining the presence and distribution of target species in a particular area. Capture probability between individuals using the artificial refugia (PVC) compared to natural refugia should be considered for studies evaluating abundance (Glorioso and Waddle 2014).

Artificial Cover

Artificial cover may be used to detect species' presence/absence. Cover objects include, but are not limited to, plywood, carpet sections, and sheet metal placed in systematic arrays to increase species detection (Mills et al. 2013). During sampling, surveyors can quickly lift one side of the object to look for species underneath before escape. Artificial cover objects can be used in conjunction with VES.

Drift Fences

The use of drift fences, which act as barriers to the movement of species, is not a stand-alone technique; instead, drift fences are used to improve the capture or detection success of other passive techniques. Species attempting to circumnavigate the fence are directed into a trap such as a pitfall or funnel trap. Researchers can later remove and process individuals from the traps. When using PIT tag readers or camera traps, the individuals are directed into a detection field (Engel 1997) where data are passively collected to be reviewed and analyzed at a later date. There are numerous ways to arrange traps along drift fences. Often, fences are arranged in a "Y" or "+" shape with traps at the central point, fence ends, or along the fence. Placement will largely be determined by trap type, trap availability, and target species. Aquatic drift fences can have weights along the bottom of the fence and floats along the top to create a barrier in the entire water column; however, this

may not be feasible in deeper water bodies. Aquatic barriers are typically made of woven, nylon mesh or similar material, but more options are available for terrestrial barriers such as silt-fencing, hardware cloth, and aluminum flashing (Metts and Graeter 2013). Transparent materials, particularly when used as terrestrial fences, should be avoided. These transparent fences may cause species to repeatedly attempt to penetrate the barrier, risking injury (Douglas et al. 1994, Willson 2013). Due to the climbing and digging abilities of some species, terrestrial fences should be buried deeply enough and extend high enough to deter target species from easily circumnavigating these fences (Jackson et al. 2015).

Aquatic Funnel Traps

Aquatic funnel traps have a conical or flat opening that leads into the body of the trap. Inside the trap, the funnel is positioned to reduce escape; usually the funnel is raised from the floor of the trap or extends away from the edges of the trap towards the center. Many additional modifications exist to reduce escape (e.g., flaps and additional funnels). Aquatic funnel traps include, but are not limited to, hoop-nets, crab traps, minnow traps, collapsible nylon traps, pyramid traps, and crayfish traps. When using aquatic traps, a portion of the trap must be exposed above water so that captured individuals are able to surface for air. The potential for drowning makes regular trap checks imperative (Willson 2013). Replicate surveys should use traps of similar size and mesh and use the same bait for data comparison.

Terrestrial Traps and Pitfalls

Numerous designs for terrestrial traps exist. Many designs employ funnels that lead into a holding area that is usually in the shape of a box consisting of wire mesh (e.g., hardware cloth) and wood (e.g., plywood). When paired with drift fences, this technique is excellent at detecting many snake and lizard species. Treadle traps are useful for surveying species like Gopher Tortoise, mainly utilized at tortoise burrow entrances to catch the resident tortoise (Engel et al. 2012). A hinged door acts



Terrestrial Traps and Pitfalls: A drift fence array with a box trap.

as the entry point, and when the weight of the tortoise is placed on a treadle in the back portion of the trap, the door closes. The basic design of a pitfall trap involves burying a container to its rim in the substrate, often at the ends of drift fences (Metts and Graeter 2013). As animals attempt to circumnavigate the fence, they fall into the container and are captured for processing. The size of the container can be adjusted to target specific species and age classes. Care should be taken when utilizing any of the aforementioned traps, as individuals can be subjected to dangerous temperatures, predation, inundation, and other hazardous conditions. Researchers can provide a source of water and a form of shelter (e.g., shade cloth on traps) to reduce stress. In the case of pitfalls, containers can have perforated bottoms to allow draining or be closed off during periods of inundation. In addition, all traps should be checked at appropriate intervals to prevent mortality (Burke 1989, Enge 2001).

Camera Traps

Camera traps can reduce time-consuming field work but still gather quality data that can inform the presence and distribution of SGCN in Louisiana (Adams et al. 2017). Currently, three types of cameras are available for monitoring wildlife: time-lapse, active infrared, and passive infrared. Time-lapse cameras take photos at specified time intervals. An active infrared camera emits an infrared beam, which functions like a trip-wire, photographing the animal as it breaks the beam. A passive infrared camera detects temperature changes in the sensor's field of view; temperature changes trigger the camera to take photographs. In order for passive infrared cameras to be effective for ectothermic species such as amphibians and reptiles, researchers need to make sure that detection areas have a uniform temperature gradient to allow sensors to differentiate between animals and the background (Welbourne 2013). Animals can be directed into the camera's field of view by drift fences (Swann and Perkins 2014, Hobbs and Brehme 2017, Martin et al. 2017, Richardson et al. 2017). Time-lapse cameras take many photographs and require researchers to spend significant amounts of time sorting through photographs



that may or may not actually capture an animal; however, advancements in machine learning may help address this challenge. Infrared cameras take significantly fewer photographs but can potentially miss species' detections by triggering too quickly, too slowly, or not triggering at all. All cameras require maintenance, but, often, one visit every two months to replace batteries and memory cards may suffice.



Camera Traps: A drift fence with a camera trap array used to photograph amphibians or reptiles entering the bucket (ABOVE). A photograph of a Louisiana Pinesnake entering a camera trap array (LEFT).

Bird monitoring techniques vary widely based on the monitoring objectives, species or guild involved, and the dependent variable of interest. For abundance, density, and similar endpoints, point counts (fixed- or unlimited-radius), transects (line or strip), area searches, and spot-mapping are among the most commonly employed survey techniques. Many of these count-based survey techniques may be modified (e.g., using distance sampling) to allow estimation of detectability, which may be used statistically to increase confidence in measurements. In addition, passive monitoring techniques, such as passive acoustic monitoring, various forms of telemetry, and additional remote sensing techniques offer increasingly sophisticated tools as technology advances. For demographic variables such as nesting productivity, recruitment, or survival, constant-effort mist-netting or nest monitoring techniques represent standard approaches. Species- (or guild-) specific survey techniques have been developed in special cases, typically based on one of the aforementioned survey concepts, to increase detectability based on unique life history or behavior attributes (e.g., for nocturnal or secretive species). Note that all monitoring techniques have limitations and inherent strengths and weaknesses and that any given technique should be selected within the framework of specific objectives, sampling design, funding availability, and other project-specific factors. Summarizing the details, pros and cons, and technical aspects of the many bird monitoring techniques available is beyond the scope of this document, but a rich literature is available for guidance (e.g., Gregory et al. 2004).

Birds represent the most widely studied animal group in North America; they are engaging, embraced by the public, widespread, and, generally, easy to detect, identify, and count (at least relative to other taxonomic groups). Because bird populations also respond to ecological and environmental changes, birds serve as ideal ecological indicators, and, as a result, a number of standardized, long-term bird monitoring programs exist. Some of these programs are continental in scale and have been in place for many years, while others are smaller in scale (e.g., state- or region-specific) or are specific to a particular species or guild. Below is an overview of select monitoring programs for which LDWF is a partner or that are otherwise recognized as important in the conservation and management of Louisiana birds.

North American Breeding Bird Survey (BBS)

Initiated in 1966 and coordinated by the U.S. Geological Survey (in the United States; and the Canadian Wildlife Service in Canada), the BBS represents the most robust long-term bird population monitoring program in North America, with over 4,100 survey routes. Based on 50 individual, 3-minute point counts per 24.5-mile long survey route, the BBS design has approximately four routes per degree block in Louisiana for a total of 67 currently active routes. Breeding Bird Surveys are conducted during the peak of the breeding season each year, 15 May – 30 June, and are best suited for monitoring passerines (songbirds) and near-passerines (cuckoos, woodpeckers, etc.). Data from these surveys allow inferences regarding the status

and trends of North American breeding bird populations and form a key component of current understanding of population declines (e.g., Rosenberg et al. 2019). The success of the BBS hinges on contributions of volunteers proficient with vocal identification of all of a region's bird species. LDWF highly values the BBS and continues its commitment to ensure that as many BBS routes as possible are surveyed every year through staff effort and recruitment of qualified volunteers. See: www.pwrc.usgs.gov/bbs/

Christmas Bird Count (CBC)

Initiated in 1900 and coordinated by the National Audubon Society, the CBC may be utilized for monitoring nonbreeding populations of resident and migratory birds of most guilds during the early winter period (14 December - 5 January). With 30 active, 15-mile diameter count circles in Louisiana, data from CBCs have great utility for calculating population indices, a relative measure of abundance and trend. Unlike more rigorous, standardized sampling protocols (e.g., BBS), the CBC was not originally designed for population monitoring, and, as a result, its data are subject to bias due to variation in observer effort and the nonrandom distribution of count circles. Increasingly sophisticated statistical techniques, however, now allow the use of CBC data to inform population trends, and the program represents a valuable source of long-term data on winter populations of many species, including numerous species not well sampled by the BBS due to inaccessible breeding areas (e.g., boreal forest). See: www.audubon.org/community-science/christmas-bird-count

Nightjar Survey Network (NSN)

Some species, due to their wetland habitat use (e.g., wading birds, seabirds), secretive behavior (e.g., marsh birds), or diel activity patterns (e.g., nightjars, owls), are not surveyed adequately by the BBS and thus require specialized survey efforts. The NSN program was established to monitor nightjars, a guild of crepuscular and nocturnal aerial insectivores that are among the most sharply declining of North American birds. The Maine Natural History Observatory is currently coordinating the NSN in the United States, in partnership with Birds Canada and the Canadian Nightjar Survey. Like the BBS, the NSN is a roadside survey, and, in many cases, NSN routes overlap the first nine miles of BBS routes. Unlike BBS routes, each NSN route consists of 10 stops located one mile apart, with each stop representing a six-minute point count. Observers conduct NSN surveys at night during very specific time-date windows that coincide with when the moon is in a bright phase and is above the horizon (and thus when nightjar activity is expected to be highest). See: www.nightjars.org

North American Marsh Bird Monitoring

Several species of marsh birds tend to be secretive in behavior, typically remaining hidden in dense vegetation, and are frequently only detectable by their vocalizations. Like nightjars, marsh birds are a group of conservation interest that traditional

survey protocols (e.g., BBS) fail to represent adequately. Coordinated marsh bird monitoring has developed since 2010, both within Louisiana, spurred by response to and assessment of the 2010 *Deepwater Horizon* oil spill, and continentally with the publication of a standardized marsh bird monitoring protocol (Conway 2011). The Conway protocol consists of three surveys per season, encompassing the breeding phenology of all focal species, conducted at a number of permanent survey points located at least 400 m apart. Individual surveys are essentially point counts that consist of alternating periods of silence and periods of focal species call-broadcast (to elicit vocal response), and utilize distance sampling to estimate detection rates. North American marsh bird monitoring data are housed on the Avian Knowledge Network.

Monitoring Avian Productivity and Survivorship (MAPS)

Initiated in 1989 and coordinated by the Institute for Bird Populations (IBP), the MAPS program represents the standard for the collection of breeding bird demographic data utilizing constant-effort mist netting. Data on demographic vital rates, including productivity, recruitment, and survival, are critical for understanding population biology of bird species and necessary for determining causes of population declines. MAPS data also link species' demographic data with breeding habitat, which is valuable in understanding bird response to habitat management, and thus of particular interest for land managers. As with all monitoring methods, it is important to recognize certain biases associated with constant-effort mist netting when using and interpreting MAPS data (e.g., variation in capture rates related to net height and species-specific ecology and behavior). See: <https://birdpop.org/pages/maps.php>

LDWF Waterfowl Surveys

LDWF conducts several different aerial surveys to develop population indices for monitoring relative changes in the abundance and distribution of different guilds and species of waterfowl. Annual surveys of the coastal zone between the

Gulf of America and U.S. Highway 90 are conducted from September through January along north-south transects that are one-quarter mile in width and range from eight to 48 miles in length. These transects are spaced at 7.5-mile intervals in southwestern Louisiana and at 15-mile intervals in southeastern Louisiana, resulting in 3% and 1.5% sampling rates in the two areas, respectively. Observers conduct these transect surveys using a fixed-wing aircraft flying at an altitude of 125 feet, at approximately 100 mph, estimating counts of waterfowl by species and habitat type. Separate aerial, transect surveys are also conducted to estimate the number of scaup (Lesser Scaup and Greater Scaup, combined) on Lakes Pontchartrain and Borgne in December and January each year and to estimate the number of breeding Mottled Ducks in the West Gulf Coast population in April. The Mottled Duck survey, which occurs simultaneously with a comparable survey in Texas, consists of 42 north-south transect lines surveyed using a low-flying, zig-zagging helicopter; randomly selected five-mile segments are re-surveyed to generate a visibility correction factor.

Colonial Waterbird Surveys

LDWF has used a number of methods to survey colonial waterbirds over the years but has typically relied on aerial surveys using list frame sampling. In this approach, observers survey known colonies and new colonies as they are discovered while flying between known colonies, estimating the number of nests (or pairs) for each species at each colony. These surveys were conducted periodically by LDWF from 1988 through 2017 using fixed-wing or rotary-wing aircraft. Since the *Deepwater Horizon* oil spill in 2010, LDWF and its partners on the Louisiana and Regionwide Trustee Implementation Groups (TIGs) have contracted Colibri Ecological Consulting and R.G. Ford Consulting Company (Colibri) to conduct colonial waterbird surveys using aerial nest photography. These surveys provide high-resolution and georeferenced photographs of all nests in a colony, with incubating adults identified (manually marked, or "dotted," on the digital images by human experts)



LDWF Waterfowl Surveys: Aerial Waterfowl Rest Area Program survey.

and enumerated by species, which provides a high level of accuracy and repeatability in both the number of nesting birds and the localities of their nests. Nest photographic surveys are conducted periodically both coast-wide, using a list of known and newly discovered colonies, as described previously, and at individual colonies for restoration project-specific performance monitoring. See: <https://avianmonitoring.com>

Motus Wildlife Tracking System (Motus)

Motus is a collaborator-driven, automated radio telemetry network of passive-monitoring receiving stations that allows for tracking the movements of migratory birds carrying miniature radio tags ("nanotags"). Coordinated by Birds Canada, Motus processes, archives, and makes available detection data collected by the network's receiving stations. Because nanotags are digitally coded, many individual birds can be tracked simultaneously on the same radio frequency and thus be detected by receiving stations maintained by collaborators anywhere in the network. As a result, Motus is revolutionizing the tracking of small, flying animals, including insects, bats, and small-bodied migratory birds, allowing researchers to address key challenges in full annual cycle biology such as identification of important stopover sites, migration routes, post-breeding dispersal, and overwinter survival (Taylor et al. 2017). LDWF maintains a network of Motus stations across Louisiana. See: <https://motus.org>.

Global Positioning System (GPS)/Global System for Mobile Communications (GSM) Telemetry

This technology may be utilized to study movement ecology of birds ranging in size from Blue-winged Teal (*Spatula discors*) to Greater White-fronted Geese (*Anser albifrons*). These lightweight (3-38 g), solar-powered devices collect highly accurate GPS locations (e.g., 3-5 m accuracy) at intervals as frequently as 15 minutes and transmit the data twice daily thru GSM/cellular networks. When not in service, data are stored on-board and later transmitted when birds reenter cellular service areas. These devices are also capable of collecting tri-axial accelerometer data, which can be used to determine a bird's behavior at the specific location ([e.g., walking, flying {altitude and ground speed are also recorded}, and sleeping]). These data provide unprecedented insight into all life stages of ecology including nest initiation, incubation, brood rearing, molting, migration, winter and breeding site fidelity, use of habitats, survival, daily movements, energy landscapes, cross-seasonal effects, and others. These devices continue to miniaturize as technology improves, which provides exciting opportunities for smaller birds.

Autonomous Recording Units (ARU)

The conspicuous vocal behavior of many bird species maximizes their detectability, particularly during the breeding season, making them ideal for large-scale monitoring programs (e.g., BBS). Vocal behavior, however, often varies dramatically with season, time of day, weather conditions, and other factors, which affects birds' detectability and thus the most appropriate survey protocol. Further, species that are rare, occur at low density, are secretive in nature, or occur in remote areas or inaccessible habitats tend to be difficult to detect by traditional avian



Motus Wildlife Tracking System (Motus): A temporary VHF tower used for the Motus Wildlife Tracking System at Richard K. Yancy Wildlife Management Area (ABOVE). A VHF station, with antennas mounted on the Lafayette LDWF office building rooftop, used for the Motus Wildlife Tracking System (BELOW).





(LEFT) *Autonomous Recording Units (ARU)*: An autonomous recording unit used to record bird vocalizations. **(RIGHT)** *Other surveys*: The LDWF Ornithologist conducts a survey for Whimbrel.

monitoring protocols and are, thus, typically under-represented in widely available monitoring data sets. Recent advances in battery life, digital storage capacity, and programmable scheduling of ARUs are revolutionizing the ability to detect those aforementioned species via passive acoustic monitoring. This approach involves deployment of ARUs to “listen” for target species over long time periods or during repeated survey periods, at any time of day or night, and then allows the biologist to download and analyze sound files at a later date.

eBird

eBird is a community science platform and online database managed by the Cornell Lab of Ornithology that documents bird distribution, abundance, and trends. The platform’s popularity with the birding public (>100 million bird sightings contributed annually) ensures a constant supply of data with the ability for users to track crowdsourced species’ occurrences in near real time. Protocols that maximize data quality on the front end, combined with statistical tools to minimize bias (e.g., spatial,

temporal, observer) on the back end, result in scientifically valuable data products representing heretofore unprecedented resources for monitoring, conservation, and management. eBird data, for example, are increasingly used as components of large-scale monitoring efforts (e.g., U.S. Fish and Wildlife Service 2020) and population status and trend analysis (e.g., Rosenberg et al. 2019). LDWF frequently uses eBird observation data and eBird data science products to inform monitoring priorities, conservation and management needs, and public outreach. See: <https://ebird.org>.

Other Surveys

In addition to the ongoing and routine survey efforts described above, LDWF and partners conduct additional types of monitoring on a less frequent or as-needed basis, including Bald Eagle nest productivity surveys, Swallow-tailed Kite roost surveys, International Piping Plover Census, and beach-nesting bird surveys, among others.

MAMMALS

Methods of detecting each of the mammal SGCN vary greatly because of the huge breadth of ecological niches that mammals occupy. Monitoring should be reliable, standardized, and easily repeatable so that results are comparable over time and across regions; unfortunately, for many mammals, established protocols are lacking. Working groups such as those for Eastern Spotted Skunk, weasels, and others are attempting to address some of these challenges. For many weasel species, targeted surveys are relatively new with most historical detections coming from trapping records or incidental sightings. Therefore, much of the current research is focused on testing methods to maximize detection. Once such methods are determined, they can be utilized to help address key data gaps.

Trapping is required for projects that mark animals, affix VHF or GPS collars, assess health or condition of the animal, or collect tissue samples. If trapping, researchers should check traps at an appropriate frequency to limit stress and reduce the risk of mortality. In addition, traps should be in locations protected from the sun, weather exposure, flooding, and potential predators, whenever possible (Silvy et al. 2020a). Researchers handling mammals should consider being up-to-date on rabies vaccinations.

Baits and lures have been used throughout history to increase mammal captures and can be paired with camera traps or more traditional, passive or active capture techniques. When used

appropriately, baits can enhance trap success, but the efficacy of baiting is understudied. The type of bait needed to increase detections is often unknown, and the rate of decay of the bait can influence success.

The list of methods below is not meant to be comprehensive but to serve as a guide to methods that are currently used for monitoring mammal SGCN in Louisiana.

Mark-Recapture

Mark-recapture is a traditional method of gathering data on population dynamics, movement, behavior, and density. Surveyors can use a variety of methods to mark mammals, including ear tags, Passive Integrated Transponder (PIT) tags, collars, tissue removal, tattoos, branding, claw clipping, fur removal, and fur dye. Researchers must consider the length of time the mark will last and if the tag will cause discomfort or changes in behavior or survivorship (Silvy et al. 2020b). In addition, genetic data can be gathered from marking methods that utilize tissue removal.

Monitoring Devices

Wearable VHF or GPS remote monitoring devices, often affixed to collars, are also integral for monitoring movement and behavior of wildlife (Silvy and Catanach 2020). In addition to determining home range size and travel corridors, collars can provide data on mortality and survivorship. The main limitation of these collars was battery life and transmitter size. However, advances in cellular, battery, and GPS technologies

have resulted in a longer battery life with transmitter options that have a wide array of applications for nearly every species of mammal. The main limitation now lies in equipment costs ranging from several hundreds of dollars to several thousands of dollars per device.

Traps

Cage traps, box traps, pitfall traps, foothold traps, and cable restraints are necessary tools for researchers conducting mark-recapture studies or affixing VHF or GPS devices to individuals. Baited culvert traps, a cylindrical cage trap with a door that closes when triggered, can be used to capture and translocate Louisiana Black Bears (USFWS 1995). Small treadle traps are excellent for sampling small mammals like rodents; however, these small box traps often under-sample some small mammal species, specifically shrews and voles (Torre et al. 2010). For under-sampled species and semi-fossorial species, a pitfall trap, a simple container buried to its lip in the substrate, is effective (Umetsu et al. 2006). Foothold traps and cable restraints are useful for capturing larger mammals and come in a variety of sizes and modifications to best sample target species (Silvy et al. 2020a, Turnbull et al. 2011). Researchers interested in using foothold traps or cable restraints should attend a training workshop and consult additional literature for BMPs in an effort to reduce the chance of injury to animals (AFWA 2022). Regardless of the technique used, surveyors should take care to reduce stress on captured animals by minimizing exposure to hazardous conditions and by checking traps frequently. When using pitfall traps, containers can become flooded with water and drown individuals; closing containers during periods of inundation or perforating the bottom to allow draining can help avoid this issue (Silvy et al. 2020a). Invasive fire ants will often prey upon small mammals caught in traps. Ant insecticide reduces mortality resulting from ant predation, and its use does not affect capture yield of small mammals; users should make sure to follow label instructions (Mitchell et al 1996). Surveyors should clean and decontaminate traps between uses to reduce presence of scent, ensure moving parts are clean and functioning properly, and minimize disease transfer (Silvy et al. 2020a).



(LEFT) *Monitoring Devices:* LDWF biologists place a GPS collar on an anesthetized Louisiana Black Bear. **(RIGHT)** *Monitoring Devices:* A Bachman's Fox Squirrel with a GPS collar.

Bat Capture Methods

Mist nets, harp traps, and hand nets can be used to capture bats in flight near roosts, flyways, or foraging grounds. Mist nets are fine nylon or polyester mesh netting extended between two poles. As bats fly, they are unable to detect the netting, subsequently flying into it and falling into a baggy portion below for collection. When selecting mist nets, researchers need to consider mist net height, mesh size, and denier/ply size. Ferreira and colleagues (2021) found that traditional mist nets (length: 12 m, height: 2.5 m, mesh: 16 mm, deniers/ply: 75/2) had a 1.5 times greater capture rate of bats than more modern, ultrathin mist nets (length: 12 m, height: 3.2 m, mesh: 20 mm, denier/ply: 45/1). Harp traps are A-framed stands with vertical strings and a collection area at the bottom. As bats turn vertically in flight to avoid the strings, they lose lift and fall into the collection area. These methods are particularly useful when researchers want to collect data on morphometric characteristics and genetics. Harp traps can be more effective at capturing bats than mist nets but are smaller, which restricts their use to roost entrances and natural flyways (Ferreira et al. 2021). Researchers should check mist nets and harp traps at least once every 10 minutes but should remove individuals immediately when captured, if possible (USFWS 2024, Kurta and Kunz 1988). Users must exercise extra precautions while removing bats from nets as their narrow wing bones are easily broken (Kurta and Kunz 1988).

Disease Monitoring

Although many diseases pose threats to mammal SGCN, few have had as widespread an impact as White-nose Syndrome (WNS), the disease caused by the fungus *Pseudogymnoascus destructans* (Pd). This fungus is a predominant threat to many bat species, and as such, monitoring for its presence is a priority; sites contaminated with Pd are considered contaminated with Pd indefinitely. When surveying for bats, and before leaving any field sites, researchers should always follow the most up-to-date decontamination protocols for all gear and personnel as described in the *National White-Nose Syndrome Decontamination Protocol* (www.whitenosesyndrome.org/static-page/decontamination-information). Handling of bats can often cause visible fungus to disappear prior to sample arrival at laboratories; therefore, researchers should endeavor to get representative close-up photographs of infected bats prior to sending samples. The USGS (2024) suggests using bat skin swabs and wing punch biopsies to detect Pd, dependent on sample locality, species, and if there are any visible signs of WNS. In addition, researchers can use ultraviolet light screening of wing membranes to detect presence of WNS, but this technique is not definitive (USGS 2024).

Citizen Science

The wide use of hand held cameras, particularly cell phones, offers the opportunity for outreach through citizen science projects. Members of the public can report sightings on platforms such as iNaturalist (www.inaturalist.org). In addition, notices on social media platforms can alert members of the public of a researcher's interest in cryptic mammal sightings. For example, informational posters were created for Eastern Spotted Skunk and distributed through various media outlets in an effort to educate members of the public and to provide

information on how to report sightings. Such reports from the public are an important part of monitoring marine mammals, as members of the public working or recreating along the coast may be more likely to spot these species.

Point-count Surveys

Point-count surveys, which involve researchers counting each individual animal in an area, are useful in monitoring easily detectable species. For example, surveyors can easily count muskrat colonies in coastal marsh which can provide an index of densities and distribution (Sadowski and Bowman 2021, Mullin and Hoggard 2000). Researchers can count individual bats in roosts or as they emerge (Anderson and LaCour 2022). Ideally, such data would be gathered consistently over long periods of time so that fluctuations can be discerned.

Detection Dogs

Although dogs have assisted with wildlife research and management for centuries, there is renewed interest in the use of detection dogs, especially for cryptic mammals. When a variety of scent samples are available, trainers can teach dogs to locate signs of scent in the wild. When dogs detect scat, researchers can analyze it for genetics, physiological characteristics, diet, and parasites. Some southeastern states have used this methodology in an effort to locate Long-tailed Weasels and other mustelids (Jachowski et al. 2024, Hassler et al. 2024). Limitations to this technique include length of time to train, lifespan of the dog, personality of the dog, ability to secure an appropriate number of scent samples for training, lack of standardized protocols, and lack of understanding regarding degradation of scent in the wild (Jachowski et al. 2024). Despite the difficulties of training detection dogs, this technique can be a more cost effective means of detecting species than many common practices such as camera traps and hair snares (Long et al. 2018).

Camera Traps

Motion activated, time-lapse, and video camera traps have become a common method for sampling a wide array of mammals, replacing other more time intensive methods such as track plates or traditional trapping. Researchers can use camera traps to estimate density, relative abundance, species diversity, and/or activity patterns (Parker et al. 2020). If species have unique pelage patterns or visible tags, researchers may be able to identify individual animals on camera. When deployed in a grid pattern, researchers can model other parameters such as occupancy. However, cameras can generate a large volume of data, that then needs to be processed. Artificial intelligence programs can help filter through the data, but more testing is needed to ensure small animals or partial captures are not missed. Martin and colleagues (2017) employed camera traps augmented with drift fences to direct animals towards cameras. LDWF applied a modified version of this technique at Coastal Prairie sites in southwest Louisiana with great success, detecting numerous shrews and rodents including the Northern Pygmy Mouse and the Eastern Harvest Mouse (Manuel and Battaglia 2024). Currently, the Weasel Working Group is investigating this method for Long-tailed Weasels throughout their range (Jachowski et al. 2024).



Hair Snare: A Louisiana Black Bear encounters a hair snare.

Ultrasonic Recording Devices

Similar to camera trapping, ultrasonic recording devices are another non-invasive way to detect highly vocal mammals such as bats or whales. Most mammals have an acute sense of hearing and use sounds for echolocation or to communicate. Distinguishing vocalizations between similar species can be problematic; nonetheless, this method can be useful for detecting certain species (Szewczak et al. 2020). Anderson and LaCour (2022) used this approach to determine species composition in bat communities across 18 parishes in Louisiana. Similar to camera traps, ultrasonic devices can generate a large volume of data. Researchers can use artificial intelligence programs to filter data but should take care to avoid misidentifications and missed detections.

Hair Snare

Mammal species are identifiable through discarded hair, which surveyors can collect through hair snare stations which can include barbed wire, brushes, or sticky paper. This technique allows researchers to gather data on species distribution, occupancy, and

densities. O'Connell (2013) employed this technique and paired it with genetic markers to determine abundance, survivorship, and growth rates in Louisiana Black Bear.

Environmental DNA

Organisms shed DNA into their environment and researchers can use assays to detect this eDNA in samples. A key limitation of eDNA studies is that they merely detect the presence of DNA and not the actual organism. However, this technique is particularly useful in informing researchers on where to target on the ground surveys to confirm the existence of the organisms. The two more commonly used methods are Quantitative PCR assays and metabarcoding. Quantitative PCR is best for targeting a single species, while metabarcoding is traditionally used for sampling a broad range of taxa groups (Wood et al. 2019). When using eDNA techniques, users should consider the various factors that can degrade eDNA or affect abundance in the environment such as ultraviolet radiation, temperature, and microbial activity, eDNA shed rate, and water chemistries (Eichmiller et al. 2016, Jo et al. 2020, Seymour et al. 2018).

PLANTS

Inventory and monitoring of rare plants are essential actions required for protecting and furthering our knowledge of plant SGCN. By consistently tracking population trends, distribution, and habitat conditions, we can identify threats, assess conservation status, determine priorities, and implement effective management strategies for conserving sensitive species. Systematically sampling a population for metrics such as frequency, density, and percent cover can provide insights into the viability of a particular species. Analyzing these data over time can allow us to identify threats and ameliorate their impacts on plant SGCN.

The inventory process often begins with review of herbarium specimens, biodiversity databases (e.g., NatureServe), and citizen science applications (e.g., iNaturalist). Detailed information such as exact location, population size, and habitat metrics can provide insight into the status and desired conditions for a particular species. Ideally, utilizing habitat data is most effective when research definitively links specific habitat conditions to target plant species. Since this information is limited for many rare plant species, hypothesized habitat associations derived from population data and known ecological relationships can often guide survey efforts for discovering new occurrences.



An LDWF botanist conducts vegetation surveys.

Field surveys that track and monitor species populations are essential to keep the status of plant SGCN up-to-date. These surveys can either be conducted as standardized routine assessments or incidental assessments. Common methods for tracking and monitoring rare plants are included below:

Meander Survey

This method is often used for detecting plants with known or hypothesized habitat associations. Surveys are conducted at sites with ideal habitat for a target species during the most optimal time of year for detection and typically focus on habitat

features that are commonly associated with these species (e.g., surveying along a stream for obligate riparian species). Upon locating the species, data are collected on various metrics including number of individuals and their life stage, areal extent, plant and habitat conditions, associated species, soil, elevation, and other pertinent details. By employing this method, larger areas can be efficiently surveyed.

FIREMON Rare Species

In this method, developed as part of the Fire Effects Monitoring and Inventory System, individual plants are studied over time to quantify temporal changes in survivorship, growth, and reproduction for rare, perennial species (Lutes et al. 2006). Plants are spatially located using distance relative to a physical baseline and marked with permanent tags. Over time, data are collected on the status, life stage, size, and reproductive effort for individual plants and can be tailored to the species of interest.

The response of rare plants cannot always be directly tied to management intervention. Along with habitat conditions, a matrix of factors must be considered including presence of invasive species, disease, herbivory/trampling, and changes to climatic conditions. In addition, certain species are more difficult to monitor such as plants with an annual life cycle, as their populations can fluctuate significantly from year to year, compared to more stable perennial species. Molecular methods such as utilizing eDNA for detecting and monitoring more cryptic species are in development and may prove useful (see Hartvig et al. 2021).

NATURAL COMMUNITIES

Tracking and consistent monitoring of natural communities allows LDWF to determine the status, distribution, and overall ecological integrity of these communities and to identify changes in these attributes over time. These data are crucial for developing effective management strategies to conserve and restore these critical ecosystems.

Utilizing remote sensing technology can be an efficient and cost-effective way to conduct preliminary surveys and to further refine or constrain survey areas when resources are limited. Remotely sensed data are useful for locating and monitoring natural communities that have distinct associations with characteristic soil types, elevation and topography, specific landscape positions, or other natural patterns. Once a survey area has been constrained to a manageable size, field surveys can become more focused and frequently become more productive. Remote sensing methods commonly used include:

Light Detection And Ranging (LiDAR)

LiDAR sensors provide visualization of small elevation changes through the use of light in the form of a pulsed laser. This method is useful for differentiating areas that still retain natural surface topography (e.g., distinguishing Coastal Prairie remnants with

pimple mounds and potholes from land-leveled agricultural lands and pastures). LiDAR data can provide important hydrologic information that can be used to identify existing, former, and restored hydrologically driven communities such as wetlands. These data can also be used to determine structure and species composition in several community types including forests with high canopy cover and marsh communities.

True Color Aerial Imagery

This method uses images captured via aerial photography to make preliminary observations of an area remotely and assess large-scale changes in structural features over time. For example, tracking changes to woody cover in prairie ecosystems can be used to evaluate whether a habitat is moving toward favorable or unfavorable conditions and if desired management goals are being achieved.

Infrared Imagery

This method uses instruments and cameras that detect and translate electromagnetic radiation beyond the visible light spectrum. Infrared imagery can allow for a better understanding of plant species, biomass, soil moisture, and water turbidity that true color aerial imagery may not be able to provide. For example,



(LEFT) *True Color Aerial Imagery*: An aerial survey used to assess large-scale habitat changes over time. **(RIGHT)** An LDWF botanist conducts natural community surveys.

vegetation health can be assessed by observing the tones of color produced; bright red typically indicates dense vegetation with large amounts of chlorophyll, while duller shades of red, green, or tan can indicate unhealthy or dead plants.

Analyzing topographic maps, soils maps, and reviewing archived field data (e.g., historical land surveys, herbarium specimens, field notes) are also used to locate potential occurrences of target natural communities. Remote sensing may be followed up with ground-truthing to verify findings and collect more detailed data.

Natural community field monitoring may involve quantitative or qualitative assessments performed by a botanist or plant ecologist who inspects a site prior to and during implementation of management activities. The biologist then determines if the natural community is responding to management interventions or if additional action is necessary. For example, a Flatwoods Pond may become overrun with invasive plant species. Through visual inspection, the extent of the infestation can be determined, and biologists can recommend adaptive management actions as needed.

More intensive monitoring for hypothesis-driven research can involve quantitative sampling. In order to obtain a comprehensive ecological assessment of a natural community, it is prudent to collect and test soil samples and, in some cases, to measure elevation and other abiotic factors such as slope percent and aspect. Because natural communities are typically defined by vegetation, evaluation of factors such as floristic quality, plant functional groups, species richness, and diversity is also essential to understanding community quality and condition. This can be achieved by conducting vegetation surveys recording metrics such as species frequency, percent cover, basal area, and density. Many vegetation sampling protocols are available, and potential modifications can be made based on the specific site and questions being addressed. Examples and brief descriptions of a few of these methods include:

Quadrat

Quadrat sampling is a highly variable method that should be customized appropriately to the plant community being sampled and the information that is being collected. A quadrat is a frame, varying in size and shape, placed on the area to be sampled. Within the quadrat, metrics of abundance including species frequency, percent cover, density, and basal area may be quantified and used to calculate species richness and diversity. To adequately sample a community, quadrat samples must be performed repeatedly in areas chosen through random, systematic, or other standardized methods.



Quadrat: An LDWF botanist using a one meter quadrat to survey a natural community.



Profile Board: LDWF botanists use a vegetation board to survey a Longleaf Pine Flatwoods community at the Kisatchie National Forest.

Profile Board

Employing a profile board or other tool (e.g., Robel Pole, forage stick, density board, cover board) is a simple, efficient, and common technique used for quantifying vegetation vertical height and horizontal cover and structure. Through this method, horizontal cover is measured by placing a board (vertically, with measurement markings) a set distance or distances from the observer. Through ocular estimations, the observer determines the height of vegetation and the percent of the board obstructed by vegetation. Quantitative data gathered with this method can be used to better assess changes in vegetative structure and response to management action or environmental factors over extended periods of time. This method is often coupled with photo-point monitoring.

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, Louisiana Department of Environmental Quality, and the Louisiana Department of Energy and Natural Resources. This group is tasked with producing the *Comprehensive Master Plan for a Sustainable Coast* (Coastal Master Plan), which outlines the State’s sound science approach to ensuring longevity of our coastal communities and habitats; the most recent iteration of the Coastal Master Plan (CPRA 2023) may be viewed at the following: https://coastal.la.gov/wp-content/uploads/2023/06/230531_CPRA_MP_Final-for-web_spreads.pdf.

The Coastal Master Plan (2023) and appendices provide information about plan development, land loss, storm surge-based flood risk and associated challenges facing south Louisiana, and proposed projects to address those challenges.

Photo-Point

Photo-point monitoring is also an effective and simple standardized method to capture changes in vegetative structure and landscape conditions over time. This method consists of taking baseline photographs of the location(s) of interest and returning at specified time intervals to take additional, follow-up photographs. These follow-up photographs must be taken from the same location(s) as the baseline photograph(s) and within the same field of view as the baseline photograph(s). With strict adherence to protocol and appropriate documentation, photo-point monitoring can be precisely replicated by different people many years apart, allowing for quantitative and qualitative assessments.

Bitterlich

This method uses a sighting device to measure basal area and canopy cover. From randomly located sampling points, the observer views shrubs or trees using a sighting device (e.g., densiometer) with a fixed viewing angle and a wedge prism to calculate basal area. Only shrubs and trees with diameters larger than the specified angle are to be included in the count. The Bitterlich method is a time-efficient way to quantify stand density and overstory structure.

The Coastal Master Plan provides ideas for a better future and offers ways to enhance the connection between our coast and all who depend on it (CPRA 2023).

Since 2007, CPRA and its partners have “secured approximately \$21.4 billion in state and federal funding for protection and restoration projects, benefited over 55,807 acres (87.2 square miles) of coastal habitat, restored 71.6 miles of barrier islands and completed more than 150 projects to benefit coastal Louisiana” (CPRA 2023) (*Figure 9.1*).

Funding for these projects comes from a variety of sources including the Louisiana State Legislature, Coastal Impact Assistance Program, Coastal Wetlands Planning, Protection and Restoration Act, Water Resources Development Act, Deepwater Horizon Settlements, and the State of Louisiana’s Coastal Protection and Restoration Fund, among others. A complete list of funding sources, collaborators, and projects including cost, size, and type can be found in CPRA’s Annual Plans.

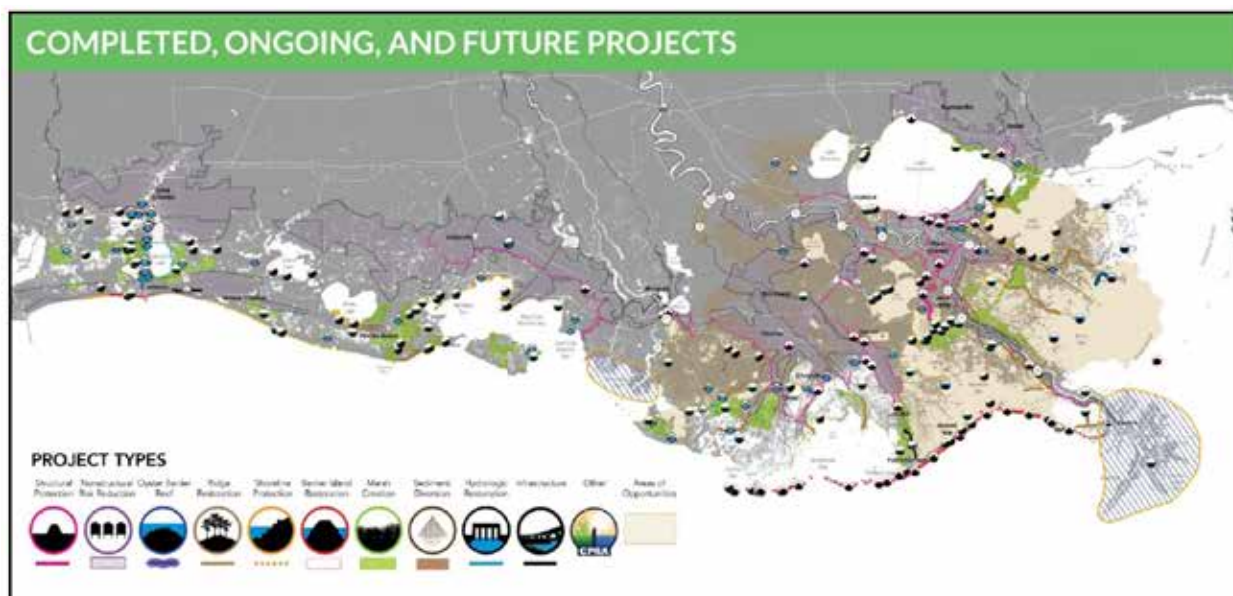


FIGURE 9.1. State of Louisiana Coastal Master Plan (2023) project map.

Future coastwide restoration activities that generate real-world benefits for wildlife and fisheries resources are critical for achieving the goals and objectives outlined within the SWAP. CPRA's Coastal Information Management System (CIMS) represents the State of Louisiana's central access point for information on protection and restoration projects and ongoing initiatives. CIMS includes a series of interactive GIS-based maps, a tabular database with a variety of project and monitoring data available for download, and a document library containing project reports and associated information.

For coastal birds, recent and significant gains have been realized and incorporated within the CIMS network through the *Guidance for Coastal Ecosystem Restoration and Monitoring to Create or Improve Bird Nesting Habitat*, the Gulf of Mexico Avian Monitoring Network, and the Avian Data Monitoring Portal. These gains, generated through active collaboration between engineers and ecologists (see detailed example below), have the capacity to inform future avian habitat restoration and enhancement, adaptive management, and performance monitoring. Further, when integrated within CPRA's ecological review process, these and future activities will provide real-world means by which CPRA and its partners can easily convey resource benefits realized to resource stakeholders with emphasis placed on the general public.

In 2004, the Coastwide Reference Monitoring System-Wetlands (CRMS) was implemented to improve the program's capability to evaluate the effectiveness of individual restoration projects as well as the combined effects of multiple projects by providing a

network of reference sites to compare to project sites (Steyer et al. 2003). CRMS was also designed to determine the ecological condition of all Louisiana wetlands, not just those affected by projects. As a result, CRMS provides the user an opportunity to evaluate restoration efforts on the ecosystems as a whole. Thus, the effectiveness of landscape-scale restoration strategies can also be determined.

Detailed Example: Suitability of habitats for marsh-nesting birds can be influenced by elevation heterogeneity, land and water interspersions, hydrologic connectivity, vegetation characteristics, and proximity to human activity. The incorporation of these target habitat characteristics into existing project design, construction, maintenance, and related items in CPRA *Marsh Creation Design Guidelines* (CPRA 2017) has the potential to create high value habitat for wetland-dependent wildlife species including marsh-nesting birds.

Integration of the CRMS network plays a critical role in LDWF's and CPRA's capacity to understand how coastal processes influence biological outcomes. In one case, the Secretive Marsh Bird Habitat Relationships and Distributions in Selected Coastal Louisiana Marshes Project (2018-2025) designated all sampling stations be co-located to established CRMS stations throughout the project's geographic extent (Pontchartrain to Terrebonne coastal basins). In doing so, resource agencies are moving towards a more comprehensive (quantitative versus qualitative) means by which future coastal marsh projects can be designed, constructed, and adaptively managed to generate real-world benefits for marsh-nesting birds.



Detailed Example: Understanding coastal processes informs future marsh-nesting bird restoration and adaptive management



SCIENTIFIC RESEARCH AND COLLECTING PERMITS

LDWF issues Scientific Research and Collecting Permits to individuals conducting valid scientific studies on wildlife, including SGCN, in Louisiana. Each permit holder is required to submit an annual report detailing the outcome of field efforts and the numbers and types of organisms impacted. Those permitted to work with SGCN must also submit additional data such as precise location information (i.e. GPS coordinates). These reports are submitted to the Wildlife Diversity Program Data Manager and relevant taxa expert. In instances where a federally listed species is encountered, USFWS staff are also notified per reporting requirements of LDWF's Section 6 Cooperative Agreement. SGCN data from permit reports are entered into the Biotics 5 database, which can be used to inform S-ranks, SGCN status, species distribution, and more.

EFFECTIVENESS OF CONSERVATION ACTIONS

Gauging the effectiveness of conservation actions outlined in the SWAP is critically important to ensure that conservation goals are met. LDWF monitors the effectiveness of State Wildlife Grants projects through the use of the USFWS Office of Conservation Investment Tracking and Reporting Actions for the Conservation of Species (TRACS) reporting module. TRACS provides a standardized grant reporting tool that allows users to create, manage, review, and approve grant proposals and performance reports. This enables the USFWS and state agencies to highlight program accountability and adherence to federal reporting requirements, demonstrate sound grant management, and provide transparency on the use of grant funds. TRACS also documents grant performance and standardizes reporting of accomplishments through numerical metrics identified by objectives that are specific, measurable, achievable, relevant, and time bound (SMART). SMART objectives provide an easy way to demonstrate achievement of goals outlined in the project. A list of past and current SWG projects can be found on the LDWF website (www.wlf.louisiana.gov/page/completed-and-ongoing-louisiana-swg-projects).

LDWF also uses a variety of other methods to ensure the effectiveness of conservation actions and the efficacy of projects.

