

3 **APPENDIX B: ISSUE REPORT**

# LAKE PONTCHARTRAIN BASIN RESTORATION PROGRAM

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The purpose of the Lake Pontchartrain Basin Restoration Program is to restore the ecological health of the basin by developing and funding restoration projects and related scientific and public education projects to reduce the risk of pollution.

## CITATION

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# EXECUTIVE SUMMARY

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31 The Lake Pontchartrain Basin Restoration Program boundary spans 5.5 million acres across 16 parishes in  
32 Louisiana and extends into four counties in southwest Mississippi. This region includes densely populated  
33 areas like New Orleans and Baton Rouge and is one of the largest estuarine systems in the Gulf of America.  
34 The Pontchartrain Basin is expansive, with changing landscape and soils from the hills in the northern  
35 portion down to the flat coastal plain draining into freshwater and estuarine systems before transitioning to  
36 the barrier islands at the Gulf of America.

## 37 Basin Characterization

38 The Basin Characterization section of this report provides a detailed overview of the natural environment,  
39 including geology, climate, hydrology, and diverse land use ranging from urban areas to wetlands and forests.  
40 It presents conservation areas as crucial for habitat and wildlife protection. It also examines demographic  
41 trends; economic activities such as fisheries, agriculture, oil and gas, and resource extraction; and the efforts  
42 of federal and state programs to maintain environmental health. Collaborative efforts with federal and state  
43 agencies are highlighted for their role in enhancing water quality, habitat restoration, conservation, and  
44 resilience.

45 The section discusses hydrological changes due to urbanization, navigation, flood protection, and industrial  
46 needs, as well as the basin's susceptibility to extreme weather events like hurricanes and floods. By  
47 integrating environmental and socioeconomic data, the section aims to provide a thorough assessment of  
48 the risks and challenges faced by the basin's communities and ecosystems. The findings emphasize the  
49 need for strategies to mitigate environmental vulnerability, promote sustainable practices, and strengthen  
50 federal and state programs to support basin resilience.

## 51 Water Quality

52 The Water Quality section provides a framework for understanding the water quality landscape in the basin,  
53 outlines monitoring efforts, describes specific water quality measurements and impairments and the  
54 significance of these issues for the environment, fisheries, and humans. Further discussion includes recent  
55 trends in nutrients in surface water of the past few decades with a look to the future emerging water quality  
56 issues linked to environmental change.

57 The hydrology of the basin is made more complex by the use of a flood release valve for the Mississippi  
58 River (the Bonnet Carré Spillway), which can be opened during flood stage altering the nutrient budget of the  
59 Pontchartrain Estuary. While nutrients are a consistent theme throughout the watershed, the uneven  
60 distribution in the landscape and human settlement and activities leads to specific causes based on location  
61 within the watershed. This section seeks to integrate human activities with the major water quality issues,  
62 mentioning potential data gaps and needs for changes for future monitoring and research. The section also  
63 identifies several successful efforts at improvements of water quality including using permitted discharges  
64 to natural wetland systems for additional nutrient removal. The section also provides an outlook for the

65 future, elucidating the need for planning efforts and increased funding for addressing aging infrastructure  
66 and moving conclusively away from decentralized wastewater treatment systems. Through increasing  
67 federal, state, and local partnerships, which include education and outreach, the current and future  
68 challenges can be addressed moving forward, ensuring safe and sustainable waters for all the citizens of the  
69 basin.

## 70 **Habitat**

71 The Pontchartrain Basin is a diverse system – from coastal plains dissected by streams that form low rolling  
72 hills and broad, gently sloping ridges in the north to flat deltaic and coastal plains and are dominated by a  
73 mix of freshwater and saline marshes. Historically, there were large areas of longleaf pine woodlands and  
74 extensive swamps maintained with seasonal inflows from the Mississippi River. The system has been altered  
75 dramatically, and in the last several decades developed land cover has continued to increase at the expense  
76 of natural forests and wetlands. The habitats are influenced by climate variability, bringing droughts and  
77 floods and temperature extremes as well as hurricanes and events like the *Deepwater Horizon* oil spill. There  
78 are many recent successes in habitat including the change in status for the red-cockaded woodpecker and  
79 restoration of habitat around Lake Pontchartrain and the Chandeleur Islands.

80 Future progress on habitat restoration and conservation in the Pontchartrain Basin will need to confront a  
81 number of ongoing challenges within the system and overcome barriers, some of which have been issues for  
82 decades (e.g., impacts of sand and gravel mining on river habitats and ongoing population increase and  
83 development). Other issues have developed more recently including the need to consider flood storage and  
84 conveyance in habitat restoration and changing habitat related regulations. However, there are opportunities  
85 that can be taken advantage of in relation to new planning initiatives (e.g., Amite River Basin Commission  
86 Master Plan and 2029 Coastal Master Plan). Several large-scale projects are likely to affect substantial areas  
87 including the River Reintroduction into Maurepas Swamp project and the Lake Pontchartrain Storm Surge  
88 Reduction project, which is undergoing renewed study. Partnerships among state and federal agencies, local  
89 governments, non-governmental organizations, and landowners offer opportunities for progress with  
90 examples such as America's Longleaf Restoration Initiative and the U.S. Department of Agriculture's Working  
91 Lands for Wildlife partnership focused on issues which are central to the future of important habitats.

## 92 **Resilient Communities**

93 The Resilient Communities section of this report outlines the significant challenges impacting people within  
94 the Pontchartrain Basin, a region vulnerable due to its low-lying topography and dependence on coastal  
95 ecosystems. Events like Hurricane Katrina and the 2016 floods highlight this vulnerability. Building resilience  
96 requires proactively addressing underlying issues hindering the long-term health, safety, and prosperity of  
97 residents. A primary challenge is the lack of a unified regional approach and consistent resources dedicated  
98 to resilience planning, particularly affecting rural and low-income communities, which often lack the capacity  
99 and funding seen in urban population centers. This disparity widens the gap between these communities and  
100 can accelerate out-migration from less-resourced areas. Measuring the success of resilience investments  
101 also proves difficult, hindering justification for long-term projects, especially given limited local budgets and  
102 political cycles that favor quick return on investments over long term sustainability. Local leaders face  
103 shortages in funding, technical assistance, and accessible information needed to make informed decisions.

104 Furthermore, a lack of redundancy in critical infrastructure, community support systems, and economic  
105 diversification leaves the basin vulnerable.

106 Public awareness and involvement in conservation efforts are insufficient. Many residents, particularly those  
107 farther from Lake Pontchartrain, lack a clear understanding of the basin's ecological and economic  
108 significance, their connection to it, and how their actions impact water quality through issues like septic  
109 system maintenance, stormwater runoff, and waste disposal. A lack of unified messaging among various  
110 organizations exacerbates this, hindering public empowerment and engagement in conservation. This limited  
111 awareness reduces community engagement, increases vulnerability to environmental threats, and leads to  
112 missed economic opportunities like ecotourism. Unequal access to the basin's recreational opportunities  
113 due to transportation barriers, financial constraints, inadequate infrastructure, and lack of awareness further  
114 impacts community well-being and resilience, particularly affecting less affluent populations.

115 Significant flood risks persist from both storm surge, historically devastating coastal areas like New Orleans,  
116 and heavy rainfall events causing riverine flooding further inland, as seen in 2016. While progress has been  
117 made through initiatives like the Hurricane Storm Damage Risk Reduction System and coastal restoration  
118 projects, ongoing challenges like subsidence, sea level rise, and infrastructure adequacy remain, particularly  
119 in areas lacking comprehensive protection. Compounding these risks are unsustainable insurance costs,  
120 driven by increased disaster frequency, rising rebuilding expenses, insurer insolvency, and the Federal  
121 Emergency Management Agency's Risk Rating 2.0, which disproportionately burden low-income communities  
122 and threaten housing affordability. Water management faces critical challenges, particularly in rural areas,  
123 which rely on small, independent systems with aging infrastructure and an aging workforce without sufficient  
124 replacements, threatening water quality and service reliability. Finally, while tourism is a vital economic  
125 driver, balancing its benefits against potential negative impacts on cultural authenticity and the environment  
126 requires careful management. Addressing these interconnected issues—planning gaps, resource limitations,  
127 lack of awareness, inequitable access, environmental hazards, insurance burdens, water management  
128 vulnerabilities, and tourism pressures—is fundamental to building a more resilient future for all communities  
129 in the Pontchartrain Basin.

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# LIST OF ABBREVIATIONS

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<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
ALE	Agricultural Land Easement
ARB	Amite River Basin
BEACH	Beaches Environmental Assessment and Coastal Health Act
BICM	Barrier Island Comprehensive Monitoring
BMP	Best Management Practices
CCMP	Comprehensive Conservation Management Plan
CCS	Carbon Capture and Sequestration
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFTZ	Compound Flooding Transition Zones
CHMP	Comprehensive Habitat Management Plan
CIMS	Coastal Information Management System
CLARA	Coastal Louisiana Risk Assessment
CMRA	Climate Mapping for Resilience and Adaptation
CPRA	Coastal Protection and Restoration Authority
CPUE	Catch-per-unit-effort
CRMS	Coastwide Reference Monitoring System
CRS	Community Rating System
CSA	Coastal Study Areas
CWA	Clean Water Act
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
CZMA	Coastal Zone Management Act
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DOP	Dissolved Organic Phosphorus
DOTD	Louisiana Department of Transportation and Development
DWH	<i>Deepwater Horizon</i>
DWPP	Drinking Water Protection Program
EQIP	Environmental Quality Incentives Program

<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
ESA	Endangered Species Act
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
FIMP	Fishery-Independent Monitoring Program
FLOW	Facilitating Learning in Our Watershed
FWOA	Future Without Action
GIWW	Gulf Intracoastal Waterway
HAB	Harmful Algal Bloom
HSDRRS	Hurricane Storm Damage Risk Reduction System
HUC	Hydrologic Unit Code
IHNC	Inner Harbor Navigation Canal
IJA	Infrastructure Investment and Jobs Act
LA SAFE	Louisiana's Strategic Adaptations for Future Environments
LA TIG	Louisiana Trustee Implementation Group
LAC	Louisiana Administrative Code
LCMP	Local Coastal Management Programs
LDAF	Louisiana Department of Agriculture and Forestry
LDENR	Louisiana Department of Energy and Natural Resources
LDEQ	Louisiana Department of Environmental Quality
LDH	Louisiana Department of Health
LDWF	Louisiana Department of Wildlife and Fisheries
LEO	Longleaf Ecosystem Occurrences
LLPI	Longleaf Pine Initiative
LOSCO	Louisiana Oil Spill Coordinator's Office
LPBF	Lake Pontchartrain Basin Foundation
LPDES	Louisiana Pollutant Discharge Elimination System
LSU	Louisiana State University
LULC	Land Use Land Cover
LWI	Louisiana Watershed Initiative
MBTA	Migratory Bird Treaty Act
MRGO	Mississippi River Gulf Outlet

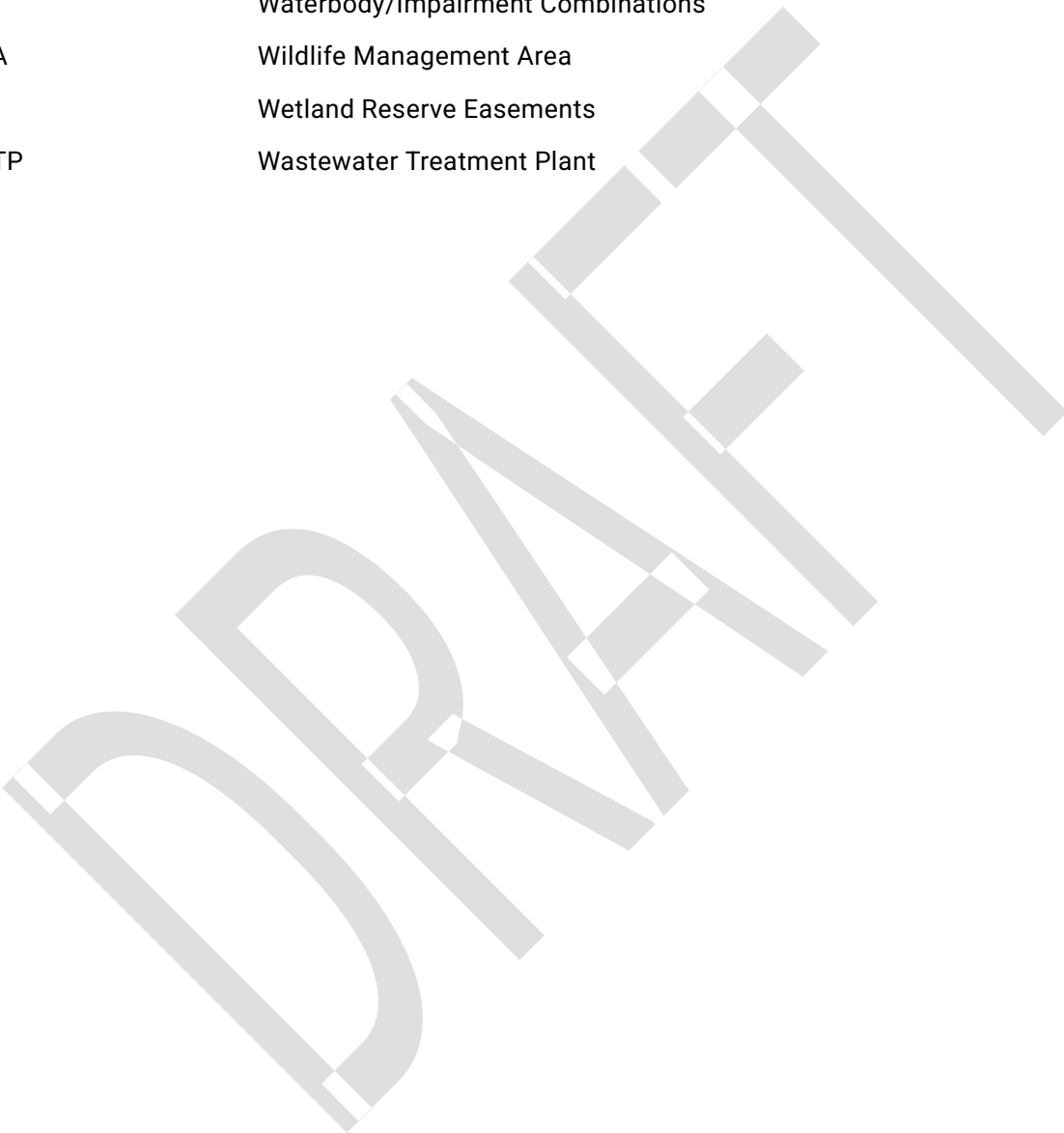
<b><u>Abbreviation</u></b>	<b><u>Definition</u></b>
MRLC	Multi-Resolution Land Characteristics Consortium
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NRDA	Natural Resource Damage Assessment
NWQP	National Water Quality Program
NWR	National Wildlife Refuge
PPT	Parts per Thousand
PRP	Lake Pontchartrain Basin Restoration Program
Q100	100-year Flood Magnitude
QAPP	Quality Assurance Project Plan
R&V	Annual Reference & Validation
RCP	Representative Concentration Pathway
SAV	Submerged Aquatic Vegetation
SGCN	Species of Greatest Conservation Need
SQRA	Semi-quantitative Risk Assessment
SRP	Soluble Reactive Phosphorus
SWAMP	System-Wide Assessment and Monitoring Program
TDR	Transferable Development Rights
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
U.S.	United States
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USD	U.S. Dollar

**Abbreviation**

**Definition**

USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WIC	Waterbody/Impairment Combinations
WMA	Wildlife Management Area
WRE	Wetland Reserve Easements
WWTP	Wastewater Treatment Plant

378



# INTRODUCTION

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380 The Lake Pontchartrain Basin Restoration Program (PRP) is committed to enhancing the water quality,  
381 habitats, and resilience of communities within the basin. A key step in achieving this goal is the development  
382 of a revised Comprehensive Conservation Management Plan (CCMP) that will guide the program's priorities  
383 and actions. The previous CCMP for the basin was developed in 1995. The revised plan is being shaped  
384 through a collaborative process involving expert Work Groups, the PRP Management Conference, the  
385 Executive Committee, interest groups, and the public.

386 The PRP aims to restore the ecological health of the basin by developing and funding restoration projects  
387 and related scientific and public education projects. The revised CCMP aligns with this purpose by setting  
388 clear objectives that seek to improve water quality, support the sustainability of important habitats, and  
389 educate and involve the public in water quality and habitat restoration projects. Specifically, the goals of the  
390 revised CCMP include improving Pontchartrain Basin water quality through point and nonpoint pollutant  
391 source reduction to support ecological health, promoting sustainability of important land-based and aquatic  
392 habitat in the Pontchartrain Basin, and increasing awareness of current and future ecological health issues in  
393 the Pontchartrain Basin to encourage active participation in efforts to increase environmental sustainability.

394 The primary purpose of this issue report is to present a comprehensive compilation of relevant priority  
395 issues related to water quality, habitat, and community resilience that the CCMP should address. This report  
396 serves as a foundational component of the revised CCMP, ensuring that key challenges are identified and  
397 addressed effectively.

398 The development of this issue report involved a rigorous and inclusive methodology designed to ensure that  
399 all major concerns were assessed. The process included reviewing previous plans and reports, including the  
400 1995 Comprehensive Conservation Management Plan, the 2006 Comprehensive Habitat Management Plan,  
401 parish master plans, journal articles, and other relevant documents, to understand past priorities and  
402 progress in recent decades. Four Work Groups—Water Quality, Habitat, Working Lands and Waters/Land Use,  
403 and Resilient Communities—were established to provide local knowledge and expertise on priority issues.  
404 Their involvement ensured that the report is wide ranging and responsive to current issues facing the basin.  
405 The Management Conference provided review and feedback, ensuring the inclusion of diverse perspectives  
406 and technical accuracy.

407 The issue report is structured around key themes. The Basin Characterization section provides a detailed  
408 overview of the basin's natural and human environments, including water resources, habitat conditions, land  
409 use patterns, demographic trends, economic activities, regulatory frameworks, and climate vulnerability. The  
410 Water Quality section explores the physical, chemical, and biological parameters affecting water quality;  
411 addressing the sources and impacts of pollution; regulatory frameworks; and strategies for improving water  
412 quality through both point and nonpoint source pollution reduction. The Habitat section examines the current  
413 condition of major habitat types within the basin, factors contributing to habitat change, and ongoing  
414 restoration efforts. The Habitat section builds upon the 2006 Comprehensive Habitat Management Plan by  
415 incorporating updated data, regional analyses, and case studies that highlight successful habitat  
416 preservation and restoration initiatives. The Resilient Communities section focuses on the social and

417 economic dimensions of resilience, emphasizing public engagement, access to recreational spaces,  
418 adaptation, and disaster preparedness. Key concerns include the effects of extreme weather events, flooding  
419 risks, and the role of education and community involvement in building long-term resilience.

420 The revised CCMP that this issue report supports represents a comprehensive and collaborative effort to  
421 address the pressing environmental and social challenges in the Pontchartrain Basin. By leveraging the  
422 expertise of Work Groups, input from the Management Conference, and direct community engagement, the  
423 plan aims to foster a sustainable and resilient future for the basin's ecosystems and communities. Through  
424 ongoing dialogue, scientific research, and targeted restoration efforts, the program seeks to ensure that the  
425 Pontchartrain Basin remains a vital and thriving natural resource for generations to come.



# BASIN CHARACTERIZATION

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## 427 Introduction

428 The Lake Pontchartrain Basin Restoration Program (PRP) is dedicated to enhancing the environmental  
429 quality, habitats, and communities within the Pontchartrain Basin. A key component of the PRP's future  
430 success is the adoption of a revised Comprehensive Conservation Management Plan (CCMP), which will  
431 guide the program's priorities and actions. To support these efforts, a Habitat Protection/Restoration  
432 Strategy will be developed to address habitat degradation as a priority issue. This document will complement  
433 the CCMP, ensuring it integrates methodologies and analyses that tackle current challenges while building on  
434 previous restoration initiatives.

435 While the Pontchartrain Basin is not currently part of the U.S. Environmental Protection Agency's (USEPA)  
436 National Estuary Program (NEP), it has been identified as a potential candidate. Inclusion in the NEP could  
437 bring additional resources and a structured framework for conservation and management efforts (United  
438 States Government Accountability, 2023). Developing a comprehensive conservation and management plan  
439 is central to the USEPA's National Estuary Program, which would further support the basin's environmental  
440 goals. However, significant progress has already been made through other initiatives.

441 This section of the CCMP provides a detailed description of the basin, covering a range of topics including  
442 water quality, habitat, working lands and waters/land use, and community resilience. It also reflects on the  
443 basin's history and changes since the last CCMP and CHMP were published. The section includes  
444 information on the natural environment, such as physical processes, land use and land cover (LULC), and  
445 public lands and waters. Additionally, it examines the human environment, focusing on population  
446 demographics, economy, industry, and relevant programs. Climate vulnerability is also addressed, with  
447 discussions on recent trends and future changes. Monitoring efforts and regulations within the basin are  
448 discussed in the Water Quality and Habitat sections.

449 The Pontchartrain Basin encompasses approximately 5.5 million acres, including 16 Louisiana parishes  
450 (Ascension, East Baton Rouge, East Feliciana, Iberville, Jefferson, Livingston, Orleans, Plaquemines, St.  
451 Bernard, St. Charles, St. Helena, St. James, St. John the Baptist, St. Tammany, Tangipahoa, Washington) and  
452 four Mississippi counties (Amite, Pike, Lincoln, Wilkinson) (Figure 1, Table 1). The basin's boundaries are  
453 defined by the Mississippi River to the west, the Amite River watershed boundary to the northwest, the Gulf  
454 of America to the southeast, and the watersheds of rivers in Mississippi that drain into lakes Pontchartrain  
455 and Maurepas to the north. The northeastern edge is delineated by the eastern watershed boundaries (HUC  
456 8s) for the Liberty Bayou and Tangipahoa subbasins.

457 Through this comprehensive characterization, the PRP aims to provide a solid foundation for addressing key  
458 issues related to water quality, habitat, and resilient communities, ultimately contributing to the long-term  
459 sustainability and health of the Pontchartrain Basin.

**Table 1. Area of each parish/county within the PRP boundary (Dewitz, 2023).**

PARISH/COUNTY	AREA (ACRES)	PARISH/COUNTY	AREA (ACRES)
Ascension Parish	153,544.99	St. Helena Parish	262,142.31
East Baton Rouge Parish	231,019.77	St. James Parish	69,038.27
East Feliciana Parish	237,807.47	St. John the Baptist Parish	200,529.45
Iberville Parish	30,430.35	St. Tammany Parish	525,613.44
Jefferson Parish	442,415.05	Tangipahoa Parish	527,882.07
Livingston Parish	442,415.05	Washington Parish	41,571.29
Orleans Parish	207,941.92	Amite County	414,173.80
Plaquemines Parish	610,505.14	Lincoln County	13,019.47
St. Bernard Parish	1,015,651.88	Pike County	129,753.92
St. Charles Parish	68,535.21	Wilkinson County	13,320.34



461  
462  
463

**Figure 1. PRP boundary with parish/county divisions (U.S. Census Bureau, Geography Division, 2024).**

## 464 **Natural Environment**

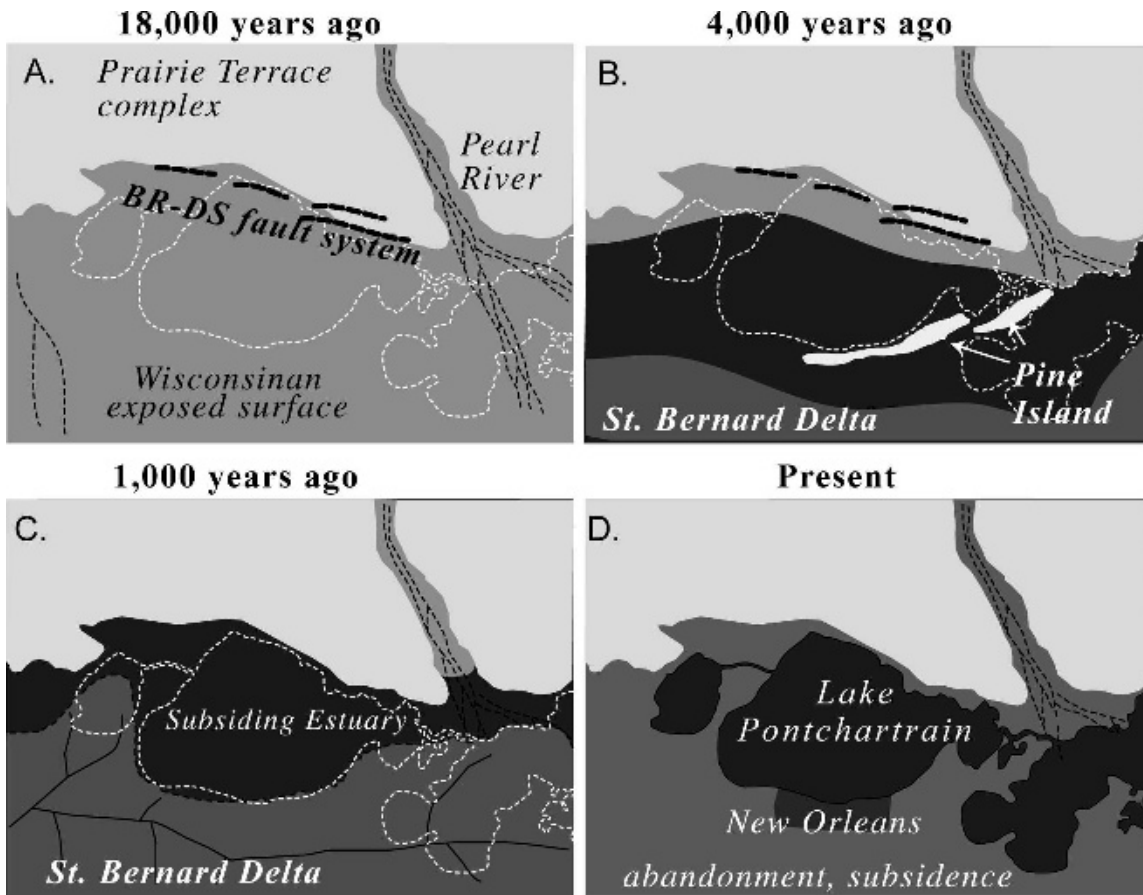
### 465 **PHYSICAL PROCESSES**

#### 466 **Geology**

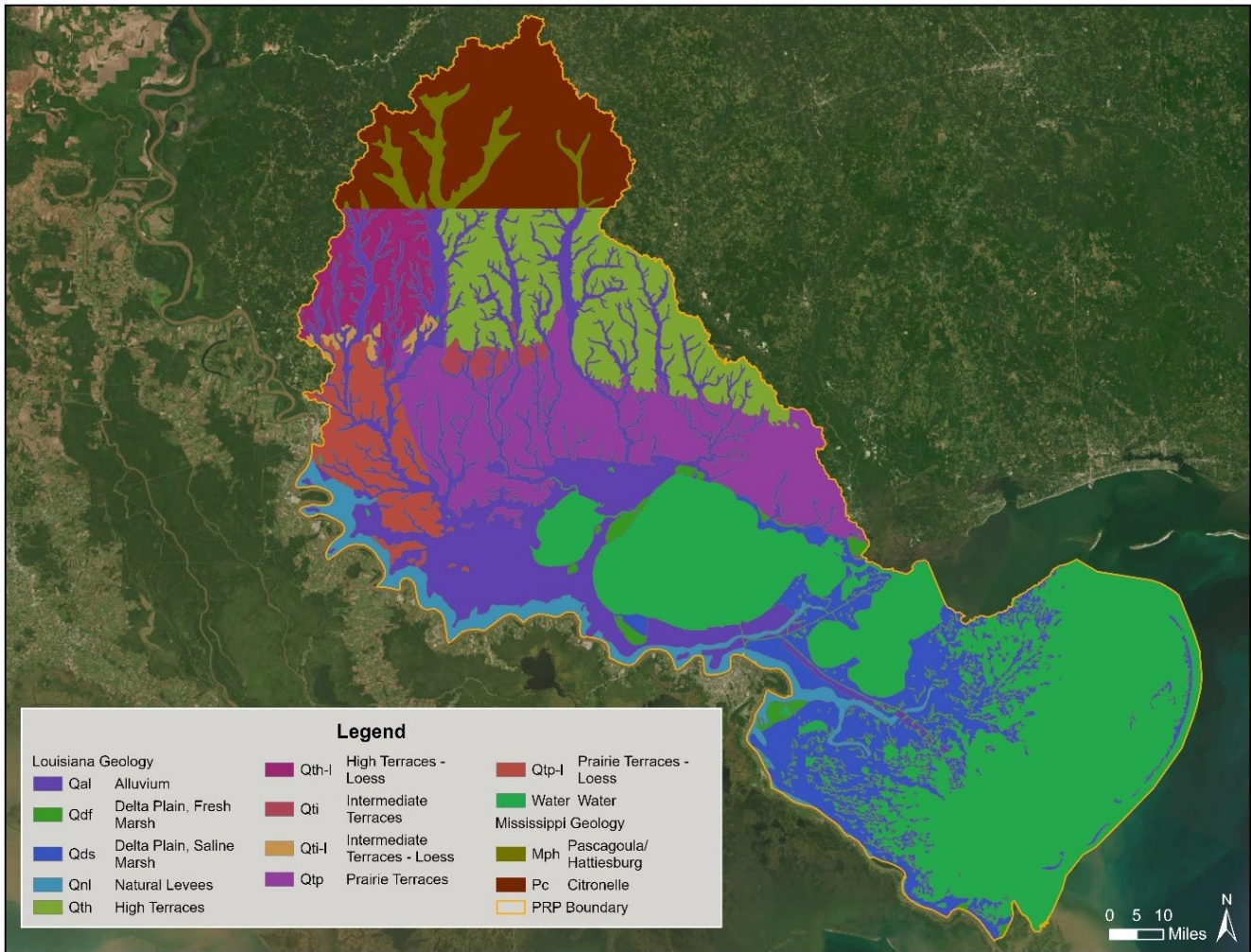
467 The modern Pontchartrain Basin formed predominantly during the Pleistocene ice age and Holocene epochs.  
468 Prior to that period, the area was depositional, with isostatic loading. Deposition continued with input from  
469 other rivers, and the shelf prograded in response to changing sea level (Flocks et al., 2009; Salvador, 1991).  
470 Pleistocene glacioeustasy led to the formation of terraces, which outcrop north of Lake Pontchartrain and  
471 comprise the northern 2/3 of the basin (Flocks et al., 2009). The terraces trend east to west and dip  
472 southward, creating a gradient of high to low elevation that also corresponds with a decreasing age from  
473 north to south (Penland et al., 2002a; Flocks et al., 2009). The terraces are divided into three complexes: the  
474 High Terrace Complex, the Intermediate Complex, and the Prairie Terraces. The High Terraces are marked by  
475 steep, erosional topography consisting of gravels, sands, and silts. The Intermediate Complex has a more  
476 complex stratigraphy with clays, loess, and rolling hills. The Prairie Terraces are the youngest and most  
477 shallowly dipping, forming the first shore-parallel terrace contacting the Holocene deltaic sediments. The  
478 communities of the Florida Parishes are built on these terraces.

479 Deglaciation around the Pleistocene-Holocene transition led to an abrupt rise in sea level, flooding, and  
480 erosion of river valleys. Subsidence and faulting further lowered the Pontchartrain embayment, and littoral  
481 transport formed the Pine Island barrier trend, creating the southern shore of Lake Pontchartrain (Flocks et  
482 al., 2009; Penland et al., 2002a; Saucier, 1994).

483 The Mississippi River Deltaic Plain shifted eastward 3,000-4,000 years before present, creating the St.  
484 Bernard Delta Complex and burying the Pine Island sediments (Figure 2) (Flocks et al., 2009; Roberts, 1997).  
485 When the Mississippi River shifted to the Lafourche Delta lobe, the St. Bernard Complex regressed, leading to  
486 the landward migration of the Chandeleur Islands. The southern third of the Pontchartrain Basin is divided  
487 into the Marginal Deltaic Basin and the Mississippi River Deltaic Plain, with the former consisting of the  
488 forested wetlands and estuarine marshes around lakes Maurepas and Pontchartrain, and the latter  
489 representing deltaic deposits from the Mississippi River's delta building cycles. This region represents the  
490 remnants of the St. Bernard Delta lobe and Pontchartrain Basin's most rapidly subsiding areas (Penland et  
491 al., 2002a). Beneath Lake Pontchartrain, the Pleistocene-Holocene contact outcrops near 6.6 feet below sea  
492 level in the northeast and decreases to around 65.6 feet in the southwest (Kindinger et al., 1997). Figure 3  
493 shows the geologic map of the Pontchartrain Basin.



494  
 495 **Figure 2. Lake Pontchartrain formation as described in text A) Pleistocene sea level**  
 496 **lowstand, B) Holocene sea level rise and formation of Pine Island Barrier trend by longshore**  
 497 **transport, C) St. Bernard Delta Complex progradation and formation of Lake Pontchartrain**  
 498 **southern border, D) subsidence and shoreline erosion of present day. Figure reproduced**  
 499 **from Flocks et al. (2009).**



500 **Figure 3. Geologic map within the PRP boundary. Figure produced from Bicker (1969) and**  
 501 **Louisiana Geological Survey (2015).**  
 502

503 Lopez (1997) identified two fault trends through Lake Pontchartrain, including east to west striking faults in  
 504 the southern portion of the lake and a separate trend parallel to the northeast shore. These faults are part of  
 505 the active Baton Rouge-Denham Springs fault system which runs from Baton Rouge to Chandeleur Sound.  
 506 Fault movement rates vary by age and may be accelerating from the Late Pleistocene into the recent  
 507 geologic history of the basin (Lopez et al., 1997).

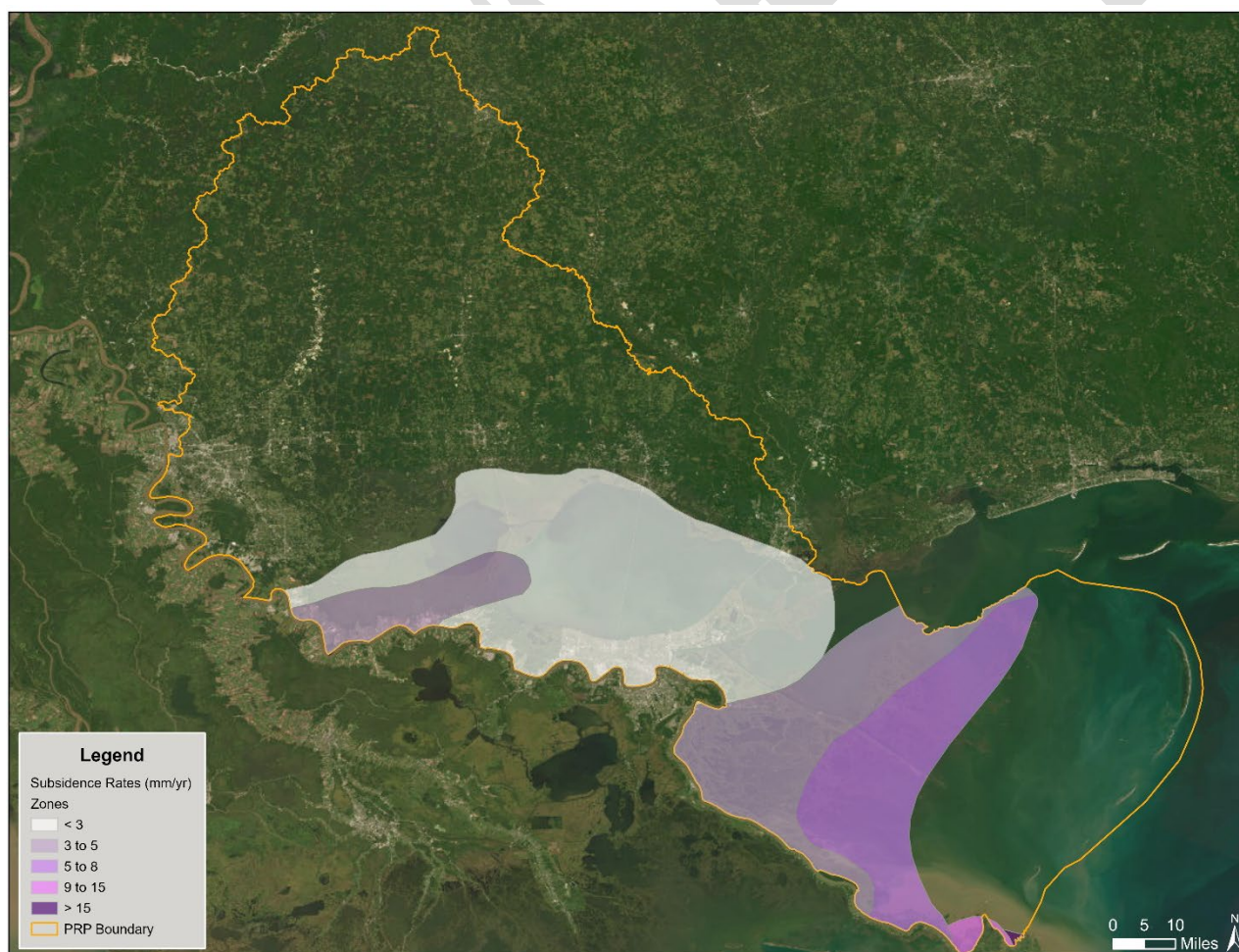
508 The formation of lakes Pontchartrain, Maurepas, and Borgne is probably related to the Baton Rouge-Denham  
 509 Springs fault system. According to Lopez (1991), the area now comprised of the lakes was an estuarine  
 510 marsh from the St. Bernard Delta lobe. Activation of the fault system then led to subsidence and accelerated  
 511 sea level rise, flooding the marshes. The lakes expanded as accommodation space exceeded sediment  
 512 supply. Currently, wave energy controls the modern lake morphology (Lopez, 1991).

513 **Subsidence**

514 Causes of subsidence can be regional or localized. Regional factors include sediment compaction; sediment  
 515 loading, which deforms the underlying crust to accommodate the additional weight; and glacial isostatic

516 adjustment resulting from the collapse of the forebulge that formed in the north-central Gulf Coast during the  
517 last glaciation. Locally, hydrocarbon and groundwater withdrawal can accelerate natural compaction, and  
518 manipulation of surface water drainage that changes soil moisture gradients and decomposition rates can  
519 also contribute (Yuill et al., 2009). Extensional faulting has long contributed to subsidence in the region, but  
520 the exact contribution of faults to subsidence is controversial (Flocks et al., 2009; Gagliano et al., 2003).

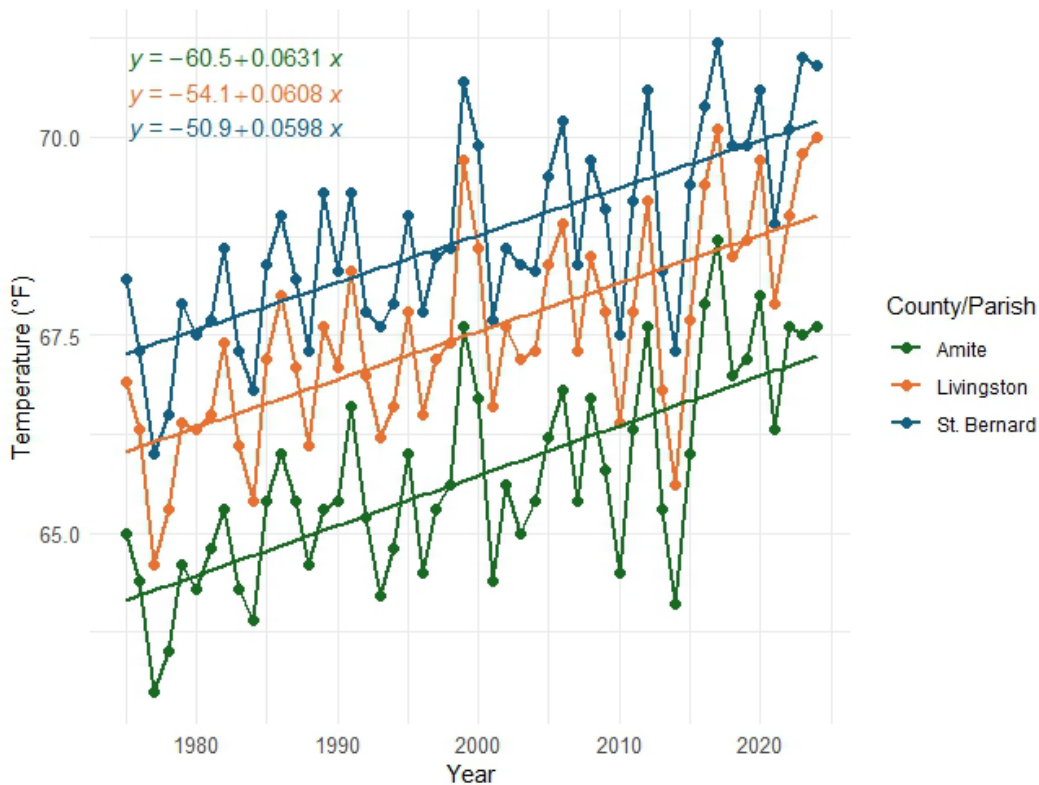
521 Few direct observations of subsidence are available. Byrnes et al. (2019) used high-resolution geodetic GPS  
522 elevation measurements at benchmarks to estimate subsidence. For the Pontchartrain Basin, Applied  
523 Coastal Research and Engineering (2022) discusses subsidence rates by zone in relation to Holocene  
524 sediment thickness (Figure 4). Within the Pontchartrain Basin, the 5 to 8 mm/yr subsidence zone spans the  
525 outer areas of Breton Sound and the Biloxi marshes. Holocene sediment thickness generally is 45 m or  
526 greater in these areas, but there are few subsidence data points in the area. A 3 to 5 mm/yr subsidence zone  
527 characterizes the upper Breton Basin and the western Biloxi marshes as well as areas close to the  
528 Mississippi River. Holocene sediment thickness is generally between 15 and 45 m. The zone extends into  
529 western Pontchartrain Basin where Holocene sediment thickness is greatest near the Maurepas Swamp. The  
530 northernmost subsidence zone documents velocities < 3 mm/yr where Holocene sediment thickness is  
531 generally less than 8 m. The zone includes most areas north of the Mississippi River, between the Rigolets  
532 and Lake Maurepas, north to the western Pontchartrain basin boundary where Holocene sediments are thin.



533 **Figure 4. Subsidence rates by zone (Applied Coastal Research and Engineering, 2022).**  
534

535 **Climate**

536 The Pontchartrain region is described as humid subtropical<sup>1</sup> (Kottek et al., 2006) with annual average rainfall  
537 reaching 66 inches in the southern portion of the basin. The large bodies of water surrounding the region  
538 moderate temperature extremes. Prior to 2000, the average temperature in July was 82°F and in January  
539 53°F. Between 2010 and the present (2024), average summer temperatures have increased to between 83  
540 and 85°F (National Oceanic and Atmospheric Administration [NOAA], n.d.). Afternoon thunderstorms are  
541 common in the summer, whereas winter (mid-December to mid-March), considered the rainy period, favors  
542 steady rain, and cold winter storms are rare (Penland et al., 2002a). July typically experiences the greatest  
543 precipitation, whereas October typically receives the least (NOAA, n.d.; Wu & Xu, 2007). Over the past decade,  
544 there has been a trend of increasing average annual temperatures, with an approximate rise of 0.6°F per  
545 decade. For the past 50 years, the average annual temperature for parishes/counties in the basin has shown  
546 a consistent upward trend from 1975 to 2025. See Figure 5 for a snapshot of average annual temperature of  
547 three counties in different parts of the basin.



548 **Figure 5. Average annual temperature for parishes/counties within the PRP boundary from**  
549 **1975 to 2025, showing a consistent upward trend. The linear trend and associated equation**  
550 **for each parish/county indicate an increase of 0.06°F per year or 0.6°F per decade (NOAA**  
551 **National Centers for Environmental Information, n.d.-a, n.d.-b, n.d.-c).**  
552

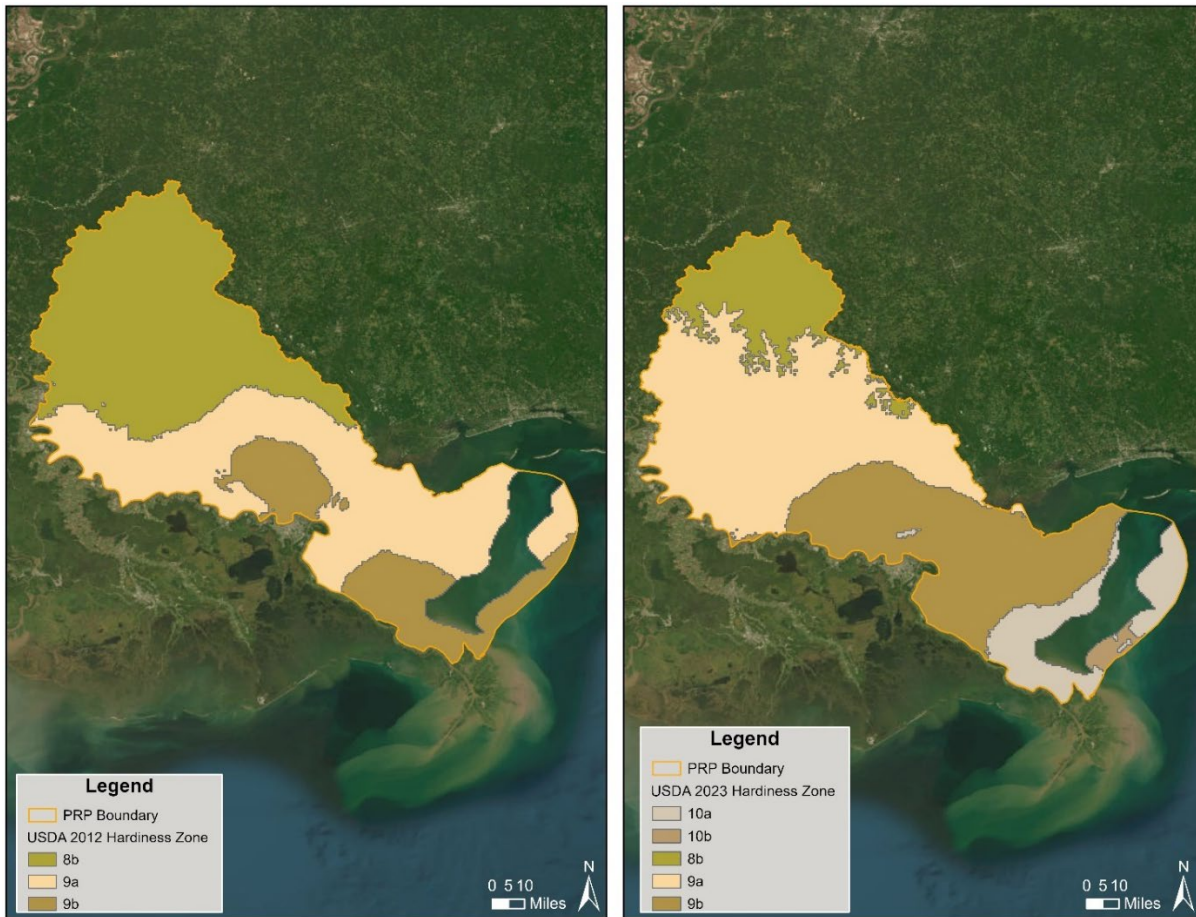
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<sup>1</sup> Mild with no dry season, hot summer. Average temperature of warmest months are over 72°F. Average temperature of coldest month is under 64°F. Year around rainfall but highly variable.

553 Climate influences on agriculture are significant, as shifts in climate patterns directly affect the viability of  
554 crops and plants. Understanding these changes is crucial for sustainable agricultural planning and  
555 ecosystem management. Agricultural practices within the project boundary are influenced by the U.S.  
556 Department of Agriculture (USDA) Plant Hardiness Zones, which categorize areas based on average annual  
557 minimum winter temperatures, helping gardeners, horticulturists, and agricultural experts select plants best  
558 suited to specific climates. The hardiness zones were updated in 2023; the update illustrates a significant  
559 warming trend from the 2012 map, with Louisiana's zones adjusted upward by half a zone, highlighting a  
560 broader pattern of warming observed across North America (Figure 6). Within the project boundary, the  
561 zones span from 8b in Amite County, Mississippi, to 10a near the Chandeleur Sound, where Zone 8b has  
562 average minimum temperatures of 15 to 20°F (-9.4 to -6.7°C) and Zone 10a ranges from 30 to 35°F (-1.1 to -  
563 6.7°C). Microclimates, such as urban heat islands<sup>2</sup>, further emphasize local variations, with a notable 10a  
564 pocket north of New Orleans within the 9b region (U.S. Environmental Protection Agency (USEPA), 2014). By  
565 acknowledging these shifts, land managers and growers can make informed decisions to optimize crop  
566 production, conserve resources, and support biodiversity.

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<sup>2</sup> Heat islands are urban or developed areas that experience significantly higher temperatures than nearby rural areas or other parts of the city.



567  
 568 **Figure 6. USDA 2012 Hardiness Zones within the PRP boundary, ranging from zones 8b to 9b**  
 569 **(left) and 2023 Hardiness Zones ranging from zones 8b to 10a (right)(USDA, 2012, 2023).**

570 **Extreme Events**

571 **TROPICAL CYCLONE HISTORY**

572 Hurricanes have long played a significant role in reshaping the Louisiana coastal landscape. Hurricanes  
 573 Camille, George, Katrina, Isaac, and Ida have had particularly devastating effects on the Pontchartrain  
 574 Watershed. Hurricane Camille, the second most intense hurricane to ever make landfall in the recorded  
 575 history of the United States (U.S.), struck near Pass Christian, Mississippi, on August 17, 1969, as a Category  
 576 5 storm with winds of around 160 miles per hour. Camille inundated 860,000 acres of the Louisiana coast,  
 577 destroyed the land between Venice and Buras, and caused nearly \$200 million in damages. Hurricane George  
 578 made landfall near the Louisiana-Mississippi coast on September 27-28, 1998. Although classified as only a  
 579 Category 2 storm, George produced storm surges exceeding 7 feet along the coasts of lakes Pontchartrain  
 580 and Borgne, with a maximum surge of over 8 feet near Pointe à la Hache. Hurricane Katrina, one of the  
 581 deadliest natural disasters in the U.S., hit the Louisiana coastline on August 29, 2005, with winds of 123  
 582 miles per hour near New Orleans (Roth, 2003). Storm surge ranged from 4.9 to 16.1 feet around the  
 583 perimeter of Lake Pontchartrain, and 80% of New Orleans flooded as a result of levee failure. The disaster  
 584 claimed nearly 2,000 lives and caused approximately \$81 billion in damages, with the majority of the  
 585 devastation occurring in Louisiana (Poirrier et al., 2008; Roth, 2003). Hurricane Ida, which made landfall on

586 August 29, 2021, brought widespread destruction to the region. This storm struck as a Category 4 hurricane  
587 with winds reaching 150 miles per hour. Ida caused catastrophic flooding and storm surges, with inundation  
588 levels of 9 to 14 feet (above ground level) in Plaquemines Parish, 6 to 11 feet in St. Bernard Parish, and  
589 significant flooding around Lake Pontchartrain, including 6 to 11 feet in St. John the Baptist and St. Charles  
590 parishes, 6 to 9 feet in Tangipahoa and western St. Tammany parishes, and 5 to 8 feet in Orleans and  
591 Jefferson parishes. The storm inundated rivers and low-lying areas, caused significant wind damage, and left  
592 millions without power, including the entire New Orleans metropolitan area. In Mississippi, counties like  
593 Amite, Pike, and Wilkinson experienced severe flooding, washed-out infrastructure, and power failures. With a  
594 death toll of 91 and approximately \$75 billion in damages, Ida became one of the most devastating  
595 hurricanes in Louisiana’s history, causing approximately \$55 billion in damages in Louisiana alone,  
596 underscoring the ongoing vulnerability of the Pontchartrain Watershed to powerful storms (Beven et al.,  
597 2022).

598 Tropical storms have been especially damaging to the Chandeleur Islands, with their impacts intensifying in  
599 recent decades. Analysis shows that the increased frequency of tropical events since 1996 has led to a  
600 significant acceleration in land loss rates, rising from 39.7 acres per year during the relatively inactive period  
601 between 1922 and 1996 to 249.6 acres per year between 1996 and 2005. Similarly, shoreline retreat rates  
602 have increased markedly, from 37.4 to 137.5 feet per year (Fearnley et al., 2009). However, despite the  
603 detrimental loss of land associated with hurricanes, these storms also have the potential to deposit large  
604 amounts of sediment. For example, Hurricane Isaac (2012) was a particularly slow-moving storm that  
605 inundated southeastern Louisiana with storm surge up to 9.8 feet around Lake Pontchartrain. Accretion rates  
606 the year of the storm were 40 and 70% higher than years before (September 2008–2012) and after the storm  
607 (September 2012–2014), respectively. Especially high rates of deposition were noted to the east of the storm  
608 track around Breton Sound Basin, most likely due to the Mississippi River and its tributaries overtopping  
609 levees (Bianchette et al., 2016). The relationship between storms and sediment accumulation and land loss  
610 is complex, and factors such as rapid subsidence post-deposition, the long-term fate of newly added  
611 sediment, and the interaction with organic matter will affect the net gain and loss for each storm event.

## 612 **Floods**

613 In addition to damage from storms, the Pontchartrain Basin is susceptible to inland flood events from  
614 hydrological hazards (i.e., rainfall and overland flow). The past 15 years have seen a dramatic increase in the  
615 frequency of Mississippi River flooding. In 2016, a weather phenomenon known as “the Maya Express,” a  
616 combination of a low-pressure system from the southward movement of the jet stream surrounded by a  
617 counterclockwise air mass, funneled warm and wet tropical air to the lower Mississippi River Valley. The  
618 result was heavy rain throughout southern Arkansas, Louisiana, eastern Texas, and western Mississippi that  
619 led to approximately \$1.3 billion in damages and at least 4 deaths. Within the Pontchartrain Watershed, the  
620 Tangipahoa and Tchefuncte basins received up to 1.1 feet and 1.4 feet of rain, and high water marks  
621 indicated water levels up to 8.4 feet and 6.9 feet, respectively (Breaker et al., 2016). The flood stage for the  
622 Tangipahoa River at Robert is 15 feet, and for the Tchefuncte River near Covington, it is 20 feet (USACE, n.d.-  
623 a, n.d.-b).

624 Although weather patterns, such as “the Maya Express” and decadal-scale climate modulators, such as El  
625 Niño-Southern Oscillation and Atlantic Multidecadal Oscillation, contribute to flood level variation, weather  
626 patterns and climate modulators alone cannot explain the estimated 20% increase in the magnitude of the  
627 100-year flood since pre-modification times. A multi-proxy reconstruction of flood frequency and magnitude

628 study spanning 500 years shows that 75% of the increase in flood height is linked to human modification of  
629 the channel (e.g., levees, revetments, channel straightening), which accelerates flood propagation  
630 downstream and increases peak discharge. The 100-year flood magnitude (Q100) from 1897–2015 is 20%  
631 larger than before major human impacts (1500–1800). Without human changes, Q100 would have increased  
632 by only 5%, indicating that human activities are the primary driver of the increased flood hazard (Munoz et al.,  
633 2018). As discussed above, the change in land use across the Mississippi River Watershed has also  
634 contributed to increased baseflow in the river, which, combined with anthropogenic modifications, has led to  
635 an increased frequency of flood events. This trend is expected to persist, with potential implications for more  
636 frequent spillway openings, increased inland flooding, and continued strain on control structures designed to  
637 manage the river's flow.

638 The Mississippi River plays a significant role in the compound flooding transition zones (CFTZ) of adjacent  
639 watersheds like the Pontchartrain. Seepage from the Mississippi River into these watersheds, particularly  
640 when the river stage is higher than the surrounding land, contributes to the complexity of flood management  
641 (Bartlett et al., 2023). The Amite River Basin (ARB) and Lake Maurepas regions in southeastern Louisiana  
642 exemplify the challenges of managing flood risks in areas vulnerable to compound flooding. This region,  
643 characterized by diverse landscapes ranging from upland forests to freshwater marshes, has faced repeated  
644 flooding driven by the interplay of riverine and coastal processes.

645 Historical events, such as the 2016 Baton Rouge flood and Hurricane Isaac in 2012, underscore the  
646 devastating impacts of combined rainfall, storm surge, and antecedent hydrologic conditions (Bartlett et al.,  
647 2023; Bilskie et al., 2021). In the ARB, major river systems like the Tickfaw, Natalbany, and Tangipahoa  
648 contribute to the region's flood vulnerability. The 2016 Baton Rouge flood, which caused over \$10 billion in  
649 damages, highlighted the role of extreme rainfall and saturated soils in amplifying flood impacts. Similarly,  
650 Hurricane Isaac demonstrated the destructive potential of compound flooding, where significant rainfall and  
651 storm surge interacted to produce widespread inundation (Bartlett et al., 2023; Bilskie et al., 2021).

652 In response to the Great Floods of 2016, the state launched the Louisiana Watershed Initiative (LWI), a  
653 watershed-based approach to flood risk reduction. Louisiana received a \$1.2 billion Community Development  
654 Block Grant for flood mitigation to expedite LWI efforts; the funds support statewide planning, watershed  
655 modeling, data collection, and projects that reduce flood risk. LWI is governed by the Council on Watershed  
656 Management, which has approved nine watershed regions throughout Louisiana. Regions 7, 8, and 9 fall  
657 within the PRP boundary; each region is currently developing a regional watershed management plan to  
658 guide future LWI investments.

659 The flood risk to the coastal zone arising from all the factors discussed above (e.g., elevated river base flow,  
660 changes in runoff, low-lying topography, tropical storms) is collectively studied as compound flood risk or  
661 multi-mechanism flooding. Recent attempts to model the risk from compound flooding include simulations  
662 of antecedent conditions such as rainfall, soil moisture, and stream base flow coupled with a singular event  
663 such as a tropical storm. These efforts aim to better understand transitional flood zones and account for  
664 uncertainties. This combined risk is only expected to increase in the future due to environmental change and  
665 continued land use change (Bartlett et al., 2023).

666 A recent study concluded that the risk of flooding in the watershed from coastal flood hazards (i.e., storms,  
667 sea level rise) is likely to become responsible for a larger share of flooding inland (Santiago-Collazo et al.,  
668 2021). Simultaneously, these inland areas are becoming more vulnerable to hydrologic flooding due to

669 factors like rising baseflow, increased rainfall, and overland flow. The issues discussed in this report will  
670 highlight the recent changes in the basin and the effects on water quality and habitat, while noting existing  
671 efforts and making suggestions for adaptive measures to protect and restore the basin's vast resources.

## 672 **Hydrology**

### 673 **Streams, Lakes, and Open Water**

674 The Pontchartrain Estuary receives drainage from 16 Louisiana parishes and 4 Mississippi counties. The  
675 Amite, Tickfaw, and Tangipahoa rivers are the major tributaries contributing to the basin, together accounting  
676 for 50% of the drainage area (see Figure 7 for surface hydrology of the Pontchartrain Basin). Annual water  
677 yields vary from 0.66 cubic miles from the Amite, 0.24 cubic miles from the Tickfaw, and 0.30 cubic miles  
678 from the Tangipahoa. The Amite River has shown an increasing annual trend in runoff and water yield  
679 between 1960 and 2000. Approximately 3/4 of the rivers' discharge occurs from December to May, with  
680 significantly lower flow during the summer and fall months. The Amite River also exhibits a much higher  
681 long-term average total suspended solids (TSS) concentration (383.9 pounds per million gallon) compared to  
682 the Tickfaw (191.4 pounds per million gallon) and Tangipahoa (242.02 pounds per million gallon), with TSS  
683 loadings peaking in winter and spring, mirroring discharge patterns. Factors such as sand and gravel mining  
684 in the Amite River and a 125% population increase between 1960 and 2000 have contributed to this  
685 increased sediment load and long-term changes in water yield (Wu & Xu, 2007). The Amite River is not only  
686 the largest watershed by area but also the most rapidly developing, and it contains the largest urban area,  
687 Baton Rouge.

688 Other tributaries of the Pontchartrain Basin include the Tchefuncte and Blind rivers, Bedico Creek, and  
689 bayous Chinchuba, Castine, Cane, Lacombe, Liberty, and Bonfouca. The Tchefuncte Watershed also contains  
690 the expanding communities of Mandeville, Madisonville, and Covington. Conversely, the Tangipahoa, which is  
691 the second largest watershed in the region, is predominantly rural with some agricultural and timber  
692 activities (Patil & Deng, 2012).

693 The Amite River was once an important navigational route during peak logging activity but is now primarily  
694 used for recreation. Similarly, the Tchefuncte River and Bayou Lacombe are used more for recreation than  
695 commercial traffic. Bayou Bonfouca serves as a navigational waterway between Slidell and Lake  
696 Pontchartrain, while Bayou Dupre, a 6-foot-deep channel, functions as a navigational route from Violet to  
697 Lake Borgne, where the primary type of cargo transported is related to the oil industry (Louisiana Department  
698 of Transportation and Development's [DOTD] Public Works and Water Resources Division, 2009). The only  
699 port in the basin is Port Manchac, located along Pass Manchac (DOTD, 2009). Evaporation and flow to the  
700 Gulf of America are the main outflows.



701  
702 **Figure 7. Surface hydrology within the PRP boundary.**

703 Lakes Maurepas, Pontchartrain, and Borgne (Figure 7) are the major lakes of the basin (Coastal Wetlands  
704 Planning, Protection and Restoration Act [CWPPRA], n.d.-b). Although termed lakes, they are actually surface  
705 estuaries interconnected through several passages. Manchac Pass connects Lake Maurepas with Lake  
706 Pontchartrain, which is then connected to Lake Borgne by Chef Menteur Pass and The Rigolets (Louisiana  
707 Department of Environmental Quality [LDEQ], 2014). Chandeleur and Breton Sounds are the major open water  
708 areas of the basin. Lake Borgne is open to Chandeleur Sound and ultimately the Gulf of America, with  
709 marginal protection provided by the Chandeleur Islands. Breton Sound borders Chandeleur Sound to the  
710 southwest.

711 **Modifications**

712 **STORMWATER INFRASTRUCTURE**

713 Alterations to the hydrologic regime can occur through local modifications such as drainage systems and  
714 stormwater infrastructure. As populations grow, the need for effective stormwater management increases,  
715 especially in low-lying areas. Stormwater pump stations play a vital role in protecting these regions by  
716 efficiently removing large volumes of water to prevent flooding. Cities near bodies of water require robust  
717 pumping systems, while flat terrain faces challenges with slow runoff. Coastal communities use engineered

718 systems to manage stormwater, but the low-lying nature of these areas presents unique challenges,  
719 exacerbated by coastal flooding. Gravity-based systems can be hindered by flat topography, prolonging  
720 flooding events. Coastal flooding can also cause backflow into the system, leading to upland flooding.

721 Increased urbanization has led to the conversion of natural habitats to impervious surfaces associated with  
722 urban and suburban communities, particularly along the Northshore of the Pontchartrain Estuary. One major  
723 impact of watershed alteration is the disruption of stormwater infiltration and flow patterns. Impervious  
724 surfaces like roads, parking lots, and roofs prevent rainfall from soaking into the ground, hindering  
725 groundwater replenishment. These surfaces also increase the volume and speed of water entering rivers and  
726 other waterbodies, leading to more severe and frequent flooding, habitat destruction, and reduced base flows  
727 in streams and aquifers.

## 728 **MAJOR MODIFICATIONS**

729 Beyond these local changes, significant hydrologic alterations have resulted from the construction of canals,  
730 navigation channels, diversions, and flood control structures. Anthropogenic modification to the region's  
731 hydrology has created additional major inputs to the Pontchartrain Basin. The constructed Inner Harbor  
732 Navigation Canal (IHNC) connects Lake Pontchartrain to the Mississippi River, and the Gulf Intracoastal  
733 Waterway (GIWW) connects Lake Pontchartrain to the Gulf of America via the Chef Menteur Pass and The  
734 Rigolets, Lake Borgne, and Chandeleur Sound (Figure 7). Storm water pumped from the New Orleans  
735 metropolitan area, openings of the Bonnet Carré Spillway, and Caernarvon Freshwater Diversion, for example,  
736 are episodic events that alter the basin's surface water quantity and quality (Figure 7). The landbridges that  
737 protect the boundaries between the lakes have been experiencing rapid land loss, prompting numerous  
738 coastal restoration efforts in the area (CPRA, 2023; CWPPRA, n.d.-b).

739 Both the upland and coastal landscapes of the basin are scarred by straight channels cut for navigation,  
740 flood protection, and the oil and gas, mining, and logging industries. Rivers of the upland portion of the basin  
741 have been modified through straightening, dredging, and flood control (Lake Pontchartrain Basin Foundation  
742 [LPBF], 2006). Channel straightening has led to steepening and increased velocity, creating more erosion and  
743 increased turbidity. The altered stream channel also affects the flooding regime of adjacent floodplains and  
744 wetlands, which developed to rely on a regular exchange of nutrients and organic matter during flood events  
745 (Weathers et al., 2009).

### 746 **Diversions**

747 Diversion projects in the Pontchartrain Basin include the Caernarvon and the Violet Siphon (Figure 7). The  
748 Caernarvon Diversion became operational in 1991 with a maximum discharge capacity of 8,000 cubic feet  
749 per second. Discharge volumes are designed to maintain a prescribed salinity gradient throughout the Breton  
750 Sound estuary and increase sediment loading in order to enhance the growth of emergent marsh vegetation  
751 and increase fish and wildlife productivity. The structure is closed during low river stage, high tidal events, or  
752 tropical storms (Louisiana Department of Natural Resources, 2003). The Violet Siphon Diversion (PO-0001)  
753 project, located along Louisiana Highway 46, rehabilitated the existing siphon to enhance operation and  
754 reduce maintenance costs, addressing increased saltwater intrusion and habitat degradation in St. Bernard  
755 Parish. The completed project reintroduces fresh water and nutrients from the Mississippi River to lower

756 salinities and improve wetland habitats (Coastal Protection and Restoration Authority [CPRA] of Louisiana,  
757 n.d.).

## 758 **Mississippi River Gulf Outlet**

759 The Mississippi River-Gulf Outlet (MRGO) was authorized by Congress in 1956 as a federal navigation  
760 channel to provide a shorter route between the Port of New Orleans and the Gulf of America (Figure 7). It  
761 was designed to be 36 feet deep and 500 feet wide, with a 38-foot depth and 600-foot width at its Gulf  
762 entrance. Construction began in 1958 and was completed in 1968. Hurricane Katrina in 2005 caused  
763 significant shoaling, reducing the channel's depth to 22 feet and limiting deep-draft vessel access. In  
764 response, Congress requested a plan for de-authorization in 2006. By January 2008, the U.S. Army Corps of  
765 Engineers (USACE) Chief of Engineers recommended de-authorizing part of the channel and constructing a  
766 closure structure at Bayou La Loutre. The MRGO was officially de-authorized on June 5, 2008, and a rock  
767 closure structure was built near Bayou La Loutre Ridge (USACE, 2012).

768 The MRGO's construction and operation led to wetland loss and damage to estuarine habitats in Louisiana,  
769 from Breton Sound's tidal marshes to the cypress forests in Lake Borgne. This resulted in the decline of  
770 crucial ecological habitats and natural surge and wave buffers, with saltwater intrusion impacting the  
771 Pontchartrain Basin. During its operation, the MRGO also connected Lake Pontchartrain directly to the Gulf  
772 and had significant effects on the Lake's stratification and dissolved oxygen (DO) levels (Poirrier, 2013). For  
773 more details on the effects of the MRGO on habitats, please refer to the Habitat section.

## 774 **Flood Control**

775 Floods are natural disasters that can cause significant damage to infrastructure, property, and human life.  
776 Flood occurrences are often unpredictable and can result from various factors, including heavy rainfall,  
777 storm surges, and river overflow. The need for effective flood control measures is important to mitigate  
778 these impacts and safeguard communities. Minimizing damage and loss of life from flooding is one of the  
779 primary tasks of both the USACE and the CPRA. Louisiana's Coastal Master Plan and the Mississippi River  
780 and Tributaries Project represent massive efforts and significant financial commitments to control the flow  
781 of surface water in the southern Mississippi River Delta to protect life and property. This crucial undertaking  
782 acknowledges that such protection fundamentally necessitates diminishing critical natural delta functions  
783 vital to local ecosystems and economies.

784 Other regional flood control initiatives include the Amite River Basin Commission. The recurring flooding in  
785 the Amite River Basin required the establishment of the Commission to reduce flood damage, manage river  
786 systems, and promote sustainable watershed practices. Their efforts include watershed management and  
787 flood risk reduction, including the development of a Master Plan to identify flood risks and areas of concern,  
788 and to prioritize flood risk reduction projects. They also actively assist in the implementation of Hazard  
789 Mitigation Plans across all seven Parishes within their jurisdiction.

790 The Amite River Diversion Canal (ARDC) is a 10.6-mile flood control channel constructed in the 1950s-1960s  
791 (Figure 7). Its purpose is to alleviate the flood risk along the Amite River by diverting flow to Lake Maurepas  
792 via the Blind River. During construction, the spoil material was placed along the banks, creating an  
793 impoundment and stressing the adjacent cypress-tupelo swamp and bottomland hardwoods. The  
794 increasingly degraded state of the swamp prompted a recent project (CPRA PO-0142) that created gaps in

795 the spoil bank to restore hydrologic exchange with the Maurepas swamp (Richard, 2018). CPRA is seeking to  
796 further increase hydrologic connectivity between the ARDC and the swamp via the Amite River Diversion  
797 Canal Swamp Restoration – Southside (PO-0206) project.

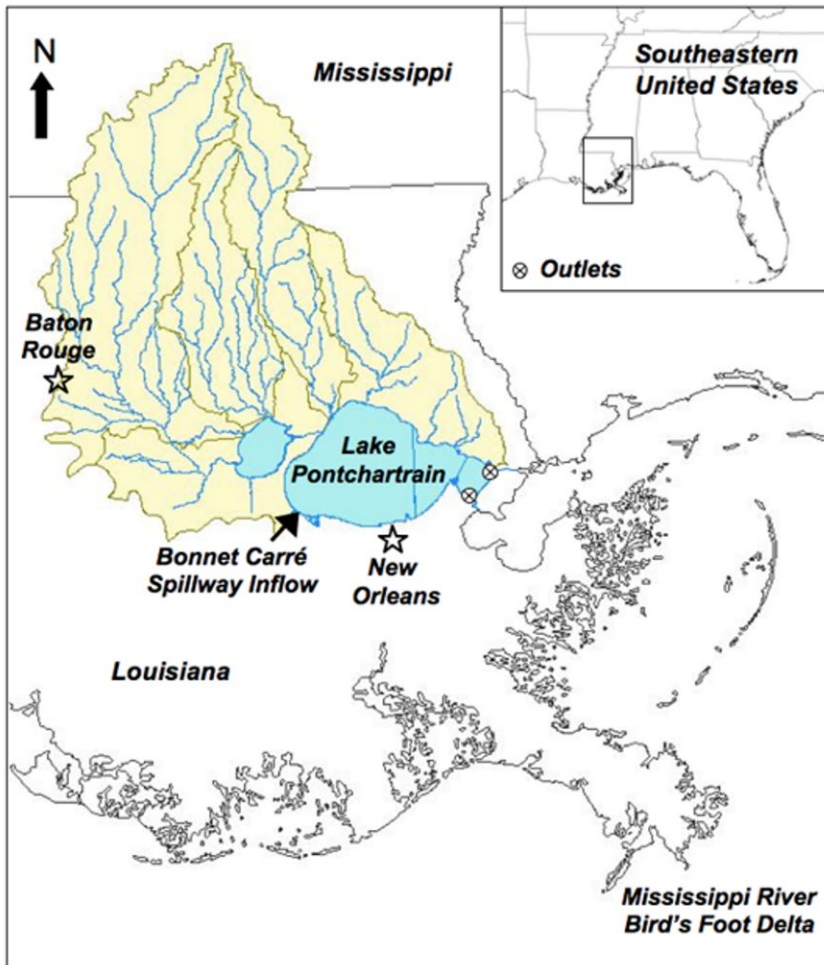
798 The Lake Pontchartrain Barrier has been discussed for decades as a project that would provide storm risk  
799 reduction for some areas within the Pontchartrain Basin. The Water Resources Development Act of 2024  
800 authorizes the Lake Pontchartrain Storm Surge Reduction Project, Louisiana, a project for hurricane and  
801 storm damage risk reduction in Lake Pontchartrain, Orleans, St. Tammany, Tangipahoa, Livingston, St.  
802 James, St. John, St. Charles, Jefferson, and St. Bernard parishes.

803 During flood conditions, unmanaged rivers overtop their banks and create crevasses, delivering a flux of  
804 fresh water and sediment to the alluvial plane. Floodplains provide important ecosystem services, chief  
805 among them improvement in water quality. They act as a hydrologic buffer between the fresh river water and  
806 the receiving basin, typically a brackish estuary. Floodplain soils, sediments, and vegetation assimilate  
807 nutrients, sequester carbon, and filter a wide range of contaminants. The regular flux of fresh water also  
808 helps to counter the intrusion of salt water from sea level rise and tropical storms (LPBF, 2006; USACE,  
809 2024).

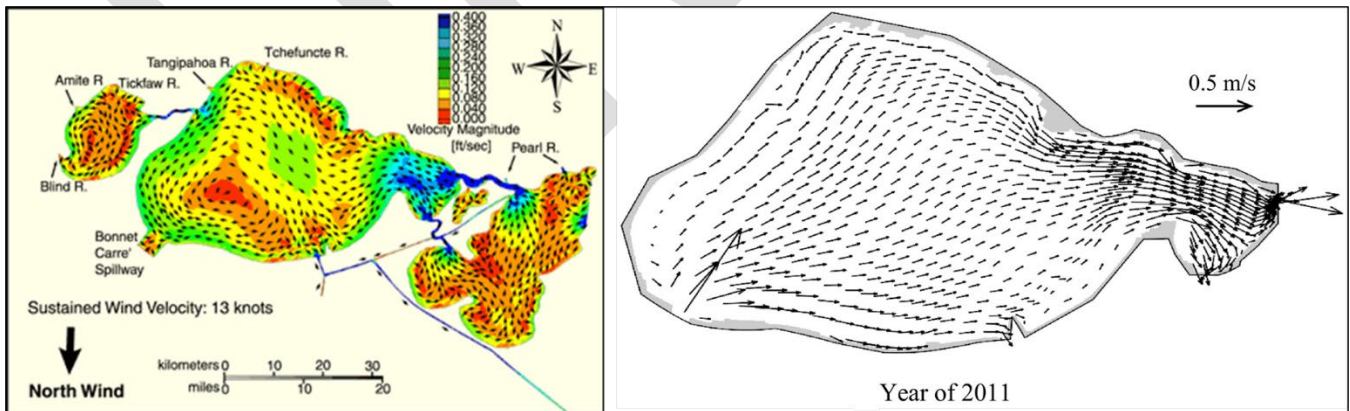
810 Flood control measures such as levees and canals have disconnected rivers and floodplains, drastically  
811 reducing the ecological function of floodplains and creating a direct circuit between the river and receiving  
812 body. Along with cutting off the supply of sediment, which contributes to regional-scale land loss, the  
813 disruption to hydrology also starves the floodplain of nutrient-rich fresh water and eliminates its ability to  
814 filter contaminants. The loss of flow develops impoundments and leads to areas of stagnation and low DO  
815 (LPBF, 2006; USACE, 2024). The receiving body also experiences adverse impacts without the hydrologic  
816 buffer and natural filtration provided by wetlands, including contaminant input and potential eutrophication  
817 (Kemp et al., 2015). This is discussed further in the Habitat section.

#### 818 BONNET CARRÉ SPILLWAY

819 The Bonnet Carré Spillway, designed to alleviate flood risk to the New Orleans metropolitan area, was  
820 completed in 1931 and has a design capacity of 250,000 cubic feet per second, which is 20% of the flood  
821 stage flow of the Mississippi River (1.25 million cubic feet per second) (USACE, 2023). The spillway  
822 discharges into the southwest corner of the estuary (Figure 8). Bonnet Carré Spillway openings abruptly  
823 introduce freshwater into the naturally brackish Pontchartrain Estuary (typically 1-6 practical salinity units)  
824 and disrupt its natural 2-gyre circulation pattern (Figure 9). The impact of the opening on lake water  
825 chemistry is influenced by various factors such as wind, tides, and other freshwater inputs, leading to  
826 increased nutrients and turbidity. These changes can alter primary productivity and increase algal blooms,  
827 affecting aquatic species and vegetation (Iles et al., 2021; McCorquodale et al., 2009). For more details, refer  
828 to the Water Quality section. Bonnet Carré Spillway openings have been occurring more regularly throughout  
829 the past decade. Of the 16 total openings since 1931, four occurred between 2019 and 2021. Analysis of  
830 Mississippi River discharge over ~200 years suggests that land use changes over the past 50 years are a  
831 major contributor to the increased river baseflow (Turner, 2022; Zhang & Schilling, 2006).



832  
 833 **Figure 8. The Pontchartrain Estuary and its northern watershed, highlighted in southeast**  
 834 **Louisiana, are depicted here. An arrow marks the location of the Bonnet Carré Spillway**  
 835 **inflow, while crosses indicate the estuary's two eastern outlets (Reproduced from Roy et al.,**  
 836 **2013).**

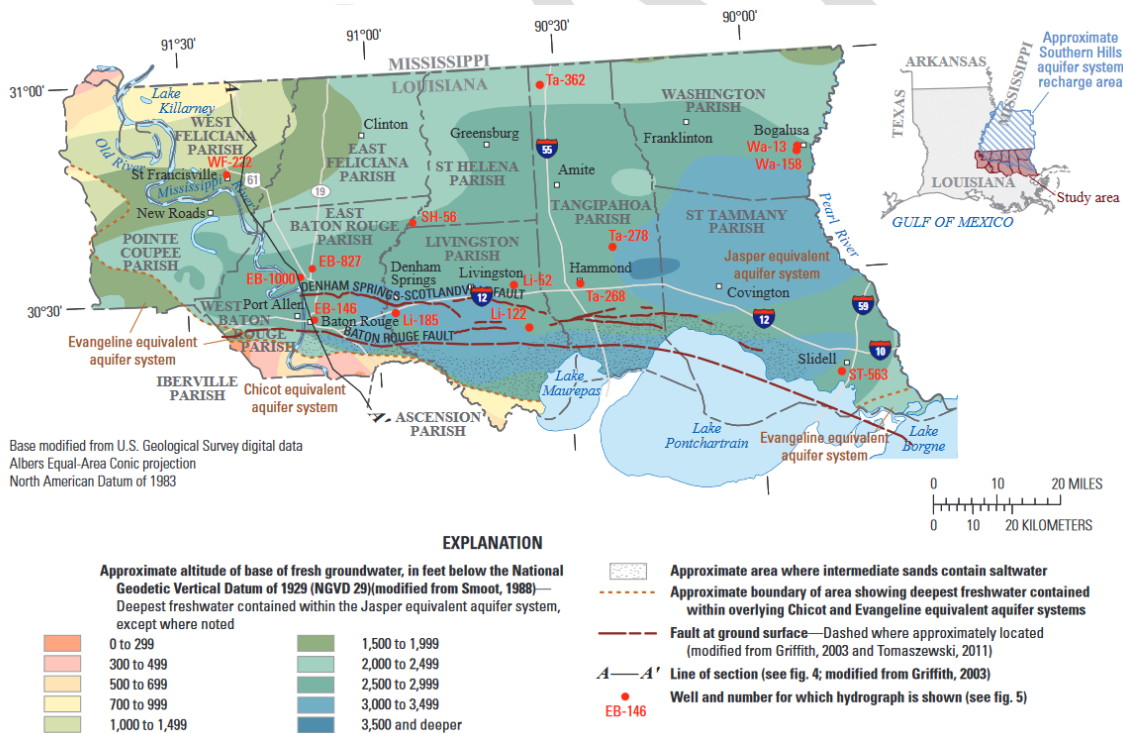


837  
 838 **Figure 9. Natural two-gyre flow circulation pattern of the lake resulting from sustained**  
 839 **winds from the north (left, from Penland et al., 2002b) and the pattern when the flow**  
 840 **discharge reached its maximum value during the 2011 Bonnet Carré Spillway opening (right,**  
 841 **from Chao et al., 2021).**

842 **Groundwater**

843 Even though most water withdrawal is made from surface waters like the Mississippi River, groundwater is  
 844 an important resource in the basin, containing significant freshwater deposits in the state. Groundwater flow  
 845 directly to Lake Pontchartrain has been estimated based on hydrologic budgets and Darcy calculations.  
 846 Carlson (2006) estimates groundwater fluxes of 8.5 million gallons per day to Lake Maurepas and 69 million  
 847 gallons per day to Lake Pontchartrain, constituting 0.5% and 2.2%, respectively, of the lakes' total water  
 848 budgets (year 2000 data). The greater hydrologic gradient from the Northshore and near sea level elevations  
 849 to the south indicates that the majority of the flow of groundwater is from the north (Carlson, 2006).

850 The major aquifers underlying the basin used for extraction are, in order of increasing depth, the Mississippi  
 851 River Alluvial Aquifer; the Chicot, Evangeline, and Jasper Equivalent aquifers, together termed the Southern  
 852 Hills Aquifer; and the Catahoula Aquifer (Figure 10). Aquifer units are coarse-grained (sand and gravel) and  
 853 separated by discontinuous layers of clay and sandy clay. The Southern Hills Aquifer is comprised of units  
 854 generally referred to by the depth of the sand lens (e.g., "400-foot" sand, "2,000-foot" sand). Aquifers  
 855 generally thicken, dip, and flow in the southward direction. Recharge occurs primarily through precipitation to  
 856 outcrop areas in the northern part of the basin. Hardness varies from soft to very hard, but most fresh water-  
 857 bearing units have circumneutral pH and provide relatively clean water, though some exceed the limits for  
 858 iron or manganese. Major aquifers found to the south of Lake Pontchartrain (e.g., Gonzales-New Orleans,  
 859 Norco, Gramercy) are generally used much less due to higher salinity and hardness (USGS, 2011). A  
 860 summary of surface and groundwater extraction by parish and sector is shown in ATTACHMENT A.



861 **Figure 10. Overview of hydrogeologic characteristics in the Southern Hills Aquifer, showing**  
 862 **section line and well locations. Reproduced from USGS Southern Plains Fact Sheet (White,**  
 863 **2017).**  
 864

865 Along the south shore of Lake Pontchartrain, the groundwater head may exceed the land surface elevation in  
866 some areas. Though most of the south shore near-surficial sediments are clay, there are point bar deposits,  
867 the Gramercy aquifer at ~ 131.2 feet depth, some isolated sand beds, and the Pine Island beach sand  
868 discussed above with substantial hydraulic conductivity. The latter's water level varies with the stages of the  
869 IHNC and Lake Pontchartrain, signaling a direct hydraulic connection. Also, the shallow confined aquifers  
870 between the Metairie-Gentilly Ridges and Lake Pontchartrain have experienced substantial compaction,  
871 making them especially susceptible to groundwater flooding from lake-derived flow (Yang & Tsai, 2020).

## 872 **LAND USE AND LAND COVER**

### 873 **Overview of Land Use and Land Cover Types**

874 The watershed within the PRP boundary is vast and dynamic and spans 5.5 million acres. This basin not only  
875 encompasses the most densely populated region of Louisiana with urban areas like New Orleans and Baton  
876 Rouge, but it also serves as one of the largest estuarine systems in the Gulf of America (Environmental  
877 Systems Research Institute [ESRI], n.d.). The land use and land cover (LULC) in the Pontchartrain Basin are  
878 diverse, ranging from urban developments and agricultural fields to extensive wetlands and forests. The  
879 topography of the basin transitions from woodlands in the north to coastal marshes in the south, with Lake  
880 Pontchartrain, a 403,200-acre, oligohaline lake, at its center (Alford, 2014).

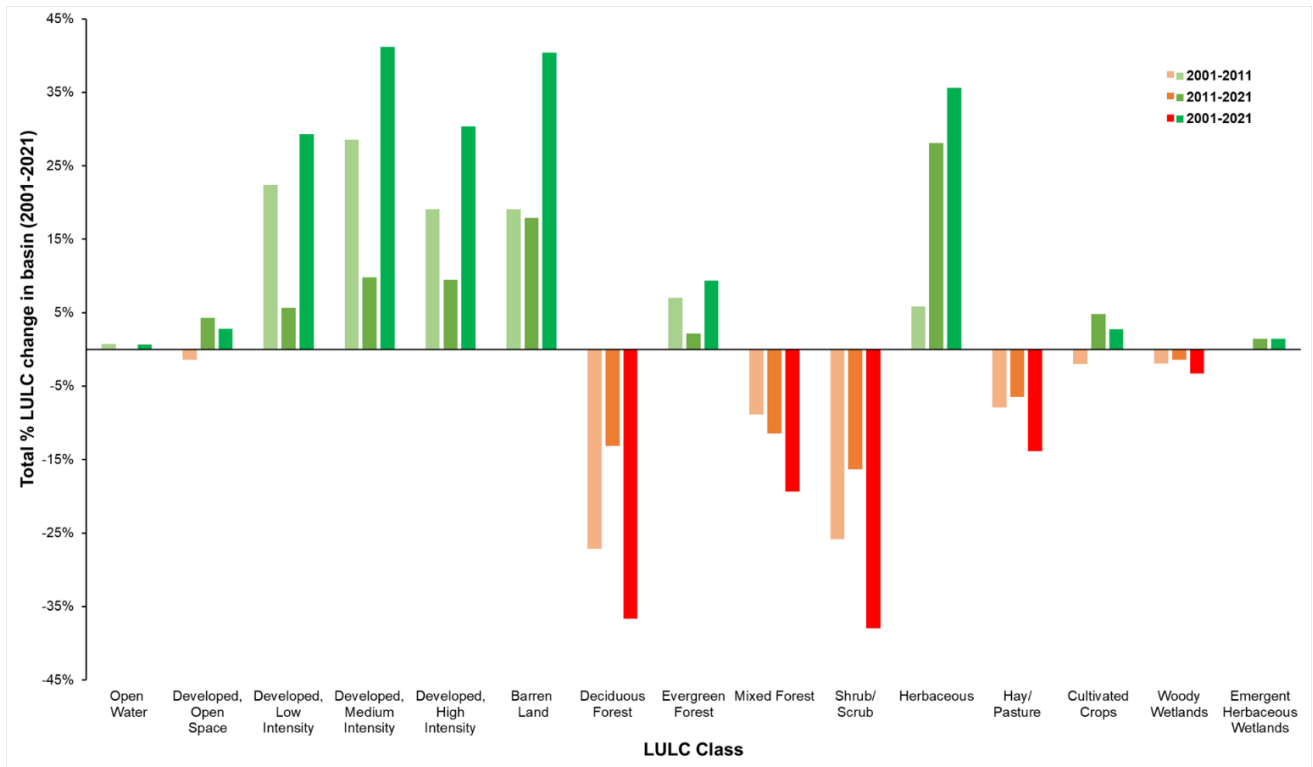
881 To analyze changes in LULC in the Pontchartrain Basin, researchers utilize data from the National Land Cover  
882 Database (NLCD). Managed by the USGS and Multi-Resolution Land Characteristics Consortium (MRLC)  
883 partners, the NLCD provides detailed 30-meter resolution land cover maps every few years. It serves as the  
884 primary Landsat-based land cover database for the U.S., offering data on land surface characteristics like  
885 urban areas, agriculture, forests, impervious surfaces, and tree canopy cover. Using advanced deep learning  
886 models and harmonic time series analysis, the NLCD generates validated annual data spanning nearly four  
887 decades. This data supports ecosystem assessments, biodiversity conservation, and environmental change  
888 analysis, helping track habitat changes and guide conservation priorities and land-use policies.

889 Historically, the Pontchartrain Basin was dominated by vast upland forests, swamps, and marshes,  
890 supporting a wide array of aquatic habitats, including cypress-tupelo swamps, backwater sloughs, and  
891 bayous. Human activities such as agriculture, silviculture, and urban development have significantly altered  
892 these landscapes (Alford, 2014). The demand for water resources has also increased due to the growth of  
893 metropolitan areas, leading to changes in land use practices, including channelization and clearing of  
894 streams for flood control and more efficient stormwater drainage (Lopez, 2009; Martinez & Penland, 2009).

895 Pontchartrain Basin LULC is dominated by open water, woody wetlands, evergreen forests, and emergent  
896 herbaceous wetlands (Table 2). The LULC dataset has gaps in spatial coverage; the total area shown in the  
897 table is less than the area of the PRP boundary. Developed lands make up about 13% of the basin, while  
898 areas of high-intensity development (80 - 90% impervious cover constitute roughly 1%. Agricultural land,  
899 particularly for pasture and hay cultivation, accounts for 11% of the basin, predominantly located north of  
900 Lake Pontchartrain (Dewitz, 2023). Table 2 and Figure 11 show changes in LULC from 2001 through 2021.

