Louisiana State Hazard Mitigation Plan Update

2024

HAZARDS

Extreme Heat
Drought
Wildfire
Winter Storms
High Wind
Hailstorms
Lightning
Tornadoes
Flooding
Dam Failure
Earthquake
Sinkholes
Expansive Soil

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Introduction to Louisiana's Hazard Mitigation Planning Process

Chapter 1 provides a brief introduction to the State of Louisiana, discusses the importance of hazard mitigation planning, and explains how the State's strategy for mitigation planning has evolved since 2005. Further, Chapter 1 describes the 2024 planning process undertaken by the State, as prescribed by Section 3.1 of FEMA's State Mitigation Planning Policy Guide (2022). Additional information on the planning process, including documentation of meetings, can be found in the Appendix.

S1. DOES THE PLAN INCLUDE A DESCRIPTION OF THE PROCESS USED TO DEVELOP THE PLAN? [44 CFR §§ 201.4(B) AND 201.4(C)(1)]

S2. DOES THE PLAN DESCRIBE HOW THE STATE COORDINATED WITH OTHER AGENCIES AND STAKEHOLDERS? [44 CFR §§ 201.4(B) AND 201.4(C)(1)]

Location and Hazard Risk

With the coastline of the Gulf of Mexico as its southern border, along with the mouth of the Mississippi River, the State of Louisiana is prone to both coastal storms and flooding. Additionally, the state's historic reliance on engineered flood protection measures such as levees, floodwalls, and forced drainage systems compound the state's vulnerability to flooding. Further, engineered flood protection measures increase rates of subsidence; subsidence, severe weather, lack of new alluvial sediments, and saltwater intrusion from navigation and extraction activities lead to further coastal erosion; and climate change is resulting in increased ocean temperatures and sea level rise across the coast. All these hazards result in more frequent extreme weather events and increased coastal land loss. Consequently, these hazards narrow the natural buffers between the Gulf of Mexico and inhabited land, resulting in less protection from high winds and storm surge, which are significant threats to the state.

Altogether, Louisiana is vulnerable to various natural hazards that are compounded by the impact of climate change and human activities, including engineered flood protection measures and natural resource extraction. Considering these challenges, the state continues its efforts to reduce impacts of hazards to which it is vulnerable. In 2003, the state began a comprehensive planning process to improve hazard mitigation, which resulted in the State of Louisiana Hazard Mitigation Strategy of 2005. The 2005 hurricane season highlighted Louisiana's vulnerability as Hurricanes Katrina and Rita caused overwhelming damage to human life and property. Following the 2005 hurricane season, Louisiana updated its Hazard Mitigation Plan, which was completed in 2008. The state continued to conduct required plan updates in 2011, 2014, and 2019.

Hazard Mitigation

FEMA defines hazard mitigation as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards" (DHS-FEMA, 2022). Hazard mitigation planning can be an important tool for the State and local governments to build disaster resilience. Effective state hazard mitigation planning increases knowledge of hazards, supports stronger partnerships between the state and local communities, creates informed strategies to reduce risk, and improves mitigation capabilities - all with equitable outcomes in mind.

In addition to being an important tool in support of disaster resilience, the Disaster Mitigation Act of 2000 mandates that States have approved Standard State Mitigation Plans to receive non-emergency Stafford Act assistance and FEMA mitigation grants to include Hazard Mitigation Grant Program (HMGP), Public Assistance (PA), Pre-Disaster Mitigation Grant Program (PDM), Building Resilient Infrastructure and Communities (BRIC) and others. Requirements for the contents of the Mitigation Plan are found in the 44 CFR § 201.

The figure below demonstrates the process of developing a hazard mitigation plan per FEMA's State Mitigation Planning Policy Guide (2022). The steps include organization of the process and resources including the coordination of stakeholders; identification of the hazards and assessment of risks associated with those hazards; evaluation of the state's mitigation capabilities; development of the mitigation strategy to include goals and actions that reduce long term vulnerabilities; assessment of local planning coordination and capability building; establishment of methods to review the plan to make sure it is kept current, to evaluate for effectiveness, and to implement following adoption; and adoption of the planning document. Overall, this hazard mitigation planning process is important to the State of Louisiana as it supports efforts to proactively address the increasing risks posed by natural hazards and climate change.

Figure 1 - State Hazard Mitigation Process

General Planning Strategy

The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), with support from the State Hazard Mitigation Planning Committee (SHMPC) first developed the **2005 State of Louisiana Hazard Mitigation Strategy**. The 2005 Strategy included four volumes:

State of Louisiana Hazard Mitigation Plan
State of Louisiana Hazard Mitigation Plan Appendix
State of Louisiana Hazard Mitigation Program, and the
State of Louisiana Administrative Guidelines and Procedures

Following Hurricanes Katrina and Rita in 2005, the Strategy was broadened to include other planning efforts including the:

State of Louisiana Emergency Operations Plan (July 2009),
State of Louisiana GOHSEP Continuity of Operations Plan (2009), and the
Regional and community-based long-term recovery plans (2005-2009).

The 2011 Plan Update was organized much like the 2005 and 2008 Plans and included the following sections:

Section 1: Introduction
Section 2: Plan Adoption
Section 3: Planning Process
Section 4: Hazard Identification and Profiles
Section 5: Statewide Risk Assessment
Section 6: Risk Assessment for State-Owned Assets
Section 7: Capability Assessment
Section 8: Mitigation Action Plan
Section 9: Coordination with Local Mitigation Planning
Section 10: Plan Maintenance Process

After three revisions, Louisiana's 2011 Hazard Mitigation Plan Update reached nearly 1,700 pages. Considering this, the SHMPC voted to revise the Plan to make it more accessible and more efficient for use by the state and local governments. Consequently, the 2014 Plan Update was reorganized and included the following sections:

Section 1: Introduction
Section 2: Hazard Identification and Statewide Risk Assessment
Section 3: State Historical Properties Risk Assessment
Section 4: Capability Assessment
Section 5: Mitigation Strategy
Section 6: Mitigation in Action
Appendix: Planning Process, Plan Maintenance, Mapping Methodology, Plan Adoption, Endnotes

The 2019 Plan Update process continued the tradition of presenting the plan in the most effective and efficient way to enhance the usability of the plan's contents. To accomplish this, a decision was made to place certain details of the hazard identification, including maps showing historic and future hazard probabilities and locations of projected losses, in a new Technical Appendix. A complete loss estimate table for each hazard by parish was also provided in the Technical Appendix. In addition, the SHMPC agreed to add a Community Rating System Strategy and a Repetitive Loss Strategy; both were included in the Appendix.

- The 2019 Plan Update included the following sections:

Chapter 1: Introduction
Chapter 2: Hazard Identification and Statewide Risk Assessment
Chapter 3: Capability Assessment
Chapter 4: Mitigation Strategy
Chapter 5: Mitigation in Action
Appendix A: Technical Appendix
Appendix B: Planning Process
Appendix D: Community Rating System Strategy
Appendix E: Repetitive Loss Strategy

For the 2024 Plan Update, members of the SHMPC agreed that efficiency in the presentation of the plan data was still important to achieve local and regional cooperation in hazard mitigation efforts as well as consistency among hazard mitigation planning across the State. Thus, the plan organization resembles the 2019 plan but has some minor differences to account for changes set forth in FEMA's updated State Mitigation Planning Policy (2022) Thus, the 2024 Plan Update includes the following sections:

Chapter 1: Introduction
Chapter 2: Hazard Identification and Statewide Risk Assessment
Chapter 3: State Mitigation Capabilities
Chapter 4: Mitigation Strategy
Chapter 5: Mitigation in Action
Chapter 6: Local Planning Coordination & Capability Building
Appendix A: Technical Appendix
Appendix B: Planning Process Documentation
Appendix C: Plan Maintenance
Appendix D: Community Rating System Strategy
Appendix E: Repetitive Loss Strategy

2024 Planning Process

Similar to past planning processes, the Governor's Office of Homeland Security & Emergency Preparedness (GOHSEP) was the lead state agency for developing the 2024 Plan Update; specific responsibility for project management was assigned to the State Hazard Mitigation Officer (SHMO). As such, the SHMO convened the State Hazard Mitigation Planning Committee (SHMPC) – an ad-hoc committee comprised of state and regional agencies, local parishes, private industry, and academia. The SHMPC was charged to direct the development of the plan, to function as a voice for the State of Louisiana, and to provide expertise and general feedback on plan elements on behalf of their constituents. The SHMPC included representatives from the following entities:

- Acadiana Planning Commission
- AECOM
- Arcadis
- Capital Region Planning Commission
- City of New Orleans
- Division of Administration, Office of Community Development, Disaster Recovery Unit (DOA-OCD-DRU)
- Division of Administration, Office of Facility Planning & Control
- Division of Administration, Office of Planning and Budget (DOA-OPB)
- Division of Administration, Office of Risk Management (DOA-ORM)
- Division of Historic Preservation, Department of Culture, Recreation & Tourism (DCRT)
- Department of Agriculture and Forestry
- Department of Corrections, Office of State Fire Marshall (OSFM)
- Department of Environmental Quality (DEQ)
- Department of Health (LDH)
- Department of Transportation and Development (DOTD)
- FEMA Region 6
- Governor's Office of Coastal Activities
- Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP)
- Henry Consulting
- Iberville Parish
- Jefferson Parish
- Louisiana Department of Insurance (LDI)
- Louisiana Hospital Association
- Louisiana Office of Motor Vehicles
- Louisiana Office of State Climatology
- Louisiana Sea Grant College Program (LSG)
- Louisiana State Uniform Construction Code Council
- Louisiana State University
- LSU AgCenter
- New Orleans Regional Planning Commission (NORPC)
- Northwest Louisiana Council of Governments
- Port of South Louisiana
- Smart Home America
- South Central Planning and Development Commission (SCPDC)
- Southwest Louisiana Regional Planning Commission
- St. John the Baptist Parish
- State Fire Marshal
- The Water Institute of the Gulf
- University of New Orleans (UNO)

The planning process began in May 2023 and the SHMPC met on four separate occasions to develop the 2024 Plan Update. The table below provides a summary of the meetings which provided opportunities for members of the SHMPC to provide input to the plan. Each meeting focused on a different plan element and allowed for input by various stakeholders. Following Meeting #1, which was held at the State's Emergency Operations Center (EOC) in Baton Rouge, LA, members of the SHMPC requested that future meetings be held via Zoom to avoid travel time for many members and to increase participation.

These meetings were facilitated by GOHSEP and its consultants from LSU AgCenter, LSU, and UNO-CHART. Information to be discussed was shared, via email and the use of

Meeting Number	Date / Place	Plan Element Focus
1	May 23, 2023; Baton Rouge, LA	Kick-off / Planning Process
2	July 7, 2023; via Zoom	Hazard Profiles
3	August 30, 2023; via Zoom	Risk Assessment
4	October 10, 2023; via Zoom	Mitigation Strategy / Goals and Actions

a Google shared folder, with members of the SHMPC before and after meetings. Overall, committee members had opportunities to provide meaningful contributions to the plan through open discussions at meetings, two digital surveys (one that focused on goals and actions, the other focused on capacity), phone calls and emails with GOHSEP and its consultants.

GOHSEP coordinated all planning activities throughout the planning process. GOHSEP directly supervised the consultants and facilitated the participation of the SHMPC members. GOHSEP also provided important oversight and quality control to ensure that the plan and the associated process met federal requirements. At the end of the process, GOHSEP provided a formal recommendation for the Governor's Authorized Representative to adopt the Plan Update.

FEMA, through its Region VI office in Denton, Texas, is responsible for reviewing the plan for compliance with DMA 2000 and the CFR. Representatives of FEMA Region VI also helped facilitate completion of this plan through on-going review of the plan as it was developed and updated.

GOHSEP's consultants from LSU AgCenter, LSU, and UNO-CHART supported the 2024 Plan Update in the following ways:

- Assembled information for inclusion in the plan
- Edited previous editions of the plan
- Wrote new material as necessary
- Provided technical support to profile the hazards and perform the statewide risk assessment
- Created materials for the meetings
- Developed the surveys
- Made presentations at the SHMPC meetings
- Provided support for outreach

[1]Supporting documentation for the meetings is included in the Appendix.

Plan Integration

The CFR requires that states describe how their mitigation planning process is integrated with other ongoing state planning efforts, as well as FEMA mitigation programs and initiatives. Through the SHMPC, the State was able to coordinate with agencies and other stakeholders that are responsible for emergency management, economic development, land use and development, housing, health and social services, infrastructure, and natural and cultural resources.

Further, integration and coordination are achieved through the participation of state agency representatives on the SHMPC who administer three programs: floodplain management under the National Flood Insurance Program (NFIP), coastal protection and restoration under the provisions of Act 8 of the First Extraordinary Session of 2005, and the State Uniform Construction Code. Furthermore, to achieve Emergency Management Accreditation Program (EMAP) compliance, GOHSEP staff that participated in the SHMPC submitted suggested changes for the Plan Update in late 2007. These changes have been brought forward through the current 2024 Update. There are also several initiatives that have fostered further coordination and integration of the SHMPC which was developed to address the roles and responsibilities of state and non- governmental (NGO) partners in responding to all threats and hazards, but especially those outlined in the State Hazard Mitigation Plan. Coordination efforts among these efforts range from seeking consistency in the way hazards are identified, to identifying opportunities to integrate mitigation practices in response and recovery operations.

Another program is the GOHSEP Continuity of Operations Plan (COOP), which was updated in 2017. The COOP was incorporated into the overall State of Louisiana Hazard Mitigation Strategy to specifically acknowledge that key provisions of that plan were part of the overall approach to reducing risk and the impacts of hazards. GOHSEP considered providing for redundancy of critical systems, equipment, flow of information, operations, and materials consistent with the overall goals and objectives of the plan. GOHSEP also provides leadership for state and local mitigation planning efforts and administers and oversees FEMA-related hazard mitigation grant programs (HMGPs) for the state that are related to hazard mitigation, emergency management, and disaster relief. Based on this role, GOHSEP can integrate mitigation planning and project information with the FEMA grant application process for the following: Hazard Mitigation Grant Program (HMGP), Public Assistance (PA), Pre-Disaster Mitigation Grant Program (PDM), Building Resilient Infrastructure and Communities (BRIC) and others.

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Hazard Identification and Statewide Risk Assessment

This chapter focuses on the following elements of the FEMA State Mitigation Plan Review Guide (2022)

Does the risk assessment provide an overview of the probabilities of future hazard events?
[44CFR §201.4(c)(2)(i)]

Does the risk assessment address the vulnerability of state assets located in hazard areas and estimate the potential dollar losses to these assets?
[44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]

Does the risk assessment include an overview and analysis of the vulnerability of jurisdictions to the identified hazards and the potential losses?
[44 CFR §§201.4(c)(2)(ii) and 201.4(c)(2)(iii)]

Was the risk assessment revised to reflect changes in development?
[44 CFR §201.4(d)]

To answer these questions, the FEMA State Mitigation Plan Review Guide requires:

» The risk assessment must provide an overview of the probability of future hazard events that includes projected changes in the location, range of anticipated intensities, frequency, and/or duration of each natural hazard.

» Probability must include considerations of changing future conditions, including climate change (e.g., long-term weather patterns, average temperature, and sea levels) on the type, location, and range of anticipated intensities of identified hazards.

» The risk assessment must include an overview and analysis of the vulnerability to state assets from the identified hazards and a summary of the most vulnerable assets. These assets may be located in the identified hazard areas and could be affected by future hazard events. State assets include state-owned or operated critical facilities, buildings, infrastructure, and community lifelines.

- The risk assessment must estimate potential dollar losses to state assets located in identified hazard areas.
- The risk assessment must provide an overview and analysis of vulnerable jurisdictions based on the state and local government risk assessments. Vulnerability must be analyzed in terms of:
    - Jurisdictions most threatened by the identified hazards based on type, location, range of anticipated intensities, and probability. Probability must include the potential impacts of climate change.
    - Jurisdictions most vulnerable to damage and loss from hazard events with respect to potential impacts to:
        - Populations, including socially vulnerable and underserved communities.
        - Structures, including critical facilities.
        - Infrastructure and community lifelines servicing jurisdictions that could affect state resilience, including Safety and Security; Food, Water, Shelter; Health and Medical; Energy; Communications; Transportation; and Hazardous Material lifelines.
- The risk assessment must include an overview and analysis of the potential losses to the identified vulnerable structures based on estimates in the local and state risk assessments.
- If the state is interested in HHPD funding eligibility, the risk assessment must address risks from high hazard potential dams in the risk assessment.
- The plan must provide a summary of recent development and potential or projected development in hazard-prone areas based on state and local government risk assessments including, but not limited to the following:
    - Changes in land use and the built environment and projected future growth or re-development of areas.
    - Changes in population demographics that may affect vulnerability to hazard events, including socially vulnerable and underserved communities.
    - Changes to the vulnerability of state assets.
    - Changes in development that could impact jurisdictions most threatened by the identified hazards based on local risk assessments, including the potential impacts of climate change.

Hazards Summary

This chapter provides details about the natural hazards that Louisiana currently encounters and anticipates encountering in the future. To assess the potential consequences of these natural hazards in 2050, a planning period of 26 years has been chosen.

The following table summarizes the information presented in this section across Louisiana. Greater detail is found in this chapter and the Technical Appendix, including maps showing historic and future hazard probabilities and locations of projected losses. Loss values represent the projected average annual statewide loss in 2050.

Extreme Heat

HISTORY: 1 to 43 days per year(on average) with temperatures exceeding 95°F
PROJECTED CHANGE BY 2050: +20% days over 95°F
PROJECTED HAZARD IN 2050: Up to 52 days per year (on average) with temperatures exceeding 95°F
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$1,000,000***

Drought

HISTORY: 0 to 31% weekly probability
PROJECTED CHANGE BY 2050: +25% probability of occurrence
PROJECTED HAZARD IN 2050: Up to 40% weekly probability of drought
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$54,000,000***

Wildfire

HISTORY: 0% to 11.3% annual burn probability
PROJECTED CHANGE BY 2050: +25% probability of occurrence
PROJECTED HAZARD IN 2050: 0% to 14.1% annual burn probability
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$30,000,000***

Extreme Cold

HISTORY: 1 to 56 days per year (on average) with temperatures less than 32°F
PROJECTED CHANGE BY 2050: -20% days under 32°F
PROJECTED HAZARD IN 2050: 1 to 44 days per year (on average) with temperatures less than 32°F
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$15,000,000***

High Wind

HISTORY: 700-year return period (0.14% annual probability) wind speeds ranging from 105 mph to 170 mph
PROJECTED CHANGE BY 2050: No projected change
PROJECTED HAZARD IN 2050: 700-year return period (0.14% annual probability) wind speeds ranging from 105 mph to 170 mph
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$1,241,000,000***

Hailstorms

HISTORY: 0 to 9 days per year (on average) experiencing hail ≥ 0.75 inches in diameter
PROJECTED CHANGE BY 2050: -10% days with hail
PROJECTED HAZARD IN 2050: 0 to 8 days per year (on average) experiencing hail ≥ 0.75 inches in diameter
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$4,000,000***

Lightning

HISTORY: 9 to 24 lightning flashes per square mile per year
PROJECTED CHANGE BY 2050: +10% increase in flash intensity
PROJECTED HAZARD IN 2050: 10 to 26 lightning flashes per square mile per year
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$54,000,000***

Tornadoes

HISTORY: 0 to 2.1 tornado touchdown days within 25 miles per year
PROJECTED CHANGE BY 2050: +10% probability of occurrence
PROJECTED HAZARD IN 2050: 0 to 2.3 tornado touchdown days within 25 miles per year
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$30,000,000***

Flooding

HISTORY: 65% of Louisiana's land area and 25% of population and structures are in the special flood hazard area (SHFA)
PROJECTED CHANGE BY 2050: No projected change
PROJECTED HAZARD IN 2050: 65% of Louisiana's land area and 25% of population and structures are in the special flood hazard area (SHFA)
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$3,632,000,000***

Dam Failure

HISTORY: One threatened out-of-state dam failure
PROJECTED CHANGE BY 2050: No projected change
PROJECTED HAZARD IN 2050: 0.01% annual probability of failure
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***DUE TO THE LOW PROBABILITY OF DAM FAILURE IN LOUISIANA, LOSSES WERE NOT ESTIMATED***

Levee Failure

HISTORY: Failures during 2005 Hurricane Katrina in New Orleans (0.3% annual probability)
PROJECTED CHANGE BY 2050: No projected change
PROJECTED HAZARD IN 2050: 0.3% annual probability
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***DUE TO THE LOW PROBABILITY OF LEVEE FAILURE IN LOUISIANA, LOSSES WERE NOT ESTIMATED***

Earthquake

HISTORY: 8 minor earthquakes in past 25 years (20% annual probability statewide)
PROJECTED CHANGE BY 2050: No projected change
PROJECTED HAZARD IN 2050: 20% annual probability statewide
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$12,000,000***

Sinkholes

HISTORY: 2 sinkholes in 52 years from 153 terrestrial salt domes (0.025% annual probability)
PROJECTED CHANGE BY 2050: +50% probability of occurrence
PROJECTED HAZARD IN 2050: 0.05% annual probability
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$1,000,000***

Expansive Soil

HISTORY: Soil swelling potential ranging from 3.5% to 58%
PROJECTED CHANGE BY 2050: +15% of soil swelling potential
PROJECTED HAZARD IN 2050: Soil swelling potential ranging from 4% to 66.7%
PROJECTED 2050 AVERAGE ANNUAL STATEWIDE LOSS: ***$96,000,000***

Risk Assessment Summary

The statewide annual average loss for each hazard is shown below and summed up for the state. Parish level loss estimates are provided in the Technical Appendix.

Projected Average Annual Loss in 2050	Building Average Annual Loss	Crop Average Annual Loss	Total Average Annual Loss
Extreme Heat	-	$1,000,000	$1,000,000
Drought	-	$54,000,000	$54,000,000
Wildfire	$30,000,000	-	$30,000,000
Extreme Cold	$13,000,000	$2,000,000	$15,000,000
Wind	$1,241,000,000	-	$1,241,000
Hail	$4,000,000	$200,000	$4,000,000
Lightning	$4,000,000	$5,000	$4,000,000
Tornado	$30,000,000	$400,000	$30,000,000
Flood	$3,632,000,000	-	$3,632,000,000
Earthquake	$12,000,000	-	$12,000,000
Sinkhole	$1,000,000	-	$1,000,000
Expansive Soil	$96,000,000	-	$96,000,000
Total Average Annual Projected Loss	**$5,064,000,000**	**$57,000,000**	

The most vulnerable jurisdictions for each of the hazards are shown visually on maps included in each hazard section. The top five jurisdictions most susceptible to damage and loss from each of the identified hazards are listed in the following table, with "1" being the most susceptible. A complete loss estimate table for each hazard by parish is provided in the Technical Appendix.

	1	2	3	4	5
Extreme Heat	St. James	Caldwell	Franklin	East Carroll	Tensas
Drought	Caddo	Vermilion	Avoyelles	St. Landry	Assumption
Wildfire	St. Tammany	Tangipahoa	Livingston	Calcasieu	East Baton Roughe
Extreme Cold	Caddo	St. Tammany	Livingston	Ascension	Lafayette
Wind	Jefferson	Orleans	St. Tammany	Terrebonne	Lafayette
Hail	Jefferson	Calcasieu	St. Tammany	Bossier	Caddo
Lighning	Livingston	Bossier	East Baton Rouge	Lafayette	St. Martin
Tornado	Bossier	Ouachita	Lincoln	Lafayette	Caddo
Flood	St. Tammany	Terrebonne	Lafayette	St. Mary	Jefferson
Sinkhole	St. Mary	St. Martin	Calcasieu	Acadia	Plaquemines
Expansive Soil	Orleans	Jefferson	East Baton Rouge	St. Tammany	Ascension
Earthquake	Ouachita	East Baton Rouge	Caddo	Bossier	St. Tammany
Total Losses	St. Tammany	Terrebonne	Lafayette	Jefferson	St. Mary

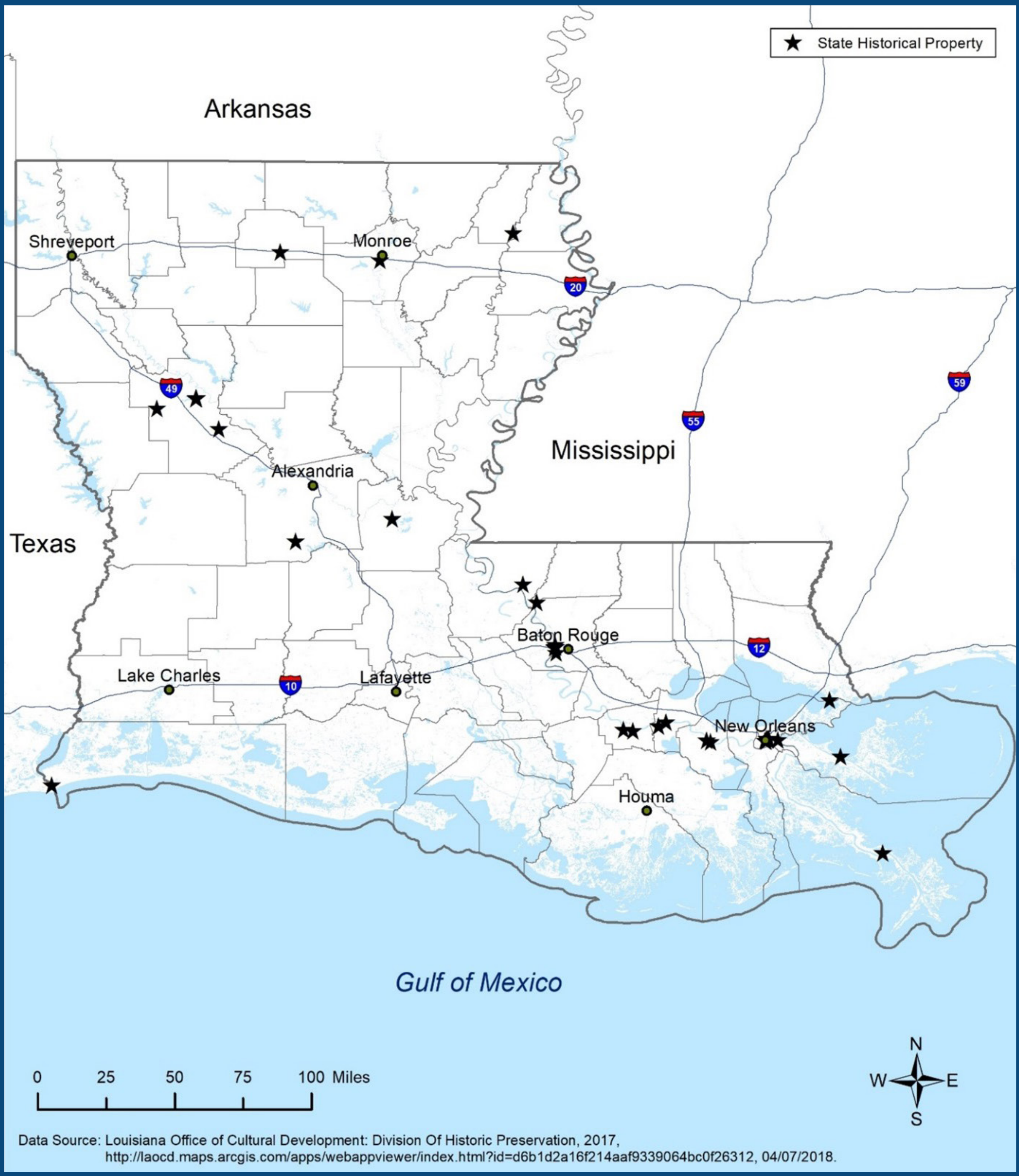
State Asset Risk Assessment Summary

Data from the Louisiana Office of Risk Management show 8,783 state buildings with a total building and contents replacement value of approximately $15.2 billion. In addition to state-owned assets, several historic properties of particular importance are identified. The potential average annual dollar losses for state assets are shown by hazard. A complete loss estimate table for state assets for each hazard by parish is provided in the Technical Appendix. Hazard exposure data are provided for the historic structures in the Technical Appendix.

HAZARD	Projected 2050 Average Annual State Asset Losses
Wildfire Property Loss	$533,438
Extreme Cold Property Loss	$225,656
Wind Property Loss	$15,062,040
Hail Property Loss	$42,060
Lightning Property Loss	$33,865
Tornado Property Loss	$675,481
Flood Property Loss	$51,200,805
Earthquake Property Loss	$249,468
Sinkhole Property Loss	$11,423
Expansive Soil Property Loss	$1,195,379

State Building Locations in Louisiana, 2023

State Historic Preservation Office (SHPO) Properties Location in Louisiana, 2017



CHANGES IN DEVELOPMENT

Parish-level population

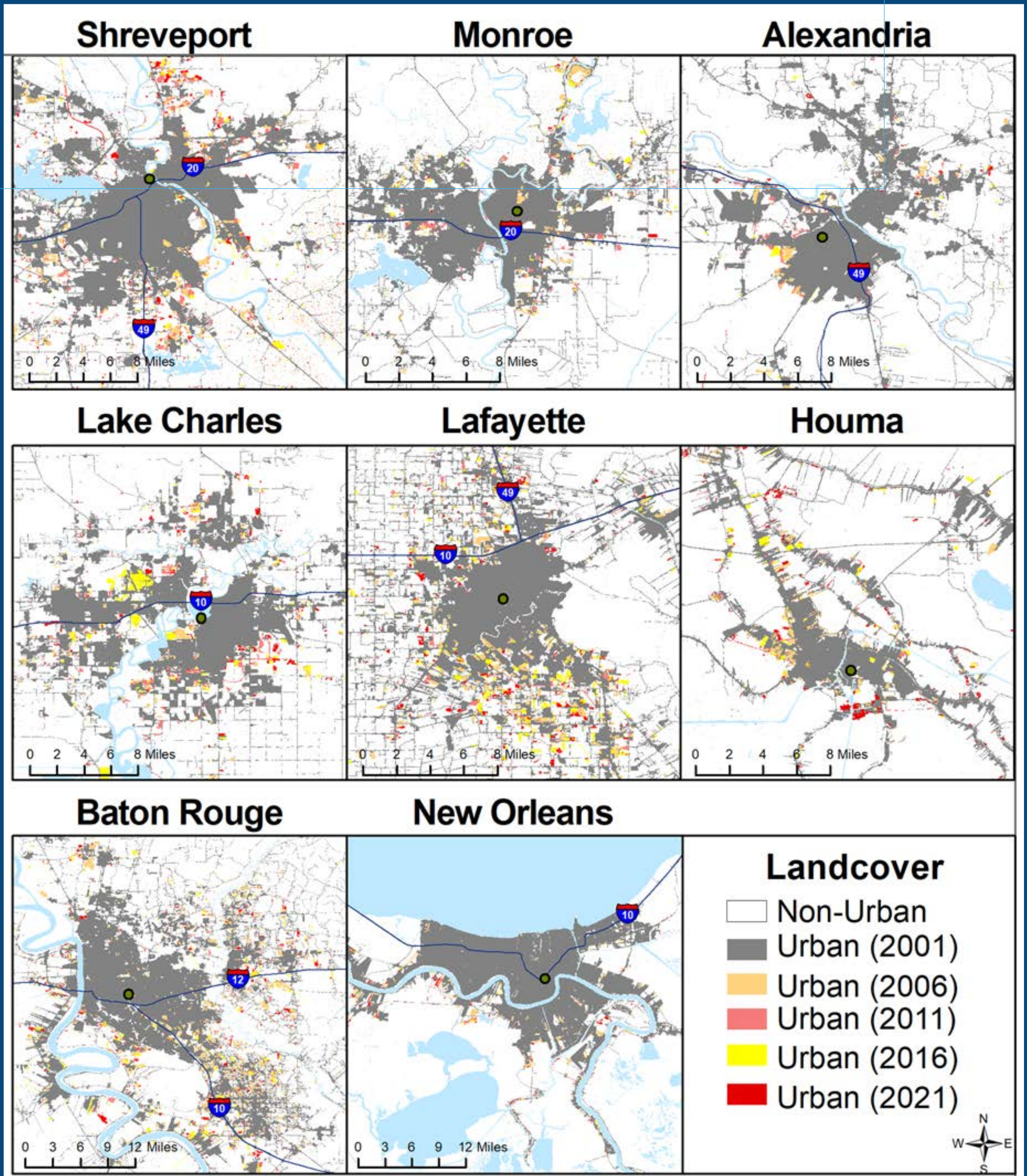
Based on land cover data for the state and major urban areas, recent urban growth in previously rural locations was limited, with most of the urban areas established in Louisiana by 2001. Recent development primarily occurred in outlying metropolitan areas of Shreveport, Monroe, Alexandria, Lake Charles, Lafayette, Houma, Baton Rouge, and New Orleans. The population of Louisiana was 4,657,757 in the 2020 census and is projected to grow by 14.36% to 5,326,484 by 2050. Due to data limitations, loss projections are based on densification of currently populated areas. Additional analysis of development patterns and areas is recommended prior to the next plan update in order to forecast future populations and development more accurately.

Vulnerable populations

The rates of growth of vulnerable populations were determined based on American Community Survey (ACS) 5-year estimates for population age, disability, poverty status, and mobile homes from 2012 to 2021. These demographic variables may not be all-inclusive indicators of vulnerability. For instance, proximity to the coast may enhance (through exposure to the hurricane hazard) or reduce (through economic opportunity) vulnerability. It is assumed here that the demographic variables listed above represent the outcome of whether proximity to the coast is a net vulnerability or an opportunity at the individual level. The parishes with the highest sum of vulnerable population growth rates, indicating a greater likelihood of future increase in demographic vulnerability, are St. Bernard, Plaquemines, Ascension, St. Tammany, West Baton Rouge, and Richland parishes. A full listing of changes in vulnerable populations is provided in the Technical Appendix.

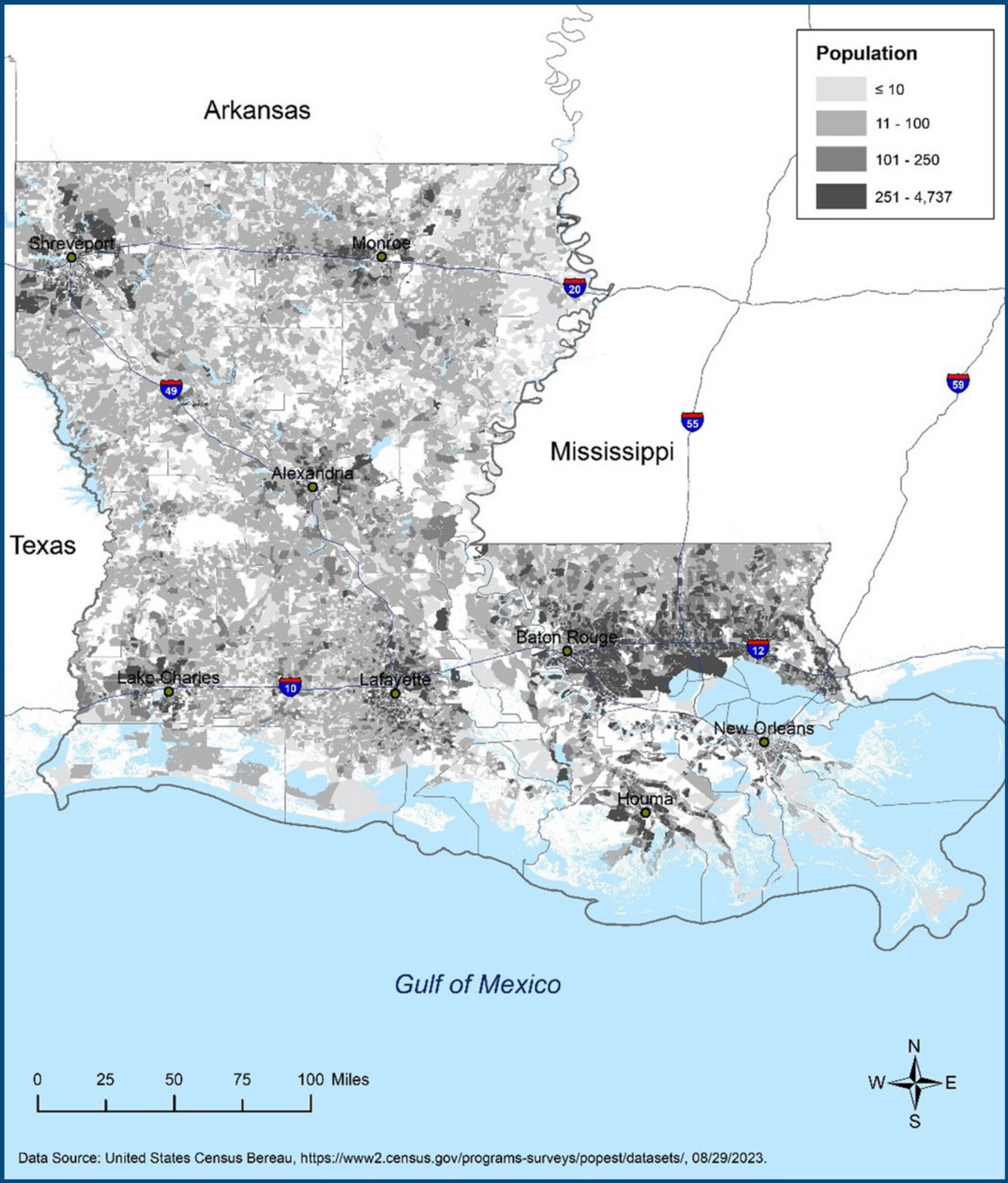
Urban Landcover Change in Louisiana 2001-2021

Urban Landcover Change in Louisiana 2001-2021



Data Source: National Land Cover Database (NLCD) 2001; 2006; 2011; 2016; 2021. https://www.mrlc.gov/index.php,11/19/2023.

Projected Population Distribution by Census Block, 2050

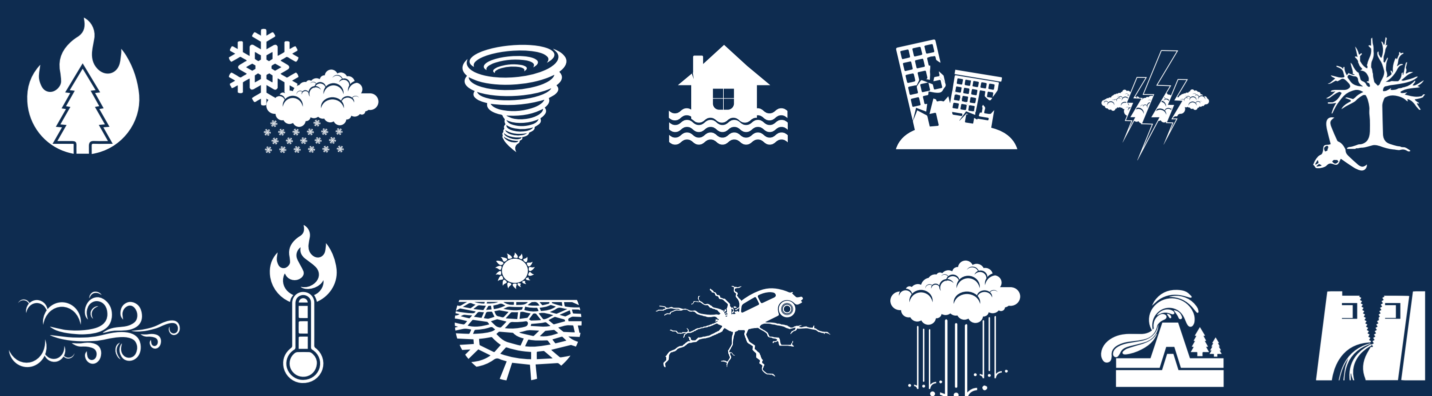


RISK ASSESSMENT ORGANIZATION

The following sections depict the locations of historical hazards using maps created through analysis of previous occurrences. These data and maps were analyzed to determine annual probability of occurrence or number of days per year for each hazard where appropriate. Anticipated hazard maps, reflecting hazard conditions in the year 2050, were developed using the historical data and evaluation of future conditions, which are described in the Technical Appendix for each hazard. The 2050 hazard maps are used in the risk assessment for each hazard to estimate the annual losses expected to occur in Louisiana 26 years from now.

TEMPERATURE HAZARDS

Hazards in Louisiana related to temperature include extreme heat, drought, wildfire, and extreme cold. The following sections contain a discussion of each of these hazards as well as a risk assessment.



EXTREME HEAT

Overview

Although all of Louisiana is vulnerable to extreme heat, summer temperatures can often exceed 100°F in the northern parishes, particularly during dry spells when clear skies allow increased solar radiation to reach the surface. Afternoon highs in the north have occasionally reached 110°F, with an all-time extreme of 114°F recorded in Plain Dealing (Bossier Parish) on August 10, 1936, during the 1936 North American Heat Wave. A more recent occurrence of extreme heat hazards is the August 2007 Heatwave, affecting Lake Charles, Lafayette, New Iberia, and Alexandria, setting new record high temperatures of between 101°F and 103°F.

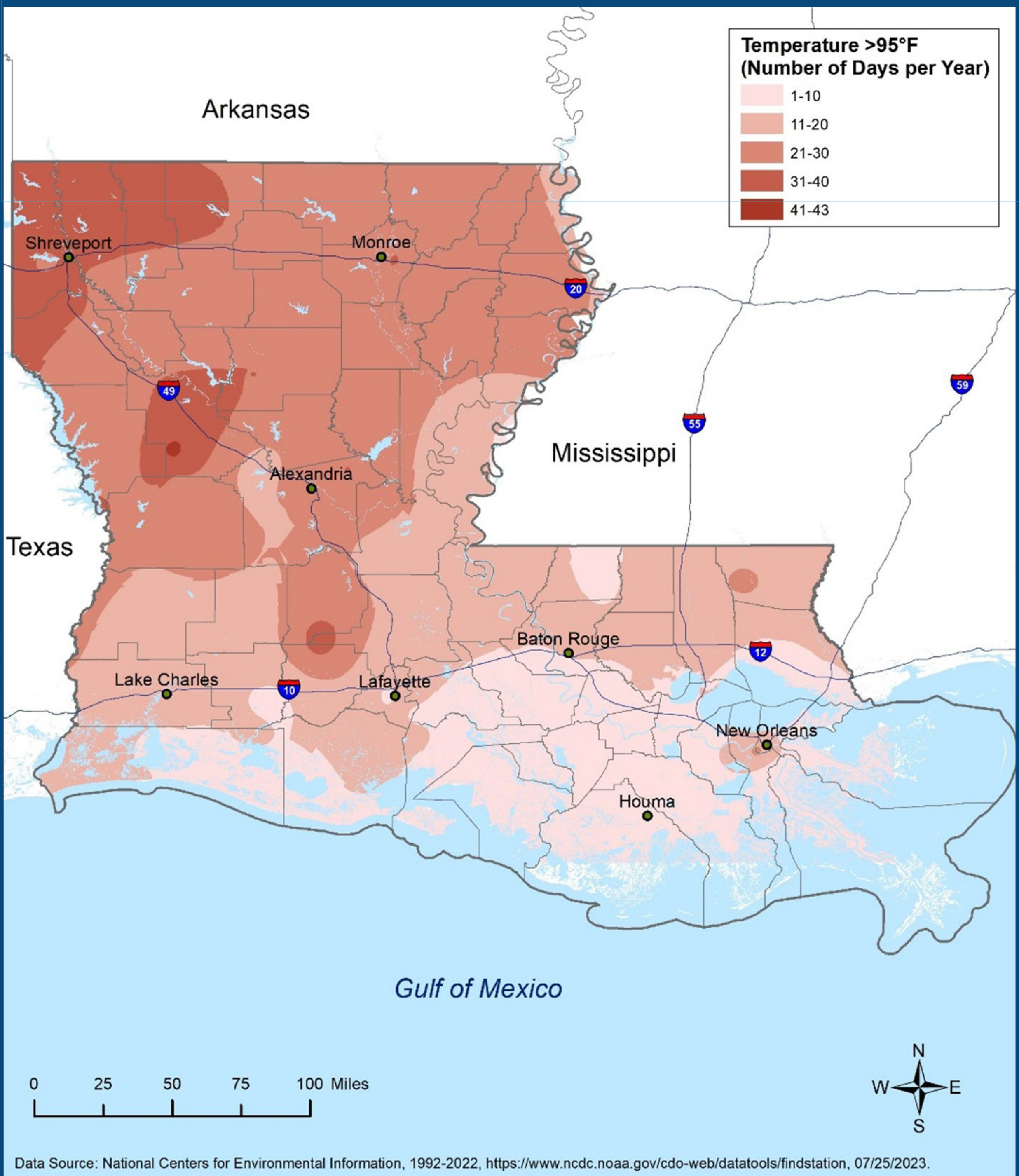
Northwest Louisiana, which includes Shreveport, experienced more than 25 days of maximum temperatures over 95°F in each of several months (June, July, and August) in 2011. Likewise, July 2016 had 25 days of these extreme temperatures, and 25 and 23 such extreme temperature days occurred in 2018 (July and August, respectively). According to the Louisiana Department of Health, 25 people died due to heat-related illness during the summer of 2023, with New Orleans experiencing its hottest summer on record.

The following map shows the historic number of days with temperatures exceeding 95°F. Most studies on the topic focus on the number of days with temperatures exceeding 95°F. The 2050 temperature map showing the number of days with temperatures exceeding 95°F considers the projected increases in the intensity of extreme heat hazards we could expect to see in the year 2050. This probability map is used in the extreme heat risk assessment.

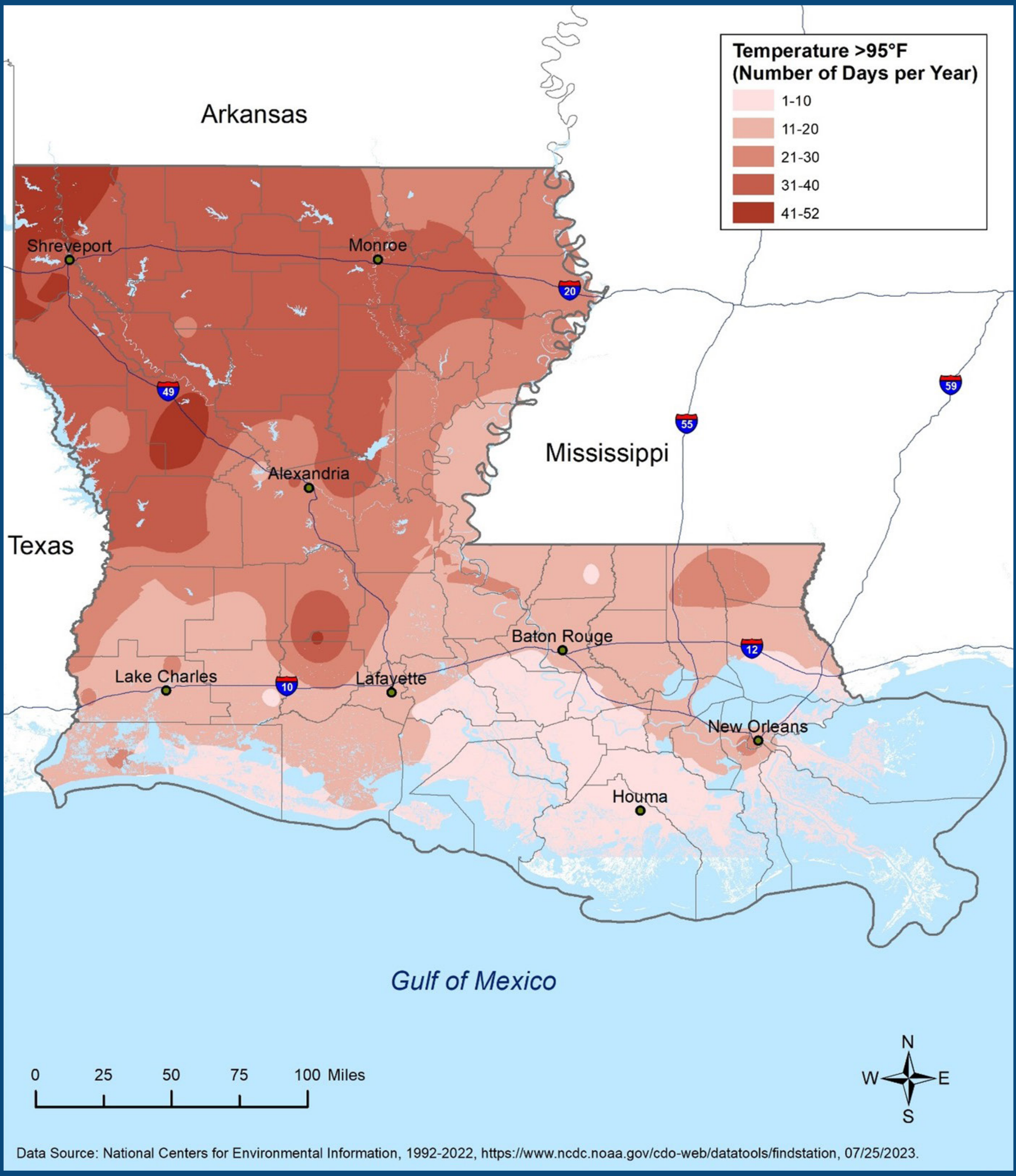
RISK ASSESSMENT

The projected crop loss map shows anticipated annual average losses due to extreme heat hazards by census block. Extreme heat has not historically caused direct property losses.

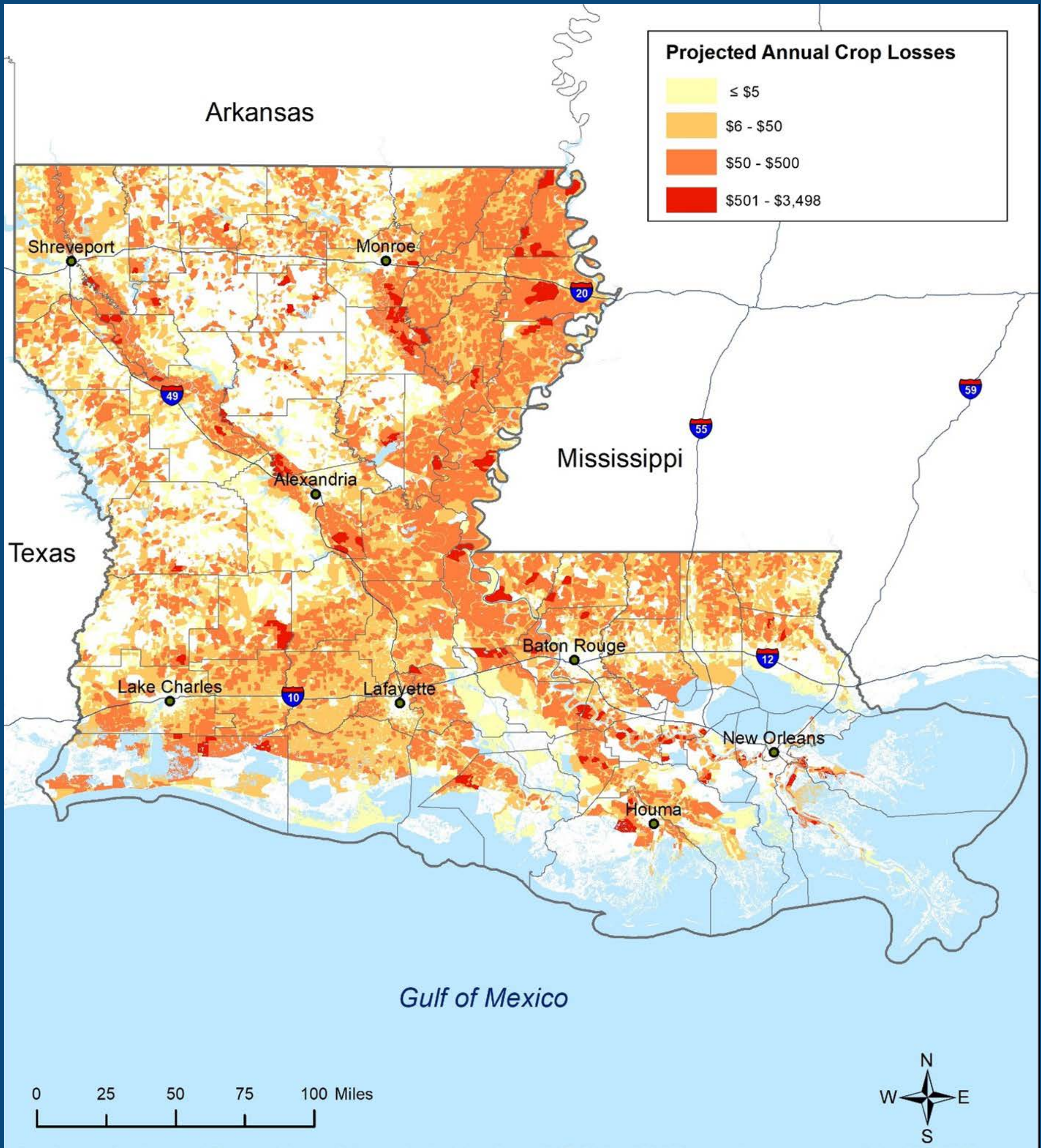
Number of Days per Year with Temperature Above 95F, 1992-2022



Projected Number of Days per Year with Temperature Above 95F, 2050



Projected Annual Crop Losses from Extreme Heat by Census Block, 2050



Data Sources: Spatial Hazard Events and Losses Database for the United States (SHELDUS), 1960-2021, https://cemhs.asu.edu/sheldus, 08/26/2023.
National Centers for Environmental Information, 1992-2022, https://www.ncdc.noaa.gov/cdo-web/datatools/findstation, 07/25/2023.
National Land Cover Database (NLCD), 2001-2021, https://www.mrlc.gov/index.php, 08/26/2023.

DROUGHT

Overview

A drought is a deficiency in water availability over an extended period of time, caused by precipitation totals and soil water storages that do not satisfy the environmental demand for water, either by evaporation or transpiration through plant leaves. It is important to note that the lack of precipitation alone does not constitute drought; the season during which the precipitation is lacking has a major impact on whether drought occurs. For example, a week of no precipitation in July, when the solar energy to evaporate water and vegetation's need for water to carry on photosynthesis are both high, may trigger a drought, while a week of no precipitation in January may not initiate a drought. The driest year on record in Louisiana occurred in 1963. The second driest year on record was 2011, with parts of southeast Louisiana in extreme drought status.

Although Louisiana features several large bodies of water, thousands of miles of rivers, streams, and bayous, and is home to thousands of acres of wetlands, the state has experienced occasional drought conditions. Significant periods of drier-than-average conditions include the mid-1890s through the mid-1900s, the 1950s, the 1960s through the early 1970s, the early 2000s and early 2010s, and late 2022.

Louisiana experienced a severe drought in 2023, with 99.9% of the state in moderate (D1) drought or worse, and 90% of the state in extreme (D3) drought or worse. This drought impacted the agricultural sector significantly, with record heat and exceptional drought affecting every major crop in the state. The U.S. Drought Monitor also reported that Louisiana faced its most widespread drought in 23 years.

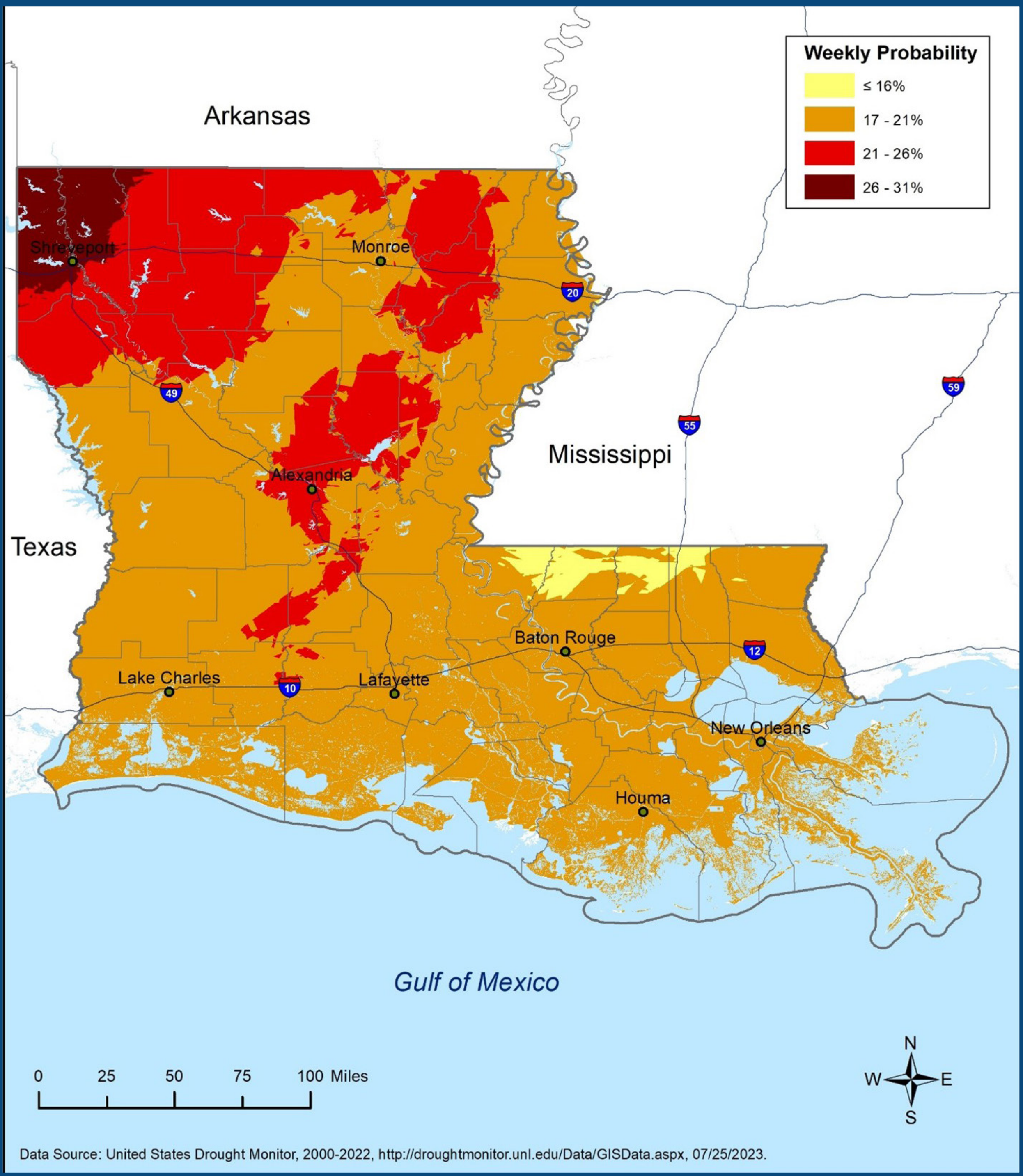
Drought is a unique and insidious hazard. Unlike other natural hazards, no specific, standard threshold of "dryness" exists for declaring a drought. In addition, the definition of drought depends on stakeholder needs. For instance, the onset (and demise) of agricultural drought is quick, as crops need water every few days; once they get rainfall, they improve. But hydrologic drought sets in (and is alleviated) only over longer time periods. A few dry days will not drain a reservoir, but a few rain showers cannot replenish it, either. Moreover, different geographical regions define drought differently based on the deviation from local, normal precipitation. And drought can occur anywhere, triggered by changes in the local-to-regional-scale atmospheric circulation over an area or by broader-scale circulation variations such as the expansion of semi-permanent oceanic high-pressure systems or the stalling of an upper-level atmospheric ridge in place over a region. The severity of a drought depends upon the degree and duration of moisture deficiency, and the size of the affected area. Periods of drought tend to be associated with other hazards such as wildfires and/or heat waves as well. Drought is a slow onset event, causing less direct—but tremendous indirect—damage. Depletion of aquifers, crop loss, and livestock and wildlife mortality rates are examples of direct impacts.