- SWG interim annual and final reports are reviewed by LDWF taxa experts who provide feedback and request any needed edits or additional information. This level of review ensures that data are collected at appropriate times and locations, that conservation measures are taken to ensure incidental take is minimized or avoided, and that all actions are informed by the best available information.
- Pilot studies are conducted by LDWF biologists to test new approaches or tools for species detections. These studies are a fraction of the cost and require less time than undertaking a full study.
- Collaboration with counterparts in other states allows LDWF biologists to receive information on successful, novel survey methods. Frecklebelly Madtom, for example, was a species that benefitted from a partnership between LDWF and the Mississippi Department of Wildlife, Fisheries, and Parks. This collaboration resulted in a *listing not warranted* determination by the USFWS after novel survey techniques were implemented by both states leading to successful survey efforts and increased detections of the species.
- Reassessment of methods during an open grant allows staff to request changes if the original approach is not working (e.g., traps or lures are not catching the intended targets despite the species' likely presence).
- Grants that support data analysis provide a mechanism to evaluate standardized monitoring protocols and determine if the protocol provides the necessary data needed to conserve species and ensure their persistence.
- Data, particularly those from SWG-funded inventory projects, are used in the NatureServe ranking calculator to update S-ranks, which assist resource managers in designing and prioritizing projects for SGCN and their associated habitats.

ADAPTIVE MANAGEMENT

If conservation actions are found to be inadequate, alternative strategies may be needed to achieve desired results under an adaptive management framework. Because the conservation of SGCN and their habitats is not a straightforward process, the SWAP is designed to be a living document. Conservation priorities are dynamic and have changed since the 2005 and 2015 versions were published, and it is expected that changes will occur before the 2035 SWAP. As such, LDWF understands the importance of adapting to changing conditions, priorities, and new information. Wind and solar energy, which were not mentioned with any urgency 10 years ago, are currently topics of immediate concern. In addition, climate change will act in combination with other threats and may prompt biologists to adapt near term and future conservation strategies to address SGCN and their habitats.

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 and colleagues (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, improving the outcomes of future conservation actions.

LDWF can also address changing conditions through the use of *emerging issues letters*. These letters provide USFWS a mechanism to fund SWG projects for high priority conservation issues, new threats (e.g., new disease outbreaks), and species that are outside the scope of the current SWAP. This allows LDWF the flexibility to decide which methods are best for each situation to better fulfill the needs of the SWAP. To that end, it will be important to periodically evaluate the effectiveness of monitoring and determine if the monitoring protocols in place adequately document the impacts, trends, and status of SGCN and their habitats.

Chapter 10: Louisiana: A Regional Perspective

In 2018, the Association of Fish and Wildlife Agencies (AFWA) adopted a resolution on landscape conservation that recognized “the importance of collaborating at landscape scales to help fish and wildlife agencies meet their statutory and regulatory responsibilities to conserve fish and wildlife and their habitats.” In response to the resolution, AFWA established a President’s Task Force on Shared Science & Landscape Conservation Priorities in 2020, which recommended that State Wildlife Action Plans (SWAPs) serve as frameworks for regional coordination and collaboration.

Within this SWAP, Louisiana has identified Species of Greatest Conservation Need (SGCN) and outlined strategies, including conservation actions, to promote species recovery and prevent federal listings under the Endangered Species Act. However, to sustain the species that are the responsibility of the state, Louisiana must consider its role and the influences of the larger Southeast landscape.

This chapter serves to examine regional, landscape-scale considerations and a means for the state to find potential collaborations across the Southeast to best support Louisiana SGCN and Regional Species of Greatest Conservation Need (RSGCN). In addition, some of the threats that impact SGCN (e.g., climate change), as well as the residents and local economies of the state, are at a regional level. Addressing these threats effectively requires aligning conservation strategies across state boundaries. By using consistent regional information shared by other states to inform their SWAPs, Louisiana may be able to better address its contributions to regional conservation priorities, identify potential landscape level threats, and help connect the lands and waters of the Southeast.

LOUISIANA’S CONSERVATION PORTFOLIO: CONNECTING THE REGION’S LANDS AND WATERS

Louisiana supports a diversity of habitats, culturally and historically significant landscapes, and ecosystems that provide benefits to the state as well as the broader Southeast region. It plays an integral role in connecting the lands and waters of the Southeast region as well as hosting some regionally important ecosystems like Salt Marsh and Longleaf Pine savanna and woodland. Many regional and local partners are working with the Louisiana Department of Wildlife and Fisheries (LDWF) to help conserve iconic and significant landscapes in the state. According to the Protected Areas Database of the United States (PAD-US, v4.0; USGS 2024), approximately 4.29 million acres (13%) in Louisiana are considered protected (*Figure 10.1*). This includes landscapes like the Kisatchie National Forest, national wildlife refuges, and state conservation areas, refuges, and wildlife management areas.

In addition to contributing to the conservation landscape of the Southeast, Louisiana lands and waters also benefit the state's economy. The Bureau of Economic Analysis (BEA) provides Outdoor Recreation Satellite Accounts for each state. In 2022, the BEA estimated that the outdoor recreation economy in Louisiana generated \$7.9 billion in value for Gross Domestic Product and another \$2.7 billion in related wages and salaries. In addition to recreational value, natural landscapes support working lands such as agriculture and timber.

LOUISIANA AND THE SOUTHEAST CONSERVATION ADAPTATION STRATEGY (SECAS)

The Southeast Conservation Adaptation Strategy (SECAS) is a regional conservation initiative that spans the southeastern United States and the Caribbean. SECAS brings together diverse partners around an ambitious goal: a 10% or greater improvement in the health, function, and connectivity of southeastern ecosystems by 2060. The Southeast Conservation Blueprint (v2024; Blueprint) is the primary product of SECAS and is a living, spatial plan that identifies priority areas where conservation action would make an impact, based on a suite of natural and cultural resource indicators, towards creating a connected network of lands and waters across the Southeast. Over 1,700 people from more than 500 organizations have been actively involved in developing this Blueprint.

The Blueprint recognizes almost 22 million acres, or roughly 66% of the state, as a priority for connecting the region's lands and waters (Table 10.1, Figure 10.2). About 10 million acres (31%) are rated as high or highest priority, meaning that these are areas where conservation action would make the biggest impact based on a suite of natural and cultural resource indicators. An additional 10.2 million acres (30%) is rated as medium priority. These are areas where conservation action would make an above-average impact based on a suite of natural and cultural resource indicators. There are also 1.5 million acres (5%) that are considered priority connections, or areas that can help facilitate the flow of species and ecological processes within the state while also considering connectivity with the broader region.

The Blueprint also includes a connectivity analysis that identifies corridors that link coastal and inland areas and span climate gradients. Based on a least-cost path analysis, hubs provide anchors to link corridors across the shortest distance possible, while also routing through Blueprint priority areas. Inland hubs are large patches (approximately 5,000 acres) of the highest priority Blueprint areas and protected lands, while inland corridors connect those hubs within broad areas of established conservation interest. About 13 million acres (39%) within Louisiana are considered hubs or corridors, providing many conservation opportunities to support species movement and migration, an important consideration for supporting wildlife adaptation to landscape-level changes (Figure 10.3).

Considering landscape connectivity across jurisdictional borders is becoming increasingly important for species management, as changes in land-use, climate, and weather patterns can shift

LOUISIANA'S CONSERVATION LANDS

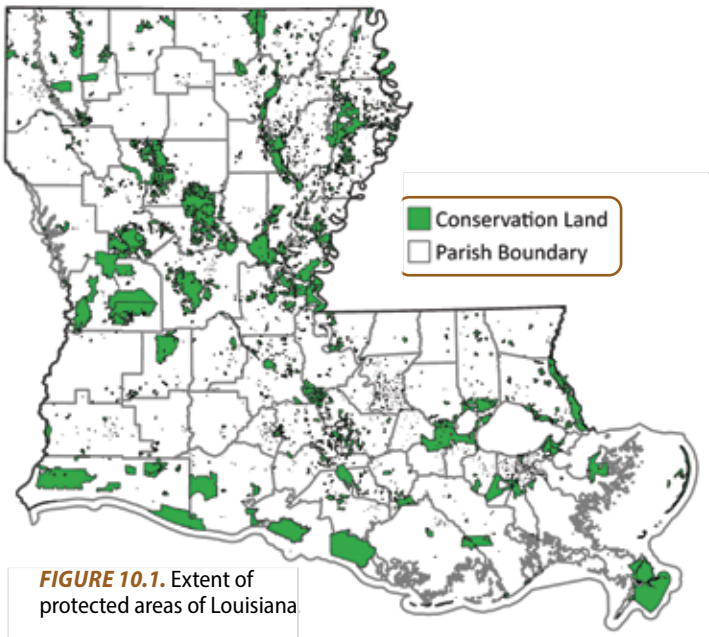


FIGURE 10.1. Extent of protected areas of Louisiana

TABLE 10.1. Lands and waters considered protected within Louisiana. These numbers are estimates based on the Protected Areas Database of the United States (PAD-US v4.0) and may not reflect the most up-to-date assessments.

Priority for a connected network	Areas (acres) prioritized with the Blueprint (v2024) and the percentage of the state within those priority categories	Existing protected areas (PAD-US 4.0) that fall within the Blueprint (acres) and their percentage of total protected lands within the state
Highest	3,903,099 (12%)	931,964 (26%)
High	6,374,810 (19%)	960,302 (27%)
Medium	10,165,169 (30%)	1,416,010 (40%)
Priority connections	1,545,555 (5%)	38,833 (1%)
Lower priority	11,531,569 (34%)	2,3568 (6%)
Total	33,520,202 (100%)	3,550,677 (100%)

species distributions. Collaborating with the neighboring states of Mississippi, Arkansas, and Texas to identify cross-boundary species migration and habitat use can increase regional connectivity for state SGCN and RSGCN. Below are maps that show Blueprint (2024) priority lands and waters and connectivity analysis as well as a map of current and predicted urbanization (Figure 10.4).

The maps also include a boundary that extends beyond the state and includes watersheds where Louisiana shares a conservation or species management interest with its neighboring states (Figure 10.5). By looking beyond the state's boundaries, Louisiana can consider how to best align actions within the state to provide the greatest benefit to species with wider ranges and to identify cross-jurisdictional opportunities

with neighboring states. This boundary was developed by LDWF staff identifying select watersheds (HUC 10) around the state border and selecting shared watersheds of conservation interest (e.g., Conservation Opportunity Area adjacent to a neighboring state).

One aspect to consider when characterizing the landscape of Louisiana is through its ecoregions as defined by The Nature Conservancy’s Terrestrial Assessment Units (2009): East Gulf Coastal Plain, Gulf Coast Prairies and Marshes, Mississippi River Alluvial Plain, Upper East Gulf Coastal Plain, Upper West Gulf Coastal Plain, and the West Gulf Coastal Plain (Chapter 2: State Overview).

Evaluating ecoregions that Louisiana shares with its neighbors can provide a potential framework to assess and compare ecosystems and ecosystem components as these areas are similar in their respective mosaics of biotic, abiotic, terrestrial, and aquatic ecosystems.

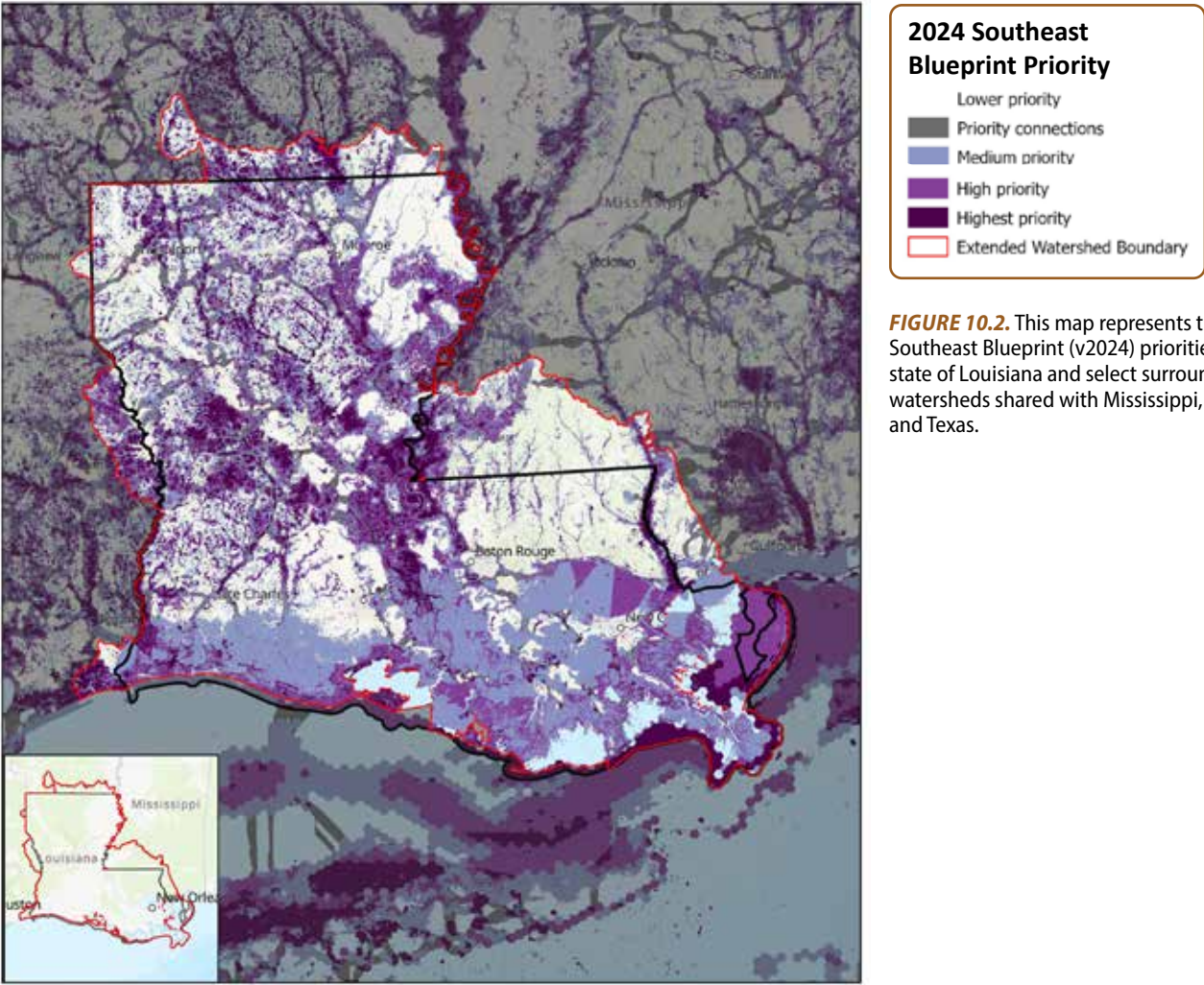
LOUISIANA AND THE SECAS GOAL

Through SECAS, partners work together to design and achieve a connected network for the benefit of ecosystems, species, and people. The long-term goal for SECAS is a 10% or greater

improvement in the health, function, and connectivity of southeastern ecosystems by 2060. To stay on track for achieving that goal, a 1% improvement will be needed every four years. Although the primary product of SECAS is the Blueprint, which serves as the framework to achieve this goal, there is also an ongoing effort to track and report on regional ecosystem metrics.

SECAS regularly releases a report—*Recent Trends in Southeastern Ecosystems* – that assesses progress toward the SECAS goal using the most current available data. The report is intended to facilitate discussion around conservation actions needed to meet the goal. This assessment of shared measures of progress toward the SECAS goal provides an essential evaluation that helps to focus conservation actions and tracks resulting impacts (Table 10.2). States can use the goal report to assess both progress in their state and overall trends for the broader Southeast region. The goal report identifies where states may be able to facilitate discussion around conservation actions for shared priorities or ways to contribute to monitoring programs that inform the annual report.

The *Recent Trends in Southeastern Ecosystems* (2024) goal report is based on a synthesis of 14 different assessments to evaluate indicator trends. Assessments ranged from



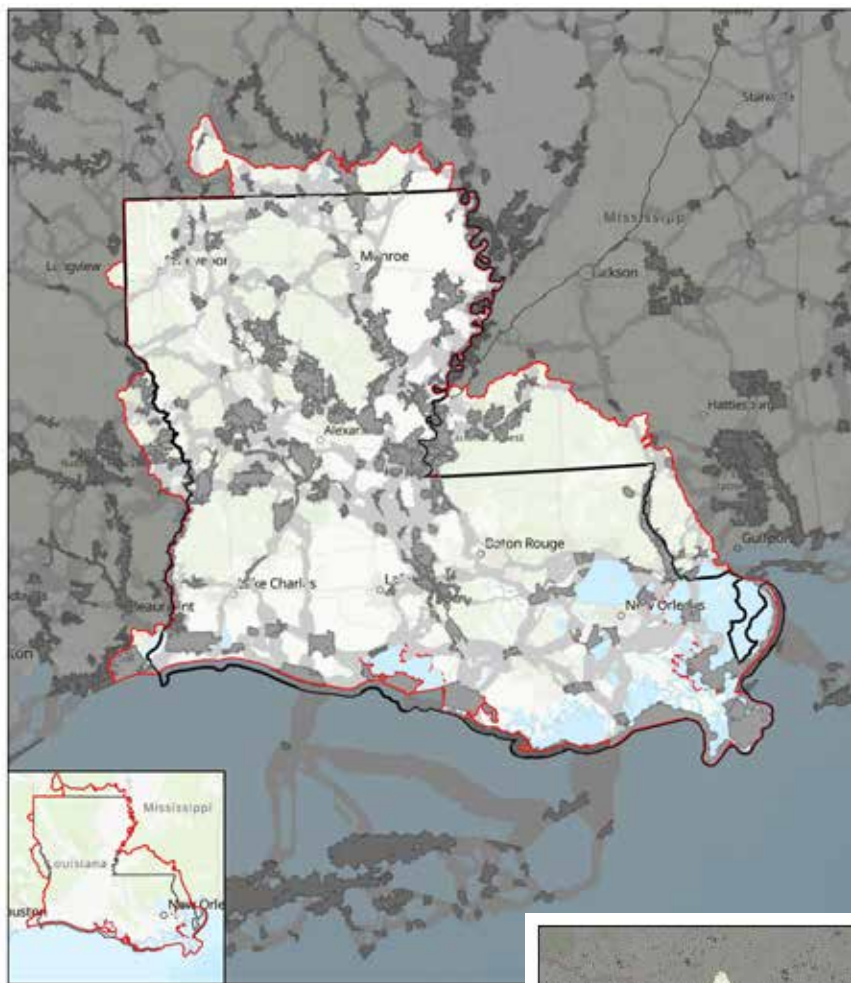
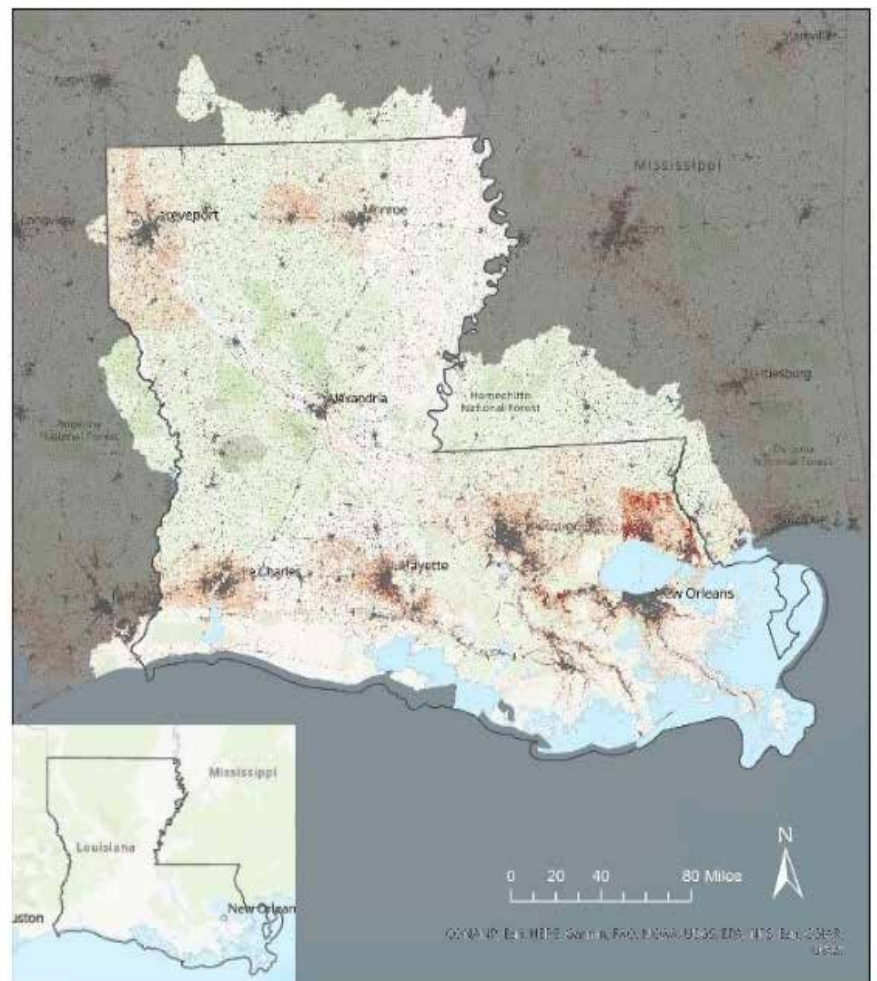
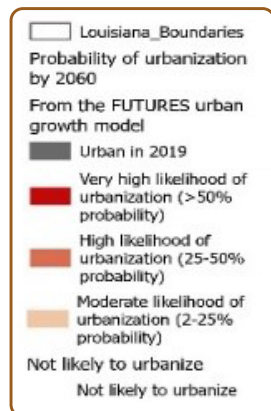
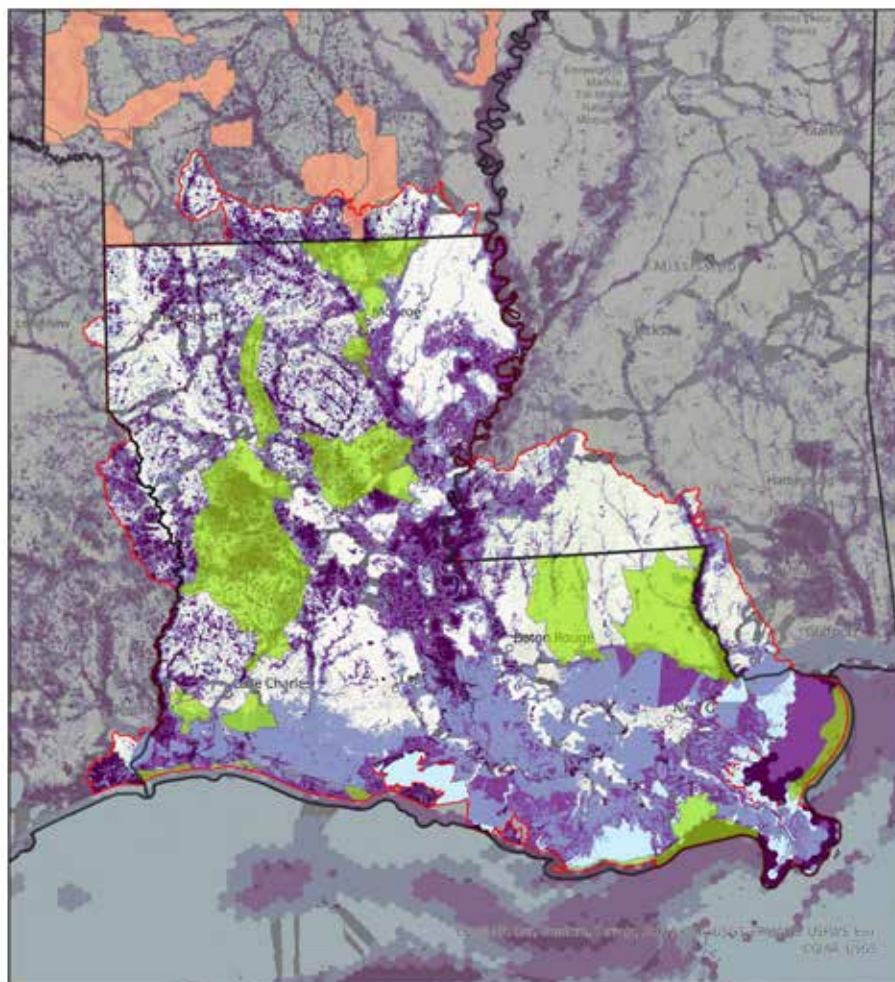


FIGURE 10.3. The Southeast Blueprint (v2024) connectivity analysis showing hubs and corridors in the state of Louisiana and select surrounding watersheds shared with Mississippi, Arkansas, and Texas.

FIGURE 10.4. Past and current (2019) urban levels were based on developed land cover classes from the National Land Cover Database. Future urban growth estimates were derived from FUTURES model projections for the contiguous United States. Data were provided by the Center for Geospatial Analytics, NC State University.





Shared Conservation Priority Areas SE Conservation Blueprint 2024

- Lower priority
- Priority connections
- Medium priority
- High priority
- Highest priority
- AR Conservation Opportunity Areas
- LA Conservation Opportunity Areas
- HUC 10 Extended Watershed Boundary

FIGURE 10.5. The Southeast Blueprint (v2024) priorities in the state of Louisiana and select surrounding watersheds shared with Mississippi, Arkansas, and Texas identifying alignment of neighboring conservation priorities in Arkansas.

remotely sensed data like the National Land Cover Database to long-term volunteer-driven monitoring programs like the USGS Breeding Bird Survey. Additional assessments used included America's Longleaf Restoration Initiative Range-wide Accomplishments reports, Forest Inventory and Analysis, Gopher Tortoise Candidate Conservation Agreement reports, USDA Soil and Water Resources Conservation Act reports, Blueprint, International Shorebird Survey, EPA 303(d) state reports, Southeast Aquatic Resources Partnership Aquatic Barrier Database, the National Oceanic and Atmospheric Administration (NOAA) C-CAP Regional Land Cover, National Coastal Condition Assessments, NOAA Reports to Congress on the Status of Fisheries, and Esri Global Land Cover.

According to the fourth annual assessment of progress (SECAS 2024), across the Southeast region, most indicators improved overall. Given the rapid changes happening in the Southeast, this is an encouraging sign for achieving the SECAS goal. Longleaf Pine area, prescribed fire in Longleaf Pine habitats, aquatic connectivity, birds of forested wetlands and upland forests, working lands conservation, coastal condition, and marine fisheries indicators improved fast enough to stay on track to meet the SECAS goal. These same indicators also demonstrated positive trends in the previous goal report released in 2021. These have all been major areas of shared conservation focus in the Southeast, and those efforts are clearly having a measurable impact.

Nine of the 19 indicators had declining trends. Of these, grassland birds continue to be the most off track for meeting the SECAS goal. Declines in habitat, especially within the West Gulf Coastal Plain, Piedmont, Southeast Coastal Plain, Central Hardwoods, and Peninsular Florida, are likely driving this pattern. Focused conservation can have a positive impact on species. For example, Bachman's Sparrow, which is subject to significant conservation attention, increased in abundance through much of the Longleaf Pine range. This further reinforces the importance of accelerating open pine, pine/oak savanna, and other grassland restoration throughout the Southeast for grassland birds, pollinators, and other key species.

The 2024 goal report shows that Louisiana has seen declining trends in certain habitat types and ecosystem functions such as landscape connectivity and water quality. There are also declining trends for specific RSGCN species in the state such as Yellow-throated Warbler, Northern Bobwhite, Prairie Warbler, Loggerhead Shrike, Bachman's Sparrow, and Louisiana Waterthrush (*Table 10.3*).

TABLE 10.2. This figure comes from the 2024 progress report and represents an overview of recent trends in ecosystem indicators across the Southeast. Indicators shown in green are on track to meet the goal ($\geq 1\%$ increase every four years); indicators shown in yellow ($< 1\%$ increase) and red (decline) are not.

ECOSYSTEM	TYPE	INDICATOR	YEARLY % CHANGE
Terrestrial	Health	Areas without invasive plants	0.33% decline
		Beach birds	1.42% decline
		Caribbean undeveloped land	0.39% decline
		Forested wetland area	0.08% increase
		Forested wetland birds	2.85% increase
		Gopher Tortoise (Eastern population)	Increasing but % change unknown
		Grassland & Savanna area	0.31% decline
		Longleaf Pine area	4.5% increase
		Grassland & Savanna birds	2.2% decline
		Prescribed fire in Longleaf Pine	4.02% increase
		Salt Marsh area	0.03% decline
		Upland forest birds	0.98% increase
	Function	Working lands conservation	11% increase
Freshwater	Connectivity	Landscape condition	0.02% decline
		Undeveloped land in corridors	0.019% decline
Marine & Estuarine	Health	Natural land cover in floodplains	0.008% decline
	Function	Water quality	0.003% increase
	Connectivity	Aquatic connectivity	16% increase

TABLE 10.3. Recent trends in bird species that are considered Southeast Association of Fish and Wildlife Agencies (SEAFWA) RSGCN within LA, MS, AR, and TX. Data is derived from the USGS Breeding Bird Surveys from 2012–2022. Up arrows indicate an increasing trend and down arrows indicate a decreasing trend. Confidence in the trend is indicated by either high confidence or low confidence.

INDICATOR	SPECIES	LOUISIANA	MISSISSIPPI	ARKANSAS	TEXAS
Forested Wetland Birds	Prothonotary Warbler	-6.5% decline ↓ Low confidence	12.3% increase ↑ High confidence	19.9% increase ↑ High confidence	10.5% increase ↑ High confidence
	Swallow-tailed Kite	17.4% increase ↑ High confidence	17.3% increase ↑ High confidence		10.3% increase ↑ High confidence
	Yellow-throated Warbler	21.9% increase ↑ High confidence	26.6% increase ↑ High confidence	28.5% increase ↑ High confidence	90.5% increase ↑ High confidence
	Swainson's Warbler	21.4% increase ↑ High confidence	34.3% increase ↑ High confidence	32.2% increase ↑ High confidence	47.4% increase ↑ High confidence
	American Kestrel	-26.4% decline ↓ High confidence	-32.4% decline ↓ High confidence	-29.8% decline ↓ High confidence	-25.1% decline ↓ High confidence
	Bachman's Sparrow	-42.9% decline ↓ High confidence	-19.4% decline ↓ High confidence	-44.7% decline ↓ High confidence	-34.6% decline ↓ High confidence
	Eastern Meadowlark	-31.1% decline ↓ High confidence	-44% decline ↓ High confidence	-44% decline ↓ High confidence	-19.1% decline ↓ High confidence
Grassland and Savanna Birds	Grasshopper Sparrow		-58.6% decline ↓ High confidence	-53.6% decline ↓ High confidence	-10.1% decline ↓ High confidence
	Loggerhead Shrike	-44.1% decline ↓ High confidence	-44.3% decline ↓ High confidence	-39.4% decline ↓ High confidence	-36.1% decline ↓ High confidence
	Northern Bobwhite	-32% decline ↓ High confidence	-38.6% decline ↓ High confidence	-40.3% decline ↓ High confidence	-37.6% decline ↓ High confidence
	Prairie Warbler	-5.7% decline ↓ Low confidence	4.2% decline ↓ Low confidence	-5.2% decline ↓ Low confidence	1.1% increase ↑ Low confidence
	Red-cockaded Woodpecker	-24.9% decline ↓ High confidence	-3.4% decline ↓ Low confidence	52.9% increase ↑ High confidence	7.9% increase ↑ Low confidence
	Scissor-tailed Flycatcher	-39.6% decline ↓ High confidence	-36.2% decline ↓ High confidence	-43.1% decline ↓ High confidence	-27.3% decline ↓ High confidence
	Cerulean Warbler		-17.4% decline ↓ Low confidence	19.4% increase ↑ High confidence	
Upland Forest Birds	Wood Thrush	52.4% increase ↑ High confidence	36.1% increase ↑ High confidence	36.1% increase ↑ High confidence	67.3% increase ↑ High confidence
	Louisiana Waterthrush	24% increase ↑ Low confidence	20% increase ↑ High confidence	13.3% increase ↑ High confidence	26.6% increase ↑ High confidence
	Worm-eating Warbler	8.9% increase ↑ Low confidence	-14.1% decline ↓ High confidence	-1.9% decline ↓ High confidence	31.4% increase ↑ High confidence

REGIONAL SPECIES OF GREATEST CONSERVATION NEED

Each state’s wildlife action plan identifies SGCN, or the species most in need of proactive conservation attention (see Chapter 4 or Appendix D for a list of Louisiana’s SGCN). Across the Southeast region, the combined list of SGCN (generated from SWAPs pre-2019) for the 15 southeastern states totals over 9,000 species, with the most common taxa represented being plants (2,174), insects (1,259), other invertebrates (571), fishes (707), and birds (280) (not all states included plants or insects; *Figure 10.6*). Many SGCN are shared by multiple states. Effective management and conservation of these species requires actions and management strategies that will best allow for species movement, migration, and availability of key ecological attributes that may be provided by different habitats across the landscape at different times.

The National Wildlife Federation, as part of the Vital Futures project funded by the U.S. Geological Survey, initiated a process for identifying a set of regional species listed as priority species in the 15 southeastern SWAPs. The Southeastern Association of Fish and Wildlife Agencies (SEAFWA) Wildlife Diversity Committee collaborated with the National Wildlife Federation and other partners to evaluate these species and produced a list of regional priority species, or RSGCN. Overall, in the Southeast, 960 species were identified as RSGCN. Freshwater fishes, crayfishes, and mussels represent nearly two-thirds of regional priority species.

Identifying RSGCN drew upon a collaborative process among southeastern state fish and wildlife agencies and partners that involved more than 100 experts and used a set of consistent criteria to review current scientific information and evaluate state-identified SGCN. Species were evaluated based on several primary factors, including the level of conservation concern (i.e. extinction risk), regional stewardship responsibility (i.e. importance of the Southeast in the conservation of the species), and biological or ecological significance (e.g., unique evolutionary lineages). The regional assessment focused on species in key groups, including vertebrates (mammals, birds, reptiles, amphibians, and fishes) as well as several better-known groups of invertebrate animals (freshwater mussels, crayfishes, and bumblebees; *Table 10.4*). Subject matter experts in each of these taxonomic groups convened to evaluate and identify those species that warranted identification as a regional priority. Additionally, the science teams characterized the level of conservation concern for each regional priority, ranging from moderate to very high concern. Through this established process, the RSGCN list can be updated as the states’ SGCN lists change over time.

The number of RSGCN that are considered the stewardship responsibilities of each state varies widely (*Figure 10.6*). These patterns reflect the underlying diversity of species in each state, particularly the number of at-risk or limited range species, which is also influenced by a state’s size and diversity of habitats. These patterns also

influenced the “regional stewardship responsibility” criterion in the assessment of priority species.

By taxa, fishes and crayfishes represent 50% of all RSGCN within the region. Many aquatic habitats and ecosystems within the Southeast are highly fragmented, resulting in severe limitations to ecosystem integrity and species persistence regionwide. Habitat fragmentation in rivers and streams is a determining factor in the decline in abundance of numerous species particularly freshwater mussels and amphibians.

Nearly 70% of regional priority species are endemic to the 15-state SEAFWA region. More than half (55%) of RSGCN are shared by three or more states, presenting opportunities for cross-state conservation collaboration. The remaining 45% of species have narrow ranges and are found in just one or two states. The full list of RSGCN is available at www.nwf.org/Our-Work/Wildlife-Conservation/southeast-regional-priority-species.

TABLE 10.4. List of RSGCN by taxa and their level of concern (very high, high, or moderate). Fish taxa have the most species categorized as “very high concern” and comprise 30% of all RSGCN within the Southeast region.

RSGCN TAXONOMIC GROUP	VERY HIGH CONCERN	HIGH CONCERN	MODERATE CONCERN	TOTAL
Amphibians	26	46	33	105 (10.9%)
Birds	10	47	17	74 (7.71%)
Bumblebees	2	1	2	5 (0.5%)
Crayfishes	54	84	34	172 (17.9%)
Fishes	102	115	94	281 (32.4%)
Mammals	11	28	28	67 (7.0%)
Mussels	70	54	12	136 (14.2%)
Reptiles	18	45	27	90 (9.4%)
Total	293	420	247	960 (100%)

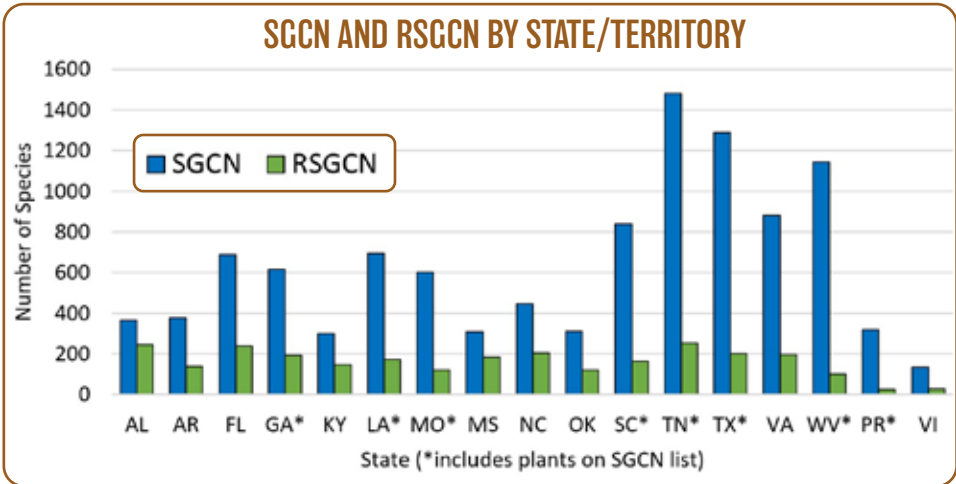


FIGURE 10.6. Species of Greatest Conservation Need (SGCN) and Regional SGCN (RSGCN) by state and territory based off information in previous state Wildlife Action Plans.

LOUISIANA'S STEWARDSHIP OF RSGCN

Louisiana identified 345 animal SGCN in the 2015 SWAP and has stewardship responsibility of 172 RSGCN. The most common RSGCN taxa types represented in Louisiana are birds (53), reptiles (31), and fishes (30) (Figure 10.7).

Although Louisiana has shared stewardship of its SGCN and RSGCN with multiple other states, it has the most in common with adjacent states. Louisiana has the greatest number of RSGCN in common with Mississippi (130) (Figure 10.8). Other states which with Louisiana shares a high number of RSGCN include Texas (n=82) and South Carolina (N=67) (Figure 10.8). The majority of those shared RSGCN are categorized as having a “High Level of Concern”, with birds (12), reptiles (10), and fishes (10) representing taxa with the highest number of “Very High Concern” RSGCN shared by these states (Figure 10.8).

Louisiana is also home to multiple species that are not only endemic to the SEAFWA region, but are also found in only one other state. Louisiana and Texas support one species of fish, two crayfishes, and two reptiles that are RSGCN only found within these two states. There are also five species of crayfishes, one mollusk, and one amphibian found only in Louisiana and Arkansas. Additionally, there are two species of fishes, one crayfish, and two reptiles found only within Louisiana and Mississippi.

By identifying shared RSGCN, Louisiana can prioritize conservation actions that not only provide local benefits but also support a regional landscape. For example, Louisiana can identify conservation strategies aimed at improving aquatic connectivity that also improve water quality and flow in watersheds that cross into neighboring states.

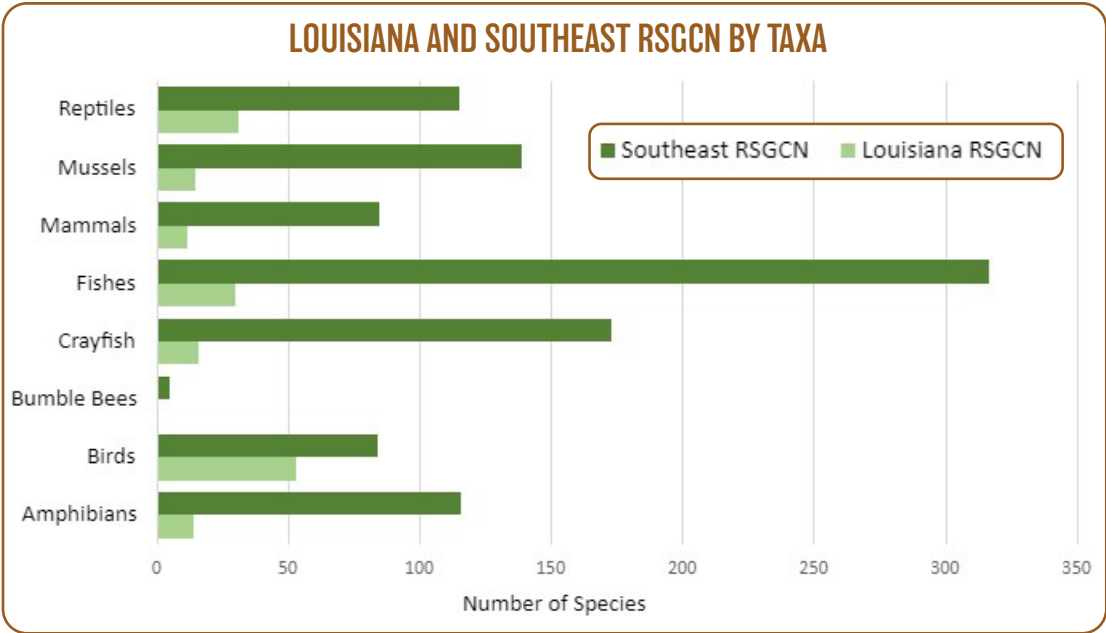


FIGURE 10.7. Number of Louisiana and Southeast Regional Species of Conservation Need by Taxa.

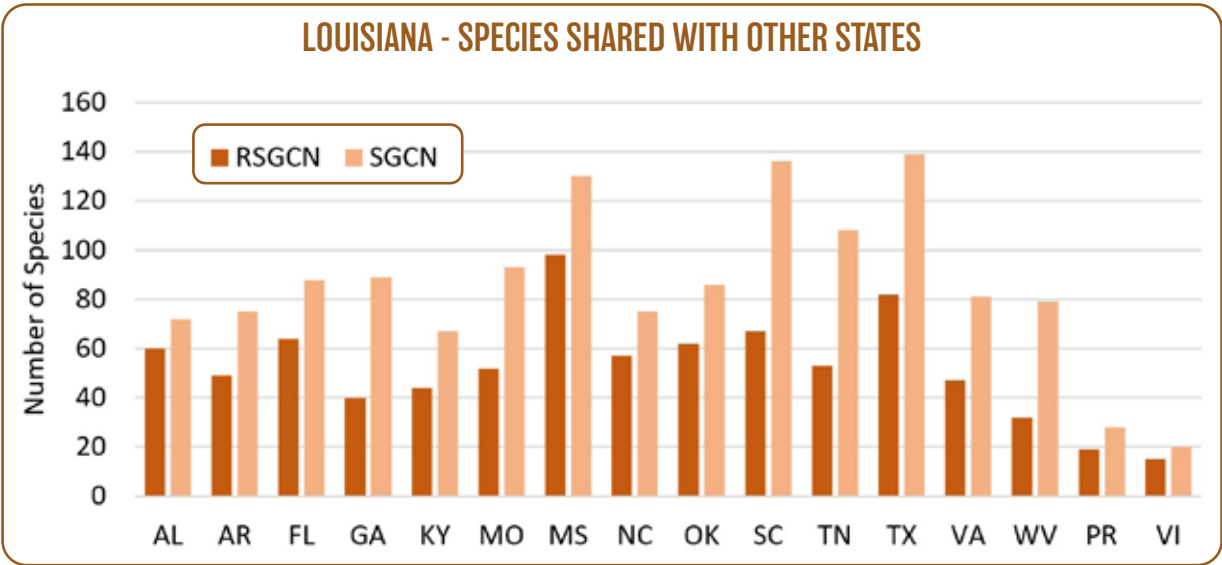


FIGURE 10.8. Number of Species of Greatest Conservation Need and Regional Species of Greatest Conservation Need Shared with Other Southeastern States and Territories.

IDENTIFYING SHARED PRIORITIES ACROSS THE LANDSCAPE TO SUPPORT REGIONAL SPECIES OF GREATEST CONSERVATION NEED

There are several regional datasets available that can help Louisiana identify lands and waters that support RSGCN and where collaborations with other states may be appropriate. For example, habitat maps from the USGS Gap Analysis Project (GAP) are available for approximately 290 of the RSGCN at the species level. Although GAP does not include habitat maps for invertebrates or plants, it does include a high percentage of vertebrate RSGCN (92% of amphibians [Figure 10.9], 88% of birds [Figure 10.10], 87% of mammals [Figure 10.11], and 78% of reptiles [Figure 10.12]). There are an additional 90 subspecies on the RSGCN list that have GAP habitat maps at the species level. In addition, using GAP habitat maps along with other regional conservation plans like the Blueprint can help identify areas where conservation actions are likely to support co-benefits.

Species’ predicted habitat maps were built using a national wildlife habitat relational database based on habitat associations described in published literature. The maps are created at 30-meter resolution using core datasets, including detailed land cover, elevation, and hydrological characteristics (e.g., salinity, water type, and velocity). While the actual distributions of many species are likely to be habitat-limited, suitable habitat will not always be occupied because of population dynamics and species interactions. Furthermore, these maps correspond to mid-

scale characterizations of landscapes, but individual animals may deem areas to be unsuitable because of the presence or absence of fine-scale features and characteristics that are not represented in the GAP models (e.g., snags, vernal pools, and shrubby undergrowth). All data, including model inputs, are available from the USGS Gap Analysis Project Species’ Habitat Maps on ScienceBase.