**Table 2. Distribution of 2021 NLCD LULC types in the PRP boundary (Dewitz, 2023).**

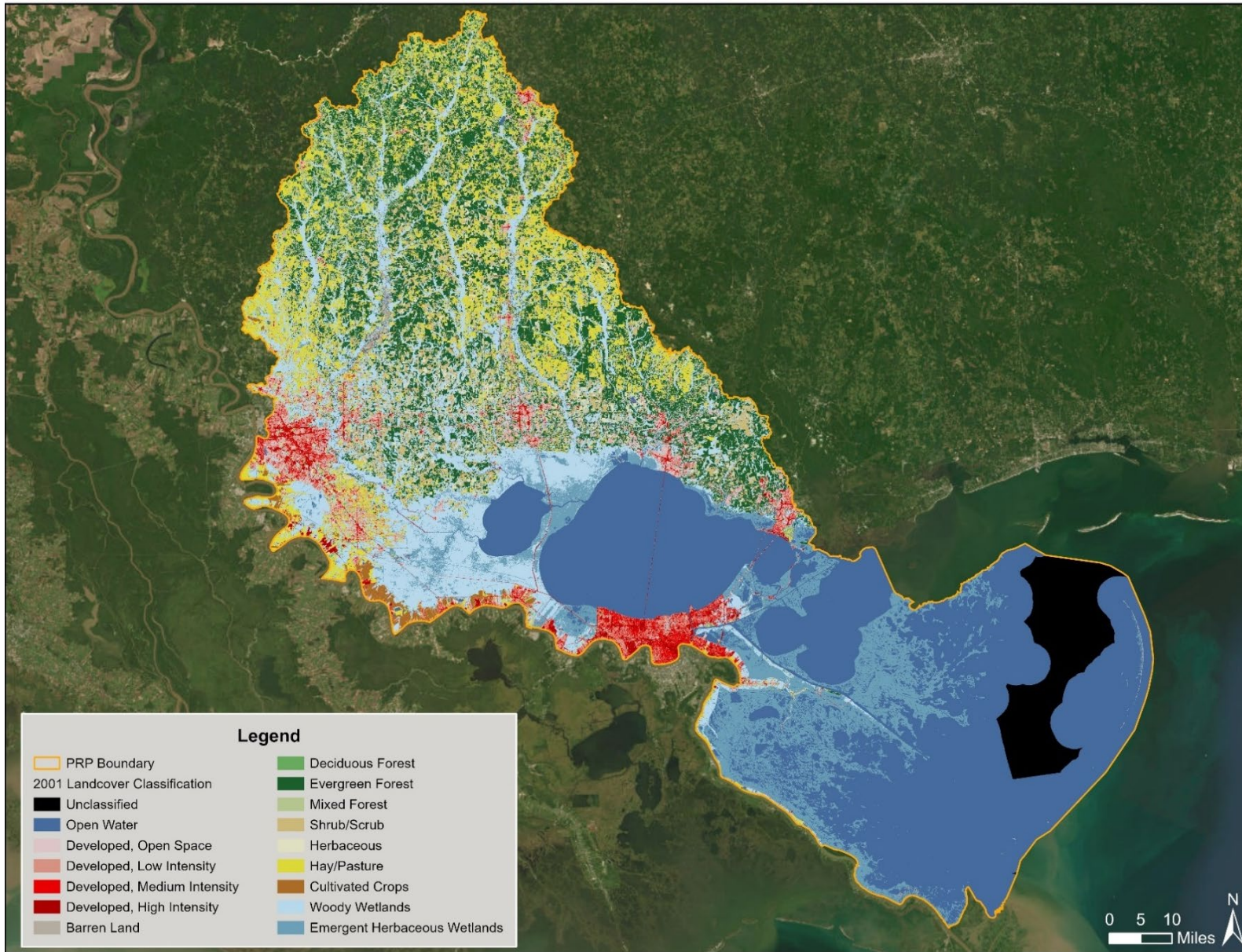
<b>LAND COVER TYPE (2021)</b>	<b>PERCENT COVER</b>	<b>AREA (ACRES)</b>	<b>PERCENT CHANGE (2001-2021)</b>
Open Water	16.4	686,749.34	0.7%
Developed, Open Space	5.6	175,055.14	2.8%
Developed, Low Intensity	4.2	169,990.14	29.3%
Developed, Medium Intensity	2.9	116,046.47	41.2%
Developed, High Intensity	0.8	46,898.04	30.4%
Barren Land	0.4	14,791.58	40.4%
Deciduous Forest	0.1	23,756.48	-36.7%
Evergreen Forest	18.8	879,168.93	9.4%
Mixed Forest	2.5	116,185.70	-19.3%
Shrub/Scrub	2.5	136,513.54	-37.9%
Herbaceous	2.1	75,168.40	35.6%
Hay/Pasture	10.9	387,815.70	-13.8%
Cultivated Crops	0.7	26,534.38	2.7%
Woody Wetlands	21.1	844,786.51	-3.3%
Emergent Herbaceous Wetlands	11.0	487,115.09	1.5%
Total	100.0%	4,186,575.44	N/A



902  
 903 **Figure 11. Percent LULC change in the PRP boundary (2001-2021).**

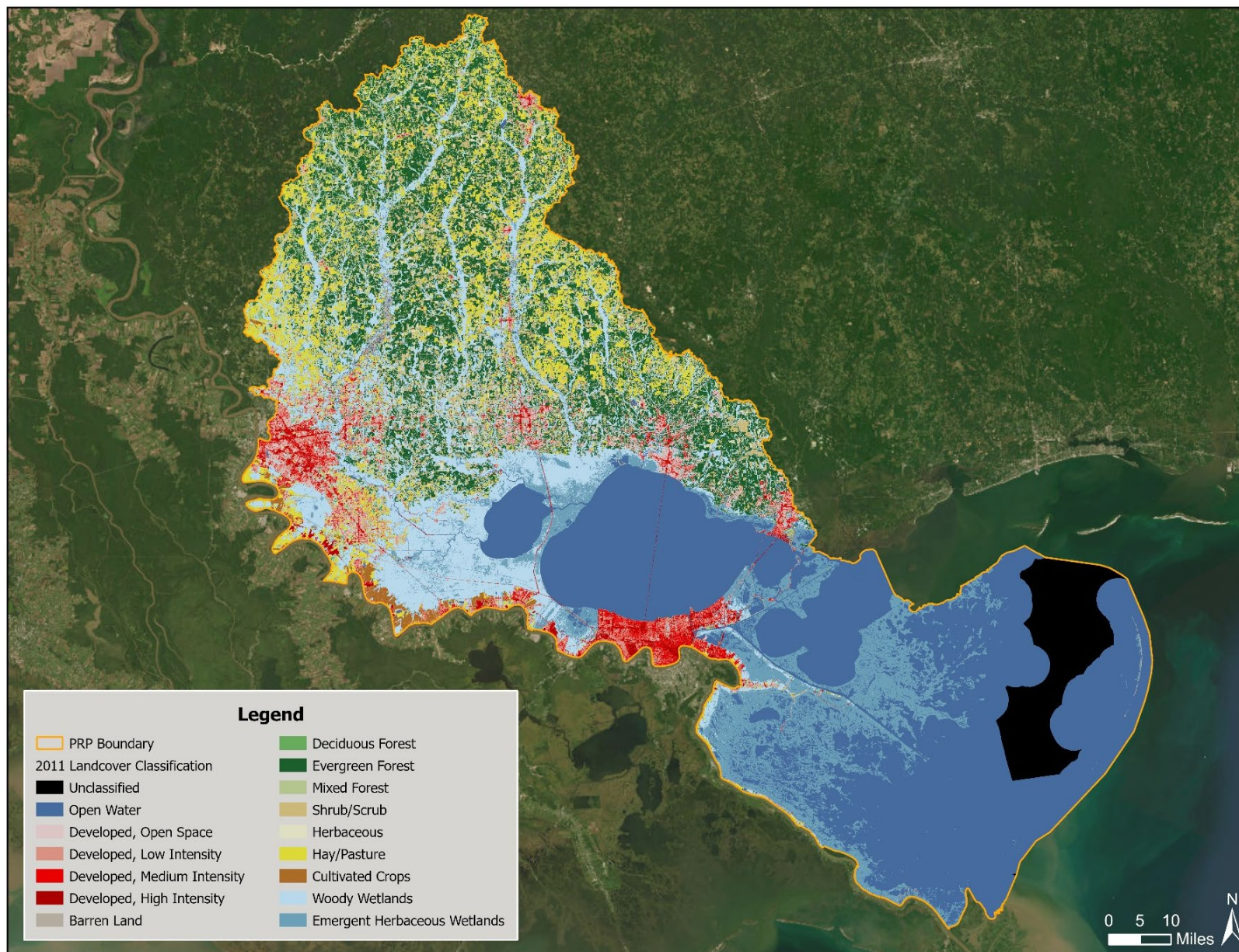
904 **Recent Changes and Trends**

905 From 2011 to 2021, the Pontchartrain Basin saw a variety of shifts in LULC across several key  
 906 classifications. See Figure 12 for LULC in 2001, Figure 13 for 2011, and Figure 14 for 2021.



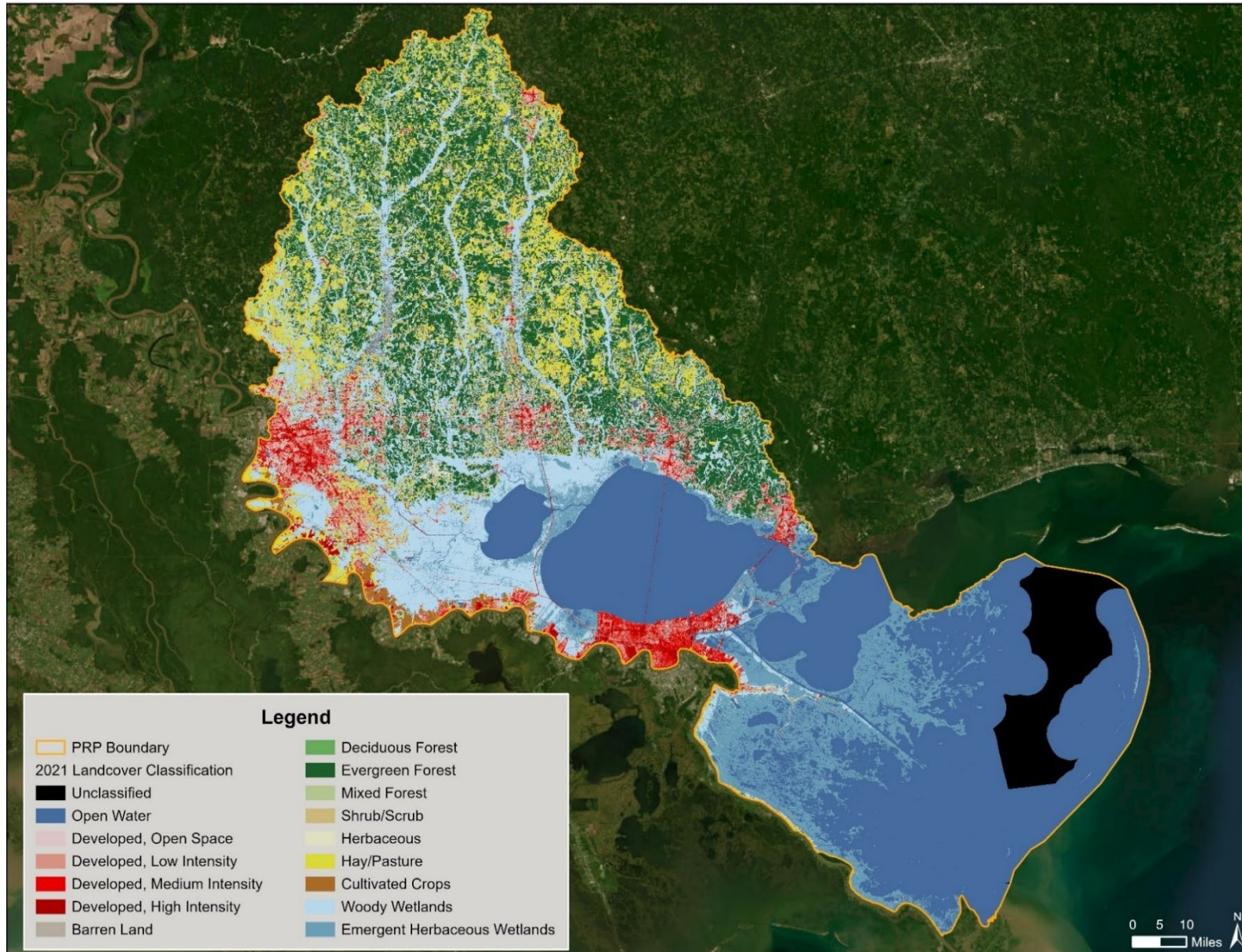
907  
908

**Figure 12. Distribution of LULC in the PRP boundary for 2001 (USGS, 2024b).**



909  
910

**Figure 13. Distribution of LULC in the PRP boundary for 2011 (USGS, 2024c).**



911  
912

**Figure 14. Distribution of LULC in the PRP boundary for 2021 (Dewitz, 2023).**

913 Developed land experienced notable increases, with high-intensity development rising by 9.46% and medium-  
914 intensity development by 9.78%, while low-intensity development increased by 5.67%. Similarly, developed  
915 open space increased by 4.32%, indicating a trend towards more intensive urbanization. Forested areas saw  
916 mixed changes: evergreen forest expanded by 2.88%, mixed forest decreased by 11.48%, and deciduous  
917 forest decreased by 13.12%. Wetland areas showed contrasting trends as well; emergent herbaceous  
918 wetlands increased by 1.45%, whereas woody wetlands declined by 1.39%.

919 Barren land in the basin expanded by 17.89% and herbaceous land cover by 28.06% marking one of the most  
920 substantial changes across categories. Shrub and scrub areas declined sharply by 16.32%. Agricultural areas  
921 showed contrasting changes, with hay and pasture decreasing by 6.44% and cultivated crops increasing by  
922 4.79%. Lastly, open water areas declined slightly, with a 0.04% reduction. Overall, these trends reveal an  
923 increase in developed land, a dynamic shift in forest cover, and notable decreases in shrub/scrub and forests  
924 in the Pontchartrain Basin over the past decade.

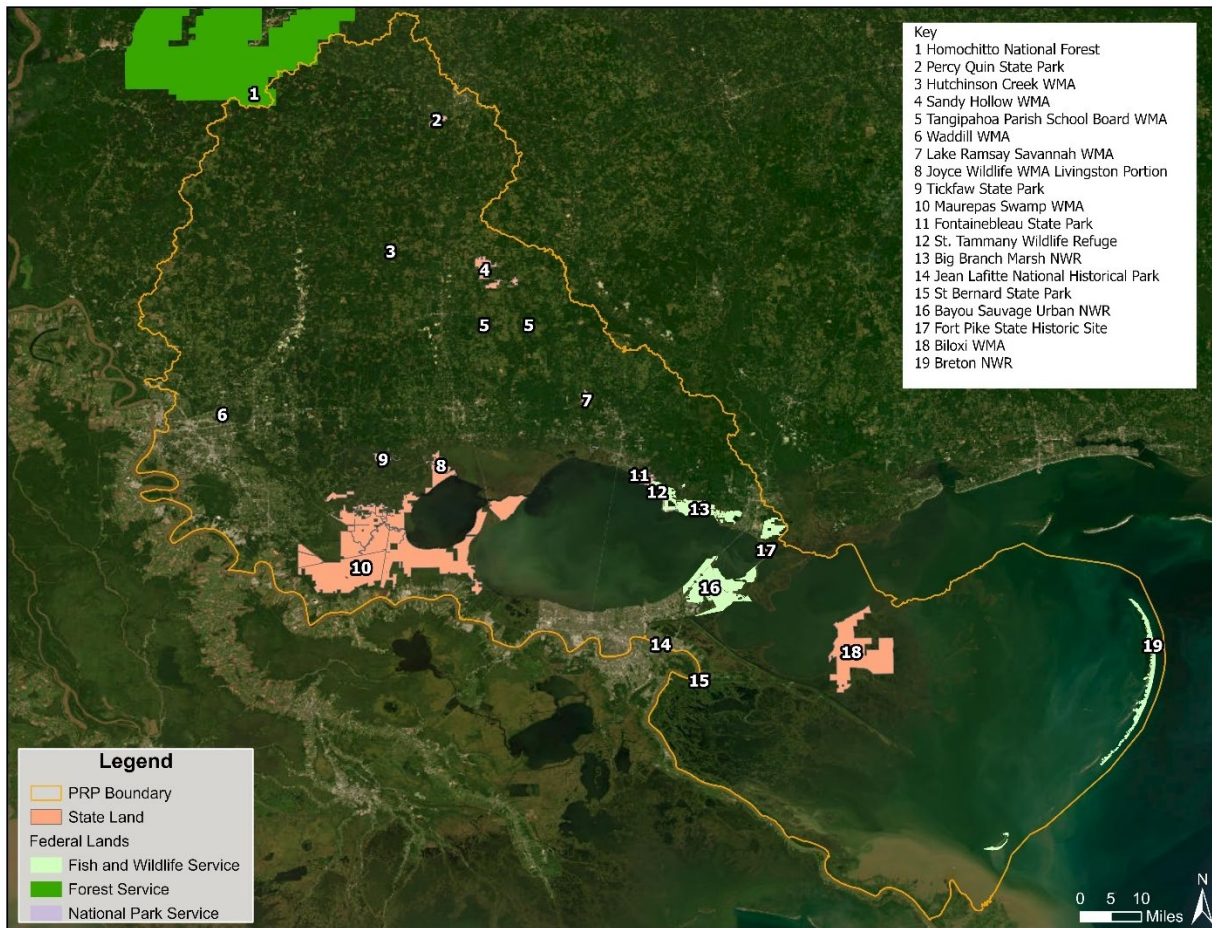
925 Recent changes in the Pontchartrain Basin's land use and land cover have significant implications for  
926 conservation, recreation, and commerce. Urban expansion and industrial activities have led to habitat  
927 fragmentation, loss of biodiversity, and changes in the hydrological regime of the basin. The historical  
928 development of the area—from settlement and levee construction to deforestation and pollution—has  
929 dramatically altered the natural landscape, leading to the degradation of habitats and ecosystem services  
930 (Lopez, 2009). In particular, the construction and eventual closure of the MRGO highlighted the adverse  
931 effects of human interventions on the basin's ecology.

932 Conservation efforts in the Pontchartrain Basin are crucial to restoring and maintaining the ecological  
933 integrity of its diverse habitats. Initiatives aimed at mitigating urban expansion, controlling water pollution,  
934 and restoring natural water flow are essential to enhance habitat quality and ensure the sustainability of  
935 ecosystem services. These efforts are also vital for recreational activities, such as fishing and boating, which  
936 are economically significant for the region. Furthermore, preserving the basin's natural landscapes is  
937 important for mitigating the impacts of natural disasters, such as hurricanes and flooding, thereby protecting  
938 both human communities and the environment.

939 More detail on these habitat changes and their consequences can be found in the Habitat section.

## 940 **PUBLIC LANDS AND WATERS**

941 The Pontchartrain Basin encompasses a diverse range of conservation areas that play a crucial role in  
942 preserving the region's unique ecological features and providing a wealth of recreational opportunities.  
943 These conservation areas include national wildlife refuges (NWR) and forests, state wildlife management  
944 areas (WMA) and parks, and scenic rivers and streams, all contributing to the protection and enhancement of  
945 the basin's natural habitats and wildlife. See Figure 15 for state and federal lands within the PRP boundary.



946  
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**Figure 15. Federal and state lands found within the PRP boundary (ESRI et al., 2024; Louisiana Office of State Parks, 2021).**

949 The Big Branch Marsh NWR in St. Tammany Parish is one of the 23 national wildlife refuges in Louisiana  
 950 overseen by the U.S. Fish and Wildlife Service (USFWS) that protects valuable wetland ecosystems. It  
 951 contains some longleaf pine (*Pinus palustris*) habitat but is mainly a unique marsh-fringing “slash pine  
 952 savanna” natural community. It contains many species that also occur in the longleaf pine ecosystem, the  
 953 most important of which is the largest population of the threatened red-cockaded woodpecker (*Dryobates*  
 954 *borealis*) in the basin. The Bayou Sauvage Urban NWR in Orleans Parish and the Breton NWR in St. Bernard  
 955 Parish are also key conservation sites that protect important coastal and estuarine habitats, providing refuge  
 956 for a variety of species and supporting biodiversity. Breton NWR, the second-oldest National Wildlife Refuge,  
 957 encompasses the Chandeleur Islands and Breton Island at the southern end of the island chain and is also  
 958 part of the National Wilderness System. Homochitto National Forest, managed by the U.S. Forest Service  
 959 (USFS) in Southwest Mississippi, spans 189,000 acres and offers diverse activities such as hunting,  
 960 camping, hiking, mountain biking, horseback riding, fishing, boating, swimming, and wildlife viewing. Jean  
 961 Lafitte National Historical Park and Preserve protects cultural and natural resources, operating the French  
 962 Quarter Visitor Center in Orleans Parish and the Chalmette Monument and Grounds in St. Bernard Parish.

963 The basin also contains several WMAs, which are managed by the Louisiana Department of Wildlife and  
 964 Fisheries (LDWF) and protect a variety of habitats. The Biloxi WMA in St. Bernard Parish is known for its  
 965 brackish to saline marshes, supporting diverse aquatic life, while Joyce WMA in Tangipahoa and Livingston  
 966 parishes features extensive cypress-tupelo swamps that are ideal for birding and wildlife viewing.

967 Hutchinson Creek WMA in St. Helena Parish and Sandy Hollow WMA in Tangipahoa Parish both feature  
968 longleaf pine habitats, with Sandy Hollow also containing some hardwood species. The Sandy Hollow WMA,  
969 totaling 4,655 acres in two units, is a premiere example of upland longleaf woodland habitat managed  
970 primarily to benefit bobwhite quail (*Colinus virginianus*). This site supports a diversity of indigenous longleaf  
971 groundcover species, grassland birds, and is an important site for rescued gopher tortoises (*Gopherus*  
972 *polyphemus*). It stands as the largest protected upland longleaf site in the basin. The Lake Ramsay Savannah  
973 WMA in St. Tammany Parish is home to one of the most important savannahs in eastern Louisiana, boasting  
974 over 18 rare plant species. It adjoins two wetland mitigation areas, The Nature Conservancy's Lake Ramsay  
975 Preserve and a DOTD wetland mitigation project, to form what is referred to as the Lake Ramsay  
976 Conservation Area, totaling 796 acres along the Little Tchefuncte River. Manchac WMA is characterized by  
977 its flat marshland and is known as one of the top waterfowl areas in the basin. Similarly, Waddill Wildlife  
978 Refuge in East Baton Rouge Parish has a mix of hardwood forest. The Maurepas Swamp WMA, spanning  
979 Ascension, Livingston, St. John the Baptist, and St. James parishes, consists mainly of flooded cypress-  
980 tupelo swamp and is a haven for bird species and other wildlife, providing ample opportunities for hunting,  
981 fishing, and camping. Located in St. Tammany Parish, Fontainebleau and Fairview-Riverside State Parks  
982 feature bottomland hardwood forests and cypress swamps, offering vital habitats for numerous nesting  
983 species. Located next to Fontainebleau State Park and Big Branch NWR, St. Tammany Wildlife Refuge is  
984 managed as part of Big Branch Marsh NWR through a cooperative agreement between the LDWF and the  
985 USFWS. Percy Quin State Park, in Pike County, Mississippi, is a public recreational area with campsites and  
986 nature trails. Tickfaw State Park, located in Livingston Parish, features trails and over 1 mile of boardwalks,  
987 allowing visitors to explore cypress-tupelo swamp, bottomland hardwood forest, mixed pine hardwood forest,  
988 and the Tickfaw River. St. Bernard State Park, situated on 358 acres along the Mississippi River, features  
989 woodlands, wetlands, and a nature trail. Fort Pike State Historic Site is a historic fort in Orleans Parish  
990 designed to withstand attacks from land or sea.

991 The Pontchartrain Basin is home to numerous scenic rivers and streams, which are preserved for their  
992 natural, cultural, and recreational values. Key rivers such as the Comite, Tickfaw, and Tangipahoa play crucial  
993 roles in maintaining water quality and supporting aquatic habitats. Other notable waterways include Bayou  
994 Manchac, Blind River, Bayou St. John, and several scenic streams in St. Bernard and St. Tammany parishes.  
995 These rivers not only offer scenic beauty but also provide significant ecological and recreational benefits.  
996 The Habitat section provides more details about these scenic rivers and streams.

997 These conservation areas and scenic rivers not only preserve the natural landscapes and biodiversity of the  
998 Pontchartrain Basin but also offer a wide range of recreational activities, such as fishing, boating, hiking,  
999 birding, and wildlife viewing. They are essential for maintaining the ecological health of the region,  
1000 supporting local economies, and enhancing the quality of life for residents and visitors alike.

## 1001 **Human Environment**

### 1002 **POPULATION AND DEMOGRAPHICS**

#### 1003 **Population Overview**

1004 An analysis of population trends between 1985 and 2015 identified increases in population southeast of  
1005 Baton Rouge around Gonzales and the Northshore communities of Lake Pontchartrain, coinciding with

1006 decreasing populations around St. Bernard, eastern St. Tammany, and parts of the New Orleans and Baton  
 1007 Rouge metropolises. This corresponds to an increase in urbanization of 0.8% and an overall increase in the  
 1008 population of the Pontchartrain Basin of 10.3% over this timeframe. Between 1982 and 2000, the 218%  
 1009 increase in the southern St. Tammany Parish population led to a loss of 48,000 acres of natural habitat,  
 1010 including pine savannah and important flood-reducing wetlands (Bourgeois-Calvin et al., 2004; Carstens &  
 1011 Amer, 2019). Similarly, between 1982 and 2006, urban areas in Tangipahoa Parish nearly doubled, leading to  
 1012 a loss of agricultural lands and upland forests. The population grew over 17% in the 1990s, and Hurricane  
 1013 Katrina in 2005 further increased the population by 6.6% within one year, exacerbating rapid growth  
 1014 (Bourgeois-Calvin, 2008). This development is likely to negatively impact the parish’s waterways and other  
 1015 water sources, including aquifers.

1016 Besides the loss of wetlands, urbanization has also impacted water sources in the region, like aquifers.  
 1017 Rapid development throughout the Northshore has also led to greater extraction through St. Tammany and  
 1018 Tangipahoa parishes and an accompanying significant decline of the potentiometric surface. Nearly all units  
 1019 of the major aquifers have experienced a decline since 1980. The largest declines are reported near the  
 1020 Baton Rouge metropolitan area. The saltwater interface, first detected in 1960, was initially constrained to  
 1021 the southern block of the Baton Rouge fault. By the 1990s, however, saltwater was detected in six of the  
 1022 traditionally freshwater aquifers of the northern fault block (DOTD, 2009).

1023 **Overview of Parish and County Data**

1024 The parishes and counties within the Pontchartrain Basin face a variety of health, environmental, and  
 1025 socioeconomic challenges that require targeted interventions and comprehensive community planning. See  
 1026 Table 3 for an overview of population, area, demographics, and income across parishes and counties.

1027 **Table 3. Overview of population, area, demographics, income, and languages for parishes**  
 1028 **and counties within the PRP boundary (U.S. Census Bureau, 2022).**

PARISH/ COUNTY	POPULATION	AREA (ACRES)	DEMOGRAPHIC COMPOSITION (WHITE, BLACK, HISPANIC)	PER CAPITA INCOME (USD)	LANGUAGES SPOKEN (ENGLISH, SPANISH)
Ascension	117,857	151,680	70%, 19%, 7%	42,790	93%, 5%
East Baton Rouge	402,710	228,480	46%, 42%, 5%	N/A	92%, 4%
East Feliciana	12,788	232,960	62%, 34%, 1%	39,024	98%, 1%
Iberville	7,183	30,080	39%, 53%, 7%	22,324	89%, 8%
Jefferson	243,954	91,443	63%, 13%, 16%	33,044	81%, 12%
Livingston	143,425	442,240	85%, 7%, 4%	34,237	96%, 3%
Orleans	330,815	205,440	32%, 55%, 6%	N/A	92%, 4%
Plaquemines	1,159	235,520	20%, 77%, 3%	26,072	100%, 0%
St. Bernard	44,038	1,379,200	60%, 24%, 11%	28,451	92%, 5%
St. Charles	25,549	68,301	66%, 23%, 7%	36,717	92%, 6%
St. Helena	10,872	261,760	50%, 48%, 1%	26,150	95%, 1%
St. James	12,467	68,730	56%, 42%, 1%	33,044	99%, 1%

PARISH/ COUNTY	POPULATION	AREA (ACRES)	DEMOGRAPHIC COMPOSITION (WHITE, BLACK, HISPANIC)	PER CAPITA INCOME (USD)	LANGUAGES SPOKEN (ENGLISH, SPANISH)
St. John the Baptist	39,076	198,835	32%, 54%, 8%	31,849	92%, 5%
St. Tammany	224,507	517,344	75%, 13%, 6%	33,044	94%, 4%
Tangipahoa	132,053	516,480	62%, 30%, 5%	28,633	96%, 3%
Washington	2,971	40,838	76%, 19%, 5%	30,001	97%, 2%
Amite	11,348	399,296	58%, 40%	24,663	99%, 1%
Lincoln	725	15,418	89%, 11%, 1%	31,719	100%, 0%
Pike	23,709	132,806	58%, 38%, 2%	N/A	98%, 1%
Wilkinson	2,431	12,550	74%, 17%, 8%	22,340	100%, 0%

1029 **Health Indicators**

1030 Life expectancy across the parishes generally aligns with national averages, with most areas reporting an  
 1031 average of 76 years. However, there are variations, such as Washington Parish with a higher life expectancy  
 1032 of 78 years and Wilkinson County with a lower expectancy of 73 years. Disability rates also vary, with some  
 1033 areas like Washington Parish having a high rate of 20%, compared to the state average of 16.4% for  
 1034 Louisiana, indicating a significant need for healthcare and social support services. St. Helena Parish faces  
 1035 higher rates of disability at 26.7%, reflecting healthcare access challenges.

1036 **Environmental Concerns**

1037 Flood risks are a common challenge, with several parishes like St. John the Baptist, Plaquemines, and St.  
 1038 Charles facing significant flood hazards that surpass national averages. Flood risk assessments estimated  
 1039 the likelihood of flooding over a 30-year period. For example, St. Charles Parish has an 85% flood risk, while  
 1040 Plaquemines Parish has a 47% flood risk, both significantly higher than Louisiana’s average of 25% and the  
 1041 national average of 12%. Proximity to hazardous waste facilities is another pressing issue, particularly in  
 1042 parishes like Livingston, St. Bernard, and Jefferson, which rank high in environmental concerns. Wildfire  
 1043 risks are notable in areas such as Washington Parish (49%) and Amite County (83%), highlighting the need  
 1044 for robust community resilience strategies. Washington Parish’s wildfire risk is significantly higher than  
 1045 Louisiana’s statewide wildfire risk of 7%, while Amite County’s risk is also higher than Mississippi’s statewide  
 1046 wildfire risk of 23%.

1047 **Socioeconomic Factors**

1048 Economic vulnerabilities are evident across the parishes, with high percentages of low-income residents and  
 1049 varying levels of educational attainment. For instance, in St. Bernard Parish, 44% of the population is  
 1050 classified as low-income, and 19% have less than a high school education (Table 4). Similarly, in Pike County,  
 1051 53% of the population is low-income, and 20% have less than a high school education (Table 5).  
 1052 Unemployment rates also differ, with some areas like Jefferson Parish having a relatively low rate of 5%,  
 1053 while others like St. Bernard Parish face higher rates of 8%, compared to Louisiana’s overall rate of 7%.

1054 **COMMUNITY RESILIENCE**

1055 The combined socioeconomic and environmental challenges underscore the need for coordinated  
 1056 interventions aimed at improving living conditions and reducing environmental health risks. Parishes like  
 1057 Tangipahoa and St. Tammany face both flood and wildfire risks, necessitating comprehensive community  
 1058 planning to enhance resilience. Community Disaster Resilience Zones (CDRZ) aim to enhance community  
 1059 resilience by directing resources to the most at-risk areas identified using FEMA’s National Risk Index. Within  
 1060 the PRP boundary, designated zones in Ascension and St. Tammany parishes receive prioritized support and  
 1061 increased funding for federal resilience projects, reducing the financial burden on their communities.

1062 **Table 4. Socioeconomic indicators of Louisiana parishes within the PRP boundary in**  
 1063 **comparison to the state and national averages (U.S. Census Bureau, 2022).**

PARISH	LOW INCOME	PEOPLE OF COLOR	UNEMPLOYMENT	LIMITED ENGLISH-SPEAKING HOUSEHOLDS	POPULATION WITH LESS THAN HIGH SCHOOL EDUCATION	POPULATION UNDER AGE 5	POPULATION OVER AGE 64
Ascension	20%	30%	4%	1%	11%	6%	12%
East Feliciana	23%	38%	4%	0%	12%	6%	21%
East Baton Rouge	34%	54%	7%	2%	8%	6%	15%
Iberville	24%	61%	4%	4%	21%	5%	11%
Jefferson	29%	37%	5%	4%	9%	6%	20%
Livingston	40%	39%	6%	1%	17%	7%	15%
Orleans	42%	68%	9%	1%	12%	6%	16%
Plaquemines	68%	80%	2%	0%	12%	3%	19%
St. Bernard	44%	40%	8%	1%	19%	7%	12%
St. Charles	25%	34%	8%	2%	8%	5%	14%
St. Helena	52%	56%	21%	1%	21%	5%	20%
St. James	26%	44%	4%	0%	8%	5%	17%
St. John the Baptist	37%	68%	9%	1%	14%	6%	14%
St. Tammany	27%	24%	6%	2%	8%	6%	18%
Tangipahoa	40%	38%	6%	1%	17%	7%	15%
Washington	39%	24%	10%	0%	11%	5%	18%
Louisiana Average	40%	43%	7%	2%	15%	6%	17%
U.S. Average	30%	40%	6%	5%	11%	5%	18%

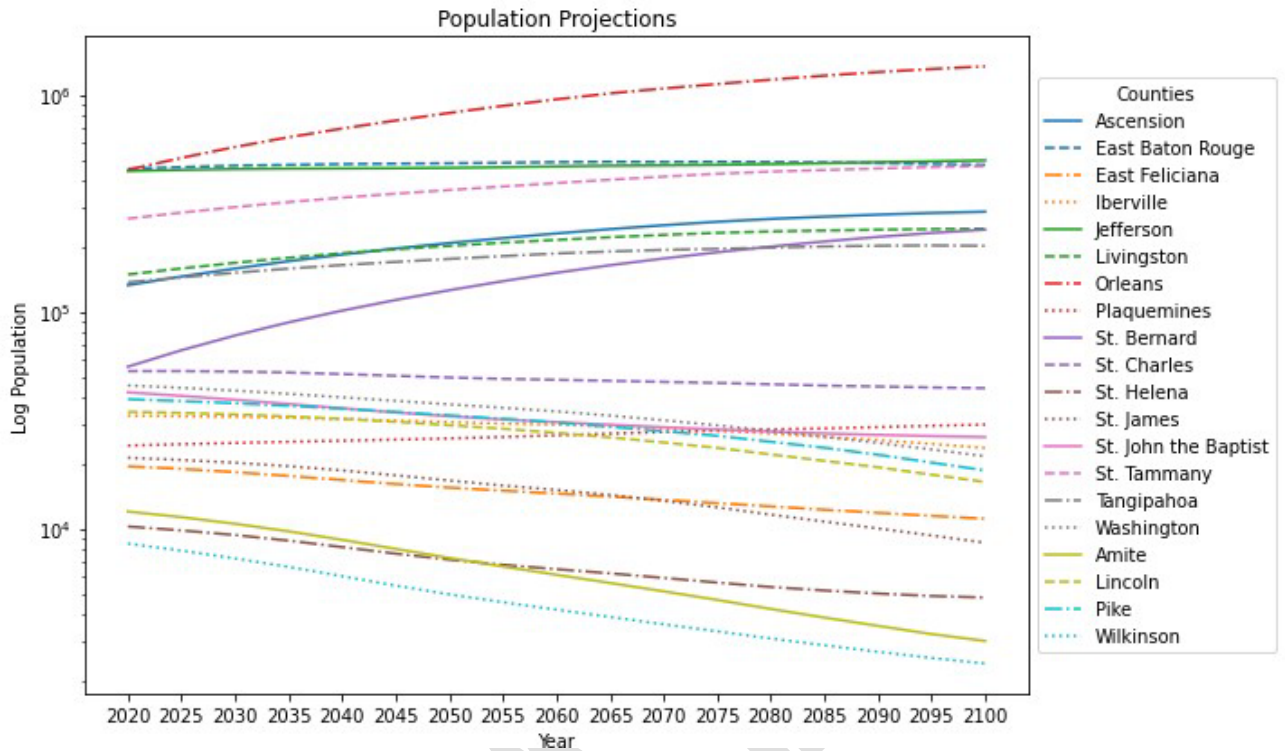
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**Table 5. Socioeconomic indicators of Mississippi counties within the PRP boundary in comparison to the state and national averages (U.S. Census Bureau, 2022).**

COUNTY	LOW INCOME	PEOPLE OF COLOR	UNEMPLOYMENT	LIMITED ENGLISH-SPEAKING HOUSEHOLDS	POPULATION WITH LESS THAN HIGH SCHOOL EDUCATION	POPULATION UNDER AGE 5	POPULATION OVER AGE 64
Amite	51%	42%	8%	0%	12%	5%	25%
Lincoln	39%	11%	4%	0%	6%	7%	12%
Pike	53%	62%	8%	1%	20%	7%	18%
Wilkinson	71%	83%	4%	0%	15%	9%	14%
Mississippi Average	43%	46%	7%	1%	15%	6%	18%
U.S. Average	30%	40%	6%	5%	11%	5%	18%

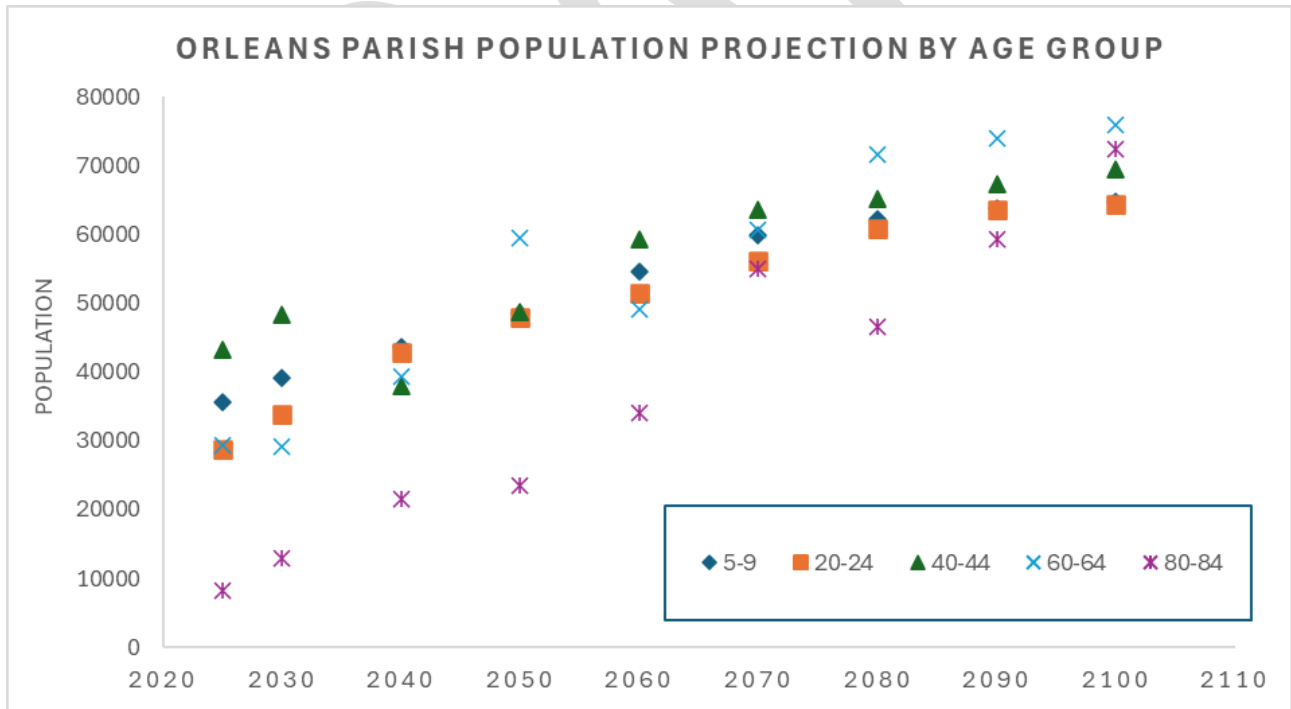
1066 **Recent and Projected Shifts in Demographics**

1067 Hauer (2019) estimated changes in population throughout the U.S. by race, gender, and age between 2020  
 1068 and 2100 using the cohort-component method, which incorporates fertility, mortality, and migration data.  
 1069 Figure 16 illustrates population projections for all parishes and counties within the project boundary. Figure  
 1070 17 and Figure 18 highlight examples of parishes where population projections are expected to increase and  
 1071 decrease, respectively. Historic U.S. census data from 1990–2015 is used to calculate cohort-change ratios  
 1072 and cohort-change differences for various age, sex, and race groups, projecting these using population  
 1073 projection models. The “Middle of the Road” scenario estimates are used here to project total population  
 1074 changes through 2100 in parishes and counties comprising the Pontchartrain Basin. Generally, parishes and  
 1075 counties with lower populations are expected to continue losing population, and parishes experiencing  
 1076 increasing populations will continue to increase.



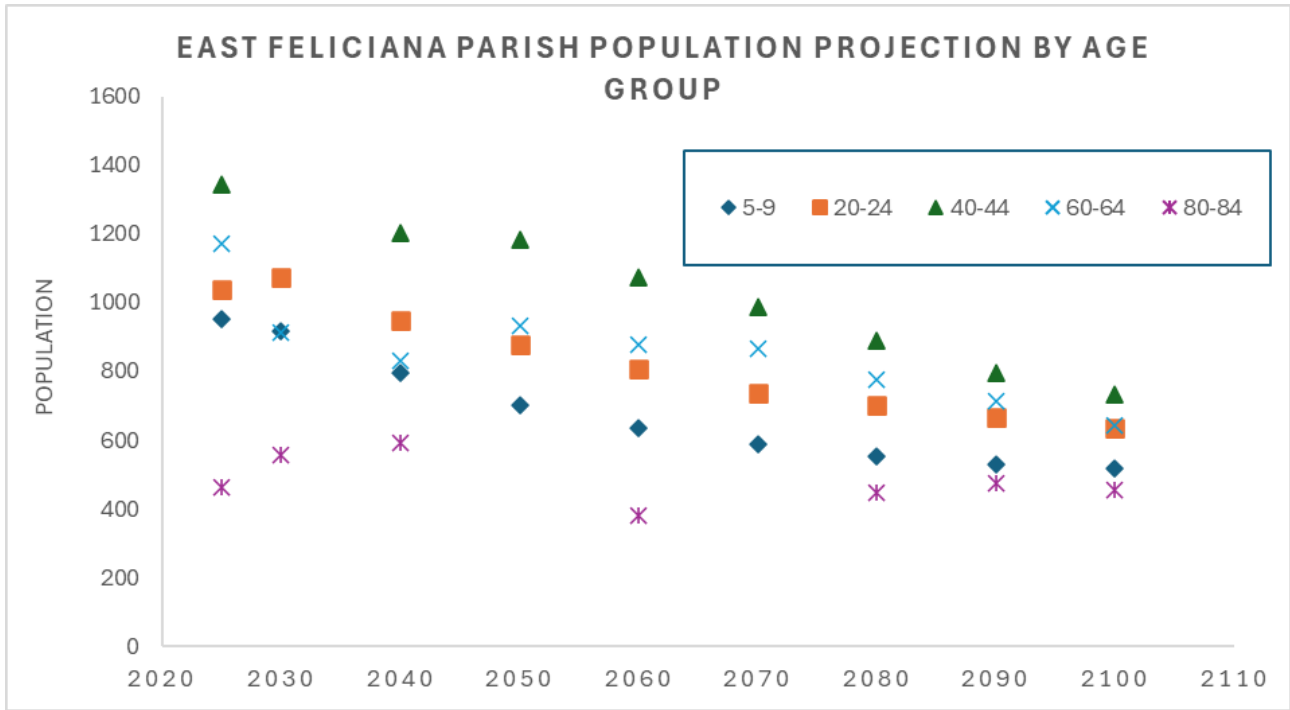
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Figure 16. Population projections through 2100 using the dataset from Hauer (2019) for Louisiana parishes and Mississippi counties within the PRP boundary.



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Figure 17. Breakdown of population projections through time by age group for Orleans Parish.



1083  
1084 **Figure 18. Breakdown of population projections through time by age group for East**  
1085 **Feliciana Parish.**

1086 **ECONOMY, INDUSTRY, AND COMMERCE**

1087 **Overview**

1088 The Pontchartrain Basin is a highly productive region rich in diverse natural resources, including fisheries,  
1089 timber, oil, gas, and minerals. Its abundance has long supported various forms of resource extraction,  
1090 recreation, and tourism, contributing to both local economies and regional development. Recreational  
1091 activities, fisheries, and the hide and skin industry tend to have a lower environmental impact compared to  
1092 the more intensive extraction industries, such as oil and gas, timber, agriculture, and shipping (USGS, 1998).

1093 Table 6 provides a detailed breakdown of the percentage of people employed in various industries across  
1094 different parishes/counties. Amite County and St. Helena Parish stand out with the highest percentages of  
1095 employment in the agriculture sector, at 8.1% and 8% respectively. Livingston Parish leads with the highest  
1096 percentage of employment in the construction sector at 14.1%. East Feliciana and St. John the Baptist  
1097 parishes follow closely with 12.9% and 11.4%, respectively. St. James Parish stands out with the highest  
1098 percentage of employment in manufacturing at 22.3%, suggesting that the parish relies heavily on  
1099 manufacturing as a key component of its local economy. In contrast to the construction and manufacturing  
1100 sectors, the educational services, health care, and social assistance sector dominates employment in most  
1101 parishes. This sector is a significant employer across the region, reflecting the importance of education and  
1102 health care services to the local economies.

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**Table 6. Percentage employment by industry for parishes and counties within the PRP boundary (U.S. Census Bureau, 2023).**

Note: Ascension (ASC), East Baton Rouge (EBR), East Feliciana (EFC), Iberville (IBV), Jefferson (JFS), Livingston (LVS), Orleans (ORL), Plaquemines (PLQ), St. Bernard (STB), St. Charles (STC), St. Helena (STH), St. James (STJ), St. John the Baptist (STB), St. Tammany (STT), Tangipahoa (TNG), Washington (WSH), Amite (AMI), Lincoln (LIC), Pike (PIK), Wilkinson (WIL).

INDUSTRY	ASC	EBR	EFC	IBV	JFS	LVS	ORL	PLQ	STB	STC	STH	STJ	SJB	STT	TNG	WSH	AMI	LIC	PIK	WIL
Agriculture, forestry, fishing and hunting, and mining	1.1	0.9	2.1	3.6	1.0	1.8	0.7	6.9	2.1	1.6	8.0	1.6	0.8	2.1	1.6	2.9	8.1	5.5	3.9	1.0
Construction	9.5	7.3	12.9	9.1	10.0	14.1	4.9	7.7	8.7	9.7	7.8	7.2	11.4	8.0	8.5	9.8	6.7	9.7	3.2	7.4
Manufacturing	14.2	7.6	8.3	11.5	5.6	9.4	3.8	7.1	7.5	10.4	10.6	22.3	10.7	5.9	7.2	8.3	13.3	8.9	16.7	5.4
Wholesale trade	3.2	2.3	1.4	1.4	3.0	2.3	1.7	1.6	2.8	3.2	2.5	1.7	2.2	3.8	1.5	0.6	1.4	2.8	0.7	0.4
Retail trade	10.2	11.3	9.6	9.3	10.8	11.5	8.6	5.0	13.2	8.5	7.7	13.1	12.8	10.9	12.5	14.2	5.6	12.7	11.2	16
Transportation and warehousing, and utilities	5.2	4.4	5.7	4.7	6.6	4.2	6.1	9.2	7.4	8.9	4.5	9.0	6.6	6.3	8.2	4.9	10.0	8.8	10.6	6.7
Information	2.1	2.0	0.7	2.4	1.1	1.2	2.2	1.5	0.7	0.6	0.8	0.2	0.6	1.7	1.3	0.8	0.5	0.3	1.6	9.8
Finance and insurance, and real estate, rental and leasing	6.1	5.5	3.9	6.7	5.8	5.9	5.2	3.1	4.4	4.7	3.3	3.1	3.8	6.9	3.6	4.1	3.4	6.0	3.2	3.1
Professional, scientific and management, and administrative and waste management services	8.4	10.5	7.8	8.0	11.8	9.0	13.8	12.2	9.8	9.5	6.9	8.5	7.6	11.2	7.1	8.8	10.1	6.6	4.0	8.6
Educational services, and health care and social assistance	21.6	26.3	24.6	22.8	22.7	21.6	29.1	20.7	22.3	24.3	26.0	20.0	27.0	24.4	27.2	26.5	22.2	25.3	25.8	21.7
Arts, entertainment, and recreation, and accommodation, and food services	6.8	10.4	6.9	5.6	11.1	8.8	14.1	11.3	10.9	8.1	9.9	5.1	5.7	8.8	10.9	8.6	4.6	4.7	9.5	0.6
Other Services, except public administration	5.3	5.3	6.3	5.5	5.7	4.4	4.9	7.0	4.4	4	3.8	3.0	5.2	5.2	5.5	4.0	9.5	6.4	4.5	8.9
Public administration	6.3	6.2	9.8	9.4	4.8	5.9	4.8	6.7	5.8	6.5	8.1	5.2	5.7	4.8	4.9	6.4	4.5	2.3	5.1	10.4

1106

## 1107 Sectors Affecting the Natural Environment

### 1108 Fishing

1109 The Louisiana seafood industry generates more than \$2.4 billion in economic impact annually, second in the  
1110 nation only to Alaska for volume produced. The 2023/2022 aquaculture (excluding crawfish) and marine  
1111 fisheries<sup>3</sup> (i.e., shrimp, crab, and finfish) sectors in Louisiana were valued at \$274.2 million and \$643.3  
1112 million, respectively. The aquaculture sector includes alligators, turtles, oysters, soft-shell crabs, bait fish,  
1113 and catfish. Within the Pontchartrain Basin, Plaquemines and Livingston parishes produce the highest value  
1114 in the aquaculture industry, between \$20 million and \$30 million, followed by St. Bernard Parish (\$10-20  
1115 million). Plaquemines and St. Bernard parishes had some of the highest gross revenues from marine  
1116 fisheries in the state, reporting >\$50 million and \$25-50 million, respectively. Jefferson Parish also  
1117 contributed to marine fisheries landings with \$10-25 million, while other communities around the lake  
1118 reported less than \$10 million. Crawfish catches are not a contributor to the economies of the Pontchartrain  
1119 Basin (LSU AgCenter, 2023). See ATTACHMENT B for more information on each parish/county.

1120 The success of Louisiana fishermen is also a proxy for health of the entire ecosystem. Many challenges  
1121 reported by the industry reflect coastwide issues, including coastal wetland loss, high river events, damages  
1122 from storms, oil spills, geographic isolation, and opportunities to influence the coastal planning projects  
1123 (Meridian Institute, 2020). The sector is also affected by basin wide pollution and waterway impairments.  
1124 According to the 2024 Louisiana Water Quality Integrated Report, there were 424 waterbody subsegments  
1125 statewide impacted by 1,032 impairments. The leading causes of impairments were DO levels, bacteria,  
1126 mercury, and turbidity (LDEQ, 2024). Various hydrologic projects throughout the basin have and continue to  
1127 alter the salinity regime of certain waterways. During its operation, the MRGO was a conduit for salinity  
1128 intrusion to Lake Pontchartrain, causing stratification and bottom water hypoxia, affecting an area of  
1129 618,000 acres (LPBF, 2006). Its closure after Katrina led to the reduction in salinity in lakes Pontchartrain and  
1130 Borgne and a decreased frequency of hypoxic zones. The response has been a return in the landings of  
1131 finfish, shrimp, and blue crab to pre-MRGO annual variability (Louisiana Department of Wildlife and Fisheries  
1132 [LDWF], 2022). Spillway openings and major hurricanes have also been the subject of study for effects on  
1133 Lake Pontchartrain assemblages and are discussed in the Water Quality section. For more details on water  
1134 quality in the basin and habitat changes, see subsequent sections.

1135 LDWF's responsibilities include ensuring sustainable fish and wildlife resources. Their strategies to maintain  
1136 quality habitat include acquiring and managing properties for wildlife habitat, developing management plans  
1137 for LDWF areas, maintaining public access on LDWF properties, conducting habitat evaluations and surveys,  
1138 providing technical expertise for other government and non-government organizations, implementing actions  
1139 to reduce aquatic nuisance species, and encouraging fisheries that are sustainable and economically viable  
1140 (LDWF, 2022). As discussed above, LDWF operates numerous WMAs to encourage recreation and fishing  
1141 within the Pontchartrain Basin, and they have emplaced several artificial reefs throughout the Pontchartrain  
1142 Basin to enhance encrusting organism growth and provide habitat for numerous aquatic species (LDWF,  
1143 n.d.). These inshore artificial reefs are made from materials like limestone, recycled concrete, and formed

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<sup>3</sup> The 2023 report issues 2022 profit for marine fisheries due to reporting requirements.

1144 concrete (e.g., reef balls). Fishers frequently use these reefs since they are closer to shore. There are 33  
1145 inshore reefs across Louisiana’s coastal basins, including six within Lake Pontchartrain. The agency also  
1146 combats nuisance invasive aquatic vegetative species around the basin through the use of herbicides and  
1147 the introduction of weevils (LDWF, 2019).

## 1148 **Agriculture and Dairy**

1149 The agricultural industry has long been an integral part of the Louisiana culture and economy. In 2023, there  
1150 were over 25,000 farms statewide, and agricultural activities brought a total economic value of over \$12.8  
1151 billion to Louisiana. Although many of these farms are to the west or northwest of the Pontchartrain Basin,  
1152 Northshore and coastal communities within the basin produce significant quantities of agricultural products.  
1153 Plaquemines and East Feliciana parishes have the greatest area of farmland (100,001-150,000 acres each),  
1154 followed by East Baton Rouge and the Northshore parishes of Tangipahoa, St. Tammany, Washington, and St.  
1155 Helena, which each have between 50,001-100,000 acres. These Northshore parishes rank in the top 10 in the  
1156 state for absolute number of farms each (751-1,200). The remaining parishes within the PRP boundary have  
1157 less than 50,000 acres of farmland, reflecting the largely urban nature of the south shore metro area (LSU  
1158 AgCenter, 2023). See ATTACHMENT B for more information on each parish/county.

1159 The Pontchartrain Basin parishes lead the state in produce cultivation, which includes commercial  
1160 vegetables, greenhouse vegetables, fruit crops, pecans, and home gardens. Jefferson, Orleans, St. Tammany,  
1161 Tangipahoa, and East Baton Rouge parishes grossed over \$20 million in 2023, while Livingston, Plaquemines,  
1162 St. Charles, and Ascension parishes grossed between \$6 million and \$20 million. The nursery crops industry,  
1163 which refers to plants, parts of plants, or other plant products grown or kept for propagation, sale, or  
1164 distribution, is also disproportionately concentrated in parishes of the Pontchartrain Basin. In Louisiana, the  
1165 commercial nursery industry primarily focuses on woody ornamentals (trees and shrubs), floriculture and  
1166 bedding plants, foliage crops, and some fruit and nut tree nursery stock production (LSU AgCenter, 2024).  
1167 Washington and Plaquemines parishes lead production with gross farm values greater than \$10 million for  
1168 2023. St. Tammany and Tangipahoa parishes are also in the top 10 parishes for production, with values  
1169 between \$5 million to \$10 million. Wheat, sweet potatoes, sugarcane, and soybean production are largely  
1170 concentrated in other parts of the state but do contribute minor amounts to the basin economy (LSU  
1171 AgCenter, 2023).

1172 The beef industry plays a significant role in the economy of the northernmost parishes in the basin,  
1173 contributing \$10 million to 20 million in gross farm value to Washington, Tangipahoa, St. Helena, and East  
1174 Feliciana parishes and \$5 million to \$10 million to Livingston, Ascension, and East Baton Rouge Parishes for  
1175 2023. Similarly, the state’s dairy industry is heavily concentrated in the parishes in the northern part of the  
1176 Pontchartrain Basin. Tangipahoa and Washington parishes are the most Profitable in the state, with gross  
1177 dairy farm values of over \$3 million. St. Helena Parish is also one of the top 5 parishes in the state for dairy  
1178 production, with a gross farm value between \$1 million and \$3 million. Gross farm value for horses is also  
1179 high in Northshore communities, especially St. Tammany Parish, which had a value of over \$20 million.  
1180 Poultry is a much less important industry for parishes in the basin compared to the northwestern part of the  
1181 state. By value, however, the industry still grossed over \$20 million for St. Helena Parish and under \$20  
1182 million for Tangipahoa and Livingston parishes (LSU AgCenter, 2023).

1183 As described above, most of the agricultural and cattle industries are concentrated in the parishes north of  
1184 Lake Pontchartrain. The runoff from these areas drains into the tributaries of Lake Pontchartrain, thereby

1185 introducing agricultural wastes throughout the entire basin. This non-point source pollutant load will be  
1186 discussed in detail in the Water Quality section.

## 1187 **Logging**

1188 The absence of sustainable practices during the logging boom of 1890-1940 led to the conversion of around  
1189 2 million acres of virgin longleaf pine forests to open area or artificial forests, which lack biologic diversity  
1190 and have diminished ecologic value. Historical and current cypress logging has significantly reduced  
1191 regrowth, resulting in the conversion of many areas to fresh marshes, causing permanent ecosystem-level  
1192 changes (refer to Habitat section for more details). Most logging activities ceased by the mid-20<sup>th</sup> century  
1193 due to the lack of sustainable practices, making this a 'boom and bust' industry. The net habitat loss of virgin  
1194 upland and wetland forests up to 2002 is estimated to be 1,948,000 acres (LPBF, 2006; Lopez, 2009).

1195 Forestry remains an important part of the economy for communities in the Pontchartrain Basin. Besides  
1196 logging, Louisiana's forest industry is comprised of six other subsectors: forestry, primary solid wood  
1197 products, secondary solid wood products, wood furniture, and primary and secondary paper products. In  
1198 2023, Washington and Livingston parishes were the most productive for the industry, grossing between \$15  
1199 million and \$45 million, followed by St. Tammany, Tangipahoa, St. Helena, and East Feliciana parishes, which  
1200 each generated \$5 million to \$15 million. The effects of this industry on water quality and habitat will be  
1201 discussed in subsequent sections.

## 1202 **Sand and Gravel Mining**

1203 Sand and gravel mining along the rivers of the upper Pontchartrain Basin has proven to be a highly  
1204 productive industry due to the abundant deposits of coarse-grained materials formed through Plio-  
1205 Pleistocene fluvial deposition. Such deposition results in well-sorted sediment layers that are often  
1206 accessible at or near the surface (Weathers et al., 2009; Yuill et al., 2016). In 2023, Louisiana was one of the  
1207 leading producing states of sand and gravel, with the largest concentration of mines in the southeastern part  
1208 of the state, near urban areas like New Orleans and Baton Rouge, which require these materials for  
1209 construction. The middle Amite River, with adjoining parishes such as St. Helena, East Feliciana, East Baton  
1210 Rouge, and Livingston, experiences the highest rates of sand and gravel production (Alrehaili, 2023; USGS,  
1211 2024a). According to projections for 2024, the sand and gravel industry in Louisiana is expected to generate  
1212 approximately \$270 million in revenue and provide employment for about 614 individuals (IBIS, 2024). It is  
1213 the second most important non-fuel mineral in Louisiana after salt (USGS, 2017). Such materials are critical  
1214 for ensuring that the infrastructure improvements needed in Louisiana can be met, such as the construction  
1215 of new roads, treatment plants, buildings, and dams (LDEQ, 2007). The effects of sand and gravel mining on  
1216 stream morphology and water quality, however, are similar to those of channel straightening: increased  
1217 erosion, turbidity, and pollutant transport. The industry has also significantly degraded the soil and  
1218 contributed to the loss of freshwater mussels (LPBF, 2006). A more detailed discussion on the disruption to  
1219 channel morphology is presented in the Water Quality section.

## 1220 **Oil and Gas**

1221 In 2018, Louisiana was the 9th largest producer of crude oil and the 4th largest producer of natural gas in the  
1222 U.S. Production occurs throughout the state, with significant new volumes sourced from the centrally located

1223 Tuscaloosa Marine Shale and the Haynesville-Bossier Shale. The Tuscaloosa Marine Shale, which covers  
1224 Tangipahoa, Livingston, Washington, West Feliciana, East Feliciana, East Baton Rouge, St. Helena, and St.  
1225 Tammany parishes, produces both oil and gas. Total job wages from oil and gas extraction in 2019 were  
1226 significant (Louisiana Mid-Continent Oil & Gas Association & American Petroleum Institute, 2020):

- 1227 ● East Baton Rouge Parish: \$20,638,000
- 1228 ● Jefferson Parish: \$21,301,000
- 1229 ● Plaquemines Parish: \$78,705,999
- 1230 ● St. Bernard, St. Charles parishes: \$5,200,168
- 1231 ● St. Tammany Parish: \$194,738,000
- 1232 ● Tangipahoa Parish: \$2,600,084

1233 The oil and gas industry has a long history of intervening in the coastal Louisiana landscape, with peak  
1234 production around 1970. The infrastructure needed to support the industry caused both direct and indirect  
1235 land loss through direct removal of wetlands to dredge canals, induced subsidence and faulting, ecological  
1236 harm from spills and production water, and altering surface hydrology, which has had multiple deleterious  
1237 effects, including acceleration of saltwater intrusion and prevention of nutrient exchange throughout the  
1238 marsh (Day et al., 2020). Between 1932 and 1990, Penland et al., (2001) estimates a direct loss of 60,259  
1239 acres, of which 80% is located in the area southeast of the Orleans Landbridge in St. Bernard and  
1240 Plaquemines parishes. Lopez (2003) estimates another 21,000 acres lost due to combined indirect impacts,  
1241 resulting in a total of 81,259 acres. The combined impact of human activity in the basin is estimated to  
1242 account for up to 2/3 of total land loss (LPBF, 2006). Oil and gas development has also had adverse effects  
1243 on water quality, which is discussed in greater detail in the Water Quality section.

## 1244 **Carbon Capture and Sequestration**

1245 New technologies like carbon capture and sequestration (CCS) are being explored to mitigate carbon dioxide  
1246 emissions from industrial sources. CCS is a technology that involves capturing carbon dioxide from  
1247 industrial sources, compressing it for transport, and injecting it deep underground. In Lake Maurepas, Air  
1248 Products plans to store 5 million tons of carbon dioxide (CO<sub>2</sub>) annually beneath the lakebed. This project is  
1249 currently facing a lawsuit from an environmental group and several Louisiana state agencies over concerns  
1250 about its potential impact on habitat, water quality, and surrounding communities (Unger, 2025). In response  
1251 to these concerns, Southeastern Louisiana University is conducting a monitoring study to provide baseline  
1252 abiotic and biotic data on aquatic and wetland habitats before the Air Products Carbon Sequestration Project  
1253 begins (refer to Habitat section and Water Quality section for monitoring efforts).

## 1254 **RELEVANT FEDERAL AND STATE PROGRAMS**

1255 Efforts to restore and maintain the environmental health of the Pontchartrain Basin rely on a complex  
1256 network of federal and state programs, which address various aspects of water quality, habitat restoration,  
1257 conservation, and community resilience. This section outlines these programs, emphasizing their  
1258 contributions and interconnectedness.

## 1259 **Federal Programs**

1260 The USEPA plays a critical role in overseeing water quality restoration and maintenance in the basin,  
1261 primarily through its implementation of the CWA. Several key programs support these efforts. The PRP  
1262 focuses on restoring the ecological health of the basin through restoration projects, scientific research, and  
1263 public education. Projects funded under this program have targeted improving wastewater and stormwater,  
1264 monitoring water quality, and identifying pollution sources. The Section 319 Nonpoint Source Management  
1265 Program provides grants to support efforts aimed at reducing nonpoint source pollution. In the basin, grants  
1266 have facilitated bacteria reduction in waterbodies such as the Tangipahoa and Tchefuncte rivers, leading to  
1267 their removal from Louisiana’s impaired waters list. The Impaired Waters and TMDL Program establishes  
1268 TMDLs for pollutants in impaired waterbodies, serving as tools for water quality restoration planning. The  
1269 Urban Waters Program revitalizes urban water systems through grants and community involvement,  
1270 supporting projects like wetland restoration monitoring near Lake Pontchartrain. The Clean Water State  
1271 Revolving Fund Program has invested over \$188 million in clean water projects across the basin’s parishes  
1272 since 2015, by offering low-cost financing for water quality infrastructure. The National Water Quality  
1273 Program (NWQP) is a key initiative funded by Congress to monitor and assess the quality of the Nation’s  
1274 freshwater resources, including streams, rivers, lakes, reservoirs, and groundwater. The NWQP aims to  
1275 provide rigorous, science-based information about water quality through various projects, such as the  
1276 National Water-Quality Assessment Project, which evaluates current conditions and trends.

1277 Other relevant federal programs include:

- 1278 ● Louisiana Coastal Area Program: administered by the USACE, takes a systematic approach to coastal  
1279 restoration, including marsh creation, shoreline protection, and barrier island restoration.
- 1280 ● Coastal Impact Assistance Program: a federal initiative designed to assist oil and gas producing  
1281 states and their coastal regions in mitigating the effects of production activities through the USFWS.  
1282 It has funded 66 projects in the basin, including initiatives like installing rock dikes along Lake  
1283 Pontchartrain’s shoreline to mitigate erosion and protect marshes.
- 1284 ● Natural Resource Conservation Service programs:
  - 1285 ○ Conservation Stewardship Program: provides cost-share to private landowners for numerous  
1286 on-the-ground management activities on agricultural lands
  - 1287 ○ Longleaf Pine Initiative is designed to strengthen the resilience of longleaf pine ecosystems,  
1288 which provide critical habitat and natural disaster buffers by promoting sustainable forestry  
1289 practices.
  - 1290 ○ Environmental Quality Incentives Program (EQIP). The Initiatives under EQIP that support  
1291 longleaf pine species include Working Lands for Wildlife - Gopher Tortoise and Northern  
1292 Bobwhite Quail focus species.
  - 1293 ○ Agricultural Conservation Easement Program: administered by the USDA, helps protect,  
1294 restore, and enhance wetlands and working farms through conservation easements.  
1295 Components include:
    - 1296 ○ Agricultural Land Easements (ALE): helps protect croplands and grasslands by limiting non-  
1297 agricultural uses through conservation easements. One limiting factor for ALE is the difficulty  
1298 in finding required match dollars, which is at least 50% of the cost of the project.
    - 1299 ○ Wetland Reserve Easements (WRE): focuses on restoring and protecting wetlands,  
1300 particularly on private lands. While there are currently no WRE nor ALE easements in the

1301 basin, the potential for such projects remains high to safeguard agricultural lands, restore  
1302 wetlands, and promote sustainable practices.

- 1303 ○ Emergency Watershed Protection Program (EWP): offers financial and technical assistance  
1304 for communities recovering from disasters, ensuring swift ecosystem restoration.
- 1305 ○ Hazard Mitigation Assistance Programs: through the Federal Emergency Management  
1306 Agency (FEMA) fund long-term solutions to reduce disaster risks, including floodplain  
1307 management and infrastructure improvements.

1308 The USACE and the USEPA, following guidelines under the CWA, oversee several wetland mitigation banks in  
1309 the basin, along with state agencies. Most of these mitigation banks in St. Tammany Parish include longleaf  
1310 pine flatwood wetlands. Wetland mitigation is intended to compensate for unavoidable loss of jurisdictional  
1311 wetlands, including longleaf pine savanna and related habitats, due to development.

## 1312 **State Programs and Local Support**

1313 In response to Louisiana’s land loss crisis, the U.S. Congress passed the Coastal Wetlands Planning,  
1314 Protection and Restoration Act (CWPPRA) in 1990. This joint federal and state initiative has, from 1990 to  
1315 2018, approved 28 projects aimed at coastal restoration and protection in the Pontchartrain Basin (U.S.  
1316 Government Accountability Office, 2023). The techniques employed include freshwater diversion, marsh  
1317 creation, shoreline protection, terracing, hydrologic restoration, barrier island restoration, and vegetative  
1318 planting (CWPPRA, n.d.-a). Louisiana’s CPRA serves as the state partner for CWPPRA. CPRA was formed in  
1319 2005 and has developed a comprehensive master plan for coastal restoration and protection every 5-6 years.  
1320 Approximately \$8.5 billion is estimated for projects in the Pontchartrain basin, as outlined in the 2023  
1321 Coastal Master Plan. These projects include marsh creation, sediment diversion, and flood risk reduction,  
1322 spanning the planning; engineering and design; construction; and operations, maintenance and monitoring  
1323 phases.

1324 SWAMP is a long-term initiative for coastal data collection in Louisiana, supporting coastal protection and  
1325 restoration. It includes CRMS and BICM. CRMS was established to evaluate the effectiveness of these  
1326 restoration efforts at various spatial scales, from individual projects to their impact on the entire coastal  
1327 landscape. CRMS sites span a range of ecological conditions across swamp habitats and fresh,  
1328 intermediate, brackish, and salt marshes. BICM provides long-term data on barrier islands to aid in  
1329 restoration projects, with USGS and CPRA collaboration.

1330 The Louisiana Department of Agriculture and Forestry (LDAF) provides small cost-share grants for  
1331 management practices of working pine forests, including longleaf pine, through their Forest Productivity  
1332 Program. The Forest Legacy Program is also managed by LDAF. This nationally competitive program, funded  
1333 through the USFS, provides funding for conservation servitudes (easements) on qualifying private land. Only  
1334 one such servitude has been established in the basin in Louisiana, and it is in longleaf pine savanna habitat.  
1335 Other initiatives include the outreach work of private lands biologists with LDWF, who assist landowners and  
1336 managers in habitat enhancement and wildlife management, offering services from simple advice to detailed  
1337 plans for all species.

1338 LDEQ oversees water quality monitoring, TMDL development, and drinking water protection through  
1339 programs like the Drinking Water Protection Program (DWPP) and the Wellhead Protection Program. The  
1340 DWPP, designed by LDEQ, aims to protect drinking water sources and prevent contamination through public

1341 education, community activism, zoning regulations, and contingency planning. The Wellhead Protection  
1342 Program, established in 1989, focuses on protecting public drinking water supplies from contamination, with  
1343 efforts to delineate and inventory source water protection areas and assess contamination risks. The  
1344 Mississippi Department of Environmental Quality's Ambient Biological Network has provided valuable data  
1345 on stream health in the basin's Mississippi watersheds.

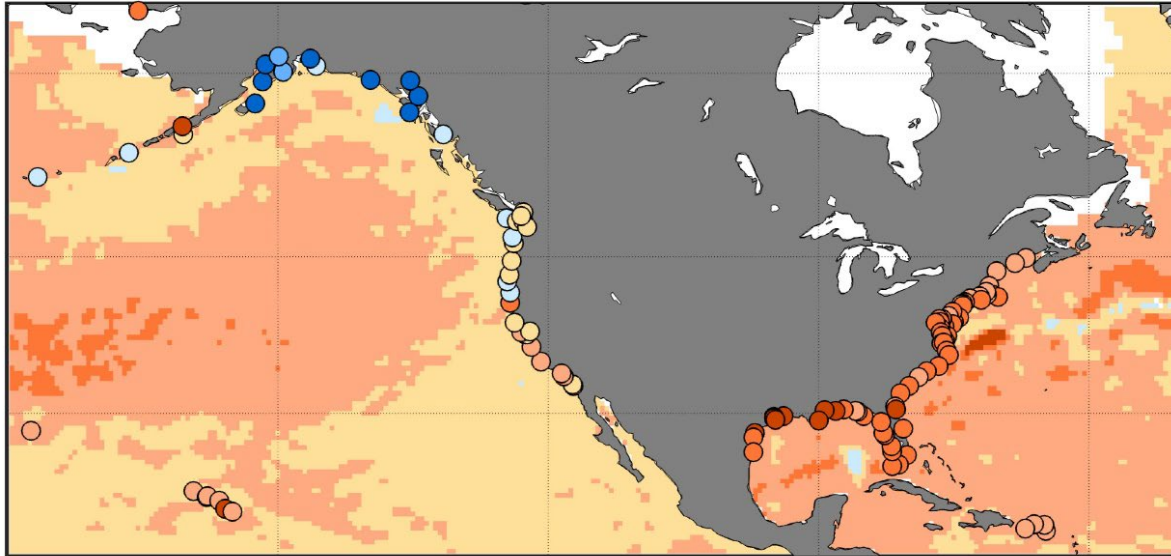
1346 Nonprofit organizations and academic institutions significantly contribute to restoration initiatives.  
1347 Pontchartrain Conservancy, for example, has been instrumental in developing and implementing  
1348 management plans, conducting research, and maintaining a comprehensive environmental health database  
1349 for the basin. Similarly, The Nature Conservancy collaborates with individuals, local communities,  
1350 government agencies, and private businesses to safeguard natural landscapes that support diverse plants,  
1351 habitats and animals. Collaborative projects with federal and state agencies enhance these efforts,  
1352 demonstrating the value of partnerships.

## 1353 **Climate Vulnerability**

1354 The southeastern U.S., rich in cultural and ecological diversity, faces growing threats from environmental  
1355 change, with Louisiana standing out as a particularly vulnerable state. Centuries of systemic inequality and  
1356 land-use decisions have left many communities and ecosystems at risk, amplifying the impacts of rising  
1357 temperatures, sea level rise, and extreme weather events (Figure 19). Heatwaves are becoming more  
1358 frequent and severe, with urban heat islands disproportionately affecting under-resourced communities. Hot  
1359 and humid weather makes it hard for the body to cool down, which can cause heat-related deaths. Vulnerable  
1360 groups, including older adults, children, pregnant individuals, and those with pre-existing conditions, face  
1361 increased risks during extreme heat events. The number of extreme heat days in Louisiana rose from 47 in  
1362 2021 to 82 in 2023, nearly three months of intense heat (Plyer et al., 2025). Heat has caused nearly twice as  
1363 many deaths as flooding in the U.S. over the past 30 years. In 2023, Louisiana saw 88 heat-related deaths, up  
1364 from 15 in 2020. By 2090, rising temperatures are expected to reduce labor hours in the state, particularly  
1365 affecting outdoor jobs in agriculture, construction, and other sectors (Plyer et al., 2025). Simultaneously,  
1366 Louisiana's coastal areas are grappling with rapid sea level rise, projected to increase 22–32 inches by 2050  
1367 relative to the year 2000 in places like Grand Isle, worsening storm surges, and flooding (Hoffman et al.,  
1368 2023). Hurricanes, growing stronger and moving slower, are causing devastating inland flooding,  
1369 compounding risks for vulnerable populations. After Hurricane Ida in 2021, many Louisianans faced  
1370 compounding crises as heatwaves followed the storm, leading to heat-related illnesses and deaths (Lin et al.,  
1371 2024).

1372 Louisiana's agricultural sector also suffers, with rising temperatures reducing crop yields and stressing  
1373 livestock, disproportionately impacting small-scale farmers. Efforts to adapt include physical defenses like  
1374 levees and seawalls and accommodation strategies like elevating structures. In Louisiana, the convergence  
1375 of extreme heat, flooding, and biodiversity loss underscore the urgency for climate adaptation. As the  
1376 population of the southeastern U.S. grows, proactive planning is essential to address climate vulnerabilities  
1377 and protect both people and ecosystems. Louisiana's experiences highlight the challenges and opportunities  
1378 for building resilience in a rapidly changing climate (Hoffman et al., 2023).

## Observed Sea Level Trends



Global average: +1.3 inches/decade  
Contiguous US average: +1.8 inches/decade

Trend (inches/decade)



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**Figure 19. From 1993 to 2020, satellite and tide gauge data reveal that sea level rise along U.S. coastlines has generally exceeded global averages. Notably, the Gulf Coast and Atlantic Coast have experienced the highest rates of increase, with Louisiana's coast showing a significant rise of 4 inches per decade (from Marvel et al., 2023).**

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### RECENT TRENDS

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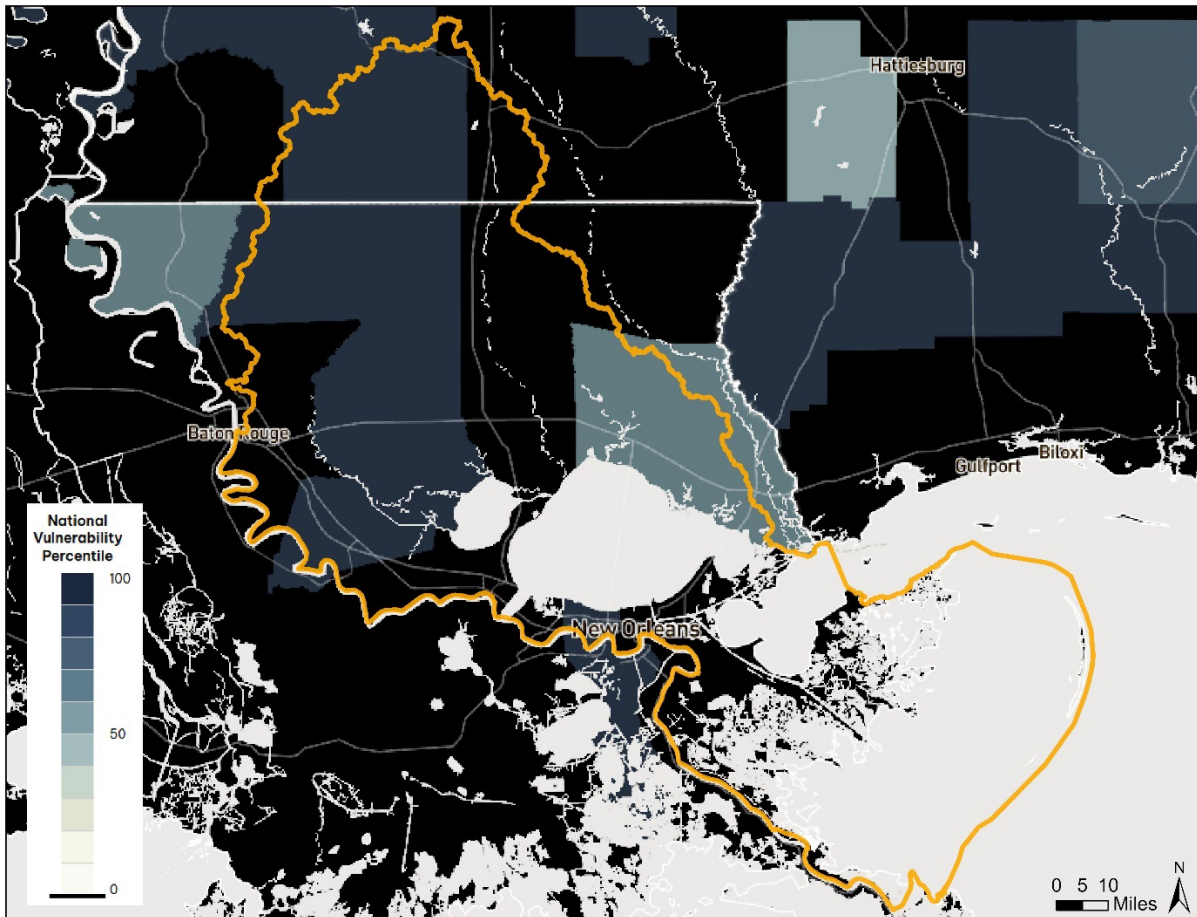
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The Environmental Defense Fund and Texas A&M University, together with numerous partners, have developed an online tool to help policy makers, researchers, and the public visualize the complex effects of environmental change on American communities and understand the interrelation between environmental and socioeconomic metrics (Environmental Defense Fund, 2024). The Climate Vulnerability Index integrates 184 indicators to provide a data-driven tool to assess climate risk at the neighborhood to state-level scale. Indicators represent a range of community baseline or climate impacts categories, including infrastructure, extreme events, social and economic factors, community health indices, and environmental risks. The overarching goal of this tool is to assist planners in allocating resources where most needed and to better prepare for the growing risks to communities from environmental change. Summary reports of overall climate vulnerability are available by state, USEPA region, counties, and census tract. The two states comprising the Pontchartrain Basin, Mississippi and Louisiana, rank 1 and 2, respectively for overall climate vulnerability (Figure 20). Driving the high vulnerability in Louisiana are the indicators for mental health and deaths of despair, infectious diseases, child and maternal health, temperature-related deaths, disaster-related deaths, economic and productivity losses, flood risk, and combined environmental factors risk to community well-being. Of the parishes/counties within the Pontchartrain Basin, Tangipahoa, Washington, St.

1400 James, St. John the Baptist, and Iberville parishes and Pike and Wilkinson counties are in the 98th and 99th  
 1401 national vulnerability percentile. Toxic air pollutants along the Mississippi River industrial corridor, lack of  
 1402 financial or internet services, costs of climate disasters, and disaster-related deaths are some of the main  
 1403 factors contributing to the vulnerabilities of these counties. See Table 7 for values for each parish/county.

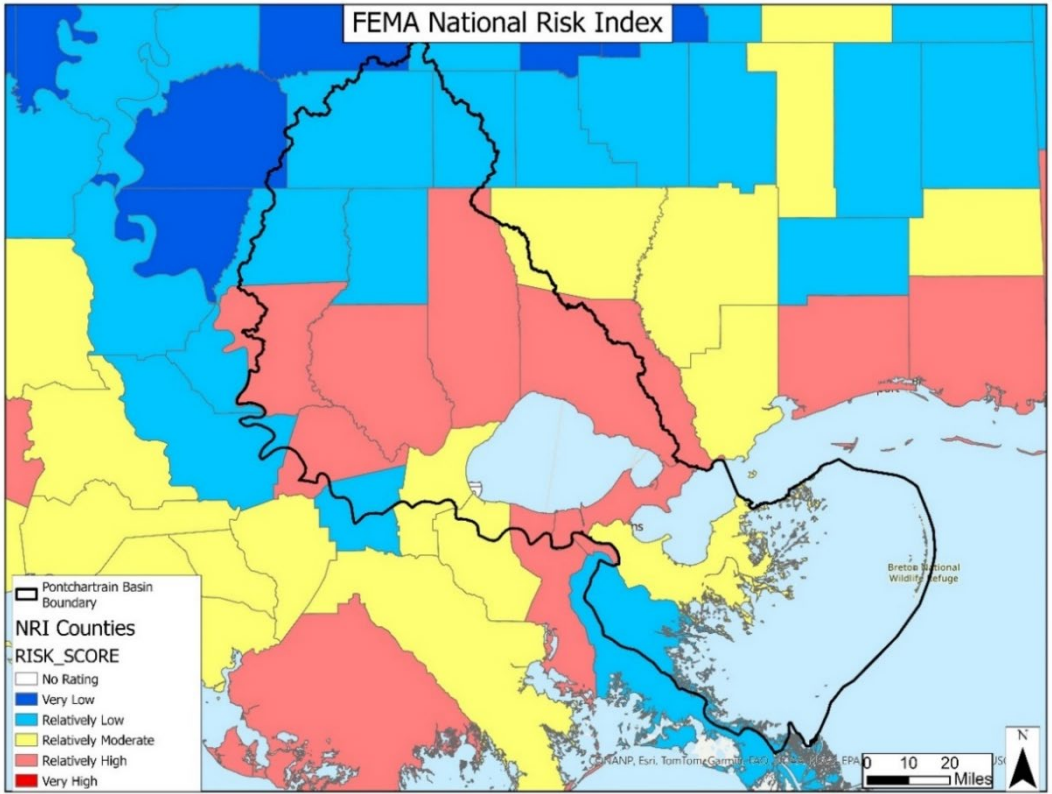
1404 **Table 7. Climate vulnerability indices for parishes/counties within the PRP boundary,**  
 1405 **including national percentiles for flooding and environmental vulnerability. (Environmental**  
 1406 **Defense Fund & Texas A&M University, 2023a, 2023b, 2023c)**

<b>PARISH/COUNTY</b>	<b>OVERALL CLIMATE VULNERABILITY PERCENTILE</b>	<b>FLOODING VULNERABILITY PERCENTILE</b>	<b>ENVIRONMENTAL VULNERABILITY PERCENTILE</b>
Ascension Parish	87	94	98
East Baton Rouge Parish	90	96	99
East Feliciana Parish	81	88	34
Iberville Parish	99	93	95
Jefferson Parish	84	97	99
Livingston Parish	88	93	89
Orleans Parish	93	98	98
Plaquemines Parish	97	92	78
St. Bernard Parish	94	93	98
St. Charles Parish	91	96	99
St. Helena Parish	87	5	9
St. James Parish	99	94	95
St. John the Baptist Parish	100	93	99
St. Tammany Parish	65	91	85
Tangipahoa Parish	99	94	88
Washington Parish	99	26	49
Amite County	81	7	10
Lincoln County	93	53	57
Pike County	98	20	52
Wilkinson County	98	88	38



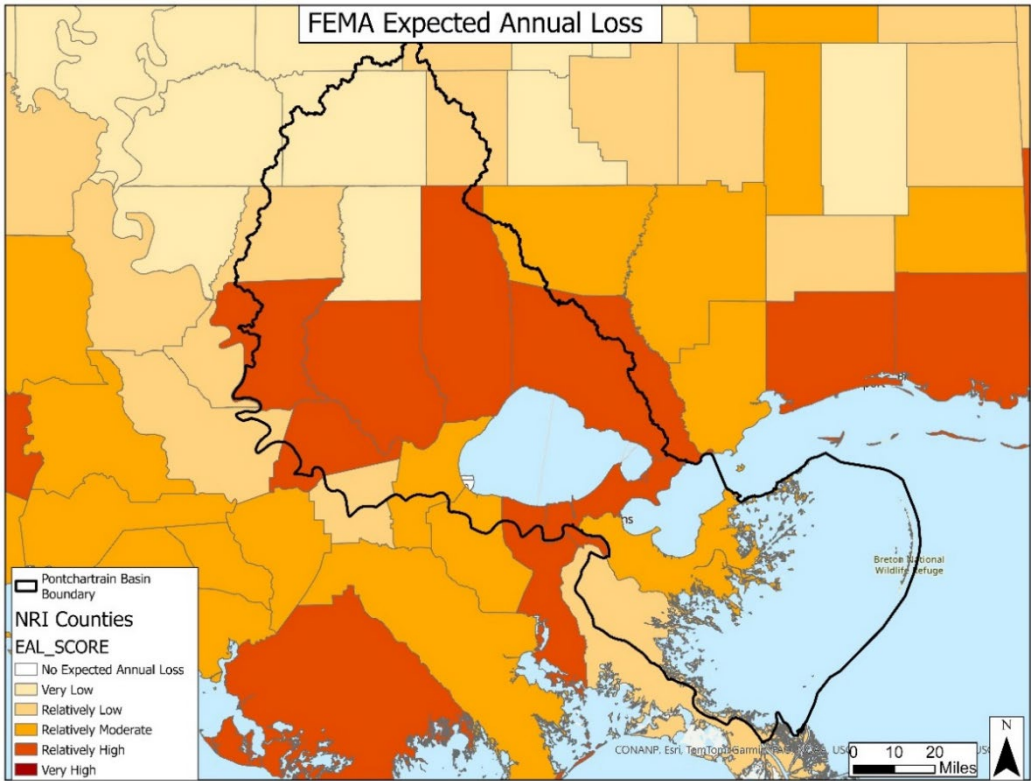
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 1408 **Figure 20. Environmental vulnerability indices for parishes and counties within the PRP**  
 1409 **boundary and adjacent areas (Environmental Defense Fund & Texas A&M University, 2023c).**

1410 FEMA has also initiated an online tool to understand risk, the National Risk Index (Federal Emergency  
 1411 Management Agency [FEMA], n.d.-a). The tool assesses the risk to communities from 18 different natural  
 1412 hazards using a risk equation comprised of expected annual loss, social vulnerability, and community  
 1413 resilience. The risk index of communities within the Pontchartrain Basin varies from very low to relatively  
 1414 high (Figure 21). East Baton Rouge, Jefferson, St. Tammany, Orleans, Livingston, Ascension, and Tangipahoa  
 1415 parishes have the greatest risk with risk index scores above 95 (out of 100). The risk from coastal flooding is  
 1416 greatest to Jefferson and St. Charles parishes, whereas the risk from riverine flooding is high for East Baton  
 1417 Rouge, St. Tammany, Livingston, Ascension, Tangipahoa, Jefferson, and St. Charles parishes. Orleans Parish  
 1418 is the only parish at high risk from heat waves, but East Baton Rouge has the greatest number of high-risk  
 1419 factors, including ice storms, winter weather, lightning, and tornadoes. Jefferson, Orleans, St. Tammany, East  
 1420 Baton Rouge, Tangipahoa, Ascension, and Livingston parishes are all at high risk from hurricanes. The risk  
 1421 index also ranks areas based on expected annual loss in dollar amounts. The parishes encompassing the  
 1422 Pontchartrain Basin range from relatively high to very low, and the pattern generally mirrors that of the risk  
 1423 index (Figure 22).