The 2000-2022 weekly drought probability map shows areas that have historically been affected by drought, while the 2050 probability map considers projected increases in the probability of drought that we could expect to see in the year 2050. This probability map is used in the drought risk assessment. A discussion of potential factors that contribute to the increased probability appears in the Technical Appendix (Future Conditions: Drought and Wildfire).

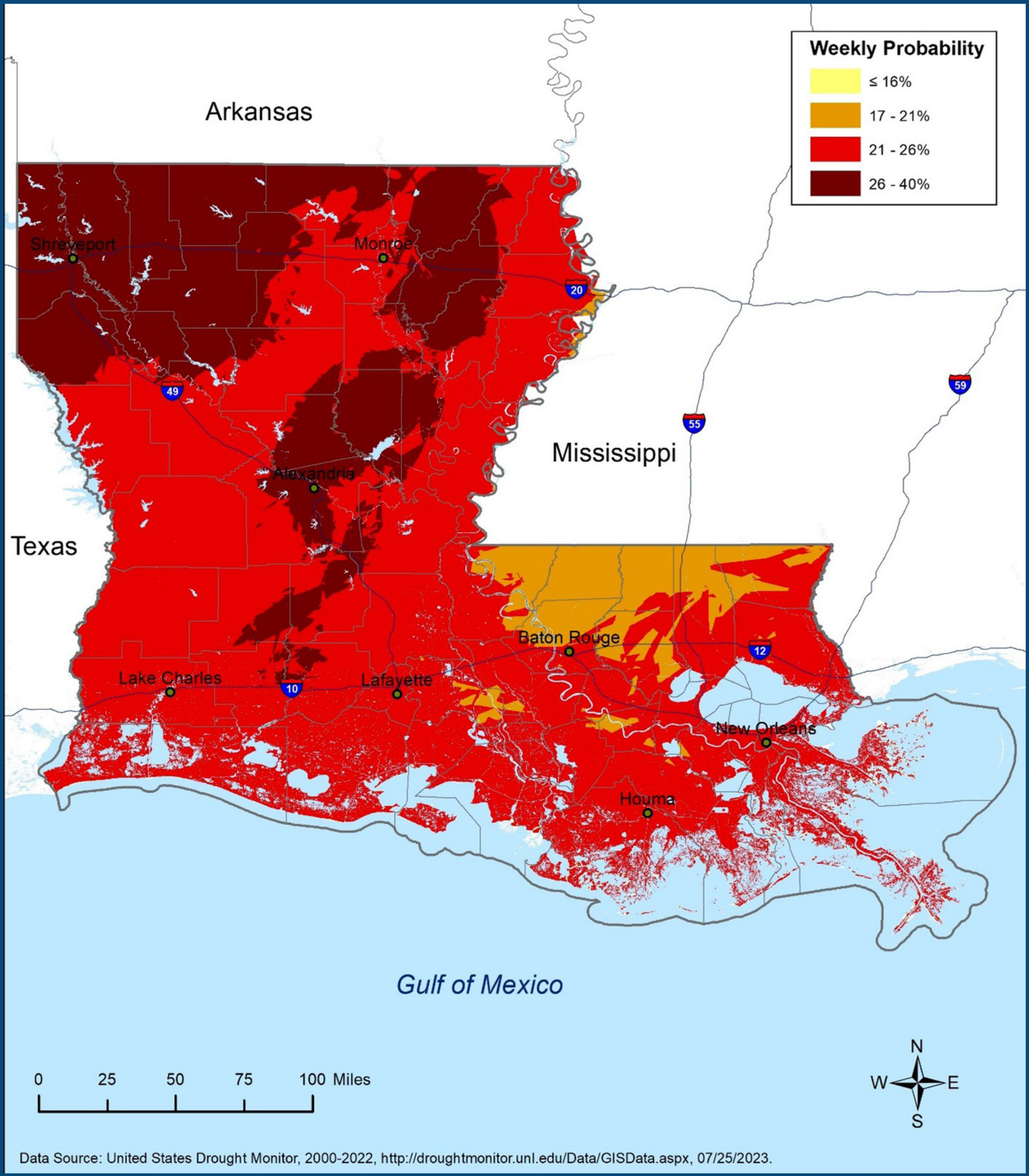
RISK ASSESSMENT

The projected crop loss map shows anticipated annual average loss due to drought hazards by census block.

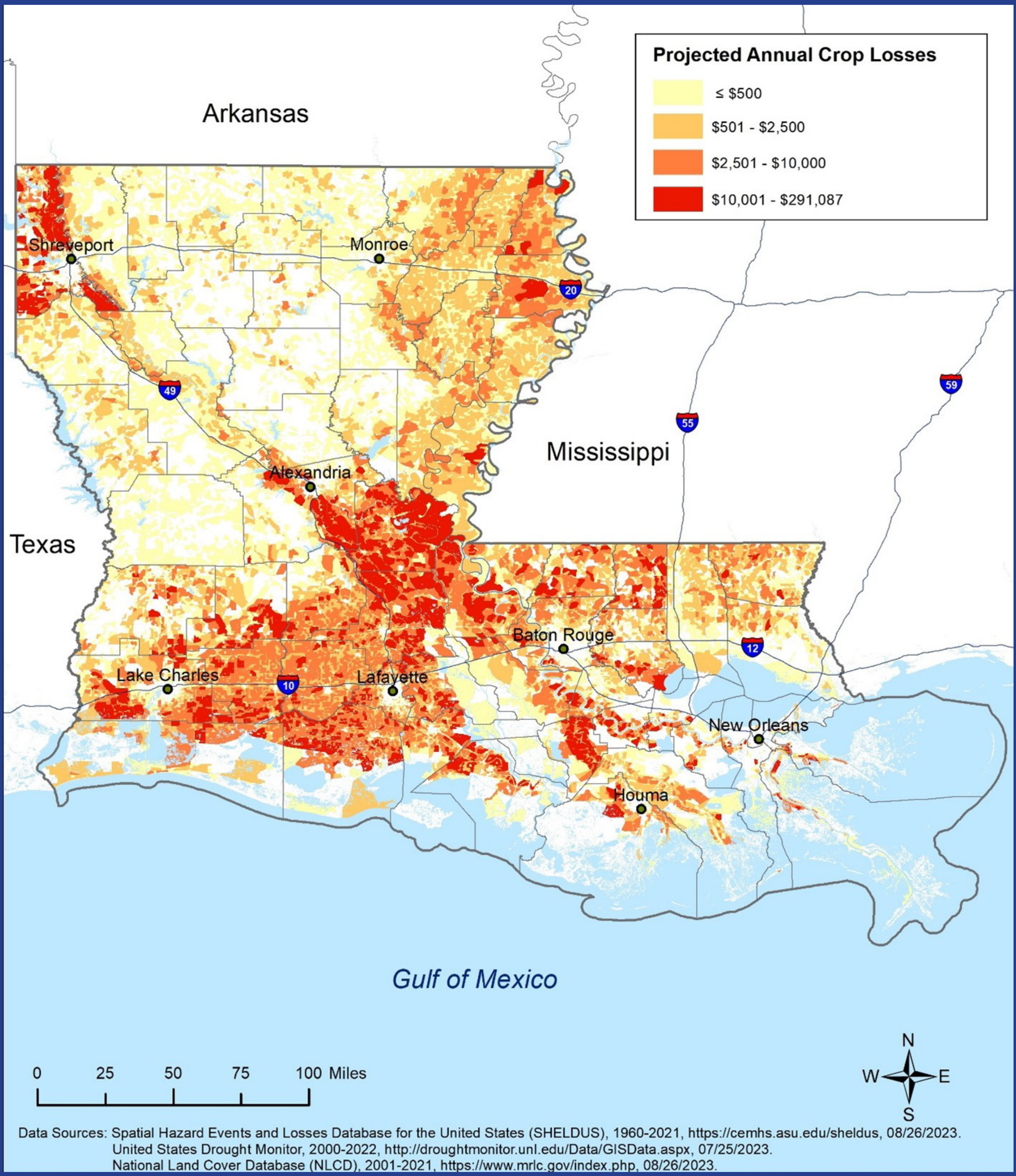
Weekly Probability of Drought in Louisiana, 2000-2022



Projected Weekly Drought Probability in Louisiana, 2050



Projected Annual Crop Losses from Drought by Census Block, 2050



WILDFIRE

Overview

Wildfire is combustion in a natural setting, marked by flames or intense heat. According to the State of Louisiana Forestry Division, most forest fires in Louisiana are caused by intentional acts (arson) or carelessness and negligence committed by people, exacerbated by human confrontation with nature. The wildland–urban interface (WUI) is the area in which development meets wildland vegetation, where both vegetation and the built environment provide fuel for fires. As development near wildland settings continues, more people and property are exposed to wildfire danger.

Wildfires are common in Louisiana. In contrast with much of the U.S., Louisiana wildfires tend to be small, averaging 10 acres in size. Data from the Louisiana Department of Agriculture and Forestry show that between 2007-2017, there have been more than 15,000 wildfires, burning nearly 160,000 acres. On average, 3% of residences threatened by fires are damaged while 97% are protected. The year 2011 was the most active fire year between 2007-2017, with 2,888 fire events and 76 damaged structures. This same year, 2,764 residences were threatened by fire but protected from damage. Without the effort and dedication of Office of Forestry personnel, the loss from wildfire could be catastrophic.

Between August and October 2023, wildfires in Louisiana ravaged over 60,000 acres (94 square miles), leading to evacuations in various towns, including Merryville and Singer. Starting on August 22, a total of 441 wildfires were active in 17 parishes, resulting in the destruction of at least 21 buildings. In response, the Federal Emergency Management Agency (FEMA) approved an assistance grant for Beauregard Parish, Louisiana. Approximately 100 Louisiana National Guard troops were placed on standby, and significant efforts were made to contain multiple wildfires. The Tiger Island fire in Beauregard Parish stands as the largest recorded wildfire in the state, consuming over 50,000 acres (about twice the area of Manhattan).

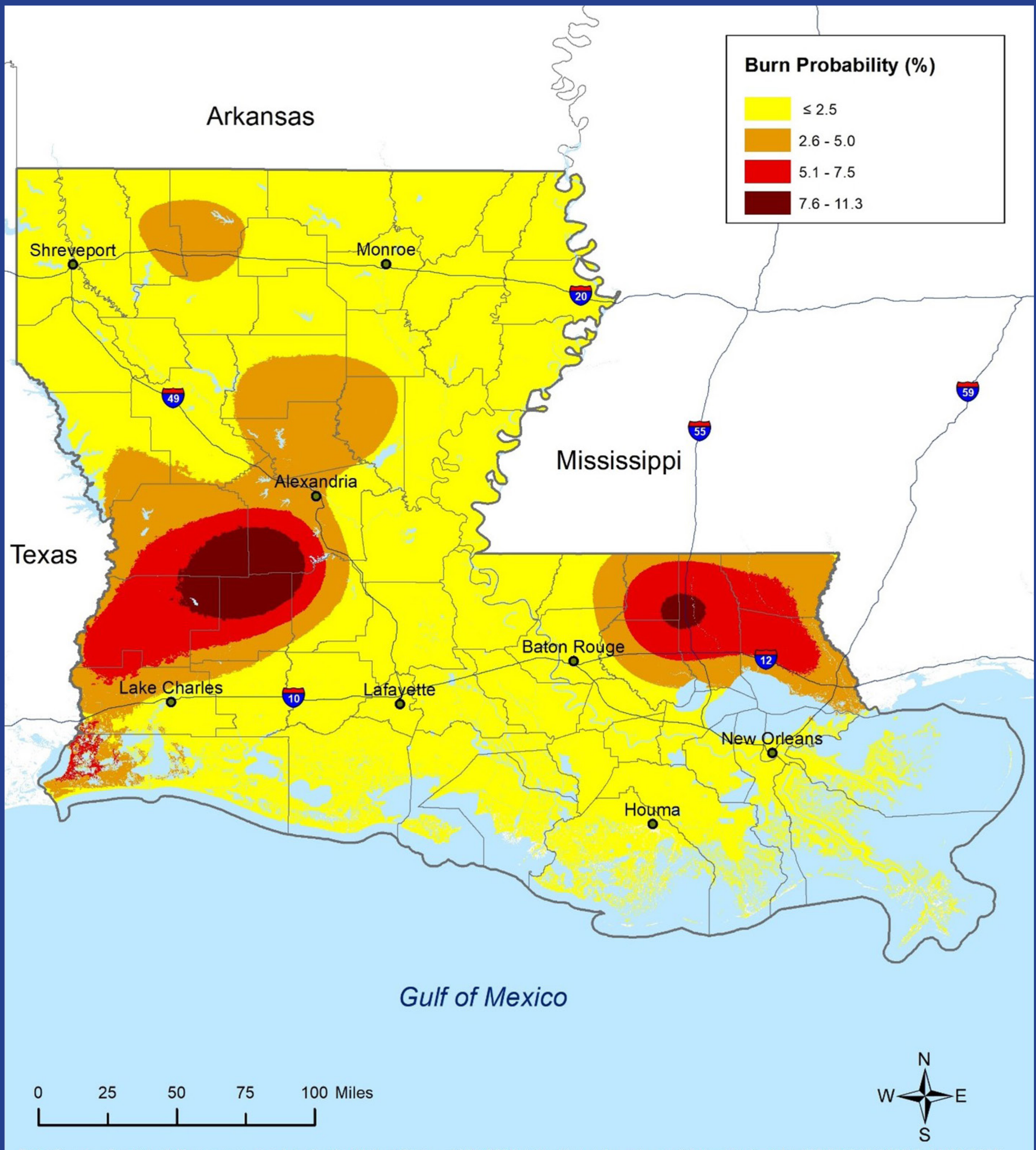
For the current plan, the 1992-2022 annual wildfire probability map was derived from previous wildfire occurrences, while the 2050 probability map considers projected increases in the probability of wildfire hazards we could expect to see in the year 2050. This probability map is used in the wildfire risk assessment. Of course, some of these wildfire-vulnerable lands are private and others are under the jurisdiction of the U.S. Forest Service.

RISK ASSESSMENT

Projected property and crop loss maps show anticipated annual average losses due to wildfire hazards by census block.

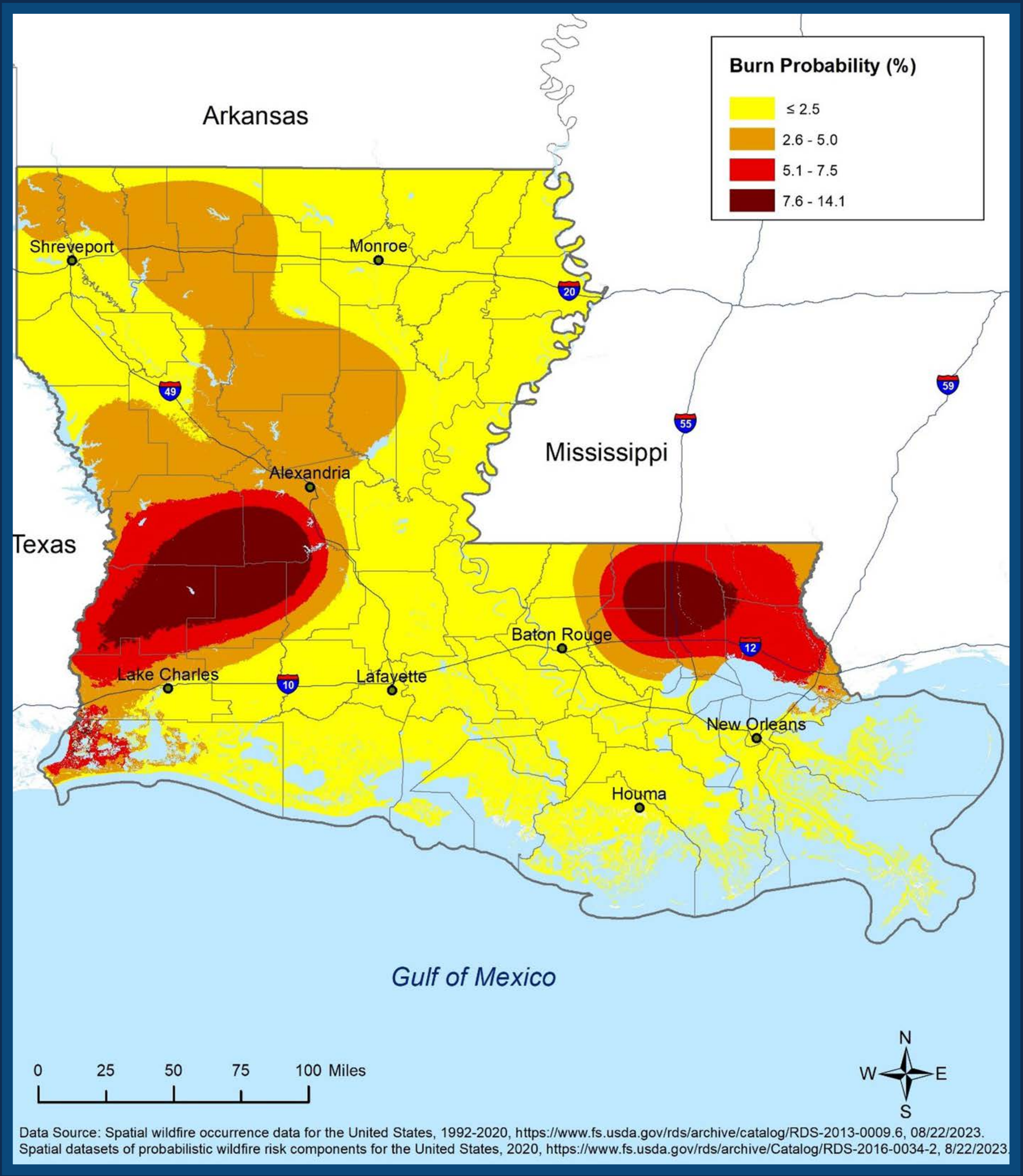
GOVERNOR'S OFFICE OF HOMELAND SECURITY GOHSEP & EMERGENCY PREPAREDNESS

Annual Probability of Wildfire in Louisiana, 1992-2020



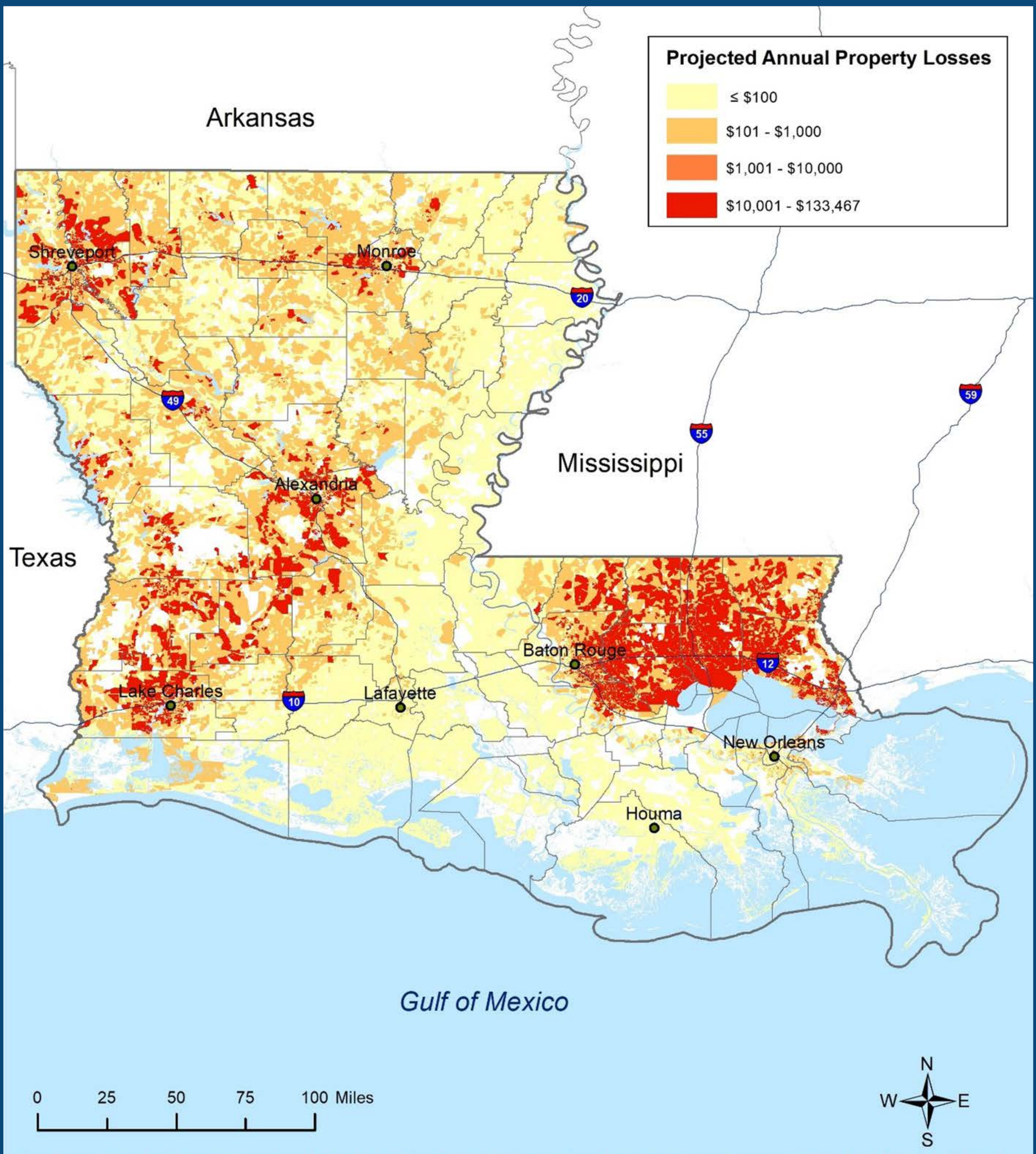
Data Source: Spatial wildfire occurrence data for the United States, 1992-2020, https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6, 08/22/2023.
Spatial datasets of probabilistic wildfire risk components for the United States, 2020, https://www.fs.usda.gov/rds/archive/Catalog/RDS-2016-0034-2, 8/22/2023.

Projected Annual Probability of Wildfire in Louisiana, 2050



GOVERNOR'S OFFICE OF HOMELAND SECURITY
GOHSEP
& EMERGENCY PREPAREDNESS

Projected Annual Property Losses from Wildfire by Census Block, 2050



Data Source: Spatial wildfire occurrence data for the United States, 1992-2020, https://www.fs.usda.gov/rds/archive/catalog/RDS-2013-0009.6, 08/22/2023. Spatial datasets of probabilistic wildfire risk components for the United States, 2020, https://www.fs.usda.gov/rds/archive/Catalog/RDS-2016-0034-2, 8/22/2023.

EXTREME COLD

Overview

Extreme cold temperatures occur in Louisiana when the normal quasi-west-to-east upper-level steering circulation patterns undulate with an unusually strong north-to-south component of motion directed toward Louisiana. A cold front generally forms on the southwestern flank of the southward-moving air mass, trailing from a surface cyclone (i.e., low-pressure center). An anticyclone (high-pressure, clear-sky area) northwest of the cold front's associated low-pressure center then follows. Once the cold front passes, temperatures fall suddenly. After the cloudiness associated with the cold front and low-pressure areas passes through the area and higher-pressure approaches, the clearing skies allow for rapid loss of radiant energy from the surface, especially at night, resulting in an even more abrupt drop in temperature. If air of Arctic origin traverses over snow-covered land on its trek southward, it can become even more bitterly cold by the time it reaches Louisiana. This scenario of cold temperatures, or "Arctic outbreaks," represents a formidable hazard in subtropical climates like Louisiana, where natural and human systems are ill-equipped to adapt, but yet are exposed to the hazard occasionally. Property (especially in the form of uninsulated pipes) and crops are particularly vulnerable. Recent extreme cold events include January 18, 2018, when temperatures at the New Orleans International Airport and Baton Rouge Metro Airport (20°F and 14°F, respectively) broke the previous record lows at those locations, which had been set in 1977.

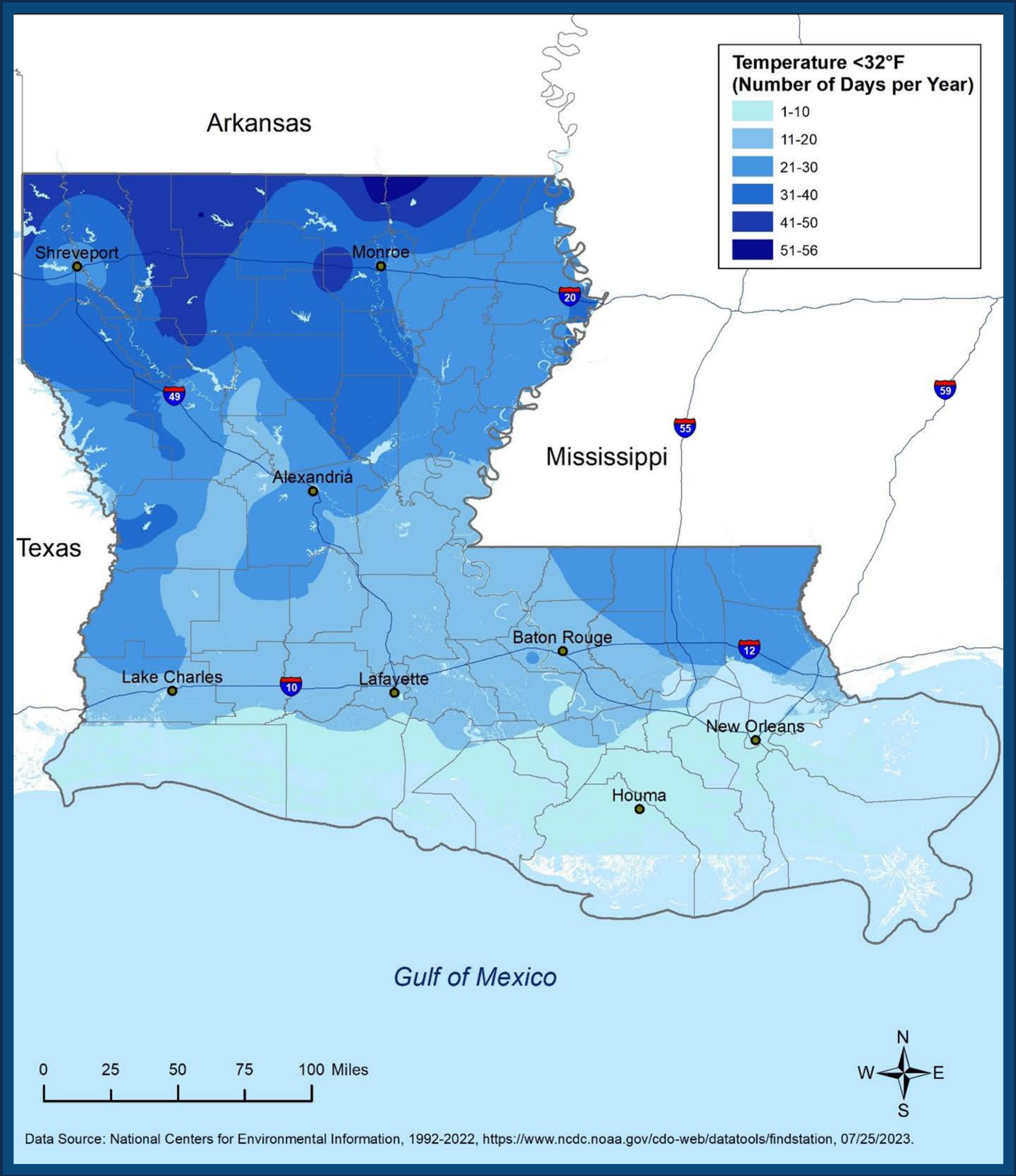
Louisiana Severe Winter Storms (DR-4590): Severe winter storms struck the state of Louisiana between February 11 and February 19. On March 9, President Biden declared a major disaster, making federal funding available to individuals and business owners affected.

The following map shows the historic number of days with temperatures below 32°F. Most studies on the topic focus on the number of days with temperatures below 32°F. The 2050 map shows the expected number of days with temperatures below 32°F considering projected decreases in the intensity of extreme cold hazards and is used in the risk assessment.

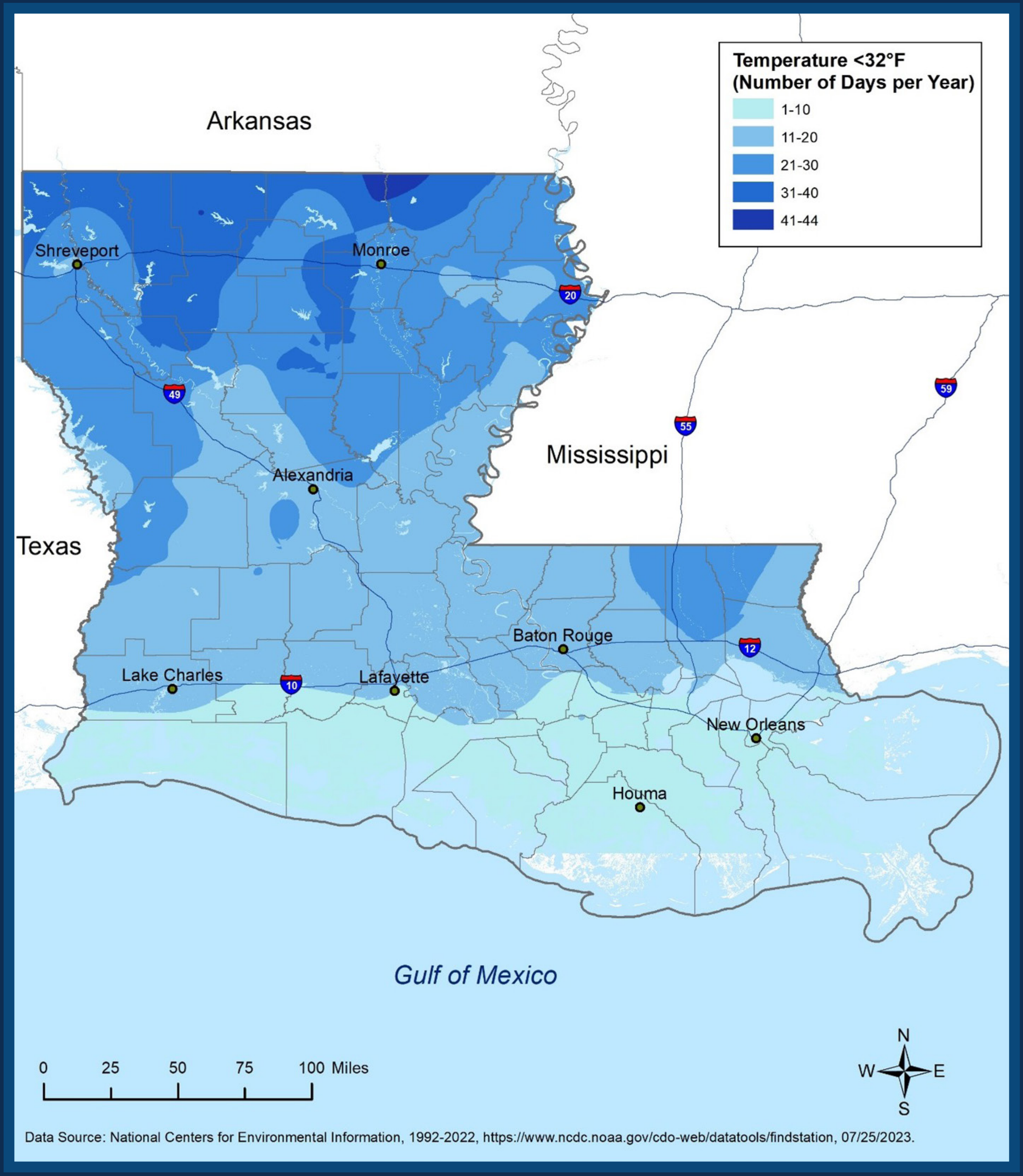
RISK ASSESSMENT

Projected property and crop loss maps show anticipated annual average losses due to extreme cold hazards by census block.

Number of Days per Year with Temperature Below 32F, 1992-2022



Projected Number of Days per Year with Temperature Below 32F, 2050



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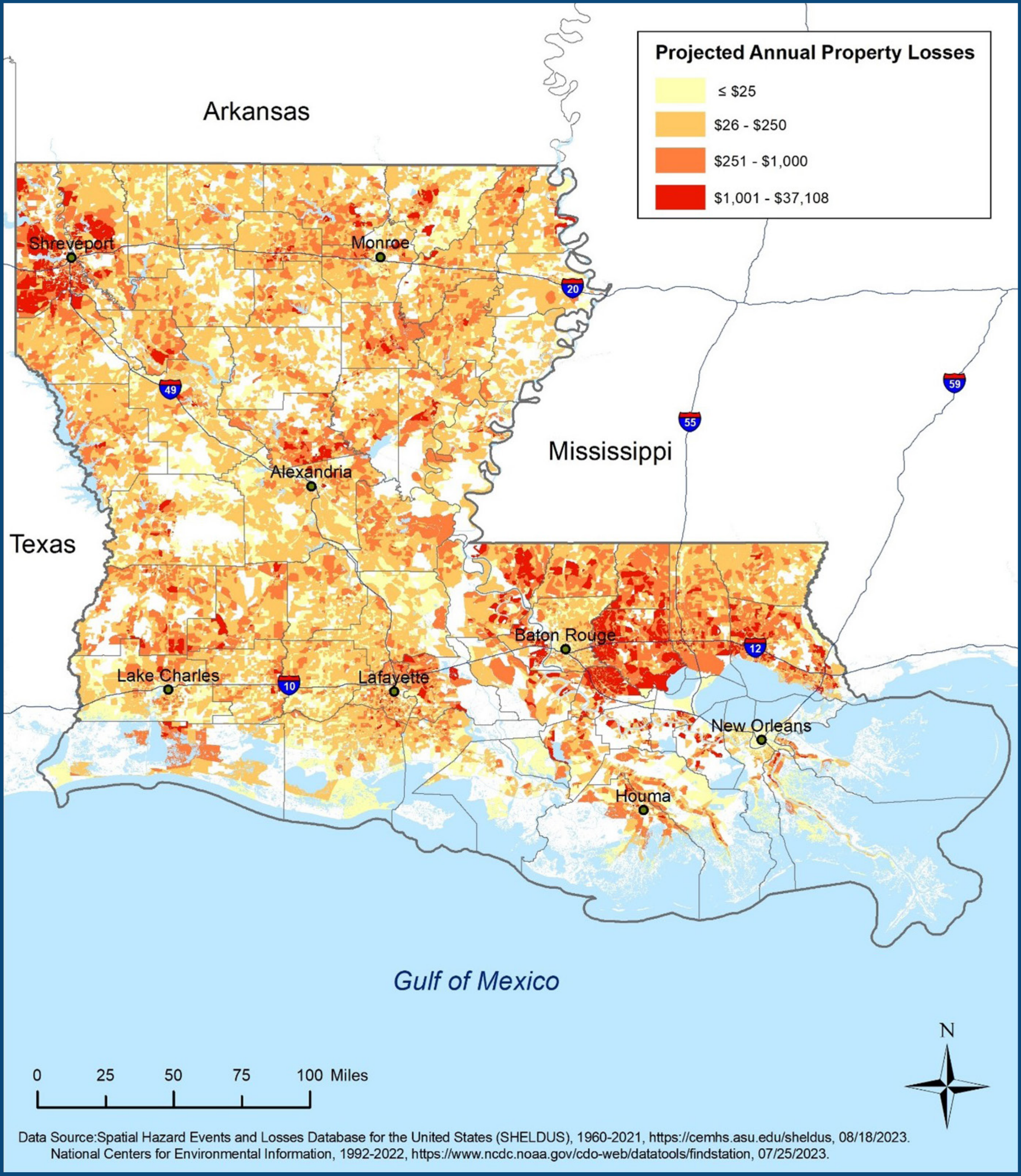
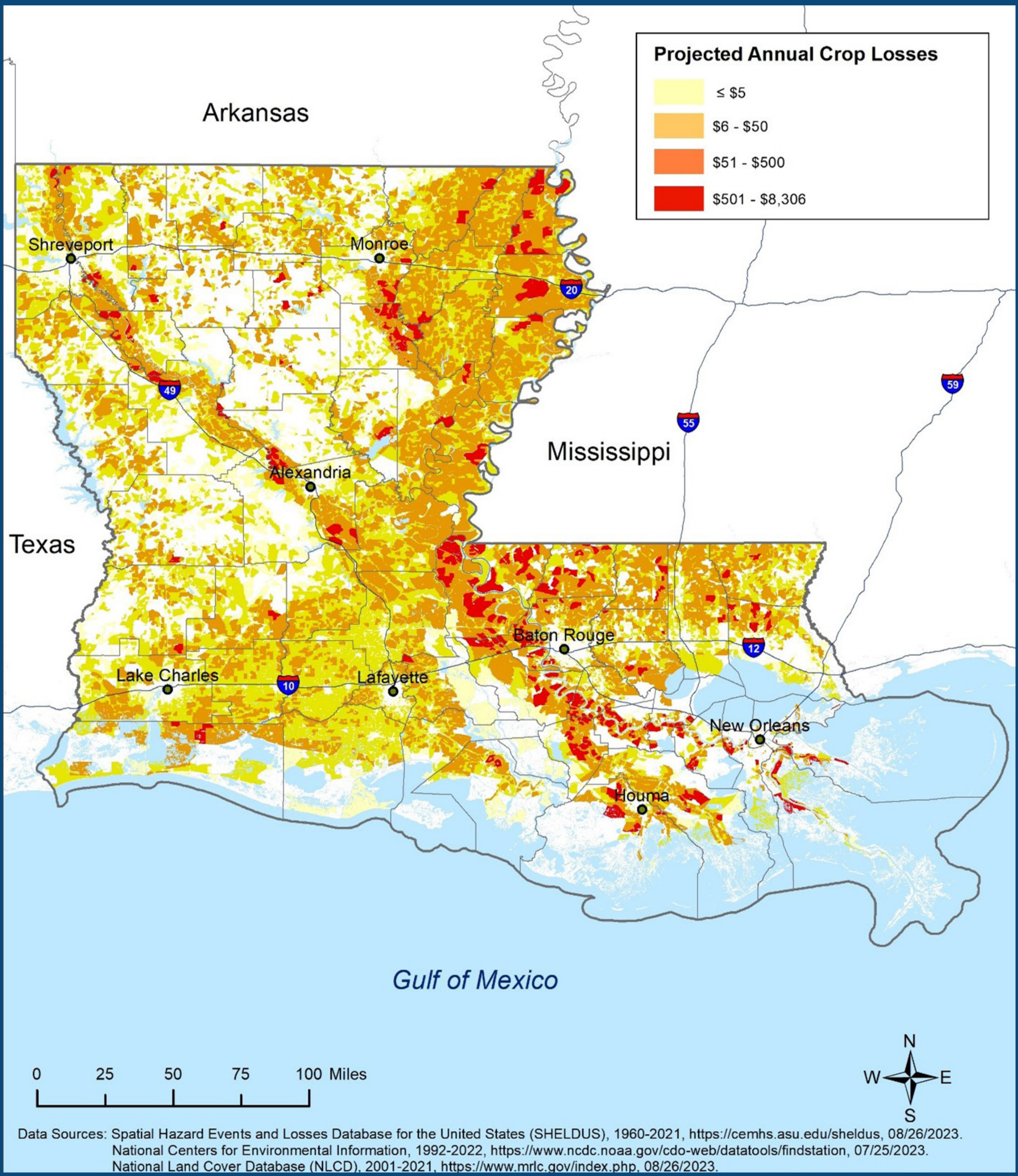
Projected Annual Property Losses from Extreme Cold by Census Block, 2050



Projected Annual Crop Losses from Extreme Cold by Census Block, 2050



WIND AND FLOOD HAZARDS

Hazards in Louisiana related to wind and flood include tropical cyclones, high wind, hailstorms, lightning, tornadoes, flooding (coastal and riverine), dam failure, and levee failure. There have been eight major disaster declarations since the 2019 State Hazard Mitigation Plan Update – all for wind and flood hazards.

Declaration Number	Description	Incident Period
DR-4611	Louisiana Hurricae Ida	August 26, 2021 - September 3, 2021
DR-4606	Louisiana Severe Storms, Tornadoes, and Flooding	May 17, 2021 - May 21, 2021
DR-4577	Louisiana Hurricane Zeta	October 26, 2020 - October 29, 2020
DR-4570	Louisiana Hurricane Delta	October 6, 2020 - October 19, 2020
DR-4559	Louisiana Hurricane Laura	August 22, 2020 - August 27, 2020
DR-4458	Louisiana Hurricane Barry	July 10, 2019 - July 15, 2019
DR-4462	Louisiana Flooding	May 10, 2019 - July 24, 2019
DR-4439	Louisiana Severe Storms and Tornadoes	April 24, 2019 - June 25, 2019
DR-4345	Louisiana Tropical Storm Harvey	August 28, 2017 - September 10, 2017
DR-4300	Louisiana Severe Storms, Tornadoes, and Straight-line Winds	February 7, 2017
DR - 4277	Louisiana Severe Storms and Flooding	August 11, 2016 - August 31, 2016
DR - 4263	Louisiana Severe Storms and Flooding	March 8, 2016 - April 8, 2016
DR - 4228	Louisiana Severe Storms and Flooding	May 18, 2015 - June 20, 2015

An overview of tropical cyclones (which includes all storms of tropical origin, from weak easterly waves to the most intense hurricanes) is provided in the following section. However, many associated hazards can occur during a hurricane, including flooding, high winds, and tornadoes. Because these hazards are discussed individually in this chapter, a risk assessment is not performed for hurricane hazards themselves. The probabilities of occurrence and annualized losses for flooding, winds, and tornadoes are inclusive of hurricane-related incidents.

The wind and flood hazards are discussed in the following sections, and a risk assessment is provided, except in the case of levee failure. Due to the low probability of levee failure, the losses have not been estimated.

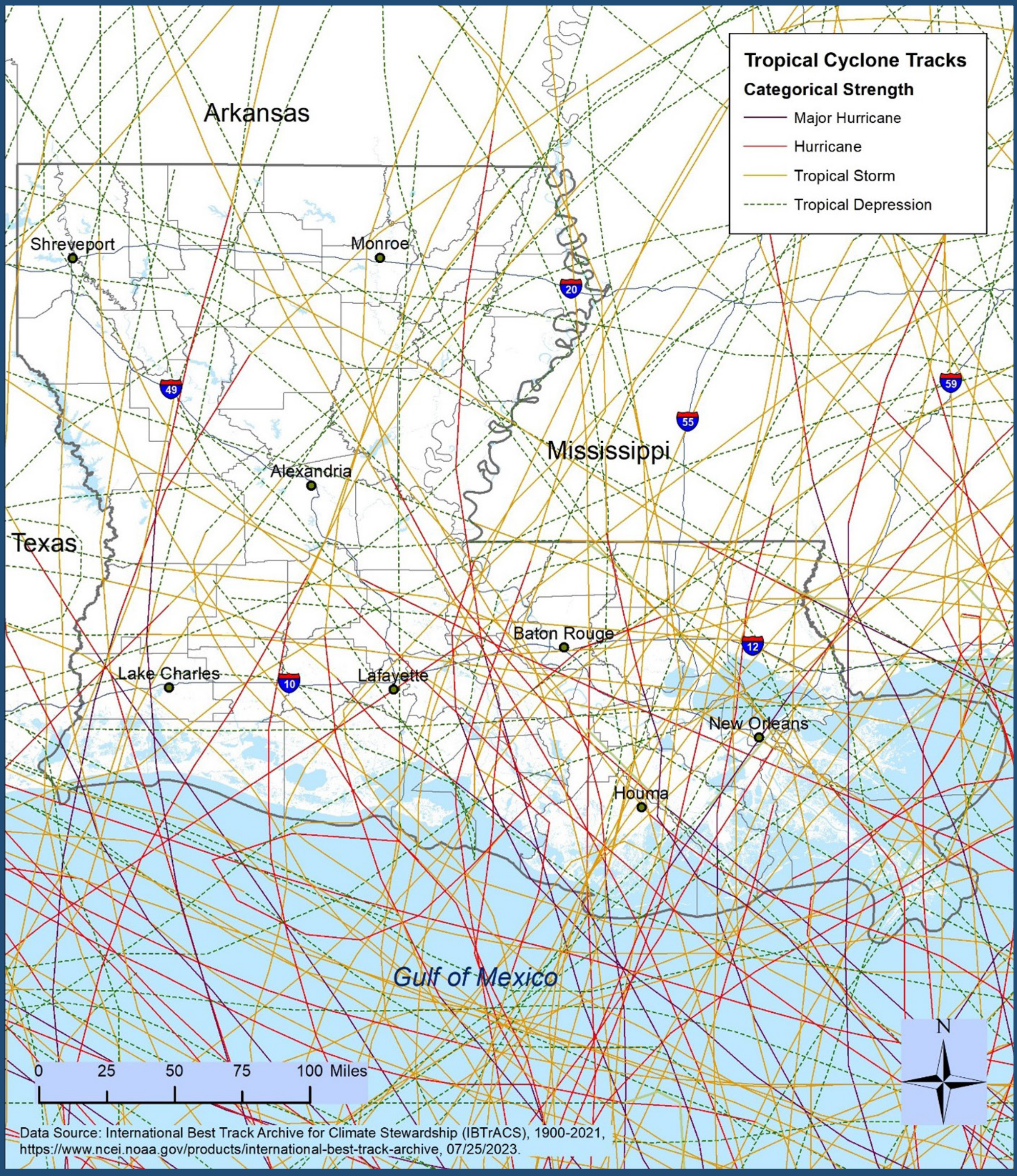
TROPICAL CYCLONES

Overview

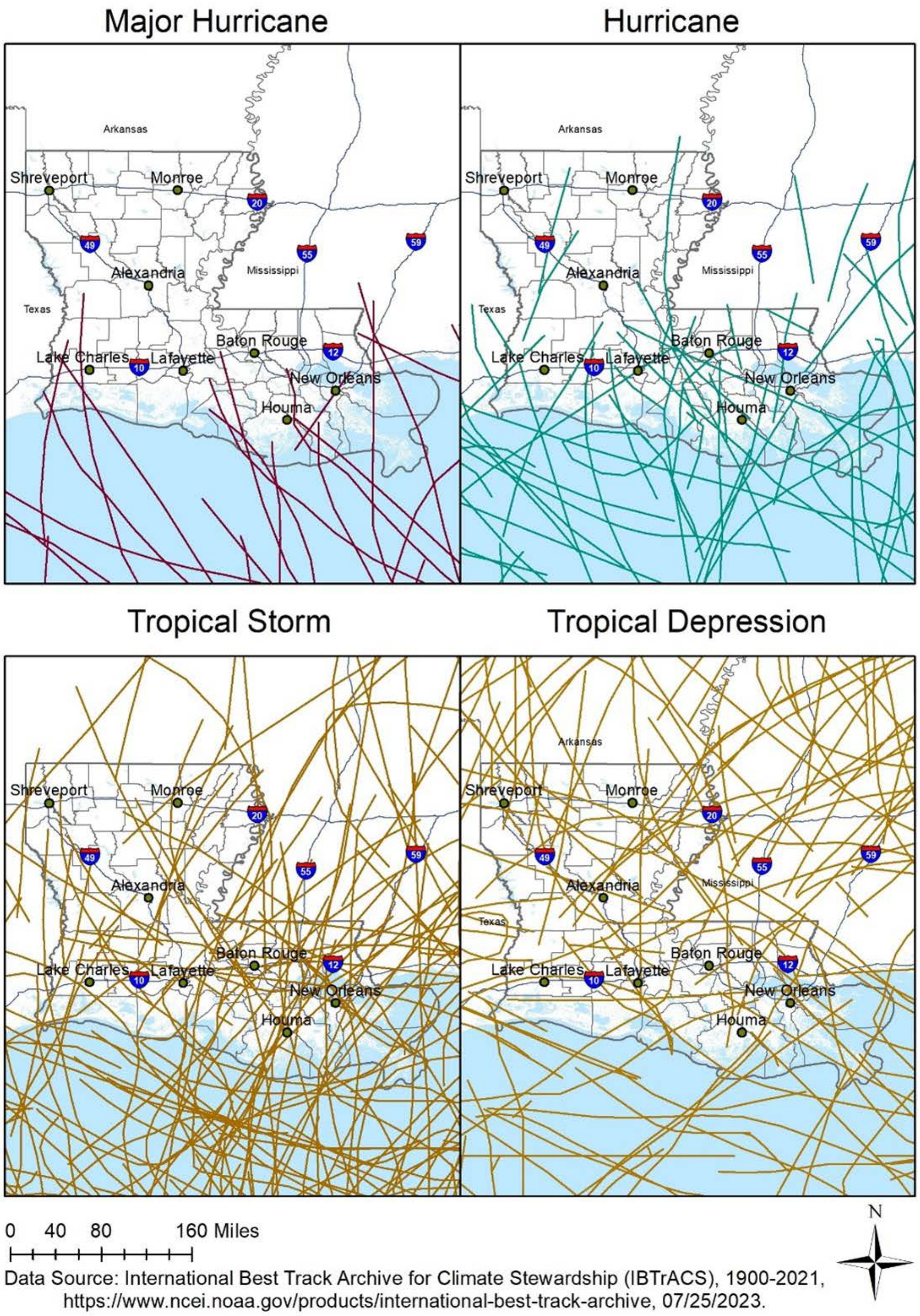
Tropical cyclones are spinning, low-pressure storms that draw surface low-latitude air into their centers and attain strength, ranging from weak tropical waves to the most intense hurricanes. Often, these storms begin as clusters of oceanic thunderstorms off the western coast of Africa, moving westward in the trade wind flow. These thunderstorms acquire a rotational component when a small "buckle" forms in the east-to-west trade wind, caused by the Earth's spin. This west-moving, counterclockwise-spinning collection of storms—now called a tropical disturbance—may then gather strength as it draws humid air toward its low-pressure center, forming a tropical depression (defined when the circulation is completely developed but maximum sustained surface wind speed is 38 mph or less), then a tropical storm (when the maximum sustained surface wind speed ranges from 39 mph to 73 mph), and finally a hurricane (when the maximum sustained surface wind speeds exceed 73 mph). Major hurricanes are classified as Category 3 to 5 based on the Saffir-Simpson Hurricane Wind Scale.

Data from 1900 to 2021 show that the entire state has been impacted by tropical cyclones, often significantly. As an example, Hurricane Katrina in 2005 remains the costliest tropical cyclone in U.S. history. However, the probabilities of occurrence and historical losses for high winds, tornadoes, lightning, and flooding that constitute the tropical cyclone hazard are best represented within each hazard. Therefore, a risk assessment is not provided for tropical cyclones as a standalone hazard.

Tropical Cyclone Tracks Across Louisiana, 1900-2021



Tropical Cyclone Tracks Across Louisiana, 1900-2021



Data Source: International Best Track Archive for Climate Stewardship (IBTrACS), 1900-2021, https://www.ncei.noaa.gov/products/international-best-track-archive, 07/25/2023.

HIGH WIND

Overview

High winds considered in this section are caused by thunderstorms, downbursts, straight-line winds, and tropical cyclones, with their scope defined in the table below. Source, frequency, and duration of high winds (source: Making Critical Facilities Safe from High Wind, FEMA).

High Wind Type	Description	Relative Maximum Duration in Louisiana
Thurderstorm Winds	Wind blowing due to thunderstorms, and thus associated with temperature and pressure gradients	Few Minutes - Several Hours
Downbursts	Sudden wind blowing down due to downdraft in a thunderstorm; spreads out horizontally at the ground, possibly forming horizontal vortex rings around the downdraft	15-20 Minutes
Straight-line Winds	Wind blowing in straight line; usually associated with intense low-pressure area	Few minutes - 1 day
Hurricane Winds	Wind blowing in spirals, converging with increasing speed toward eye; associated with temperature and pressure gradients between the Atlantic and Gulf and land	Several days

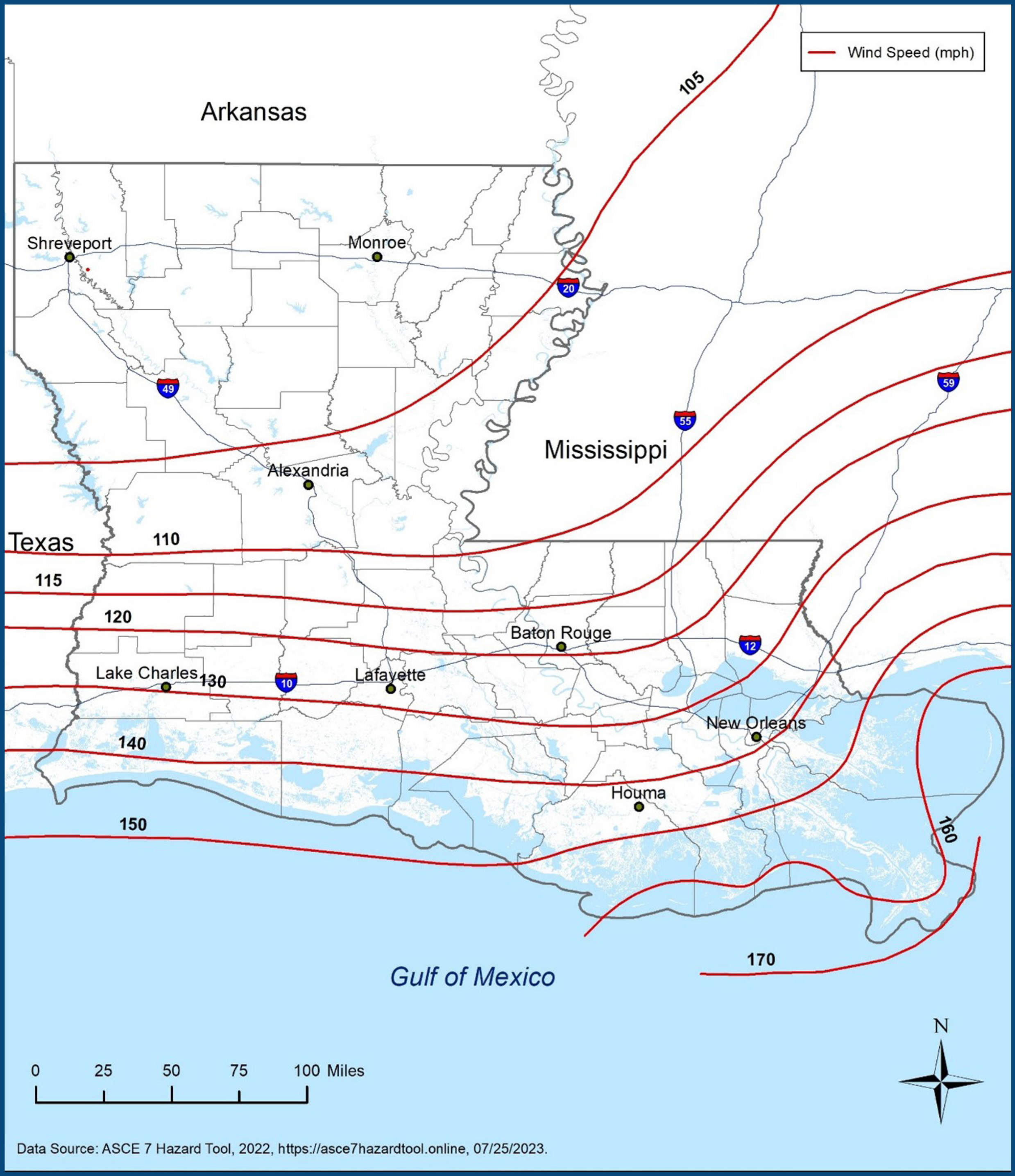
Recent high wind events (excluding tornadoes, which are discussed separately) include the severe storms and straight-line winds from May 17-21, 2021 (DR-4606) in Ascension, Calcasieu, East Baton Rouge, Iberville, and Lafayette parishes, and the winds associated with Tropical Storm Ida in 2021 (DR-4611).

The wind contour map depicts historic wind speeds by location, representing the 700-year return period wind speeds for Louisiana, corresponding to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.14%). Wind speeds for other return periods (e.g., 300-year, 1700-year return period) defined by the American Society of Civil Engineers are used to more fully describe the probability of hazard occurrence used in the risk assessment. Higher wind speeds near the coast reflect the intensity of tropical cyclone winds. These wind speeds are the basis for the design of smaller buildings, including homes. No increase in wind speed is projected in 2050; therefore, only one hazard map is provided, which is used in the risk assessment.

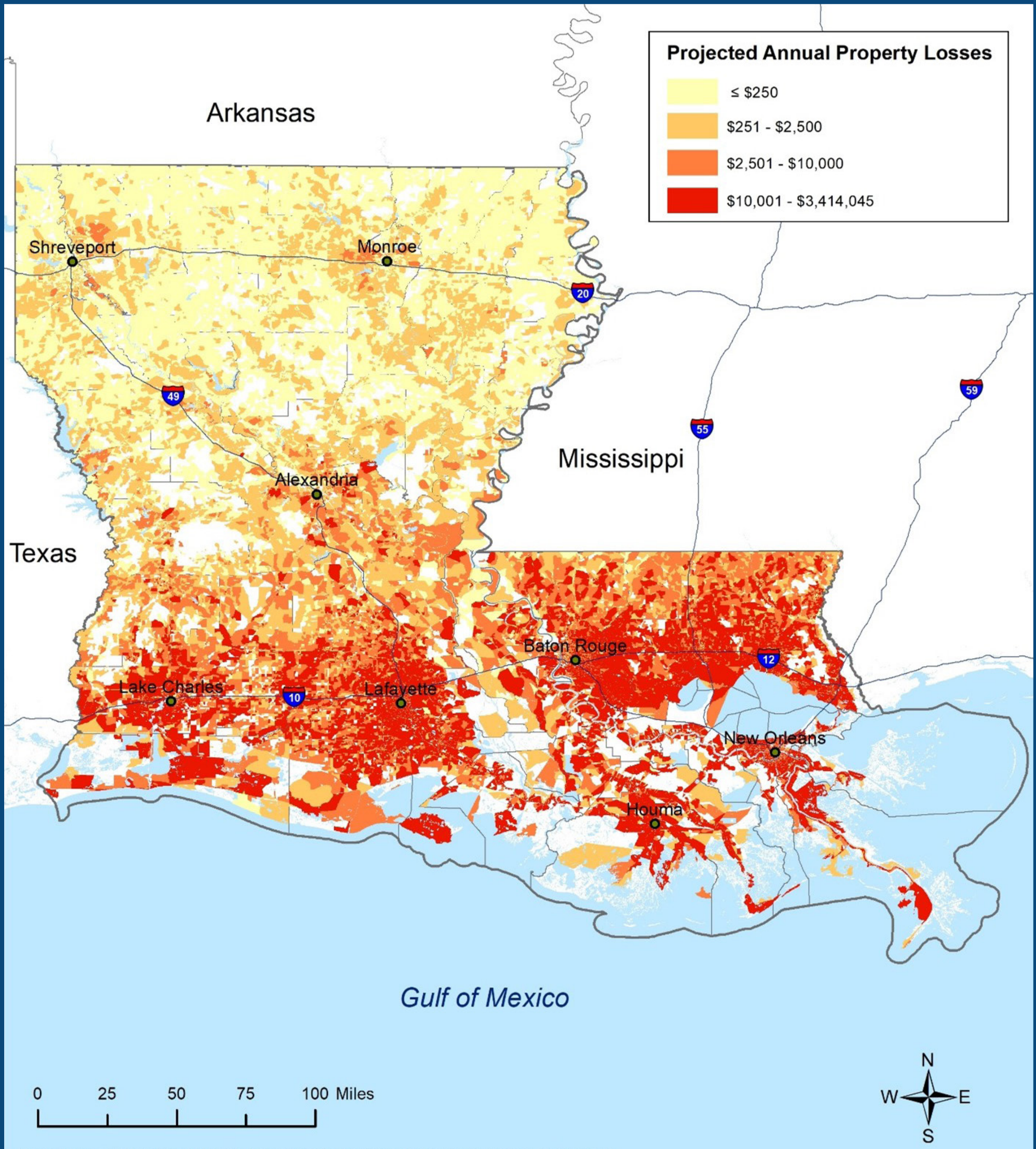
RISK ASSESSMENT

The projected property loss map shows anticipated annual average losses due to wind hazards by census block.