Using GAP species’ habitat maps, species richness of reptile RSGCN that fall within the high concern category occur predominantly within the East Gulf Coastal Plain and Mississippi River Alluvial Plain ecoregions (Figure 10.13). Similarly, the GAP species’ habitat maps show high species richness for bird RSGCNs listed in the high or very high concern category in the Gulf Coast Prairies and Marshes and the Mississippi River Alluvial Plain ecoregions (Figure 10.10).

Using available habitat maps from GAP for specific RSGCN, along with regional conservation plans like the Blueprint, can also help to identify not only a species’ habitat across its range, but areas where conservation action can achieve multiple co-benefits. Using the Blueprint with the modeled habitat of species that occur in multiple states can help visualize and highlight important areas for species conservation across multiple jurisdictions. As recommended by AWFA, cross-jurisdictional or regional strategies can enhance ecosystem resiliency, function, and connectivity, especially in the face of climate change.

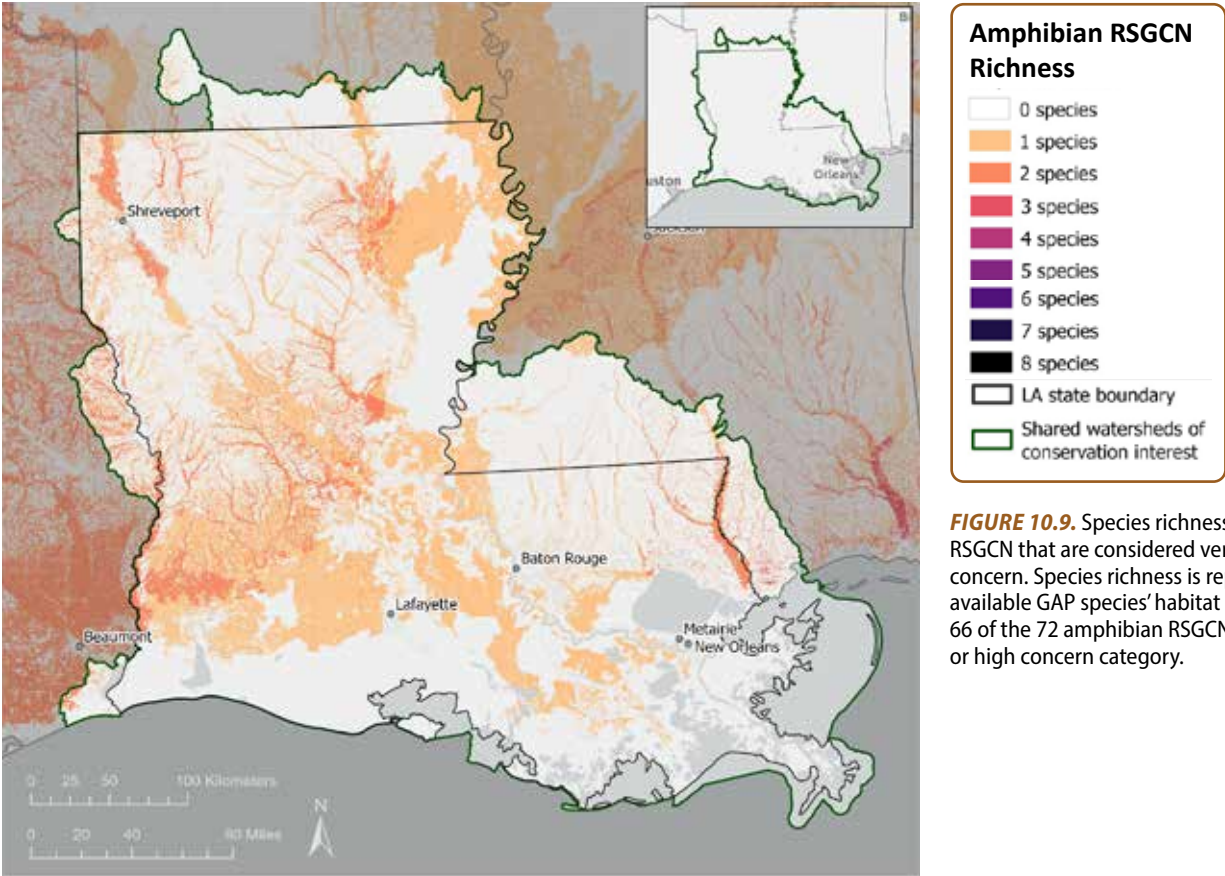


FIGURE 10.9. Species richness for amphibian RSGCN that are considered very high or high concern. Species richness is represented using available GAP species’ habitat models (2001) for 66 of the 72 amphibian RSGCN in the very high or high concern category.

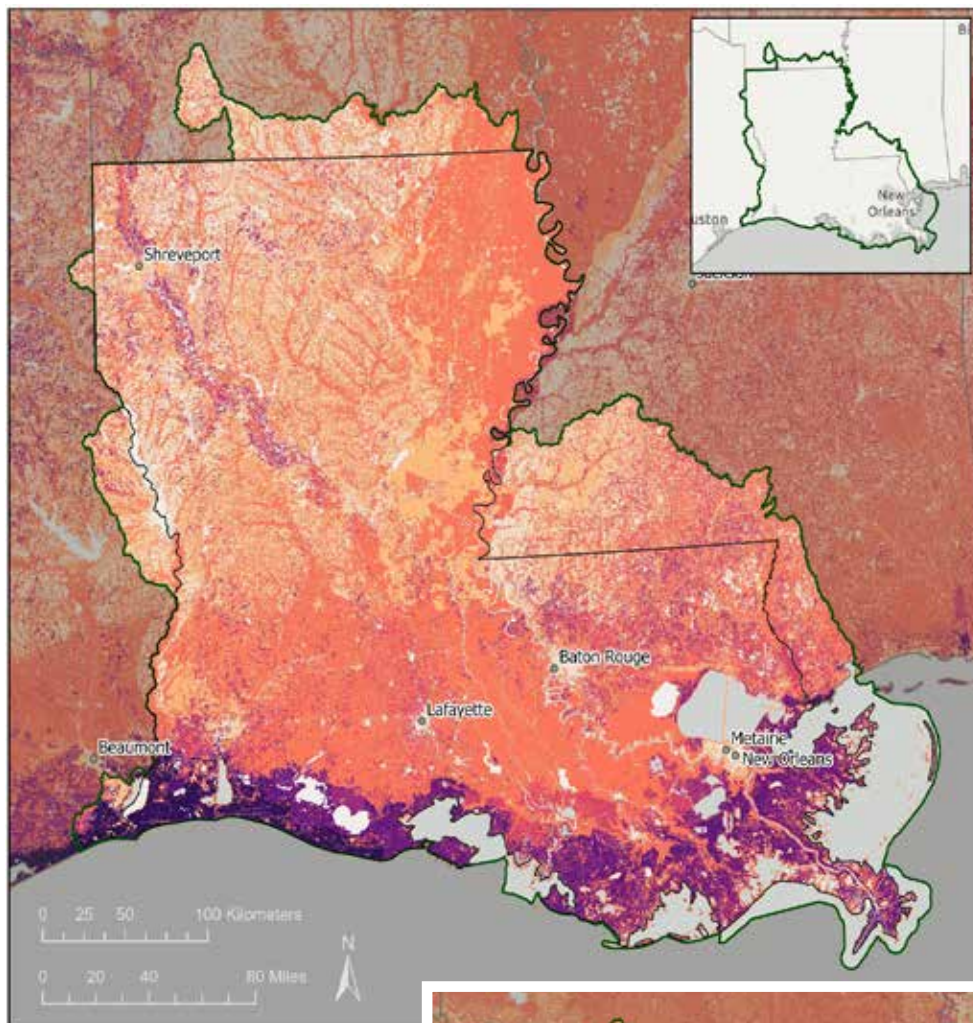


FIGURE 10.10. Species richness of bird RSGCN that are considered very high or high concern. Species richness is represented using available GAP species' habitat models (2001) for 50 of the 57 bird RSGCN in the very high or high concern category.

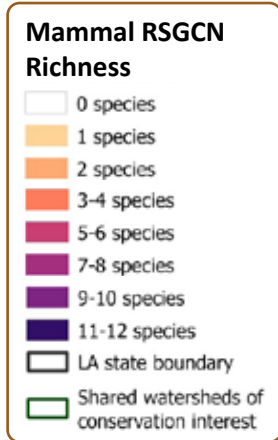
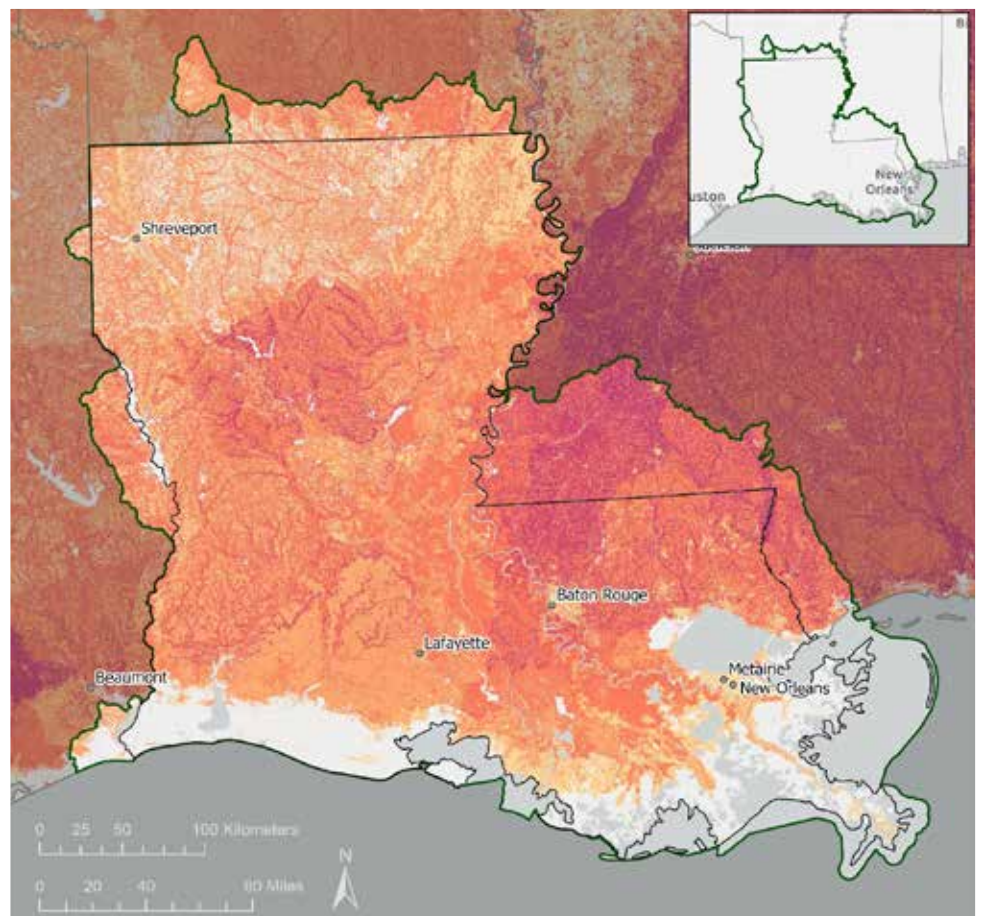


FIGURE 10.11. Species richness of mammal RSGCN that are considered very high or high concern. Species richness is represented using available GAP species' habitat models (2001) for 33 of the 38 mammal RSGCN in the very high or high concern category.



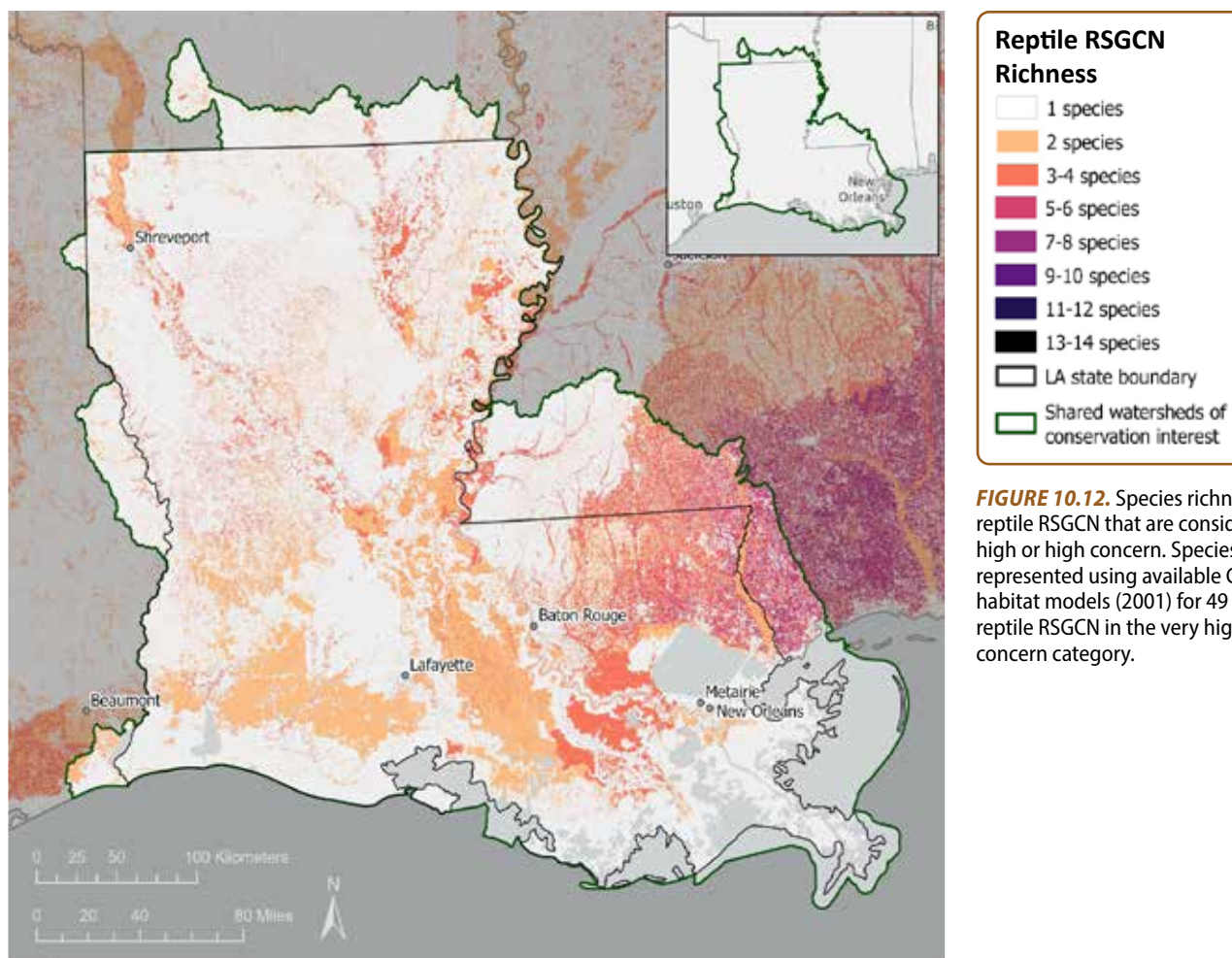


FIGURE 10.12. Species richness of reptile RSGCN that are considered very high or high concern. Species richness is represented using available GAP species' habitat models (2001) for 49 of the 63 reptile RSGCN in the very high or high concern category.

CLIMATE RESILIENCY

Many factors impacting the Southeast regional landscape like sea level rise, changing weather patterns, and habitat loss are often too pervasive for any one agency to address independently. While Louisiana must evaluate the impact of landscape level stressors and threats like climate change and land use change within its own boundaries, management efforts must also be coordinated on a regional scale. The AFWA 2022 (2nd Edition) *Voluntary Guidance for States to Incorporate Climate Adaptation into State Wildlife Action Plans and Other Management Plans* provides recommended steps for developing and implementing adaptation strategies. Much of the guidance includes taking a broader, regional approach to incorporating climate adaptation into SWAPs.

Projections of Earth's future surface temperatures depend primarily on future emissions and how sensitive the climate system will be to these emissions. Projections of climate change can be examined using two approaches: (1) global warming levels (GWLs) and (2) scenarios. GWLs are defined levels of warming for Earth's average temperature that correspond to increases of 2.7°F (1.5°C), 3.6°F (2°C), 5.4°F (3°C), and 7.2°F (4°C) degrees above pre-industrial levels (IPCC 2018, Arias et al. 2021). A scenario-based approach can be used to explore plausible climate outcomes under a coherent future trajectory

of greenhouse gases and other anthropogenic forcings (Leung et al. 2023). The Fourth National Climate Assessment (NCA4; USGCRP 2018) used projections created with Representative Concentration Pathways (RCPs) to predict future climate in the United States (USGCRP 2018). The Fifth National Climate Assessment (NCA5; USGCRP 2023) used newly developed climate projections created with Shared Socioeconomic Pathways (SSPs) that represent plausible trajectories of GDP and population growth and trends of economic and technological progress globally for the 21st century (USGCRP 2023). The climate projections used in the NCA5 were created using global climate models from the Coupled Model Intercomparison Project Phase 6 (CMIP6) that were statistically downscaled to translate large scale changes in the climate under a given SSP or GWL to local scales for impact assessment and planning (Basile et al. 2023). Three of the SSPs used with the new climate models from the CMIP6 correspond to three of the RCPs used with the past global climate models from the Coupled Model Intercomparison Project Phase 5 (CMIP5) in their overall forcing levels (SSP1-2.6 corresponds with RCP2.6, SSP2-4.5 with RCP4.5, and SSP5-8.5 with RCP8.5) (Leung et al. 2023). Scenarios can predict when the planet will reach a certain global warming level. Hereafter, throughout this section, a mix of the SSPs and GWLs will be used to show climate impacts (*Figure 10.13*).

Using available climate change data and information that assume a specific GWL- or SSP-based scenario can allow land managers to consider possible future conditions. Exactly when and if we reach a particular GWL depends on the trends of global emissions and how sensitive the climate system is to these emissions. For example, in a very high scenario such as SSP5-8.5, the Earth is very likely to exceed GWL 2 (3.6°F) between 2033 and 2054, depending on the climate sensitivity to greenhouse gas emissions from each global climate model (Marvel et al. 2023; *Figure 10.13*). By contrast, in a low scenario such as SSP1-2.6, the Earth is very likely not to cross GWL 2 at all (Marvel et al. 2023; *Figure 10.13*). However, the rate of global warming varies across these scenarios, as well, with high and very high scenarios assuming the Earth warms faster (Marvel et al. 2023). Since 1850, the Earth's temperature has risen by an average of 0.11°F per decade and, as of 2023, has risen about 2°F in total (NOAA 2025b). However, since 1982, the rate of warming increased over three times as fast to about 0.36°F per decade. Currently, the planet is estimated to warm by nearly 5.4°F by the end of this century, meaning crossing a GWL 3 threshold, despite current global emission reduction pledges, according to the most recent United Nation's Annual 2023 Emissions Gap Report (UN 2023). Based on these trends, it is likely that the habitats, ecosystems, and conditions of Louisiana will also change as faster rates of climate change also increases the challenge of adaptation for natural systems and wildlife.

Climate projections use the best available physical science to predict how the climate system will respond to changes in human activities, but not all climate projections are developed in the same manner (IPCC 2023). Climate experts across the world have produced more than 50 global climate models under multiple greenhouse gas emissions and socioeconomic scenarios, each with unique variations and nuances. Some have undergone transformations like downscaling to improve spatial resolutions for smaller areas in order to make management decisions at a local scale. The most recent climate projections used in the NCA5 and associated climate parameters can be viewed on the National Climate Change Viewer. This tool, developed by USGS, allows for visualizations of climate change impacts such as days of extreme

heat under projections of degree warming days, under SSP-based scenarios, and GWLs (Alder and Hostetler 2013). Additionally, these data are available as interactive maps and layers as part of the Fifth National Climate Assessment Interactive Atlas (National Climate Assessment Interactive Atlas [globalchange.gov]) and is where spatial climate data for this report were derived. Information pertaining to sea level rise, as well as easy-to-understand state-level summaries on climate change impacts, are available from the NOAA via their Sea Level Rise Technical Reports, Sea Level Rise Viewer Tool, and State Climate Summaries website (Kunkel et al. 2022, Sweet et al. 2022).

In the Southeast, climate change will have pervasive impacts on natural habitats, ecological processes, and ecosystem services, and regional efforts to mitigate or adapt to these impacts will be extremely important. According to NCA4 and NCA5, conditions in the Southeast may change dramatically (USGCRP 2018, 2023). Both assessments indicate that current trends will continue: increasing frequency, intensity, and duration of heatwaves; increasing wildfire risk; and accelerating rising sea levels. The resulting projected changes include extreme heat, extreme precipitation events, increased drought, accelerated sea level rise, and stronger tropical cyclones as well as decreases in the intensity and frequency of cold-season events. Despite the significant threat climate change poses to the landscape, understanding the tools and resources available to address climate change and develop effective strategies is difficult. As part of the survey administered to SWAP coordinators in 2021, the majority of SEAFWA states and territories reported integrating climate change as one of the most challenging aspects of the upcoming SWAP revision. Anecdotally, some SWAP coordinators noted that it is difficult to discern what tools are available, decide which tool is the right one to use, and choose the appropriate scale and timeframe when using tools. Some also reported it challenging to determine what climate-change associated threats to include and how to spatially represent the impacts. As such, the Southeast and South Central Climate Adaptation Science Centers (SE CASC and SC CASC) have provided data and information for this chapter to help translate the actionable implications of future climate projections.

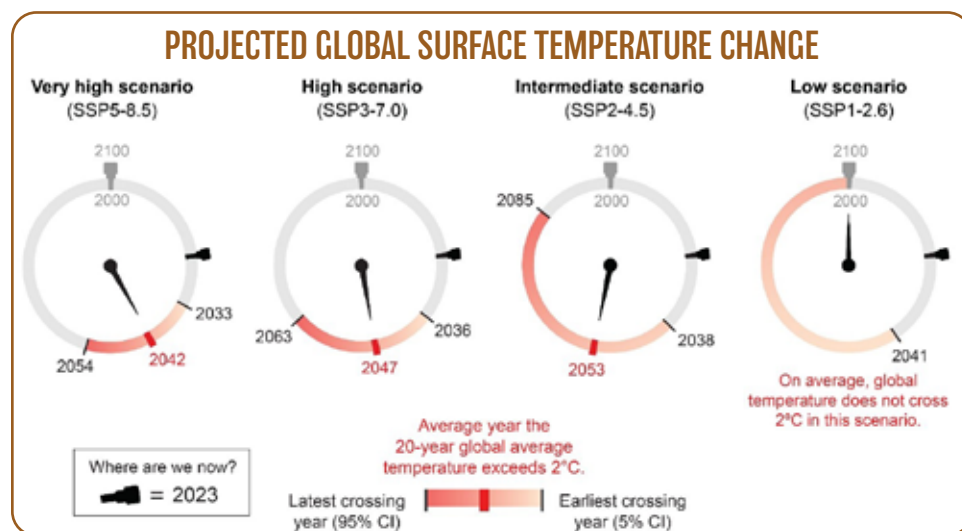


FIGURE 10.13. When (or if) the world reaches 2°C of warming depends on future greenhouse gas emissions and the sensitivity of the climate system to those emissions. Shown are the IPCC AR6 assessed warming projections for four future scenarios, with projected years at which the 2°C (3.6°F) global warming level would be reached. For example, under a very high scenario (SSP5-8.5), models project reaching 2°C between 2033 and 2054, with an average estimate of 2042. Under a low scenario (SSP1-2.6), the 5% CI (confidence interval) range begins at 2041, but the average projection shows that warming would actually stay below 2°C. Taken from the Fifth National Climate Assessment Figure 2.14 (Marvel et al. 2023).

LOUISIANA AND CLIMATE HAZARDS

Like the rest of the Southeast, Louisiana is predicted to experience a number of climate impacts, although the magnitude of change often varies by ecoregion, emissions scenario, and future timeframe. Generally, these impacts include hotter summers, warmer winters, more frequent extreme precipitation events, and rising sea levels (USGCRP 2018, 2023).

Hotter Summers, Warmer Winters, and Flash Droughts

Temperatures in Louisiana have risen by 0.5°F since the beginning of the 20th century with the warmest consecutive 5-year interval for the state occurring from 2019-2024 (Kunkel et al. 2013, Frankson et al. 2022, NASA 2024). Since 1995, the number of extremely hot days (i.e. days with high temperatures $\geq 95^{\circ}\text{F}$) in Louisiana has begun to increase but has generally remained below average (Frankson et al. 2022). By contrast, the number of very warm nights (i.e. days with above average nighttime temperatures) has increased steadily since 2000, reaching a record-high level during 2015-2020 (Frankson et al. 2022). Additionally, heatwaves in the United States have become hotter, more frequent, larger, and longer lasting in recent decades. These trends are projected to continue, which has implications for drought in the region (Hoffman et al. 2023).

Higher temperatures throughout the year in Louisiana will increase the rate of soil moisture loss (i.e. evapotranspiration) during dry spells, which could lead to more intense droughts (Frankson et al. 2022). Any increases in temperature will cause more rapid loss of soil moisture during consecutive dry days (i.e. consecutive days without rainfall), increasing the intensity of naturally occurring droughts in the future (Runkel et al. 2022). Although, hydrological droughts have become less frequent in eastern regions of the country since the 19th century, higher increases in evapotranspiration (the processes by which water is transferred to the atmosphere from Earth's surface) have generally made the Southeast more drought-prone than the Northeast (Hoffman et al. 2023). However, future changes in the annual number of consecutive extreme dry days in Louisiana are fortunately not projected to increase substantially – by 2-4% by 2025-2049 and by 1-6% by 2050-2074 depending

Figure 10.15 shows the change in the projected number of extremely hot days in Louisiana at GWL 1.5 (2.7°F warmer than the 1991-2020 time period) and GWL 2 (3.6°F warmer than the 1991-2020 time period). Overall, the projections used in the NCA5 indicate that the number of extremely hot days will increase across Louisiana, with the most pronounced increases occurring in the northern, inland portions of the state, although the magnitude of change often varies greatly by GWL or SSP scenario and location within the state (Figure 10.15).

Another way to look at future climate projections is through the lens of GWLs. If the Earth surpasses GWL 1.5 (2.7°F) or GWL 2 (3.6°F) for a sustained period of time, the number of days where the temperature reaches 100°F or higher will increase across the state, compared to the past 30 years (1991-2020) (Figure 10.15). Estimates of when these GWL might be reached depend on the emission scenario.

LOUISIANA'S EPA LEVEL III ECOREGIONS

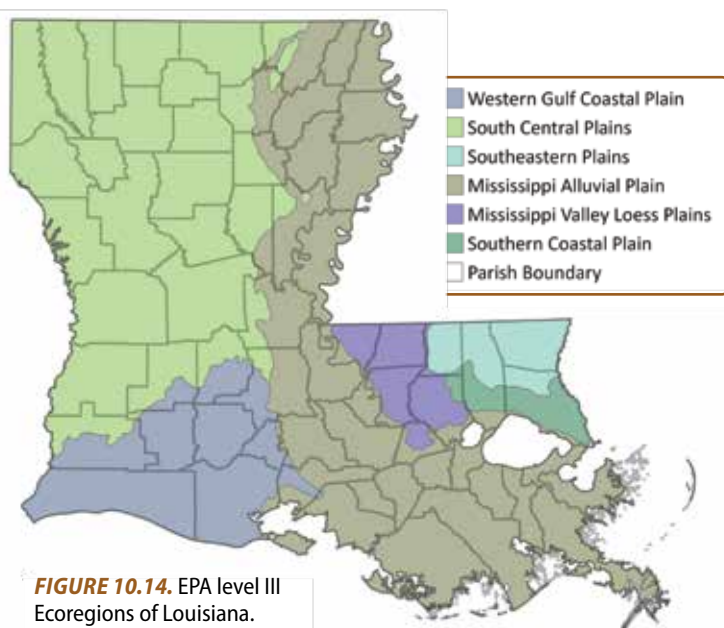


FIGURE 10.14. EPA level III Ecoregions of Louisiana.

Winter is the fastest warming season in most of the United States. Louisiana has recently experienced several warm years (2020, 2023, and 2024) that were the three warmest years on record (Frankson et al. 2022, NASA 2024). Although the recent trend is toward fewer extremely cold events, an Arctic blast in January 2025 brought record-breaking low temperatures and historic snowfall to Louisiana; The National Weather Service issued blizzard warnings for portions of the state, and Baton Rouge and New Orleans received over 7 inches of snow (NOAA 2025c). Overall, projections used in the NCA5 indicate that the number of extremely cold days (days with low temperatures of $\leq 32^{\circ}\text{F}$) will decrease across Louisiana, with the most pronounced decreases occurring throughout the northern half of the state, but the magnitude of change often varies greatly by GWL or SSP scenario and location within the state (Figure 10.16). If the Earth surpasses GWL 1.5 (2.7°F) or GWL 2 (3.6°F) for a sustained period of time, the number of days where the temperature is 32°F or lower (freezing temperatures) will decrease across the state, compared to the past 30 years (1991-2020) (Figure 10.16). Estimates of when these GWL might be reached depend on the emission scenario.

Extreme Storms and Precipitation Events, Warmer Waters, and Altered Flows

Climate change projections suggest that the Southeast will get wetter overall, meaning some seasonal, annual average, and extreme precipitation amounts will increase across the region, driven mainly by more extreme events (e.g., precipitation of 3 or more inches in 24 hours) at higher levels of global warming (Hoffman et al. 2023). Little change in total annual precipitation is projected over this century, although the timing and intensity of precipitation events will change (Hoffman et al. 2023). However, total annual precipitation has generally been above average in Louisiana since 1970 (Frankson et al. 2022). While 2010 and 2011 were very dry, the majority of the years between 2011 and 2020 have been above average years for precipitation (Frankson et al. 2022).

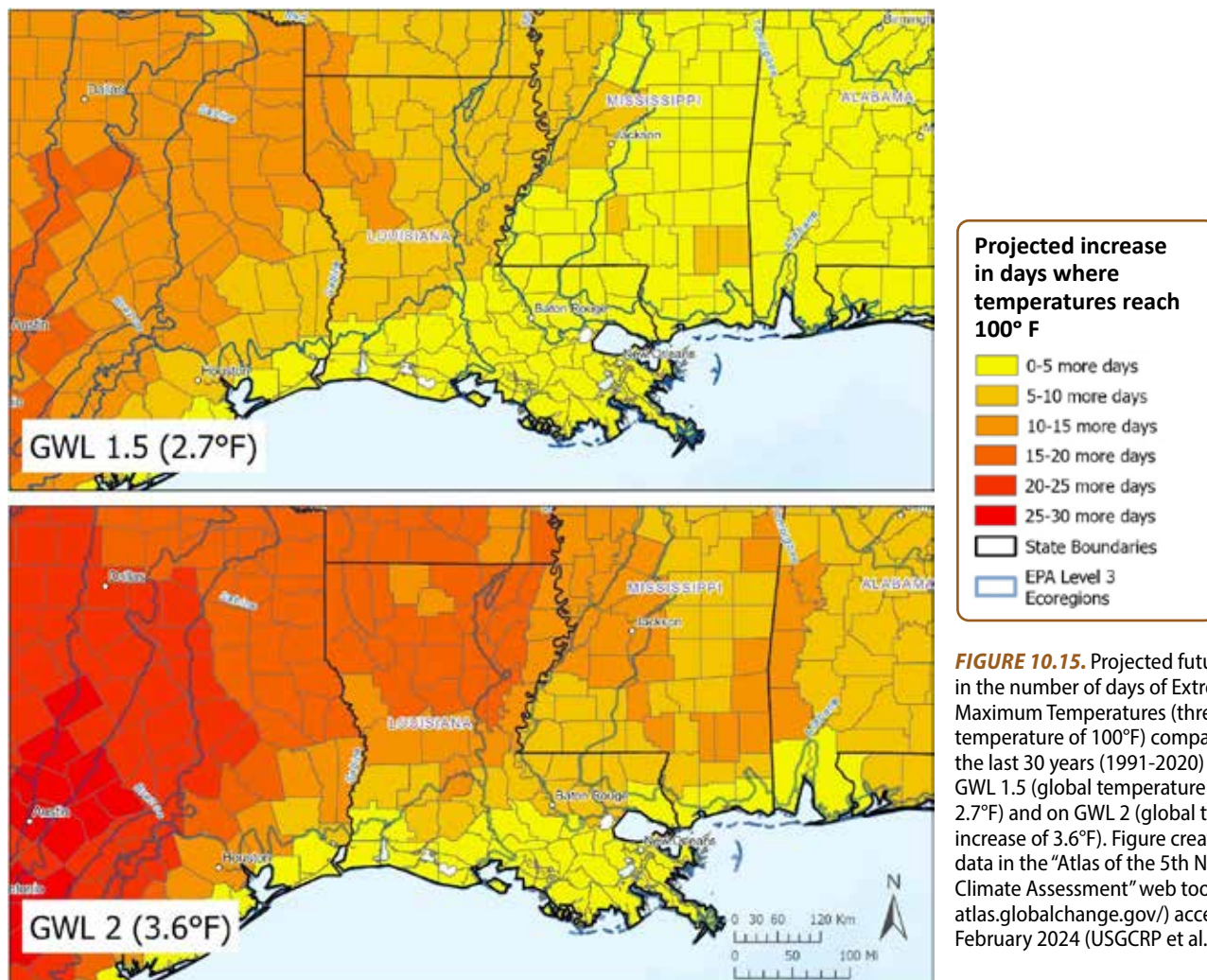


FIGURE 10.15. Projected future changes in the number of days of Extreme Maximum Temperatures (threshold temperature of 100°F) compared to the last 30 years (1991-2020) based on GWL 1.5 (global temperature increase of 2.7°F) and on GWL 2 (global temperature increase of 3.6°F). Figure created from data in the “Atlas of the 5th National Climate Assessment” web tool (<https://atlas.globalchange.gov/>) accessed on 1 February 2024 (USGCRP et al. 2024).

Extreme precipitation events are expected to increase in the future and often manifest as extreme weather and increased flooding (Wong et al. 2014). In Louisiana, the number of extreme precipitation events with 4 or more inches of rain has been generally above average since 1980 and was well above average during 2015-2020 (Frankson et al. 2022). After Florida, Louisiana has, on average, the second-highest annual number of thunderstorms in the contiguous United States, with a typical location in the state averaging more than 60 thunderstorms per year (Frankson et al. 2022). Models indicate that extreme rainfall events like the mid-August 2016 downpour in Louisiana have decreased from an average of once every 50 years to once every 30 years and have increased in magnitude; a typical 30-year event in 1900 would have had 10% less rain than a similar event today (e.g., approximately 23 inches instead of 25 inches) (Van der Wiel et al. 2016). Extreme rainfall that occurs while ocean water inundates and affects low-lying areas in the coastal plain (e.g., because of high tides or storm surges) creates compound flooding events (Hoffman et al. 2023).

In the Southeast region, extreme weather events are generally characterized by hurricanes and tropical storms, which will likely increase in frequency and magnitude (USGCRP 2018). Hurricanes and tropical storms have been responsible for some

of the Southeast’s biggest and most damaging flooding events since 2018 (Hoffman et al. 2023). The likelihood of hurricanes slowing down or stalling near the Southeast coastline has increased, which exacerbates the rainfall-related flooding threats from these storm systems (Hoffman et al. 2023). Climate change is expected to strengthen North Atlantic hurricanes to at least Category 4 intensity and cause rapid intensification as well as potentially increasing the likelihood of storms making landfall (Hoffman et al. 2023). More severe weather, combined with subsequent wave action, high winds, and storm surge, can severely erode beaches and dunes, eliminate nests of sea turtles and beach-nesting birds, and degrade or erode maritime forests and salt marshes (USGCRP 2018). Hurricanes strike Louisiana an average of once every three years, but as the climate continues to warm, hurricane-associated rainfall rates are projected to increase. The resulting flooding is a particular concern for the state (Frankson et al. 2022).

Figure 10.17 shows the projected future percent change in the number of days per year with extreme precipitation (e.g., days with the top 1% of rainfall) in Louisiana at GWL 1.5 (2.7°F warming) and GWL 2 (3.6°F warming) compared to the last 30 years. Estimates of when these GWL might be reached depend on the emission scenario. Although all ecoregions

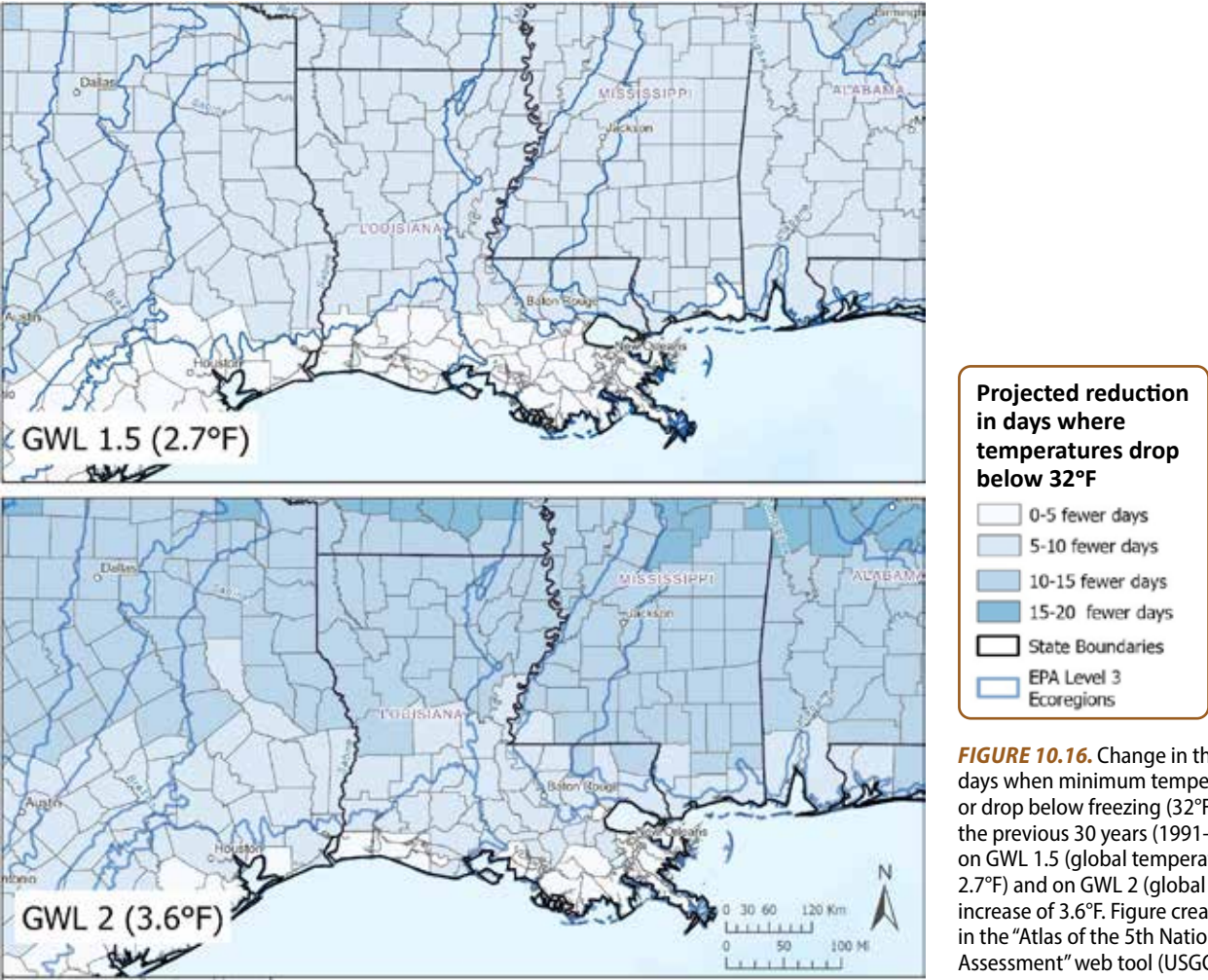
within Louisiana will experience changes in days with extreme precipitation, the central and northern parts of the state in the Mississippi Alluvial Plain Ecoregion and South Central Plains Ecoregions are projected to experience the greatest percent change across GWLs (Figure 10.17).

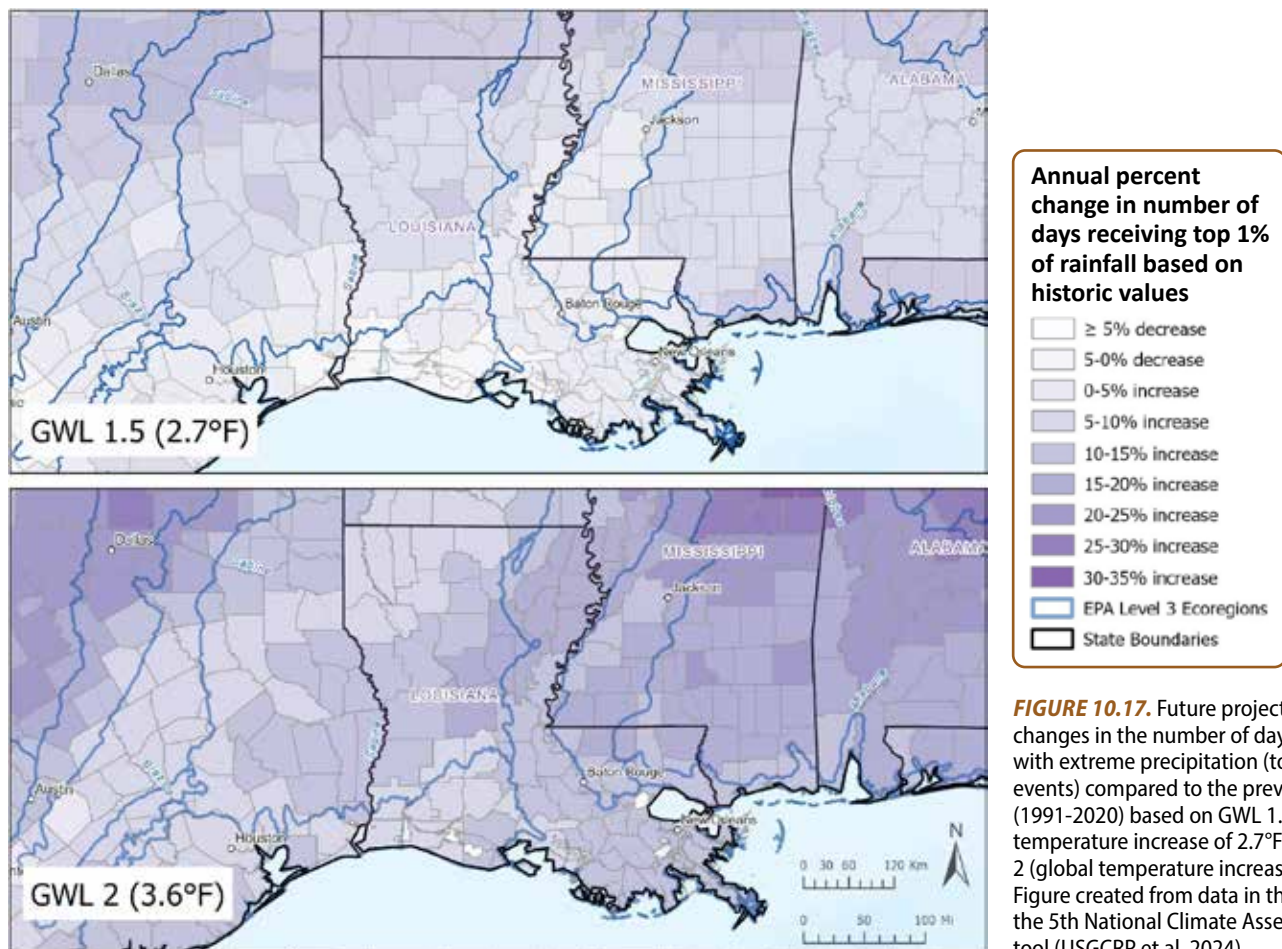
The Southeast has the highest aquatic diversity of any temperate system; however, the ecological relationships and life histories of many of the endemic species are not well understood within the constraints of climate change (Ingram et al. 2013). Freshwater ecosystems (e.g., streams, rivers, lakes, and wetlands) of the Southeast are highly vulnerable to warming. Impacts on rare species of fishes and mussels are of particular concern in a changing climate. The combined effects of warming and changes in precipitation will likely alter overall hydrology including increased evapotranspiration and reduced stream base flow. Currently, many species declines are associated with widespread alteration of flow regimes and are expected to be exacerbated by climate change. Impacts of climate change on riverine and wetland ecosystems are predicted to also include increased water temperatures, which dictate many species ranges and exacerbates low dissolved oxygen conditions (Ingram et al. 2013). In general, temperature regimes of freshwater ecosystems are projected to increase in parallel with shifts in air temperatures, which, in turn, may alter plant and animal communities (Princé and Zuckerberg 2015).