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1426

**Figure 21. FEMA National Risk Index for parishes and counties within the PRP boundary and adjacent areas (FEMA, 2023a).**



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**Figure 22. FEMA Expected Annual Loss score for parishes and counties within the PRP boundary and adjacent areas (FEMA, 2023b).**

1430 Since 2020, Louisiana has faced an unprecedented number of FEMA-declared disasters, with every parish  
 1431 experiencing at least 13 such events, a figure higher than other states (FEMA, n.d.-b). From the parishes and  
 1432 counties within the project boundary, at least 6 events have been experienced by all. Please refer to Table 8  
 1433 for detailed information. This surge in disasters has significantly impacted housing availability and driven up  
 1434 costs, including insurance rates. Louisiana has suffered the largest damages per capita, amounting to over  
 1435 \$20 billion per million residents, highlighting its heightened exposure to extreme weather events and the  
 1436 strain on its infrastructure and economy. The National Climate Assessment warns that without substantial  
 1437 efforts to adapt to our changing environment, the frequency and magnitude of extreme weather disasters will  
 1438 continue to accelerate, leading to property and infrastructure losses and slowing economic growth (Jay et  
 1439 al., 2023).

1440 **Table 8. Number of FEMA disaster declarations (2020 - 2024) by parish/county within the**  
 1441 **PRP boundary (FEMA, n.d.-b).**

1442 Note: Covers all county-level disaster declarations, excluding COVID. Examples include dam/levee breaks, droughts, earthquakes, fires,  
 1443 floods, hurricanes, landslides, severe storms, tornadoes, and water crises.

PARISH/COUNTY	NUMBER OF DECLARED DISASTERS	PARISH/COUNTY	NUMBER OF DECLARED DISASTERS
Ascension Parish	16	St. Helena Parish	15
East Baton Rouge Parish	16	St. James Parish	15
East Feliciana Parish	15	St. John the Baptist Parish	15
Iberville Parish	16	St. Tammany Parish	15
Jefferson Parish	16	Tangipahoa Parish	15
Livingston Parish	15	Washington Parish	15
Orleans Parish	16	Amite County	7
Plaquemines Parish	16	Lincoln County	6
St. Bernard Parish	16	Pike County	7
St. Charles Parish	15	Wilkinson County	7

1444 One of the most noticeable consequences of Louisiana's environmental vulnerabilities is the rising cost of  
 1445 flood insurance. The National Flood Insurance Program (NFIP) began adjusting policy rates in 2021 to better  
 1446 reflect each property's flood risk, leading to a projected 87 percent increase in the median cost of flood  
 1447 insurance in Louisiana, compared to 64 percent across the U.S. For single-family homeowners, the median  
 1448 cost is expected to reach \$1,470, with even higher costs in certain parishes, such as over \$2,000 in St. John  
 1449 and Jefferson parishes, and more than \$4,000 in Plaquemines parish (First Street Foundation, 2023; Plyer et  
 1450 al., 2025). This significant rise underscores the severe economic impact of increased flood risk on local  
 1451 communities.

1452 **FUTURE CHANGES**

1453 The Climate Mapping for Resilience and Adaptation (CMRA) integrates data from multiple federal data  
 1454 repositories to aid in assessments of community exposure to climate-related hazards projected through the  
 1455 end of the century. Projected future conditions through the end of the century indicate serious challenges  
 1456 posed by five climate-related hazards—extreme heat, drought, wildfire, flooding, and coastal inundation—

1457 under both lower and higher emissions scenarios. Southeastern Louisiana is expected to be at the highest  
1458 risk for coastal inundation in the U.S., particularly in late-century projections where large areas may remain  
1459 below sea level (U.S. Federal Government, 2022). Furthermore, this region is likely to face significant threats  
1460 from pluvial flooding, also ranking among the highest risk areas nationwide. The Gulf Coast as a whole will  
1461 also contend with extreme heat, with estimates suggesting that the Pontchartrain Basin area could  
1462 experience between 109 and 135 days per year exceeding 90°F. The analysis also considers the adoption  
1463 rates of hazard-resistant building codes among jurisdictions at risk from natural hazards, including wind,  
1464 tornadoes, floods, and seismic activity.

1465 NOAA publishes a climate vulnerability assessment tool to evaluate the susceptibility of important species to  
1466 a changing environment (NOAA, 2024). It ranks a species' overall vulnerability based on sensitivity attributes  
1467 and exposure variables, using future projections based on the Representative Concentration Pathway (RCP)  
1468 8.5 scenario. The tool evaluates multiple species within the functional groups (coastal pelagic, coastal,  
1469 elasmobranch, groupers, offshore bottomfish, invertebrate, pelagics, snappers, other reef fish, and  
1470 diadromous). In the Gulf of America, sea surface temperature, ocean acidification, salinity, and air  
1471 temperature are key exposure variables with high scores that will greatly impact species vulnerability. The  
1472 Gulf sturgeon (*Acipenser oxyrinchus desotoi*), which is considered a threatened species under the  
1473 Endangered Species Act, is, by far, the most sensitive to environmental changes, with very high rankings for 9  
1474 of the 12 sensitivity attributes used to assess species vulnerability.

1475 Indices such as the above attempt to holistically assess risk by not only quantifying the predicted damage to  
1476 the environment but also factoring in socioeconomic variables. This approach allows one to predict how well  
1477 a community can withstand stressors, which is important for planning and allotting resources. To better  
1478 understand the results of these analyses, it is helpful to understand the demographics of the region. This is  
1479 discussed in depth in the above Human Environment section.

1480 In summary, the integration of climate and socioeconomic data through tools like CMRA and NOAA's climate  
1481 vulnerability assessment provides a comprehensive understanding of the risks faced by communities and  
1482 species in the Pontchartrain Basin and the Gulf of America. These insights are crucial for developing  
1483 targeted interventions and adaptive strategies to mitigate the impacts of climate-related hazards. By  
1484 considering both environmental and socioeconomic factors, planners and policymakers can better allocate  
1485 resources and implement measures to enhance resilience and protect populations and ecosystems  
1486 vulnerable to extreme weather events.

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# WATER QUALITY

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## Introduction

The measure of water quality is linked to the suitability or capacity of surface and groundwater for specific uses or needs, such as drinking water or support of fisheries or recreation, among other important uses. The measures are linked to specific physical, chemical, and biological parameters. Physical parameters include measures of turbidity, dissolved solids, and color. These measures can affect light penetration in the water column as well as impact water column oxygenation. Chemical measures usually include dissolved oxygen (DO), pH, alkalinity, and conductivity as a proxy for salinity and also include concentrations of nutrients, metals, and organic contaminants. The biological measures include biochemical oxygen demand and quantification of coliforms, bacteria, viruses, toxins produced by harmful algae, and chlorophyll  $\alpha$  as an indicator of photosynthetic organisms. The criterion for measures is dependent upon the waterbody use and the assimilative capacity of the waterbody for the specific contaminant.

A watershed is a parcel of land where all the precipitation and surface waters such as streams, rivers, and lakes flow “downhill” into a final collection point at the bottom of the watershed. Some watersheds are small in area, while the Mississippi River watershed makes up all or parts of 31 United States (U.S.) states and 2 Canadian provinces. All that water eventually flows down to Louisiana and discharges into the northern Gulf of America. All the human activities that take place in a watershed that produce nutrients, contaminants, and even trash, can be carried by the water and deposited in the sediments of the lakes, rivers, and streams or carried to the ultimate destination, the coastal ocean.

There are generally two “sources” of nutrients or contaminants in a watershed. They can be classified as point sources and non-point sources. The U.S. Environmental Protection Agency (USEPA) defines “point source”<sup>4</sup> as a single, identifiable source of pollution that can be traced to a specific location. These can include pipes, ditches, sewage treatment plants, industrial facilities, and stormwater drainage systems.

The non-point source is a source of pollution that does not meet the Clean Water Act (CWA) definition of a point source. Non-point source pollutants are driven by rainfall or snowmelt that moves across and through the ground collecting natural and human-produced pollutants which eventually discharge into lakes, streams, rivers, wetlands, coastal, and ground waters. Non-point source can also be referred to as run-off, as the water collects contaminants from various sources before ending up in streams, lakes, and rivers and can therefore not be identified from a single source. There are also contaminants which are considered hydrophobic while others are easily dissolved in water. For example, salts which dissolve readily in water can be transported through a watershed. Hydrophobic compounds do not dissolve well in water (e.g., oil and

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<sup>4</sup> More information can be accessed via the following link:

[https://oceanservice.noaa.gov/education/tutorial\\_pollution/03pointsource.html#:~:text=The%20U.S.%20Environmental%20Protection%20Agency%20\(EPA\)%20defines%20point%20source%20pollution,common%20types%20of%20point%20sources](https://oceanservice.noaa.gov/education/tutorial_pollution/03pointsource.html#:~:text=The%20U.S.%20Environmental%20Protection%20Agency%20(EPA)%20defines%20point%20source%20pollution,common%20types%20of%20point%20sources)

1856 pesticides) and tend to move through the watershed attached to organic particles or at the surface as a  
1857 scum.

1858 Once contaminants and nutrients are deposited in sediments, they can slowly be re-released back into the  
1859 water. This contamination is called the internal or sediment load, which is more difficult to quantify. Over  
1860 long periods of time, contaminants build up in the sediments of aquatic systems. Unless these sediments  
1861 are physically removed through dredging, the sediments can release these contaminants back into the water  
1862 column, further degrading water quality. When that occurs, the nutrients and contaminants leak out of the  
1863 sediment even faster, under a larger concentration gradient, and can work against nutrient and contaminant  
1864 reduction programs. Some contaminants can be degraded by biological processes while other contaminants  
1865 are not so easily broken down. Further, contaminants can accumulate in both plants and animals depending  
1866 on specific characteristics.

1867 Wetlands play a special role in the watershed, providing numerous ecosystem services and benefits, and they  
1868 are especially important for water quality improvement. The broad definition of wetlands includes areas  
1869 which undergo intermittent to continuous flooding to develop hydric soils and have specially adapted  
1870 vegetation for surviving flooded conditions. Wetlands provide numerous mechanisms for water quality  
1871 improvement including promoting particle settling, sorption of nutrients and contaminants to soils, microbial  
1872 transformations such as converting bioavailable nitrate to nitrogen gas, as well as plant uptake of nutrients  
1873 and subsequent storage in the soil. Therefore, any processes which lead to degradation or disconnect of  
1874 wetland systems from surface waters, generally leads to reduction of water quality of surface waters.

## 1875 **WATER QUALITY STANDARDS**

### 1876 **Role of Government in Maintaining Water Quality**

#### 1877 **Permitting**

1878 The Louisiana Department of Environmental Quality's (LDEQ) Louisiana Pollutant Discharge Elimination  
1879 System (LPDES) is responsible for permitting discharges in Louisiana waterways in compliance with the  
1880 CWA and the Louisiana Environmental Quality Act (La. R.S. § 30:2001). A permit is required for any activity  
1881 that discharges a pollutant from a point source into water. This includes required stormwater discharge  
1882 permits for certain construction operations. Permits are also required for solid and hazardous waste  
1883 disposal, offshore oil and gas facilities with produced water, and sewage sludge and biosolids. LDEQ is the  
1884 agency responsible for enacting Section 401 of the CWA requiring federal license or permit applicants  
1885 discharging into water to obtain either a water quality certification or waiver. Such certifications are required  
1886 for USACE CWA Section 404 and Section 10 of the Rivers and Harbors Act permits. Other permits affecting  
1887 water quality are issued by the Louisiana Department of Energy and Natural Resources (LDENR), including  
1888 groundwater and surface water use and extraction.

#### 1889 **Enforcement and Surveillance**

1890 LDEQ is responsible for the enforcement of water quality standards and regulations. Their process relies on  
1891 reviews of files and discharge monitoring reports, instances of permit noncompliance, and field  
1892 investigations. During the reporting period between quarter four of 2018 and 2022, LDEQ issued numerous

1893 enforcement actions, including 36 notices of corrected violations, 85 notices of violations, 681 compliance  
1894 orders, 91 amended compliance orders, 36 notices of potential penalty, 13 administrative orders, 211  
1895 penalties, 147 settlement agreements, and 30 instances of sanitary wastewater assistance training. This  
1896 resulted in receipt of over \$3 million in penalties and over \$4 million from settlement agreements (LDEQ,  
1897 2024a).

## 1898 **Water Use Designations and Standards**

### 1899 **Federal Level**

1900 At the federal level, water quality standards, defined by USEPA, consist of three components: the designated  
1901 use of the waterbody, criteria, and antidegradation requirements.<sup>5</sup> Some typical designated uses include  
1902 protection and propagation of fish, shellfish, and wildlife; recreation; public drinking water supply; and  
1903 agricultural, industrial, or navigational. The criteria can be numeric or narrative (e.g., a description that  
1904 describes the desired condition of the water body being free from certain negative conditions) and adopted  
1905 to protect the designated use. Antidegradation is one of the principal objectives of the CWA which is to  
1906 “maintain the chemical, physical, and biological integrity of the nation’s waters.” This provides the framework  
1907 for maintaining and protecting water quality that has already been achieved.

### 1908 **State Level**

1909 LDEQ is the state agency responsible for ensuring comprehensive environmental protection. In addition to  
1910 regulating uses and standards, LDEQ also conducts monitoring efforts to help ensure comprehensive water  
1911 quality protection. Water quality standards are established by LDEQ within the Louisiana Administrative Code  
1912 (LAC). Specifically, Title 33, Part IX, of the LAC outlines the state's water quality regulations and standards.  
1913 The LDEQ, through this code, sets standards for surface water quality and other water-related regulations.  
1914 The Louisiana Department of Health (LDH) also plays a role in enforcing drinking water regulations through  
1915 its Safe Drinking Water Program. These standards consist of designated uses, water quality criteria, and  
1916 antidegradation. Louisiana’s code designates major Louisiana waterbodies for specific uses, which include  
1917 recreational uses (Table 9), of which there is primary contact recreation (e.g., swimming) or secondary  
1918 contact recreation (e.g., skin contact), aquatic life uses (i.e., fish and wildlife propagation, limited aquatic life  
1919 and wildlife use, oyster propagation), and other uses (i.e., drinking water supply, agriculture, or outstanding  
1920 natural resource waters). Designated uses serve as the framework for water management planning and  
1921 regulatory enforcement. Water quality criteria are either general or numerical criteria that set permissible  
1922 amounts of substances or characteristics to support a designated use. General criteria are narrative  
1923 descriptions, such as aesthetics, color and odor, while numeric criteria are set values applied to specified  
1924 water based on their designated uses. These criteria are reviewed and updated to reflect new knowledge and  
1925 methods every three years as required by the CWA in a process called the “triennial review.” The review  
1926 includes the opportunity for the public to voice any concerns at a hearing. The antidegradation policy

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<sup>5</sup> More information can be accessed via the following link: <https://www.epa.gov/wqs-tech/what-are-water-quality-standards>

1927 prevents unnecessary degradation of water quality by any new or increased discharges. Exceptions are made  
 1928 for activities that accommodate “important economic or social development” (Phillippe, n.d.; LDEQ, 2024a).

1929 **Table 9. Measurements by LDEQ to support designated uses for Louisiana waterbodies**  
 1930 **(LDEQ, 2022a).**

1931 Notes:

- 1932 1. LDEQ’s Ambient Water Quality Monitoring Network DO routine grab samples are used as an initial screening for DO criteria  
 1933 assessments. In the event the criterion is not met, continuous monitoring for DO may be initiated.  
 1934 2. Enterococci criteria apply only to coastal marine waters, gulf waters to the state three-mile limit, coastal bays, estuarine waters,  
 1935 and adjacent subsegments with recreational beach waters. (LAC 33:IX.1113.C.5.a.i)

DESIGNATED USE	CORE INDICATORS AND BASIS FOR USE SUPPORT DECISION
Fish and Wildlife Propagation	<ul style="list-style-type: none"> <li>• Dissolved Oxygen (mg/L) (Continuous Monitoring) - Percent exceedance<sup>1</sup></li> <li>• Temperature - Percent exceedance</li> <li>• pH - Percent exceedance</li> <li>• Chloride - Percent exceedance</li> <li>• Sulfate - Percent exceedance</li> <li>• Total Dissolved Solids - Percent exceedance</li> <li>• Turbidity - Percent exceedance</li> <li>• Toxic Substances - Less than two exceedances in three years</li> <li>• Ammonia - Less than two exceedances in three years</li> <li>• Metals - Less than two exceedances in three years - Percent exceedance<sup>1</sup></li> </ul>
Limited Fish and Wildlife Use	<ul style="list-style-type: none"> <li>• Dissolved Oxygen - Percent exceedance<sup>1</sup></li> <li>• Dissolved Oxygen (mg/L) (Continuous Monitoring) - Percent exceedance<sup>1</sup></li> </ul>
Primary Contact Recreation	<ul style="list-style-type: none"> <li>• Fecal Coliform - Percent exceedance</li> <li>• Enterococci<sup>2</sup> - Percent exceedance and geometric mean</li> <li>• Temperature - Percent exceedance</li> <li>• Toxic Substances - Less than two exceedances in three years</li> </ul>
Secondary Contact Recreation	<ul style="list-style-type: none"> <li>• Fecal Coliform - Percent exceedance</li> <li>• Toxic Substances - Less than two exceedances in three years</li> </ul>
Drinking Water Supply	<ul style="list-style-type: none"> <li>• Color - Percent exceedance</li> <li>• Fecal Coliform - Percent exceedance</li> <li>• Toxic Substances - Less than two exceedances in three years</li> <li>• Metals - Less than two exceedances in three years</li> </ul>
Outstanding Natural Resource Waters	<ul style="list-style-type: none"> <li>• Turbidity - Percent exceedance</li> </ul>
Agriculture	<ul style="list-style-type: none"> <li>• None (indicated by support of other designated uses) – N/A</li> </ul>
Oyster Propagation	Fecal Coliform - Percent exceedance

1936 Louisiana continues to work with USEPA to collect information that will inform water quality criteria  
 1937 development and implementation. USEPA recognizes that “one size fits all” criteria are not appropriate and  
 1938 recommends that each state’s criteria be waterbody-specific (e.g., lakes, rivers and streams, estuaries, etc.)  
 1939 and applicable within an appropriate ecoregional framework (LDEQ, 2024a). Louisiana has prioritized inland  
 1940 waterbodies with projects in inland rivers and streams, lakes, and reservoirs (LDEQ, 2024a).

1941 Louisiana’s water quality regulations (LAC, Title 33:IX.1101 et seq; LAC 2021) were used to determine water  
 1942 quality uses, criteria, and assessment procedures. One of the primary foci of USEPA’s Integrated Report

1943 guidance is on the use of categories to which waterbodies or waterbody/impairment combinations (WIC)  
1944 may be assigned. A WIC is a single parameter (e.g., low DO) or other impairment assigned to a waterbody  
1945 subsegment for assessment purposes. Subsegments are watersheds or portions of watersheds delineated  
1946 as management units for water quality monitoring, assessment, permitting, inspection, and enforcement  
1947 purposes. Categorization under Integrated Report guidance allows for a more focused approach to water  
1948 quality management by clearly determining which actions are required to protect or improve individual  
1949 waters of the state (LDEQ, 2024a).

## 1950 **Background and Progress**

### 1951 **WATER QUALITY MONITORING IN THE PONTCHARTRAIN BASIN**

1952 Multiple agencies regularly sample and maintain water quality databases throughout Louisiana, including the  
1953 Pontchartrain Basin. LDEQ is the state agency responsible for ensuring comprehensive environmental  
1954 protection. LDEQ breaks up the Pontchartrain Basin into 108 subsegments. Most waterbodies are identified  
1955 as a single subsegment, however several are subdivided into two or more. For example, the Tangipahoa River  
1956 is divided into two subsegments, and the Tchefuncte River is divided into four subsegments, based on the  
1957 areal expanse.

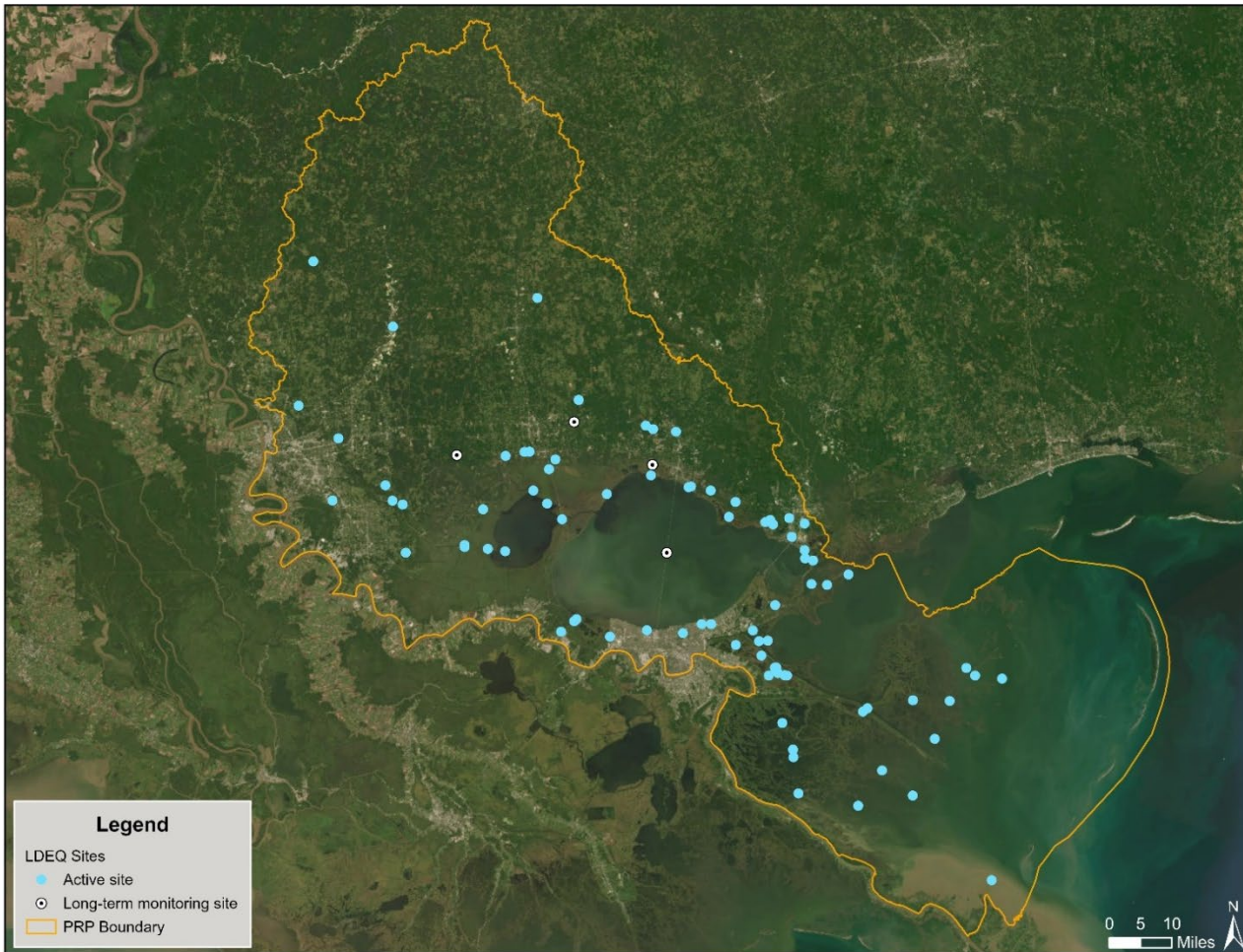
1958 LDEQ provides the largest, most comprehensive database of water quality data in the Pontchartrain Basin  
1959 through their Ambient Water Quality Monitoring Network and provides additional data through other  
1960 programs available through the Louisiana Environmental Assessment Utility Web Portal (Figure 23). Initiated  
1961 in 1958, the Ambient Water Quality Monitoring Program<sup>6</sup> collects and analyzes surface water samples  
1962 throughout the state, providing data for more than 500 sites. In 1998, the program implemented a 4-year  
1963 rotating monitoring plan, whereby ~125 stations are sampled each month (Figure 23). An additional 21 sites  
1964 across 16 waterbodies are sampled monthly as part of an effort to identify long-term trends. The program  
1965 also runs special projects such as the Mercury Initiative and the Statewide Pesticide Monitoring Program.  
1966 Within the Pontchartrain Basin, there are currently 103 active monitoring stations in the Pontchartrain Basin.  
1967 Field sampling campaigns include field measurements of traditional ancillary parameters such as  
1968 conductivity, temperature, pH, and DO in addition to collection of samples for laboratory analysis. The  
1969 constituents analyzed vary through time and across sites. Typical parameters include metals, alkalinity,  
1970 organic compounds, halogens, and nutrients (LDEQ, 2024a). Groundwater quality is similarly measured  
1971 through the Aquifer Sampling and Assessment Program (ASSET), albeit with much fewer samples. The  
1972 program includes approximately 200 wells, though the absolute number depends on owner participation.  
1973 Samples throughout 14 of the major aquifers are monitored on a 3-year rotating basis. LDENR also oversees  
1974 water quality as part of its responsibility for managing resource extraction.

1975 The U.S. Geological Survey (USGS) and USEPA also provide a combined dataset from numerous agencies  
1976 through their water quality portal.<sup>7</sup>

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<sup>6</sup> More information can be found via the following link: <https://deq.louisiana.gov/page/ambient-water-quality-monitoring-data>

<sup>7</sup> More information can be found via the following link: <https://www.waterqualitydata.us/>



1977  
1978  
1979

**Figure 23. Spatial distribution of active water quality LDEQ sampling stations (103 stations) and long-term monitoring stations (4 stations).**

1980 The Pontchartrain Conservancy maintains monitoring programs for the Lake Pontchartrain system. The  
 1981 Recreational Monitoring Program has been sampling 13 recreational locations around the lake weekly since  
 1982 2001 (Figure 24). Parameters that are measured include salinity, temperature, DO, water clarity, and both  
 1983 biological parameters of enterococci and fecal coliform. In 2023, the program was extended to Lake  
 1984 Maurepas. The water quality team works with individuals around the basin to help assess and repair  
 1985 wastewater treatment plants (WWTP). The Pontchartrain Conservancy also launched a program with St.  
 1986 Tammany Parish to monitor Bayou Bonfouca through assessment of both home septic systems and water  
 1987 quality in the outfall areas.



1988  
1989  
1990

**Figure 24. Pontchartrain Conservancy water quality sampling stations which report data weekly focused on recreational use (Pontchartrain Conservancy, n.d.).**

1991

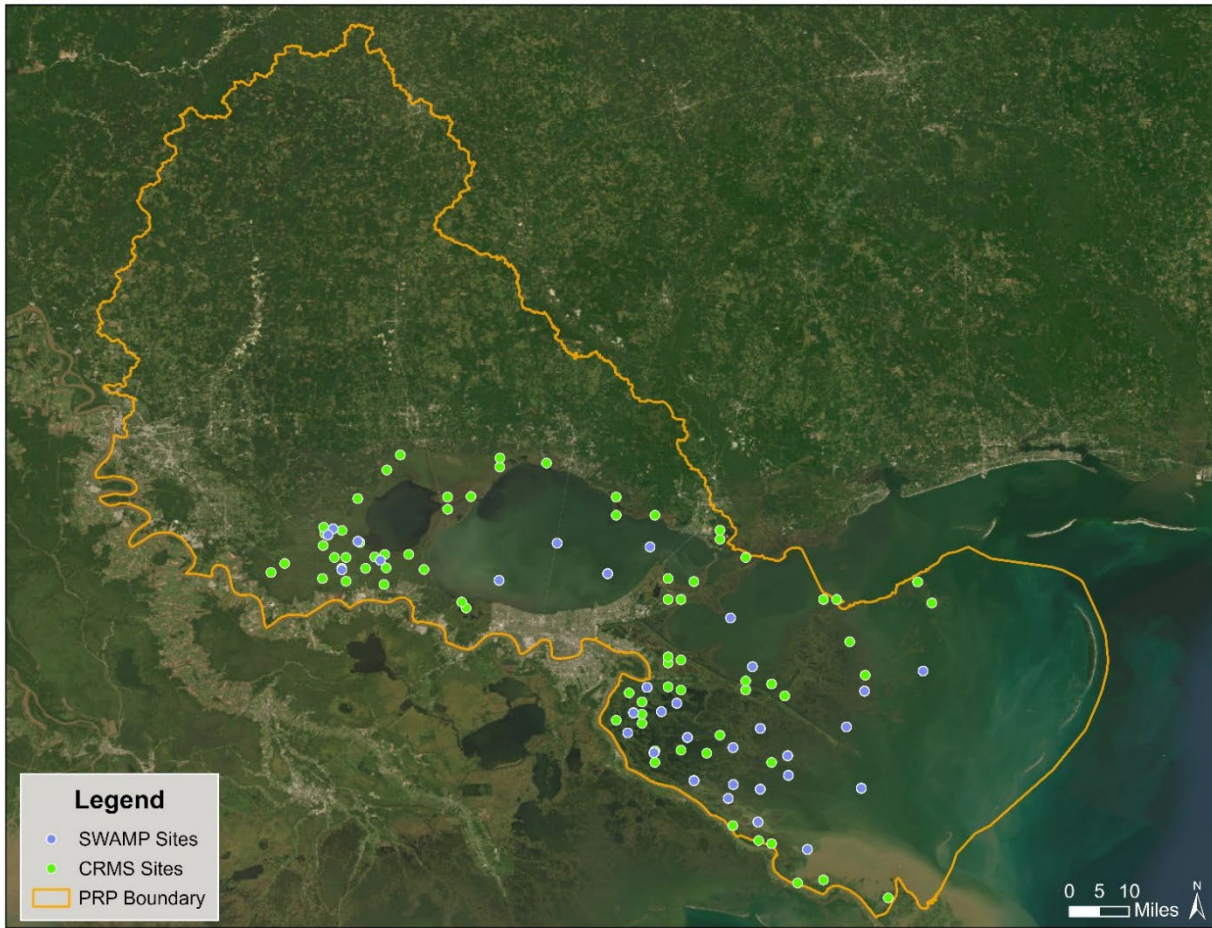
### **State, Regional, and National Level Collaborations**

1992 The Coastal Protection and Restoration Authority (CPRA) and USGS jointly operate the Coastwide Reference  
 1993 Monitoring System (CRMS)<sup>8</sup> to monitor and evaluate the effectiveness of coastal restoration projects (Figure  
 1994 25). CRMS was designed to monitor the effectiveness of restoration actions at multiple spatial scales from  
 1995 individual projects to the influence of projects on the entire coastal landscape. The monitoring includes  
 1996 surface water level, salinity, and temperature on an hourly basis and porewater nutrients monthly (if present).  
 1997 The data can be accessed and downloaded from the Coastal Information Management System (CIMS)  
 1998 database.<sup>9</sup> The System-wide Assessment and Monitoring Program (SWAMP) program is the overarching  
 1999 program under which falls CRMS for wetland monitoring; SWAMP stations are represented in Figure 25.

<sup>8</sup> More information can be accessed via the following link: <https://lacoast.gov/crms/>

<sup>9</sup> More information can be accessed via the following link: <https://cims.coastal.louisiana.gov/>

2000 There is also the Barrier Island Comprehensive Monitoring (BICM) program, which provides long-term data  
2001 on the barrier islands of Louisiana, which also falls under SWAMP.



2002  
2003 **Figure 25. CRMS and SWAMP monitoring sites within the PRP boundary (CPRA, 2018; CPRA**  
2004 **& USGS Wetland and Aquatic Research Center, n.d.).**

2005 The U.S. Army Corps of Engineers (USACE) maintains several dozen surface water gages throughout the  
2006 Pontchartrain Basin.<sup>10</sup> This dataset predominantly reports river stage but provides information at certain  
2007 sites for temperature, wind velocity, cumulative precipitation, and atmospheric pressure.

2008 The Water Quality Portal<sup>11</sup> is the primary database for water quality in the U.S., combining data from the  
2009 USGS, USEPA, and local agencies. This data set includes the National Water Information System from the  
2010 USGS and the Water Quality Exchange and now archived STORET databases from the USEPA. Hundreds of

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<sup>10</sup> More information can be accessed via the following link: <https://rivergages.mvr.usace.army.mil/WaterControl/new/layout.cfm>

<sup>11</sup> More information can be accessed via the following link: <https://www.waterqualitydata.us/>

2011 constituents are reported, including organic compounds, salts, metals, nutrients, bacteria, etc. in addition to  
2012 descriptive parameters (e.g., color, turbidity).

2013 The RESTORE Council Monitoring and Assessment Program (CMAP)<sup>12</sup> is administered by NOAA and USGS  
2014 with a goal to create a comprehensive environmental monitoring network in the Gulf of America. CMAP  
2015 Phase 1 focused on existing habitat and water quality monitoring and mapping programs, and Phase 2  
2016 included living marine resources monitoring. An ArcGIS dashboard was developed to provide access to  
2017 tabular and spatial programmatic information from both phases.

2018 Gulf of America Alliance (GOAA)<sup>13</sup> oversees a data and monitoring program focusing on improving the  
2019 region's environmental and economic health through data sharing and collaboration. This program includes  
2020 the Gulf Online Mapping Open Data Platform (GOMOD) with the goal of improving stakeholder access to data  
2021 related to coastal and ocean management. GOAA also develops a comprehensive monitoring structure to  
2022 support state and regional program coordination and reduce redundancy.

2023 The Mississippi River/Gulf of America Hypoxia Task Force<sup>14</sup> membership includes federal and state agencies  
2024 and tribes. There are ten states along the mainstem of the Mississippi River and two states along the  
2025 mainstem of the Ohio River that participate. The tribes are represented by the National Tribal Water Council.  
2026 The role of the task force is to provide executive level direction and support for coordinating the actions of  
2027 participating organizations working on nutrient management (nitrogen and phosphorus) in the Mississippi-  
2028 Atchafalaya River basin.

## 2029 Water Quality Issues

### 2030 WATER QUALITY ISSUES IN THE PONTCHARTRAIN BASIN

2031 There are a number of water quality issues/impairments within the basin which have been identified by  
2032 LDEQ's long-term monitoring (Table 10). These impairments from the large-scale sampling in 2022 include  
2033 enterococcus (48), DO (46), mercury (42), fecal coliform (20); turbidity (16), low pH (16), and total dissolved  
2034 solids (13) (LDEQ, 2022a). There were also additional impairments from <10 stations, which included sulfate,  
2035 temperature, chloride, ammonia, and copper (Table 10). These results are from 103 active stations, such that  
2036 the number of stations approximates percent of stations in the watershed under a specific listed impairment.

2037 **Table 10. Results from the 2022 basin wide monthly water quality survey by LDEQ listing**  
2038 **cause of impairment and number of stations in the basin where the impairment was found**  
2039 **(LDEQ, 2022a).**

CAUSE OF IMPAIRMENT	NUMBER OF SAMPLING STATIONS
Enterococcus	48

<sup>12</sup> More information can be accessed via the following link: <https://coastalscience.noaa.gov/project/restore-council-monitoring-and-assessment-program-building-a-comprehensive-monitoring-network/>

<sup>13</sup> More information can be accessed via the following link: <https://gulfofamericaalliance.org/>

<sup>14</sup> More information can be accessed via the following link: <https://www.epa.gov/ms-htf>

CAUSE OF IMPAIRMENT	NUMBER OF SAMPLING STATIONS
Dissolved Oxygen (DO)	46
Mercury, Fish Consumption Advisory	45
Fecal Coliform	20
Turbidity	16
pH, Low	14
Total Dissolved Solids	13
Chloride	8
Sulfate	8
Temperature	7
Ammonia, Total	3
Copper	2

2040 **Ammonia**

2041 Ammonia, as a nutrient, can come from breakdown of organic matter or as fertilizers or wastewater sources.  
 2042 Elevated ammonia can lead to eutrophication or excessive plant and algal growth. This excessive algal  
 2043 growth can lead to low DO in the water when the plant matter decomposes. Elevated concentrations can be  
 2044 toxic to aquatic organisms, interfering with the respiratory system.

2045 **Chloride**

2046 Chloride is a naturally occurring element and can come from the weathering of rocks and minerals as well as  
 2047 from human activities. Chloride is the most abundant anion in seawater and a major component of salinity.  
 2048 Concentrations of chloride in surface water can cause damage to freshwater aquatic ecosystems by  
 2049 damaging organisms. Elevated chloride concentrations can be toxic to amphibians and fish. Chloride can  
 2050 enter the aquatic environment due to road salting in northern areas as mitigation for icy roads.

2051 **Copper**

2052 Copper is a naturally occurring element and can come from industrial waste as well as from weathering of  
 2053 rocks. Copper can impact the taste of drinking water and chronic exposure can lead to kidney and liver  
 2054 damage. Less severe effects can include digestion issues and allergic reactions.

2055 **Dissolved Oxygen**

2056 DO is important for supporting all stages of fish species and can be impacted by stagnating water. While O<sub>2</sub>  
 2057 (oxygen) makes up ~21% of the atmosphere, the diffusion of O<sub>2</sub> in water is 10,000 times slower than in the  
 2058 air. Consequently, very low velocity surface water can have very low DO as a consequence of this low  
 2059 diffusion rate. Faster flowing water typically has much higher DO as ripples and waves drive air bubbles into  
 2060 the water, providing a much quicker aeration compared to slow diffusion. Low DO can lead to fish kills and  
 2061 death of other aquatic organisms.

## 2062 **Enterococcus and Fecal Coliform**

2063 The biological water quality measures of enterococcus and fecal coliform<sup>15</sup> indicate that problems exist in  
2064 the watershed related to potential septic tank leakage, wastewater treatment failure, or runoff. Enterococci  
2065 are bacteria which can indicate the presence of fecal material, viruses, and pathogenic bacteria. Fecal  
2066 coliforms also refers to a type of bacteria indicating the presence of human or animal waste, which could  
2067 then lead to waterborne diseases.

## 2068 **Mercury**

2069 Mercury is an element and comes from volcanoes as well as from the weathering of rocks. Mercury is  
2070 typically sourced from the atmosphere from coal-fired power plants, industrial processes, and incinerators  
2071 and makes up the majority of listings for either atmospheric deposition or sources unknown. Smaller  
2072 amounts of mercury can also come from the natural environment as well. Mercury can be found in the  
2073 elemental form where vapors are an issue. Inorganic mercury can damage kidneys and organic mercury,  
2074 which is the most common form in fish and shellfish, can lead to neurological damage and developmental  
2075 problems in children (Sharma et al., 2019).

## 2076 **pH**

2077 The pH is a measure of the amount of acid or base present in a liquid. The acid, H<sup>+</sup>, and the base, OH<sup>-</sup>, are  
2078 actually the two components of water, H<sub>2</sub>O. The value of 7 is considered neutral, and most aquatic systems  
2079 pH values range between 6-8. At low pH, considered acidic, heavy metals can be leached, which can impact  
2080 environmental health. Low pH can affect gills of fish and can lead to reproductive failure and even mortality.  
2081 High pH is also problematic, damaging gills, skin, and eyes of fish and decreasing reproduction and  
2082 biodiversity.

## 2083 **Sulfate**

2084 Sulfate is a naturally occurring oxidized form of sulfur and is the second most abundant anion in seawater  
2085 after chloride. Reduced sulfur (hydrogen sulfide) can give a "rotten egg" smell that you typically experience in  
2086 salt marshes as a result of microbial activity. Elevated sulfate in drinking water can lead to gastrointestinal  
2087 issues and can also lead to eye/throat irritation during swimming activities.

## 2088 **Temperature**

2089 Warmer temperatures lead to decreases in the DO concentrations in surface waters, which can impact  
2090 benthic organisms, causing death. Colder water can contain the highest concentrations of DO. Higher  
2091 temperatures can increase the proliferation of harmful bacteria, viruses, and other pathogens, including  
2092 *Vibrio* sp., which may be present in surface waters.

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<sup>15</sup> More information can be accessed via the following link: <https://archive.epa.gov/water/archive/web/html/vms511.html>

## 2093 **Turbidity and Total Dissolved Solids**

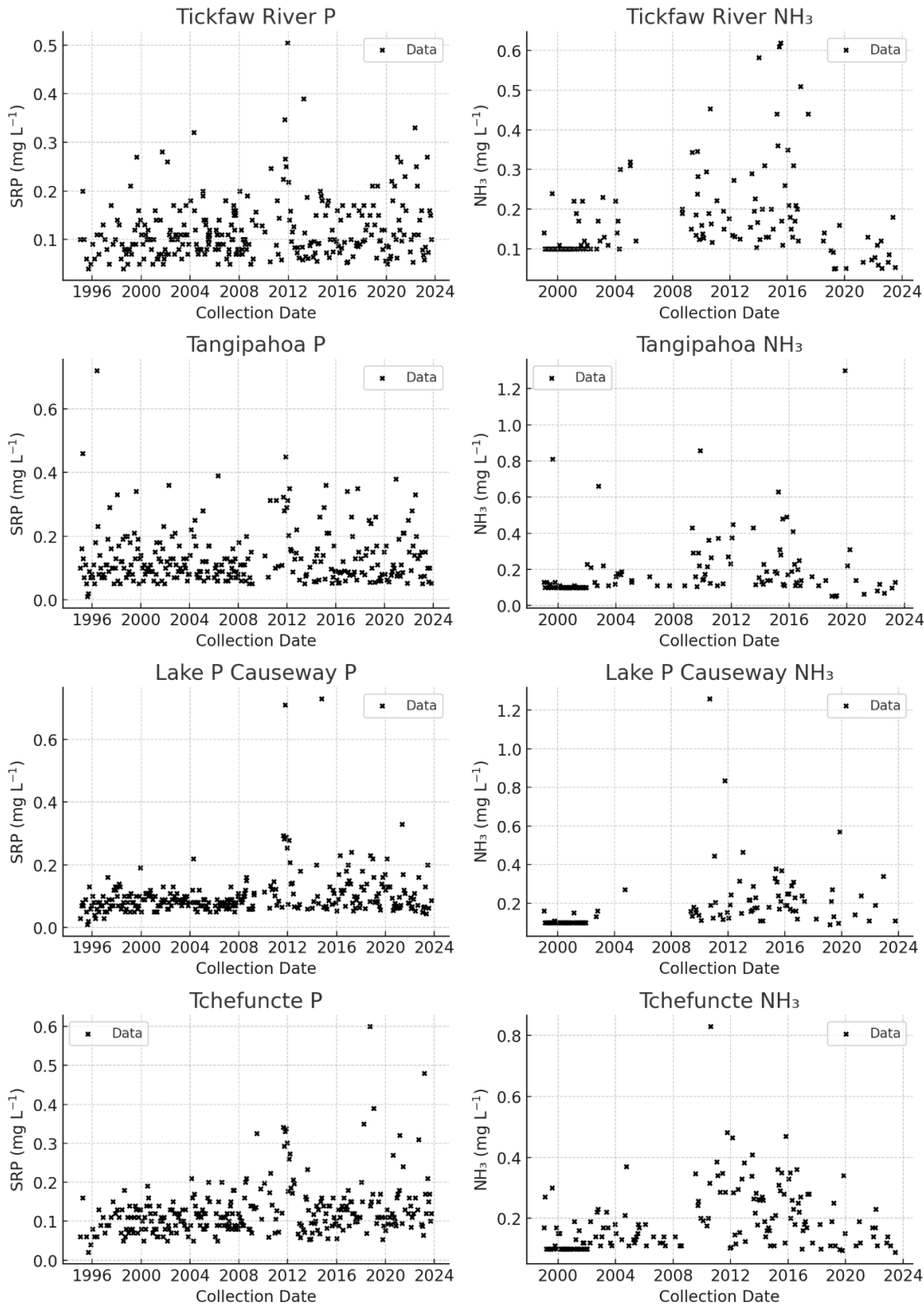
2094 Turbidity and total dissolved solids are two distinct measures of water clarity. Turbidity is an optical property  
2095 that measures how much light can pass through the water, while total dissolved solids is the fraction of  
2096 particles and ions, including metals, minerals, and salts, that can pass through a filter with a 2-micron  
2097 (micrometer) pore size. The measurement of turbidity is more focused on light attenuation by particles in the  
2098 water, while total dissolved solids is focused on chemical constituents in the water, but some dissolved  
2099 substances can impart color, which can limit light penetration of the water column.

## 2100 **Watershed Dynamics, Processes, and Long-term Water Quality Trends**

2101 When examining nutrient trends, one can look at concentrations with time in the LDEQ database. Figure 26  
2102 depicts data from the four LDEQ long-term, continuous water quality stations in the Pontchartrain Basin for  
2103 both ammonia and total phosphorus, as both nitrogen and phosphorus can lead to expressions of  
2104 eutrophication in waterbodies (Figure 26). When plotting the data, there appears to be a slightly increasing  
2105 trend for ammonia, however, there is significant scatter within the time series (Figure 26; left panel). The  
2106 ammonia presence is likely related to the generally low DO that is found in basin waterbodies and could also  
2107 be potentially sourced from wastewater and septic systems. The ammonia concentrations demonstrate high  
2108 variability over time, and this is usually the case with long-term data. Large rainfall events as well as drought  
2109 periods can all lead to high variability in surface water quality concentrations. High rainfall events will dilute  
2110 the concentrations, while droughts will lead to increased evaporation of water and actually increase the  
2111 overall concentrations. Ammonia is a concern at high concentrations because it can contribute to algal  
2112 blooms.

2113 There appears to be a general increasing trend. However, again, there is large variability over time, with high  
2114 values, likely related to higher river discharge or storms, which suspend sediment particles into the water  
2115 column (Figure 26: right panel). This apparent pattern is particularly true for the three river stations: Tickfaw,  
2116 Tangipahoa, and Tchefuncte. The total phosphorus values for the Lake Pontchartrain causeway station are  
2117 more muted with far fewer excursions from the trendline. This is likely related to the greater depth of the  
2118 lake, distance from the inflow points, and low velocity flow. Examining total phosphorus concentrations are  
2119 important because high concentrations, as with N, can lead to algal blooms.

2120 To better analyze statistical trends, LDEQ published a report in 2021, which examined the long-term data  
2121 (LDEQ, 2021). One potential issue with the water quality database is that values below the detection limit are  
2122 coded at the detection limit, where the likelihood is that numbers are lower. Also, water quality data are  
2123 generally not normally distributed and therefore require specialized statistical tests (non-parametric) to  
2124 examine the trends. They found that for TKN (a measure of ammonia and organic nitrogen), there was a  
2125 significant decreasing trend for all long-term sites in the Lake Pontchartrain watershed. The trend for nitrous  
2126 oxides showed no significant change at Lake Pontchartrain or Tchefuncte sites, while decreasing at the  
2127 Tangipahoa and Tickfaw sites. The overall long-term trend for total phosphorus was increasing at Lake  
2128 Pontchartrain, significantly decreasing at Tangipahoa, with no change in trend for Tchefuncte and Tickfaw  
2129 River sites. The increasing trend for Lake Pontchartrain is likely linked to the increased use of the Bonnet  
2130 Carré Spillway, which diverts phosphorus-rich sediment from the river into the coastal basin (Roy et al.,  
2131 2017).



2132

2133 **Figure 26. Water quality trends in the Pontchartrain Basin at the four LDEQ long-term**  
 2134 **stations from 1995-2023. The left panel depicts total phosphorus, while the right panel**  
 2135 **depicts ammonia (LDEQ, 2024b).**

2136 The Pontchartrain Conservancy focuses much of its water quality sampling along the shore of Lake  
 2137 Pontchartrain on recreational use. Therefore, enterococci and fecal coliforms are monitored weekly as  
 2138 potential human health issues. Table 11 shows a long-term average and range for a number of water quality  
 2139 parameters for a single station. The Pontchartrain Conservancy publishes a warning via a map of the lake  
 2140 indicating safety for recreation to inform the public of the more recent water quality results.<sup>16</sup>

2141 **Table 11. Example of select water quality data from the Pontchartrain Conservancy focused**  
 2142 **on recreational use.**

2143 Note: MPN = most probable number.

WQ MEASURE	STATISTICAL MEASURE	STATION LP1	UNITS
DO	mean	7.99	mg/L
DO	range	3.18-13.5	mg/L
pH	mean	7.41	pH units
pH	range	5.06-8.87	pH units
Salinity	mean	1.39	parts per thousand
Salinity	range	0-6.26	parts per thousand
Enterococcus	geometric mean	144	MPN
Enterococcus	range	1-2,420	MPN
Fecal coliform	geometric mean	193	MPN/100 ml
Fecal coliform	range	1-5,400	MPN/100 ml

2144 The term "pollutant" means dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge,  
 2145 munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded  
 2146 equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water  
 2147 (CWA, section 502).<sup>17</sup> Studies on pollution throughout Pontchartrain Basin waterways are relatively sparse,  
 2148 considering the extent and nature of the problem. To illustrate this point, a literature search was made on  
 2149 Scopus, a database of research literature and web sources, including abstracts and research paper citations.  
 2150 The literature review of "Pontchartrain" and "pollution" returns only 62 results compared to 912 results when  
 2151 searching "Chesapeake Bay" and "pollution." This disparity may be related to the fact that the Chesapeake  
 2152 Bay program is defined under the CWA (Section 117) and has received an executive order 2021-2025 budget  
 2153 of approximately \$455 million. Consequently, continuous federal funding for some locations allows much  
 2154 greater research efforts than other watersheds. Despite acknowledgement from numerous agencies that  
 2155 quantifying the annual pollutant load into the Pontchartrain Estuary would be valuable, the necessary data to  
 2156 make such determinations is lacking and would require more investment than is currently allotted (LDENR,  
 2157 n.d.). Furthermore, most studies on water quality in the Pontchartrain Estuary are focused on the effects of  
 2158 Mississippi River spillway openings and other river diversions as opposed to a baseline level of pollution (see  
 2159 Basin Characterization section). Lopez (2009) outlines the main causes of water pollution, largely beginning

<sup>16</sup>More information can be accessed via the following link: <https://sciencefourcoast.org/water-quality/water-quality-results>

<sup>17</sup> More information can be accessed via the following link: <https://www.epa.gov/cwa-404/clean-water-act-section-502-general-definitions>

2160 in 1950, which coincides with a doubling in the human population in the watershed, the establishment of the  
2161 petrochemical corridor, oil and gas production direct discharge to wetlands, oil spills, and the use of  
2162 dichlorodiphenyltrichloroethane (DDT). LDEQ recently identified thousands of miles of impaired rivers and  
2163 streams in Louisiana. Although the exact source of each impairment is not fully understood, a large share of  
2164 the impairments is attributed to septic systems and discharge from unsewered areas (LDEQ, 2024a).

## 2165 **Urban Growth**

2166 As far back as the 1940s, municipal planning has struggled to keep pace with urban growth in the basin.  
2167 Water quality has been consistently degraded through stormwater runoff and a lack of wastewater  
2168 treatment. In particular, the development of St. Tammany Parish and the conversion of rural land to  
2169 impervious surfaces characteristic of suburban sprawl, coupled with poorly managed sewage treatment,  
2170 resulted in widespread contamination of the basin's waterways.<sup>18</sup> Beginning in the 1980s, an increase in  
2171 fecal coliform levels, a decrease in nitrogen levels, an increase in phosphorus, and a decrease in DO resulted  
2172 from the urban expansion, and waterways historically used for swimming and fishing came under  
2173 restrictions. (Bourgeois-Calvin et al., 2004; Carstens & Amer, 2019). Urban expansion comes with increased  
2174 population, which puts greater demand on centralized wastewater treatment systems and increased septic  
2175 system use in the basin. The increase in fecal coliform levels is likely due to septic systems aging/lack of  
2176 maintenance, and the increase in phosphorus likely stems from increased runoff associated with impervious  
2177 surfaces and agriculture. A decrease in nitrogen is generally seen when land use changes from agricultural  
2178 to forested due to decreased fertilizer use (Kim et al., 2023). Locally, nutrients can increase due to runoff  
2179 from golf courses and lawns.

2180 A review by the Lake Pontchartrain Basin Foundation (now Pontchartrain Conservancy) identified issues with  
2181 individual wastewater treatment plants, many of which lacked discharge permits and/or did not function  
2182 properly in the mostly clay soils (Bourgeois-Calvin et al., 2004). In clay soils, water cannot drain through the  
2183 soil. When these systems do not function properly, the septic systems can back up and overflow at the  
2184 surface, with untreated water being released to the environment.

2185 Installation permits are required by LDH for individual and package WWTPs. In Livingston Parish, these  
2186 systems were found to be a significant contributor to degraded surface water quality. It is clear that regional-  
2187 scale WWTPs are necessary to treat wastewater and to handle the increase in development/growth in the  
2188 basin watersheds. (Livingston Parish Planning Commission, 2013).

2189 Urban runoff is a significant mechanism of pollution to surface streams and lakes, especially on the south  
2190 shore of Lake Pontchartrain, where much of the area consists of impervious surfaces. Large rainfall events  
2191 contribute to large surface runoff events. If surface runoff is not captured, there can be large discharge loads  
2192 of fecal bacteria to Lake Pontchartrain in the stormwater. Following a large rainfall event, indicator  
2193 organisms (i.e., fecal coliform, *Escherichia coli*, enterococci) are generally elevated in the surface water for a  
2194 few days before returning to background concentrations. Bacterial die off is a function of several factors,

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<sup>18</sup> More information can be accessed via the following link:  
[https://www.stpgov.org/departments/environmental\\_services/wastewater.php](https://www.stpgov.org/departments/environmental_services/wastewater.php)

2195 including sorption and sedimentation, sunlight, temperature, and salinity (Jeng et al., 2005; Xue et al., 2018).  
2196 Runoff can also discharge debris into surface waters, which also serves to degrade water quality.

2197 The primary metals impairing the Pontchartrain Basin are copper (two impairments) and mercury (140 fish  
2198 consumption impairments, one swimming impairment) (LDEQ, 2024a). LDEQ is currently looking at two  
2199 Pontchartrain subsegments and has an approved Quality Assurance Project Plan (QAPP) from the USEPA for  
2200 metals (LDEQ, 2024b). In addition, LDEQ has approved QAPPs for *Escherichia coli* and enterococci (LDEQ,  
2201 2023b) and harmful cyanobacterial blooms (cyanoHABs; LDEQ, 2022b). Beyond the standard water quality  
2202 parameters measured, there is a class of emerging contaminants for which there are no current criteria.  
2203 These can include pharmaceutically active compounds and microplastics. Stormwater runoff to drainage  
2204 canals in Orleans Parish was found to have detectable concentrations of pharmaceuticals, personal care  
2205 products, and endocrine disrupting chemicals, and their contaminant level correlated with rainfall (Boyd et  
2206 al., 2004). Much less is known about these 'emerging' contaminants (see more details under Data Gaps), and  
2207 the impact on the Pontchartrain Basin ecosystem is unknown. Litter (e.g., trash bags, tires, appliances, and  
2208 other illegal dumping) has also been noted to contribute a variety of contaminants to the lake and its  
2209 tributaries (Weathers et al., 2009). Stormwater management needs better structuring to prevent future  
2210 development from increasing flood hazards to existing development, to protect existing hydrologic functions  
2211 within the watershed, and to maintain and improve water quality (Louisiana Silver Jackets, 2021).

2212 The Municipal Separate Storm Sewer Systems (MS4) Storm Water Management Program (SWMP)<sup>19</sup> requires  
2213 permittees to develop and implement a comprehensive program that includes pollution prevention measures,  
2214 treatment or removal techniques, monitoring, and other appropriate measures to control the quality of  
2215 stormwater discharged to the storm drains and thence to the waters of the U.S.

2216 Stormwater best management practices (BMPs) can include detention and retention systems, infiltration  
2217 systems, and filtration systems. These systems can be structural, or they can employ nature-based solutions  
2218 (green infrastructure) that can improve habitat and water infiltration. Detention systems are designed to hold  
2219 water during storm events and allow it to percolate into the ground or be released over time, usually within  
2220 24-72 hours from collection, removing pollutants. Retention systems are usually wet systems, which are  
2221 designed to hold water and retain it on the landscape for the long term, controlled by outlet structures (weirs,  
2222 spillways, outlets, etc.), and release excess water to help manage flood waters. Infiltration systems are  
2223 highly porous surfaces that allow water to quickly penetrate the soil, though these systems require highly  
2224 permeable soils like sand and can include pervious paving, which can be combined with aggregate  
2225 subsurface storage. Filtration systems seek to filter stormwater using plants, sands, and gravel and may be  
2226 combined with other BMPs. These may include wetlands or bioswales. LDEQ also seeks to educate the  
2227 public and increase the community's involvement in watershed protection activities. Educational materials  
2228 include one-page fact sheets entitled Home Sewage, Fertilizing Lawns, Household Hazards, Nutrient  
2229 Impairments, and Sedimentation Impairment.

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<sup>19</sup> More information can be accessed via the following link: <https://www.epa.gov/tx/municipal-separate-storm-sewer-system-ms4-storm-water-management-program-swmp>

## 2230 **Industry**

2231 The LDEQ 2024 Water Quality Integrated Report suggests that industrial activities are not a major source of  
2232 chemicals to drinking water. Their monitoring results indicate 237 detectable concentrations from 63,300  
2233 organic chemical analyses. Of the detectable concentrations, 12 exceeded human health drinking water  
2234 criteria, one exceeded human health non-drinking water criteria, and four exceeded aquatic life criteria  
2235 (LDEQ, 2024a).

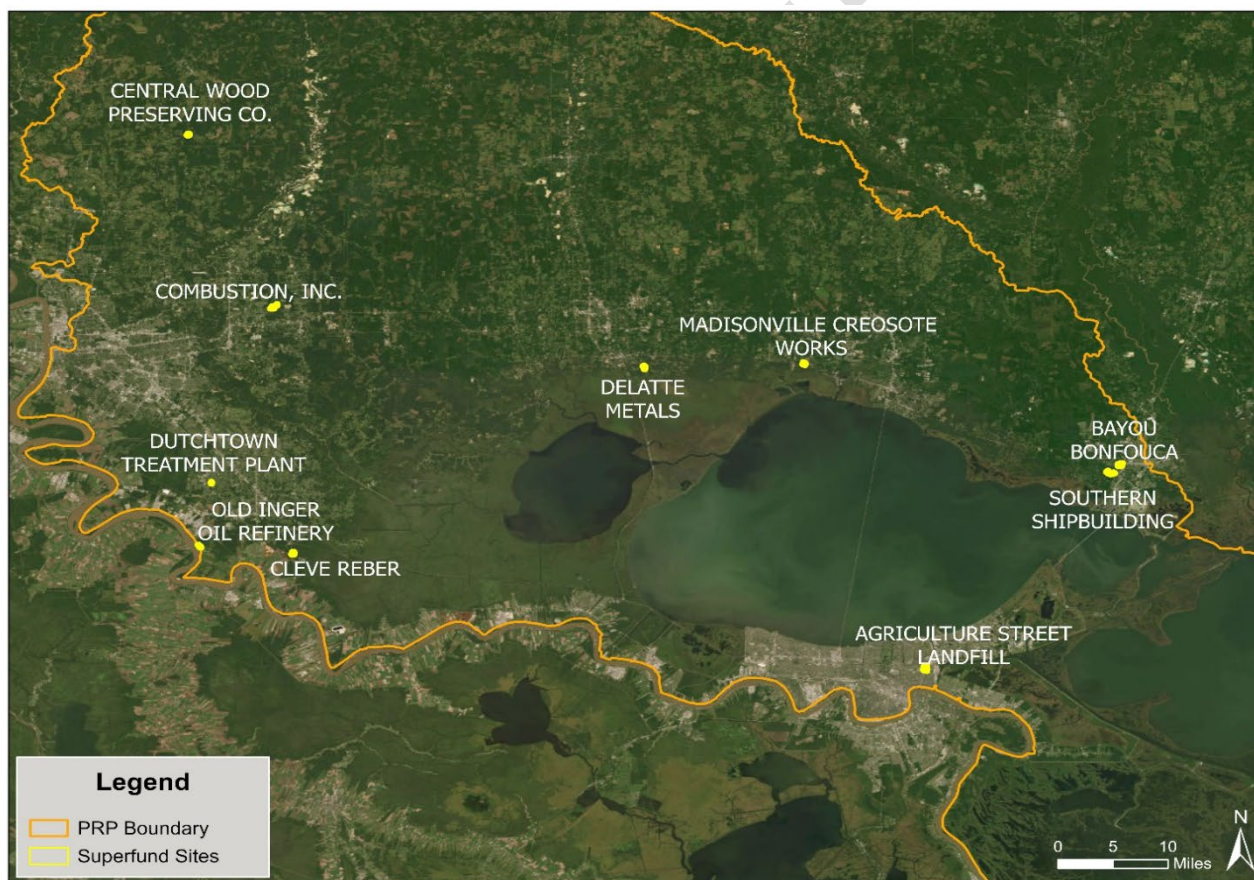
2236 The St. Charles Coastal Program notes that heavy metals and industrial by-products contribute to degraded  
2237 water quality in surface waters, including not only the Mississippi River but minor bayous and canals as well  
2238 (Kemp et al., 2015).

## 2239 **Superfund Sites**

2240 Superfund sites are also a potential source of contamination locally. Superfund is the informal name of the  
2241 Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) passed by the U.S.  
2242 Congress in 1980. CERCLA demands that the responsible parties either perform the cleanup or reimburse the  
2243 government for USEPA-led cleanups. When there is no viable responsible party, the act allows the USEPA to  
2244 clean up contaminated sites. There are 10 superfund sites within the boundary of the Pontchartrain Basin  
2245 (Figure 27).

- 2246 ● The Agricultural Street Landfill in Orleans Parish is a 95-acre former city disposal area that was  
2247 partially redeveloped. The remediation included excavation of contaminated soils and replacement  
2248 with clean fill. The undeveloped portion was lined and covered with one foot of fill.
- 2249 ● Tangipahoa Parish hosts the Delatte Metals site, where soil, sediment, and water were contaminated  
2250 with battery recycling and smelting operations in the 1960s. The USEPA finished remediation efforts  
2251 in 1995 and removed the site from the National Priorities List in 2005.
- 2252 ● The Bayou Bonfouca site in Slidell, Louisiana, was the site of a creosote plant from 1882-1972, when  
2253 a fire led to large volumes of creosote being released into the bayou. The soil and sediments were  
2254 remediated by the USEPA in 1997.
- 2255 ● The Southern Shipbuilding site in Bayou Bonfouca in Slidell, Louisiana, had contaminated soil,  
2256 sediments, and surface water. Contaminated soils and sediments have been incinerated and/or  
2257 capped, and USEPA removed the site from the National Priorities List in 1998.
- 2258 ● The Central Wood Preserving Co. site in Slaughter, Louisiana (East Feliciana Parish) was a wood  
2259 preserving facility that was active from 1950-1991. Lack of sufficient containment led to creosote,  
2260 copper oxide, chromic acid, and arsenic acid being released. Soils were excavated, and the areas  
2261 were backfilled.
- 2262 ● The Dutchtown Treatment Plant was an oil refinery and waste oil and solvent collection facility.  
2263 Disposal practices contaminated the soil and groundwater with a list of hazardous substances. This  
2264 site was removed from the National Priorities List in 1999 after cleanup, and groundwater monitoring  
2265 continues.
- 2266 ● The Madisonville Creosote Works had two unlined process water ditches and two unlined ponds  
2267 containing waste liquids and sludge. A recovery trench system is still operating with over 23,616  
2268 gallons of creosote having been recovered as of the December 2024 Monthly Operation Report.
- 2269 ● The Cleve Reber site in Sorrento, Louisiana, was a municipal and industrial waste facility from 1970-  
2270 1974. Waste disposal contaminated soil and groundwater. Post-closure of the landfill, the

- 2271 remediation is ongoing, including thermal destruction of wastes, capping, backfilling, and fencing the  
 2272 site.
- 2273 ● The Old Inger Oil Refinery site, located near Darrow, Louisiana, was a former oil refinery and waste oil  
 2274 reclamation facility that operated from 1967-1978. After cleanup, the site was removed from the  
 2275 National Priority List in 2008.
  - 2276 ● Combustion, Inc., in Denham Springs, Louisiana was the site of waste oil recycling from the 1960s-  
 2277 1980s. Operations contaminated soils, sediments, sludge, and waste. Over 17,000 cubic yards of soil  
 2278 and debris along with over 58,000 gallons of oil were excavated and removed for energy recovery  
 2279 offsite. Ongoing activity includes phytoremediation and groundwater monitoring.



2280  
 2281 **Figure 27. Map of superfund sites within the PRP boundary (USEPA, 2018).**

2282 **Mercury**

2283 Mercury is a major cause of water quality impairments in the Pontchartrain Basin, accounting for numerous  
 2284 named waterbodies in Louisiana being under fish consumption advisories (LDEQ, n.d.). LDEQ maintains an  
 2285 interactive fish consumption and swimming advisory map<sup>20</sup> which in 2024 included Lake Maurepas, Amite

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<sup>20</sup> More information can be accessed via the following link: <https://deq.louisiana.gov/page/fishing-consumption-and-swimming-advisories>

2286 River, Tangipahoa River, Tickfaw River, Blind River, Natalbany River, Ponchatoula Creek, Lizard Creek, and  
2287 Blood River. The major source of mercury, however, cannot be traced to any particular industry or activity in  
2288 Louisiana. Rather, LDEQ estimates that nearly 69% of mercury emissions are from natural sources, such as  
2289 ocean emissions and volcanic activity (LDEQ, 2024a). Of the anthropogenic sources, global coal and oil  
2290 combustion and artisanal gold mining are the main culprits. LDEQ concludes that the causes of mercury in  
2291 Louisiana watersheds are of national and international origin. Therefore, no specific actions beyond regular  
2292 monitoring are proposed (LDEQ, 2022a). LDEQ maintains the Mercury Initiative, a program to monitor and  
2293 report impaired waterbodies and post fish advisory warnings (LDEQ, 2022c). Over 500 sites statewide are  
2294 tested, and testing includes water, fish tissue, vegetation, and sediment media (LDEQ, 2024a).

## 2295 **Agriculture**

2296 As outlined in the Agriculture and Dairy section, agriculture is a key driver of the local economy, primarily  
2297 through produce and nursery crop production, with smaller contributions from wheat, sweet potatoes,  
2298 sugarcane, and soybeans. The beef, dairy, horse, and poultry sectors, largely concentrated on the Northshore,  
2299 also generate millions in revenue for basin parishes. However, these industries may create a suite of  
2300 nonpoint source pollutant loads including pesticides, organic carbon, nutrients (primarily nitrogen and  
2301 phosphorus), fecal coliform, animal waste, and sediment. Excess sediment hinders photosynthesis,  
2302 smothers benthic organisms, poses navigation and flood hazards by clogging waterways, and potentially  
2303 sorbs and transports other contaminants. Pesticides and their degradation products can persist in the  
2304 environment for long periods of time, bioaccumulating in organisms, inhibiting development or causing  
2305 death. The concentration and toxicity of pesticides varies significantly depending on the type of pesticide,  
2306 means of application, rainfall and wind patterns, exposure to sun, soil type, and slope. Nutrient runoff from  
2307 fertilizers and animal waste leads to algae blooms, which deplete oxygen and harm fish populations.  
2308 Additionally, ammonia—a form of Nitrogen—can prove toxic to fish, as can nitrites and nitrates, and nitrates  
2309 are especially dangerous in drinking water. Excess organic matter from animal waste and crop debris, once  
2310 introduced to receiving waters, increases the biochemical oxygen demand, lowering DO and potentially  
2311 harming or killing aquatic life. Development of anoxic waters also triggers methane, amine, and sulfide  
2312 production, exacerbating the toxic load of a waterway. Animal waste also introduces nutrients, bacteria,  
2313 viruses, salts, and solids. LDEQ has partnered with the U.S. Department of Agriculture (USDA) to develop  
2314 BMPs such as rotational grazing and no-till techniques (Louisiana Nutrient Reduction and Management  
2315 Strategy Interagency Team, 2024). The majority of the BMPs involve preventing the sediment or runoff from  
2316 the fields from directly discharging into nearby waterbodies. The USEPA finds that maintaining vegetative  
2317 filter strips is one effective technique for trapping particles contained within the runoff and significantly  
2318 reducing transport into adjacent aquatic systems.

## 2319 **Forestry**

2320 Although a smaller source than agriculture, forestry practices contribute a significant amount of nonpoint  
2321 source pollution to Louisiana waterways in the absence of BMPs. Erosion is especially an issue in the two  
2322 years post-harvest due to the lack of BMPs and loss of forest canopy. The ecosystem services of intact  
2323 forests are no longer operating by mitigating erosion as before. The industry also introduces metals,  
2324 organics, pathogens, nutrients, herbicides, and pesticides, and the decrease in canopy cover increases  
2325 temperature in waterways (LDEQ, 2012). Forestry is largely concentrated in the northern part of the basin in  
2326 Washington Parish, northern St. Tammany Parish, and parts of Mississippi.

2327 There are several pellet production facilities throughout Louisiana and Mississippi. This activity has been  
2328 under scrutiny for violating the emissions limits of a wide range of hazardous air pollutants. Though some of  
2329 these pollutants are not regulated in Louisiana, when Mississippi tested, they learned that one specific mill  
2330 was putting out 50 tons of hazardous air pollutants per year, which exceeded the legal limit by almost two-  
2331 fold (Baurick, 2023). There are no studies on the effects of atmospheric fallout of these particulates on the  
2332 hydrosphere, so the effect on the Pontchartrain Basin water quality is unknown.

### 2333 **Hydrologic Alterations**

2334 Leveeing of the Mississippi River has had especially detrimental impacts on the Maurepas Swamp, isolating  
2335 it from nutrients and oxygenated fresh water. A river diversion from the Mississippi River to the swamp is  
2336 attempting to reverse this impact, and as designed, is expected to provide a beneficial quantity of nutrients  
2337 and fresh water necessary for sustaining marsh health (FTN, 2019). Diverting river water through the swamp  
2338 will also take advantage of the water quality improvement function of wetlands, reducing both nitrogen and  
2339 phosphorus.

### 2340 **Erosion Control**

2341 There have been a number of projects to slow shoreline erosion around Lake Pontchartrain. Tangipahoa  
2342 Parish has constructed jetties near the mouth of the Tangipahoa River, resulting in the creation of over 71.2  
2343 acres of swamp habitat since 2013. Fish dips are openings incorporated into breakwaters allowing the  
2344 passage of marine life. While NOAA suggests fish dips be 20 feet wide, the widest ones created the most  
2345 erosion. Therefore, fish dips should be narrower than 20 feet with a 10-foot recommendation (Shaffer et al.,  
2346 2019). In July 2024, a \$10 million funded project included the construction of a breakwater system at Frenier,  
2347 Louisiana to protect the Pontchartrain shoreline from further erosion.

### 2348 **Resource Extraction**

#### 2349 **Sand and Gravel**

2350 LDEQ estimates that there are over 1,200 abandoned mines (primarily sand and gravel mines) in the state  
2351 with varying size footprints up to 1,000 acres (LDEQ, 2012). As of 2006, there were 323 sand and gravel  
2352 mines in the Pontchartrain and Pearl River basins, largely concentrated along the Amite, Bogue Chitto,  
2353 Tangipahoa, and Pearl rivers, and only 68 were reportedly adequately reclaimed (LPBF, 2006). Although  
2354 mining disturbs less area than agriculture, its impacts on water quality can be disproportionately high. There  
2355 is a high rate of runoff of the unconsolidated material associated with sand and gravel mining operations,  
2356 delivering large amounts of sediment and turbidity to nearby waterways (Poonia et al., 2024). This high influx  
2357 of inorganic material acts to smother low trophic level species in waterways, decrease photosynthesis, and  
2358 reduce the transport of organic material by overwhelming the stream's carrying capacity (Poonia et al.,  
2359 2024). The net effect has been the extinction of stream fauna through water quality impairment. It also  
2360 creates a higher burden for water treatment plants and deters recreational or transportation use of the  
2361 waterway (LDEQ, 2012; Weathers et al., 2009). LDEQ lists 28.7 miles of river impacted by sand and gravel  
2362 mining operations (LDEQ, 2024a). Additionally, sand and gravel mining has contributed to the loss of  
2363 freshwater mussels (Holcomb et al., 2015). These interconnected processes highlight the critical

2364 environmental implications of sand and gravel extraction in the region, necessitating careful management to  
2365 mitigate adverse effects on river systems and their surrounding ecosystems.

## 2366 Oil and Gas

2367 There are hundreds of oil spill notifications received each year in Louisiana. The Louisiana Oil Spill  
2368 Coordinator's Office (LOSCO) is the single point of contact for oil spills identified in Louisiana. Their goals  
2369 include minimizing unauthorized discharges of oil, providing an effective spill response, compensating the  
2370 public for damage to the state's natural resources, and engaging in public outreach. They serve as the lead  
2371 administrative trustee for the state trustees in the Natural Resource Damage Assessment (NRDA). Oil spills  
2372 can include a range of products, including unleaded gasoline, diesel oil, heavy oil, crude oil, liquid asphalt,  
2373 and a range of other liquid petroleum products. Spills can occur through discharge from boats and other  
2374 vessels, ruptured pipelines, and ruptured storage tanks. There have been a number of spill events in the  
2375 parishes surrounding Lake Pontchartrain since 2000, from very small spills of one barrel up to thousands of  
2376 barrels of oil (Figure 28). In many cases, the actual volume is unknown. There are small spills at gas stations  
2377 that are also reported.

2378 Oil and gas and chemical spills have historically been a major source of pollution to the Pontchartrain Basin.  
2379 Prior to the LDEQ ban in 1996 on stopping produced water associated with oil and gas production from being  
2380 directly discharged at the surface, an estimated 2 million barrels per day flowed into Louisiana coastal  
2381 wetlands. This toxic mix of brine, hydrocarbons, solids, injection fluids, and radioactive material is even more  
2382 toxic than oil, and spills of the material have led to both acute and chronic stress on plants and animals (Day  
2383 et al., 2020; Lopez, 2009). In 1996, the Marathon Pipeline rupture led to the release of 11,308 barrels of  
2384 gasoline near Blind River (LPBF, 2006). In 2017, there was an oil platform in Lake Pontchartrain, owned by the  
2385 New Orleans-based Clovelly Oil Company, that exploded, releasing about 500 barrels of crude oil (NOAA,  
2386 2017). The 2010 *Deepwater Horizon* (DWH) oil spill from the BP-operated Macondo Prospect well was  
2387 particularly catastrophic and was classified as an ecosystem-level injury by the DWH Trustee group set up  
2388 under the Oil Pollution Act. Damages included the coastal wetlands of the Lower Pontchartrain and Breton  
2389 Sound basins. As a result, the Louisiana Trustee Implementation Group (LA TIG) proposed reconciliation  
2390 through the proposal of multiple coastal restoration projects, including several within the PRP boundary,  
2391 including East Orleans Landbridge and Bayou La Loutre (LA TIG, 2022). The impact of oil spills has both  
2392 direct and indirect impacts on water quality. Both the oil and the dispersant used to treat the spill have been  
2393 found to kill microbes in the sediments and marsh soil responsible for improving water quality (Pietroski,  
2394 White, & DeLaune, 2015; Pietroski, White, DeLaune, et al., 2015). The large network of pipelines and energy  
2395 infrastructure throughout the basin will be a continued potential source of contamination in the event of  
2396 accidental discharges, which can negatively impact water quality in the future.



2397

2398 **Figure 28. Location of oil spill incidents in parishes within the PRP boundary from 2000-**  
 2399 **2024 (LOSCO, n.d.).**

2400 In addition to direct inputs of hydrocarbons from industry activities, oil and grease from urban runoff, and  
 2401 associated with boating, have contributed to the basin’s pollution load. Jefferson Parish alone estimates a  
 2402 load of over 1 million pounds of oil and grease (227,000 gallons) per year from urban runoff into the  
 2403 Pontchartrain Estuary. Additionally, 2-cycle marine engines release 25 to 40% of their fuel/oil mixture  
 2404 unburned into the water. Therefore, recreational boating has recently been estimated to release 150,000  
 2405 gallons per year of unburned oil and fuel into the Lake (LDENR, n.d.).

2406 **Environmental Change**

2407 One of the important facts about environmental change is that the climate has been changing since the early  
 2408 history of the Earth. For example, during the past 18,000 years, the planet has been emerging from the most  
 2409 recent ice age. Sea level has risen nearly 300 feet during that time as the world’s major ice sheets underwent  
 2410 melting from a warming Earth. The sea level rise was rapid early on compared to today’s rates, up until  
 2411 ~7000 years ago, when the rates slowed but still continued to rise. During this time, many of the coastal  
 2412 wetlands have moved landward as the sea level rise continues.

2413 Modeling to support Louisiana’s Coastal Master Plan indicates that large parts of the Pontchartrain Basin are  
2414 at high risk for flooding currently and in the near future (CPRA, 2023). Satellite-based estimates of flood risk  
2415 suggest that climate-induced hydrological change will threaten an additional 65 km<sup>2</sup> of cropland and 27,400  
2416 residents for an annual flood event compared to sea level rise-induced flooding, which is estimated to  
2417 threaten 3 km<sup>2</sup> of cropland and 3,300 residents in coastal Louisiana (Getirana et al., 2023). Increased inland  
2418 flooding will affect water quality through transport of contaminants by overland flow, stormwater runoff, and  
2419 more frequent river spillway openings, whereas increased flooding from sea level rise will affect water quality  
2420 by introducing salinity and sulfate, threatening marsh health.

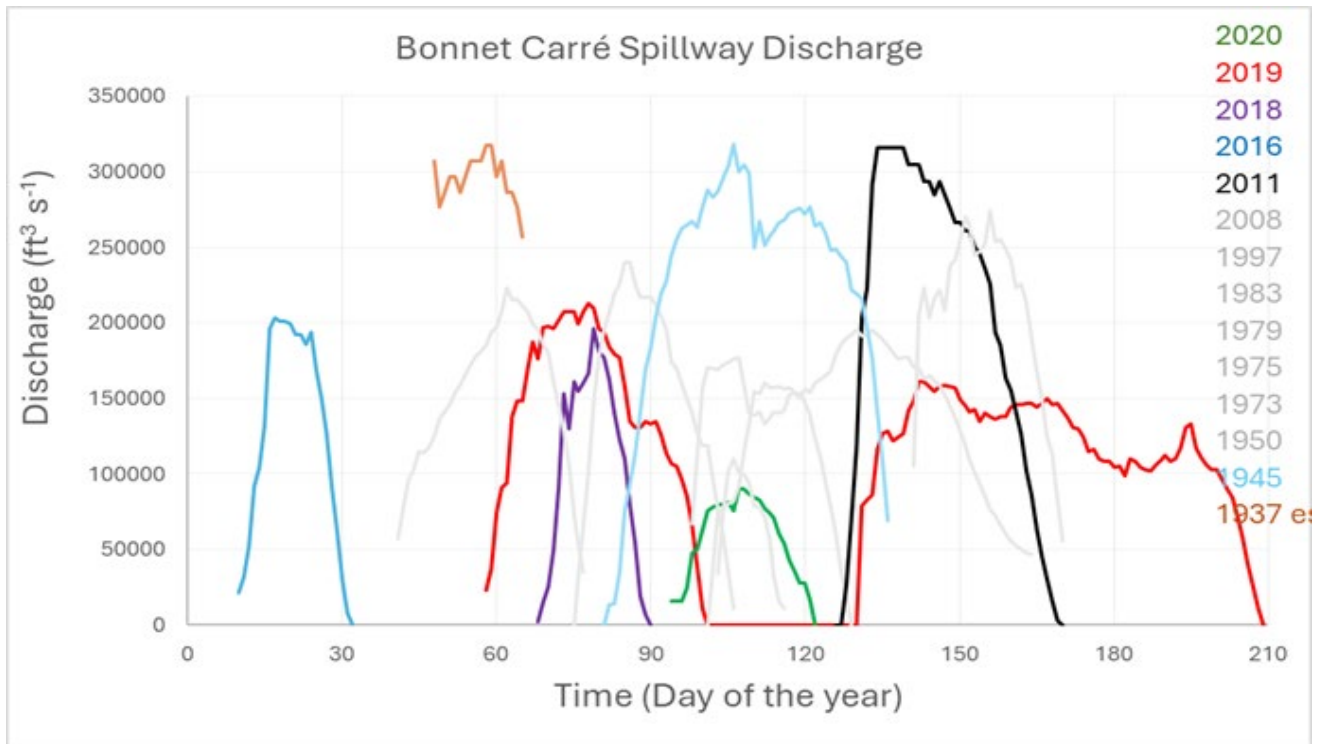
2421 As discussed in the Bonnet Carré Spillway section, spillway openings have been increasingly necessary in  
2422 recent years, with consequences for the estuarine water quality. As floods become more prevalent, the use of  
2423 flood control structures like the spillway is likely to continue into the foreseeable future. Since 2008, the  
2424 USGS and USACE have sponsored continuous and discrete sampling campaigns of lakes Pontchartrain and  
2425 Borgne and the Mississippi Sound before, during, and after each spillway opening. In addition, several  
2426 universities in both Louisiana and Mississippi have taken part in sampling water quality related to spillway  
2427 openings (White et al., 2009; Gledhill et al., 2020). Sampling is also conducted weekly by the Pontchartrain  
2428 Conservancy.<sup>21</sup> Water quality parameters analyzed include nutrients, carbon, total suspended solids, major  
2429 ions, herbicides, chlorophyll  $\alpha$ , phytoplankton composition, algal toxins, salinity, temperature, DO, and pH.<sup>22</sup>

2430 The spillway has been opened 14 times since construction after the great flood of 1927 (counting the two  
2431 openings in 2019 as one; Figure 29). It is noteworthy that for the 93-year history since the spillway  
2432 construction, six of the 14 openings have occurred since 2008, a disproportionate 42% of the openings in  
2433 just 17% of the time. For the sake of this report, the recent operative openings include 2008, 2011, 2016,  
2434 2018, 2019, and 2020 flood events. Since 2020, the spillway has not been operated, as of the writing of this  
2435 report, as Mississippi River flood stage levels have not threatened the City of New Orleans or downstream  
2436 communities. The timing and duration of spillway openings both vary, resulting in differences in freshwater  
2437 discharge, nutrient loading, and other environmental parameters that may influence estuarine water quality  
2438 and system response. Openings can discharge volumes greater than the entire volume of the Pontchartrain  
2439 Estuary (approximately 6 km<sup>3</sup>) over a short time period (usually one month). The exception was the 2019  
2440 event during which the spillway was opened for a record of 123 days, diverting more than 28 km<sup>3</sup> of  
2441 Mississippi River water into the Pontchartrain Estuary (Snow et al., 2024). This discharge can therefore  
2442 dramatically alter the annual nutrient budget for the lake, impacting both water column nutrient  
2443 concentration as well as sediment quality (Turner et al., 2002; McCorquodale et al., 2009).

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<sup>21</sup> More information can be accessed via the following link: <https://scienceforourcoast.org/water-quality>

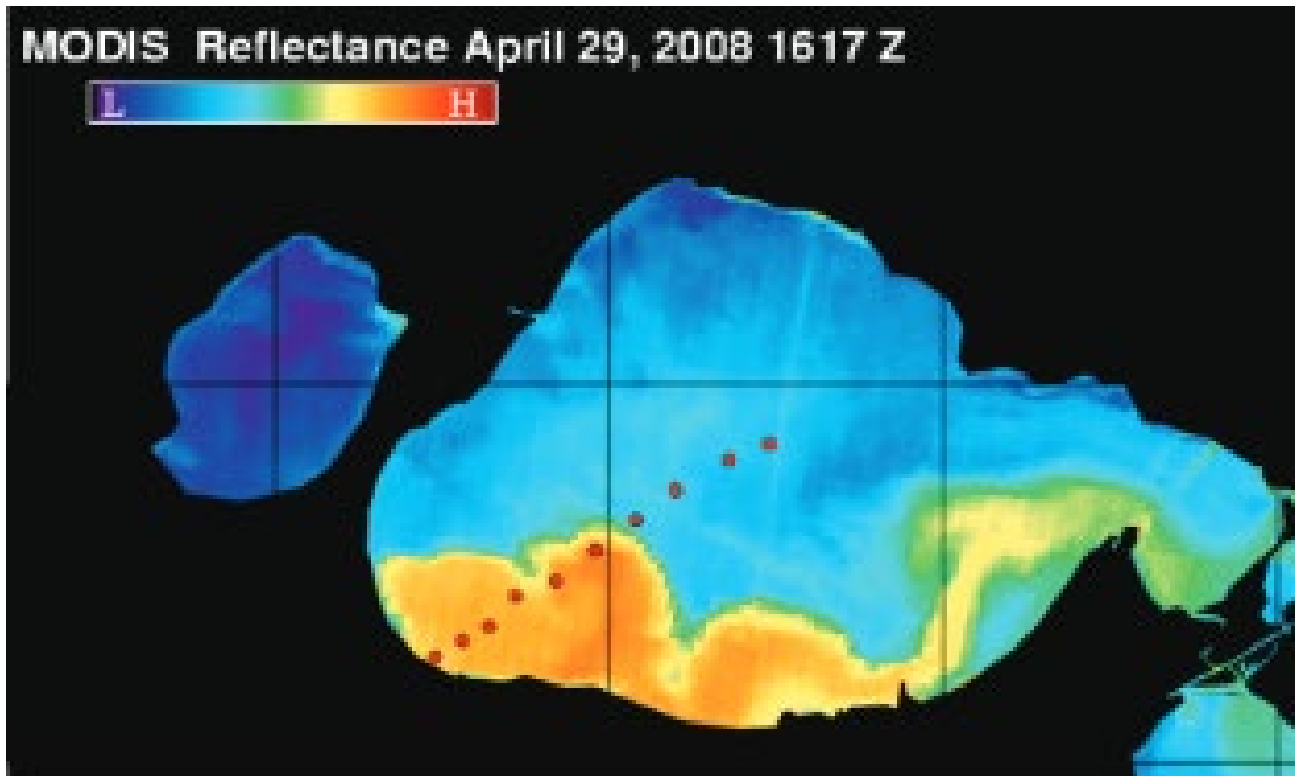
<sup>22</sup> More information can be accessed via the following link: <https://www.epa.gov/waterdata/water-quality-data>



2444  
2445  
2446  
2447

**Figure 29. Discharge over time for the 14 yearly events in which the Bonnet Carré Spillway has been opened to prevent flooding to the City of New Orleans and downstream communities (USACE, n.d.-a, n.d.-b).**

2448 The typical response, seen in 2008 and 2011, is that significant changes in water quality are observed  
2449 immediately after the opening, including the presence of a turbid plume with a high suspended sediment  
2450 load, which moves through the estuary and discharges to the coastal ocean along coastal Mississippi (Roy et  
2451 al., 2013; Figure 30). This has the impact of decreasing the salinity in the Pontchartrain Estuary for months  
2452 on end (White et al., 2009). Once the spillway closes, the sediment settles out of the water column, at which  
2453 time an algal bloom, primarily composed of river water freshwater diatoms occurs (White et al., 2009). Within  
2454 three weeks, the diatom bloom has scavenged all available phosphorus out of the water column along with a  
2455 proportional amount of nitrogen. Over the ensuing month to six weeks, the particulate iron-bound  
2456 phosphorus in the sediment begins to release phosphorus due to the anoxic sediment conditions, increasing  
2457 soluble reactive phosphorus (SRP) in the lake. This increased phosphorus then triggers a cyanobacterial  
2458 harmful algal bloom (HAB) (Roy et al., 2013). This release of phosphorus from the deposited sediment is  
2459 called the internal load and needs to be accounted for in any development for a nutrient criterion. For  
2460 example, the 2011 spillway opening increased the total phosphorus of the surface sediment by 35% with a  
2461 total estimated loading of 5,000 metric tons of total phosphorus to the estuarine sediment (Roy et al., 2017).