700-Year 3-Second Peak Gust Wind Speeds in Louisiana, 2022



Projected Annual Property Losses from Wind by Census Block, 2050



Data Source: FEMA Hazus-MH 6.0, https://msc.fema.gov/portal/resources/hazus, 08/29/2023.
National Structure Inventory, https://www.hec.usace.army.mil/confluence/nsi, 08/29/2023.

HAILSTORMS

Overview

Hailstorms are severe thunderstorms in which balls or chunks of ice fall along with rain. Hail develops in the upper atmosphere as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface, fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, get caught in another updraft whereupon re-freezing and deposition grows another concentric layer of ice, and fall after developing enough weight, sometimes after several trips up and down the cloud. The size of hailstones varies depending on the severity and height of the thunderstorm.

Because of this cycle, hailstorms generally occur more frequently during the late spring and early summer—a period of extreme variation between ground surface temperatures and upper atmospheric temperatures, which contributes to vigorous updrafts of air. Hailstorms can cause widespread damage to homes and other structures, automobiles, and crops. While the damage to individual structures or vehicles is often minor, the cumulative cost to communities, especially across large metropolitan areas, can be quite significant. Hailstorms can also be devastating to crops. Thus, the severity of hailstorms depends on the size of the hailstones, the length of time the storm lasts, and where it occurs. An example of a recent significant hail event is the January 21, 2017, severe weather event, where several reports of large hail, up to 2 inches in diameter, were documented in Northwest Louisiana.

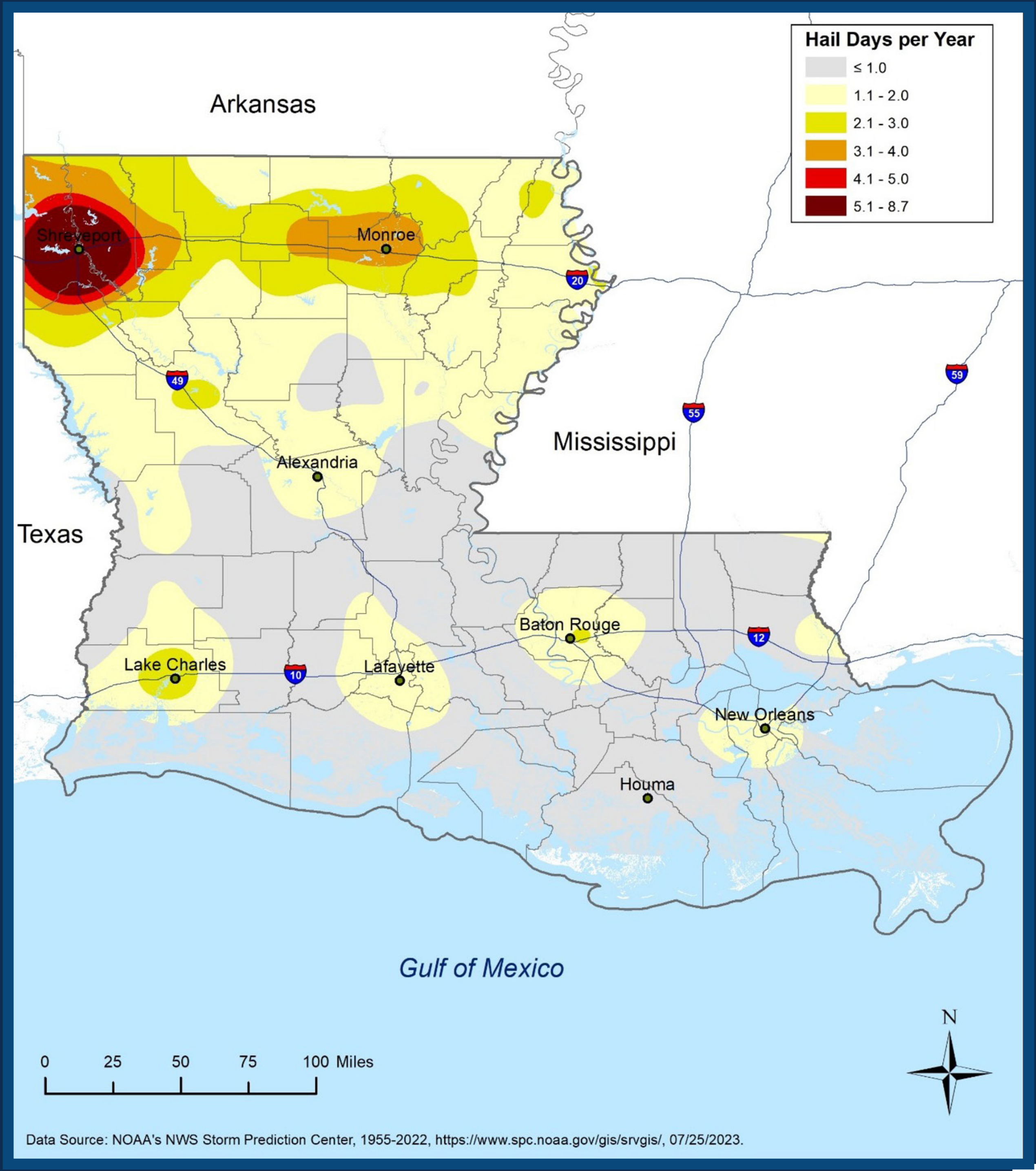
The largest hail recorded in Louisiana, with a 4.5-inch diameter, was spotted in four different parishes. A total of 69 hailstorms occurred in the state from 2009 to 2018. The worst by far was the storm of 2012 in Avoyelles Parish, which inflicted $1 million in property damage.

Historic hail occurrences are represented through the 1955-2022 annualized map showing the number of days per year experiencing events with hailstones ¾" diameter or larger within 25 miles. The 2050 annual projected occurrence map considers projected increases in the probability of tornado hazards we could expect to see in the year 2050. This projected occurrence is used in the risk assessment.

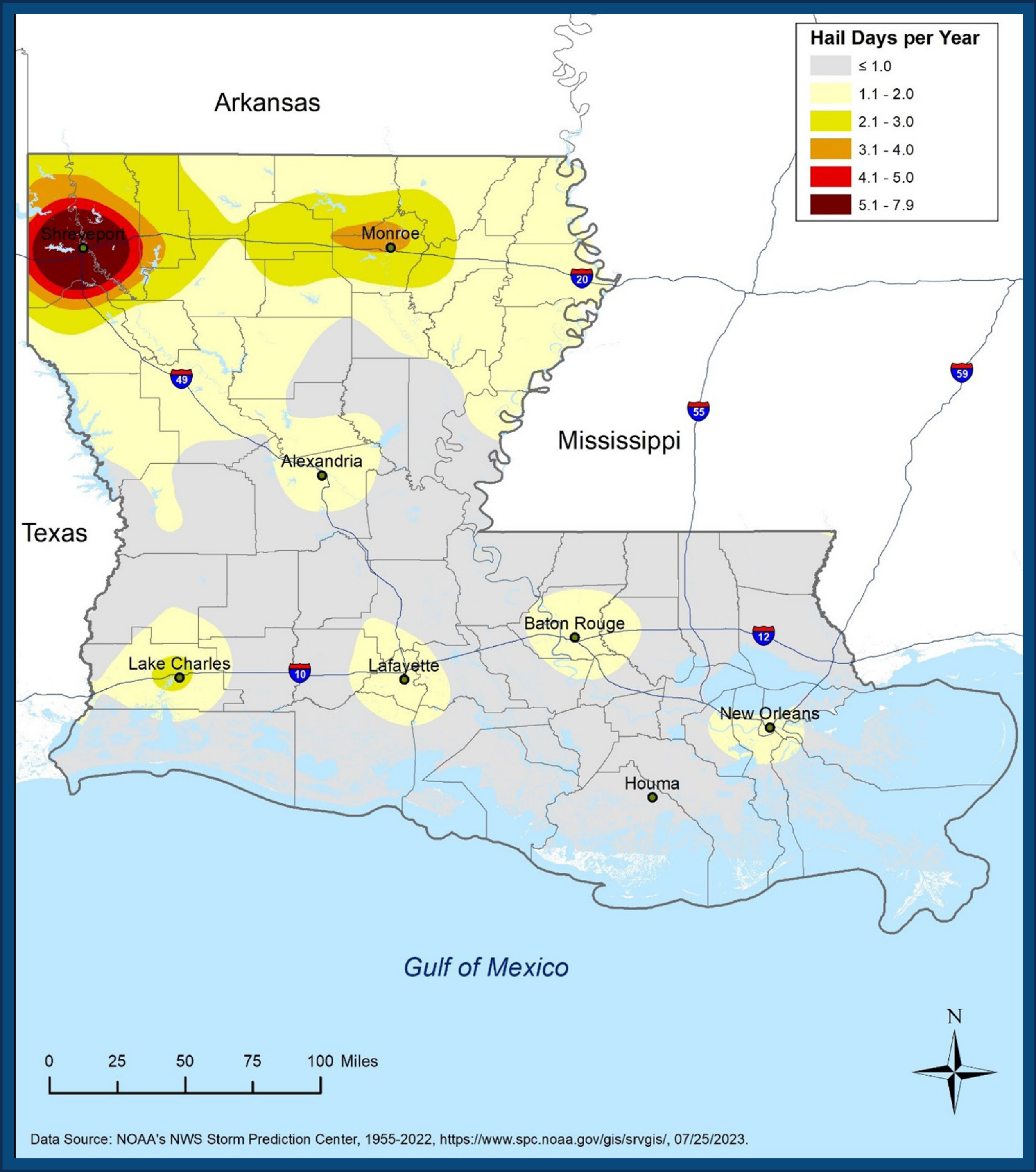
RISK ASSESSMENT

The projected property and crop loss maps show the anticipated annual average losses due to hail hazards by census block.

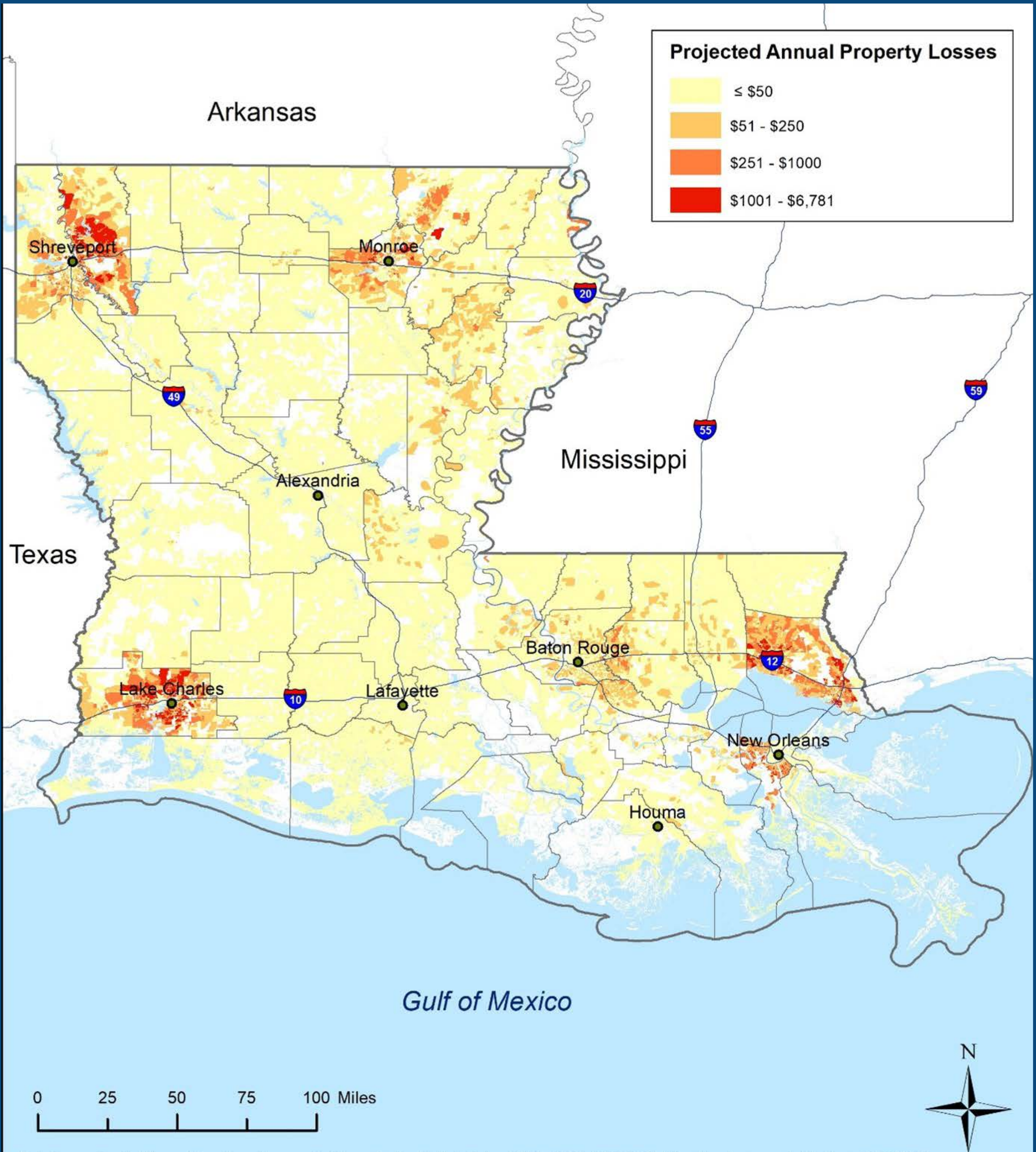
Number of Days per Year Experiencing Hail > 0.75" within 25 Miles, 1955-2022



Projected Number of Days per Year Experiencing Hail > 0.75" within 25 Miles, 2050



Projected Annual Property Losses from Hail by Census Bock, 2050



Data Source:Spatial Hazard Events and Losses Database for the United States (SHELDUS), 1960-2021, https://cemhs.asu.edu/sheldus, 08/18/2023.
NOAA's NWS Storm Prediction Center, 1955-2022, https://www.spc.noaa.gov/gis/srvgis/, 07/25/2023.

Projected Annual Crop Losses from Hail by Census Block, 2050

LIGHTNING

Overview

The warning signs for possible cloud-to-ground lightning strikes are high winds, rainfall, and darkening cloud cover. While many lightning casualties happen at the beginning of an approaching storm, more than half of lightning deaths occur after a thunderstorm has passed. The lightning threat diminishes after the last sound of thunder, but still may persist for more than 30 minutes. When thunderstorms are in the area but not overhead, the lightning threat can exist even when overhead skies are clear. Lightning can even strike more than ten miles from the storm in an area with clear skies.

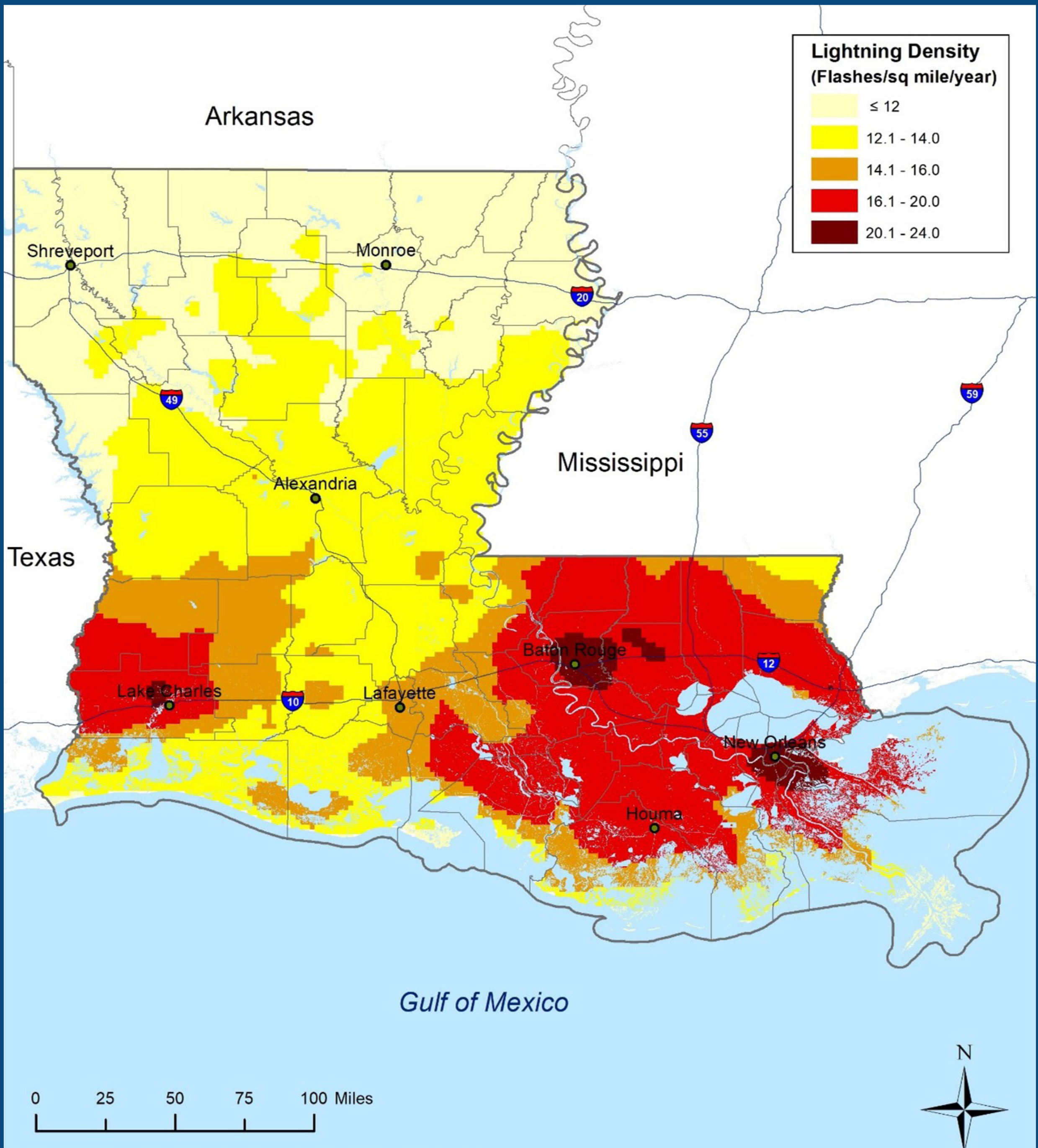
According to NOAA, Louisiana is the second-most lightning-prone state, with around 825,000 lightning strikes per year, following Florida. The year 2016 was one of the worst years nationally for lightning deaths, with 38 fatalities around the country. Louisiana recorded 4 lightning-related deaths that year. In 2022, Louisiana recorded approximately 11.6 million lightning strikes, reinforces its ranking as one of the top states for lightning activity. The state's high humidity and frequent storminess contribute to the relatively high frequency of lightning strikes.

The 1987 to 2022 average annual lightning density is based on historic lightning observations, while the 2050 lightning density map considers projected increases in the probability of lightning hazards we could expect to see in the year 2050. The probability of lightning hazards in 2050 is used in the risk assessment.

RISK ASSESSMENT

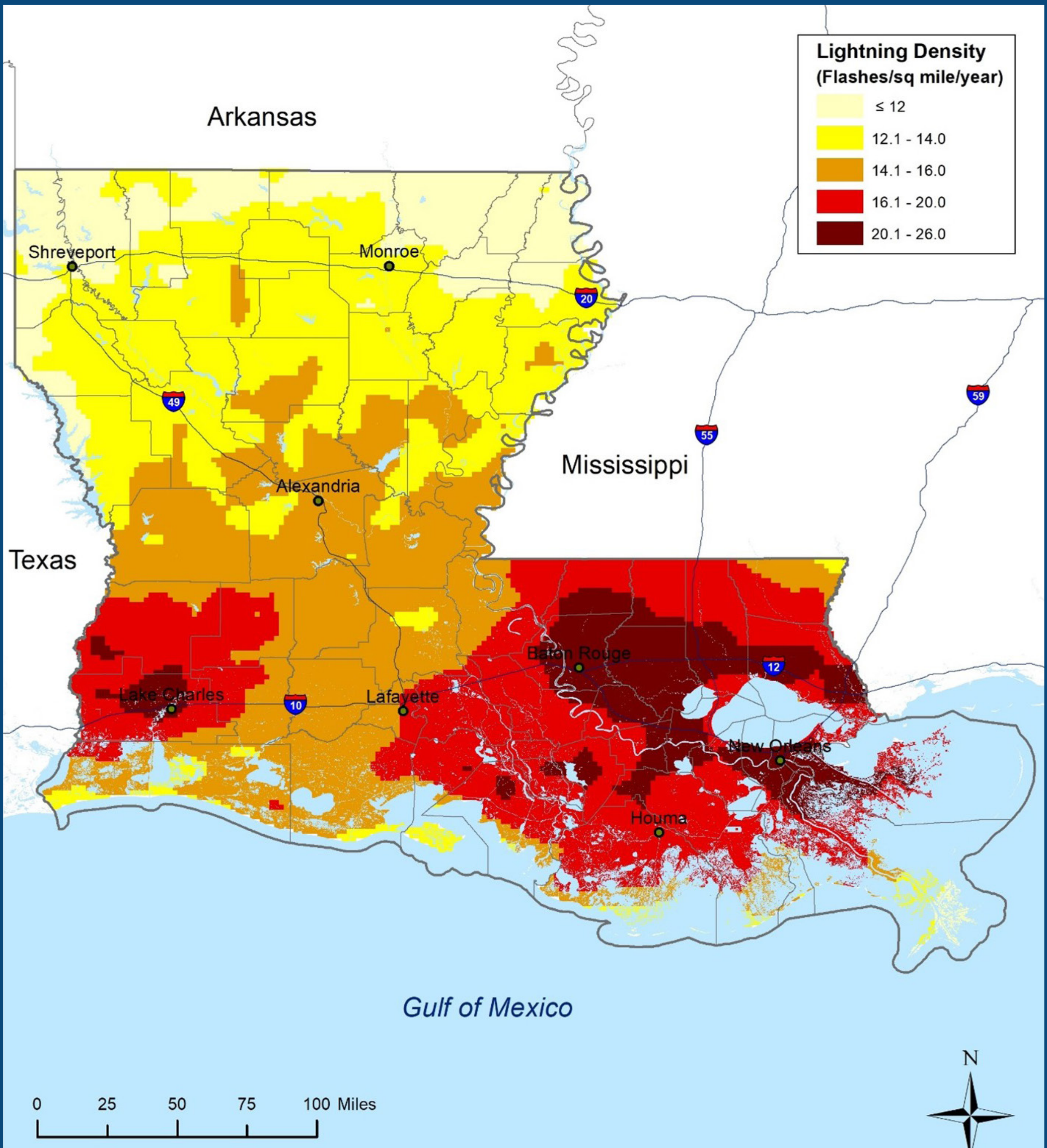
The projected property and crop loss maps show the anticipated annual average losses due to lightning hazards by census block.

Average Lightning Density per Year in Louisiana, 1987-2022



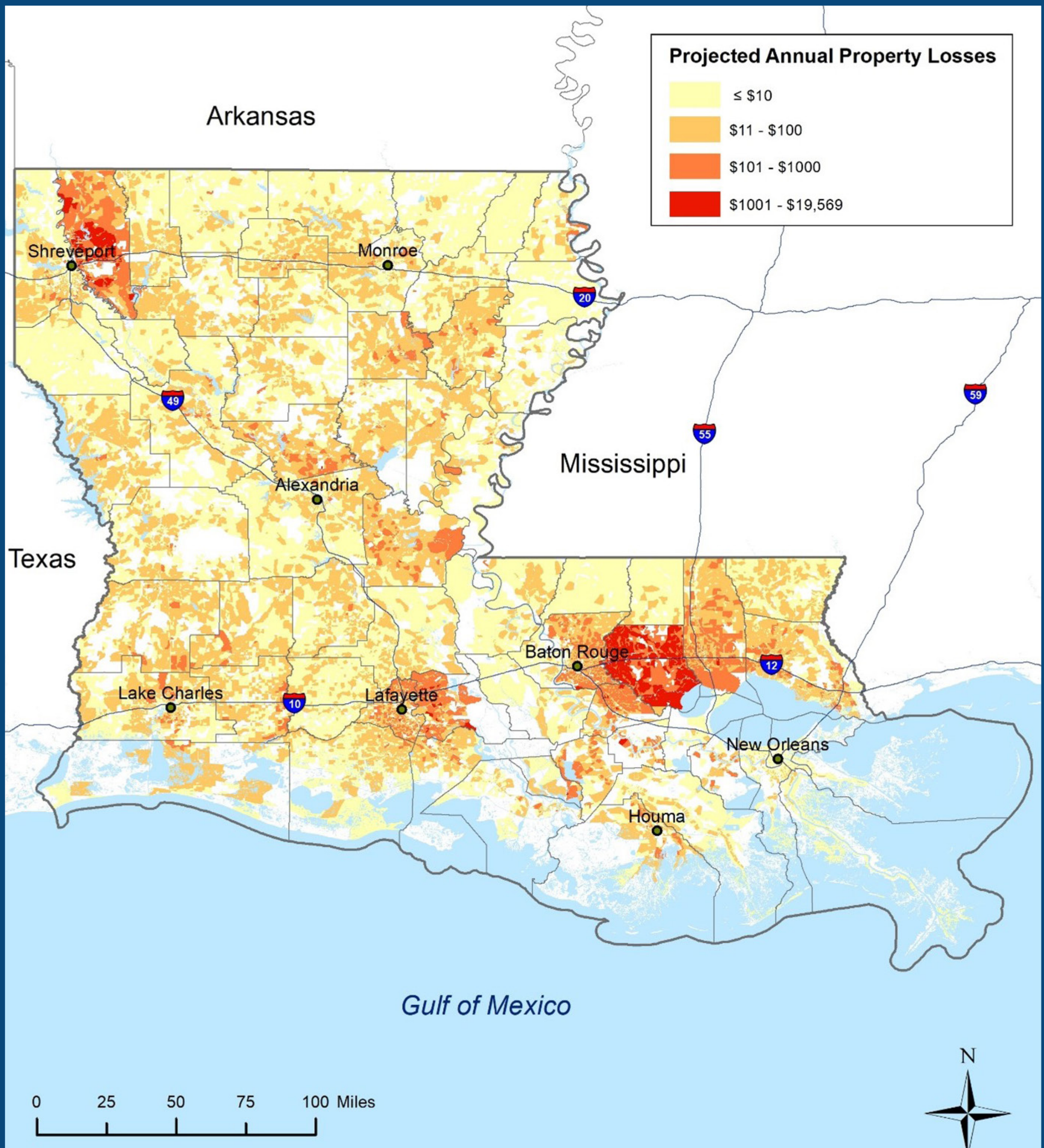
Data Source: U.S. National Lightning Detection Network (NLDN), 1987-2022, https://www1.ncdc.noaa.gov/pub/data/swdi/database-csv/v2/?fbclid=IwAR2WrtQsAplwWBPRu1UAzNaegJkY3lPXX5RGOjDFMUb_RcZSbT18A7DCA1A, 07/25/2023.

Projected Lightning Density per Year in Louisiana, 2050



Data Source: U.S. National Lightning Detection Network (NLDN), 1987-2022, https://www1.ncdc.noaa.gov/pub/data/swdi/database-csv/v2/?fbclid=IwAR2WrtQsAplwWBPRu1UAzNaegJkY3lPXX5RGOjDFMUb_RcZSbT18A7DCA1A, 07/25/2023.

Projected Annual Property Losses from Lightning by Census Block, 2050



Data Source:Spatial Hazard Events and Losses Database for the United States (SHELDUS), 1960-2021, https://cemhs.asu.edu/sheldus, 08/18/2023. U.S. National Lightning Detection Network (NLDN), 1987-2022,

Projected Annual Crop Losses from Lightning by Census Block, 2050

Data Sources: Spatial Hazard Events and Losses Database for the United States (SHELDUS), 1960-2021, https://cemhs.asu.edu/sheldus, 08/26/2023.
U.S. National Lightning Detection Network (NLDN), 1987-2022, 07/25/2023.
National Land Cover Database (NLCD), 2001-2021, https://www.mrlc.gov/index.php, 08/26/2023.

TORNADOES

Overview

Tornadoes are rapidly rotating funnels of wind extending between storm clouds and the ground. For their size, tornadoes are the most severe storms. Approximately 70 percent of the world's reported tornadoes occur within the continental U.S., making them one of the most significant hazards Americans face. When tornadoes exist over water, they are considered waterspouts. Tornadoes and waterspouts form during severe weather events, such as thunderstorms, when cold air overrides a layer of warm air, causing the warm air to rise rapidly, which usually occurs in a counterclockwise direction in the northern hemisphere. Tornadoes can also occur in association with hurricanes but are more likely to be weaker in intensity than land-based tornadoes that occur shortly before a cold frontal passage.

Peak tornado activity in Louisiana occurs during the spring, as it does in the rest of the United States. Nearly one-third of observed tornadoes in the U.S. occur during April and May. About half of the tornadoes in Louisiana, including many of the strongest, occur between March and June. Fall and winter tornadoes are less frequent, but the distribution of tornadoes throughout the year is more uniform in Louisiana than in locations farther north. Recent tornado outbreaks in Louisiana include those on May 17-21, 2021 (DR-4606), in Ascension, Calcasieu, East Baton Rouge, Iberville, and Lafayette parishes, as well as the Morehouse, Union, and Lincoln Parish tornadoes on April 24-June 2019 (DR-4439).

Historic tornado occurrence is shown by Enhanced Fujita (EF) classification (from the weakest tornadoes starting at EF0 to the most powerful category of EF5) of tornado tracks, as well as through an annualized map depicting the number of days per year with a tornado touchdown within 25 miles. The 2050 annual projected occurrence map considers projected increases in the probability of tornado hazards we could expect to see in the year 2050. These projected increases are used in the risk assessment.

Risk Assessment

The projected property and crop loss maps show the anticipated annual average losses due to tornado hazards by census block.

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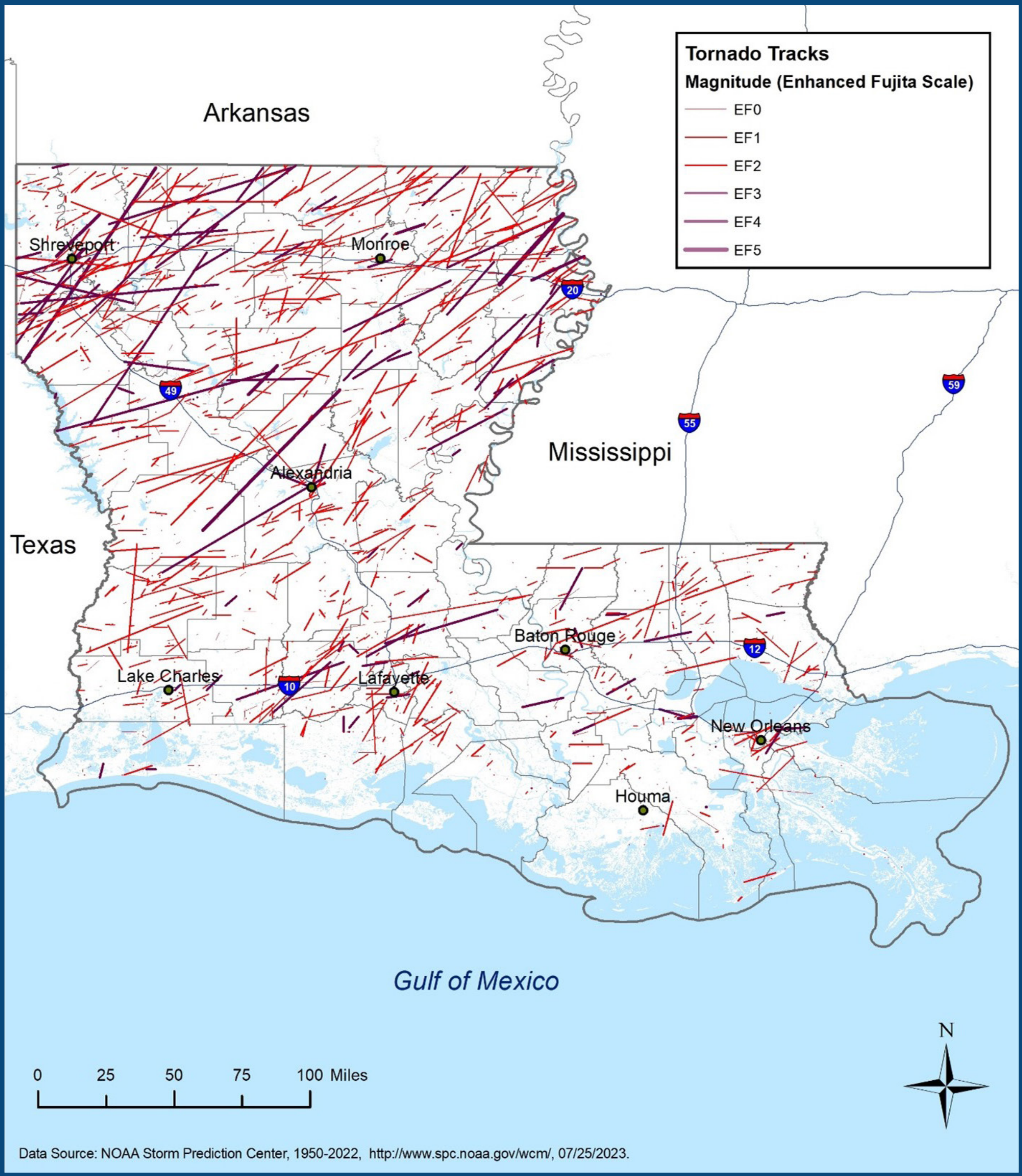
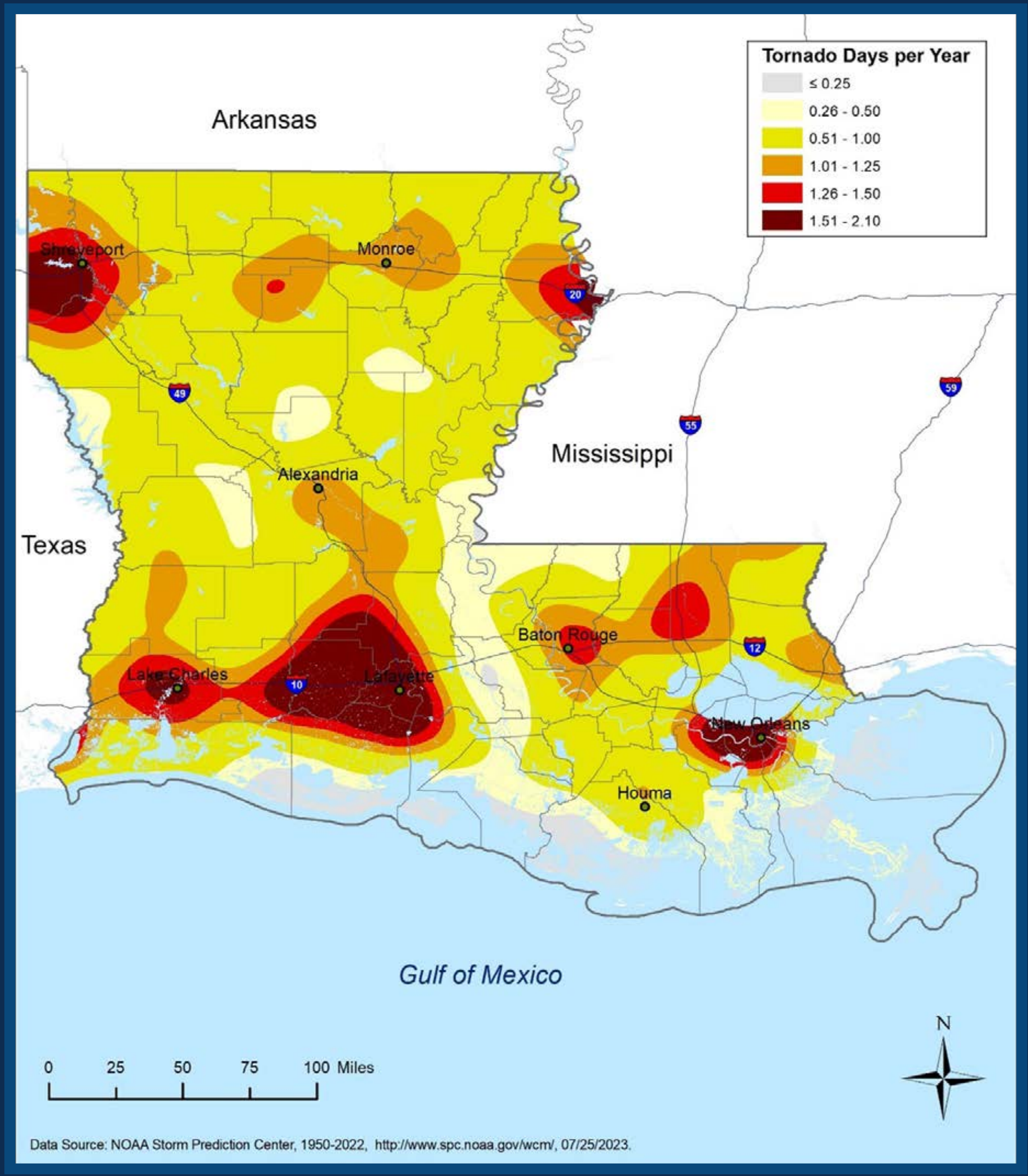
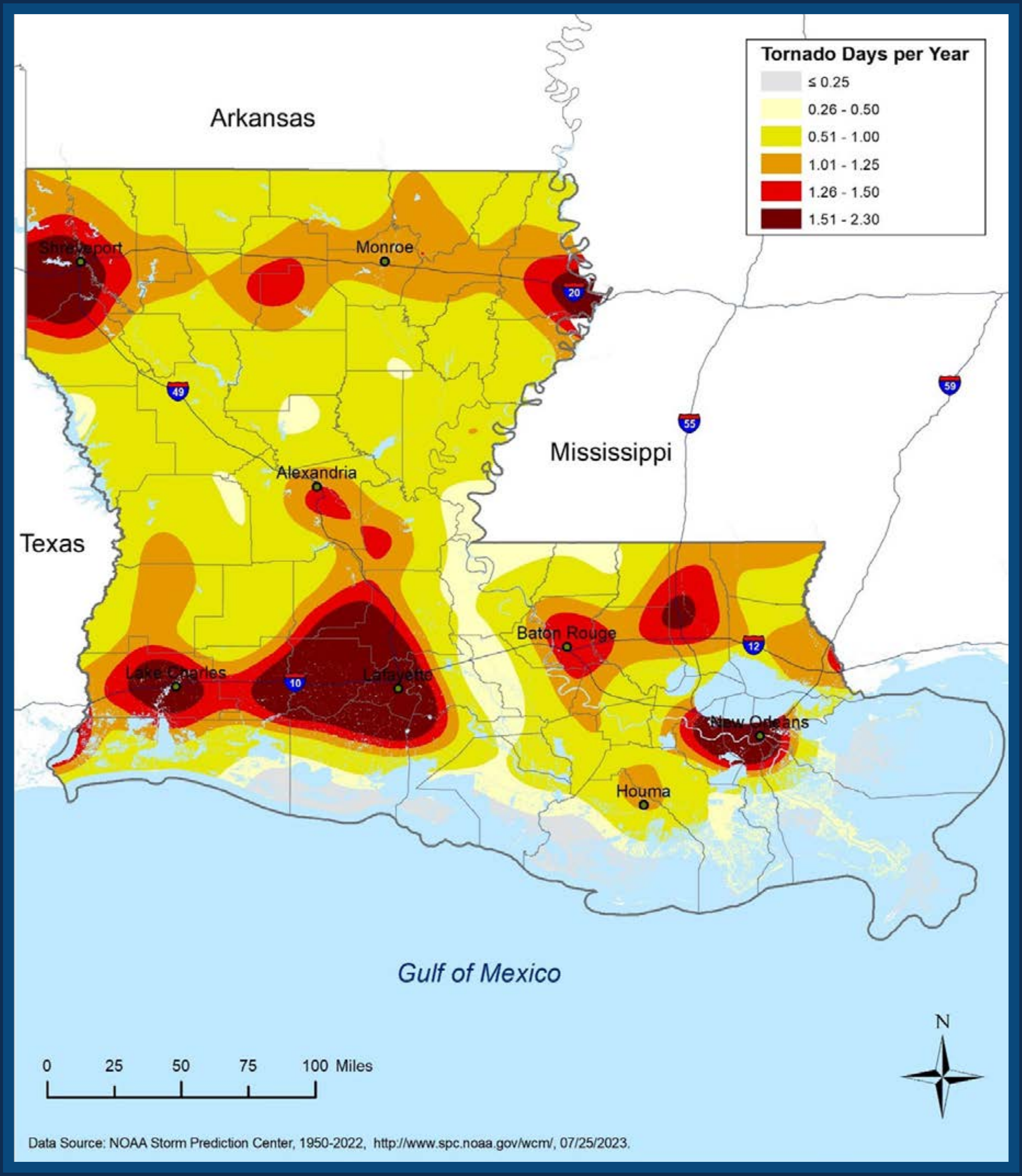
Tornado Tracks in Louisiana, 1950-2022



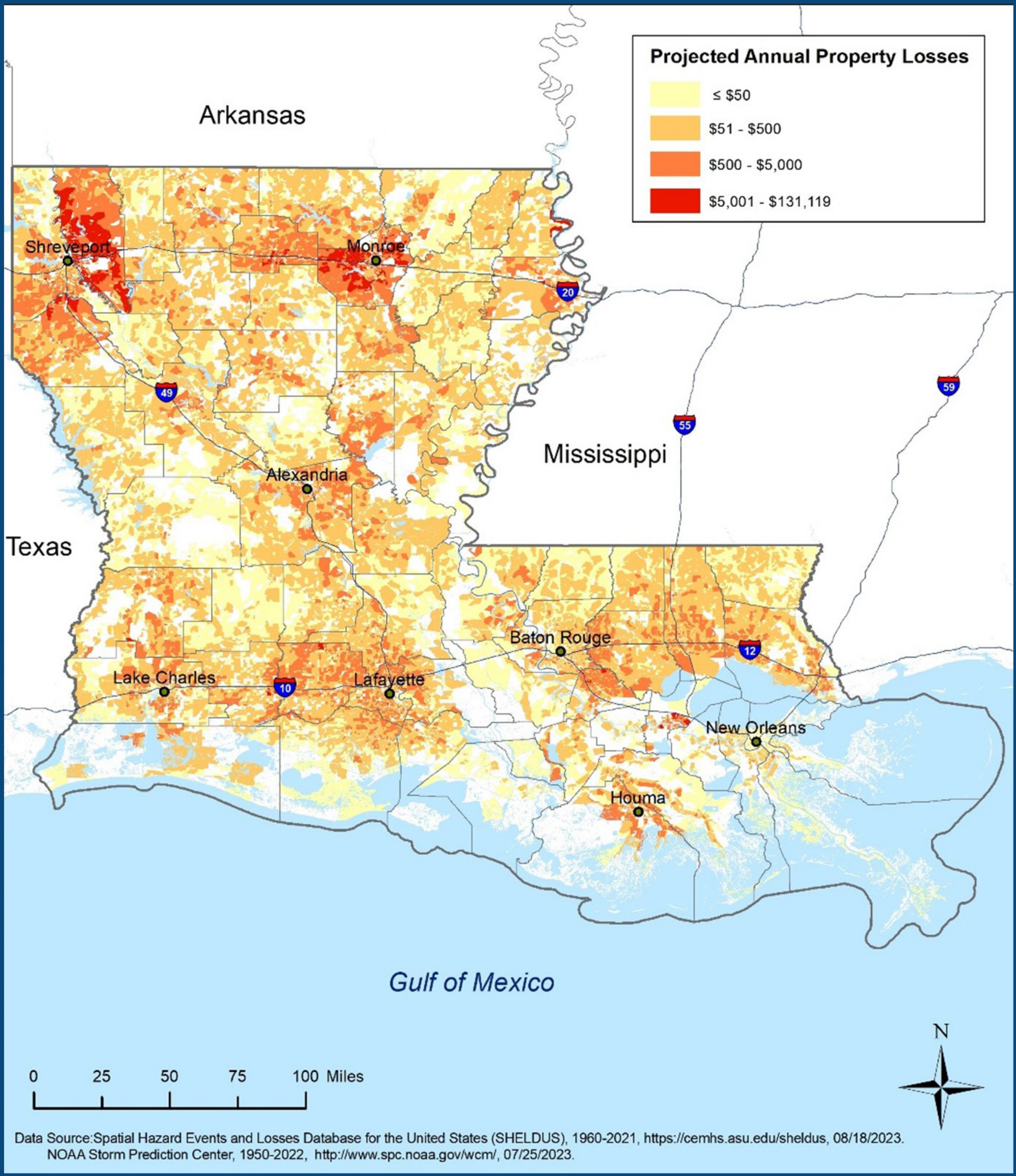
Number of Days per Year Having a Tornado Touchdown within 25 Miles, 1950-2022



Projected Number of Days per Year Having a Tornado Touchdown within 25 Miles, 2050

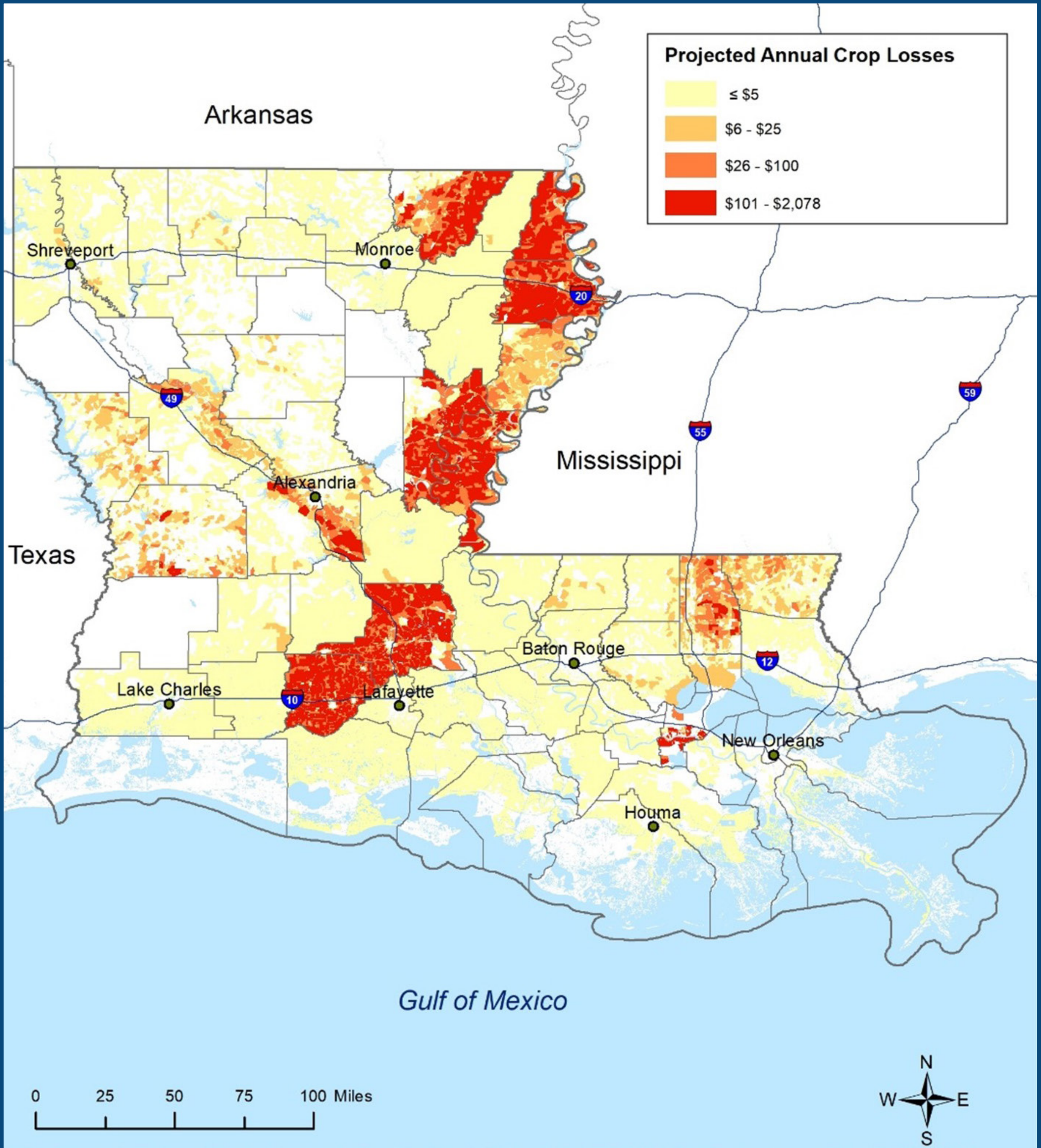


Projected Annual Property Losses from Tornado by Census Block, 2050



GOVERNOR'S OFFICE OF HOMELAND SECURITY GOHSEP & EMERGENCY PREPAREDNESS

Projected Annual Crop Losses from Tornado by Census Block, 2050



Data Sources: Spatial Hazard Events and Losses Database for the United States (SHELDUS), 1960-2021, https://cemhs.asu.edu/sheldus, 08/26/2023.
NOAA Storm Prediction Center, 1950-2022, http://www.spc.noaa.gov/wcm/, 07/25/2023.
National Land Cover Database (NLCD), 2001-2021, https://www.mrlc.gov/index.php, 08/26/2023.

FLOODING

Overview

A flood is the overflow of water onto land that is typically not inundated. Excess precipitation, produced from thunderstorms or hurricanes, is often the major initiating condition for flooding, and Louisiana can have high rainfall totals at any time of the day or year. In Louisiana, five specific types of floods are of main concern: riverine, flash, ponding, backwater, and urban. The 1% annual exceedance probability flood (often called the 100-year flood, corresponding to a mean recurrence interval of 100 years) is of particular significance, because it is used as the basis for regulatory standards, such as building codes and flood insurance requirements.

Over the period 1959 to 2005, Louisiana ranked 18th among the states in flood fatalities (excluding those related to Katrina), but third in flood-related injuries and in total flood casualties. Recent significant floods include the 11-31 August 2016 flood affecting southeast Louisiana (DR-4277), the 8 March - 8 April 2016 flood affecting northern Louisiana (DR-4263), and the 18 May - 20 June 2015 flood along the Red River in northwestern Louisiana (DR-4228).

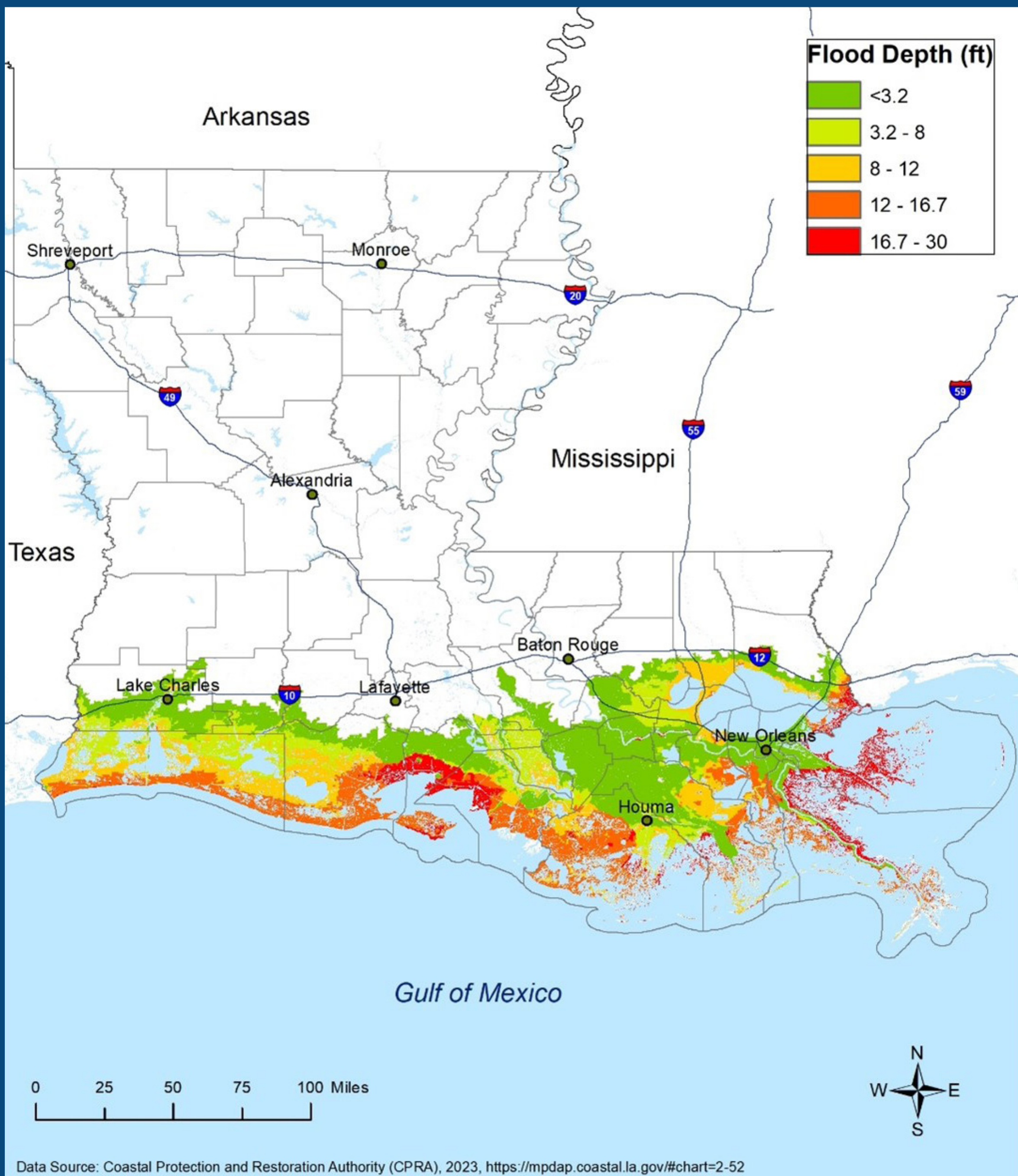
The special flood hazard area (SHFA) is defined by FEMA, as the land area that has a 1% or greater chance of flooding per year (map on the following page). However, this is not a complete picture of flood risk, as the flood inundation boundaries corresponding with other likelihoods have not yet been defined systematically. While no changes are projected for riverine flooding due to lack of data, the Louisiana Coastal Protection and Restoration Agency (CPRA) has predicted increases in coastal flooding. The risk assessment merges predicted (increased) 100-year coastal inundation under a high environmental scenario with plan implementation scenario in 2055 (elapsed 32 years) with the FEMA's 100-year flood maps.

Risk Assessment

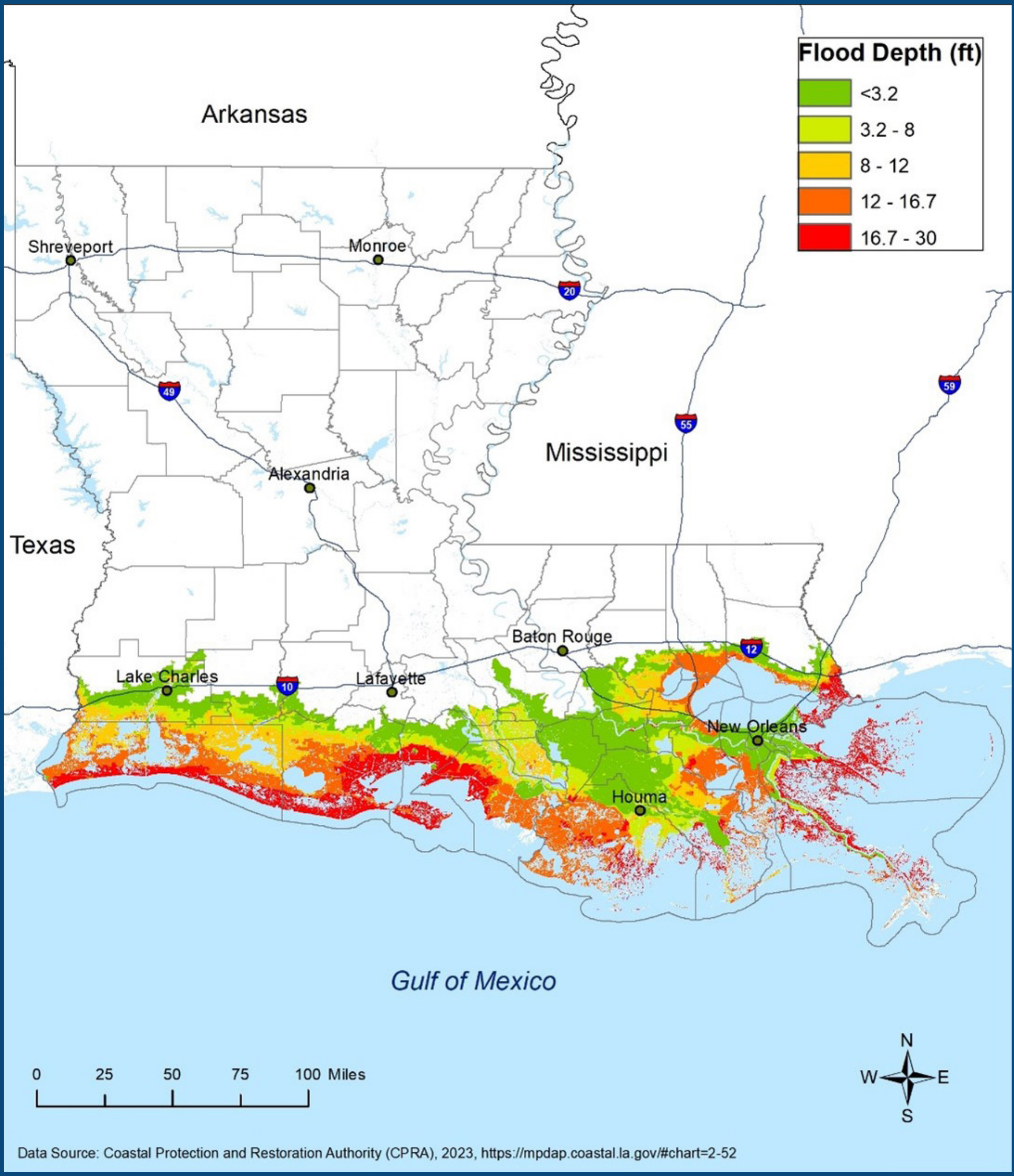
The projected property loss map shows the anticipated annual average losses due to flood hazards by census block.