Sea level rise scenarios for the Southeast, described in more detail in the following section, project a higher frequency of compound flooding along the coast by midcentury (Hoffman et al. 2023). Extreme rainfall events also contribute to increases in river and stream flooding across the landscape, which have different effects in different ecoregions and topography. For example, in the Western Gulf Coastal Plain, Southern Coastal Plain, and lower Mississippi Alluvial Plain ecoregions, where elevation is low, there is growing concern for river levels and future water management in the Mississippi Basin (Van der Wiel et al. 2016, Miller et al. 2023). As climate change continues, understanding the interplay between increased precipitation and extreme rainfall events, evaporation (with increased temperatures), and river flow will be vital for protecting natural and water resources and managing flooding in Louisiana’s coastal habitats (Van der Wiel et al. 2016, Miller et al. 2023).

Sea Level Rise

Beyond the changes for temperature and precipitation, sea level rise will also impact Louisiana. Coastal and low-lying areas are highly likely to experience a myriad of changes due to sea level rise (Wong et al. 2014). Sea level rise along the United States’ coast is increasing faster than the global average with the highest rates currently observed along the Gulf and Mid-Atlantic coasts of the Southeast region (Hoffman et al. 2023). Due to the magnitude of sea level rise projected throughout the 21st





century and beyond, coupled with subsidence, coastal systems and low-lying areas will increasingly experience adverse impacts such as submergence, flooding, and erosion (Wong et al. 2014). Historically, coastal ecosystems in the Southeast region have adjusted to sea level rise by vertical (accretion) and horizontal movement across the landscape. As sea levels continue to rise, some coastal ecosystems will be submerged and convert to open water, and saltwater intrusion will allow salt-tolerant coastal ecosystems to move inland at the expense of upslope and upriver ecosystems. Louisiana's coastline is extremely vulnerable to sea level rise due to coastal subsidence, wetland loss, and low elevation in the southern portion of the state. Projected sea level rise poses widespread and continuing threats to the state's coastal ecological communities (Frankson et al. 2022).

The NOAA 2022 Sea Level Rise Technical Report, *Global and Regional Sea Level Rise Scenarios for the United States*, provides the most recent projections available to all United States coastal areas out to the year 2150 (Sweet et al. 2022). The following tables show the predicted extent of flooding for coastal Louisiana at the average highest daily tide due to sea level rise (Table 10.5) and the projected amount of sea level rise by decade under various emissions scenarios (Table 10.6). Figure 10.17 also provides a statewide map of areas likely to experience flooding at high tide based on each foot of sea level rise above current levels.

SPECIES' RESPONSE TO CHANGES IN CLIMATE

As the climate, regional landscape, and weather patterns change, there is value in identifying regional strategies and conservation actions to support the SGCN and RSGCN that are most vulnerable to the impacts. A species is considered vulnerable to climate change if it is both sensitive and exposed to climate change impacts (Williams et al. 2008). For example, a species may be exposed to climate change, because it experiences an impact like warmer stream temperatures; but if it is resilient to that change or able to disperse into new habitats, it may, ultimately, have low vulnerability. Conversely, a species that would be sensitive to climate change but is unlikely to experience any impacts and is, therefore, not exposed may also be less vulnerable. Understanding if a species is sensitive and will be exposed to climate change can help managers develop strategies to support the species most likely to be impacted.

Two common tools that have been used to determine climate vulnerability of species are (1) the Climate Change Vulnerability Index (CCVIs) (Young et al. 2016) developed by NatureServe and (2) environmental niche modeling-based vulnerability estimates produced by the academic research community. The CCVI is a worksheet-based tool where users apply expert opinions, as well as readily available information about a species' natural history, distribution, and landscape circumstances, to predict whether the species will likely suffer a range contraction and/or population reduction due to climate change. By design,

the resulting climate change vulnerability score is distinct from NatureServe’s national vulnerability ranking system that considers other threats. A species could score as not particularly vulnerable in terms of its Global or State rank (G- or S-rank), but could still rate as vulnerable to climate change. CCVI is based on an evaluation of the species’ direct and indirect exposure to climate change and its sensitivity to climate change. To date, several SEAFWA states (West Virginia DNR 2011; Tennessee SWAP Team 2015; Florida FWC 2011; and Louisiana, Holcomb et al. 2015) have used the CCVI tool to conduct assessments of their SGCN in order to inform previous SWAPs, management priorities, and research and conservation planning. Previous CCVI assessments can be accessed from those states’ 2015 SWAPs or from an archived online integrated dataset collated by the Armsworth lab at the University of Tennessee-Knoxville (Armsworth et al. 2025). Those CCVI assessments can serve as references for what has been done in the past and to shape future planning and conservation efforts.

FIGURE 10.18. NOAA's sea level rise (SLR) inundation models represent areas likely to experience flooding at high tide based on each foot of SLR above current levels. Darker blue areas will experience flooding first, and at greater depth, compared to lighter blue areas. These models are not linked to a future timeframe; see the projections in *Tables 10.5 and 10.6*. NOAA calculates the inundation footprint at "mean higher high water," or the average highest daily tide. The area covered in each SLR scenario includes areas projected to be inundated at lower levels. For example, the area inundated by 4 ft of SLR also includes areas inundated by 3 ft, 2 ft, 1 ft, and 0 ft of SLR (where 0 ft represents current levels).

TABLE 10.5. Extent of flooding by projected average highest daily tide due to sea level rise in Louisiana. Values from the NOAA sea level rise inundation data.

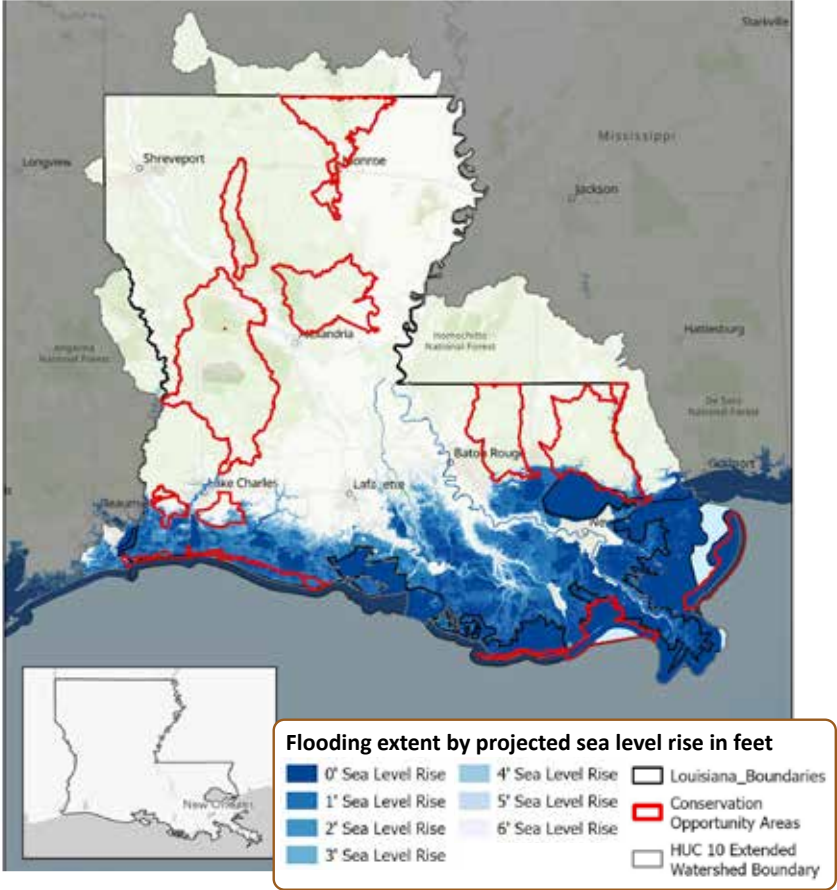
FEET OF SEA-LEVEL RISE	ACRES	PERCENT OF AREA
0 feet	7,470,554	22.3%
1 foot	8,858,790	26.4%
2 feet	9,529,120	28.4%
3 feet	9,872,741	29.5%
4 feet	10,140,259	30.3%
5 feet	10,362,719	30.9%
6 feet	10,566,111	31.5%
7 feet	10,757,384	32.1%
8 feet	10,919,039	32.6%
9 feet	11,083,055	33.1%
10 feet	11,248,763	33.6%

TABLE 10.6. Projected sea level rise by decade in Louisiana. Values are based on area-weighted averages of decadal projections for 1-degree grid cells that overlap this area based on NOAA's 2022 Sea Level Rise Report.

SLR SCENARIO	2020 (ft)	2030 (ft)	2040 (ft)	2050 (ft)	2060 (ft)	2070 (ft)	2080 (ft)	2090 (ft)	2100 (ft)
Low	0.58	0.89	1.2	1.5	1.8	2.1	2.3	2.6	2.8
Intermediate-low	0.61	0.96	1.3	1.7	2	2.4	2.7	3.1	3.4
Intermediate	0.62	0.98	1.4	1.8	2.2	2.8	3.4	4.1	4.9
Intermediate-high	0.62	1	1.5	2	2.7	3.5	4.4	5.4	6.5
High	0.62	1	1.5	2.2	3.1	4.2	5.4	6.8	8.1

An ecological niche model (also called a species distribution model) is a common approach for evaluating a species’ vulnerability to climate change. These models, typically created by the academic research community, start by identifying shared climate conditions at sites where a species is known to have occurred and then predict where similar climate conditions may be found on the landscape in the future. Some models also take into account a species’ ability to disperse to new areas that may become climatically suitable. The resulting predictions from these models allow researchers to create spatially explicit estimates of whether suitable climate conditions for a species are likely to remain stable, become more widespread in the landscape (i.e. increase), or become more geographically rare in the future (i.e. decrease).

For example, if suitable climate conditions for a species were projected to decrease greatly in an area in the future, then the species would be considered more vulnerable to climate change



than a species for which climate conditions were predicted to remain stable. It is important to note that raw data from niche models (e.g., spatial raster data) are not usually readily available to the public due to the large size of the files but instead are available in summary form in the research literature (i.e. academic journal articles). Therefore, more translational effort is needed with niche model results, as the form of the data might not be readily interpretable by users. A collated and readily interpretable dataset of niche models conducted for Southeast RSGCN has been compiled (Armsworth et al. 2025).

Niche model results can be used in tandem with CCVI estimates to enhance the understanding of a given species' vulnerability, as CCVIs and niche models have complementary strengths that can help land managers make informed conservation decisions. Niche models offer more refined and spatially explicit predictions (e.g., changes in suitable habitat) about the direct exposure of a species to climate change but are only available for a limited set of species, in part, because the models require extensive data on a species before they can be applied. CCVI estimates use an expert judgment-based approach that allows integration of different types of information about species (e.g., their natural history) and what might make them vulnerable to climate change. It is important to compare CCVI estimates with available ecological niche model predictions for SGCN to fully understand a given species' vulnerability to climate change while keeping in mind the geographic (e.g., region or habitat evaluated) and biological (e.g., estimated dispersal distance) contexts of these assessments.

Summary of Available Climate Change Vulnerability Indices

The USGS Southeast Climate Adaptation Science Center (SE CASC) and the University of Tennessee-Knoxville launched a research effort to support the SEAFWA states in integrating climate change considerations into their 2025 SWAP revisions. This effort collated CCVI scores from 10 data sources within the eastern United States (Armsworth et al. 2025). It draws from CCVI assessments published in four SWAPs in the Southeast (West Virginia DNR 2011; Tennessee SWAP Team 2015; Florida FWC 2011; and Louisiana, Holcomb et al. 2015) as well as the Illinois SWAP (Illinois DNR 2011), Natural Heritage Programs in the Northeast (Schlesinger et al. 2011, Furedi et al. 2011), the Appalachian and North Atlantic Landscape Conservation Cooperatives (Sneddon and Galbraith 2015, Sneddon and Hammerson 2014), and the National Park Service Cumberland Piedmont Network (Bruno et al. 2012), all of which were informed by state conservation practitioners. This work compiles 1,600 CCVI estimates for 795 species (note: some species have multiple CCVI estimates from different states). Many of these species are on the RSGCN list for the Southeast. For Louisiana, 176 SGCN have been scored by 400 CCVI estimates to date by other institutions (Armsworth et al. 2025).

Most CCVI assessments of Louisiana's SGCN have focused on birds. Many of these CCVI assessments indicate that although some bird species may be vulnerable, a larger proportion may remain stable or likely increase under changing climatic conditions. Although more assessments are needed for other

taxa, especially those that are not as well studied (e.g., plants), current CCVI estimates show that amphibians and reptiles, fishes, invertebrates, and mussels have the largest proportions of Louisiana SGCN that are vulnerable to climate change; mammals have the smallest proportion. In addition, while about half of the assessed amphibian and reptile SGCN in Louisiana are vulnerable to climate change, the other half are presumed stable.

Summary of Available Ecological Niche Models

In addition to the collation and summary of CCVI estimates, the SE CASC and the University of Tennessee-Knoxville summarized complementary information on available ecological niche models. For Louisiana, 173 SGCN have been evaluated, which consists of ~450 vulnerability scores (note: some species have multiple scores for different future climate scenarios) across 12 academic research studies (Mckenny et al. 2007, Iverson et al. 2008, Matthews et al. 2011, Sutton et al. 2014, Bucklin et al. 2015, Struecker and Milanovich 2017, Pandey and Papeş 2018, Bateman et al. 2020, Lawler et al. 2020, Zellmer et al. 2020, Zhu et al. 2021, Lyon and Papeş 2022). Similar to the CCVI assessments, most niche models have focused on birds and have found that many species of birds will experience increases in their climatically suitable landscape within the Southeast region as a result of climate change.

Comparing CCVI and Available Ecological Niche Models Results

Comparing the results of the ecological niche models to the CCVI estimates for SGCN within Louisiana reveals similar trends for taxa that were evaluated using both methods. All assessed taxa (including plants) will experience some vulnerability and some decreases in suitable range due to climate change. However, besides birds, these results suggest that large proportions of Louisiana amphibian, fish, insect, and mussel SGCN will be vulnerable to climate change. Amphibians have the fewest species with predicted stable populations across both methods and show virtually no SGCN to be presumed stable or increasing in the CCVI estimates. Birds have the most species identified as vulnerable to climate change but also the most species with predicted stable or increasing populations across both approaches, partially due to the number of bird SGCN evaluated as compared to other taxa.

However, there are currently few overlaps between the species assessed by both the CCVI and ecological niche model datasets, limiting the scope of comparisons until more assessments and niche models are completed. In particular, niche model estimates are not yet available for many aquatic species such as fishes and mussels, which the scientific literature suggests may be some of the most vulnerable to climate change in Louisiana and the Southeast region (Halpern and Kappel 2012, Poff et al. 2012, Ingram et al. 2013). In fact, the available CCVI for these aquatic taxa suggest that more fish and mussel SGCN of Louisiana are predicted to be vulnerable to climate change than not.

The comparison of these two methods supports focusing climate adaptation strategies on the conservation of amphibian and reptile species. SARP already considers identification and

remediation of anthropogenic barriers to aquatic organism passage a priority conservation action, and this can also be an important climate adaptation strategy to support the resilience of fishes and other aquatic species that rely on aquatic connectivity. Additionally, more research is needed on the vulnerability of invertebrates like insects that had the greatest number of highly vulnerable SGCN from compiled CCVI estimates.

CASE STUDY

A Closer Look - Climate Impacts on Louisiana Wetlands and Their Amphibian Species of Greatest Conservation Need

Isolated inland wetlands, particularly those ephemeral in nature such as prairies of northwestern Louisiana, Macon Ridge Green Ash Ponds in northeastern Louisiana, and flatwoods ponds throughout the state, are vital for successful amphibian reproduction. These habitats, combined with other types of wetlands throughout Louisiana such as the swamps and bottomland hardwood forests, are critical to amphibian biodiversity and rely on precipitation patterns that are increasingly variable (Walls et al. 2013, Ansley et al. 2022).

Many amphibians that inhabit these wetlands are consistently listed in the IUCN Red List as vulnerable, endangered, or critically endangered (Adams et al. 2013, Li et al. 2013, Halsted et al. 2022). Several studies have shown that climatic changes affecting temperature and rainfall patterns can result in negative consequences to amphibians that rely on wetlands, leading to population and occurrence declines (Walls et al. 2011, Adams et al. 2013, Li et al. 2013, Salas et al. 2017). Amphibians are useful as ecological indicators of system conditions, and their decline may be more widespread than currently documented (Adams et al. 2013, Halsted et al. 2022). Future climate projections forecast more extreme temperatures and tropicalization of these habitats, which will further constrict the viable range of amphibian species distribution in the Southeast (Salas et al. 2017, Ansley et al. 2022).

Future climate projections also predict increases in the frequency of extreme precipitation events in Louisiana, which have negative effects on wetlands such as stream flooding, high-velocity water flow, high levels of sediment being deposited, and subsequent increases in water turbidity (Henley et al. 2000, Walls et al. 2013). Flooding, with its associated high-water flow and transport of debris, has been linked to declines and extirpations of a variety of stream and river-dwelling amphibians (Walls et al. 2013). For example, Gulf Coast Waterdog (*Necturus beyeri*) populations seem robust in streams with preferred microhabitats and adequate depth, but sedimentation from erosion and flooding within occupied watersheds may impact the species' habitat and ability to thrive (Glorioso et al. 2021). Additionally, extreme flooding events can increase opportunities for predators of amphibians; a recent monitoring study of the Coastal Plain of the southeastern United States found that the most prominent effects of flooding on the amphibian community were caused by changes in the fish community that led to increased predation of amphibians

and resource competition (Davis et al. 2022). Avoidance of fish predation is a key benefit to ephemeral ponds, which periodically dry out, preventing usage by fish.

To varying extents, all amphibians rely on the availability of fresh water in their reproductive cycles. This is true whether they directly deposit their eggs in aquatic habitats or on land (Wells 2007). The success of amphibian breeding is closely tied to the length of time and portion of the year that wetlands hold water, called hydroperiods. Shifting hydroperiods and variations in water availability due to climate change can influence amphibian breeding seasons, larval development, and body size, and have profound impacts on extinction rates (Walls et al. 2013, Davis et al. 2017, LeSage et al. 2022). Periods of drought, increased temperatures, and excessive rainfall can dramatically alter the hydroperiod of freshwater wetlands (Walls et al. 2013). For example, higher temperatures in the driest quarter of the year increase the rate at which ponds dry out, leading to shorter hydroperiods. In a recent study by Boycott and colleagues (2024), hydroperiod was the most important variable associated with the presence of the Crawfish Frog (*Lithobates areolatus*) on the landscape.

However, species-specific traits and varying adaptive capacity of amphibians lead to species responding differently to changes in climatic conditions (Davis et al. 2017). *Table 10.7* lists a selection of Louisiana's updated amphibian SGCN, the results from NatureServe conservation status and Climate Change Vulnerability Index (CCVI) assessments, and results from ecological niche modeling. Results for some species like Four-Toed Salamander, Louisiana Slimy Salamander, Gulf Coast Mud Salamander, and Eastern Spadefoot show moderate to extremely vulnerable CCVI scores and show large decreases of their climatically suitable habitat (*Table 10.7*). When regional niche model results disagree with CCVI assessments in the table, it is due to the niche models representing the projected trend for the region or for eastern North America, whereas CCVI assessments were conducted at a state level. However, regional niche models are still useful as they show the projected regional trends for the species (*Table 10.7*). Additionally, to date, many species still need to be assessed using the NatureServe CCVI tool, and many have not been the subject of regional ecological niche modeling efforts. Both instances are indicated by the "Not Assessed" boxes in *Table 10.7*. Data collected in long-term monitoring programs will be necessary to address many of these questions related to amphibian success in a changing climate (Salas et al. 2017, Carter et al. 2021, Ansley et al. 2022). Observation periods of less than 10 years or periods with long multiyear gaps are likely to be too short or incomplete to determine if a species is experiencing long-term declines or increases in abundance or occupancy (Carter et al. 2021). Future research needs to include the potential effects of variable precipitation patterns, including more extreme precipitation events, which have largely been overlooked in studies with amphibians (Walls et al. 2013). Most amphibians rely on the presence of water for reproduction and development, and precipitation patterns likely have impacts to their occupancy of a site (Adams et al. 2013). Therefore a

need exists to test impacts of the pattern and timing of rainfall events on amphibians, rather than the total amount of rainfall, especially in relation to seasonal reproduction (Walls et al. 2013).

ADAPTATION STRATEGIES

Identifying adaptation strategies to address impacts and vulnerability is a step towards climate resiliency. Climate adaptation and mitigation come in various forms, and multiple frameworks have been built to support planning and implementation of climate adaptation. Most climate adaptation frameworks include:

1. Recognizing limitations to adaptation such as the degree of natural resource management, availability of funding, or staffing capacity; and
2. Deciding which type(s) of adaptation approach(es) meet specific conservation goals.

Two well-known examples of frameworks include the Resist-Accept-Direct (RAD) Framework developed by the U.S. National Park Service and the Climate Adaptation in Practice: Resistance, Resilience and Transition (RRT) Framework developed by Colorado State University. There are also multiple sources for adaptation and mitigation strategies. *The Adaptation Workbook* (Swanston et al. 2016), a compilation of resources developed by the Northern Institute of Applied Climate Science and its partners, provides an excellent overview of strategies.

The Adaptation Workbook is broken down into sections, one of which is Adaptation Strategies and Approaches. In this section, climate adaptation strategies are listed in menus, categorized by focal areas, with the goal of providing conservationists with specific, actionable adaptation options from which to select. The menus are not all-encompassing, nor are they intended to serve as guidance for management decisions. They simply serve as a starting point for those interested in climate adaptation.

WORKING IN RESILIENT LANDSCAPES

Regardless of the projected impacts of climate hazards, some portions of the state are predicted to be more resilient than others. Focusing conservation actions within resilient places is a climate-smart investment.

Terrestrial Resilience

Much of Louisiana's natural landscape is considered a resilient terrestrial site. The Nature Conservancy (TNC) developed a data set called the Resilient Land Data and identifies areas with different landscape characteristics estimated to be the most resilient to climate change (i.e. the areas most likely to maintain species diversity and ecosystem function in the face of climate change). It measures two factors that influence resilience. The first, landscape diversity, reflects the number of microhabitats and climatic gradients created by topography, elevation, and hydrology. The second, local connectedness, reflects the degree of habitat fragmentation and strength of barriers to species movement. Highly resilient sites contain many different habitat niches that support biodiversity and allow species to move freely through the landscape to find suitable microclimates as the climate changes. Resilience emphasizes diverse landscapes where species are likely to be able to move and adjust to changing conditions. While the species composition may change, these areas will likely to be able to host a continued diversity of species into the future.

Coastal Resilience

Louisiana's coastal and estuarine environments are key areas to build and sustain resiliency in the face of climate change. In particular, tidal marshes and other tidal habitats provide vital ecosystem services like shoreline stabilization, water filtration, food production, and recreational opportunities. Identifying places where tidal marshes and other tidal habitats provide resiliency to climate hazards currently and in the future is a key strategy in mitigating climate change impacts.



A selection of Louisiana amphibian Species of Greatest Conservation Need: A) Gulf Coast Waterdog; B) Eastern Tiger Salamander; C) Louisiana Slimy Salamander; and D) Hurter's Spadefoot Toad.

The U.S. Geological Survey (USGS) used remote sensing to calculate the unvegetated-vegetated ratio of tidal wetlands, which compares the percentage of wetland covered by sediment, rocks, and open water to the percentage covered by plants. Marshes that maintain a higher proportion of vegetation tend to be more stable and resilient to threats like sea level rise, erosion, and coastal development. These data offer a method to identify marshes that may be good candidates for restoration to help them persist in the face of changing conditions (USGS 2018). Recent research shows that a high unvegetated-vegetated ratio correlates with elevation measurements that detect vertical changes due to accretion, subsidence, or compaction- meaning that stable marshes with high vegetative cover tend to better keep pace with sea level rise.

In addition to resilient terrestrial sites, TNC also developed Resilient Coastal Sites, which provides a way to map and visualize coastal habitats with the capacity to migrate to adjacent lowlands in order to sustain biodiversity and natural services under increasing inundation from sea level rise. Scientists from TNC evaluated more than 1,500 coastal sites in the Gulf of America region that contained tidal marsh and tidal habitats to identify places more likely to continue to support biological diversity and ecological functions under rising sea levels (Anderson and Barnett 2019). The sites are based on the characteristics of current tidal complexes, their predicted migration space, and surrounding buffer areas. These characteristics include marsh complex size, shared edge with migration space, sediment balance, water quality, natural land cover, landform diversity, and many others.

TABLE 10.7. Conservation indicators of select amphibian SGCN. This includes species name, Regional Species of Greatest Conservation Need (RSGCN) rank, Louisiana State Rank (SRank), NatureServe Climate Change Vulnerability Index (CCVI) assessment, and Ecological niche model vulnerability scores. CCVI assessments from southeastern states (Sneddon and Hammerson 2014, Glick et al. 2015, Holcomb et al. 2015) are included and summarized by Armsworth and colleagues (2025). Ecological niche model vulnerability scores from eastern North America geographic areas (Struecker and Milanovich 2017, Sutton et al. 2014, Zellmer et al. 2020) are included and summarized by Armsworth and colleagues (2025).

	Species	RSGCN	Conservation Status for LA (S-Rank)	NatureServe CCVIs by SE States	Niche Models for SE Region
FROGS					
Gray Treefrog	<i>Dryophytes versicolor</i>		S3	Moderately Vulnerable	Decrease *
Southern Crawfish Frog	<i>Lithobates areolatus areolatus</i>	X	S1	Highly Vulnerable	Species Stable (subsp.not assessed)
Dusky Gopher Frog	<i>Lithobates sevosus</i>	X	SH	Not Assessed	Not Assessed
Ornate Chorus Frog	<i>Pseudacris ornata</i>	X	SH	Not Assessed	Decrease - Large Decrease
Strecker's Chorus Frog	<i>Pseudacris streckeri</i>	X	SH	Not Assessed	Decrease*
SALAMANDERS					
Small-mouthed Salamander	<i>Ambystoma texanum</i>		S3	Highly Vulnerable	Increase
Eastern Tiger Salamander	<i>Ambystoma tigrinum</i>		S1	Highly Vulnerable	Species Stable (subsp.not assessed)
Valentine's Southern Dusky Salamander	<i>Desmognathus valentinei</i>		S2	Not Assessed	Not Assessed
Southern Two-lined Salamander	<i>Eurycea cirrigera</i>		S3	Not Assessed	Decrease*
Three-lined Salamander	<i>Eurycea guttolineata</i>		S3	Not Assessed	Large Decrease
Southeastern Dwarf Salamander	<i>Eurycea quadridigitata</i>		SU	Not Assessed	Decrease*
Four-toed Salamander	<i>Hemidactylium scutatum</i>		S1	Moderately Vulnerable	Decrease - Large Decrease
Gulf Coast Waterdog	<i>Necturus beyeri</i>	X	S3	Not Assessed	Stable
Red River Mudpuppy	<i>Necturus louisianensis</i>	X	S2	Presumed Stable	Species Stable (subsp.not assessed)
Louisiana Slimy Salamander	<i>Plethodon kisatchie</i>	X	S2	Extremely Vulnerable	Large Decrease
Southern Red-backed Salamander	<i>Plethodon serratus</i>	X	S1	Not Assessed	Large Decrease
Webster's Salamander	<i>Plethodon websteri</i>	X	S1	Not Assessed	Large Decrease
Gulf Coast Mud Salamander	<i>Pseudotriton montanus flavissimus</i>	X	S1	Highly Vulnerable	Decrease
Southern Red Salamander	<i>Pseudotriton ruber vioscai</i>		S1	Not Assessed	Decrease - Large Decrease
Dwarf American Toad	<i>Anaxyrus americanus charlesmithi</i>		S3	Not Assessed	Species Stable (subsp.not assessed)
Oak Toad	<i>Anaxyrus quercicus</i>	X	S2	Not Assessed	Decrease
Southern Toad	<i>Anaxyrus terrestris</i>		S3	Not Assessed	Decrease
Eastern Spadefoot Toad	<i>Scaphiopus holbrookii</i>		S2	Highly Vulnerable	Stable - Large Decrease
Hurter's Spadefoot Toad	<i>Scaphiopus hurterii</i>	X	S2	Not Assessed	Stable

*Multiple studies had different climate change vulnerabilities estimated from niche models.

WORKING WITH PARTNERS ACROSS THE REGION

There are multiple regional partnerships that include the state of Louisiana within their conservation planning. Below, we describe opportunities for Louisiana to rally conservation partners to shared areas of interest and describe on-going collaborations.

USFWS BIRDS OF CONSERVATION CONCERN

The U.S. Fish and Wildlife Service (USFWS) Birds of Conservation Concern (BCC) are identified as migratory and non-migratory species that are not listed as federally threatened or endangered but still represent high conservation priority. Birds considered for this list do not have sport hunting seasons or have a sport hunting season where very little harvest occurs. Louisiana falls within the boundaries of the Mississippi Flyway and has multiple BCC recognized by USFWS that are also identified by LDWF as a SGCN. Louisiana recognizes 38 of these species as SGCN; all but 14 of these species are also considered RSGCN (*Table 10.8*).

LOWER MISSISSIPPI VALLEY JOINT VENTURE

Operating within the Lower Mississippi River Valley, West Gulf Coastal Plain, and Ouachita regions, the Lower Mississippi Valley Joint Venture (LMVJV) aims to function as a forum in which the private, state, and federal conservation communities develop a shared vision of bird conservation. This geographic footprint includes not only portions of Louisiana but also spans into all neighboring states and partners with a variety of organizations to develop research and analysis supporting conservation actions and decision support. This expanded network can provide additional opportunities for collaboration in landscape conservation efforts. Several BCC within the LMVJV footprint are also listed as shared RSGCN between multiple states. These species are Prothonotary Warbler, Swallow-tailed Kite, Prairie Warbler, Bachman's Sparrow, Wood Thrush, King Rail, Southeastern American Kestrel, Brown-headed Nuthatch, Henslow's Sparrow, LeConte's Sparrow, Red-cockaded Woodpecker, Kentucky Warbler, Cerulean Warbler, Rusty Blackbird, Wood Thrush, and Little Blue Heron. Additional focus on the habitat supporting these species could prove to be beneficial to not only these species but additional associated species as well.

GULF COAST JOINT VENTURE

The Gulf Coast Joint Venture (GCJV) is separated into six initiative area. The Mississippi River Coastal Wetlands and Louisiana Chenier Plain Initiative areas are both located in South Louisiana and provide critical habitat for bird species. Like the LMVJV, the GCJV is a collaborative partnership including private landowners, non-governmental organizations, and state and federal agencies focused on priority bird habitat and conservation. The Northern Bobwhite, Loggerhead Shrike, and Seaside Sparrow are recognized on Louisiana's shared RSGCN and GCJV lists of priority species. Aside from an additional expanded network of conservation partners, the GCJV actively pursues advancement of conservation research, design, evaluation, and monitoring. Collaboration on conservation projects could help ensure preservation of critical habitat in these areas.

DEPARTMENT OF DEFENSE PRIORITIES AND LOUISIANA

The Department of Defense (DoD) manages nearly 29 million acres within the United States. While one of the primary functions of these lands and waters are to support vital military readiness testing, training, and operations, they also encompass some of the most important and biodiverse lands under federal control. DoD managed lands provide habitat for nearly 500 federally listed plant and animal species and for over 550 additional at-risk species. Sixty federally listed species and 74 at-risk-species occur only on DoD lands. Protecting species and managing natural resources helps DoD sustain the use of their lands for realistic and mission-essential testing, training, and operations. Given the frequent alignment between military and conservation goals, working with the DoD bases offers opportunities to promote conservation actions and collaborate with the DoD to support both regional and state SGCN.

TABLE 10.8. U.S. Fish and Wildlife Services' Birds of Conservation Concern (USFWS 2021a) that are also identified as SGCN (first column) and whether species is also considered an RSGCN in the Southeast (second column).

LOUISIANA BIRD SGCN THAT ARE BIRDS OF CONSERVATION CONCERN	
Species	RSGCN
American Golden-Plover	No
American Oystercatcher	Yes
Bachman's Sparrow	Yes
Black Rail	Yes
Black Skimmer	Yes
Black Tern	No
Canada Warbler	No
Cerulean Warbler	Yes
Chimney Swift	Yes
Common Nighthawk	No
Eastern Whip-poor-will	Yes
Golden-winged Warbler	Yes
Henslow's Sparrow	Yes
Hudsonian Godwit	No
Kentucky Warbler	Yes
King Rail	Yes
Least Tern	Yes
LeConte's Sparrow	Yes
Lesser Yellowlegs	No
Marbled Godwit	No
Mottled Duck	Yes
Pectoral Sandpiper	No
Prairie Warbler	Yes
Reddish Egret	Yes
Red-headed Woodpecker	No
Ruddy Turnstone	No
Seaside Sparrow	Yes
Semipalmated Sandpiper	No
Short-billed Dowitcher	No
Short-eared Owl	No
Snowy Plover	No
Swallow-tailed Kite	Yes
Whimbrel	Yes
Willet	Yes
Wilson's Plover	Yes
Wood Thrush	Yes
Yellow-billed Cuckoo	Yes
Yellow Rail	Yes

There are four military bases located in Louisiana: Fort Polk, Barksdale Air Force Base, Camp Beauregard, and the Naval Air Station Joint Reserve Base. The largest of these facilities is Fort Polk. Beyond the facilities and bases themselves, the military also conducts training exercises in a larger physical footprint across the state. There are several main tools that Louisiana can use to look for opportunities to manage and support SGCN through the DoD. These tools include Integrated Natural Resource Management Plans, the Army Compatible Use Buffer, and the Readiness and Environmental Protection Integration program.

Integrated Natural Resource Management Plans (INRMPs)

There is already an existing avenue of collaboration with the DoD through Integrated Natural Resource Management Plans (INRMPs). INRMPs serve as management plans for the highly diverse habitats for which the DoD is responsible. These plans are installation-specific and designed to balance conservation and mission activities in order to satisfy environmental legal requirements without compromising the capability of installation lands to support the military mission. As part of a comprehensive revision of the Sikes Act in 1997 (the statute governing natural resources management on military lands; 16 U.S.C. §670 et seq.), INRMPs are mandatory for all installations including state-owned National Guard installations with significant natural resources. INRMPs must be prepared in cooperation with the USFWS and appropriate state fish and wildlife agencies and are meant to reflect the mutual agreement of all parties concerning the conservation, protection, and management of fish and wildlife resources.

The Readiness and Environmental Protection Integration (REPI) Program

While INRMPs focus primarily on those lands and resources within DoD installation boundaries, many installations' species and habitats are more effectively and efficiently managed on an ecosystem or landscape scale. The DoD has legal authority to spend appropriated funds for conservation beyond its installation fence lines through the Readiness and Environmental Protection Integration (REPI) Program.

The REPI program addresses land use conflicts that restrict military activities, and a key component of the REPI Program is the use of encroachment management partnerships, referred to as REPI projects, authorized by Congress within 10 USC 2684a. The REPI enables DoD to enter into cost-shared agreements with specified parties (including state and local governments) to acquire interests in real property in order to, among other purposes, preserve habitat or improve installation resilience. Properties targeted for acquisition using this authority need only be ecologically related to a military installation in order to be eligible. These cost-sharing partnerships between the military services, state and local governments, and private conservation organizations allow for the acquisitions of easements or other interests in land from willing sellers that preserve critical buffer areas and habitat near military installations. Importantly, REPI funding may be used to facilitate off-installation natural resources management when a real property may not be necessary nor available.

In the Fiscal Year 2019 National Defense Authorization Act (NDAA), Congress expanded the REPI authority in 10 USC 2684a

to extend the traditional REPI real property authorities to address military installation resilience. Specifically, the language now includes a provision that allows the Secretary of Defense or the Secretary of a military department to "enter into an agreement to address the use or development of real property in the vicinity of, or ecologically related to, a military installation... for the purposes of... preserving off base habitat on the property in a manner that... maintains or improves military installation resilience."

"Military installation resilience" carries a specific definition in the law: "the capability of a military installation to avoid, prepare for, minimize the effect of, adapt to, and recover from extreme weather events, or from anticipated or unanticipated changes in environmental conditions, that do, or have the potential to, adversely affect the military installation or essential transportation, logistical, or other necessary resources outside of the military installation that are necessary in order to maintain, improve, or rapidly reestablish installation mission assurance and mission-essential functions." The terms "anticipated or unanticipated changes in environmental conditions" encompass climate change. By incorporating resilience into 10 USC 2684a, a statute focused on limiting encroachment impacts on military testing, training, and operations, Congress has cast climate change as an encroachment concern. REPI will absorb this responsibility by maintaining its focus on readiness and expanding its encroachment mission to incorporate climate change as a threat.

Because Louisiana already has a statutory seat at the table during the preparation and annual reviews of DoD installation INRMPs, the state has an opportunity to bring off-installation conservation opportunities to the installation's attention. Conversely, inviting installation natural resources managers to be more engaged in the SWAP process could reveal to the states previously unrecognized opportunities to collaborate on cost-shared conservation projects to the mutual benefit of DoD and the states as well as the species and habitats addressed by the effort.

WORKING WITH TRIBAL NATIONS

Meaningful engagement with tribes requires demonstrated respect of their individual tribal sovereignty as well as their history, culture, and governmental structure.

Currently, only four tribes are federally recognized in Louisiana: The Jena Choctaw Band of Indians, the Tunica-Biloxi Tribe of Indians, the Coushatta Tribe of Louisiana, and the Chitimacha Tribe of Louisiana. An additional 11 tribes are recognized by the state.

The Native American Fish and Wildlife Society (NAFWS) is a national Native American non-profit organization that serves as an informative communication network between tribal, federal, and state fish and wildlife management entities. NAFWS maintains a database of Tribal Natural Resource Departments staff.

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Appendix A

STATE WILDLIFE ACTION PLAN COMPREHENSIVE REVISION TEAMS

Core Team	Affiliation	Marine Taxa Team	Affiliation	Invasive Species Team	Affiliation
Jeff Duguay	Office of Wildlife	Jason Adriance	Office of Fisheries	Robert Bourgeois	Office of Fisheries
Beau Gregory	Office of Fisheries	Robert Caballero	Office of Fisheries	Chris Doffitt	Office of Wildlife
Raynie Harlan	Office of Fisheries	Peyton Cagle	Office of Fisheries	Brian Sean Early	Office of Wildlife
Sarabeth Klueh-Mundy	Office of Wildlife	Jordan Frantz	Office of Fisheries	Samuel Holcomb	Contractor
Nicole Lorenz	Office of Wildlife	Mary Grigor	Office of Fisheries	Sarabeth Klueh-Mundy	Office of Wildlife
Robby Maxwell	Office of Fisheries	Sarabeth Klueh-Mundy	Office of Wildlife	Keri Lejeune	Office of Wildlife
Michael Seymour	Office of Wildlife	Nicole Lorenz	Office of Wildlife	Nicole Lorenz	Office of Wildlife
Mollusk Taxa Team	Affiliation	David Norris	Office of Fisheries	Wesley Maddox	Office of Fisheries
Charles Battaglia	Office of Wildlife	Josh Parks	Office of Fisheries	Robby Maxwell	Office of Fisheries
Matthew Duplessis	Office of Fisheries	Amphibian and Reptile Taxa Team	Affiliation	Michael Seymour	Office of Wildlife
Beau Gregory	Office of Fisheries	Charles Battaglia	Office of Wildlife		
Raynie Harlan	Office of Fisheries	Dustin Garig	Office of Wildlife		
Sean Kinney	Office of Fisheries	Sarabeth Klueh-Mundy	Office of Wildlife		
Sarabeth Klueh-Mundy	Office of Wildlife	Keri Lejeune	Office of Wildlife		
Nicole Lorenz	Office of Wildlife	Nicole Lorenz	Office of Wildlife		
Shelby Richard	Office of Fisheries	Avian Taxa Team	Affiliation		
Crustacean Taxa Team	Affiliation	Robert Dobbs	Office of Wildlife		
Charles Battaglia	Office of Wildlife	Sarabeth Klueh-Mundy	Office of Wildlife		
Beau Gregory	Office of Fisheries	Nicole Lorenz	Office of Wildlife		
Sarabeth Klueh-Mundy	Office of Wildlife	Michael Seymour	Office of Wildlife		
Nicole Lorenz	Office of Wildlife	Phillip Vasseur	Office of Wildlife		
Non-crustacean Arthropod Taxa Team	Affiliation	Mammal Taxa Team	Affiliation		
Charles Battaglia	Office of Wildlife	Charles Battaglia	Office of Wildlife		
Sarabeth Klueh-Mundy	Office of Wildlife	Cody Cedotal	Office of Wildlife		
Nicole Lorenz	Office of Wildlife	Jennifer Hogue-Manuel	Office of Wildlife		
Michael Seymour	Office of Wildlife	Sarabeth Klueh-Mundy	Office of Wildlife		
Inland Taxa Team	Affiliation	Nicole Lorenz	Office of Wildlife		
Matthew Duplessis	Office of Fisheries	Plant and Habitat Team	Affiliation		
Raynie Harlan	Office of Fisheries	Hannah Cauley-March	Office of Wildlife		
Sarabeth Klueh-Mundy	Office of Wildlife	Chris Doffitt	Office of Wildlife		
Nicole Lorenz	Office of Wildlife	Brian Sean Early	Office of Wildlife		
Robby Maxwell	Office of Fisheries	Sarabeth Klueh-Mundy	Office of Wildlife		
Shelby Richard	Office of Fisheries	Nicole Lorenz	Office of Wildlife		
Brac Salyers	Office of Fisheries	Michael Seymour	Office of Wildlife		
James Seales	Office of Fisheries	Layla Tagert	Office of Wildlife		
Gary Vitrano	Office of Fisheries				
Jonathan Winslow	Office of Fisheries				

Appendix B

EXTERNAL PARTNERS LIST

GOVERNMENT

- U.S. Fish and Wildlife Service
- Louisiana Department of Environmental Quality
- Arkansas Game and Fish Commission
- Louisiana Department of Culture, Recreation, and Tourism
- U.S. National Park Service
- Natural Resources Conservation Service
- National Oceanic and Atmospheric Administration
- U.S. Geological Survey
- National Fish and Wildlife Foundation
- Southeast Conservation Adaptation Strategy
- Southeast Climate Adaptation Science Center
- South Central Climate Adaptation Science Center
- Coastal Protection and Restoration Authority
- Louisiana Department of Agriculture and Forestry
- Louisiana Department of Energy and Natural Resources
- Louisiana Department of Transportation and Development
- Louisiana Division of Administration Office of State Lands
- U.S. Army Corps of Engineers
- Mississippi Department of Wildlife, Fisheries, and Parks
- U.S. Department of the Army
- U.S. Forest Service

INDIVIDUALS

- Dr. John Himes
- John Michael Kelley
- Craig Marks
- Charles Pfeifer
- Larry Raymond
- Malcolm Vidrine

NATIVE AMERICAN TRIBES

- Band of Choctaw Indians
- Chitimacha Tribe of Louisiana
- Coushatta Tribe of Louisiana
- Houma Tribe
- Jena Band of Choctaw Indians
- Tunica-Biloxi Indian Tribe of Louisiana

NON-GOVERNMENTAL ORGANIZATIONS

- Acadiana Native Plant Project
- American Bird Conservancy
- American Fisheries Society- Louisiana Chapter
- American Forest Management
- Amphibian and Reptile Conservancy
- Audubon Delta
- Audubon Institute

- Barataria-Terrebonne National Estuary Program
- BREC
- Crowell Forest Resources
- Ducks Unlimited
- East Gulf Coastal Plain Joint Venture
- Edge Engineering
- Forest Investment Associates
- Gulf Coast Joint Venture
- Louisiana Ecological Forestry Center
- Louisiana Forestry Association
- Louisiana Master Naturalists of Greater Baton Rouge
- Louisiana Native Plant Society
- Louisiana Purchase Cypress Legacy
- Louisiana Watershed Initiative
- Louisiana Wildlife Federation
- Lower Mississippi Valley Joint Venture
- Manulife Investment Management Timber & Agriculture
- Molpus Woodlands Group
- National Audubon Society
- Native Plant Initiative of Greater New Orleans
- The Nature Conservancy
- Orleans Audubon Society
- Quail Forever
- Restore the Earth
- Southeast Partners in Amphibian and Reptile Conservation
- Southeast Aquatics Resources Partnership
- TTG Forestry
- Water Institute of the Gulf
- Weyerhaeuser
- Woodlands Conservancy
- The Xerxes Society

UNIVERSITIES

- Louisiana State University
- Louisiana Tech University
- McNeese State University
- Millsaps College
- Nicholls State University
- Southeastern Louisiana University
- Tulane
- University of Alabama
- University of Illinois
- University of Louisiana at Lafayette
- University of Louisiana at Monroe
- University of Tennessee
- University of Texas at Tyler

Appendix C

EXTERNAL TECHNICAL EXPERTS

Mollusks	Affiliation
Malcolm Vidrine	LSU Eunice
Charles Randklev	Texas A&M University
Chase Smith	Independent
Neil Ford	University Texas at Tyler
Nate Johnson	USGS
Garrett Hopper	Louisiana State University
Clint Robertson	Texas Parks and Wildlife Department
Robbie Ellwanger	Mississippi Department of Wildlife, Fisheries, and Parks
Matt Wagner	USFWS
Gerry Dinkins	University of Tennessee
Crustaceans	Affiliation
Michael Kaller	Louisiana State University
John Himes	Independent
Matthew Greenwold	University of Texas at Tyler
Maxwell Hartman	Arkansas Game and Fish Commission
Chris Bonvillain	Nicholls State University
Will Budnick	USGS
Darryl Felder	University of Louisiana at Lafayette
Non-crustacean Arthropods	Affiliation
Craig Marks	Independent
Janice Bossart	Southeastern Louisiana University
Chris Carlton	Louisiana State University
Vicki Bayless	Louisiana State University
Brittany Owens	Louisiana State University
John Himes	Independent
John Abbott	University of Alabama
Ed DeWalt	Illinois Natural History Survey
Brad Moon	University of Louisiana at Lafayette
Mark Genung	University of Louisiana at Lafayette
Inland Fishes	Affiliation
Bill Kelso	Louisiana State University
Mike Kaller	Louisiana State University
Robbie Ellwanger	Mississippi Department of Wildlife, Fisheries, and Parks
Matt Wagner	USFWS
Quenton Fontenot	Nicholls State University
Brian Alford	Ohio State University