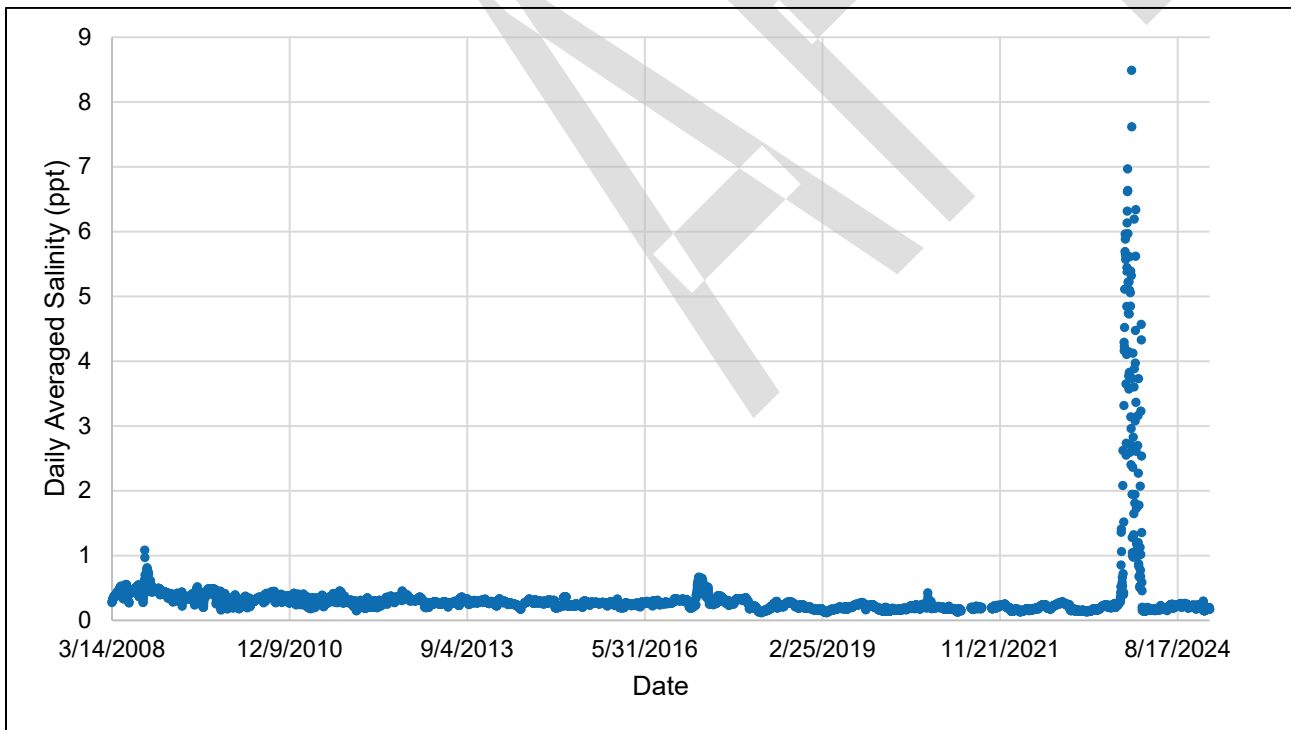
2462  
 2463 **Figure 30. Satellite image using reflectance to show the turbid Bonnet Carré Spillway plume**  
 2464 **along the southern portion of the Pontchartrain Estuary in 2008 (after White et al., 2009).**  
 2465 **The red dots indicate discrete water quality sampling stations, which capture both**  
 2466 **Mississippi River water and Lake Pontchartrain estuarine water characteristics.**

2467 Phytoplankton assemblages have been shown to shift later in the year, with a relative increase in HABs (Mize  
 2468 & Demcheck, 2009). Phytoplankton blooms associated with spillway openings have led to bottom water  
 2469 hypoxia, though the location of the bloom depends on the intensity of the diversion flow and other hydrologic  
 2470 modifications (Mize et al., 2011). Spillway openings also generally increase turbidity and decrease fecal  
 2471 coliform levels through dilution, which are more influenced by contaminants in stormwater runoff (Adebayo &  
 2472 Amer, 2017). The frequency and duration of the openings, as well as antecedent lake conditions (e.g.,  
 2473 temperature, salinity) and input from other surface streams, will affect the response of the estuary to  
 2474 spillway openings and other flood events.

2475 Another consequence of environmental change is sea level rise, which will alter the marsh types in the  
 2476 coastal zone. As freshwater marshes convert to open water or transition to brackish and saline marshes,  
 2477 their ability to sequester carbon and remove nutrients and contaminants will become affected. The effect of  
 2478 salinization on organic matter decomposition is complex, with reports of increasing, decreasing, or no effect  
 2479 on the rate depending on a number of factors. When organic matter decomposes, it is changed into  
 2480 dissolved organic carbon (DOC). This DOC is mobile and can pick up otherwise insoluble metals and  
 2481 transport them into the aquatic system, spreading them further throughout the watershed. In addition to  
 2482 chloride, salinization introduces large amounts of sulfate, prompting sulfate reduction to toxic hydrogen  
 2483 sulfide. Iron moderates the flux of sulfide production through precipitation of iron sulfide minerals. When iron  
 2484 links to the sulfides, the phosphorus can be released, promoting downstream eutrophication.

2485 The effects of salinization on nitrogen cycling are not well constrained. Nitrate is well removed in wetlands  
2486 through a process called denitrification, where nitrate is converted to nitrogen gas by soil microbes. There  
2487 have been some reports that increasing salinity can decrease this natural microbial process, which removes  
2488 nitrogen from surface waters in wetlands (Marks et al., 2016), with other studies reporting increasing or no  
2489 net change in denitrification. In general, though, salinization promotes nitrogen mineralization (production of  
2490 ammonium from organic matter decomposition), decreases denitrification, and increases dissolved  
2491 ammonium concentrations by forcing ammonium off the exchange phase of the soil. The effects of  
2492 salinization on silica biogeochemistry are also poorly understood but need to be an important consideration  
2493 as silica is a crucial element for plants and algae (diatoms) (Herbert et al., 2015 and references therein).

2494 Environmental change is expected to exacerbate extreme hydrologic conditions (e.g., drought and heavy  
2495 rainfall). The year 2023 was an exceptionally dry year locally in southern Louisiana, resulting in a marked  
2496 increase in salinity in the coastal zone. Freshwater or oligohaline (low salt wetlands) can experience a spike  
2497 in salinity as surface water evaporates, leaving behind the salt (Figure 31). As discussed in this section,  
2498 dramatic changes in salinity can alter the ability of the wetlands to provide water quality improvement by  
2499 affecting the soil microbial populations and can also lead to plant stress or death of fresh marshes exposed  
2500 to increasing salinity. The loss of wetlands then has long-term implications for water quality as plant uptake  
2501 and biogeochemical processes are curtailed.



2502  
2503 **Figure 31. Surface water salinity in a coastal freshwater marsh. The surface salinity**  
2504 **increased to ~9 parts per thousand during the 2023 drought (CPRA, n.d.).**

2505 Drought and decreased surface water levels affect water quality by severely compromising the ability for  
2506 dilution to reduce contaminant concentrations. Additionally, as soils become desiccated, their infiltration  
2507 capacity is reduced, prompting greater surface runoff and reducing the natural filtration of contaminants by  
2508 soils and sediments. Soils containing contaminants are then exposed to the sun and become more toxic

2509 through phototoxicity. The impact of sea level rise can also affect the flow of freshwater. On low sloping  
2510 coastlines found in Louisiana, surface water flow can be slowed by a rising sea. Consequently, climate  
2511 adaptations might require more storage of water in the Pontchartrain Basin to mitigate flood risk and counter  
2512 salinity shifts. Greater storage time will also improve nutrient removal. As the watershed experiences a  
2513 greater severity of wet-dry climate cycles going forward, BMPs may need to be designed to compensate for  
2514 these conditions. The consequences of a rising sea also increase the likelihood of salinity intrusions through  
2515 tropical storm and hurricane storm surges, which can negatively impact agricultural land productivity.

## 2516 **SIGNIFICANCE OF WATER QUALITY IN ENVIRONMENTAL, HEALTH, AND** 2517 **SOCIETAL TERMS**

### 2518 **Recreational Use and Fisheries**

2519 LDEQ designates recreational use as either primary (swimming) or secondary contact recreation (boating)  
2520 exposures. The percentage of waterways not fully supporting primary contact recreation has decreased in  
2521 recent years, down from a high of 84% in 2010 to 48% in 2024, which is attributed to the implementation of  
2522 enterococci criteria, which is appropriate for marine waters. This maximum criterion is 70 colony-forming  
2523 units per 100 mL. The impairments are predominantly due to *Enterococcus* and fecal coliform, with a small  
2524 number of impairments from temperature and chemical contamination. These findings are currently being  
2525 investigated by LDEQ (LDEQ, 2023b). The percentage of waterways supporting the secondary contact  
2526 recreation use has stayed relatively the same (>95%). Of the impaired segments, fecal coliform accounted  
2527 for 80% and toxins 20%. Full support for fish and wildlife propagation is much less (32%) due to the greater  
2528 number of parameters needed to support this use (LDEQ, 2024a).

### 2529 **Navigation**

2530 Activities that increase sediment in waterways may clog them and lead to navigational hazards. Numerous  
2531 waterways are listed as impaired for turbidity and total dissolved solids, which can lead to sedimentation  
2532 that reduces water depth and impacts navigation.<sup>23</sup> This is a significant safety issue as sediment can cause  
2533 sandbars to form in areas where water was previously navigated safely. Unexpected underwater hazards to  
2534 boating can cause serious injuries to recreational boaters when speeding boats run aground, potentially  
2535 ejecting the passengers.

### 2536 **Human and Animal Water Consumption**

2537 A relatively small proportion of surface water in the Pontchartrain Basin is used for human consumption. In  
2538 the parishes with saline groundwater, nearly all drinking water is sourced from the Mississippi River. Smaller  
2539 amounts of surface water throughout the basin are used for livestock, aquaculture, and irrigation. The  
2540 majority of surface water used for industrial applications is sourced from the Mississippi River and is not

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<sup>23</sup> More information can be accessed via the following link: <https://mywaterway.epa.gov/>

2541 necessarily consumptive.<sup>24</sup> The largest threat to drinking water in the basin is the progressive intrusion of  
2542 salt in major aquifers. Withdrawal rates exceeding recharge have led to saltwater leakage across the  
2543 southern block of the Baton Rouge fault to the northern block into the municipal sand aquifer called the  
2544 Southern Hills Aquifer (Lovelace, 2007).

## 2545 **Impact on Environment and Health**

### 2546 **IMPACT ON AQUATIC ECOSYSTEMS AND BIODIVERSITY**

2547 Changes to water quality can impose a range of ecosystem responses to the wetland and aquatic  
2548 ecosystems. High suspended sediment loads can fill in aquatic systems, decrease water depth, and reduce  
2549 sunlight to submerged aquatic vegetation beds. Organic sediment loading can also increase oxygen demand  
2550 in the water, leading to hypoxic or anoxic conditions that degrade fisheries stocks and can decrease fish  
2551 diversity. High nutrient loads can change the species make-up of the vegetation in wetlands, and increase  
2552 algae and nuisance invasive aquatic species, which can clog waterways and lead to HABs. Loading of metals  
2553 can lead to metal toxicity in organisms, as well as threats to human health through the consumption of fish  
2554 and shellfish. Bacteria, especially *Escherichia coli*, which is an indication of sewage and animal waste  
2555 contamination, fecal pollution, and the possible presence of other pathogens, is traced back to wastewater  
2556 discharges and can impact recreational activities as well as human health. While toxins related to HABs are  
2557 a more recent issue, they can result in negative impacts to drinking water, irritation to mucous membranes in  
2558 humans, negative impacts on fish, and harm to domestic pets swimming in affected waters.

### 2559 **IMPACT ON FISHERIES AND RECREATION**

2560 The USEPA's "How's My Waterway" tool<sup>25</sup> provides water quality guidelines for communities based on LDEQ's  
2561 Integrated Report, noting which waterways are impaired and by which contaminants. As of November 2024,  
2562 much of the Pontchartrain Basin is listed as impaired. For example, of the 145 listed waterways around the  
2563 Pontchartrain sub watershed, only 14 are considered "Fully Supporting," whereas 131 are listed as "Not  
2564 Supporting." Impairments include those affecting aquatic life, primary and secondary contact recreation, or  
2565 "other" uses such as agricultural, industrial, or for navigation. Causes of impairment around the basin are  
2566 varied, but are largely due to bacteria/microbes, with additional impairments from low DO, metals, murky  
2567 water, metals, salts, acidity, temperature, nitrogen and/or phosphorus, and nuisance plants or invasive  
2568 organisms. The Bonnet Carré Spillway openings freshen up the Pontchartrain Estuary, negatively impacting  
2569 fisheries.

### 2570 **IMPACT ON HUMAN HEALTH**

2571 A recent study has highlighted another concerning consequence of untreated sewage effluent in the  
2572 environment. The population of the southern house mosquito (*Culex quinquefasciatus*)—one of the primary

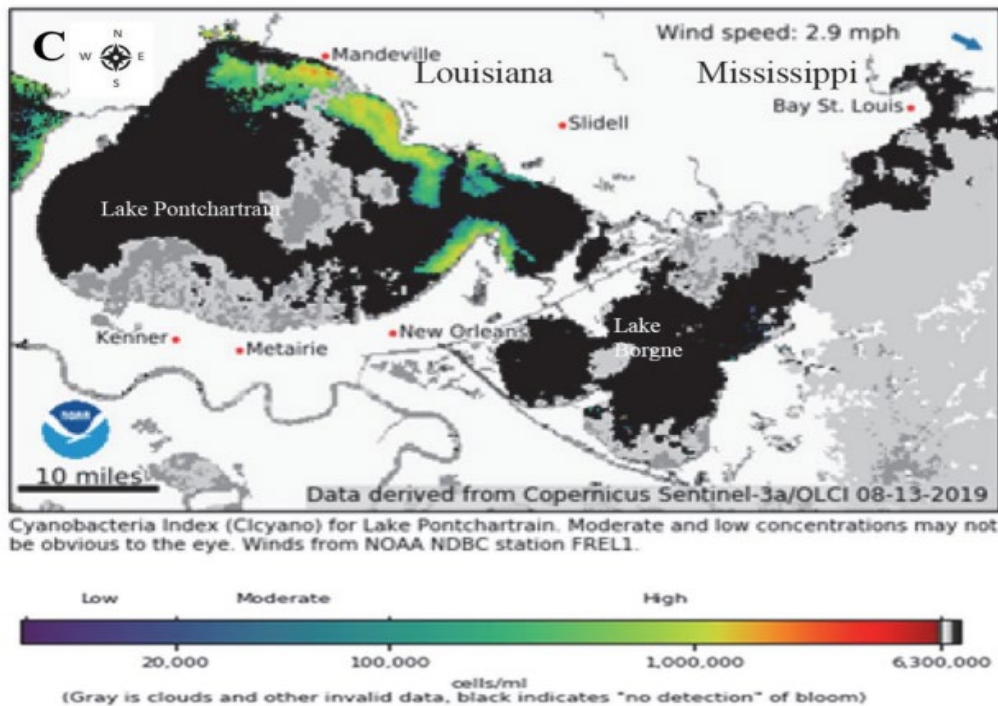
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<sup>24</sup> More information can be accessed via the following link: <https://www.usgs.gov/centers/lower-mississippi-gulf-water-science-center/science/water-resources-louisianas-parishes>

<sup>25</sup> More information can be accessed via the following link: <https://www.epa.gov/waterdata/how-my-waterway>

2573 transmitters of West Nile virus—has surged in St. Tammany Parish, prompting an investigation into the health  
2574 of its key predator. The western mosquitofish (*Gambusia affinis*) is known for regulating mosquito  
2575 populations throughout the American South due its ability to survive relatively inhospitable habitats. This  
2576 study revealed that mosquitofish can tolerate moderate sewage effluent, but it cannot survive and actively  
2577 evades water with a high proportion of sewage effluent. The decline is linked to an increase in total dissolved  
2578 solids, but the exact mechanism of toxicity is not yet known. Effluent from WWTPs flows into drainage  
2579 ditches, creating breeding grounds for mosquitoes and raising the risk of mosquito-borne diseases (Kane et  
2580 al., 2024).

2581 CyanoHABs are a global phenomenon, especially in calm, warm, and nutrient-rich freshwater and estuarine  
2582 systems. They can produce a variety of potent toxins that are responsible for animal poisonings and human  
2583 health problems (Paerl & Barnard, 2020; Paerl & Huisman, 2008). Toxins from HABs can lead to beach  
2584 closures along the Northshore of Lake Pontchartrain in order to protect humans and pets from exposure as  
2585 seen in the National Oceanic and Atmospheric Administration (NOAA) remote sensing tool for August 13,  
2586 2019 (Figure 32) (Bargu et al., 2023). LDH warned residents to avoid areas in lakes Maurepas and  
2587 Pontchartrain due to algal blooms in 2023<sup>26</sup> (Schleifstein, 2023).



2588  
2589 **Figure 32. NOAA remote sensing tool output of HABs along the Lake Pontchartrain shoreline**  
2590 **in 2019 (after Bargu et al., 2023).**

2591 The presence of toxin-producing cyanoHABs in several Louisiana estuaries has been documented at high  
2592 levels – including contamination of blue crab by cyanotoxins, microcystin, in Lac Des Allemandes (Garcia et  
2593 al., 2010); high toxic cyanobacterial abundance in Breton Sound (Riekenberg et al., 2015); and recurring

<sup>26</sup> More information can be accessed via the following link: <https://ldh.la.gov/news/7052>

2594 cyanoHABs in the Pontchartrain Estuary (Mize & Demcheck, 2009; White et al., 2009; Bargu et al., 2011).  
2595 LDEQ conducted a study of cyanoHABs in southeast coastal lakes, which included lakes Maurepas and  
2596 Pontchartrain. Sampling has concluded with data evaluation currently ongoing (LDEQ, 2022b).

2597 The environmental implication of HABs is that they deplete the water column of oxygen when the bloom  
2598 declines and begins to degrade. Microbes begin decomposing the algal cells, consuming oxygen as they do.  
2599 Fish gills can be impacted by toxins in the water and clogged with algal cells (Bargu et al., 2023). For  
2600 humans, mild impacts include irritation to mucous membranes and skin, as well as respiratory symptoms,  
2601 including coughing and shortness of breath. The more severe impacts include gastrointestinal issues,  
2602 neurological problems, and even liver damage (Chorus & Bartram, 1999; Roy et al., 2016).

## 2603 **Monitoring and Assessment**

### 2604 **MEASUREMENT OF NITROGEN AND PHOSPHORUS**

2605 Measurement of nutrients is typically partitioned into the dissolved bioavailable forms and the less available  
2606 dissolved organic and particulate forms. A number of monitoring programs nationwide measure the total  
2607 pool of nitrogen and phosphorus due to cost restrictions per sample in determining all the available pools.

#### 2608 **Nitrogen**

2609 In the Pontchartrain Watershed, most monitoring programs determine several fractions for nitrogen,  
2610 including ammonium and nitrate, the two bioavailable forms of nitrogen. In addition, there are measurements  
2611 for total nitrogen, which includes the above bioavailable forms in combination with the particulate nitrogen,  
2612 which is less available.

#### 2613 **Phosphorus**

2614 The monitoring data available for phosphorus is more strictly limited to total phosphorus. While this is not  
2615 unusual for long-term monitoring projects across the U.S., in the context of identifying water quality  
2616 degradation and improvement, it is important to have data on both the bioavailable and particulate forms  
2617 described below. For phosphorus, the forms entering waterways and wetland systems are in either  
2618 particulate or dissolved form and can be classified into four distinct forms: 1) SRP or dissolved phosphate,  
2619 2) dissolved organic phosphorus (DOP), 3) particulate inorganic, and 4) particulate organic phosphorus  
2620 (White et al., 2004). The sum of all these phosphorus forms is total phosphorus, and total phosphorus is  
2621 typically the analysis that is conducted for water quality monitoring. However, the various forms have  
2622 different levels of availability and environmental conditions, which release the bioavailable form of  
2623 phosphorus from the sediments and soils back to the water. The SRP fraction represents the most  
2624 bioavailable form of phosphorus that can be readily taken up by phytoplankton, macrophytes, and algae. The  
2625 DOP must undergo an enzymatic process to become bioavailable. The organic particulate must be broken  
2626 down by microbial activity, transitioning into DOP and eventually the bioavailable form, SRP. The particulate  
2627 inorganic phosphorus can be released by changes in pH for the calcium-magnesium bound phosphorus or by  
2628 changes in oxygenation status for iron-bound phosphorus. Given the differences in availability of the  
2629 phosphorus fractions, it is important to measure various fractions in environmental monitoring efforts to

2630 understand what the problem is in the watershed driving eutrophication. For example, a heavy sediment  
2631 phosphorus load, dominated by iron-bound sediment, phosphorus will not become available until it becomes  
2632 deposited underwater, and then, over time, will leak SRP out of the sediments (Roy et al., 2017). However, if  
2633 the dominant form of total phosphorus is SRP, then the nutrient is immediately available in the environment,  
2634 potentially triggering expressions of eutrophication such as algal blooms or hypoxia. The dominant form of  
2635 total phosphorus in the Mississippi River is the particulate iron-bound phosphorus from soil erosion  
2636 processes (Sutula et. al., 2004). Differences in land use can ultimately dictate the forms of phosphorus  
2637 discharged from the watershed (Wang et al., 2023). The focus on SRP is due to the fact that soluble  
2638 phosphorus has been found to be a strong determining factor in cyanobacterial bloom intensity. As  
2639 phosphate increased, cyanobacterial biomass increased, while increasing nitrate has shown to have the  
2640 opposite effect (Bargu et al., 2023).

## 2641 **IMPORTANCE OF DATA COLLECTION AND ANALYSIS**

### 2642 **Phosphorus Forms**

2643 There is an ever-growing need for long-term, both temporally and spatially explicit, data sets to track changes  
2644 with time in all watersheds. Long-term data sets can identify changes to any one specific station; however,  
2645 they cannot identify changes across the landscape. These changes can be used by resource managers to  
2646 track if water quality is improving, declining, or holding static. These data are also important to help identify  
2647 if changes to land use or implementation of restoration projects or BMPs are effective. These long-term data  
2648 sets are also needed to capture environmental variability, as there are cyclical climate cycles that operate at  
2649 the decadal scale. The Lake Pontchartrain watershed, locally, is impacted by the ENSO (El Niño Southern  
2650 Oscillation), which leads to a somewhat regular cycle of wet and dry years over the decade and introduces  
2651 variability in rainfall and runoff.

### 2652 **Spatial Distribution of Water Quality Stations**

2653 The Pontchartrain Estuary is also subject to flood releases of the Mississippi River, as aforementioned on the  
2654 topic of the Bonnet Carré Spillway. The Mississippi River watershed can have a very different wet-dry cycle,  
2655 given the large spatial extent of the watershed when compared with the local watershed hydrology of the  
2656 Pontchartrain Basin. For example, there have been years when the Bonnet Carré Spillway has been opened  
2657 when the Pontchartrain Basin is experiencing low precipitation rates. Other times, the spillway has been  
2658 opened when the basin was experiencing a wet year, which increased nutrient and contaminant loading to  
2659 Lake Pontchartrain.

### 2660 **Standardization in Analyses**

2661 It is also important that data used to assess water quality change are analyzed by laboratories that follow  
2662 certified methods and procedures. These certified laboratories follow consistent practices over time, which  
2663 prevent changes to the long-term data set due to laboratory methodological differences as a source of  
2664 change over time. Consequently, not all water quality data is equivalent, since not all published  
2665 measurements contain information on standardized procedures.

## 2666 DATA GAPS

### 2667 Phosphorus Forms

2668 For the Pontchartrain Watershed, a recent analysis has identified that SRP can be significant and up to 60%  
2669 of the total phosphorus, while the DOP fraction is minimal (J.R. White, Unpublished data). Consequently,  
2670 monitoring that includes total phosphorus and SRP would provide valuable information as to the cause and  
2671 potential source of impairment. Subtracting SRP from total phosphorus would provide the sediment  
2672 phosphorus load, which is a distinct problem associated with runoff. Whereas high SRP concentrations could  
2673 be related to wastewater and fertilizers. As discussed earlier, most all the water quality monitoring lumps  
2674 together all phosphorus forms as total phosphorus, making it challenging to assess changes.

### 2675 Spatial Distribution of Water Quality Stations

2676 As indicated in Figure 23, there is a concentration of water quality sampling sites on the north shores of  
2677 lakes Maurepas and Pontchartrain. This distribution is for good reason, as this region does coincide with the  
2678 areas of increasing population and development in the watershed, as well as discharge to these large  
2679 waterbodies. However, it does present very few stations in the upper watershed. This sparse distribution can  
2680 make it difficult to determine sources of impairment. This is because the surface water, arriving lower in the  
2681 watershed, has been impacted by a number of different land uses and, therefore, presents uncertainty in  
2682 actions for remediation. This uncertainty can also make it difficult to detect results from restoration efforts,  
2683 unless new additional stations are added for a discrete length of time. However, adding new stations for a  
2684 shorter period does not capture the long-term trends.

### 2685 Temporal Sampling of Water Quality Stations

2686 For temporal sampling, there are four stations that are monitored continuously, every month in the basin,  
2687 which is useful for providing an uninterrupted record at those three rivers and one lake location. However, the  
2688 return interval of every four years for the detailed monthly spatial sampling of the basin is perhaps too long.  
2689 There are interdecadal climate patterns, like the El Niño Southern Oscillation (ENSO), that can add variability  
2690 to the data record. During some stages, the precipitation patterns are higher than normal, while others can  
2691 lead to low precipitation years. Depending on the cycle, the large-scale sampling trends every four years  
2692 might be impacted by these cyclical variations.

### 2693 Concentration Versus Mass Loading of Contaminants

2694 There is also the issue that nutrient concentration continues to be the standard for environmental  
2695 monitoring, and many watersheds base runoff criteria on concentration. The issue with this approach is that  
2696 concentration does not capture the total load of nutrients. For a given concentration, a wet year will lead to  
2697 far greater mass loading of nutrients than a dry year, even if they present similar concentrations. For  
2698 example, a concentration of 2 ppm for nitrate in a shallow system has less nitrate than 2 ppm for nitrate in a  
2699 deeper system. This is because there is more water and hence more nutrients. While the concentrations are  
2700 identical, the impact on the watershed and receiving waterbodies is not, due to far greater total mass loading  
2701 in the wet years. This has led resource managers to develop TMDL (total maximum daily load) targets, which  
2702 not only consider concentration but also use water flux to get to the total mass. This process sets a target

2703 load (TMDL), and loading above the target load would constitute a water quality impairment. This process  
2704 included assessing the nonpoint sources and point sources, as well as follow-up monitoring to ensure  
2705 successful implementation.

2706 LDEQ has been calculating TMDLs for various waterbodies over time. This process can be expensive and  
2707 time-consuming but generally yields a better water quality outcome in the long run. The LDEQ's New Vision  
2708 Program<sup>27</sup> develops total maximum daily load pollution budgets and new vision activities for targeted  
2709 watersheds through CWA 303(d) programs.

## 2710 **Emerging Contaminants**

2711 There are emerging contaminants that are of increasing concern. The fate of pharmaceutically active  
2712 compounds (PhACs) in the aquatic environment is a rapidly growing area of research since the first large-  
2713 scale study in the U.S. by Kolpin et al., (2002), which examined waters across the U.S. Humans take in any  
2714 number of drug compounds, and those drug compounds find their way into the waste stream primarily  
2715 through excretion. Some personal care products can also have negative impacts on the environment  
2716 because they are chemically similar to natural hormones. These compounds can find their way into the  
2717 waste stream from washing of hands and bathing. Many personal care products contain nanoparticle  
2718 compounds, which are found in cosmetics, sunscreen, and even food.

2719 For drug compounds, there has also been mounting concern over antibiotic resistance in the environment, as  
2720 well as the potential for human ingestion through drinking water and consumption of aquatic organisms.  
2721 While much of the research on the vector for drugs has focused on traditional WWTP removal, a study in  
2722 Louisiana examined the capacity of the Mandeville assimilation wetland at removing drug compounds  
2723 discharged into Bayou Chinchuba, which enters into the Pontchartrain Estuary at the Northshore (Figure 33).  
2724 This research found that the wastewater plant, which uses aerated ponds and wetlands, was very efficient at  
2725 removing these drug compounds from wastewater (i.e., 30%-99% removal; Conkle et al., 2008). For some  
2726 drugs, an additional 1% up to 52% removal was achieved in the forested assimilation wetland, preventing  
2727 discharge into the aquatic environment (Table 12). Removal rates for the assimilation wetland were much  
2728 greater than published values for standard WWTPs (Conkle et al., 2008). It was found that the highly organic  
2729 wetland soils have a strong affinity for the removal of drug compounds from water and with a very low  
2730 chance of release back into the water (Conkle et al., 2010).

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<sup>27</sup> More information can be accessed via the following link: <https://deq.louisiana.gov/page/newvisionprogram>



2731

2732 **Figure 33. The Mandeville WWTP with an arrow denoting discharge into the Bayou**  
 2733 **Chinchuba assimilation wetland.**

2734 **Table 12. Loading rates of select drug compounds for the Mandeville WWTP, Bayou**  
 2735 **Chinchuba, and Lake Pontchartrain for 2007 (Conkle et al., 2008).**

DRUG CLASS	COMPOUND	LOADING AT INFLOW TO WWTP (KG/YEAR)	LOADING TO BAYOU CHINCHUBA (KG/YEAR)	LOADING TO L. PONTCHARTRAIN (KG/YEAR)
Neutral	Cotinine	2.99	0.04	0.03
Neutral	Caffeine	69.68	0.09	0.18
Neutral	CBZ	0.15	0.24	0.08
Neutral	Fluoxetine	ND	ND	ND
Acidic	Acetaminophen	107.11	0.03	0.00
Acidic	Naproxen	28.39	0.25	0.08
Acidic	Ibuprofen	27.04	0.11	0.05
Acidic	Gemfibrozil	4.50	1.66	0.22
Beta blockers	Atenolol	3.93	0.27	0.04
Beta blockers	Nadolol	0.08	0.02	0.00
Beta blockers	Propranolol	ND	ND	ND
Beta blockers	Metoprolol	0.57	0.05	0.00
Beta blockers	Sotalol	0.47	0.34	0.09
Sulfonamides	Sulfapyridine	0.19	0.04	0.00
Sulfonamides	SMX	11.15	0.97	0.91

2736 Additional issues of concern include microplastics and nanoplastics, which are present in the environment.  
 2737 They are defined as plastic particles smaller than 5 mm in size, and they form from the breakdown of large

2738 plastic items. Some nanoparticles are manufactured and are used in cosmetics (as exfoliants) and in  
2739 textiles. These compounds have been found in surface waters, rivers, and coastal regions around the globe.  
2740 At this point, there is not much known about the health effects on humans or the environmental impact, but  
2741 research is ongoing.

2742 Per- and polyfluoroalkyl (PFAS) substances are a group of thousands of man-made chemicals used in  
2743 products for their non-stick and water repellent properties and have been used since the 1950s.<sup>28</sup> They  
2744 contain a carbon-fluorine bond, which leads to their nickname of “Forever Chemicals” since these bonds are  
2745 not susceptible to degradation in the environment.

2746 The recognition of emerging contaminants comes primarily from our improving ability to detect and measure  
2747 very small concentrations in environmental samples. There is a mixture of compounds at very low  
2748 concentrations, and our understanding of how those compounds may interact is still very limited. In many  
2749 cases, standardization of measurement is the first step in detecting the spatial distribution of these  
2750 compounds, after which toxicology studies will follow.

## 2751 **Regulatory Framework and Policies**

### 2752 **EXISTING REGULATIONS AND POLICIES**

#### 2753 **Federal**

2754 Numerous legislative acts are in place to ensure the protection of the nation’s and state’s waterbodies. The  
2755 CWA is the primary piece of legislation giving federal authority to control water pollution. It was initially  
2756 called the Federal Water Pollution Control Act of 1948 but was expanded and restructured in 1972. This act  
2757 tasks the USEPA with developing and implementing pollution control programs. The USEPA sets national  
2758 water quality standards and prevents unregulated discharge of pollutants into the nation’s surface  
2759 waterbodies, including that from WWTPs, industrial discharge, and stormwater runoff. The CWA’s National  
2760 Pollution Discharge Elimination System (NPDES) regulates the point sources contributing to discharge–  
2761 monitoring compliance within the system. Some states are authorized to oversee their own NPDES  
2762 programs, as is the case with Louisiana. Permits are required for certain municipal, industrial, and  
2763 agricultural discharges. Additionally, Section 404 of the CWA, which is jointly operated by the USACE and the  
2764 USEPA, ensures that dredged material placed into wetlands or surface waters minimizes damage. The Safe  
2765 Drinking Water Act (SDWA), enacted in 1974, authorizes the USEPA to set drinking water standards to protect  
2766 the public against aqueous contaminants. Initially focused only on treatment, the act was expanded in 1996  
2767 to provide protection for source waters, improve water system infrastructure, ensure properly trained water  
2768 treatment personnel, and require regular monitoring. The USEPA has granted primacy to most states to  
2769 implement the SWDA.

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<sup>28</sup> More information can be accessed via the following link: <https://www.niehs.nih.gov/health/topics/agents/pfc>

## 2770 **State**

2771 At the state level, the Louisiana Environmental Quality Act tasks LDEQ with ensuring a healthy and safe  
2772 environment for the public by protecting the water and air quality, scenic rivers and streams, and protecting  
2773 against hazardous wastes and radiation. LDEQ manages several programs dedicated to safeguarding the  
2774 state's water resources. The Louisiana Water Quality Management Plan serves as the primary guide for  
2775 pollution control, water quality management, and planning efforts under the CWA. This plan aims to maintain  
2776 water quality standards and ensure that waterbodies meet the requirements for their designated uses. Title  
2777 33, Environmental Quality, Part IX, Water Quality, serves as the legal framework for maintaining water quality  
2778 and enforcing pollution control measures. It outlines regulations, standards, and requirements related to  
2779 water pollution control, including wastewater discharge permits, water monitoring programs, and pollution  
2780 prevention measures to protect Louisiana's water resources. LDEQ also manages a nonpoint source pollution  
2781 (NPS) control program as required by Section 319 of the CWA to address pollution from runoff of agriculture,  
2782 forestry, home septic systems, urban runoff, sand and gravel mining, construction, and hydromodifications.  
2783 The aim of the NPS program is to restore waters marked as impaired by implementing watershed-scale  
2784 programs that use BMPs to improve water quality. The program goals are to implement statewide and  
2785 watershed programs that result in the implementation of BMPs to increase DO concentrations and reduce  
2786 the concentration of fecal coliform bacteria, sediment, and nutrients that contribute to water quality  
2787 problems in state waters (LDEQ, 2023a). The LPDES is the point source counterpart to NPS and regulates  
2788 point source pollution through permits, which ensure discharges from industrial and treatment facilities meet  
2789 regulatory standards.

2790 The Louisiana Department of Energy and Natural Resources (LDENR) also oversees water quality as part of  
2791 its responsibility for managing resource extraction. The Groundwater Management Plan ensures sustainable  
2792 use and protection of the state's aquifers by regulating withdrawal through a permitting process, monitoring  
2793 groundwater levels and quality, and endeavoring to protect recharge areas of aquifers. Similarly, the Surface  
2794 Water Management Plan regulates the extraction of surface water.

## 2795 **Conservation and Restoration Efforts**

### 2796 **EFFORTS AND INITIATIVES FOR IMPROVING WATER QUALITY**

2797 Several acts and amendments to the major legislation discussed above have had more specific effects on  
2798 improving water quality throughout the U.S. and Louisiana. These acts grant additional authority to some  
2799 federal agencies to intervene in activities that may affect water quality.

### 2800 **BEACH Act**

2801 The Beaches Environmental Assessment and Coastal Health Act (BEACH) of 2000 amended the CWA to  
2802 include a specific plan to address pathogens in coastal recreation waters. It requires any local government  
2803 with coastal recreation waters to adopt water quality standards for pathogens and provides grants to  
2804 implement monitoring and assessment programs. The BEACH Act criteria were adopted for Louisiana's  
2805 coastal marine waters in 2016, which includes Lake Pontchartrain.

2806 **River and Harbors Act**

2807 The Rivers and Harbors Act of 1899 regulates the construction of structures in or over navigable waters, and  
2808 the Water Resources Development (WRDA) Act authorizes the USACE to conduct studies and construct  
2809 projects that will improve waters and harbors. These legislative acts give the USACE indirect influence on  
2810 water quality by regulating construction activities, dredging operations, and discharge.

2811 **Fish and Wildlife Coordination Act**

2812 The Fish and Wildlife Coordination Act also impacts water quality through directing the U.S. Fish and Wildlife  
2813 Service to evaluate the effects of proposed federal actions on waterbodies and offer recommendations to  
2814 minimize negative impacts on habitat.

2815 **Community Water Systems Grading**

2816 Beginning in 2021, LDH was granted authority to develop grades for community water systems to increase  
2817 accountability and evaluate community water system quality and performance. The seven standards against  
2818 which communities are evaluated include federal water quality, state water quality, financial stability,  
2819 operation and maintenance, infrastructure, customer satisfaction, and secondary contaminants. These  
2820 grades are based on a combination of factors related to water quality, infrastructure, and financial  
2821 sustainability. For Louisiana, of 951 community water systems, 41% received an A, 27% received a B, 18%  
2822 received a C, 6% received a D, and 9% received an F.<sup>29</sup> The grades for all parishes within the Pontchartrain  
2823 Watershed are shown in Table 13 and are based on a traditional A-F scale, which omits E. These grades are  
2824 similar to how you received grades in your classes in school, with “A” being excellent and “F” being failing.  
2825 Generally, water quality grades are much lower for parishes that lack freshwater aquifers and rely heavily on  
2826 surface water supply. Systems with grades D or F may be subject to enforcement, oversight, and/or  
2827 restrictions on new debt, which can only be used for water system improvements (LDH, 2023).

2828 **Table 13. LDH community water systems grades for parishes within the PRP boundary (LDH,**  
2829 **2023). The number indicates the number of water systems within the parish that scored a**  
2830 **particular letter. The letter A is excellent, going all the way down to F, as a failing grade.**

PARISH	GRADE	PARISH	GRADE
Ascension	9 A, 3 B, 6 C, 1 D	St. Bernard	1 B
East Baton Rouge	3 A, 2 B	St. Charles	1 B
East Feliciana	10 A	St. Helena	1 A, 1 B, 1 C
Iberville	9 A, 1 B, 2 C	St. James	2, A, 1 B, 1 C
Jefferson	3 B, 1 C	St. John the Baptist	4 A
Livingston	10 A, 7 B, 1 D, 1 F	St. Tammany	70 A, 20 B, 6 C, 2 D, 2 F
Orleans	1 B, 1 D	Tangipahoa	12 A, 7 B, 2 C, 1 D, 1 F

<sup>29</sup> More information can be accessed via the following link: <https://ldh.la.gov/news/final-water-grades-2023>

PARISH	GRADE	PARISH	GRADE
Plaquemines	1 C, 1 D, 2F	Washington	6 A, 6 B, 1 C, 1 F

2831 LDH has also attempted to address water quality degradation from the untreated discharge of sewage  
 2832 through LAC Title 51, Part XIII, sewage disposal. This code regulates sewage and septic systems by setting  
 2833 standards for design, operation, maintenance, inspection, and disposal. This code therefore prevents sewage  
 2834 and septic systems from being improperly designed and operated which would lead to discharges of sewage,  
 2835 severely impacting water quality.

2836 **Sand and Gravel Mining Best Management Practices**

2837 LDEQ and the Congregate and Aggregate Association of Louisiana have worked together to develop a  
 2838 document outlining BMPs to be followed for wet mining of sand and gravel to lessen the detrimental effects  
 2839 of excess sediment and turbidity loads associated with the process. These include, for example, vegetative  
 2840 controls to reduce erosion, structural controls to isolate mined areas from surface flows, better pre-site  
 2841 investigations to understand drainage patterns and minimize land needing to be cleared, and site  
 2842 stabilization post closure (LDEQ, 2007).

2843 **Louisiana Watershed Initiative**

2844 The efforts of the Louisiana Watershed Initiative (LWI) likewise have an indirect impact on water quality.  
 2845 Their mission is focused on restoring floodplain and watershed health, thereby improving stormwater runoff,  
 2846 enhancing wetland filtration capacity, and reducing nonpoint source pollution and erosion. With a large share  
 2847 of support through Community Development Block Grant mitigation funds, LWI has awarded nearly \$900  
 2848 million for projects in Louisiana, with the largest single share going to East Baton Rouge Parish. Project  
 2849 types include dam and spillway improvements, floodwater storage, infrastructure improvements, drainage  
 2850 improvements, floodplain preservation, and property buyout (LWI, n.d.). These projects help improve water  
 2851 quality by trapping sediments and reducing nutrient loads.

2852 **St. Tammany Parish Septic System Pilot**

2853 There has been increasing public awareness and calls to action for Northshore communities to address their  
 2854 septic issues. Of the 36,000 septic systems in St. Tammany Parish, approximately half are malfunctioning;  
 2855 the parish has proposed a mandate to inspect septic systems every three years. A pilot project from St.  
 2856 Tammany Parish’s Department of Environmental Services is set to inspect 1,000 of these on-site treatment  
 2857 systems, with the goal of applying for larger grants to help the parish build sewer systems which will  
 2858 decrease the number of septic systems (Lubben, 2023, 2024).

2859 **Highlights on Successful Water Quality Improvement Projects**

2860 The Pontchartrain Conservancy is the primary environmental advocacy group working to improve the water  
 2861 quality of Lake Pontchartrain through science and community engagement. As previously discussed, their  
 2862 Recreational Water Monitoring initiative samples 13 recreational sites around the lake every week for basic  
 2863 water quality parameters and bacterial indicators. This not only enhances the availability of data on the lake’s  
 2864 surface water but also ensures that timely assessments are provided to the public for recreational use. The

2865 organization's On-Site Wastewater Treatment Plants (WWTP) Assistance to Small Businesses and  
2866 Homeowners program works to educate the public on the importance of properly functioning WWTP  
2867 systems. There are approximately 150,000 on-site WWTP systems in unincorporated areas in the basin, and  
2868 some of their project work has improved pass rates from 59% to 95%. The Litter Glitter Program has  
2869 successfully collected over 227 pounds of trash, alleviating some of the pollution load from stormwater  
2870 runoff into the lake. The Pollution Source Tracking initiative coordinates local, state, and academic partners  
2871 to identify pollution sources and educate the public on care and maintenance of home WWTPs. The  
2872 Community Science Program increases available water quality data by engaging the public in sample  
2873 collection. The Water Quality and Green Infrastructure effort aims to increase the green infrastructure in New  
2874 Orleans East to alleviate negative impacts from flooding and stormwater runoff, as well as to improve the  
2875 area's aesthetics (Pontchartrain Conservancy, n.d.).

2876 Permitted point source wetland assimilation projects are an opportunity for wetland restoration while also  
2877 reducing nutrient loading to aquatic systems. The assimilation wetlands receive nutrient-rich water from  
2878 treated municipal/sanitary wastewater sources to provide fresh water and nutrients for wetland areas. There  
2879 are 15 permitted point source wetland assimilation projects in Louisiana, with more being proposed moving  
2880 forward. LDEQ found that from 2018-2022, efficiencies of nutrient removal for assimilation wetlands  
2881 averaged 73% for total nitrogen and 27% for total phosphorus (Louisiana Nutrient Reduction and  
2882 Management Strategy Interagency Team, 2024). In the basin, both the cities of Mandeville and Hammond are  
2883 whole-city assimilation wetlands. Guste Island is a housing development discharging to Lake Pontchartrain,  
2884 and the Tchefuncte Country Club Estates housing development discharges to the Tchefuncte River, and both  
2885 utilize assimilation wetlands (Pers comm, J. Day).

2886 St. Tammany Parish received \$48 million in 2023 through the American Rescue Plan Act for funding three  
2887 projects targeting water quality improvement. The West Tammany Wastewater Consolidation project will add  
2888 5 miles of new sewer main benefitting ~6,400 residents and emergency generators to support the system. A  
2889 second project includes the East Slidell Regional Water Consolidation Project, which will improve water  
2890 quality for ~10,000 residents. A third project involves improvements to the existing water treatment facilities  
2891 in Madisonville, Louisiana.

2892 The University Lakes project is an example of a successful partnership to improve urban water quality with  
2893 funding from the Baton Rouge Area Foundation, Louisiana Department of Transportation, City of Baton  
2894 Rouge, East Baton Rouge City Parish, Baton Rouge Recreation and Parks Commission, and Louisiana State  
2895 University for project implementation by the LSU Real Estate and Facilities Foundation.<sup>30</sup> The project is  
2896 funded at \$41 million to improve water quality, increase flood protection, and improve recreational  
2897 opportunities across the six lakes and is expected to be completed by the end of 2025. The most significant  
2898 project activity involves dredging the lakes and restoring vegetative buffers.

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<sup>30</sup> More information can be accessed via the following link: <https://www.universitylakesproject.org/>

## 2899 Challenges and Barriers

### 2900 CHALLENGES IN MAINTAINING AND IMPROVING WATER QUALITY

#### 2901 Aging Infrastructure

2902 The high number of decentralized wastewater treatment (septic) systems in more rural areas continues to be  
2903 a challenge for water quality. It may be cost-prohibitive to link these systems to centralized wastewater  
2904 treatment infrastructure. Programs that incentivize homeowners of septic systems to routinely maintain  
2905 these systems would improve the situation in the short term. Some septic systems are located on clay soils,  
2906 which do not allow water to percolate, and these systems can overflow at the surface, allowing untreated  
2907 wastewater discharges. Systems located in sandy soils can allow untreated wastewater to leak into adjacent  
2908 aquatic systems through lateral movement, because the water moves too quickly through the sand with  
2909 limited treatment.

#### 2910 Rapid Development

2911 The population continues to increase (see Population and Demographics section) as the municipal WWTPs  
2912 are at or near capacity. This increasing population puts excessive demand on treatment plants and requires  
2913 the expansion of wastewater capacity on existing plants or the construction of new facilities, which can be  
2914 costly. If the population expands faster than the facilities can be renovated or retrofitted, then the flow speed  
2915 has to increase, which can lead to less effective treatment and poor water quality. Stormwater treatment is  
2916 another system that is overloaded with rapid development. While new construction can provide for the  
2917 construction of stormwater retention and detention systems, the continued development may require  
2918 expansion of already existing infrastructure.

#### 2919 Records Management and Reporting

2920 LDEQ maintains access to the water quality data through its Environmental Data Management System.  
2921 Access to CRMS data is provided at the following link: <https://www.lacoast.gov/crms/Home.aspx>. Given the  
2922 number of federal, state, and non-profit entities and researchers conducting monitoring in the basin, a single  
2923 clearinghouse at the state level where data is maintained or links provided to the data would improve the  
2924 ability of managers to assess changes in water quality over time, as well as to understand project-specific  
2925 effectiveness.

#### 2926 Future Outlook

2927 This report provides both a summary of the issues today and a number of challenges going forward that  
2928 should be addressed to assure safe and sustainable water quality for all communities. Continued progress  
2929 on water quality improvements is achievable through planning, funding, and significant investments in  
2930 infrastructure projects.

- 2931 • Planning for population shifts can be challenging in the coastal zone. While there is some  
2932 predictability of increasing population with time, coastal calamities like continued severe hurricanes

2933 can cause an almost instantaneous shift in population. This was noteworthy in the basin in response  
2934 to Hurricane Katrina in 2005, when populations in the lower basin parishes dramatically exceeded the  
2935 long-term growth rates. This put severe stress on municipal wastewater treatment facilities and led  
2936 to a construction boom, impacting water quality.

- 2937 ● The continuing rise in sea level will impact water resources through salinity intrusion in the  
2938 groundwater and higher salinization in the surface waters, impacting agriculture. Mitigating  
2939 groundwater withdrawals can assure protection of drinking water, while development of minimum  
2940 flows and levels for waterways can mitigate surface salinity incursions.
- 2941 ● The Infrastructure and Jobs Act provided the Pontchartrain Restoration Program (PRP) with  
2942 approximately \$10 million per year in funds from 2022-2026 for projects in the basin on top of the  
2943 base funding. In 2024, the PRP issued requests for \$12 million in project proposals. Continuity of  
2944 funding is important in building upon successful projects for improving water quality.
- 2945 ● Funding for improving the performance of aging municipal treatment systems is critical, as is  
2946 continuing to seek funding to move communities and individuals off of failing septic systems to  
2947 centralized wastewater treatment. While the cost of moving rural communities off of septic systems  
2948 can seem prohibitive, short-term programs such as programs focused on maintenance of septic  
2949 systems can be a stopgap measure to reduce the negative impacts of failing systems.
- 2950 ● Wetlands can only provide water quality improvement function if the hydrologic connection to the  
2951 lakes, rivers, or streams has not been disrupted by levees or bulkheads. Opportunities for relocating  
2952 or reducing levee height in select areas can reconnect wetland systems to the watershed, providing  
2953 both storage of water and improvement of surface water quality.
- 2954 ● Continue implementation of assimilation wetlands in the basin. See the Highlights on Successful  
2955 Water Quality Improvement Projects section for more details.

## 2956 **Concluding Remarks on Water Quality**

2957 There is one water-quality specific goal for the CCMP: improve Pontchartrain Basin water quality through  
2958 point and nonpoint source pollutant reduction to support ecological health. This section focuses on a variety  
2959 of specific water quality issues that can be found across the basin, recognizing that while there are common  
2960 themes, different regions of the watershed can have unique issues. A number of these water quality issues  
2961 are more historical or legacy, having persisted for decades. Others are new issues of emerging contaminants  
2962 of concern, for which our understanding of fate and both human health and environmental impact are not  
2963 well understood. Regardless, they are all issues that relate to the CCMP water quality goal.

2964 The water quality issues that have been summarized below are based on the CCMP water quality objectives.  
2965 This section provides the framework for how CCMP actions can address these issues and provide a plan for  
2966 improvement of water quality for all communities in the basin.

2967 *Water Quality Objective 1: Provide a technical basis for the formulation of water quality improvement actions*  
2968 *through water quality monitoring, needs assessment, and research.*

2969 Improvements in water quality can only be assured if projects and restoration actions are followed up by  
2970 monitoring efforts to ensure that projects are delivering the intended beneficial outcomes to the citizens of  
2971 the basin. Monitoring can be project-specific or cast basin wide and examined long term to understand the  
2972 general basin water quality trends. Assessing needs for large-scale efforts should be based on initial

2973 monitoring to provide the greatest improvement outcome. Success will include planning for a future of  
2974 environmental change, which includes floods, droughts, inevitable sea level rise, and understanding emerging  
2975 contaminant threats through needed research.

2976 *Water Quality Objective 2: Reduce adverse impacts of urban runoff; sewage; and agricultural, industrial and*  
2977 *commercial activities by improving stormwater management, practices, and implementing restoration projects.*

2978 This issue report has compiled information from state agencies, local experts, and through direct community  
2979 engagement on the primary causes of degradation of water quality related to both point and nonpoint  
2980 sources. While point source pollution falls under environmental regulations, non-point source pollution is far  
2981 more challenging, as it is responsible for discharging sediments, nutrients, and other contaminants. Targeted  
2982 funding programs are needed that can address urban runoff; sewage discharges; and agricultural, industrial,  
2983 and commercial activities through infrastructure improvements and wide-scale BMP implementation to  
2984 assure the citizens' continued and safe access to the waters of the basin.

2985 Going forward, reducing the extent of impaired waters in the basin to provide fishable, swimmable waters for  
2986 all is achieved by developing partnerships among the federal, state, local governments, and NGOs and  
2987 engaging the public to achieve future success. Building on already successful programs, water quality can  
2988 continue to improve for the citizens of the basin.

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# HABITAT

## 3257 Introduction

3258 Habitat includes all the physical, chemical, and biological attributes that affect or sustain the organisms  
 3259 within an ecosystem (See What is habitat?). This section provides an assessment of the recent trends and  
 3260 current condition of the major habitat types of the Pontchartrain Basin, outlines the factors that result in  
 3261 habitat change within the system, highlights the importance of some of the habitats, and highlights the  
 3262 consequences of habitat change. This section also builds on the 2006 *Comprehensive Habitat Management*  
 3263 *Plan for the Lake Pontchartrain Basin* (hereafter 2006 CHMP) (Lake Pontchartrain Basin Foundation [LPBF],  
 3264 2006) by outlining how issues have changed in the last two decades. The work in this section further seeks  
 3265 to provide a foundation for the development of actions that target habitat restoration and/or enhancement.  
 3266 This foundation is set by describing recent restoration efforts, the regulatory and policy context for habitat  
 3267 actions, and by providing case studies to illustrate the types of activities around the basin that support  
 3268 sustainable habitat.

### What is habitat?

Habitat includes all the physical, chemical, and biological attributes that affect or sustain the organisms within an ecosystem. The extent and diversity of the Pontchartrain Basin requires this to consider both terrestrial and aquatic systems. In this context, this section will interpret habitat in terms of both dynamic (physical-chemical) and stationary (structural) components (Peterson, 2003). This conceptual model (Figure 34) encompasses seasonal and annual changes in salinity or turbidity, for example, as well as long-term changes in the type or extent of vegetation cover that may be utilized by organisms.

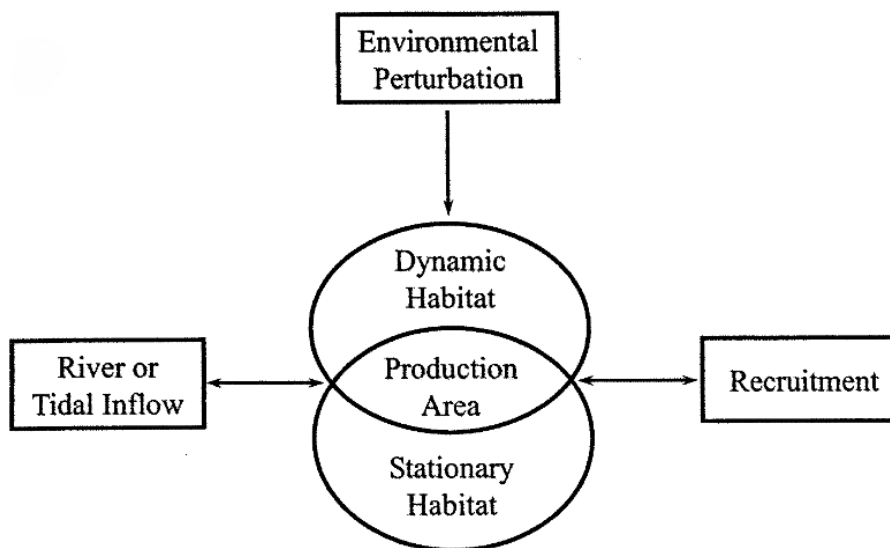
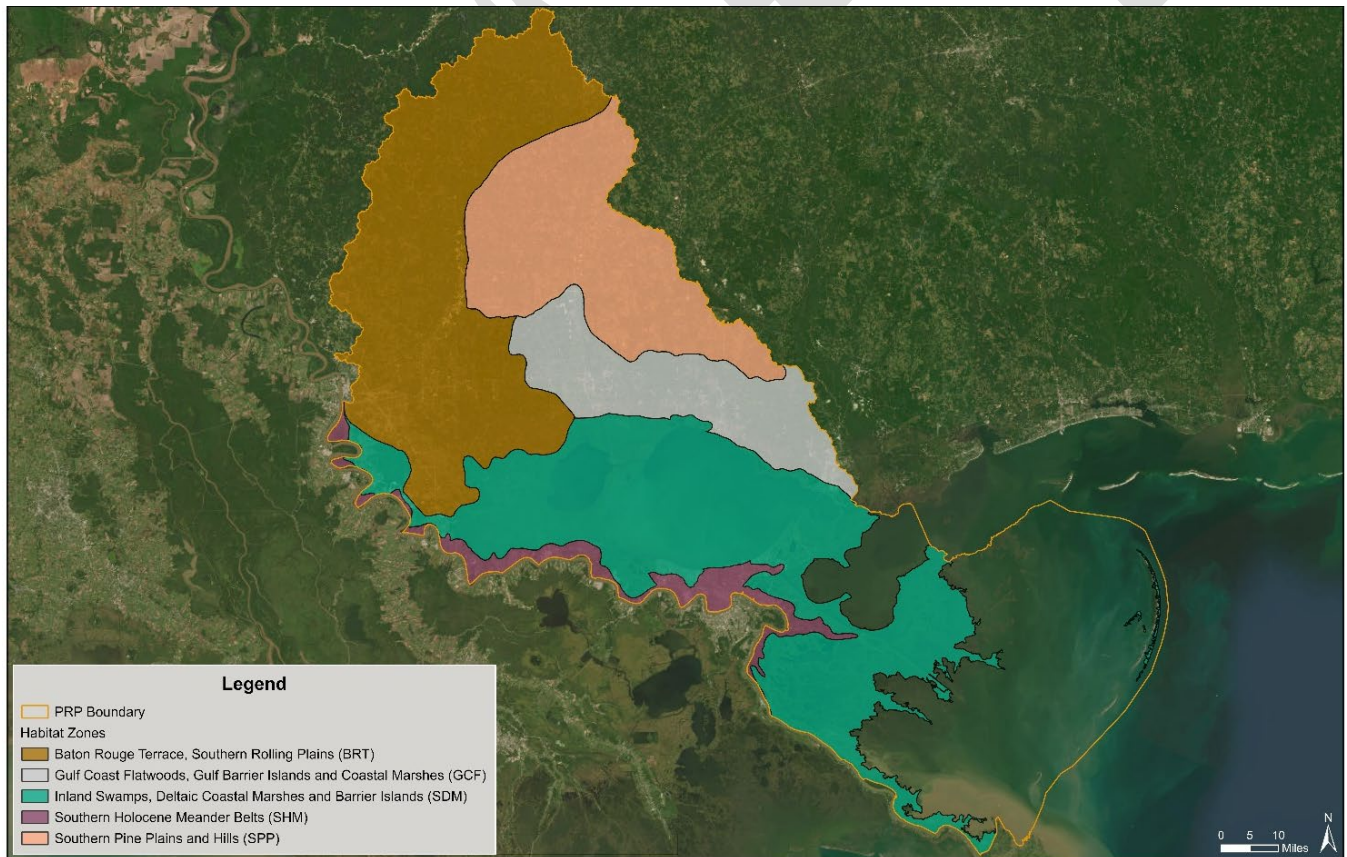


Figure 34. Conceptual model of the connection of dynamic and stationary environmental components and production area in tidal-river estuaries (Peterson, 2003).

3269 **HABITAT CHARACTERIZATION**

3270 In this section, habitat zones have been identified based in part on an ecoregion framework (Omernik, 1987).  
3271 These ecoregions denote areas of similarity in the mosaic of biotic, abiotic, terrestrial, and aquatic  
3272 ecosystem components, with humans being considered as part of the biota. A review of the Level III and  
3273 Level IV ecoregions (Omernik & Griffith, 2014) for Pontchartrain Basin showed that the eight Level IV  
3274 ecoregions within the basin could be grouped into five habitat zones to reflect major differences and  
3275 similarities (Figure 35). These five habitat zones are used throughout this section (Level IV ecoregion names  
3276 are italicized):

- 3277 ● *Southern Pine Plains and Hills (SPP)*: Corresponds to the Level IV ecoregion.
- 3278 ● *Southern Holocene Meander Belts (SHM)*: Corresponds to the Level IV ecoregion.
- 3279 ● Inland Swamps, Deltaic Coastal Marshes and Barrier Islands (SDM): Combines two Level IV  
3280 ecoregions - *Inland Swamps* and *Deltaic Coastal Marshes and Barrier Islands*.
- 3281 ● Gulf Coast Flatwoods, Gulf Barrier Islands and Coastal Marshes (GCF): Combines two Level IV  
3282 ecoregions - *Gulf Coast Flatwoods* and *Gulf Barrier Islands and Coastal Marshes*.
- 3283 ● Baton Rouge Terrace, Southern Rolling Plains (BRT): Combines two Level IV ecoregions - *Baton Rouge*  
3284 *Terrace* and *Southern Rolling Plains*.



3285 **Figure 35. Five habitat zones within the Lake Pontchartrain Basin Restoration Program**  
3286 **(PRP) boundary.**  
3287

3288 **HABITAT TYPES**

3289 To ensure coverage of the entire basin, this report has utilized data from the National Land Cover Database  
 3290 (NLCD) which uses Landsat data to produce data with a 30-meter spatial resolution<sup>31</sup> for 16 land use/land  
 3291 cover (LULC) types based on a modified Anderson Level II classification system (Anderson et al., 1976).  
 3292 NLCD is described in the Basin Characterization section. Figure 14 shows the distribution of these classes  
 3293 for the Pontchartrain Basin, and Table 14 describes the LULC categories.

3294 **Table 14. Definitions of LULC classes.**<sup>32</sup>

LULC CLASS	DEFINITION
Open Water	Areas of open water, generally with less than 25% cover of vegetation or soil.
Developed, Open Space	Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover.
Developed, Low Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover.
Developed, Medium Intensity	Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover.
Barren Land	Areas of bedrock, scarps, talus, slides, sand dunes, strip mines, gravel pits, and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
Deciduous Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.
Evergreen Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year.
Mixed Forest	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.
Shrub/Scrub	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation.
Grassland/Herbaceous	Areas dominated by graminoid or herbaceous vegetation, generally greater than 80% of total vegetation.
Pasture/Hay	Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.
Cultivated Crops	Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards.
Woody Wetlands	Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Emergent Herbaceous Wetlands	Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

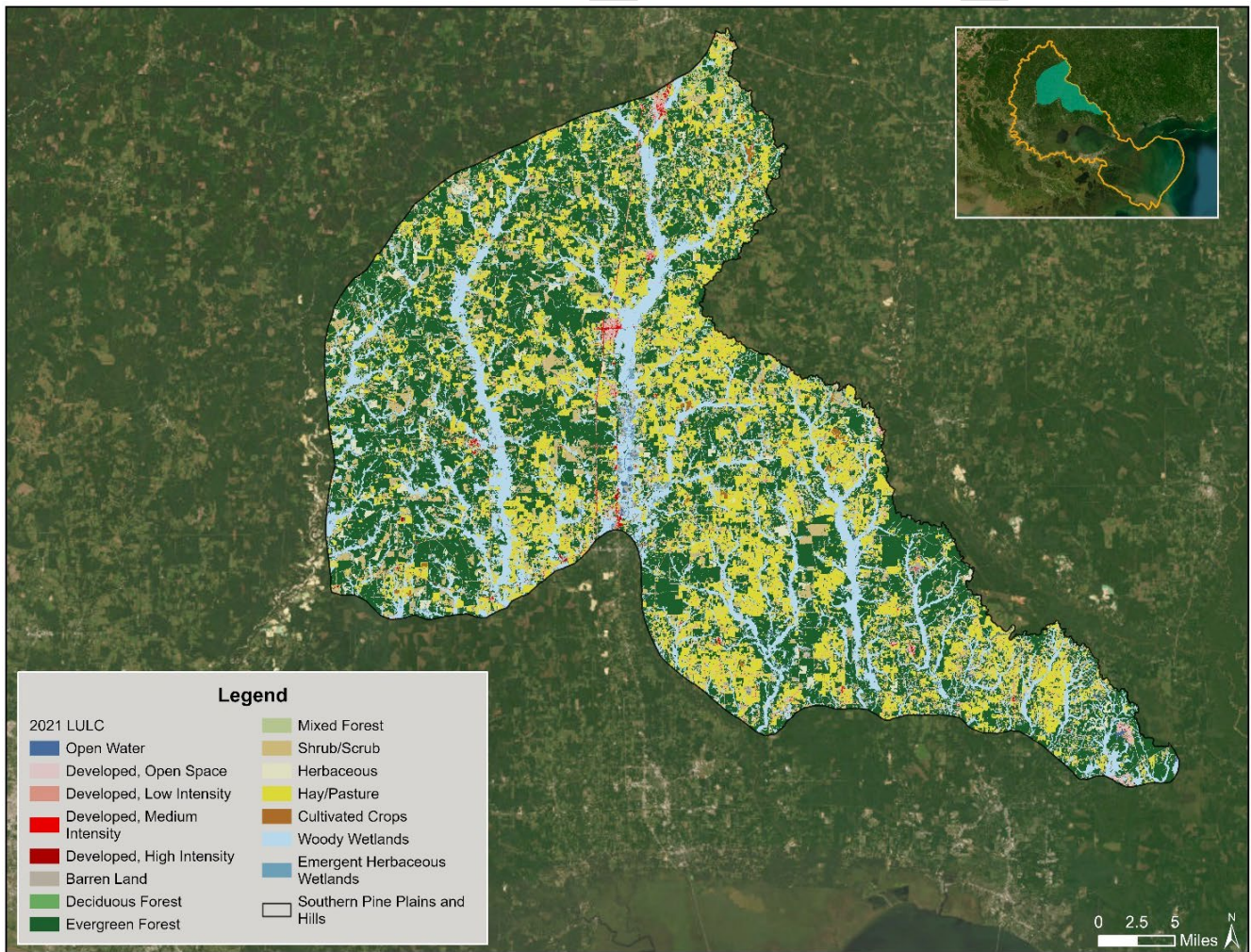
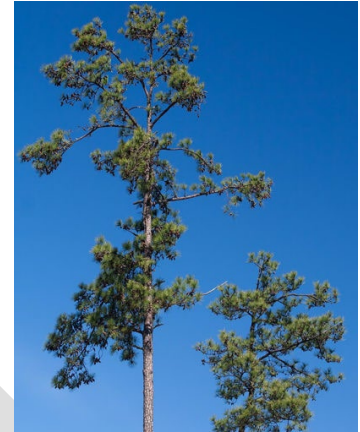
<sup>31</sup> Note that the 30m spatial resolution may not capture small scale variations in wetlands and changes that occur at the local scale.

<sup>32</sup> More information can be accessed via the following link: <https://www.mrlc.gov/data/legends/national-land-cover-database-class-legend-and-description>

3295 **HABITAT ZONES**

3296 **Southern Pine Plains and Hills**

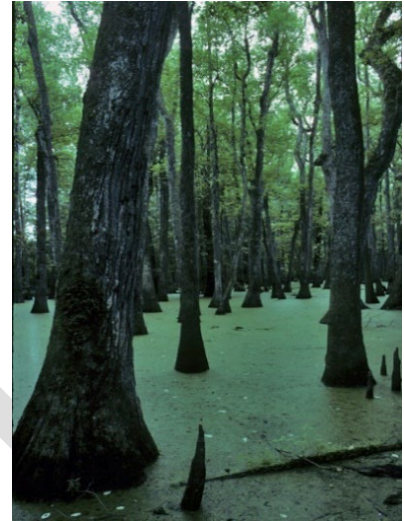
3297 The Southern Pine Plains and Hills (SPP) habitat zone covers areas of southern  
3298 Mississippi and Alabama, extending into eastern Louisiana, with a landscape  
3299 characterized by coastal plains moderately to deeply dissected by streams that  
3300 form low rolling hills and broad, gently sloping ridges. The zone was  
3301 historically dominated by longleaf pine (*Pinus palustris*) woodlands. These  
3302 ecosystems, which supported species such as the gopher tortoise (*Gopherus*  
3303 *polyphemus*) and the red-cockaded woodpecker (*Dryobates borealis*), have  
3304 largely been replaced by mixed forests of loblolly pine (*Pinus taeda*) and slash  
3305 pine (*Pinus elliottii*) in wetter areas. Present land use includes forestland, pine  
3306 plantations, cattle and dairy production, and some minor cropland, reflecting  
3307 the shift in both land cover and agricultural practices (Figure 36).



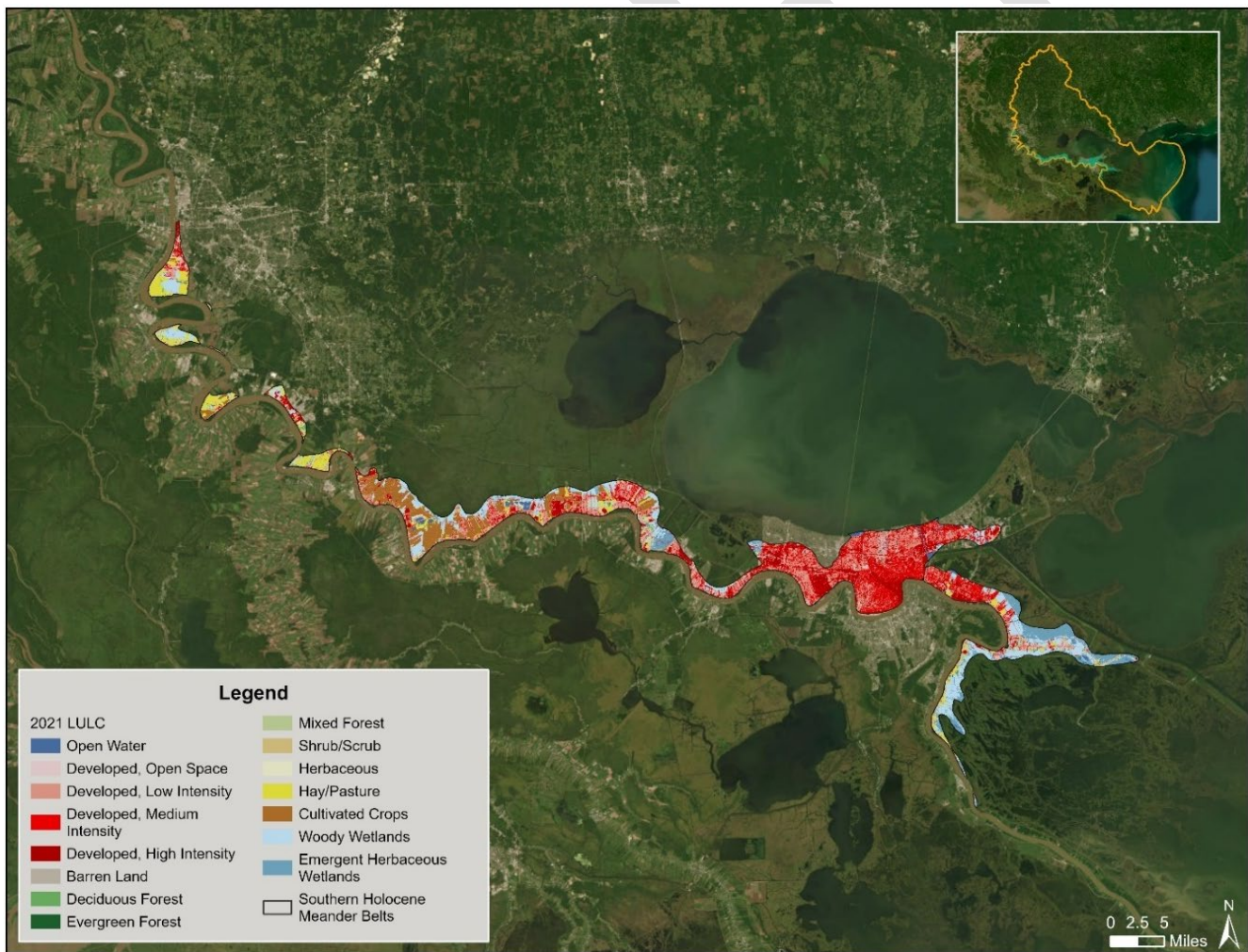
3308 **Figure 36. Distribution of LULC for 2021 in the Southern Pine Plains and Hills habitat zone**  
3309 **(Dewitz, 2023).**  
3310

3311 **Southern Holocene Meander Belts**

3312 The Southern Holocene Meander Belts (SHM) zone stretches along the  
3313 current natural levees of the Mississippi River, creating flat plains and  
3314 river meander belts with natural levees, oxbows, and abandoned  
3315 channels. This zone spans parishes such as St. Bernard, Plaquemines,  
3316 Orleans, Jefferson, St. Charles, St. John, St. James, Ascension, Iberville,  
3317 and East Baton Rouge. Vegetation includes baldcypress (*Taxodium*  
3318 *distichum*)-tupelo gum (*Nyssa aquatica*) swamps in the wettest areas and  
3319 sweetgum (*Liquidambar styraciflua*), live oak (*Quercus virginiana*), water  
3320 oak (*Quercus nigra*), nuttall oak (*Quercus texana*), and green ash (*Fraxinus*  
3321 *pennsylvanica*) in less frequently flooded zones. The zone has been  
3322 extensively modified for agriculture and flood control, with crops such as  
3323 sugarcane and soybeans dominating the land cover (Figure 37). Crawfish  
3324 aquaculture is also found in this zone.



3325

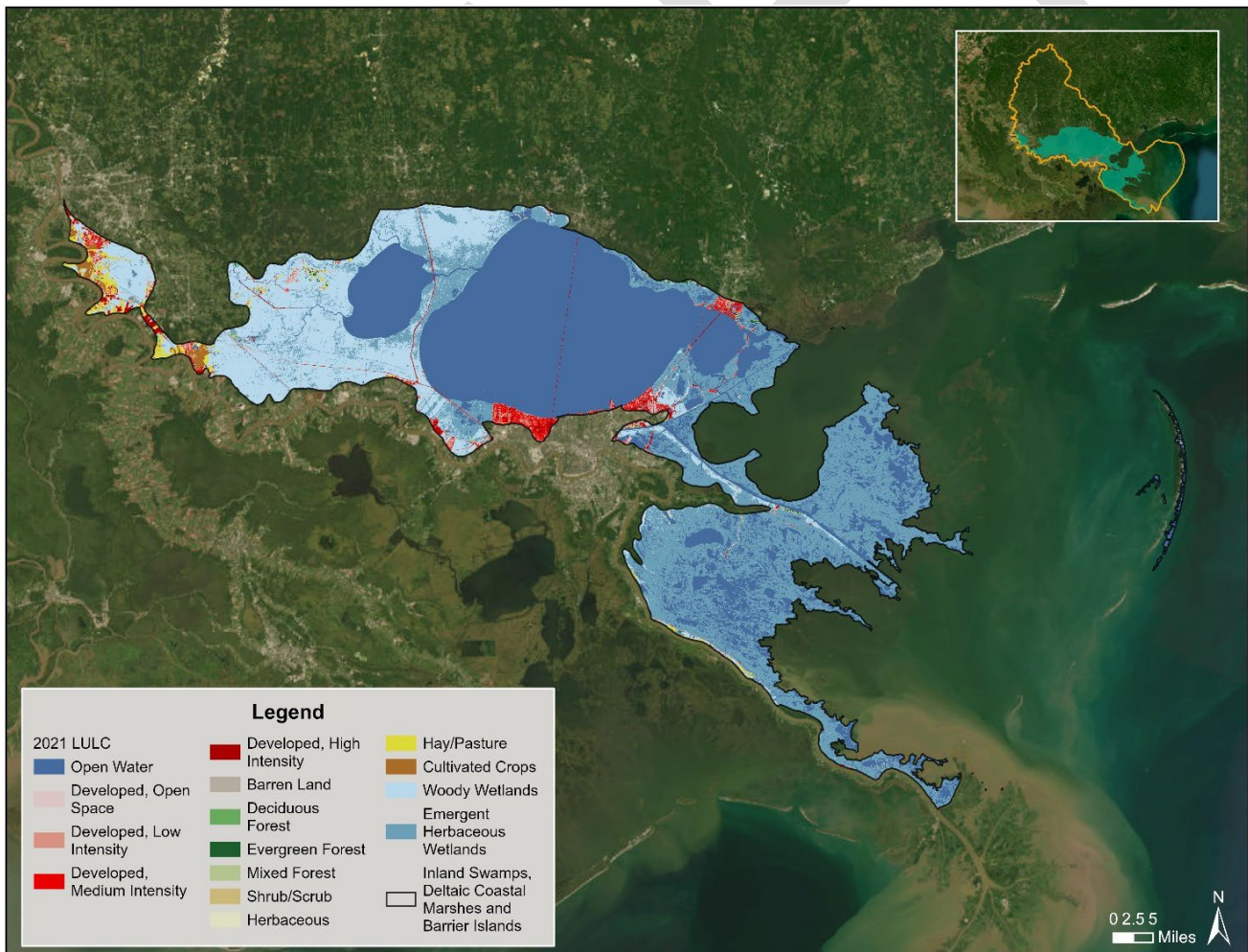


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3328

**Figure 37. Distribution of LULC for 2021 in the Southern Holocene Meander Belt habitat zone (Dewitz, 2023).**

3329 **Inland Swamps, Deltaic Coastal Marshes and Barrier Islands**

3330 Further seaward, in lower elevations, is the Inland Swamps, Deltaic Coastal Marshes and Barrier Islands  
3331 (SDM) habitat zone. The Inland Swamps represent a transition zone from freshwater environments to  
3332 brackish and saline marshes near the coast. Spanning parishes like St. Charles, St. John, St. James,  
3333 Ascension, Livingston, Tangipahoa, Iberville, and parts of East Baton Rouge and St. Tammany, this area is  
3334 characterized by baldcypress-tupelo gum swamp forests, with sedges, grasses, and rushes prevalent in  
3335 frequently flooded areas. These wetlands provide important wildlife habitats and are utilized for activities  
3336 such as fishing (commercial and recreational) and hunting. Oil and gas production is also prevalent,  
3337 reflecting the zone's economic reliance on natural resources. Adjacent to the swamps, the Deltaic Coastal  
3338 Marshes and Barrier Islands lie on the flat deltaic and coastal plains and are dominated by a mix of  
3339 freshwater and saline marshes (Figure 38). In St. Bernard Parish, this zone is notable for its vegetation  
3340 tolerant of saline conditions, including species like saltgrass (*Distichlis spicata*), black needlerush (*Juncus*  
3341 *gerardii*), and wiregrass (*Spartina patens*). The zone is under threat due to land loss from subsidence and  
3342 erosion and a lack of extensive sediment input (Penland et al., 2001). Nevertheless, these wetlands support  
3343 vital wildlife habitats and are economically important for activities such as hunting, fishing, and oil/gas  
3344 production.



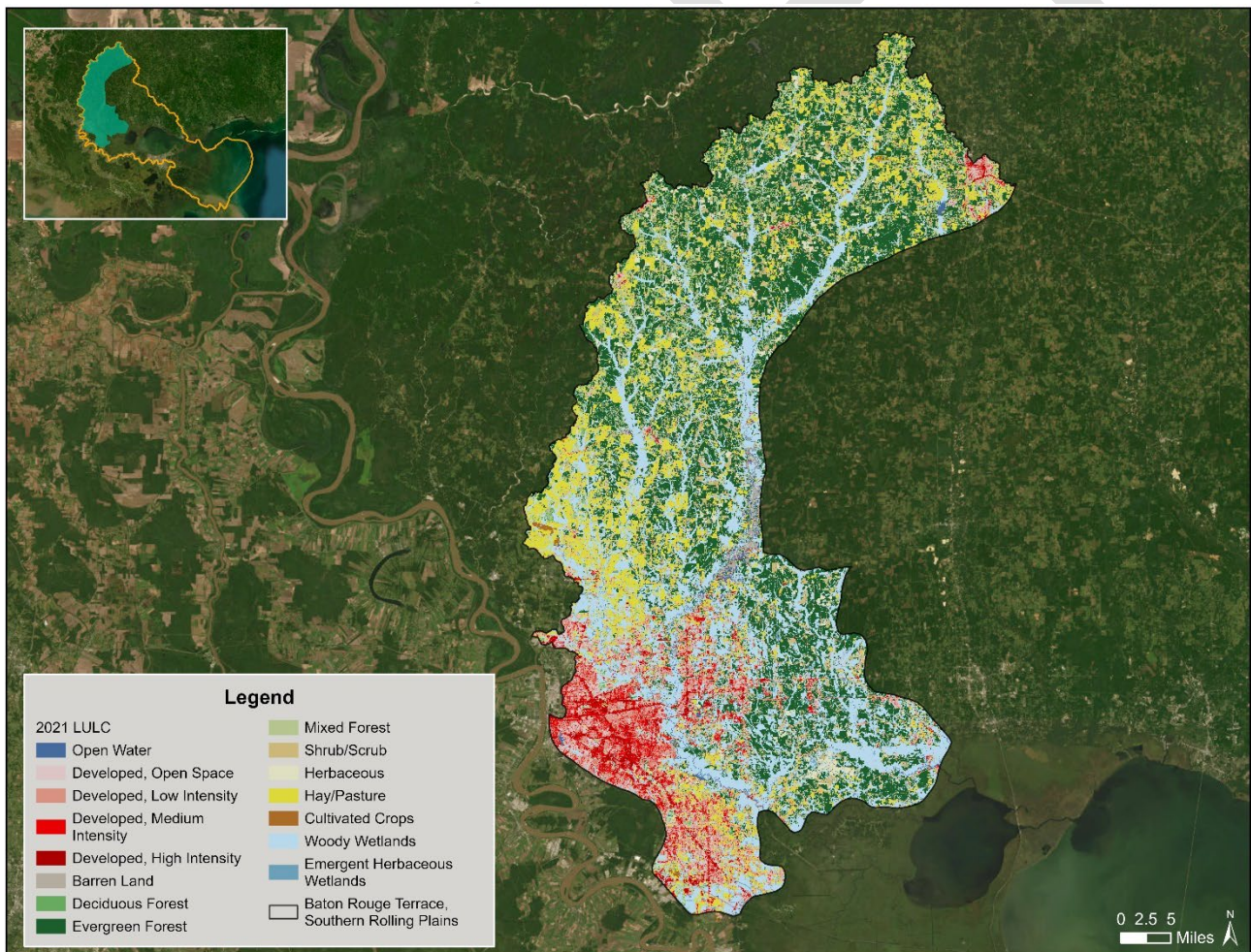
3345 **Figure 38. Distribution of LULC in 2021 for the Inland Swamps, Deltaic Coastal Marshes and**  
3346 **Barrier Islands habitat zone (Dewitz, 2023).**  
3347

3348 **Southern Rolling Plains and Baton Rouge Terrace**

3349 Moving inland, the Southern Rolling Plains and Baton Rouge  
3350 Terrace habitat zone (BRT) features gently rolling hills and flat  
3351 plains dissected by low-gradient streams. In parishes like  
3352 East Feliciana and St. Helena, the Southern Rolling Plains are  
3353 characterized by pine-oak forests, with shortleaf pine (*Pinus*  
3354 *echinata*) and loblolly pine alongside white oak (*Quercus alba*)  
3355 and live oak. Land use here includes pine plantations, mixed  
3356 pine-hardwood forests, pasture, hay land, and some oil and  
3357 gas production.



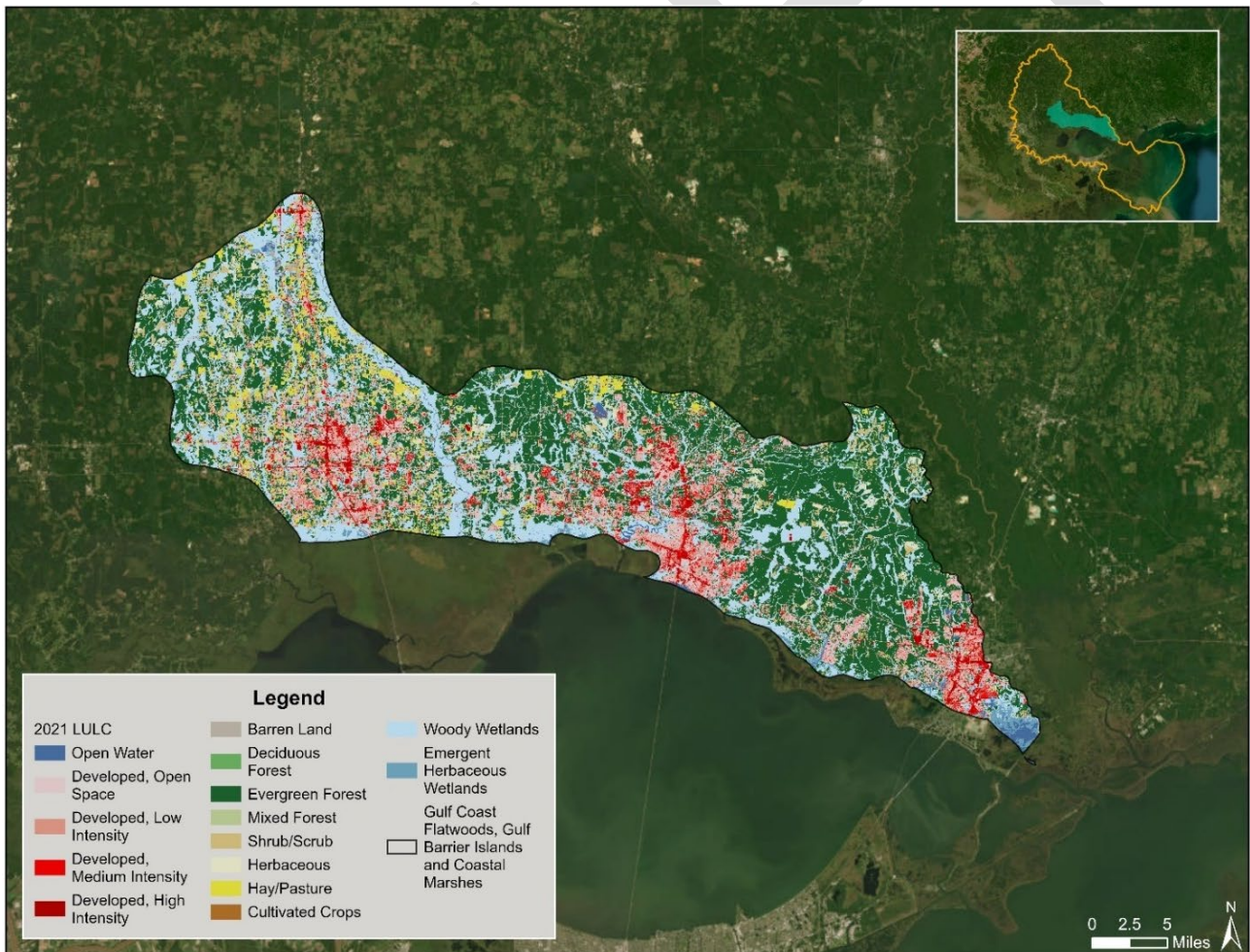
3358 The Baton Rouge Terrace, spanning Livingston, East Baton Rouge, Ascension, and East Feliciana parishes,  
3359 features hardwood forests of cherrybark oak (*Quercus pagoda*), swamp chestnut oak (*Quercus michauxii*),  
3360 sweetgum, and sycamore (*Platanus occidentalis*), as well as urban and industrial development. Large areas  
3361 of mixed pine-hardwood forest have been cleared for agriculture and urbanization (Figure 39), with oil and  
3362 gas production continuing as an important land use.



3363  
3364 **Figure 39. Distribution of LULC in 2021 for the Southern Rolling Plains and Baton Rouge**  
3365 **Terrace habitat zone (Dewitz, 2023).**

3366 **Gulf Coast Flatwoods, Gulf Barrier Islands and Coastal Marshes**

3367 The Gulf Coast Flatwoods, Gulf Barrier Islands and Coastal Marshes (GCF) represent another unique  
 3368 landscape. The Gulf Coast Flatwoods, located primarily in St. Tammany, Tangipahoa, Livingston, and St.  
 3369 Helena parishes, is characterized by flat to gently undulating coastal plains that historically supported  
 3370 longleaf-pine-dominated flatwoods and savannas. Frequent fires maintained this landscape. Today, most  
 3371 longleaf pine savannas have been lost. The few remaining areas of pine  
 3372 savannah are biodiversity hotspots. Over time, much of this area has  
 3373 been converted to pine plantations, mixed pine forests, pasture, and  
 3374 urban developments (Figure 40). The zone’s remaining natural areas  
 3375 are important wildlife habitat and support diverse plant communities,  
 3376 including bog communities with pitcher plants and orchids, and are  
 3377 important for habitat-dependent amphibians (e.g., dusky gopher frog  
 3378 [*Lithobates sevosus*]), reptiles (e.g., pinewoods snake [*Rhadinaea*  
 3379 *flavilata*]), and birds (e.g., Henslow’s sparrow [*Centronyx henslowii*] and Bachman’s sparrow [*Peucaea*  
 3380 *aestivalis*]). Only a small portion of the Gulf Barrier Islands and Coastal Marshes habitat zone occurs within  
 3381 the PRP boundary near the mouth of the Pearl River. It is characterized by tidal freshwater marshes.