100-Year Flood Inundation Area in Louisiana, 2023

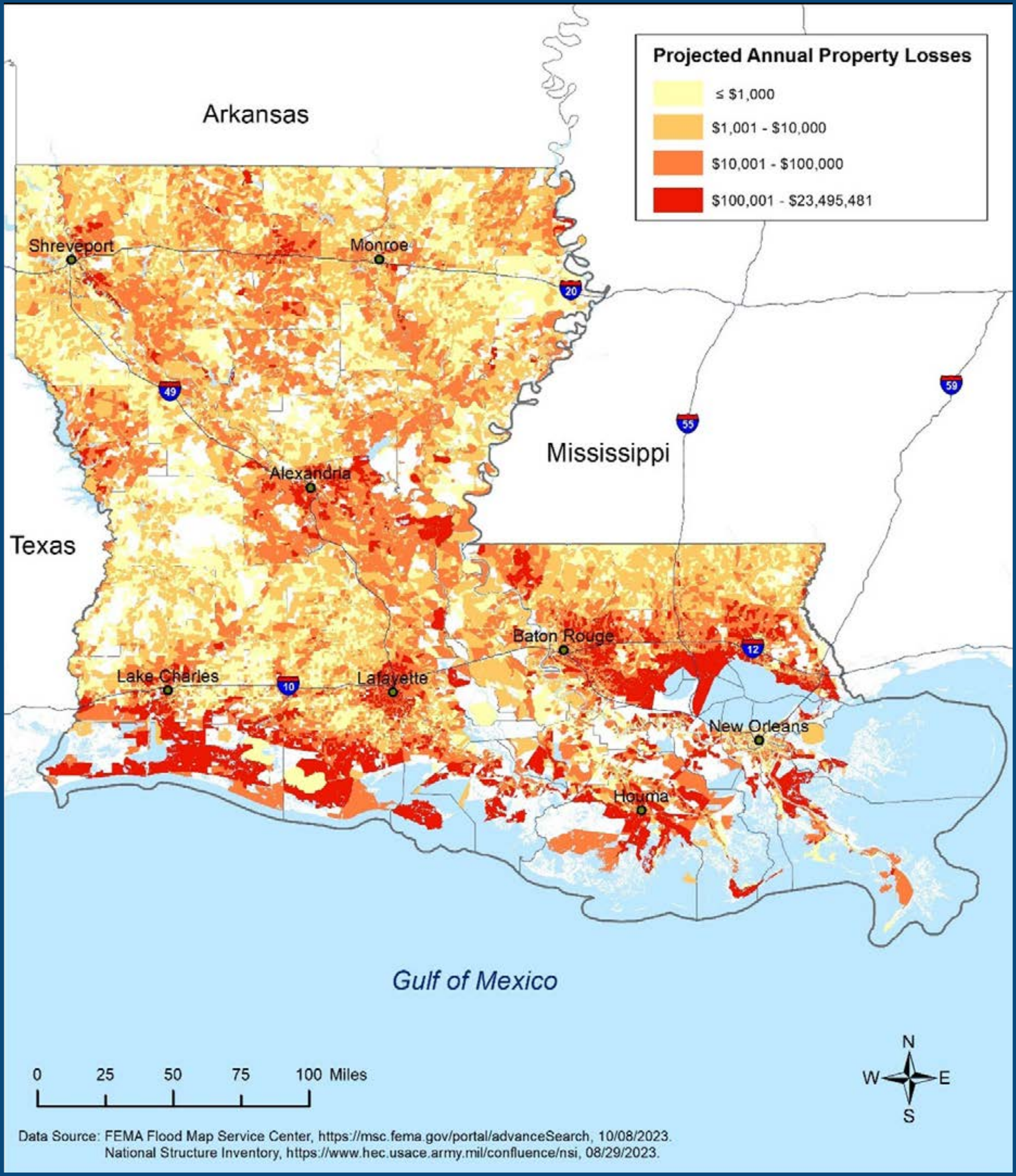
Predicted 100-Year Flood Coastal Inundation High Environmental Scenario with plan implementation, 2055



Predicted 500-Year Flood Coastal Inundation High Environmental Scenario with plan implementation, 2055



Projected Annual Property Losses from Flood by Census Block, 2050



DAM FAILURE

Overview

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dams are a vital part of our nation's infrastructure, providing drinking water, flood protection, renewable hydroelectric power, navigation, irrigation, and recreation. These critical daily benefits are also inextricably linked to the potential harmful consequences of a dam failure.

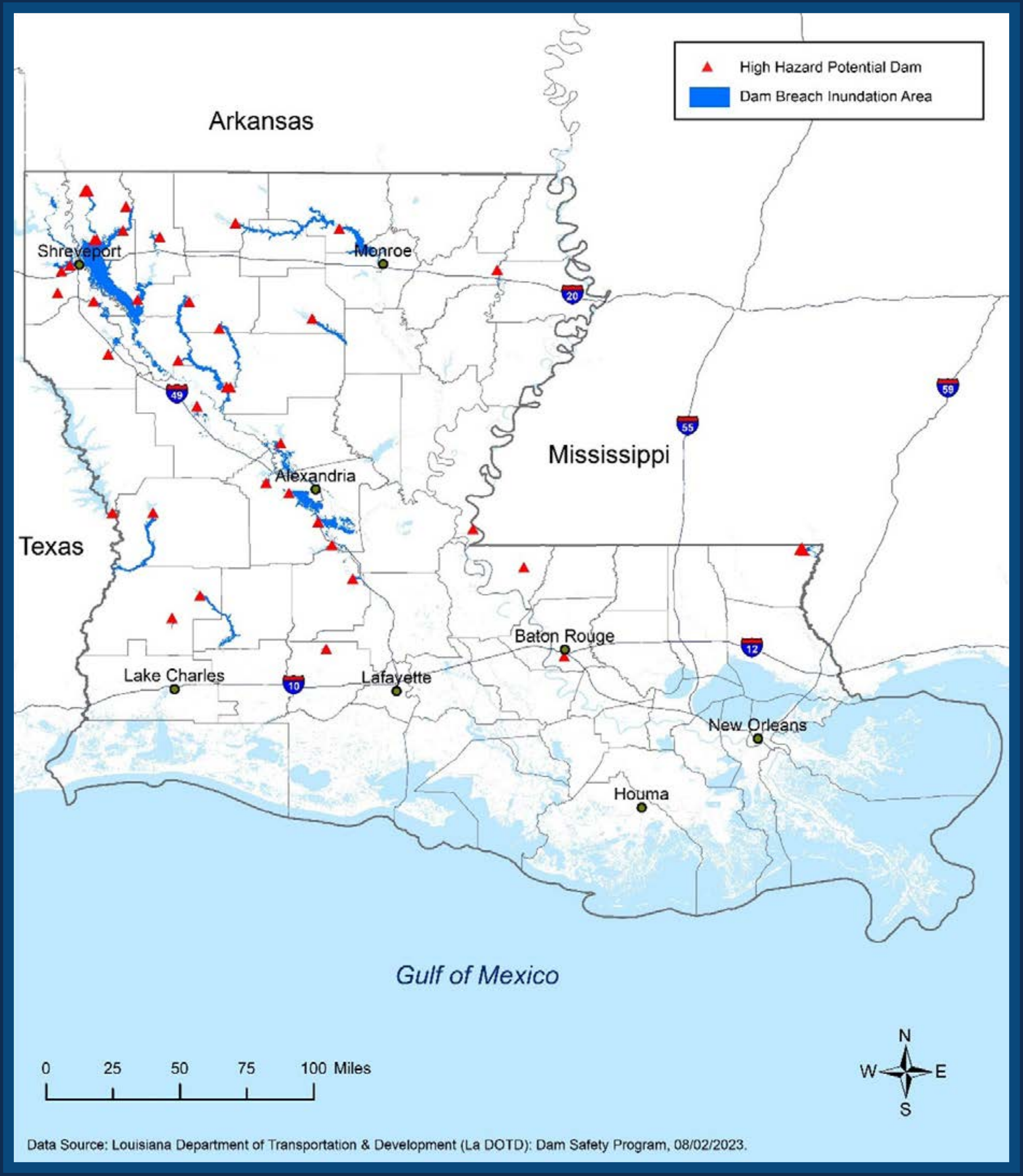
Dam failure is a collapse or breach in the structure that can result in severe loss of life, economic disaster, and extensive environmental damage. While most dams have storage volumes small enough that failures have few repercussions, dams with large storage volumes can cause significant flooding downstream. Dam failures often have a rapid rate of onset, leaving little time for evacuation. The first signs of failure may go unnoticed upon visual inspection of the dam structure. However, appropriate design and continual maintenance and inspection of dams often provide the opportunity to identify possible deficiencies in their early stages and can prevent a possible catastrophic failure event.

High hazard potential dams are dams where failure or improper operation will most likely cause loss of human life. According to the Dam Safety Program of DOTD Public Works & Water Resources, Louisiana has 42 high hazard potential dams. There have been zero high hazard dam failures in the state of Louisiana, although a threatened failure of the Percy Quin Dam in Mississippi following 2012 Hurricane Isaac resulted in a mandatory evacuation for Tangipahoa Parish. In 2021, an aqua-dam failure in Iberville Parish forced hundreds to evacuate. Because Louisiana does not have a history of high hazard dam failures, this section assumes a future probability of 0.0001 (0.01% annual probability) for dam failure in 2050.

Risk Assessment

A risk assessment was not performed due to the low probability of dam failure in Louisiana.

High Hazard Potential Dams in Louisiana, 2023



LEVEE FAILURE

Overview

Levees and floodwalls are flood control barriers constructed of earth, concrete, or other materials. For the purposes of this plan, levees are distinguished from smaller flood barriers (such as berms) by their size and extent. Berms are barriers that only protect a small number of structures, or in some cases, only a single structure. Levees and floodwalls are barriers that protect significant areas of residential, commercial, or industrial development; at a minimum, they protect a neighborhood or small community.

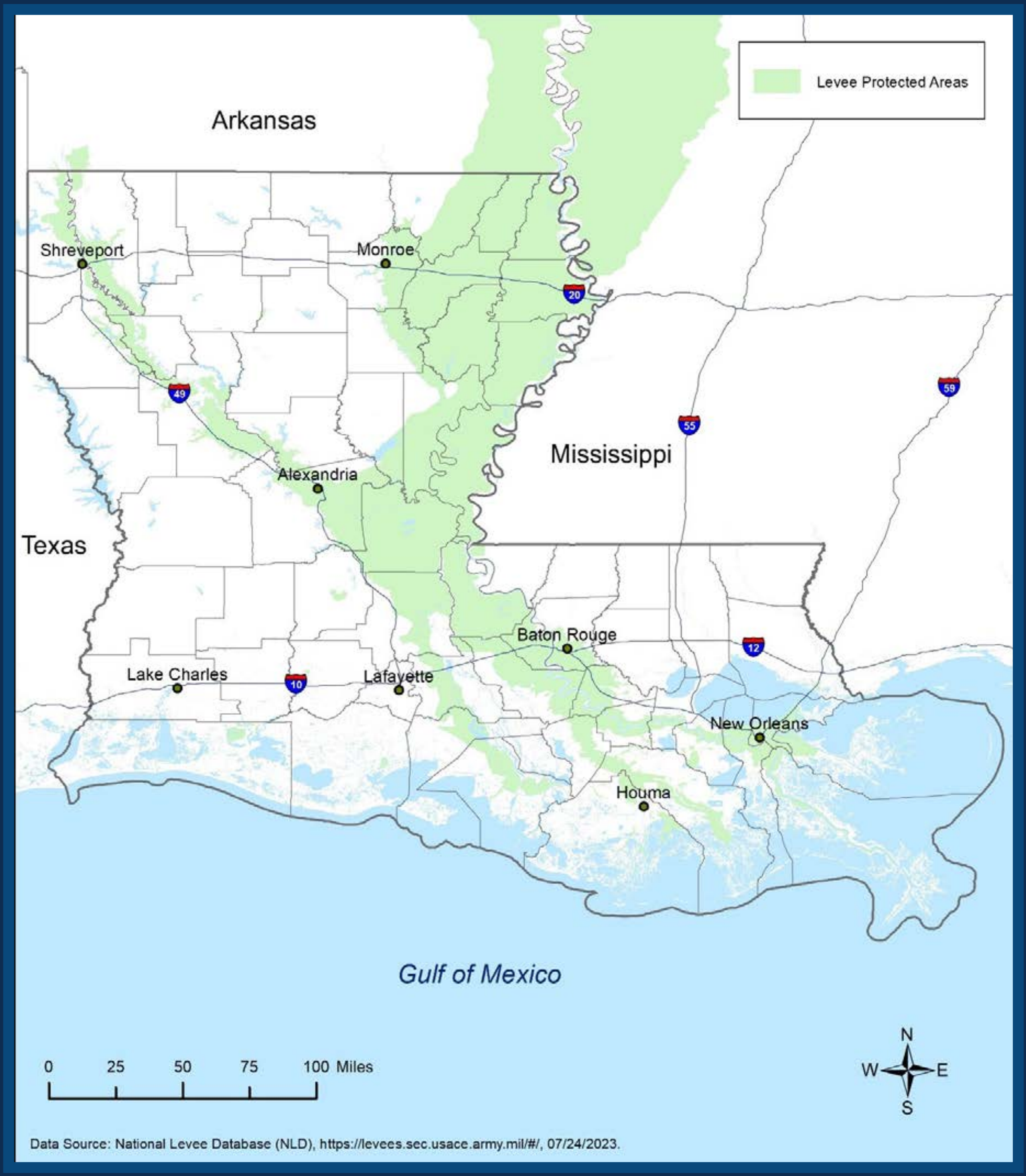
Levees are commonplace throughout Louisiana. Northern Louisiana is protected by levees on the Ouachita River, under the authority of the Vicksburg District of the U.S. Army Corps of Engineers (USACE). The Vicksburg District encompasses 68,000 mi2 in Arkansas, Mississippi, and Louisiana, and manages seven drainage basins, including the Yazoo, Pearl, Big Black, Red, Ouachita, and Mississippi Rivers; 12 locks and dams on the Pearl, Red, and Ouachita rivers; 1,808 miles of levees, including 468 along the Mississippi River; and multiple lakes with 1,709 mi. of shoreline. The New Orleans East Bank Levee System, comprising approximately 176 miles of Mississippi River Levees (MRL) and the Hurricane and Storm Damage Risk Reduction System (HSDRRS), is classified as Moderate to High risk, with ongoing armoring efforts to enhance resilience and reduce the potential consequences of overtopping or breach in St. Charles, Orleans, Jefferson, and St. Bernard parishes. The New Orleans West Bank Levee System, covering 115 miles with MRL and HSDRRS, is classified as Moderate to High risk, featuring locally operated MRL with USACE major maintenance, locally operated HSDRRS, ongoing armoring efforts, and completed 100-year risk reduction features, aiming to protect commercial and residential areas in St. Charles, Jefferson, Orleans, and Plaquemines parishes with an estimated population of 246,048 and assets valued at $41.1 billion. The following map illustrates the leveed areas in the Vicksburg and New Orleans Districts.

Levee failure involves the overtopping, breach, or collapse of the levee and can be especially destructive to nearby development during flood and hurricane events. The most well-known levee breaches in Louisiana occurred in association with Hurricane Katrina in 2005, when several sections along Lake Pontchartrain and along both navigation and drainage canals failed in New Orleans. The extent and depth of these levee failures resulting from Hurricane Katrina caused extreme flooding in New Orleans. However, given the quantity of levees in Louisiana, the annual probability of levee failure is 0.3%. The state has faced concerns about the potential breach of levees in cities such as Baton Rouge and New Orleans, prompting emergency measures to prevent failure and mitigate flooding.

Risk Assessment

Due to the low probability of occurrence and insufficient failure model data, a risk assessment was not performed.

Levee Protected Areas in Louisiana, 2023



GEOLOGIC HAZARDS

EARTHQUAKE

Overview

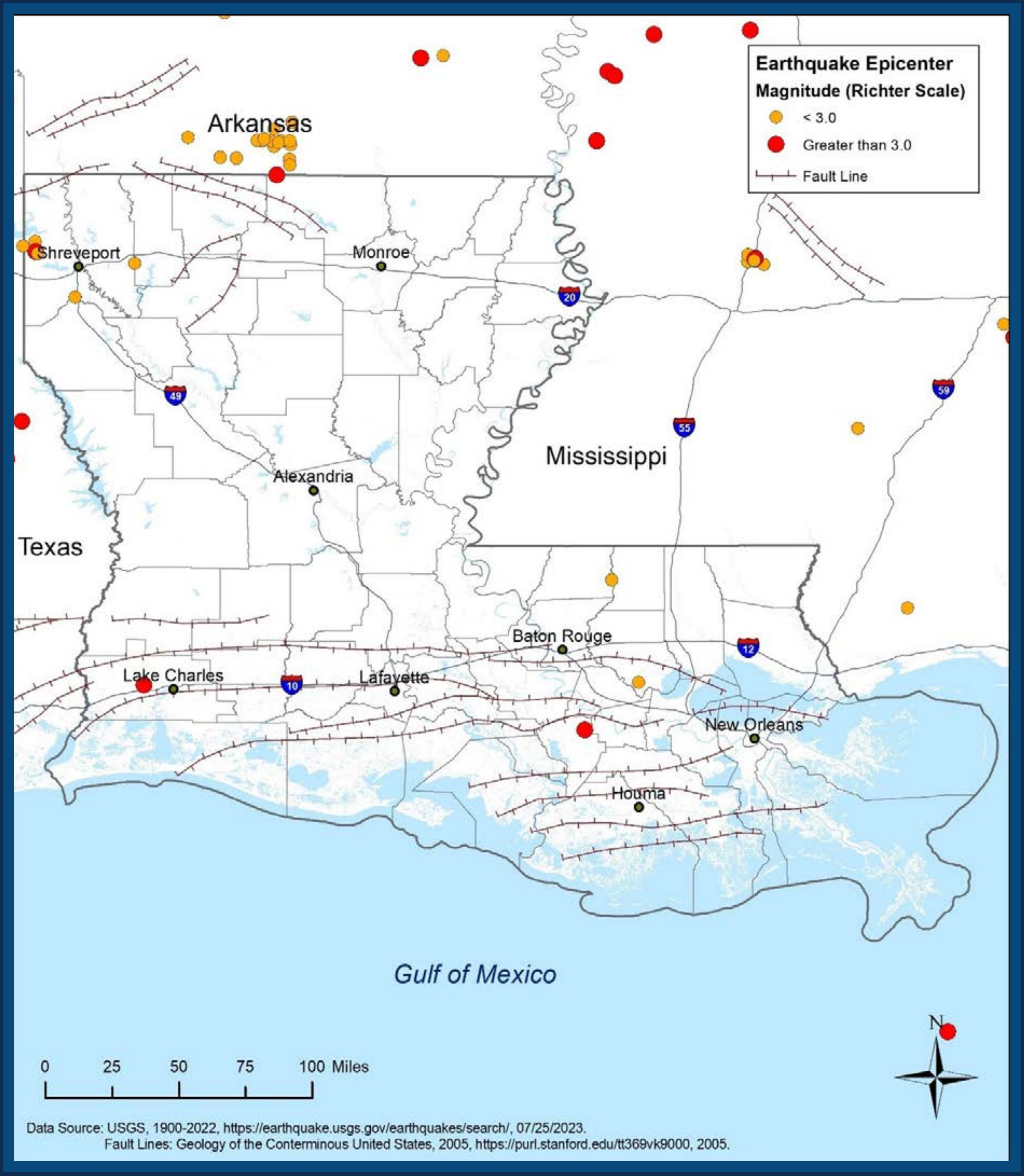
An earthquake is a sudden motion or trembling of the Earth caused by an abrupt release of stored energy in the rocks beneath the Earth's surface. The energy released results in vibrations known as seismic waves. Ground motion from seismic waves is expressed as peak ground acceleration (PGA), the fastest measured change in speed for a particle at ground level that is moving because of an earthquake. PGA is commonly measured as a percentage of acceleration due to Earth's gravity (%g). This measurement is considered in seismic load engineering design and construction requirements.

Based on historic events, the most severe earthquakes in the state are likely to occur to the very north (near the Arkansas–Mississippi border), originating from the New Madrid seismic zone, and to the south (near the coast) from the subsidence fault system. Nevertheless, the USGS has recorded only eight minor earthquakes in Louisiana in the past 25 years. Historically, earthquakes have caused minimal damage in Louisiana.

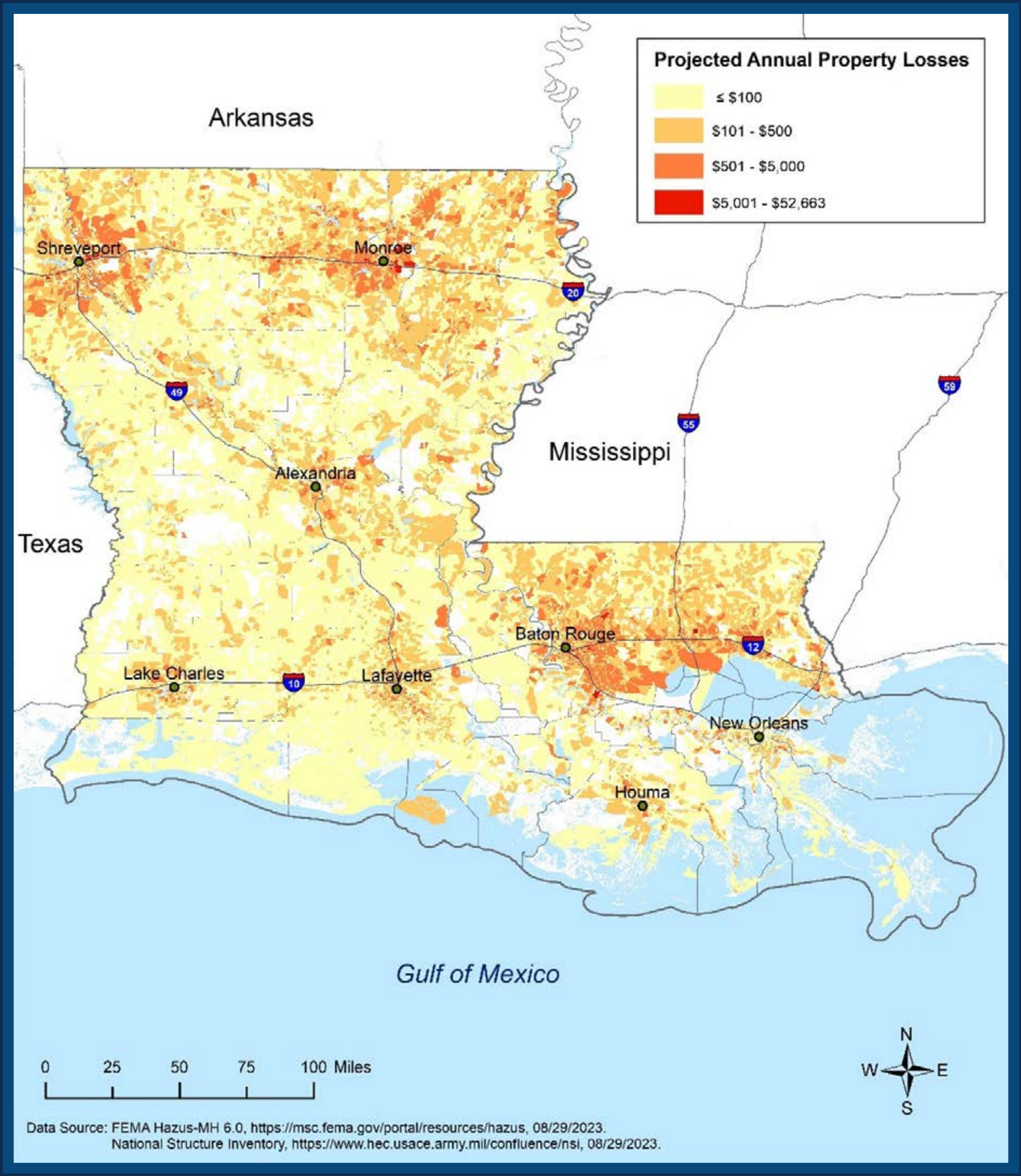
Risk Assessment

The projected property loss map shows the anticipated annual average losses due to earthquake hazards by census block using Hazus-MH.

Earthquake Events and Fault Lines in and near Louisiana, 1900-2022



Projected Annual Propety Losses from Earthquake by Census Block, 2050



SINKHOLES

Overview

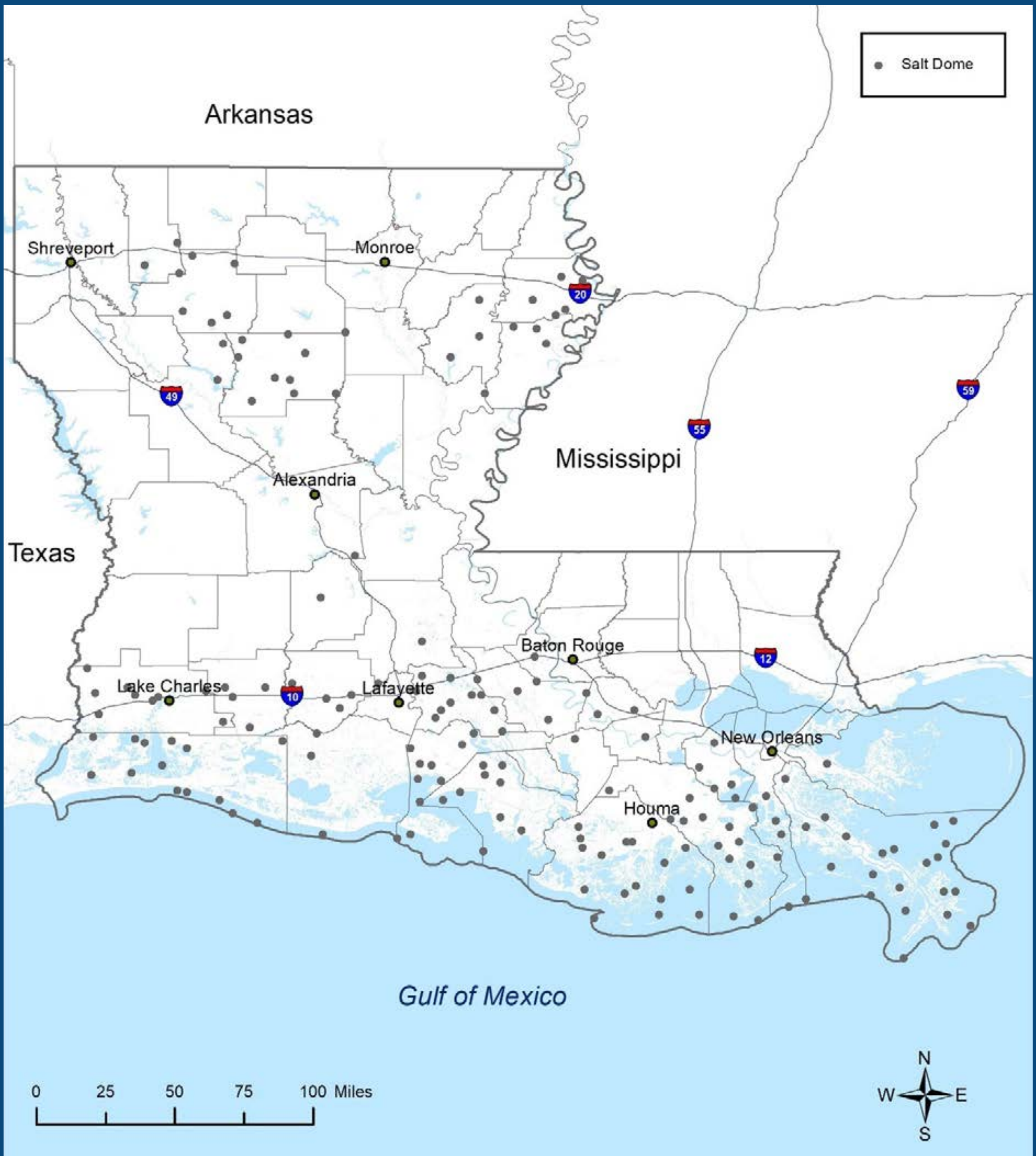
Sinkholes are areas of ground with no natural external surface drainage where the Earth's surface has collapsed. They vary in size from a few square feet to hundreds of acres and reach in depth from 1 to more than 100 feet. In Louisiana, sinkholes are typically formed when a natural salt dome is perforated, fills with water, and the salt dissolves, leading to failure of the surface.

Two recent Louisiana sinkhole events occurred at Lake Peigneur (Iberia Parish), which began to form in 1980, and at Bayou Corne (Assumption Parish), which formed in 2012. Both sinkholes were caused by the human-influenced collapse of salt dome caverns. Thus, future sinkholes are more likely to occur in locations that contain salt domes. Based on historic sinkhole formation, the future annual probability of sinkholes in 2050 is 0.01%.

Risk Assessment

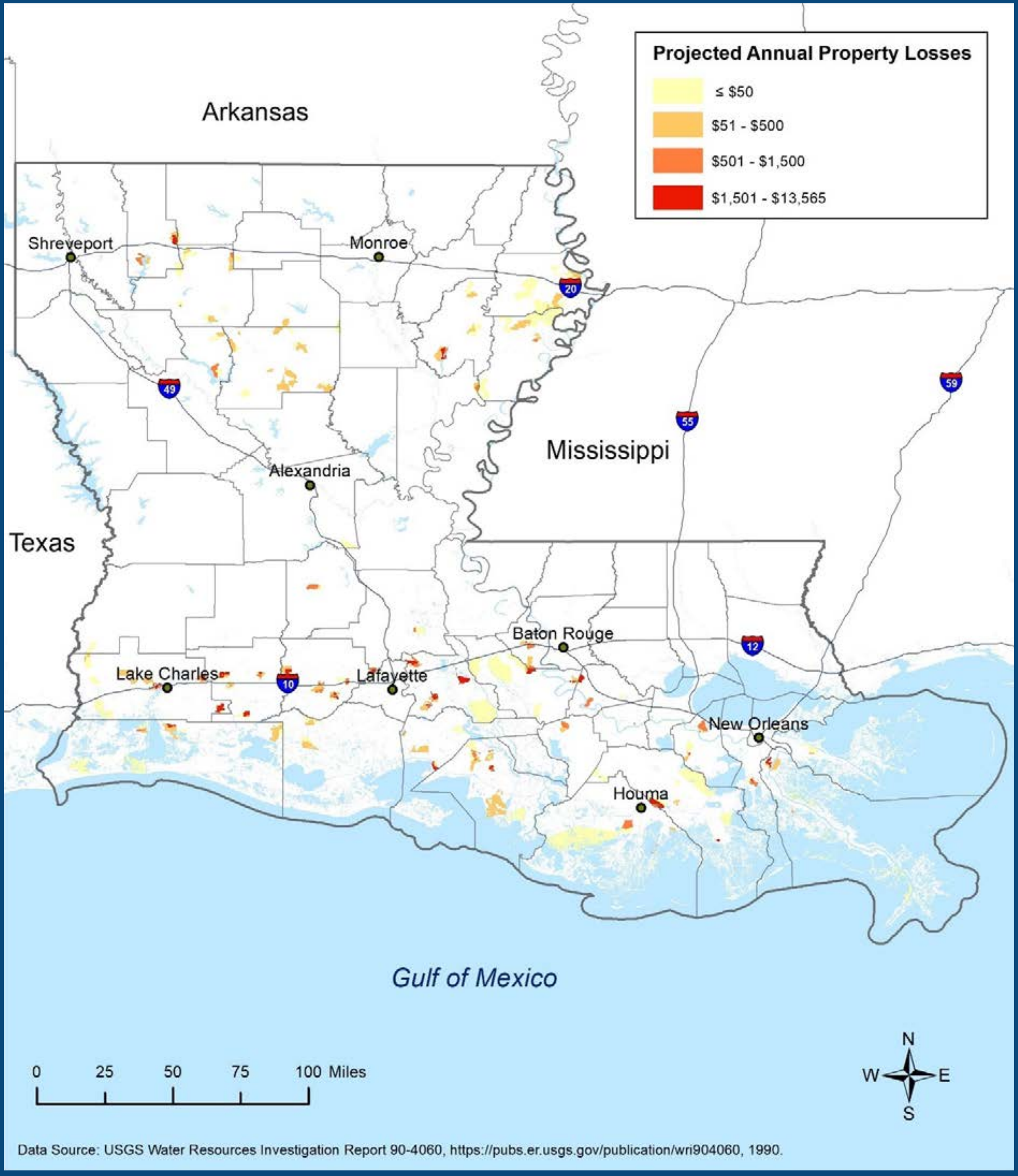
The projected property loss map shows the anticipated annual average losses due to sinkholes by census block.

Location of Salt Domes in Louisiana, 1990



Data Source: USGS Water Resources Investigation Report 90-4060, https://pubs.er.usgs.gov/publication/wri904060, 1990.

Projected Annual Property Losses from Sinkhole by Census Block, 2050



EXPANSIVE SOIL

Overview

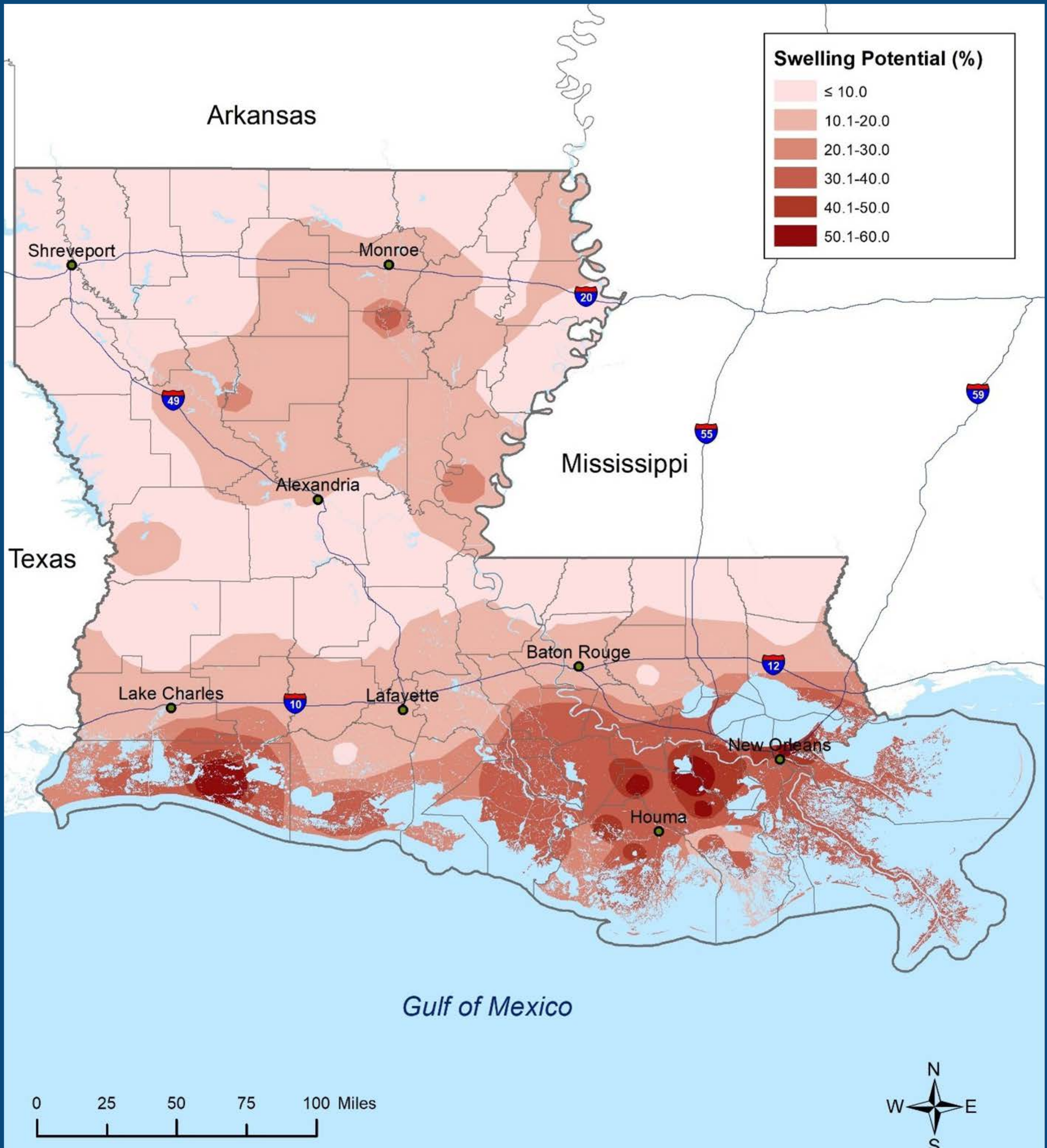
Soil and soft rock that tend to swell or shrink due to changes in moisture content are commonly known as expansive soil. Changes in soil volume present a hazard to lightweight structures built on expansive soil. Differential settlement of structures may occur, causing uneven shifting and settlement, cracks in the foundation and walls, and windows and doors that do not open properly. The American Society of Civil Engineers estimates that one-quarter of all homes in the U.S. are affected by expansive soil. Unlike the other hazards considered in this plan update, the effects of expansive soil are not manifested in a single event but rather become evident over time. Therefore, no significant past events exist for discussion.

Researchers at Louisiana Tech University previously predicted the swelling potential of Louisiana soil. The following map indicates the existing severity of potential soil expansion. No increase in swelling potential is projected for 2050; therefore, the current hazard map is used in the risk assessment.

Risk Assessment

The projected property loss map shows anticipated annual average losses due to expansive soil by census block.

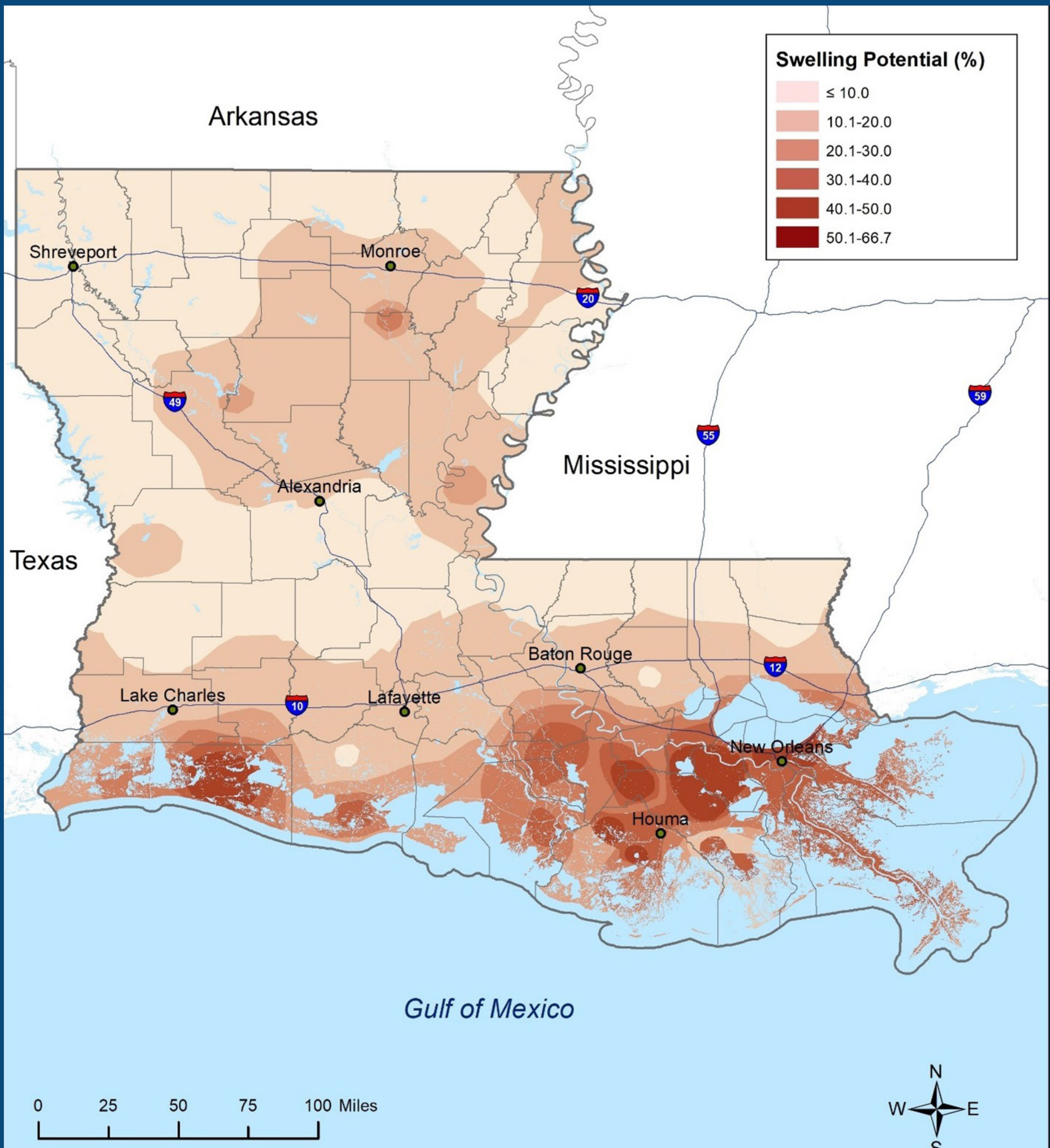
Expansive Soil in Louisiana: Swelling Potential Distribution, 2016



Data Source: Expansive Soils and Practice in Foundation Engineering, 2016, http://www.ltrc.lsu.edu/ltc_16/pdf/presentations/10-University%20Transportation%20Centers%20(Part%201)-Characterization%20of%20Expansive%20Soils%20in%20Northern%20Louisiana.pdf, 03/07/2016.

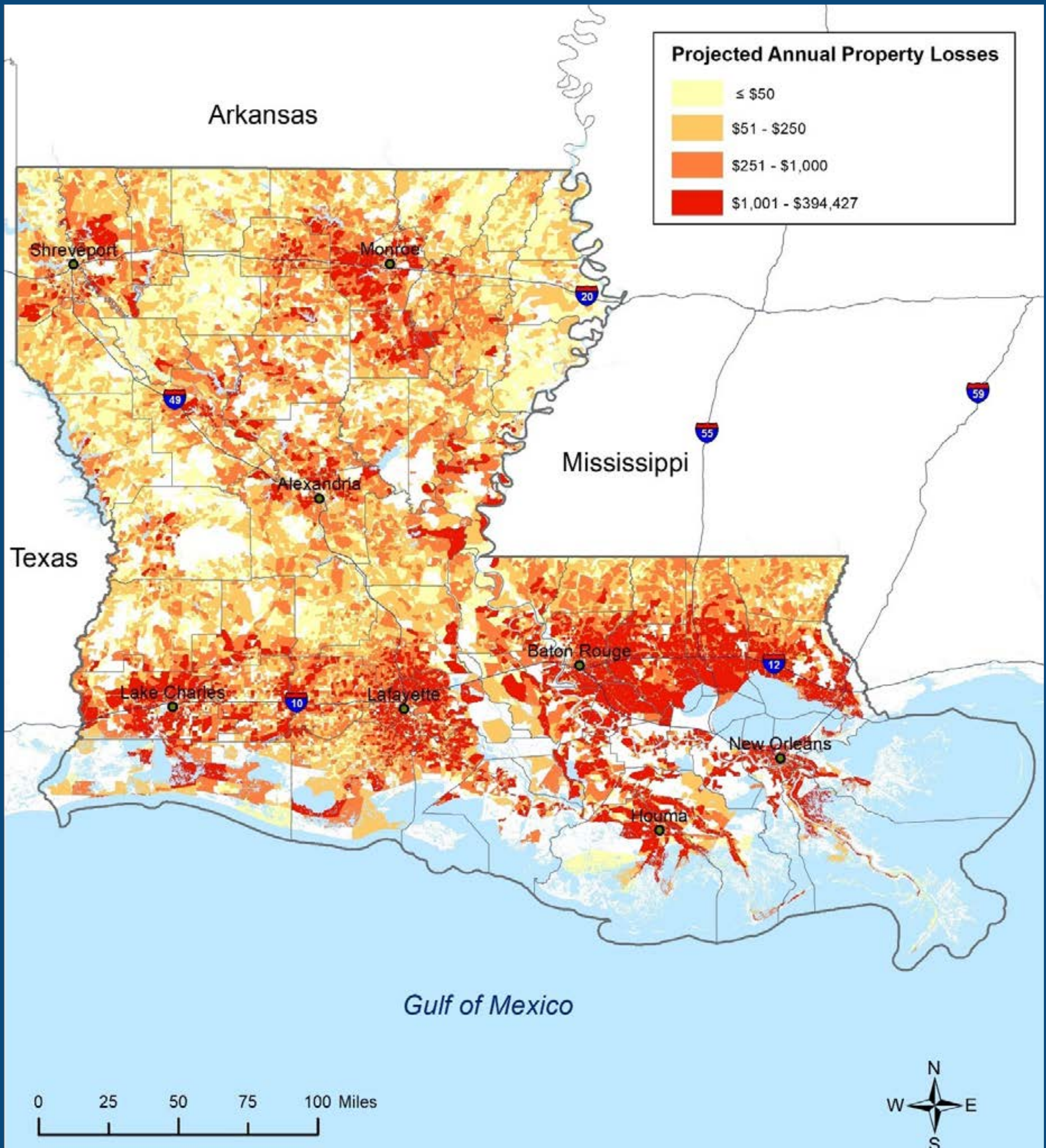
GOVERNOR'S OFFICE OF HOMELAND SECURITY GOHSEP & EMERGENCY PREPAREDNESS

Projected Expansive Soil in Louisiana: Swelling Potential Distribution, 2050



Data Source: Expansive Soils and Practice in Foundation Engineering, 2016, http://www.ltrc.lsu.edu/ltc_16/pdf/presentations/10-University%20Transportation %20Centers%20(Part%201)-Characterization%20of%20Expansive%20Soils%20in%20Northern%20Louisiana.pdf, 03/07/2016.

Projected Annual Property Losses from Expansive Soil by Census Block, 2050



Data Source: Expansive Soils and Practice in Foundation Engineering, 2016, http://www.ltrc.lsu.edu/ltc_16/pdf/presentations/10-University%20Transportation%20Centers%20(Part%201)-Characterization%20of%20Expansive%20Soils%20in%20Northern%20Louisiana.pdf, 03/07/2016.

3

State Mitigation Capabilities

Chapter 3: State Mitigation Capabilities

This chapter describes and evaluates the state of Louisiana's capabilities to reduce risk and increase resilience through the implementation of its mitigation strategy. This section explores both pre- and post-disaster capabilities, including authorities, policies, programs, staff, funding, and other available resources that aid mitigation efforts and demonstrate its commitment to mitigation. Information is also included on non-state stakeholder agents that collaborate with the state to reduce the impact of hazards. This Capability Assessment not only summarizes the resources available to support mitigation, but it also identifies changes since the last plan update as well as opportunities for the state to improve its current capacity to reduce risk. As FEMA recognizes the connections between community resilience and areas such as emergency management, economic development, land use and development, housing, health and social services, infrastructure, and natural and cultural resources, these areas are addressed to the extent possible.

Overall, this chapter addresses the following requirement per the State Mitigation Planning Policy Guide (2022):

S8. **Does the plan discuss the evaluation of the state's hazard management policies, programs, capabilities, and funding sources to mitigate the hazards identified in the risk assessment? [44 CFR § 201.4(c)(3)(ii)]**

State Authorities, Policies, and Programs

This section describes the legal framework that supports hazard mitigation in Louisiana. It includes summaries of laws, planning and development authorities, state agencies, programs and policies, and other tools that directly or indirectly support statewide mitigation.

Overall, hazard mitigation directives originate mostly from the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) and the Coastal Protection and Restoration Authority (CPRA). Other state entities with planning and development related authority and programs in hazard-prone areas include:

- **Department of Administration (DOA) - Office of Facility Planning and Control (FPC): regulation of state–owned property**
- **Department of Agriculture & Forestry (LDAF): enforcement of timber laws**
- **Department of Environmental Quality (DEQ): permitting programs**
- **Department of Natural Resources (DNR): Louisiana Coastal Resources Program (LCRP) and Coastal Use Permit (CUP)**
- **Department of Public Safety and Correction (DPS): Uniform Construction Code**
- **Department of Transportation and Development (DOTD): Statewide Flood Control Program; National Flood Insurance Program (NFIP) and the Community Rating System (CRS): building permits**
- **Department of Wildlife and Fisheries (LDWF): Scenic Rivers Program**

The mitigation related activities of these state agencies as well as others are summarized in the next sections on plans, policies, and programs. According to FEMA, there are four types of hazard mitigation actions or activities. These include

- **Plans and regulations: government authorities or codes that guide the way we develop land and buildings.**
- **Natural systems protection: actions that minimize damage and loss or preserve and restore natural systems.**
- **Structure and infrastructure projects: actions that change structures and infrastructure to protect them from a hazard or remove them from a hazard area.**
- **Education and outreach: actions that teach the public about hazards and mitigation.**

All four types of actions or activities were considered when identifying agencies to include in this assessment.

Plans and Policies

The State of Louisiana has many mitigation related acts, plans, executive orders, and policies that support pre- and post-disaster hazard mitigation. Although some are integrated and take a holistic approach to hazard mitigation throughout the state, there is room for more coordination.

- **Examples of current mitigation related documents and responsible agencies include:**
- **Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA)**
- **Louisiana State Continuity of Operations Plan (GOHSEP)**
- **Louisiana State Emergency Operations Plan (GOHSEP)**
- **Louisiana State Hazard Mitigation Plan (GOHSEP)**
- **Louisiana State Public Assistance Administrative Plan (GOHSEP)**
- **Louisiana State Uniform Construction Code (Department of Public Safety and Correction; Louisiana State Uniform Construction Code Council)**
- **Louisiana Unified Shelter Plan (GOHSEP)**
- **Executive Order NO. JBE 2016-09, signed on April 4, 2016, directs all state agencies to operate in a manner consistent with Louisiana's Comprehensive Master Plan for a Sustainable Coast. This Plan was recently updated in 2023.**
- **The Louisiana Homeland Security and Emergency Assistance and Disaster Act (Louisiana Disaster Act) R.S. 29:721-739 remains the driving legislation that affects preparedness, response, recovery, and mitigation programs. The Act provides structure and empowers the State and local governments to act in these phases of emergency management in the event of a natural or manmade disaster. Overall, the Louisiana Disaster Act defines roles for state, parish, local governments, and non-governmental agencies and requires that emergency management functions be coordinated with those of the federal government and other states. Additionally, the Act provides guidance related to shelters, evacuations and curfews, financing, assistance identification, interstate and intrastate cooperation, liability limitations and immunity of personnel responding to disasters.**

The goals of the Louisiana Disaster Act related to mitigation remain as follows:

- **To reduce vulnerability of people and communities of this state to damage, injury, and loss of life and property resulting from natural or man-made catastrophes, riots, or hostile military or paramilitary action;**
- **To authorize and provide for cooperation in emergency or disaster prevention, mitigation, preparedness, response, and recovery; and**
- **To authorize and provide for management systems represented by coordination of activities relating to emergency or disaster prevention, mitigation, preparedness, response, and recovery by agencies and officers of this state, and similar state-local, interstate, and foreign activities in which the state and its political subdivisions may participate.**

Among its many functions, the Louisiana Disaster Act established GOHSEP and its responsibilities. The Act authorizes GOHSEP's Hazard Mitigation Section within its Disaster Recovery Division to administer the Hazard Mitigation Grant Program and the Non-Disaster Hazard Mitigation Assistance Grants. The Hazard Mitigation Section, managed by the State Hazard Mitigation Officer and a Hazard Mitigation Section Chief, conducts outreach to communities, provides technical assistance to applicants, and manages grants to sub-grantees. Sub-grantees include state agencies, local governments, federally recognized Native American tribes, and private non-profit organizations.

Another significant policy is the establishment of the Coastal Zone Boundary in Louisiana Revised Statutes Article 49, §214.24. The Coastal Zone Boundary provides for state management of coastal resources in areas with a high level of coastal influence, ensures consistency with the Coastal Master Plan, and allows for reduction of coastal hazards and wetland impacts through permit review of development proposals. This work is conducted by DNR's Office of Coastal Management - Permits & Mitigation Division and demonstrates Louisiana's strong commitment to coastal sustainability and improves the state's chances for federal funding for mitigation.

Programs

In addition to GOHSEP, various state departments implement programs and activities that support mitigation efforts throughout the state. Many of these programs are summarized here and although the programs often complement each other, they are not all implemented in coordination or support of one another.

Various offices under the Division of Administration (DOA) support mitigation activities throughout the state. These include the following offices:

- **Facility Planning and Control (FPC)**
- **Office of Community Development (OCD)**
- **Office of Risk Management (ORM)**

The Office of Facility Planning and Control (FPC) is responsible for administration of the state's capital outlay budget process, which includes preparation of a preliminary state construction plan. The state construction plan outlines state and local projects for possible funding. FPC is an effective mechanism for influencing the location of state-owned facilities within hazard areas. The DOA's regulation of state-owned property via capital outlay is effective because the funds are appropriated to FPC, and the design of the buildings is under that office's direction. For example, the FPC's location of new construction outside flood hazard areas and/or above base flood elevations actively supports the state's overall efforts to mitigate risk through land development. As the building code authority for state-owned property, FPC also enforces the International Building Code for all state buildings, whether or not they are funded through capital outlay. As the central leasing authority for all state-owned property, FPC further enforces standards in the procurement of leases and has the authority to set the geographic limits for the bidding of leases. FPC has less control over decisions related to construction of state-owned facilities because such construction usually takes place on existing state-owned sites. Decisions for such facilities are usually guided by proximity to existing facilities and similar functional concerns.

The Disaster Recovery Unit within the Division of Administration's Office of Community Development (OCD-DRU) is dedicated to helping Louisiana's residents recover from hurricanes Katrina, Rita, Gustav, Ike, Isaac, Ida and the Great Floods of 2016. As the state's central point for disaster recovery, OCD-DRU manages the most extensive rebuilding efforts in American history, working closely with local, state, and federal partners to ensure that Louisiana's recovery is safer, stronger, and smarter. Since the last plan update, OCD-DRU continues to implement the Restore Louisiana Homeowner Assistance Program in response to the significant flooding that occurred in 2016. Applicants of Restore Louisiana, who are required to elevate their homes, must agree to elevate to either the local jurisdiction's elevation height requirement or two feet above the Advisory Base Flood Elevation (ABFE), whichever is higher. OCD-DRU also administers two new planning efforts, LA SAFE and the relocation of Isle de Jean Charles (see Mitigation in Action for more details on the implementation of LA SAFE). OCD-DRU also oversees the Louisiana Watershed Initiative (LWI) which coordinates funding, data and resources among five state agencies to reduce flood risk through a watershed-based approach (see the Mitigation in Action for details on the implementation of LWI).
The Office of Risk Management (ORM) administers the state's self-insurance program. ORM is responsible for managing all state insurance coverage covering property and liability exposure. It offers risk management training resources through conference presentations and on its website.

The National Flood Insurance Program (NFIP) is another tool used by the State to mitigate the impacts of flooding through the regulation of development in vulnerable areas. All parishes in the state of Louisiana participate in the NFIP; a total of 316 communities participate in the program. LA DOTD houses Louisiana's Floodplain Management Office, which is a statewide resource for floodplain management activities to include the NFIP. Floodplain Management Office staff also serve as liaisons with FEMA Region VI and the regional NFIP office. Participation in the NFIP is required for a community to apply for Flood Mitigation Assistance (FMA) funds (administered by GOHSEP). As of January 2024, there were 454,053 NFIP policies in force across the state; a decrease of close to 8% or 35,207 properties from June 2018. LA DOTD also supports the participation of Louisiana communities in the NFIP's Community Rating System (CRS). The CRS is a voluntary program that rewards communities that implement floodplain management activities that go beyond those required by the NFIP. Thirty-nine Louisiana NFIP communities participate in the CRS. These 39 communities represent 78% of the state's NFIP policies – a slight decrease from the last 2019 Plan Update. Table 1 provides information on Louisiana communities that participate in the CRS along with their class ratings and the number of NFIP policies.

Community	Class	Number of Policies
Ascension Parish	7	13,754
City of Baker	9	738
Bossier City	9	3,017
Caddo Parish	8	610
Calcasieu Parish	8	7,493
City of Carencro	7	476
City of Central	7	4,859
City of Covington	8	1,375
City of Denham Springs	8	1,970
East Baton Rouge Parish	7	37,764
City of Gonzales	8	1,278
City of Gretna	6	2,848
City of Houma	7	3,101
Town of Jean Lafitte	7	407
Jefferson Parish	5	73,557
City of Kenner	6	14,221
City of Lafayette	7	7,738
Lafayette Parish	7	7,970
City of Lutcher	8	231
City of Mandeville	5	2,931
Morgan City	9	1,286
Orleans Parish	7	74,945
Ouachita Parish	8	1,993
City of Rayne	9	236
City of Ruston	8	86
City of Scott	7	1,051
City of Shreveport	8	4,141
City of Slidell	6	6,111
City of Sorrento	9	290
St. Charles Parish	7	11,405
St. James Parish	8	1,038
St. John the Baptist Parish	7	6,474
St. Tammany Parish	7	35,832
Tangipahoa Parish	8	6,861
Terrebonne Parish	7	10,766
City of Walker	8	1,067
West Baton Rouge Parish	8	972
City of Westwego	7	1,174
City of Zachary	8	1,017
Total		353,083

The State Hazard Mitigation Officer (SHMO) demonstrates support of LA DOTD and NFIP/CRS communities by attending field deployed NFIP/CRS classes, participating in CRS Users group meetings, and plans to participate in substantial damage trainings as well. In addition, the State has again collaborated with the University of New Orleans' Center for Hazards assessment, Response and Technology (UNO-CHART) to update the CRS Strategy for the State, first developed under the 2019 Plan Update. See Appendix for the 2024 CRS Strategy Update.

La DOTD also implements the Statewide Flood Control Program. This program supports flood risk reduction through the construction of flood control infrastructure. With funds allocated annually by the Legislature, La DOTD constructs projects that reduce or eliminate the incidence of flooding or damages in specific areas. Types of projects include channel modifications; levee, canal, and spillway construction; stormwater detention; floodproofing of structures; regulation of floodplains; relocation assistance; or other structural or non-structural measures.

FEMA is working with federal, state, tribal and local partners across the nation to identify flood risk and promote informed planning and development practices to help reduce that risk through the Risk Mapping, Assessment and Planning (Risk MAP) program. Since the last mitigation plan update, the State of Louisiana continues to be an active participant in Risk MAP through the Cooperating Technical Partners (CTP) Program. DOTD – State Floodplain Management Office manages the CTP program with support from contractors. Since becoming a CTP with FEMA Region VI, LADOTD has been diligently planning and working toward the release of updated flood risk information for Louisiana. Historically, LADOTD mapping partners have focused on Risk MAP Phases 1 and 2 while FEMA focused on Phase 3. Moving forward, LADOTD will align our planned project areas with the FEMA Region VI Multi-Year Investment Plan. The goal is for data collected through the Louisiana Watershed Initiative (LWI) data can be leveraged through the CTP program to provide FEMA with significant impact to their metrics while providing communities with much needed flood risk data. More information on both programs can be found in Ch. 5 - Mitigation in Action.

In 2015, the Water Institute was also selected as CTP and awarded funding for the following activities: the creation and annual updates of the Institute's CTP 5-year Business Plan, implementation of flood risk mapping through watershed discovery projects, special communication projects, and creation of training materials for university engineering students and local engineering practitioners.

Following Hurricanes Katrina and Rita in 2005, the Coastal Protection and Restoration Authority (CPRA) was established as the single state entity with authority to articulate a clear statement of priorities to achieve comprehensive coastal protection and create a more sustainable Louisiana. The Louisiana State Legislature charged CPRA with responsibility for "hurricane protection and the protection, conservation, restoration, and enhancement of coastal wetlands and barrier shorelines or reefs" throughout southern Louisiana's coastal zone, which is comprised of the contiguous areas subject to storm or tidal surge. CPRA's mandate is to develop, implement, and enforce a comprehensive, long-term coastal protection and restoration strategy This is done through the Louisiana's Comprehensive Master Plan for a Sustainable Coast, a document with a 50-year planning horizon (updated every 6 years) and the Integrated Ecosystem Restoration and Hurricane Protection in Coastal Louisiana Annual Plan, a projection of expenditures (updated yearly). CPRA acts in direct response to both legislative and executive orders. According to the Louisiana Revised Statutes §214.1(C),

the State must act to conserve, restore, create, and enhance wetlands and barrier shorelines or reefs in coastal Louisiana while encouraging use of coastal resources and recognizing that it is in the public interest of the people of Louisiana to establish a responsible balance between development and conservation.