Marine Fishes	Affiliation
Steve Midway	Louisiana State University
Mike Dance	Louisiana State University
Amphibians and Reptiles	Affiliation
Brad Glorioso	USGS
Chris Melder	CEMML Cooperator, Fort Polk Conservation Branch, ENRMD
John Carr	University of Louisiana at Monroe
Will Selman	Millsaps College
Avians	Affiliation
Erik Johnson	Audubon Delta
Van Remsen	Louisiana State University
Aaron Pierce	Ducks Unlimited
Bill Vermillion	USFWS
Dean Demarest	USFWS
Paul Leberg	University of Louisiana at Lafayette
Phil Stouffer	Louisiana State University
Charles Pfeifer	Independent
Mammals	Affiliation
Justin Hoffman	McNeese State University
Paul Leberg	University of Louisiana at Lafayette
Steve Shively	USFS
Plants and Habitats	Affiliation
Chris Reid	Louisiana State University
John Michael Kelly	Independent
Lowell Urbatsch	Louisiana State University
Jennifer Kluse	Louisiana State University
Eric Keith	Raven Environmental
Shirley Tucker	Louisiana State University

Appendix D

SPECIES OF GREATEST CONSERVATION NEED (SGCN)

MOLLUSKS (39)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: MOLLUSCA				
CLASS: BIVALVIA				
ORDER: PECTINIDA				
FAMILY: PECTINIDAE				
<i>Argopecten irradians</i>	Bay Scallop	G5	SU	
ORDER: PTERIIDA				
FAMILY: PINNIDAE				
<i>Atrina seminuda</i>	Half-Naked Penshell	GNR	SU	
<i>Atrina serrata</i>	Sawtooth Penshell	G5	SU	
ORDER: UNIONIDA				
FAMILY: MARGARITIFERIDAE				
<i>Margaritifera hembeli</i>	Louisiana Pearlshell	G1G2	S2	Threatened
FAMILY: UNIONIDAE				
<i>Ellipsaria lineolata</i>	Butterfly	G4G5	S1	
<i>Elliptio arca</i>	Alabama Spike	G2G3	S1	
<i>Elliptio crassidens</i>	Elephantear	G5	S3	
<i>Eurynia dilatata</i>	Spike	G5	S1	
<i>Fusconaia askewi</i>	Texas Pigtoe	G2?	S1	
<i>Lampsilis abrupta</i>	Pink Mucket	G1G2	S1	Endangered
<i>Lampsilis cardium</i>	Plain Pocketbook	G5	S2	
<i>Lampsilis ornata</i>	Southern Pocketbook	G5	S3	
<i>Lampsilis satura</i>	Sandbank Pocketbook	G2?	S2	
<i>Lampsilis siliquoidea</i>	Fatmucket	G5	S1	
<i>Lasmigona complanata</i>	White Heelsplitter	G5	S2	
<i>Ligumia recta</i>	Black Sandshell	G4G5	S1	
<i>Obovaria arkansasensis</i>	Southern Hickorynut	G3G4	S3	
<i>Obovaria olivaria</i>	Hickorynut	G4	S1	
<i>Obovaria cf. unicolor</i>	Obovaria sp.	G1G2	S2	
<i>Ortmanniana ligamentina</i>	Mucket	G5	S1	
<i>Pleurobema beadleianum</i>	Mississippi Pigtoe	G3	S2	
<i>Pleurobema riddellii</i>	Louisiana Pigtoe	G1G2	S3	
<i>Pleurobema sintoxia</i>	Round Pigtoe	G4?	S2	
<i>Potamilus amphichaenus</i>	Texas Heelsplitter	G1G3	S1	
<i>Potamilus capax</i>	Fat Pocketbook	G3	S1	Endangered
<i>Potamilus inflatus</i>	Inflated Heelsplitter	G1G2Q	S1	Threatened
<i>Pseudodontoideus subvexus</i>	Southern Creekmussel	G3	S1	
<i>Ptychobranchus occidentalis</i>	Ouachita Kidneyshell	G3G4	S1	
<i>Reginaia ebenus</i>	Ebonyshe	G4G5	S3	
<i>Strophitus pascagoulaensis</i>	Pascagoula Creekshell	GNR	S2	
<i>Strophitus undulatus</i>	Creeper	G5	S2	
<i>Theliderma cylindrica</i>	Rabbitsfoot	G3	S1	Threatened

MOLLUSKS (39) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: UNIONIDAE (cont.)				
<i>Theliderma metanevra</i>	Monkeyface	GNR	S2	
<i>Truncilla donaciformis</i>	Fawnsfoot	G5	S2	
<i>Utterbackiana hartfieldorum</i>	Cypress Floater	G4	S3	
<i>Villosa vibex</i>	Southern Rainbow	G5	S2	
CLASS: GASTROPODA				
ORDER: NEOGASTROPODA				
FAMILY: BUSYCONIDAE				
<i>Sinistrofulgur pulleyi</i>	Texas Lightning Whelk	GNR	SU	
ORDER: NEOTAENIOGLOSSA				
FAMILY: EPITONIIDAE				
<i>Gyroscala rupicola</i>	Brown-band Wentletrap	GNR	SU	
ORDER: STYLOMMATOPHORA				
FAMILY: DISCIDAE				
<i>Anguispira alternata</i>	Flamed Tigersnail	G5	S3	

CRUSTACEANS (22)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: ARTHROPODA				
CLASS: MALACOSTRACA				
ORDER: DECAPODA				
FAMILY: CAMBARIDAE				
<i>Creaserinus clausus</i>	a crayfish	GNR	SU	
<i>Creaserinus crenastylus</i>	a crayfish	GNR	SU	
<i>Creaserinus oryktes</i>	Flatwoods Digger	G4	S1	
<i>Fallicambarus dissitus</i>	Pine Hills Digger	G3	S3	
<i>Fallicambarus macneesei</i>	Old Prairie Digger	G3	S2	
<i>Fallicambarus petilicarpus</i>	Slenderwrist Burrowing Crayfish	G3	SU	
<i>Faxonella blairi</i>	Blair's Fencing Crayfish	G4G5	S3	
<i>Faxonius hathawayi blacki</i>	Calcasieu Painted Crayfish	G3T2T3	S3	
<i>Faxonius hathawayi hathawayi</i>	Teche Painted Crayfish	G3T3	S3	
<i>Faxonius hobbsi</i>	Pontchartrain Painted Crayfish	G4Q	S2	
<i>Faxonius maletae</i>	Kisatchie Painted Crayfish	G3?	S2	
<i>Procambarus bivittatus</i>	Ribbon Crayfish	G5	S1	
<i>Procambarus dupratzi</i>	Southwestern Creek Crayfish	G5	S3	
<i>Procambarus elegans</i>	Elegant Creek Crayfish	G3	S3	
<i>Procambarus geminus</i>	Twin Crayfish	G3	S3	
<i>Procambarus jaculus</i>	Javelin Crayfish	G4	S3	
<i>Procambarus machardy</i>	Caddo Chimney Crayfish	G1G2	S2	
<i>Procambarus penni</i>	Pearl Blackwater Crayfish	G3	S2	
<i>Procambarus pentastylus</i>	Calcasieu Creek Crayfish	G3	S3	
<i>Procambarus planirostris</i>	Flatnose Crayfish	G4	S2	
<i>Procambarus shermani</i>	Gulf Crayfish	G4	S1	
<i>Procambarus viaeviridis</i>	Vernal Crayfish	G5	S2	

NON-CRUSTACEAN ARTHROPODS (86+1)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: ARTHROPODA				
CLASS: ARACHNIDA				
ORDER: SCORPIONES				
FAMILY: VAEJOVIDAE				
<i>Vaejovis carolinianus</i>	Southern Unstriped Scorpion	G5	S2	
CLASS: INSECTA				
ORDER: COLEOPTERA				
FAMILY: CARABIDAE				
<i>Anillinus felicianus</i>	an Anillinus ground beetle	GNR	S1	
FAMILY: CERAMBYCIDAE				
<i>Dryobius sexnotatus</i>	Six-banded Longhorn Beetle	GNR	S2	
FAMILY: CICINDELIDAE				
<i>Cicindela formosa</i>	Big Sand Tiger Beetle	G5	S2	
<i>Dromochorus pilatei</i>	Cajun Tiger Beetle	G4	S3	
<i>Ellipsoptera wapleri</i>	White Sand Tiger Beetle	G3G4	S3	
<i>Habroscelimorpha dorsalis venusta</i>	Gulf Beach Tiger Beetle	G3T3	S2	
FAMILY: ELMIDAE				
<i>Dubiraphia parva</i>	Little Dubiraphian Riffle Beetle	G2	S1	
FAMILY: SCARABAEIDAE				
<i>Ataenius robustus</i>	Saline Prairie Scarab Beetle	GNR	S1	
ORDER: HYMENOPTERA				
FAMILY: APIDAE				
<i>Bombus fraternus</i>	Southern Plains Bumble Bee	G3G4	S2	
<i>Bombus pensylvanicus</i>	American Bumble Bee	G3G4	S3	
<i>Bombus variabilis</i>	Variable Cuckoo Bumble Bee	G1G2	SU	
FAMILY: FORMICIDAE				
<i>Pogonomyrmex badius</i>	Florida Harvester Ant	G5	S1	
<i>Pogonomyrmex comanche</i>	Comanche Harvester Ant	G2G3	S2	
ORDER: LEPIDOPTERA				
SUPERFAMILY: BOMBYCOIDEA				
FAMILY: SATURNIIDAE				
<i>Automeris louisiana</i>	Louisiana Eyed Silkmoth	G1G3	S2	
FAMILY: SPHINGIDAE				
<i>Lapara phaeobrachycerous</i>	Gulf Pine Sphinx	G3G4	S1	
SUPERFAMILY: NOCTUOIDEA				
FAMILY: EREBIDAE				
<i>Catocala atocala</i>	Brou's Underwing	G3G4	SU	
FAMILY: NOCTUIDAE				
<i>Bagisara brouana</i>	Brou's Mallow Moth	G3	SU	
SUPERFAMILY: PAPILIONOIDEA				
FAMILY: HESPERIIDAE				
<i>Amblyscirtes aesculapius</i>	Lace-winged Roadside-Skipper	G4	S3	
<i>Amblyscirtes alternata</i>	Dusky Roadside-Skipper	G3G4	S2	
<i>Amblyscirtes matheri</i>	Mather's Roadside-Skipper	GNR	SU	
<i>Amblyscirtes nemoris</i>	a roadside-skipper	GNR	S2	
<i>Amblyscirtes vialis</i>	Common Roadside-Skipper	G5	S3	
<i>Atrytone arogos</i>	Arogos Skipper	G2G3	S1	
<i>Atrytonopsis hianna</i>	Dusted Skipper	G4G5	S3	
<i>Erynnis baptisiae</i>	Wild Indigo Duskywing	G5	S2	

NON-CRUSTACEAN ARTHROPODS (86+1) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
SUPERFAMILY: PAPILIONOIDEA				
FAMILY: HESPERIIDAE				
<i>Erynnis martialis</i>	Mottled Duskywing	G3	S2	
<i>Euphyes bayensis</i>	Bay Skipper	G2G3	S2	
<i>Euphyes dion</i>	Dion Skipper	G5	S2	
<i>Euphyes pilatka</i>	Palatka Skipper	G3	S1	
<i>Hesperia meskei</i>	Meske's Skipper	G3G4	S1	
<i>Hesperia metea</i>	Cobweb Skipper	G4	SH	
<i>Lon zabulon</i>	Zabulon Skipper	G5	S3	
<i>Megathymus streckeri</i>	Strecker's Giant-Skipper	G5	S1	
<i>Megathymus yuccae</i>	Yucca Giant-Skipper	G5	S1	
<i>Panoquina panoquinoides</i>	Obscure Skipper	G5?	S2	
<i>Poanes aaroni</i>	Aaron's Skipper	G4	S2	
FAMILY: LYCAENIDAE				
<i>Brephidium exilis</i>	Western Pygmy Blue	G4G5	S2	
<i>Brephidium pseudofea</i>	Eastern Pygmy Blue	G4	S2	
<i>Callophrys henrici</i>	Henry's Elfin	G5	S3	
<i>Callophrys irus</i>	Frosted Elfin	G3	S3	
<i>Satyrium kingi</i>	King's Hairstreak	G3G4	S3	
FAMILY: NYMPHALIDAE				
<i>Anthanassa texana seminole</i>	Seminole Texan Crescent	G5T3T4	S3	
<i>Chlosyne gorgone</i>	Gorgone Checkerspot	G5	SU	
<i>Danaus plexippus</i>	Monarch	G4	S4	
<i>Lethe appalachia</i>	Appalachian Brown	G5	S3	
<i>Lethe creola</i>	Creole Pearly-eye	G4	S3	
ORDER: MECOPTERA				
FAMILY: PANORPIDAE				
<i>Panorpa americana</i>	a panorpid scorpionfly	GNR	S1	
<i>Panorpa lugubris</i>	Mourning Scorpionfly	GNR	S1	
<i>Panorpa rupeculana</i>	a panorpid scorpionfly	GNR	S1	
<i>Panorpa vernalis</i>	a panorpid scorpionfly	GNR	S2	
ORDER: ODONATA				
SUBORDER: ANISOPTERA				
FAMILY: AESHNIDAE				
<i>Gomphaeschna antilope</i>	Taper-tailed Darner	G4	S1	
<i>Triacanthagyna trifida</i>	Phantom Darner	G5	S1	
FAMILY: CORDULEGASTRIDAE				
<i>Zoraena bilineata</i>	Brown Spiketail	G5	S1	
<i>Zoraena sarracenia</i>	Pitcher Plant Spiketail	G3	S2	
FAMILY: CORDULIIDAE				
<i>Neurocordulia alabamensis</i>	Alabama Shadowdragon	G5	SU	
<i>Somatochlora filosa</i>	Fine-lined Emerald	G5	S1	
<i>Somatochlora margarita</i>	Texas Emerald	G2G3	S1	
<i>Somatochlora provocans</i>	Treetop Emerald	G4	S1	
<i>Somatochlora tenebrosa</i>	Clamp-tipped Emerald	G5	S1	
FAMILY: GOMPHIDAE				
<i>Arigomphus lentulus</i>	Stillwater Clubtail	G5	S3	
<i>Dromogomphus armatus</i>	Southeastern Spinyleg	G4	S1	
<i>Erpetogomphus designatus</i>	Eastern Ringtail	G5	S1	
<i>Gomphurus dilatatus</i>	Blackwater Clubtail	G5	S1	
<i>Hylogomphus apomyius</i>	Banner Clubtail	G3G4	S2	

NON-CRUSTACEAN ARTHROPODS (86+1) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: GOMPHIDAE (cont.)				
<i>Ophiogomphus australis</i>	Southern Snaketail	G1G2	S1	
<i>Phanogomphus australis</i>	Clearlake Clubtail	G4	S1	
<i>Phanogomphus hodgesi</i>	Hodges' Clubtail	G3	S1	
<i>Stylurus amnicola</i>	Riverine Clubtail	G4	S1	
<i>Stylurus laurae</i>	Laura's Clubtail	G4	S2	
<i>Stylurus townesi</i>	Townes' Clubtail	G3	S1	
FAMILY: LIBELLULIDAE				
<i>Celithemis bertha</i>	Red-veined Pennant	G5	S1	
SUBORDER: ZYGOPTERA				
FAMILY: COENAGRIONIDAE				
<i>Enallagma concisum</i>	Cherry Bluet	G4	S1	
<i>Enallagma weewa</i>	Blackwater Bluet	G5	S1	
<i>Nehalennia gracilis</i>	Sphagnum Sprite	G5	S1	
ORDER: PLECOPTERA				
FAMILY: LEUCTRIDAE				
<i>Leuctra szczytkoi</i>	Louisiana Needlefly	G1	S1	
<i>Leuctra species</i>	needleflies	N/A	N/A	
FAMILY: NEMOURIDAE				
<i>Amphinemura texana</i>	Texas Forestfly	G3	S1	
FAMILY: PERLODIDAE				
<i>Helopicus bogaloosa</i>	Masked Springfly	G3G4	SU	
ORDER: TRICHOPTERA				
FAMILY: HYDROPSYCHIDAE				
<i>Cheumatopsyche morsei</i>	Morse's Net-spinning Caddisfly	G1G3	SU	
<i>Diplectrona rossi</i>	Schoolhouse Springs Net-spinning Caddisfly	G1	S1	
FAMILY: HYDROPTILLIDAE				
<i>Hydroptila molsonae</i>	Molson's Microcaddisfly	G2	SU	
<i>Hydroptila ouachita</i>	Schoolhouse Springs Purse Casemaker Caddisfly	G1G2	S1	
<i>Hydroptila poirrieri</i>	a purse casemaker caddisfly	G2	S1	
FAMILY: LEPTOCERIDAE				
<i>Ceraclea spongillovorax</i>	a longhorned caddisfly	G3G4	SU	
FAMILY: PHILOPOTAMIDAE				
<i>Chimarra holzenthali</i>	Holzenthals' Philopotamid Caddisfly	G1G2	S1	
FAMILY: SERICOSTOMATIDAE				
<i>Agarodes libalis</i>	Spring-loving Psiloneuran Caddisfly	G3	SU	

INLAND FISHES (55)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: CHORDATA				
CLASS: ACTINOPTERYGII				
ORDER: ACIPENSERIFORMES				
FAMILY: ACIPENSERIDAE				
<i>Acipenser oxyrinchus desotoi</i>	Gulf Sturgeon	G2G3T2T3	S1	Threatened
<i>Scaphirhynchus albus</i>	Pallid Sturgeon	G2	S1	Endangered
<i>Scaphirhynchus platyrhynchus</i>	Shovelnose Sturgeon	G4	S3	
FAMILY: POLYDONTIDAE				
<i>Polyodon spathula</i>	Paddlefish	G4	S4	
ORDER: ANGUILLIFORMES				
FAMILY: ANGUILLIDAE				
<i>Anguilla rostrata</i>	American Eel	G4	S4	
ORDER: CLUPEIFORMES				
FAMILY: ALOSIDAE				
<i>Alosa alabamae</i>	Alabama Shad	G2?	S1M	
ORDER: CYPRINIFORMES				
FAMILY: CATASTOMIDAE				
<i>Carpiodes cyprinus</i>	Quillback	G5	S3	
<i>Carpiodes velifer</i>	Highfin Carpsucker	G4G5	S3	
<i>Cycleptus elongatus</i>	Blue Sucker	G3G4	S3	
<i>Cycleptus meridionalis</i>	Southeastern Blue Sucker	G3G4	S1	
<i>Moxostoma carinatum</i>	River Redhorse	G4	S1	
FAMILY: LEUCISCIDAE				
<i>Alburnops blennius</i>	River Shiner	G5	S3	
<i>Alburnops chalybaeus</i>	Ironcolor Shiner	G4	S3	
<i>Alburnops potteri</i>	Chub Shiner	G4	S3	
<i>Campostoma anomalum</i>	Central Stoneroller	G5	S1	
<i>Cyprinella camura</i>	Bluntnose Shiner	G5	S2	
<i>Cyprinella whipplei</i>	Steelcolor Shiner	G5	SH	
<i>Ericymba amplamala</i>	Longjaw Minnow	G5	S2	
<i>Hybognathus hayi</i>	Cypress Minnow	G4G5	S3	
<i>Hybopsis winchelli</i>	Clear Chub	G5	S4	
<i>Macrhybopsis hyostoma</i>	Shoal Chub	G5	S3	
<i>Macrhybopsis tomellerii</i>	Gulf Chub	GNR	S2	
<i>Miniellus boops</i>	Bigeye Shiner	G5	S3	
<i>Miniellus sabinae</i>	Sabine Shiner	G4	S3	
<i>Notropis atrocaudalis</i>	Blackspot Shiner	G4	S2	
<i>Paranotropis buechanani</i>	Ghost Shiner	G5	S3	
<i>Paranotropis shumardi</i>	Silverband Shiner	G5	S3	
<i>Phenacobius mirabilis</i>	Suckermouth Minnow	G5	S1	
<i>Pteronotropis hubbsi</i>	Bluehead Shiner	G3	S2	
<i>Pteronotropis signipinnis</i>	Flagfin Shiner	G5	S2	
<i>Pteronotropis welaka</i>	Bluenose Shiner	G3G4	S1	
ORDER: CYPRINODONTIFORMES				
FAMILY: FUNDULIDAE				
<i>Fundulus blairae</i>	Western Starhead Topminnow	G4	S3	
<i>Fundulus dispar</i>	Northern Starhead Topminnow	G4	S3	
<i>Fundulus euryzonus</i>	Broadstripe Topminnow	G3	S2	
<i>Fundulus nottii</i>	Southern Starhead Topminnow	G5	S3	

INLAND FISHES (55) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: HIODONTIFORMES				
FAMILY: HIODONTIDAE				
<i>Hiodon alosoides</i>	Goldeye	G5	S4	
<i>Hiodon tergisus</i>	Mooneye	G5	S3	
ORDER: LEPISTOSTEIFORMES				
FAMILY: LEPISTOSTEIDAE				
<i>Atractosteus spatula</i>	Alligator Gar	G3G4	S5	
ORDER: MORONIFORMES				
FAMILY: MORONIDAE				
<i>Morone saxatilis</i>	Striped Bass (Gulf Strain)	G5	S1	
ORDER: PERCIFORMES				
FAMILY: PERCIDAE				
<i>Ammocrypta clara</i>	Western Sand Darter	G3	S1	
<i>Crystallaria asprella</i>	Crystal Darter	G3	S2	
<i>Etheostoma artesiae</i>	Redspot Darter	G5	S3	
<i>Etheostoma caeruleum</i>	Rainbow Darter	G5	S2	
<i>Etheostoma parvipinne</i>	Goldstripe Darter	G4G5	S4	
<i>Etheostoma thompsoni</i>	Gumbo Darter	G3	S2	
<i>Percina aurora</i>	Pearl Darter	G1	SH	
<i>Percina copelandi</i>	Channel Darter	G4	S1	
<i>Percina lenticula</i>	Freckled Darter	G3	S1	
<i>Percina macrolepida</i>	Bigscale Logperch	G5	S2	
<i>Percina shumardi</i>	River Darter	G5	S3	
<i>Percina suttkusi</i>	Gulf Logperch	G5	S3	
<i>Percina vigil</i>	Saddleback Darter	G5	S3	
ORDER: SILURIFORMES				
FAMILY: ICTALURIDAE				
<i>Noturus munitus</i>	Frecklebelly Madtom	G3	S3	
<i>Noturus phaeus</i>	Brown Madtom	G4	S2	
ORDER: SYNGNATHIFORMES				
FAMILY: SYNGNATHIDAE				
<i>Syngnathus scovelli</i>	Gulf Pipefish (Inland Populations)	G5	S3	

MARINE FISHES (46)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: CHORDATA				
CLASS: ACTINOPTERYGII				
ORDER: CARANGIFORMES				
FAMILY: CARANGIDAE				
<i>Alectis ciliaris</i>	African Pompano	GNR	S4	
<i>Seriola dumerili</i>	Greater Amberjack	GNR	S4	
<i>Trachinotus carolinus</i>	Florida Pompano	G5	S4	
FAMILY: RACHYCENTRIDAE				
<i>Rachycentron canadum</i>	Cobia	GNR	S4	
ORDER: CYPRINODONTIFORMES				
FAMILY: FUNDULIDAE				
<i>Adinia xenica</i>	Diamond Killifish	G5	S4	
<i>Fundulus jenkinsi</i>	Saltmarsh Topminnow	G3	S3	
<i>Fundulus pulvereus</i>	Bayou Killifish	G5	S4	

MARINE FISHES (46)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: ELOPIFORMES				
FAMILY: MEGALOPIDAE				
<i>Megalops atlanticus</i>	Tarpon	G5	S3	
ORDER: GOBIIFORMES				
FAMILY: ELEOTRIDAE				
<i>Eleotris amblyopsis</i>	Large-scaled Spinycheek Sleeper	G5	SU	
<i>Erotelis smaragdus</i>	Emerald Sleeper	GNR	SU	
FAMILY: GOBIIDAE				
<i>Bathygobius soporator</i>	Frillfin Goby	GNR	SU	
<i>Ctenogobius stigmaticus</i>	Marked Goby	GNR	S3	
FAMILY: OXUDERCIDAE				
<i>Gobioides broussonetii</i>	Violet Goby	G5	SU	
ORDER: ISTIOPHORIFORMES				
FAMILY: ISTIOPHORIDAE				
<i>Istiophorus platypterus</i>	Sailfish	GNR	S3	
<i>Kajikia albida</i>	White Marlin	GNR	S3	
<i>Makaira nigricans</i>	Blue Marlin	GNR	S3	
<i>Tetrapturus pfluegeri</i>	Longbill Spearfish	GNR	S3	
ORDER: OPHIDIIFORMES				
FAMILY: BYTHITIDAE				
<i>Gunterichthys longipenis</i>	Gold Brotula	GNR	SU	
ORDER: PERCIFORMES				
FAMILY: CENTROPOMIDAE				
<i>Centropomus undecimalis</i>	Common Snook	G5	S4M	
FAMILY: SERRANIDAE				
<i>Dermatolepis inermis</i>	Marbled Grouper	GNR	S3	
<i>Epinephelus itajara</i>	Goliath Grouper	G3	S1	
<i>Mycteroperca interstitialis</i>	Yellowmouth Grouper	GNR	S3	
<i>Mycteroperca microlepis</i>	Gag Grouper	GNR	S3	
ORDER: PLEURONECTIFORMES				
FAMILY: PARALICHTHYIDAE				
<i>Paralichthys lethostigma</i>	Southern Flounder	G5	S3	
ORDER: RHINOPRISTIFORMES				
FAMILY: PRISTIDAE				
<i>Pristis pectinata</i>	Smalltooth Sawfish	G1G3	S1	Endangered
ORDER: SCOMBRIFORMES				
FAMILY: SCOMBRIDAE				
<i>Scomberomorus cavalla</i>	King Mackerel	GNR	S4	
<i>Thunnus obesus</i>	Bigeye Tuna	GNR	S3	
ORDER: SYNGNATHIFORMES				
FAMILY: SYNGNATHIDAE				
<i>Hippocampus erectus</i>	Lined Seahorse	GNR	S3	
<i>Hippocampus zosterae</i>	Dwarf Seahorse	GNR	SU	
<i>Microphis lineatus</i>	Opossum Pipefish	G4G5	SU	
ORDER: TETRAODONTIFORMES				
FAMILY: TETRAODONTIDAE				
<i>Sphoeroides nephelus</i>	Southern Puffer	G5	SU	

MARINE FISHES (46) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
CLASS: CHONDRICTHYES				
ORDER: CARCHARHINIFORMES				
FAMILY: CARCHARHINIDAE				
<i>Carcharhinus falciformis</i>	Silky Shark	G3	S3	
<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark	GNR	S3	Threatened
<i>Carcharhinus obscurus</i>	Dusky Shark	G3	S3	
<i>Carcharhinus perezi</i>	Caribbean Reef Shark	G4	S3	
<i>Carcharhinus plumbeus</i>	Sandbar Shark	G4	S3	
<i>Carcharodon carcharias</i>	White Shark	G2	S4M	
<i>Negaprion brevirostris</i>	Lemon Shark	G3G4	S3	
FAMILY: GALEOCERDONIDAE				
<i>Galeocerdo cuvier</i>	Tiger Shark	G4	S3	
FAMILY: SPHYRNIDAE				
<i>Sphyrna lewini</i>	Scalloped Hammerhead	G4	S3	
<i>Sphyrna mokarran</i>	Great Hammerhead	G3G4	S3	
ORDER: LAMIFORMES				
FAMILY: ALOPIIDAE				
<i>Alopias superciliosus</i>	Bigeye Thresher Shark	G3	S3	
FAMILY: LAMNIDAE				
<i>Isurus oxyrinchus</i>	Shortfin Mako Shark	GNR	S3	
<i>Isurus paucus</i>	Longfin Mako Shark	G2G3	S3	
ORDER: MYLIOBATIFORMES				
FAMILY: MOBULIDAE				
<i>Mobula birostris</i>	Giant Manta Ray	G3G4	SU	Threatened
ORDER: ORECTOLOBIFORMES				
FAMILY: RHINCODONTIDAE				
<i>Rhincodon typus</i>	Whale Shark	G4G5	S3	

AMPHIBIANS (25)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: CHORDATA				
CLASS: AMPHIBIA				
ORDER: ANURA				
FAMILY: BUFONIDAE				
<i>Anaxyrus americanus charlesmithi</i>	Dwarf American Toad	G5T5	S3	
<i>Anaxyrus quercicus</i>	Oak Toad	G5	S2	
<i>Anaxyrus terrestris</i>	Southern Toad	G5	S3	
FAMILY: HYLIDAE				
<i>Dryophytes versicolor</i>	Gray Treefrog	G5	S3	
<i>Pseudacris ornata</i>	Ornate Chorus Frog	G4	SH	
<i>Pseudacris streckeri</i>	Strecker's Chorus Frog	G5	SH	
FAMILY: RANIDAE				
<i>Lithobates areolatus areolatus</i>	Southern Crawfish Frog	G4T4	S1	
<i>Lithobates sevosus</i>	Dusky Gopher Frog	G1	SH	Endangered
FAMILY: SCAPHIOPODIDAE				
<i>Scaphiopus holbrookii</i>	Eastern Spadefoot	G5	S2	
<i>Scaphiopus hurterii</i>	Hurter's Spadefoot	G5	S2	

AMPHIBIANS (25) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: CAUDATA				
FAMILY: AMBYSTOMATIDAE				
<i>Ambystoma texanum</i>	Small-mouthed Salamander	G5	S3	
<i>Ambystoma tigrinum</i>	Eastern Tiger Salamander	G5	S1	
FAMILY: PLETHODONTIDAE				
<i>Desmognathus valentinei</i>	Valentine's Southern Dusky Salamander	GNR	S2	
<i>Eurycea cirrigera</i>	Southern Two-lined Salamander	G5	S3	
<i>Eurycea guttolineata</i>	Three-lined Salamander	G5	S3	
<i>Eurycea quadridigitata</i>	Southeastern Dwarf Salamander	G5	SU	
<i>Hemidactylium scutatum</i>	Four-toed Salamander	G5	S1	
<i>Plethodon kisatchie</i>	Louisiana Slimy Salamander	G3G4	S2	
<i>Plethodon serratus</i>	Southern Red-backed Salamander	G5	S1	
<i>Plethodon websteri</i>	Webster's Salamander	G3G4	S1	
<i>Pseudotriton montanus flavissimus</i>	Gulf Coast Mud Salamander	G5T4	S1	
<i>Pseudotriton ruber vioscai</i>	Southern Red Salamander	G5T4T5	S1	
FAMILY: PROTEIDAE				
<i>Necturus beyeri</i>	Gulf Coast Waterdog	GNR	S3	
<i>Necturus louisianensis</i>	Red River Mudpuppy	G4	S2	
FAMILY: SIRENIDAE				
<i>Siren sphagnicola</i>	Seepage Siren	GNR	SU	

REPTILES (47)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
CLASS: REPTILIA				
ORDER: SQUAMATA				
FAMILY: ANGUIDAE				
<i>Ophisaurus attenuatus attenuatus</i>	Western Slender Glass Lizard	G5T5	S3	
<i>Ophisaurus ventralis</i>	Eastern Glass Lizard	G5	S2	
FAMILY: COLUBRIDAE				
<i>Carphophis vermis</i>	Western Wormsnake	G5	S1	
<i>Cemophora coccinea</i>	Common Scarletsnake	G5	S3	
<i>Lampropeltis elapsoides</i>	Scarlet Kingsnake	G5	S2	
<i>Lampropeltis rhombomaculata</i>	Northern Mole Kingsnake	G5	SH	
<i>Lampropeltis triangulum</i>	Eastern Milksnake	G5	S2	
<i>Pituophis melanoleucus</i>	Eastern Pinesnake	G4	SH	Threatened
<i>Pituophis ruthveni</i>	Louisiana Pinesnake	G1G2	S1	Threatened
<i>Tantilla coronata</i>	Southeastern Crowned Snake	G5	S1	
<i>Tantilla gracilis</i>	Flat-headed Snake	G5	S3	
<i>Thamnophis saurita</i>	Eastern Ribbonsnake	G5	S3	
FAMILY: CROTALIDAE				
<i>Crotalus adamanteus</i>	Eastern Diamond-backed Rattlesnake	G3	S1	
<i>Crotalus horridus</i>	Timber Rattlesnake	G4	S3	
<i>Sistrurus miliarius streckeri</i>	Western Pygmy Rattlesnake	G5T5	S2	
FAMILY: DIPSADIDAE				
<i>Farancia erythrogramma erythrogramma</i>	Common Rainbow Snake	G4T4	S1	
<i>Heterodon platirhinos</i>	Eastern Hog-nosed Snake	G5	S3	
<i>Rhadinaea flavilata</i>	Pine Woods Littersnake	G4	S1	

REPTILES (47) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: ELAPIDAE				
<i>Micrurus fulvius</i>	Harlequin Coralsnake	G5	SH	
FAMILY: NATRICIDAE				
<i>Nerodia clarkii clarkii</i>	Gulf Saltmarsh Snake	G4T3	S3	
FAMILY: SCINCIDAE				
<i>Plestiodon anthracinus</i>	Coal Skink	G5	S2	
<i>Plestiodon septentrionalis obtusirostris</i>	Southern Prairie Skink	G5T5	S1	
FAMILY: TEIIDAE				
<i>Aspidozelis sexlineatus</i>	Six-lined Racerunner	G5	S4	
ORDER: TESTUDINES				
FAMILY: CHELONIIDAE				
<i>Caretta caretta</i>	Loggerhead Sea Turtle	G2G4	S1	Threatened
<i>Chelonia mydas</i>	Green Sea Turtle	G3	S1	Threatened
<i>Eretmochelys imbricata</i>	Hawksbill Sea Turtle	G3	SNA	Endangered
<i>Lepidochelys kempi</i>	Kemp's Ridley Sea Turtle	G1	S1	Endangered
FAMILY: CHELYDRIDAE				
<i>Macrochelys temminckii</i>	Western Alligator Snapping Turtle	G3	S2	
FAMILY: DERMOCHELYIDAE				
<i>Dermochelys coriacea</i>	Leatherback Sea Turtle	G2	SNA	Endangered
FAMILY: EMYDIDAE				
<i>Chrysemys dorsalis</i>	Southern Painted Turtle	G5	S3	
<i>Deirochelys reticularia miaria</i>	Western Chicken Turtle	G5T5	S1	
<i>Deirochelys reticularia reticularia</i>	Eastern Chicken Turtle	G5T5	S1	
<i>Graptemys oculifera</i>	Ringed Map Turtle	G2	S1	Threatened
<i>Graptemys ouachitensis</i>	Ouachita Map Turtle	G5	S3	
<i>Graptemys pearlensis</i>	Pearl River Map Turtle	G2G3	S1	Threatened
<i>Graptemys sabinensis</i>	Sabine Map Turtle	G5	S3	
<i>Malaclemys terrapin pileata</i>	Mississippi Diamondback Terrapin	G4T3	S3	
<i>Terrapene carolina major</i>	Gulf Coast Box Turtle	G5T4	S3	
<i>Terrapene ornata</i>	Ornate Box Turtle	G4G5	SH	
<i>Terrapene triunguis</i>	Three-toed Box Turtle	GNR	S4	
FAMILY: KINOSTERNIDAE				
<i>Kinosternon subrubrum hippocrepis</i>	Mississippi Mud Turtle	G5T5	S4	
<i>Sternotherus carinatus</i>	Razor-backed Musk Turtle	G5	S4	
<i>Sternotherus odoratus</i>	Eastern Musk Turtle	G5	S4	
<i>Sternotherus peltifer</i>	Stripe-necked Musk Turtle	GNR	S1	
FAMILY: TESTUDINIDAE				
<i>Gopherus polyphemus</i>	Gopher Tortoise	G3	S1	Threatened
FAMILY: TRIONYCHIDAE				
<i>Apalone mutica calvata</i>	Gulf Coast Smooth Softshell	G5T5	S2	
<i>Apalone mutica mutica</i>	Midland Smooth Softshell	G5T5	S3	

BIRDS (84)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
KINGDOM: ANIMALIA				
PHYLUM: CHORDATA				
CLASS: AVES				
ORDER: ACCIPITRIFORMES				
FAMILY: ACCIPITRIDAE				
<i>Elanoides forficatus</i>	Swallow-tailed Kite	G5	S2S3B	
<i>Haliaeetus leucocephalus</i>	Bald Eagle	G5	S4	
ORDER: ANSERIFORMES				
FAMILY: ANATIDAE				
<i>Anas acuta</i>	Northern Pintail	G5	S4N	
<i>Anas fulvigula</i>	Mottled Duck	G4	S4	
<i>Aythya affinis</i>	Lesser Scaup	G5	S3S4N	
<i>Aythya americana</i>	Redhead	G5	S4N	
<i>Aythya valisineria</i>	Canvasback	G5	S4N	
<i>Mareca americana</i>	American Wigeon	G5	S3S4N	
ORDER: APODIFORMES				
FAMILY: APODIDAE				
<i>Chaetura pelagica</i>	Chimney Swift	G4G5	S3B	
ORDER: CAPRIMULGIFORMES				
FAMILY: CAPRIMULGIDAE				
<i>Antrostomus carolinensis</i>	Chuck-will's-widow	G5	S4B	
<i>Antrostomus vociferus</i>	Eastern Whip-poor-will	G5	S3M	
<i>Chordeiles minor</i>	Common Nighthawk	G5	S4B	
ORDER: CHARADRIIFORMES				
FAMILY: CHARADRIIDAE				
<i>Anarhynchus nivosus</i>	Snowy Plover	G3	S1	
<i>Anarhynchus wilsonia</i>	Wilson's Plover	G5	S2	
<i>Charadrius melodus</i>	Piping Plover	G3	S2N	Threatened
<i>Pluvialis dominica</i>	American Golden-Plover	G5	S3M	
FAMILY: HAEMATOPODIDAE				
<i>Haematopus palliatus</i>	American Oystercatcher	G5	S1	
FAMILY: LARIDAE				
<i>Chlidonias niger</i>	Black Tern	G4G5	S3M	
<i>Gelochelidon nilotica</i>	Gull-billed Tern	G5	S3	
<i>Rynchops niger</i>	Black Skimmer	G5	S3	
<i>Sterna forsteri</i>	Forster's Tern	G5	S4	
<i>Sternula antillarum antillarum</i>	Coastal Least Tern	G4TNRQ	S3B	
<i>Sternula antillarum athalassos</i>	Interior Least Tern	G4T3Q	S1B	
<i>Thalasseus maximus</i>	Royal Tern	G5	S5	
<i>Thalasseus sandvicensis</i>	Sandwich Tern	G5	S4B	
FAMILY: SCOLOPACIDAE				
<i>Arenaria interpres</i>	Ruddy Turnstone	G5	S2?N	
<i>Bartramia longicauda</i>	Upland Sandpiper	G5	S2M	
<i>Calidris canutus</i>	Red Knot	G4	S2N	Threatened
<i>Calidris himantopus</i>	Stilt Sandpiper	G5	S4N	
<i>Calidris melanotos</i>	Pectoral Sandpiper	G5	S4S5M	
<i>Calidris pusilla</i>	Semipalmated Sandpiper	G5	S3S4M	
<i>Calidris subruficollis</i>	Buff-breasted Sandpiper	G4	S3M	
<i>Limnodromus griseus</i>	Short-billed Dowitcher	G3	S3N	
<i>Limosa fedoa</i>	Marbled Godwit	G5	S4N	

BIRDS (84) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: SCOLOPACIDAE (cont.)				
<i>Limosa haemastica</i>	Hudsonian Godwit	G4	S3M	
<i>Numenius americanus</i>	Long-billed Curlew	G4	S3N	
<i>Numenius phaeopus</i>	Whimbrel	G5	S3M	
<i>Scolopax minor</i>	American Woodcock	G5	S1B, S5N	
<i>Tringa flavipes</i>	Lesser Yellowlegs	G5	S5N	
<i>Tringa semipalmata</i>	Willet	G5	S3	
ORDER: CICONIIFORMES				
FAMILY: CICONIIDAE				
<i>Mycteria americana</i>	Wood Stork	G4	S3N	
ORDER: CUCULIFORMES				
FAMILY: CUCULIDAE				
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	G5	S4B	
ORDER: FALCONIFORMES				
FAMILY: FALCONIDAE				
<i>Falco sparverius paulus</i>	Southeastern American Kestrel	G5T4	S2	
ORDER: GALLIFORMES				
FAMILY: ODONTOPHORIDAE				
<i>Colinus virginianus</i>	Northern Bobwhite	G4G5	S3	
ORDER: GRUIFORMES				
FAMILY: GRUIDAE				
<i>Grus americana</i>	Whooping Crane	G1	S1	Endangered
FAMILY: RALLIDAE				
<i>Coturnicops noveboracensis</i>	Yellow Rail	G4	S3S4N	
<i>Laterallus jamaicensis jamaicensis</i>	Eastern Black Rail	G3T1	S1	Threatened
<i>Rallus crepitans</i>	Clapper Rail	G5	S4	
<i>Rallus elegans</i>	King Rail	G4	S3	
ORDER: PASSERIFORMES				
FAMILY: CARDINALIDAE				
<i>Passerina ciris</i>	Painted Bunting	G5	S5B	
FAMILY: ICTERIDAE				
<i>Euphagus carolinus</i>	Rusty Blackbird	G4	S3N	
<i>Quiscalus quiscula</i>	Common Grackle	G5	S4S5	
<i>Sturnella magna</i>	Eastern Meadowlark	G5	S3B,S4N	
FAMILY: LANIIDAE				
<i>Lanius ludovicianus</i>	Loggerhead Shrike	G4	S3S4	
FAMILY: MOTACILLIDAE				
<i>Anthus spragueii</i>	Sprague's Pipit	G3G4	S2N	
FAMILY: PARULIDAE				
<i>Cardellina canadensis</i>	Canada Warbler	G5	S3M	
<i>Geothlypis formosa</i>	Kentucky Warbler	G5	S4B	
<i>Helmitheros vermivorum</i>	Worm-eating Warbler	G4G5	S3B	
<i>Parkesia motacilla</i>	Louisiana Waterthrush	G5	S3B	
<i>Protonotaria citrea</i>	Prothonotary Warbler	G5	S5B	
<i>Setophaga cerulea</i>	Cerulean Warbler	G4	S2M	
<i>Setophaga dominica</i>	Yellow-throated Warbler	G5	S4B	
<i>Vermivora chrysoptera</i>	Golden-winged Warbler	G4	S2S3M	

BIRDS (84) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: PASSERELLIDAE				
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	G5	S1B,S3N	
<i>Ammospiza leconteii</i>	LeConte's Sparrow	G5	S4N	
<i>Ammospiza maritima</i>	Seaside Sparrow	G4	S4	
<i>Ammospiza nelsoni</i>	Nelson's Sparrow	G5	S3S4N	
<i>Centronyx henslowii</i>	Henslow's Sparrow	G4	S3N	
<i>Peucaea aestivalis</i>	Bachman's Sparrow	G3	S3	
<i>Spizella pusilla</i>	Field Sparrow	G5	S3?	
FAMILY: SITTIDAE				
<i>Sitta pusilla</i>	Brown-headed Nuthatch	G4	S4	
FAMILY: TROGLODYTIDAE				
<i>Cistothorus palustris marianae</i>	Marian's Marsh Wren	G5T3	S3	
FAMILY: TURDIDAE				
<i>Hylocichla mustelina</i>	Wood Thrush	G4	S4B	
ORDER: PELECANIFORMES				
FAMILY: ARDEIDAE				
<i>Botaurus exilis</i>	Least Bittern	G4	S4B	
<i>Egretta caerulea</i>	Little Blue Heron	G5	S3N, S4B	
<i>Egretta rufescens</i>	Reddish Egret	G4	S1	
<i>Egretta thula</i>	Snowy Egret	G5	S4N,S5B	
<i>Egretta tricolor</i>	Tricolored Heron	G5	S5B	
FAMILY: PELECANIDAE				
<i>Pelecanus occidentalis</i>	Brown Pelican	G4	S3?	
FAMILY: THRESKIORNITHIDAE				
<i>Platalea ajaja</i>	Roseate Spoonbill	G5	S4	
ORDER: PICIFORMES				
FAMILY: PICIDAE				
<i>Colaptes auratus</i>	Northern Flicker	G5	S4	
<i>Dryobates borealis</i>	Red-cockaded Woodpecker	G3	S2	Threatened
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	G5	S4	
ORDER: STRIGIFORMES				
FAMILY: STRIGIDAE				
<i>Asio flammeus</i>	Short-eared Owl	G5	S2N	
ORDER: ANIMAL ASSEMBLAGE				
FAMILY: ANIMAL ASSEMBLAGE				
<i>Migratory Stopover Site</i>	Migratory Stopover Site	GNR	SNRM	
<i>Waterbird Nesting Colony</i>	Waterbird Nesting Colony	GNR	SNRB	