3382 **Figure 40. Distribution of LULC in 2021 for the Gulf Coast Flatwoods, Gulf Barrier Islands and Coastal Marshes habitat zone (Dewitz, 2023).**  
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3385 **HABITATS ACROSS THE PONTCHARTRAIN BASIN**

3386 The distribution of LULC across Pontchartrain Basin as a whole and by habitat zone for 2021 is shown in Table 15.

3387 **Table 15. Distribution of LULC classes for 2021 across the habitat zones within the PRP boundary.**

LULC CLASS	SPP ACRES	SPP % OF ZONE	SHM ACRES	SHM % OF ZONE	SDM ACRES	SDM % OF ZONE	GCF ACRES	GCF % OF ZONE	BRT ACRES	BRT % OF ZONE	TOTAL ACRES	TOTAL % OF PB
Open Water	3,172	0.41%	2,740	1.62%	663,790	45.08%	5,501	1.14%	10,530	0.81%	685,732	16.38%
Developed, Open Space	42,357	5.53%	13,987	8.29%	10,363	0.70%	55,952	11.57%	112,571	8.68%	235,230	5.62%
Developed, Low Intensity	11,361	1.48%	29,411	17.42%	17,442	1.18%	45,261	9.36%	72,871	5.62%	176,347	4.21%
Developed, Medium Intensity	1,802	0.24%	38,772	22.97%	24,188	1.64%	17,052	3.53%	38,640	2.98%	120,455	2.88%
Developed High Intensity	292	0.04%	14,149	8.38%	6,356	0.43%	3,614	0.75%	8,939	0.69%	33,350	0.80%
Barren Land	2,660	0.35%	526	0.31%	1,193	0.08%	2,536	0.52%	10,350	0.80%	17,265	0.41%
Deciduous Forest	346	0.05%	82	0.05%	103	0.01%	1	0.00%	4,737	0.37%	5,268	0.13%
Evergreen Forest	261,099	34.10%	248	0.15%	2,738	0.19%	180,529	37.34%	342,091	26.38%	786,704	18.79%
Mixed Forest	29,700	3.88%	765	0.45%	493	0.03%	366	0.08%	75,425	5.82%	106,749	2.55%
Shrub/Scrub	42,806	5.59%	49	0.03%	51	0.00%	10,393	2.15%	52,868	4.08%	106,168	2.54%
Grassland/Herbaceous	30,069	3.93%	66	0.04%	1,767	0.12%	9,857	2.04%	45,806	3.53%	87,564	2.09%
Pasture/Hay	191,742	25.04%	12,970	7.68%	16,423	1.12%	26,515	5.48%	207,400	15.99%	455,050	10.87%
Cultivated Crops	2,469	0.32%	17,525	10.38%	5,878	0.40%	391	0.08%	3,329	0.26%	29,591	0.71%
Woody Wetlands	142,908	18.67%	25,260	14.97%	292,359	19.85%	117,811	24.37%	303,396	23.39%	881,734	21.06%
Emergent Herbaceous Wetlands	2,854	0.37%	12,241	7.25%	429,428	29.16%	7,718	1.60%	8,033	0.62%	460,273	10.99%
Total	765,635	N/A	168,790	N/A	1,472,571	N/A	483,497	N/A	1,296,987	N/A	4,187,479	N/A

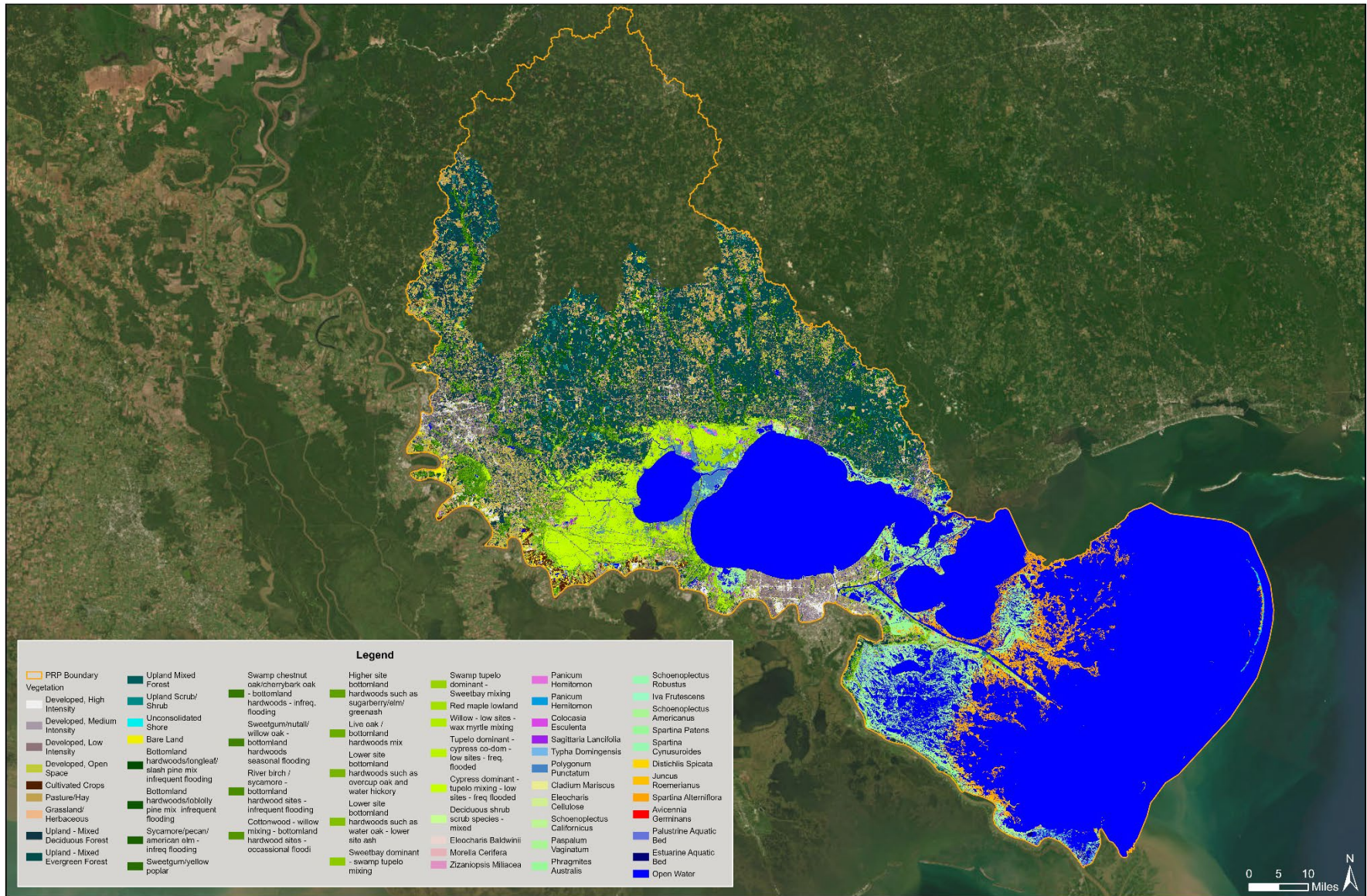
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3389 The northernmost habitat zones (SPP and BRT) are dominated by woody wetlands, evergreen forest, and  
3390 pasture/hay. Developed open space is also important, with larger areas in BRT than SPP, probably due to  
3391 more urban developed areas closer to the Mississippi River. GCF is dominated by evergreen forest and  
3392 woody wetlands for natural land cover, with a large proportion of developed low-intensity and developed  
3393 open space. This habitat zone includes the towns and communities on the Northshore of Lake Pontchartrain.  
3394 Close to the Mississippi River is the SHM habitat zone, with over 55% of the area in one of the developed land  
3395 categories. Cultivated crops and pasture/hay are also important cover types in these areas along the  
3396 Mississippi River. Over 45% of the SDM habitat zone is open water, with woody wetlands and emergent  
3397 herbaceous wetlands dominating the non-water categories.

3398 The NLCD database groups large areas of the lower basin, especially the SDM habitat zone as either woody  
3399 wetlands or emergent herbaceous wetlands. Figure 41 shows more detail in this area using a dataset  
3400 developed for use in the 2023 Louisiana Coastal Master Plan (Couvillion, 2023). These data distinguish  
3401 different species for bottomland hardwood, swamp, and marsh areas based on those species considered in  
3402 the master plan analysis.

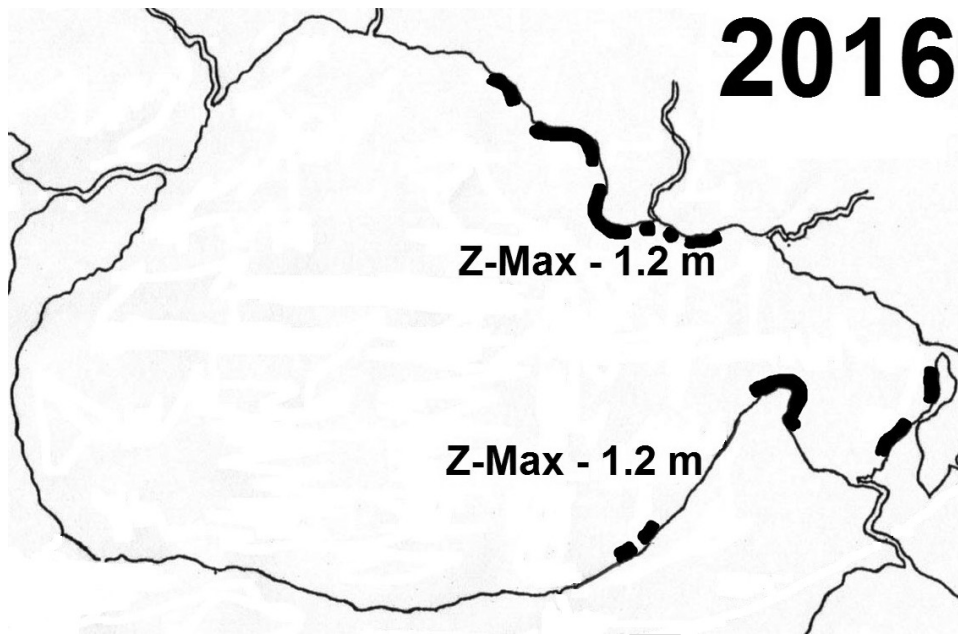
3403 Submerged aquatic vegetation (SAV) provides critical structural habitat for valuable nekton and wildlife  
3404 species and can buffer wave energy in shallow waters. Across the Pontchartrain Basin, SAV exists along a  
3405 salinity zonation with freshwater species that colonize brackish water, brackish water species, and true  
3406 marine seagrasses (Hester et al., 2005). The nature and distribution of SAV in the basin varies due to a  
3407 number of conditions (see Effects of Climate Variability and Environmental Change on Habitat section),  
3408 including the hardening of many shorelines. The distribution of SAV in Lake Pontchartrain is limited to the  
3409 eastern shorelines, and has been in an overall state of decline since first surveyed in 1953, with an  
3410 approximate 90 percent decrease of SAV by 2016 compared to 1953 (Poirrier et al., 2017). Figure 42 shows  
3411 the most recent map available for 2016. SAV was found along the north shore of Lake Pontchartrain from the  
3412 area of Fontainebleau State Park to west of Slidell. On the south shore, some SAV were found on New  
3413 Orleans East and around Irish Bayou with additional patches on the landbridge between Chef Menteur Pass  
3414 and the Rigolets. The back barrier shallows of the Chandeleur Islands is the only area in Louisiana where true  
3415 marine seagrasses occur, and these seagrass meadows support complex marine communities (Darnell et al.,  
3416 2017).

3417 Dynamic habitats vary so much on a seasonal and interannual basis as well as with operations (e.g., of the  
3418 Bonnet Carré Spillway) and are not described in detail here. Rather, throughout this section, where dynamic  
3419 habitat factors are key components of habitats (e.g., for estuarine nekton), these are discussed in relation to  
3420 specific species and with case studies.



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Figure 41. Vegetation map for 2018 using Sentinel-2 imagery for areas within the PRP boundary (Couvillion, 2023).



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 3424 **Figure 42. Littoral distribution of SAV in Lake Pontchartrain in 2016 and the maximum**  
 3425 **colonization depth (from Poirrier et al., 2017).**

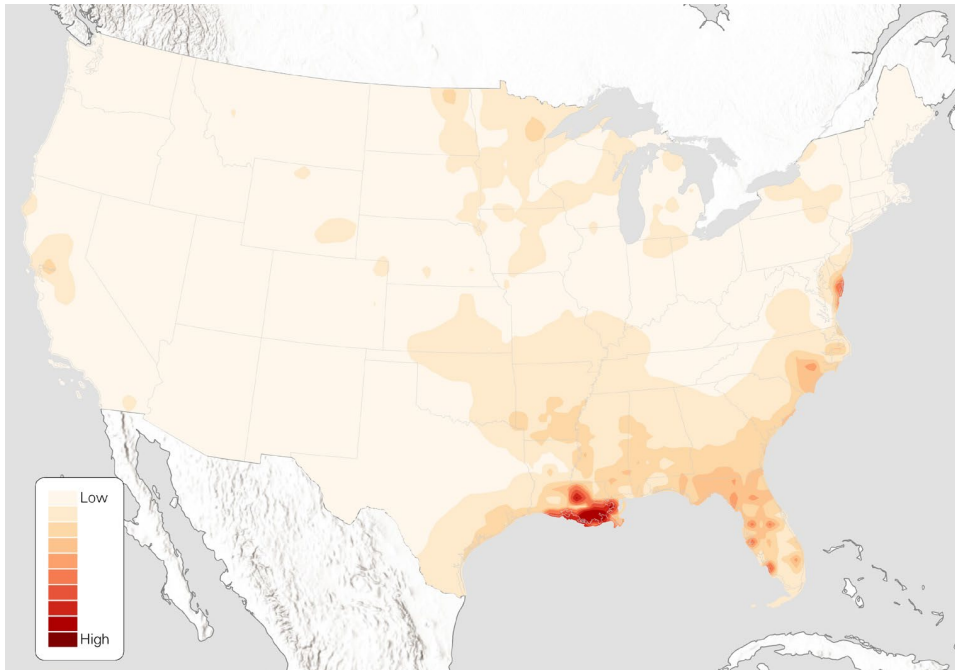
3426 **SECTION OVERVIEW**

3427 This section uses the habitat zone designations above to describe habitat change since 2001. These  
 3428 changes, and their causes, are discussed in the context of how they were considered in the 2006 CHMP, as  
 3429 well as the current understanding of drivers of change, including the role of environmental change. The  
 3430 importance of habitats is described, especially for species of concern, and case studies are used to illustrate  
 3431 the diverse problems associated with habitat change. Ongoing monitoring and assessment efforts are  
 3432 outlined, and aspects of the policy and regulatory framework for habitat conservation and restoration are  
 3433 described. Conservation and restoration is ongoing across the basin and case studies are used to illustrate  
 3434 approaches, successes, and lessons learned. Lastly, challenges and opportunities for future restoration  
 3435 efforts are discussed.

3436 **Habitat Change**

3437 **NATIONAL CONTEXT**

3438 The U.S. Fish and Wildlife Service (USFWS) recently published a report to Congress on the status and trends  
 3439 of wetlands in the contiguous United States (U.S.) from 2009 to 2019 (Lang et al., 2024); the report noted a  
 3440 net wetland loss of 221,000 acres. Figure 43 demonstrates that south Louisiana generally is a hotspot for  
 3441 loss of wetlands far exceeding the national average and not only in the coastal area. This underscores the  
 3442 national importance of the change going on in this region and the need to document and understand habitat  
 3443 change to provide a basis for restoration and conservation efforts.



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**Figure 43. Map showing relative density of net vegetated wetland decrease (loss to upland and deepwater and change to non-vegetated wetlands) in the conterminous U.S. between 2009 and 2019 (from Lang et al., 2024).**

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## A HISTORY OF CHANGE

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The Pontchartrain Basin has experienced profound LULC changes over the past two centuries, as documented in the 2006 CHMP. These transformations, driven by industrialization, logging, agriculture, and hydrological modifications, resulted in the near eradication of vast longleaf pine forests, which were replaced by less ecologically valuable managed forests and open lands. Canebrake habitats (monotypic stands of giant cane, or switch cane, *Arundinaria gigantea*) were similarly cleared for agricultural use, further diminishing biodiversity and altering the landscape. Wetlands throughout the basin faced severe degradation, with large areas transformed into open water or repurposed for human activities. The cumulative effects of these changes reflect extensive habitat loss and significant shifts in the basin's ecological framework.

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Hydrological modifications, such as distributary closure and levee construction and canal development, as identified in the CHMP, disrupt natural water and sediment flow and accelerate wetland decline and habitat degradation. Clear-cutting practices and industrial expansion compounded these impacts, converting thousands of acres into degraded landscapes or open water. Additionally, natural disasters like hurricanes exacerbated these losses, causing widespread erosion and destruction of important habitats. The 2006 CHMP highlights these changes as a significant threat to the basin's ecological health, emphasizing the urgent need for habitat restoration and sustainable management to mitigate further losses and support native biodiversity.

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The 2006 CHMP identified important habitat changes and highlighted priority areas for restoration and conservation in the Pontchartrain Basin. It served as a baseline for understanding the region's ecological dynamics and the pressures influencing land cover transformations.

3469 **RECENT PATTERNS OF CHANGE**

3470 Building on the work of the 2006 CHMP, the current analysis examines LULC changes over the past two  
3471 decades, from 2001 to 2021 (Dewitz, 2023; U.S. Geological Survey [USGS], 2024a, 2024b). This updated  
3472 evaluation provides a clearer picture of ongoing shifts and emerging priorities for habitat management in the  
3473 basin. Table 16 and Table 17 show the change in habitat distribution by habitat zone in terms of percentage  
3474 change and acreage change. LULC changes in the Pontchartrain Basin between 2001 and 2021 are observed  
3475 in several habitat zones, but changes above 25% are not always associated with substantial acre differences.  
3476 In summary, by habitat zone (Figure 35):

- 3477 ● In SHM, evergreen forest expanded by 211.2%, amounting to a gain of 168 forest acres. Shrub/scrub  
3478 vegetation showed a striking 1,360% increase, but this only represents an addition of 45 acres, while  
3479 barren land rose by 196.9%, equivalent to 348 acres. Contrarily, mixed forest saw a 27.1% decline,  
3480 losing 285 acres, reflecting a reduction in forest diversity in this region.
- 3481 ● In SDM, emergent herbaceous wetlands decreased by 0.7%, losing 3,116 acres, underscoring wetland  
3482 retreat. Similarly, shrub/scrub cover plummeted by 79.6%, with a loss of 199 acres, indicating  
3483 vegetation transformation. Hay/pasture cover decreased by 26.6%, losing 5,961 acres, and mixed  
3484 forest lost 251 acres, 33.8%. Open water increased by 0.2%, with 1,383 more acres in 2021.
- 3485 ● The BRT displayed an 80.6% increase in herbaceous cover, translating to a gain of 20,443 acres, and  
3486 a 156.4% rise in emergent herbaceous wetlands, equating to an addition of 4,900 acres. Conversely,  
3487 deciduous and mixed forests declined by 36.4% and 20.0%, corresponding to losses of 2,708 acres  
3488 and 18,888 acres, respectively. Shrub/scrub land cover decreased by 35.3% with a loss of 28,893  
3489 acres. All classifications of developed land increased, with low-intensity gaining 17,520 acres  
3490 (31.7%), medium-intensity gaining 15,977 acres (70.5% increase), and high-intensity gaining 3,377  
3491 acres (60.7% increase). Cultivated land also increased by 51.8%, with a gain of 1,136 acres.
- 3492 ● Urbanization was a defining trend in GCF, where medium-intensity development expanded by 100.7%,  
3493 accounting for an increase of 8,555 acres. Similar urban growth patterns were observed in high-  
3494 intensity development, which increased by 81.4%, adding 1,621 acres. Deciduous forest, mixed forest,  
3495 shrub/scrub, herbaceous, and cultivated crops land cover decreased by 62.5%, 35.9%, 65.8%, 29.8%,  
3496 and 38.9% respectively. Shrub/scrub lost 19,967 acres, and woody wetlands lost 6,926 acres.
- 3497 ● Similar to GCF, SPP saw an increase in all the developed land categories between 2001 and 2021: a  
3498 39.2% increase of low intensity developed land (3,200 acres); a 62.9% increase of medium intensity  
3499 developed land (696 acres); and a 114.2% increase in high intensity developed land (156 acres).  
3500 There was a 48.9% decline in coverage of deciduous forests (331 acres) and a 27.1% decline in  
3501 shrub/scrub coverage (15,886 acres). Evergreen forest expanded by 10.5%, amounting for a gain of  
3502 24,746 acres, highlighting forest recovery efforts. Herbaceous land cover increased by 28.4%, with an  
3503 addition of 6,649 acres. Emergent herbaceous wetlands tripled in size, with a 217.3% increase equal  
3504 to an addition of 1,954 acres.
- 3505 ● These Figures highlight the intensifying human footprint in these habitat zones. The percentage of  
3506 developed land categories increased in SPP, GCF, and BRT with most of that change occurring  
3507 between 2001 and 2011, potentially associated with Hurricane Katrina. The acreage data identifies  
3508 spatial variation in impacts of LULC changes with increased evergreen forest in SPP and BRT and  
3509 loss of shrub/scrub in all habitat zones except SHM. Overall, these changes reflect ecological and  
3510 anthropogenic forces shaping the Pontchartrain Basin landscape, but they do not provide data on the  
3511 quality of the habitat provided or whether tracts of forest, for example, are continuous or fragmented.  
3512 The implications of these LULC changes will be felt locally in different ways across the basin.

**Table 16. Change in LULC by habitat zone for 2001 to 2021 as % (Dewitz, 2023; USGS, 2024a, 2024b).**

HABITAT ZONE AND DATES OF CHANGE	SPP 2001- 2011	SPP 2011- 2021	SPP 2001- 2021	SHM 2001- 2011	SHM 2011- 2021	SHM 2001- 2021	SDM 2001- 2011	SDM 2011- 2021	SDM 2001- 2021	GCF 2001- 2011	GCF 2011- 2021	GCF 2001- 2021	BRT 2001- 2011	BRT 2011- 2021	BRT 2001- 2021
Open Water	-10.0	35.9	22.3	-2.3	16.6	13.8	0.7	-0.5	0.2	10.0	-4.0	5.5	-1.2	27.7	26.2
Dev., Open Space	4.0	3.0	7.1	-14.7	4.0	-11.2	-13.7	7.9	-6.9	2.8	5.5	8.5	-2.2	4.0	1.7
Dev., Low Intensity	29.2	7.7	39.2	3.1	1.7	4.8	9.5	2.2	11.9	44.6	7.0	54.8	23.0	7.1	31.7
Dev., Medium Intensity	41.8	14.9	62.9	8.9	1.7	10.8	22.7	9.1	33.9	69.1	18.7	100.7	47.8	15.4	70.5
Dev., High Intensity	58.2	35.4	114.2	7.9	4.4	12.7	10.9	7.5	19.2	55.8	16.4	81.4	38.2	16.3	60.7
Barren Land	45.7	18.5	72.6	81.2	63.9	196.9	-15.5	-0.5	-15.9	31.9	45.7	92.2	16.5	13.2	32.0
Deciduous Forest	-40.4	-14.2	-48.9	-6.5	-2.1	-8.5	-2.5	0.4	-2.1	-18.8	-53.8	-62.5	-26.5	-13.4	-36.4
Evergreen Forest	6.1	4.1	10.5	164.8	17.5	211.2	1.4	14.1	15.7	-2.8	4.4	1.5	13.5	-0.4	13.0
Mixed Forest	-6.7	-10.8	-16.7	-22.3	-6.3	-27.1	-29.7	-5.8	-33.8	-24.7	-14.8	-35.9	-9.3	-11.8	-20.0
Shrub/Scrub	-13.2	-15.9	-27.1	560.0	121.2	1360.0	16.4	-82.5	-79.6	-31.1	-50.3	-65.8	-33.1	-3.4	-35.3
Herbaceous	6.2	20.9	28.4	-14.5	-16.1	-28.3	-29.7	51.2	6.3	-9.9	-22.1	-29.8	16.7	54.8	80.6
Hay/Pasture	-4.0	-3.1	-7.0	-5.6	-17.6	-22.2	-15.4	-13.3	-26.6	-9.8	-7.7	-16.7	-10.3	-7.9	-17.4
Cultivated Crops	-5.7	-8.7	-13.9	-5.1	1.4	-3.8	6.7	12.5	20.1	-19.9	-23.8	-38.9	14.9	32.1	51.8
Woody Wetlands	-2.0	-1.3	-3.3	-4.6	-2.7	-7.2	-0.4	-0.1	-0.4	-3.2	-2.5	-5.6	-2.7	-2.1	-4.7
Em. Herb. Wetlands	105.3	54.6	217.3	4.2	2.9	7.3	-1.0	0.3	-0.7	11.7	23.6	38.0	78.8	43.4	156.4

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**Table 17. Change in LULC by habitat zone for 2001 to 2021 in acres (Dewitz, 2023; USGS, 2024a, 2024b).**

HABITAT ZONE AND DATES OF CHANGE	SPP 2001- 2011	SPP 2011- 2021	SPP 2001- 2021	SHM 2001- 2011	SHM 2011- 2021	SHM 2001- 2021	SDM 2001- 2011	SDM 2011- 2021	SDM 2001- 2021	GCF 2001- 2011	GCF 2011- 2021	GCF 2001- 2021	BRT 2001- 2011	BRT 2011- 2021	BRT 2001- 2021
Open Water	-258	837	579	-56	390	333	4,924	-3,541	1,383	520	-232	288	-97	2,284	2,187
Dev., Open Space	1,581	1,216	2,797	-2,316	544	-1,772	-1,527	755	-773	1,452	2,916	4,367	-2,433	4,310	1,877
Dev., Low Intensity	2,387	813	3,200	866	493	1,359	1,486	370	1,857	13,040	2,977	16,017	12,713	4,807	17,520
Dev., Medium Intensity	462	234	696	3,119	647	3,766	4,095	2,028	6,123	5,872	2,683	8,555	10,833	5,145	15,977
Dev., High Intensity	79	76	156	987	602	1,589	580	442	1,022	1,111	510	1,621	2,125	1,252	3,377
Barren Land	704	414	1,118	144	205	348	-220	-6	-226	420	796	1,216	1,297	1,210	2,508
Deciduous Forest	-274	-57	-331	-6	-2	-8	-3	0	-2	-1	-2	-2	-1,973	-735	-2,709
Evergreen Forest	14,432	10,314	24,746	131	37	168	34	338	372	-4,934	7,601	2,667	40,820	-1,480	39,341
Mixed Forest	-2,393	-3,581	-5,974	-234	-51	-285	-221	-30	-251	-141	-64	-205	-8,773	-10,116	-18,888
Shrub/Scrub	-7,773	-8,114	-15,886	19	27	45	41	-241	-199	-9,430	-10,537	-19,967	-27,048	-1,846	-28,893
Herbaceous	1,458	5,191	6,649	-13	-13	-26	-494	598	104	-1,385	-2,803	-4,188	4,231	16,212	20,443
Hay/Pasture	-8,256	-6,171	-14,427	-932	-2,768	-3,700	-3,446	-2,516	-5,961	-3,112	-2,208	-5,319	-25,977	-17,682	-43,659
Cultivated Crops	-162	-235	-397	-934	247	-687	328	654	982	-127	-122	-249	327	809	1,136
Woody Wetlands	-2,935	-1,944	-4,879	-1,258	-706	-1,964	-1,149	-166	-1,315	-3,936	-2,990	-6,926	-8,513	-6,602	-15,115
Em. Herb. Wetlands	947	1,008	1,954	484	349	833	-4,432	1,316	-3,116	652	1,473	2,125	2,468	2,432	4,900

3515

## 3516 Causes of Habitat Change

3517 The 2006 CHMP identified several impairments across the Pontchartrain Basin. These were described in  
3518 relation to four subbasins, which were delineated within the basin by major roadways. These subbasins do  
3519 not directly align with the habitat zones used in this section. This section does not aim to provide a direct  
3520 crosswalk between the issues identified in 2006 and those of today, but it is useful to consider them as a  
3521 way of identifying those issues that have been ongoing within the basin and which are newly emerging. The  
3522 impairments from the 2006 CHMP are listed in relation to the general geography of the Pontchartrain Basin  
3523 rather than specific locations.

### 3524 Upland Forest Impairments

- 3525 ● Deforestation of all virgin upland forests, including longleaf pine habitats
- 3526 ● Displacement of virgin forests by artificial forests, originating either by planting or by succession  
3527 without fire, which are not fire dependent
- 3528 ● Invasion by numerous exotic plants
- 3529 ● Changes in land use, including dairy, agriculture, and commercial and residential, and associated  
3530 changes in surface runoff
- 3531 ● Forest management that utilizes dense plantations, herbicides, bedding, and fire suppression
- 3532 ● Hydrologic impacts to pine flatwood wetlands

### 3533 Upland Riverine Impairments

- 3534 ● Landscape denudation and altered hydrology from strip mining of the river beds and adjacent riverine  
3535 deposits
- 3536 ● Loss of riverine bank vegetation and significantly reduced potential to re-vegetate
- 3537 ● Increases in sediment load from a denuded landscape
- 3538 ● Dramatically reduced freshwater mussel populations due to the combined effects of harvesting,  
3539 water quality, and decline in overall habitat quality
- 3540 ● Altered hydrology of the Pearl and Bogue Chitto rivers due to the construction of two sills and a  
3541 bypass canal, which has impacted the natural migration of several species, including the  
3542 anadromous Gulf sturgeon
- 3543 ● Loss of canebrake habitat along rivers and streams

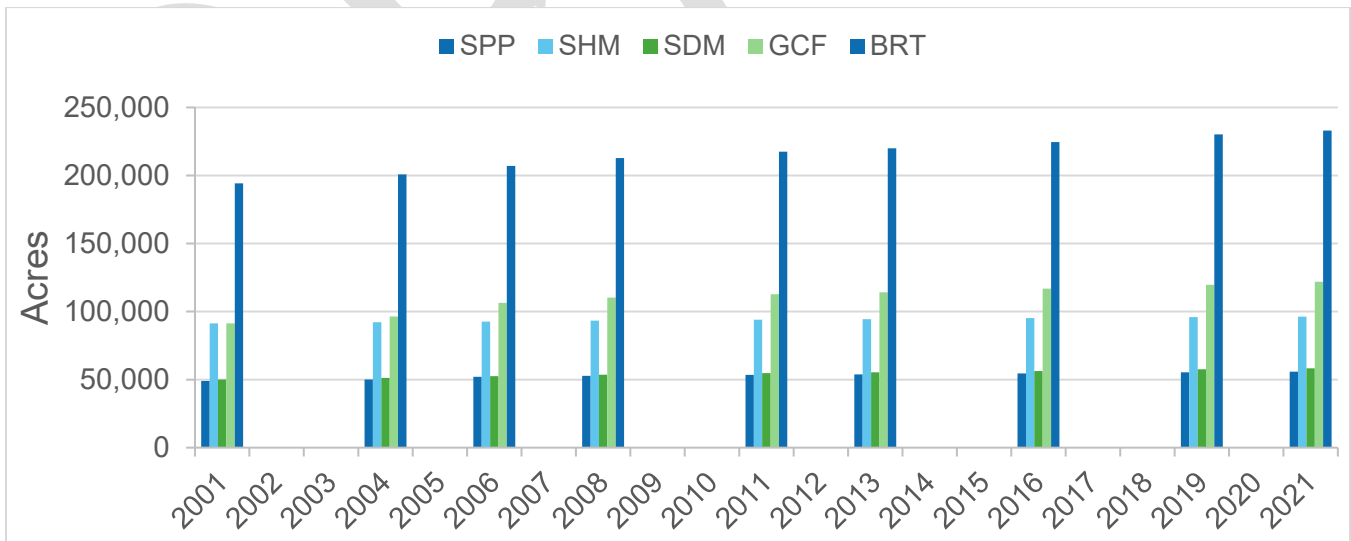
### 3544 Lake and Estuary Basins Impairments

- 3545 ● Mississippi River levees
- 3546 ● Loss of mineral sediment input, reducing sediment accumulation in wetlands
- 3547 ● Significant reduction in nutrient input, resulting in limited productivity in swamp forests due to  
3548 insufficient nitrogen
- 3549 ● Significant reduction of freshwater input
- 3550 ● Loss of regeneration potential of second-growth cypress-tupelo forests
- 3551 ● Salinity changes, especially those associated with the Mississippi River Gulf Outlet (MRGO)
- 3552 ● Impoundments: The generally unintended impoundment of wetlands by canals, berms, logging  
3553 ditches, roads, highways, railroads, etc.

- 3554 ● Cypress logging: Historical cypress clear-cut logging of the entire stand of virgin wetland forest
- 3555 ● Subsidence: Relative subsidence, as a result of combined absolute sea level rise and absolute
- 3556 sinking of the wetland soil platform
- 3557 ● Urbanization: The Upper Sub-basin has significant historical and potential encroachment of
- 3558 urbanization along the southern and western regions.
- 3559 ● Shoreline erosion & shoreline modification (hard armoring)
- 3560 ● Herbivory
- 3561 ● Invasive species

3562 Many of these impairments remain and have ongoing or legacy impacts on habitats in the basin. For  
 3563 example, the effects of sand and gravel mining on riverine habitat continue (see Habitat Change and the  
 3564 Inflated Heelsplitter (*Potamilus Inflatu*)), and invasion by exotic plants remains a problem in many areas  
 3565 (see Invasive Species section). The Mississippi River levees still isolate much of the basin from riverine  
 3566 inputs. However, the freshwater diversion at Caernarvon, the development of Mardi Gras Pass, and the  
 3567 expansion of Neptune Pass provide an ongoing connection between the Mississippi River and the waters of  
 3568 lower Breton Sound. The under-construction River Reintroduction to Maurepas Swamp project is expected to  
 3569 do the same west of Lake Pontchartrain. The effects of opening the Bonnet Carré Spillway on the basin are  
 3570 discussed in the Water Quality section.

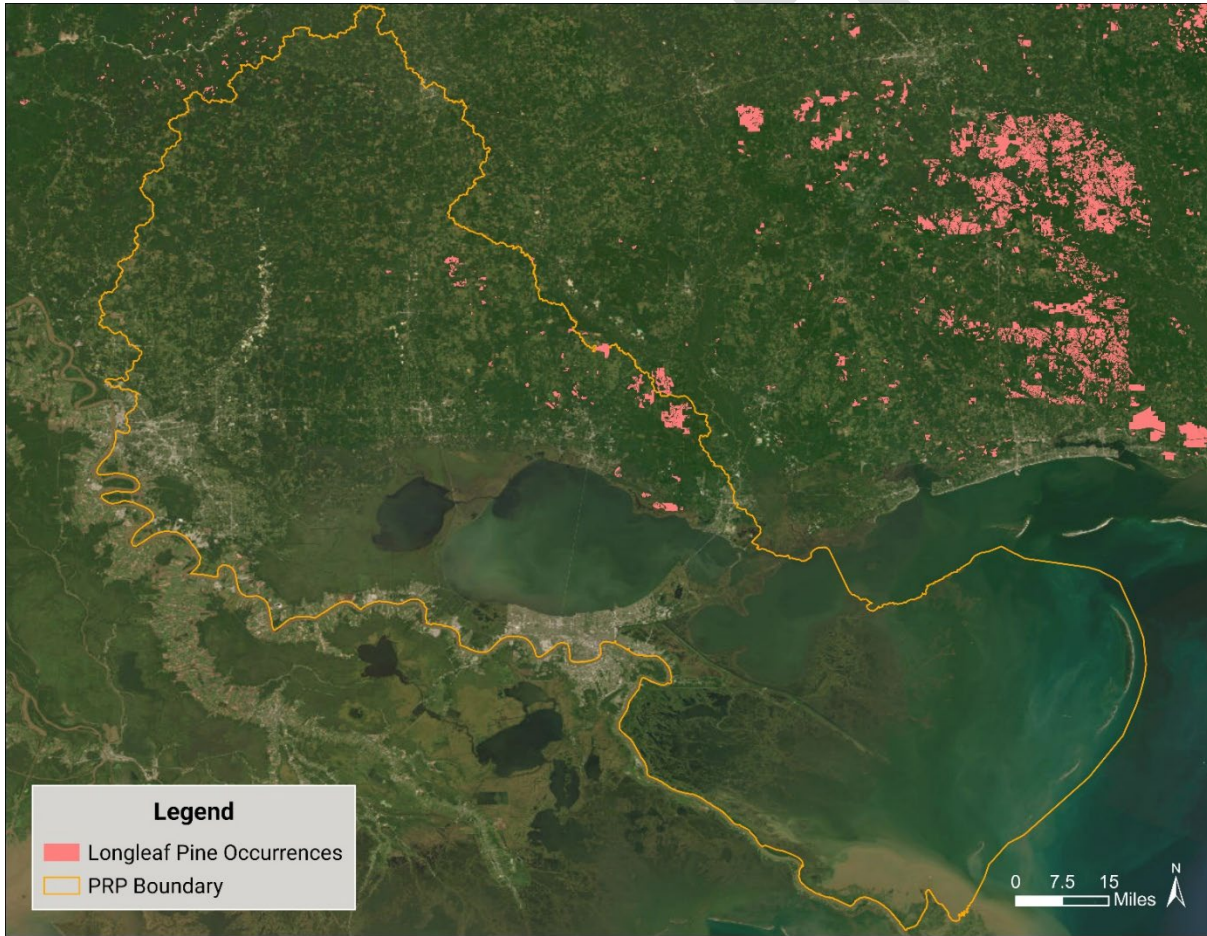
3571 Increasing urban development and growth were seen as threats to habitat in the 2006 CHMP. Figure 44  
 3572 shows that these trends are continuing, as indicated by the area of land classed as developed. The Basin  
 3573 Characterization section discusses population changes and notes that the overall population of the basin  
 3574 has increased by more than 10% between 1985 and 2015. Requirements for mitigation of some habitat  
 3575 impacts associated with development (e.g., for wetlands) can limit the overall impact of development, but  
 3576 few studies are available to provide quantitative assessments of such mitigation effectiveness (see Longleaf  
 3577 Pine Flatwood Wetland Mitigation Banks).



3578 **Figure 44. Total acreage for developed LULC classes (Open Space, Low Intensity, Medium**  
 3579 **Intensity, and High Intensity) by habitat zone.**  
 3580

3581 Longleaf pine habitat continues to be threatened. Longleaf pine forests once dominated the landscape of the  
 3582 southeastern U.S. According to America’s Longleaf Pine Initiative (LLPI), the major threats facing the future

3583 sustainability of longleaf forest systems include land fragmentation, development, conversion to other land  
3584 uses or vegetative types, non-native invasive species, exclusion of natural fire regimes, and negative  
3585 economic perceptions. Even though substantial resources are being invested to establish new longleaf pine  
3586 stands across the region, the loss of mature stands remains a challenge. The rapid urban development and  
3587 changing landscape within the southeast continue to impact the ability to protect existing longleaf habitats,  
3588 manage forests with prescribed fire, and establish new longleaf stands. Figure 45 shows the current  
3589 distribution of the over 19,000 acres remaining in the Pontchartrain Basin and surrounding areas as  
3590 documented by the Southeast Longleaf Ecosystem Occurrences (LEO) Geodatabase Project.<sup>33</sup> The habitat is  
3591 distributed across Amite County (156 acres), St. Tammany Parish (15,833 acres), Tangipahoa Parish (3,132  
3592 acres), and Washington Parish (101 acres) and spans state, federal, conservation, and private lands, with  
3593 both natural and planted stands.



3594  
3595 **Figure 45. Distribution of longleaf pine within the PRP boundary and surrounding areas**  
3596 **(Florida Natural Areas Inventory, 2023).**

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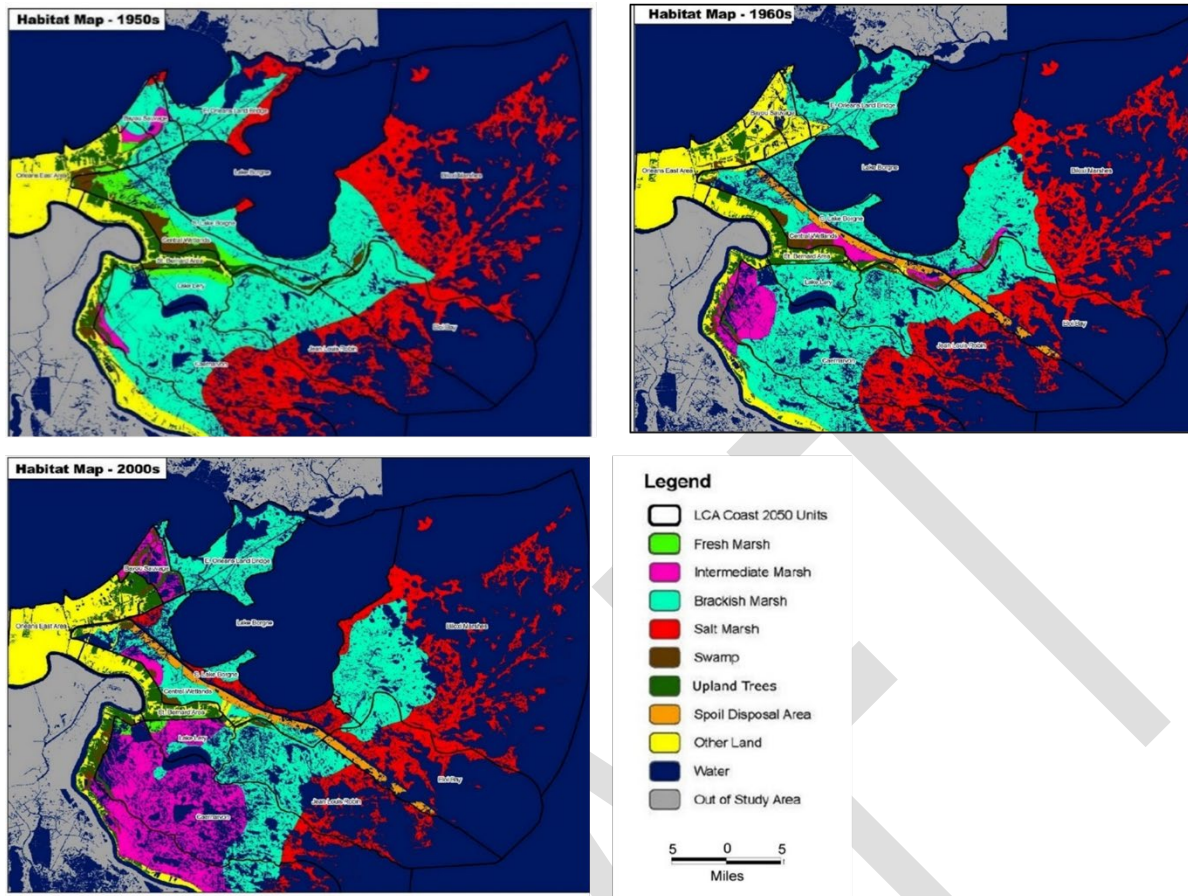
<sup>33</sup> Developed by the Florida Natural Areas Inventory (FNAI) with partners, LEO informs conservation planning and tracks LLP conditions. Funded by NRCS and the Florida Forest Service, the project integrates field assessments and datasets into a GIS database

3597 One of the sources of impairment discussed in the 2006 CHMP, which has been addressed in the years since,  
3598 is the salinity changes associated with the MRGO. The effects of the closure of MRGO are discussed in more  
3599 detail in the section below.

3600 In the years since the 2006 CHMP, several other issues have risen to the fore as impacting habitats in the  
3601 basin. These include the near- and long-term effects of the 2010 *Deepwater Horizon* (DWH) Oil Spill, the  
3602 effects of tropical storms and hurricanes, sea level rise, and climate variability. These are each discussed in  
3603 separate sections below, in addition to invasive species, which continue to be an issue.

## 3604 **CLOSURE OF THE MISSISSIPPI RIVER GULF OUTLET**

3605 Canals dredged to support deep-draft waterborne commerce have provided a conduit for saltwater  
3606 penetration in several areas across South Louisiana. Changes in salinity at the basin scale associated with  
3607 the MRGO were highlighted in the 2006 CHMP. Increases in salinity and associated sulfate levels impacts  
3608 marsh vegetation by altering its composition, reducing productivity, and in some cases, causing die-offs.  
3609 Baldcypress - tupelo gum swamps, while resilient to flooding, are especially vulnerable to salt exposure  
3610 (Shaffer et al., 2009). Salinity as low as 1.6 parts per thousand (ppt) can reduce growth. Along the coast,  
3611 ghost forests remain, marking the areas where baldcypress have succumbed to osmotic stress. However, the  
3612 precise salinity thresholds and exposure durations required to trigger these die-offs remain unknown,  
3613 highlighting the need for further research (Day et al., 2024). Figure 46 shows changes in vegetation type in  
3614 coastal wetlands in parts of the Pontchartrain Basin from before the MRGO was dredged (1950s) to after  
3615 (1960s and 2000s) (Shaffer et al., 2009). The direct loss of wetland along the channel footprint and due to  
3616 the adjacent placement of spoil is shown, as is the loss of swamp habitat.



3617  
 3618 **Figure 46. Habitat maps during the 1950s (top left: constructed from U.S. Geological Survey**  
 3619 **(USGS) topographic maps and the vegetation map of O’Neal, (1949)), the 1960s (top right:**  
 3620 **constructed from vegetation survey of Chabreck et al., (1968)), and the early 2000s**  
 3621 **(bottom: constructed from Barras et al., (2003)) (from Shaffer et al., 2009).**

3622 The closure of the MRGO navigation channel resulted from the Deep-Draft De-authorization Report submitted  
 3623 by the U.S. Army Corps of Engineers (USACE) to Congress in June 2008, which officially de-authorized the  
 3624 channel from the Gulf Intracoastal Waterway to the Gulf of America and authorized the construction of a  
 3625 rock closure structure. In late July 2009, the last loads of armor stone were placed onto the MRGO rock  
 3626 closure structure. The rock structure was built 1,500 feet southeast of Bayou La Loutre in St. Bernard Parish  
 3627 (Figure 7). The barrier includes approximately 352,000 tons of stone materials (approximately 126,000 tons  
 3628 of stone came from the south jetty at the end of the MRGO channel). It has a 12-foot crown, a 450-foot  
 3629 bottom width, and a top height of +8 feet NAVD 88. Channel bank tie-ins are 50 feet wide, extending  
 3630 approximately 150 feet onto the south bank and 250 feet onto the north bank (Figure 47).

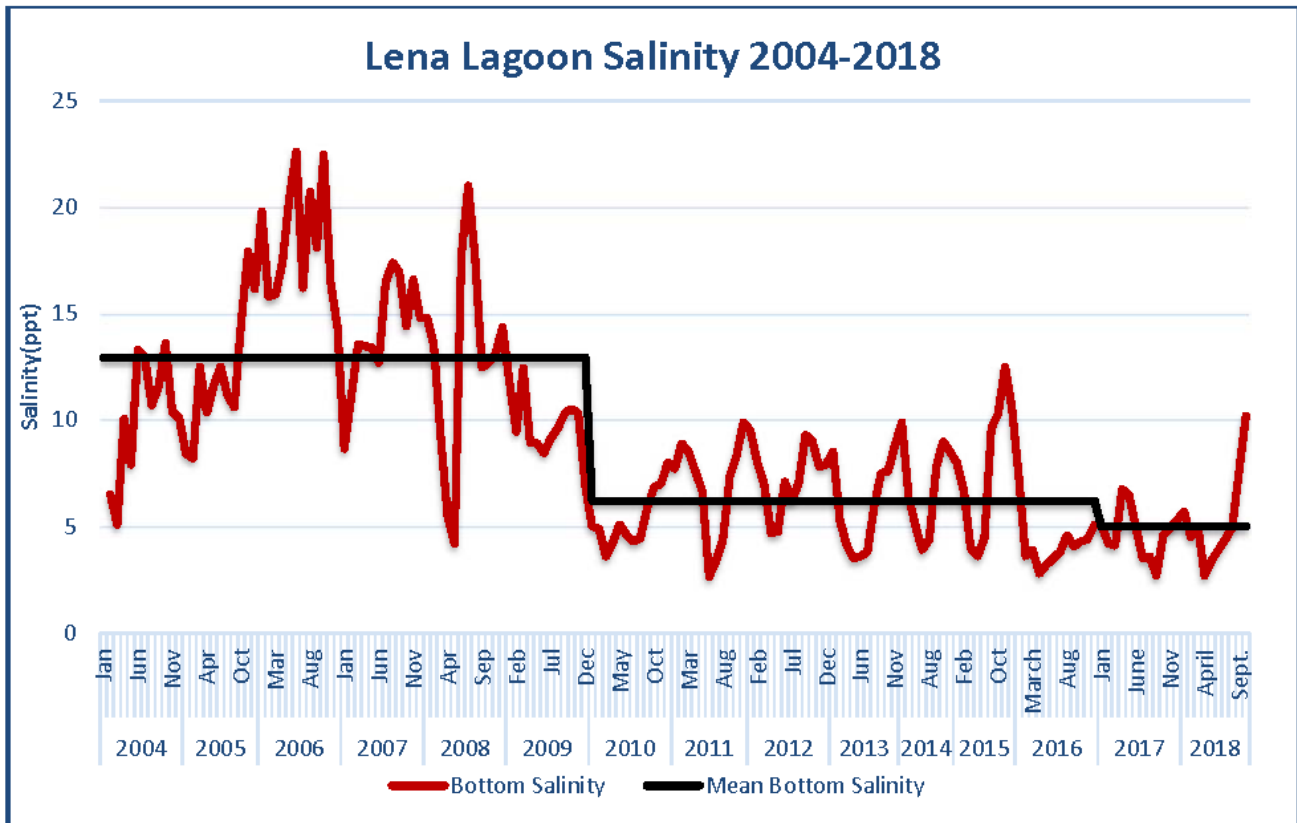


3631  
3632 **Figure 47. Closure structure across MRGO completed in 2009.**

3633 **Effect on Fishery Species**

3634 The 2009 closure of the MRGO led to significant hydrological changes in Lake Pontchartrain and Lake  
3635 Borgne, with measurable impacts on local fisheries as documented by the Louisiana Department of Wildlife  
3636 and Fisheries (LDWF; Adriance et al., 2018). These changes provide insights into the dynamic relationships  
3637 between estuarine ecosystems, salinity regimes, and fisheries populations.

3638 The closure of the MRGO brought a noticeable reduction in salinity levels in lakes Pontchartrain and Borgne.  
3639 LDWF data highlights that salinity in Lake Borgne at Lena Lagoon, for example, dropped significantly from an  
3640 average of 12.9 ppt pre-closure to 6.2 ppt in the subsequent seven years, further declining to 5.0 ppt in 2017-  
3641 2018 (Figure 48). Additionally, stratification-related hypoxic zones, once frequent in southern Lake  
3642 Pontchartrain due to high-salinity Gulf water influx, have largely disappeared post-closure (Adriance et al.,  
3643 2018). However, sporadic hypoxic events continue, driven by environmental conditions such as temperature  
3644 extremes, rainfall, or anthropogenic factors like shoreline restoration.



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**Figure 48. Salinity changes at LDWF’s Lena Lagoon monitoring station (Adriance et al., 2018).**

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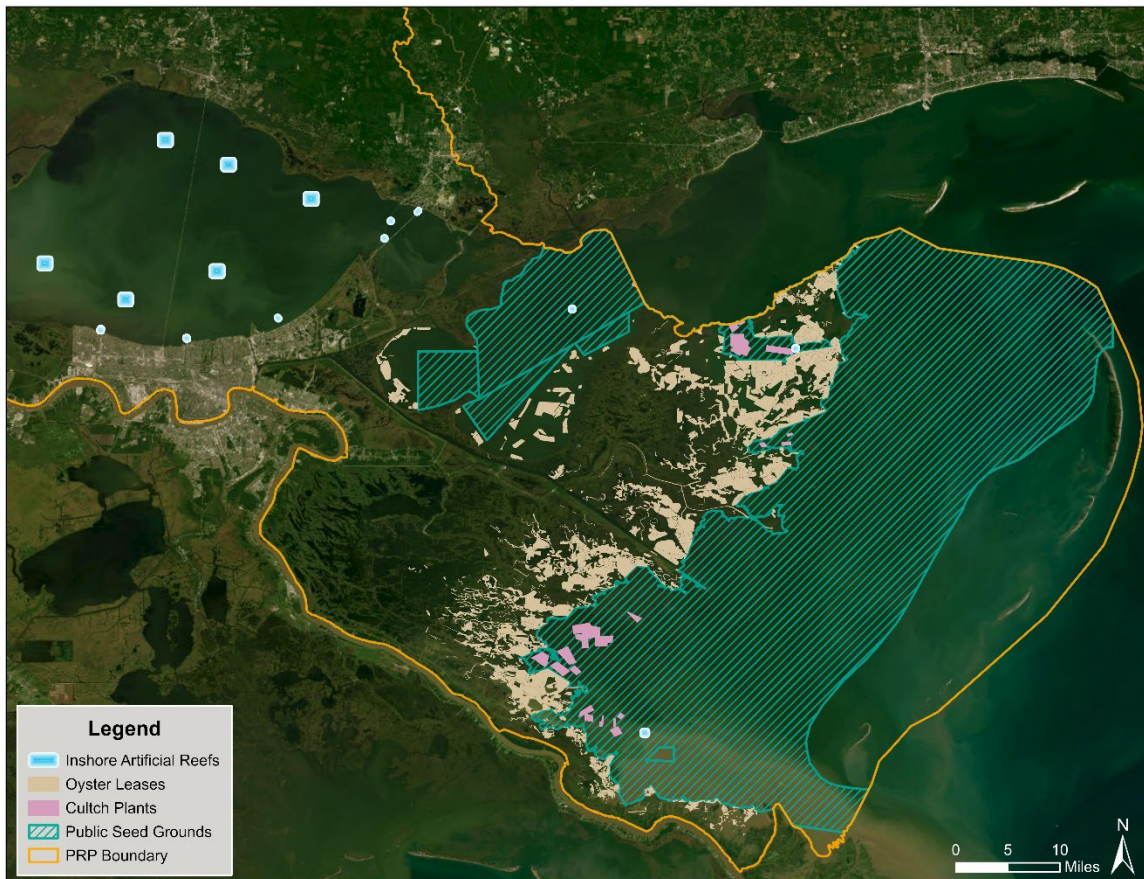
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The altered salinity regime has had varying effects on fisheries populations. Reduced salinity levels have led to a decline in oyster populations in Lake Borgne. Optimal salinity zones for oyster production have shifted further seaward, influenced not only by the MRGO closure but also by freshwater inputs from sources like the Pearl River and Mississippi River outlets (e.g., Mardi Gras Pass, Neptune Pass). Figure 49 shows that the majority of oyster leases and public seed grounds are further to the east and that while some leases are in Lake Borgne, an area that became fresher following MRGO closure, extensive oyster areas were unimpacted.



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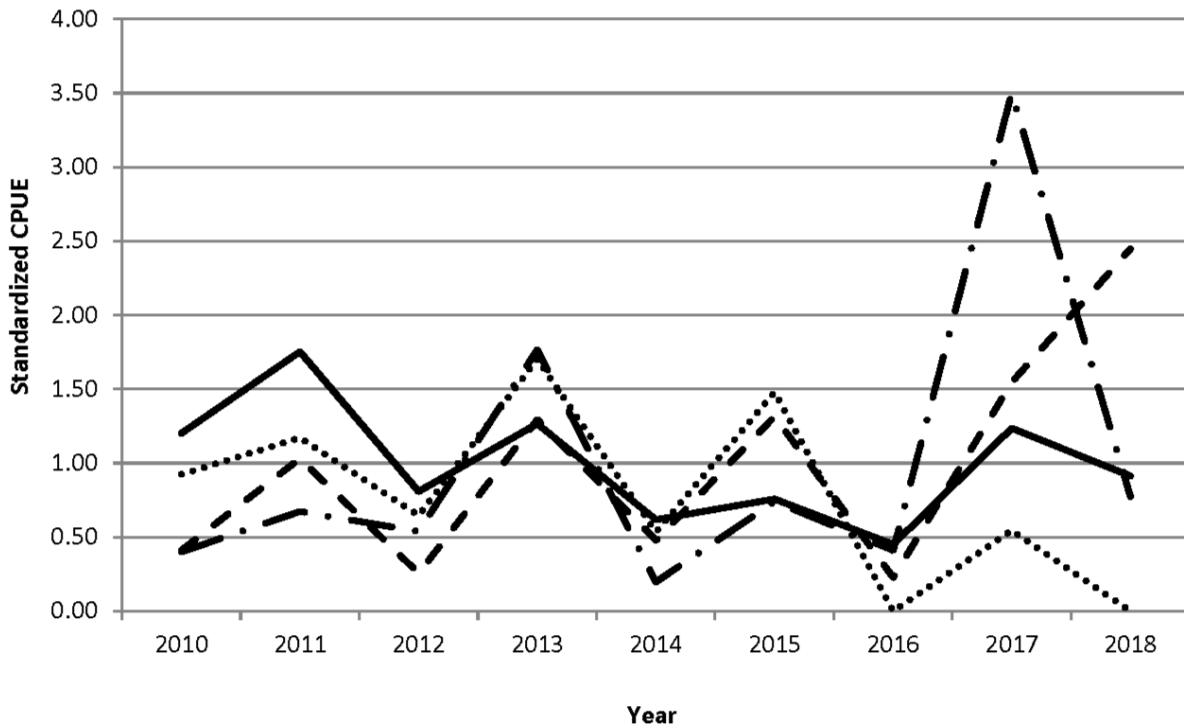
**Figure 49. Map of LDWF inshore artificial reefs, oyster leases, public seed ground, and cultch plants within the PRP boundary (LDWF, n.d.-a, n.d.-b).**

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LDWF has described a number of changes for finfish as well as crustaceans in the area associated with the closure of MRGO (Adriance et al., 2018). For example, species like spotted seatrout (*Cynoscion nebulosus*), which require salinity levels of 15-21 ppt for successful spawning, are affected by the freshening of Lake Borgne. Changes in salinity may influence their migration patterns and spawning behaviors though spotted seatrout continue to extensively utilize eastern Lake Pontchartrain, Lake Borgne, the MRGO, and Biloxi Marsh when not spawning. Fisheries such as shrimp, blue crab (*Callinectes sapidus*), and various finfish have shown patterns of variability in recreational and commercial landings, both before and after the MRGO closure. This suggests that their populations are influenced by multiple factors beyond salinity, including weather events, hydrological conditions, and sampling variations. Largemouth bass (*Micropterus salmoides*), freshwater catfish (*Ictaluridae* sp.), and other freshwater species are now widespread throughout marshes adjacent to Lake Pontchartrain and Lake Borgne.

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LDWF's data collection is influenced by environmental variability, sampling protocols, and major weather events, such as hurricanes (e.g., Katrina, Gustav, Zeta) and extreme winters (e.g., 2009, 2010). These factors complicate efforts to isolate the long-term effects of the MRGO closure. While there are observed increases in populations of species like spotted seatrout, red drum (*Sciaenops ocellatus*), and black drum (*Pogonias cromis*) post-2016 (Figure 50) (Adriance et al., 2018), others, such as sheepshead (*Archosargus probatocephalus*), have declined in recent years. The lack of long-term datasets and evolving hydrological modifications further limits comprehensive assessments.



— Spotted Seatrout    - - Red Drum    - • Black Drum    ••••• Sheepshead

**Figure 50. Standardized CPUE of Select Species from LDWF gillnet samples from Lake Borgne and Lake Pontchartrain during the months of April through September (Adriance et al., 2018).**

The closure of the MRGO created a shift in habitat availability. Freshwater habitats in the western portions of the basin expanded, potentially benefiting SAV, critical for juvenile estuarine species. The loss of higher salinity habitats negatively impacted species like oysters. Ultimately, the trade-offs between salinity adjustments, hypoxia risks, and habitat availability underscore the complexities of managing estuarine ecosystems. The data collected since the MRGO closure offers valuable insights but remains insufficient for definitive long-term conclusions, given the myriad influences on fisheries populations. Continued monitoring and adaptive management are crucial to balance ecological and economic interests in the region.

### Effects on Basin Habitat

The Maurepas Landbridge shows early signs of natural swamp regeneration, with improving environmental conditions linked to the closure of the MRGO. An investigation highlights these developments, while also identifying challenges that may impact long-term forest recovery in the region (Henkel et al., 2019).

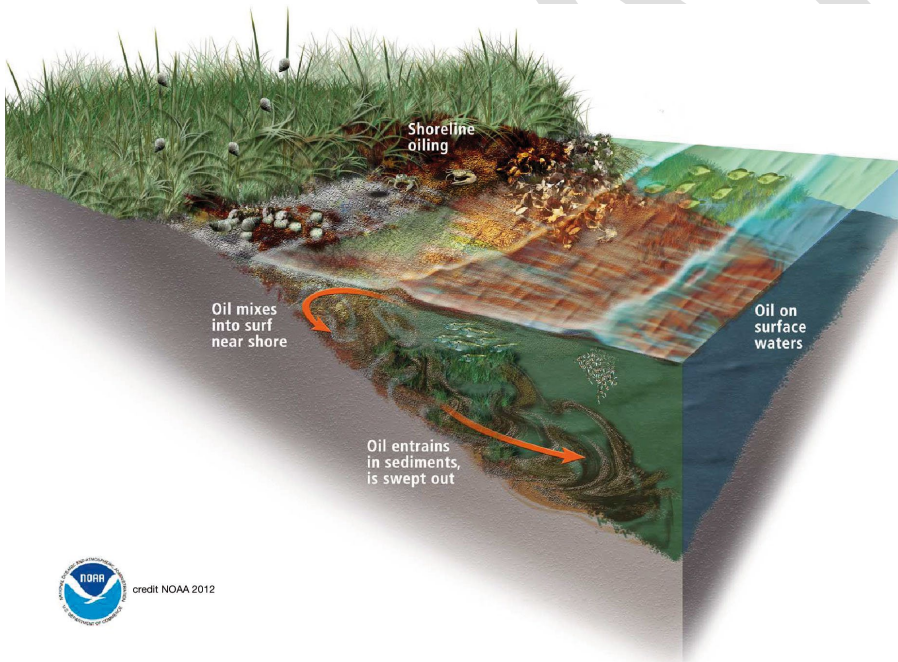
The closure of the MRGO in 2009 has been a key factor in reducing both surface and soil salinities on the Maurepas Landbridge, improving conditions for regeneration. Post-closure data from the Coastwide Reference Monitoring System (CRMS) confirms a consistent decline in salinity levels, a trend further supported by periodic freshening events, such as the Bonnet Carré Spillway openings in 2016, 2018, and twice in 2019. These changes have reduced the likelihood of extreme salinity spikes, such as those seen during the 1999-2000 drought when salinity levels reached 16 ppt in the vicinity of the Maurepas Landbridge.

3696 Tree ring analyses on the Maurepas Landbridge (Henkel et al., 2019) for green ash trees greater than 40  
3697 years old showed diminished growth rates after 1978, further diminishing after 1991, and then an increase in  
3698 growth rate after 2011. Similar analysis for red maple (*Acer rubrum*) showed a general trend of diminished  
3699 growth rates after 1981, a slight increase from 1987 to 1992, then a decrease again from 1992 to 2007, and  
3700 then an increase after 2007. However, the study notes that due to the noisiness of the data and the nature of  
3701 tree growth, it is difficult to correlate changing growth rates to particular environmental events in the basin  
3702 (Henkel et al., 2019). These data may suggest improved conditions for swamp forest growth. Seedlings of  
3703 climax species are beginning to establish themselves, signaling the initial stages of natural regeneration.

3704 Continued monitoring has identified germination events, such as a baldcypress event, which provide  
3705 opportunities to study the factors supporting seedling survival into adulthood.

### 3706 **DEEPWATER HORIZON OIL SPILL**

3707 The Pontchartrain Basin is subject to a number of relatively small oil spills from industrial facilities across  
3708 the basin and vessel traffic (see Water Quality section), and there were more extensive releases during  
3709 Hurricane Katrina<sup>34</sup>. However, following the DWH explosion on April 20, 2010, oil traveled upward from the  
3710 wellhead through the water column to form expansive surface oil slicks, which were transported to nearshore  
3711 coastal ecosystems by wind and currents. This oil reached nearshore habitats via a number of different  
3712 pathways (Figure 51).



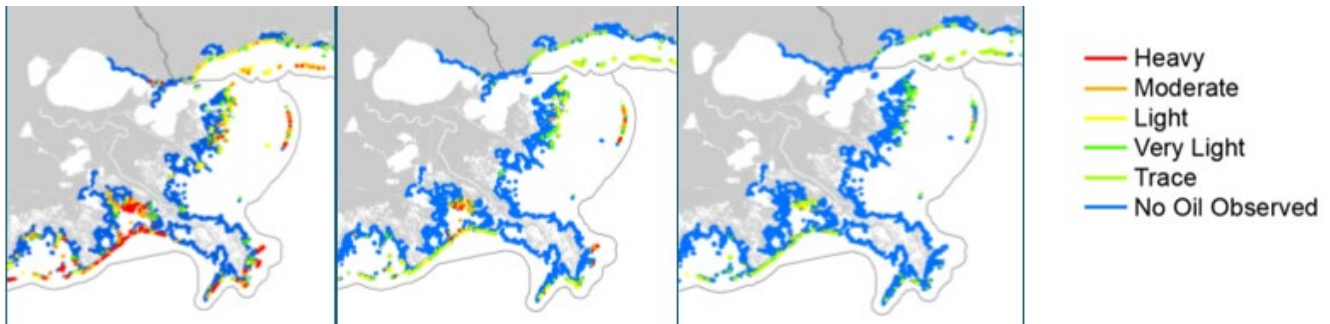
3713 **Figure 51. Pathways for oil to reach nearshore habitats (from Baker et al., 2017).**  
3714

3715 Figure 52 shows the degree and extent of shoreline oiling for the period of maximum oiling (between May  
3716 2010 to May 2012) as well as one year (May 2011) and two years (May 2012) after the spill (Michel et al.,

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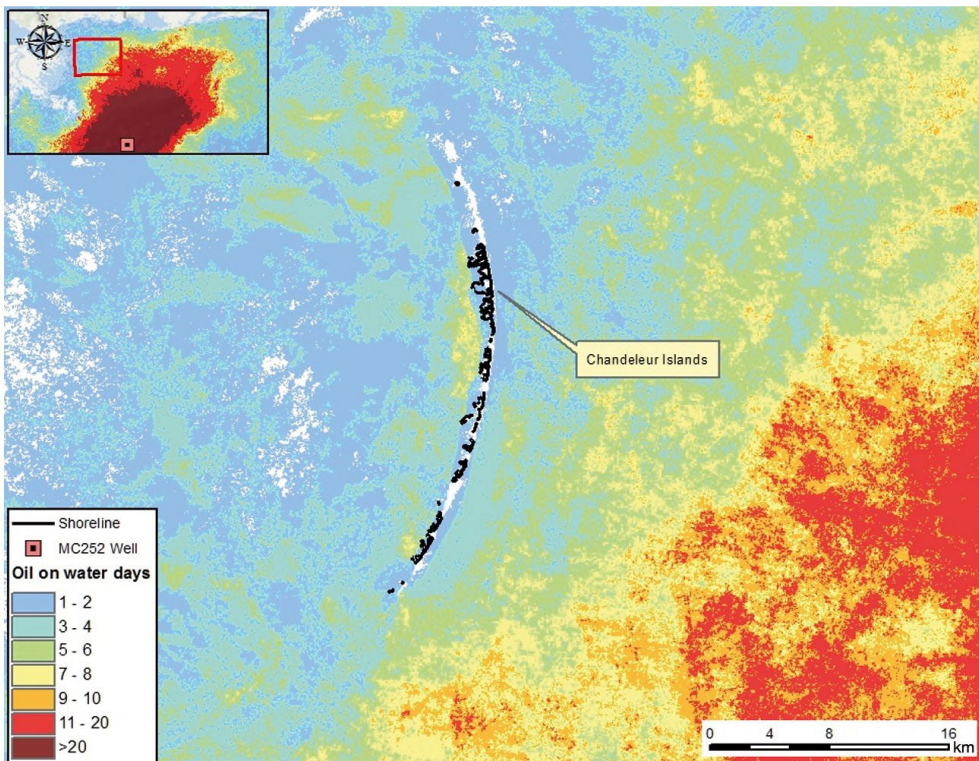
<sup>34</sup> More information can be accessed via the following link: <https://data.losco.org/PublicSpillSearch/PublicSpillResponseSearch>

3717 2013). While there was also extensive oiling in the Barataria Basin, as shown in Figure 52, the outer Biloxi  
3718 marshes and the Chandeleur Islands were the most heavily oiled areas within the Pontchartrain Basin.



3719  
3720 **Figure 52. Maps by shoreline oiling category at maximum oiling conditions, one year (May**  
3721 **2011), and two years (May 2012) post-spill (from Michel et al., 2013).**

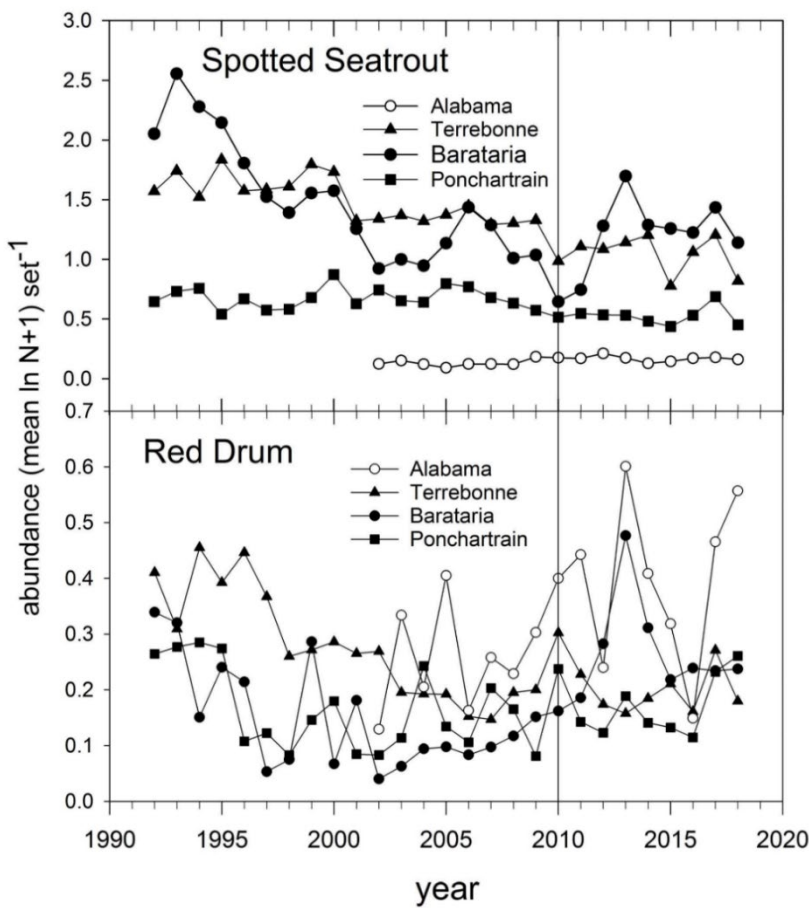
3722 SAV was injured by both oiling and response actions. Chandeleur Islands seagrass was particularly affected,  
3723 with more than 270 acres destroyed (Kenworthy et al., 2017). Figure 53 shows the exposure of the  
3724 Chandeleur Islands area to oil. Chandeleur Islands seagrass habitat is unique in its extent and ecological  
3725 connection to the wider Gulf of America, representing one of the largest areas of seagrass beds between  
3726 Pensacola Bay, Florida, and Laguna Madre, Texas. Seagrass meadows of the Chandeleur Islands provide  
3727 forage and refuge for birds, sea turtles, pelagic juvenile fish, and invertebrates while also trapping and  
3728 stabilizing sediment (Kenworthy et al., 2017).



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3730 **Figure 53. Estimated number of days that oil from the DWH spill remained on the water**  
3731 **surface at the Chandeleur Islands (based on Synthetic Aperture Radar satellite imagery)**  
3732 **(from Kenworthy et al., 2017).**

3733 Response measures, such as the operation of freshwater diversions from the Mississippi River to prevent oil  
 3734 from moving onshore, compounded the effects on marine resources. The spill's impact on living marine  
 3735 resources was extensive and varied (Murawski et al., 2021). See ATTACHMENT C for a full list of species  
 3736 considered by Murawski et al., (2021).

3737 Blue crabs also faced vulnerabilities due to their reliance on benthic prey in oil-contaminated sediments.  
 3738 However, crab densities in the Pontchartrain Basin remained relatively stable, while abundance declined in  
 3739 Barataria Bay. Fish species like Gulf menhaden (*Brevoortia patronus*), spotted seatrout, and red drum showed  
 3740 different responses (Murawski et al., 2021). For example, the life history and spawning dynamics of Gulf  
 3741 menhaden resulted in minimum spatial overlap with oil coming ashore from DWH and the distribution of  
 3742 sensitive early life stages of the species. Because of the estuarine dependence of juveniles and adults of  
 3743 spotted seatrout and red drum, they were subject to exposure in marsh areas contaminated with oil. Figure  
 3744 54 shows an increase in red drum in the Pontchartrain Estuary between 2009 and 2010, and a decrease in  
 3745 spotted seatrout.



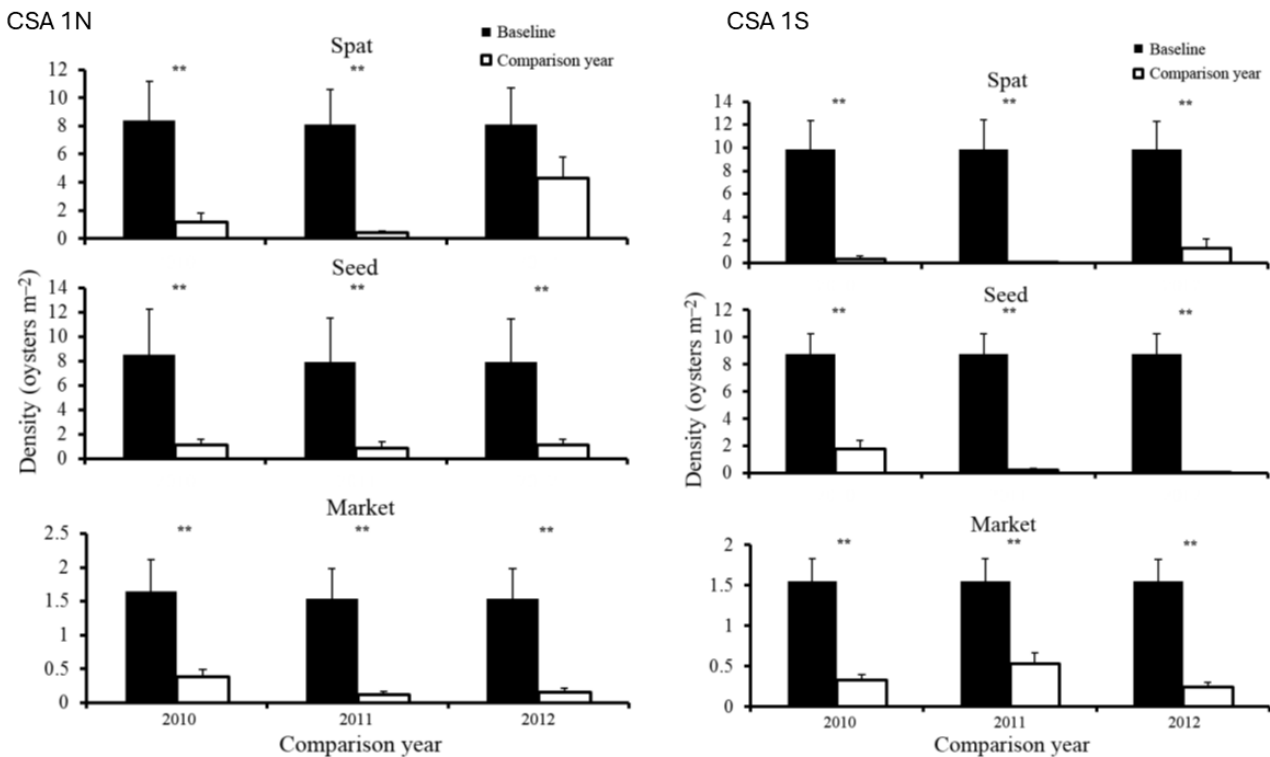
3746  
 3747 **Figure 54. Annual relative abundance of spotted seatrout and red drum in fishery-**  
 3748 **independent gill net surveys off Alabama and in three Louisiana basins.(Murawski et al.,**  
 3749 **2021)**

3750 Fishery independent monitoring data was used by researchers (Grabowski et al., 2017) to assess changes in  
 3751 subtidal oyster reef populations before (2006–2009) and after (2010–2012) the DWH spill. LDWF annually  
 3752 estimated oyster abundance on public oyster grounds. These data are reported by coastal study areas

3753 (CSA<sup>35</sup>). CSA 1N includes the areas north of MRGO and inshore to Lake Maurepas, and CSA 1S includes the  
3754 area between MRGO and the Mississippi River.

3755 Comparison of data for spat seed and market-sized oysters is shown in Figure 55 (significant *t*-tests are  
3756 identified at \**p* < 0.1, \*\**p* < 0.05. Error bars indicate +1 SE). All 3 size classes within CSA 1S remained  
3757 significantly (85–100%) lower than the baseline period through 2012, with spat and seed oysters largely  
3758 absent from almost all samples. In CSA 1N, densities of all three size classes of oysters were 77–87% lower  
3759 in 2010 relative to the baseline period, and seed and market densities remained significantly lower through  
3760 2012.

3761 The opening of the Caernarvon Freshwater Diversion in 2010 in response to the spill resulted in prolonged  
3762 periods of low salinity (<3‰) in much of CSA 1S, which can be detrimental to oysters. Further, the Bonnet  
3763 Carré Spillway was opened in 2011, providing freshwater to the CSA 1N area. These freshening events make  
3764 it challenging to identify the specific impact of DWH. However, it has been noted that the declines in oyster  
3765 abundances in the regions impacted by these openings, including CSA 1N, largely began occurring in 2010,  
3766 prior to the opening of the spillway (Grabowski et al., 2017), although the causality is not clear.



3767 **Figure 55. Pairwise comparisons of spat-, seed-, and market-sized eastern oyster**  
3768 **(*Crassostrea virginica*) densities in CSA 1N and CSA 1S, during the baseline period**  
3769 **(2006–2009) versus 2010, 2011, and 2012 (from Grabowski et al., 2017).**  
3770

<sup>35</sup> More information can be accessed via the following link: <https://www.usgs.gov/media/images/ldwf-coastal-study-areas-csa-coastal-louisiana-estuaries>

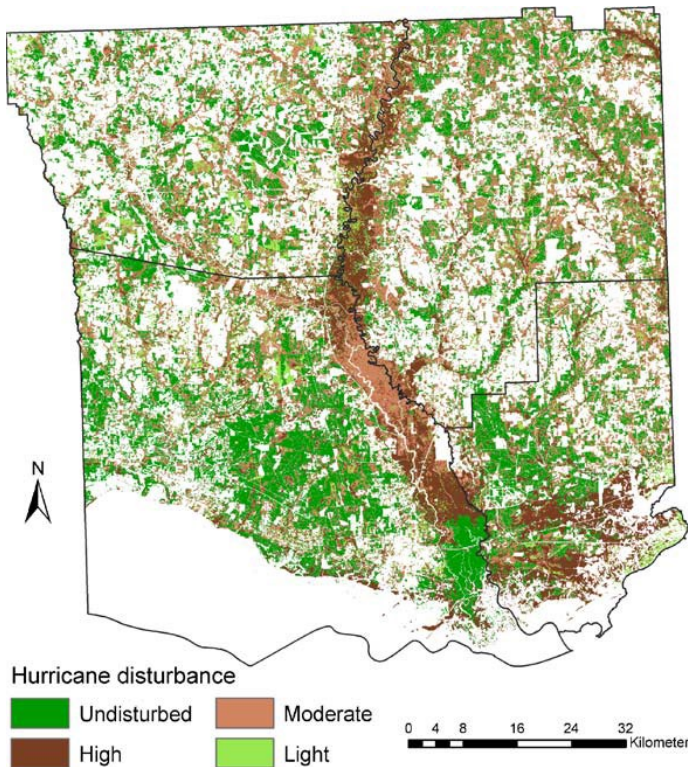
3771 Overall, the DWH oil spill highlighted the interconnectedness of Gulf ecosystems and the challenges of  
3772 mitigating large-scale environmental disasters. The DWH spill serves as a stark reminder of the need for  
3773 proactive measures to protect marine ecosystems from future catastrophes.

## 3774 HURRICANE EFFECTS

3775 The Pontchartrain Basin has always been subject to hurricane impacts. The Basin Characterization section  
3776 has noted some of the events which have resulted in inundation and/or erosion. The 2006 CHMP was  
3777 released soon after Hurricane Katrina and included only a preliminary assessment of the effects on habitat.  
3778 A number of studies have been completed since then examining different aspects of how storms impact  
3779 both dynamic and structural habitat in the basin (e.g., Liu et al., (2014); O'Connell et al., (2014); Reed et al.,  
3780 (2009). Highlights of several studies are described here to illustrate the variations in effects across PB.

3781 Beyond the immediate damages from storm surge and flooding from Hurricane Katrina, stratification in Lake  
3782 Pontchartrain led to the loss of benthic organisms from 50% of the lake bottom (Poirrier et al., 2008). Apart  
3783 from benthic indicators, however, lake health recovered quickly after the storm as contaminants and  
3784 microorganisms were rapidly flushed out (Heitmuller & Perez, 2007).

3785 Advances in remote-sensing technology have led to its increased use for post-hurricane disaster response  
3786 and assessment. Wang & Xu (2009) evaluated forest damage caused by Hurricane Katrina in the Lower Pearl  
3787 River Valley and surrounding area in St. Tammany and Washington parishes and Hancock and Pearl River  
3788 counties. Statistical models were used to analyze the effects of forest characteristics and site conditions on  
3789 the hurricane disturbance. Hurricane Katrina damaged 60% of the forested land with 18% highly, 35%  
3790 moderately, and 7% lightly disturbed (Figure 56). The hurricane altered the forest landscape to a mosaic of  
3791 undisturbed and disturbed forest patches across the region. There was also a close association of  
3792 disturbance intensity with the drainage network in the watersheds indicating a high susceptibility of  
3793 bottomland forests to hurricane damage.



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**Figure 56. Spatial distribution of hurricane-induced forest disturbance by severity level (from Wang & Xu, 2009).**

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More recently, the LSU AgCenter estimated that a total of 168,000 timber trees were affected by Hurricane Ida in 2021. Most of these were in the Florida Parishes, and about 50% of the damaged timber was estimated to be in St. Tammany Parish<sup>36</sup>.

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While much of the hurricane impacts on Northshore forests are breakage, salinity incursions during storms can affect coastal forests. Failure of levees surrounding the Bayou Sauvage NWR during Hurricane Katrina resulted in flooding with surface water salinity of approximately 17 ppt that persisted for four weeks. This resulted in 68% mortality (Howard, 2012) of the forest occupying the natural levee of Bayou Sauvage and caused the forest to convert to a thicket of early successional shrubs and invasive tree species. Keim et al., (2019) found that elevated salinity remained in Bayou Sauvage 11 years after Hurricane Katrina. They also note that salinity itself may not be the only or even the primary cause of tree mortality and ecosystem change in the natural levee, because seawater leads to other biogeochemical changes in soils. Keim et al., (2019) also found high spatial variability in soil salinity on the natural levee and hotspots of high salinity that prevent or retard tree growth despite average salinity values that may be conducive for bottomland hardwoods. Recovery requires not only the return to suitable salinity but also management of invasives such as Chinese tallow (*Triadica sebiferum*) (see Invasive Flora section) which have invaded in the meantime.

3812  
3813

Animals that live in forests and wetlands can also be impacted. In studies conducted during the period impacted by Hurricanes Ivan and Katrina in the Manchac Wildlife Management Area and Alligator Island

<sup>36</sup> More information can be accessed via the following link: <https://www.lsuagcenter.com/articles/page1632415649946>

3814 (west of Lake Maurepas), it was found that hurricane impacts decreased abundance and diversity and  
3815 increased evenness of the herpetofaunal communities in marsh, levee, and forested swamp habitats. Salinity  
3816 increased in these habitats and to a greater degree after Hurricane Katrina than after Hurricane Ivan  
3817 (Schriever et al., 2009).

## 3818 **EFFECTS OF CLIMATE VARIABILITY AND ENVIRONMENTAL CHANGE ON** 3819 **HABITAT**

3820 The Basin Characterization section includes a description of recent changes in climate in the Pontchartrain  
3821 Basin and discusses potential future conditions. Here, the focus is on the response of habitats and the  
3822 species that occupy them. The Fifth National Climate Assessment<sup>37</sup> notes that the southeastern United  
3823 States will be subject to sea level rise and coastal flooding, extreme heat, and heavy rain with longer dry  
3824 spells. These all have implications for habitats. For example, decreased precipitation can affect the health of  
3825 baldcypress stands, which, in the face of sea level rise and lack of freshwater input from rivers, almost solely  
3826 rely on precipitation or wastewater discharges to keep groundwater salinity low enough for survival (Day et  
3827 al., 2024). While there have been few specific studies of these impacts specific to the Pontchartrain Basin,  
3828 some information is available regarding changes that have occurred in response to climate variability, and  
3829 other studies have used modeling to project future changes.

### 3830 **Aquatic Species**

3831 Within Lake Pontchartrain, annual SAV surveys and monthly water quality monitoring were conducted at four  
3832 to five sites from 1996 through 2003 (Cho & Poirrier, 2005). This included a period of La Niña<sup>38</sup> conditions,  
3833 which produced a drought in southern Louisiana and led to increased salinity and water clarity. The study  
3834 found a rapid increase in the distribution and abundance of the euryhaline species widgeon grass (*Ruppia*  
3835 *maritima*) in 1999 that persisted through 2002, associated with increased water clarity. There was also a  
3836 rapid increase in widgeon grass in deeper water and at historic sites where SAV had not been found since  
3837 1953. As salinity increased, the freshwater species *Vallisneria americana* and Eurasian watermilfoil  
3838 (*Myriophyllum spicatum* L.) declined, and southern water nymph (*Najas guadalupensis* (Spreng.) Magnus) and  
3839 clasping leaf pondweed (*Potamogeton perfoliatus* L.) disappeared. Several of these are extremely important  
3840 habitats for waterfowl species.

3841 In 2003, after the La Niña phase, salinity and water clarity decreased, widgeon grass decreased, and the  
3842 freshwater species increased, but clasping leaf pondweed was still absent. The period of stable high  
3843 salinities associated with the El Niño-related drought also impacted Atlantic rangia (*Rangia cuneata*), a clam  
3844 that occurs in low salinity zones of the estuary. Additional studies (Poirrier & Caputo, 2015) found that stable  
3845 higher salinities resulted in the establishment of higher salinity communities. The hooked mussel (*Ischadium*  
3846 *recurvum*) increased abruptly and colonized live Atlantic rangia. However, changes in the benthic community

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<sup>37</sup> More information can be accessed via the following link: <https://toolkit.climate.gov/NCA5>

<sup>38</sup> During La Niña, the polar jet stream dips through the central part of the country, potentially leading to colder temperatures in the northern and midwestern states, while the southern U.S. and southeastern Louisiana may experience warmer-than-average temperatures. It is part of the El Niño-Southern Oscillation, a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean.

3847 following the drought were complicated by several hurricane impacts that mobilized sediment and disturbed  
3848 bottom sediments. These studies demonstrate how some important aspects of subaqueous habitats can  
3849 respond to fluctuations in climate. Hurricane effects are discussed in the next section.

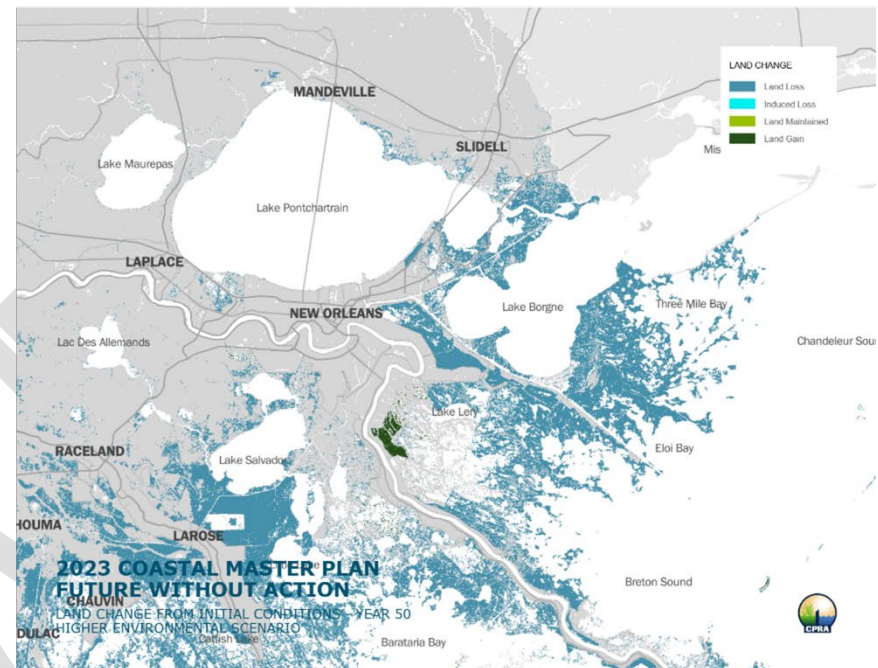
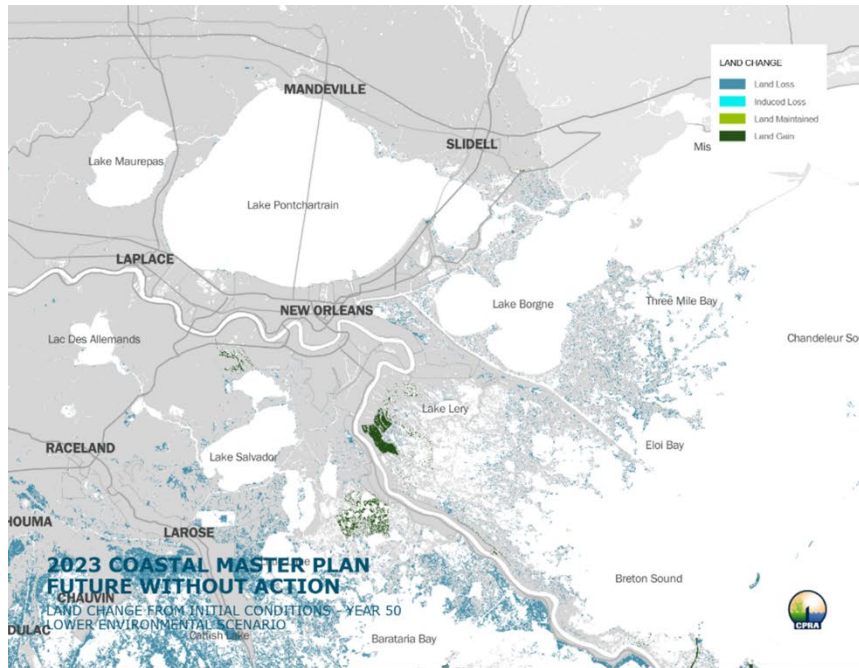
3850 Other researchers have used fishery-independent monitoring data to examine the role of climate in changes  
3851 in fisheries (Erickson et al., 2021). Southern flounder (*Paralichthys lethostigma*) are a coastal flatfish species  
3852 that supports recreational and commercial fisheries but are currently experiencing range-wide declines. One  
3853 study (Erickson et al., 2021) examined trends in sampling data of age-0 flounder across the Gulf of America,  
3854 including estuaries within the Pontchartrain Basin. They found a significant effect of year on age-0 southern  
3855 flounder catch-per-unit-effort (CPUE) in CSA1, indicating a significant decline. Southern flounder are sexually  
3856 determined during a narrow development window at 35-65 millimeters total length, which is typically reached  
3857 in the spring. More males develop during warmer temperatures. Erickson et al., (2021) found that in CSA1,  
3858 the duration of cold temperatures during spawning had significantly decreased. The development window for  
3859 sexual determination in Pontchartrain Basin has closed by an estimated 50 days between 1996 and 2020,  
3860 which could be a factor in their decline.