Management of renewable coastal resources must proceed in a manner that is consistent with and complementary to the efforts to establish a proper balance between development and conservation. Moreover, Executive Order No. 2016- 09 highlights the need for the master plan to drive and expedite state action across agencies. The same need applies to the state's partners at the local and federal levels, consistent with their mandates and missions. Given the coastal erosion emergency facing Louisiana, it is imperative that all government agencies act quickly and in accordance with CPRA's Coastal Master Plan. To help achieve this, CPRA continue to work closely with other entities on coastal issues, including local and parish governments; the state legislature; the Governor's Advisory Commission on Coastal Protection, Restoration, and Conservation; and Louisiana citizens and coastal stakeholders.

Since the last Update, former state representative and former Terrebonne Parish President, Gordon Dove, was appointed as Chair of the CPRA Board. Agency representatives on the CPRA Board include the secretaries of the: Department of Natural Resources (DNR), Department of Transportation and Development (DOTD), Department of Environmental Quality, Department of Wildlife and Fisheries, Department of Economic Development; the commissioners of the Department of Agriculture and Forestry, Department of Insurance, Division of Administration; and the Director of the Governor's Office of Homeland Security and Emergency Preparedness. Additionally, CPRA Board membership includes levee district presidents from coastal Louisiana, and designees of the Senate President and Speaker of the House.

CPRA also administers the Flood Risk and Resilience Program, which is described in Chapter 5 – Mitigation in Action.

Coordination between state and local authorities is vital to the implementation of hazard mitigation activities. For instance, although the Louisiana Uniform Construction Code (UCC) may be enforced at the state level through the Office of State Fire Marshal (upon request for commercial construction), local education regarding the UCC is coordinated and supported by DPS through the Louisiana State Uniform Construction Code Council (LSUCCC). Since it went into effect in 2007, the UCC has had a significant impact on lowering risk by reducing exposure to wind- and flood-related hazards in hazard areas through the direct regulation of land use and development. Additionally, the UCC is adopted on the state level and all parishes are required to provide enforcement of the UCC. There remains an issue regarding a small percentage of local officials are either not aware of UCC-enforcement, or they are inadequately equipped to provide proper enforcement. Continuing education of local officials is still needed.

Since the last plan update the LSUCCC adopted the 2021 International Codes with Louisiana Amendments and the 2020 National Electrical Code with Louisiana Amendments that are in effect for all projects submitted on or after January 1, 2023. Moreover, LSUCCC voted to adopt the freeboard recommendation from the International Residential Code starting on August 1, 2023. While many local jurisdictions do enforce at least one foot of freeboard, this is the first time Louisiana will have a statewide freeboard requirement. Moreover, this will help CRS communities with the new prerequisite for achieving CRS Class 8; communities must adopt and enforce at least one foot of freeboard for residential buildings in all numbered zones of the Special Flood Hazard Area (SFHA).

Many mitigation programs operate effectively and are integral to agency objectives. The permanent protection of wildlife habitat through cash sale acquisitions, donations, or conservation easements in the Land Acquisition Program is a way to help accomplish the DWF's mission and to advance hazard mitigation goals. Since its inception, the program has acquired almost 610,000 acres of wildlife habitat through fee title acquisitions, donations, or land transfers. An additional 516,167 acres are under variable-length, lease agreements between DWF and private corporations, governmental agencies, and non-governmental organizations. The leased properties represent unprotected fish and wildlife habitat. The owned and leased properties collectively make up the 61 Wildlife Management Areas and Refuges managed by DWF. The WMAs and refuges provide a wide variety of habitats that help fulfill DWF's mission. The success of the land acquisition programs depends upon several factors. Funding is the primary limiting factor and therefore, it is extremely important to have a sufficient and sustained funding source. Land prices continue to escalate, particularly within the past few years as competing interests from land development, alternative fuels, and environmental projects such as carbon sequestration have emerged. Unfortunately, DWF's funding source has been static, thereby severely limiting its ability to acquire habitat from willing sellers.

Another program related to mitigation and mission is the Scenic Rivers Program at DWF, which is responsible for preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. DWF identifies projects requiring Scenic River Permits by (1) conducting routine surveillance of these streams; (2) responding to information provided by the public and local governing authorities; and (3) reviewing notices published by those seeking other state and federal permits for potential impacts to these streams. Channelization, clearing and snagging, channel realignment, reservoir construction, commercial clear cutting of trees within 100 feet of the ordinary low water mark, and use of motor vehicles within the stream are prohibited on designated Scenic Rivers in Louisiana. By imposing restrictive permit conditions, modifying proposed activities in ways that minimize or eliminate impacts, and enforcing the provisions of the Scenic Rivers Act to ensure compliance, DWF has been very effective in preserving vegetated stream buffers, protecting water quality, and minimizing the encroachment of development and protecting the natural character and flood-mitigation capacity of these streams. There are currently approximately 61 streams, rivers and bayous in Louisiana's Natural and Scenic Rivers System, which includes approximately 3,000 linear stream miles.

Established in 1980, the DNR's Louisiana Coastal Resources Program (LCRP) requires permits for activities which have direct and significant impacts on coastal waters. Coastal Use Permit (CUP) applications are processed with respect to the consistency of the proposed use with the LCRP. Impacts to wetlands and coastal protective features, as well as hazard potentials, are elements which are evaluated during the CUP review process. The DNR developed a strategic plan pursuant to state law that requires the creation of performance measures. The LCRP's major performance measure is wetland mitigation. The goal is for the LCRP to obtain 100% compensatory habitat mitigation for permitted wetland impacts. This allows for the state to be eligible for a 10% reduction in its cost-share for major coastal restoration projects. The performance measure is reported to the Legislature on a quarterly basis, is subject to auditing, and is available to the public. The LCRP mitigation performance measure has never been less than 100% and is usually greater than 100%.

The Louisiana Coastal Wetland Conservation Plan also provides documentation of the state's mitigation requirements through the conditional use permit (CUP) process managed by DNR. The documentation takes the form of a biannual report to Congress composed by the U.S. Fish and Wildlife Service, EPA, and USACE. Louisiana's Coastal Zone Inland boundary was modified in the 2012 Regular Session of the Louisiana Legislature with the passage of House Bill 656 (Act 588). Boundary changes are based on the recommendations of a scientific study conducted for and approved by CPRA.

Since the last Plan Update, the Office of the Governor for Coastal Activities directed the development of Louisiana's 2022 Climate Action Plan which lays out measures the state can take to mitigate and adapt to global climate change. As the climate crisis threatens the wellbeing of Louisiana's communities, economies, ecosystems and infrastructure, this plan sets out a path to reduce GHG emissions to net zero by 2050. Decreasing carbon emissions is paramount to minimizing the severity of global climate change, and its impacts on Louisiana's residents. The plan includes diverse strategies including the creation of economic incentives to expand the availability of renewable energy, as well as support for the restoration of wetlands which serve as natural carbon sinks.

In addition to decreasing the state's emissions, the actions proposed have the potential to mitigate anticipated climate risks, such as rising sea levels and increasingly severe storms. One key strategy involves the restoration and conservation of coastal wetlands which play a crucial role in buffering against rising sea levels, hurricanes, and severe storms, benefiting both communities and ecosystems. Another strategy focuses on preserving and expanding natural lands and urban green spaces. The expansion of green infrastructure, such as urban tree canopy, can reduce the heat island effect and improve stormwater management, decreasing localized flooding. In supporting the preservation, conservation and expansion of natural lands and urban green spaces, including coastal wetlands, the Climate Action Plan endeavors to mitigate the consequences of natural hazards such as flooding, heat, hurricanes, and severe storms.

Overall, these findings demonstrate the State's commitment to mitigation, pre- and post-disaster as well as through regulation of development, by numerous state entities. While many of the programs focus on mitigation through coastal zone monitoring, permitting and restoration, a variety of programs focus on risk reduction related to riverine and backwater flooding as well as high winds, wildfires, drought, and other hazards. While many of the programs included in this table are quite successful, many are impacted by limited resources (e.g., staff, funding, and/or technical support).

Agency / CPRA

Pre-Disaster

Planning and implementation of structural and nonstructural protection programs and projects throughout coastal Louisiana

- Quarterly and annual inspection of federal, state, and local levees and other flood protection projects in Louisiana coastal area
- Local cost-share partner for levee construction and other structural protection measures
- Provide technical assistance, training, and certification for levee inspectors and levee owners
- Review of permits on riverine and hurricane protection activities
- Development and prioritization of nonstructural projects in 2023 Coastal Master Plan
- Support of land use planning through: CPRA's Flood Risk and Resilience Program, publication of Best Practices Manual for Development in Coastal Louisiana and the Louisiana Coastal Land Use Toolkit

Planning, engineering, design, construction, operation, maintenance, and monitoring of coastal restoration projects

- State-funded coastal restoration projects (e.g., sediment diversions, marsh creation, barrier island restoration, ridge restoration, hydrologic restoration, shoreline protection, bank stabilization, oyster barrier reefs, and others)
- Obtains federal cost-share funding for and implements coastal restoration programs, feasibility studies, and projects.

Public outreach and education

- 4-H Youth Wetlands Education and Outreach Program
- Coastal Science Assistantship Program (CSAP)
- LSU Center for River Studies
- Master Plan Data Viewer

Post-Disaster

- **None**

Regulation of Development

- **None**

Agency / GOHSEP

Pre-Disaster

- State administration of federal grant programs
- Coordination of state and local mitigation planning
- Community Education and
- Outreach
- Training Programs

Post-Disaster

State administration of federal grant programs:

- HMGP
- Individual Assistance (IA)
- Public Assistance (PA)
- PA/406 HMGP
- State Emergency Operations Center (SEOC)

Regulation of Development

- **None**

Agency / LA Department of Agriculture and Forestry (LDAF)

Pre-Disaster

- Fire weather forecasting
- Soil and water conservation
- Animal Health Services (food security)
- Formosan Termite Initiative
- Louisiana Project Learning Tree (K-12 environmental education)
- Partner with CPRA in pre-disaster exercises
- Hazard Mitigation is taken into consideration as part of planning, development projects, and timber management

Post-Disaster

- Production of reforestation seedlings
- Livestock recovery information and activities, working with CPRA

Regulation of Development

- Enforcement of timber laws

Agency / LA Department of Corrections (DOC)

Pre-Disaster

- Mass care and evacuation support for municipal and parish correctional facilities.
- Loss Prevention Unit (employee injury, property and records loss)
- State and local emergency management planning (ESF-6, housing, feeding, medical and mental healthcare)

Post-Disaster

- General Support
- EOC Task Force
- DOC HQ Incident Management Center
- Continued mass care and evacuation support for municipal and parish correctional facilities
- Backup power generation

Regulation of Development

- **None**

Agency / Louisiana Economic Development (LED)

Pre-Disaster

- LED's CommunityCompetitiveness initiative offers support to community adherence to emergency preparedness principles including mitigation and emphasizes its importance in an "economic development" capacity building program. Additionally, the Community Development Toolkit provides public information on emergency preparedness and management.

Post-Disaster

- Post-Disaster Economic Impact
- Analysis in coordination with LSU
- Work closely with Small Business Administration (SBA) and Small Business Development Centers to provide post-disaster support

Regulation of Development

- **None**

Agency / LA Department of Environmental Quality (DEQ)

Pre-Disaster

- Nuclear Power Plant Off-site
- Emergency Preparedness
- Program
- Radiological Emergency Planning and Response
- Remediation program
- Ozone Action
- Drinking Water Well Protection Program
- Motor Vehicle Inspection and
- Enforcement Program
- EnviroFlash

Post-Disaster

- Underground Storage Tank and Remediation Division (USTRD)

Regulation of Development

- Permitting Programs (Air, Water, Waste)

Agency / LA Department of Health (LDH)

Pre-Disaster

- Fight the Bite Program (West Nile Virus)
- Bioterrorism Unit (training)
- Pandemic program

Post-Disaster

- Disaster Case Management
- Regional Response Team
- Mobile Field Units
- Immunization Teams
- Evacuation Planning Requirement for Licensing Nursing Homes and Home Health Agencies
- Special Needs Shelters

Regulation of Development

- **None**

Agency / LA Department of Insurance (LDI)

Pre-Disaster

- Consumer 101 public education includes oversight "watchdog" functions for protecting policyholders with private insurance companies and providing information on the NFIP. Also is proactive in storm mitigation education via press conferences, news releases and a mitigation brochure.
- Manages the Fortify Homes Program and helps connect homeowners to approved evaluators and contractors.

Post-Disaster

- Office of Consumer Advocacy receives inquiries and complaints from consumers; prepares and disseminates information to inform and assist consumers; and may provide direct assistance and advocacy via one on one presentations and consultations. Office of Property and Casualty also receives complaints from consumers and seeks to resolve complaints in a timely manner with insurance companies.

Regulation of Development

- Performs regulatory permit functions and mitigation activities related to the State's coastal zone; issues Coastal Use permits

Agency / LA Department of Natural Resources (DNR)

Pre-Disaster

- Digital Mapping (Geographic
- Information System (GIS))
- Distributes information on causes of coastal and wetland erosion and methodologies to restore coastal and wetland areas
- Coastal Zone Management program and grants
- Coastal Wetlands Reserve Program
- Parish Coastal Wetlands Restoration program
- Prepares and plans for large scale evacuations and/or disruptions to the public fuel supply

Post-Disaster

- Surveys coastal restoration projects for damages and seeks FEMA funding as appropriate for needed repairs
- Digital Mapping (GIS)

Regulation of Development

- Performs regulatory permit functions and mitigation activities related to the State's coastal zone; issues Coastal Use permits

Agency / LA Department of Public Safety (DPS)

Pre-Disaster

- Provides for the administration of the Louisiana State Uniform
- Construction Code Council (LSUCCC)
- Provides assistance to the LSUCCC and supports local education and training of the UCC

Post-Disaster

- OSFM Urban Search and Rescue and Rapid Response teams assist local efforts
- Louisiana Traffic Safety Incident
- Management System (ICS)
- Oil Spill Coordinator's Office manages the response to oil related environmental disasters

Regulation of Development

- OSFM reviews all new construction and renovation of existing structures statewide for compliance with life safety, fire protection, and accessibility regulations
- OSFM provides enforcement of the LSUCC where requested by parishes and municipalities or individuals

Agency / LA Department of Culture, Recreation and Tourism (CRT)

Pre-Disaster

- Public education on disaster related topics included in agency nature programs

Post-Disaster

- Extended Recreation Sites operational hours for possible housing locations
  Sites used as staging areas

Regulation of Development

- **None**

Agency / LA Department of Transportation and Development (DOTD)

Pre-Disaster

- State management of NFIP
- Statewide Flood Control Program
- Ports Construction and Development Program
- Dam Safety Program
- Floodplain Management Program
- FEMA Cooperating Technical
- Partner (CTP)
- Supports CRS communities
- Educates and encourages working relationships between
- local NFIP staff and local HMGP POCs
- Plans and conducts educational workshops for local officials to include substantial damage planning
- Produces and distributes a quarterly NFIP newsletter

LA. Emergency Evacuation Plan, including highway

Post-Disaster

- Floodplain Management Staff contacts each community within the declared disaster area to discuss the rules and regulations of the NFIP with a special emphasis on the community's post-disaster responsibilities
- Ports Construction and Development Program
- Post-disaster damage assessments
- State Substantial Damage Plan

Regulation of Development

- Permitting for all state roads and highways including road access and easements
- Permitting for all new construction and modifications to dams in Louisiana

Agency / LA Wildlife and Fisheries (WLF)

Pre-Disaster

- Environmental Education
- Commission Courses and Programs
- Woodworth & Waddill Outdoor Education Centers
- La Green Schools Program

Post-Disaster

- Operates staging facilities for Search and Rescue (Enforcement Division)
- Utilizes building elevation and hardening in reconstruction effort

Regulation of Development

- Land Acquisition for Wildlife
- Management Program
- Scenic Rivers Program

Agency / LA Division of Administration (DOA)

Pre-Disaster

- Construction of state-owned structures via Facility Planning and Control (FPC)
- Integrating mitigation design features when feasible
- Enforcement of State and Federal regulations for design and construction of State buildings
- Loss Prevention Unit provides safety and health audits and training to other state agencies (ORM)
- Maintenance of Facilities
- Management database
- LA SAFE (OCD)
- Louisiana Watershed Initiative (LWI)

Post-Disaster

- Disaster Recovery projects for state facilities (FPC)
- Designated applicant for public assistance to FEMA for all permanent repairs for Katrina and Rita (FPC)
- Administers Restore Louisiana
- Homeowner Assistance Program (OCD)
- Elevation, Pilot Reconstruction, and Individual Mitigation Measures (OCD)
- Administers CDBG infrastructure grants through the Office of Community Development
- Information/Business Continuity– (DOA)
- Disaster Recovery Program (LDRP)

Regulation of Development

- FPC is the Building Code authority for all State owned buildings (with limited exceptions)
- FPC administers development activities of all non-DOTD State owned property through administration of the capital outlay bill
- FPC is the central leasing authority for all State agencies

Hazard Mitigation Capabilities

This section describes the state's hazard mitigation capabilities, which include dedicated staff, technical expertise, and financial resources.

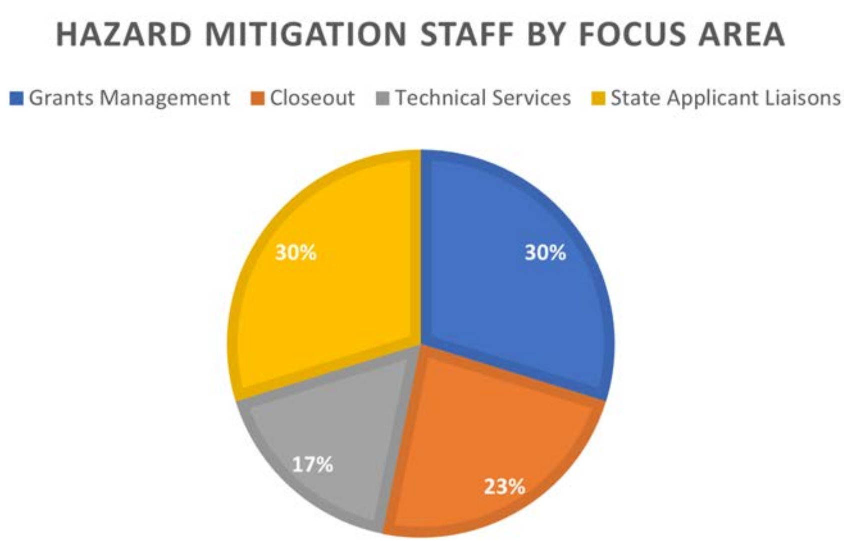
Mitigation Personnel

Since the 2019 Plan Update, GOHSEP continues to streamline internal processes and maintains a relatively small staff. The total number of employees in the Hazard Mitigation Division is 50; this number includes only seven contractors or about 16% of the staff. The relatively low number of contractors on staff reflects the continued building of internal capacity within the Mitigation Division.

Staff members as are assigned as follows:

Assistant Director:	1 State Staff
Executive Officer:	2 State Staff
Grants Management:	14 State Staff / 0 contractors
Closeout:	10 State Staff / 1 Contract Staff
Technical Services:	5 State Staff / 3 Contract Staff
State Applicant Liaisons:	11 State Staff / 3 contract Staff

The following figure shows the staff divided by focus area. The allocation has not changed significantly since the last update however, the largest groups include grants management and the state applicant liaisons followed by the closeout staff. The technical services team remains the smallest of the groups.



Although there are no plans for additional staff at this time, there is still a need for additional capacity to review and perform benefit cost analysis. One issue that has remained constant since the last plan update relates to salary. Salary levels for mitigation staff remain non-competitive with salaries for similar work in the private sector and at federal levels. This remains a challenge for the state to maintain staff levels.

The Mitigation Division continues to participate with FEMA in the annual State Mitigation Program Consultation. The State Hazard Mitigation Officer attends the meeting along with various state agencies. This annual meeting allows GOHSEP to check-in with its FEMA partners and to review strengths and weaknesses. Mitigation staff also attend federal and state sponsored training and professional development classes, in person and online. Staff plan to also participate in Substantial Damage Training with LaDOTD in support of the Substantial Damage planning at the local and state levels.

Although many mitigation programs are implemented at the local level (e.g., floodplain management, Uniform Construction Code (UCC) enforcement, coastal zone management, etc.), the State is prepared to offer technical assistance in various areas related to mitigation, as referenced in the list of mitigation related programs. GOHSEP leads the development, implementation, and maintenance of the Hazard Mitigation Plan Updates. In addition, it is the lead agency in the administration and management of FEMA related grants. Since the last Plan update, GOHSEP continues to use LouisianaHM.com (LAHM), a web-based tool designed to manage all aspects of a State's activities relative to FEMA's Hazard Mitigation Assistance (HMA) grant programs. GOHSEP uses LouisianaHM.com for all open disasters as a tool to manage the relationship between a State or recipient and its applicants or subrecipients, and to serve as a central repository to track all data, documents, and activities relative to a State's fiduciary responsibility to administer FEMA HMA grant funding. This tool also integrates with the State financial system so that payments approved and generated in the system trigger payments from the State to the subrecipients. The system provides audit and history logs, and permissions based workflows and triggers. In addition to staff within GOHSEP, various other state agencies and departments have staff dedicated to mitigation planning and project implementation. These include CPRA, DOTD, DNR, and OCD. Since the 2019 Update, there is a new State Planning Office within the Office of Planning & Budget; the State Planning Manager participated in the 2024 Plan Update process.

Technical Capacity

Various state agencies collect, maintain, and share GIS data that support hazard mitigation activities. These agencies include CPRA, DOTD, DOA, DNR, DEQ and others. Additionally, there are regional entities, universities, and local jurisdictions that maintain and share GIS data with the State. The Louisiana Geographic Information Council (LAGIC), composed of representatives from various state agencies and several local, regional, and federal organizations, also supports the coordination of data. CPRA makes its coastal protection and restoration data publically available through CIMS (Coastal Information Management System). CIMS provides geospatial, tabular database and document access to CPRA's suite of protection and restoration projects, Coastwide Reference Monitoring System (CRMS) stations, the 2017 Master Plan, geophysical data, and coastal community resiliency information. There are three options for viewing CPRA's spatial data: a main spatial viewer, a coastal project map portal, and the Master Plan Data Viewer. The Master Plan Data Viewer is an interactive tool that connects coastal Louisiana residents with more information about their current and future risk. The Viewer includes data collected for the 2017 Coastal Master Plan and includes information on land change, flood risk and economic damage, coastal vegetation change, social vulnerability, 2017 Coastal Master Plan projects, and resources that direct homeowners to potential actions that can reduce risk. In addition, all the information in the Master Plan Data Viewer is available to download and serve as a powerful resource for hazard mitigation.

Virtual Louisiana is a Google Earth Enterprise platform that serves as an information-sharing gateway for emergency management. It is available to various state agencies but is not widely used. Additional infrastructure to allow for GIS data sharing includes a Geospatial portal built by the Stephenson Disaster Management Institute (SDMI) at Louisiana State University. SDMI also developed a Geospatial portal for GOHSEP; the portal hosts all hazard mitigation related infrastructure data. The Geospatial portal is a one-stop shop; however, this may change as DOTD has also started a new GIS initiative. Although the state's capacity to manage GIS data regarding risk and hazard mitigation continues to improve, areas for improvement still remain since the last plan update. GOHSEP still relies on the GIS capabilities of other state agencies, as there is currently only one part-time staffer with GIS expertise. Overall, recommendations to provide better technical support for future mitigation planning and implementation remain since the last plan update:

- **Increase skill-specific professional development opportunities for hazard mitigation staff**
- **Increase funding for GIS and hazard modeling software maintenance and licensing**
- **Build an internship program to support staffing needs**
- **Participate in EMAC events to share and implement best practices**

GOHSEP should continue to pursue collaborations with Louisiana universities and other state, regional and local entities to implement these recommendations and to address gaps in its technical capacity. In addition, the State should support the interest of some GOHSEP staff to pursue professional certification under programs such as the Certified Floodplain Management administered by the Association of State Floodplain Managers (ASFPM).

Financial Capacity

The State continues to implement hazard mitigation projects using both federal and state funding sources. These sources vary across federal and state agencies and are summarized below beginning with federal programs upon which the state relies. Much of our funding supports hazard mitigation through coastal programs and projects and are included in this section.

Federal Sources of Funding

FEMA provides funding for eligible mitigation planning and projects through the following Hazard Mitigation Assistance (HMA) programs: the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the Building Resilient Infrastructure and Communities (BRIC) Program. HMA funds support the State of Louisiana in its implementation of mitigation activities that protect lives and property, and support hazard resilience across the state. Activities that may be funded under HMA programs are described in FEMA's 2022 Hazard Mitigation Assistance Guidance and are summarized below.

Since the last mitigation plan update, the State of Louisiana has successfully applied for millions of dollars in HMA funds. FEMA's Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments/private non-profits (through the state) to implement long-term hazard mitigation measures following a presidential disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable implementation of mitigation measures during the recovery phase. Mitigation projects for which the state has received funding include drainage projects, structure elevations, floodwalls, road elevations, property acquisitions, development of mitigation plans, development of land-use regulations, safe rooms, and more.

Figure 2 - Eligible Activities by FEMA program (Hazard Mitigation Assistance Program and Policy Guide, March 23, 2023)

Eligible Activities	HMGP	HMGP Post-Fire	BRIC	FMA
1. Capability and Capacity-Building				
New Plan Creation and Updates	x	x	x	x*
Planning-Related Activities	x	x	x	
Project Scoping/Advance Assistance	x	x	x	x
Financial Technical Assistance				x
Direct Non-financial Technical Assistance			x	
Partnerships			x	x
Codes and Standards	x	x	x	
Innovative Capability and Capacity-Building^	x	x	x	
2. Mitigation Projects				
Property Acquisition	x	x	x	x
Structure Elevation	x	x	x	x
Mitigation Reconstruction	x	x	x	x
Localized Flood Risk Reduction	x	x	x	x
Non-Localized Flodd Risk Reduction	x	x	x	x**
Stabilization	x	x	x	x
Dry Floodproofing Non-Residential Building	x	x	x	x
Safe Room	x	x	x	
Wildfire Mitigation	x	x	x	
Retrofit	x	x	x	x^
Secondary Power Source	x	x	x	
Warning System (excluding earthquake early warning system)	x	x	x	
Aquifer Recharge, Storage, and Recovery	x	x	x	x***
Innovative Mitigation Project ^^	x	x	x	x
3. Management Costs	x	x	x	x

The goal of FEMA's Flood Mitigation Assistance (FMA) is to reduce or eliminate claims under the NFIP. FMA provides funding to assist states and NFIP-participating communities in implementing plans, projects, and programs to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. This includes acquisitions and elevations. In 2015, the University of New Orleans, in partnership with the State successfully applied for FMA funds to develop a CRS Strategy for the State of Louisiana as part of the 2019 Plan Update. This Strategy has been updated as part of the 2024 Plan Update (See Appendix).

The state also successfully participates in FEMA's Pre-Disaster Mitigation (PDM) program, designed to reduce overall risk to people and structures from future hazard events, while also reducing reliance on federal funding in future disasters. This program awards planning and project grants focused on reducing future losses before disasters occur. Louisiana continues to compete for PDM funds to update current mitigation plans and to fund projects such as flood and wind retrofits.

Since the last update, Louisiana was awarded funds from the Building Resilient Infrastructure and Communities (BRIC) program which was established as part of Section 1234 of the Disaster Recovery Reform Act. The goal of the BRIC program is to "fund effective and innovative activities that will reduce risk, increase resilience, and serve as a catalyst to encourage the whole community to invest in and adopt mitigation policies."

Another new funding mechanism utilized by Louisiana since the last update is the Flood Mitigation Assistance (FMA) Swift Current (Swift Current) program. Swift Current provides funding to state, local, tribal and territorial governments to mitigate buildings insured through the NFIP following a presidentially declared disaster to reduce flood risk. It focuses funding for individual residential buildings when policyholders are in the recovery process; this differs from the competitive FMA program that grants awards on a competitive basis once a year.

The following table provides a summary of the funding awarded from the aforementioned FEMA programs received by the state of Louisiana since the last Plan update. Most of the funds were awarded by HMGP followed by FMA.

Figure 3 - FEMA Funding Per Program

	Total Project Cost	Federal Obligated
HMGP		
2019	$505,749,930.92	$137,666,123.26
2020	$496,713,834.19	$40,384,317.65
2021	$348,573,028.05	$35,267,266.88
2022	$204,827,535.41	$29,495,829.85
2023	$1,285,836,392.88	$131,665,265.12
BRIC		
2022	$1,716,934.00	$1,290,563.00
2023	$89,523.00	$89,523.00
FMA		
2019	$12,451,579.52	$12,451,579.52
2020	$46,497,223.88	49,592,356.78
2021	$111,535,511.86	$103,662,865.32
2022	$87,121,871.67	$80,062,345.74
2023	$43,179,863.22	$42,232,861.00
LPDM		
2023	$3,787,000.00	$2,520,000.00
PDM		
2020	$3,192,217.65	$2,393,157.75
2021	$4,871,776.54	$3,653,832.40
2023	$14,516,220.00	$10,887,165.10
Swift Current		
2022	$3,025,682.00	$2,978,762.00
2023	$42,016,284.52	$35,670,893.62

FEMA's Public Assistance (PA) also includes a mitigation program. PA provides supplemental federal disaster grant assistance for the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private, non-profit organizations. Eligible projects include debris removal, emergency protective measures, repair to transportation infrastructure, repair to utility infrastructure, and more. PA covers a share of the costs, up to 75%. The PA program contains a mitigation component wherein eligible damaged infrastructure can be mitigated if mitigation measures are deemed cost-effective and environmentally-sound. Since the last Update, the State of Louisiana continued to administer a significant amount of PA funding. The following table summarizes the Public Assistance funds, Category C-G, obligated since the;

Year	Sum of Eligible Amt	Sum of Federal Obligated	Sum of Admin Oblilgated	Sum of State Obligated	Sum of Total Amount Paid
2019	$77,612,034.28	$73,914,476.07	$205,300.72	$0.00	$32,333,239.98
2020	$72,492,500.79	$55,382,339.54	$12,525.81	$0.00	$42,023,149.95
2021	$151,972,200.64	$136,294,447.48	$44,800.04	$0.00	$57,207,075.15
2022	$536,330,327.29	$483,489,423.29	$68,979.23	$0.00	$298,998,242.20
2023	$1,127,091,886.20	$1,014,445,605.86	$16,520.04	$0.00	$359,387,756.55
Grand Total	**$1,965,498,949.20**	**$1,763,526,292.24**	**$348,125.84**	**$0.00**	**$789,949,463.84**

The Emergency Support Function #14, Long Term Recovery (ESF #14 LTCR) provides a structure under the National Response Framework (NRF) to promote successful long-term recoveries for tribes, territories, states, and communities suffering extraordinary damages, where local capacity to implement a recovery process is limited. ESF #14 LTCR provides coordination and technical assistance to support federal, state, and local recovery processes.

The Office of Community Development (OCD) continues to rely on grants awarded by the U.S. Department of Housing and Urban Development to improve quality of life for Louisiana residents. These funds support mitigation through two specific programs - the Community Development Block Grant (CDBG) Program and the Disaster Recovery Unit (DRU). CDBG funds help communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. The state's program awards and administers these funds to local governments for improvements to public facilities, economic development, demonstrated needs projects and LaSTEP projects, which funds materials for local community projects while citizens provide a portion of the labor. OCD-DRU administers disaster recovery grants to help residents recover from hurricanes Katrina, Rita, Gustav, Ike and Isaac. Funds are distributed through other state agencies, local governments, businesses and nonprofit organizations to support and improve housing, infrastructure, economic development, planning and resilience. As such, OCD-DRU manages the most extensive rebuilding effort in American history and works closely with local, state and federal partners to ensure that Louisiana recovers safer, stronger and smarter than before. Since the 2019 Update, Louisiana has been allocated more than $3.1 billion in federal CDBG-DR funds to administer recovery through homeowner and rental assistance, economic revitalization, infrastructure and community resilience programs for areas impacted by Hurricanes Laura, Delta, Ida and the May 2021 Severe Storms.

Louisiana's Office of Rural Development (ORD), funded through the US Department of Agriculture, has a mission to reach all of Louisiana's rural communities with resources to help them grow and benefit the lives of their citizens. The organization serves as the single point of contact for rural government service providers, state and federal agencies, and individuals interested in rural policies and programs of the State. As such, it can play an integral role in the dissemination of mitigation actions.

State Sources of Funding

The following entities and/or programs are implemented by the State but are funded by state and/ or federal funding sources. Those programs with a statewide reach are listed first, followed by those that focus on Louisiana's coastal area.

The Capital Outlay Section of DOA prepares the capital outlay bill that contains state budget General Fund expenditures for acquiring lands, buildings, equipment, or other properties, or for their preservation or development or permanent improvement. Capital outlay planning and budgeting are directed toward the acquisition or renovation of fixed assets.

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating water quality standards for surface waters. The CWA makes it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit is obtained. Violations can result in both civil and criminal prosecutions and penalties.

The Louisiana Department of Environmental Quality (DEQ) administers the Clean Water State Revolving Fund (CWSRF) Program. This program provides financial assistance in the form of low interest loans to finance eligible projects, bringing them into compliance with the requirements of the Clean Water Act. Funding for this program is provided by federal grants and match funds generated by the program's interest and loan repayments. Interest and loan repayments provide a permanent source for funding in future Louisiana projects.

As mentioned, the Department of Transportation and Development (DOTD) houses Louisiana's Floodplain Management Office, which is a statewide resource for floodplain management activities to include the NFIP. This office promotes local government compliance with NFIP regulations to ensure the availability of low-cost flood insurance and to minimize loss of life and property due to catastrophic flooding. This is accomplished through on-site assessments, distribution of a quarterly newsletter, conducting workshops, providing technical assistance on local government ordinance development, and participation in post-disaster flood hazard mitigation activities. The program is jointly funded by FEMA and the state based on a 75:25 cost share.

DOTD's statewide Flood Control Program provides an average of $10 million annually to parish and municipal governments, levee boards, and drainage districts to support projects that (1) reduce existing flood damages, (2) discourage additional development in flood-prone areas,(3) do not increase upstream or downstream flooding, and (4) have a total construction cost of$100,000 or more. Eligible projects include channel enlargement, levees, pump stations, relocation of dwellings and business structures, reservoirs, and other flood damage reduction measures.

The Natural Resources Damage Assessment (NRDA) is the legal process used by the Louisiana Oil Spill Coordinator's Office (LOSCO) to seek compensation for damages to waterways, vegetation, or wildlife by oil spills.

Supplemental Environmental Projects (SEPs) are tools used by the EPA and DOJ in civil settlements in environmental enforcement actions. The EPA describes SEPs as environmentally beneficial projects that a violator agrees to undertake when settling an enforcement action. The purpose of a SEP is to provide environmental or public health benefits beyond those required to remediate environmental damages.

The Water Resources Development Act (WRDA) refers to any of a set of public laws enacted by Congress to address various aspects of water resources including environmental, structural, navigation, flood protection, and hydrologic issues. The state is partnered with the USACE on multiple large-scale protection and restoration projects that have been authorized through past WRDA bills. Because WRDA projects are generally dependent upon Congressional appropriation for construction funding, federal fund procurement is the principal issue that affects project implementation. Other issues affecting WRDA projects include cost-share agreement issues with federal partners, land rights issues, and permitting issues.

Berm to Barrier is one of many coastal programs that support CPRA projects. As a result of the Deepwater Horizon oil in 2010, a significant amount of sand was pumped along Louisiana's barrier island chain to create berms to block oil threatening our marshes. CPRA continues to utilize that foundation of sand to build more substantial and sustainable barrier islands that can serve as our first line of defense against storm surge and ecosystem degradation.

The Coastal Protection and Restoration (CPR) Trust Fund was established in 1989 by the Louisiana Legislature to provide a dedicated source of funding for coastal restoration. Income for the fund is a dedication of a percentage of the state's mineral income and severance taxes from oil and gas production on state lands. This trust fund pays for the coastal program's ongoing operating expenses and for continuing state efforts in coastal restoration and protection, including activities such as the CPRA/NRCS/Soil and Water Conservation Committee Vegetation Planting Program, upfront costs for projects funded through federal grant programs (e.g., CIAP, NFWF, and RESTORE), and state cost-share through programs like CWPPRA or LCA. DWH settlement payments dispersed to the state are also deposited in a trust fund that pays for NRDA project implementation and OM&M as well as NRDA-funded adaptive management efforts. CPRA is charged with developing an annual plan for these expenditures, managing, and administering the funds, and implementing coastal restoration and protection activities.

The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) was authorized by Congress in 1990 to identify, prepare, and fund the construction of coastal wetlands restoration projects. CWPPRA is managed by a Task Force comprised of the State and five Federal agencies, including the EPA, the U.S. Fish and Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS), the National Marine Fisheries Service (NMFS), and the USACE. The CWPPRA Task Force evaluates projects proposed for inclusion in the CWPPRA program and prepares a ranked list of candidate projects based on cost-effectiveness, longevity, risk, supporting partnerships, public support, and support of CWPPRA goals. From this ranked list, the Task Force annually selects a final list of projects, the Priority Project List, for implementation.

The CPRA/NRCS/Soil and Water Conservation Committee Vegetation Planting Program ensures that native marsh vegetation is planted and monitored throughout the coastal zone of Louisiana. CPRA enters into annual cooperative agreements with the Louisiana Department of Agriculture and Forestry (DAF). It is through the DAF and the Soil and Water Conservation Committee, Soil and Water Conservation Districts (SWCD) that the planting tasks are selected, planned, evaluated, planted, and monitored. Each NRCS District Conservationist provides technical assistance to their respective SWCD throughout the planting task process.

The Gulf of Mexico Energy Security Act (GOMESA), signed into law in 2006, provides four Gulf States, including Louisiana, with a share of revenues generated by oil and gas leasing in specific offshore areas of the Gulf of Mexico. GOMESA funds provide Louisiana with a consistent source of funding to address land loss. Louisiana voters constitutionally dedicated GOMESA funds to coastal protection through the Coastal Protection and Restoration Trust Fund. Louisiana was allocated (in millions of dollars), $94.7 in 2019, $155.7 in 2020, $109.9 in 2021, and $111.8 in 2022.

Following Hurricane Katrina, the U.S. Army Corps of Engineers constructed the $14.5 billion Hurricane and Storm Damage Risk Reduction System (HSDRRS). It is one of the most technically advanced coastal flood protection systems in the world. The HSDRRS includes a system of barriers, sector gates, floodwalls, floodgates and levees that provide a veritable “wall” around the New Orleans Metropolitan area. The System significantly reduces the risk of flooding for over 1 million residents from a 100- year storm. The system was authorized by Public Law 109 - 234 - Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006 and requires non-federal cost share to pay for operation and maintenance. The state along with the local flood authorities serve as the non-federal sponsors.

As reported in the 2014 Plan, the Deepwater Horizon oil spill of 2010 resulted in significant funding for Gulf Coast states including Louisiana. Under terms set by the US Department of Justice, BP and Transocean agreed to pay $2.394 billion and $150 million respectively. These payments were directed to the National Fish and Wildlife Foundation (NFWF) for natural resources restoration in the Gulf of Mexico. Approximately $1.2 billion of the funds directed to NFWF is dedicated to targeting Louisiana impacts by using the funds to “create or restore barrier islands off the coast of Louisiana and/or to implement river diversion projects on the Mississippi and/or Atchafalaya Rivers for the purpose of creating, preserving and restoring coastal habitat.” The agreement states that NFWF must consider the Coastal Master Plan and the Mississippi River Hydrodynamic and Delta Management Study “to identify the highest priority projects, and to maximize the environmental benefits of such projects.” Final payments were made in January 2018 but work continues to restore coastal areas damaged by the oil spill.

The Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012 (the RESTORE Act) dedicates 80% of the administrative and civil penalties paid under the Federal Water Pollution Control Act related to the Deepwater Horizon oil spill to the Trust Fund for the restoration and protection of the Gulf Coast region. The RESTORE Act also outlines a structure by which the funds can be utilized to restore and protect the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, coastal wetlands, and economy of the Gulf Coast region. The RESTORE Act sets forth the following framework for allocation of the Trust Fund: 35% to be divided equally between the five Gulf States (to include Louisiana) for ecological and economic restoration efforts in the region; 30% through the Gulf Coast Ecosystem Restoration Council to implement a comprehensive plan for ecosystem and economic recovery of the Gulf Coast; 30% for states' plans based on impacts from the Deepwater Horizon oil spill; 2.5% to create the Gulf Coast Ecosystem Restoration Science, Observation, Monitoring and Technology Program within the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA); and 2.5% to the Centers of Excellence Research grants, which will each focus on science, technology, and monitoring related to Gulf restoration. In 2017, the Gulf Coast Ecosystem Restoration Council and the U.S. Department of Treasury accepted the CPRA's First Amended Multiyear Implementation and State Expenditure Plan (RESTORE Plan). Since the 2019 Plan Update, a plan was put in place that allocates $91.034 million to be paid out every year until 2031.

Since the last update, **The Coastal Impact Assistance Program (CIAP)** no longer exists as it was completed in 2017 and is no longer available.

As many of Louisiana's mitigation programs focus on the coastal area, CPRA is integral to the state's mitigation strategy. CPRA projects are funded by numerous sources, federal and/or state, to include Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA), Water Resources Development Act (WRDA), Capital Outlay, CDBG, Natural Resource Damage Assessment (NDRA) Restoration, BP and Transocean Settlements, Restore Act funding, and the Gulf of Mexico Energy Security Act (GOMESA). The following table lists current projects, funding sources, and demonstrates the capacity of the state through CPRA to administer several projects that will play an integral role in hazard reduction across Louisiana's coastal zone.

Figure 4 *- CPRA Project and Funding Sources*

Project Name	Program	Mobilization Date	Total	State Dollars
Northwest Turtle Bay Marsh Creation	CWPPRA	5/28/2019	$33,664,671	$5,049,700
Queen Bess Island Restoration	NRDA	8/5/19	$18,710,000	$18,710,000
Grand Isle & Vicinity Breakwater	WRDA	10/1/2019	$15,000,000	$5,250,000
40 Arpent Canal Levee-Lockport Company Canal to Butch Hill Station	GOMESA	10/15/2019	$10,386,418	$6,500,000
Levee Improvements For Gheens Community	GOMESA	10/17/2019	$2,127,992	$1,000,000
Grand Isle Bayside Breakwater	State	10/25/2019	$6,500,000	$6,500,000
Magnolia Ridge Levee Lift and Road	GOMESA	1/17/2020	$3,500,000	$3,500,000
Island Road Fishing Piers	NRDA	2/3/2020	$2,400,193	$2,400,193
Terrebonne Basin Barrier Island and Beach Nourishment	NFWF	2/10/2020	$160,147,615	$160,147,615
Cameron-Creole Freshwater Introduction	CWPPRA	2/10/2020	$26,776,735	$4,016,510
Des Allemands FDA Pump Station Rehabilitation	GOMESA	2/18/2020	$762,595	$400,000
Bayou Terre Aux Boeufs Ridge	State	2/24/20	$2,000,000	$2,000,000
West Grand Terre Beach Nourishment and Stabilization	NRDA	3/17/2020	$102,009,216	$101,759,216
Pass a Loutre Crevasses NRDA	NRDA	3/19/2020	$920,260	$920,260
Pass a Loutre Campgrounds NRDA	NRDA	3/19/2020	$1,911,740	$1,911,740
Rockefeller Piers and Signage	NRDA	3/24/2020	$690,000	$690,000
Storm Surge Risk Reduction for US-90 at Bayou Folse	GOMESA	4/6/2020	$1,804,148	$1,500,000
Bayou Chene Floodgate	GOMESA	5/15/2020	$80,000,000	$80,000,000
LaCache Pump Station	State	6/1/2020	$2,000,000	$2,000,000
Paradis Canal Gate	RESTORE	6/15/2020	$5,367,874	$2,827,150
Grand Bayou Floodgate	GOMESA	7/1/2020	$20,000,000	$20,000,000
Atchafalaya Delta WMA Boat Access Project	NRDA	9/28/2020	$920,450	$920,450
Violet Canal Repairs	State	11/2/2020	$500,000	$500,000
Bayou De Cade Ridge & Marsh Creation	CWPPRA	11/10/2020	$24,781,121	$3,717,168

Bayou De Cade Ridge & Marsh Creation	CWPPRA	11/10/2020	$24,781,121	$3,717,168
Rockefeller Shorline Protection	State	11/23/2020	$9,270,263	$5,000,000
Rabbit Island Restoration Project	NRDA	12/1/2020	$16,440,000	$16,440,000
Pointe-Aux-Chenes Wildlife Management Area Enhancement	NRDA	1/11/2021	$5,000,000	$5,000,000
Cameron Meadows Marsh Creation and Terracing	CWPPRA	1/12/2021	$32,081,560	$3,296,439
Barataria Basin Ridge and Marsh Creation Spanish Pass Increment	NRDA	3/15/2021	$100,290,142	$100,290,142
Section D South Floodwall	GOMESA	3/16/2021	$1,800,000	$1,800,000
Middle River Pearl River Wildlife Management Area Boat Launch	NRDA	7/12/2021	$775,000	$775,000
North Lafourche Levee Improvements	State	10/30/2021	$3,000,000	$3,000,000
Atchafalaya Delta WMA Campground Improvements	NRDA	2/7/2022	$4,207,807	$4,207,807
South Grand Chenier Marsh Creation	CWPPRA	3/21/2022	$23,873,346	$3,393,502
Biloxi Marsh Living Shoreline	NRDA	7/11/2022	$69,820,460	$66,600,000
Freshwater Bayou Shoreline	State	4/24/2023	$3,671,432	$3,671,432
South Pass Bird Island Enhancement Project	State	5/22/2023	$1,893,000	$725,000
Henderson Lake Water Management Spoil Bank Gapping	State	7/15/2023	$1,500,000	$1,500,000

Other Resources

Fortunately, numerous stakeholders support and collaborate with the state to plan for and implement mitigation activities. Activities of these stakeholders enhance the hazard mitigation capabilities of the state. While many are listed in this section, others are highlighted in Chapter 5 – Mitigation in Action.

APA Louisiana, a chapter of the American Planning Association (APA), promotes the practice of community and regional planning in Louisiana by enhancing the effectiveness of planners in impacting public policy. Its' mission is carried out through community service and members services such as newsletters and professional development opportunities such as workshops and an annual state conference. Workshop and conference topics that support statewide mitigation efforts at the state and local levels include managing stormwater, coastal inundation mapping, green infrastructure, resilience and sustainability planning.

The Capital Region Planning Commission (CRPC) is a Council of Governments serving eleven Louisiana parishes: Ascension, East Baton Rouge, East Feliciana, Iberville, Livingston, Pointe Coupee, St. Helena, Tangipahoa, Washington, West Baton Rouge, and West Feliciana. Through planning and communication, CRPC coordinates and collaboratively addresses regional issues related to transportation, land use, economic development, and the environment. CRPS has worked with FEMA to produce a series of webinars/ seminars focused on flood risk and resiliency. Seemingly, there is room for more coordination and collaboration between the state and regional planning entities, such as CRPC, as they provide training for planning commissioners and planning materials parishes. These trainings and materials could include more information provided by state agencies, such as GOHSEP, on mitigation.

The Coastal Land Use Toolkit, a document made for public use by the non-profit CPEX, has been used in numerous Louisiana communities to guide development code amendments. The Toolkit explains the national and local best management practices (BMPs) in coastal development for Louisiana on a range of scales. It also has recommendations based on geological land types. Strategies in the Toolkit include the following: natural resource protection; wetland restoration; streetscape/ parking lot design, maintaining networks of infrastructure, and designing infrastructure in a resilient way while preserving local character. Specific zoning suggestions include the following: elevation standards, impervious land cover limitations, on-site design of elements to deal with stormwater management, and erosion control standards

Community Rating System Users Groups (CRS Users Groups) are informal organizations that support community representatives interested in the CRS. Four CRS Users groups currently exist in Louisiana including CRAFT, FLOAT, JUMP, and SWIFT. The Capital Region Area Floodplain Taskforce (CRAFT) includes the following communities: Ascension Parish, East Baton Rouge, West Baton Rouge Parish, City of Central, City of Denham Springs, City of Gonzales, City of Walker, and the City of Zachary. The Flood Loss Outreach & Awareness Task force (FLOAT) is made up of communities in the Greater New Orleans area including Lafourche Parish, Orleans Parish, St. Charles Parish, St. John the Baptist Parish, St. Tammany Parish, Tangipahoa Parish, Terrebonne Parish, City of Covington, City of Mandeville, and City of Slidell. The Jefferson United Mitigation Professionals (JUMP) is a Jefferson Parish based group, comprised of Unincorporated Jefferson Parish, the Cities of Gretna, Harahan, Kenner, Westwego, and the Town of Jean Lafitte. RAIN is a new group since the last Plan Update and is composed of SWIFT is composed of 16 parishes of Region 5 of the Louisiana Watershed Initiative.

The Louisiana Business Emergency Operations Center (LABEOC) is a partnership between LED, GOHSEP, and the National Incident Management Systems & Advanced Technologies (NIMSAT) Institute at the University of Louisiana at Lafayette. LABEOC focuses on providing situational awareness and resource support, supporting community recovery, mitigation, and economic stabilization within the business community.

The Louisiana Floodplain Management Association (LFMA) serves as a forum for parish and municipal employees, state and federal officials, and the private sector to meet and share experiences, ideas, and solutions to common flooding problems. LFMA supports comprehensive floodplain management, advocates for coordination among all levels of government and existing programs and provides and promotes training and assistance to local governance. LFMA's activities include an annual state conference, semi-annual workshops, a newsletter known as "Floodwatch", and an active website.

Louisiana Sea Grant, part of the National Oceanic and Atmospheric Administration's (NOAA) National Sea Grant Program, works to promote stewardship of the state's coastal resources through a combination of research, education, and outreach. Louisiana Sea Grant's strategic initiatives address four issues identified as especially pertinent to state, regional, and national needs: healthy coastal ecosystems, sustainable fisheries and aquaculture, resilient communities and economies, and environmental literacy and workforce development. Through educational programs and practical assistance, Sea Grant Extension agents serve Louisiana's coastal population – about 70 percent of the state's residents and connect residents to research in various areas such as coastal and wetland management. Sea Grant publications, such as the Louisiana Homeowners Handbook to Prepare for Natural Hazards, help citizens prepare for natural hazards so that risks to families and property may be reduced.

SBP, formerly known as the St. Bernard Project, is a national organization headquartered in New Orleans, LA. In addition to its recovery work, SBP provides free resilience training for households and businesses in communities facing disaster risks, equipping participants with information and tools to proactively identify and mitigate risks to life safety, property, and finances.

The Stephenson Disaster Management Institute (SDMI) at Louisiana State University conducts applied research with a focus on crisis and disaster management. Following the 2016 flooding, SDMI supported GOHSEP through its Disaster Lab. Specifically, SDMI provided statistical analyses highlighting the potential impacts of reported flooding for more than 20 parishes to help GOHSEP better understand the extent of the flooding. Additionally, SDMI, in partnership with Louisiana Sea Grant, is working to integrate SDMI's Storm Surge Consequence Modeling into LSU's CERA website which provides emergency managers with accurate extends and depths of storm surge. The CERA website is currently being updated. SDMI, in collaboration with GOHSEP, also supports Mitigation Plan updates for parishes throughout Louisiana.

The mission of the Louisiana State University Agricultural Center (LSU AgCenter) is to provide the people of Louisiana with research-based educational information. The LSU AgCenter includes the Louisiana Agricultural Experiment Station, which conducts agricultural-based research, and the Louisiana Cooperative Extension Service, which extends knowledge derived from research to Louisiana residents. The LSU AgCenter plays an integral role in supporting agricultural industries, enhancing the environment, and improving the quality of life through its 4-H youth, family and consumer sciences, and community development programs. The Louisiana Cooperative Extension Service offers online and in-person classes, seminars, workshops, field days, publications and news releases to residents throughout Louisiana. Education efforts focus on various areas, with sustainable housing and coastal restoration as those that most support mitigation activities. The LSU AgCenter's Louisiana Home and Landscape Resource Center, also known as LaHouse, provides a model for how to build sustainable housing in the Deep South. The AgCenter also developed GIS Web Applications such as a wind speed map and elevation map and flood insurance rate maps, all of which are widely used by local and state officials as well as residents and are accompanied by related floodplain management education. LSU AgCenter's Forestry Management Extension and Research Program conducts research and workshops focused on selection of species and genotypes resilient to drought, ice, and hurricanes. Additionally, LSU AgCenter developed the Resilient Communities and Economies Initiative Economic; administers a Master Farmer Program; and developed a youth program in hazard mitigation. LSU AgCenter staff also participate in local CRS committees and collaborate with LDAF in pre-disaster exercises.

In post-disaster times, LSU AgCenter provides general information and support regarding post-disaster recovery and related mitigation activities generated at the state level, using printed publications, web and social media; distributes recovery info by social media and to local government; state and local personnel participate in high- water mark studies; participates in Ag Crop and Animal commodity losses and damage assessments; provides food safety information; and provides livestock recovery information and activities in coordination with LDAF.

The University of New Orleans' Center for Hazards Assessment, Response & Technology (UNO-CHART) is an applied social science hazards research center that collaborates with and supports Louisiana communities in efforts to achieve disaster resilience with a focus on mitigation. UNO-CHART's applied research efforts address repetitive flooding, disaster mitigation planning, community resilience, coastal restoration, community continuity, risk literacy, risk management, adaptation planning and hurricane evacuation of vulnerable populations. UNO-CHART is currently the leading expert in conducting repetitive flood loss area analyses and facilitates two CRS Users groups.

The Water Institute is a not-for-profit, independent applied research and technical services institution with a mission to help coastal and deltaic communities thoughtfully prepare for an uncertain future. The Institute's focus areas include integrated watershed management; resilience lab; dynamics of rivers, deltas and coasts; ecosystem based management; and human and natural systems modeling. The Water Institute plays various roles in regional and statewide risk reduction including contributions to the Louisiana Coastal Master Plan; functions as a FEMA Cooperating Technical Partner; conducts real-time flood forecasting, flood modeling, critical facility identification, and nature-based defense planning and design. Technical data provided to the state in support of mitigation activities include 1-D, 2-D, and 3-D models, stakeholder participatory mapping, and real-time flood forecasting.

Conclusion

The State of Louisiana has great capacity to develop and implement mitigation projects that reduce the impact of hazards throughout the state. Louisiana has various plans, policies, and programs that are necessary to implement a successful mitigation program. In addition to the state's own resources, there are many stakeholders mentioned in this Chapter and in Chapter 5 that enhance the state's capacity to implement the mitigation strategy proposed in this plan update.

This State Mitigation Capability Assessment not only summarizes the resources available to support mitigation, it identifies changes since the last plan update as well as opportunities for the state to improve its current capacity to reduce risk. As FEMA recognizes the connections between community resilience and areas such as the economy, housing, health and social services, infrastructure, and natural and cultural resources, these areas are addressed to the extent possible.

Overall, the State of Louisiana continues to demonstrate its capacity to implement its mitigation strategy. Although there are opportunities for improvement mentioned in this chapter, the State of Louisiana has many examples of mitigation success throughout the state. Specific examples of successful mitigation projects are included in Chapter 5 – Mitigation in Action.

4

Mitigation Strategies

Chapter 4 presents Louisiana's 2024 Mitigation Strategy including goals and actions that were developed and prioritized to reduce statewide vulnerabilities. It addresses the following requirements per the *State Mitigation Planning Policy Guide (2022):*

S9 **DOES THE MITIGATION STRATEGY INCLUDE GOALS TO REDUCE LONG-TERM VULNERABILITIES FROM THE IDENTIFIED HAZARDS? [44 CFR § 201.4(C)(3)(I)]**

S10 **DOES THE PLAN PRIORITIZE MITIGATION ACTIONS TO REDUCE VULNERABILITIES IDENTIFIED IN THE RISK ASSESSMENT? [44 CFR §§ 201.4(C)(1); 201.4(C)(3)(I), 201.4(C)(3)(II) AND 201.4(C)(3)(III); 201.4(C)(4)(II); FMAG: 44 CFR § 204.51(D)(2)]**

S11 **DOES THE PLAN IDENTIFY CURRENT AND POTENTIAL SOURCES OF FUNDING TO IMPLEMENT MITIGATION ACTIONS AND ACTIVITIES? [44 CFR § 201.4(C)(3)(IV)]**

S12 **WAS THE PLAN UPDATED TO REFLECT PROGRESS IN STATEWIDE MITIGATION EFFORTS AND CHANGES IN PRIORITIES? [44 CFR § 201.4(D)]**

The State of Louisiana identified a hazard mitigation strategy to reduce long term vulnerabilities from the hazards identified in Chapter 2 – Hazard Identification and Statewide Risk Assessment. The strategy also reflects the identification of areas and situations experiencing a combination of geographic, social, and economic needs. Overall, the State of Louisiana's hazard mitigation strategy is to reduce risks and the impacts of hazards by providing guidance to decision makers on the commitment of resources, implementation of mitigation programs, and coordination of mitigation efforts that foster more resilient and sustainable people, property, and lifestyles across the State.

The state, with the help of the 2024 State Hazard Mitigation Planning Committee (SHMPC) identified goals and actions to implement this strategy. These goals and actions provide guidance to the state to identify, evaluate, and prioritize activities at the parish and municipal level that are technically feasible, cost effective, and environmentally sound mitigation. By doing so, the state can continue to work toward reducing identified risks. Per FEMA's State Mitigation Planning Policy Guide (2022), goals are defined as "long-term policy or vision statements that guide the implementation of hazard mitigation actions". Mitigation actions are more specific and refer to projects, policies and programs that support each of the goals.

The following sections provide an overview of the 2019 goals and objectives followed by a description of the 2024 updated goals and actions and the process under which they were developed.

2019 Goals and Objectives

The current goals of this plan update represent long-term commitments by the State of Louisiana to reduce risks identified in the statewide risk assessment. The 2024 goals were set by the SHMPC after a thorough review and update of the goals and objectives set for the 2019 Plan.

The 2014 goals and objectives are as follows:

GOAL 1 — **Protect the people, property and natural resources of Louisiana, by promoting strategies and policies that increase resiliency, and minimize vulnerability to natural hazards.**

- **OBJECTIVE 1.1** — Support the capacity of the State to implement mitigation policies, practices and programs.
- **OBJECTIVE 1.2** — Improve communication, collaboration, and integration among Stakeholders.
- **OBJECTIVE 1.3** — Boost commitment to mitigation and resilient measures, opportunities, and activities.
- **OBJECTIVE 1.4** — Identify technical feasibility and cost-effectiveness of proposed mitigation measures and projects.
- **OBJECTIVE 1.5** — Establish and coordinate effective partnerships between state agencies for floodplain and watershed management and development.

GOAL 2

Increase public and private sector awareness and support of mitigation activities and opportunities in Louisiana.

OBJECTIVE 2.1 Promote efforts to improve resiliency through public awareness/ education, developments and improvements to infrastructure, planning and zoning requirements, floodplain management, and building codes.

OBJECTIVE 2.2 Work with other state and regional entities to incorporate mitigation concepts and information into their outreach efforts.

OBJECTIVE 2.3 Ensure that all communities are aware of available mitigation funding sources and cycles.

OBJECTIVE 2.4 Educate risk management entities on mitigation incentives and benefits.

OBJECTIVE 2.5 Educate Louisiana private sector about mitigation concepts and opportunities.

GOAL 3

Support local and regional mitigation initiatives and strategies.