MAMMALS (24)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: CHORDATA				
CLASS: MAMMALIA				
ORDER: ARTIODACTYLA				
FAMILY: BALAENOPTERIDAE				
<i>Balaenoptera ricei</i>	Rice's Whale	G1	S1	Endangered
FAMILY: PHYSETERIDAE				
<i>Physeter macrocephalus</i>	Sperm Whale	G3G4	SNA	Endangered
ORDER: CARNIVORA				
FAMILY: CANIDAE				
<i>Canis rufus</i>	Red Wolf	G1	SX	Endangered
FAMILY: MEPHITIDAE				
<i>Spilogale interrupta</i>	Plains Spotted Skunk	G3	SH	
<i>Spilogale putorius</i>	Alleghanian Spotted Skunk	G4	S1	
FAMILY: MUSTELIDAE				
<i>Neogale frenata</i>	Long-tailed Weasel	G5	S2	
FAMILY: URSIDAE				
<i>Ursus americanus luteolus</i>	Louisiana Black Bear	G5T2	S3	
ORDER: CHIROPTERA				
FAMILY: VESPERTILIONIDAE				
<i>Corynorhinus rafinesquii</i>	Rafinesque's Big-eared Bat	G3G4	S3	
<i>Eptesicus fuscus</i>	Big Brown Bat	G5	S3	
<i>Lasionycteris noctivagans</i>	Silver-haired Bat	G3G4	S2M	
<i>Lasiurus cinereus</i>	Hoary Bat	G3G4	S2M	
<i>Lasiurus intermedius</i>	Northern Yellow Bat	G5	S4	
<i>Myotis austroriparius</i>	Southeastern Myotis	G4	S3	
<i>Myotis septentrionalis</i>	Northern Long-eared Bat	G2G3	S1	Endangered
<i>Perimyotis subflavus</i>	Tricolored Bat	G3G4	S3	
ORDER: EULIPTYPHILA				
FAMILY: SORICIDAE				
<i>Sorex longirostris</i>	Southeastern Shrew	G5	S1	
ORDER: RODENTIA				
FAMILY: CRICETIDAE				
<i>Baiomys taylori</i>	Northern Pygmy Mouse	G4G5	SU	
<i>Ochrotomys nuttalli</i>	Golden Mouse	G5	SU	
<i>Reithrodontomys humulis</i>	Eastern Harvest Mouse	G5	SU	
<i>Ondatra zibethicus</i>	Common Muskrat	G5	S4	
FAMILY: HETEROMYIDAE				
<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse	G5	S2	
FAMILY: SCIURIDAE				
<i>Sciurus niger bachmani</i>	Bachman's Fox Squirrel	G5TNR	S3	
<i>Tamias striatus</i>	Eastern Chipmunk	G5	S3	
ORDER: SIRENIA				
FAMILY: TRICHECHIDAE				
<i>Trichechus manatus</i>	West Indian Manatee	G2G3	S2	Threatened

PLANTS AND LICHENS (552)				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
PHYLUM: ASCOMYCOTA				
CLASS: ASCOMYCETES				
ORDER: OPEGRAPHALES				
FAMILY: OPEGRAPHACEAE				
<i>Fouragea filicina</i>	a lichen	GNR	SNR	
ORDER: OSTROPALES				
FAMILY: GRAPHIDACEAE				
<i>Helminthocarpon leprevostii</i>	a lichen	GNR	SNR	
CLASS: LECANOROMYCETES				
ORDER: LECANORALES				
FAMILY: BACIDIACEAE				
<i>Phyllopsora halei</i>	a lichen	GNR	SNR	
PHYLUM: ANTHOPHYTA				
CLASS: DICOTYLEDONEAE				
ORDER: APIALES				
FAMILY: APIACEAE				
<i>Eryngium hookeri</i>	Hooker's Eryngo	G4G5	S3	
<i>Perideridia americana</i>	Eastern Yampah	G4	S1	
<i>Polytaenia nuttallii</i>	Prairie Parsley	G5	S2	
<i>Ptilimnium texense</i>	Texas Bishopweed	G3	S3	
<i>Sanicula marilandica</i>	Maryland Black Snakeroot	G5	SH	
<i>Sanicula odorata</i>	Clustered Black Snakeroot	G5	S3	
<i>Sium suave</i>	Hemlock Water-parsnip	G5	S1S2	
<i>Taenidia integerrima</i>	Yellow Pimpernel	G5	S2	
<i>Thaspium chapmanii</i>	Meadowparsnip	GNR	S1	
FAMILY: ARALIACEAE				
<i>Panax quinquefolius</i>	American Ginseng	G3G4	S1	
ORDER: ARISTOLOCHIALES				
FAMILY: ARISTOLOCHIACEAE				
<i>Asarum canadense</i>	Canada Wild Ginger	G5	S1	
ORDER: ASTERALES				
FAMILY: ASTERACEAE				
<i>Antennaria solitaria</i>	Single-head Pussytoes	G5	S1	
<i>Baccharis dioica</i>	Broom-bush Baccharis	G4G5	S1	
<i>Boltonia apalachicolaensis</i>	Apalachicola Doll's-daisy	G2	S1	
<i>Chaetopappa asteroides</i>	Arkansas Leastdaisy	G5	S1	
<i>Chrysopsis hyssopifolia</i>	Cottony Goldenaster	G5T3T5	S1	
<i>Cirsium lecontei</i>	Le Conte's Thistle	G3	S2	
<i>Cirsium muticum</i>	Swamp Thistle	G5	SU	
<i>Coreopsis intermedia</i>	Golden-wave Tickseed	G3	S2	
<i>Coreopsis major</i>	Wood Tickseed	G5	S3	
<i>Coreopsis nudata</i>	Georgia Tickseed	G3?	S2	
<i>Coreopsis palmata</i>	Stiff Tickseed	G5	S2	
<i>Diaperia verna</i>	Cotton-rose	G5	S1	
<i>Echinacea angustifolia</i>	Narrow-Leaved Purple Coneflower	G5	S1	
<i>Echinacea purpurea</i>	Purple Coneflower	G5	S2	
<i>Eupatorium lancifolium</i>	Lance-Leaf Thoroughwort	G3?	S2	
<i>Eupatorium mohrii</i>	Mohr's Thoroughwort	G4?	S2	
<i>Eupatorium sullivaniae</i>	Sullivan's Thoroughwort	GNR	S1	
<i>Eutrochium purpureum</i>	Sweet Joe-pyeweed	G5	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: ASTERALES (cont.)				
FAMILY: ASTERACEAE				
<i>Grindelia lanceolata</i>	Narrowleaf Gumweed	G3G5	S1	
<i>Helenium brevifolium</i>	Shortleaf Sneezeweed	G4	S1	
<i>Helenium campestre</i>	Old Field Sneezeweed	G4	S1	
<i>Helianthus floridanus</i>	Florida Sunflower	G3G4	SH	
<i>Helianthus silphioides</i>	Rosinweed Sunflower	G4	S2	
<i>Heliopsis gracilis</i>	Smooth Oxeye	G5T5?	S2	
<i>Hieracium longipilum</i>	Hairy Hawkweed	G4G5	S1	
<i>Iva imbricata</i>	Seacoast Marsh-elder	G5	S3	
<i>Krigia wrightii</i>	Wright's Dwarf-dandelion	G3G4	S1	
<i>Liatris punctata</i>	Dotted Gayfeather	G5	S1	
<i>Liatris tenuis</i>	Slender Gayfeather	G3	S1	
<i>Lindheimera texana</i>	Texas Yellowstar	G5	S1	
<i>Marshallia trinervia</i>	Broadleaf Barbaras-buttons	G3	S1	
<i>Melanthera nivea</i>	Snow Melanthera	G5	S2	
<i>Nabalus altissimus</i>	Tall Rattlesnake-root	G5	S3	
<i>Nabalus asper</i>	Rough Rattlesnake-root	G4?	SH	
<i>Nabalus barbatus</i>	Barbed Rattlesnake-root	G3	S2	
<i>Packera anonyma</i>	Appalachian Ragwort	G5	S2	
<i>Packera obovata</i>	Roundleaf Ragwort	G5	S3	
<i>Palafoxia callosa</i>	Small Palafoxia	G4G5	SH	
<i>Palafoxia texana</i> var. <i>ambigua</i>	Texas Palafoxia	G3G5TNR	S1	
<i>Pterocaulon virgatum</i>	Wand Blackroot	G5	S3	
<i>Ratibida peduncularis</i>	Mexican Hat	G4G5	S2	
<i>Ratibida pinnata</i>	Gray-head Prairie Coneflower	G5	S2	
<i>Rudbeckia grandiflora</i>	Largeflower Rudbeckia	G5	S1	
<i>Rudbeckia missouriensis</i>	Missouri Coneflower	G4G5	S2	
<i>Rudbeckia scabrifolia</i>	Sabine Coneflower	G3G4	S3	
<i>Rudbeckia texana</i>	Texas Coneflower	G4	S3	
<i>Rudbeckia triloba</i>	Three-lobed Coneflower	G5	S3	
<i>Sclerolepis uniflora</i>	Pink Bog Button	G3	S1	
<i>Senecio ampullaceus</i>	Texas Ragwort	G4	S1S2	
<i>Sericocarpus linifolius</i>	Narrowleaf Whitetop Aster	G5	S2	
<i>Silphium perfoliatum</i>	Cup-plant	G5	SH	
<i>Solidago discoidea</i>	Rayless Mock-goldenrod	G4G5	S3	
<i>Solidago flexicaulis</i>	Zigzag Goldenrod	G5	S1	
<i>Solidago juncea</i>	Early Goldenrod	G5	S1	
<i>Symphyotrichum attenuatum</i>	Gulf Coast Smooth Aster	GNR	S3	
<i>Symphyotrichum elliotii</i>	Elliott's Aster	G4	S1	
<i>Symphyotrichum puniceum</i> var. <i>scabricaulis</i>	Pineland Purple-stem Aster	G5T2	SH	
<i>Tetragonotheca ludoviciana</i>	Louisiana Squarehead	G4	S3	
<i>Thelesperma filifolium</i>	Stiff Greenthread	G4G5	S1	
<i>Thelesperma flavodiscum</i>	East Texas Greenthread	G4	S1	
<i>Vernonia baldwinii</i>	West Ironweed	G5	S2	
ORDER: BORAGINALES				
FAMILY: HELIOTROPIACEAE				
<i>Euploca tenella</i>	Slender Heliotrope	G5	S2	
<i>Euploca convolvulacea</i>	Bindweed Heliotrope	G5	S1	
ORDER: BRASSICALES				
FAMILY: CLEOMACEAE				
<i>Polanisia erosa</i>	Large Clammyweed	G5	S2	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: CAMPANULALES				
FAMILY: CAMPANULACEAE				
<i>Campanulastrum americanum</i>	Tall Bellflower	G5	S1	
<i>Lobelia elongata</i>	Elongated Lobelia	G4G5	SH	
<i>Lobelia flaccidifolia</i>	Coastal Plain Lobelia	G5	S3	
<i>Lobelia inflata</i>	Indian-tobacco	G5	S2	
<i>Lobelia rogersii</i>	McVaugh's Lobelia	G3G4	S1	
<i>Lobelia siphilitica</i>	Great Blue Lobelia	G5	S3	
<i>Triodanis lamprosperma</i>	Prairie Venus's Looking-glass	G5?	S2	
FAMILY: GOODENIACEAE				
<i>Scaevola plumieri</i>	Gullfeed	G5	SH	
ORDER: CAPPARALES				
FAMILY: BRASSICACEAE				
<i>Borodinia canadensis</i>	Mustard Sicklepod	G5	S1	
<i>Cakile harperi</i>	Harper's Searocket	G5	S1	
<i>Cardamine concatenata</i>	Cutleaf Toothwort	G5	S3	
<i>Physaria gracilis</i>	Spreading Bladderpod	G5	SH	
<i>Rorippa aquatica</i>	North American Lake-Cress	G4?	SH	
<i>Streptanthus hyacinthoides</i>	Smooth Twistflower	G3	S2	
<i>Tomostima cuneifolia</i>	Wedgeleaf Whitlow-grass	G5	S1	
ORDER: CARYOPHYLLALES				
FAMILY: AMARANTHACEAE				
<i>Amaranthus greggii</i>	Gregg's Amaranth	G4?	S2	
<i>Blutaparon vermiculare</i>	Silverhead	G5	S3	
<i>Gossypianthus lanuginosus</i>	Woolly Cotton-flower	G5	S1	
<i>Tidestromia lanuginosa</i>	Woolly Honeysweet	G5	S1	
FAMILY: CARYOPHYLLACEAE				
<i>Geocarpon minimum</i>	Earth-fruit	G2	S1	Threatened
<i>Geocarpon nuttallii</i>	Drummond's Sandwort	G5	S1	
<i>Loeflingia squarrosa</i>	Spreading Pygmyleaf	G5	S1	
<i>Paronychia drummondii</i>	Drummond's Nailwort	G4G5	S2	
<i>Sabulina muscorum</i>	Dixie Stitchwort	GNR	S3	
<i>Silene stellata</i>	Starry Campion	G5	S2	
<i>Silene subciliata</i>	Scarlet Catchfly	G3	S2	
<i>Silene virginica</i>	Fire Pink	G5	S2	
<i>Stipulicida setacea</i>	Pineland Scaly-pink	G4G5	S1	
FAMILY: MONTIACEAE				
<i>Phemeranthus parviflorus</i>	Small-flower Fameflower	G5	S3	
<i>Phemeranthus rugospermus</i>	Prairie Fameflower	G3G4	S1	
FAMILY: NYCTAGINACEAE				
<i>Mirabilis albida</i>	Pale Umbrella-wort	G5	S1	
ORDER: CELASTRALES				
FAMILY: AQUIFOLIACEAE				
<i>Ilex amelanchier</i>	Sarvis Holly	G4	S2	
<i>Ilex myrtifolia</i>	Myrtle Holly	G5?	S2	
FAMILY: CELASTRACEAE				
<i>Celastrus scandens</i>	Climbing Bittersweet	G5	S1	
<i>Euonymus atropurpureus</i>	Wahoo	G5	S1	
<i>Parnassia grandifolia</i>	Large-leaved Grass-of-Parnassus	G3G4	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: DIPSACALES				
FAMILY: CAPRIFOLIACEAE				
<i>Triosteum angustifolium</i>	Yellowleaf Tinker's-weed	G5	S2	
<i>Triosteum perfoliatum</i>	Perfoliate Tinker's-weed	G5	SH	
ORDER: EBENALES				
FAMILY: SAPOTACEAE				
<i>Sideroxylon reclinatum</i>	Florida Bully	G4G5	SH	
ORDER: ERICALES				
FAMILY: CYRILLACEAE				
<i>Cliftonia monophylla</i>	Black Titi	G4G5	S1	
FAMILY: ERICACEAE				
<i>Kalmia latifolia</i>	Mountain Laurel	G5	S2	
<i>Lyonia mariana</i>	Staggerbush	G5	S1	
<i>Monotropa hypopithys</i>	American Pinesap	G5	S2	
<i>Vaccinium ashei</i>	Rabbit-eye Blueberry	GNR	SH	
ORDER: EUPHORBIALES				
FAMILY: BUXACEAE				
<i>Pachysandra procumbens</i>	Allegheny-spurge	G4G5	S2	
FAMILY: EUPHORBIACEAE				
<i>Cnidoscolus stimulosus</i>	Risky Tread-softly	G5	S3	
<i>Croton argyranthemus</i>	Silver Croton	G5	S1	
<i>Euphorbia bombensis</i>	Sand Dune Spurge	G4G5	S1	
<i>Euphorbia discoidalis</i>	Summer Spurge	G4	S2	
<i>Euphorbia meganaesos</i>	Glabrous Spotted Spurge	G2	S1	
<i>Euphorbia tetrapora</i>	Weak Spurge	G4	S2	
ORDER: FABALES				
FAMILY: FABACEAE				
<i>Acaciella hirta</i>	Prairie Acacia	G5	S3	
<i>Acmispon americanus</i>	American Bird's-foot-trefoil	G5	S2	
<i>Amorpha laevigata</i>	Smooth Indigo-bush	G3?	SH	
<i>Amorpha nitens</i>	Shining False Indigo	G4	SH	
<i>Amorpha paniculata</i>	Panicked Indigo-bush	G3	S2	
<i>Astragalus crassicaupus</i>	Berliander's Ground-Plum	G5	S2	
<i>Astragalus nuttallianus</i>	Nuttall's Milkvetch	G5	S2	
<i>Astragalus soxmaniorum</i>	Soxman's Milkvetch	G3	S2	
<i>Astragalus trichocalyx</i>	Ground-plum	G5T5?	S1	
<i>Cladrastis kentukea</i>	Yellow-wood	G4	S1	
<i>Crotalaria purshii</i>	Pursh's Rattlebox	G5	S2	
<i>Dalea compacta</i> var. <i>pubescens</i>	Compact Prairie-clover	G5T5	S1	
<i>Dalea emarginata</i>	Wedgeleaf Prairie-clover	G5	S2	
<i>Dalea grisea</i>	Silky Prairie-clover	G5T4	S2	
<i>Dalea lanata</i>	Downy Prairie-clover	G5	S1	
<i>Dalea phleoides</i>	Slimspike Prairie-clover	G4	S1	
<i>Dalea pinnata</i> var. <i>trifoliata</i>	Summer Farewell	G5T3T4	SH	
<i>Desmodium nuttallii</i>	Nuttall's Tick-trefoil	G5	S1	
<i>Indigofera miniata</i>	Coast Indigo	G5	S1	
<i>Lathyrus pusillus</i>	Tiny Pea	G5?	S3	
<i>Lathyrus venosus</i>	Forest Pea	G5	S3	
<i>Lupinus villosus</i>	Lady Lupine	G4	S2	
<i>Pediomelum digitatum</i>	Palm-leaf Scurfpea	G5	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: FABALES (cont.)				
FAMILY: FABACEAE				
<i>Pediomelum hypogaeum</i> var. <i>subulatum</i>	Awl-shaped Scurfpea	G5T4	S2	
<i>Pediomelum rhombifolium</i>	Roundleaf Scurfpea	G5	S2	
<i>Tephrosia florida</i>	Florida Hoary-pea	G4G5	S2	
<i>Tephrosia hispidula</i>	Sprawling Hoary-pea	G4G5	S2?	
<i>Trifolium amphianthum</i>	Peanut Clover	GNR	SH	
<i>Trifolium bejariense</i>	Bejar Clover	G4	S1	
<i>Trifolium carolinianum</i>	Carolina Clover	G5	S3	
<i>Trifolium reflexum</i>	Buffalo Clover	G3G4	S3	
<i>Zornia bracteata</i>	Viperina	G5?	S2	
ORDER: FAGALES				
FAMILY: BETULACEAE				
<i>Corylus americana</i>	American Hazelnut	G5	S1	
FAMILY: FAGACEAE				
<i>Castanea ozarkensis</i>	Ozark Chinquapin	GNR	S1	
<i>Quercus arkansana</i>	Arkansas Oak	G3	S2	
<i>Quercus coccinea</i>	Scarlet Oak	G5	S1	
<i>Quercus imbricaria</i>	Shingle Oak	G5	S1	
<i>Quercus laevis</i>	Turkey Oak	G5	S1	
<i>Quercus macrocarpa</i>	Bur Oak	G5	S1	
<i>Quercus oglethorpensis</i>	Oglethorpe's Oak	G3	S1	
<i>Quercus rubra</i>	Northern Red Oak	G5	S2	
<i>Quercus durandii</i>	Durand Oak	G4G5	S1	
ORDER: GENTIANALES				
FAMILY: APOCYNACEAE				
<i>Amsonia ludoviciana</i>	Louisiana Bluestar	G3	S3	
<i>Asclepias humistrata</i>	Pinewoods Milkweed	G4G5	SH	
<i>Asclepias incarnata</i>	Swamp Milkweed	G5	S2	
<i>Asclepias michauxii</i>	Michaux's Milkweed	G4G5	S2	
<i>Asclepias purpurascens</i>	Purple Milkweed	G4G5	S1	
<i>Asclepias rubra</i>	Red Milkweed	G4G5	S3	
<i>Asclepias stenophylla</i>	Narrow-leaved Milkweed	G4G5	SH	
<i>Matelea cynanchoides</i>	Prairie Milkvine	G4G5	S1	
FAMILY: GELSEMIACEAE				
<i>Gelsemium rankinii</i>	Rankin's Trumpet-flower	G5	S2	
FAMILY: GENTIANACEAE				
<i>Bartonia paniculata</i> ssp. <i>texana</i>	Texas Screwstem	G2G3	S1	
<i>Bartonia verna</i>	White Screwstem	G5?	S3	
<i>Gentiana villosa</i>	Striped Gentian	G4	S2	
<i>Obolaria virginica</i>	Virginia Pennywort	G5	S2	
<i>Sabatia arenicola</i>	Sand Rose-gentian	G3G5	S1	
ORDER: GERANIALES				
FAMILY: GERANIACEAE				
<i>Geranium maculatum</i>	Wild Crane's-bill	G5	S1	
ORDER: HALORAGALES				
FAMILY: HALORAGACEAE				
<i>Myriophyllum laxum</i>	Loose-flowered Water-milfoil	G3	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: ILLICIALES				
FAMILY: SCHISANDRACEAE				
<i>Schisandra glabra</i>	Bay Starvine	G3	S3	
ORDER: JUGLANDALES				
FAMILY: JUGLANDACEAE				
<i>Carya pallida</i>	Sand Hickory	G5	S1	
ORDER: LAMIALES				
FAMILY: BORAGINACEAE				
<i>Hackelia virginiana</i>	Virginia Stickseed	G5	S3	
<i>Lithospermum canescens</i>	Hoary Puccoon	G5	S1	
<i>Lithospermum incisum</i>	Narrowleaved Puccoon	G5	S1	
FAMILY: LAMIACEAE				
<i>Clinopodium georgianum</i>	Georgia Savory	G4	S2	
<i>Collinsonia canadensis</i>	Canada Horsebalm	G5	S2?	
<i>Collinsonia punctata</i>	Florida Horsebalm	G3?	S1	
<i>Monarda lindheimeri</i>	Lindheimer's Beebalm	G4	S1	
<i>Physostegia correllii</i>	Correll's False Dragonhead	G2	S1	
<i>Physostegia longisepala</i>	Long-sepaled False Dragonhead	G2G3	S3	
<i>Scutellaria cardiophylla</i>	Heartleaf Skullcap	G4?	S2	
<i>Scutellaria thieretii</i>	Thieret's Skullcap	G2Q	S2	
FAMILY: PHRYMACEAE				
<i>Mimulus ringens</i>	Square-stem Monkeyflower	G5	S2	
ORDER: LAURALES				
FAMILY: LAURACEAE				
<i>Lindera melissifolia</i>	Pondberry	G3	SH	Endangered
<i>Lindera subcoriacea</i>	Bog Spicebush	G3	S1	
<i>Litsea aestivalis</i>	Pondspice	G3	SH	
ORDER: LINALES				
FAMILY: LINACEAE				
<i>Linum floridanum</i> var. <i>chrysocarpum</i>	Florida Yellow Flax	G5?T3?	S1	
<i>Linum macrocarpum</i>	Spring Hill Flax	G2	S1	
<i>Linum sulcatum</i>	Grooved Yellow Flax	G5	S1	
ORDER: MAGNOLIALES				
FAMILY: MAGNOLIACEAE				
<i>Magnolia pyramidata</i>	Pyramid Magnolia	G4	S2	
ORDER: MALPIGHIALES				
FAMILY: HYPERICACEAE				
<i>Hypericum brachyphyllum</i>	Coastal Plain St. John's Wort	G5	S3	
<i>Hypericum pseudomaculatum</i>	Large Spotted St. John's Wort	G5?	S1	
<i>Hypericum sphaerocarpum</i>	Round-seed St. John's Wort	G5	S2	
<i>Hypericum stragulum</i>	Straggling St. John's Wort	G5	SH	
<i>Hypericum suffruticosum</i>	Pineland St. John's Wort	G4G5	SH	
<i>Hypericum virgatum</i>	Coppery St. John's Wort	G4?	SH	
ORDER: MALVALES				
FAMILY: MALVACEAE				
<i>Callirhoe alcaeoides</i>	Clustered Poppy-mallow	G5?	S1	
<i>Callirhoe digitata</i>	Fringed Poppy-mallow	G4	S1	
<i>Callirhoe involucrata</i>	Purple Poppy-mallow	G5	SH	
<i>Hibiscus leucophyllus</i>	White-Leaf Prairie Hibiscus	GNR	S1	
<i>Sida elliottii</i>	Elliott's Sida	G4G5	SH	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: MYRICALES				
FAMILY: MYRICACEAE				
<i>Morella inodora</i>	Odorless Bayberry	G4	S2	
ORDER: MYRTALES				
FAMILY: LYTHRACEAE				
<i>Didiplis diandra</i>	Water-purslane	G3G4	S1	
FAMILY: MELASTOMATACEAE				
<i>Rhexia nashii</i>	Nash's Meadow-beauty	G5	S2	
FAMILY: ONAGRACEAE				
<i>Circaea canadensis</i>	Canada Enchanter's-nightshade	G5	S2	
<i>Ludwigia alata</i>	Winged Seedbox	G3G5	S1	
<i>Ludwigia microcarpa</i>	Small-fruit Seedbox	G5	S1	
<i>Ludwigia sphaerocarpa</i>	Grapefruit Primrose-willow	G4	S1	
<i>Oenothera heterophylla</i>	Sandhill Evening-primrose	G4	S3	
<i>Oenothera rhombipetala</i>	Four-point Evening Primrose	G4G5	S1	
<i>Oenothera sessilis</i>	Prairie Evening Primrose	G2	S1	
<i>Oenothera spachiana</i>	Spach's Evening-primrose	G5	S3	
FAMILY: THYMELAEACEAE				
<i>Dirca palustris</i>	Eastern Leatherwood	G5	S1	
ORDER: NEPENTHALES				
FAMILY: DROSERACEAE				
<i>Drosera intermedia</i>	Spoonleaf Sundew	G5	S2	
<i>Drosera tracyi</i>	Tracy's Sundew	G3G4	SH	
FAMILY: SARRACENIACEAE				
<i>Sarracenia psittacina</i>	Parrot Pitcher Plant	G4	S3	
<i>Sarracenia rosea</i>	Rosy Pitcher Plant	G3	SH	
ORDER: NYMPHAEALES				
FAMILY: NYMPHAEACEAE				
<i>Nymphaea elegans</i>	Blue Water-lily	G4?	S2S4	
ORDER: PAPAVERALES				
FAMILY: PAPAVERACEAE				
<i>Corydalis flavula</i>	Yellow Fumewort	G5	S2	
<i>Sanguinaria canadensis</i>	Bloodroot	G5	S2	
ORDER: PLANTAGINALES				
FAMILY: PLANTAGINACEAE				
<i>Collinsia violacea</i>	Violet Blue-eyed Mary	G4	SH	
<i>Gratiola floridana</i>	Florida Hedge-hyssop	G4	SH	
<i>Gratiola ramosa</i>	Branched Hedge-hyssop	G4G5	S1	
<i>Gratiola torreyi</i>	Yellow Hedge-hyssop	G3	S1	
<i>Penstemon murrayanus</i>	Cupleaf Beardtongue	G4	S1	
<i>Plantago patagonica</i>	Woolly Plantain	G5	S2	
<i>Veronicastrum virginicum</i>	Culver's-root	G4	SH	
ORDER: PODOSTEMALES				
FAMILY: PODOSTEMACEAE				
<i>Podostemum ceratophyllum</i>	Riverweed	G4	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: POLYGALALES				
FAMILY: POLYGALACEAE				
<i>Asemeia grandiflora</i>	Showy Milkwort	G5?	S2	
<i>Polygala boykinii</i>	Boykin's Milkwort	G4	S1	
<i>Polygala brevifolia</i>	Littleleaf Milkwort	G4G5	S1	
<i>Polygala chapmanii</i>	Chapman's Milkwort	G3G5	S1	
<i>Polygala crenata</i>	Scalloped Milkwort	G4?	S2	
<i>Polygala hookeri</i>	Hooker's Milkwort	G3	S1	
ORDER: POLYGONALES				
FAMILY: POLYGONACEAE				
<i>Eriogonum longifolium</i>	Longleaved Wild-buckwheat	G4	S2	
<i>Eriogonum multiflorum</i>	Many-flowered Wild-buckwheat	G5	S3	
<i>Polygonella americana</i>	American Jointweed	G5	S2	
<i>Polygonella polygama</i>	October-flower	G4	S1	
ORDER: PRIMULALES				
FAMILY: PRIMULACEAE				
<i>Primula meadia</i>	Eastern Shooting Star	G5	S2	
<i>Samolus ebracteatus</i> var. <i>alyssoides</i>	Limewater Brookweed	G4G5T2T4	S1	
ORDER: RANUNCULALES				
FAMILY: RANUNCULACEAE				
<i>Actaea pachypoda</i>	White Baneberry	G5	S2	
<i>Anemone berlandieri</i>	Southern Thimbleweed	G4G5	S2	
<i>Anemone virginiana</i>	Virginia Anemone	G5	S1	
<i>Clematis arenicola</i>	West Gulf Leatherflower	GNR	S2	
<i>Clematis catesbyana</i>	Satin-curls	G5	S1	
<i>Clematis glaucophylla</i>	Whiteleaf Leatherflower	G4?	S1	
<i>Ranunculus flabellaris</i>	Yellow Water-crowfoot	G5	S1	
<i>Ranunculus hispidus</i>	Hairy Buttercup	G5	SH	
<i>Thalictrum amphibolum</i>	Waxyleaf Meadowrue	G5	S1	
<i>Xanthorhiza simplicissima</i>	Yellowroot	G5	S1	
ORDER: RHAMNALES				
FAMILY: RHAMNACEAE				
<i>Ceanothus herbaceus</i>	Prairie Redroot	G5	S1	
<i>Endotropis lanceolata</i>	Lanceleaved Buckthorn	G5	SH	
ORDER: ROSALES				
FAMILY: CHRYSOBALANACEAE				
<i>Geobalanus oblongifolius</i>	Gopher-apple	G4G5	SH	
FAMILY: CRASSULACEAE				
<i>Sedum nuttallii</i>	Yellow Stonecrop	G5	S1	
FAMILY: GROSSULARIACEAE				
<i>Ribes curvatum</i>	Granite Gooseberry	G4	S2	
FAMILY: HYDRANGEACEAE				
<i>Hydrangea arborescens</i>	Wild Hydrangea	G5	S2	
FAMILY: ROSACEAE				
<i>Agrimonia incisa</i>	Incised Groovebur	G3G4	S1	
<i>Crataegus ashei</i>	Ashe Hawthorn	G2	SH	
<i>Crataegus brachyacantha</i>	Blueberry Hawthorn	G4	S3	
<i>Crataegus florens</i>	Mississippi Hawthorn	GNR	SH	
<i>Crataegus mendosa</i>	Albertville Hawthorn	G3Q	SH	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: ROSACEAE (cont.)				
<i>Crataegus pruinosa</i>	Frosted Hawthorn	G5T5	S2	
<i>Crataegus pulcherrima</i>	Beautiful Hawthorn	G2G4	S1	
<i>Crataegus triflora</i>	Three-flowered Hawthorn	G2G3	S1	
<i>Crataegus uniflora</i>	Dwarf Hawthorn	G5	S3	
<i>Gillenia stipulata</i>	American Ipecac	G5	S3	
<i>Prunus gracilis</i>	Oklahoma Plum	G4G5	S2	
<i>Prunus munsoniana</i>	Wild Goose Plum	G5	S3	
<i>Rosa setigera</i>	Climbing Prairie Rose	G5	S2	
FAMILY: SAXIFRAGACEAE				
<i>Heuchera americana</i>	American Alumroot	G5	S2	
<i>Micranthes texana</i>	Texas Saxifrage	G4	S1	
<i>Micranthes virginianensis</i>	Virginia saxifrage	G5	SH	
ORDER: RUBIALES				
FAMILY: RUBIACEAE				
<i>Galium circaezans</i>	Forest Bedstraw	G5	S3	
<i>Galium bermudense</i>	Coastal Bedstraw	G5	S2	
<i>Galium orizabense</i> ssp. <i>laevicaule</i>	Smoothstem Bedstraw	G5?T4?	S1	
<i>Galium virgatum</i>	Southwestern Bedstraw	G4G5	S2	
<i>Houstonia lanceolata</i>	Purple Bluet	G5	S2	
<i>Houstonia procumbens</i>	Roundleaf Bluet	G5	S2	
ORDER: SALICALES				
FAMILY: SALICACEAE				
<i>Salix caroliniana</i>	Carolina Willow	G5	SH	
<i>Salix humilis</i> var. <i>humilis</i>	Prairie Willow	G5T5	S1	
<i>Salix occidentalis</i>	Dwarf Prairie Willow	G5	S2	
ORDER: SAPINDALES				
FAMILY: RUTACEAE				
<i>Zanthoxylum americanum</i>	Northern Prickly-ash	G5	S1	
FAMILY: SAPINDACEAE				
<i>Acer leucoderme</i>	Chalk Maple	G5	S2	
FAMILY: STAPHYLEACEAE				
<i>Staphylea trifolia</i>	American Bladdernut	G5	SH	
ORDER: SCROPHULARIALES				
FAMILY: ACANTHACEAE				
<i>Justicia americana</i>	American Water-willow	G5	S2	
<i>Ruellia noctiflora</i>	Night-flowering Wild-petunia	G3?	S1	
<i>Ruellia pinetorum</i>	Pineland Wild-petunia	G5	S1	
FAMILY: LENTIBULARIACEAE				
<i>Pinguicula lutea</i>	Yellow Butterwort	G4G5	S2	
<i>Utricularia juncea</i>	Southern Bladderwort	G5	S3	
<i>Utricularia purpurea</i>	Purple Bladderwort	G5	S2	
FAMILY: OLEACEAE				
<i>Forestiera ligustrina</i>	Upland Swamp Privet	G4G5	S3	
FAMILY: OROBANCHACEAE				
<i>Agalinis aphylla</i>	Coastal Plain False Foxglove	G3G4	S1	
<i>Agalinis caddoensis</i>	Caddo Parish Agalinis	GH	SX	
<i>Agalinis filicaulis</i>	Thread-stem False Foxglove	G3	S2	
<i>Agalinis linifolia</i>	Flax-leaf False Foxglove	G4?	S2	
<i>Agalinis skinneriana</i>	Pale False Foxglove	G3G4	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: OROBANCHACEAE (cont.)				
<i>Aphyllon uniflorum</i>	One-flowered Broomrape	G5	S1	
<i>Castilleja coccinea</i>	Scarlet Indian-paintbrush	G5	SH	
<i>Dasistoma macrophyllum</i>	Mullein Foxglove	G4	SH	
<i>Macranthera flammula</i>	Bog Flame Flower	G3	S2	
<i>Schwalbea americana</i>	American Chaffseed	G2	S1	Endangered
ORDER: SOLANALES				
FAMILY: CONVULVULACEAE				
<i>Stylisma patens</i>	Coastal Plain Dawnflower	G5	S1	
<i>Stylisma villosa</i>	Hairy Dawnflower	G4	S1	
FAMILY: HYDROPHYLLACEAE				
<i>Phacelia glabra</i>	Smooth Scorpionweed	G4	S2	
<i>Phacelia strictiflora</i> var. <i>robinsonii</i>	Sandhills Scorpionweed	G5T4	S2	
FAMILY: MENYANTHACEAE				
<i>Nymphoides cordata</i>	Little Floatingheart	G5	SH	
FAMILY: POLEMONIACEAE				
<i>Phlox pilosa</i> ssp. <i>pulcherrima</i>	Lundell's Phlox	G5TNR	S1	
FAMILY: SOLANACEAE				
<i>Calliphysalis carpenteri</i>	Carpenter's Ground-cherry	G3	S1	
<i>Physalis angustifolia</i>	Coastal Ground-cherry	G3G4	S1	
<i>Physalis macrocarpa</i>	Large-seed Ground-cherry	G2G3	S1	
<i>Solanum dimidiatum</i>	Western Horse-nettle	G5	S2S3	
<i>Solanum pseudogracile</i>	Glowing Nightshade	G4	S1	
ORDER: THEALES				
FAMILY: THEACEAE				
<i>Stewartia malacodendron</i>	Silky Camellia	G4	S2	
ORDER: URTICALES				
FAMILY: URTICACEAE				
<i>Parietaria praetermissa</i>	Clustered Pellitory	G3G4	S1	
ORDER: VIOLALES				
FAMILY: CISTACEAE				
<i>Crocianthemum rosmarinifolium</i>	Rosemary Rockrose	G4	S2	
<i>Lechea minor</i>	Thymeleaf Pinweed	G5	S2	
<i>Lechea san-sabeana</i>	San Saba Pinweed	G4	S1	
<i>Lechea pulchella</i> var. <i>ramosissima</i>	Leggett's Pinweed	G5	S1	
FAMILY: VIOLACEAE				
<i>Viola pubescens</i>	Downy Yellow Violet	G5	S1	
CLASS: MONOCOTYLEDONEAE				
ORDER: ALISMATALES				
FAMILY: ALISMATACEAE				
<i>Helianthemum tenellum</i>	Dwarf Burhead	G5?	SH	
<i>Sagittaria chapmanii</i>	Chapman's Arrowhead	G3?	SH	
FAMILY: TOFIELDIACEAE				
<i>Triantha racemosa</i>	Coastal False Asphodel	G5	S2S3	
ORDER: ARALES				
FAMILY: ARACEAE				
<i>Peltandra sagittifolia</i>	Spoon-flower	G3G4	S1	
ORDER: ARECALES				
FAMILY: ARECACEAE				
<i>Serenoa repens</i>	Saw Palmetto	G4G5	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: ASPARAGALES				
FAMILY: AMARYLLIDACEAE				
<i>Zephyranthes chlorosolen</i>	Evening Rainlily	G5	S2	
FAMILY: ASPARAGACEAE				
<i>Camassia scilloides</i>	Atlantic Camas	G5	S3	
<i>Maianthemum racemosum</i>	Solomon's-plume	G5	SH	
<i>Schoenolirion wrightii</i>	Texas Sunnybell	G3	S2	
<i>Yucca cernua</i>	Nodding Yucca	G2	S1	
FAMILY: HYPOXIDACEAE				
<i>Hypoxis curtissii</i>	Swamp Stargrass	G4?	S2	
ORDER: COMMELINALES				
FAMILY: COMMELINACEAE				
<i>Tradescantia reverchonii</i>	Reverchon's Spiderwort	G4	S3	
<i>Tradescantia subaspera</i>	Broad-leaved Spiderwort	G5	S1	
FAMILY: MAYACACEAE				
<i>Mayaca fluviatilis</i>	Bog Moss	G5	S2	
FAMILY: XYRIDACEAE				
<i>Xyris fimbriata</i>	Fringed Yellow-eyed-grass	G5	S3	
<i>Xyris louisianica</i>	Kral's Yellow-eyed-grass	G2G3	S2	
<i>Xyris platylepis</i>	Tall Yellow-eyed-grass	G5	S2	
<i>Xyris scabrifolia</i>	Harper's Yellow-eyed-grass	G3	S2	
<i>Xyris serotina</i>	Acid-swamp Yellow-eyed-grass	G3G4	S1	
<i>Xyris smalliana</i>	Small's Yellow-eyed-grass	G4G5	S1	
<i>Xyris stricta</i>	Pineland Yellow-eyed-grass	G4	S2	
<i>Xyris torta</i>	Twisted Yellow-eyed-grass	G5	S2	
ORDER: CYPERALES				
FAMILY: CYPERACEAE				
<i>Carex arkansana</i>	Arkansas Caric Sedge	G4	S1	
<i>Carex bushii</i>	Bush's Sedge	G5	S2	
<i>Carex decomposita</i>	Cypress-knee Sedge	G3G4	S3	
<i>Carex fissa</i> var. <i>aristata</i>	Hammock Sedge	G4?T4?	S1T1	
<i>Carex granularis</i>	Limestone Meadow Sedge	G5	S2	
<i>Carex hirsutella</i>	Hairy Green Sedge	G5	S1	
<i>Carex meadii</i>	Mead's Sedge	G5	S3	
<i>Carex microdonta</i>	Small-toothed Caric Sedge	G4	S3	
<i>Carex oblita</i>	Southern Dark-green Sedge	G4	S1	
<i>Carex ozarkana</i>	Ozark Sedge	G4	S1	
<i>Carex stricta</i>	Tussock Sedge	G5	SH	
<i>Carex styloflexa</i>	Bent Sedge	G5?	S3	
<i>Carex tenax</i>	Wire Sedge	G4	S3	
<i>Carex turgescens</i>	Swollen Sedge	G4G5	S1	
<i>Cyperus cephalanthus</i>	Cryptic Flatsedge	G2?	S2	
<i>Cyperus distinctus</i>	Marshland Flatsedge	G4	S1	
<i>Cyperus grayoides</i>	Illinois Flatsedge	G3G4	S3	
<i>Cyperus subsquarrosus</i>	Dwarf Bulrush	G5	S1	
<i>Dulichium arundinaceum</i>	Threeway Sedge	G5	S2	
<i>Eleocharis ambigens</i>	Ambiguous Spikerush	G4G5	S2	
<i>Eleocharis atropurpurea</i>	Purple Spikerush	G4G5	S1	
<i>Eleocharis bicolor</i>	Two-tone Spikerush	GNR	S1	
<i>Eleocharis compressa</i>	Flat-Stem Spikesedge	G5	SH	
<i>Eleocharis elongata</i>	Slim Spikesedge	G5?	S2	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
ORDER: CYPERALES (cont.)				
FAMILY: CYPERACEAE				
<i>Eleocharis engelmannii</i>	Engelmann's Spikerush	G5	S1	
<i>Eleocharis geniculata</i>	Canada Spikesedge	G5	S1	
<i>Eleocharis lanceolata</i>	Ozark Spikesedge	G4G5	S1	
<i>Eleocharis melanocarpa</i>	Black-fruited Spikesedge	G4	S1	
<i>Eleocharis minima</i>	Small Spikesedge	GNR	SH	
<i>Eleocharis radicans</i>	Rooted Spikesedge	G5	S1	
<i>Eleocharis rostellata</i>	Walking Spikesedge	G5	S1	
<i>Fuirena scirpoidea</i>	Southern Umbrella-sedge	G5	S1	
<i>Fuirena simplex</i> var. <i>aristulata</i>	Western Umbrella-sedge	G5T4	S1	
<i>Rhynchospora baldwinii</i>	Baldwin's Beaksedge	G4	S1	
<i>Rhynchospora capitellata</i>	Brownish Beaksedge	G5	S1	
<i>Rhynchospora chalarocephala</i>	Loose-head Beaksedge	G5	S2	
<i>Rhynchospora chapmanii</i>	Chapman's Beaksedge	G4	S3	
<i>Rhynchospora ciliaris</i>	Ciliate Beaksedge	G4	S3	
<i>Rhynchospora compressa</i>	Flat-fruit Beaksedge	G4	S2	
<i>Rhynchospora debilis</i>	Savanna Beaksedge	G4?	S1	
<i>Rhynchospora decurrens</i>	Swamp-forest Beaksedge	G3G4	SH	
<i>Rhynchospora divergens</i>	Spreading Beaksedge	G4	S1	
<i>Rhynchospora inundata</i>	Narrow-fruit Horned Beaksedge	G4	S1	
<i>Rhynchospora leptocarpa</i>	Slender-fruit Beaksedge	G3	S1	
<i>Rhynchospora macra</i>	Large Beaksedge	G3G4	S3	
<i>Rhynchospora microcarpa</i>	Southern Beaksedge	G5	S3	
<i>Rhynchospora microcephala</i>	Small-headed Beaksedge	G5T5	S2	
<i>Rhynchospora nitens</i>	Short-beak Beaksedge	G4	S3	
<i>Rhynchospora scirpoides</i>	Long-beak Beaksedge	G4	S3	
<i>Rhynchospora stenophylla</i>	Coastal Plain Beaksedge	G4	S1	
<i>Rhynchospora tracyi</i>	Tracy's Beaksedge	G4	S1	
<i>Rhynchospora pinetorum</i>	Small's Beaksedge	G3G4	S1	
<i>Schoenoplectus deltarum</i>	Delta Bulrush	G3G4	S3	
<i>Schoenoplectus etuberculatus</i>	Canby's Bulrush	G3G4	S1	
<i>Scirpus divaricatus</i>	Spreading Bulrush	G4	S2	
<i>Scleria bellii</i>	Smooth-seed Hairy Nutrush	G3	S1	
<i>Scleria nitida</i>	Shining Nutrush	G4	SH	
<i>Scleria verticillata</i>	Low Nutsedge	G5	S1	
FAMILY: POACEAE				
<i>Andropogon cretaceus</i>	Purple Bluestem	G3G5	S1	
<i>Andropogon mohrii</i>	Mohr's Bluestem	G4?	S1	
<i>Andropogon perangustatus</i>	Narrowleaf Bluestem	G4	S2	
<i>Anthenantia texana</i>	Texas Silkyscale	G3G4	S1	
<i>Aristida palustris</i>	Longleaf Three-awn	G4	S2	
<i>Bouteloua curtipendula</i>	Sideoats Grama	G5	S1	
<i>Bouteloua rigidiseta</i>	Texas Grama	G5	S1	
<i>Bromus pubescens</i>	Common Eastern Brome	G5	S2	
<i>Cenchrus myosuroides</i>	Big Sandbur	G4	S1	
<i>Cenchrus tribuloides</i>	Dune Sandbur	G5	S2	
<i>Chasmanthium ornithorhynchum</i>	Birdbill Spike Grass	G4	S2	
<i>Coelorachis tessellata</i>	Lattion Jointgrass	G5?	S2	
<i>Coleataenia tenera</i>	Southern Narrow Panic Grass	G4	S2	
<i>Danthonia sericea</i>	Silky Oatgrass	G5?	S2	
<i>Dichanthelium caeruleum</i>	Blue Witchgrass	G3	S1	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: POACEAE (cont.)				
<i>Dichanthelium chamaelonche</i>	Carpet Witchgrass	GNR	S1	
<i>Dichanthelium clandestinum</i>	Deer-tongue Witchgrass	G5	S2	
<i>Dichanthelium fusiforme</i>	Spindle-fruited Witchgrass	G5?	S1	
<i>Dichanthelium linearifolium</i>	Slender Leaf Witchgrass	G5	S2	
<i>Dichanthelium strigosum</i> var. <i>glabrescens</i>	Hairless Witchgrass	G5T4T5	S1	
<i>Dichanthelium strigosum</i> var. <i>leucoblepharis</i>	Dwarf Witchgrass	G5T3T5	S1	
<i>Distichlis littoralis</i>	Key Grass	G4G5	S1	
<i>Echinochloa polystachya</i>	River Grass	G5	S2	
<i>Eragrostis curtispedicellata</i>	Gummy Lovegrass	G5	S3	
<i>Erianthus brevibarbis</i>	Short-beard Plumegrass	G3G5	S1	
<i>Eriochloa punctata</i>	Louisiana Cupgrass	G5	S2	
<i>Festuca paradoxa</i>	Cluster Fescue	G5	S3	
<i>Glyceria arkansana</i>	Arkansas Mannagrass	G4	S3	
<i>Glyceria septentrionalis</i>	Floating Mannagrass	G5	S1	
<i>Glyceria striata</i>	Fowl Mannagrass	G5	S1	
<i>Koeleria macrantha</i>	June Grass	G5	S1	
<i>Muhlenbergia sericea</i>	Southern Hairgrass	G5?	S1	
<i>Muhlenbergia paniculata</i>	Tumble Grass	G5	S1	
<i>Panicum flexile</i>	Wiry Witch Grass	G5	S2	
<i>Panicum filipes</i>	Hall's Panic Grass	G5T5	S1	
<i>Paspalum monostachyum</i>	Gulfdune Paspalum	G4?	S2	
<i>Poa sylvestris</i>	Woodland Bluegrass	G5	S1	
<i>Schizachyrium maritimum</i>	Gulf Bluestem	G3G4Q	S1	
<i>Spartina pectinata</i>	Prairie Cord Grass	G5	S2	
<i>Sporobolus neglectus</i>	Small Dropseed	G5	S1	
<i>Sporobolus silveanus</i>	Silveus Dropseed	G4	S1	
<i>Tridens carolinianus</i>	Carolina Fluff Grass	G3G4	S2	
<i>Triplasis americana</i>	Perennial Sand Grass	G5	S1	
<i>Uniola paniculata</i>	Sea Oats	G5	S2	
ORDER: DIOSCOREALES				
FAMILY: NARTHECIACEAE				
<i>Lophiola aurea</i>	Goldencrest	G4	S2S3	
ORDER: ERIOCAULALES				
FAMILY: ERIOCAULACEAE				
<i>Eriocaulon texense</i>	Texas Pipewort	G4	S3	
<i>Lachnocaulon digynum</i>	Pineland Bogbutton	G3G4	S3	
ORDER: HYDROCHARITALES				
FAMILY: HYDROCHARITACEAE				
<i>Halophila engelmannii</i>	Engelmann's Sea-grass	G3G5	S1	
<i>Thalassia testudinum</i>	Turtle-grass	G4G5	S2?	
ORDER: JUNCALES				
FAMILY: JUNCACEAE				
<i>Juncus longii</i>	Long's Rush	G3Q	S1	
<i>Juncus paludosus</i>	Swamp Rush	G3G4	S1	
<i>Luzula acuminata</i> var. <i>carolinae</i>	Southern Hairy Woodrush	G5T5?	S1	
ORDER: LILIALES				
FAMILY: COLCHICACEAE				
<i>Uvularia perfoliata</i>	Perfoliate Bellwort	G5	S2	
<i>Uvularia sessilifolia</i>	Sessile-leaf Bellwort	G5	S2	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: HAEMODORACEAE				
<i>Lachnanthes caroliniana</i>	Carolina Redroot	G5	S3	
FAMILY: IRIDACEAE				
<i>Herbertia lahue</i>	Prairie-nymph	G4G5	S1	
<i>Iris nelsonii</i>	Abbeville Red Iris	G1Q	S1	
<i>Nemastylis geminiflora</i>	Prairie Pleatleaf	G4	S2	
FAMILY: LILIACEAE				
<i>Erythronium albidum</i>	White Trout Lily	G5	S2	
<i>Lilium michauxii</i>	Carolina Lily	G4G5	S3	
<i>Lilium superbum</i>	Turk's-cap Lily	G5	S1	
<i>Lilium catesbaei</i>	Southern Red Lily	G4	S1	
<i>Medeola virginiana</i>	Indian Cucumber-root	G5	S1	
FAMILY: MELANTHIACEAE				
<i>Amianthium muscitoxicum</i>	Fly-poison	G4G5	SH	
<i>Chamaelirium luteum</i>	Devil's-bit	G4G5	S2S3	
<i>Stenanthium leimanthoides</i>	Pine Barren Death-camas	G2	S1	
<i>Stenanthium texanum</i>	Black Death-camas	G3	S1	
<i>Toxicoscordion nuttallii</i>	Nuttall's Poison Camas	G5	S1	
<i>Trillium gracile</i>	Sabine River Wakerobin	G2G3	S3	
<i>Trillium recurvatum</i>	Reflexed Trillium	G5	S2	
<i>Trillium texanum</i>	Texas Trillium	G2	S1	
FAMILY: PONTEDERIACEAE				
<i>Heteranthera missouriensis</i>	Missouri Mud-Plantain	G5?	S1	
FAMILY: SMILACACEAE				
<i>Smilax auriculata</i>	Earleaf Greenbrier	G4?	S1	
FAMILY: STEMONACEAE				
<i>Croomia pauciflora</i>	Croomia	G3	SH	
ORDER: NAJADALES				
FAMILY: CYMODOCEACEAE				
<i>Halodule wrightii</i>	Shoal-grass	G5	S1	
<i>Syringodium filiforme</i>	Manatee-grass	G4	SU	
FAMILY: JUNCAGINACEAE				
<i>Triglochin striata</i>	Arrow-grass	G5	S1	
FAMILY: POTAMOGETONACEAE				
<i>Potamogeton epiphydrus</i>	Nuttall's Pondweed	G5	SH	
<i>Potamogeton perfoliatus</i>	Claspingleaf Pondweed	G5	S1	
ORDER: ORCHIDALES				
FAMILY: BURMANNIACEAE				
<i>Burmannia biflora</i>	Northern Burmannia	G4G5	S2	
FAMILY: ORCHIDACEAE				
<i>Aspidogyne quercetica</i>	Little Jug Orchid	G4	S1	
<i>Calopogon barbatus</i>	Bearded Grass-pink	G4?	S1	
<i>Calopogon multiflorus</i>	Many-flowered Grass-pink	G3	S1	
<i>Calopogon oklahomensis</i>	Oklahoma Grass-pink	G2	S1	
<i>Calopogon pallidus</i>	Pale Grass-pink	G4	S2	
<i>Cleistesiopsis oricamporum</i>	Spreading Pogonia	G3?	S1	
<i>Corallorhiza odontorhiza</i>	Autumn Coralroot	G5	S1	
<i>Cypripedium kentuckiense</i>	Southern Lady's-slipper	G3	S1	
<i>Habenaria quinqueseta</i>	Long-horned Habenaria	G4G5	S1	
<i>Hexaletris spicata</i>	Crested Coralroot	G5	S2	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: ORCHIDACEAE (cont.)				
<i>Isotria verticillata</i>	Large Whorled Pogonia	G5	S2	
<i>Orthochilus ecristatus</i>	Giant Orchid	G4	S2	
<i>Platanthera integra</i>	Yellow Fringeless Orchid	G3G4	S3	
<i>Platanthera lacera</i>	Green Fringed Orchid	G5	S1	
<i>Platanthera conspicua</i>	Large White Fringed Orchid	G4	S1	
<i>Ponthieva racemosa</i>	Shadow-witch Orchid	G5	S2	
<i>Spiranthes brevilabris</i>	Texas Ladies'-tresses	G1G2	SNR	
<i>Spiranthes eatonii</i>	Eaton's Ladies'-tresses	G3Q	SNR	
<i>Spiranthes floridana</i>	Florida Ladies'-tresses	G1	SH	
<i>Spiranthes longilabris</i>	Giant-spiral Ladies'-tresses	G3	SNR	
<i>Spiranthes magnicamporum</i>	Great Plains Ladies'-tresses	G3G4	S2	
<i>Spiranthes ovalis</i> var. <i>ovalis</i>	October Ladies'-tresses	G5?T3T4	S3	
<i>Triphora trianthophora</i>	Nodding Pogonia	G4?	S2	
ORDER: ZINGIBERALES				
FAMILY: CANNACEAE				
<i>Canna flaccida</i>	Golden Canna	G4?	S3	
FAMILY: MARANTACEAE				
<i>Thalia dealbata</i>	Powdery Thalia	G4	S2	
PHYLUM: BRYOPHYTA				
CLASS: BRYOPSIDA				
ORDER: ARCHIDIALES				
FAMILY: ARCHIDIACEAE				
<i>Archidium minus</i>	Small Archidium Moss	G2?	SH	
ORDER: DICRANALES				
FAMILY: DICRANACEAE				
<i>Campylopus angustiretis</i>	Campylopus Moss	G2?	SNR	
FAMILY: HYMENOPHYLLACEAE				
<i>Didymoglossum petersii</i>	Dwarf Filmy Fern	G4	S2	
ORDER: FISSIDENTALES				
FAMILY: FISSIDENTACEAE				
<i>Fissidens amoenus</i>	Hall's Pocket Moss	G3	SH	
<i>Fissidens leptophyllus</i>	Reese's Fissidens Moss	G2?	SH	
<i>Fissidens scalaris</i>	Neon Fissidens Moss	G2?	SH	
<i>Fissidens submarginatus</i>	Koch's Pocket Moss	G1G2	SH	
ORDER: FUNARIALES				
FAMILY: EPHEMERACEAE				
<i>Micromitrium wrightii</i>	Wright's Millimetre Moss	G2?	SH	
ORDER: HOOKERIALES				
FAMILY: PILOTRICHACEAE				
<i>Trachypodium hypnaceum</i>	a moss	G2?	SH	
PHYLUM: FILICINOPHYTA				
CLASS: FILICOPSIDA				
ORDER: FILICALES				
FAMILY: BLECHNACEAE				
<i>Blechnum occidentale</i>	Sink-hole Fern	GNR	SH	