## 3861 Coastal Habitats

3862 Predicting the effects of future sea level rise and climate variability on habitat requires the use of numerical  
3863 models. While not available across the Pontchartrain Basin, extensive analysis for the coastal parts of the  
3864 basin has been conducted for the 2023 Louisiana Coastal Master Plan. Figure 57 and Figure 58 show  
3865 predicted changes in land-water and vegetation cover, respectively, for the next 50 years under two  
3866 environmental scenarios (Reed & White, 2023). The lower and higher scenarios use different values of sea  
3867 level rise, equivalent to the National Oceanic and Atmospheric Administration (NOAA) Intermediate and  
3868 NOAA Intermediate High, respectively, as well as different rates of subsidence and patterns of riverine inputs  
3869 from Northshore rivers. Figure 57 shows an increase in open water area for Future Without Action (FWOA)  
3870 (i.e., conditions which would occur without the master plan projects) in the lower estuary at year 50 under  
3871 the higher scenario, with minimal change under the lower scenario. Note that for both scenarios the Mid-  
3872 Breton Diversion is operating.

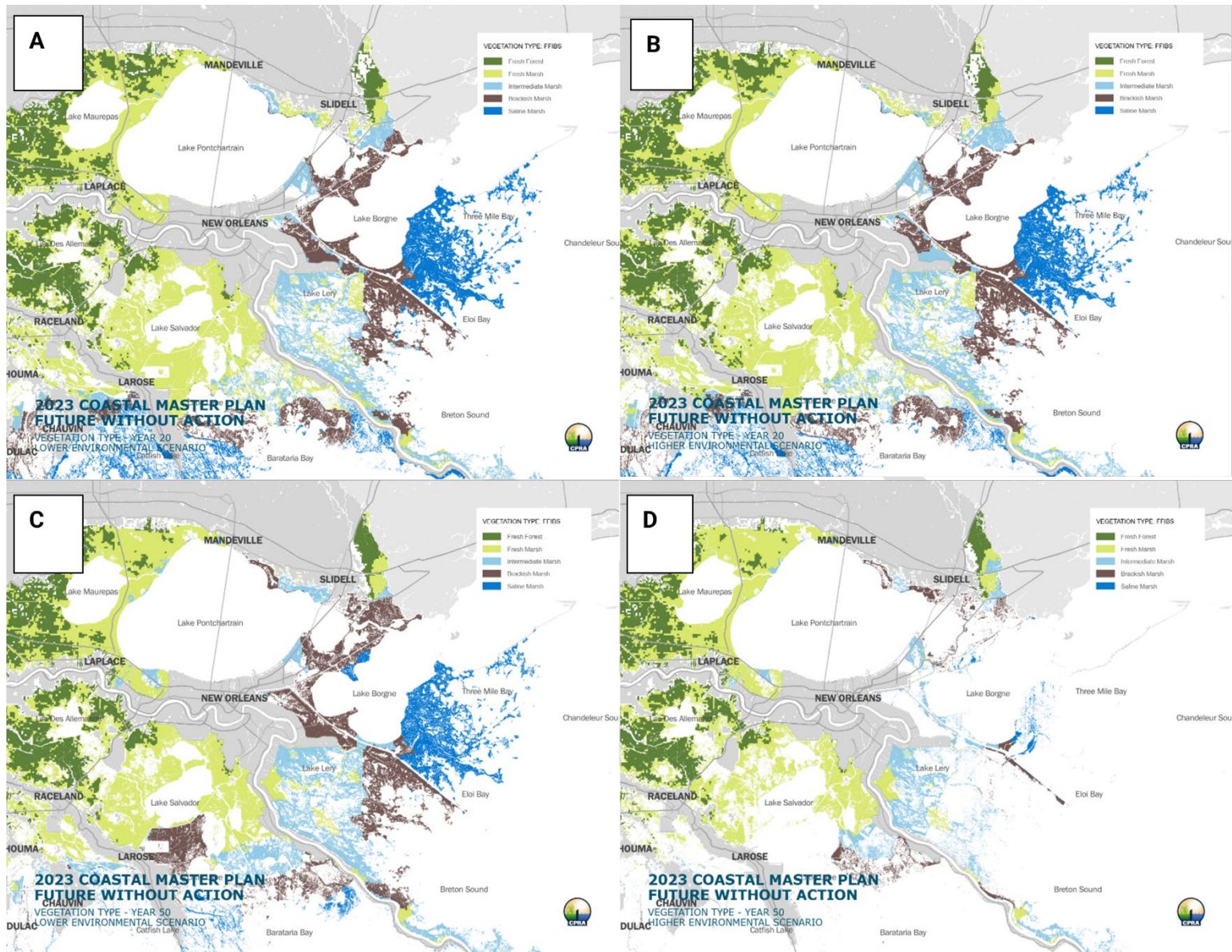
3873 The master plan models also predict changes in the type of coastal vegetation, classified as fresh forested,  
3874 fresh marsh, intermediate marsh, brackish marsh, and saline marsh. Figure 58 shows how the distribution of  
3875 these types varies over time and with scenario. Forested wetland and fresh marsh dominate the area west of  
3876 Lake Pontchartrain (the River Reintroduction into Maurepas Swamp project is assumed to be operating). The  
3877 main differences shown are the extensive loss of saline and brackish marshes by year 50 under the higher  
3878 scenario, associated with the effects of sea level rise and subsidence.

3879 Researchers used outputs from the 2017 Coastal Master Plan to examine potential future changes in the  
3880 biomass and distribution of several fisheries species using an ecosystem model (de Mutsert et al., 2021).  
3881 For blue crabs, there is a decrease in biomass across much of the lower Pontchartrain and Breton Sound  
3882 areas in year 50 under the high scenario compared to year 0 (Figure 59). This is also the case for spotted  
3883 seatrout; however, there are general increases in biomass, albeit to low levels, within Lake Pontchartrain.



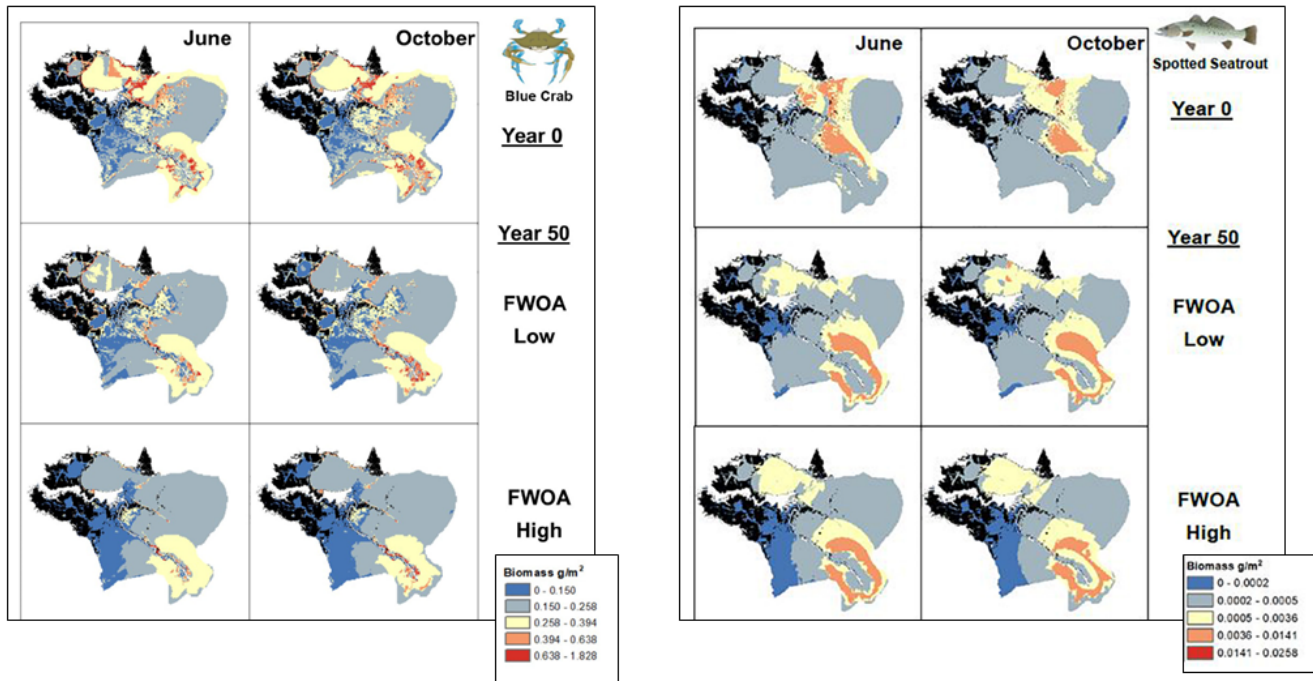
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3885

Figure 57. Land loss over 50 years into the future predicted for the lower scenario (left) and higher scenario (right).



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3887  
3888

Figure 58. Distribution of vegetation types: A - year 20 lower scenario, B - year 20 higher scenario, C - year 50 lower scenario, D - year 50 higher scenario.



**Figure 59. Biomass distribution for blue crab (left) and spotted seatrout (right) for initial conditions and year 50 FWOA for the lower and higher environmental scenarios from the 2017 Coastal Master Plan (from DeMutsert et al., 2021).**

These studies, both of recent climatic variation and the future effects of sea level rise and other climate factors, show the complexity of the response of organisms in the lower estuary to changes in both dynamic and structural habitat. Important factors include change in temperature related to an organism’s development patterns, loss in habitat due to sea level rise and related changes in food availability and habitat structure for aquatic fauna.

## INVASIVE SPECIES

An invasive species is an organism that causes ecological or economic harm in a new environment where it is not native. They can harm both the natural resources in an ecosystem as well as threaten human use of these resources. Invasive species are capable of causing extinctions of native plants and animals, reducing biodiversity, competing with native organisms for limited resources, and altering habitats. Habitats of the Pontchartrain Basin are subject to threat from both invasive flora and fauna.

### Invasive Flora

LDWF identifies four ‘tiers’ for invasive species. Tier I species are defined as “currently causing severe or widespread negative impacts on wildlife or natural communities in Louisiana”. Tier II species are “currently causing moderately negative impacts on wildlife or natural communities in Louisiana” (LDWF, 2019). Tiers III through IV are not discussed here as they either have no known or anticipated significant impacts on wildlife or natural communities in Louisiana or are not known to currently occur. Table 18 lists Tier I invasive flora found in the Pontchartrain Basin.

3911 **Table 18. Nonnative Invasive Tier I Flora in the Pontchartrain Basin (LDWF, 2019).**

TYPE	SPECIES
Terrestrial	Coral ardisia ( <i>Ardisia crenata</i> ), camphor tree ( <i>Cinnamomum camphora</i> ), bermuda grass ( <i>Cynodon dactylon</i> ), air yam ( <i>Dioscorea bulbifera</i> ), Chinese privet ( <i>Ligustrum sinense</i> ), Japanese climbing fern ( <i>Lygodium japonicum</i> ), Japanese twin-sorus fern ( <i>Deparia petersenii</i> ), Chinese Parasol tree ( <i>Firmiana simplex</i> ), Cogon grass ( <i>Imperata cylindrica</i> ), trifoliolate orange ( <i>Poncirus trifoliata</i> ), kudzu ( <i>Pueraria montana</i> ), Chinese tallow tree ( <i>Triadica sebiferum</i> ), elephant ear ( <i>Colocasia esculenta</i> ), torpedo grass ( <i>Panicum repens</i> ), smut grass ( <i>Sporobolus indicus</i> ), McCartney rose ( <i>Rosa bracteata</i> ), Cherokee Rose ( <i>Rosa laevigata</i> ), Tongoil tree ( <i>Vernicia fordii</i> ), vasey grass ( <i>Paspalum urvillei</i> ), Yellow Flag Iris ( <i>Iris pseudacorus</i> )
Aquatic	Water hyacinth ( <i>Eichhornia crassipes</i> ), hydrilla ( <i>Hydrilla verticillata</i> ), common salvinia ( <i>Salvinia minima</i> ), giant salvinia ( <i>Salvinia molesta</i> ), Brazilian waterweed ( <i>Egeria densa</i> )

3912 While all the species listed in Table 18 can have a severe impact, a summary of some of the impacts of the  
 3913 invasive plants on native ecosystems is outlined below:

- 3914 ● Chinese tallow: Originating from eastern Asia, this tree poses significant risks to local habitats. Its  
 3915 seeds are highly dispersible and grow rapidly, often replacing native plants, including trees. This  
 3916 leads to drastic changes in species composition and ecosystem dynamics within marshes, forests,  
 3917 and coastal prairies. Shallow wetlands, such as Flatwoods Ponds, are particularly susceptible to  
 3918 becoming dense tallow thickets when frequent prescribed fires are absent. Affected ecosystems  
 3919 include the Eastern Longleaf Pine Flatwoods Savanna.
- 3920 ● Water hyacinth: Native to South America, this aquatic plant can  
 3921 spread unchecked across lakes and ponds, forming dense,  
 3922 impenetrable mats. These mats disrupt water flow, block  
 3923 sunlight, and alter aquatic ecosystems, often causing the death  
 3924 of native plant species.
- 3925 ● Giant salvinia: This aquatic fern, native to southeastern Brazil,  
 3926 grows aggressively, replacing native plants that serve as vital  
 3927 habitats and food sources for local wildlife, such as waterfowl. It can block sunlight and deplete  
 3928 oxygen levels in the water, harming fish and other aquatic organisms.
- 3929 ● Cuban bulrush (*Cyperus blepharoleptos*)<sup>39</sup>: A floating aquatic plant from South America and the West  
 3930 Indies, it forms large mats in waterbodies such as lakes, rivers, and ponds. These mats displace  
 3931 native vegetation and aquatic life, obstruct navigation, and dominate aquatic ecosystems,  
 3932 particularly in southern areas of Lake Pontchartrain.



3933 **Invasive Fauna**

3934 Table 19 lists Tier I invasive fauna found in the Pontchartrain Basin.

3935 **Table 19. Nonnative Invasive Tier I Fauna in the Pontchartrain Basin (LDWF, 2019; Holcomb**  
 3936 **et al., 2015a).**

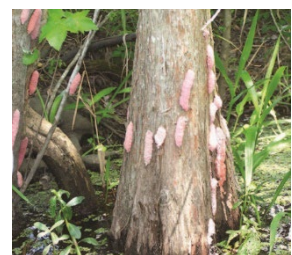
TYPE	SPECIES
Mammals	Nutria ( <i>Myocaster coypus</i> ), Norway rat ( <i>Rattus norvegicus</i> ), feral cat ( <i>Felis catus</i> ), feral hogs ( <i>Sus scrofa</i> )

<sup>39</sup> This is a Tier II species for LDWF at the state level, but it has a locally important impact in the Pontchartrain Basin.

TYPE	SPECIES
Birds	European starling ( <i>Sturnus vulgaris</i> ), house sparrow ( <i>Passer domesticus</i> )
Fishes	Common carp ( <i>Cyprinus carpio</i> ), grass carp ( <i>Ctenopharyngodon idella</i> ), silver carp ( <i>Hypophthalmichthys molitrix</i> ), Rio Grande cichlid ( <i>Cichlasoma cyanoguttatum</i> )
Mollusks	Apple snail ( <i>Pomacea</i> spp.)
Insects	Argentine ant ( <i>Linepithema humile</i> ), red imported fire ant ( <i>Solenopsis invicta</i> )

3937 As for flora, all the species listed in Table 19 will have some impact, a summary of some of the impacts of  
 3938 the invasive animals on native ecosystems is outlined below:

- 3939
- 3940 ● Feral hogs: These animals significantly affect ecosystems through their foraging and movement,  
 3941 which harm ground-nesting birds, damage vegetation, increase soil erosion, and alter ecological  
 3942 dynamics. Additionally, their predation on ground-nesting bird eggs and reptiles, including alligators,  
 3943 has been reported as a growing concern. Studies have highlighted that feral hogs destroy alligator  
 3944 nests, reducing reproductive success, particularly in areas where hog populations are high (Eley et  
 3945 al., 2012). They also shed coliform bacteria into waterways and carry diseases, including swine  
 3946 brucellosis, which can infect humans. Wild pigs influence vegetation structure, canopy cover, and  
 species diversity (Bradley & Lockaby, 2021).
  - 3947 ● Nutria: Semi-aquatic rodents from South America, nutria feed  
 3948 on plant roots, seedlings, and saplings, often stripping  
 3949 vegetation completely in high-concentration areas. This leads  
 3950 to soil erosion and the transformation of vegetated areas into  
 3951 open water. Their feeding habits have detrimental effects on  
 3952 coastal marshes and baldcypress swamps (Louisiana  
 3953 Department of Wildlife and Fisheries (LDWF), 2019). They can  
 3954 locally cause heavy damage (see Case Study of Invasive Nutria Impacts)
  - 3955 ● Asian carp: These invasive fish, including silver, bighead (*Hypophthalmichthys nobilis*), and grass  
 3956 carp, reproduce rapidly and grow to large sizes. They consume vast amounts of plankton, disrupting  
 3957 aquatic food webs and competing with native fish species. Bighead and silver carp consume  
 3958 phytoplankton and zooplankton, respectively, while black carp feed on mollusks, threatening  
 3959 endangered freshwater mussels. Grass carp graze heavily on aquatic plants, reducing habitat quality  
 3960 for native species. These carp populations significantly alter aquatic  
 3961 ecosystems if left unchecked (Kelso, 2019).
  - 3962 ● Apple snails: Originating in South America, apple snails are prolific  
 3963 breeders, with females laying hundreds of eggs every few days. They  
 3964 aggressively graze on wetland plants, affecting plant communities and  
 3965 serving as disease vectors (Louisiana Department of Wildlife and  
 3966 Fisheries (LDWF), 2019). These snails host the rat lung worm, which can  
 3967 infect humans and animals. Handling their egg clusters is hazardous due to the presence of  
 3968 neurotoxins.



## Case Study of Invasive Nutria Impacts

Prior to the Coastwide Nutria Control Program (Normand & Manuel, 2019), started in 2002, estimates of vegetative damage caused by nutria encompassed as much as 102,585 acres. Overgrazing by nutria removes vegetation from the surface of the marsh. If damaged areas do not revegetate quickly, they often transition to open water. Frequently, nutria grazing damages the plant's root systems, making recovery through vegetative regeneration very slow.

In the fall of 2006, the city of Hammond, Louisiana began discharging 11,000–15,000 cubic meters per day of disinfected secondarily treated municipal effluent into the Hammond Assimilation Wetland on the northern border of the Joyce Wetlands. The primary goals of the project were to improve local water quality by wetland filtration and, in the process, to revitalize the hydrologically isolated and saltwater-influenced wetlands with fresh water and nutrients. However, by late fall 2007, the emergent wetlands in the immediate vicinity of the effluent discharge began to deteriorate, and within months, nearly the entire marsh south of the discharge had converted to open water or mudflat (Shaffer et al., 2015). During the spring of 2008, to experimentally determine if the conversion from wetland to open water was caused primarily by nutria, ten exclosures were constructed and compared against controls.

In the exclosures, cattails displayed nearly 100% cover inside all ten exclosures within a 3-month period. In stark contrast, cattail in all ten controls was destroyed within 48 hours of planting (see Figure 60).

Aggressive nutria control at the site resulted in vegetation recovery in areas near the discharge area.

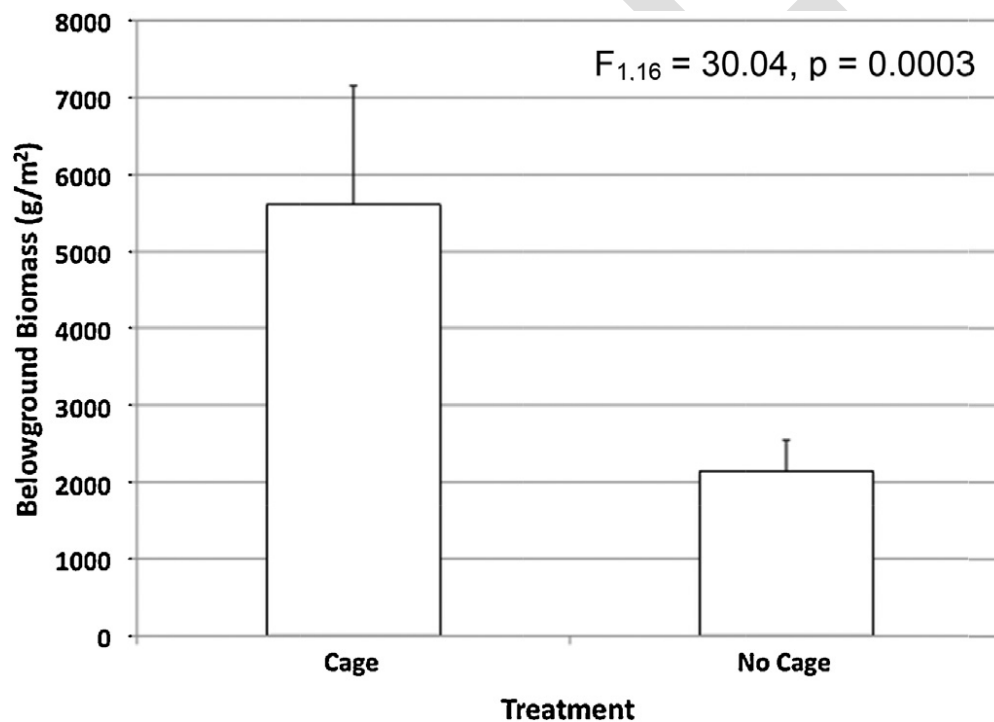


Figure 60. Live belowground biomass measured within nutria exclosures (cages) (from Shaffer et al., 2015).

## 3969 Impacted Species and Natural Communities

3970 Habitat change has important consequences for natural ecosystems. Natural communities are groups of  
3971 plant and animal species that typically occur in association with each other in certain landscapes or physical  
3972 environments. Factors such as associated vegetation, soil, substrate, hydrology, topography, climate, and fire  
3973 history help define a particular community and make it unique. Natural communities and their associations

3974 are one of the factors used to define ecoregions (Omernik, 1987), and they are used by LDWF as a framework  
 3975 for prioritizing which areas to protect and determining research needs.

3976 Although much of Louisiana is still covered in native vegetation, undisturbed examples of natural  
 3977 communities are exceedingly rare. Essentially, no habitat untouched by humans exists in the state. The  
 3978 primary threat to Louisiana's natural communities is habitat loss and alteration driven by urban expansion;  
 3979 residential and commercial development; land disturbance operations; introduction of exotic species; lack of  
 3980 proper habitat management; coastal erosion; subsidence and sea level rise; climate variability; extreme  
 3981 weather events; and many other natural and manmade factors. Almost 700 species of native Louisiana  
 3982 plants and animals are considered Species of Greatest Conservation Need (SGCN) by LDWF (Holcomb et al.,  
 3983 2015a), a designation that includes threatened and endangered species as well as uncommon species that  
 3984 rely on imperiled habitats (e.g., barrier islands) for survival.

3985 The Pontchartrain Basin is home to many SGCN. The Gulf Coastal Plain is bisected by the Mississippi River  
 3986 Alluvial Valley and the modern delta of the river, which forms a significant ecological barrier for many  
 3987 species. As a consequence, the basin hosts a number of terrestrial species characteristic of the lower Gulf  
 3988 Coast that reach their westernmost range, adding significantly to the biodiversity of Louisiana. Of the 140  
 3989 species of herpetofauna in this region native to Louisiana, 26 are found nowhere else in the state, or almost  
 3990 20% of the state's herpetofauna (Boundy & Carr, 2017). Of these 26, 10 are species of conservation concern  
 3991 (nearly 40%), a stark indication of how much habitat alteration and degradation is affecting native species.

3992 **SPECIES OF GREATEST CONSERVATION NEED**

3993 Habitat loss poses significant challenges to Louisiana's SGCN, including terrestrial, marine, and freshwater  
 3994 wildlife. Urban development, agriculture, invasive species, habitat fragmentation, degradation, natural system  
 3995 modifications, climate variability, and severe weather are some of the threats identified for the Pontchartrain  
 3996 Basin. There are 227 SGCN identified by LDWF in the basin (ATTACHMENT B)(Louisiana Department of  
 3997 Wildlife and & Fisheries' Wildlife Diversity Program [WDP], 2024). These species are ranked, with the highest  
 3998 rank (S1) being critically imperiled, meaning at very high risk of extirpation in Louisiana due to very restricted  
 3999 range, very few populations or occurrences (five or fewer known populations), very steep declines, severe  
 4000 threats, or other factors. All S1 species in the Pontchartrain Basin are also listed as critically imperiled,  
 4001 imperiled, or vulnerable globally. Table 20 summarizes their distribution by habitat zone.

4002 **Table 20. Distribution by habitat zone of SGCN ranked as critically imperiled (S1) at the**  
 4003 **state level or critically imperiled, imperiled, or vulnerable globally (Louisiana Department of**  
 4004 **Wildlife and & Fisheries WDP, 2024).**

HABITAT ZONE	VERTEBRATE ANIMALS	NATURAL COMMUNITIES	INVERTEBRATE ANIMALS	PLANTS
SPP	1	4	2	3
BRT	1	1	5	0
GCF	3	5	3	7
SHM	1	0	0	0
SDM	0	3	0	0

4005 Eight species occur in more than one habitat zone.

- 4006 ● Alabama Hickorynut (*Obovaria unicolor*) – SSP, BRT, GCF
- 4007 ● Freshwater mussel
- 4008 ● Alabama Shad (*Alosa alabamae*) – BRT, GCF
- 4009 ● Anadromous fish
- 4010 ● Arogos Skipper (*Atrytone arogos*) – BRT, GCF
- 4011 ● Butterfly
- 4012 ● Carpenter’s Ground-cherry (*Calliphysalis carpenteri*) – GCF, SPP
- 4013 ● Annual plant
- 4014 ● Gopher Tortoise (*Gopherus polyphemus*) – GCF, SPP
- 4015 ● Tortoise
- 4016 ● Slender Gayfeather (*Liatris tenuis*) – GCF, SPP
- 4017 ● Perennial plant
- 4018 ● Southern Snaketail (*Ophiogomphus australis*) – BRT, SPP
- 4019 ● Dragonfly
- 4020 ● Spring Hill Flax (*Linum macrocarpum*) – GCF, SPP
- 4021 ● Perennial plant

4022 Some of the SGCN in the Pontchartrain Basin are very specifically associated with recognized habitat issues  
4023 in the area, including, for example, the freshwater mussel, the inflated heelsplitter found in the BRT habitat  
4024 zone (see Habitat Change and the Inflated Heelsplitter (*Potamilus Inflatus*)).

## Habitat Change and the Inflated Heelsplitter (*Potamilus Inflatus*)

The inflated heelsplitter historically occurred in the Tangipahoa and Pearl rivers in southeastern Louisiana; however, this species now occurs only in the Amite River in Louisiana, and the Tombigbee and Black Warrior Rivers in Alabama. The species is listed as threatened in the Amite River by USFWS, where it occurs in protected depositional habitats. The Amite River Basin has experienced considerable alteration by humans. In Louisiana, the reaches of the river from Grangeville to Greenwell Springs, north of Baton Rouge, have been subjected to extensive gravel mining, which started in the 1950s and peaked in the 1980s (Alrehaili & Mossa, 2025).

The Amite River population of the heelsplitter is under the dual threats of gravel mining in the northern portion of its range, which results in channel widening, braided flow, and bank destabilization that lead to higher stranding rates of mussels, and increased urbanization of the watershed in the lower portion of its range (Brown & Daniel, 2014).

A survey of the river in 2007-2008 (Brown et al., 2010) found that heelsplitters were more common upstream from most of the residential development associated with Baton Rouge (Figure 61). Sites with heelsplitters had significantly more riparian zone covered in wetland forest at the reach scale and an order of magnitude less area in residential use. The researchers note that urbanization could be affecting heelsplitter populations in the Amite River in several ways. Increased development could be increasing runoff and the severity of seasonal flooding. Urbanization also impacts lotic mussel communities through stream bed erosion and channel degradation or through producing non-point source pollutants that lower the survival or growth of mussels. Wetlands and riparian vegetation can dampen these effects through water storage, filtering, and increased water residence time.

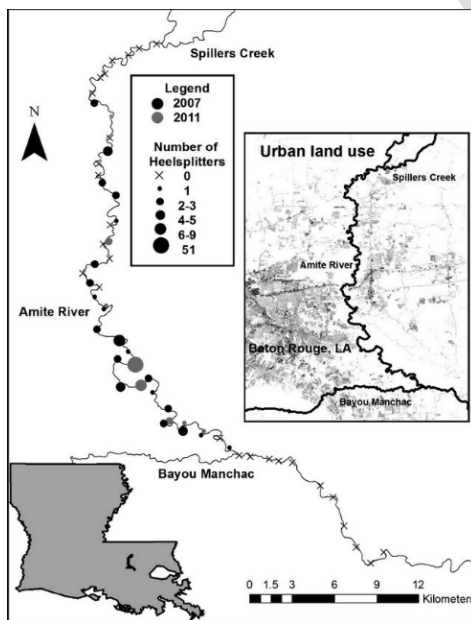


Figure 61. The range of the inflated heelsplitter in the Amite River in Louisiana. Size of circles reflects numbers of inflated heelsplitters collected during 90 minutes of qualitative sampling (2007) or quantitative sampling (2011). Sites marked with an "x" had no inflated heelsplitters.

4025 The status of species can change with conservation efforts. For example, the red-cockaded woodpecker,  
4026 which is found in BRT, GCF, SDM, and SPP habitat zones, was recently downgraded at the federal level from  
4027 endangered to threatened (see Habitat Change and the Red-cockaded Woodpecker).

## Habitat Change and the Red-cockaded Woodpecker

Red-cockaded woodpeckers make their homes in mature pine forests. While other woodpeckers bore out cavities in dead trees where the wood is rotten and soft, the red-cockaded woodpecker is the only one that excavates cavities that are exclusively in living pine trees. Once abundant from New Jersey to Florida, west to Texas, and north to Missouri, the red-cockaded woodpecker's range dwindled to a few states by the 1960s, following more than a century of habitat loss. In the late 1970s, populations were at an all-time low of an estimated 1,470 clusters of red-cockaded woodpeckers. Today, the USFWS estimates there are 7,800 clusters of this colonial species ranging across 11 states from southern Virginia to eastern Texas.

Because the red-cockaded woodpecker's habitat requirements are so narrow, land use restrictions imposed by the Endangered Species Act (ESA) to protect the species make it difficult to encourage private and other non-federal landowners to manage for the species. As a solution, LDWF partnered with the USFWS to create a 'Safe Harbor Program' to encourage landowners to manage their pine timberlands for the benefit of red-cockaded woodpeckers while reducing their fear of having an endangered species on their property.

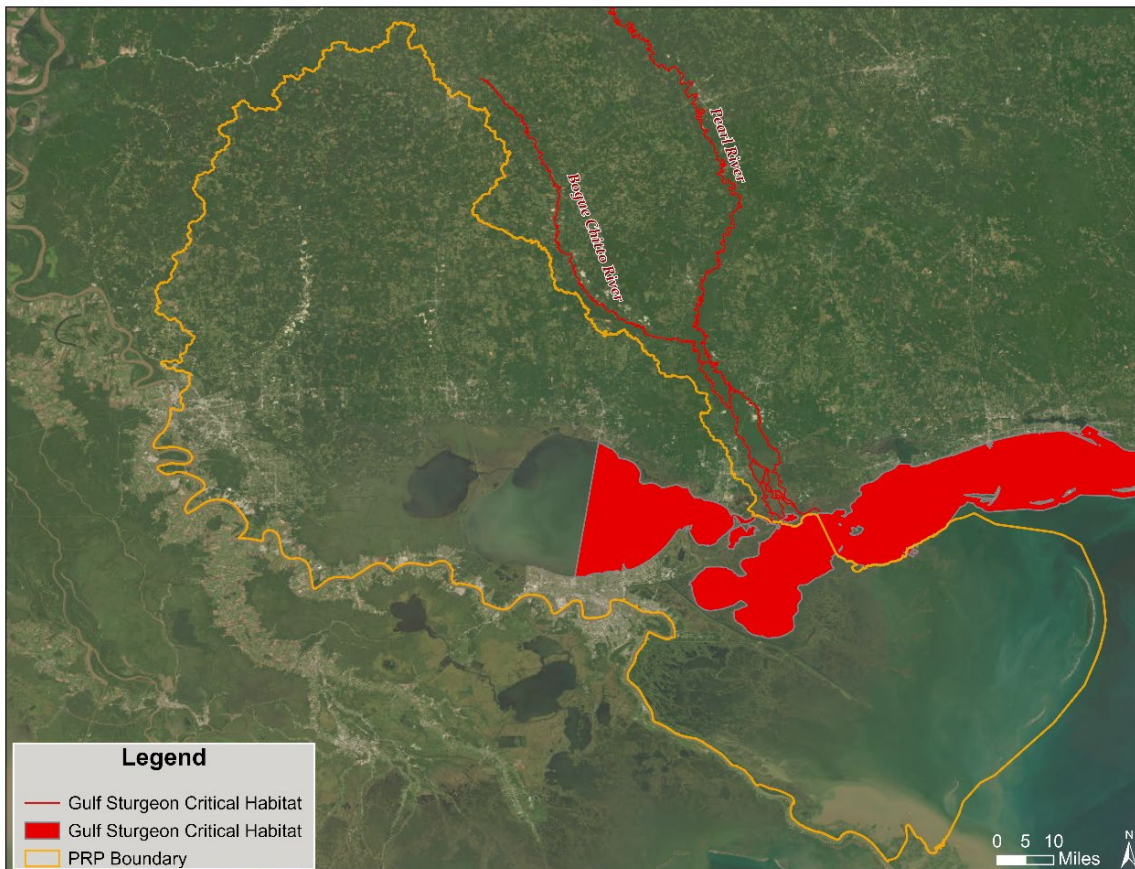
In October 2024, USFWS downlisted the red-cockaded woodpecker from endangered to threatened status under the ESA. Big Branch NWR is one of the sites across the country where artificial nests have been inserted into live pine trees. These nests help the woodpeckers as building their nests can take years. The nests can also be deployed when forest fires, tornados, or hurricanes knock out trees with active nests in them. In 2024, 60 individual birds were counted in Big Branch, spread out across 24 family clusters, 20 of which are believed to be reproducing



4028 In Louisiana's Wildlife Action Plan, 18 marine fish are classified as SGCN, with monitoring data revealing  
4029 varying levels of occurrence (Holcomb et al., 2015b; Midway et al., 2021). These fish range from globally  
4030 unranked species to those categorized as critically imperiled (S1) or vulnerable (G3). Monitoring data from  
4031 the Fishery-Independent Monitoring Program (FIMP) of the LDWF has been used to examine their presence  
4032 and trends within the Pontchartrain Basin (Midway et al., 2021). The study looked at nine of the most  
4033 commonly recorded marine SGCN fish species with varying levels of occurrence in the Pontchartrain Basin  
4034 from 1986 to 2018. While species such as the broad flounder (*Paralichthys squamilentus*) and lemon shark  
4035 (*Negaprion brevirostris*) were not encountered, others like the chain pipefish (*Syngnathus louisianae*; 410  
4036 encounters), diamond killifish (*Fundulus xenicus*; 241 encounters), bayou killifish (*Fundulus pulvereus*; 174  
4037 encounters), and violet goby (*Gobioides broussonnetii*; 115 encounters) were relatively more prevalent. The  
4038 saltmarsh topminnow (*Fundulus jenkinsi*), notable for being within the SDM habitat zone, stands out with an

4039 increase in CPUE over time, contrasting with general declines observed in other species (Midway et al.,  
4040 2021).

4041 The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) is a subspecies of the Atlantic sturgeon with Lake  
4042 Pontchartrain and the Pearl River at the western end of its range. It is classified as threatened under the ESA.  
4043 As an anadromous species, Gulf sturgeon are impacted by dams on rivers, dredging in channels and  
4044 nearshore waters, as well as by hurricanes impacting their habitat. Within the Pontchartrain Basin, critical  
4045 habitat for Gulf sturgeon is designated in Lake Borgne and eastern Lake Pontchartrain for populations that  
4046 utilize the Pearl River and the Bogue Chitto River (Figure 62).



4047  
4048 **Figure 62. Critical habitat for the Gulf sturgeon (NMFS Office Of Protected Resources,**  
4049 **2022a, 2022b).**

## 4050 NATURAL COMMUNITIES

4051 Twenty-seven natural communities are considered under threat in the Pontchartrain Basin by LDWF  
4052 (ATTACHMENT B). Table 21 describes the natural communities ranked as S1 and G1 (globally imperiled). Of  
4053 these, five occur in more than one habitat zone:

- 4054 ● Eastern Hillside Seepage Bog – GCF, SPP
- 4055 ● Natural wetlands
- 4056 ● Eastern Longleaf Pine Savanna – GCF, SPP
- 4057 ● Natural community

- 4058 ● Eastern Upland Longleaf Pine Forest – GCF, SPP
- 4059 ● Natural community
- 4060 ● Pondcypress-Blackgum Swamp – GCF, SDM
- 4061 ● Natural wetlands
- 4062 ● Shortleaf Pine/oak-hickory Forest – GCF, SPP
- 4063 ● Natural forests

4064 **Table 21. Overview of habitats of greatest conservation need in Louisiana (Holcomb et al.,**  
 4065 **2015).**

HABITAT	ECO-REGION	DESCRIPTION	CURRENT EXTENT & STATUS	THREATS
Eastern Hillside Seepage Bog	GCF, SPP	Very rare herb-dominated wetlands, persistently wet from groundwater seepage, rich in sedges, grasses, and unique species like Pitcher Plants. Fire-dependent system, sensitive to land management.	Less than 10% of pre-settlement extent (less than 2,000 acres). Degraded by land use, surrounded by timberlands. Minimal protection, with some preserved in TNC's Abita Creek Preserve.	Development, woody encroachment, fire exclusion, land management practices altering hydrology.
Eastern Longleaf Pine Flatwoods Savanna	GCF, SPP	Herb-dominated wetlands, sparsely stocked with Longleaf Pine. Dependent on frequent fire for maintenance of open structure and biodiversity.	Less than 1% remains of historical extent (100,000-500,000 acres). Fragmented with ongoing restoration efforts by TNC and other agencies. Benefits from wetland mitigation banking.	Habitat loss, development, fire suppression, invasive species.
Eastern Upland Longleaf Pine Woodland	GCF, SPP	Longleaf Pine-dominated woodlands with diverse herbaceous understory, home to species like the federally threatened Gopher Tortoise. Requires frequent fire to maintain biodiversity.	Less than 5% of original 1-2 million acres remain. Preserved in LDWF-managed areas and private lands under restoration.	Fire exclusion, habitat conversion, development.
Shortleaf Pine/Oak-Hickory Woodland	GCF, SPP	Dry hills with Shortleaf Pine and hardwood species. Historically, grassy with herbaceous cover, fire-dependent, but varied ground cover due to more shaded areas.	5-10% of original extent (4-6 million acres) remains. Rarity due to fire exclusion and habitat conversion. Extremely rare habitat.	Fire exclusion, habitat loss, mineral extraction, disturbance, fragmentation.
Coastal Live Oak-Hackberry Forests (Cheniers) <sup>40</sup>	SDM	Forests on the Chenier Plain, vital for storm buffering and providing habitat for migratory birds. Limited extent and fragmented.	About 2,000-10,000 acres remain. Threatened by development and sand mining, invasive plants and animals. Some areas protected in state-managed lands.	Erosion, storm damage, habitat conversion, invasive species.
Spruce Pine-Hardwood Flatwoods	BRT	Mix of Spruce Pine and hardwood species in the western Florida Parishes. Historically widespread. Spruce Pine Hardwood Flatwoods usually have a dense canopy.	A few small patches remain, with ongoing restoration. Some tracts protected by conservation groups.	Development, hydrological changes, invasive species.
Coastal Dune Grassland	SDM	Found on Louisiana's barrier islands and mainland beaches. Dominated by salt-tolerant plants, valuable for coastal resilience but vulnerable to storms and erosion.	Less than 2,000 acres historically, with 50-75% remaining. Coastal areas like Grand Isle support extensive shrub thickets.	Storm surges, sea level rise, limited nutrient supply, inadequate sand supply, erosion.

<sup>40</sup> Presence in St. Tammany, St. Bernard, and Orleans parishes within SDM habitat zone.

HABITAT	ECO-REGION	DESCRIPTION	CURRENT EXTENT & STATUS	THREATS
Pondcypress-Blackgum Swamps	GCF, SDM	Occurs in backwater areas of larger swamps, with acidic, nutrient-poor soils. Habitat for diverse flora and fauna, sensitive to nutrient pollution.	Restricted to eastern Florida Parishes, no historical extent estimates. Protected on state and private lands.	Nutrient pollution, water quality degradation.

4066 **Monitoring and Assessment**

4067 **HABITAT RELATED MONITORING**

4068 Habitat-related monitoring within the basin employs diverse and precise methodologies to collect important  
 4069 environmental data. Some monitoring efforts are conducted long-term, such as the System-Wide  
 4070 Assessment and Monitoring Program (SWAMP). SWAMP is a monitoring program designed to establish a  
 4071 coastal data collection network to support coastal protection and restoration efforts. The Coastwide  
 4072 Reference Monitoring System (CRMS) was implemented under SWAMP, focusing on monitoring various  
 4073 environmental factors across Louisiana's coast. CRMS uses standardized techniques at 390 monitoring sites  
 4074 to evaluate restoration impacts across Louisiana's coastal zones. Out of these, 73 CRMS sites are within the  
 4075 project boundary (Figure 25). The system captures data on ecological conditions across swamp habitats and  
 4076 marshes ranging from fresh to saline environments (Table 22). CRMS employs standardized methods to  
 4077 ensure consistent data collection across sites and time, enabling reliable comparisons.

4078 **Table 22. CRMS collects data on vegetation biomass, soil properties, sediment dynamics,**  
 4079 **and hydrographic parameters (Coastal Protection and Restoration Authority (CPRA) of**  
 4080 **Louisiana, n.d.).**

DATA TYPE	PARAMETER	METHOD	FREQUENCY
Land change	Land:Water Ratio	Satellite Imagery	4 years
Land change	Land:Water Ratio	Digital Aerial Photography	3 years
Vegetation	Emergent Vegetation	Braun Blanquet: % Cover, Species Richness, Height of Dominant Species	Annually during peak biomass
Vegetation	Forested Vegetation	DBH, Canopy Cover, Understory veg	Every 3 years during peak biomass
Vegetation	Aboveground Biomass	Live and dead biomass, stem counts, stem height, stem diameter, and total C, N, & P of leaf material	Every 5 years at select CRMS sites
Soils	Soil Characteristics	Soil profile of bulk density, OM%, soil salinity, pH, and moisture.	6 to 10 years
Soils	Soil Nutrients	Soil profile of total C, N, & P of sediment	Every 5 years at select CRMS sites
Soils	Belowground Biomass	Profile of live and dead biomass components	Every 5 years at select CRMS sites
Soils	Vertical Accretion	Feldspar Plots/Cryogenic Cores	Twice/year 2006- 2020, Once/year after 2020
Soils	Marsh Elevation Change	Rod Surface Elevation Table (RSET)	Twice/year 2006- 2020, Once/year after 2020

DATA TYPE	PARAMETER	METHOD	FREQUENCY
Hydrology	Soil Porewater	10- and 30-centimeter syringe sippers	Variable at boardwalk, annually at veg plots
Hydrology	Surface Water Salinity, Temperature, and Water Level	Submersible Data Logger	Hourly

4081 Fish and shellfish populations are sampled regularly by LDWF biologists in both freshwater and saltwater  
4082 systems using a range of methods. LDWF fish and shellfish monitoring employs specialized techniques for  
4083 specific environments. Freshwater sampling includes electrofishing, hoop nets, gill nets, and shoreline  
4084 seining to collect fish by species, age, and habitat. Electrofishing targets freshwater species like bass and  
4085 crappie, while hoop and lead nets focus on catfish and sunfish. Saltwater monitoring uses trawls to assess  
4086 shrimp and crab populations, and gill nets to sample juvenile fish species like spotted seatrout. Oyster  
4087 populations are studied through square-meter sampling and dredging, assessing live and dead oysters, spat,  
4088 and reef conditions. These methods are repeated seasonally and across set stations for standardized, long-  
4089 term data collection.

4090 The LDWF Wildlife Diversity Program conserves rare species and habitats through a geospatial database  
4091 with over 10,000 occurrence records and classification of natural communities. Tracking the presence or  
4092 absence of species highlights ecological imbalances enables timely interventions to protect biodiversity. The  
4093 program uses field surveys and collaborations with researchers to catalog data on more than 350  
4094 ecologically significant sites statewide.

4095 The NLCD is described in the Basin Characterization section. Validation of the land cover data occurs  
4096 through the Annual Reference & Validation (R&V) process, which organizes independent datasets to confirm  
4097 land cover classifications at the Anderson Level II taxonomy. NLCD provides consistent national land cover  
4098 data, supporting ecosystem assessments, biodiversity conservation, and analysis of the impacts of climate  
4099 variability and extreme weather events. Habitat change maps can reveal patterns of degradation and  
4100 development, guiding conservation priorities and land-use policies. Annual updates using advanced  
4101 technologies now offer detailed insights into land cover changes from 1985 onward.

4102 There are also monitoring efforts in the Pontchartrain Basin that are temporary or conducted for specific  
4103 periods. For instance, the Seagrass Resilience project at the Chandeleur Islands, running from October 2023  
4104 to September 2028 under NOAA’s RESTORE Science Program<sup>41</sup>, focuses on protecting and enhancing  
4105 seagrass habitats. The team, comprising members from CPRA, USFWS, LDWF, The Water Institute, University  
4106 of Louisiana at Lafayette, University of Southern Mississippi, University of Florida, the Gulf of America  
4107 Alliance, NOAA, and St. Bernard Parish Government, is collecting detailed spatial and temporal data to  
4108 understand disturbance impacts and assess seagrass resilience. They are working collaboratively to gather  
4109 data, conduct responsive sampling, and connect physical and biological systems. The project aims to guide  
4110 restoration efforts and inform a long-term monitoring and adaptive management plan. Expected outcomes

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<sup>41</sup> More information can be accessed via the following link: <https://restoreactscienceprogram.noaa.gov/projects/seagrass-resilience-at-the-chandeleur-islands>

4111 include detailed data, species distribution maps of seagrass cover under various conditions, and  
4112 recommended criteria for successful seagrass restoration.

4113 Acoustic telemetry has been used to document the presence of multiple species throughout the  
4114 Pontchartrain Basin. Starting in 2012, Louisiana State University (LSU), in conjunction with LDWF, deployed a  
4115 coarse-scale acoustic receiver array across Lake Pontchartrain and the tidal passes to better understand  
4116 movement and distribution patterns of tagged spotted seatrout (Baer, 2019). This array complemented an  
4117 ongoing effort by USFWS to document seasonal migration patterns of Gulf sturgeon tagged in the Pearl River  
4118 system (Baer et al., 2024; Brogdon et al., 2024). Over time, LDWF tagged and further investigated movement  
4119 patterns of spotted seatrout, red drum, and juvenile bull sharks (*Carcharhinus leucas*), along with researchers  
4120 from the University of New Orleans. A collaborative effort between USFWS and LSU has expanded the  
4121 telemetry array to survey Gulf sturgeon habitat usage in Lake Borgne, as well as at the Chandeleur Islands.  
4122 Additionally, USFWS deployed a fine-scale telemetry array over various habitats (including SAV beds) on the  
4123 northeastern shoreline of Lake Pontchartrain near Goose Point to identify habitat preferences of Gulf  
4124 sturgeon of different size classes. Most recently, LDWF has partnered with USFWS to use acoustic telemetry  
4125 to better understand migratory patterns and habitat use of tagged striped bass and has deployed receiver  
4126 stations in a few areas of Lake Pontchartrain, the Rigolets, and in major rivers into the basin (e.g., Pearl,  
4127 Tangipahoa, Tchefuncte).

4128 Southeastern Louisiana University is conducting a monitoring study to gather biological data from the  
4129 aquatic and wetland habitats of Lake Maurepas (Piller et al., 2024). This effort aims to provide baseline  
4130 abiotic and biotic data regarding the lake's condition. The team is focused on several key areas of monitoring  
4131 to ensure a thorough understanding of the lake's current state. Their aquatics team monitors fish, crab, and  
4132 shrimp populations, biodiversity, fish captures, invertebrates, and environmental DNA. Under their aquatic  
4133 physiology team, they are also assessing baseline levels for human-consumed species like crabs, alligators,  
4134 and catfish, focusing on physiological stress, endocrine disruption, and heavy metal markers. Additionally,  
4135 their wetland monitoring team examines wetland vegetation, tree productivity, accretion, subsidence, and  
4136 habitat status mapping. This comprehensive study aims to understand the lake's current conditions, assess  
4137 the impacts of the carbon sequestration project, and ensure its health and sustainability.

4138 Data on habitats in the Pontchartrain Basin is available from long-term programs that track changes over  
4139 time, as well as short-term studies that focus on local or near-term changes. Both are important to provide a  
4140 complete picture of the ecosystem. These systematic approaches ensure comprehensive, consistent, and  
4141 accurate environmental data, which can be used to support informed management and conservation across  
4142 the basin. However, the data themselves may be of less use than efforts that seek to gather and synthesize  
4143 data into an assessment of changing conditions.

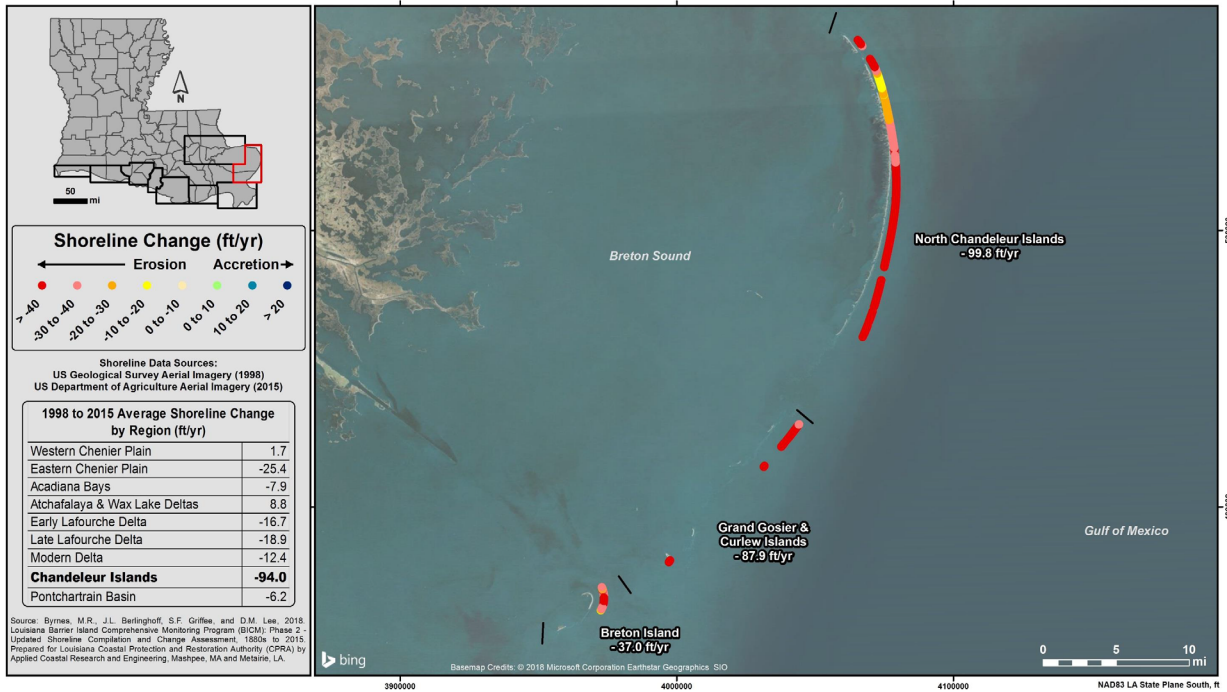
## 4144 HABITAT RELATED ASSESSMENT

4145 Monitoring efforts in the Pontchartrain Basin can only provide insights into ecological conditions, habitat  
4146 dynamics, and stressor impacts if they are accompanied by assessment and synthesis to aid resource  
4147 management and restoration initiatives. While such assessments are less common than routine monitoring,  
4148 several efforts have been conducted in the basin, some of which are outlined here.

4149 The Barrier Island Comprehensive Monitoring (BICM) program, implemented under SWAMP, exemplifies such  
4150 efforts, using historical and modern datasets (e.g., aerial photography, lidar, bathymetry, and sediment

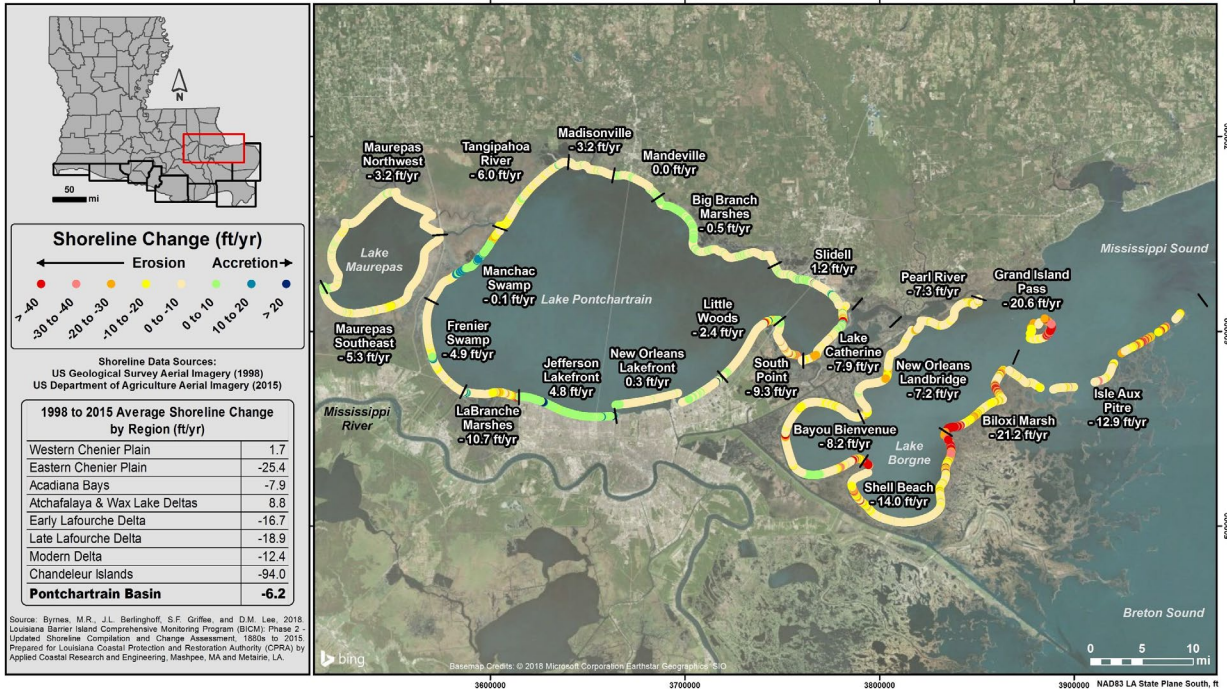
4151 samples) to evaluate shoreline processes and habitat changes (Byrnes et al., 2018). The goal of BICM is to  
 4152 provide long-term data on Louisiana’s barrier islands to aid in planning, designing, evaluating, and  
 4153 maintaining restoration projects, with the USGS collaborating with CPRA to achieve this. Key findings include  
 4154 substantial shoreline recession between 1998 and 2015. The Chandeleur Islands absorbed the greatest  
 4155 impact of Hurricane Katrina in coastal Louisiana, and it is reflected in extreme shoreline recession recorded  
 4156 for this period. Mean shoreline change was -94.0 feet/year (Figure 63), the majority of which can be related  
 4157 to Katrina. These data inform coastal restoration and planning while offering a baseline for system-wide  
 4158 changes. Figure 64 shows shoreline change rates for the interior shoreline areas for the same period that  
 4159 locally exceed 21 feet/year on the shoreline of Lake Borgne.

**Louisiana Shoreline Change: Chandeleur Islands Region, 1998 to 2015**  
**Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2**



4160  
 4161 **Figure 63. Shoreline change for the Chandeleur Islands Region, 1998 to 2015 (from Byrnes**  
 4162 **et al., 2018).**

**Louisiana Shoreline Change: Pontchartrain Basin Region, 1998 to 2015**  
**Barrier Island Comprehensive Monitoring Program (BICM) - Phase 2**



**Figure 64. Shoreline change for the Pontchartrain Basin region, 1998 to 2015 (from Byrnes et al., 2018).**

NOAA RESTORE Science Program funded a Gulf-wide assessment of turtlegrass (*Thalassia testudinum*) that emphasized its role as a vital habitat for many important finfish and shellfish. In the northern Gulf of America, turtlegrass supports food webs and provides shelter and foraging grounds. In 2018, the project, which targeted six sites including the Chandeleur Islands in Louisiana, conducted trawl and benthic sled surveys to investigate how animals utilize turtlegrass as habitat and its benefits to species like blue crabs, whose populations have been declining. The study found that blue crab survival improved with longer and wider turtlegrass leaves and larger juvenile crabs. The Chandeleur Islands had notably high turtlegrass coverage, averaging over 80%, with the highest seagrass shoot density and an average canopy height of 319 ± 58 mm (Belgrad et al., 2021). Penaeid shrimp were abundant, and common species included pinfish (*Lagodon rhomboides*), silver perch (*Bairdiella chrysoura*), blue crab, seagrass shrimp (*Hippolytidae*), grass shrimp (*Palaemonidae*), and pink shrimp (*Penaeus duorarum*). The Chandeleur Islands also showed the greatest diversity of nekton species among the sites surveyed.<sup>42</sup>

The LDWF Wildlife Action Plan also plays a vital role in assessing and prioritizing conservation efforts (Holcomb et al., 2015). Developed and revised by LDWF with input from diverse stakeholders, the 2015 Wildlife Action Plan updated the SGCN list and identified threats, research needs, and conservation actions.

<sup>42</sup> More information can be accessed via the following link:  
<https://static1.squarespace.com/static/56fef2a6a3360c0321cbbe9d/t/626c4028359672240ee95ee5/1651261482344/Louisiana+Flyer.pdf>

4181 The Wildlife Action Plan serves as a framework for all conservation stakeholders in Louisiana, enabling  
4182 targeted efforts to protect vulnerable species and habitats.

4183 Assessments of freshwater diversion impacts, such as the "Characterizing Ecological Conditions in Breton  
4184 Sound Basin" report, leverage data from CRMS, USGS, and LDWF to evaluate environmental changes (CPRA  
4185 New Orleans Regional Office, 2020). Findings show the Caernarvon Freshwater Diversion improved  
4186 vegetation growth and reduced marsh loss near its outfall but had limited influence farther downstream,  
4187 where decreases in marsh elevation and vegetation cover were observed.

4188 Additionally, a multi-scale habitat and stressor study in the basin demonstrated that fish assemblages are  
4189 shaped by a mix of natural geomorphic factors and anthropogenic stressors (Alford, 2014). By utilizing LULC,  
4190 fish CPUE, and HUC-12 data, they determined that reach-scale habitat (e.g., stream depth, vegetation, and  
4191 debris) was the strongest determinant, while watershed-level variables like road density and land use  
4192 influenced species with "opportunistic" life-history strategies (e.g., shorter life spans, lingering spawning  
4193 season).

4194 Collectively, these assessments highlight the role of monitoring data in understanding and managing the  
4195 complex interplay of natural and human factors shaping the basin's ecological conditions. However, many  
4196 are limited in time and scope, and while they can provide insight into some aspects of habitat and the  
4197 ecological health of the system, comprehensive routine assessment is presently lacking.

## 4198 Regulatory Framework and Policies

4199 While much of the habitat change in the Pontchartrain Basin in the last 50 years has been as a result of  
4200 development and other human uses of the land, there are a number of protective and proactive regulations  
4201 and policies in place that limit further impacts (Table 23). It is important to recognize that there are also a  
4202 number of local ordinances and programs that can influence the pace and magnitude of habitat alteration  
4203 due to human activities. For example, the 2022 St. Tammany Parish Comprehensive Plan<sup>43</sup> identifies some  
4204 lands as 'conservation protected' where most types of development are generally prohibited, but which may  
4205 be used for regulated recreation or eco-tourism purposes.

4206 **Table 23. Federal and state laws and policies influencing habitat change within the PRP**  
4207 **boundary.**

FEDERAL OR STATE	POLICY NAME	LEAD AGENCY	PURPOSE
Federal	Wild and Scenic Rivers Act	Bureau of Land Management	Protect and enhance free-flow, water quality, and outstandingly remarkable values of rivers.
Federal	National Environmental Policy Act (NEPA)	Council on Environmental Quality	Requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions.
Federal	Coastal Zone Management Act (CZMA)	National Oceanic and Atmospheric Administration (NOAA)	Promotes sustainable management and development of coastal resources.

<sup>43</sup> More information can be accessed via the following link: [https://www3.stpgov.org/pdf/ND2040\\_Comprehensive\\_Plan.pdf](https://www3.stpgov.org/pdf/ND2040_Comprehensive_Plan.pdf)

FEDERAL OR STATE	POLICY NAME	LEAD AGENCY	PURPOSE
Federal	Magnuson-Stevens Act	NOAA	Primary law that governs marine fisheries management in U. S. federal waters; preserves essential fish habitat.
Federal	Marine Mammal Protection Act	NOAA, USFWS	National policy to prevent marine mammal species and population stocks from declining beyond the point where they cease to be significant functioning elements of their ecosystem.
Federal	Clean Water Act (CWA)	USEPA, USACE	Protects water quality and wetlands and regulates pollutant discharge and quality standards of surface waters.
Federal	Endangered Species Act (ESA)	USFWS, NOAA	Establishes protections for fish, wildlife, and plants that are listed as threatened or endangered.
Federal	Migratory Bird Treaty Act (MBTA)	USFWS	Ensures sustainability of all protected migratory bird species.
Federal	Fish and Wildlife Coordination Act	USFWS, NOAA	Investigates and reports on proposed Federal actions that affect any stream or other body of water and provides recommendations to minimize impacts on fish and wildlife resources.
State	Louisiana Surface Water Management Plan	Louisiana Department of Energy and Natural Resources (LDENR)	Preserve, conserve, and protect the state's water resources and authority to enter into cooperative agreements for surface water withdrawal.
State	Wetland Mitigation	LDENR	Actions to avoid, minimize, restore, and compensate for ecological values lost due to a permitted activity.
State	Louisiana Coastal Zone Management Program	LDENR	Regulates development activities and manages the resources of the coastal zone.
State	Louisiana Surface Mining and Reclamation Act	LDENR	Prevents unreasonable degradation of land and water resources.
State	Louisiana Scenic Rivers Act	LDWF	Preserves, protects, develops, reclaims, and enhances the wilderness qualities, scenic beauties, and ecological regimes of designated free-flowing Louisiana rivers, streams, bayous, and segments thereof.

4208 Some of these policies regulate activities and require permits or other approvals for certain activities to take  
4209 place. Some involve federal agency staff, while others delegate responsibility to different levels of  
4210 government. Two examples are provided here that are active in the Pontchartrain Basin.

## 4211 COASTAL ZONE MANAGEMENT

4212 The Coastal Zone Management Act of 1972 established the National Coastal Zone Management Program  
4213 that addresses the nation's coastal issues through a voluntary partnership between the federal government  
4214 and coastal and Great Lakes states and territories. The national program provides the basis for protecting,  
4215 restoring, and responsibly developing the nation's diverse coastal resources.

4216 State partners must follow basic requirements; the program also gives states the flexibility to design unique  
4217 programs that best address their coastal challenges and regulations. The state program is housed in the  
4218 Office of Coastal Management within LDENR. The primary authority for the coastal management program is  
4219 the State and Local Coastal Resources Management Act of 1978.

4220 Local Coastal Management Programs (LCMP) give the opportunity for a local coastal parish to be the  
4221 permitting authority for coastal uses of local concern defined as "those uses which directly and significantly

4222 affect coastal waters and need coastal management but are not uses of state concern and which should be  
4223 regulated primarily at the local level if the local government has an approved program" (RS. 49:214.25.A.2).  
4224 To become an official LCMP, a parish must complete a process and obtain federal and state approval. Once  
4225 approved, the Office of Coastal Management provides technical assistance and guidance to the parish  
4226 program. Within the Pontchartrain Basin, the following coastal parishes have approved local programs:  
4227 Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, and St. Tammany.

## 4228 LOUISIANA SCENIC RIVER PROGRAM

4229 Away from the coast, one of the most important programs protecting aquatic habitat is the Louisiana Scenic  
4230 River Program administered by LDWF. The Scenic Rivers Program allows individuals and communities to get  
4231 involved in protecting, conserving, and preserving valued local resources.

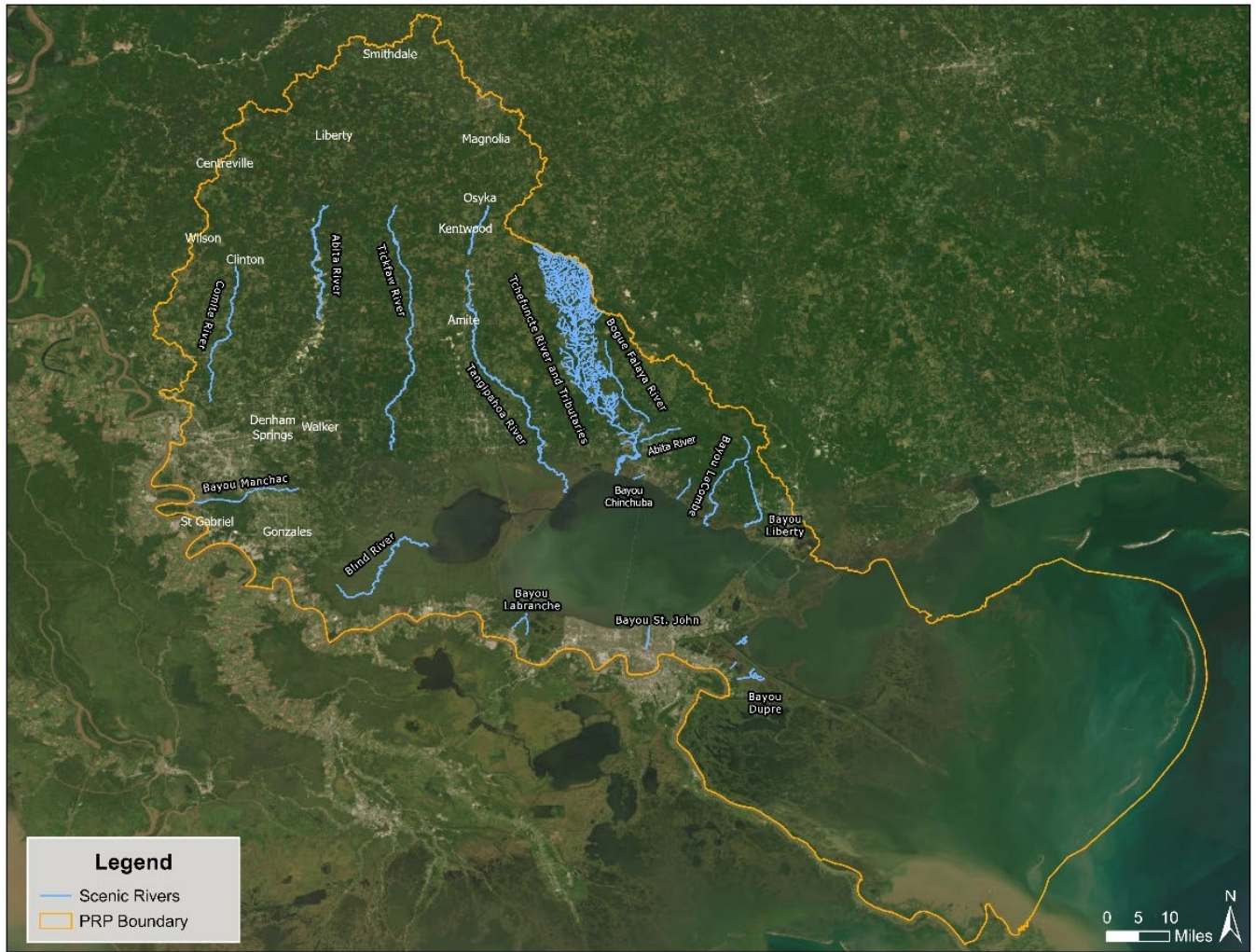
4232 Certain activities that could have detrimental ecological impacts on designated Scenic Rivers are prohibited:

- 4233 ● Channelization,
- 4234 ● Channel realignment,
- 4235 ● Clearing and snagging,
- 4236 ● Reservoir construction (impoundments), and
- 4237 ● Commercial clear-cutting of timber within 100 feet of the low watermark.

4238 Some activities on or near these waterbodies require Scenic Rivers Permits. Permit applications are reviewed  
4239 by LDWF as well as other state agencies: the Louisiana Departments of Environmental Quality; Agriculture  
4240 and Forestry; and Culture, Recreation, and Tourism; and the Offices of State Lands and State Planning and  
4241 Budget. Permit are required for:

- 4242 ● Crossings by roads, railroads, pipelines, or utilities across any Scenic River and sharing of land and  
4243 air space by such roads, railroads, pipelines, and utilities;
- 4244 ● Point source discharge of any pollutant, with the concurrence of the Louisiana Department of  
4245 Environmental Quality;
- 4246 ● Prospecting, drilling, and mining for nonrenewable natural resources;
- 4247 ● Structures and buildings;
- 4248 ● Signs or other forms of outdoor advertising that are visible from waters within a Scenic River;
- 4249 ● Piers, boat slips, bulkheads, and landings;
- 4250 ● Mooring of houseboats or floating camps;
- 4251 ● Commercial uses, activities, and access; and
- 4252 ● Water withdrawals.

4253 LDWF requires best management practices for many activities near designated Scenic Rivers to avoid or  
4254 minimize their impacts. These activities include construction, oil and gas, sand and gravel mining,  
4255 streambank stabilization, timber harvesting, and water withdrawal. Landowners with property adjacent to  
4256 designated Scenic Rivers may wish to enter into scenic and/or surface servitude agreements with LDWF to  
4257 provide additional protection for these areas. Many of the rivers on the Northshore of Lake Pontchartrain  
4258 have reaches designated as Scenic Rivers (Figure 65). LDWF has also developed Scenic River Management  
4259 Plans for some streams, including Bayou Manchac (see Bayou Manchac – A Louisiana Historic and Scenic  
4260 River).



4261  
4262

**Figure 65. Scenic rivers within the PRP boundary.**

## Bayou Manchac – A Louisiana Historic and Scenic River

Bayou Manchac once connected the Mississippi River and the Amite River and was an important navigational route. An earthen closure severing the connection with the Mississippi was constructed in 1828. From the Amite River to the Mississippi River, Bayou Manchac was designated a Louisiana Historic and Scenic River in an amendment to the Scenic Rivers Act passed during the regular legislative session of 2009. Bayou Manchac is a state-claimed and historically navigable waterbody that was utilized by Native Americans for thousands of years and was utilized by European settlers as early as 1699.

Primary recreational uses include fishing, boating, paddling, bird watching, and hunting. Bayou Manchac has long been known for its bass, bream, catfish, and crappie fishing and is a favorite of many local fishermen. While some of the lands adjacent to Bayou Manchac are heavily developed for both residential and agricultural purposes, there is a riparian corridor composed of greater than 90% native vegetation for most of its length. Three species of conservation concern and one natural community of conservation concern are known to occur within 1,300 feet of Bayou Manchac. Those species are the West Indian manatee (*Trichechus manatus*), eastern harvest mouse (*Reithrodontomys humulis*), and inflated heelsplitter mussel (*Potamilus inflatus*). The natural community is the spruce pine-hardwood mesic flatwoods.

The Scenic Rivers Act requires that any activities that have the potential for significant ecological degradation require a permit. Channelization, clearing and snagging, channel realignment, and reservoir construction are prohibited.

As much of the riparian land is privately owned, LDWF seeks to establish working relationships with riparian landowners to provide technical assistance to those landowners attempting to manage and enhance fish and wildlife habitat. LDWF will negotiate scenic easements with willing landowners. Those easements will be designed to provide maximum protection to the wildlife habitat along and in Bayou Manchac without usurping the landowners' use and enjoyment of their property.



## 4263 WETLAND MITIGATION

4264 Some of the efforts identified in Table 23 promote and/or fund restoration of habitats. In some cases,  
4265 restoration may be required as part of a permitted activity. For example, Section 404 of the Clean Water Act  
4266 (CWA) establishes a program to regulate the discharge of dredged or fill material into waters of the U.S.,  
4267 including wetlands. Applicants for permits must show that steps have been taken to avoid impacts to  
4268 wetlands, streams, and other aquatic resources; that potential impacts have been minimized; and that  
4269 compensation will be provided for all remaining unavoidable impacts. A mitigation bank is a wetland, stream,  
4270 or other aquatic resource area that has been restored, established, enhanced, or (in certain circumstances)  
4271 preserved for the purpose of providing compensation for unavoidable impacts to aquatic resources  
4272 permitted under Section 404 or a similar state or local wetland regulation. Mitigation banks are a form of

4273 "third-party" compensatory mitigation, in which the responsibility for compensatory mitigation  
4274 implementation and success is assumed by a party other than the permittee. Several mitigation banks exist  
4275 in the Pontchartrain Basin,<sup>44</sup> including several operated by The Nature Conservancy (TNC) for longleaf pine.

### Longleaf Pine Flatwood Wetland Mitigation Banks

The use of wetland mitigation banking to mitigate the loss of **rare** longleaf pine wetlands and associated wetland habitats through development was first undertaken in the basin by TNC, which established the Southeast Louisiana Pine Wetland Mitigation Bank in 1992. The establishment of this bank was the result of work with regulatory agencies, including USACE and USEPA, to recognize this unique wetland type the USACE designated as Pine Flatwood/Savanna Wetlands. This recognition enabled the acquisition and restoration of degraded but restorable critically important natural areas, focusing on longleaf pine savannas—a highly threatened habitat with less than 5% of its original acreage remaining. The TNC bank encompasses three preserves that include the Lake Ramsay Savanna (583 acres), Abita Creek Flatwoods and Perino Tract (996 acres), and Talisheek Pine Wetlands and McCulla Tract (3,013 acres) mitigation banks, the latter of which are adjacent to but outside the basin.

These key preserves protect some of the highest-quality examples of longleaf pine flatwood savanna and other associated wetlands in southeast Louisiana, including state-rare bayhead swamps and slash pine - pond cypress/hardwood woodlands, as well as non-wet longleaf pine flatwood woodlands. Over 30 state and/or globally rare plant species have been identified on these lands, such as the federally endangered Louisiana quillwort (*Isoetes louisianensis*), and numerous rare animal and invertebrate species. Two of the areas, Lake Ramsay and Abita Flatwoods, have trails and boardwalks for public use during daylight hours.

In the early 2000s, TNC set as a goal to protect at least 20,000 acres of longleaf pine savanna habitat in St. Tammany Parish to ensure the long-term viability of these ecosystems, a goal yet to be achieved. Much progress has been made, albeit because of mitigating wetland loss elsewhere. Additional pine flatwood wetland mitigation banks have been established by for-profit bank sponsors that conserve similar species and habitats in St. Tammany and Tangipahoa parishes, where these wetland types occur in the basin. Some are located near or adjacent to TNC bank sites in the Talisheek, Louisiana area, making it the largest concentration of protected longleaf pine habitats just outside the basin. The total acres of TNC pine flatwood wetland mitigation banks in the basin is approximately 4,592 acres. Other mitigation banks in the basin conserve different wetland types such as bottomland hardwood forest and cypress swamp forests.

Restoration efforts in pine flatwood wetlands include prescribed burns every 1-4 years, invasive species control, mechanical and chemical brush control, and longleaf pine planting.



<sup>44</sup> Access the following link

[https://www.dnr.louisiana.gov/assets/OCM/Mitigation/Mitigation\\_Bank\\_Summary\\_Spread\\_Sheet\\_04.11.2025.pdf](https://www.dnr.louisiana.gov/assets/OCM/Mitigation/Mitigation_Bank_Summary_Spread_Sheet_04.11.2025.pdf) for a list in the coastal zone.

4276 **OTHER HABITAT RELATED PROGRAMS**

4277 While not directly related to the management of habitat, the Oil Pollution Act of 1990 and the Louisiana Oil  
4278 Spill Prevention and Response Act authorize Natural Resource Damage Assessment (NRDA) trustees to  
4279 evaluate the impacts of an oil spill on the natural resources that were affected and develop restoration plans  
4280 to offset these impacts. The NRDA process associated with the DWH oil spill has resulted in several habitat-  
4281 related projects in the Pontchartrain Basin<sup>45</sup>. The NRDA process has also been conducted in relation to other  
4282 oil spills within the Pontchartrain Basin, including one associated with Tropical Storm Arlene in 2005 that  
4283 impacted brown pelicans (*Pelecanus occidentalis*; see Natural Resource Damage Assessment - Breton Island  
4284 Brown Pelican Habitat Creation).

**Natural Resource Damage Assessment - Breton Island Brown Pelican Habitat Creation**

On June 12, 2005, approximately 12 barrels of crude oil were released into Breton Sound from an oil storage tank located on an offshore platform as a result of Tropical Storm Arlene. The offshore platform was located near Breton Island and was owned and operated by Hess Corporation. Over 1,300 brown pelican fledglings were killed, and much of their nesting habitat on West Point Island (formerly connected to North Breton Island) within the Breton National Wildlife Refuge was covered in oil. The purpose of restoration is to compensate the public for injuries to natural resources and natural resource services lost from the Breton Island 2005 Oil Spill by returning the injured natural resources and natural resource services to the condition that would have existed if the oil spill had not occurred and compensating for associated interim losses.

The Breton Island Brown Pelican Habitat Creation – Additional Increment project is part of a larger project (the North Breton Island Barrier Island Restoration project) implemented under the Programmatic and Phase III Early Restoration Plan and Early Restoration Programmatic Environmental Impact Statement, funded by settlements from the DWH NRDA, implemented and managed by the USFWS. The restoration objectives are to 1) create barrier island habitat for the purposes of providing nesting habitat to support existing brown pelican colonies and 2) create this habitat as close as possible to the location of the oil spill.

From the period of 2020 to 2022, the island was expanded from 290 acres to 426 acres of constructed barrier island habitat, including beaches, dunes, and back-barrier marsh through the placement of approximately 6.59 million cubic yards of fill. During construction, approximately 14,700 linear feet of sand fencing were installed, and 66,400 native plants were installed during 2023 to facilitate the development of nesting habitat.



<sup>45</sup> More information can be accessed via the following link: <https://la-dwh.com/restoration-projects/>

4285 Programs not directly related to the regulation or restoration of habitat can be leveraged to limit habitat  
4286 degradation or even make improvements. For example, in an effort to enhance flood management and  
4287 environmental conservation under FEMA’s Community Rating System program, St. John Parish has  
4288 implemented new regulations. For developments (excluding single-family residential) that increase  
4289 impervious surfaces by 5,000 square feet or more, it is now mandatory to ensure that post-development peak  
4290 flow rates match pre-development levels for specific storm events. Additionally, erosion and sediment  
4291 controls, such as silt fencing and check dams, are required during construction to prevent soil erosion. A  
4292 Land Disturbance Permit is now required for any earthwork on sites larger than one acre to ensure that large-  
4293 scale land alterations are monitored and managed to minimize environmental impact. For residential  
4294 development, fill regulations have been established to control the amount of structural fill used. Finally, the  
4295 Environmental Conservation District was introduced to protect the Maurepas Swamp. This district imposes  
4296 strict usage limitations, allowing only fishing camps, environmental education facilities, parks, and structures  
4297 dedicated to recreation and ecotourism.

## 4298 **Conservation and Restoration Efforts**

4299 Efforts to conserve and restore habitats in the basin often represent a collaborative commitment among  
4300 federal and state agencies, parishes, non-governmental organizations (NGOs), and private sector interests to  
4301 enhance environmental resilience.

4302 CPRA has spearheaded extensive restoration efforts across the basin, completing over 40 projects since  
4303 1991 (CPRA, 2023). Since 2007, these have been guided by the Louisiana Coastal Master Plan, which is now  
4304 updated every six years. The plan identifies activities to support the long-term coastal protection and  
4305 restoration of Louisiana’s Coastal Zone. ATTACHMENT E provides a complete list of constructed CPRA  
4306 projects in the Pontchartrain Basin. Sixteen of these projects have been funded by the Coastal Wetlands  
4307 Planning, Protection and Restoration Act (CWPPRA), which provides federal funding to identify, prepare, and  
4308 fund the construction of coastal wetland restoration projects. CWPPRA is jointly administered by Louisiana,  
4309 the USACE, USEPA, USFWS, USDA, and NOAA.

4310 CPRA projects in the Pontchartrain Basin include:

- 4311 ● The Lake Borgne Shoreline Protection project, funded through the CWPPRA program. The project’s  
4312 objectives include preventing and reducing Lake Borgne shoreline retreat in the areas adjacent to Old  
4313 Shell Beach and Bayou Dupre to mitigate further joining of the lake and MRGO; reestablishing a  
4314 sustainable lake rim; and preventing or reducing conversion of emergent marsh to open water.
- 4315 ● The East LaBranche Shoreline Protection project, supported by CIAP funds. This project constructed  
4316 1,400 linear feet of shoreline protection in critical areas of the East LaBranche shoreline in St.  
4317 Charles Parish.

4318 Additionally, CPRA has invested in oyster barrier reef projects and mitigation measures associated with the  
4319 Hurricane Storm Damage Risk Reduction System (HSDRRS). Many of these efforts have been funded through  
4320 settlements from the DWH oil spill, enabling transformative projects such as Lake Borgne Marsh Creation –  
4321 Increment I, which combat habitat loss and saltwater intrusion.

4322 The isolation of the Mississippi River from coastal wetlands and the resulting lack of freshwater input was  
4323 one of the issues identified in the 2006 CHMP. The Maurepas Swamp is one area suffering from hydrologic

4324 isolation. One of the most significant ongoing CPRA projects is the River Reintroduction into Maurepas  
4325 Swamp project, a \$300 million endeavor to restore 45,000 acres of swamp habitat by reconnecting the  
4326 Mississippi River to the Maurepas Swamp. This project seeks to improve swamp hydrology, replenish  
4327 sediments, and enhance vegetation, addressing long-term ecosystem decline. Shaffer et al., (2016)  
4328 estimated that, without the intervention of a regional diversion, the forested wetlands around Lake Maurepas  
4329 will transition to emergent wetlands by mid-century. This project is proposed as mitigation for impacts to  
4330 baldcypress and tupelo gum swamp habitats incurred by the adjacent West Shore Lake Pontchartrain Flood  
4331 Protection project, part of the HSDRRS, demonstrating integrated coastal restoration and flood risk reduction  
4332 efforts. Another Maurepas Swamp restoration effort includes the Amite River Diversion Canal (ARDC) Swamp  
4333 Restoration – Southside project, which seeks to reverse the degradation of the Western Maurepas Swamp by  
4334 improving hydrologic connectivity between the Amite River and Bayou Pierre.

### **Amite River Diversion Canal Swamp Restoration – Southside (PO-0206)**

This project aims to increase the hydrologic connectivity of the Amite River to the adjacent cypress-tupelo swamp by installing culverts in the ARDC embankment (under River Highlands Drive) to reconnect flow between the ARDC and Bayou Pierre and improve the ecological health of the Western Maurepas Swamp (Figure 66). The project would reverse the disruption of natural flow and exchange of freshwater, sediment, and nutrients that resulted from construction of the ARDC.

The project is expected to work synergistically with the LA 22 Gapping project being designed by the Pontchartrain Levee District. The gapping project will construct two bridge structures along LA 22 and selectively excavate within the floodplain to reestablish flow from the ARDC into the swamp and improve local hydrology.

The ARDC Swamp Restoration – Southside project is progressing through preliminary engineering and design; milestones, including a data gap analysis, survey and geotechnical data collection, and hydrologic and hydraulic (H&H) modeling, are complete. H&H modeling results indicated that installation of culverts improved flow delivery into the swamp with minimal increases in water depth (typically  $\leq 1.05$  feet) near residential structures and roadways. The combination of culverts along with the bridge structures and excavation proposed by the LA 22 Gapping project further improved flow delivery. The estimated cost of project construction is \$4 million.



Figure 66. PO-0206 project area.

## 4335 HIGHLIGHTS ON SUCCESSFUL HABITAT IMPROVEMENT PROJECTS

4336 At the parish level, Jefferson Parish has undertaken targeted projects to complement regional efforts. These  
4337 include the Landscape and Stormwater Management Design Plan for Bucktown Marina Ecology Park, which  
4338 integrates habitat restoration with stormwater management and education, and the Bucktown Harbor Marsh  
4339 Boardwalk and Kayak Launch, which increases public access and fosters outreach on wetland conservation.  
4340 Additional projects like the Lake Pontchartrain Lake Villa Site Improvements and Marsh Monitoring invest in  
4341 green infrastructure and public awareness, reinforcing community resilience against natural hazards. Such  
4342 initiatives demonstrate the parish's proactive approach to habitat restoration and water quality improvement.

4343 St. John the Baptist Parish is implementing key restoration projects to enhance environmental resilience. The  
4344 Sunset Park Restoration project, funded by a Conservation and Restoration Partnership Award, aims to  
4345 revitalize Sunset Park with shoreline protection measures, including riprap installation, bank stabilization,  
4346 and planting native marshland plants. The project will restore 1.5 acres on the western side of Pass  
4347 Manchac, incorporating 650 linear feet of shoreline protection, and engage the community through public  
4348 outreach. The Lake Pontchartrain Shoreline Protection Project, funded by GOMESA, addresses erosion on the  
4349 western shore of Lake Pontchartrain. The project involves installing breakwaters made of graded riprap  
4350 along two reaches of the shoreline. This project aims to reduce erosion, stabilize the shoreline, and promote  
4351 sediment accretion, providing better protection against flood risks and storm surges. In addition to these  
4352 efforts, St. John the Baptist Parish is enhancing urban green infrastructure to manage water and improve  
4353 environmental health. The Airline and Main Complete Streets project, funded by LA SAFE, features permeable  
4354 parking, planted curb bump-outs, and a stormwater management park with educational signage. Another  
4355 initiative, the Greater New Orleans Foundation Green Infrastructure Pilot Project, funded by the Next 100  
4356 Years Challenge, will develop a green infrastructure pilot at Belle Point Park in LaPlace, also with educational  
4357 signage.

4358 Complementing these government-led efforts, NGOs like TNC have contributed significantly through projects  
4359 such as the Southeast Louisiana Pine Wetland Mitigation Bank, which restores longleaf pine savanna  
4360 ecosystems using aggressive restoration techniques like timber thinning, invasive species control, and  
4361 prescribed fire (see Longleaf Pine Flatwood Wetland Mitigation Banks).

4362 Together, these efforts—driven by federal and state agencies, local parishes, and NGOs—showcase a  
4363 coordinated strategy to protect biodiversity, enhance ecological functions, and mitigate the impacts of  
4364 environmental change and development on the basin's natural resources.

## Bucktown Harbor Marsh and Park

The Pontchartrain Conservancy, in collaboration with Jefferson Parish, recently concluded a second three-year monitoring program (2022-2024) assessing the Bucktown Harbor Marsh and Park (Hillmann, 2020; Hillmann, Baker, & Connolly, 2024) and monitoring of the Lake Villa Pond project (2018-2024). This initiative evaluated the health and ecological status of these areas before and during extensive shoreline revitalization along Lake Pontchartrain.

The Bucktown Harbor Marsh, a 3.5-acre mitigation site created in the early 2000s, continues to demonstrate resilience in the face of environmental challenges. Despite a direct hit from Hurricane Zeta (2020) and Ida (2021), the marsh sustained minimal damage, strengthened by sediment deposition and riprap boundaries. Soil salinity shifted from 0.5-3.6 ppt in 2020 to 1.6-3.6 ppt in 2023, indicating a move from fresh to intermediate salinity conditions in some areas (Figure 67). Plant surveys recorded 23 species in 2020, including wiregrass, but by 2023, no wiregrass was found, and the species count dropped to 20. Invasive torpedograss (*Panicum repens*) has expanded, presenting challenges alongside its erosion control benefits. The marsh's future trajectory—whether transitioning to freshwater or maturing within its current classification—remains under observation.

The adjacent Bucktown Harbor Park has displayed significant progress, with tree canopy coverage increasing by 27% since 2018. This growth stems from collaborative tree-planting events featuring species such as baldcypress (*Taxodium distichum*), live oak (*Quercus virginiana*), and sweet bay magnolia (*Magnolia virginiana*). Improvements in drainage alleviated stress on older trees, resulting in a healthier urban forest that enhances ecological and recreational benefits.