OBJECTIVE 3.1 Develop integrated solutions for the implementation of regional and local mitigation strategies and comprehensive emergency management plans.

OBJECTIVE 3.2 Assist with the integration of local hazard mitigation plans and local land use plans, zoning codes, and other relevant plans a jurisdiction may maintain.

OBJECTIVE 3.3 Support local and regional capacity.

OBJECTIVE 3.4 Support floodplain management activities, such as the Community Rating System.

OBJECTIVE 3.5 Support hazard mitigation research and development.

GOAL 4

Reduce Louisiana's repetitive and severe repetitive loss property inventory.

OBJECTIVE 4.1 Develop and implement the state Repetitive Loss Strategy for reducing RL and SRL properties.

OBJECTIVE 4.2 Investigate possible actions to mitigate RL and SRL properties.

OBJECTIVE 4.3 Update the RL and SRL inventory.

OBJECTIVE 4.4 Prioritize repetitive loss properties for funding.

GOAL 5

Implement and maintain a comprehensive and effective enhanced statewide hazard mitigation plan.

OBJECTIVE 5.1 Integrate mitigation practices throughout all state plans, programs, and policies.

OBJECTIVE 5.2 Pursue methodologies that will enhance mitigation successes.

OBJECTIVE 5.3 Develop plan performance and effectiveness strategy.

OBJECTIVE 5.4 Provide training opportunities.

2024 Goals and Actions

In its review of the previous goals and objectives, the SHMPC confirmed the importance of the common themes identified in the 2019 goals and objectives. These themes included hazard mitigation planning to minimize risk, increase awareness, support for local and regional initiatives, the reduction of repetitive flood loss, and implementation of statewide mitigation.

The SHMPC updated the goals and related actions to support those goals. Members of the committee also ranked the goals and objectives in terms of importance to the reduction of vulnerabilities identified in the statewide assessment and prioritization for funding. Input from members of the SHMPC was provided during in-person and online meetings, email communications, and through an online survey. A total of 14 SHMPC members prioritized the goals and actions using the survey. The updated and prioritized goals and objectives are as follows:

GOAL 1 **Protect the people, property, and natural resources of Louisiana by promoting strategies and policies that increase resiliency, support equity, and minimize vulnerability to natural hazards.**

ACTION 1.1 Support the capacity of the State to implement mitigation policies, practices, and programs.

ACTION 1.2 Improve communication, collaboration, and integration among all state agencies, local decision makers, and the public.

ACTION 1.3 Boost commitment to mitigation and resilient measures and activities while providing more equitable opportunities.

ACTION 1.4 Develop tools to assess the technical feasibility and cost-effectiveness of proposed mitigation measures and projects.

ACTION 1.5 Establish and coordinate partnerships among state agencies to evaluate the recognition and consideration of disaster risk and resilience in state agency project planning.

GOAL 2

Support local, regional, and state mitigation initiatives and strategies.

ACTION 3.1 Develop integrated solutions for the implementation of state, regional and local mitigation strategies, and comprehensive emergency management plans.

ACTION 3.2 Assist with the integration of local hazard mitigation plans, local land use plans, zoning codes, and other relevant plans a jurisdiction may maintain.

ACTION 3.3 Support local and regional capacity to plan for and implement mitigation.

ACTION 3.4 Support the implementation of floodplain management activities, such as the Community Rating System and substantial damage plans, and other risk reduction programs such as Firewise USA, and FORTIFIED programs.

ACTION 3.5 Support hazard mitigation research and development across all levels of government.

GOAL 3

Reduce Louisiana's repetitive loss and severe repetitive loss property inventory.

ACTION 4.1 Develop and implement the state Repetitive Loss Strategy for reducing RL and SRL properties.

ACTION 4.2 Investigate actions to mitigate RL and SRL properties.

ACTION 4.3 Update the RL and SRL inventory.

ACTION 4.4 Prioritize repetitive loss properties for funding.

GOAL 4

Implement and maintain a comprehensive and effective statewide hazard mitigation plan.

ACTION 5.1 Integrate mitigation practices throughout all state plans, programs, and policies.

ACTION 5.2 Provide statewide training opportunities.

ACTION 5.3 Pursue methodologies that will enhance mitigation successes.

ACTION 5.4 Develop a plan performance and effectiveness strategy.

GOAL 5

Increase public and private sector awareness and support of mitigation activities and opportunities throughout Louisiana.

ACTION 1.1 Promote efforts to improve resiliency through public awareness/education, development and improvements to infrastructure, planning and zoning requirements, floodplain management, and building codes.

ACTION 1.2 Work with other state and regional entities to incorporate mitigation concepts and information into their outreach efforts.

ACTION 1.3 Ensure that all communities are aware of available mitigation funding sources and cycles.

ACTION 1.4 Educate risk management entities on mitigation incentives and benefits.

ACTION 1.5 Educate the Louisiana private sector about mitigation concepts and opportunities.

Changes in Priorities

Based on recommendations from the 2024 SHMPC, several changes were made from the mitigation priorities set for the 2019 Update. While the number and substance of the goals remained largely the same, two significant changes were made. First, support for equitable strategies and policies was added to the first goal. Second, the goal related to public and private sector awareness was moved in the list of priorities from Goal 2 to Goal 5.

Regarding the mitigation actions tied to each goal, the number of actions and the substance of each action remained the same; however, a few actions now include a bit more specificity. For instance, under the goal to support local , regional, and state initiatives, there is an action that now includes a reference to substantial damage plans, Firewise USA, and FORTIFIED programs. Additionally, the order of the actions was changed for the implementation goal. Specifically, the action to provide statewide training opportunities was moved in order of importance from the last action to the second action. Also, the term “action” is now used and replaced the term “objective” which was used in previous mitigation planning efforts.

Funding

The SHMPC had multiple discussions concerning funding and how to prioritize mitigation activities. The committee stressed the importance of prioritizing projects that minimize impacts on people, property and natural resources while supporting equitable outcomes. To do this, the committee discussed focusing on communities at highest risk, those undergoing development, and those with repetitive loss properties.

The results of a survey completed by fourteen members of the SHMPC provided more insight related to the prioritization of mitigation funding. Committee members stated the need for projects to “meet multiple state mitigation priorities” that provide a “range of benefits.” Additionally, members argued for critical facilities to be prioritized for funding. Others suggested that repetitive loss areas impacted by federal disaster declarations and those with vulnerable populations should be prioritized for funding while others argued for CRS communities to be given priority. The following is a list of funding sources that the State of Louisiana can utilize to implement its stated mitigation goals and actions. This list includes funding sources currently utilized by the State.

The following is a list of funding sources that the State of Louisiana can utilize to implement its stated mitigation goals and actions. This list includes funding sources currently utilized by the State.

- **FEMA**
  - Building Resilient Infrastructure and Communities (BRIC)
  - Flood Mitigation Assistance (FMA)
  - Flood Mitigation Assistance Swift Current (Swift Current)
  - Hazard Mitigation Grant Program
  - Legislative Pre-Disaster Mitigation (LPDM)
  - Pre-Disaster Mitigation (PDM)
  - Public Assistance
  - Safeguarding Tomorrow Revolving Loan Fund Program
- **US Department of Housing & Urban Development**
  - Community Development Block Grant (CDBG)
- **US Department of Agriculture**
- **US Environmental Protection Agency**
- **US Fish & Wildlife Service**
- **National Park Service**
- **CPRA**
  - Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA)
  - Water Resources Development Act (WRDA)
- **La DOTD Statewide Flood Control Program**
- **State of Louisiana Capital Outlay/general funds**
- **Gulf of Mexico Energy Security Act (GOMESA)**
- **Natural Resource Damage Assessment (NDRA) Restoration funding**
- **Restore Act funding**
- **BP and Transocean Settlements**

Private partnerships

Statewide Mitigation Funding Since 2019

The following table provides information on disaster and non-disaster grants funds awarded from 2019.

	Total Project Cost	Federal Obligated
HMGP		
2019	$505,749,930.92	$137,666,123.26
2020	$496,713,834.19	$40,384,317.65
2021	$348,573,028.05	$35,267,266.88
2022	$204,827,535.41	$29,495,829.85
2023	$1,285,836,392.88	$131,665,265.12
BRIC		
2022	$1,716,934.00	$1,290,563.00
2023	$89,523.00	$89,523.00
FMA		
2019	$12,451,579.52	$12,451,579.52
2020	$46,497,223.88	$49,592,356.78
2021	$111,535,511.86	$103,662,865.32
2022	$87,121,871.67	$80,062,345.74
2023	$43,179,863.22	$42,232,861.00
LPDM	**$3,787,000.00**	**$2,520,000.00**
2023	$3,787,000.00	$2,520,000.00
PDM		
2020	$3,192,217.65	$2,393,157.75
2021	$4,871,776.54	$3,653,832.40
2023	$14,516,220.00	$10,887,165.10
Swift Current		
2022	$3,025,682.00	$2,978,762.00
2023	$42,016,284.52	$35,670,893.62

Mitigation Monitoring and Review

Each funded mitigation project or activity has an established period of performance that GOHSEP and FEMA monitor throughout the development and execution of the project or activity. Monitoring is essential to ensure that sub-grantees are making progress, meeting financial requirements, maintaining proper documentation, and are held accountable for all federal resources allocated for a specific mitigation project or activity. As described in the State of Louisiana Administrative Guidelines and Procedures, GOHSEP uses the following system for monitoring mitigation projects and project closeouts. No changes have been made to this system in this plan update.

Monitoring Mitigation Projects

Mitigation projects are monitored as follows:

- **GOHSEP meets regularly with representatives from FEMA Region VI to coordinate project monitoring activities.**
- **Every calendar quarter, GOHSEP sends correspondence to all sub-grantees with open projects (i.e., ones that have been funded but are not completed) requesting a project progress update.**
- **Each sub-grantee responds to GOHSEP's request by preparing a standard report that details progress on individual mitigation projects and indicates a percent complete estimate.**
- **GOHSEP compiles the sub-grantee progress reports and produces a consolidated quarterly progress report that is sent to FEMA Region VI for review. The consolidated quarterly report identifies changes from previous reports, areas of concern, and strategies to address any identified problems.**

Monitoring Project Closeouts

Mitigation project closeouts occur in the following sequence, as established in the State of Louisiana Administrative Guidelines and Procedures, and in accordance with FEMA requirements for State Administrative Plans and Hazard Mitigation Grant Program (HMGP) guidelines set in the HMGP Desk Reference and the Hazard Mitigation Assistance Program and Policy Guide (2023).

- **Sub-grantees indicate that a mitigation project is 100% complete in a quarterly project progress report**

- GOHSEP reconciles the FEMA SmartLink account for the project (by disaster)
- GOHSEP initiates a comprehensive internal financial audit of the project
- GOHSEP works with sub-grantees to resolve any issues discovered in the audit
- GOHSEP sends FEMA Region VI a closeout letter that identifies the final eligible cost of the project, de-obligations that are required, and any monies that will be recovered from the sub-grantee

Monitoring Mitigation Strategy Progress

To review progress on the implementation of the mitigation strategy, GOHSEP ensures that both the annual and five-year plan evaluations include a detailed examination and analysis of the goals and related actions identified in this chapter. Chapter 4 describes five major hazard mitigation goals and twenty-three actions that the State and the SHMPC identified as part of overall mitigation strategy. Future versions of the plan will include the status of the various actions, and a general indication of progress on each action.

GOHSEP will initiate a review of all mitigation activities and projects noted in the mitigation strategy as part of an annual review and its five year evaluation and update. The review takes place in five stages:

1. In cooperation with the SHMPC, GOHSEP's Hazard Mitigation Planning Section will undertake a preliminary review and analysis of progress on the goals and actions.
2. GOHSEP's Hazard Mitigation Planning Section will prepare a draft report that describes progress, remaining tasks, and projected time to complete the tasks.
3. The draft report will be presented to the SHMPC during the meeting(s) related to the yearly (and five-year) updates. Members of the SHMPC requested that the report be shared via email and posted to GOHSEP's website.
4. After SHMPC review, comment, and approval, results of the progress review will be included as a new or updated column in the tabulation of mitigation goals and actions.

5

Mitigation in Action

The State of Louisiana supports numerous successful mitigation efforts statewide. These include efforts at the local and regional level. This section details some of the successful mitigation efforts implemented in the state including the Louisiana Department of Transportation and Development's (LADOTD) risk mapping, assessment, and planning, the planning and outreach work of the Coastal Protection and Restoration Authority (CPRA), the implementation of LA SAFE - a regional adaptation strategy implemented by the Office of Community Development (OCD) with local partners, a statewide watershed plan called the Louisiana Watershed Initiative (LWI) and continuing state and local efforts to implement the Community Rating System (CRS).

DOTD as a FEMA Cooperating Technical Partner (CTP) for Risk MAP

On March 11, 2015, the Louisiana Department of Transportation and Development (LADOTD) signed a partnership agreement with FEMA Region VI to become a Cooperating Technical Partner (CTP) for Risk MAP. Pam Lightfoot manages this program under the direction of the State Coordinator, Susan Veillon, for the National Flood Insurance Program (NFIP), which resides in the LADOTD Public Works/Water Resources Section within the Engineering Division.

Since becoming a CTP with FEMA Region VI, LADOTD has been diligently planning and working toward the release of updated flood risk information for Louisiana. Historically, LADOTD mapping partners have focused on Risk MAP Phases 1 and 2 while FEMA focused on Phase 3. Moving forward, LADOTD will align our planned project areas with the FEMA Region VI Multi-Year Investment Plan.

PROJECT UPDATE

In 2018, LADOTD's CTP contractor was issued a Task Order to do Phase 2-Analysis & Mapping, work for West Feliciana Parish. That work was then pushed to FEMA to complete Phase 3-Preliminary Flood Map Release, and Phase 4-Map Adoption, to get updated Flood Insurance Rate Maps (FIRM) for the parish. Phase 3 has been completed by FEMA and has now moved on to Phase 4, which is the final phase. West Feliciana Parish's Letter of Final Determination (LFD) is set to go out on January 31, 2024. This gives the communities 6 months to adopt the maps.

In 2019, LADOTD's CTP contractor was issued a Task Order to do Phase 2 work for Allen Parish. That work was then pushed to FEMA to complete Phase 3 and Phase 4 to get updated FIRMs for the parish. On January 9, 2024, FEMA conducted the Consultation Coordination Officer (CCO) Meeting, which is a step in Phase 3. This will trigger the 90-Day Appeal Period. After the appeal period FEMA will make changes, if necessary, and move on to Phase 4.

The CTP contractor has recently completed Phase 1-Discovery, in six (6) watersheds (Lower Red-Lake Iatt, Tensas, Upper Calcasieu, Toledo Bend, Whiskey Chitto, and Bayou Macon) and is currently working on Phase 1 in nine (9) watersheds (Lower Sabine, Cross Bayou, Middle Red-Coushatta, Black Lake Bayou, Bodcau Bayou, Loggy Bayou, Red Chute, Bayou Pierre, and Saline Bayou) along with a Phase 2 project in Rapides Parish.

The Louisiana Watershed Initiative (LWI) has made a significant investment in the development of flood hazard identification information. The hope is that this data can be leveraged through the CTP program to provide FEMA with significant impact to their metrics while providing communities with much needed flood risk data.

Flood Risk & Resilience Program

Coastal Protection and Restoration Authority

As a part of the 2017 Coastal Master Plan, the Coastal Protection and Restoration Authority (CPRA) began work to implement a Flood Risk and Resilience Program, focused on reducing the impacts of storm surge based flooding on Louisiana's coastal communities. The program emphasizes planning for and implementation of nonstructural risk reduction projects and recommends the implementation of large-scale nonstructural risk reduction projects. These projects work to support the Coastal Master Plan.

The Flood Risk and Resilience Program works at the local level to support local decision making through parish prioritization of structures to be mitigated. It also promotes higher standards of risk reduction by recommending the elevation of residential structures to 100 year flood depths plus two feet above grade. Unlike other nonstructural programs, it provides reduced cost requirements, with 90% CPRA funding and up to 100% full state funding when certain requirements are met. It further functions as part of the multiple lines of defense strategy, by complementing other structural risk reduction measures, such as levees and flood gates. Additionally, it helps the most vulnerable, by requiring the prioritization of low to moderate income households. The nonstructural projects included in this program are activities that do not stop floodwaters but reduce the impacts of flooding to buildings and infrastructure by floodproofing, elevation, or voluntary acquisition. The program recommends floodproofing for non-residential structures in areas where flood depths are less than 3 feet, elevation for residential structures in areas where flood depths are between 3 and 14 feet, and voluntary acquisition for residential structures in areas where flood depths are greater than 14 feet. See the following graphic from the 2023 Coastal Master Plan that continues to support the program first mentioned in the 2017 Plan. The 2023 Coastal Master Plan argues for a $50 billion investment in coastal Louisiana over the next 50 years. It includes 61 restoration projects, 12 structural risk reduction projects, and earmarks $11 billion for nonstructural risk reduction (Wilson, et. al, 2023).

Figure 2 - https://coastal.la.gov/wp-content/uploads/2023/06/230531_CPRA_MP_Final-for-web_spreads.pdf

LA SAFE - Update

In coastal Louisiana, subsidence, and sea level rise, plus the threat of hurricanes and flooding, combine to create one of the highest rates of relative sea level rise in the world. This relative sea level rise and continual damage from hurricanes and flooding has an acute effect on coastal communities in southeast Louisiana. To help address these issues, the National Disaster Resilience Competition (NDRC), sponsored by the U.S. Department of Housing and Urban Development (HUD) and the Rockefeller Foundation, awarded funding for LA SAFE – Louisiana's Strategic Adaptations for Future Environments. The LA SAFE program, a partnership between the La Office of Community Development (OCD) and the Foundation for Louisiana (FFL), supported an inclusive public process to identify adaptation strategies to enhance the resilience of coastal Louisiana, and provided funding for at least one project in each of six identified parishes. These parishes were impacted by Hurricane Isaac in 2012 and included Jefferson, Lafourche, Plaquemines, St. John the Baptist, St. Tammany, and Terrebonne.

LA SAFE was discussed in the 2019 Plan Update and a significant amount of progress has been made since then. Here are updates on some of the projects identified through LA SAFE.

Jefferson Parish

Gretna Resilience District Kickstart & Louisiana Wetland Education Center

The Gretna Resilience District was established in 2017 by the Gretna City Council to position resources to promote low-impact design infrastructure features that support community scale flood risk reduction while satisfying long standing demands for other neighborhood amenities. The District centers around improvements to the 25th St. Canal and Gretna City Park. Improvements to the park included greater stormwater retention, enhanced entryways, pathways and signage, additional seating and pavilions, and the installation of a tiered dock that will connect visitors to the water.

Figure 3 - Gretna Resilience District - City Of Gretna - City Of Gretna (gretnala.com)

Status: The Gretna City Park was completed and opened to the public in April 2023.

The Louisiana Wetland Education Center will be an educational asset serving the citizens of the region with programs geared for all ages. The 3,500 square foot facility, located in Jean Lafitte, will promote preservation, conservation, and adaptation related to wetland ecosystems by using the Lafitte area as an outdoor classroom.

Status: The education center is in the construction phase.

St. Tammany Parish

Safe Haven Blue-Green Campus & Trails

Safe Haven Campus provides a collaborative healing environment focused on behavioral health. The Safe Haven Blue-Green Campus & Trails project is a community nonstructural mitigation/flood risk reduction and public services project that will enhance detention capabilities in a critical drainage area adjacent to Cane Bayou, protecting campus facilities and surrounding neighborhood residences.

Status: Construction expected to start at the end of January 2024; Estimated construction end date is August 31, 2024.

St. John the Baptist

Airline & Main Complete Streets

This is a resilient infrastructure and community nonstructural mitigation/flood risk reduction project to provide both green infrastructure and transportation improvements along both Airline Highway and Main Street in LaPlace, LA. This project serves as a model of how the Parish can plan for a future of heightened flood risk in a low risk area by incorporating stormwater management strategies into public infrastructure projects while providing residents with enhanced transportation options. Once complete, the project will consist of streetscape improvements on a 1.6 mile stretch of Airline Highway between Tiffany Drive and Main Street and 0.3 miles of improvements along Main Street between Airline Highway and West 5th. Features will include green infrastructure installations to hold and filter stormwater runoff, sidewalks, permeable parking, native plantings, and bike lanes.

Status: The projected completion date for the Airline and Main Complete Streets project is June 30, 2024. More information can be found at:

https://www.sjbparish.gov/Departments/Planning-and-Zoning/Resilience-Projects#section-3.

Terrebonne Parish

Lake Boudreaux Living Mitigation Terraces

This project operates as one of multiple lines of defense that will work together to protect the people and property of Terrebonne Parish to reduce the impacts of storm surge. These improvements are designed to reduce the velocity and wave action of the flow of water above Lake Boudreaux and the surrounding area during future major storm events.

Status: Construction of over 13 miles of marsh terraces is complete; Phase I – vegetation planting is complete; and Phase II – education component of project is underway.

Plaquemines Parish

Harbor of Refuge

The seafood industry is one of the leading employers in Louisiana, producing millions of pounds of shrimp, oysters, crabs, and fish annually. However, as flood risk increases and land loss continues to occur, this industry's viability faces a significant threat – specifically as it relates to vital equipment and infrastructure. This project creates a harbor of refuge for 50+ vessels to shelter in place during disaster events. The parish-operated harbor will incorporate marina amenities, wet-and dry-docking facilities as well as green infrastructure to help manage storm water.

Figure 5 -Harbor of Refuge Design & Construction — Infinity Engineering Consultants, LLC. (infinityec.com)

Status: This project is near completion.

Louisiana Watershed Initiative (LWI)

The widespread disaster caused by the Great Floods of 2016 emphasized how vulnerable Louisiana is to floods. In 2018, the state launched the Louisiana Watershed Initiative (LWI), introducing a new watershed-based approach to reducing flood risk in Louisiana, guided by the following principles:

- **Using scientific tools and data**
- **Enabling transparent, objective decision-making**
- **Maximizing the natural function of floodplains**
- **Establishing regional, watershed-based management of flood risk**

During the 2017 Regular Legislative Session, Senate Resolution 172 (SR172) was passed and directed state agencies to "provide recommendations to establish, implement, and enforce floodplain management plans for each watershed in Louisiana." An executive order (EO JBE18-16) further defined a level of interagency collaboration through the establishment of the Council on Watershed Management to oversee and coordinate Louisiana's progress toward a statewide vision for sustainability and resilience. The Council is working to implement a statewide, watershed-based floodplain management program. Since the 2019 Plan Update, significant work has taken place across the following LWI programs:

- **Local and Regional Projects and Programs**
- **Regional Capacity Building Grant Program**
- **Statewide Data and Modeling Program**
- **State Projects and Programs**
- **Statewide Buyout Program**
- **Nature-Based Solutions Program**
- **Non-Federal Cost Share Assistance Program**
- **PRO Louisiana**

Project funding, disbursed in three rounds, is designed to encourage regional collaboration and prioritization of mitigation projects. Overall, $570 million will be awarded over three rounds. Round 1 awarded $100 million to 28 flood mitigation projects submitted by local and regional public entities. This round focused on implementation-ready, low-risk projects that address flood risks through a watershed-based approach. As depicted in the below figure, the projects are located around the State.

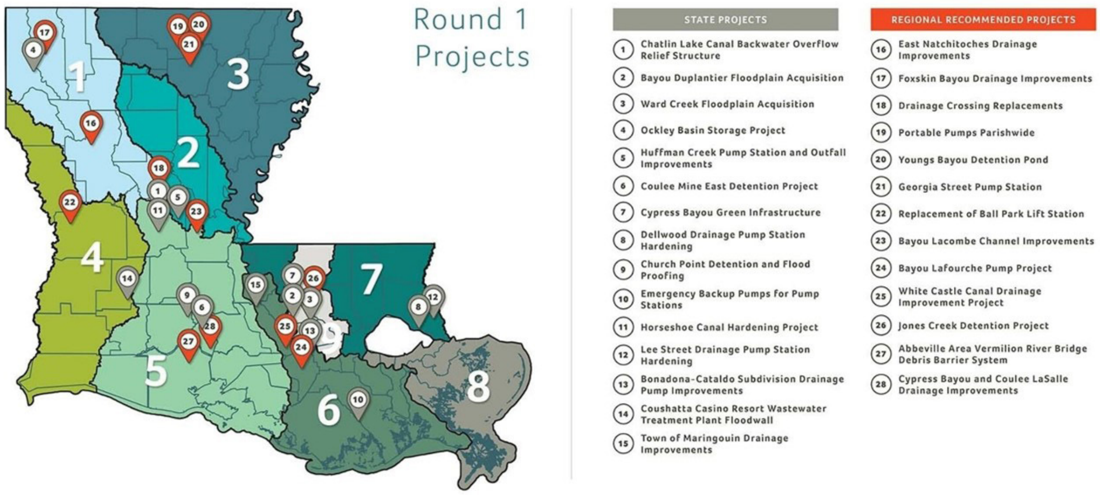


Figure 6 - https://watershed.la.gov/local-and-regional-projects

Round 2 project awards were made on a conditional basis at the end of 2023. State agencies reviewed and recommended 40 projects across nine regions, totaling $221.8 million, to the Council on Watershed Management. The funding awards are contingent on applicants completing, and receiving state approval of a final, completed application. The state will provide technical assistance, including engineering services, such as hydrologic and hydraulic modeling, and project scoping support to complete the applications (https://watershed.la.gov/local-and-regional-projects).

Local Community Rating System (CRS) Efforts Continue

The Community Rating System (CRS) is a voluntary program, which provides incentives for communities to implement floodplain management activities that exceed those required by the National Flood Insurance Program (NFIP). The goals of the CRS are to (1) reduce flood damage to insurable property; (2) strengthen and support the insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management. Beyond flood reduction, another incentive for communities to participate in the CRS is discounts on flood insurance premiums for local policyholders. A community earns points for each CRS activity completed; the number of points determines the amount of the flood insurance premium discount given. Louisiana's CRS

Program Manager resides within the Public Works/Water Resources Section of the Louisiana Department of Transportation and Development and supports community participation in the CRS from the state level, providing resources, training, and assistance visits to participating communities. Currently, 39 Louisiana communities participate in the CRSA which equals 12% of the NFIP communities statewide. Most of these communities participate in one of the four active CRS users groups located across Southern Louisiana. CRS users groups are informal groups of neighboring cities and parishes who meet regularly to discuss CRS activities and sometimes implement multijurisdictional activities. Often, meetings focus on how one or more communities implemented a specific activity for credit. This section describes those groups and how they support CRS activity in Louisiana.

For more details on the implementation of the CRS in Louisiana, refer to the **2024 Community Rating System Strategy Update** found in the Appendix.

CRAFT

Formed in 2012, the Capital Region Area Floodplain Task-force (CRAFT) continues to be a network of parish and municipal partners that support each other in the implementation of the CRS. CRAFT includes the following communities: Ascension Parish, East Baton Rouge, City of Central, City of Denham Springs, City of Gonzales, City of Walker, and the City of Zachary. Representatives of the Louisiana Department of Transportation and Development (DOTD), Verisk/ISO, and the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) are also often in attendance at CRAFT meetings. CRAFT meetings are held monthly and are facilitated by the University of New Orleans' Center for Hazards Assessment, Response & Technology (UNO-CHART). Meeting locations are currently rotated among CRAFT member communities, and group members or guest speakers present on various CRS activities. CRAFT communities work on multijurisdictional activities to include the development of a multijurisdictional Program for Public Information (PPI) as well as multiple outreach projects.

FLOAT

The Flood Loss Outreach & Awareness Task force (FLOAT) is a CRS Users Group that provides support and educational resources for local communities who participate in or are interested in participating in the CRS. Essentially, FLOAT is a space for community officials to come together and share their best practices and greatest struggles with the CRS program. In 2011, the member jurisdictions formed FLOAT with support from the State of Louisiana's Floodplain Management Office, the CRS Specialist for the SE Louisiana Region for the Insurance Services Office (ISO), and the University of New Orleans' Center for Hazards Assessment, Response and Technology (UNO-CHART). Since that time, FLOAT continues to work together to increase outreach to the public regarding natural hazard preparation, and to continue planning for sustainable communities. FLOAT currently includes 12 participating communities: St. Tammany Parish, the City of Slidell, the City of Mandeville, the City of Covington, Tangipahoa Parish, St. Charles Parish, St. James Parish, St. John the Baptist Parish, Terrebonne Parish, the City of Houma, Orleans Parish, and Lafourche Parish. FLOAT member communities hold 42% of the NFIP Policies in the State of Louisiana.

FLOAT members have developed educational and outreach projects over the years with input and support from numerous stakeholders. With such aggressive outreach programs spread out over multiple jurisdictions composed of eight parishes and four municipalities, several FLOAT members chose to coordinate and build upon their outreach activities to create a strategy for flood reduction related outreach for the future.

JUMP

Jefferson United Mitigation Professionals (JUMP), our CRS users group, continues to be a valuable tool for all the CRS communities in Jefferson Parish. JUMP helps to facilitate the planning, drafting, and implementation of multiple multijurisdictional plans; collaboratively performs Repetitive Loss Area Analyses, and share appropriate and important resources and information. JUMP acted as a training classroom for non-CRS communities in Jefferson that wanted to (and did) eventually join the CRS, and

JUMP has played a major role in improving class ratings for five CRS communities. More than anything, JUMP has allowed us to depend and rely on each other, professionally and personally, especially in chaotic times like those following major disaster events like Hurricane Ida and the Gretna tornados. Our jobs are stressful and challenging, but we cannot let that prevent us from providing our communities with the services they expect and deserve. JUMP helps us make sure that happens.

RAIN – The Newest CRS Users Group in Louisiana

The CRS User Group, RAIN (Regional Acadiana Information Network), had its first meeting in April 2021. RAIN was created through Region 5 of the Louisiana Watershed Initiative (LWI). The LWI Region 5 Steering Committee, formed in the fall of 2019, originally had three subcommittees: 1) Capital Improvement Program Subcommittee, 2) Governance and Long-Term Sustainability Subcommittee and 3) Floodplain Management Subcommittee. The Floodplain Management Subcommittee's goal was to establish a regional CRS User Group in Acadiana. That goal came to fruition in April 2021.

RAIN is comprised of the 16 parishes in LWI Region 5, but not limited to these parishes. The participants include floodplain managers, floodplain administrators, and emergency operations directors. With regional watershed management comes regional floodplain coordination and management. The main goal of establishing RAIN is to have more municipal and parish participation in CRS to lower flood insurance premiums, educate citizens and elected officials, and help to better manage local flooding. LWI Region 5, now the Acadiana Watershed District, will continue to promote best practices for development for inclusion in the CRS and create public awareness of the CRS program and its benefits.

6

Local Planning Coordination and Capability Building

Although the state is responsible for supporting local governments with mitigation planning through training, technical assistance, and, when available, funding, mitigation activities often depend on local communities. For successful mitigation, the State of Louisiana works to make sure that communities are aware of available hazard data, planning resources, and state priorities for mitigation. It is also important for locals to consider local mitigation strategies and capabilities and for the State to be aware of local priorities and local data.

Overall, this chapter addresses the following requirement per the State Mitigation Planning Policy Guide (2022):

S13	**Does the plan include a general description and analysis of the effectiveness of local government mitigation policies, programs, and capabilities? [44 CFR § 201.4(c)(3)(ii)]**
S14	**Does the plan describe the process to support the development of approvable local government mitigation plans? [44 CFR §§ 201.3(c)(5) and 201.4(c)(4)(i)]**
S15	**Does the plan describe the criteria for prioritizing funding? [44 CFR § 201.4(c)(4)(iii)]**
S16	**Does the plan describe the process and time frame to review, coordinate, and link local mitigation plans with the state mitigation plan? [44 CFR §§ 201.3(c)(6), 201.4(c)(2)(ii), 201.4(c)(3)(iii), and 201.4(c)(4)(ii)]**

Coordination of Local Planning

During the planning process, the State Hazard Mitigation Planning Committee worked to provide an accessible and easy to use document that incorporates state and local planning goals and provides a vehicle for local and regional cooperation for effective hazard mitigation. As a first step, the project team conducted a review of the hazards covered in parish mitigation plans to ensure those were also covered in the State's plan (See Chapter 2 for summary table). Coordination efforts between the State and local parishes were then examined to include technical assistance provided by the State. The team also reviewed local mitigation capacity as well as successful mitigation projects implemented at the local level. Throughout the planning process, local risk information and local capacity were considered to the extent possible in developing the state mitigation strategy. The State of Louisiana continues to provide support to local and tribal governments with mitigation planning efforts and project. This support includes training, technical assistance, sharing of data, and funding. As of the writing of this Plan Update, 52 (81%) of Louisiana's 64 parishes have approved mitigation plans while twelve are under revision. We have four tribal plans: Chitimacha Tribe – in St. Mary Parish, Coushatta Tribe, Jena Band of Choctaw Indians in LaSalle Parish and Tunica-Biloxi Indian Tribe. This is an increase from only two plans during the time of the 2019 Update.

HM Kick-off meetings

From 2019 to 2023, GOHSEP conducted a series of mitigation planning meetings with jurisdictions across Louisiana. Focusing on local mitigation plan updates, these coordination meetings consisted of identifying funding for plan updates, options for plan updates, and a review of the overall planning process.

Additionally, during this timeframe, GOHSEP contractors began multiple local plan updates, beginning with kick-off meetings and multiple meetings at the local level to review risk assessments, mitigation strategies, and final draft plans.

Local Capacity

An analysis of local mitigation capabilities reveal various existing authorities, polices and resources that reduce hazard impacts or could be used to implement hazard mitigation activities.

The following list provides a summary of the types of tools upon which Louisiana parishes rely to implement local mitigation programs.

- **LOCAL PLANS**
  - Comprehensive / Master Plan
  - Capital Improvements Plan
  - Economic Development Plan
  - Local Emergency Operations Plan
  - Continuity of Operations Plan
  - Transportation Plan
  - Stormwater Management Plan
  - Community Wildfire Protection Plan
  - Green Infrastructure Plans
  - Other plans (climate action, redevelopment, recovery, coastal zone management, species protection)

- **LOCAL ORDINANCES**
  - Zoning Ordinance
  - Subdivision Ordinance
  - Floodplain Ordinance
  - Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)
- **OTHER**
  - Flood Insurance Rate Maps
  - Acquisition of land for open space and public recreation uses
  - Other (stormwater fees, etc.)

Despite the local mitigation tools listed here, the capacity to implement mitigation varies across Louisiana parishes and tribes. Many local entities continue to face challenges in their attempts to implement mitigation policies and programs as many do not have the necessary resources to implement certain mitigation activities. For instance, many parishes lack the time and/or expertise to carry out mitigation policies and programs. Many local municipalities have one staff member or perhaps a part-time staffer focused on the implementation of mitigation policies and programs. Some do not have staff with the required expertise to include GIS, floodplain management, planning, etc., which makes it difficult to apply for funding and/or implement mitigation tasks.

Federally recognized tribes in Louisiana include the following: Chitimacha Tribe of Louisiana, Coushatta Tribe of Louisiana, Jena Band of Choctaw Indians, and Tunica-Biloxi Indian Tribe of Louisiana. The State of Louisiana also recognizes the following tribes: Addai Caddo Tribe; Biloxi-Chitimacha Confederation of Muskogee; Choctaw-Apache Community of Ebarb; Clifton Choctaw; Four Winds Tribe Louisiana Cherokee Confederacy; Grand Caillou/Dulac Band; Isle de Jean Charles Band; Louisiana Choctaw Tribe; Pointe-Au-Chien Indian Tribe; and the United Houma Nation. The state does reach out to support tribal communities; however, only the federally recognized tribes currently have approved plans. A major challenge is the fact that only federally recognized tribes can act as state applicants; this right has not been exercised in Louisiana. Another challenge lies in the fact that the tribes that are not federally recognized must coordinate with the parishes in which they are located. The lack of resources and local politics often make coordination difficult.

These challenges continue at the local and tribal level and suggest additional support is needed from the State. Suggestions for this support include education and outreach related to funding opportunities, planning workshops, and reminders and site visits to local and tribal jurisdictions prior to plan expiration dates. Additional education and outreach efforts should concentrate on Louisiana tribes – both federally recognized, and state recognized. These efforts should be coordinated with Louisiana's Director of Indian Affairs, as well as the tribal leaders and tribal councils, to be successful.

Local Plan Review Process

GOHSEP continues to follow the steps listed below in its review of local plans:

STEP 1 The initial draft of a parish or municipal plan is sent to GOHSEP for review. GOHSEP staff develop and provide parish or municipal officials with comprehensive guidance for improving the format and content of the plan.

STEP 2 Parish or municipal officials revise the plan in accordance with GOHSEP guidance and re-submit the plan for GOHSEP review. With satisfactory revisions, GOHSEP forwards the plan, with comments, to FEMA Region VI.

STEP 3 FEMA Region VI reviews the plan and forwards comments to GOHSEP. GOHSEP relays these new comments back to the parish or municipality. GOHSEP continues to interface with parish or municipal officials to discuss and clarify all review comments on a point-by-point basis.

STEP 4 The parish or municipality addresses both GOHSEP and FEMA Region VI comments and revises the plan.

STEP 5 The parish or municipality submits a revised draft to GOHSEP for review. GOHSEP staff evaluate the revisions and forward the updated plan to FEMA Region VI.

STEP 6 FEMA Region VI reviews the revised plan, and if it addresses all comments, FEMA mails a letter stating that the plan is "approvable pending adoption" to GOHSEP and the parish or municipality. In cases where the comments were not addressed, the parish or municipality again repeats the process.

STEP 7 All participating jurisdictions then formally adopt the plan through a Resolution.

STEP 8 The Regional Director of FEMA Region VI officially approves the plan.

The timeframe for this review process is approximately six months. The six month timeframe does not include the time spent by parishes or municipalities revising the plans in response to GOHSEP and FEMA comments. The timeframe is also based on the following assumptions:

- **Step 1 requires approximately 45 days for State review.**
- **Step 2 requires an additional 45 days for FEMA review.**
- **After resubmitting the plan for final review, the state and FEMA are each given an additional 45-day review period.**

Prioritizing Parish and Municipal Assistance

It is stated in CFR Section 201.4(c)(4)(iii) that the State Hazard Mitigation Plan must include "[c]riteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures. Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs."

The sub-sections below discuss these criteria in addition to "community commitment to mitigation". The following sections include details of how the state intends to prioritize applications for funding future planning efforts. In all cases, applicants must demonstrate that their risk is sufficient to merit grant funds, particularly when compared to the project cost, but there is often considerable uncertainty in risk determinations. Hence, the state continues to consider a variety of factors in addition to risk and benefit-cost analysis in determining its priorities for mitigation grants.

The SHMPC had multiple discussions concerning how to prioritize funding selected mitigation projects. Like the 2019 Update planning process, the committee underlined communities at highest risk as the most important priority, followed by communities with repetitive loss properties, communities undergoing development, and finally, community commitment to mitigation.

Communities at Highest Risk

One of the primary purposes of this update is to identify the areas in Louisiana with the highest risk from natural hazards. The parishes in Louisiana have different levels of exposure and risk. In general, the state will direct mitigation grant funds to the areas with the highest risk. However, in many cases, more localized risk assessments (possibly produced in the parish and municipal mitigation planning process), as well as risk assessments and benefit-cost analyses done in support of applications, may indicate areas with high risk outside the highest-risk parishes identified in this update. The most worthwhile mitigation projects are a product of both the risk in a particular place, and the effectiveness of a project. Although risk is clearly an initial indicator of mitigation potential, the state will also carefully consider the effectiveness and cost of mitigation projects in determining funding priorities.

Communities with Repetitive Loss Properties

The State presently considers the repetitive loss status of properties in determining the grants it will support (i.e., forward to FEMA for consideration and funding), and will continue to do so as additional grant funds are available. The FMA program mandates that grant funds are directed to NFIP repetitive loss properties, and the state will continue to comply with this requirement. The Flood Insurance Reform Act of 2004, which was signed into law by the President on June 30, 2004, requires the NFIP to provide a disincentive to property owners to live in repetitively flooded areas. Rather than continue to rebuild, the program provides repeatedly flooded homeowners assistance in either elevating or moving their homes away from floodwaters.

In addition, the Biggert-Waters Flood Insurance Reform Act of 2012 called for 25% annual increases for Severe Repetitive Loss Properties insured with subsidized rates until their premium rates are full risk premiums. The Homeowner Flood Insurance Affordability Act of 2014 later confirmed this increase.

Communities Undergoing Development

The state will also include development as a review criterion. Parish and municipal plans should provide some indication of the implications of future development, per DMA 2000 requirements for local plans. Although development is a potential factor in any risk determination, development that occurs in accordance with current building codes, land use planning and floodplain management principles should in many cases be less vulnerable than development that pre-dates these codes and principles. However, the state is aware that increased development does cause related increases in population, impacts on infrastructure, etc., and may in some cases have adverse impacts on existing areas. These factors will continue to be carefully considered in GOHSEP reviews.

Community Commitment to Mitigation

Additionally, the state will consider parish and municipality commitment to mitigation when prioritizing projects. The commitment to mitigation should be clear in the plans submitted by the parish and municipality in addition to participation in the Community Rating System (CRS). By demonstrating their commitment to mitigation, the parishes and municipalities will show the need for various projects. The state will consider this commitment as a final review criterion.

Maximizing Benefits According to Benefit-Cost Review of Local Projects

Regulations for FEMA's HMA grant program state that proposed mitigation projects must be cost effective. Under some pre-established conditions, certain projects may be exempt from this regulation. However, in most cases, projects include a benefit-cost analysis, either prior to submission to GOHSEP and FEMA for funding consideration, or during the grant evaluation process.

In most cases, grant applications either include a benefit-cost analysis, or GOHSEP or FEMA performs one in accordance with FEMA and the Louisiana Office of Management and Budgets regulations. Projects that do not achieve the required 1.0 benefit-cost ratio, and are not exempted from benefit-cost analysis, are rejected from funding consideration. This is the case for all FEMA HMA grants.

Prioritization of Parishes to Receive HMGP Funding

GOHSEP shall submit recommendations to the Governor or his/her Designee for the use of available HMGP funds. These recommendations will include:

- **Priority for use of funds, if any**
- **Allocation of funds to parishes based on their prorated share of damages as determined by the final damage assessment figures**
- **Allocations of available funds to State and Regional Agencies**
- **Use of all available initiative funds**
- **Other priority related issues as a result of the disaster**

Funds will only be made available to those eligible applicants that have or are covered by a FEMA approved state or local mitigation plan. The parishes will submit eligible project applications to GOHSEP in prioritized order, up to the amount of their allocation. Parishes are encouraged to submit more projects than their allocation in case several projects are deemed ineligible.

Conclusion

Since the last Plan update, through its collaboration with local municipalities and other non-governmental stakeholders, the State has successfully managed a mitigation program through ten federally declared disasters. The following are the Major Declared Disasters since 2019:

- **Louisiana Hurricane Ida (DR-4611-LA)**
  Incident Period: August 26, 2021 - September 3, 2021
  Major Disaster Declaration declared on August 29, 2021

- **Louisiana Severe Storms, Tornadoes, and Flooding (DR-4606-LA)**
  Incident Period: May 17, 2021 - May 21, 2021
  Major Disaster Declaration declared on June 2, 2021

- **Louisiana Severe Winter Storms (DR-4590-LA)**
  Incident Period: February 11, 2021 - February 19, 2021
  Major Disaster Declaration declared on March 9, 2021

- **Louisiana Hurricane Zeta (DR-4577-LA)**
  Incident Period: October 26, 2020 - October 29, 2020
  Major Disaster Declaration declared on January 12, 2021

- **Louisiana Hurricane Delta (DR-4570-LA)**
  Incident Period: October 6, 2020 - October 10, 2020
  Major Disaster Declaration declared on October 16, 2020

- **Louisiana Hurricane Laura (DR-4559-LA)**
  Incident Period: August 22, 2020 - August 27, 2020
  Major Disaster Declaration declared on August 28, 2020

- **Louisiana Covid-19 Pandemic (DR-4484-LA)**
  Incident Period: January 20, 2020 - May 11, 2023
  Major Disaster Declaration declared on March 24, 2020

- **Louisiana Flooding (DR-4462-LA)**
  Incident Period: May 10, 2019 - July 24, 2019
  Major Disaster Declaration declared on September 19, 2019

- **Louisiana Hurricane Barry (DR-4458-LA)**
  Incident Period: July 10, 2019 - July 15, 2019
  Major Disaster Declaration declared on August 27, 2019

- **Louisiana Severe Storms and Tornadoes (DR-4439-LA)**
  Incident Period: April 24, 2019 - June 25, 2019
  Major Disaster Declaration declared on June 3, 2019

Simultaneously, Louisiana's mitigation capacity allowed GOHSEP, with local support, to continue to address repetitive loss properties through funding of numerous mitigation projects across all FEMA's HMA portfolio of federal funding programs. However, considering the high numbers of repetitive loss that continue to impact our local communities, these properties should remain a priority for mitigation funding. GOHSEP is currently working with FEMA to update the repetitive loss data and will provide updates across implementation cycles of projects.

During the last Plan Update, a Loss Strategy was developed for the State. The intention is for the State to update this Strategy in 2024.

Overall, coordination between the State and local communities informs and influences the state's risk assessment and mitigation priorities. This mutual understanding between states and local governments allows for a more efficient planning review and approval process, better aligns mitigation strategies and plans, and directs available resources toward effective mitigation planning statewide.

A

Appendix A: Technical Appendix

Local Risk Assessments

As part of the hazard identification and risk assessment process, the planning team reviewed parish plans to identify profiled hazards that were consistent with the State Hazard Mitigation Plan Committee's (SHMPC's) evaluation of the most serious natural hazard threats to the state. Some hazards identified in parish and municipal plans are not addressed directly in this plan update. Generally, these hazards appear in a small number of parish and municipal plans and were not consistent with the SHMPC's evaluation of the most serious natural hazard threats to the state.

Members from the SHMPC and the LSU Advisory Team reviewed each of the 60 available most up-to-date parish plans in the state to identify the hazards profiled in each plan in order to determine (1) the frequency with which each was addressed, and (2) whether sufficient consistency between the local plans exists to integrate the data, methods, and results systematically into the plan update.

The following table lists the hazards profiled in the available 60 parish plans for each of the hazards (or sub-hazards) included in this plan update. The hazard most often addressed by parish plans was tropical cyclones, which appeared in all the parishes for hazard profiling. Sinkhole hazard was addressed by 17 parish plans, and only two parish plans profiled sea level rise as a hazard. Parish plans included an average of 9 of the 21 hazards (or sub-hazards) included in this plan update. The Avoyelles Parish plan considers the fewest hazards profiled in this plan update (4 hazards), while three parish plans (East Baton Rouge, Jefferson, and Red River) considered 12 or more from among the 22 hazards profiled in this plan update.

Overall, the parish plans and the state plan update were found to be consistent in identifying natural hazards that impact areas of the state. Although the identified hazards are largely consistent, the parish plans vary widely in key characteristics, including hazard identification definitions, risk assessment data, risk assessment methodologies, and economic loss estimation. The primary commonality among the plans is the inclusion of Hazus Level 1 analyses. This update includes Level 1 flood, wind, and combined wind and flood model results. Thus, the risk assessments for these prevalent hazards are consistent among the parish and state plans.

	La Salle	Jefferson Davis	Jefferson	Jackson	Iberville	Iberia	Grant	Franklin	Evangeline	East Feliciana	East Carroll	East Baton Rouge	DeSoto	Concordia	Claiborne	Catahoula	Cameron	Caldwell	Caddo	Bossier	Bienville	Beauregard	Avoyelles	Assumption	Ascension	Acadia
Subsidence			X		X	X				*		*													X	
Land Loss					X	X						*					X									
Coastal Erosion			X																							
Saltwater Intrusion						X																				
Sea Level Rise						X																				
Drought	X	X	X			*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X
Earthquake			X									*	*	*	*				*	*						
Flooding	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Extreme Heat			X					X					X	X	X		X		X		X	X				
Thunderstorms	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tornadoes	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tropical Cyclones	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wildfires	X	X	X				X			X	X	X	X	X	X		X	X	X	X	X	X				
Winter Storms	X	X	X				X	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X
Dam Failure				+				X	+	+		+	*	+	+			+	+	+	X					
Levee Failure		X		+	X	X	X	+		+	X	+	*	+	+			+	+	+					X	
Sinkholes						X		X	X								X					X		X	X	
Storm Surge			X																							
Fog																										
Expansive Soil																										
Hailstorms			X																							
Hazardous Materials																										

	Subsidence	Land Loss	Coastal Erosion	Saltwater Intrusion	Sea Level Rise	Drought	Earthquake	Flooding	Extreme Heat	Thunderstorms	Tornadoes	Tropical Cyclones	Wildfires	Winter Storms	Dam Failure	Levee Failure	Sinkholes	Storm Surge	Fog	Expansive Soil	Hailstorms	Hazardous Materials
Lincoln						X	*	X	X	X	X	X	X	X	+							
Livingston	X	X				X		X		X	X	X		X							X	
Madison								X		X	X	X		X		+	X					
Morehouse						X		X	X	X	X	X	X	X	+	+						
Natchitoches						X		X		X	X	X	X	X								
Orleans	X	X						X	X	X	X	X		X	X	X		X				
Ouachita						X	*	X	X	X	X	X	X	X	+	+						
Plaquemines	X			X	X			X		X	X	X				X	X					
Point Coupee						X		X		X	X	X		X	+	+						
Rapides						X		X	X	X	X	X	X	X								
Red River	X	X				X	*	X	X	X	X	X	X	X	+	+				*		
Richland						X		X		X	X	X		X	+	*						
Sabine						X		X		X	X	X	X	X	+							
St. Bernard	X			X				X		X	X	X					X					
St. Charles		X	X	X								X		X		X						X
St. Helena								X		X	X	X	X	X								
St. James	X					X		X		X	X	X	X	X			X			X		
St. John the Baptist						X		X		X	X	X		X						X		
St. Landry						X		X		X	X	X	X	X								
St. Martin	X					X		X			X	X				X				X	X	
St. Mary			X			X		X		X	X	X		X								
St. Tammany		X				X		X		X	X	X	X		X	X			X			
Tangipahoa	X	X						X		X	X	X	X	X								
Tensas						X	*	X	X	X	X	X	X	X		X	X					
Terrebonne	X		X	X				X	X	X	X	X				X	X					
Union						X	*	X	X	X	X	X	X	X	+	+						

	Subsidence	Land Loss	Coastal Erosion	Saltwater Intrusion	Sea Level Rise	Drought	Earthquake	Flooding	Extreme Heat	Thunderstorms	Tornadoes	Tropical Cyclones	Wildfires	Winter Storms	Dam Failure	Levee Failure	Sinkholes	Storm Surge	Fog	Expansive Soil	Hailstorms	Hazardous Materials
Vermilion		X						X		X	X	X					X					
Vernon						X	*	X	X	X	X	X	X	X	+	+						
Washington								X		X	X	X	X	X								
Webster						X		X	X	X	X	X	X	X	X		X					
West Baton Rouge	*	*				X		X		X	X	X	X	X			X					
West Carroll						X		X		X	X	X		X								
West Feliciana								X		X	X	X	X		X	X						
Winn						X		X		X	X	X	X				X					

X - Hazard Profiled
* - Hazard Profiled but Discounted
+ - Hazard Profiled but Data Deficiency

Most of the recent updates to jurisdictional plans follow the general methodology of the 2014 and 2019 State Hazard Mitigation Plans. This plan update utilizes data from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). This is considered an improvement over parish plan data, as SHELDUS integrates data from National Centers for Environmental Information with additional data from the NOAA Storm Prediction Center, National Hurricane Center, and U.S. Fire Administration. Additionally, data from multiple state agencies have been integrated into the current plan.

Changes in Development

Parish-level population

Future population estimations were calculated at the census block level of each Louisiana parish for 2050. Annual estimates and census data were obtained from U.S. Census Bureau for each parish. The file consists of yearly population estimates (Pyear) for each parish from 1981 to 2020. These population estimates are used to calculate how the population changed from the previous year up until 2020 for each parish. The overall average rate (r) of population change was calculated based of the 40 annual population changes determined for each parish (Equation 1).

Average population change from 1980 to 2020

$$r = \left(\frac{(P_{1981} - P_{1980})}{P_{1980}} + \frac{(P_{1982} - P_{1981})}{P_{1981}} + \ldots\ldots + \frac{(P_{2020} - P_{2019})}{P_{2019}} \right) / 40 \quad \text{(Equation 1)}$$

After the average annual population rate (r) was determined, future population estimates (Pf) for each Louisiana parish at the census block level were calculated for 2050 (Equation 2). The 2020 block level U.S. Census population data (Po) was used as the initial base to estimate how the future population Louisiana changed during the 30-year period (t).

$$P_f = P_0 e^{rt} \quad \text{(Equation 2)}$$

The following table presents the parish-level population results.

Parish	Population 2020	Population 2050	Projected Change
Acadia	57,576	56,738	(838)
Allen	22,750	19,850	(2,900)
Ascension	126,500	264,000	137,500
Assumption	21,039	17,998	(3,041)
Avoyelles	39,693	36,316	(3,377)
Beauregard	36,549	42,796	6,247
Bienville	12,981	9,636	(3,345)
Bossier	128,746	183,717	54,971
Caddo	237,848	209,827	(28,021)
Calcasieu	216,785	239,947	23,162
Caldwell	9,645	8,519	(1,126)
Cameron	5,617	2,392	(3,225)
Catahoula	8,906	6,538	(2,368)
Claiborne	14,170	11,205	(2,965)
Concordia	18,687	16,257	(2,430)
DeSoto	26,812	29,193	2,381
East Baton Rouge	456,781	509,869	53,088
East Carroll	7,459	4,863	(2,596)
East Feliciana	19,539	16,726	(2,813)
Evangeline	32,350	28,432	(3,918)
Franklin	19,774	17,447	(2,327)
Grant	22,169	27,900	5,731
Iberia	69,929	63,160	(6,769)
Iberville	30,241	26,211	(4,030)
Jackson	15,031	14,554	(477)
Jefferson	440,781	400,031	(40,750)
Jefferson Davis	32,250	32,858	608
Lafayette	241,753	350,331	108,578

Lafourche	97,557	106,639	9,082
LaSalle	14,791	15,529	738
Lincoln	48,396	56,799	8,403
Livingston	142,282	276,258	133,976
Madison	10,017	6,325	(3,692)
Morehouse	25,629	18,331	(7,298)
Natchitoches	37,515	34,650	(2,865)
Orleans	383,997	379,918	(4,079)
Ouachita	160,368	173,360	12,992
Plaquemines	23,515	19,412	(4,103)
Pointe Coupee	20,758	17,818	(2,940)
Rapides	130,023	130,521	498
Red River	7,620	5,546	(2,074)
Richland	20,043	18,550	(1,493)
Sabine	22,155	20,907	(1,248)
St. Bernard	43,764	78,104	34,340
St. Charles	52,549	57,309	4,760
St. Helena	10,920	11,154	234
St. James	20,192	18,100	(2,092)
St. John the Baptist	42,477	38,169	(4,308)
St. Landry	82,540	75,047	(7,493)
St. Martin	51,767	56,138	4,371
St. Mary	49,406	42,249	(7,157)
St. Tammany	264,570	431,427	166,857
Tangipahoa	133,157	206,004	72,847
Tensas	4,147	1,988	(2,159)
Terrebonne	109,580	109,756	176

Union	21,107	18,838	(2,269)
Vermilion	57,359	62,567	5,208
Vernon	48,750	42,766	(5,984)
Washington	45,463	47,077	1,614
Webster	36,967	29,980	(6,987)
West Baton Rouge	27,199	39,028	11,829
West Carroll	9,751	7,150	(2,601)

The latest six National Land Cover Databases (NLCD) are used to describe how the urban land cover across Louisiana has changed between 2001, 2006, 2011, 2016, 2019, and 2021. A description of the data sets used in the analysis is readily available and stated below from NLCD (https://www.mrlc.gov/data).

National Land Cover Database 2021 (NLCD 2021) is the most recent national land cover product created by the Multi-Resolution Land Characteristics (MRLC) Consortium. NLCD 2021 builds upon the foundation of NLCD 2016, and it follows an update-based approach where certain products, such as Land Cover and Impervious Surface, remain unchanged from the 2019 release. These unchanged products are utilized directly with NLCD 2021 for change analysis over the specified time span. However, it is noted that science products and the change index have been updated to incorporate additional changes observed in 2021. Therefore, users interested in the most recent and comprehensive analysis of land cover changes during the NLCD timespan would need to acquire the updated science products and change index for NLCD 2021. This approach ensures that the data set reflects the latest developments in land cover and impervious surface changes, providing researchers and practitioners with accurate and up-to-date information for their analyses and applications.

The NLCD 2019 and NLCD 2016 design is formulated to offer innovative, consistent, and robust methodologies for generating a multi-temporal land cover and land cover change database spanning from 2001 to 2019 at 2-3-year intervals. The development process involved extensive research, leading to the implementation of several key strategies for NLCD 2019, including the continued integration of impervious surface with all land cover products, a streamlined compositing process based on Landsat imagery and geospatial ancillary data sets, a comprehensive approach to training data development using multiple sources and decision-tree-based land cover classifications, a strategy for temporally, spectrally, and spatially integrated land cover change analysis, a hierarchical theme-based post-classification and integration protocol for generating land cover and change products, a modeling method for continuous fields biophysical parameters, and the establishment of an automated scripted operational system for NLCD 2019 production.

NLCD 2011 provides, for the first time, the capability to assess wall-to-wall, spatially explicit, national land cover changes and trends across the U.S. from 2001 to 2011. As with two previous NLCD land cover products, NLCD 2011 keeps the same 16-class land cover classification scheme that has been applied consistently across the U.S. at a spatial resolution of 30 meters. NLCD 2011 is based primarily on a decision-tree classification of circa 2011 Landsat satellite data.

National Land Cover Database 2006 (NLCD 2006) is a 16-class land cover classification scheme that has been applied consistently across the conterminous U.S. at a spatial resolution of 30 meters. NLCD 2006 is based primarily on a decision-tree classification of circa 2006 Landsat satellite data. NLCD 2006 also quantifies land cover change between the years 2001 to 2006. The NLCD 2006 land cover change product was generated by comparing spectral characteristics of Landsat imagery between 2001 and 2006, on an individual path/row basis, using protocols to identify and label change based on the trajectory from NLCD 2001 products.

National Land Cover Database 2001 (NLCD 2001) is a 16-class (additional four classes in Alaska only) land cover classification scheme that has been applied consistently across all 50 states of the U.S. and Puerto Rico at a spatial resolution of 30 meters. NLCD 2001 is based primarily on a decision-tree classification of circa 2001 Landsat satellite data. NLCD 2001 improves on NLCD92 in that it is comprised of three different elements: land cover, percent developed impervious surface, and percent tree canopy density.

To understand how the urban landscape has changed across Louisiana, NLCDs from 2001, 2006, 2011, 2016, 2019. and 2021 were obtained. Pixel values that are classified as "Developed" (21, 22, 23, and 24) were used to define an urban location in Louisiana for each NLCD. Once the urban pixels were selected for each database, a cross-comparison was conducted using the raster calculator made available in ArcGIS. This method determines how the urban landscape has changed between the periods of 2001 to 2006, 2006 to 2011, 2011 to 2016, 2016 to 2019, and 2019 to 2021 for the state of Louisiana and its major cities (Shreveport, Monroe, Alexandria, Lake Charles, Lafayette, Houma, Baton Rouge, and New Orleans).

Developed	
21	**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. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
22	**Developed, Low Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.
23	**Developed, Medium Intensity** - areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.
24	**Developed, High Intensity** - highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.