PLANTS AND LICHENS (552) cont.				
Scientific Name	Common Name	G-Rank	S-Rank	Federal Status*
FAMILY: DRYOPTERIDACEAE				
<i>Ctenitis submarginalis</i>	Brown-hair Comb Fern	G5	S1	
<i>Dryopteris australis</i>	Southern Woodfern	GNA	SH	
<i>Dryopteris celsa</i>	Log Fern	G4	S1	
<i>Dryopteris ludoviciana</i>	Southern Shield Woodfern	G5	S2	
FAMILY: PTERIDACEAE				
<i>Adiantum pedatum</i>	Northern Maidenhair Fern	G5	S3	
<i>Ceratopteris pteridoides</i>	Floating Antler Fern	G5?	S2	
<i>Cheilanthes alabamensis</i>	Alabama Lipfern	G5	SH	
<i>Myriopteris lanosa</i>	Hairy Lipfern	G5	S1	
FAMILY: THELYPTERIDACEAE				
<i>Amauropelta noveboracensis</i>	New York Fern	G5	S1	
<i>Cyclosorus interruptus</i>	Willdenow's Maiden Fern	G5?	S1	
ORDER: POLYPODIALES				
FAMILY: ATHYRIACEAE				
<i>Deparia acrostichoides</i>	Silver False Spleenwort	G5	S2	
<i>Diplazopsis pycnocarpa</i>	Glade Fern	G5	S2	
<i>Diplazium lonchophyllum</i>	Lanceleaved Glade Fern	G3G5	S1	
FAMILY: CYSTOPTERIDACEAE				
<i>Cystopteris protrusa</i>	Lowland Bladderfern	G5	S3	
CLASS: OPHIOGLOSSOPSIDA				
ORDER: OPHIOGLOSSALES				
FAMILY: OPHIOGLOSSACEAE				
<i>Sceptridium jenmanii</i>	Alabama Grape Fern	G3G4	S2	
PHYLUM: HEPATOPHYTA				
CLASS: JUNGERMANNIOPSIDE				
ORDER: JUNGERMANNIALES				
FAMILY: LEJEUNACEAE				
<i>Cololejeunea setiloba</i>	a liverwort	G2?	SNR	
PHYLUM: LYCOPHYTA				
CLASS: ISOETOPSIDA				
ORDER: ISOETALES				
FAMILY: ISOETACEAE				
<i>Isoetes louisianensis</i>	Louisiana Quillwort	G2G3	S2	Endangered
ORDER: SELAGINELLALES				
FAMILY: SELAGINELLACEAE				
<i>Bryodesma corallinum</i>	Sand Spikemoss	G4	S3	
<i>Selaginella ludoviciana</i>	Gulf Spikemoss	G3G4	S1	
CLASS: LYCOPODIOPSIDA				
ORDER: LYCOPODIALES				
FAMILY: LYCOPODIACEAE				
<i>Palhinhaea cernua</i>	Staghorn Clubmoss	G5	S2	

*Species designated as Federally Threatened or Endangered are deemed to be State Threatened or Endangered

Appendix E

NATURAL COMMUNITY LIST

Natural Community	G-Rank	S-Rank	Page
FOREST SYSTEMS			
Alluvial Plain Forests			
Baldcypress-Tupelo Swamp Forest	G3G5	S4	102
Batture Forest	G4G5	S4	103
Bottomland Hardwood Forest	G4G5	S4	104
➤ <i>Hackberry-American Elm-Green Ash Bottomland Hardwood Forest</i>	G4G5	S4	104
➤ <i>Overcup Oak-Water Hickory Bottomland Hardwood Forest</i>	G3G4	S4	104
➤ <i>Sweetgum-Water Oak Bottomland Hardwood Forest</i>	G4?	S5	104
Canebrake	G2?	SX	105
Hardwood Flatwoods			106
➤ <i>Wet Hardwood Flatwoods</i>	G2G3	S2S3	106
➤ <i>Mesic Hardwood Flatwood</i>	G1G2?	S2S3	106
Macon Ridge Green Ash Pond	G2?	S1	106
Coastal Plain Forests			
Forest Barrier Island Live Oak Forest	G1	S1	108
Coastal Live Oak-Hackberry Forest	G2	S1	108
Forest Salt Dome Hardwood Forest	G1	S1	110
Live Oak Natural Levee Forest	G3G4	S1	110
Live Oak-Pine-Magnolia Forest	G2G3	S1	112
Interior Southern Plains Forests (Eastern/Western)			
Acidic Bay Forest	G3?	S2	113
Calcareous Forest	G2?Q	S2	114
Hardwood Slope Forest	G2G3	S3	115
Pondcypress-Swamp Tupelo Forest	G3	S1	116
Small Stream Forest	G3	S3	116
Loess Plain Forest			
Southern Mesophytic Hardwood Forest	G1G2	S2	118
Spruce Pine-Hardwood Flatwoods Forest	G1G2	S1	118

Natural Community	G-Rank	S-Rank	Page
SAVANNAS AND WOODLANDS			
Eastern Gulf Coastal Plain Savannas and Woodlands			
Eastern Hillside Seepage Bog	G2	S1	120
Eastern Longleaf Pine Flatwoods Savanna	G1	S1	121
Eastern Upland Longleaf Pine Savanna and Woodland	G1G2	S1	122
Slash Pine-Pondcypress Woodland	G2?	S1	123
Western Gulf Coastal Plain Savannas and Woodlands			
Ouachita Sand Prairie and Woodland	G2G3	S1	125
Sandstone Glade/Barren	G1G2	S2	126
Sparta Sand Pond	GNR	S1	126
West Gulf Coastal Plain Muck Bog	G1	S1	127
Western Hillside Seepage Bog	G2G3	S2	128
Western Longleaf Pine Flatwoods Savanna			129
➤ <i>Acidic</i>	G2G3	S1	129
➤ <i>Saline</i>	G1	S1	129
Western Upland Longleaf Pine Savanna and Woodland	G2G3	S3	130
Interior Southern Plains Savannas and Woodlands			
Flatwoods Pond (East and West Gulf Coastal Plain)	G2Q	S1	132
Shortleaf Pine/Oak Hickory Woodland	G2G3	S1	133
Xeric Sandhill Woodland	G2G3	S1	134

Natural Community	G-Rank	S-Rank	Page
NON-FORESTED GRASSLANDS AND OPEN TERRAIN			
Marshes			
Brackish Marsh	G4?	S3	136
Coastal Mangrove-Marsh and Shrubland	G2?	S2	137
Freshwater Floating Marsh	GNR	S2	138
Freshwater Marsh	G3G4	S2	139
Intermediate Marsh	G4?	S3	140
Salt Marsh	G5	S4	141
Vegetated Pioneer Emerging Delta	G3G4	S3	143
Beaches, Barrier Islands, and Sandbars			
Barrier Island	N/A	S1	144
Coastal Dune Grassland and Coastal Dune Shrub Thicket	G2G3	S1	145
Louisiana Beach	GNR	S2	146
Sandbar	G4G5	S4	147
Prairies			
Calcareous Prairie	G1	S1	148
Coastal Prairie	G2Q	S1	149
Mississippi Terrace Prairie	G2	SX	150
Prairie Pothole	GNR	S1	151
Sodic/Alkali Barren (formerly Saline Prairie)	G1G2	S1	152
AQUATIC AND MARINE WATERS			
Lentic Water Bodies			
Coastal Freshwater Submerged Aquatic Vegetation	G4	S3S4	154
Interior Freshwater Submerged Aquatic Vegetation	G4	S5	154
Lakes and Reservoirs	N/A	S5	155
Ponds	N/A	S5	156
Lotic Water Bodies			
River Delta Freshwater Submerged Aquatic Vegetation	G3G5	SNR	157
Rivers, Streams, Creeks, and Bayous	GNR	SNR	157
Marine and Estuarine Water Bodies			
Estuarine Submerged Aquatic Vegetation	G4	S1	159
Marine Submerged Aquatic Vegetation	G4?	S1	159
Marine Substrate Habitats			160
➤ <i>Hard Mud/Clay Bottom</i>			160
➤ <i>Sandy Bottom</i>			161
➤ <i>Shell/Shell Hash Bottom</i>			161
➤ <i>Soft Mud Bottom</i>			162
➤ <i>State Territorial Open Water</i>			162

Natural Community	G-Rank	S-Rank	Page
ANTHROPOGENIC HABITATS			
Agriculture and Improved Pasture (excluding rice)		SNA	163
Pine Plantation and Contemporary Forest		SNA	164
Rice Agriculture and Aquaculture		SNA	165
BASINS			
Atchafalaya Basin			167
Barataria Basin			168
Calcasieu Basin			170
Mermentau Basin			171
Mississippi Basin			172
Ouachita Basin			173
Pearl Basin			174
Pontchartrain Basin			175
Red Basin			177
Sabine Basin			178
Terrebonne Basin			179
Vermilion-Teche Basin			180

Appendix F

SPECIES OF GREATEST CONSERVATION NEED BY ECOLOGICAL SUBTYPE

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Bay Scallop	<i>Argopecten irradians</i>									•				•	
Half-Naked Penshell	<i>Atrina seminuda</i>									•				•	
Sawtooth Penshell	<i>Atrina serrata</i>									•				•	
Louisiana Pearlshell	<i>Margaritifera hembeli</i>			•									•		
Butterfly	<i>Ellipsaria lineolata</i>											•	•		
Alabama Spike	<i>Elliptio arca</i>												•		
Elephantear	<i>Elliptio crassidens</i>											•	•		
Spike	<i>Euryntia dilatata</i>											•	•		
Texas Pigtoe	<i>Fusconaia askewi</i>												•		
Pink Mucket	<i>Lampsilis abrupta</i>											•	•		
Plain Pocketbook	<i>Lampsilis cardium</i>												•		
Southern Pocketbook	<i>Lampsilis ornata</i>												•		
Sandbank Pocketbook	<i>Lampsilis satura</i>												•		
Fatmucket	<i>Lampsilis siliquoidea</i>												•		
White Heelsplitter	<i>Lasmigona complanata</i>			•								•	•		
Black Sandshell	<i>Ligumia recta</i>												•		
Southern Hickorynut	<i>Obovaria arkansasensis</i>			•									•		
Hickorynut	<i>Obovaria olivaria</i>											•	•		
<i>Obovaria cf. unicolor</i>	<i>Obovaria sp.</i>												•		
Mucket	<i>Ortmanniana ligamentina</i>											•	•		
Mississippi Pigtoe	<i>Pleurobema beadleianum</i>												•		
Louisiana Pigtoe	<i>Pleurobema riddellii</i>			•									•		
Round Pigtoe	<i>Pleurobema sintoxia</i>											•	•		
Texas Heelsplitter	<i>Potamilus amphichaenus</i>											•	•		
Fat Pocketbook	<i>Potamilus capax</i>											•	•		

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Inflated Heelsplitter	<i>Potamilus inflatus</i>											•	•		
Southern Creekmussel	<i>Pseudodontoideus subvexus</i>												•		
Ouachita Kidneyshell	<i>Ptychobranchus occidentalis</i>												•		
Ebonyshell	<i>Reginaia ebenus</i>											•	•		
Pascagoula Creekshell	<i>Strophitus pascagoulaensis</i>												•		
Creeper	<i>Strophitus undulatus</i>			•									•		
Rabbitsfoot	<i>Theliderma cylindrica</i>												•		
Monkeyface	<i>Theliderma metanevra</i>												•		
Fawnsfoot	<i>Truncilla donaciformis</i>											•	•		
Cypress Floater	<i>Utterbackiana hartfieldorum</i>											•	•		
Southern Rainbow	<i>Villosa vibex</i>			•									•		
Texas Lightning Whelk	<i>Sinistrofulgur pulleyi</i>									•				•	
Brown-band Wentletrap	<i>Gyroscala rupicola</i>									•				•	
Flamed Tigersnail	<i>Anguispira alternata</i>	•													
a crayfish	<i>Creaserinus clausus</i>			•				•			•				•
a crayfish	<i>Creaserinus crenastylus</i>			•				•							•
Flatwoods Digger	<i>Creaserinus oryctes</i>					•					•				•
Pine Hills Digger	<i>Fallicambarus dissitus</i>						•				•				•
Old Prairie Digger	<i>Fallicambarus macneesei</i>										•				•
Slenderwrist Burrowing Crayfish	<i>Fallicambarus petilicarpus</i>						•								•
Blair's Fencing Crayfish	<i>Faxonella blairi</i>	•		•							•				•
Calcasieu Painted Crayfish	<i>Faxonius hathawayi blacki</i>			•									•		
Teche Painted Crayfish	<i>Faxonius hathawayi hathawayi</i>			•									•		
Pontchartrain Painted Crayfish	<i>Faxonius hobbsi</i>			•									•		
Kisatchie Painted Crayfish	<i>Faxonius maletae</i>			•									•		
Ribbon Crayfish	<i>Procambarus bivittatus</i>	•		•									•		
Southwestern Creek Crayfish	<i>Procambarus dupratzi</i>			•									•		

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Elegant Creek Crayfish	<i>Procambarus elegans</i>	•		•									•		
Twin Crayfish	<i>Procambarus geminus</i>	•		•				•				•			•
Javelin Crayfish	<i>Procambarus jaculus</i>	•		•				•			•	•			•
Caddo Chimney Crayfish	<i>Procambarus machardy</i>			•				•				•			•
Pearl Blackwater Crayfish	<i>Procambarus penni</i>			•									•		
Calcasieu Creek Crayfish	<i>Procambarus pentastylus</i>			•									•		
Flatnose Crayfish	<i>Procambarus planirostris</i>	•			•	•		•				•			•
Gulf Crayfish	<i>Procambarus shermani</i> n/a	•		•		•		•				•			•
Vernal Crayfish	<i>Procambarus viaeviridis</i>	•						•				•			•
Southern Unstriped Scorpion	<i>Vaejovis carolinianus</i>				•										
an ground beetle	<i>Anillinus felicianus</i>				•										
Big Sand Tiger Beetle	<i>Cicindela formosa</i>						•								
Cajun Tiger Beetle	<i>Dromochorus pilatei</i>	•		•											
White Sand Tiger Beetle	<i>Ellipsoptera wapleri</i>			•						•					
Gulf Beach Tiger Beetle	<i>Habroscelimorpha dorsalis venusta</i>									•					
Six-banded Longhorn Beetle	<i>Dryobius sexnotatus</i>	•		•											
Little Dubiraphian Riffle Beetle	<i>Dubiraphia parva</i>			•											
Saline Prairie Scarab Beetle	<i>Ataenius robustus</i>										•				
Southern Plains Bumble Bee	<i>Bombus fraternus</i>					•	•				•				
American Bumble Bee	<i>Bombus pensylvanicus</i>	•	•	•	•	•	•	•			•				•
Variable Cuckoo Bumble Bee	<i>Bombus variabilis</i>														
Florida Harvester Ant	<i>Pogonomyrmex badius</i>					•									
Comanche Harvester Ant	<i>Pogonomyrmex comanche</i>						•	•		•	•				•
Louisiana Eyed Silkmoth	<i>Automeris louisiana</i>								•	•					
Gulf Pine Sphinx	<i>Lapara phaeobrachycerous</i>					•									

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Brou's Underwing	<i>Catocala atocala</i>	•		•							•				
Brou's Mallow Moth	<i>Bagisara brouana</i>					•									
Lace-winged Roadside-Skipper	<i>Amblyscirtes aesculapius</i>	•		•	•	•	•	•							
Dusky Roadside-Skipper	<i>Amblyscirtes alternata</i>					•	•								
Mather's Roadside-Skipper	<i>Amblyscirtes matheri</i>				•										
a roadside-skipper	<i>Amblyscirtes nemoris</i>				•		•								
Common Roadside-Skipper	<i>Amblyscirtes vialis</i>						•								
Arogos Skipper	<i>Atrytone arogos</i>			•		•	•								
Dusted Skipper	<i>Atrytonopsis hianna</i>					•	•				•				
Wild Indigo Duskywing	<i>Erynnis baptisiae</i>		•	•	•	•	•			•	•				
Mottled Duskywing	<i>Erynnis martialis</i>					•	•								
Bay Skipper	<i>Euphyes bayensis</i>								•	•					
Dion Skipper	<i>Euphyes dion</i>			•		•	•		•						
Palatka Skipper	<i>Euphyes pilatka</i>								•						
Meske's Skipper	<i>Hesperia meskei</i>						•								•
Cobweb Skipper	<i>Hesperia metea</i>					•	•	•							
Zabulon Skipper	<i>Lon zabulon</i>	•		•	•										
Strecker's Giant-Skipper	<i>Megathymus streckeri</i>						•								
Yucca Giant-Skipper	<i>Megathymus yuccae</i>				•	•	•								
Obscure Skipper	<i>Panoquina panoquinoides</i>								•	•					
Aaron's Skipper	<i>Poanes aaroni</i>								•						
Western Pygmy Blue	<i>Brephidium exilis</i>								•						
Eastern Pygmy Blue	<i>Brephidium pseudofea</i>								•	•					
Henry's Elfin	<i>Callophrys henrici</i>			•	•	•	•								
Frosted Elfin	<i>Callophrys irus</i>			•			•				•				
King's Hairstreak	<i>Satyrrium kingi</i>	•		•											
Seminole Texan Crescent	<i>Anthanasia texana seminole</i>	•		•											
Gorgone Checkerspot	<i>Chlosyne gorgone</i>						•	•			•				
Monarch	<i>Danaus plexippus</i>	•	•	•	•	•	•	•	•	•	•				
Appalachian Brown	<i>Lethe appalachia</i>	•		•											
Creole Pearly-eye	<i>Lethe creola</i>	•	•	•	•		•	•				•			
a panorpid scorpionfly	<i>Panorpa americana</i>					•									

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Mourning Scorpionfly	<i>Panorpa lugubris</i>					•									
a panorpid scorpionfly	<i>Panorpa rupeculana</i>						•								
a panorpid scorpionfly	<i>Panorpa vernalis</i>					•									
Taper-tailed Darner	<i>Gomphaeschna antilope</i>					•	•								
Phantom Darner	<i>Triacanthagyna trifida</i>	•	•												
Brown Spiketail	<i>Zoraena bilineata</i>			•	•										
Pitcher Plant Spiketail	<i>Zoraena sarracenia</i>			•			•								
Alabama Shadowdragon	<i>Neurocordulia alabamensis</i>														
Fine-lined Emerald	<i>Somatochlora filosa</i>					•	•								
Texas Emerald	<i>Somatochlora margarita</i>			•			•								
Treetop Emerald	<i>Somatochlora provocans</i>					•									
Clamp-tipped Emerald	<i>Somatochlora tenebrosa</i>			•	•										
Stillwater Clubtail	<i>Arigomphus lentulus</i>	•						•				•			
Southeastern Spinyleg	<i>Dromogomphus armatus</i>			•		•									
Eastern Ringtail	<i>Erpetogomphus designatus</i>			•		•									
Blackwater Clubtail	<i>Gomphurus dilatatus</i>			•											
Banner Clubtail	<i>Hylogomphus apomyius</i>			•			•								
Southern Snaketail	<i>Ophiogomphus australis</i>			•		•									
Clearlake Clubtail	<i>Phanogomphus australis</i>					•						•			
Hodges' Clubtail	<i>Phanogomphus hodgesi</i>			•		•									
Riverine Clubtail	<i>Stylurus amnicola</i>			•		•									
Laura's Clubtail	<i>Stylurus laurae</i>			•		•	•								
Townes's Clubtail	<i>Stylurus townesi</i>			•		•									
Red-veined Pennant	<i>Celithemis bertha</i>					•						•			
Cherry Bluet	<i>Enallagma concisum</i>					•						•			
Blackwater Bluet	<i>Enallagma weewa</i>			•		•									
Sphagnum Sprite	<i>Nehalennia gracilis</i>			•		•	•								
Louisiana Needlefly	<i>Leuctra szczytkoi</i>			•											
Texas Forestfly	<i>Amphinemura texana</i>			•											

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Masked Springfly	<i>Helopicus bogaloosa</i>			•											
Morse's Net-spinning Caddisfly	<i>Cheumatopsyche morsei</i>			•											
Schoolhouse Springs Net-spinning Caddisfly	<i>Diplectrona rossi</i>			•											
Molson's Microcaddisfly	<i>Hydroptila molsonae</i>			•											
Schoolhouse Springs Purse Casemaker Caddisfly	<i>Hydroptila ouachita</i>			•											
a purse casemaker caddisfly	<i>Hydroptila poirrieri</i>			•											
a longhorned caddisfly	<i>Ceraclea spongillovorax</i>			•											
Holzenthal's Philopotamid Caddisfly	<i>Chimarra holzenthali</i>			•											
Spring-loving Psiloneuran Caddisfly	<i>Agarodes libalis</i>			•											
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>												•	•	
Pallid Sturgeon	<i>Scaphirhynchus albus</i>												•		
Shovelnose Sturgeon	<i>Scaphirhynchus platyrhynchus</i>												•		
Paddlefish	<i>Polyodon spathula</i>											•	•		
American Eel	<i>Anguilla rostrata</i>								•			•	•	•	
Alabama Shad	<i>Alosa alabamiae</i>												•	•	
Quillback	<i>Carpionodes cyprinus</i>												•		
Highfin Carpsucker	<i>Carpionodes velifer</i>												•		
Blue Sucker	<i>Cycleptus elongatus</i>												•		
Southeastern Blue Sucker	<i>Cycleptus meridionalis</i>												•		
River Redhorse	<i>Moxostoma carinatum</i>												•		
River Shiner	<i>Alburnops blennius</i>												•		
Ironcolor Shiner	<i>Alburnops chalybaeus</i>												•		
Chub Shiner	<i>Alburnops potteri</i>												•		
Central Stoneroller	<i>Camptostoma anomalum</i>												•		
Bluntnose Shiner	<i>Cyprinella camura</i>												•		
Steelcolor Shiner	<i>Cyprinella whipplei</i>												•		
Longjaw Minnow	<i>Ericymba amplamala</i>												•		

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Cypress Minnow	<i>Hybognathus hayi</i>												•		
Clear Chub	<i>Hybopsis winchelli</i>												•		
Shoal Chub	<i>Macrhybopsis hyostoma</i>												•		
Gulf Chub	<i>Macrhybopsis tomellerii</i>												•		
Bigeye Shiner	<i>Miniellus boops</i>												•		
Sabine Shiner	<i>Miniellus sabinae</i>												•		
Blackspot Shiner	<i>Notropis atrocaudalis</i>												•		
Ghost Shiner	<i>Paranotropis buchanani</i>												•		
Silverband Shiner	<i>Paranotropis shumardi</i>												•		
Suckermouth Minnow	<i>Phenacobius mirabilis</i>												•		
Bluehead Shiner	<i>Pteronotropis hubbsi</i>												•		
Flagfin Shiner	<i>Pteronotropis signipinnis</i>												•		
Bluenose Shiner	<i>Pteronotropis welaka</i>												•		
Western Starhead Topminnow	<i>Fundulus blairae</i>								•			•	•		
Northern Starhead Topminnow	<i>Fundulus dispar</i>								•			•	•		
Broadstripe Topminnow	<i>Fundulus euryzonus</i>												•		
Southern Starhead Topminnow	<i>Fundulus nottii</i>								•			•	•		
Goldeye	<i>Hiodon alosoides</i>												•		
Mooneye	<i>Hiodon tergisus</i>												•		
Alligator Gar	<i>Atractosteus spatula</i>								•			•	•	•	
Striped Bass (Gulf strain)	<i>Morone saxatilis</i>								•			•	•	•	
Western Sand Darter	<i>Ammocrypta clara</i>												•		
Crystal Darter	<i>Crystallaria asprella</i>												•		
Redspot Darter	<i>Etheostoma artesiae</i>												•		
Rainbow Darter	<i>Etheostoma caeruleum</i>												•		
Goldstripe Darter	<i>Etheostoma parvipinne</i>												•		
Gumbo Darter	<i>Etheostoma thompsoni</i>												•		
Pearl Darter	<i>Percina aurora</i>												•		
Channel Darter	<i>Percina copelandi</i>												•		
Freckled Darter	<i>Percina lenticula</i>												•		

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Bigscale Logperch	<i>Percina macrolepida</i>											•	•		
River Darter	<i>Percina shumardi</i>												•		
Gulf Logperch	<i>Percina suttkusi</i>												•		
Saddleback Darter	<i>Percina vigil</i>												•		
Frecklebelly Madtom	<i>Noturus munitus</i>												•		
Brown Madtom	<i>Noturus phaeus</i>														
Gulf Pipefish	<i>Syngnathus scovelli</i>											•		•	
African Pompano	<i>Alectis ciliaris</i>														
Greater Amberjack	<i>Seriola dumerili</i>														
Florida Pompano	<i>Trachinotus carolinus</i>														
Cobia	<i>Rachycentron canadum</i>														
Diamond Killifish	<i>Adinia xenica</i>								•						
Saltmarsh Topminnow	<i>Fundulus jenkinsi</i>								•						
Bayou Killifish	<i>Fundulus pulvereus</i>								•			•			
Tarpon	<i>Megalops atlanticus</i>														
Large-scaled Spinycheek Sleeper	<i>Eleotris amblyopsis</i>								•				•		
Emerald Sleeper	<i>Erotelis smaragdus</i>								•					•	
Frillfin Goby	<i>Bathygobius soporator</i>								•					•	
Marked Goby	<i>Ctenogobius stigmaticus</i>								•					•	
Violet Goby	<i>Gobioides broussonetii</i>								•					•	
Sailfish	<i>Istiophorus platypterus</i>														
Blue Marlin	<i>Makaira nigricans</i>														
White Marlin	<i>Kajikia albida</i>														
Longbill Spearfish	<i>Tetrapturus pfluegeri</i>														
Gold Brotula	<i>Gunterichthys longipenis</i>								•						
Common Snook	<i>Centropomus undecimalis</i>														
Marbled Grouper	<i>Dermatolepis inermis</i>														
Goliath Grouper	<i>Epinephelus itajara</i>														
Yellowmouth Grouper	<i>Mycteroperca interstitialis</i>														
Gag Grouper	<i>Mycteroperca microlepis</i>														
Southern Flounder	<i>Paralichthys lethostigma</i>														

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Smalltooth Sawfish	<i>Pristis pectinata</i>														
King Mackerel	<i>Scomberomorus cavalla</i>														
Bigeye Tuna	<i>Thunnus obesus</i>														
Lined Seahorse	<i>Hippocampus erectus</i>														
Dwarf Seahorse	<i>Hippocampus zosterae</i>													•	
Opossum Pipefish	<i>Microphis lineatus</i>								•					•	
Southern Puffer	<i>Sphoeroides nephelus</i>														
Silky Shark	<i>Carcharhinus falciformis</i>														
Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>														
Dusky Shark	<i>Carcharhinus obscurus</i>														
Caribbean Reef Shark	<i>Carcharhinus perezi</i>														
Sandbar Shark	<i>Carcharhinus plumbeus</i>														
White Shark	<i>Carcharodon carcharias</i>														
Lemon Shark	<i>Negaprion brevirostris</i>														
Tiger Shark	<i>Galeocerdo cuvier</i>														
Scalloped Hammerhead	<i>Sphyrna lewini</i>														
Great Hammerhead	<i>Sphyrna mokarran</i>														
Bigeye Thresher Shark	<i>Alopias superciliosus</i>														
Shortfin Mako Shark	<i>Isurus oxyrinchus</i>														
Longfin Mako Shark	<i>Isurus paucus</i>														
Giant Manta Ray	<i>Mobula birostris</i>														
Whale Shark	<i>Rhincodon typus</i>														
Dwarf American Toad	<i>Anaxyrus americanus charlesmithi</i>			•	•	•		•							
Oak Toad	<i>Anaxyrus quercicus</i>		•			•		•							•
Southern Toad	<i>Anaxyrus terrestris</i>		•			•		•							•
Gray Treefrog	<i>Hyla versicolor</i>	•						•							
Ornate Chorus Frog	<i>Pseudacris ornata</i>	•		•		•	•	•			•				
Strecker's Chorus Frog	<i>Pseudacris streckeri</i>	•					•	•			•				•
Southern Crawfish Frog	<i>Lithobates areolatus areolatus</i>	•					•	•			•				

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Dusky Gopher Frog	<i>Lithobates sevosus</i>	•				•	•	•							
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>			•		•	•	•			•				
Hurter's Spadefoot	<i>Scaphiopus hurterii</i>			•			•	•			•				
Small-mouthed Salamander	<i>Ambystoma texanum</i>	•		•	•			•							•
Eastern Tiger Salamander	<i>Ambystoma tigrinum tigrinum</i>	•				•	•	•							
Valentine's Southern Dusky Salamander	<i>Desmognathus valentinei</i>	•		•	•										
Southern Two-lined Salamander	<i>Eurycea cirrigera</i>	•		•		•		•							
Three-lined Salamander	<i>Eurycea guttolineata</i>	•		•		•		•							
Southeastern Dwarf Salamander	<i>Eurycea quadridigitata</i>	•		•		•		•							
Four-toed Salamander	<i>Hemidactylium scutatum</i>	•		•	•	•	•	•							
Louisiana Slimy Salamander	<i>Plethodon kisatchie</i>	•		•				•							
Southern Red-backed Salamander	<i>Plethodon serratus</i>			•			•	•							
Webster's Salamander	<i>Plethodon websteri</i>			•	•										
Gulf Coast Mud Salamander	<i>Pseudotriton montanus flavissimus</i>			•	•	•									
Southern Red Salamander	<i>Pseudotriton ruber vioscai</i>			•		•									
Gulf Coast Waterdog	<i>Necturus beyeri</i>											•	•		
Red River Mudpuppy	<i>Necturus louisianensis</i>											•	•		
Seepage Siren	<i>Siren sphagnicola</i>											•	•		
Western Slender Glass Lizard	<i>Ophisaurus attenuatus attenuatus</i>		•				•	•		•	•				
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>		•			•		•		•	•				
Western Wormsnake	<i>Carphophis vermis</i>	•		•											
Scarletsnake	<i>Cemophora coccinea</i>					•		•							
Scarlet Kingsnake	<i>Lampropeltis elapsoides</i>				•	•		•							
Northern Mole Kingsnake	<i>Lampropeltis rhombomaculata</i>					•		•							
Eastern Milksnake	<i>Lampropeltis triangulum</i>	•													
Louisiana Pinesnake	<i>Pituophis ruthveni</i>						•	•							
Southeastern Crowned Snake	<i>Tantilla coronata</i>					•		•							

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Flat-headed Snake	<i>Tantilla gracilis</i>							•							
Eastern Ribbonsnake	<i>Thamnophis saurita</i>	•		•		•		•							•
Eastern Diamond-backed Rattlesnake	<i>Crotalus adamanteus</i>			•		•		•							
Timber Rattlesnake	<i>Crotalus horridus</i>	•		•	•	•	•	•							
Western Pygmy Rattlesnake	<i>Sistrurus miliarius streckeri</i>	•		•	•	•	•	•							
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>	•		•									•		
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>	•		•	•	•	•	•			•				
Pine Woods Littersnake	<i>Rhadinaea flavilata</i>					•		•							•
Harlequin Coralsnake	<i>Micrurus fulvius</i>			•		•		•							
Gulf Saltmarsh Snake	<i>Nerodia clarkii clarkii</i>								•	•		•			
Coal Skink	<i>Plestiodon anthracinus</i>			•	•	•	•	•							
Southern Prairie Skink	<i>Plestiodon septentrionalis obtusirostris</i>							•			•				
Six-lined Racerunner	<i>Aspidoscelis sexlineatus</i>			•		•		•			•				
Loggerhead Sea Turtle	<i>Caretta caretta</i>									•				•	
Green Sea Turtle	<i>Chelonia mydas</i>									•				•	
Atlantic Hawksbill Sea Turtle	<i>Eretmochelys imbricata imbricata</i>													•	
Kemp's Ridley Sea Turtle	<i>Lepidochelys kempii</i>									•				•	
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	•		•						•		•	•		
Leatherback Sea Turtle	<i>Dermochelys coriacea</i>													•	
Southern Painted Turtle	<i>Chrysemys dorsalis</i>	•		•								•			
Western Chicken Turtle	<i>Deirochelys reticularia miaria</i>	•		•			•	•	•		•	•			•
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>	•		•		•		•	•		•	•			•
Ringed Map Turtle	<i>Graptemys oculifera</i>									•			•		
Ouachita Map Turtle	<i>Graptemys ouachitensis</i>	•		•						•		•	•		•
Pearl River Map Turtle	<i>Graptemys pearlensis</i>									•			•		

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Sabine Map Turtle	<i>Graptemys sabinensis</i>	•								•			•		
Mississippi Diamond-backed Terrapin	<i>Malaclemys terrapin pileata</i>								•	•				•	
Gulf Coast Box Turtle	<i>Terrapene carolina major</i>	•	•	•					•	•	•				
Three-toed Box Turtle	<i>Terrapene carolina triunguis</i>	•	•	•	•			•		•	•				
Ornate Box Turtle	<i>Terrapene ornata</i>		•								•				
Mississippi Mud Turtle	<i>Kinosternon subrubrum hippocrepis</i>	•		•								•	•		•
Razor-backed Musk Turtle	<i>Sternotherus carinatus</i>	•		•								•	•		
Eastern Musk Turtle	<i>Sternotherus odoratus</i>	•		•								•	•		•
Stripe-necked Musk Turtle	<i>Sternotherus peltifer</i>			•									•		
Gopher Tortoise	<i>Gopherus polyphemus</i>					•	•	•							
Gulf Coast Smooth Softshell	<i>Apalone mutica calvata</i>									•			•		
Midland Smooth Softshell	<i>Apalone mutica mutica</i>									•			•		
Swallow-tailed Kite	<i>Elanoides forficatus</i>	•	•	•	•	•	•								•
Bald Eagle	<i>Haliaeetus leucocephalus</i>	•	•	•	•	•	•	•	•			•			•
Northern Pintail	<i>Anas acuta</i>								•		•	•			•
Mottled Duck	<i>Anas fulvigula</i>								•	•	•	•	•	•	•
Lesser Scaup	<i>Aythya affinis</i>								•	•		•		•	•
Redhead	<i>Aythya americana</i>								•	•		•	•	•	•
Canvasback	<i>Aythya valisineria</i>								•	•		•	•	•	•
American Wigeon	<i>Mareca americana</i>								•		•	•			•
Chimney Swift	<i>Chaetura pelagica</i>	•	•	•	•	•	•	•							
Chuck-will's-widow	<i>Antrostomus carolinensis</i>	•	•	•	•	•	•	•							
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	•	•	•	•	•	•	•							
Common Nighthawk	<i>Chordeiles minor</i>		•			•	•	•	•	•	•				•
Snowy Plover	<i>Anarhynchus nivosus</i>								•	•					
Wilson's Plover	<i>Anarhynchus wilsonia</i>								•	•					
Piping Plover	<i>Charadrius melodus</i>								•	•					
American Golden-Plover	<i>Pluvialis dominica</i>								•		•				•