Bucktown Harbor Marsh and Park exemplify the balance between resilience and change in coastal ecosystems. Continued monitoring, strategic plantings, and community involvement will ensure these areas thrive as vital components of the Lake Pontchartrain shoreline.

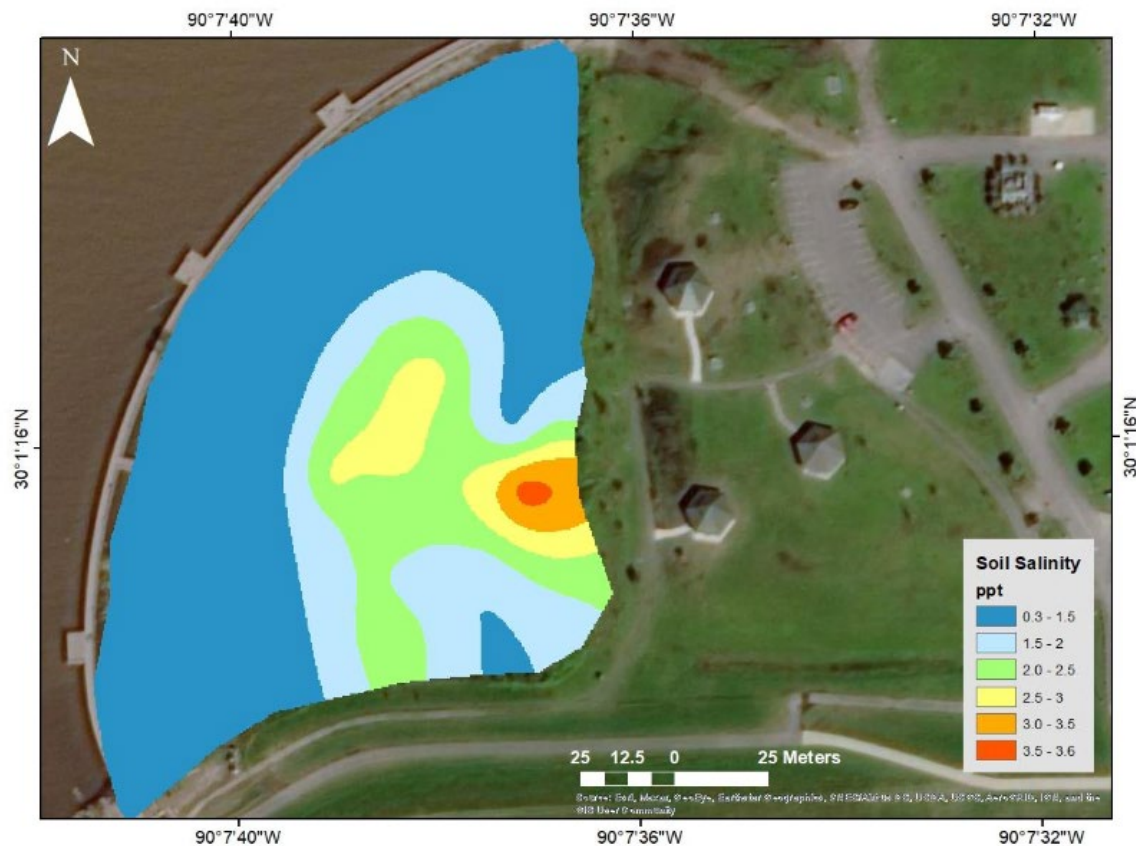


Figure 67. Interpolation of soil salinity across Bucktown Harbor Marsh in 2020 reveals a gradient ranging from 0.5 to 3.6 ppt, spanning fresh to intermediate conditions. The highest salinity (3.6 ppt) was observed in the eastern marsh, where values ranged from 1.6 to 3.6 ppt (data taken from Hillmann, 2020).

## Swamp Regeneration in the Pontchartrain Estuary

Swamp regeneration is a process that demands a deep understanding of hydrology, ecology, and adaptive management. Two significant restoration projects in Louisiana's Pontchartrain Estuary—the Caernarvon Freshwater Diversion (CFD) and the Maurepas Landbridge (MLB)—offer valuable insights into restoring degraded swamps in diverse hydrological and geological conditions.

From 2011 to 2021, the Pontchartrain Conservancy planted approximately 80,000 baldcypress saplings and other species in these two regions (Hillmann et al., 2024). Their efforts revealed critical patterns:

**Survival versus Growth:** In the MLB region, saplings displayed higher survival rates but slower growth due to nutrient-poor conditions, prolonged inundation, and limited freshwater inputs. Meanwhile, in the CFD region, saplings grew faster but had lower survival rates, benefitting from periodic access to nutrient-rich, oxygenated Mississippi River water.

**Hydrologic Restoration Approaches:** The MLB region represents traditional saltwater intrusion management, while the CFD region demonstrates the advantages of reconnecting wetlands to riverine processes. Proximity to the CFD enhanced sapling growth and survival, with both variables declining farther from the diversion.

**Environmental Challenges:** Challenges included herbivory by white-tailed deer (*Odocoileus virginianus*) and feral pig damage. The CFD region faced greater herbivory and competition, whereas prolonged inundation in the MLB likely delayed sapling growth.

The LaBranche Wetlands in St. Charles Parish provide another model for swamp recovery. Formerly a swamp ecosystem, these wetlands transitioned to brackish marsh due to saltwater intrusion from the MRGO and storm surges compounded by poor drainage (LPBF, 2016).

Following the MRGO's 2009 closure, salinity levels began to decline, fostering a return to fresher conditions (Figure 68). Soil salinity surveys from 2016 revealed fresher areas with vegetation transitions, supported by freshwater inputs from pump stations and periodic releases from the Bonnet Carré Spillway. Current CWPRA efforts, including one completed (Bayou LaBranche Wetland Creation) and two planned marsh creation projects (LaBranche East Marsh Creation and LaBranche Central Marsh Creation), highlight the region's potential to regain resilience and ecological function.

These initiatives highlight the complex interplay of hydrology, nutrient dynamics, and stressors in swamp restoration, offering a comprehensive guide for regenerating degraded wetlands in Louisiana and beyond.

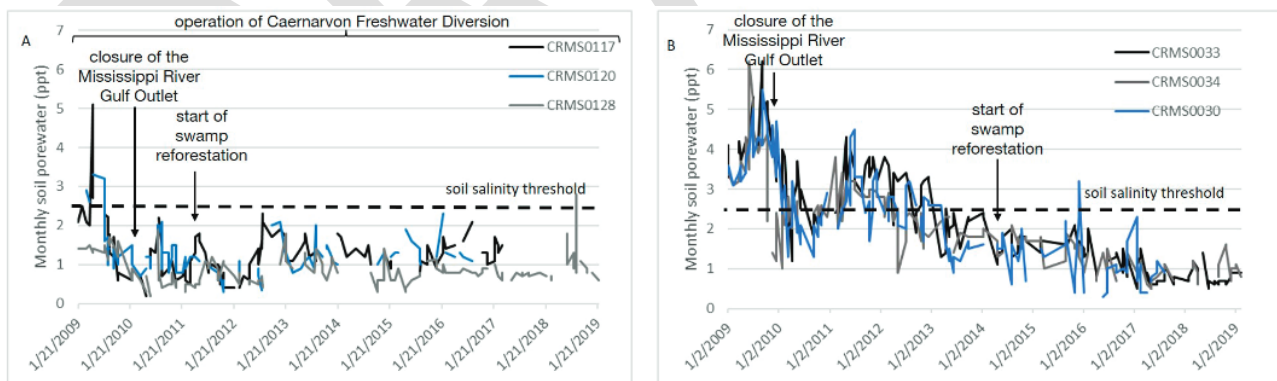


Figure 68. Porewater salinity has decreased over the past decade in both reforestation areas: Caernarvon Freshwater Diversion area (A) and Maurepas Landbridge (B) after the closure of MRGO (data taken from Hillmann et al., 2024).

## Conservation Efforts for Longleaf Pine Forests in Louisiana and Mississippi

Longleaf pine forests once spanned over 90 million acres across the southeastern U.S. but have suffered a dramatic 97% decline due to urban development, timber harvesting, and fire suppression. It is estimated that around 1.5 to 2 million acres of longleaf pine were present in the eastern Florida Parishes in the late 1800s, and that today, less than 30,000 acres remain in relatively natural condition. These ecosystems are among the most biologically diverse in North America, serving as habitats for nearly 600 plant and animal species, many of which are endemic or near-endemic. Wildlife species of note are specialists of open piney woodlands, including red-cockaded woodpecker (federally listed as “Threatened”), Henslow’s sparrow, Bachman’s sparrow, Northern bobwhite (*Colinus virginianus*), gopher tortoise (federally-listed as “Threatened” in Louisiana), and many other open pineland species, particularly birds. More rare plant species are associated with longleaf pine habitats than any other in Louisiana, including many that are unique and unusual, such as numerous carnivorous plants and various native orchids and lilies.

Fire is critically important to the maintenance and promotion of native longleaf pine habitat and species. Without fire, the habitat and many of the species it supports would not exist. Numerous relatively small tracts with longleaf pine are scattered in the basin in St. Tammany, Tangipahoa, Washington, and St. Helena parishes, primarily on private land, but some are school board properties, parish recreation areas, current or former scouts or religious camps, and other areas. Most are not managed to the maximum benefit of longleaf pine ecosystems and are not permanently protected. Some, however, get management support from state and federal cost-share programs mentioned earlier. Complementing government-led efforts, NGOs like TNC and the Land Trust for Louisiana hold conservation servitudes (easements) on some mitigation banks and private lands that provide long-term protection of those areas. In addition, there has been much outreach education regarding the importance of the longleaf pine ecosystem and its management needs to area decision makers, landowners, civic groups, and others to promote conservation of longleaf pine habitats within the basin. At least one parish, St. Tammany, has included the importance of longleaf pine habitat conservation in their latest comprehensive plan.

Of the limited acres of longleaf habitat remaining in southeast Louisiana, only about 15,000 acres are currently being managed for conservation purposes. These areas are critically important for many species of plants and animals that are only found in longleaf habitats in southeast Louisiana. Recognizing the ecological and economic importance of these forests, conservation efforts in Louisiana and Mississippi are intensifying, led by initiatives like the LLPI and projects by organizations such as TNC.

### Restoration through the LLPI

Launched in 2010 by the Natural Resources Conservation Service (NRCS), the LLPI has restored over 870,000 acres of longleaf pine forests. In Louisiana and Mississippi, the program has enrolled 1,826 acres and 13,218 acres, as of 2023, respectively. LLPI focuses on restoring fragmented habitats, often near national forests, parks, and wildlife refuges, to create corridors that support biodiversity and ecosystem resilience. Key strategies include:

**Prescribed Burning:** Mimicking natural fire regimes to maintain open canopies and promote a diverse understory of grasses and wildflowers.

**Tree Planting:** Supporting the re-establishment of longleaf pine stands.

**Invasive Species Control:** Enhancing forest health and resilience to wildfires and extreme weather.

Through these efforts, native species such as the gopher tortoise and Louisiana pine snake (*Pituophis ruthveni*) are regaining key habitats, while landowners benefit from sustainable forestry practices and improved natural resources.

### Broader Benefits of Longleaf Pine Restoration

Restoring longleaf pine forests benefits not only biodiversity but also human communities. These forests store carbon, improve water quality, and support recreation and sustainable timber production. In Louisiana and Mississippi, conservation initiatives align ecological goals with economic and cultural priorities, showcasing how restoration can benefit both nature and people. By protecting and expanding longleaf pine habitats, these efforts contribute to the resilience of the landscapes and wildlife of the southeastern U.S.

## Chandeleur Island Restoration Project

The Chandeleur Island Restoration Project is aimed at revitalizing the Chandeleur Islands to support a diverse array of coastal and marine species. The engineering and design phase of the project is funded by the Region-wide Trustee Implementation Group. The project targets the restoration of 13 miles of this barrier island chain, with construction anticipated to begin in early 2026. By dredging and redistributing sediment, the project will restore and enhance habitats essential for bird nesting and foraging, sea turtle nesting productivity, seagrasses, and overall barrier island sustainability. These efforts not only address habitat loss but also support ecosystem resilience in the face of extreme weather events and rising sea levels.

The Chandeleur Islands, part of the Breton National Wildlife Refuge, are situated within the SDM habitat zone. The islands provide significant nesting and stopover habitats for over 300,000 migratory birds annually, including species like piping plovers (*Charadrius melodus*), red knots (*Calidris canutus*), and the Chandeleur gull (*Larus dominicanus* × *smithsonianus*), the latter of which nests exclusively here. Recent discoveries of sea turtle nesting, particularly by the endangered Kemp’s Ridley sea turtle (*Lepidochelys kempii*), underscore the islands’ growing importance for marine biodiversity. In 2022 and 2023, researchers documented over 50 sea turtle crawls each year, from Kemp’s Ridley and loggerhead (*Caretta caretta*) sea turtles, a milestone not observed in over 75 years.

The islands harbor the northern Gulf of America’s most expansive and diverse seagrass beds—spanning over 5,000 acres and including turtle grass (*Thalassia testudinum*), shoal grass (*Halodule wrightii*), star grass (*Halophila engelmannii*), manatee grass (*Syringodium filiforme*), and widgeon grass (*Ruppia maritima*)—which also represent the only marine seagrass beds in Louisiana waters. These SAV zones are crucial for nutrient cycling, sediment stabilization, and as nursery grounds for numerous fish and invertebrate species, including red snapper (*Lutjanus campechanus*), tarpon (*Megalops atlanticus*), and the endangered lemon sharks (*Negaprion brevirostris*) and Gulf sturgeon (*Acipenser oxyrinchus desotoi*). Without intervention, the ongoing erosion—accelerated by Hurricanes Georges (1998) and Katrina (2005), sea level rise, and the 2010 DWH oil spill—threatens to obliterate this vital ecosystem within decades (Figure 69). Insufficient sand reserves, combined with rapid relative sea level rise, ongoing sand losses, and marsh erosion, exacerbate their fragility and highlight the urgency for restoration efforts (Moore et al., 2014).

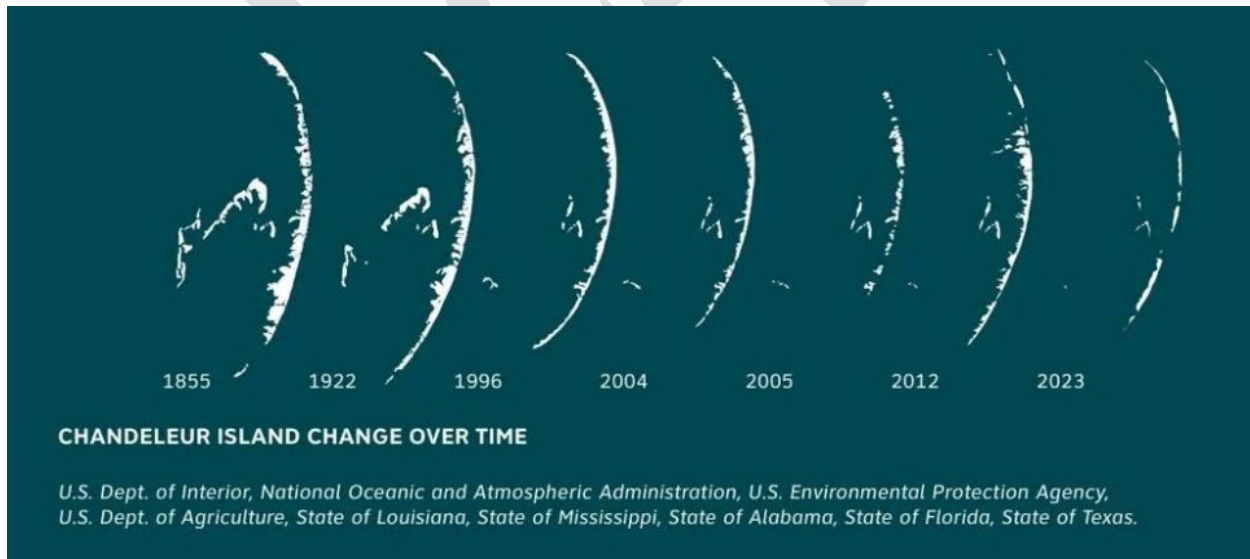


Figure 69. Historical changes of Chandeleur Island highlighting significant alterations in size and shape from 1855 to 2023 (CPRA, n.d.).

## 4365 Challenges and Barriers

4366 Future progress on habitat restoration and conservation in the Pontchartrain Basin will need to confront a  
4367 number of ongoing challenges within the system, and overcome barriers, some of which have been issues  
4368 for decades, while others have developed more recently.

4369 As discussed above, several of the habitat issues identified in the 1995 Comprehensive Conservation  
4370 Management Plan (CCMP) remain. The extensive sand and gravel mining in the rivers draining to Lake  
4371 Pontchartrain and Lake Maurepas causes ongoing adjustments in those channels, with the number of pit  
4372 depressions increasing from 163 to 289 between 2005 and 2018 on the Amite River (Alrehaili & Mossa,  
4373 2025). This changes not only floodplain and channel habitats for organisms but also influences flood  
4374 vulnerability. Best management practices for the sand and gravel mining industry are available in Louisiana,<sup>46</sup>  
4375 but there are limited funds available to support their implementation, except on a voluntary basis.

4376 Ongoing development in the Pontchartrain Basin has resulted in loss of habitat across the basin (Figure 44).  
4377 Three parishes – Livingston, St. Tammany, and Tangipahoa – are in the top five fastest-growing parishes in  
4378 Louisiana<sup>47</sup> for population. St. Tammany adopted a new Unified Development Code in August 2024, and their  
4379 2020 comprehensive plan includes the identification of ‘conservation protected’ areas across the parish.  
4380 Adherence to this plan may alleviate future pressures on some key habitats in the area, but as the protected  
4381 areas include public and private lands designated as parks, pine wetland mitigation banks, and habitat for  
4382 endangered wildlife, many other valuable habitats may still be subject to development pressure.

4383 In many of the Pontchartrain Basin watersheds, the 2016 floods provided a wake-up call that changes in land  
4384 use across the basin have consequences for flood conveyance and storage. Such events often lead to calls  
4385 for waterways to be cleared of debris to enhance water conveyance. Removal of bank vegetation can lead to  
4386 increased bank erosion and downstream sedimentation as well as the loss of instream and riparian habitat.  
4387 Excessive clearing and snagging on most designated scenic rivers (Figure 65) is a prohibited activity and a  
4388 criminal offense. Balancing the need for flood risk reduction in basin communities with the conservation of  
4389 important aquatic habitat remains a challenge.

4390 This is further exacerbated by a limited understanding of the different causes of flooding. The Amite River  
4391 Basin Commission identifies four types of flooding:

- 4392 ● Backwater-driven flooding occurs when upstream runoff on large flooding sources, such as the  
4393 Amite River, works its way downstream and flows backwards into tributaries, including, for example,  
4394 Bayou Manchac. This prevents them from draining freely and causes flooding even though rain may  
4395 not be directly impacting these areas.

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<sup>46</sup> More information can be accessed via the following link:

[https://www.wlf.louisiana.gov/assets/Conservation/Maintaining\\_Natural\\_Scenic\\_Rivers/Files/LDEQ\\_recommended\\_BMPs\\_sand\\_and\\_gravel\\_mining.pdf](https://www.wlf.louisiana.gov/assets/Conservation/Maintaining_Natural_Scenic_Rivers/Files/LDEQ_recommended_BMPs_sand_and_gravel_mining.pdf)

<sup>47</sup> More information can be accessed via the following link: <https://worldpopulationreview.com/us-counties/louisiana>

- 4396 ● Flash flooding occurs when excess rainfall over a short period of time overwhelms local drainage  
4397 systems, causing short-term localized flooding.
- 4398 ● Wind-driven coastal/lake flooding occurs when strong winds push water onto the shore and  
4399 upstream into channels, causing water levels to rise and flood coastal or lakeside areas. This is  
4400 associated with storms, hurricanes, or severe weather events.
- 4401 ● Rainfall-driven flooding occurs when an area receives an excessive amount of rain over a short  
4402 period of time, resulting in tributaries overflowing their banks.

4403 Each of these direct causes can interact with others across the watershed to make the causes of flooding,  
4404 and thus the development of viable solutions, challenging. Current FEMA flood maps, which are an important  
4405 tool to guide development away from flood-prone areas, which may include wetland areas, fail to account for  
4406 the combination of rainfall and wind-driven flooding, commonly known as compound flooding (Santiago-  
4407 Collazo et al., 2021) which can impact many communities in the lower watersheds of the Pontchartrain  
4408 Basin.

4409 Pressures for residential and commercial development, and the transportation routes that support them, in  
4410 expanding Pontchartrain Basin parishes/counties make protection of natural communities and important  
4411 habitats crucial. Historically, a number of key statutes (Table 23) have provided protection for some habitats,  
4412 including wetlands. The CWA, for example, prohibits discharging pollutants into “the waters of the United  
4413 States,” which had previously been interpreted as “relatively permanent, standing or continuously flowing  
4414 bodies of water and wetlands with a continuous surface connection or a significant nexus to a relatively  
4415 permanent body of water connected to traditional interstate navigable waters.” In 2023, the Supreme Court  
4416 ruled in the case of Sackett et ux. v. Environmental Protection Agency.<sup>48</sup> The Sacketts purchased property in  
4417 Idaho and began backfilling the lot with dirt to prepare for building a home. USEPA viewed this backfilling as  
4418 a violation of the CWA, as they classified the wetlands on the Sacketts’ lot as “waters of the United States”  
4419 because they were near a ditch that fed into a creek, which fed into a navigable, intrastate lake. The Sacketts  
4420 sued, alleging that their property was not “waters of the United States.” The Supreme Court ruled that the  
4421 CWA’s use of “waters” refers only to “geographic[al] features that are described in ordinary parlance as  
4422 streams, oceans, rivers, and lakes” and to adjacent wetlands that are “indistinguishable” from those bodies  
4423 of water due to a continuous surface connection. This somewhat narrower interpretation of wetlands subject  
4424 to CWA regulation may make some basin wetlands and aquatic habitats more vulnerable to development.

4425 Ongoing habitat fragmentation, loss of connectivity, and extensive coastal land loss are clear problems in the  
4426 Pontchartrain Basin. While this section has demonstrated that a number of successful conservation and  
4427 restoration efforts have occurred, funding is limited, especially for proactive projects that seek to alleviate  
4428 problems before they become severe. One of the potential funding sources for coastal restoration projects,  
4429 the Coastal Wetlands Planning, Protection and Restoration Act project selection process considers the  
4430 benefits of a project relative to conditions if the project were not selected. The amount of land maintained or  
4431 built is a key consideration, and projects that seek to improve wetland conditions and increase sustainability  
4432 may be considered less important than those that address land loss that has already occurred. This limits

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<sup>48</sup> More information can be accessed via the following link: [https://www.supremecourt.gov/opinions/22pdf/21-454\\_4g15.pdf](https://www.supremecourt.gov/opinions/22pdf/21-454_4g15.pdf)

4433 the opportunity for proactive restoration and may not lead to strategic restoration where efforts are focused  
4434 on making a meaningful difference to things people care about.

4435 Further, future funding for coastal restoration is not secure at the high levels of expenditures that have  
4436 occurred in recent years. Funds available to Louisiana for restoration following the DWH oil spill have largely  
4437 been committed. Although a constitutional amendment was recently passed that dedicates state revenues  
4438 generated from alternative offshore energy sources to the Coastal Protection and Restoration Fund, the  
4439 future of alternative offshore energy in state waters is unclear.

4440 This section has outlined several ongoing monitoring programs across the Pontchartrain Basin that provide  
4441 valuable information. However, there is less effort to routinely assess the extent and health of habitat across  
4442 the system, limiting overall tracking of habitat change over time and across the basin.

## 4443 **Future Outlook**

4444 While the numerous challenges and barriers identified can be daunting, there are some forthcoming  
4445 opportunities that may be leveraged to support habitat conservation and restoration in the Pontchartrain  
4446 Basin, particularly in areas of planning and funding, large-scale projects, and federal initiatives. Several of  
4447 these are outlined here, recognizing that the details of some of these efforts are still being developed.

## 4448 **PLANNING AND FUNDING**

4449 In addition to parish efforts such as the comprehensive planning and code development in St. Tammany,  
4450 there are other funding and planning opportunities on the horizon:

- 4451 ● Under the Infrastructure Investment and Jobs Act (IIJA), the Pontchartrain Restoration Program  
4452 received approximately \$10 million per year in project funds for fiscal years 2022-2026. In 2024, this,  
4453 in addition to the program's base funds, allowed the PRP to issue requests for proposals for over \$12  
4454 million in projects.
- 4455 ● The 2029 Coastal Master Plan is under development, which provides an opportunity for coastal  
4456 restoration projects within the Pontchartrain Basin to undergo modeling to assess their performance  
4457 in terms of land area and other metrics over the next 50 years. The Coastal Master Plan will also  
4458 include risk reduction projects to address storm surge-based flooding, and, like the 2023 Coastal  
4459 Master Plan, will include information on how coastal communities are already being impacted by  
4460 high tide flooding, made worse in the future by sea level rise.
- 4461 ● The Amite River Basin Commission Master Plan was developed pursuant to the 2021 House  
4462 Continuing Resolution 46, Act 490, which required that the commission create a master plan for  
4463 comprehensive drainage, flood control, and water resource management, which shall address both  
4464 long- and short-term watershed management. As well as flood risk reduction projects, the plan  
4465 includes a review of existing sedimentation conditions on the Amite River and the development of  
4466 management strategies to better maintain the basin's waterways, and the development of best  
4467 practice recommendations to foster more resilient communities, both of which could have important  
4468 implications for habitat in the Amite River Basin.

4469 **LARGE-SCALE PROJECTS**

4470 Habitat conservation and restoration efforts are ongoing across the Pontchartrain Basin. Construction on  
4471 several large-scale projects has recently started, and a system-level flood risk reduction project under  
4472 consideration for many years is now receiving renewed attention. The projects below have the potential to  
4473 influence habitat directly or indirectly across large areas of the basin.

- 4474 ● The 2024 Water Resources Development Act authorized USACE to conduct an investigation of the  
4475 Lake Pontchartrain Storm Surge Reduction project to provide risk reduction for Orleans, St. Tammany,  
4476 Tangipahoa, Livingston, St. James, St. John the Baptist, St. Charles, Jefferson, and St. Bernard  
4477 parishes. In the 2023 Coastal Master Plan, this project is described as closure gates and weirs  
4478 across the passes at Chef Menteur and the Rigolets for storm surge risk reduction within the  
4479 Pontchartrain Basin. It has the potential to impact exchange between Lake Pontchartrain and the  
4480 Gulf and influence the ingress and egress of estuarine fishes and other organisms.
- 4481 ● The West Shore Lake Pontchartrain project is located in St. Charles, St. John the Baptist, and St.  
4482 James parishes. The project received \$760 million in funding in the Bipartisan Budget Act of 2018. It  
4483 is an 18.5-mile risk reduction system, comprising 13.2 miles of levees, 8 flood walls, 7 drainage  
4484 structures, 3 gates, and 2 pump stations. To date, 11 of the 14 construction contracts have been  
4485 awarded, with the remaining three construction contracts scheduled for award through Spring 2026.  
4486 When completed in 2029, the project will change the hydrology of a large area of swamp habitat  
4487 south of Lake Maurepas.
- 4488 ● The River Reintroduction into Maurepas Swamp project is designed to convey up to 2,000 cubic feet  
4489 per second of water from the Mississippi River, approximately 5 miles north via Hope Canal into the  
4490 Maurepas Swamp. The specific objectives of the project are to: restore natural swamp hydrology;  
4491 increase sediment and nutrient loading to the project area; increase substrate accretion; retain and  
4492 increase existing areas of swamp vegetation, including overstory cover; and reduce salinity levels.  
4493 The project's benefits to the swamp are expected to mitigate any detrimental effects of the West  
4494 Shore Lake Pontchartrain project, and it will influence salinity over a large area of the southwestern  
4495 part of the basin.

4496 **FEDERAL AND OTHER INITIATIVES**

4497 Several federal agencies support habitat conservation and, in some instances, restoration through programs  
4498 that are primarily designed to support other activities. Several are outlined here. In addition, regional  
4499 initiatives that support cooperation across agencies, the private sector, and NGOs could be of value to  
4500 habitat conservation in the Pontchartrain Basin.

- 4501 ● The American Relief Act, 2025, extended the 2018 Farm Bill for one year through September 30,  
4502 2025. The conservation provisions of the Farm Bill provide billions of dollars a year for voluntary  
4503 conservation of soil, water, and wildlife habitat on private lands through delivery of financial and  
4504 technical assistance to our nation's farmers, ranchers, and non-industrial forest landowners.  
4505 USFWS's Partners for Fish and Wildlife Program and Coastal Program leverage the resources  
4506 available through Farm Bill conservation programs to expand the conservation footprint and help  
4507 landowners adopt land use practices that serve their needs while benefiting fish and wildlife.

- The USDA Working Lands for Wildlife partnership is a collaborative approach to conserving habitat on working lands. NRCS provides technical and financial assistance to participants who voluntarily make improvements to their working lands, while the USFWS provides participants with regulatory predictability for the ESA when needed. This approach provides landowners with a means to make on-the-ground improvements and with the assurance that no matter the legal status of a species, they can keep their working lands working. The gopher tortoise is the only land tortoise native to the southeast, living in longleaf pine savannahs. More than 80 percent of gopher tortoise habitat is privately owned. Landowners are helping the gopher tortoise by enhancing and restoring longleaf pine forests through this program.
- America's Longleaf Restoration Initiative is a voluntary partnership of concerned, motivated organizations and individuals. The overarching goal of the initiative is to reach eight million acres of longleaf pine forest in the southeast. Implementation is accomplished at multiple scales through voluntary collaborative efforts of partners represented on the Longleaf Partnership Council, the Federal Coordinating Committee, landowners, other agencies and organizations, private businesses, and research and extension institutions associated with longleaf efforts across the range. The initiative brings together experts from federal, state, and local organizations to leverage resources and expertise in support of longleaf pine.
- FEMA's Community Rating System (CRS) program is designed to address development concerns in the floodplain and may be leveraged to support habitat conservation and restoration. CRS is a voluntary program that rewards communities for exceeding the basic floodplain management standards of the National Flood Insurance Program (NFIP). Flood insurance premiums in CRS communities are reduced due to the community's efforts to lower flood risks. One of the activities communities can get credit for is flood damage reduction, such as stormwater management, which includes watershed planning and regulations to prevent future development from increasing flood hazards or diminishing water quality.
- Providing incentives for work on habitats at the local scale is the goal of USEPA's Campus Rain Works Challenge. The challenge is a green infrastructure design competition for American colleges and universities. It seeks to engage with the next generation of environmental professionals, foster a dialogue about the need for innovative stormwater management techniques, and showcase the environmental, economic, and social benefits of green infrastructure. Within the Pontchartrain Basin, both the University of New Orleans and Southeastern Louisiana University have competed.

## Concluding Remarks on Habitat Change

One of the goals of the CCMP is to promote the sustainability of important land-based and aquatic habitat in the Pontchartrain Basin. This section illustrates the array of issues facing habitat in the basin, some of which are newly emerging and others that have been impacting the system for decades or longer. The issues facing the system can be summarized relative to CCMP habitat objectives to set a foundation for consideration of how CCMP actions can be framed to address the issues identified:

*Habitat Objective 1: Reduce loss of wetlands within the Basin and restore the natural processes that sustain them where possible.*

4547 Regulatory processes are in place that can limit the loss of wetlands due to development, and there are  
4548 extensive mitigation banks in the basin. Conserved or restored wetlands must retain appropriate hydrology,  
4549 which in some instances means consideration of off-site factors such as groundwater and surface drainage.  
4550 In the coastal areas, sea level rise and subsidence are major threats in the future, and proactive  
4551 consideration of wetland processes that support sustainability will need to be pursued.

4552 *Habitat Objective 2: Promote sustainable aquatic habitats, including SAV, throughout the Basin to support*  
4553 *diverse native communities and improve water quality.*

4554 The future of aquatic habitats depends greatly on future climate conditions and large-scale management of  
4555 the system. Fluctuations in water temperature and salinity, associated with drought, have been shown to  
4556 dramatically impact SAV and fisheries habitat. In the estuary, projects such as River Reintroduction into  
4557 Maurepas Swamp and the Lake Pontchartrain Barrier could shift the estuarine gradient in complex ways,  
4558 which organisms may be able to adjust to if management can be sufficiently adaptive to support aquatic  
4559 habitat needs.

4560 *Habitat Objective 3: Manage invasive species to reduce impacts to native species and their habitats.*

4561 Invasive species are likely to continue to impact Pontchartrain Basin habitats. Increasing awareness of their  
4562 effects and getting community members involved can help locally, and perhaps prevent additional  
4563 introductions. However, targeting areas for direct control may be needed to support scarce and important  
4564 natural communities and species.

4565 *Habitat Objective 4: Protect and restore habitat for species of greatest conservation need and threatened*  
4566 *natural communities.*

4567 The Pontchartrain Basin includes important habitat areas for many species and areas of scarce natural  
4568 communities, such as longleaf pine savannah. Efforts to protect and restore these need to be coordinated  
4569 with agencies, landowners, and others, and several federal programs, such as LLPI, will need to be effectively  
4570 leveraged.

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# 4806 RESILIENT COMMUNITIES

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## 4807 Introduction

4808 The Pontchartrain Basin, a region characterized by its unique ecological systems and vibrant communities,  
4809 faces a confluence of pressing challenges that test its resilience. Its geographical position, low-lying  
4810 topography, and dependence on delicate coastal ecosystems render it inherently vulnerable to natural  
4811 hazards like hurricanes, flooding, and the accelerating impacts of sea level rise. Events such as Hurricane  
4812 Katrina in 2005 and the widespread flooding of 2016 starkly illustrated the potential for devastation when  
4813 these hazards intersect with the Basin's communities and infrastructure.

4814 In this context, understanding the multifaceted nature of community resilience—the capacity to withstand,  
4815 adapt, and recover from adversity—is paramount. Building resilience is not merely about reacting to  
4816 disasters, but about proactively identifying and addressing the underlying vulnerabilities that compromise  
4817 the long-term health, safety, and prosperity of the Basin's residents. This requires a clear-eyed assessment of  
4818 the existing barriers and gaps that hinder progress toward a more secure future.

4819 This report serves as an initial step in that process, focusing specifically on identifying and characterizing  
4820 the key issues that undermine community resilience across the diverse parishes and counties of the  
4821 Pontchartrain Basin. By delving into challenges such as gaps in planning and resources, insufficient public  
4822 awareness and engagement in conservation, inequitable access to essential resources like recreational  
4823 opportunities, pervasive flood risks, unsustainable insurance burdens, and critical water management  
4824 concerns, this document aims to establish a shared understanding of the problems at hand. The goal is to  
4825 lay the groundwork for the subsequent development of targeted strategies and actions designed to address  
4826 these specific issues and foster stronger, more adaptable communities throughout the basin.

## 4827 Resilience Planning and Prioritization in the Pontchartrain Basin

4828 This section of the priority issue report focuses on the challenges to, and opportunities for, building resilient  
4829 and more educated communities in the Pontchartrain Basin. The Lake Pontchartrain Basin Restoration  
4830 Program's (PRP) 16 Louisiana parishes and four Mississippi counties are home to a diverse array of  
4831 populations. From isolated farms to urban population centers, the common thread of existence within the  
4832 geographic bounds of the Pontchartrain Basin ties these seemingly dissimilar areas together.

4833 Issues and challenges look different across the different communities and landscapes of the Pontchartrain  
4834 Basin. The basin is a vital economic and ecological resource for the region, but it is also vulnerable to a  
4835 variety of natural hazards, including hurricanes, flooding, and other environmental challenges. To maintain  
4836 the Pontchartrain Basin as a viable home for its over 2.1 million residents, effective communication,  
4837 education, and investment in resilience are necessary.

## 4838 NO UNIFIED APPROACH TO ADDRESSING SHARED CHALLENGES

4839 One of the most pressing issues facing communities in the Pontchartrain Basin is the lack of resources and  
4840 redundancies that are needed to properly prepare and respond to adverse events. Within the Pontchartrain  
4841 Basin, communities vary significantly, including both urban and rural settings, as well as areas with differing  
4842 economic resources, from affluent to low-income. Despite this diversity, not all municipalities, counties, or  
4843 parishes currently possess the funding for an office of resilience or similar. This uneven resource allocation  
4844 across the region hinders coordinated resilience efforts and impedes effective responses to events like  
4845 flooding.

4846 This disparity only widens the gap between communities, as the communities that can dedicate resources  
4847 toward resilience are more prepared for and respond more effectively to adverse events. Resilience also  
4848 includes improving the quality of life and investing in communities' ability to remain in an area into the  
4849 future. If rural and low-income communities continue to lack resilience relative to the communities around  
4850 them, the population in these areas may continue to decline.

### 4851 Gaps in Resilience Coordination, Prioritization, and Planning

4852 Some current gaps that exist in resilience coordination, prioritization, and planning in the Pontchartrain Basin  
4853 include:

- 4854 ● **Lack of regional and statewide resilience plans:** There are no comprehensive regional or statewide  
4855 resilience plans that coordinate the efforts of different governments in the Pontchartrain Basin. This  
4856 can lead to duplication of efforts and inefficient use of resources.
- 4857 ● **Inconsistent prioritization of resilience:** Different governments in the basin have different priorities  
4858 when it comes to resilience. This can make it difficult to allocate resources effectively and to ensure  
4859 that all communities are adequately prepared for natural disasters.
- 4860 ● **Limited community engagement:** Many municipalities in the basin have conducted limited  
4861 community engagement in resilience planning, leading to plans that do not adequately address the  
4862 needs of the community.

### 4863 Resilience Planning Challenges in the Pontchartrain Basin

4864 Strategic actions and investments in resilience are not widespread across the Pontchartrain Basin. While  
4865 urban areas have the resources and capacity to invest in and focus on resilience, rural communities  
4866 oftentimes do not for a myriad of reasons, including:

- 4867 ● **Capacity limitations:** Rural communities typically have smaller local governments with fewer staff  
4868 members. They may lack personnel with specialized knowledge in areas like hazard mitigation,  
4869 environmental adaptation, and resilience planning.
- 4870 ● **Resource limitations:** Rural areas generally have a smaller tax base and lower property values,  
4871 resulting in less revenue for local governments to invest in infrastructure upgrades, mitigation  
4872 projects, and resilience planning.
- 4873 ● **Geographic isolation:** Remote locations can pose challenges for accessing resources, evacuating  
4874 residents, and receiving timely assistance during disasters. In the Pontchartrain Basin, this becomes

4875 more apparent the farther one travels from the New Orleans or Baton Rouge metro areas. Lack of  
 4876 resource and infrastructure integration among rural communities with larger urban areas does not  
 4877 allow them the stability and opportunity to invest in resilience measures.  
 4878 ● **Out-migration:** Rural areas in the Pontchartrain Basin have experienced some of the most severe  
 4879 cases of out-migration in the United States (Table 24). While general urbanization takes place across  
 4880 the region, the smaller, less populated areas are seeing their tax bases decrease.

4881 **Table 24. Rural population decline 2010-2019 (U.S. Census Bureau, 2022).**

PARISH/COUNTY	POPULATION LOSS	% OF POPULATION LOSS
St. John the Baptist	-4,366	-9.3%
St. Helena Parish	-994	-8.3%
St. James Parish	-1,556	-7.2%
St. Charles Parish	-1,680	-3.1%

4882 **CHALLENGES MEASURING SUCCESS OF RESILIENCE INVESTMENTS**

4883 One roadblock to funding and implementing effective resilience measures is the capacity and ability to track  
 4884 their success. Often, investments in resilience do not see an immediate or definite return on investment, and  
 4885 without the ability to properly value the results of such investments, it may be difficult for municipalities to  
 4886 justify the costs when working on a limited budget. Politicians who want to get re-elected are also less likely  
 4887 to pursue efforts that may take over a decade to be fruitful, and so these efforts struggle at times to gain  
 4888 political support. Evaluating the success of resilience investments is crucial to ensure they effectively  
 4889 achieve their intended goals (Table 25). However, tracking and assessing the long-term impacts of these  
 4890 investments can present significant challenges.

4891 The National Academies of Sciences, Engineering, and Medicine highlight the importance of addressing gaps  
 4892 in current community resilience measurement efforts. Their report offers key actions that communities can  
 4893 take to build and measure their resilience (National Academies of Sciences, Engineering, and Medicine,  
 4894 2019). These include:

- 4895 ● **Monitoring and evaluating** the progress of resilience projects and measuring their impact on the  
 4896 community. All resilience planning measures should be put in place with specific objectives that can  
 4897 be measured after a set amount of time. If resilience plans set out to improve community  
 4898 engagement and education, the plan should include a baseline assessment of current levels of  
 4899 engagement and education, along with the desired levels.
- 4900 ● **Gathering community feedback** from residents about the effectiveness of resilience projects and  
 4901 their benefit to the community.
- 4902 ● **Conducting a cost-benefit analysis** to compare the costs of resilience projects to the benefits they  
 4903 provide. For example, the four structural risk reduction projects in the Pontchartrain/Breton region  
 4904 are expected to reduce future surge-based flood risk in the region by 35% and provide a \$1.6 billion  
 4905 reduction in future flood risk (CPRA, 2023).

## 4906 **RESOURCE SHORTAGES FOR LOCAL LEADERS**

4907 Local leaders in the Pontchartrain Basin often grapple with significant resource constraints when trying to  
4908 prioritize and implement resilience measures. Navigating the complex landscape of resilience planning  
4909 requires synthesizing information from diverse fields like environmental science, coastal engineering, and  
4910 socioeconomic impact analysis. Accessing and fully evaluating the specific opportunities, long-term  
4911 benefits, and potential drawbacks associated with various resilience strategies can be demanding,  
4912 particularly given the competing priorities and day-to-day pressures of local governance. Furthermore,  
4913 obtaining easily digestible, actionable information tailored to their specific community's context can be  
4914 difficult. Technical reports may be dense, funding application processes complex, and the sheer volume of  
4915 available data overwhelming, especially for communities with limited administrative staff or budgets to hire  
4916 specialized consultants. This situation can make it challenging for leaders to consistently make fully  
4917 informed decisions and effectively champion resilience initiatives amidst other pressing local needs.

### 4918 **Funding**

4919 Securing adequate funding for crucial resilience projects within the Pontchartrain Basin presents a  
4920 significant and multifaceted challenge for local leaders. A major hurdle stems from the difficulty in simply  
4921 identifying potential funding streams; information on grants, federal programs, and other financial resources  
4922 is often fragmented across various agencies and platforms, making it hard for officials, especially those in  
4923 smaller communities with limited staff capacity, to navigate the complex landscape and pinpoint suitable  
4924 opportunities. Compounding this issue is the inherently limited nature of the available funding itself. Even  
4925 when opportunities are identified, the total pool of resources dedicated to resilience and coastal restoration  
4926 frequently falls short of the immense scale of need within the basin, leading to intense competition for  
4927 scarce dollars and forcing difficult decisions about which vital projects can move forward.

### 4928 **Technical Assistance**

4929 Communities surrounding the basin face a critical shortage of technical assistance. This lack of access to  
4930 expert guidance hinders their ability to develop and implement effective resilience strategies, leaving them  
4931 ill-equipped to address the complex challenges they face.

### 4932 **Other Tools and Resources**

4933 Communities surrounding the basin face significant barriers to accessing crucial resources. Essential tools,  
4934 such as informational and educational materials, and opportunities for collaborative action, like group  
4935 meetings, are often scarce or difficult to find, hindering their ability to effectively address local challenges.

## 4936 **LACK OF REDUNDANCIES TO INCREASE RESILIENCE**

4937 Areas surrounding the Pontchartrain Basin lack sufficient redundancy in critical infrastructure and services.  
4938 Redundancies involve having multiple systems in place to provide critical services in the event of a natural  
4939 disaster. These may include:

- 4940 • Infrastructure redundancy includes backup power systems, redundant communication systems, and  
4941 alternative transportation routes available in the wake of natural disasters.
- 4942 • Community redundancy encompasses community emergency response teams, neighborhood  
4943 support networks, and backup shelters.
- 4944 • Economic redundancy involves having a diversified economy that is not reliant on a single industry.

## 4945 **CURRENT STATE OF RESILIENCE PLANNING AND INVESTMENT: POTENTIAL** 4946 **ACTIONS AND CASE STUDIES**

### 4947 **Trends in Prioritizing Resilience**

4948 In recent years, there has been a growing trend toward prioritizing resilience in some, mostly urban, areas  
4949 across the Pontchartrain Basin, driven by several factors, including:

- 4950 • **Increased awareness of the risks of natural disasters:** The increasing frequency and intensity of  
4951 natural disasters like hurricanes and flooding has raised awareness of the importance of resilience.  
4952 For example, the City of New Orleans has long experienced power grid failures and catastrophic  
4953 flooding from severe weather events like tropical cyclones and extreme temperatures, which cause  
4954 and exacerbate power failures (National Renewable Energy Laboratory, 2024).
- 4955 • **Availability of funding:** The availability of federal and state funding for resilience projects created an  
4956 environment for communities to invest in resilience measures. For example, with \$4.5 million in  
4957 National Oceanic and Atmospheric Administration (NOAA) funds under the Bipartisan Infrastructure  
4958 Law and Inflation Reduction Act, Jefferson Parish partnered with Louisiana’s Coastal Protection and  
4959 Restoration Authority (CPRA) to construct the Bucktown Living Shoreline to fortify the shoreline  
4960 along the southern rim of Lake Pontchartrain and to protect the federal levee system (NOAA, 2023).
- 4961 • **Community alignment on prioritizing resilience:** Strong community leadership is essential for  
4962 prioritizing resilience. Where resilience has been most successful, every level of leadership  
4963 understands its role and executes it in alignment with partners. Local and state leaders, in  
4964 partnership with federal funders and local community organizations, have increased awareness of  
4965 and led strategic efforts toward resilient planning (Land Trust Alliance, 2015).

### 4966 **Governments Investing in Resilience**

4967 The Pontchartrain Basin faces significant coastal challenges, including land subsidence, erosion, frequent  
4968 hurricane threats, and socioeconomic disparities that can amplify vulnerability. Recognizing these  
4969 interconnected issues, local and parish governments across the basin are actively investing in multifaceted  
4970 resilience strategies. These efforts aim not only to protect against immediate threats but also to build long-  
4971 term environmental health and community well-being.

4972 These investments manifest in several key areas. Governments are increasingly utilizing Green  
4973 Infrastructure, employing natural and nature-based solutions for flood control and stormwater management  
4974 to reduce reliance solely on traditional "gray" infrastructure. An example of this is the Belle Terre Streetscape  
4975 and Stormwater Enhancements project in St. John the Baptist Parish, which integrates features like  
4976 bioswales and permeable paving along a major commercial corridor to reduce localized flooding by

4977 absorbing and filtering stormwater runoff, while also improving pedestrian safety and stimulating economic  
4978 activity.

4979 Hazard Mitigation is another core focus, with measures implemented to lessen the impact of disasters, often  
4980 guided by Parish Hazard Mitigation Plans. This involves both structural defenses and non-structural  
4981 approaches. Structurally, projects like the Lake Pontchartrain Shoreline Protection Project in St. John the  
4982 Baptist Parish address high erosion rates by constructing breakwaters, creating a more resilient shoreline as  
4983 an additional line of defense against storm surge and wave action. Non-structurally, many Parish Hazard  
4984 Mitigation Plans emphasize strategies such as promoting the elevation of homes and businesses in flood-  
4985 prone areas above expected flood levels (Base Flood Elevation plus freeboard) to reduce future flood  
4986 damage.

4987 Building Community Resilience is also crucial, requiring the strengthening of communities' capacity to  
4988 prepare for, withstand, and recover from disasters through education, planning, and addressing social  
4989 vulnerabilities. In St. John the Baptist Parish, for instance, a Resilient Housing Plan developed under the LA  
4990 SAFE initiative analyzes housing vulnerability and proposes strategies like home elevation assistance, buyout  
4991 programs, and resilient building standards to help residents adapt to increasing flood threats.

4992 Furthermore, Coastal Restoration efforts protect and restore the basin's natural defenses—its wetlands,  
4993 swamps, and shorelines—which are critical for buffering storm impacts and adapting to sea level rise. In  
4994 Mandeville (St. Tammany Parish), the Sunset Point Park Restoration project restored eroding shoreline by  
4995 creating marsh terraces and breakwaters using recycled glass material, thereby enhancing habitat,  
4996 recreation, and the area's natural capacity to absorb wave energy.

4997 Finally, ensuring Community Infrastructure Resilience is vital so that critical facilities like hospitals and  
4998 schools can continue functioning during and after disasters. Hazard Mitigation Plans across the basin often  
4999 prioritize actions to harden critical infrastructure, including projects to ensure backup power, elevate or flood-  
5000 proof essential buildings, and strengthen key transportation routes.

5001 Taken together, these diverse investments—spanning engineered solutions, nature-based approaches, policy  
5002 changes, and community programs—demonstrate a growing commitment across the Pontchartrain Basin to  
5003 build a more resilient future in the face of environmental change. These investments aim to improve the  
5004 basin's resilience to natural hazards and build stronger, more sustainable communities.

5005 **Table 25. Tracking outcomes of resilience projects.**

COMMUNITY	PROJECT	OUTCOME
New Orleans	Gentilly Resilience District	Increased water storage capacity at 193 homes (Starpoli, 2023)
St. John the Baptist Parish	Airline and Main Complete Streets	Reduced flood risk and improved transportation (St. John the Baptist Parish, n.d.)
Jefferson Parish	Bucktown Living Shoreline	Reduced erosion, restored habitat, and created recreational opportunities (NOAA, 2023)
Mandeville	Home elevations	Reduced flood risk for historic homes (City of Mandeville, 2023)

## 5006 Resilience Planning Case Study

### 5007 St. John the Baptist Resilience Plan

5008 St. John the Baptist Parish has developed a resilience plan, updated building codes, and created incentives  
5009 for property owners to invest in resilience measures. For example, St. John the Baptist Parish envisions  
5010 potentially creating a Transferable Development Rights (TDR) program, as indicated in the parish's  
5011 Comprehensive Plan Land Use's Hazard Mitigation Element. The parish has prioritized resilience by creating  
5012 a plan that involves several projects, including Airline and Main Complete Streets, Lake Pontchartrain  
5013 Shoreline Protection, and Belle Terre Streetscape and Stormwater Enhancements (Georgetown Climate  
5014 Center, 2023).

- 5015 ● The **Airline and Main Complete Streets** project in LaPlace will integrate green infrastructure and  
5016 transportation improvements to mitigate flood risk and enhance transportation options along Airline  
5017 Highway and Main Street.
- 5018 ● The **Lake Pontchartrain Shoreline Protection** project involves constructing breakwaters to create a  
5019 more resilient shoreline and reduce flood risk. The shoreline has eroded at a rate of approximately 10  
5020 feet per year since 1915, threatening residents, businesses, and critical infrastructure.
- 5021 ● The **Belle Terre Streetscape and Stormwater Enhancements** is a comprehensive streetscape project  
5022 designed to revitalize a major parish corridor, boost the local economy, and address localized  
5023 flooding. It aims to implement green infrastructure solutions and serve as a model for future  
5024 projects, combining resilience, transportation, economic development, and hazard mitigation.

### 5025 Lack of Public Awareness and Involvement in Conservation Efforts

5026 Addressing the environmental challenges in the Pontchartrain Basin requires a comprehensive approach that  
5027 includes strong public awareness. When environmental issues remain unaddressed, this undermines  
5028 community resilience, can increase vulnerability to natural hazards, and can reduce the quality of life for  
5029 residents. This section explores a lack of awareness of not only what the Pontchartrain Basin is, but why it is  
5030 important and how communities fit into the system. While communities near Lake Pontchartrain generally  
5031 have a shared understanding that they exist within the Lake Pontchartrain Watershed together, other  
5032 communities, especially those further north within the watershed, may not be aware of their potential  
5033 influence and impact on the system.

5034 It is crucial to acknowledge the historical focus on the Lake Pontchartrain vicinity. Decades of concentrated,  
5035 highly public efforts on lake cleanup, shell dredging, and the closure of the controversial Mississippi River  
5036 Gulf Outlet (MRGO) have significantly shaped public perception and engagement. These efforts increased  
5037 awareness of the Pontchartrain Basin for both negative and positive reasons. However, this focus may have  
5038 inadvertently created a disconnect for communities geographically distant from the Lake, who may not fully  
5039 understand or appreciate their integral connection to the broader Pontchartrain Basin watershed.

## 5040 CONTRIBUTING FACTORS TO LACK OF AWARENESS

### 5041 Lack of Unified Messaging and Educational Materials

5042 The 1995 Comprehensive Conservation and Management Plan (CCMP) highlighted the need for more  
5043 educational materials about the basin's environmental challenges and restoration efforts. However, before  
5044 the public can be educated on specific issues, they need to be made aware of the watershed, its importance,  
5045 and how they play a role in maintaining its ecological health.

5046 Currently, the PRP exists to restore and enhance the ecological health of the Pontchartrain Basin, but as an  
5047 organization, the PRP lacks recognizable branding and consistent, unified public messaging to promote and  
5048 inform the public about the Pontchartrain Basin. Several entities, such as science organizations and  
5049 environmental nonprofits exist concurrently with the PRP and also aim to improve the ecological health of  
5050 the Pontchartrain Basin. While these organizations make positive impacts in the Basin, their existence can  
5051 dilute the influence and awareness of the PRP, and messaging from different organizations is not consistent.  
5052 This creates a challenge for unified messaging in the Pontchartrain Basin.

5053 Because of this inconsistency, the Pontchartrain Basin lacks a unifying identity that, in other geographic  
5054 areas, has increased awareness and active participation in conservation by creating a shared identity across  
5055 communities that otherwise may not know they share common threads.

5056 In addition to basic awareness, education on how to participate in conservation issues continues to be an  
5057 issue today, as evidenced by the ongoing need for that aim to increase public awareness and knowledge of  
5058 water quality issues (USEPA, 2024).

5059 According to input on issues from the Resilient Communities Work Group, basic education on water quality  
5060 issues in the Pontchartrain Basin is needed. People may not have a clear understanding of the potential  
5061 impacts that their everyday actions can have on the ecological health of the Pontchartrain Basin.

5062 The public understanding of the following is not as high as it could be:

- 5063 ● **Home Septic Systems:** Many residents may not fully understand that septic systems require regular  
5064 maintenance (pumping every 3-5 years) and inspection. Failing systems can leach harmful bacteria  
5065 (like *Escherichia coli*) and excess nutrients (nitrogen, phosphorus) into groundwater, ditches, canals,  
5066 and eventually larger waterbodies like Lake Pontchartrain, contributing to health risks and algal  
5067 blooms.
- 5068 ● **Stormwater Runoff:** There's often a misconception that storm drains lead to a treatment plant. In  
5069 most areas, storm drains flow directly into local bayous, canals, rivers, and lakes, carrying untreated  
5070 pollutants picked up from streets, driveways, and lawns. This includes litter, pet waste, vehicle fluids  
5071 (oil, antifreeze), fertilizers, pesticides, and sediment.
- 5072 ● **Lawn and Garden Chemical Use:** Overuse or improper application of fertilizers and pesticides can  
5073 lead to excess chemicals being washed into waterways via stormwater runoff. These nutrients  
5074 contribute to eutrophication (oxygen depletion) and algal blooms, while pesticides can harm aquatic  
5075 life.

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- **Proper Waste Disposal:**

- **Pet Waste:** Leaving pet waste on the ground allows bacteria and nutrients to wash into storm drains and waterways.
- **Trash/Litter:** Improperly disposed of trash, especially plastics, pollutes waterways, harms wildlife, and degrades habitats.
- **Household Hazardous Waste:** Pouring paints, solvents, cleaners, medications, or automotive fluids down drains or onto the ground introduces toxic substances directly into the water system or groundwater.
- **Yard Waste Management:** Piling leaves and grass clippings near storm drains or ditches can cause clogs and flooding. As they decompose in water, they also release excess nutrients.
- **Vehicle Washing:** Washing cars on driveways allows soap, detergents, and grime containing oils and heavy metals to flow directly into storm drains.
- **Protecting Groundwater/Aquifers:** While individual home wells access groundwater, the primary public impact is ensuring activities *on the surface* don't contaminate these shared resources. Leaking septic systems, improper chemical disposal, and underground fuel storage tank leaks can all threaten the quality of aquifers that supply drinking water.
- **Boating Practices:** For recreational boaters, improper disposal of sewage from boat holding tanks, fuel spills during refueling, and littering can directly impact water quality in lakes and bayous.

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Voluntary public participation could increase across the basin if members of the public had a clearer understanding of the PRP and its potential benefits. Local leaders across the basin could also benefit from increased information and resource sharing. If local leaders view the PRP as a partner and valuable resource, the investments made across the Pontchartrain Basin could focus on building more resilient communities. While this is happening in some areas, the disconnect with parishes outside of close proximity to Lake Pontchartrain still exists.

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Without regular communication to and engagements with interested parties, the only engagement will come from those groups who seek it out and those who are geographically located closer to the Lake. This leads to some areas being less informed and less involved in conservation management efforts. This also means there may be fewer opportunities for some communities to receive funding from the PRP.

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Additionally, accurate and up-to-date information on the current and comprehensive activities in the Pontchartrain Basin is not centralized or easy to find. While some information is available on the PRP website, it does not include information about activities in the Basin as a whole.

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## **Inadequate Public Empowerment**

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A persistent challenge highlighted as far back as the 1995 Comprehensive Conservation Management Plan (CCMP) is the inadequate empowerment of the public in environmental education and planning processes within the Pontchartrain Basin. One of the major changes since the 1995 CCMP is the advent of digital communication, changing the methods by which meaningful public engagement across such a large and diverse basin is able to be distributed. The core issue identified decades ago – a disconnect between residents and the complex processes of environmental management – continues to manifest.

5115 Translating awareness of environmental issues into active, sustained participation can be difficult. Residents  
5116 may face barriers such as a lack of time, difficulty accessing or understanding technical information about  
5117 proposed projects or water quality data, or insufficient opportunities for providing meaningful input early in  
5118 the decision-making process. General awareness and education shortfalls, as outlined earlier in this section,  
5119 also lead to a lack of public empowerment among communities.

5120 Consequently, even with more information available today than in 1995, a gap often persists between the  
5121 planning conducted by agencies and the understanding or involvement of the communities directly affected.  
5122 This lack of robust engagement can hinder the success of conservation initiatives, lead to reduced public  
5123 buy-in for necessary projects or behavioral changes, and result in missed opportunities to incorporate  
5124 valuable local knowledge into resilience strategies.

## 5125 **Undervalued Ecological and Economic Significance of the Basin**

5126 The Resilient Communities Work Group emphasized the need to educate the public about the Pontchartrain  
5127 Basin's importance, stating that "people are unaware of the ecological and economic impacts of the region."  
5128 This disconnect can lead to a lack of support for conservation efforts, which the revised CCMP aims to  
5129 address. The basin provides crucial habitats for a variety of species, including fish, shellfish, and migratory  
5130 birds (Lopez, 2009). It also plays a vital role in the state's economy, supporting industries like fishing,  
5131 tourism, and recreation (Environmental Defense Fund, 2017). Land loss in the basin could result in an annual  
5132 loss of 7,800 to 10,500 jobs and \$460 to \$620 million in wages (Environmental Defense Fund, 2017).

## 5133 **Lack of Education about Water Quality Issues**

5134 There is also a lack of educational materials that exist about the specific types of pollutants that affect the  
5135 basin, making it difficult for people to "understand why they should care" about water quality issues and  
5136 related conservation efforts, according to the Resilient Communities Work Group. Prior to cleanup efforts,  
5137 the lake's degraded condition significantly impacted residents' quality of life. Recreational activities were  
5138 severely limited, fishing opportunities diminished, and local water systems struggled to maintain reliable  
5139 service. Stormwater runoff, wastewater discharge, and agricultural runoff are major sources of pollution in  
5140 the basin that introduce pollutants like bacteria, viruses, heavy metals, and excess nutrients into the water,  
5141 posing risks to human health and the environment (USEPA, 2024).

## 5142 **IMPACTS OF LACK OF AWARENESS**

5143 The lack of awareness of conservation efforts has negative impacts on the resilience of communities in the  
5144 Pontchartrain Basin.

## 5145 **Reduced Community Engagement**

5146 When communities are not aware of the environmental challenges facing the basin or the efforts being made  
5147 to address them, they are less likely to participate in conservation activities or support initiatives that  
5148 promote environmental protection. This lack of awareness directly undermines the effectiveness of  
5149 environmental stewardship, as meaningful progress requires active public involvement in decision-making

5150 and implementation. For example, a community may be unaware of the need to reduce fertilizer use or  
5151 properly dispose of hazardous waste, leading to continued pollution of local waterways. Without informed  
5152 public input, local governments and organizations struggle to develop and enforce effective environmental  
5153 policies, and residents miss opportunities to contribute their unique knowledge and perspectives to  
5154 solutions. Public involvement, through forums, workshops, and citizen science, is essential to building a  
5155 shared understanding of the issues and fostering a sense of ownership in protecting the Pontchartrain Basin.

### 5156 **Increased Vulnerability to Environmental Threats**

5157 A lack of awareness can lead to behaviors that exacerbate environmental problems, such as improper waste  
5158 disposal, overuse of fertilizers, and unsustainable land-use practices. This can increase the vulnerability of  
5159 communities to environmental threats like flooding, water pollution, and habitat loss. For instance,  
5160 communities unaware of the importance of wetlands in mitigating flood risks may support development  
5161 projects that destroy these vital ecosystems, leaving them more susceptible to flooding during storms.

### 5162 **Missed Opportunities for Economic Development**

5163 Conservation efforts can create economic opportunities through ecotourism, sustainable fisheries, and the  
5164 development of green technologies. However, a lack of awareness can limit community involvement in these  
5165 opportunities. For example, a community with pristine natural resources could develop ecotourism initiatives  
5166 that attract visitors and generate revenue, but a lack of awareness about the value of these resources may  
5167 prevent such initiatives from being realized.

## 5168 **GAPS IN AWARENESS AND EDUCATIONAL RESOURCES**

5169 The necessity for targeted community outreach shows that several communities in the Pontchartrain Basin  
5170 have significant gaps in awareness and educational resources related to water quality issues. These gaps are  
5171 often more pronounced in some communities with limited access to information and resources.

5172 Factors contributing to these gaps include:

- 5173 ● **Socioeconomic disparities:** Some communities may have limited access to technology, internet  
5174 connectivity, and educational programs.
- 5175 ● **Language barriers:** Information about environmental issues may not be readily available in  
5176 languages other than English, hindering access for non-native speakers.
- 5177 ● **Lack of trust:** A lack of engagement with some communities can lead to distrust.

## 5179 **POTENTIAL BENEFITS OF IMPROVED AWARENESS**

5180 Improving awareness and educational resources could have several positive impacts on communities in the  
5181 Pontchartrain Basin. These potential metrics can be considered when developing actions related to  
5182 improving awareness across the Pontchartrain Basin.

5183 **Increased Community Engagement**

5184 Providing communities with information about the basin's environmental challenges and conservation efforts  
5185 can empower them to act and participate in local initiatives, leading to increased volunteerism, support for  
5186 conservation policies, and greater community ownership of environmental stewardship.

5187 **Reduced Pollution**

5188 Educating the public about the sources and impacts of pollution can lead to changes in behavior that reduce  
5189 pollution levels and improve water quality. This can include reducing fertilizer use, properly disposing of  
5190 hazardous waste, and participating in community cleanup events.

5191 **Enhanced Resilience**

5192 Increased awareness can help communities understand the importance of environmental protection and the  
5193 role it plays in enhancing their resilience to environmental threats, creating increased support for initiatives  
5194 that protect wetlands, restore shorelines, and promote sustainable land-use practices.

5195 **Economic Benefits**

5196 Increased awareness can create economic opportunities by promoting ecotourism, supporting sustainable  
5197 fisheries, and fostering the development of green technologies (Environmental Defense Fund, 2017). By  
5198 understanding the connection between a healthy environment and economic prosperity, communities can  
5199 leverage their natural resources to create jobs and attract investment (Bailleau, 2024).

5200 **CASE STUDIES FOR INCREASING AWARENESS**

5201 Several communities in the Pontchartrain Basin have made positive strides in education and awareness of  
5202 water quality issues. These communities can serve as case studies for other communities, cities, and  
5203 parishes within the Basin.

5204 **New Orleans, Louisiana**

5205 The U.S. Environmental Protection Agency (USEPA) and U.S. Geological Survey (USGS) launched the Village  
5206 Blue project in New Orleans to increase community awareness about Lake Pontchartrain's water quality and  
5207 its connection to the Mississippi River. This project uses water quality sensors to provide real-time data to  
5208 the community, helping to close information gaps and inform environmental restoration efforts (USEPA,  
5209 2021).

5210 The New Canal Lighthouse, operated by the Pontchartrain Conservancy, serves as a museum and education  
5211 center, teaching locals and visitors about water quality, habitats of the Pontchartrain Basin, and critical  
5212 coastal issues facing south Louisiana (USEPA, 2018).

## 5213 **St. Bernard Parish, Louisiana**

5214 The Facilitating Learning in Our Watershed (FLOW) project enhances environmental education by providing  
5215 extensive training for science teachers in St. Bernard Parish (Pontchartrain Conservancy, n.d.). Participating  
5216 teachers collaborate to create locally focused curriculum and STEM kits, helping students gain a more  
5217 meaningful understanding of their watersheds (Pontchartrain Conservancy, n.d.). This initiative focuses on  
5218 building capacity within the education system to promote environmental awareness and stewardship among  
5219 young people.

## 5220 **Unequal Access to Recreational Opportunities**

5221 This section focuses on the issue of unequal access to open lands and waters for recreation in the  
5222 Pontchartrain Basin and its impact on communities and individuals. The Pontchartrain Basin is a valuable  
5223 natural resource that is home to various ecosystems, landscapes, and an abundance of opportunities for  
5224 recreational activities. However, these recreational activities are not as accessible to some individuals and  
5225 communities in the Pontchartrain Basin, whether due to geographic, economic, or other circumstances. The  
5226 issue with recreational opportunities not being afforded across the basin is one of community well-being and  
5227 ultimately community resilience.

5228 This lack of access can disproportionately affect less affluent communities, exacerbating existing health  
5229 disparities and hindering community resilience. In addition to the social benefits, the Pontchartrain Basin  
5230 provides significant economic benefits, supporting commercial fishing, agriculture, and forestry operations  
5231 (U.S. Government Accountability Office, 2023). This section examines the correlation between recreational  
5232 access and quality of life, discusses the impact of recreational access on community resilience, and  
5233 explores potential solutions to increase access in the basin.

5234 The Pontchartrain Basin's geography lends itself to a wide range of recreational opportunities, including  
5235 boating, fishing, hunting, kayaking, birdwatching, hiking, and biking. These activities not only benefit  
5236 individuals' well-being but also contribute to the local economy by attracting tourists and supporting  
5237 businesses.

- 5238 ● **Parks in urban areas** provide green space for recreation and community engagement within cities.
- 5239 ● **Rivers and bayous** offer natural waterways for fishing, boating, and other water-based activities.
- 5240 ● **Recreational fishing and boating** offer opportunities for leisure and sport on bodies of water.
- 5241 ● **Recreational hunting** offers outdoor experiences and the potential for harvesting game animals.

5242 Access to recreational opportunities is essential for healthy individuals and communities. Recreation and  
5243 leisure time are standard indicators of quality of life, as defined by the World Health Organization. There is a  
5244 positive correlation between participation in leisure activities and subjective well-being. Engaging in cultural  
5245 events, family leisure activities, and active socializing contributes to a higher quality of life. Notably, family  
5246 leisure activities have a significant positive correlation with subjective well-being across different age  
5247 groups, highlighting the importance of family-oriented recreational access (Children & Nature Network,  
5248 2022).

## 5249 **BARRIERS TO ACCESSING RECREATIONAL OPPORTUNITIES IN THE** 5250 **PONTCHARTRAIN BASIN**

5251 Despite the abundance of lakes, bayous, forests, and parks offering potential opportunities for recreation  
5252 within the Pontchartrain Basin, significant barriers prevent many residents and visitors from fully accessing  
5253 and enjoying these resources. Addressing these barriers is crucial for promoting public health, environmental  
5254 stewardship, and equitable enjoyment of the Basin's natural and developed recreational assets.

### 5255 **Transportation**

5256 Accessing many of the Basin's prime recreational areas often requires reliable personal transportation,  
5257 creating a significant hurdle for individuals and families without it. Many state parks, wildlife management  
5258 areas, fishing spots, and boat launches are located in rural or semi-rural settings, far from urban centers and  
5259 poorly served, if at all, by public transit routes. Even reaching access points along the shores of Lake  
5260 Pontchartrain or Lake Maurepas can be challenging without a car. For activities like fishing or paddling, the  
5261 nearest public boat launch or accessible shoreline might be a prohibitive distance away, particularly for  
5262 those reliant on unreliable vehicles. Furthermore, the rising cost of fuel and vehicle maintenance adds  
5263 another layer to this transportation barrier. Even within more developed areas, inadequate pedestrian or  
5264 cycling infrastructure, such as lack of sidewalks or safe road crossings on the way to parks or lakefronts, can  
5265 deter access for those living nearby but lacking vehicular transport.

### 5266 **Financial Constraints**

5267 Participating in many traditional outdoor recreational activities popular in the Pontchartrain Basin involves  
5268 significant costs that can be prohibitive for individuals and families on limited budgets. Engaging in fishing  
5269 requires not only state licenses but also an initial investment in rods, reels, and tackle, plus ongoing  
5270 expenses for bait, and potentially boat fuel, maintenance, and launch fees. Similarly, hunting often  
5271 necessitates substantial upfront costs for firearms, ammunition, specialized clothing, licenses, and tags,  
5272 with access frequently requiring expensive memberships in hunting clubs or private land lease payments.  
5273 Even seemingly simpler activities like visiting state parks, such as Fontainebleau on the north shore, incur  
5274 per-vehicle or per-person entrance fees. Pursuing other interests like kayaking or canoeing involves the cost  
5275 of purchasing or renting boats and associated safety gear, while camping necessitates buying tents and  
5276 other equipment. These cumulative expenses, including potential participation fees for programs run by  
5277 partner organizations at public facilities, effectively place many recreational pursuits out of reach for lower-  
5278 and middle-income residents, limiting their ability to engage with the Basin's natural resources.

### 5279 **Infrastructure**

5280 The condition and availability of public infrastructure supporting recreation are critical barriers throughout  
5281 the Basin. Many publicly managed facilities suffer from age, wear and tear, storm damage, and insufficient  
5282 maintenance funding, hindering access and enjoyment. Examples are widespread, including fishing piers that  
5283 are closed or unsafe, including two in St. Tammany Parish that have been out of commission since Hurricane  
5284 Ida, alongside crumbling picnic shelters and restrooms along the New Orleans lakefront, boat launches in  
5285 need of repair, and trails or boardwalks damaged by storms or neglect.

5286 Hurricane impacts exacerbate these deficiencies, and recovery efforts can be protracted due to funding  
5287 delays, such as waiting on insurance or FEMA reimbursements. Local and state recreation departments  
5288 often operate with limited budgets, leading to a cycle of deferred maintenance where facilities gradually  
5289 deteriorate because agencies struggle to keep up with routine upkeep, let alone undertake major repairs or  
5290 improvements. Beyond typical park amenities, environmental infrastructure issues also impede recreation;  
5291 poor drainage can render park grounds unusable after rain, while sedimentation, sometimes resulting from  
5292 altered hydrology due to canals or spoil banks, can choke waterways and block access for boaters and  
5293 paddlers.

## 5294 **Awareness**

5295 A simple lack of awareness can prevent people from taking advantage of recreational opportunities.  
5296 Potential users may simply not know what recreational facilities, parks, trails, or public access points exist  
5297 within the Basin or in their vicinity, as information might be decentralized, hard to find, or not effectively  
5298 communicated. The issue of awareness related to recreational access is not independent of the issue  
5299 described in the previous section of this section, which covered a broader overview of the lack of public  
5300 awareness of what the Basin is and how to participate in its ecological health.

5301 Public feedback associated with the development of this Issue Report also highlighted that complex  
5302 regulations regarding fishing seasons, size/bag limits, hunting rules, boating safety requirements, or park  
5303 usage can intimidate newcomers or lead to unintentional violations. Some individuals also lack foundational  
5304 outdoor skills, having never learned how to fish, paddle a canoe, set up a campsite, or identify local wildlife.  
5305 Without accessible introductory programs, mentors, or clear guidance on how to get started, the barrier to  
5306 entry for these activities can seem insurmountable.

## 5307 **RECREATIONAL ACCESS AND COMMUNITY RESILIENCE**

5308 Access to recreational opportunities plays a vital role in fostering community resilience. Recreation provides  
5309 avenues for social interaction, stress reduction, and community cohesion, all of which contribute to a  
5310 community's ability to cope with challenges. Moreover, access to recreational spaces can contribute to  
5311 disaster preparedness and recovery by providing gathering places, promoting social support, and facilitating  
5312 community organization. In times of crisis, these spaces can serve as community hubs for information  
5313 sharing, resource distribution, and emotional support, strengthening the community's ability to respond and  
5314 recover.

### 5315 **Negative Impacts of Limited Recreational Access**

5316 Limited access to recreational opportunities can have several negative impacts on individuals and  
5317 communities (Lee et al., 2022):

- 5318 ● **Reduced Physical Activity:** Lack of access to parks and green spaces can lead to decreased physical  
5319 activity, increasing the risk of chronic health problems such as cardiovascular disease, obesity,  
5320 diabetes, and depression.

- 5321 ● **Mental Health Concerns:** Studies have shown a correlation between limited access to green spaces  
5322 and higher rates of chronic stress and mental health disorders. Green spaces provide opportunities  
5323 for stress reduction, relaxation, and improved mental well-being.
- 5324 ● **Social Isolation:** Inadequate access to recreational spaces can contribute to social isolation and limit  
5325 opportunities for community interaction and engagement. Parks and recreational areas serve as  
5326 gathering places for social interaction, community events, and fostering a sense of belonging.
- 5327 ● **Reduced Quality of Life:** Limited access to recreation can negatively impact overall quality of life by  
5328 restricting opportunities for leisure, relaxation, and enjoyment of the natural environment. Access to  
5329 recreational opportunities enhances quality of life by providing spaces for personal growth,  
5330 enjoyment, and community engagement.

5331 **UNREALIZED BENEFITS TO THOSE LACKING ACCESS TO RECREATIONAL**  
5332 **OPPORTUNITIES**

5333 Recreational opportunities offer numerous benefits for individuals, including improved physical and mental  
5334 health, stress reduction, and increased social interaction. These benefits are particularly significant for  
5335 individuals in communities who may face greater barriers to accessing recreational resources. Inclusive  
5336 recreation programs and adaptive methods can also ensure that people with disabilities have equal  
5337 opportunities to participate in recreational activities.

5338 Despite challenges, there have been positive efforts to improve recreational access, such as boat launches,  
5339 parks, restoration projects, community initiatives, and policy interventions in the Pontchartrain Basin,  
5340 including:

- 5341 ● The **Miller Bayou Marsh Creation and Rigolets South Shore Restoration** projects, led by the USEPA  
5342 and National Marine Fisheries Service (NMFS), focus on creating and restoring marsh habitats, which  
5343 can provide increased recreational access for activities like fishing, kayaking, and birdwatching
- 5344 ● The **Bucktown Living Shoreline project** created calmer waters and restored shoreline, enhancing  
5345 opportunities for kayaking, paddleboarding, and fishing.
- 5346 ● The **St. Tammany Fishing Pier** will enhance recreational use by expanding fishing access, improving  
5347 amenities, enhancing safety, and increasing resilience to future storms, creating a more enjoyable  
5348 and accessible experience for all
- 5349 ● The **Bonnabel Boat Launch Refurbishment** will provide improved and safer access to the water for  
5350 boaters, facilitating activities like fishing, waterskiing, and exploring Lake Pontchartrain.
- 5351 ● The **Central Wetlands Nature Trail/Pier** offers a place for visitors to connect with nature through  
5352 activities like walking, birdwatching, and learning about the local environment.

5353 **Flood Risks Associated with Storm Surge and Heavy Rain Events**

5354 As detailed in the Basin Characterization section of this issue report, the Pontchartrain Basin faces  
5355 significant challenges from flood and storm surge risks associated with heavy rainfall events. This section  
5356 delves into the history of these threats, their disproportionate impact on economically and physically  
5357 vulnerable communities, and the progress made in addressing them. It also identifies population centers at

5358 risk, assesses their vulnerability, and evaluates the adequacy of existing infrastructure to handle future  
5359 events.

## 5360 **SURGE AND FLOOD IMPACTS IN THE PONTCHARTRAIN BASIN**

5361 The Pontchartrain Basin has a long history of grappling with storm surge and flooding. The region's low-lying  
5362 topography, proximity to the Gulf of Mexico, and extensive coastline render it particularly susceptible to the  
5363 impacts of heavy rainfall events. To understand the historical context of storm surge affecting the areas  
5364 along the rim of Lake Pontchartrain, the SURGEDAT database provides valuable insights. SURGEDAT, a  
5365 compilation of observed peak surge observations from historical records dating back to 1880, helps  
5366 researchers examine surge focusing effects, where geographical features can amplify surge heights (Lopez,  
5367 et al., 2016).

5368 One of the most devastating events in recent history, Hurricane Katrina in 2005, brought this vulnerability into  
5369 sharp focus. Katrina's storm surge, reaching up to 19 feet in eastern New Orleans, St. Bernard Parish, and  
5370 Plaquemines Parish, and 10 to 14 feet in western New Orleans along the southern shores of Lake  
5371 Pontchartrain (City of New Orleans Office of Homeland Security and Emergency Preparedness, 2021),  
5372 overwhelmed levees and caused widespread flooding across southeastern Louisiana. The highest surge  
5373 levels were recorded east of Katrina's eye, with an 11.45-foot surge at the Mobile State Docks and potentially  
5374 reaching close to 20 feet along the Mississippi-Alabama border (National Weather Service, 2005). In New  
5375 Orleans, approximately 80% of the city was submerged by August 30, 2005, due to the combined effects of  
5376 heavy rainfall (10 inches) and storm surge overtopping the levee system protecting the city from the waters  
5377 of Lake Pontchartrain and Lake Borgne (Britannica, 2025). The flooding led to the release of sewage,  
5378 industrial chemicals, and other hazardous materials into the floodwaters, creating a public health crisis  
5379 (Heitmuller & Perez, 2007).

5380 New Orleans, however, is not the only area within the Basin prone to dangerous and damaging floods. While  
5381 coastal storm surge poses a significant threat, intense rainfall events driving riverine and flash flooding have  
5382 devastated communities further inland. The catastrophic floods of August 2016 serve as a stark reminder of  
5383 this vulnerability. This event, triggered not by a hurricane but by a slow-moving, low-pressure system,  
5384 dropped unprecedented amounts of rain across southern Louisiana over several days, with some areas  
5385 receiving over 30 inches (NOAA National Centers for Environmental Information, 2018). Parishes like  
5386 Livingston and East Baton Rouge, situated along the Amite and Comite Rivers, experienced catastrophic  
5387 riverine and backwater flooding as waterways swelled far beyond their banks, inundating tens of thousands  
5388 of homes and businesses and tragically claiming lives (USGS, 2016). This event underscored that  
5389 devastating flooding in the Basin can occur far from the coast and be driven entirely by rainfall overwhelming  
5390 river systems and drainage capacity.

5391 The susceptibility to flooding extends throughout the numerous parishes within the Pontchartrain Basin  
5392 watershed. The Northshore parishes, including Tangipahoa, St. Tammany, and Washington, face significant  
5393 risks from rivers like the Tangipahoa, Tchefuncte, Bogue Chitto, and Pearl. These river systems can rise  
5394 rapidly after heavy rainfall, leading to flash flooding and widespread inundation of adjacent communities  
5395 (Hahne, 2021). Similarly, parishes like East Feliciana, St. Helena, and Livingston contend with risks  
5396 associated with rivers like the Amite and Tickfaw. Historical data and flood risk assessments consistently  
5397 show that large portions of these parishes lie within floodplains, vulnerable not only to major events like the

5398 2016 floods but also to more frequent, smaller-scale flooding events driven by intense thunderstorms or  
5399 prolonged wet periods (CPRA, 2023). Therefore, understanding and addressing flood risk within the  
5400 Pontchartrain Basin requires looking beyond coastal surge to encompass the widespread threat of riverine  
5401 and rainfall-driven flooding across its diverse geography.

## 5402 **Progress Made in Addressing Flood and Storm Surge Risks**

5403 Since Hurricane Katrina, significant progress has been made in addressing flood and storm surge risks in the  
5404 Pontchartrain Basin through a multi-faceted approach that combines structural improvements with non-  
5405 structural measures and community engagement.

- 5406 ● **Louisiana Watershed Initiative (LWI):** The Louisiana Watershed Initiative has coordinated funding,  
5407 invested in data and modeling, supported key projects like the St. Tammany Flood Risk Management  
5408 Project, and engaged with communities to reduce flood and storm surge risks in the Pontchartrain  
5409 Basin.
- 5410 ● **Comprehensive Hurricane Protection System:** Following the devastation of Hurricane Katrina,  
5411 USACE rebuilt the levee system protecting New Orleans, now known as the Hurricane Storm Damage  
5412 Risk Reduction System (HSDRRS) (City of New Orleans Office of Homeland Security and Emergency  
5413 Preparedness, 2021). This system is designed to provide protection from a 100-year flood event.
- 5414 ● **Levee Operations and Maintenance:** Recognizing the critical role of ongoing maintenance, multiple  
5415 federal, state, and local organizations, including the Southeastern Louisiana Flood Authority-East and  
5416 West, created in 2006, are responsible for the regional coordination of levee upkeep (City of New  
5417 Orleans Office of Homeland Security and Emergency Preparedness, 2021). Since Hurricane Katrina, a  
5418 more aligned, concerted effort to both mitigate potential impacts and plan for increased future  
5419 resilience has been implemented through effective coordination.
- 5420 ● **Coastal Restoration Projects:** Louisiana has invested in a comprehensive approach to coastal  
5421 restoration, guided by the Coastal Master Plan, with many of the shoreline protection and marsh  
5422 creation projects located in the Pontchartrain and Breton Sound Basins.

5423 These advancements highlight the importance of a multi-faceted approach to resilience, combining robust  
5424 infrastructure with ecological restoration and community engagement. Despite these advancements, the  
5425 continued loss of coastal wetlands, subsidence, and sea level rise contribute to increased flood risk.  
5426 Ensuring the long-term resilience of communities in the basin requires ongoing investment in infrastructure  
5427 improvements, coastal restoration, and community engagement.

## 5428 **Level of Risk and Infrastructure Adequacy**

5429 Assessing the level of risk for each population center requires consideration of factors like elevation,  
5430 proximity to the coast, and the condition of protective infrastructure. Studies have shown that communities  
5431 on the Northshore of Lake Pontchartrain, such as Slidell, Eden Isles, and Pearl River, have some of the  
5432 highest risks from storm surge-based flooding in coastal Louisiana. The Slidell Ring Levee project aims to  
5433 reduce this risk by constructing and improving levees and floodwalls around Slidell (CPRA, 2023).

5434 Evaluating the adequacy of infrastructure involves examining the capacity and adequacy of sewerage,  
5435 drainage, and pump systems to handle extreme events. The HSDRRS provides a level of protection for New  
5436 Orleans, but concerns remain about the long-term performance of the system due to factors like subsidence  
5437 and sea level rise (USACE, 2019). To address this, a semi-quantitative risk assessment (SQRA) was  
5438 conducted to evaluate the risk of levee overtopping (USACE, 2019). The SQRA helps to identify the risk  
5439 associated with levee overtopping and informs decisions about necessary improvements and maintenance.  
5440 In other areas, such as the West Shore of Lake Pontchartrain, the lack of comprehensive flood protection  
5441 infrastructure increases vulnerability to storm surge. However, the ongoing construction of the West Shore  
5442 Lake Pontchartrain Hurricane Protection System aims to address these gaps and further resilience in the  
5443 region (USACE, 2013).

5444 To further assess flood risk, the Coastal Louisiana Risk Assessment (CLARA) model (Fischbach et al., 2017)  
5445 characterizes the landscape, hurricane protection systems, and assets at risk along the Louisiana coastline.  
5446 It considers factors like the presence of levees and floodwalls, storm surge and wave overtopping, and the  
5447 vulnerability of critical infrastructure and historically significant structures to flooding (Fischbach et al.,  
5448 2017). This comprehensive approach helps in understanding the complex interplay of factors that contribute  
5449 to flood risk in different areas.

## 5450 **UNSUSTAINABLE INSURANCE COSTS**

5451 Insurance costs in southern coastal areas, particularly for flood and property insurance, have been on the  
5452 rise in recent years, creating financial challenges for homeowners and communities. This section delves into  
5453 the trends driving these costs, explores their impact on vulnerable populations, and examines potential  
5454 solutions to address this pressing issue.

5455 Louisiana has been significantly impacted by rising flood insurance rates, with many residents facing  
5456 significant increases in flood insurance rates due to the implementation of FEMA's Risk Rating 2.0 system.  
5457 This system, designed to make premiums more accurately reflect individual property risk, has led to dramatic  
5458 price hikes, particularly in high-risk coastal areas like many of the communities in the Pontchartrain Basin.  
5459 These increases have raised concerns about affordability and have led some homeowners to drop their  
5460 coverage, which could further destabilize the National Flood Insurance Program.

5461 Property insurance costs have also been on the rise. Homeowners insurance rates in Louisiana experienced  
5462 an overall increase of 3%, or \$112, from 2022 to 2023 (Gite, 2024). The average annual cost of home  
5463 insurance in Louisiana is \$2,240, which is 17% more than the national average (Schlichter, 2025). In Baton  
5464 Rouge, the average cost of home insurance is \$3,698 per year for \$300,000 in dwelling coverage (Martin,  
5465 2025).

5466 Increased frequency and intensity of hurricanes that have impacted South Louisiana and tornadoes that have  
5467 damaged areas in southern Mississippi are also a possible factor in insurance premiums on the rise.  
5468 Insurance companies also consider future projections, which take into account environmental changes.

5469 **Contributing Factors**

5470 FEMA's Risk Rating 2.0, implemented in 2021, aims to more accurately reflect flood risk in insurance  
5471 premiums. While this has led to premium decreases for some policyholders, others have experienced  
5472 significant increases, particularly those in higher-risk areas (U.S. Government Accountability Office, 2023).  
5473 This can exacerbate affordability challenges for individuals. The median annual premium for flood insurance  
5474 was \$689 in December 2022, but it needs to increase to \$1,288 to reach full risk (U.S. Government  
5475 Accountability Office, 2023).

5476 Several other factors contribute to rising insurance costs in Louisiana:

- 5477 ● **Increased Frequency and Severity of Natural Disasters:** Louisiana's vulnerability to hurricanes,  
5478 floods, and other natural disasters has increased in recent years, leading to more frequent and costly  
5479 insurance claims (Henry Insurance, 2024).
- 5480 ● **Rising Costs of Repairs and Rebuilding:** Increased construction expenses, material shortages, and  
5481 supply chain disruptions have driven up the cost of repairing and rebuilding homes, leading to higher  
5482 insurance premiums (Henry Insurance, 2024).
- 5483 ● **Insurance Company Insolvency:** The financial strain from mounting claims has led to the insolvency  
5484 of several insurance companies in Louisiana (Duvall, 2024), reducing competition and driving up  
5485 costs. This creates a vicious cycle where fewer insurers are willing to take on the risk of covering  
5486 properties in high-risk areas, leading to higher premiums for those who can find coverage.
- 5487 ● **Environmental Changes:** The growing awareness of environmental trends in the region and their  
5488 potential to exacerbate flooding and other natural disasters is also influencing insurance costs (Dan  
5489 Burghardt Insurance, 2024). As the frequency and severity of extreme weather events increase,  
5490 insurers are adjusting their risk assessments and premiums accordingly.
- 5491 ● **Reinsurance Costs:** Reinsurance plays a significant role in the cost of homeowners insurance. As the  
5492 cost of reinsurance has been rising, particularly in regions like Louisiana that have a high risk of  
5493 natural disasters, these increased costs are passed down to policyholders in the form of higher  
5494 premiums (Dan Burghardt Insurance, 2024).
- 5495 ● **Factors Affecting Flood Insurance Rates:** Several factors influence flood insurance rates, including  
5496 elevation above sea or river level, the height of the home's lowest floor, the presence of a basement,  
5497 distance from a body of water, the presence of flood vents, coverage levels, and deductible amounts  
5498 (Kleinpeter Schwartzberg Boutwell, n.d.). Flood mitigation tools, such as levees, can also play a role  
5499 in determining premiums.

5500 **Impact on Communities**

5501 Rising insurance costs disproportionately burden low-income communities that often face socioeconomic  
5502 challenges, including a higher likelihood of residing in areas more susceptible to flooding and other hazards.  
5503 As insurance premiums rise, these residents face difficult choices and consequences:

- 5504 ● **Reduced Access to Housing:** Higher insurance costs can make it more challenging for low- and  
5505 moderate-income families to afford housing, especially in areas with already high housing costs. This  
5506 can lead to displacement and exacerbate existing inequalities. For example, a family may be forced

5507 to move to a less desirable neighborhood with lower housing costs but potentially higher crime rates  
5508 or fewer amenities.