Vulnerable populations

Age demographics

Age demographic population estimations for young (<20 years old) and aging (>64 years old) populations were calculated at the parish level of each Louisiana parish for the year of 2050. Annual American Community Survey (ACS) 5-year estimates of the Age and Sex File (S0101) from 2012 to 2021 were obtained from U.S. Census Bureau American Fact Finder for each parish. The file consists of yearly population estimates (Pyear) for each parish from 2012 to 2021. These population estimates were used to calculate how the population changed in recent history until 2021 for each parish. The overall average rate (r) of vulnerable population change was calculated based of the nine annual population changes determined for each parish (Equation 1).

Average population vulnerable population change from 2012 to 2021:

$$r = \left(\frac{(P_{13} - P_{12})}{P_{12}} + \frac{(P_{14} - P_{13})}{P_{13}} + \frac{(P_{15} - P_{14})}{P_{14}} + \frac{(P_{16} - P_{15})}{P_{15}} + \cdots + \frac{(P_{20} - P_{19})}{P_{19}} + \frac{(P_{21} - P_{20})}{P_{20}} \right) / 9 \quad \text{(Equation 1)}$$

Positive rates of change indicate parishes that have experienced increases in vulnerable populations over the past nine years. Negative rates of change indicate parishes that have experienced overall average decreases in vulnerable populations over the past nine years.

Using the same growth rate model, the following rates of change of vulnerable populations were evaluated.

Disability demographics

Annual ACS 5-year estimates of Disability Characteristics (S1810) data were obtained from U.S. Census Bureau American Fact Finder for each parish from 2012 to 2021.

Poverty demographics

Annual ACS 5-year estimates of Poverty Status in the Past 12 Months (S1701) data were obtained from U.S. Census Bureau American Fact Finder for each parish from 2012 to **2021.**

Manufactured home estimates

Annual ACS 5-year estimates of Physical Housing Characteristics for Occupied Housing Units (S2504) data were obtained from U.S. Census Bureau American Fact Finder for each parish from 2012 to 2021.

The table below gives the parish level average annual growth rates for each identified vulnerable population. These values are summed by parish to provide an overarching indication of the direction of change for each parish across populations, where higher positive numbers indicate increased vulnerability, and higher negative numbers indicate decreased vulnerability. Rates closer to zero indicate less change from the current populations. The change rates are also averaged for the parishes, showing that on average, across the state, change in demographic vulnerability is modest in a positive or negative direction. By contrast, many parishes show more exaggerated increases in vulnerable populations. The parishes with the highest sum of vulnerable population growth rates, indicating a greater likelihood of future increase in demographic vulnerability, are St. Bernard, Plaquemines, Ascension, St. Tammany, West Baton Rouge, and Richland parishes. It is noted that no parishes have a negative growth rate for aging populations, defined as older than 64 years old.

Table X: Average annual vulnerable population growth rates; positive values indicate increases in vulnerability while negative values indicate decreases in vulnerability.

Parish	Younger than 20	Older than 64	Population with disabilities	Population living in poverty	Population living in mobile Homes	Sum of vulnerable population growth rates
Acadia	-1%	2%	0%	2%	-2%	1%
Allen	-2%	0%	1%	0%	0%	-1%
Ascension	1%	5%	3%	0%	0%	9%
Assumption	-2%	3%	-2%	-2%	0%	-3%
Avoyelles	-1%	1%	1%	1%	0%	2%
Beauregard	0%	2%	2%	0%	1%	5%
Bienville	-2%	0%	-2%	0%	1%	-3%
Bossier	0%	3%	2%	4%	-2%	7%
Caddo	-1%	2%	1%	1%	-1%	2%
Calcasieu	1%	3%	-1%	1%	0%	4%
Caldwell	-1%	2%	-1%	1%	2%	3%
Cameron	-3%	1%	-3%	-2%	-3%	-10%
Catahoula	-3%	0%	-4%	1%	1%	-5%
Claiborne	-4%	0%	-3%	0%	2%	-5%
Concordia	-2%	1%	0%	0%	-4%	-5%
De Soto	0%	2%	2%	1%	0%	5%
East Baton Rouge	0%	3%	2%	0%	-1%	4%

East Carroll	-2%	2%	-1%	-2%	9%	6%
East Feliciana	-2%	3%	-3%	-5%	1%	-6%
Evangeline	-2%	1%	3%	2%	0%	4%
Franklin	-1%	1%	-5%	-1%	2%	-4%
Grant	-1%	2%	-2%	-1%	-2%	-4%
Iberia	-1%	2%	0%	1%	-1%	1%
Iberville	-2%	2%	0%	0%	0%	0%
Jackson	-2%	1%	-1%	0%	-2%	-4%
Jefferson	0%	3%	2%	1%	1%	7%
Jefferson Davis	0%	1%	-2%	0%	-1%	-2%
Lafayette	0%	4%	1%	1%	-1%	5%
Lafourche	-1%	2%	1%	1%	-1%	2%
LaSalle	0%	2%	-1%	6%	-1%	6%
Lincoln	0%	2%	1%	1%	2%	6%
Livingston	0%	4%	0%	-1%	-1%	2%
Madison	-2%	0%	2%	-3%	-5%	-8%
Morehouse	-1%	1%	-3%	1%	-2%	-4%
Natchitoches	-1%	2%	-2%	-1%	-1%	-3%
Orleans	0%	5%	1%	0%	-9%	-3%
Ouachita	0%	3%	2%	1%	-1%	5%
Plaquemines	0%	2%	3%	6%	1%	12%
Pointe Coupee	-2%	2%	4%	0%	0%	4%
Rapides	-1%	2%	-1%	-1%	3%	2%
Red River	-3%	1%	1%	-1%	0%	-2%
Richland	-1%	2%	1%	4%	2%	8%
Sabine	-1%	1%	-1%	0%	2%	1%
St. Bernard	3%	5%	6%	5%	-2%	17%
St. Charles	-1%	4%	0%	-2%	-2%	-1%
St. Helena	-2%	3%	3%	0%	2%	6%

St. James	-2%	2%	-1%	-3%	1%	-3%
St. John the Baptist	-2%	3%	-1%	-1%	0%	-1%
St. Landry	0%	2%	0%	0%	-1%	1%
St. Martin	-1%	3%	0%	0%	1%	3%
St. Mary	-2%	2%	-1%	-1%	-2%	-4%
St. Tammany	1%	5%	3%	2%	-2%	9%
Tangipahoa	1%	4%	3%	0%	-1%	7%
Tensas	-2%	2%	-2%	1%	-1%	-2%
Terrebonne	-1%	3%	0%	1%	-1%	2%
Union	-1%	2%	-2%	-1%	3%	1%
Vermilion	-1%	2%	2%	0%	-2%	1%
Vernon	-1%	2%	1%	3%	-2%	3%
Washington	-1%	2%	-1%	-1%	2%	1%
Webster	-2%	1%	-3%	1%	-2%	-5%
West						
Baton Rouge	1%	4%	1%	2%	1%	9%
West Carroll	-2%	0%	-1%	-1%	1%	-3%
West Feliciana	-1%	4%	-4%	1%	5%	5%
Winn	-2%	1%	-3%	-2%	-4%	-10%

Risk Assessment Approaches

The risk assessment calculates average annual losses in 2050 using an approach that considers the annual probability of occurrence and loss given that occurrence.

SHELDUS Loss Approach

For extreme heat, drought, extreme cold, hail, lightning, and tornado hazards, the planning team used the SHELDUS per capita property loss data to calculate losses at the census block level. This value is adjusted to 2021 dollars, but it is not population-adjusted. The team then normalized the SHELDUS average per capita property loss by the hazard intensity and population, to represent hazard loss properly as a function of hazard and population.

$$PL_{i,k,2050} = \frac{\overline{C_{j,k}} \sum_{i=1}^{i} P_{i,2020}}{\sum_{i=1}^{n}(H_{i,k} \times P_{i,2020})} \times H_{i,k} \times F_{k,2050} \times P_{i,2050}$$

where,

$PL_{i,k,2050}$ = projected annual property loss of census block i for hazard k in 2050
$\overline{C_{j,k}}$ = SHELDUS average per capita property loss (2021 dollars) of parish j for hazard k
$P_{i,2020}$ = population of census block i in 2020
$H_{i,k}$ = historical hazard intensity of census block i for hazard k
$F_{k,2050}$ = future hazard multification factor for hazard k in 2050
$P_{i,2050}$ = projected population in census block i in 2050

Crop Loss

The planning team used the SHELDUS average annual crop loss data, which is already adjusted to 2021 dollars, to calculate the losses by census block. The team did not consider population growth in the annual crop loss of each census block.

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$$CL_{j,k,2050} = \frac{\bar{C}_{j,k}}{\sum_{i=1}^{n}(H_{i,k} \times CLC_{i,2016})} \times H_{i,k} \times F_{k,2050} \times CIC_{2050} \times CLC_{i,2050}$$

$$CIC_{2050} = CD_{2050} \times CL_{2050}$$

$$CD_{2050} = 1 + (C_{World} \times P_{World,2050} + C_{US} \times P_{US,2050})$$

where

$CL_{2050,i}$ = projected annual crop loss of census block i in 2050
$\bar{C}_{j,k}$ = SHELDUS historical average annual crop loss (2021 dollars) of parish j for hazard k
$CLC_{k,2021}$= crop land cover area in census block i in 2021
F_i= future hazard multification factor for census block i in 2050
$H_{i,k}$ = historical hazard intensity of census block i for hazard k
$F_{k,2050}$ = future hazard multification factor for hazard k in 2050
CIC_{2050} = future cropping intensity and technological development coefficien in 2050
$CLC_{i,2050}$ = projected crop land cover area in census block i in 2050
CD_{2050} = consumer demand coefficient of Louisiana crops in 2050
CL_{2050}= the projected crop land cover coefficient in 2050
C_{World}= percent of Louisiana's crop consumed by the rest of the world
$P_{World,2050}$ = percent of world population increase by 2050
C_{US} = percent of Louisiana's crop consumed within United States
$P_{US,2050}$ = percent of U. S. population increase by 2050

Alternative Loss Approaches

For wildfire, sinkholes, and expansive soil, we developed customized loss estimation approaches based on consultation with state agencies and members of the SHMPC. For wind and flood, loss estimation used the data from FEMA's Hazus-MH model and USACE's National Structure Inventory (NSI). The methods for alternative loss approaches are described in the following sections.

State Asset Loss Approach

All state buildings are vulnerable to hazards. At the state level, historic hazard losses for state buildings and detailed building stock information are lacking. These data limitations preclude utilization of either of the previously defined loss approaches. Therefore, because of this data deficiency and in consultation with the Louisiana Department of Insurance, the planning team derived a methodology to estimate average annual state asset losses. The methodology assumes that average annual losses for state buildings would echo historic/modeled losses for other occupancies, considering that the state building inventory is representative of the total building inventory in Louisiana.

Utilizing building-level data from the Louisiana Office of Risk Management, 8,783 state buildings were included in the loss assessment, considering a total building and contents replacement value of approximately $15.2 billion. The following table details the buildings considered in each parish, along with the replacement value of state buildings and the total building value within each parish. State asset losses were calculated using the ratio of state property value to total property value (building + contents) and multiplied by the loss assessment results for each individual hazard. State asset losses are included in the total loss results and also reported separately.

Parish	State Building Count	State Property Value ($)	Total Property Value ($)
Acadia	126	$183,189,471	$12,761,905,085
Allen	56	$68,193,547	$4,017,410,850
Ascension	27	$67,862,280	$35,674,794,234
Assumption	5	$2,320,851	$3,715,586,559
Avoyelles	156	$146,390,032	$7,311,449,264
Beauregard	107	$65,518,466	$6,698,350,732
Bienville	12	$4,898,386	$2,830,101,125
Bossier	148	$233,285,613	$23,065,813,208

Caddo	194	$847,673,180	$52,556,450,950
Calcasieu	231	$747,741,258	$47,636,460,693
Caldwell	34	$15,340,851	$1,785,678,747
Cameron	31	$29,618,272	$1,421,615,071
Catahoula	16	$3,988,782	$1,686,489,971
Claiborne	167	$86,305,383	$3,083,461,617
Concordia	30	$28,141,054	$3,538,510,424
DeSoto	24	$13,646,343	$4,430,351,606
East Baton Rouge	783	$965,758,591	$122,348,231,945
East Carroll	27	$11,186,373	$1,463,463,101
East Feliciana	265	$346,102,492	$6,405,477,364
Evangeline	81	$32,005,695	$5,414,736,987
Franklin	63	$33,489,343	$3,432,021,380
Grant	69	$23,576,395	$3,063,977,392
Iberia	131	$171,485,060	$12,732,962,273
Iberville	321	$381,631,771	$5,977,485,681
Jackson	60	$17,690,820	$3,352,879,006
Jefferson	156	$407,866,828	$74,820,010,581
Jefferson Davis	30	$42,799,794	$5,946,871,734
Lafayette	276	$1,579,944,999	$55,420,596,002
Lafourche	139	$604,069,060	$15,491,623,352
LaSalle	41	$14,124,912	$2,402,384,690
Lincoln	343	$1,584,185,490	$8,249,776,981
Livingston	68	$49,346,930	$26,435,675,788
Madison	66	$48,662,532	$1,568,864,843
Morehouse	45	$15,086,595	$5,566,498,859
Natchitoches	142	$483,728,847	$7,737,165,719
Orleans	563	$1,085,772,704	$73,039,836,872
Ouachita	278	$901,720,320	$35,572,945,453

Plaquemines	20	$6,974,739	$6,301,745,322
Pointe Coupee	20	$9,750,411	$5,416,174,616
Rapides	982	$913,754,399	$27,654,248,737
Red River	9	$4,791,058	$1,706,662,982
Richland	68	$29,064,451	$4,152,157,065
Sabine	190	$49,472,698	$5,616,258,528
St. Bernard	47	$122,114,695	$7,269,805,346
St. Charles	5	$2,137,969	$10,258,854,277
St. Helena	14	$17,158,995	$1,688,091,274
St. James	3	$794,614	$6,310,538,269
St. John the Baptist	32	$95,268,663	$8,836,443,087
St. Landry	42	$59,752,471	$17,074,198,676
St. Martin	75	$71,406,746	$11,234,018,710
St. Mary	36	$56,441,020	$16,476,516,936
St. Tammany	145	$137,197,087	$45,050,334,430
Tangipahoa	274	$1,069,782,861	$23,861,838,450
Tensas	48	$12,968,024	$1,586,902,328
Terrebonne	45	$140,550,909	$27,417,613,412
Union	50	$11,994,968	$4,684,704,278
Vermilion	75	$43,869,321	$7,510,038,951
Vernon	68	$40,369,279	$7,464,498,315
Washington	186	$122,513,647	$8,113,186,898
Webster	353	$207,407,868	$12,299,311,315
West Baton Rouge	16	$14,876,223	$6,255,435,681
West Carroll	24	$9,925,633	$1,809,568,702
West Feliciana	564	$508,026,607	$2,805,960,545
Winn	81	$91,009,729	$2,626,678,901
Total	8,783	$15,193,724,405	$970,139,702,171

Risk Assessment Results

Property Loss Results

The following parish-level property losses were determined for each hazard. All losses represent average annual losses, and the parish total reflects the summation of these values to portray the relative risk for Louisiana parishes.

Parish	Wildfire Property Loss	Extreme Cold Property Loss	Wind Property Loss	Hail Property Loss	Lightning Property Loss
Acadia	$43,081	$109,225	$18,976,095	$2,279	$9,263
Allen	$430,960	$133,528	$2,283,424	$1,214	$11,188
Ascension	$1,044,837	$829,971	$71,081,674	$35,304	$111,734
Assumption	$678	$93,815	$8,465,731	$4,164	$17,346
Avoyelles	$76,552	$135,698	$1,946,783	$15,922	$34,921
Beauregard	$932,945	$260,788	$3,713,809	$5,473	$24,375
Bienville	$96,067	$72,618	$54,794	$949	$12,842
Bossier	$1,049,712	$361,084	$403,395	$474,036	$553,536
Caddo	$1,447,672	$2,302,449	$484,708	$193,647	$34,794
Calcasieu	$1,891,692	$216,945	$68,915,361	$804,736	$42,227
Caldwell	$54,886	$94,320	$97,434	$1,575	$10,051
Cameron	$18,267	$32,204	$2,852,792	$327	$3,349
Catahoula	$22,011	$65,380	$113,551	$10,168	$6,075
Claiborne	$115,159	$75,642	$49,288	$1,211	$3,277
Concordia	$6,360	$89,947	$370,669	$5,361	$8,342
DeSoto	$113,314	$149,631	$154,410	$2,808	$2,179
East Baton Rouge	$1,815,265	$198,391	$87,071,815	$83,656	$258,652
East Carroll	$6,023	$62,274	$32,686	$4,182	$4,529
East Feliciana	$191,027	$82,200	$1,439,261	$3,447	$468

Evangeline	$178,868	$90,370	$3,224,871	$1,968	$11,730
Franklin	$23,195	$95,749	$196,802	$24,052	$14,291
Grant	$216,290	$207,188	$509,932	$2,773	$27,761
Iberia	$1,313	$113,998	$27,717,448	$1,221	$28,258
Iberville	$9,256	$127,525	$6,532,949	$3,412	$3,287
Jackson	$121,727	$93,024	$121,221	$1,401	$6,161
Jefferson	$312,244	$158,323	$136,541,928	$1,276,719	$22,317
Jefferson Davis	$86,092	$151,216	$11,506,461	$2,117	$26,809
Lafayette	$48,647	$442,289	$102,021,247	$3,690	$186,885
Lafourche	$1,451	$173,436	$66,709,800	$7,493	$7,176
LaSalle	$136,552	$118,546	$248,638	$3,374	$12,713
Lincoln	$354,867	$219,949	$192,029	$10,781	$17,501
Livingston	$3,021,288	$886,024	$44,095,016	$38,668	$1,703,676
Madison	$2,774	$52,335	$64,720	$12,305	$381
Morehouse	$88,787	$89,594	$80,092	$47,665	$1,026
Natchitoches	$275,526	$99,346	$435,297	$7,551	$15,633
Orleans	$701,272	$59,511	$126,031,732	$6,017	$13,592
Ouachita	$780,221	$198,896	$788,678	$190,017	$21,373
Plaquemines	$14,442	$77,231	$18,477,371	$4,535	$1,318
Pointe Coupee	$10,316	$116,390	$2,907,389	$7,897	$1,650
Rapides	$1,577,914	$168,614	$3,378,896	$3,636	$18,292
Red River	$38,831	$70,220	$34,325	$986	$1,176
Richland	$41,717	$103,569	$129,494	$15,254	$5,683
Sabine	$222,821	$131,239	$519,470	$5,421	$12,223
St. Bernard	$112,732	$196,535	$28,042,826	$9,760	$1,580
St. Charles	$12,185	$234,538	$18,430,989	$12,670	$17,470
St. Helena	$204,755	$114,829	$1,024,743	$4,632	$858
St. James	$16,265	$93,138	$7,443,881	$3,743	$34,373
St. John the Baptist	$38,878	$183,549	$11,439,528	$8,403	$858

St. Landry	$96,645	$92,149	$13,299,187	$842	$10,277
St. Martin	$7,308	$179,286	$15,924,562	$1,761	$145,966
St. Mary	$353	$78,509	$34,617,551	$3,532	$14,841
St. Tammany	$6,055,785	$907,727	$116,499,172	$572,683	$86,438
Tangipahoa	$4,081,624	$320,804	$22,417,890	$22,591	$98,181
Tensas	$963	$26,941	$78,852	$7,025	$2,236
Terrebonne	$621	$162,086	$105,325,259	$6,387	$26,715
Union	$114,385	$126,315	$117,431	$2,391	$4,642
Vermilion	$2,321	$149,918	$29,576,452	$11,127	$19,897
Vernon	$648,276	$162,281	$1,475,941	$5,736	$14,928
Washington	$704,415	$104,081	$7,827,702	$4,773	$8,762
Webster	$445,566	$91,907	$112,333	$3,333	$10,720
West Baton Rouge	$24,619	$342,510	$5,339,153	$11,017	$2,159
West Carroll	$15,730	$82,688	$39,927	$7,851	$500
West Feliciana	$17,333	$127,212	$980,090	$1,254	$2,060
Winn	$100,861	$62,355	$102,624	$2,047	$6,673
Total Loss	$30,324,536	$13,250,045	$1,241,089,577	$4,032,967	$3,820,196

Crop Loss Results

The following parish-level crop losses were determined for each hazard. All losses represent average annual losses, with the exception of flood hazards.

Parish	Extreme Heat Crop Loss	Drought Crop Loss	Extreme Cold Crop Loss	Hail Crop Loss	Lightning Crop Loss	Tornado Crop Loss	Parish Average Annual Crop Loss
Acadia	$17,137	$2,045,651	$16,082	$910	$55	$105,949	$2,185,783
Allen	$15,914	$1,091,979	$14,880	$129	$51	$219	$1,123,172
Ascension	$14,810	$318,261	$37,322	$117	$48	$13	$370,571
Assumption	$17,229	$2,384,705	$42,819	$541	$55	$83	$2,445,432
Avoyelles	$17,126	$3,752,972	$18,415	$137	$96	$209	$3,788,954
Beauregard	$14,802	$945,399	$13,902	$324	$351	-	$974,778
Bienville	$15,258	$77,426	$17,583	$132	$50	$14	$110,462
Bossier	$14,569	$161,131	$16,801	$117	$48	$121	$192,786
Caddo	$15,099	$8,385,258	$17,378	$1,552	$49	$181	$8,419,517
Calcasieu	$16,202	$2,102,749	$15,089	$129	$52	$5	$2,134,226
Caldwell	$17,671	$89,747	$20,335	$186	$60	-	$127,999
Cameron	$15,914	$335,991	$14,983	$130	$562	-	$367,580
Catahoula	$16,997	$197,421	$18,294	$18,430	$55	$28,665	$279,861
Claiborne	$15,616	$79,240	$17,996	$127	$51	$261	$113,292
Concordia	$17,166	$218,617	$18,414	$16,297	$511	$32,257	$303,261
DeSoto	$12,015	$132,851	$13,913	$397	$40	-	$159,215
East Baton Rouge	$14,348	$517,025	$35,718	$393	$46	$13	$567,544
East Carroll	$17,315	$335,036	$19,965	$17,543	$109	$21,699	$411,667
East Feliciana	$12,976	$765,251	$31,636	$109	$41	$284	$810,297
Evangeline	$16,869	$1,289,329	$17,315	$658	$54	$15	$1,324,240
Franklin	$17,520	$265,814	$20,231	$35,638	$58	$7	$339,268
Grant	$15,623	$79,881	$16,864	$144	$51	$119	$112,682
Iberia	$16,655	$1,035,531	$15,632	$134	$54	$15	$1,068,020
Iberville	$16,550	$481,546	$41,287	$132	$53	$15	$539,584
Jackson	$14,626	$74,453	$16,773	$153	$48	-	$106,052
Jefferson	$13,278	$279,267	$34,379	$230	$44	$29	$327,227
Jefferson Davis	$17,045	$2,199,231	$15,970	$137	$55	$22	$2,232,459

Lafayette	$15,722	$1,853,637	$14,716	$134	$50	$25	$1,884,284
Lafourche	$16,234	$549,846	$40,750	$130	$51	$14	$607,026
LaSalle	$16,293	$82,730	$17,472	$321	$52	-	$116,869
Lincoln	$15,035	$76,325	$17,358	$178	$49	$84	$109,029
Livingston	$13,688	$811,498	$33,896	$107	$44	$586	$859,818
Madison	$17,048	$269,745	$20,010	$28,842	$56	$27,075	$362,776
Morehouse	$17,138	$297,373	$19,656	$611	$56	$24,251	$359,085
Natchitoches	$15,786	$80,098	$16,926	$182	$51	$1,876	$114,919
Orleans	$16,207	$329,739	$40,249	$277	$52	$15	$386,539
Ouachita	$16,619	$84,514	$19,125	$967	$55	$36	$121,316
Plaquemines	$10,545	$205,312	$25,773	$244	$33	$10	$241,916
Pointe Coupee	$17,195	$929,586	$41,210	$138	$55	$15	$988,199
Rapides	$16,735	$1,825,785	$17,967	$2,198	$54	$5,826	$1,868,566
Red River	$15,039	$76,369	$17,323	$130	$50	-	$108,911
Richland	$17,253	$297,442	$20,292	$5,094	$57	$32	$340,169
Sabine	$15,580	$171,978	$16,706	$2,223	$50	$2,232	$208,769
St. Bernard	$14,174	$294,783	$36,184	$246	$47	$13	$345,448
St. Charles	$15,664	$345,926	$39,368	$263	$51	$14	$401,286
St. Helena	$12,856	$1,161,536	$31,824	$104	$41	$283	$1,206,644
St. James	$19,916	$806,192	$40,355	$131	$52	$15	$866,661
St. John the Baptist	$16,230	$329,065	$40,302	$131	$52	$44,177	$429,957
St. Landry	$16,817	$3,485,047	$15,743	$578	$94	$103,768	$3,622,047
St. Martin	$16,750	$1,157,057	$15,731	$134	$54	$15	$1,189,742
St. Mary	$16,991	$1,255,931	$15,957	$137	$55	$15	$1,289,085
St. Tammany	$13,926	$285,219	$35,158	$113	$45	$13	$334,474
Tangipahoa	$13,475	$273,514	$33,813	$108	$43	$10,910	$331,863
Tensas	$17,301	$234,133	$19,955	$31,068	$57	$3,067	$305,582
Terrebonne	$14,392	$436,445	$36,296	$149	$46	$13	$487,341
Union	$15,317	$77,822	$17,682	$398	$74	$3	$111,296
Vermilion	$16,054	$4,095,274	$15,088	$142	$51	$26	$4,126,635
Vernon	$16,182	$6,917	$17,379	$175	$52	$5,834	$46,540
Washington	$13,214	$863,789	$32,972	$107	$48	$3,932	$914,062
Webster	$14,640	$74,322	$16,857	$142	$48	$2	$106,011

West Baton Rouge	$16,783	$401,571	$41,432	$134	$54	$15	$459,988
West Carroll	$17,077	$296,049	$19,679	$2,970	$134	$332	$336,241
West Feliciana	$13,891	$426,917	$33,249	$110	$44	$12	$474,223
Winn	$12,537	$63,494	$13,406	$281	$41	$361	$90,120
Total Loss	**$1,002,631**	**$53,954,740**	**$1,527,834**	**$174,325**	**$4,745**	**$425,091**	**$57,089,365**

Total Loss Results

The following parish level total (property and crop) losses were determined for each hazard. All losses represent average annual losses, and the parish total reflects the summation of these values, to portray the relative risk for Louisiana parishes.

Lightning Loss	Tornado Loss	Flood Loss	Earthquake Loss	Sinkhole Loss	Expansive Soil Loss	Parish Average Annual Loss
$9,318	$1,036,581	$18,425,191	$80,874	$171,242	$674,209	$41,527,000
$11,239	$23,538	$2,671,918	$26,709	-	$156,984	$6,835,707
$111,782	$464,886	$52,340,977	$527,442	$3,242	$7,053,207	$133,336,391
$17,401	$51,615	$19,702,188	$20,474	$2,155	$573,336	$31,356,376
$35,016	$155,369	$28,150,312	$85,809	$-	$108,340	$34,412,643
$24,726	$269,029	$2,126,313	$54,800	$374	$154,403	$8,462,287
$12,892	$157,157	$8,749,796	$45,120	$4,312	$28,391	$9,287,374
$553,584	$9,690,243	$32,912,641	$693,651	-	$489,890	$46,127,201
$34,843	$1,070,304	$16,784,058	$933,517	-	$585,454	$31,322,422
$42,279	$552,635	$169,161,544	$280,885	$177,929	$4,028,018	$247,925,307
$10,112	$81,796	$2,264,200	$32,263	$61	$183,049	$2,915,372
$3,910	$25,496	$139,940,134	$2,724	$8,723	$88,293	$143,337,164
$6,130	$84,293	$5,148,022	$28,071	$1,320	$72,592	$5,774,607
$3,328	$176,354	$10,059,884	$55,921	$112	$34,502	$10,628,460
$8,853	$94,398	$1,472,192	$64,352	-	$172,104	$2,490,377
$2,219	$547,968	$1,394,269	$62,516	-	$72,860	$2,596,654
$258,698	$322,084	$137,866,362	$1,248,538	-	$10,319,714	$238,503,472
$4,638	$78,564	$3,878,129	$92,162	-	$30,131	$4,486,486
$509	$15,314	$1,081,581	$44,754	-	$59,593	$3,682,905
$11,784	$121,108	$3,601,291	$42,786	$1,314	$96,134	$8,651,877
$14,349	$34,865	$1,708,592	$124,207	$3,208	$128,531	$2,568,548
$27,811	$30,166	$1,523,423	$51,665	$-	$220,571	$2,850,668
$28,311	$147,671	$24,461,415	$64,541	$3,429	$907,874	$54,450,631
$3,341	$26,597	$3,067,641	$40,872	$18,741	$643,170	$10,972,147
$6,210	$61,560	$12,950,426	$78,972	$347	$157,942	$13,619,862

Jefferson	$13,278	$279,267	$312,244	$192,702	$136,541,928	$1,276,949
Jefferson Davis	$17,045	$2,199,231	$86,092	$167,185	$11,506,461	$2,254
Lafayette	$15,722	$1,853,637	$48,647	$457,005	$102,021,247	$3,824
Lafourche	$16,234	$549,846	$1,451	$214,186	$66,709,800	$7,623
LaSalle	$16,293	$82,730	$136,552	$136,018	$248,638	$3,695
Lincoln	$15,035	$76,325	$354,867	$237,306	$192,029	$10,960
Livingston	$13,688	$811,498	$3,021,288	$919,920	$44,095,016	$38,774
Madison	$17,048	$269,745	$2,774	$72,345	$64,720	$41,147
Morehouse	$17,138	$297,373	$88,787	$109,250	$80,092	$48,275
Natchitoches	$15,786	$80,098	$275,526	$116,272	$435,297	$7,733
Orleans	$16,207	$329,739	$701,272	$99,760	$126,031,732	$6,294
Ouachita	$16,619	$84,514	$780,221	$218,020	$788,678	$190,984
Plaquemines	$10,545	$205,312	$14,442	$103,004	$18,477,371	$4,779
Pointe Coupee	$17,195	$929,586	$10,316	$157,600	$2,907,389	$8,035
Rapides	$16,735	$1,825,785	$1,577,914	$186,581	$3,378,896	$5,834
Red River	$15,039	$76,369	$38,831	$87,543	$34,325	$1,116
Richland	$17,253	$297,442	$41,717	$123,860	$129,494	$20,348
Sabine	$15,580	$171,978	$222,821	$147,945	$519,470	$7,644
St. Bernard	$14,174	$294,783	$112,732	$232,720	$28,042,826	$10,006
St. Charles	$15,664	$345,926	$12,185	$273,906	$18,430,989	$12,933
St. Helena	$12,856	$1,161,536	$204,755	$146,652	$1,024,743	$4,736
St. James	$19,916	$806,192	$16,265	$133,494	$7,443,881	$3,874
St. John the Baptist	$16,230	$329,065	$38,878	$223,851	$11,439,528	$8,533
St. Landry	$16,817	$3,485,047	$96,645	$107,892	$13,299,187	$1,420
St. Martin	$16,750	$1,157,057	$7,308	$195,017	$15,924,562	$1,895
St. Mary	$16,991	$1,255,931	$353	$94,466	$34,617,551	$3,669
St. Tammany	$13,926	$285,219	$6,055,785	$942,884	$116,499,172	$572,796
Tangipahoa	$13,475	$273,514	$4,081,624	$354,617	$22,417,890	$22,700
Tensas	$17,301	$234,133	$963	$46,896	$78,852	$38,093
Terrebonne	$14,392	$436,445	$621	$198,382	$105,325,259	$6,536
Union	$15,317	$77,822	$114,385	$143,998	$117,431	$2,789

Vermilion	$16,054	$4,095,274	$2,321	$165,006	$29,576,452	$11,269
Vernon	$16,182	$6,917	$648,276	$179,660	$1,475,941	$5,912
Washington	$13,214	$863,789	$704,415	$137,053	$7,827,702	$4,880
Webster	$14,640	$74,322	$445,566	$108,764	$112,333	$3,475
West Baton Rouge	$16,783	$401,571	$24,619	$383,943	$5,339,153	$11,151
West Carroll	$17,077	$296,049	$15,730	$102,367	$39,927	$10,821
West Feliciana	$13,891	$426,917	$17,333	$160,461	$980,090	$1,363
Winn	$12,537	$63,494	$100,861	$75,761	$102,624	$2,328
Total Loss	**$1,002,631**	**$53,954,740**	**$30,324,536**	**$14,777,880**	**$1,241,089,577**	**$4,207,292**

State Asset Loss Results

The following parish-level state asset losses were determined for each hazard. All losses represent average annual losses, and the parish total reflects the summation of these values, to portray the relative risk for Louisiana parishes.

Tornado Property Loss	Flood Property Loss	Earthquake Property Loss	Sinkhole Property Loss	Expansive Soil Property Loss	State Property Average Annual Loss
$13,359	$264,483	$1,161	$2,458	$9,678	$564,720
$396	$45,354	$453	-	$2,665	$96,967
$884	$99,565	$1,003	$6	$13,417	$252,934
$32	$12,306	$13	$1	$358	$18,059
$3,107	$563,626	$1,718	-	$2,169	$613,148
$2,631	$20,798	$536	$4	$1,510	$73,237
$272	$15,144	$78	$7	$49	$15,884
$98,005	$332,876	$7,016	-	$4,955	$464,577
$17,260	$270,707	$15,057	-	$9,443	$369,397
$8,675	$2,655,299	$4,409	$2,793	$63,227	$3,858,140
$703	$19,452	$277	$1	$1,573	$23,946
$531	$2,915,547	$57	$182	$1,840	$2,978,663
$132	$12,176	$66	$3	$172	$12,996
$4,929	$281,574	$1,565	$3	$966	$294,317
$494	$11,708	$512	-	$1,369	$17,394

$1,688	$4,295	$193	-	$224	$7,508
$2,542	$1,088,251	$9,855	-	$81,459	$1,878,153
$435	$29,644	$704	-	$230	$31,147
$812	$58,440	$2,418	-	$3,220	$155,214
$716	$21,287	$253	$8	$568	$43,313
$340	$16,672	$1,212	$31	$1,254	$21,753
$231	$11,722	$398	-	$1,697	$21,068
$1,989	$329,442	$869	$46	$12,227	$718,947
$1,697	$195,853	$2,609	$1,196	$41,063	$666,066
$325	$68,330	$417	$2	$833	$71,303
$2,055	$1,137,207	$2,624	$87	$65,823	$1,959,151
$2,885	$107,191	$245	$158	$4,777	$199,738
$31,017	$9,195,997	$15,628	$293	$144,007	$12,299,191
$8,429	$4,371,223	$4,097	$546	$111,122	$7,099,945
$1,755	$59,863	$287	-	$623	$65,298
$236,995	$7,413,574	$65,294	$10	$68,790	$7,872,057
$547	$372,036	$798	-	$6,105	$471,545
$13,283	$25,625	$1,800	$38	$1,611	$44,668
$171	$2,984	$701	-	$162	$4,149
$13,398	$304,295	$8,425	$68	$27,019	$396,882
$2,209	$1,152,419	$8,235	-	$188,566	$3,228,318
$133,092	$537,196	$39,211	-	$43,641	$764,099
$25	$56,786	$34	$59	$651	$78,079
$100	$7,885	$78	-	$313	$13,777
$21,506	$3,663,565	$12,152	$1	$25,151	$3,880,300
$41	$14,477	$63	-	$79	$15,006
$343	$16,467	$1,231	-	$1,039	$19,919
$532	$176,950	$366	-	$748	$186,080
$594	$1,126,480	$1,365	$4	$47,611	$1,651,123
$7	$30,104	$13	$3	$505	$34,518
$296	$7,799	$179	-	$687	$22,503
$2	$1,775	$4	$2	$115	$2,850
$7,347	$574,643	$597	-	$16,878	$724,699

St. Landry	$338	$322	$46,542	$3	$36
St. Martin	$46	$1,140	$101,221	$11	$928
St. Mary	$1	$269	$118,584	$12	$51
St. Tammany	$18,442	$2,764	$354,789	$1,744	$263
Tangipahoa	$182,989	$14,382	$1,005,047	$1,013	$4,402
Tensas	$8	$220	$644	$57	$18
Terrebonne	$3	$831	$539,929	$33	$137
Union	$293	$323	$301	$6	$12
Vermilion	$14	$876	$172,769	$65	$116
Vernon	$3,506	$878	$7,982	$31	$81
Washington	$10,637	$1,572	$118,203	$72	$132
Webster	$7,514	$1,550	$1,894	$56	$181
West Baton Rouge	$59	$815	$12,697	$26	$5
West Carroll	$86	$454	$219	$43	$3
West Feliciana	$3,138	$23,032	$177,448	$227	$373
Winn	$3,495	$2,160	$3,556	$71	$231
Total	**$533,438**	**$225,656**	**$15,062,040**	**$42,060**	**$33,865**

Historic Properties Hazard Exposure

Because building and contents values are not available for many historic sites, hazard parameters were extracted for each of the evaluated historic properties, which can help inform risk for these properties.

700 Year Peak Gust Wind Speed (mph)	Hail Days per Year	Flashes/sq. mile/year	Tornado Days per Year	Soil Clay Content of High Swelling Potentiality (%)	Distance to the Nearest High Hazard Potential Dam (miles)	Distance to the Nearest Sinkhole (miles)	Flood Zone
105	2	12	1	<40	1.5	10.4	X
138	2	22	2	>40	64.4	9.8	X
138	2	22	2	>40	64.1	10.1	X
135	1	18	2	>40	50.5	3.5	A
105	2	12	1	<40	1.5	10.4	X
130	0	20	1	<40	35.4	5.5	X
160	0	13	1	<40	103.7	4.7	A
142	1	17	1	<40	51.0	17.6	VE
148	0	19	0	<40	70.0	6.3	VE
139	2	23	2	<40	64.3	9.4	X
105	3	12	1	<40	18.4	24.0	X
139	2	23	2	>40	64.7	9.1	X
139	2	22	2	>40	64.5	9.7	X
105	2	12	1	<40	1.5	10.4	X
105	2	13	1	<40	10.1	20.7	X
119	2	22	2	<40	5.0	7.2	X
139	2	22	2	>40	64.5	9.8	X
120	2	21	2	<40	3.3	7.8	X
139	2	22	2	>40	64.4	9.9	X
109	1	13	1	<40	19.6	14.6	X
105	2	13	1	<40	12.4	15.0	X
105	2	12	1	<40	1.4	10.5	X
131	0	18	1	<40	31.4	2.6	X

113	1	16	1	<40	6.5	20.8	X
105	2	12	1	<40	1.4	10.5	X
119	2	21	2	<40	4.4	7.4	X
119	2	21	2	<40	4.6	7.1	X
139	2	22	2	>40	64.6	9.9	X
139	2	22	2	>40	64.5	9.9	X
135	1	18	2	>40	49.2	2.9	A
130	0	18	1	<40	29.4	4.9	X
114	1	17	1	<40	12.9	14.8	X
105	2	11	1	<40	10.3	17.5	X
139	2	22	2	>40	64.4	9.8	X
105	2	12	1	<40	1.5	10.4	X
104	3	12	1	<40	19.0	13.4	X
144	0	11	1	<40	65.1	13.6	AE
130	0	20	1	<40	36.1	7.7	X
110	1	14	1	<40	9.5	16.4	X
138	2	22	2	>40	64.4	9.8	X
139	2	22	2	>40	64.4	9.7	X
139	2	22	2	<40	64.0	9.6	X
119	2	21	2	<40	4.6	7.0	AE

Historic Properties Hazard Exposure

Because building and contents values are not available for many historic sites, hazard parameters were extracted for each of the evaluated historic properties, which can help inform risk for these properties.

Hail Days per Year	Flashes/sq. mile/year	Tornado Days per Year	Soil Clay Content of High Swelling Potentiality (%)	Distance to the Nearest High Hazard Potential Dam (miles)	Distance to the Nearest Sinkhole (miles)	Flood Zone
2	12	1	<40	1.5	10.4	X
2	22	2	>40	64.4	9.8	X
2	22	2	>40	64.1	10.1	X
1	18	2	>40	50.5	3.5	A
2	12	1	<40	1.5	10.4	X
0	20	1	<40	35.4	5.5	X
0	13	1	<40	103.7	4.7	A
1	17	1	<40	51.0	17.6	VE
0	19	0	<40	70.0	6.3	VE
2	23	2	<40	64.3	9.4	X
3	12	1	<40	18.4	24.0	X
2	23	2	>40	64.7	9.1	X
2	22	2	>40	64.5	9.7	X
2	12	1	<40	1.5	10.4	X
2	13	1	<40	10.1	20.7	X
2	22	2	<40	5.0	7.2	X
2	22	2	>40	64.5	9.8	X
2	21	2	<40	3.3	7.8	X
2	22	2	>40	64.4	9.9	X
1	13	1	<40	19.6	14.6	X
2	13	1	<40	12.4	15.0	X

2	12	1	<40	1.4	10.5	X
0	18	1	<40	31.4	2.6	X
1	16	1	<40	6.5	20.8	X
2	12	1	<40	1.4	10.5	X
2	21	2	<40	4.4	7.4	X
2	21	2	<40	4.6	7.1	X
2	22	2	>40	64.6	9.9	X
2	22	2	>40	64.5	9.9	X
1	18	2	>40	49.2	2.9	A
0	18	1	<40	29.4	4.9	X
1	17	1	<40	12.9	14.8	X
2	11	1	<40	10.3	17.5	X
2	22	2	>40	64.4	9.8	X
2	12	1	<40	1.5	10.4	X
3	12	1	<40	19.0	13.4	X
0	11	1	<40	65.1	13.6	AE
0	20	1	<40	36.1	7.7	X
1	14	1	<40	9.5	16.4	X
2	22	2	>40	64.4	9.8	X
2	22	2	>40	64.4	9.7	X
2	22	2	<40	64.0	9.6	X
2	21	2	<40	4.6	7.0	AE

Changes in Future Hazard Conditions

Billion-dollar weather disasters, already at a relatively high frequency of approximately 2 per year for Louisiana (Figure X.Xa, which appears as Figure 22.3 in the recently available Fifth National Climate Assessment (NCA5; Jay et al., 2023; https://www.globalchange.gov/reports/fifth-national-climate-assessment-overview), have been exacerbated by several recent hurricane strikes (Figure X.Xb; Jay et al., 2023). To project changes in future conditions, NCA5 utilizes output from the Intergovernmental Panel for Climate Change (IPCC) reports, with specialized focus on each U.S. region. While useful, it is noteworthy that Louisiana appears on the southwestern edge of the Southeast U.S. region, both in NCA5 (Figure X.X) and in the IPCC reports (Figure X.Y). Thus, "bulk" projections of climatic changes for the U.S. Southeast may not always best represent the case of Louisiana. Furthermore, textual information in the NCA5 chapters was unavailable at this writing; only the figures and "Key Points" from the regional chapters (including Chapter 22 entitled "Southeast") were available. A key theme emphasized throughout NCA5 is that the risks resulting from current hazards are not distributed equitably, with health, economic, and social inequalities widened and felt disproportionately among those from underserved communities. The following sections describe the rationale behind our projections of changes in future hazard conditions and explain our specialized risk assessment approaches for hazards that did not use the SHELDUS loss methodology.

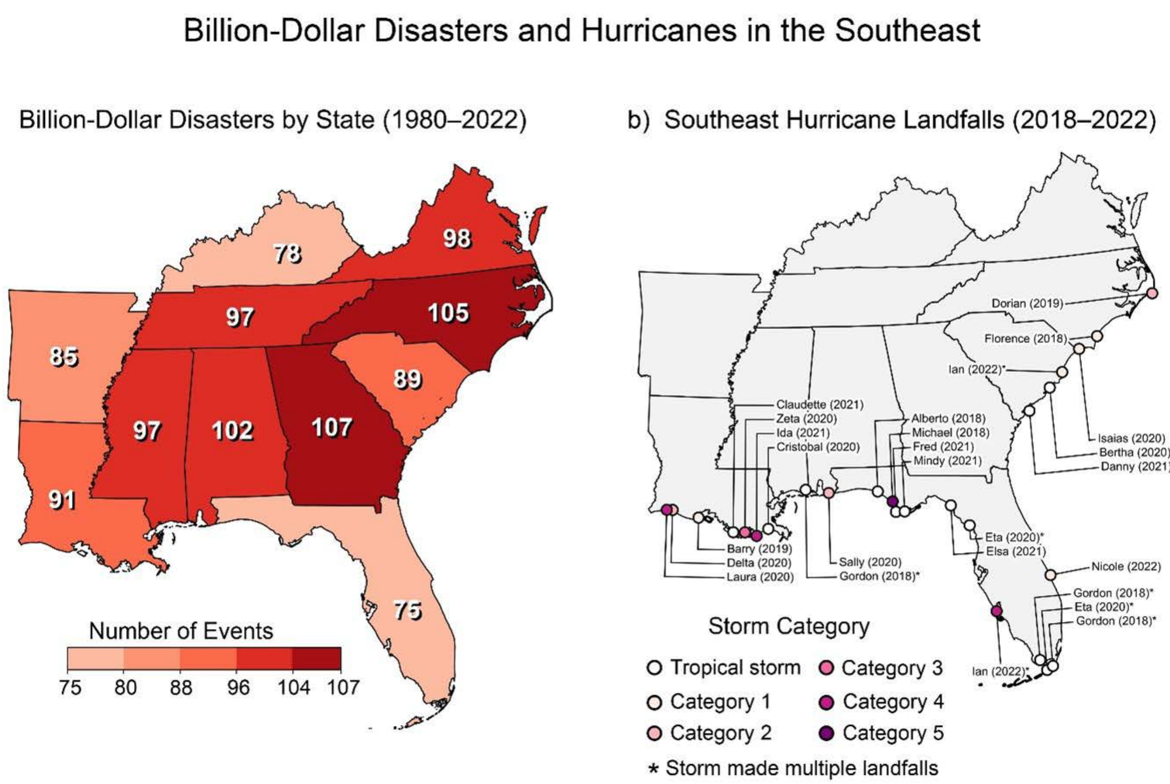

Figure X.X. Billion-dollar disasters and hurricanes in the Southeast (2018-2022): (a) billion-dollar disaster by state (b) Southeast hurricane landfalls (Jay et al., 2023).

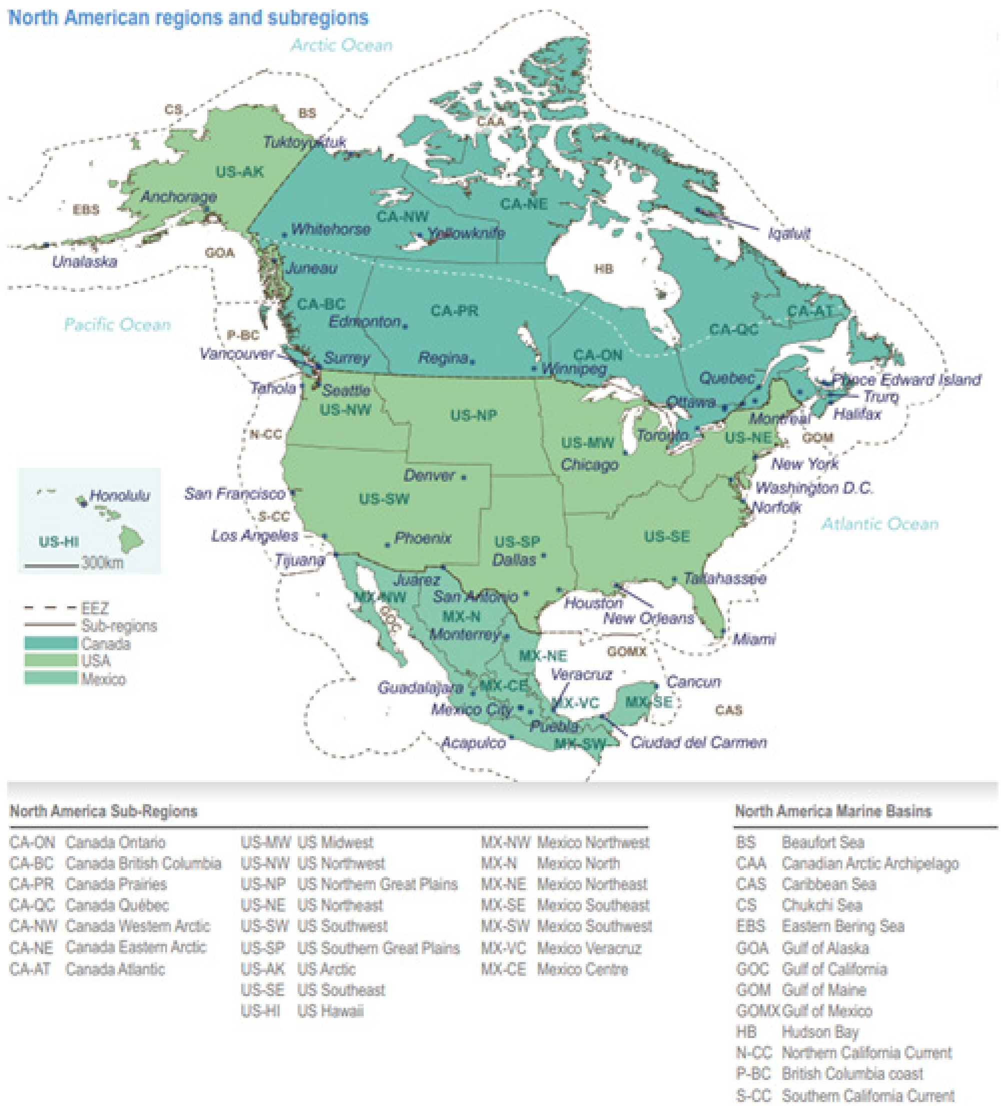

Figure X.Y. North America subregions as depicted in IPCC's (2022) Figure 14.1.

References:

IPCC. (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Pörtner, H.- O., Roberts, D. C., Tignor, M., Poloczanska, E. S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A., & Rama, B. (Eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., https://doi.org/10.1017/9781009325844

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Temperature Hazards

Future Conditions: Extreme Heat and Cold

Our assessment of future vulnerability to extreme temperatures begins with a review of the consensus of the major general circulation model (GCM) output for mean temperature. From that point, more specific estimates of extreme temperatures might be possible. NCA5 (Jay et al., 2023) notes that all U.S. regions are experiencing increasing temperatures and longer-lasting heatwaves. Concurrently, cascading and compounding negative impacts of the more frequent and severe extreme events are increasing nationwide, such as via heat-related illnesses and mortality, increased loss from storms, lengthening droughts, and more frequent and severe wildfires (Jay et al., 2023), all of which exacerbate societal inequalities.

The observed temperature record of the U.S. Southeast region is characterized by a warm peak during the 1930s and 1940s, followed by a cool period in the 1960s and 1970s, with temperatures increasing again since 1970 (NCA, 2017). While the southeastern U.S., including Louisiana, exhibited little or no change in surface temperature from 1986 to 2015 relative to 1901 to 1960 (Wuebbles et al., 2017; their Figure 1.3) and little overall warming over the 20th century (Frankson et al., 2017), the 1986 to 2016 period was up to 1°F warmer than the 1901 to 1960 period in Louisiana, with most of the Louisiana warming concentrated in the northeastern and coastal southeastern parts of the state (Vose et al., 2017). This warming was much less than that reported in most of the northern and western United States.

More recently, Kunkel et al. (2022) reiterates a similar historical temperature climatology for Louisiana, while also noting that Louisiana temperatures have increased by only 0.5°F since 1900 – less than one-third of that experienced by the contiguous U.S. as a whole – but with the 2016 to 2020 period being the warmest five-year interval in that period. The most recent numbers from NCA5 (Jay et al., 2023) would place this amount of warming as only one-fifth of that experienced by the contiguous United States. The spatial distribution of observed warming by season for the U.S. is shown in Figure X.M, and overall warming across the terrestrial and marine Earth is shown in Figure X.N. NCA5 (Jay et al., 2023) also notes the increasing stress from extreme heat on human health in the U.S. Southeast, including Louisiana. The confidence in these conclusions by NCA4 (2017) was reported as "very high," and NCA5 (Jay et al., 2023) forecasts that with projected changes in annual surface temperature compared to the present-day (1991–2020) under a global warming level of 3.6°F (2°C) above preindustrial levels, the U.S. Southeast would experience six more days per year with temperatures exceeding 100°F.

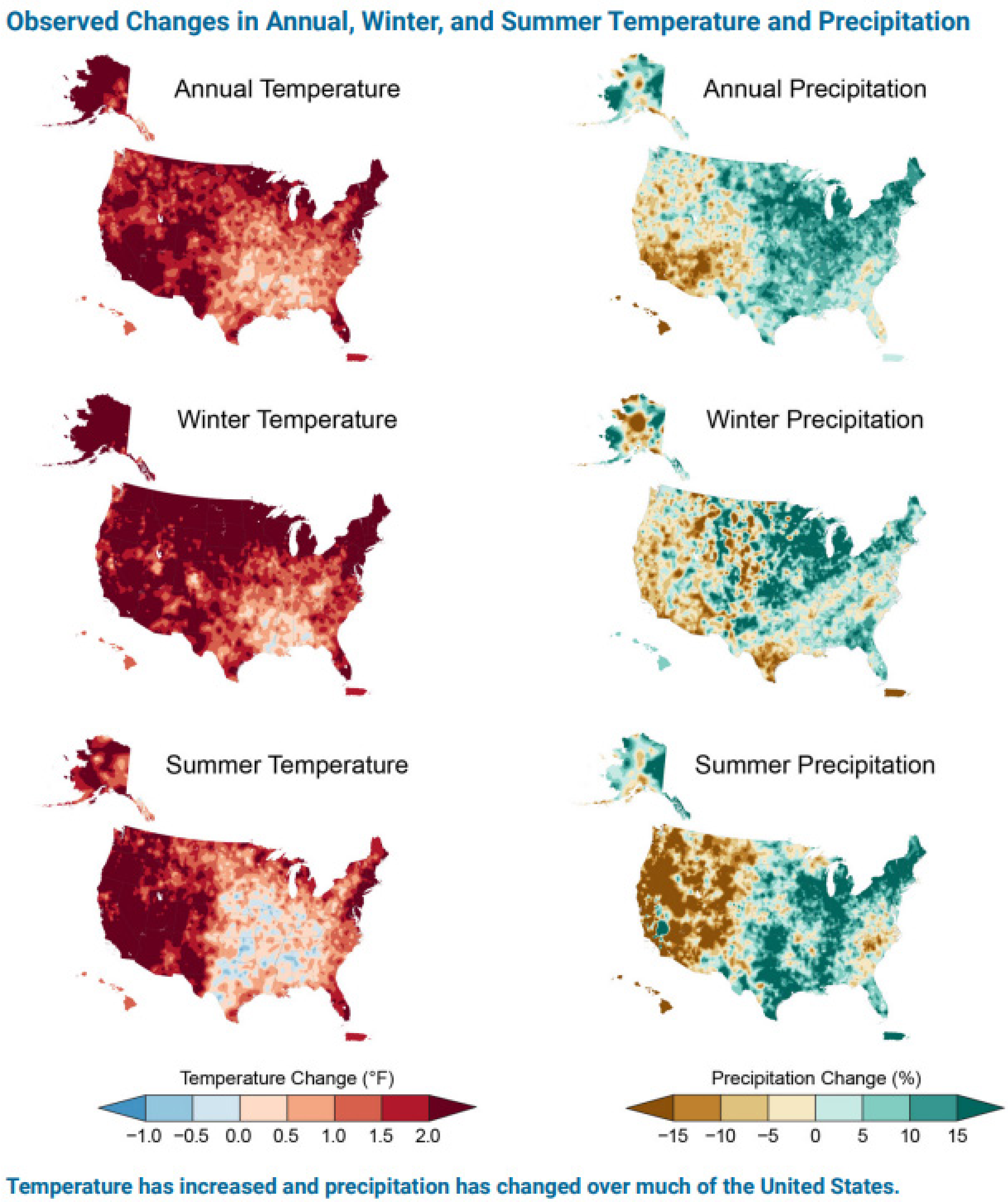

Figure X.M. Spatial distribution of observed temperature and precipitation changes for the U.S., as represented by the 2002 through 2021 means minus the 1901 to 1960 means & Source: Figure 2.4 in Jay et al., 2023.

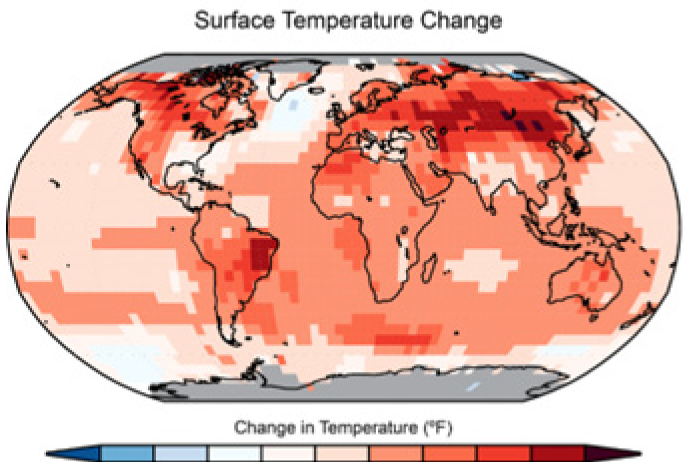

Fig X.N: Surface temperature change (in °F) for the period 1986–2015 relative to 1901–1960 from the NOAA National Centers for Environmental Information's (NCEI) surface temperature product. (Figure source: updated from Vose et al. (2012))

NCA5 summarizes other research that bases outcomes on current policies by estimating a global warming of around 2.6°C (ranging from 2°-3.7°C) by 2100. The prevailing scientific literature suggests that by 2050, warming is expected to intensify for the southeastern U.S., including Louisiana. More specifically, NCA4 (2017) says that "statistically significant warming is projected for all parts of the U.S. throughout the [21st] century...warming rates (and spatial gradients) are greater at higher latitudes." The confidence in these conclusions by NCA4 (2017) is reported as "high." The additional evapotranspiration in the Southeast due to warming, will allow additional condensation and cloud cover, which will in turn suppress further warming. This contrasts with other regions in which moisture is not as abundant. In those regions, the extra energy input will result in higher increases in temperature.

NCA4 (2017) analyzed modeled changes in mean temperature by 2036–2065, as compared to 1976–2005. Two scenarios were chosen, to conform to those used by the Intergovernmental Panel on Climate Change. The higher radiative forcing scenario (Representative Concentration Pathway (RCP) 8.5 (suggesting an increase of 8.5 Watts per square meter of energy loading)) would result in a mean temperature increase of 2–6°F in Louisiana across the two 30-year periods (Figure X.O; same as Figure 6.7 in NCA4 (2017)), with a mean Increase across the U.S. Southeast of 4.30°F. The lower forcing scenario (RCP4.5) would result in 2–4°F increases in mean temperature across Louisiana, with a mean increase by mid-century of 3.40°F for the U.S. Southeast region. Under a higher emissions pathway, historically unprecedented warming is projected for Louisiana by the end of the 21st century (Frankson et al., 2017).