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American Oystercatcher	<i>Haematopus palliatus</i>								•	•					
Black Tern	<i>Chlidonias niger</i>								•	•	•	•	•	•	
Gull-billed Tern	<i>Gelochelidon nilotica</i>								•	•	•				•
Black Skimmer	<i>Rynchops niger</i>								•	•			•	•	
Forster's Tern	<i>Sterna forsteri</i>								•	•	•	•	•	•	•
Coastal Least Tern	<i>Sternula antillarum antillarum</i>								•	•		•	•	•	
Interior Least Tern	<i>Sternula antillarum athalassos</i>								•	•		•	•	•	
Royal Tern	<i>Thalasseus maximus</i>								•	•		•	•	•	
Sandwich Tern	<i>Thalasseus sandvicensis</i>								•	•				•	
Ruddy Turnstone	<i>Arenaria interpres</i>								•	•					•
Upland Sandpiper	<i>Bartramia longicauda</i>										•				•
Red Knot	<i>Calidris canutus</i>								•	•					
Stilt Sandpiper	<i>Calidris himantopus</i>								•		•				•
Pectoral Sandpiper	<i>Calidris melanotos</i>								•	n/a	•				•
Semipalmated Sandpiper	<i>Calidris pusilla</i>								•	•	•				•
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>										•				•
Short-billed Dowitcher	<i>Limnodromus griseus</i>								•	•	•				•
Marbled Godwit	<i>Limosa fedoa</i>								•	•	•				
Hudsonian Godwit	<i>Limosa haemastica</i>								•						•
Long-billed Curlew	<i>Numenius americanus</i>								•	•	•				•
Whimbrel	<i>Numenius phaeopus</i>								•	•	•				•
American Woodcock	<i>Scolopax minor</i>	•	•	•	•	•	•	•			•				•
Lesser Yellowlegs	<i>Tringa flavipes</i>								•		•				•
Willet	<i>Tringa semipalmata</i>								•	•					•
Wood Stork	<i>Mycteria americana</i>	•	•	•					•		•	•			•
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	•	•	•	•	•	•	•							•
Southeastern American Kestrel	<i>Falco sparverius paulus</i>					•	•	•							•
Northern Bobwhite	<i>Colinus virginianus</i>					•	•	•			•				•
Whooping Crane	<i>Grus americana</i>	•					•	•	•		•				•
Yellow Rail	<i>Coturnicops noveboracensis</i>					•	•		•		•				•
Eastern Black Rail	<i>Laterallus jamaicensis jamaicensis</i>								•		•				

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Clapper Rail	<i>Rallus crepitans</i>								•	•					
King Rail	<i>Rallus elegans</i>								•		•				•
Painted Bunting	<i>Passerina ciris</i>	•	•	•	•	•	•	•			•				•
Rusty Blackbird	<i>Euphagus carolinus</i>	•	•	•	•			•							•
Common Grackle	<i>Quiscalus quiscula</i>	•	•	•	•	•	•	•	•		•				•
Eastern Meadowlark	<i>Sturnella magna</i>					•	•	•			•				•
Loggerhead Shrike	<i>Lanius ludovicianus</i>					•	•	•	•	•	•				•
Sprague's Pipit	<i>Anthus spragueii</i>										•				•
Canada Warbler	<i>Cardellina canadensis</i>	•	•	•	•	•	•	•							
Kentucky Warbler	<i>Geothlypis formosa</i>	•	•	•	•	•	•	•							
Worm-eating Warbler	<i>Helmitheros vermivorum</i>	•	•	•	•	•	•	•							
Louisiana Waterthrush	<i>Parkesia motacilla</i>	•	•	•	•	•	•	•							
Prothonotary Warbler	<i>Protonotaria citrea</i>	•	•	•	•	•		•							
Cerulean Warbler	<i>Setophaga cerulea</i>	•	•	•	•	•	•	•							
Yellow-throated Warbler	<i>Setophaga dominica</i>	•	•	•	•	•		•							
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	•	•	•	•	•	•	•							
Grasshopper Sparrow	<i>Ammodramus savannarum</i>					•	•	•			•				•
LeConte's Sparrow	<i>Ammospiza leconteii</i>					•	•		•		•				•
Seaside Sparrow	<i>Ammospiza maritima</i>								•	•					
Nelson's Sparrow	<i>Ammospiza nelsoni</i>								•	•					•
Henslow's Sparrow	<i>Centronyx henslowii</i>					•	•	•			•				
Bachman's Sparrow	<i>Peucaea aestivalis</i>					•	•	•							
Field Sparrow	<i>Spizella pusilla</i>					•	•	•			•				•
Brown-headed Nuthatch	<i>Sitta pusilla</i>			•		•	•	•							•
Marian's Marsh Wren	<i>Cistothorus palustris marianae</i>								•	•	•				•
Wood Thrush	<i>Hylocichla mustelina</i>	•	•	•	•	•	•	•							
Least Bittern	<i>Botaurus exilis</i>								•	•	•	•			•
Little Blue Heron	<i>Egretta caerulea</i>	•							•	•	•	•			•
Reddish Egret	<i>Egretta rufescens</i>								•	•					
Snowy Egret	<i>Egretta thula</i>	•							•	•	•	•			•
Tricolored Heron	<i>Egretta tricolor</i>								•	•	•	•			•
Brown Pelican	<i>Pelecanus occidentalis</i>								•	•		•			

Common Name	Scientific Name	Alluvial Plain Forests	Coastal Plain Forests	Interior Southern Plains Forest	Loess Plain Forests	Eastern Gulf Coastal Plain Savannas and Woodlands	Western Gulf Coastal Plain Savannas and Woodlands	Interior Southern Plains Savannas and Woodlands	Marshes	Beaches, Barrier Islands, and Sandbars	Prairies	Lentic Water Bodies	Lotic Water Bodies	Marine and Estuarine Water Bodies	Anthropogenic Habitats
Roseate Spoonbill	<i>Platalea ajaja</i>	•	•						•	•	•	•			•
Northern Flicker	<i>Colaptes auratus</i>	•		•	•	•	•	•							
Red-cockaded Woodpecker	<i>Dryobates borealis</i>					•	•	•							
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>			•	•	•	•	•							
Short-eared Owl	<i>Asio flammeus</i>								•	•	•				•
Rice's Whale	<i>Balaenoptera ricei</i>													•	n/a
Sperm Whale	<i>Physeter macrocephalus</i>													•	
Red Wolf	<i>Canis rufus</i>	•		•	•	•	•	•			•				•
Plains Spotted Skunk	<i>Spilogale interrupta</i>	•	•	•			•	•			•				•
Alleghanian Spotted Skunk	<i>Spilogale putorius</i>	•	•	•	•	•		•			•				•
Long-tailed Weasel	<i>Neogale frenata</i>	•		•	•	•	•	•							•
Louisiana Black Bear	<i>Ursus americanus luteolus</i>	•	•	•	•	•	•	•			•				•
Rafinesque's Big-eared Bat	<i>Corynorhinus rafinesquii</i>	•		•	•										•
Big Brown Bat	<i>Eptesicus fuscus</i>	•		•	•	•	•	•							•
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	•		•	•	•	•	•							
Hoary Bat	<i>Lasiurus cinereus</i>	•	•	•	•	•	•	•							
Northern Yellow Bat	<i>Lasiurus intermedius</i>	•	•	•	•										
Southeastern Myotis	<i>Myotis austroriparius</i>	•	•	•	•	•	•								•
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	•		•	•		•	•							•
Tricolored Bat	<i>Perimyotis subflavus</i>	•		•	•	•	•	•							•
Southeastern Shrew	<i>Sorex longirostris</i>	•		•	•	•		•							
Northern Pygmy Mouse	<i>Baiomys taylori</i>			•							•				
Golden Mouse	<i>Ochrotomys nuttalli</i>	•		•	•	•	•	•							
Common Muskrat	<i>Ondatra zibethicus</i>								•			•	•		
Eastern Harvest Mouse	<i>Reithrodontomys humulis</i>					•	•	•			•				•
Hispid Pocket Mouse	<i>Chaetodipus hispidus</i>						•	•							
Bachman's Fox Squirrel	<i>Sciurus niger bachmani</i>	•	•	•	•	•		•							•
Eastern Chipmunk	<i>Tamias striatus</i>	•		•	•			•							•
West Indian Manatee	<i>Trichechus manatus</i>								•			•	•	•	

Appendix G

MANAGED AREAS BY ECOREGION

UPPER WEST GULF COASTAL PLAIN SELECT PUBLIC LANDS	
Name	Manager
Chemin-A-Haut State Park	Louisiana Department of Culture, Recreation, and Tourism
Fort Jesup State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Lake Bistineau State Park	Louisiana Department of Culture, Recreation, and Tourism
Lake Claiborne State Park	Louisiana Department of Culture, Recreation, and Tourism
Lake D'Arbonne State Park	Louisiana Department of Culture, Recreation, and Tourism
Los Adaes State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Mansfield State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
North Toledo Bend State Park	Louisiana Department of Culture, Recreation, and Tourism
Rebel State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Bayou Pierre Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Bodcau Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Bussey Brake Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
John Franks Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Loggy Bayou Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Sabine Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Soda Lake Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Barksdale Air Force Base	U.S. Department of Defense
Camp Minden, Army National Guard	U.S. Department of Defense
Black Bayou Lake National Wildlife Refuge	U.S. Fish and Wildlife Service
D'Arbonne National Wildlife Refuge	U.S. Fish and Wildlife Service
Red River National Wildlife Refuge	U.S. Fish and Wildlife Service
Upper Ouachita National Wildlife Refuge	U.S. Fish and Wildlife Service
Kisatchie National Forest, Caney Ranger District	U.S. Forest Service

WEST GULF COASTAL PLAIN SELECT PUBLIC LANDS	
Name	Manager
Jena Band of Choctaw Reservation	Choctaw Nation
Chicot State Park	Louisiana Department of Culture, Recreation, and Tourism
Earl K. Long State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Fort St. Jean Baptiste State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Jimmie Davis State Park	Louisiana Department of Culture, Recreation, and Tourism
Kent House State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Sam Houston Jones State Park	Louisiana Department of Culture, Recreation, and Tourism
South Toledo Bend State Park	Louisiana Department of Culture, Recreation, and Tourism
Alexander State Forest Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Clear Creek Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Elbow Slough Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Esler Field Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Flatwoods Savanna Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Fort Polk - Vernon Wildlife Management Area	Louisiana Department of Wildlife and Fisheries

WEST GULF COASTAL PLAIN SELECT PUBLIC LANDS (cont.)	
Name	Manager
Fort Polk North Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
J. C. "Sonny" Gilbert Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Little River Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Marsh Bayou Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Sabine Island Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Walnut Hill Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
West Bay Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Camp Beauregard, Army National Guard	U.S. Department of Defense
Fort Polk	U.S. Department of Defense
Red River National Wildlife Refuge	U.S. Fish and Wildlife Service
Kisatchie National Forest, Calcasieu Ranger District	U.S. Forest Service
Kisatchie National Forest, Catahoula Ranger District	U.S. Forest Service
Kisatchie National Forest, Kisatchie Ranger District	U.S. Forest Service
Kisatchie National Forest, Winn Ranger District	U.S. Forest Service
Cane River Creole National Historical Park	U.S. National Park Service

MISSISSIPPI RIVER ALLUVIAL PLAIN SELECT PUBLIC LANDS	
Name	Manager
Chitimacha Reservation	Chitimacha Nation
Bayou Segnette State Park	Louisiana Department of Culture, Recreation, and Tourism
Chicot State Park	Louisiana Department of Culture, Recreation, and Tourism
Cypremort Point State Park	Louisiana Department of Culture, Recreation, and Tourism
Edward Douglass White Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Fort Derussy State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Lake Bruin State Park	Louisiana Department of Culture, Recreation, and Tourism
Lake Fausse Pointe State Park	Louisiana Department of Culture, Recreation, and Tourism
Longfellow-Evangeline State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Marksville State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Plaquemine Lock State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Poverty Point Reservoir State Park	Louisiana Department of Culture, Recreation, and Tourism
St. Bernard State Park	Louisiana Department of Culture, Recreation, and Tourism
Watson Brake State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Winter Quarters State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Acadiana Conservation Corridor	Louisiana Department of Wildlife and Fisheries
Attakapas Island Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Bayou Macon Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Ben Lilly Conservation Area	Louisiana Department of Wildlife and Fisheries
Big Colewa Bayou Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Big Lake Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Boeuf Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Buckhorn Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Bussey Brake Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Dewey W. Wills Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Elbow Slough Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Elm Hall Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Floy McElroy Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Grassy Lake Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Joyce Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Lake Boeuf Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Manchac Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Maurepas Swamp Wildlife Management Area	Louisiana Department of Wildlife and Fisheries

MISSISSIPPI RIVER ALLUVIAL PLAIN SELECT PUBLIC LANDS (cont.)

Name	Manager
Pomme de Terre Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Richard K. Yancey Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Russell Sage Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Sherburne Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Spring Bayou Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Thistlethwaite Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Tunica-Biloxi Reservation	Tunica-Biloxi Nation
Indian Bayou	U.S. Army Corps of Engineers
Atchafalaya National Wildlife Refuge	U.S. Fish and Wildlife Service
Bayou Cocodrie National Wildlife Refuge	U.S. Fish and Wildlife Service
Bayou Teche National Wildlife Refuge	U.S. Fish and Wildlife Service
Black Bayou Lake National Wildlife Refuge	U.S. Fish and Wildlife Service
Cat Island National Wildlife Refuge	U.S. Fish and Wildlife Service
Catahoula National Wildlife Refuge	U.S. Fish and Wildlife Service
Grand Cote National Wildlife Refuge	U.S. Fish and Wildlife Service
Handy Brake National Wildlife Refuge	U.S. Fish and Wildlife Service
Lake Ophelia National Wildlife Refuge	U.S. Fish and Wildlife Service
Tensas River National Wildlife Refuge	U.S. Fish and Wildlife Service

UPPER EAST GULF COASTAL PLAIN SELECT PUBLIC LANDS

Name	Manager
Audubon State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Locust Grove State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Tunica Hills Wildlife Management Area	Louisiana Department of Wildlife and Fisheries

EAST GULF COASTAL PLAIN SELECT PUBLIC LANDS

Name	Manager
Bogue Chitto State Park	Louisiana Department of Culture, Recreation, and Tourism
Centenary and Jackson State Historic Sites	Louisiana Department of Culture, Recreation, and Tourism
Fairview Riverside State Park	Louisiana Department of Culture, Recreation, and Tourism
Fontainebleau State Park	Louisiana Department of Culture, Recreation, and Tourism
Port Hudson State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Tickfaw State Park	Louisiana Department of Culture, Recreation, and Tourism
Hutchinson Creek Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Lake Ramsay Savannah Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Pearl River Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Sandy Hollow Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
St. Tammany Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Tangipahoa Parish School Board Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Waddill Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Camp Villere, Army National Guard	U.S. Department of Defense
Big Branch Marsh National Wildlife Refuge	U.S. Fish and Wildlife Service
Bogue Chitto National Wildlife Refuge	U.S. Fish and Wildlife Service

GULF COAST PRAIRIES AND MARSHES SELECT PUBLIC LANDS

Name	Manager
Coushatta Reservation	Coushatta Nation
Bayou Segnette State Park	Louisiana Department of Culture, Recreation, and Tourism
Cypremort Point State Park	Louisiana Department of Culture, Recreation, and Tourism
Fontainebleau State Park	Louisiana Department of Culture, Recreation, and Tourism
Fort Pike State Historic Site	Louisiana Department of Culture, Recreation, and Tourism
Grand Isle State Park	Louisiana Department of Culture, Recreation, and Tourism
Palmetto Island State Park	Louisiana Department of Culture, Recreation, and Tourism
Atchafalaya Delta Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Biloxi Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Elmer's Island Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Isles Dernieres Barrier Islands Refuge	Louisiana Department of Wildlife and Fisheries
Marsh Island Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Pass-A-Loutre Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Pearl River Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Pointe-aux-Chenes Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
Queen Bess Island Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Rockefeller Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Salvador Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
St. Tammany Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
State Wildlife Refuge	Louisiana Department of Wildlife and Fisheries
Timken Wildlife Management Area	Louisiana Department of Wildlife and Fisheries
White Lake Wetlands Conservation Area	Louisiana Department of Wildlife and Fisheries
Bayou Sauvage Urban National Wildlife Refuge	U.S. Fish and Wildlife Service
Big Branch Marsh National Wildlife Refuge	U.S. Fish and Wildlife Service
Breton National Wildlife Refuge	U.S. Fish and Wildlife Service
Cameron Prairie National Wildlife Refuge	U.S. Fish and Wildlife Service
Delta National Wildlife Refuge	U.S. Fish and Wildlife Service
Lacassine National Wildlife Refuge	U.S. Fish and Wildlife Service
Mandalay National Wildlife Refuge	U.S. Fish and Wildlife Service
Sabine National Wildlife Refuge	U.S. Fish and Wildlife Service
Shell Keys National Wildlife Refuge	U.S. Fish and Wildlife Service
Jean Lafitte National Historical Park and Preserve	U.S. National Park Service

Appendix H

NATURAL COMMUNITY CROSSWALK

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
ARCHETYPE: FORESTS						
SUB-TYPE: ALLUVIAL PLAIN						
Batture Forest	M031	Southern Coastal Plain Floodplain Forest	G033	Bald-cypress - Tupelo Floodplain Forest	CES203.195	Mississippi River Low Floodplain (Bottomland) Forest
					CES203.488	West Gulf Coastal Plain Large River Floodplain Forest
			G034	Oak - Sweetgum Floodplain Forest	CES203.489	East Gulf Coastal Plain Large River Floodplain Forest
			G759	Southern Ash - Elm - Willow Floodplain Forest	CES203.065	Red River Large Floodplain Forest
Bottomland Hardwood Forest	M029	Central Hardwood Floodplain Forest	G673	Central Interior-Northeast Floodplain Forest	None	None
	M031	Southern Coastal Plain Floodplain Forest	G033	Bald-cypress - Tupelo Floodplain Forest	CES203.195	Mississippi River Low Floodplain (Bottomland) Forest
			G034	Oak - Sweetgum Floodplain Forest	CES203.489	East Gulf Coastal Plain Large River Floodplain Forest
			G759	Southern Ash - Elm - Willow Floodplain Forest	CES203.065	Red River Large Floodplain Forest
					CES203.190	Mississippi River Riparian Forest
Canebrake	M031	Southern Coastal Plain Floodplain Forest	G034	Oak - Sweetgum Floodplain Forest	CES203.196	Mississippi River High Floodplain (Bottomland) Forest
					CES203.487	West Gulf Coastal Plain Small Stream and River Forest
					CES203.489	East Gulf Coastal Plain Large River Floodplain Forest
			G759	Southern Ash - Elm - Willow Floodplain Forest	CES203.190	Mississippi River Riparian Forest
					CES203.488	West Gulf Coastal Plain Large River Floodplain Forest
					CES203.372	West Gulf Coastal Plain Seepage Swamp and Baygall
	M032	Coastal Plain Evergreen Hardwood - Conifer Swamp	G037	Southern Coastal Plain Mixed Evergreen Swamp	CES203.505	Southern Coastal Plain Seepage Swamp and Baygall
					CES203.459	West Gulf Coastal Plain Near-Coast Large River Swamp
Cypress-Tupelo Swamp Forest	M031	Southern Coastal Plain Floodplain Forest	G033	Baldcypress-Tupelo Swamp Forest Floodplain Forest	CES203.459	West Gulf Coastal Plain Near-Coast Large River Swamp
					CES203.490	Mississippi River Bottomland Depression
			G759	Southern Ash - Elm - Willow Floodplain Forest	CES203.065	Red River Large Floodplain Forest
Hardwood Flatwoods Forest	M008	Southern Mesic Mixed Broadleaf Forest	G007	Southern Mesic Beech - Magnolia - Oak Forest	CES203.476	Southern Coastal Plain Mesic Slope Forest
	M033	Southern Coastal Plain Basin Swamp & Flatwoods	G130	Hardwood - Pine Nonriverine Wet Flatwoods	CES203.548	West Gulf Coastal Plain Nonriverine Wet Hardwood-Pine Flatwoods
Macon Ridge Green Ash Pond	M031	Southern Coastal Plain Floodplain Forest	G034	Oak - Sweetgum Floodplain Forest	None	None
			G979	Lower Mississippi River Alluvial Plain Floodplain Forest	CES203.196	Mississippi River High Floodplain (Bottomland) Forest
	M033	Southern Coastal Plain Basin Swamp & Flatwoods	G130	Hardwood - Pine Nonriverine Wet Flatwoods	CES203.548	West Gulf Coastal Plain Nonriverine Wet Hardwood-Pine Flatwoods

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
ARCHETYPE: FORESTS						
SUB-TYPE: COASTAL PLAIN						
Live Oak Natural Levee Forest	M031	Southern Coastal Plain Floodplain Forest	G979	Lower Mississippi River Alluvial Plain Floodplain Forest	CES203.190	Mississippi River Riparian Forest
			G979	Lower Mississippi River Alluvial Plain Floodplain Forest	CES203.196	Mississippi River High Floodplain (Bottomland) Forest
Live Oak-Pine-Magnolia Forest	M885	Southeastern Coastal Plain Evergreen Oak Forest	G895	Southern Coastal Plain Dry Oak Forest	No good Match	n/a
Maritime Forest: Coastal Live Oak-Hackberry Forest	M886	Southeastern Coastal Plain Evergreen Oak Forest	G798	Southeast Maritime Live Oak - Palmetto Forest	CES203.466	West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland
Maritime Forest: Salt Dome Hardwood Forest	M887	Southeastern Coastal Plain Evergreen Oak Forest	G798	Southeast Maritime Live Oak - Palmetto Forest	CES203.466	West Gulf Coastal Plain Chenier and Upper Texas Coastal Fringe Forest and Woodland
Maritime Forest: Barrier Island Live Oak Forest	M888	Southeastern Coastal Plain Evergreen Oak Forest	G798	Southeast Maritime Live Oak - Palmetto Forest	CES203.513	Mississippi Delta Maritime Forest
ARCHETYPE: FORESTS						
SUB-TYPE: INTERIOR SOUTHERN PLAINS						
Acidic Bay Forest	M032	Coastal Plain Evergreen Hardwood - Conifer Swamp	G037	Southern Coastal Plain Mixed Evergreen Swamp	CES203.372	West Gulf Coastal Plain Seepage Swamp and Baygall
					CES203.505	Southern Coastal Plain Seepage Swamp and Baygall
	M033	Coastal Plain Basin Swamp & Flatwoods	G038	Coastal Plain Wet Flats & Basin Swamp	CES203.384	Southern Coastal Plain Nonriverine Basin Swamp
Calcareous Forest	M008	Southern Mesic Mixed Broadleaf Forest	G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest	CES203.379	West Gulf Coastal Plain Southern Calcareous Prairie
					None	None
Hardwood Slope Forest	M008	Southern Mesic Mixed Broadleaf Forest	G007	Southern Mesic Beech - Magnolia - Oak Forest	CES203.476	Southern Coastal Plain Mesic Slope Forest
			G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest	CES203.280	West Gulf Coastal Plain Mesic Hardwood Forest
Pondcypress-Swamp Tupelo Forest	M161	Pond-cypress Basin Swamp	G036	Pond-cypress Basin Swamp	CES203.251	Southern Coastal Plain Nonriverine Cypress Dome
					None	n/a
			G033	Bald-cypress - Tupelo Floodplain Forest	CES203.299 (In Part)	East Gulf Coastal Plain Freshwater Tidal Wooded Swamp
Small Stream Forest	M031	Southern Coastal Plain Floodplain Forest	G034	Oak - Sweetgum Floodplain Forest	CES203.487	West Gulf Coastal Plain Small Stream and River Forest
					CES203.559 (In Part)	East Gulf Coastal Plain Small Stream and River Floodplain Forest
	M154	Southern Great Plains Floodplain Forest & Woodland	G784	Southeastern Great Plains Floodplain Forest	None	None
ARCHETYPE: FORESTS						
SUB-TYPE: LOESS PLAIN						
Southern Mesophytic Hardwood Forest	M008	Southern Mesic Mixed Broadleaf Forest	G007	Southern Mesic Beech - Magnolia - Oak Forest	CES203.556	East Gulf Coastal Plain Southern Loess Bluff Forest
			G166	Southern Mesic Beech - Oak - Mixed Deciduous Forest	CES203.476	Southern Coastal Plain Mesic Slope Forest
	M111	Eastern North American Cliff, Talus & Rock	G842	Southeast Coastal Plain Cliff & Rock	CES203.398	Southeastern Coastal Plain Cliff
Spruce Pine-Hardwood Flatwoods Forest	M033	Southern Coastal Plain Basin Swamp & Flatwoods	G130	Hardwood & Pine Nonriverine Wet Flatwoods	CES203.557	East Gulf Coastal Plain Southern Pine-Hardwood Flatwoods

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
ARCHETYPE: SAVANNAS AND WOODLANDS						
SUB-TYPE: EASTERN GULF COASTAL PLAIN						
Eastern Hillside Seepage Bog	M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	G187	Southeastern Coastal Plain Seepage Wetland	CES203.078	Southern Coastal Plain Herbaceous Seep and Bog
Eastern Longleaf Pine Flatwoods Savanna	M007	Longleaf Pine Woodland	G190	Wet-Mesic Longleaf Pine Woodland	CES203.375	East Gulf Coastal Plain Near-Coast Pine Flatwoods
Eastern Longleaf Pine Flatwoods Savanna	M007	Longleaf Pine Woodland	G596	Mesic Longleaf Pine Flatwoods - Spodosol Woodland	CES203.375	East Gulf Coastal Plain Near-Coast Pine Flatwoods
Eastern Upland Longleaf Pine Savanna and Woodland	M007	Longleaf Pine Woodland	G009	Dry-Mesic Loamy Longleaf Pine Woodland	CES203.496	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland
Slash Pine-Pondcypress Woodland	M007	Longleaf Pine Woodland	G190	Wet-Mesic Longleaf Pine Woodland	CES203.375	East Gulf Coastal Plain Near-Coast Pine Flatwoods
ARCHETYPE: SAVANNAS AND WOODLANDS						
SUB-TYPE: WESTERN GULF COASTAL PLAIN						
Ouachita Sand Prairie and Woodland	M542	Southeastern Prairies	G1182	Lower Mississippi River Valley Prairie	None	n/a
Sparta Sand Pond	M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	G915	South Atlantic & Gulf Coastal Plain Pondshore	None	n/a
West Gulf Coastal Plain Muck Bog	M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	G187	Southeastern Coastal Plain Seepage Wetland	CES203.194	West Gulf Coastal Plain Herbaceous Seep and Bog
Western Hillside Seepage Bog	M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	G187	Southeastern Coastal Plain Seepage Wetland	CES203.194	West Gulf Coastal Plain Herbaceous Seep and Bog
Western Longleaf Pine Flatwoods Savanna (Acidic, Saline)	M007	Longleaf Pine Woodland	G190	Wet-Mesic Longleaf Pine Woodland	CES203.191	West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods
Western Upland Longleaf Pine Savanna and Woodland	M007	Longleaf Pine Woodland	G009	Dry-Mesic Loamy Longleaf Pine Woodland	CES203.293	West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland
ARCHETYPE: SAVANNAS AND WOODLANDS						
SUB-TYPE: INTERIOR SOUTHERN PLAINS						
Flatwoods Pond	M007	Longleaf Pine Woodland	G190	Wet-Mesic Longleaf Pine Open Woodland	CES203.191	West Gulf Coastal Plain Wet Longleaf Pine Savanna and Flatwoods
					CES203.375	East Gulf Coastal Plain Near-Coast Pine Flatwoods
	M067	Atlantic & Gulf Coastal Plain Wet Prairie & Marsh	G915	South Atlantic & Gulf Coastal Plain Pondshore	CES203.547	West Gulf Coastal Plain Flatwoods Pond
	M161	Pond-cypress Basin Swamp	G036	Pond-cypress Basin Swamp	None	None
Shortleaf Pine-Oak-Hickory Woodland	M540	South-Central Oak - Pine Forest & Woodland	G013	West Gulf Coastal Plain Pine - Oak Forest & Woodland	CES203.378	West Gulf Coastal Plain Pine-Hardwood Forest
			G951	Upper Gulf Coastal Plain Oak Forest & Woodland	CES203.506	East Gulf Coastal Plain Interior Shortleaf Pine-Oak Forest
Xeric Sandhill Woodland	M007	Longleaf Pine Woodland	G154	Xeric Longleaf Pine Woodland	CES203.056	West Gulf Coastal Plain Sandhill Oak and Shortleaf Pine Forest and Woodland
					CES203.293	West Gulf Coastal Plain Upland Longleaf Pine Forest and Woodland
					CES203.496	East Gulf Coastal Plain Interior Upland Longleaf Pine Woodland

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
ARCHETYPE: NON-FORESTED GRASSLANDS AND OPEN TERRAIN						
SUB-TYPE: BEACHES, BARRIER ISLANDS, AND SANDBARS						
Barrier Island	M067	Atlantic-Gulf Coastal Plain Wet Prairie & Freshwater Marsh	G777	Atlantic & Gulf Coastal Interdunal Swale	CES203.258	Southeastern Coastal Plain Interdunal Wetland
	M551	North American Coastal Beach & Rocky Shore	G661	South Atlantic & Gulf Coastal Beach	CES203.469	Louisiana Beach
	M553	North American Atlantic Coastal Dune, Grassland & Rocky Headland	G494	South Atlantic & Gulf Coastal Dune Grassland & Strand	None	None
Coastal Dune Grassland / Coastal Dune Shrub Thicket	M067	Atlantic-Gulf Coastal Plain Wet Prairie & Freshwater Marsh	G777	Atlantic & Gulf Coastal Interdunal Swale	CES203.258	Southeastern Coastal Plain Interdunal Wetland
	M551	North American Coastal Beach & Rocky Shore	G661	South Atlantic & Gulf Coastal Beach	CES203.469	Louisiana Beach
	M553	North American Atlantic Coastal Dune, Grassland & Rocky Headland	G494	South Atlantic & Gulf Coastal Dune Grassland & Strand	None	None
Louisiana Beach	M551	North American Coastal Beach & Rocky Shore	G661	South Atlantic & Gulf Coastal Beach	CES203.469	Louisiana Beach
					CES203.544	Gulf Coast Chenier Plain Beach
Sandbar	M880	Eastern North American Rivershore & Riverbed	G756	Eastern Wet Shoreline	None	None
			G978	Eastern Riverine Sand-Gravel Bar	None	None
ARCHETYPE: NON-FORESTED GRASSLANDS AND OPEN TERRAIN						
SUB-TYPE: MARSHES						
Freshwater Marsh	M066	Atlantic & Gulf Coastal Freshwater & Oligohaline Tidal Marsh	G913	South Atlantic & Gulf Coastal Tidal Freshwater Marsh	CES203.467	Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
					CES203.470	Mississippi Delta Fresh and Oligohaline Tidal Marsh
	M067	Atlantic-Gulf Coastal Plain Wet Prairie & Freshwater Marsh	G188	South Atlantic-Gulf Coastal Plain Freshwater Marsh & Wet Meadow	None	None
Freshwater Floating Marsh	M066	Atlantic & Gulf Coastal Freshwater & Oligohaline Tidal Marsh	G913	South Atlantic & Gulf Coastal Tidal Freshwater Marsh	CES203.470	Mississippi Delta Fresh and Oligohaline Tidal Marsh
Vegetated Pioneer Emerging Delta	M066	Atlantic & Gulf Coastal Freshwater & Oligohaline Tidal Marsh	G913	South Atlantic & Gulf Coastal Tidal Freshwater Marsh	CES203.470	Mississippi Delta Fresh and Oligohaline Tidal Marsh
Intermediate Marsh	M066	Atlantic & Gulf Coastal Freshwater & Oligohaline Tidal Marsh	G913	South Atlantic & Gulf Coastal Tidal Freshwater Marsh	CES203.467	Gulf Coast Chenier Plain Fresh and Oligohaline Tidal Marsh
					CES203.470	Mississippi Delta Fresh and Oligohaline Tidal Marsh
Brackish Marsh	M079	North American Atlantic & Gulf Coastal Salt Marsh	G982	South Atlantic & Gulf Coast Salt Marsh	CES203.468	Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh
					CES203.471	Mississippi Delta Salt and Brackish Tidal Marsh
Salt Marsh	M079	North American Atlantic & Gulf Coastal Salt Marsh	G982	South Atlantic & Gulf Coast Salt Marsh	CES203.468	Gulf Coast Chenier Plain Salt and Brackish Tidal Marsh
					CES203.471	Mississippi Delta Salt and Brackish Tidal Marsh
Coastal Mangrove-Marsh Shrubland	M079	North American Atlantic & Gulf Coastal Salt Marsh	G982	South Atlantic & Gulf Coast Salt Marsh	CES203.471	Mississippi Delta Salt and Brackish Tidal Marsh
ARCHETYPE: NON-FORESTED GRASSLANDS AND OPEN TERRAIN						

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
SUB-TYPE: PRAIRIES AND BARRENS						
Calcareous Prairie	M542	Southeastern Prairies	G1180	Gulf Coastal Plain Blackland Prairie	CES203.379	West Gulf Coastal Plain Southern Calcareous Prairie
Coastal Prairie	M542	Southeastern Prairies	G981	Gulf Coastal Prairie	CES203.550	Texas-Louisiana Coastal Prairie
Prairie Pothole	M542	Southeastern Prairies	G981	Gulf Coastal Prairie	CES203.541	Texas-Louisiana Coastal Prairie Pondshore
Mississippi Terrace Prairie	M542	Southeastern Prairies	G1182	Lower Mississippi River Valley Prairie	CES203.549	Lower Mississippi Alluvial Plain Grand Prairie
Sandstone Glade/Barren	M546	South-Central Interior Glade & Barrens	G584	Southeastern Coastal Plain Barrens & Glade	CES203.364	West Gulf Coastal Plain Catahoula Barrens
Sodic/Alkali Barren	M546	South-Central Interior Glade & Barrens	G584	Southeastern Coastal Plain Barrens & Glade	CES203.291	South-Central Saline Barrens

WAP Natural Community	NVC Macrogroup Code	NVC Macrogroup Name	NVC Group Code	NVC Group Name	CES Code	CES Name
ARCHETYPE: INLAND AND MARINE WATERS						
SUB-TYPE: LOTIC WATER BODIES						
River Delta Freshwater Submerged Aquatic Vegetation	M108	Eastern North American Freshwater Aquatic Vegetation	G1217	Eastern North American Freshwater Aquatic Vegetation	None	None
ARCHETYPE: INLAND AND MARINE WATERS						
SUB-TYPE: LENTIC WATER BODIES						
Coastal Freshwater Submerged Aquatic Vegetation	M108	Eastern North American Freshwater Aquatic Vegetation	G1217	Eastern North American Freshwater Aquatic Vegetation	None	None
Interior Freshwater Submerged Aquatic Vegetation	M108	Eastern North American Freshwater Aquatic Vegetation	G1217	Eastern North American Freshwater Aquatic Vegetation	None	None
Lakes and Reservoirs	M881	Eastern North American Rivershore & Riverbed	G756	Eastern North American Wet Shoreline Vegetation (In part)	None	None
Ponds	M882	Eastern North American Rivershore & Riverbed	G756	Eastern North American Wet Shoreline Vegetation (In part)	None	None
ARCHETYPE: INLAND AND MARINE WATERS						
SUB-TYPE: MARINE AND ESTUARINE WATER BODIES						
Estuarine Submerged Aquatic Vegetation	M108	Eastern North American Freshwater Aquatic Vegetation	G924	Atlantic & Gulf Coast Freshwater Subtidal Marsh	CES203.511	Texas-Louisiana Fresh-Oligohaline Subtidal Aquatic Vegetation
Marine Seagrass Bed	M180	Indo-Pacific & Caribbean Seagrass Vegetation	G376	Manatee-grass - Turtle-grass Seagrass Beds	None	None
Marine Substrate Habitats	None	None	None	None	None	None
Estuarine Submerged Aquatic Vegetation	M108	Eastern North American Freshwater Aquatic Vegetation	G924	Atlantic & Gulf Coast Freshwater Subtidal Marsh	CES203.511	Texas-Louisiana Fresh-Oligohaline Subtidal Aquatic Vegetation
Marine Seagrass Bed	M180	Indo-Pacific & Caribbean Seagrass Vegetation	G376	Manatee-grass - Turtle-grass Seagrass Beds	None	None
Marine Substrate Habitats	None	None	None	None	None	None

Note this cross walk excludes ruderal and planted WAP and NVC community codes and nomenclature.

Appendix I

EXPLANATION OF FEDERAL AND STATE LISTING CATEGORIES AND RANKS¹

Every element – whether a plant, animal, natural community, etc. – is assigned a Global Rank as well as a Subnational Rank (hereafter, State Rank) for each state in which it occurs. These ranks impart the level of vulnerability of these elements, which assists resource managers and other conservationists in designing and prioritizing projects and programs to benefit Species of Greatest Conservation Need and their associated habitats. NatureServe² designates Global Ranks, whereas, each states' Wildlife Diversity Program or Natural Heritage Program assigns its own State Ranks. State Ranks of any particular element may vary considerably from state to state, depending on the element's status within that individual state. Federally threatened and endangered species status is designated by the U.S. Fish & Wildlife Service or the U.S. National Marine Fisheries Service under the provisions of the Endangered Species Act of 1973. In Louisiana, the responsibility of the Louisiana Department of Wildlife and Fisheries for the conservation of threatened and endangered species is promulgated by Title 56 of the Louisiana Revised Statutes; Louisiana's threatened and endangered species are listed in Title 76 of the Louisiana Administrative Code. Listings and ranks below are a subset of the most frequently encountered codes.

See also: <https://explorer.natureserve.org/AboutTheData/Statuses>
<https://explorer.natureserve.org/AboutTheData/DataTypes/NationalLegalStatus>

FEDERAL PROTECTION STATUS

Endangered - at risk of extinction without immediate conservation action; take or harassment is a violation of State and federal laws.

Threatened - at risk of becoming endangered without conservation action; take or harassment is a violation of State and federal laws.

Proposed Endangered - proposed to be federally listed as endangered under the federal Endangered Species Act (ESA)
Proposed Threatened - proposed to be federally listed as threatened under the federal ESA

Candidate - under consideration for federal listing

Essential Experimental Population - a reintroduced population without which a species may become extinct; take or harassment is a violation of State and federal laws.

Nonessential Experimental Population - a reintroduced population not required for species' persistence; take or harassment is a violation of State and federal laws.

Listed Endangered, Proposed Threatened (LE, PT) - currently listed as federally endangered, but is proposed for downlisting to federally threatened; LT, PE is also a possible combination (i.e. an uplisting).

Listed Endangered, Proposed for Delisting (LE, PDL) - currently listed as federally endangered, but is proposed for delisting (i.e. will no longer be federally listed under the ESA); LT, PDL is also a possible combination.

Delisted - no longer listed as federally threatened or endangered
Field blank (i.e. null): Element has no ESA status as of the most recent update published in the U.S. Federal Register. Beware of lag time in the Federal Register and associated updates to databases.

GLOBAL RANKS

G1: Critically Imperiled - at very high risk of extinction or elimination due to very restricted range, very few populations or occurrences [5 or fewer known populations], very steep declines, very severe threats, or other factors

G2: Imperiled - at high risk of extinction or elimination due to restricted range, few populations or occurrences [6 to 20 extant populations], steep declines, severe threats, or other factors

G3: Vulnerable - at moderate risk of extinction or elimination due to a fairly restricted range, relatively few populations or occurrences [21 to 100 extant populations], recent and widespread declines, threats, or other factors

G4: Apparently Secure - at fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences [100 to 1000 known extant populations], but with possible cause for some concern as a result of local recent declines, threats, or other factors

G5: Secure - at very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences [1000+ extant populations], and little to no concern from declines or threats

¹ **DISCLAIMER:** This document is not an official copy of the laws in effect and should not be utilized or relied upon as such. In addition, due to potential lag time between publication of a species' status change in the Federal Register and the species' status change in Biotics (the central database of NatureServe) or in state databases, some listings and ranks may be inaccurate. As such, the accuracy of the information contained within this document cannot be guaranteed, and the reader is cautioned that it shall be their responsibility to be apprised of and to abide by the laws in effect at any given time. These laws include, but are not limited to, those contained within the Louisiana Revised Statutes, particularly Title 56, the official regulations of the Louisiana Wildlife and Fisheries Commission, federal laws, and any local or parish (county) ordinances.

² NatureServe. 2025. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available <https://explorer.natureserve.org> (Accessed: March 13, 2025).

G#G#: **Range Rank** - range used to indicate uncertainty about the exact status of a taxon or ecosystem type (e.g., G2G3)
GU: **Unrankable** - Species may be imperiled, but lack of information or substantially conflicting information about status or trends makes ranking impossible.
GNR: **Not Ranked**- global rank not yet assessed
G#?: **Inexact Numeric Rank**- denotes inexact numerical rank
G#Q: **Questionable taxonomy** - distinctiveness of element questionable
GX: **Presumed Extinct (species) or Presumed Eliminated (natural communities)** - element demonstrably no longer occurs on the landscape
GH: **Possibly Extinct (species) or Possibly Eliminated (natural communities)** - known from historical occurrences and not detected for 20 or more years, but rediscovery may be possible
G#T# **Infraspecific Taxon (trinomial) status** - global rank of subspecies or variety (e.g., G5T2 – species globally secure, but subspecies is globally imperiled)

STATE RANKS

S1: Critically Imperiled - at very high risk of extirpation³ in Louisiana due to very restricted range, very few populations or occurrences [5 or fewer known populations], very steep declines, severe threats, or other factors
S2: Imperiled - at high risk of extirpation in Louisiana due to restricted range, few populations or occurrences [6 to 20 extant populations], steep declines, severe threats, or other factors
S3: Vulnerable - at moderate risk of extirpation in Louisiana due to a fairly restricted range, relatively few populations or occurrences [21 to 100 extant populations], recent and widespread declines, threats, or other factors
S4: Apparently Secure - at a fairly low risk of extirpation in Louisiana due to an extensive range and/or many populations or occurrences [100 to 1000 known extant populations], but with possible cause for some concern as a result of local recent declines, threats, or other factors
S5: Secure- at very low or no risk of extirpation in Louisiana due to a very extensive range, abundant populations or occurrences [1000+ extant populations], with little to no concern from declines or threats
S#S#: **Range Rank** - range used to indicate uncertainty about the exact status of a taxon or community type (e.g., S1S2)
SU: **Unrankable** - Species may be imperiled, but lack of information or substantially conflicting information about status or trends makes ranking impossible.
SH: **Possibly Extirpated (species) or Possibly Eliminated (natural communities)** - known from historical occurrences and not detected for 20 or more years, but rediscovery may be possible
SX: **Presumed Extirpated (species) or Presumed Eliminated (natural communities)**- believed to be extirpated or eliminated from the Louisiana landscape (equivalent to “Regionally Extinct” in IUCN Red List⁴ terminology)

State Rank Qualifiers: B, N, and M - If a species’ occurrence or abundance in Louisiana is seasonal or otherwise temporally dependent, State Ranks may contain qualifiers to designate separate ranks; this is most commonly found in birds or other migratory elements. Resident populations of species that are not augmented by migrant populations and migrant species in which abundance remains the same for both breeding and nonbreeding will not have qualifiers; instead, those species receive a single rank applicable the entire year (e.g., Northern Bobwhite, a resident species not augmented by migrants, is ranked S3 in Louisiana).

S#B: Breeding- Numerical rank refers to the breeding population of the species; if not followed by “S#N,” then the species is only found in Louisiana during its breeding season (e.g., Louisiana Waterthrush breeds in Louisiana but is absent from the state in nonbreeding season; its State Rank is S3B).

S#N: Non-breeding- Numerical rank refers to the nonbreeding population of the species; if not preceded by “S#B,” then the species is only found in Louisiana during its nonbreeding season.

S#B, S#N: Breeding, Non-breeding - Numerical ranks refer to breeding and non-breeding populations, respectively (e.g., Grasshopper Sparrow is a critically imperiled breeding species, but the species occurs in greater abundance in non-breeding season; its State Rank is S1B, S3N).

S#M: Migrant- migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention; rank refers to the aggregating transient population of the species in Louisiana.

STATE PROTECTION STATUS

Endangered - at risk of extinction; take or harassment of this species is a violation of State and federal laws.

Threatened - at risk of becoming endangered; take or harassment of this species is a violation of State and federal laws.

Prohibited - possession of this species is prohibited; no legal harvest or legal possession is allowed without valid Scientific Research and Collecting Permit issued by Department.

Restricted - harvest restrictions regarding the take and possession of this species exist; see current seasons and regulations at www.wlf.louisiana.gov.

Delisted - no longer listed as State threatened or endangered

Field blank (i.e. null) - usually indicates that the taxon does not have any state status; note that this does not preclude protection under other possible applicable federal protections (e.g., Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, etc.) or municipal or other local protections (e.g., bird sanctuary designations).

For more information on Louisiana’s Species of Greatest Conservation Need and rare or otherwise outstanding natural communities visit the Louisiana Department of Wildlife and Fisheries’ website:
www.wlf.louisiana.gov

³ Extirpation is extinction on a less-than-global scale. For example, American Bison is extirpated in Louisiana, but the species is not extinct in the wild.

⁴ International Union for Conservation of Nature’s Red List of Threatened Species; <https://www.iucnredlist.org>

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