- 5509 ● **Increased Financial Strain:** As insurance premiums consume a larger portion of household budgets,  
5510 some families may be forced to cut back on essential expenses like food, healthcare, and education  
5511 (Artiga et al., 2017). This can create a cycle of poverty and limit opportunities for upward mobility.  
5512 Children in these families may have less access to nutritious food, quality healthcare, and  
5513 educational resources, hindering their development and prospects.
- 5514 ● **Limited Access to Insurance:** In some cases, rising costs may make insurance unaffordable, leaving  
5515 some communities with less protection against financial losses from floods and other disasters  
5516 (Sullivant et al., 2024). This can have devastating consequences in the wake of catastrophic events.  
5517 Without insurance, families may struggle to rebuild their homes and lives, potentially leading to long-  
5518 term financial hardship and displacement.
- 5519 ● **Exacerbation of Existing Inequalities:** Rising insurance costs can worsen existing inequalities by  
5520 disproportionately impacting vulnerable populations, including renters, those on fixed incomes, and  
5521 communities of color (Sullivant et al., 2024). This can further marginalize these groups and limit their  
5522 access to safe and affordable housing. For instance, renters may face rent increases as landlords  
5523 pass on the higher cost of insurance, further straining their budgets.
- 5524 ● **Impact on Affordable Housing Developers:** Rising insurance costs are not only affecting individual  
5525 homeowners but also affordable housing developers. These developers are facing challenges like  
5526 program cuts, staff layoffs, and the sale of properties due to the increasing financial burden of  
5527 insurance (Schneider, 2024). This can further reduce the availability of affordable housing options for  
5528 some communities.
- 5529 ● **Credit Score Impact:** In Louisiana, credit scores play a significant role in determining insurance rates.  
5530 Those with poor credit pay an average of \$4,010 per year for homeowners insurance, 79% more than  
5531 those with good credit (Schlichter, 2025). This practice can exacerbate existing inequalities by  
5532 making insurance more expensive for those who can least afford it, potentially trapping them in a  
5533 cycle of poverty.
- 5534 ● **Potential "Tipping Point":** A "tipping point" where high-risk areas become uninsurable due to repeated  
5535 natural disasters could lead to increased displacement and economic decline, particularly in  
5536 communities that are already vulnerable to environmental changes and their impacts (Sullivant et al.,  
5537 2024).

## 5538 Water Management: Resilience and Economic Impacts

5539 Water management is a critical aspect of community resilience, ensuring the availability of clean and safe  
5540 water for various needs. However, water management as an industry in the Pontchartrain Basin faces  
5541 challenges posed by regional workforce shortages and a lack of adequate training programs to replace  
5542 retiring professionals. There is also a lack of awareness of the issue and where the issue may exist.  
5543 Anecdotally, water management roles are currently filled by an aging population, and the number of new  
5544 entrants into the field is not adequate to take these roles in the future. This issue is more prominent in rural  
5545 areas with limited resources and smaller systems that rely on only a few people. This section examines the  
5546 current state of water management as a career, explores industry trends, identifies opportunities presented  
5547 by the workforce shortage, and discusses the reasons why these opportunities are not being fully utilized.

5548 **INFRASTRUCTURE ISSUES: INDEPENDENT WATER SYSTEMS**

5549 Many rural communities in the Pontchartrain Basin rely on small, independent water systems that operate  
5550 without the benefit of being tied into larger, more extensive infrastructure networks. These systems often rely  
5551 on a combination of groundwater wells and surface water sources, coupled with localized treatment and  
5552 distribution facilities. Due to their remote locations and smaller service populations, these systems face  
5553 unique challenges in terms of maintenance, operation, and long-term sustainability.

5554 When a community depends on a small, independent water treatment facility, the departure of experienced  
5555 personnel can pose a significant risk. Anecdotal research suggests that in the Pontchartrain Basin, these  
5556 jobs are occupied by an older population without an adequate amount of expertise to replace these water  
5557 management specialists.

5558 Water treatment is a complex process that demands specialized knowledge to ensure safe and reliable  
5559 service. If long-time workers retire and their positions remain unfilled, crucial expertise and institutional  
5560 knowledge walk out the door with them. This can lead to a decline in the quality of the water, as the intricate  
5561 treatment process requires careful operation and maintenance of sophisticated equipment.

5562 **Aging Infrastructure**

5563 Much of the water infrastructure in the United States is aging and in need of repair or replacement (Mills,  
5564 2023). This aging infrastructure poses challenges to water quality, reliability, and efficiency. The cost of  
5565 upgrading this infrastructure has been rising sharply, as shown in Table 26 (Mills, 2023).

5566 **Table 26. Rising cost of infrastructure upgrades.**

ASSESSMENT YEAR	TOTAL NATIONAL NEED (CURRENT YEAR \$)	TOTAL NATIONAL NEED (2021 \$)	NOMINAL PERCENT CHANGE FROM PREVIOUS ASSESSMENT
1995	\$137.1B	\$292.8B	-
1999	\$148.7B	\$288.2B	8.5%
2003	\$274.3B	\$484.6B	84.5%
2007	\$331.9B	\$489.7B	21.0%
2011	\$380.9B	\$495.5B	14.8%
2015	\$468.8B	\$546.6B	23.1%
2021	\$625.0B	\$625.0B	33.3%

5567 **WORKFORCE ISSUES: WATER MANAGEMENT IN THE BASIN**

5568 Without skilled technicians to ensure proper function and address any malfunctions, the water supply  
5569 becomes vulnerable to contamination. As outlined in the Water Quality section of this report, disease-  
5570 causing pathogens, harmful chemicals, and excessive minerals could all slip through a poorly maintained  
5571 system, posing a direct threat to public health. Furthermore, service disruptions are more likely to occur,  
5572 leaving residents and businesses without a consistent source of clean water.

5573 In the event of an emergency, like a natural disaster or equipment failure, the lack of experienced personnel  
5574 can severely hinder the community's ability to respond effectively. Troubleshooting complex issues and  
5575 restoring the water system quickly and safely become much more difficult without the seasoned judgment of  
5576 trained operators.

5577 This situation also raises concerns about the long-term sustainability of the water system. Attracting and  
5578 retaining qualified personnel in rural areas with limited labor pools can be a challenge, especially when  
5579 competing with larger systems that offer better pay and benefits. The financial burden of training new staff  
5580 and upgrading aging equipment can also strain the resources of a small, independent facility.

5581 Ultimately, a community relying on such a facility faces the risk of declining water quality, service  
5582 disruptions, and increased vulnerability to emergencies. This can lead to serious public health  
5583 consequences, economic impacts, and a loss of trust in the local water system. To mitigate these risks,  
5584 proactive measures like succession planning, regional partnerships, investment in training and technology,  
5585 and community engagement are essential.

## 5586 **Water Management Workforce Needs**

5587 Water management encompasses a wide range of professions that involve the sustainable use,  
5588 development, and protection of water resources. These professionals play a crucial role in ensuring the  
5589 availability of clean water for drinking, sanitation, irrigation, and industrial purposes. Some common water  
5590 management positions include:

- 5591 ● **Water resource specialists** who assess water availability, develop conservation strategies, and  
5592 manage water rights.
- 5593 ● **Water treatment plant and system operators** who manage the day-to-day operations of water  
5594 treatment facilities, ensuring that water meets quality standards.
- 5595 ● **Hydrologists** who study the movement, distribution, and quality of water, providing valuable insights  
5596 for water management planning.
- 5597 ● **Environmental engineers** who design and implement solutions for water pollution control and  
5598 wastewater treatment.
- 5599 ● **Water resource engineers** who design and construct water infrastructure, such as dams, canals, and  
5600 pipelines.

## 5601 **Education and Training for Water Management Careers**

5602 Educational requirements for entry-level water management positions generally include a bachelor's degree  
5603 in a related field, such as environmental science, engineering, or hydrology (National Center for O\*NET  
5604 Development, n.d.). However, some positions, like water treatment plant operators, may accept an associate  
5605 degree or certificate in water quality and wastewater treatment technology. For many water management  
5606 roles, a bachelor's degree is not a strict requirement (Career Ready News Center, n.d.). Water treatment plant  
5607 operators, for example, typically need a high school diploma or equivalent, along with on-the-job training and  
5608 licensure (U.S. Bureau of Labor Statistics, n.d.). Obtaining certifications, such as the Certified Water

5609 Professional credential offered by the American Water Works Association, can also enhance career  
5610 prospects (American Water Works Association (AWWA), 2018).

## 5611 **Growing Demand**

5612 Population growth and urbanization increase water demand for domestic, industrial, and agricultural  
5613 purposes (Biswas et al., 2023). This growing demand strains existing water resources, particularly in water-  
5614 stressed regions. There is a distinction between physical water scarcity, resulting from inadequate natural  
5615 water resources, and economic water scarcity, stemming from a lack of infrastructure and technology to  
5616 access and distribute water (Akvo, 2024). Water managers must find ways to meet this increasing demand  
5617 while ensuring the long-term sustainability of water resources, considering both the availability of water and  
5618 the capacity to manage it effectively.

## 5619 **Workforce Development Challenges**

### 5620 **Lack of Awareness of Career Opportunities**

5621 Many individuals are unaware of the diverse career paths available in water management. This lack of  
5622 awareness contributes to the perception that water management jobs are low-paying or undesirable (Loyola  
5623 University Center for Environmental Communication, n.d.). Furthermore, there is a misconception that a four-  
5624 year college degree is always required for these positions, which may discourage some individuals from  
5625 considering this career path. Additionally, there is a general lack of awareness around this growing need in  
5626 the Pontchartrain Basin.

### 5627 **Funding**

5628 Limited funding for training and education programs restricts the development of a skilled workforce. This is  
5629 particularly challenging in small municipalities with limited resources (Loyola University Center for  
5630 Environmental Communication, n.d.). To create more resilient communities, water management must be a  
5631 high funding priority.

## 5632 **Tourism as an Economic Driver**

5633 The Pontchartrain Basin faces the challenge of balancing the benefits of tourism with the potential impacts  
5634 on its unique cultural heritage. This section examines the economic and cultural aspects of tourism in the  
5635 basin, explores community perspectives, and identifies strategies for sustainable tourism development that  
5636 prioritize cultural preservation.

5637 While there is significant overlap between the recreational opportunities described earlier in this section and  
5638 the tourism opportunities available to people in the Pontchartrain Basin, this section focuses on the tourism  
5639 industry and the challenges that come with it. The Pontchartrain Basin is home to a wide range of industries  
5640 across its different geographic regions, but tourism is one that is a common thread throughout. While the  
5641 urban tourism industry that drives millions to the New Orleans French Quarter is significantly different from

5642 the offshore fishing opportunities in Venice or the rivers and trails that draw visitors to the Pike County Amite  
5643 River Nature Trail, these visitors can all provide an economic stimulant for their respective areas.

## 5644 **ECONOMIC IMPACT OF TOURISM IN THE PONTCHARTRAIN BASIN**

5645 Tourism plays a significant role in the economy of the Pontchartrain Basin. In 2022, Louisiana welcomed  
5646 42.6 million domestic and international visitors, generating \$17.1 billion in visitor spending. This spending  
5647 resulted in \$1.9 billion in state and local tax revenue, effectively saving each Louisiana household an  
5648 additional \$377 (Louisiana Office of Tourism, 2013). Visitor spending is categorized by travel-related  
5649 categories, including lodging, restaurants/meals, and bars (Hossain, 2023). The travel and tourism industry  
5650 in Louisiana created jobs equivalent to 7.4% of all jobs in the state in 2022 (Tourism Economics, 2023).

5651 In 2016, tourism in Louisiana generated \$16.8 billion in economic impact, supported 226,000 jobs, and  
5652 generated \$1.7 billion in state and local tax revenue (Tourism Economics, 2016). Tourism-related businesses  
5653 in the Pontchartrain Basin provide a range of services, including accommodations, restaurants, attractions,  
5654 and transportation. These businesses generate revenue, create jobs, and contribute to the overall economic  
5655 well-being of the region. For example, the St. Tammany Parish Tourist and Convention Commission actively  
5656 promotes the Northshore's festivals, culture, cuisine, and quality of life to attract visitors. These visitors  
5657 generate tax revenue that saves residents more than \$1,100 in annual state and local taxes.

## 5658 **CULTURAL IMPACT OF TOURISM**

5659 While tourism provides economic benefits, it can also impact the cultural identity of the Pontchartrain Basin.  
5660 The Resilient Communities Work Group discussed how tourism can lead to the commodification of culture,  
5661 where traditions and practices are transformed into marketable products for tourists. This can dilute the  
5662 authenticity of tourist experiences by prioritizing profit-oriented offerings over genuine cultural engagement  
5663 and creates local friction. The economic benefits of tourism can sometimes come at the cost of cultural  
5664 authenticity and social disruption. The influx of tourists can also disrupt local communities, leading to social  
5665 tensions and altered lifestyles. Destinations may become more commercialized to cater to tourists,  
5666 potentially causing a loss of traditional culture and values.

## 5667 **Community Attitudes Towards Tourism**

5668 Understanding local attitudes towards tourism is crucial for sustainable tourism development. Areas with a  
5669 high percentage of land dedicated to tourism-related activities may experience more significant social and  
5670 cultural changes due to tourism.

5671 On the Northshore of Lake Pontchartrain, the St. Tammany Parish Tourist and Convention Commission, a  
5672 public agency funded by a hotel occupancy tax and a portion of the state sales tax levied on lodging, works  
5673 to promote tourism in the area. This suggests a level of community support for tourism development. The  
5674 tourism industry supports numerous local businesses in the surrounding parishes, creating more economic  
5675 benefits and better preparation for economic downturns. However, it is important to consider the potential  
5676 concerns of residents regarding the impact of tourism on their daily lives and cultural heritage, particularly in  
5677 areas with high tourism activity.

## 5678 ENVIRONMENTAL IMPACT OF TOURISM

5679 While tourism can bring economic benefits, it also exerts significant pressure on the environment of the  
5680 Pontchartrain Basin, a region already facing acute ecological challenges. Coastal Louisiana, encompassing  
5681 much of the Basin, is exceptionally vulnerable, experiencing some of the highest rates of relative sea level  
5682 rise and coastal land loss globally due to factors like subsidence (e.g., Couvillion et al., 2017; CPRA, 2023).  
5683 Tourism development can exacerbate these environmental stresses. The construction of tourism-related  
5684 infrastructure, such as hotels, resorts, marinas, roads, and recreational facilities, often leads to habitat  
5685 conversion, increased impervious surface area contributing to polluted runoff, and alteration of coastal  
5686 processes (United Nations Environment Programme, 2023). Furthermore, accommodating visitors  
5687 significantly increases local resource consumption, placing greater demands on freshwater supplies, energy  
5688 (which impacts air quality and carbon emissions), and local ecosystems beyond the needs of the resident  
5689 population (Gössling, 2002). Tourism activities also inevitably lead to increased waste generation, including  
5690 solid waste that can strain local landfill capacity, litter that pollutes waterways and natural areas, and  
5691 potentially higher loads on wastewater treatment systems (e.g., Tudor et al., 2002; Jambeck et al., 2015).  
5692 Therefore, careful planning and sustainable management practices are crucial to mitigate these negative  
5693 environmental impacts and ensure that tourism activities do not further compromise the ecological integrity  
5694 of the vulnerable Pontchartrain Basin.

## 5695 Concluding Remarks on Resilient Communities

5696 The Resilient Communities section of this report identifies challenges concerning education, awareness, and  
5697 engagement related to the Pontchartrain Basin's ecological health. It directly addresses the CCMP goal of  
5698 increasing awareness by highlighting a lack of unified messaging, insufficient public empowerment, and an  
5699 undervaluing of the basin's significance as key barriers. It also notes that while past efforts focused near  
5700 Lake Pontchartrain raised awareness, communities further away from Lake Pontchartrain often lack  
5701 understanding of their connection and impact on the broader system. Characterizing these specific gaps lays  
5702 the groundwork for actions aimed at fostering active public participation in environmental sustainability  
5703 efforts throughout the entire basin.

5704 *Resilient Communities Objective 1: Educate the public on the effects of the changing ecological health of the*  
5705 *basin to promote responsible stewardship.*

5706 The Resilient Communities section of this report underscores the current lack of necessary educational  
5707 materials and low levels of public understanding. It details specific knowledge gaps regarding issues like  
5708 home septic system maintenance, the direct impact of stormwater runoff, the consequences of improper  
5709 chemical use and waste disposal, and the importance of groundwater protection. It also outlines how  
5710 improved awareness could lead to behavioral changes, such as reduced fertilizer use and proper waste  
5711 disposal, directly promoting responsible stewardship by illustrating how individual actions impact the basin's  
5712 overall health.

5713 *Resilient Communities Objective 2: Identify and promote local efforts to improve the ecological health of the*  
5714 *basin.*

5715 While acknowledging the existence of various organizations working towards this objective, the Resilient  
5716 Communities section of this report points out that their lack of coordinated efforts and lack of unified  
5717 messaging can dilute overall impact and awareness of the PRP itself. Promoting awareness of existing local  
5718 successes is implicitly suggested as a pathway toward achieving broader ecological health.

5719 *Resilient Communities Objective 3: Promote increased public participation in water quality improvement and*  
5720 *habitat restoration projects.*

5721 Finally, the Resilient Communities section of this report identifies the factors hindering achievement of this  
5722 objective, such as inadequate public empowerment, lack of accessible information, and potential distrust  
5723 towards governing bodies. It argues that overcoming these barriers through improved, unified messaging  
5724 and targeted outreach to all communities is essential. Increased awareness of the basin's importance, its  
5725 specific environmental issues, and the connection between individual actions and ecological health will  
5726 naturally lead to greater public involvement in water quality improvements and habitat restoration projects.

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# ATTACHMENT A. GROUNDWATER AND SURFACE WATER WITHDRAWAL

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**Table 27. Groundwater and surface water withdrawal by parish and aquifer in millions of gallons per day in 2015 (Collier & Sargent, 2018).**

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Note: Ascension (ASC), East Baton Rouge (EBR), East Feliciana (EFC), Iberville (IBV), Jefferson (JFS), Livingston (LVS), Orleans (ORL), Plaquemines (PLQ), St. Bernard (STB), St. Charles (STC), St. Helena (STH), St. James (STJ), St. John the Baptist (STB), St. Tammany (STT), Tangipahoa (TNG), Washington (WSH). Withdrawals ranging from 0 to 0.005 million gallons per day are marked as 0.00, with N/A representing no withdrawals.

<b>WITHDRAWAL (MILLION GALLONS PER DAY)</b>	<b>ASC</b>	<b>EBR</b>	<b>EFC</b>	<b>IBV</b>	<b>JFS</b>	<b>LVS</b>	<b>ORL</b>	<b>PLQ</b>	<b>STB</b>	<b>STC</b>	<b>STH</b>	<b>STJ</b>	<b>SJB</b>	<b>STT</b>	<b>TNG</b>	<b>WSH</b>
Total	188.88	169.81	3.51	533.28	813.11	13.93	414.11	60.91	214.05	2398.13	1.61	184.11	79.76	29.71	19.63	27.73
Groundwater	6.22	153.12	3.34	29.6	6.47	13.89	12.01	0.05	0.02	1.17	1.6	0.03	13.24	29.57	19.39	23.04
Mississippi River Alluvial Aquifer	0.13	0.04	N/A	25.44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02	N/A	N/A	N/A	N/A
Chicot Equivalent Aquifer System	6.09	17.02	0.34	3.71	6.47	2.92	12.01	0.05	0.02	1.17	0.91	0.01	8.73	5.99	3.93	7.16
Evangeline Equivalent Aquifer System	N/A	64.82	0.25	N/A	N/A	5.3	N/A	N/A	N/A	N/A	N/A	N/A	4.51	16.71	3.64	0.15
Jasper Equivalent Aquifer System	N/A	71.24	2.15	0.45	N/A	5.67	N/A	N/A	N/A	N/A	0.69	N/A	N/A	6.87	11.82	15.73
Catahoula Aquifer	N/A	N/A	0.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Surface water	182.66	16.69	0.17	503.68	806.64	0.04	402.1	60.86	214.03	2396.96	0.01	184.08	66.52	0.14	0.24	4.69
Lake Pontchartrain - Lake Maurepas	0.01	0.01	0.17	N/A	N/A	0.04	N/A	N/A	N/A	N/A	0.01	2.89	N/A	0.12	0.24	0.01
Mississippi River Mainstem	181.28	16.68	N/A	503.68	806.6	N/A	140.9	60.81	214.03	2396.93	N/A	179.94	66.36	N/A	N/A	N/A
Mississippi River Delta	1.37	N/A	N/A	N/A	0.04	N/A	261.2	0.05	N/A	0.03	N/A	1.25	0.16	N/A	N/A	N/A

WITHDRAWAL (MILLION GALLONS PER DAY)	ASC	EBR	EFC	IBV	JFS	LVS	ORL	PLQ	STB	STC	STH	STJ	SJB	STT	TNG	WSH
Pearl River	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.02	N/A	4.68

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5907 **Table 28: Groundwater and surface water extraction by sector in millions of gallons per day in 2015 (Collier & Sargent, 2018).**

5908 Note: Ascension (ASC), East Baton Rouge (EBR), East Feliciana (EFC), Iberville (IBV), Jefferson (JFS), Livingston (LVS), Orleans (ORL), Plaquemines (PLQ), St. Bernard (STB), St. Charles  
 5909 (STC), St. Helena (STH), St. James (STJ), St. John the Baptist (STB), St. Tammany (STT), Tangipahoa (TNG), Washington (WSH). Withdrawals ranging from 0 to 0.005 million gallons per  
 5910 day are marked as 0.00, with N/A representing no withdrawals.

WITHDRAWAL (MILLION GALLONS PER DAY)	ASC	EBR	EFC	IBV	JFS	LVS	ORL	PLQ	STB	STC	STH	STJ	SJB	STT	TNG	WSH
Total	188.89	169.81	3.5	541.51	813.12	13.93	414.12	60.9	214.05	2398.14	1.61	184.09	79.77	29.7	19.64	27.75
Industrial	183	89.27	0.03	390.26	6.46	0.01	0.89	53.66	206.86	596.3	0.03	178.48	72.07	0.13	1.17	21.13
Public supply	2.66	72.21	2.84	1.98	61.79	11.55	140.9	7.14	7.16	9.09	0.9	4	7.45	24.04	15.07	4.63
Rural domestic	2.69	0.24	0.27	0.15	0.03	2	0.21	0.05	0.01	0.02	0.52	0.01	0.08	5.28	2.86	1.36
Aquaculture	N/A	0.22	N/A	8.56	N/A	0.26	N/A	N/A	N/A	N/A	N/A	1.25	N/A	0.08	N/A	N/A
Livestock	0.09	0.08	0.11	0.05	0.04	0.1	0.01	0.05	0.02	0.02	0.14	0.01	0.01	0.15	0.34	0.24
Power generation	N/A	7.4	N/A	139.03	744.77	N/A	272.06	N/A	N/A	1792.66	N/A	N/A	N/A	N/A	N/A	N/A
General irrigation	0.45	0.39	0.25	1.48	0.03	0.01	0.05	0	N/A	0.05	0.02	0.34	0.16	0.02	0.2	0.39

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## ATTACHMENT B. INDUSTRY FARM VALUES BY PARISH

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**Table 29. Gross farm value of industries for parishes within the PRP boundary (LSU AgCenter, 2023).**

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Note: M = million, K = thousand

PARISH	BEEF	AQUACULTURE	MARINE FISHERIES	DAIRY	HORSES	PRODUCE
Ascension	\$5M–\$10M	none	< \$10M	none	\$10M–\$20M	\$13M–\$20M
East Baton Rouge	\$5M–\$10M	none	< \$10M	none	\$2M–\$4.5M	\$20M–\$40M
East Feliciana	\$10M–\$20M	none	none	< \$200K	\$4.5M–\$10M	< \$3M
Iberville	\$5M–\$10M	none	none	< \$200K	\$2M–\$4.5M	< \$3M
Jefferson	< \$5M	< \$5M	\$10M–\$25M	none	< \$2M	\$20M–\$40M
Livingston	\$5M–\$10M	\$20M–\$30M	none	none	\$10M–\$20M	\$13M–\$20M
Orleans	none	none	< \$10M	none	\$2M–\$4.5M	\$20M–\$40M
Plaquemines	< \$5M	\$20M–\$30M	\$50M–\$110M	none	< \$2M	\$10M–\$20M
St. Bernard	< \$5M	\$10M–\$20M	\$25M–\$50M	none	< \$2M	\$3M–\$6M
St. Charles	< \$5M	none	< \$10M	none	< \$2M	\$10M–\$20M
St. Helena	\$10M–\$20M	none	none	\$1M–\$3M	< \$2M	< \$3M
St. James	< \$5M	none	< \$10M	none	< \$2M	< \$3M
St. John the Baptist	< \$5M	none	< \$10M	none	< \$2M	\$3M–\$6M
St. Tammany	< \$5M	< \$5M	< \$10M	none	\$20M–\$50M	\$20M–\$40M
Tangipahoa	\$10M–\$20M	< \$5M	< \$10M	\$3M–\$15M	\$4.5M–\$10M	\$20M–\$40M
Washington	\$10M–\$20M	none	< \$10M	\$3M–\$15M	\$10M–\$20M	\$3M–\$6M

5915

# ATTACHMENT C. TRAWL SURVEY DATA

5917 **Table 30. Species caught in LDWF trawl surveys (1994-2018) across Pontchartrain Basin**  
 5918 **(from Murawski et al., 2021).**

5919 Note: Species groups - FW = freshwater species, FF = finfishes, INV = invertebrates.

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Alligator Gar	<i>Atractosteus spatula</i>	FW
American Eel	<i>Anguilla rostrata</i>	FW
Arrow Crab	<i>Stenorhynchus seticornis</i>	INV
Atlantic Brief Squid	<i>Lolliguncula brevis</i>	INV
Atlantic Bumper	<i>Chloroscombrus chrysurus</i>	FF
Atlantic Croaker	<i>Micropogonias undulatus</i>	FF
Atlantic Cutlassfish	<i>Trichiurus lepturus</i>	FF
Atlantic Herring	<i>Clupea harengus</i>	FF
Atlantic Marsh Fiddler	<i>Uca pugnax</i>	INV
Atlantic Midshipman	<i>Porichthys porosissimus</i>	FF
Atlantic Moonfish	<i>Selene setapinnis</i>	FF
Atlantic Mud Crab	<i>Panopeus herbstii</i>	INV
Atlantic Needlefish	<i>Strongylura marina</i>	FF
Atlantic Sharpnose shark	<i>Rhizoprionodon terraenovae</i>	FF
Atlantic Spadefish	<i>Chaetodipterus faber</i>	FF
Atlantic Stingray	<i>Hypanus sabinus</i>	FF
Atlantic Thread herring	<i>Opisthonema oglinum</i>	FF
Atlantic Threadfin	<i>Polydactylus octonemus</i>	FF
Banded Drum	<i>Larimus fasciatus</i>	FF
Bank Cusk Eel	<i>Ophidion holbrookii</i>	FF
Bay Anchovy	<i>Anchoa mitchilli</i>	FF
Bay Whiff	<i>Citharichthys spilopterus</i>	FF
Bigeye Searobin	<i>Prionotus longispinosus</i>	FF
Bighead Searobin	<i>Prionotus tribulus</i>	FF
Bigmouth Buffalo	<i>Ictiobus cyprinellus</i>	FW
Bigmouth Sleeper	<i>Gobiomorus dormitor</i>	FW
Black Drum	<i>Pogonias cromis</i>	FF
Blackcheek Tonguefish	<i>Symphurus plagiusa</i>	FF
Blackedge Cusk Eel	<i>Lepophidium brevibarbe</i>	FF

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Blackwing Searobin	<i>Prionotus rubio</i>	FF
Blue Catfish	<i>Ictalurus furcatus</i>	FW
Blue Crab	<i>Callinectes sapidus</i>	INV
Blue Runner	<i>Caranx crysos</i>	FF
Bluefish	<i>Pomatomus saltatrix</i>	FF
Bluegill	<i>Lepomis macrochirus</i>	FW
Bluntnose Jack	<i>Hemicaranx amblyrhynchus</i>	FF
Bonnethead Shark	<i>Sphyrna tiburo</i>	FF
Brown Rock Shrimp	<i>Sicyonia brevirostris</i>	INV
Brown Shrimp	<i>Farfantepenaeus aztecus</i>	INV
Butterfish	<i>Peprilus triacanthus</i>	FF
Carp	<i>Cyprinus carpio</i>	FW
Catfish	<i>Ictalurus spp.</i>	FW
Chain Pipefish	<i>Syngnathus louisianae</i>	FF
Channel Catfish	<i>Ictalurus Punctatus</i>	FW
Clown Goby	<i>Microgobius gulosus</i>	FF
Clupeids	Family Clupeidae	FF
Cobia	<i>Rachycentron canadum</i>	FF
Code Goby	<i>Gobiosoma robustum</i>	FF
Cownose Ray	<i>Rhinoptera bonasus</i>	FF
Crab spp.	<i>Petrolisthes spp.</i>	INV
Crappie	<i>Pomoxis spp.</i>	FW
Crawfish	<i>Cambarus spp.</i>	INV
Crested Blenny	<i>Hypleurochilus geminatus</i>	FF
Crested Cusk Eel	<i>Ophidion welshi</i>	FF
Crevalle Jack	<i>Caranx hippos</i>	FF
Darter Goby	<i>Ctenogobius boleosoma</i>	FF
Delta Shrimp	<i>Palaemon longirostris</i>	INV
Diamond Killifish	<i>Adinia xenica</i>	FF
Diamondback terrapin	<i>Malaclemys terrapin</i>	FW
Dusky Anchovy	<i>Anchoa lyolepis</i>	FF
Dwarf Sandperch	<i>Diplectrum bivittatum</i>	FF
Eastern Oyster	<i>Crassostrea virginica</i>	INV
Eel spp.	Order Anguilliformes	FF
False Arrow Crab	<i>Metoporphaphis calcarata</i>	INV

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Fat Sleeper	<i>Dormitator maculatus</i>	FF
Feather Blenny	<i>Hypsoblennius hentzi</i>	FF
Flathead Catfish	<i>Pylodictis olivaris</i>	FW
Florida Pompano	<i>Trachinotus carolinus</i>	FF
Florida Stone Crab	<i>Menippe mercenaria</i>	INV
Flounder spp.	Order <i>Pleuronectiformes</i>	FF
Freckled Blenny	<i>Hypsoblennius lonthas</i>	FF
Freshwater Drum	<i>Aplodinotus grunniens</i>	FW
Freshwater Goby	<i>Gobionellus shufeldti</i>	FW
Frillfin Goby	<i>Bathygobius soporator</i>	FF
Fringed Flounder	<i>Etropus crossotus</i>	FF
Furrowed Mud Crab	<i>Panopeus occidentalis</i>	INV
Gafftopsail Catfish	<i>Bagre marinus</i>	FF
Gizzard Shad	<i>Dorosoma cepedianum</i>	FF
Goby spp.	Family <i>Gobiidae</i>	FF
Grass Shrimp spp.	<i>Palaemonetes</i> spp.	INV
Gray Snapper	<i>Lutjanus griseus</i>	FF
Greater Amberjack	<i>Seriola dumerili</i>	FF
Green Goby	<i>Microgobius thalassinus</i>	FF
Green Snapping shrimp	<i>Alpheus normanni</i>	INV
Green Sunfish	<i>Lepomis cyanellus</i>	FW
Guaguanche	<i>Sphyaena guachancho</i>	FF
Gulf Butterfish	<i>Peprilus burti</i>	FF
Gulf Hake	<i>Urophycis cirrata</i>	FF
Gulf Killifish	<i>Fundulus grandis</i>	FF
Gulf Kingfish	<i>Menticirrhus littoralis</i>	FF
Gulf Menhaden	<i>Brevoortia patronus</i>	FF
Gulf Pipefish	<i>Syngnathus scovelli</i>	FF
Gulf Stone Crab	<i>Menippe adina</i>	INV
Gulf Toadfish	<i>Opsanus beta</i>	FF
Harris Mud Crab	<i>Rhithropanopeus harrisi</i>	INV
Harvestfish	<i>Peprilus alepidotus</i>	FF
Herring spp.	Family <i>Clupeidae</i>	FF
Hogchoker	<i>Trinectes maculatus</i>	FF
Inland Silverside	<i>Menidia beryllina</i>	FF

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Inshore Lizardfish	<i>Synodus foetens</i>	FF
Iridescent Swimming crab	<i>Portunus gibbesii</i>	INV
Jack Spp.	Family <i>Carangidae</i>	FF
King Mackerel	<i>Scomberomorus cavalla</i>	FF
Ladyfish	<i>Elops saurus</i>	FF
Lane Snapper	<i>Lutjanus synagris</i>	FF
Largemouth Bass	<i>Micropterus salmoides</i>	FW
Least Puffer	<i>Sphoeroides parvus</i>	FF
Leatherjacket	<i>Oligoplites saurus</i>	FF
Lesser Blue Crab	<i>Callinectes similis</i>	INV
Lesser Rock Shrimp	<i>Sicyonia dorsalis</i>	INV
Lined Seahorse	<i>Hippocampus erectus</i>	FF
Lined Sole	<i>Achirus lineatus</i>	FF
Longfin Squid	<i>Doryteuthis pealeii</i>	INV
Longnose Anchovy	<i>Anchoa nasuta</i>	FF
Longnose Gar	<i>Lepisosteus osseus</i>	FW
Longnose Killifish	<i>Fundulus similis</i>	FF
Longnose Spider crab	<i>Libinia dubia</i>	INV
Longwrist Hermit crab	<i>Pagurus longicarpus</i>	INV
Lookdown	<i>Selene vomer</i>	FF
Madtoms	<i>Noturus</i> spp.	FW
Mantis Shrimp	<i>Squilla chydrea</i> , <i>Squilla mpusa</i>	INV
Marsh Killifish	<i>Fundulus confluentus</i>	FF
Mojarra spp.	<i>Eucinostomus</i> spp.	FF
Mosquito Fish	<i>Gambusia</i> spp.	FF
Mud Crab Spp.	<i>Micropanope xanthiformes</i>	INV
Naked Goby	<i>Gobiosoma boscii</i>	FF
Net Clinger	<i>Acetes americanus</i>	INV
Ocellated Flounder	<i>Ancylosetta quadrocellata</i>	FF
Offshore Lizardfish	<i>Synodus poeyi</i>	FF
Palaemonetes paludosus	<i>Palaemonetes</i>	INV
Pancake Batfish	<i>Halieutichthys aculeatus</i>	FF
Permit	<i>Trachinotus falcatus</i>	FF
Pigfish	<i>Orthopristis chrysoptera</i>	FF

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Pinfish	<i>Lagodon rhomboides</i>	FF
Pink Shrimp	<i>Penaeus duorarum</i>	INV
Pipefish	<i>Syngnathidae</i> spp.	FF
Pirate Perch	<i>Aphredoderus sayanus</i>	FW
Pistol Shrimp	<i>Alpheus floridanus, Alpheus heterochaelis</i>	INV
Planehead Filefish	<i>Stephanolepis hispidus</i>	FF
Portly Spider Crab	<i>Libinia emarginata</i>	INV
Purse Crab	<i>Persephona punctata</i>	INV
Rainwater Killifish	<i>Lucania parva</i>	FF
Red Drum	<i>Sciaenops ocellatus</i>	FF
Red Snapper	<i>Lutjanus campechanus</i>	FF
Redear Sunfish	<i>Lepomis microlophus</i>	FW
Redspotted Sunfish	<i>Lepomis miniatus</i>	FW
Remora	<i>Remora remora</i>	FF
River Shrimp	<i>Macrobrachium ohione</i>	INV
Rock Bass	<i>Ambloplites rupestris</i>	FW
Rock Sea Bass	<i>Centropristis philadelphica</i>	FF
Rough Silverside	<i>Membras martinica</i>	FF
Roughneck Shrimp	<i>Trachypeneus constrictus, Trachypeneus similis</i>	INV
Roughneck Shrimp spp.	<i>Trachypeneus</i> spp.	INV
Sailfin Molly	<i>Poecilia latipinna</i>	FW
Sand Perch	<i>Diplectrum formosum</i>	FF
Sand Seatrout	<i>Cynoscion arenarius</i>	FF
Scaled Sardine	<i>Harengula jaguana</i>	FF
Sea Catfish	<i>Arius felis</i>	FF
Seabob	<i>Xiphopenaeus kroyeri</i>	INV
Searobin spp.	<i>Prionotus</i> spp.	FF
Sergeant Major	<i>Abudefduf saxatilis</i>	FF
Sharksucker	<i>Echeneis naucrates</i>	FF
Sharptail Goby	<i>Gobionellus hastatus</i>	FF
Sheepshead	<i>Archosargus probatocephalus</i>	FF
Sheepshead Minnow	<i>Cyprinodon variegatus</i>	FF
Shortnose Gar	<i>Lepisosteus platostomus</i>	FW
Shrimp Eel	<i>Ophichthus gomesi</i>	FF

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Silver Jenny	<i>Eucinostomus gula</i>	FF
Silver Perch	<i>Bairdiella chrysoura</i>	FF
Silver Seatrout	<i>Cynoscion nothus</i>	FF
Silverjaw Minnow	<i>Notropis buccatus</i>	FW
Skilletfish	<i>Gobiesox strumosus</i>	FF
Skilletfish spp.	Family <i>Gobiesocidae</i>	FF
Skipjack Herring	<i>Alosa chrysochloris</i>	FF
Smooth Butterfly Ray	<i>Gymnura micrura</i>	FF
Smooth Puffer	<i>Lagocephalus laevigatus</i>	FF
Southern Flounder	<i>Paralichthys lethostigma</i>	FF
Southern Hake	<i>Urophycis floridana</i>	FF
Southern Kingfish	<i>Menticirrhus americanus</i>	FF
Southern Oyster Drill	<i>Stramonita haemastoma</i>	INV
Southern Puffer	<i>Sphoeroides nephelus</i>	FF
Southern Stargazer	<i>Astroscopus graecum</i>	FF
Southern Stingray	<i>Dasyatis americana</i>	FF
Spanish Mackerel	<i>Scomberomorus maculatus</i>	FF
Spanish Sardine	<i>Sardinella aurita</i>	FF
Speckled Worm Eel	<i>Myrophis punctatus</i>	FF
Spider Crab spp.	<i>Libinia</i> spp.	INV
Spinycheek Sleeper	<i>Eleotris pisonis</i>	FF
Spot	<i>Leiostomus xanthurus</i>	FF
Spotfin Mojarra	<i>Eucinostomus argenteus</i>	FF
Spotted Gar	<i>Lepisosteus oculatus</i>	FW
Spotted Seatrout	<i>Cynoscion nebulosus</i>	FF
Squid	<i>Loligo</i> spp.	INV
Squid spp.	<i>Pickfordiateuthis</i> spp.	INV
Squilla spp.	<i>Squilla</i> spp.	INV
Star Drum	<i>Stellifer lanceolatus</i>	FF
Stone Crab spp.	<i>Menippe</i> spp.	INV
Striped Anchovy	<i>Anchoa hepsetus</i>	FF
Striped Blenny	<i>Chasmodes bosquianus</i>	FF
Striped Burrfish	<i>Chilomycterus schoepfi</i>	FF
Striped Mullet	<i>Mugil cephalus</i>	FF
Striped Snapping Shrimp	<i>Alpheus ochrostriatus</i>	INV

COMMON NAME	SCIENTIFIC NAME	SPECIES GROUP
Threadfin Shad	<i>Dorosoma petenense</i>	FF
Three-Eye Flounder	<i>Ancylopsetta dilecta</i>	FF
Tripletail	<i>Lobotes surinamensis</i>	FF
Unidentified Elbow Crab	Family <i>Parthenopidae</i>	INV
Unidentified Mud Crab	Family <i>Xanthidae</i>	INV
Violet Goby	<i>Gobioides broussoneti</i>	FF
White Mullet	<i>Mugil curema</i>	FF
White Shrimp	<i>Litopenaeus setiferus</i>	INV

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# ATTACHMENT D. SGCN BY HABITAT ZONE

5921 **Table 31. SGCN by habitat zone with state (S) and global (G) conservation ranks, along with**  
 5922 **their classification meanings and types (Louisiana Department of Wildlife and Fisheries**  
 5923 **WDP, 2024).**

5924 Note: State and global ranks assess the risk of extinction or extirpation based on factors such as population size, range, threats, and  
 5925 trends. Types represent the general category of the element being evaluated. Types: A: Vertebrate Animal; C: Natural Community; I:  
 5926 Invertebrate Animal; O: Other (e.g., migratory bird stopovers, colonies); P: Plant. State Ranks: S1 (Critically Imperiled); S2 (Imperiled);  
 5927 S3 (Vulnerable); S4 (Apparently Secure); S5 (Secure); S#S# (Uncertainty about status Rank); SU (Unrankable); SH (Possibly Extirpated);  
 5928 SX (Presumed Extirpated). Global Ranks: G1 (Critically Imperiled); G2 (Imperiled); G3 (Vulnerable); G4 (Apparently Secure); G5 (Secure);  
 5929 G#G# (Uncertainty status Range Rank); GU (Unrankable); GNR (Not Ranked); G#? (Inexact Numeric Rank); G#Q (Questionable  
 5930 Taxonomy).

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Alabama Hickorynut	<i>Obovaria unicolor</i>	BRT	I	S1	G2G3
Alabama Shad	<i>Alosa alabamae</i>	BRT	A	S1	G2?
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	BRT	A	S3	G3
Arogos Skipper	<i>Atrytone arogos</i>	BRT	I	S1	G2G3
Bachman's Sparrow	<i>Peucaea aestivalis</i>	BRT	A	S3	G3
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BRT	A	S3	G5
Bay Starvine	<i>Schisandra glabra</i>	BRT	P	S3	G3
Bottomland Hardwood Forest	N/A	BRT	C	S4	G4G5
Broadstripe Topminnow	<i>Fundulus euryzonus</i>	BRT	A	S2	G3
Brou's Mallow Moth	<i>Bagisara brouana</i>	BRT	I	SU	G3
Carpet Witchgrass	<i>Dichanthelium chamaelonche</i>	BRT	P	SNR	GNR
Channel Darter	<i>Percina copelandi</i>	BRT	A	S2	G4
Clear Chub	<i>Hybopsis winchelli</i>	BRT	A	S3	G5
Clustered Black-snakeroot	<i>Sanicula odorata</i>	BRT	P	SNR	G5
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>	BRT	A	S2	G4T4
Creole Pearly-eye	<i>Lethe creola</i>	BRT	I	S3	G4
Cypress Floater	<i>Utterbackiana hartfieldorum</i>	BRT	I	S3	G4
Cypress-tupelo Swamp	N/A	BRT	C	S4	G3G5
Dusted Skipper	<i>Atrytonopsis hianna</i>	BRT	I	S3	G4G5
Dwarf Filmy Fern	<i>Trichomanes petersii</i>	BRT	P	S2	G4
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	BRT	A	S3	G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Eastern Harvest Mouse	<i>Reithrodontomys humulis</i>	BRT	A	SU	G5
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>	BRT	A	S3	G5
Elephant-ear	<i>Elliptio crassidens</i>	BRT	I	S3	G5
Fatmucket	<i>Lampsilis siliquoidea</i>	BRT	I	S2	G5
Fawnsfoot	<i>Truncilla donaciformis</i>	BRT	I	S3	G5
Four-toed Salamander	<i>Hemidactylium scutatum</i>	BRT	A	S1	G5
Gulf Coast Waterdog	<i>Necturus beyeri</i>	BRT	A	S3	GNR
Gulf Logperch	<i>Percina suttkusi</i>	BRT	A	S2	G5
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>	BRT	A	S1	G3T2T3
Hackberry-American Elm-Green Ash Bottomland Forest	N/A	BRT	C	S4	G4G5
Hardwood Slope Forest	Hardwood slope forest	BRT	C	S3	G2G3
Inflated Heelsplitter	<i>Potamilus inflatus</i>	BRT	I	S1	G1G2Q
Lace-winged Roadside-Skipper	<i>Amblyscirtes aesculapius</i>	BRT	I	S3	G4
Little Metalmark	<i>Calephelis virginiensis</i>	BRT	I	S4	G4
Long-tailed Weasel	<i>Neogale frenata</i>	BRT	A	S2	G5
Louisiana Pigtoe	<i>Pleurobema riddellii</i>	BRT	I	S1S2	G1G2
Low Erythrodes	<i>Platythelys querceticola</i>	BRT	P	S1	G3G5
Mississippi Pigtoe	<i>Pleurobema beadleianum</i>	BRT	I	S2	G3
Mixed Hardwood-loblolly Forest	N/A	BRT	C	S3	G3G4
Monarch	<i>Danaus plexippus</i>	BRT	I	S4	G4
Pascagoula Creekshell	<i>Strophitus pascagoulaensis</i>	BRT	I	S2	GNR
Powdery Thalia	<i>Thalia dealbata</i>	BRT	P	S2S3	G4
Prairie Rose	<i>Rosa setigera</i>	BRT	P	SNR	G5
Pygmy Rattlesnake	<i>Sistrurus miliarius</i>	BRT	A	S2	G5
Razor-backed Musk Turtle	<i>Sternotherus carinatus</i>	BRT	A	S3S4	G5
Red-cockaded Woodpecker	<i>Dryobates borealis</i>	BRT	A	S2	G3
Saddleback Darter	<i>Percina vigil</i>	BRT	A	S3	G5
Sand Hickory	<i>Carya pallida</i>	BRT	P	S1	G5
Silky Camellia	<i>Stewartia malacodendron</i>	BRT	P	S2	G4

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Small Stream Forest	<i>Small stream forest</i>	BRT	C	S2	G3
Smooth Softshell	<i>Apalone mutica</i>	BRT	A	S3	G5
Southeastern Shrew	<i>Sorex longirostris</i>	BRT	A	S1	G5
Southern Creekmussel	<i>Pseudodontoideus subvexus</i>	BRT	I	S1	G3
Southern Hickorynut	<i>Obovaria arkansasensis</i>	BRT	I	S1S2	G3G4
Southern Pocketbook	<i>Lampsilis ornata</i>	BRT	I	S3	G5
Southern Rainbow	<i>Villosa vibex</i>	BRT	I	S2	G5
Southern Shield Woodfern	<i>Dryopteris ludoviciana</i>	BRT	P	S2	G5
Southern Snaketail	<i>Ophiogomphus australis</i>	BRT	I	S1	G1G2
Southern Woodfern	<i>Dryopteris x australis</i>	BRT	P	SH	GNA
Spruce Pine-Hardwood Mesic Flatwoods	N/A	BRT	C	S1	G1G2
Starry Champion	<i>Silene stellata</i>	BRT	P	S2	G5
Swallow-tailed Kite	<i>Elanoides forficatus</i>	BRT	A	S1S2B	G5
Sweetgum-water Oak Bottomland Forest	N/A	BRT	C	S4	G4?
West Indian Manatee	<i>Trichechus manatus</i>	BRT	A	S1N	G2G3
Worm-eating Warbler	<i>Helmitheros vermivorum</i>	BRT	A	S3B	G5
Alabama Hickorynut	<i>Obovaria unicolor</i>	GCF	I	S1	G2G3
Alabama Shad	<i>Alosa alabamae</i>	GCF	A	S1	G2?
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	GCF	A	S3	G3
Arogos Skipper	<i>Atrytone arogos</i>	GCF	I	S1	G2G3
Bachman's Sparrow	<i>Peucaea aestivalis</i>	GCF	A	S3	G3
Bald Eagle	<i>Haliaeetus leucocephalus</i>	GCF	A	S3	G5
Baygall Caric Sedge	<i>Carex venusta</i>	GCF	P	S1	G4
Bayhead Swamp	<i>Bayhead swamp</i>	GCF	C	S3	G3?
Bent Sedge	<i>Carex styloflexa</i>	GCF	P	SNR	G4G5
Big Brown Bat	<i>Eptesicus fuscus</i>	GCF	A	S3	G5
Bigeye Shiner	<i>Notropis boops</i>	GCF	A	S3	G5
Birdbill Spikegrass	<i>Chasmanthium ornithorhynchum</i>	GCF	P	S2	G4
Bog Flame Flower	<i>Macranthera flammea</i>	GCF	P	S2	G3
Bog Moss	<i>Mayaca fluviatilis</i>	GCF	P	S2	G5
Bottomland Hardwood Forest	N/A	GCF	C	S4	G4G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Branched Hedge-hyssop	<i>Gratiola ramosa</i>	GCF	P	S1	G4G5
Broadstripe Topminnow	<i>Fundulus euryzonus</i>	GCF	A	S2	G3
Brou's Mallow Moth	<i>Bagisara brouana</i>	GCF	I	SU	G3
Carolina Clover	<i>Trifolium carolinianum</i>	GCF	P	SNR	G5
Carpenter's Ground-cherry	<i>Calliphysalis carpenteri</i>	GCF	P	S1	G3
Chapman's Beaksedge	<i>Rhynchospora chapmanii</i>	GCF	P	S3	G4
Chapman's Milkwort	<i>Polygala chapmanii</i>	GCF	P	S1	G3G5
Ciliate Beaksedge	<i>Rhynchospora ciliaris</i>	GCF	P	S3	G4
Clear Chub	<i>Hybopsis winchelli</i>	GCF	A	S3	G5
Clustered Black-snakeroot	<i>Sanicula odorata</i>	GCF	P	SNR	G5
Coastal False Asphodel	<i>Triantha racemosa</i>	GCF	P	S2S3	G5
Coastal Plain Beaksedge	<i>Rhynchospora stenophylla</i>	GCF	P	S1	G4
Coastal Plain False Foxglove	<i>Agalinis aphylla</i>	GCF	P	S1	G3G4
Coastal Plain Willow	<i>Salix caroliniana</i>	GCF	P	S1	G5
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>	GCF	A	S2	G4T4
Correll's False Dragon-head	<i>Physostegia correllii</i>	GCF	P	S1	G2
Crystal Darter	<i>Crystallaria asprella</i>	GCF	A	S2	G3
Cypress Floater	<i>Utterbackiana hartfieldorum</i>	GCF	I	S3	G4
Cypress Swamp	Cypress swamp	GCF	C	S4	G4G5
Cypress-knee Sedge	<i>Carex decomposita</i>	GCF	P	S3	G3G4
Devil's-bit	<i>Chamaelirium luteum</i>	GCF	P	S2S3	G4G5
Dwarf Filmy Fern	<i>Trichomanes petersii</i>	GCF	P	S2	G4
Earleaf Greenbrier	<i>Smilax auriculata</i>	GCF	P	S1	G4?
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>	GCF	A	SNR	G5T5
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	GCF	A	S3	G5
Eastern Hillside Seepage Bog	N/A	GCF	C	S1	G2
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>	GCF	A	S3	G5
Eastern Longleaf Pine Savanna	N/A	GCF	C	S1	G1
Eastern Slender Glass Lizard	<i>Ophisaurus attenuatus longicaudus</i>	GCF	A	SNR	G5T5
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>	GCF	A	S3	G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Eastern Upland Longleaf Pine Forest	N/A	GCF	C	S1	G1G2
Elephant-ear	<i>Elliptio crassidens</i>	GCF	I	S3	G5
Flagfin Shiner	<i>Pteronotropis signipinnis</i>	GCF	A	S2	G5
Flat-fruit Beaksedge	<i>Rhynchospora compressa</i>	GCF	P	S2	G4
Flatwoods Digger	<i>Creaserinus oryktes</i>	GCF	I	S1	G4
Flax-leaf False-foxglove	<i>Agalinis linifolia</i>	GCF	P	S2	G4?
Frecklebelly Madtom	<i>Noturus munitus</i>	GCF	A	S1	G3
Freshwater Marsh	Freshwater marsh	GCF	C	S2	G3G4
Georgia Satyr	<i>Neonympha areolatus</i>	GCF	I	S3	G3G4
Georgia Tickseed	<i>Coreopsis nudata</i>	GCF	P	S2	G3?
Giant Orchid	<i>Pteroglossaspis ecristata</i>	GCF	P	S2	G4
Glabrous Spotted Spurge	<i>Euphorbia meganaeos</i>	GCF	P	SNR	G2
Goldencrest	<i>Lophiola aurea</i>	GCF	P	S2	G4
Gopher Tortoise	<i>Gopherus polyphemus</i>	GCF	A	S1	G3
Grass Hybrid	<i>Chasmanthium x 1</i>	GCF	P	S1	GNA
Gulf Coast Waterdog	<i>Necturus beyeri</i>	GCF	A	S3	GNR
Gulf Crawfish	<i>Procambarus shermani</i>	GCF	I	S1	G4
Gulf Logperch	<i>Percina suttkusi</i>	GCF	A	S2	G5
Gulf Saltmarsh Snake	<i>Nerodia clarkii clarkii</i>	GCF	A	S3S4	G4T3
Gulf Spikemoss	<i>Selaginella ludoviciana</i>	GCF	P	S1	G3G4
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>	GCF	A	S1	G3T2T3
Hardwood Slope Forest	Hardwood slope forest	GCF	C	S3	G2G3
Harlequin Coralsnake	<i>Micrurus fulvius</i>	GCF	A	S2	G5
Hemlock Water-parsnip	<i>Sium suave</i>	GCF	P	S1	G5
Henslow's Sparrow	<i>Centronyx henslowii</i>	GCF	A	S3N	G4
Hirsute Sedge	<i>Carex hirsutella</i>	GCF	P	SNR	G5
Hodges' Clubtail	<i>Phanogomphus hodgesi</i>	GCF	I	S1	G3
Hooker's Milkwort	<i>Polygala hookeri</i>	GCF	P	S1	G3
Indian Cucumber-root	<i>Medeola virginiana</i>	GCF	P	S1	G5
King's Hairstreak	<i>Satyrrium kingi</i>	GCF	I	S3	G3G4
Lace-winged Roadside-Skipper	<i>Amblyscirtes aesculapius</i>	GCF	I	S3	G4

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Lady Lupine	<i>Lupinus villosus</i>	GCF	P	S2	G4
Large White Fringed Orchid	<i>Platanthera blephariglottis</i> var. <i>conspicua</i>	GCF	P	S1	G5T4
Lattion Joint Grass	<i>Coelorachis tessellata</i>	GCF	P	S3	G5?
Le Conte's Thistle	<i>Cirsium lecontei</i>	GCF	P	S2	G3
Leggett's Pinweed	<i>Lechea pulchella</i>	GCF	P	S1	G5
Longleaf Three-awned Grass	<i>Aristida palustris</i>	GCF	P	SNR	G4
Long-tailed Weasel	<i>Neogale frenata</i>	GCF	A	S2	G5
Louisiana Quillwort	<i>Isoetes louisianensis</i>	GCF	P	S2	G2G3
Louisiana Quillwort Habitat	Louisiana Quillwort	GCF	P	S2	G2G3
Low Nut Sedge	<i>Scleria verticillata</i>	GCF	P	S1	G5
Many-flowered Grass-pink	<i>Calopogon multiflorus</i>	GCF	P	S1	G2G3
Maryland's Black Snake-root	<i>Sanicula marilandica</i>	GCF	P	SH	G5
Michaux's Milkweed	<i>Asclepias michauxii</i>	GCF	P	S2	G4G5
Mixed Hardwood-loblolly Forest	N/A	GCF	C	S3	G3G4
Mohr Bluestem	<i>Andropogon mohrii</i>	GCF	P	S3	G4?
Mole Kingsnake	<i>Lampropeltis rhombomaculata</i>	GCF	A	S1S2	G5
Myrtle Holly	<i>Ilex myrtifolia</i>	GCF	P	S2	G5?
Night-flowering Wild Petunia	<i>Ruellia noctiflora</i>	GCF	P	S1	G3?
Odorless Bayberry	<i>Morella inodora</i>	GCF	P	S2	G4
Ornate Chorus Frog	<i>Pseudacris ornata</i>	GCF	A	SH	G4
Pale Grass-pink	<i>Calopogon pallidus</i>	GCF	P	S2	G4G5
Parrot Pitcher Plant	<i>Sarracenia psittacina</i>	GCF	P	S3	G4
Pine Flatwoods	Pine flatwoods	GCF	C	S3	G2G3
Pine Woods Littersnake	<i>Rhadinaea flavilata</i>	GCF	A	S1	G4
Pinebarrens Death-Camas	<i>Stenanthium leimanthoides</i>	GCF	P	S1	G2
Pineland Yellow-eyed Grass	<i>Xyris stricta</i>	GCF	P	S2	G4
Pondcypress-Blackgum Swamp	N/A	GCF	C	S1	G3
Pygmy Rattlesnake	<i>Sistrurus miliarius</i>	GCF	A	S2	G5
Rainbow Darter	<i>Etheostoma caeruleum</i>	GCF	A	S2	G5
Rayless Mock Goldenrod	<i>Solidago discoidea</i>	GCF	P	SNR	G4G5
Razor-backed Musk Turtle	<i>Sternotherus carinatus</i>	GCF	A	S3S4	G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Red Milkweed	<i>Asclepias rubra</i>	GCF	P	S3	G4G5
Red-cockaded Woodpecker	<i>Dryobates borealis</i>	GCF	A	S2	G3
Ribbon Crawfish	<i>Procambarus bivittatus</i>	GCF	I	S1	G5
Ringed Map Turtle	<i>Graptemys oculifera</i>	GCF	A	S2	G2
Saddleback Darter	<i>Percina vigil</i>	GCF	A	S3	G5
Sarvis Holly	<i>Ilex amelanchier</i>	GCF	P	S2	G4
Savanna Beaksedge	<i>Rhynchospora debilis</i>	GCF	P	S1	G4?
Saw Palmetto	<i>Serenoa repens</i>	GCF	P	S1	G4G5
Scalloped Milkwort	<i>Polygala crenata</i>	GCF	P	S2	G4?
Scarletsnake	<i>Cemophora coccinea</i>	GCF	A	S3S4	G5
Short-beard Plumegrass	<i>Saccharum brevibarbe</i>	GCF	P	S1	G3G5
Shortleaf Pine/oak-hickory Forest	N/A	GCF	C	S1	G2G3
Shortleaf Sneezeweed	<i>Helenium brevifolium</i>	GCF	P	S1	G4
Silky Camellia	<i>Stewartia malacodendron</i>	GCF	P	S2	G4
Slash Pine-Pondcypress/Hardwood Forest	N/A	GCF	C	S2	G2?
Slender Gayfeather	<i>Liatrix tenuis</i>	GCF	P	S1	G3
Slim Spikesedge	<i>Eleocharis elongata</i>	GCF	P	S2	G5?
Small Stream Forest	Small stream forest	GCF	C	S2	G3
Southeastern Blue Sucker	<i>Cycleptus meridionalis</i>	GCF	A	S1	G3G4
Southern Horse-balm	<i>Collinsonia serotina</i>	GCF	P	S1	G3G4
Southern Pocketbook	<i>Lampsilis ornata</i>	GCF	I	S3	G5
Southern Rainbow	<i>Villosa vibex</i>	GCF	I	S2	G5
Southern Red Lily	<i>Lilium catesbaei</i>	GCF	P	S1	G4
Southern Red Salamander	<i>Pseudotriton ruber vioscai</i>	GCF	A	S2	G5T4T5
Southern Shield Woodfern	<i>Dryopteris ludoviciana</i>	GCF	P	S2	G5
Spach's Evening-primrose	<i>Oenothera spachiana</i>	GCF	P	SNR	G5
Spoonleaf Sundew	<i>Drosera intermedia</i>	GCF	P	S2	G5
Sprawling Hoary-pea	<i>Tephrosia hispida</i>	GCF	P	S2	G4G5
Spreading Beaksedge	<i>Rhynchospora divergens</i>	GCF	P	S1	G4
Spreading Pogonia	<i>Cleistesiosis oricamporum</i>	GCF	P	S1	G3?
Spring Hill Flax	<i>Linum macrocarpum</i>	GCF	P	S1	G2

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Staghorn Clubmoss	<i>Palhinhaea cernua</i>	GCF	P	S2	G5
Swallow-tailed Kite	<i>Elanoides forficatus</i>	GCF	A	S1S2B	G5
Swamp Thistle	<i>Cirsium muticum</i>	GCF	P	S1	G5
Swollen Sedge	<i>Carex turgescens</i>	GCF	P	S1S2	G4G5
Tarpon	<i>Megalops atlanticus</i>	GCF	A	S3	G5
Thread-stem False Foxglove	<i>Agalinis filicaulis</i>	GCF	P	S2	G3
Threeway Sedge	<i>Dulichium arundinaceum</i>	GCF	P	S2	G5
Tricolored Bat	<i>Perimyotis subflavus</i>	GCF	A	S3	G3G4
Valentine's Southern Dusky Salamander	<i>Desmognathus valentinei</i>	GCF	A	S1	GNR
Waterbird Nesting Colony	N/A	GCF	O	SNRB	GNR
West Indian Manatee	<i>Trichechus manatus</i>	GCF	A	S1N	G2G3
White Screwstem	<i>Bartonia verna</i>	GCF	P	S3S4	G5?
Winged Seedbox	<i>Ludwigia alata</i>	GCF	P	S1	G3G5
Yellow Butterwort	<i>Pinguicula lutea</i>	GCF	P	S1	G4G5
Yellow Fringeless Orchid	<i>Platanthera integra</i>	GCF	P	S2	G3G4
Yellow-eyed Grass	<i>Xyris serotina</i>	GCF	P	S1	G3G4
American Oystercatcher	<i>Haematopus palliatus</i>	SDM	A	S1	G5
Bachman's Sparrow	<i>Peucaea aestivalis</i>	SDM	A	S3	G3
Bald Eagle	<i>Haliaeetus leucocephalus</i>	SDM	A	S3	G5
Bay Scallop	<i>Argopecten irradians</i>	SDM	I	S1	G5
Beaked Spikesedge	<i>Eleocharis rostellata</i>	SDM	P	SNR	G5
Bent Sedge	<i>Carex styloflexa</i>	SDM	P	SNR	G4G5
Black Rail	<i>Laterallus jamaicensis</i>	SDM	A	S2N,S1B	G3G4
Bottomland Hardwood Forest	N/A	SDM	C	S4	G4G5
Brackish Marsh	N/A	SDM	C	S3	G4?
Caspian Tern	<i>Hydroprogne caspia</i>	SDM	A	S1S2B,S3N	G5
Claspingleaf Pondweed	<i>Potamogeton perfoliatus</i>	SDM	P	S1	G5
Clear Chub	<i>Hybopsis winchelli</i>	SDM	A	S3	G5
Clustered Black-snakeroot	<i>Sanicula odorata</i>	SDM	P	SNR	G5
Coastal Dune Grassland	N/A	SDM	C	S1	G2G3
Coastal Live Oak-hackberry Forest	N/A	SDM	C	S1	G2
Creeping Spikesedge	<i>Eleocharis fallax</i>	SDM	P	S1?	G4G5

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Cypress Swamp	N/A	SDM	C	S4	G4G5
Cypress-tupelo Swamp	N/A	SDM	C	S4	G3G5
Earleaf Greenbrier	<i>Smilax auriculata</i>	SDM	P	S1	G4?
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	SDM	A	S3	G5
Eastern Pygmy Blue	<i>Brephidium pseudofea</i>	SDM	I	S2	G4
Elephant-ear	<i>Elliptio crassidens</i>	SDM	I	S3	G5
Engelmann's Sea-grass	<i>Halophila engelmannii</i>	SDM	P	S1	G3G5
Estuarine Submergent Vascular Vegetation	Submergent vascular vegetation (estuarine)	SDM	C	S1S2	G4?
Fatmucket	<i>Lampsilis siliquoidea</i>	SDM	I	S2	G5
Flatwoods Digger	<i>Creaserinus oryctes</i>	SDM	I	S1	G4
Floating Antler Fern	<i>Ceratopteris pteridoides</i>	SDM	P	S2	G5?
Freshwater Marsh	N/A	SDM	C	S2	G3G4
Gulf Saltmarsh Snake	<i>Nerodia clarkii clarkii</i>	SDM	A	S3S4	G4T3
Gulf Sturgeon	<i>Acipenser oxyrinchus desotoi</i>	SDM	A	S1	G3T2T3
Hemlock Water-parsnip	<i>Sium suave</i>	SDM	P	S1	G5
Intermediate Marsh	N/A	SDM	C	S3	G4?
Kemp's Ridley Sea Turtle	<i>Lepidochelys kempii</i>	SDM	A	S1B,S3N	G1
Lightning Whelk	<i>Sinistrofulgur sinistrum</i>	SDM	I	SNR	GNR
Live Oak Natural Levee Forest	<i>Quercus virginiana</i> - ( <i>Pinus taeda</i> ) / ( <i>Sabal minor</i> , <i>Serenoa repens</i> ) Swamp Forest	SDM	C	S1	G3G4
Loggerhead Sea Turtle	<i>Caretta caretta</i>	SDM	A	S1B,S3N	G2G4
Long-tailed Weasel	<i>Neogale frenata</i>	SDM	A	S2	G5
Louisiana Eyed Silkmoth	<i>Automeris louisiana</i>	SDM	I	S2	G1G3
Meadow Sedge	<i>Carex granularis</i>	SDM	P	SNR	G5
Mississippi Diamond-backed Terrapin	<i>Malaclemys terrapin pileata</i>	SDM	A	S3	G4T3
Monarch	<i>Danaus plexippus</i>	SDM	I	S4	G4
Piping Plover	<i>Charadrius melodus</i>	SDM	A	S2N	G3
Pondcypress-Blackgum Swamp	N/A	SDM	C	S1	G3
Red Knot	<i>Calidris canutus</i>	SDM	A	S2N	G4
Red Milkweed	<i>Asclepias rubra</i>	SDM	P	S3	G4G5
Red-cockaded Woodpecker	<i>Dryobates borealis</i>	SDM	A	S2	G3

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River Grass	<i>Echinochloa polystachya</i>	SDM	P	S2	G5
Salt Marsh	N/A	SDM	C	S3S4	G5
Saltmarsh Topminnow	<i>Fundulus jenkinsi</i>	SDM	A	S3	G3
Sand Rose-gentian	<i>Sabatia arenicola</i>	SDM	P	S1	G3G5
Sarvis Holly	<i>Ilex amelanchar</i>	SDM	P	S2	G4
Saw Palmetto	<i>Serenoa repens</i>	SDM	P	S1	G4G5
Sea Oats	<i>Uniola paniculata</i>	SDM	P	S2	G5
Shoal-grass	<i>Halodule wrightii</i>	SDM	P	S1	G5
Slash Pine/Post Oak Forest	N/A	SDM	C	S3S4	GNR
Snow Melanthera	<i>Melanthera nivea</i>	SDM	P	S2	G5
Snowy Plover	<i>Anarhynchus nivosus</i>	SDM	A	S1B,S2N	G3
Square-stem Monkeyflower	<i>Mimulus ringens</i>	SDM	P	S2	G5
Tarpon	<i>Megalops atlanticus</i>	SDM	A	S3	G5
Timber Rattlesnake	<i>Crotalus horridus</i>	SDM	A	S3S4	G4
Turtle-grass	<i>Thalassia testudinum</i>	SDM	P	S1	G4G5
Waterbird Nesting Colony	N/A	SDM	O	SNRB	GNR
West Indian Manatee	<i>Trichechus manatus</i>	SDM	A	S1N	G2G3
Western Umbrella Sedge	<i>Fuirena simplex</i> var. <i>aristulata</i>	SDM	P	S1	G5T4
Wilson's Plover	<i>Anarhynchus wilsonia</i>	SDM	A	S2	G5
Bald Eagle	<i>Haliaeetus leucocephalus</i>	SHM	A	S3	G5
Batture	N/A	SHM	C	S3	G4G5
Bent Sedge	<i>Carex styloflexa</i>	SHM	P	SNR	G4G5
Big Brown Bat	<i>Eptesicus fuscus</i>	SHM	A	S3	G5
Clustered Black-snakeroot	<i>Sanicula odorata</i>	SHM	P	SNR	G5
Lace-winged Roadside-Skipper	<i>Amblyscirtes aesculapius</i>	SHM	I	S3	G4
Little Metalmark	<i>Calephelis virginensis</i>	SHM	I	S4	G4
Monarch	<i>Danaus plexippus</i>	SHM	I	S4	G4
Pallid Sturgeon	<i>Scaphirhynchus albus</i>	SHM	A	S1	G2
Saw Palmetto	<i>Serenoa repens</i>	SHM	P	S1	G4G5
Southwestern Bedstraw	<i>Galium virgatum</i>	SHM	P	S2	G4G5
Three-angle Spikesedge	<i>Eleocharis tricostata</i>	SHM	P	S1?	G4
Waterbird Nesting Colony	N/A	SHM	O	SNRB	GNR

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
West Indian Manatee	<i>Trichechus manatus</i>	SHM	A	S1N	G2G3
Alabama Hickorynut	<i>Obovaria unicolor</i>	SPP	I	S1	G2G3
Alligator Snapping Turtle	<i>Macrochelys temminckii</i>	SPP	A	S3	G3
Bachman's Sparrow	<i>Peucaea aestivalis</i>	SPP	A	S3	G3
Baldwin's Ironweed	<i>Vernonia baldwinii</i>	SPP	P	SNR	G5
Baygall Caric Sedge	<i>Carex venusta</i>	SPP	P	S1	G4
Bayhead Swamp	N/A	SPP	C	S3	G3?
Big Brown Bat	<i>Eptesicus fuscus</i>	SPP	A	S3	G5
Birdbill Spikegrass	<i>Chasmanthium ornithorhynchum</i>	SPP	P	S2	G4
Bog Flame Flower	<i>Macranthera flammea</i>	SPP	P	S2	G3
Bog Moss	<i>Mayaca fluviatilis</i>	SPP	P	S2	G5
Broadstripe Topminnow	<i>Fundulus euryzonus</i>	SPP	A	S2	G3
Canada Horse-balm	<i>Collinsonia canadensis</i>	SPP	P	S2?	G5
Canby's Bulrush	<i>Schoenoplectus etuberculatus</i>	SPP	P	S1	G3G4
Carolina Fluff Grass	<i>Tridens carolinianus</i>	SPP	P	S2	G3G4
Carpenter's Ground-cherry	<i>Calliphysalis carpenteri</i>	SPP	P	S1	G3
Channel Darter	<i>Percina copelandi</i>	SPP	A	S2	G4
Chapman's Beaksedge	<i>Rhynchospora chapmanii</i>	SPP	P	S3	G4
Ciliate Beaksedge	<i>Rhynchospora ciliaris</i>	SPP	P	S3	G4
Clear Chub	<i>Hybopsis winchelli</i>	SPP	A	S3	G5
Coastal False Asphodel	<i>Triantha racemosa</i>	SPP	P	S2S3	G5
Coastal Plain False Foxglove	<i>Agalinis aphylla</i>	SPP	P	S1	G3G4
Common Rainbow Snake	<i>Farancia erythrogramma erythrogramma</i>	SPP	A	S2	G4T4
Cypress Swamp	N/A	SPP	C	S4	G4G5
Dwarf Filmy Fern	<i>Trichomanes petersii</i>	SPP	P	S2	G4
Dwarf Gray Willow	<i>Salix humilis</i> var. <i>tristis</i>	SPP	P	S2	G5T5
Eastern Chicken Turtle	<i>Deirochelys reticularia reticularia</i>	SPP	A	SNR	G5T5
Eastern Glass Lizard	<i>Ophisaurus ventralis</i>	SPP	A	S3	G5
Eastern Hillside Seepage Bog	N/A	SPP	C	S1	G2
Eastern Longleaf Pine Savanna	N/A	SPP	C	S1	G1
Eastern Spadefoot	<i>Scaphiopus holbrookii</i>	SPP	A	S3	G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Eastern Upland Longleaf Pine Forest	N/A	SPP	C	S1	G1G2
Elephant-ear	<i>Elliptio crassidens</i>	SPP	I	S3	G5
Fatmucket	<i>Lampsilis siliquoidea</i>	SPP	I	S2	G5
Flagfin Shiner	<i>Pteronotropis signipinnis</i>	SPP	A	S2	G5
Flat-fruit Beaksedge	<i>Rhynchospora compressa</i>	SPP	P	S2	G4
Flatwoods Digger	<i>Creaserinus oryktes</i>	SPP	I	S1	G4
Flax-leaf False-foxglove	<i>Agalinis linifolia</i>	SPP	P	S2	G4?
Four-point Evening Primrose	<i>Oenothera rhombipetala</i>	SPP	P	S1	G4G5
Georgia Satyr	<i>Neonympha areolatus</i>	SPP	I	S3	G3G4
Georgia Tickseed	<i>Coreopsis nudata</i>	SPP	P	S2	G3?
Giant Orchid	<i>Pteroglossaspis ecristata</i>	SPP	P	S2	G4
Goldencrest	<i>Lophiola aurea</i>	SPP	P	S2	G4
Gopher Tortoise	<i>Gopherus polyphemus</i>	SPP	A	S1	G3
Gulf Coast Waterdog	<i>Necturus beyeri</i>	SPP	A	S3	GNR
Gulf Crawfish	<i>Procambarus shermani</i>	SPP	I	S1	G4
Gulf Logperch	<i>Percina suttkusi</i>	SPP	A	S2	G5
Gulf Pine Sphinx	<i>Lapara phaeobrachycerous</i>	SPP	I	S1	G3G4
Hardwood Slope Forest	N/A	SPP	C	S3	G2G3
Harper's Yellow-eyed-grass	<i>Xyris scabrifolia</i>	SPP	P	S2	G3
Henslow's Sparrow	<i>Centronyx henslowii</i>	SPP	A	S3N	G4
Indian Cucumber-root	<i>Medeola virginiana</i>	SPP	P	S1	G5
Ironcolor Shiner	<i>Notropis chalybaeus</i>	SPP	A	S3	G4
Leggett's Pinweed	<i>Lechea pulchella</i>	SPP	P	S1	G5
Little Metalmark	<i>Calephelis virginiensis</i>	SPP	I	S4	G4
Littleleaf Milkwort	<i>Polygala brevifolia</i>	SPP	P	S1	G4G5
Long-horned Habenaria	<i>Habenaria quinqueseta</i>	SPP	P	S1	G4G5
Louisiana Quillwort	<i>Isoetes louisianensis</i>	SPP	P	S2	G2G3
Louisiana Quillwort Habitat	N/A	SPP	P	S2	G2G3
Meadow Sedge	<i>Carex granularis</i>	SPP	P	SNR	G5
Michaux's Milkweed	<i>Asclepias michauxii</i>	SPP	P	S2	G4G5
Mississippi Pigtoe	<i>Pleurobema beadleianum</i>	SPP	I	S2	G3

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Mixed Hardwood-loblolly Forest	N/A	SPP	C	S3	G3G4
Narrowleaf Whitetop Aster	<i>Sericocarpus linifolius</i>	SPP	P	S2	G5
Night-flowering Wild Petunia	<i>Ruellia noctiflora</i>	SPP	P	S1	G3?
Odorless Bayberry	<i>Morella inodora</i>	SPP	P	S2	G4
One-flowered Broomrape	<i>Orobanche uniflora</i> var. <i>uniflora</i>	SPP	P	S1	G5T5
Pale Grass-pink	<i>Calopogon pallidus</i>	SPP	P	S2	G4G5
Parrot Pitcher Plant	<i>Sarracenia psittacina</i>	SPP	P	S3	G4
Pascagoula Creekshell	<i>Strophitus pascagoulaensis</i>	SPP	I	S2	GNR
Pineland Bogbutton	<i>Lachnocaulon digynum</i>	SPP	P	S3	G3G4
Pineland Yellow-eyed Grass	<i>Xyris stricta</i>	SPP	P	S2	G4
Pursh's Rattlebox	<i>Crotalaria purshii</i>	SPP	P	S3	G5
Rayless Mock Goldenrod	<i>Solidago discoidea</i>	SPP	P	SNR	G4G5
Red-cockaded Woodpecker	<i>Dryobates borealis</i>	SPP	A	S2	G3
Redtop Panicum	<i>Panicum rigidulum</i> ssp. <i>combsii</i>	SPP	P	S1	G5T5?
Robin's-plantain	<i>Erigeron pulchellus</i>	SPP	P	SNR	G5
Saddleback Darter	<i>Percina vigil</i>	SPP	A	S3	G5
Sand Hickory	<i>Carya pallida</i>	SPP	P	S1	G5
Sarvis Holly	<i>Ilex amelanchier</i>	SPP	P	S2	G4
Scalloped Milkwort	<i>Polygala crenata</i>	SPP	P	S2	G4?
Shortleaf Pine/oak-hickory Forest	N/A	SPP	C	S1	G2G3
Silky Camellia	<i>Stewartia malacodendron</i>	SPP	P	S2	G4
Silver False Spleenwort	<i>Deparia acrostichoides</i>	SPP	P	S2	G5
Slash Pine-Pondcypress/Hardwood Forest	N/A	SPP	C	S2	G2?
Slender Gayfeather	<i>Liatis tenuis</i>	SPP	P	S1	G3
Slim-leaf Witchgrass	<i>Dichanthelium linearifolium</i>	SPP	P	SNR	G5
Small Stream Forest	N/A	SPP	C	S2	G3
Small's Ragwort	<i>Packera anonyma</i>	SPP	P	SNR	G5
Southeastern Blue Sucker	<i>Cycleptus meridionalis</i>	SPP	A	S1	G3G4
Southeastern Crowned Snake	<i>Tantilla coronata</i>	SPP	A	S1	G5

COMMON NAME	SCIENTIFIC NAME	HABITAT ZONE	TYPE	STATE RANK	GLOBAL RANK
Southern Pocketbook	<i>Lampsilis ornata</i>	SPP	I	S3	G5
Southern Rainbow	<i>Villosa vibex</i>	SPP	I	S2	G5
Southern Red Lily	<i>Lilium catesbaei</i>	SPP	P	S1	G4
Southern Snaketail	<i>Ophiogomphus australis</i>	SPP	I	S1	G1G2
Spoonleaf Sundew	<i>Drosera intermedia</i>	SPP	P	S2	G5
Spreading Pogonia	<i>Cleistesiosis oricamporum</i>	SPP	P	S1	G3?
Spring Hill Flax	<i>Linum macrocarpum</i>	SPP	P	S1	G2
Swallow-tailed Kite	<i>Elanoides forficatus</i>	SPP	A	S1S2B	G5
Swamp-forest Beaksedge	<i>Rhynchospora decurrens</i>	SPP	P	S1	G3G4
Swollen Sedge	<i>Carex turgescens</i>	SPP	P	S1S2	G4G5
Thread-stem False Foxglove	<i>Agalinis filicaulis</i>	SPP	P	S2	G3
Thymeleaf Pinweed	<i>Lechea minor</i>	SPP	P	S2	G5
Tricolored Bat	<i>Perimyotis subflavus</i>	SPP	A	S3	G3G4
Turk's-Cap Lily	<i>Lilium superbum</i>	SPP	P	S1	G5
Valentine's Southern Dusky Salamander	<i>Desmognathus valentinei</i>	SPP	A	S1	GNR
Viperina	<i>Zornia bracteata</i>	SPP	P	S2	G5?
Wild Licorice	<i>Galium circaezans</i>	SPP	P	SNR	G5
Yellow Butterwort	<i>Pinguicula lutea</i>	SPP	P	S1	G4G5
Yellow Corydalis	<i>Corydalis flavula</i>	SPP	P	SNR	G5
Yellow Fringeless Orchid	<i>Platanthera integra</i>	SPP	P	S2	G3G4

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# ATTACHMENT E. CONSTRUCTED CPRA RESTORATION PROJECTS

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**Table 32. Constructed CPRA restoration projects within the PRP boundary (CPRA, 2023).**

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Note: Project types are freshwater diversion (FD), hurricane protection (HP), hydrologic restoration (HR), marsh creation (MC), oyster barrier reef (OR), other project types (OT), ridge restoration (RR), sediment diversion (SD), shoreline protection (SP), terrace (TE).

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PROJECT ID	PROJECT NAME	DESCRIPTION	PROJECT TYPE
PO-0030	Lake Borgne Shoreline Protection	Constructed a continuous nearshore rock breakwater to maintain the integrity of the marsh separating Lake Borgne from the Mississippi River Gulf Outlet (MRGO), protecting Shell Beach, Yscloskey, and Hopedale from wave energy and storm surges	SP
PO-0094	MRGO and Lake Borgne (Bayou Bienvenue Segment)	Building 14,440 linear feet of stone foreshore dike along the southwest shoreline of Lake Borgne near Bayou Bienvenue, impacting three oyster leases.	SP
PO-0010	Turtle Cove Shore Protection	Constructed a 1,640-foot rock-filled gabion breakwater to protect the Lake Pontchartrain shoreline and encourage sediment deposition, with additional maintenance funding in 2001.	SP
PO-0016	Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 1	Isolated units 3 and 4 of the Bayou Sauvage Wildlife Refuge with a levee, creating a large freshwater impoundment and establishing a means to remove excess water during spring and summer.	HR
PO-0003	Labranche Shoreline Stabilization and Canal Closure	Restored the shoreline separating Lake Pontchartrain from the western edge of the LaBranche wetlands.	SP
PO-0006	Fritchie Marsh Restoration	Aimed to remediate wetland loss causes and improve wildlife and fisheries habitat by increasing freshwater flow into the marsh and managing the outfall.	HR
PO-0002-C	Bayou Chevee	Installed 2,000 feet of brush fences at the mouth of Bayou Chevee.	SP
PO-0022	Bayou Chevee Shoreline Protection	Constructed a 5,000-foot earthen dike to contain dredged material from Lake Pontchartrain, creating about 150 acres of marsh.	SP
PO-0174	Biloxi Marsh Living Shoreline	Built a living breakwater structure off the shoreline of Eloi Bay and Eloi Point near Bayou La Loutre.	OR
PO-0104	Bayou Bonfouca Marsh Creation	Created and nourished approximately 621 acres of marsh adjacent to Bayou Bonfouca using 3.6 million cubic yards of sediment from Lake Pontchartrain.	MC
PO-0003-B	Labranche Shoreline Protection	Constructed a rock breakwater along the Lake Pontchartrain shoreline east of Bayou LaBranche to protect the hydrologic boundary.	SP
PO-0001	Violet Siphon Diversion	Rehabilitated the Violet Siphon in St. Bernard Parish to enhance operation and reduce long-term maintenance costs.	FD

PROJECT ID	PROJECT NAME	DESCRIPTION	PROJECT TYPE
PO-0146	LPV Mitigation, Manchac WMA Marsh Creation	Provided 110 acres of marsh as mitigation for impacts from the Lake Pontchartrain and Vicinity Hurricane Storm Damage Risk Reduction System, increasing breakwater height and filling gaps with dredged sediment.	SP
PO-0095	MRGO and Lake Borgne (Shell Beach Segment)	Constructing 15,700 linear feet of stone foreshore dike along the southern shoreline of Lake Borgne, west of Shell Beach, impacting four oyster leases.	SP
PO-0148	Living Shoreline	Constructed bioengineered oyster reefs along coastal fringe marsh in St. Bernard Parish, from Eloi Point to the mouth of Bayou La Loutre, extending around Treasure Bay. Implemented with other living shoreline projects in Plaquemines and Jefferson parishes.	OR
PO-0019	Mississippi River Gulf Outlet (MRGO) Disposal Area Marsh Protection	Repaired 28,000 linear feet of lateral and rear dikes of the MRGO disposal areas, including installation of metal box weirs with a 40-inch pipe to control water flow and prevent marsh drainage.	MC
PO-0073-1	Central Wetlands - Riverbend	Discharged effluent from a CWBNO oxidation plant into the Central Wetlands to promote vegetation growth and save costs on sewer line construction.	HR
PO-0008	Central Wetlands Pump Outfall	Provided freshwater, nutrients, and sediment from storm water runoff to marsh near the Violet Siphon (PO-01).	FD
PO-0036-EB	Orleans Land Bridge SP & Marsh Creation	Protected 7.8 miles of the northwestern shoreline of Lake Borgne in Orleans Parish, preventing the loss of up to 140 acres of marsh and minimizing shoreline retreat. Included protection for the Bayou Sauvage National Wildlife Refuge.	SP
LA-0009	Sediment Containment System for Marsh Creation Demonstration	Assessed the effectiveness of a sediment containment system as an alternative to earthen containment in dredging, informing future CWPPRA projects.	MC
PO-0073-3	Central Wetlands Demonstration Expansion	Restored 17.2 acres of critical wetlands in Orleans Parish using treated wastewater effluent and beneficial use of ash/biosolids, promoting ecological diversity with indigenous planting.	HR
PO-0142	Hydrologic Restoration of the Amite River Diversion Canal	Increased hydrologic connectivity of the Amite River Diversion Canal with adjacent baldcypress-tupelo swamp habitat through cuts in the spoil bank, conveyance channels, and vegetative plantings, benefiting 1,600 acres of bottomland forest swamp habitat.	HR
PO-0072	Biloxi Marsh	Constructed approximately four miles of shoreline protection along the southeastern shoreline of Lake Borgne in St. Bernard Parish.	SP
PO-0161	Lake Pontchartrain Hurricane Mitigation	Built a near-shore, segmented breakwater system in Lake Pontchartrain parallel to a five-mile reach of the Manchac Wildlife Management Area, mitigating damages from the Lake Pontchartrain Hurricane Protection project.	SP
PO-0027	Chandeleur Islands Marsh Restoration	Accelerated recovery of 364 acres of barrier island areas overwashed by Hurricane Georges in 1998 through planting smooth cordgrass at 22 sites along the Chandeleur Sound side.	VP
PO-0033	Goose Point/Point Platte Marsh Creation	Created 437 acres and nourished 114 acres of marsh along the Northshore of Lake Pontchartrain in St. Tammany Parish using 3.1 million cubic yards of dredged sediment.	MC

PROJECT ID	PROJECT NAME	DESCRIPTION	PROJECT TYPE
PO-0145	LPV Task Force Guardian Mitigation- Bayou Sauvage	Restored 145 acres of habitat, including 142 acres of intermediate marsh, in the Bayou Sauvage National Wildlife Refuge to mitigate impacts from the Lake Pontchartrain and Vicinity Hurricane Storm Damage Risk Reduction System.	HR
PO-0017	Bayou Labranche Wetland Creation	Dredged sediments from Lake Pontchartrain to create vegetated wetlands in an area bounded by I-10, Lake Pontchartrain, and Bayou LaBranche.	MC
PO-0043	East Labranche Shoreline Protection	Constructed 1,400 linear feet of shoreline protection in critical areas of the remaining 18,000 linear feet of East LaBranche shoreline in St. Charles Parish using State and parish CIAP funding.	SP
PO-0093	MRGO and Lake Borgne (Bayou Dupre Segment)	Constructing 17,650 linear feet of stone foreshore dike along the southwest shoreline of Lake Borgne near Bayou Dupre, impacting two oyster leases.	SP
PO-0024	Hopedale Hydrologic Restoration	Replaced collapsed culverts near Yscloskey, Louisiana, to improve drainage and fisheries access and protect 3,086 acres of marsh.	HR
PO-0018	Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 2	Installed two 36-inch pumps to maintain water levels and promote vegetative growth in marsh impounded by U.S. Highway 90, canals, railroad lines, and Lake Pontchartrain hurricane protection levees.	HR
LA-0163	Emergency Barrier Berms	Constructed 16 miles of sand berms along barrier islands in Plaquemines and St. Bernard parishes to minimize oil spill impact, with materials later used in barrier island restoration projects.	OT
MR-0009	Delta Wide Crevasses	Promoted emergent freshwater and intermediate marsh formation in the Pass-a-Loutre Wildlife Management Area and Delta National Wildlife Refuge by cleaning or creating splays.	SD
BS-0045	Bayou Terre Aux Boeuf Ridge Restoration Phase III	Phased approach to armor 6,200 linear feet of shoreline and plant 68 acres of cypress/tupelo in adjacent marsh near Delacroix, LA, to combat erosion, sea level rise, and provide natural storm surge protection.	RR
BS-0016	South Lake Lery Shoreline and Marsh Restoration	Created 396 acres of marsh and restored 32,000 feet of the southern Lake Lery shoreline in Plaquemines Parish using 3.7 million cubic yards of dredged sediment.	MC
BS-0011	Delta Management at Fort St. Philip	Enhanced delta-building by constructing six artificial crevasses to divert freshwater and sediment and built linear vegetated terraces to retain sediment and reduce wave energy.	TE
BS-0006	Lake Lery Hydrologic Restoration	Built a pumping station along the south-central edge of the St. Bernard Parish Ridge to discharge collected rainfall into the marsh north of Lake Lery, preventing saltwater intrusion. Completed in partnership with the Lake Borgne Basin Levee District in May 1997.	HR
BS-0040	Bayou Terre Aux Boeufs Ridge	Strategically armored 1,992 linear feet of the Central reach of the Bayou Terre Aux Boeufs Ridge Restoration Project in St. Bernard Parish to address subsidence, sea level rise, and shoreline erosion, providing natural storm surge protection.	RR
BS-0008	Caernarvon Freshwater Diversion	Diverts up to 8,000 cubic feet per second of freshwater, nutrients, and sediment from the Mississippi River to coastal bays and marshes in Breton Sound for fish and wildlife enhancement.	FD

PROJECT ID	PROJECT NAME	DESCRIPTION	PROJECT TYPE
BS-0003-A	Caernarvon Diversion Outfall Management	Enhances marsh by increasing the utilization of freshwater, nutrients, and sediments from the Mississippi River through the Caernarvon Freshwater Diversion Structure.	HR

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