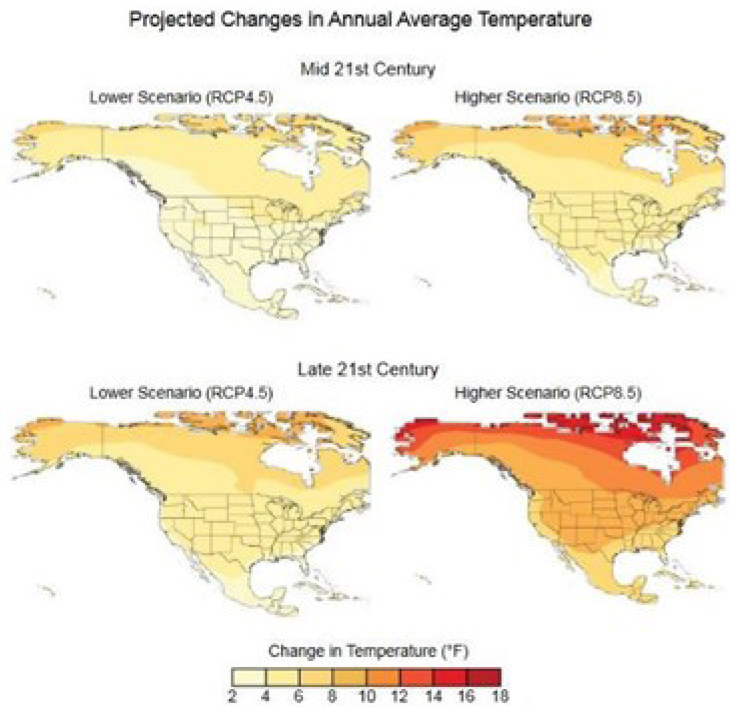

Fig X.O: Projected changes in annual average temperatures (°F). Changes are the difference between the average for mid-century (2036–2065; top) or late-century (2070–2099, bottom) and the average for near-present (1976–2005) (Source: CICS-NC and NOAA NCEI).

NCA4 (2017) also projected changes to temperature extremes. RCP8.5 would increase the temperature of the coldest day of the year by 2–4°F and the warmest day of the year by 2–4°F in Louisiana, except for the extreme coastal southeast, where increases of 0–2°F are projected (Figure X.P – Same as Figure 6.8 in Vose et al., 2017). Mean increases for the U.S. Southeast region are 4.97°F and 5.79°F, respectively (Vose et al., 2017). Louisiana might expect 20 to 30 more days annually with temperatures above 90°F and 1 to 20 fewer days per year with freezing temperatures by the 2036–2065 period (Figure X.Q – same as Figure 6.9 in Vose et al., 2017). Larger increases in extreme high temperature frequency are expected in inland regions, including northern Louisiana. Much smaller increases in the mean number of days per year exceeding 95°F are expected in coastal Louisiana, but these increases are also substantial on a percentage basis. The confidence in these conclusions by NCA4 (2017) about changes to U.S. extreme temperature days is reported as "very high." NCA4 (2017) does not examine the changes to extremes that would occur in an RCP4.5 scenario.

While at the time of this writing, textual detailed projections by U.S. regions are not yet available in Jay et al. (2023), figures from that source are available. Figure X.R (reproduced from Jay et al., 2023) shows that extreme temperature increases will burden households inequitably in much of the U.S. Southeast, including Louisiana, and that Louisiana rivals all of the other U.S. southeastern states in the projected increase in frequency of days at or above 95°F by 2050.

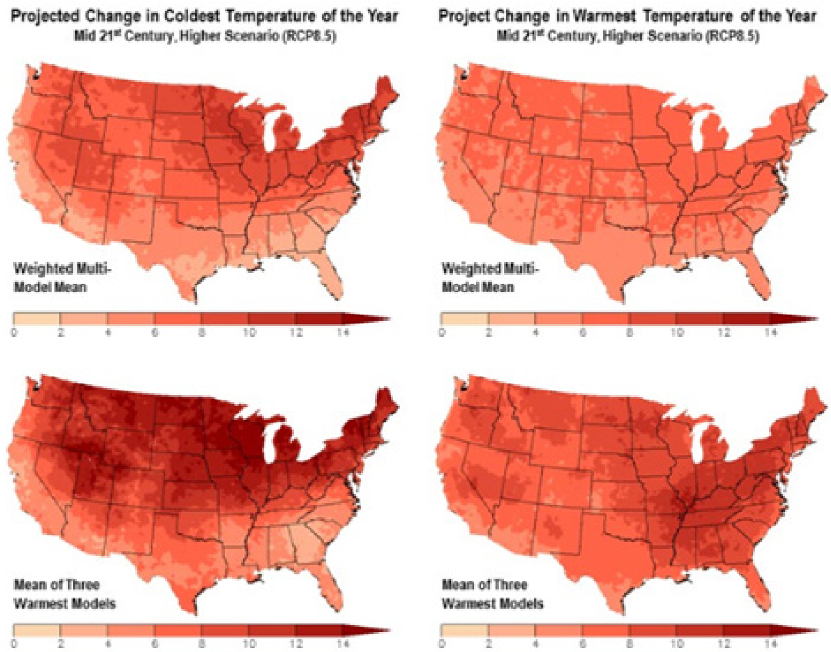

Figure X.P: Projected changes in the coldest and warmest daily temperatures (°F) of the year in the contiguous United States. Changes are the difference between the average for mid-century (2036–2065) and the average for near-present (1976–2005) under the high-emission scenario (RCP8.5) (Source: CICS-NC and NOAA NCEI)

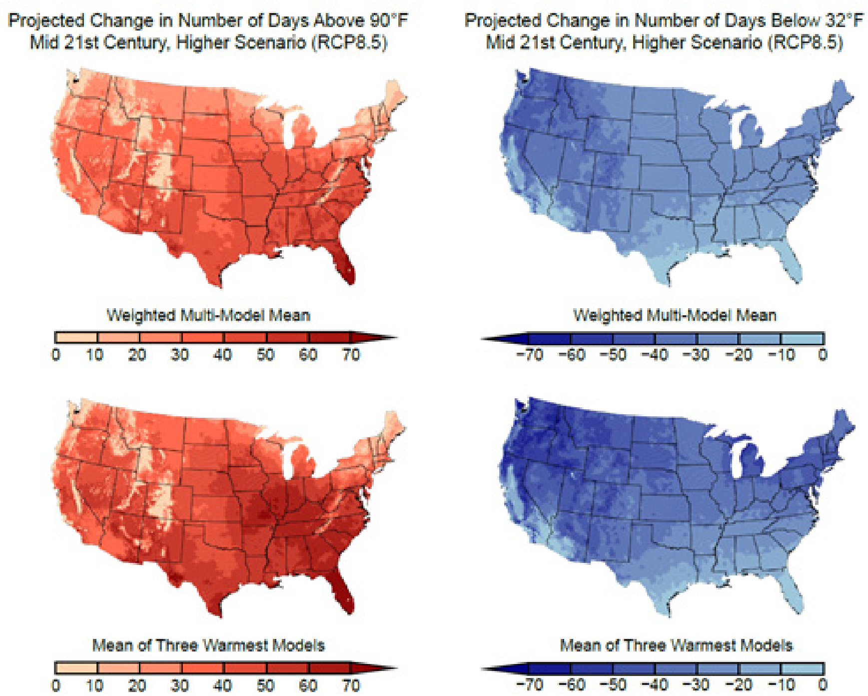

Figure X.O: Projected changes in the number of days per year with a maximum temperature above 90°F and a minimum temperature below 32°F in the contiguous United States. Changes are the difference between the average for mid-century (2036–2065) and the average for near-present (1976–2005) under the high-emission scenario (RCP8.5) (Figure source: CICS-NC and NOAA NCEI)

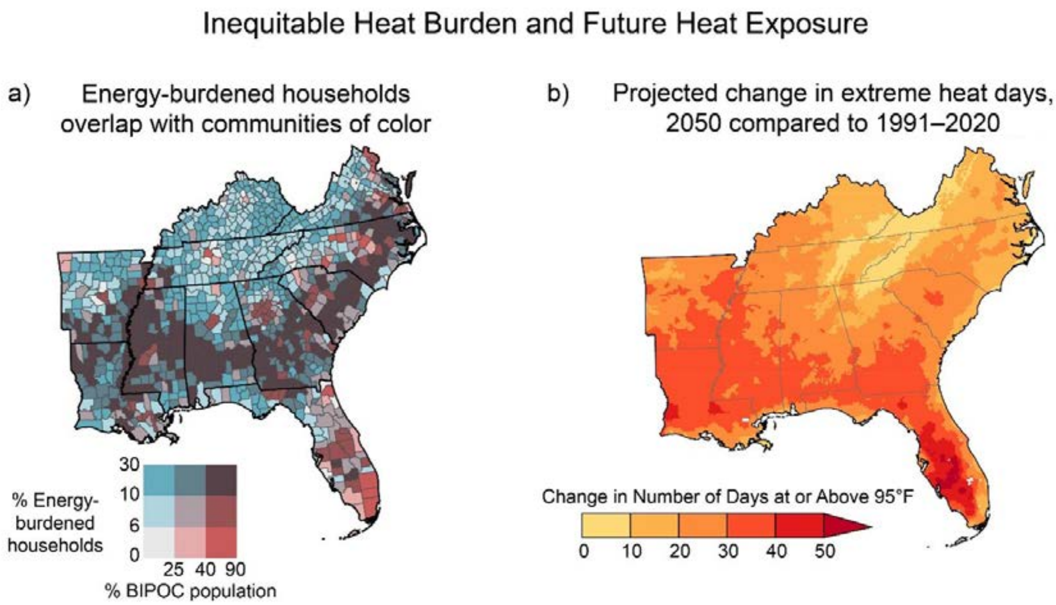

Figure X.R. Energy-burdened households relative to BIPOC populations, and projected change in the number of days with temperatures exceeding 95°F (Figure 22.9 in Jay et al., 2023).

Our study considers a 20 percent increase by the year 2050 in the days per year having maximum temperature exceeding 95°F, based on the data in NCA4 by Vose et al. (2017; their Figure 6.9) and the information in Figures X.P, X.Q, and X.R, although the Vose et al. (2017) figure used 90°F as the threshold rather than the 95°F used in the historical analysis (Mostafiz et al., 2022). According to the Texas A&M's Southern Regional Climate Center "Climate Data Portal," a total of 652 days between 1991 and 2020 (i.e., 21.7 per year) and 261 days between 2011 and 2020 (i.e., 26.1 per year) reached or exceeded 95°F in Baton Rouge (station KBTR). At KSHV, the respective numbers are 1277 and 520 (42.6 and 52.0 per year, respectively). At KMSY, the respective numbers are 508 and 243 (16.9 and 24.3 per year, respectively). If approximately 35 more days per year have a temperature of at least 95°F in Louisiana by 2050, our projection of a 20 percent increase in extreme hot days may be unduly conservative. And others (e.g., Twumasi et al., 2020) project rises in sea level near the Louisiana coast that promote abrupt, strong warming. Nevertheless, the unavailability (at this writing) of textual information in Jay et al. (2023) that explains the rationale and caveats behind their Figure 22.9 leaves us uncomfortable with more aggressive temperature projections than we used for the 2019 update to the Louisiana State Hazard Mitigation Plan. The 20 percent increase used in Mostafiz et al. (2022) passed through the peer review process.

As described in Mostafiz et al. (2020), changes to the extreme cold temperature hazard were assumed to parallel the projected changes to the annual mean frequency of sub- 0°C days. Vose et al. (2017; their Figure 6.9) also estimated such changes. Thus, the number of days per year below 32°F was assumed to decrease by 20 percent by 2050. The 20 percent decrease used in Mostafiz et al. (2020) passed through the peer review process.

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Future Conditions: Drought and Wildfire

The Louisiana droughts and wildfires of 2023 will remain etched in the minds of many for a long time. In fact, the term "flash drought" (Rakkasagi et al., 2023) has recently come into the lexicon to refer to relatively sudden onset of impacts from drought, which come with increased risk as the world continues to warm (Christian et al., 2023). Regardless of the speed of onset, impacts of such droughts are far reaching. For example, Figure 22.16 from Jay et al. (2023) highlights the effects of navigation lock closure on the Calcasieu River (Figure Z.Z).

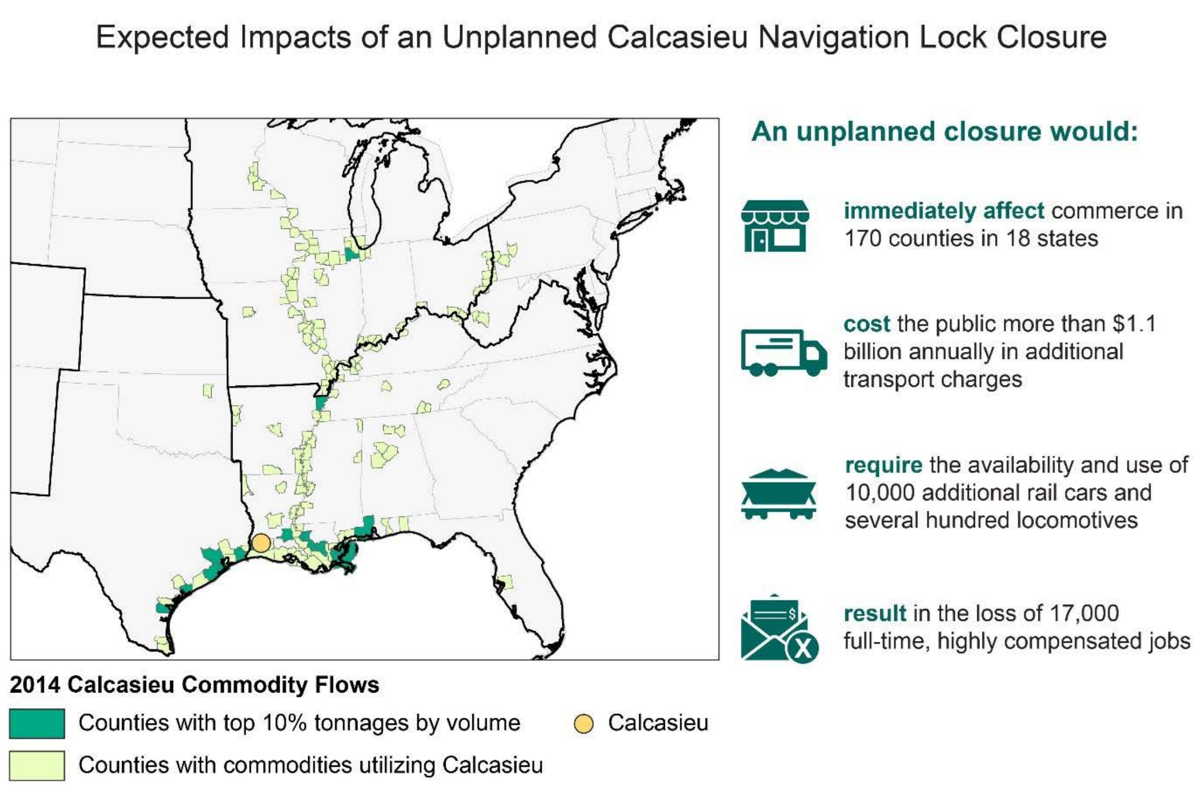

Figure Z.Z. Expected impacts of an unplanned Calcasieu Navigation Lock closure (Jay et al., 2023)

Nevertheless, until the detailed information from Jay et al. (2023) becomes available, I definitive study on future conditions of drought and wildfire in the U.S. remains the Fourth National Climate Assessment (NCA4, 2017). The Drought, Floods, and Wildfire section of that report (Wehner et al., 2017) concludes that:

"The human effect on recent major U.S. droughts is complicated. Little evidence is found for a human influence on observed precipitation deficits, but much evidence is found for a human influence on surface soil moisture deficits due to increased evapotranspiration caused by higher temperatures."

Wehner et al. (2017) suggest that by 2050, daily precipitation will increase by 9–13 percent in Louisiana, with higher increases corresponding to the higher radiative forcing scenario. The report also uses dynamically downscaled model output to find that, for the U.S. in the higher forcing scenario, a more extreme precipitation climate is to be expected by 2100. This includes substantial increases in the frequency of "no precipitation" and the (present) zero-to-tenth-percentile precipitation daily totals, sharp increases in the frequency of days having a greater than 90th percentile of precipitation, and decreases in every other decile of precipitation totals.

The projected increases in temperature and precipitation, and the seasonality of each, would induce changes in soil moisture, which in turn would cause changes in drought and wildfire. Therefore, it is appropriate to search the literature for projected changes in soil moisture by mid-century. Wehner et al. (2017) acknowledge that projections of seasonal precipitation deficits lack confidence. Louisiana precipitation is expected to change little by 2100 (Figure Y.A; Easterling et al., 2017, their Figure 7.5), enhanced evapotranspiration caused by increased temperatures may result in drying soils by 2100 over much of the continental U.S., including Louisiana, at least under the higher radiative forcing and emissions scenario (Figure Y.B; Wehner et al., 2017; their Figure 8.1).

These changes will impact soil moisture availability in Louisiana. Specifically, in Louisiana, winter, spring, and summer soil moisture decreases, made with a "medium" degree of confidence, are projected to be large relative to natural variability (Wehner et al., 2017). For these reasons, an increase in drought hazard of 25 percent was assumed for the state by 2050.

Soil moisture changes could be expected to produce changes in wildfire vulnerability. However, because the Fourth NCA focuses on the western U.S. in its discussion of wildfire, other sources must be used to assess the threat to Louisiana by 2050. Prestemon et al. (2016) used three general circulation models and three IPCC-based emission scenarios to assess future conditions of wildfire in the U.S. Southeast; the study concluded that median annual area affected by lightning-ignited wildfire will increase by 34 percent, and that total wildfire will increase by 4 percent by 2056–60 compared with the years 2016–2020.

A few other studies have been conducted in the last 15 years to make projections to changes in wildfire vulnerability. For such purposes, the Keetch-Byram Drought Index (KBDI), which is calculated based on observed or simulated changes in maximum temperature and precipitation, is most useful. The KBDI was developed by the U.S. Forest Service using a water balance approach. Specifically, it examines the relationship of modeled evapotranspiration (driven largely by temperature and latitude, the latter of which controls sun angle and number of hours of daylight) to precipitation in the organic matter on a forest floor and in the highest soil layers. The KBDI represents the number of millimeters of precipitation required to saturate the soil (i.e., reduce the KBDI to zero). Values from 0 to 200 indicate minimal wildfire threat, with values of 200 to 400 suggesting that the lower litter layer is drying and beginning to be susceptible to drought. Values from 400 to 600, which are more typical of late summer and early autumn, indicate that there is a moderate burn potential. Values of 600 to 800 are associated with more severe drought and active potential for burning.

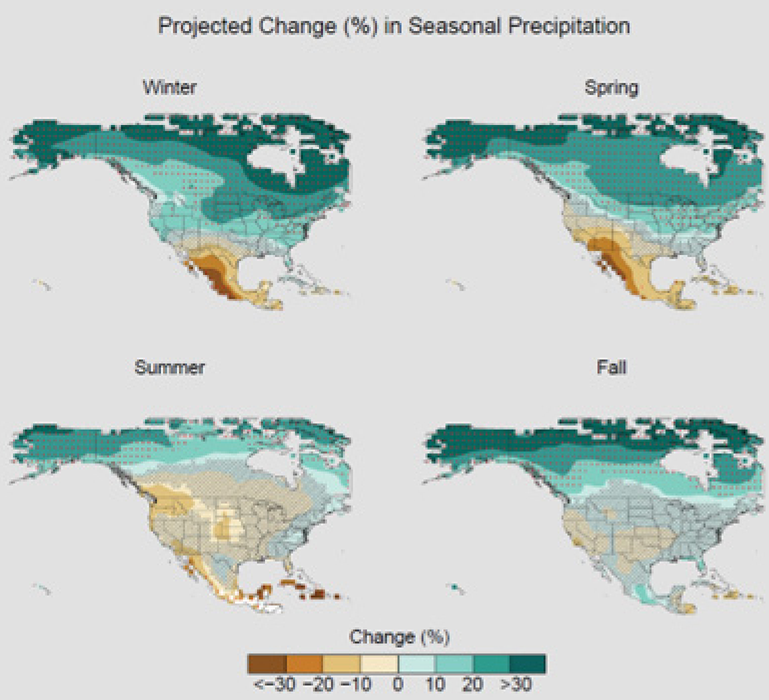

Figure Y.A: Projected change (%) in total seasonal precipitation from CMIP5 simulations for 2070–2099 (Source: NOAA NCEI)

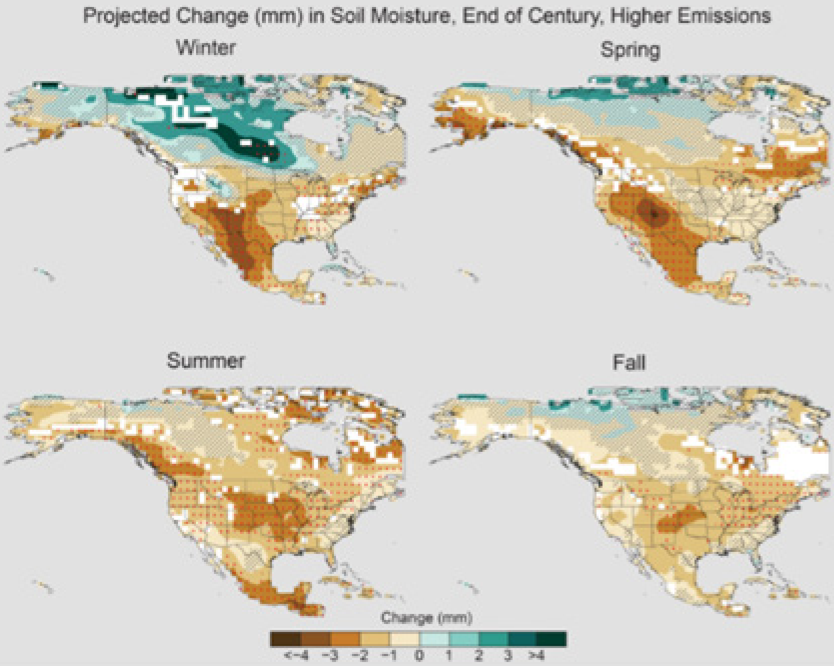

Figure Y.B. Projected end of the 21st century weighted CMIP5 multimodel average percent changes in near surface seasonal soil moisture under the higher scenario (RCP8.5). Stippling indicates that changes are assessed to be large compared to natural variations. Hashing indicates that changes are assessed to be small compared to natural variations. Blank regions (if any) are where projections are assessed to be inconclusive (Appendix B). (Source: NOAA NCEI and CICS-NC).

Liu et al. (2009) modeled seasonal changes to the KBDI (Figure Y.C) using the A2a scenario – the “non-fossil-intensive” variety of the “A2” scenario that had been used by NCA before its Fourth Assessment Report. The A2a scenario assumed that global population surpasses 10 billion by 2050, with relatively slow economic and technological development, creating global CO_2 mixing ratios of 575 parts per million (ppm) by 2050 and 870 ppm by 2100 (compared to the current 407 ppm). Validation of output from four general circulation models for global climate for the 1961–1990 period led Liu et al. (2009) to conclude that the Hadley Centre climate model version 3 (Pope et al., 2000) is most effective for simulating global KBDI for the 2070–2100 period. Figure Y shows those projected changes to the KBDI (2070–2100 minus 1961–1990) for the United States. In autumn and winter (September through February), decreases of 50–150 mm per three-month period were forecasted in Louisiana, while in March through May and June through August decreases of 200–250 mm per three-month period were projected in Louisiana.

The midpoint of the time series of the projection by Liu et al. (2009) is 2085, so we assumed that half of the projected changes in KBDI will occur by 2050. Thus, decreases of 25–75 mm per three-month period (or 8–25 mm per month, with 17 mm per month as the midpoint) are projected for each month from September through February in Louisiana by 2050. Decreases of 100–125 mm per three-month period (or 33–42 mm per month, with 38 mm per month as the midpoint) are projected for each month from March through August in Louisiana by 2050 (Table 1). Recent research (Krueger et al., 2017) suggests that the fraction of available water (FAW) is a better predictor of large growing-season wildfires than the KBDI. FAW is calculated as the ratio of plant available water to soil water capacity. But FAW has not yet been projected as confidently to 2050 as precipitation. Other research from northern Europe (Bakke et al., 2021) points to shallow volumetric soil water anomaly as the dominant wildfire predictor; as remotely-sensed data become more precise, such a variable may become a more appropriate indicator of wildfire likelihood. Yu et al. (2023) found that regional-climate-model-based changes in the mean number of days that exceed the 95th percentile of four fire danger indices to 2100 is higher in the south-central U.S., which includes Louisiana, than elsewhere in the continental United States.

To provide more detail for Louisiana based on Liu et al.'s (2009) results, we collected average monthly precipitation data for 31°°N, 91.5°°W from the Web-based, Water-Budget, Interactive, Modeling Program (WebWIMP, http://climate.geog.udel.edu/~wimp/wimp_map_input.php). Results suggest that decreases in soil moisture in the upper layers of 12.2 percent (February) to 46.1 percent (August) are projected.

Based on these model results and other recent research which suggests a future increase in lightning-ignited wildfire for some parts of the world, though not necessarily the U.S. Southeast (Pérez-Invernón et al., 2023), we project a 25 percent decrease in available moisture in the organic matter and uppermost soil layers and a 25 percent increase in wildfire occurrence across Louisiana by 2050. Our projections are not without their caveats. For example, these changes do not consider projected changes in global air temperature. According to NCICS (https://statesummaries.ncics.org/la), Louisiana's mean air temperature trends have not mimicked global temperature trends, as:

> "Louisiana has exhibited little overall warming in surface temperatures over the 20th century. However, under a higher emissions pathway, historically unprecedented warming is projected by the end of the 21st century."

The changes described here assume no change in temperature by 2050 from current values. Nor do they consider the precipitation changes expected to replenish the soil layers during wet times but also desiccate the soil more rapidly during the lengthening dry periods. And projections for increases in wildfire in the western U.S. are more aggressive 50 percent, albeit from the 2001–2010 to 2050–2059 period (Liu et al., 2021). Thus, despite the fact that our use of a 25 percent increase in wildfire occurrence has passed peer review (Mostafiz et al., 2022), caution should be exercised in our interpretation of the results.

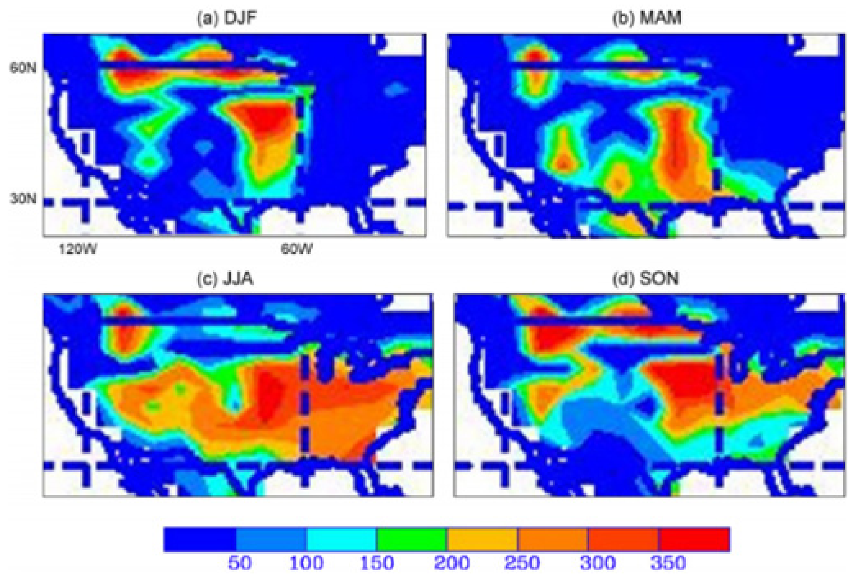

Figure Y.C: Projected changes to KBDI (mm) by annual quarter (Liu et al., 2009)

Table 1. Current monthly precipitation and projected decrease in KBDI and available water for precipitation by 2050, for 31˚°N, 91.5°˚W.

Month	Mean current precipitation (mm)	Projected decrease (mm) in available moisture in upper litter layers (KBDI)	Projected decrease in available water as a percentage of current precipitation (%)
January	133.8	17	12.7
February	139.5	17	12.2
March	159.7	38	23.8
April	130	38	29.2
May	132.6	38	28.7
June	95.6	38	39.7
July	94	38	40.4
August	82.4	38	46.1
September	80.1	17	21.2
October	74.1	17	22.9
November	113	17	15.0
December	128.6	17	13.2

Regarding risk, the most recent research suggests that the impacts of drought on the agricultural sector in the U.S. Southeast (which includes parts of Louisiana) is up to 42.7 and 25.4 percent for maize and soybean, respectively (Nguyen et al., 2023).

Wildfire Risk Assessment:

Property loss due to wildfire is calculated as

$$L_{2050,i} = PV_{2050,i} \times p(f)_i \times p(d|f_i) \times d \times F_{2050,i}$$

where

$L_{2050,i}$ = projected annual property loss of census block i in 2050

$PV_{2050,i}$ = estimated total property (building + content) value of census block$i$ in 2050

$p(f)_i$ = probability of fire occurrence of census block i

$p(d|f)_i$ = conditional probability of damage of census block i when a fire occurs

d = average percent of damage for each damaged building

$F_{2050,i}$= future hazard multiplication factor for census block i in 2050

We summed the probability of large fires from FSim and calculated the annual probability of small fires using FPA data. Based on LDAF records 2007–2017, 12,979 Louisiana residences have been threatened by fire. Of these, 389 were damaged and 12,590 were protected, a relative damage frequency of 0.03. Therefore, p(d|f) = 0.03. The losses were calculated, assuming that 3% of buildings exposed to fire were damaged, with a relative loss of 5% of the value of each building.

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Wind and Flood Hazards

Future Conditions: Tropical Cyclones

Future vulnerability to tropical cyclones has been a topic of intense scrutiny in scholarly literature of the last decade. On the one hand, several natural processes linked to enhancement of tropical cyclones might seem to become more favored in a warming world. For example, warming would increase the geographic extent at which water temperatures are high enough to provide the energy required to support or enhance a tropical cyclone and/or lead to a longer period in the year in which tropical cyclones may occur. Also, because the Earth's surface is anticipated to warm at a greater rate than the upper-level atmosphere, thermal turbulence and atmospheric instability would be enhanced, possibly leading to more evaporation from the surface. Atmospheric water vapor capacity would also increase under warmer conditions. Furthermore, a warming world could also be likely to cause a poleward retreat in the west-to-east-moving subtropical and polar front jet stream, both of which separate tropical air from much colder air. Because the jet streams shear the tops off developing tropical cyclones, their migration poleward would provide a more favorable environment for growth of tropical systems, unimpeded by the shear that might weaken them or carry them eastward across the Atlantic Ocean, away from Louisiana. These concerns are exacerbated by research that suggests a tight positive linkage between global temperature and tropical cyclone activity via feedback related to ocean mixing and transport, including rapid intensification (e.g., Sriver, 2010; Singh and Roxy, 2022).

On the other hand, simulation models do not necessarily agree that the frequency of tropical cyclones will increase in a warming world. Bengtsson et al. (2007) projected a 20 percent decrease in frequency by the end of the 21st century, including a 5–10 percent decrease in the Gulf of Mexico from the 20th to the 21st century. Ensemble modeling by Colbert et al. (2013) suggested that the weakening easterly trade winds under double CO_2 conditions (i.e., 720 ppm) by 2100 would decrease the frequency of tropical cyclones in the Gulf of Mexico by one to 1.5 per decade. Wang and Wu (2013) isolated the impacts of global warming from that attributable to the Atlantic Multidecadal Oscillation (AMO) – a naturally-occurring warm-cold oscillation of Atlantic Ocean temperatures that began its most recent warm phase in 1995 – with the conclusion that global warming causes an eastward shift in the Atlantic tropical cyclone genesis zone, while the warm-phase AMO is responsible for basin wide enhancement. The implication is that frequency may decrease when the AMO flips back to the cold phase in the coming decades. Work summarized in the Fourth National Climate Program Assessment (Kossin et al., 2017) suggests that, with low confidence, the frequency of the most intense Atlantic tropical cyclones is projected to increase. More recently, Chand et al. (2022) concurred that global tropical cyclone frequency would decrease under additional warming; while an increasing frequency trend in the North Atlantic basin has been noted over the last few decades, perhaps because of reduced aerosol forcing and other factors, these researchers otherwise found no statistically significant trend when an extended period of reconstructed observational data are considered.

The impact of global warming on the intensity of tropical cyclones, however, is a different matter. Bengtsson et al. (2007) projected no decreases, and perhaps a substantial increase, in the frequency of the most intense tropical cyclones. Tory et al. (2013) confirmed such projections with a new generation of models. More recent research on the topic generally seems to confirm the "increased intensity" conclusions of previous studies, with warning of additional dangers associated with the increased intensity of tropical cyclones under a warming global climate. For example, Moore et al. (2015) concurred with the previous conclusions, while also anticipating a decrease in the periodicity of the El Niño/Southern Oscillation, which is known to suppress Gulf-Caribbean-Atlantic tropical cyclone activity. The resulting increased interannual variability could leave people uncertain of the trend of the hazard. Walsh et al. (2016) projected increases in tropical cyclone precipitation intensities in addition to the changes previously discussed. Such precipitation could increase even farther inland than today. Sun et al. (2017) noted that the area of the tropical cyclone-induced high winds will increase under global warming scenarios. And Appendini et al. (2017) warned that the wave activity associated with tropical cyclones will likely increase in the northern Gulf of Mexico under global warming scenarios. The Fourth National Climate Assessment (Kossin et al., 2017) provides an ominous reminder that atmospheric scientists tend to be converging toward a conclusion on the matter:

> "Both theory and numerical modeling simulations generally indicate an increase in tropical cyclone (TC) intensity in a warmer world, and the models generally show an increase in the number of very intense TCs. For Atlantic and eastern North Pacific hurricanes and western North Pacific typhoons, increases are projected in precipitation rates (high confidence) and intensity (medium confidence)."

Most recently, Feng et al. (2023) and Garner (2023) are among those who have found increasing intensity in North Atlantic tropical cyclones in a warming world. Yet there is still marked uncertainty (Méndez-Tejeda &Hernández-Ayala, 2023). Thus, more work is needed, particularly under assumptions of less drastic increases in CO_2 emissions, with a focus on the middle of the 21st century rather than the end, and at the regional rather than the basin wide scale.

Scholars have also estimated the future impacts resulting from such a consensus of increases in intensity and/or frequency of the most intense tropical cyclones. While emphasizing the inherent uncertainty and difficulty with projecting the future tropical cyclone hazard, Knutson et al. (2010) cautiously projected no major macro-scale changes in tropical cyclone genesis location, tracks, duration, or areas of impact, but cautioned that the future vulnerability to tropical-cyclone-induced storm surge-related flooding will increase due to sea level rise and coastal development. Ranson et al. (2014) used ensemble models to project a 63 percent increase in tropical cyclone damage in the North Atlantic basin – the highest increase of any basin in the world. Most recently, Petrolia et al. (2022) found that "FORTIFIED" coastal home construction reduces wind risk and insurance costs while increasing a home's value.

Regardless of projections of the impact of global warming on regional tropical cyclone activity, Louisiana will always be in a geographic position in which tropical cyclones may track. Any increased intensities in the future, even with decreased frequencies, are likely to enhance Louisiana's future vulnerability, given that the intense storms have enormous potential to devastate the physical, urban, agricultural, economic, and sociocultural infrastructure of our state. We project a 25 percent increase in the future vulnerability to tropical cyclones, with a near-certain expectation that Louisiana will experience another major tropical cyclone before mid-century.

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Future Conditions: High Wind

Future frequency of high wind events is particularly difficult to predict, because high wind may accompany many different types of storms, each with their own distinct patterns of projected changes. *NCA4 (2017) is again the most comprehensive source that synthesizes recent research on the topic. That document reports:*

> "Climate models consistently project environmental changes that would putatively support an increase in the frequency and intensity of severe thunderstorms (a category that combines tornadoes, hail, and winds), especially over regions that are currently prone to these hazards, but confidence in the details of this projected increase is low."

More recent literature (Jung and Schindler, 2019) suggests that under the RCP8.5 scenario of future human activities, 10-m mean wind speed distributions increase in some parts of the world but decrease in others, including in much of the United States. But the mean wind speed changes may not necessarily be correlated with those of extremes. Meucci et al. (2020) projects a general increase in wind-driven wave heights under medium- and RCP8.5 scenarios. Even though the frequency of the most intense tropical cyclones and tornadoes is expected to increase, such events are rare. High-wind events are much more commonly linked to thunderstorms, for which there is presently little evidence of a major frequency change by mid-century. And with an increasing trend toward building wind resilient structures as they become more widely recognized as profitable (Petrolia et al., 2023), we estimate no change to future conditions.

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Future Conditions: Hail

Hail has been studied fairly comprehensively for temporal trends and relationship to global climate change. As was described in the severe thunderstorm future vulnerability section, several counteracting potential forces seem to be at work. Increases in surface temperatures, at a rate exceeding the increase in upper-atmospheric temperatures, would destabilize the atmosphere further. In other words, the warmed air at the surface would acquire increased buoyancy, allowing for enhancement in vertical cloud growth, assuming that adequate moisture is present, which would in turn support stronger and perhaps more frequent hail events. The energized atmosphere under global warming situations would also presumably provide more evaporation over the oceans, which would indeed contribute the moisture needed to produce the enhanced cumulonimbus clouds that would support hail-bearing thunderstorms. However, an atmosphere in which the poles warm more strongly than the tropical parts of the Earth might be expected to weaken the tropical-to-pole gradient of energy, and therefore weaken frontal boundaries separating the two, making hail-bearing thunderstorms less frequent and intense. Likewise, any increases in atmospheric temperature might be more likely to allow hail to melt partially or completely when precipitating, but with high uncertainty in projections of net changes in hailstone diameter (Raupach et al., 2021).

In China, observational reports of a decrease in both the number of hail days (Xie et al., 2008) and the size of hail (Ni et al., 2017) have been identified. In a follow up study, Xie et al. (2010) found no significant trends in hail size across five provinces analyzed, as increases in convective available potential energy (CAPE) – a thermodynamic indicator of severe thunderstorms that often produce hail – tended to be offset by an increase in the height of the freezing level, which would tend to oppose hail generation. These results generally support the notion that opposing meteorological factors are at work.

Recent studies in various other world regions often have conflicting results regarding future hail occurrences. For example, modeling work suggests future decreases in CAPE in southeastern Australia under enhanced greenhouse concentrations (Niall and Walsh, 2005). However, Leslie et al. (2008) disagrees, reporting model simulations of a gradual increase in frequency and intensity of hailstorms in the Sydney Basin out to 2050. In Europe, Sanderson et al. (2015) projected a decrease in damaging hailstorms in the United Kingdom throughout the 21st century. Dessens et al. (2015) generally concur for the southern Atlantic French coast, forecasting a slight decrease in the number of hailstorms, but with no significant change in hail frequency by 2040. On the other hand, observational studies suggest that synoptic environments that favor hail precipitation have increased in the Mediterranean region (Sanchez et al., 2017) and much of central Europe (Mohr and Kunz, 2013). Bayesian modeling suggests a modest increase in the number of hail days by 2031–2045 in Germany (Kapsch et al., 2015). In the U.S., Mahoney et al. (2012) used high-resolution modeling to predict substantial decreases in hail frequency in the Colorado mountains by mid-century (2041–2070). But Allen (2017) disagreed, suggesting a potential increase in both the mean hail size and the frequency of major hailstorms in North America. Brooks (2013) summarized previous work by suggesting that CAPE can be expected to increase in the future, while wind shear will decrease, leaving the net effect on tornado and hail occurrence in the future open to question. Again, this conclusion supports the notion that theoretical factors important to generating hail under a warming climate are in opposition.

Closer to Louisiana, Brimelow et al. (2017) used sophisticated modeling techniques to conclude that fewer days of small, medium, and large hail are expected over much of North America over the 2041–2070 period, including the U.S. Southeast and Louisiana, in spring and summer (Figure X). Figure X does suggest some possible increase in the frequency of large hail for southeastern Louisiana.

The Fourth National Climate Assessment (2017) cites Allen and Tippett (2015) in reaching the conclusion that although evidence exists for an increasing hail frequency in the U.S., the uncertainty in reported hailstone size reduces the confidence in projections (Kossin et al., 2017). Robinson (2021) cites projections by Trapp et al. (2019) of minor increases in mean number of spring hail days for much of the central and eastern U.S., counteracted by a decrease in summer hail occurrence over the eastern United States. Given the conflicting theoretical impacts of hail above, the comprehensiveness of the Brimelow et al. (2017) work, and the near certainty of an increased population to be impacted, we project 10 percent decrease in the future vulnerability to hail in Louisiana by mid-century (Mostafiz et al., 2020, 2022).

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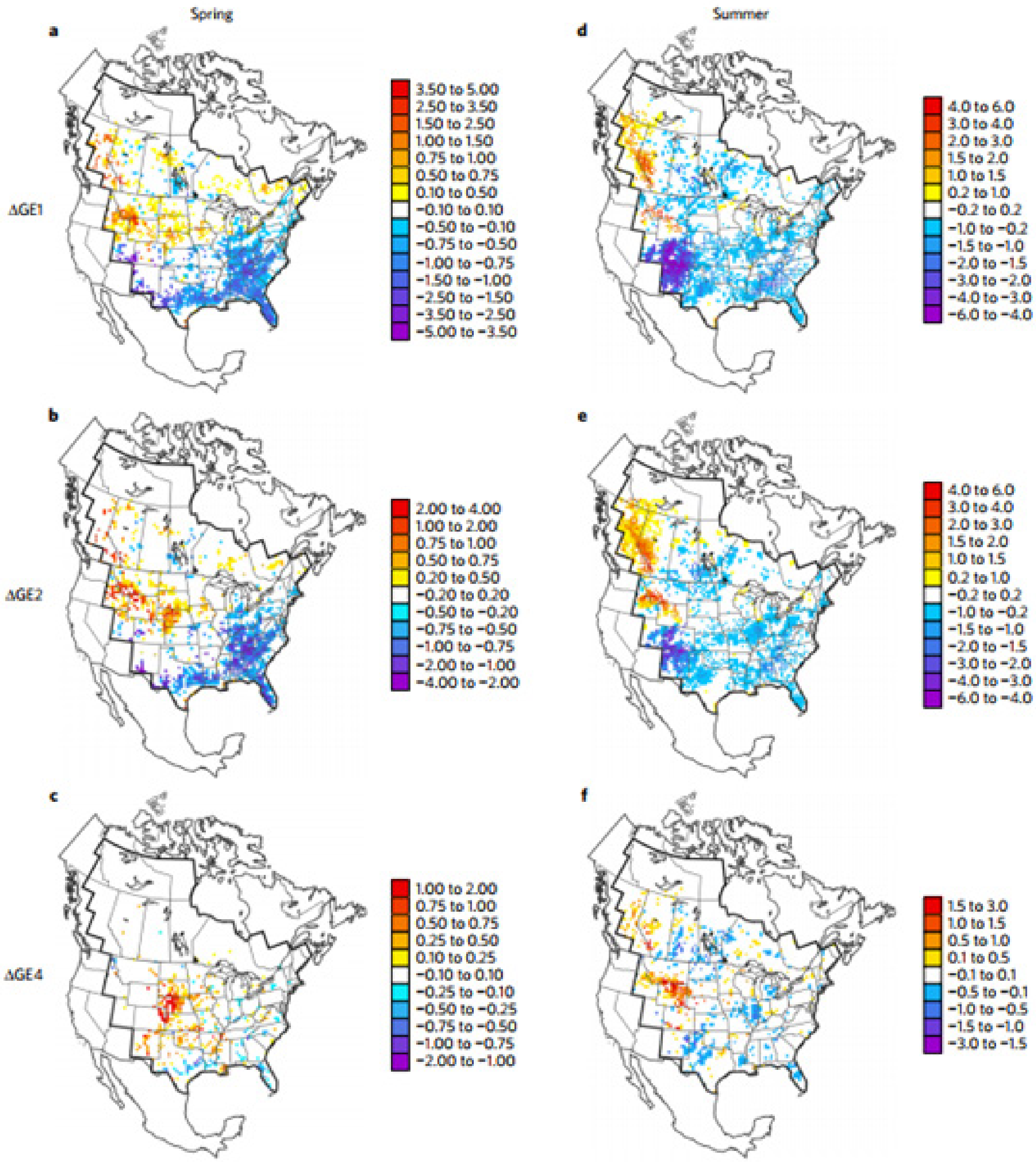

Figure 1 | Spatial changes in hail diameter classes for spring and summer. a–c, Mean multi-model changes in future (2041–2070) minus present (1971–2000) for spring hail days (GE1; $D_s \geq 1.0$ cm) per season (**a**), severe hail days (GE2; $D_s \geq 2$ cm) per season (**b**), and very large-hail days (GE4; $D_s \geq 4$ cm) per season (**c**). **d–f**, The same variables as for **a–c**, except for summer. Coloured cells indicate mean changes for all model pairings that agree on the direction of change; cells with coloured circles indicate mean changes for at least two model pairings that are statistically significant (90% significance).

Source: Verbatim from Brimelow et al. (2017)

Future Conditions: Lightning

Future changes to lightning frequency in the southern U.S. are not discussed directly in NCA4 (2017), nor is the topic covered extensively in the refereed literature. Etten-Bohm et al. (2021) note the wide range in future lightning predictions. As was described in the assessment of future conditions for high winds, there is currently low confidence in projection of severe thunderstorms. Furthermore, there is even less evidence for changes in weak to moderate thunderstorms. Because weak to moderate thunderstorms are much more frequent than severe thunderstorms, collectively they produce most of the lightning strokes. Therefore, there is very little certainty in any changes in lightning by mid-century. Recent research from China (Yang et al., 2018) suggests that future increases can be expected. For the U.S., a suite of 11 general circulation models predicted mean increases in lightning strikes for the 2079-2088 period of between 3.4% and 17.6% per °C of temperature increase (Romps et al., 2014). Yet Finney et al. (2018) projected a 15 percent global decrease in total flash rates by 2100 under RCP8.5. Based on the preponderance of evidence a 10 percent increase in the lightning hazard is assumed here for Louisiana by 2050 (Mostafiz et al., 2020, 2022).

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Future Conditions: Tornadoes

The updraft of air in tornadoes always rotates because of wind shear (differing horizontal speed height), and it can rotate in either a clockwise or counterclockwise direction. Clockwise rotations (in the northern hemisphere) will always result in near-immediate demise, but counterclockwise rotations (in the northern hemisphere) will sustain the system, at least until other forces cause it to die seconds to minutes later.

The Enhanced Fujita (EF) Scale is used to classify tornadoes based on their damage pattern, not wind speed; wind speed is then derived and estimated. This contrasts with the Saffir-Simpson scale used for hurricane classification, which is based on measured wind speed.

Enhanced Fujita (EF) Scale.

ENHANCED FUJITA SCALE						
	EF0	EF1	EF2	EF3	EF4	EF5
Wind Speed	65-85 mph	86-110 mph	111-135 mph	136-165 mph	166-200 mph	>200 mph

Any estimates on changing tornado frequencies or intensities should begin with an assessment of the likelihood of changing precursor conditions for tornadoes. Increases in the frequency of convergence of very warm, humid air masses with very cold air masses and/or increases in the intensity of the temperature gradient across air masses would be likely to increase the tornado frequency and/or intensity, and therefore presumably increase vulnerability to tornadoes. Likewise, increasing vertical temperature gradients between the surface and aloft (i.e. more rapid decreases in temperature with increasing height) would also make tornadoes stronger and/or more likely, and therefore exacerbate tornado vulnerability. A related ingredient is vertical wind shear (i.e., sharp increases in wind speed with increasing height), with increasing vertical wind shear over time promoting increasing situations of the horizontal rotation that could then be raised to a vertically oriented rotating mass if warming air near the surface increases the tendency for it to rise. Increases in tropical cyclone frequency would also be likely to increase the number of tropical cyclone-induced tornadoes, and presumably tornado vulnerability. And finally, enhancements in detection capabilities and increasing population generally would increase the number of reported tornadoes, particularly weaker ones.

There remains a general lack of consensus regarding the impact of global climatic change on tornado frequency and/or intensity (Long and Stoy, 2014). Part of the difficulty in making such projections is the large difference in scale between global climate change projections and the local nature of the weather conditions that create tornadoes (Mika, 2013), along with an incomplete understanding of the physics involved (Moore et al., 2015). Nevertheless, the existing scientific literature can give at least some basis for assessing tornado vulnerability regarding the scenarios described in the previous paragraph.

Atmospheric scientists overwhelmingly agree that global temperatures will continue increasing, though the magnitude and rate of increase will vary spatially, seasonally, and within the diurnal cycle (National Climate Assessment, *2017; https://science2017.globalchange.gov).*

As was discussed, temperature is expected to increase in Louisiana at least through mid-century. Increasing temperatures would logically move the boundary between the cold and warm air masses poleward, leaving Louisiana farther from the most dangerous zone for tornadic development a larger percentage of the time, and therefore reduce tornado frequency and/or intensity. Because tornado frequency in Louisiana is less seasonal than in most other places, the nuances of changing tornado vulnerability may be slightly less dependent on the uncertainties of the seasonal temperature changes than in most other places.

However, the other factors that also impact tornado frequencies must also be considered. As suggested above, tornadic activity is also favored when very warm, humid air near the surface underlies air that is much colder aloft. Thus, amplification of the temperature difference between the surface and the upper atmosphere (i.e., destabilizing the atmosphere) might be considered to enhance the probability of tornadic development. Brooks (2013) used climate model simulations to conclude that indeed, that vertical gradient, as represented by convective available potential energy (CAPE), is projected to increase into the future. However, Brooks (2013) also noted that the vertical wind shear needed for tornadic development is generally weakening under global change climate simulations. Gensini et al. (2014) noted using a regional model simulation that extreme destabilization of the atmosphere (in the form of the number of days having an extremely high CAPE) is likely to increase over a large section of the northeastern U.S.A., which would make tornadoes more likely. However, the same study showed that CAPE is likely to decrease over nearly all of Louisiana, at least when the 2041–2065 period is compared to the 1981–1995 interval, which would create a less favorable environment for tornadoes.

On the other hand, Diffenbaugh et al. (2013) disagreed, noting that the days with weakening vertical wind shear tend to be concentrated on days when CAPE is low; with high-CAPE days showing less evidence of weakening shear. Seeley and Romps (2015) generally concurred with Diffenbaugh et al. (2013), excepting that their analysis was for severe thunderstorms rather than tornadoes per se. Through ensemble modeling, Seeley and Romps (2015) found consistent spring and summer increases in the frequency of severe-thunderstorm environments over the U.S., including Louisiana, from 2079-2088, as represented by high CAPE days and vertical wind shear, under medium and high scenarios of greenhouse forcing.

Furthermore, tornadic development also occurs in association with tropical cyclones, so any changes in tropical cyclone frequency and/or intensity might coincide with a change in tropical-cyclone-induced tornadic development. As previously discussed, tropical cyclones are expected to become more problematic in the future, even if only because of increased coastal population. Therefore, in the absence of prevailing scientific consensus on the topic in the refereed literature, it seems reasonable to suggest that the tropical-cyclone-induced tornado hazard will follow a proportionate increase to that of tropical cyclones for Louisiana, with the caveat that as tornado detection capabilities continue to improve due to larger populations and improved equipment to observe their occurrence, the percentage of tornado frequencies that are reported is expected to increase.

When comparing the 1954–1983 period to the 1984–2013 period, Agee et al. (2016) found that, not surprisingly, winter was the season in which the most prominent tornado frequency increases occurred. For Louisiana, that study showed an increase in the latter period in EF5 tornadoes. However, Louisiana experienced a simultaneous decrease in the number of days on which a tornado occurred (Agee et al., 2016), which suggests that tornado outbreaks may be becoming more frequent, even while tornado frequencies are not. Tippett et al. (2016) concurred, suggesting that increases in larger outbreaks will be more pronounced than increases in smaller outbreaks. And importantly, NCA4 (2017) agrees that the frequency of tornado days in the U.S. has decreased since 1970, but that the number of tornadoes touching down on those days has increased over the same time period (Kossin et al., 2017). The latter study also reports an earlier onset of tornado season in the United States.

Modeling studies of future tornadic activity reveal a mixed bag. Trapp and Hoogewind (2016) found that updrafts, while intense under projected increases in CAPE by the latter 21st century, do not increase proportionately to the projected CAPE. Kossin et al. (2017) agree in NCA4, as historical tornado outbreaks such as the Joplin, Missouri, tornadoes of 2011 do not become even more severe when placed in an environment of CAPE by the late 21st century, but nor do such outbreaks break apart either.

As coastal population increases and temperature rises, the destabilization in the atmosphere could result in more frequent tornado outbreaks, which would occur when abundant vertical wind shear is present over Louisiana and/or in the presence of a tropical cyclone. However, the literature is uncertain on whether the windows of time in which these conditions are met may change. And the impacts due to increased vulnerabilities may outstrip the increasing tornado frequencies in the future (Strader et al., 2017). All these factors lead us to estimate an increase in Louisiana tornadoes by 10 percent by 2050 (Mostafiz et al., 2020, 2022), despite a likely relatively constant frequency in the most reliable portions of the climatological record (Gensini, 2021).

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Future Conditions: Floods

As noted in NCA4 (2017), projection of the flood hazard to 2050 is a complex multivariate problem, as human activities such as deforestation, urban development, construction of dams, flood mitigation measures, and changes in agricultural practices impact future flood statistics. In addition, Louisiana's geography superimposes such local-to-regional-scale changes on similar changes upstream over a significant portion of the nation, and these changes are superimposed on climatic changes and eustatic sea level rise.

Despite these complications inviting caution in the interpretation of results, it is safe to conclude that flooding is likely to remain Louisiana's costliest, most ubiquitous, and most life-threatening hazard. This is because floods are the by-product of several other hazards profiled earlier in this report, including thunderstorms, tropical cyclones, coastal hazards, dam failure, and levee failure. The "future conditions" sections of those hazards (presented earlier in this report) projected changes in vulnerability as summarized in Table X below.

Table X. Estimated change in future vulnerability in Louisiana by 2050, by hazard

Hazard	Estimated Change in Future Vulnerability by 2050 (%)
Severe thunderstorms	+10
Tropical cyclones	+25
Coastal hazards	"High"
Dam failure	0
Levee failure	0

Based on the information summarized in Table X, there is no reason to expect that the flood hazard in Louisiana will abate, particularly as population increases. We fully support the use of Louisiana's Comprehensive Master Plan for a Sustainable Coast in planning for the future flood hazard.

However, the news is not all dire, nor is the situation hopeless. By some accounts, the rate of coastal land loss has shown some signs of slowing. Renewed commitment to smart-growth strategies, especially in floodplains, levee-protected areas, and in the area vulnerable to direct inundation from storm surge or meteotsunami, will mitigate future flood disasters. These strategies include, but are not limited to, the "multiple lines of defense" approach (Lopez, 2009) and effective implementation of recommendations in

Louisiana's Comprehensive Master Plan for a Sustainable Coast (Coastal Protection and Restoration Authority of Louisiana, 2017, 2023). And there are several effective examples of environmental challenges that have been mitigated through public awareness/education, and mutual resolve (e.g., ozone hole, oil spills, nuclear power plant meltdowns, etc.). While the flooding hazard in Louisiana will never be eliminated, it is possible that we can coexist sustainably alongside the hazard.

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Future Conditions: Dam Failures

Even if extreme precipitation events would increase in frequency and/or magnitude in the future and earthquake probability increases, there is no evidence to suggest that future conditions would contribute to an enhanced likelihood of dam failures due to natural causes. As the dams are designed to standards, this should already be contemplated in the design guidance. The anthropogenic component of the dam failure hazard is beyond the scope of this analysis. Therefore, despite anticipated increases in other natural hazards, there is no indication that these increases will result in additional dam failures, at least from a natural hazard perspective.

Future Conditions: Levee Failures

Any assessment of the future conditions relating to levee failures in Louisiana must begin with an assessment of the future conditions relative to the natural hazards that would most likely cause the levees to fail. These hazards include tropical cyclones (including storm surge), flooding, and earthquakes. Earlier reports in this document have assessed each of these hazards as likely to increase in the future.

Possible opposing forces that might mitigate the levee hazard include smart growth, lessons learned from the Katrina levee failures, new science and technology, and improved engineering.

To calculate the current probability of failure, it is conservatively assumed that 2,000 distinct levee breaches have occurred nationally in the past 25 years. This figure includes The Great Flood of 1993, where Mississippi River levees were overtopped or breached in over 1,000 locations, and Hurricane Katrina in 2005, where 50 levee breaches were reported to have occurred. Assuming 1 mile between distinct breaches and the 22,950 miles of levees in the U.S. (https://levees.sec.usace.army.mil/#/), the probability of failure within one mile of levee is calculated as:

$$\frac{\frac{2{,}000 \text{ breaches}}{22{,}950 \text{ miles of levees}}}{25 \text{ years}} = 0.3\% \text{ annual probability}$$

But because the previous occurrences for this hazard are rare, the increased hazard in the future will be minimal.

There are no future conditions related to the levees themselves that would enhance the probability of levee failures due to natural causes. Design guidance and oversight in the future should ensure that the levees are designed to standards. Therefore, even though we anticipate increases in rainfall and earthquake hazards, there is no indication that these increases will result in additional levee failures.

Geologic Hazards

Earthquake

Earthquakes are typically described in terms of magnitude and intensity. Magnitude is the measure of the amplitude of the seismic wave and is often expressed by the Richter scale. The Richter scale is a logarithmic measurement, whereby an increase in the scale by one whole number represents a tenfold increase in measured ground motion of the earthquake (and a more than thirty-fold increase in energy released). An increase by two whole numbers represents a 102 (or 100-fold) increase in ground motion, and thus more than 302 (or 900) times the energy released. Intensity is a measure of how strongly the shock was felt at a particular location, indexed by the Modified Mercalli Intensity (MMI) scale.

A fault Is a fracture in the Earth's crust where movement occurs on one side relative to the other. Known faults in Louisiana are often caused by subsidence. The system of subsidence faults in southern Louisiana developed due to accelerated land subsidence and rapid sediment deposition from the Mississippi River. The system stretches across the southern portion of the state from Beauregard Parish in the west to St. Tammany Parish in the east, including every parish south of this line. This system is thought to be responsible for many of the recorded earthquakes from 1843 to the present. All earthquakes that occurred over this period were of low magnitude, resulting mostly in limited property damage (such as broken windows, damaged chimneys, and cracked plaster).

Future Conditions: Earthquakes

Earthquakes are considered by most to be among the least ominous hazards in Louisiana's future. However, there are several indications that the hazard in Louisiana is likely to increase in the future. First, wastewater injection into deep wells, oil and gas exploration, and hydraulic fracturing ("fracking") are believed to be contributing to a sudden increase in earthquake activity, especially in the oil and gas mining areas, with such activities showing no signs of decrease in the near future. In the most comprehensive recent research on the earthquake hazard for the central and eastern U.S., Petersen et al. (2016) found that seismicity has increased by up to one order of magnitude over the last decade in some oil and gas-producing areas. While Petersen et al. (2016) found no induced earthquakes reported in Louisiana over the 2014–2015 period, several earthquakes associated with wells were reported in nearby adjacent Arkansas and Texas (Figure X.Y). Walter et al. (2016) suggested that seismicity is increasing in northwestern Louisiana in response to energy extraction activities. Second, Louisiana lies sufficiently near the New Madrid fault to be impacted by future movement, as it was during the series of quakes from 1811 to 1812. Page and Hough (2014) found no evidence to suggest that the seismicity associated with this fault is decaying with time. Increasing development over time would make any impacts to the Mississippi River, including but not limited to a catastrophic change of its course as happened in 1811–1812, catastrophic. These impacts could trigger a levee failure. And third, the continuing lax building codes for mitigating earthquake damage invites additional concern for an increased future vulnerability to this hazard. If anything, elevation of structures to mitigate the flood, storm surge, rising sea level, and tropical cyclone hazards might increase vulnerability to damage from non-Mississippi-River-impacted earthquakes.

For these reasons, the team assessed the future conditions relative to the earthquake hazard over the next thirty years as increasing by 10 percent.

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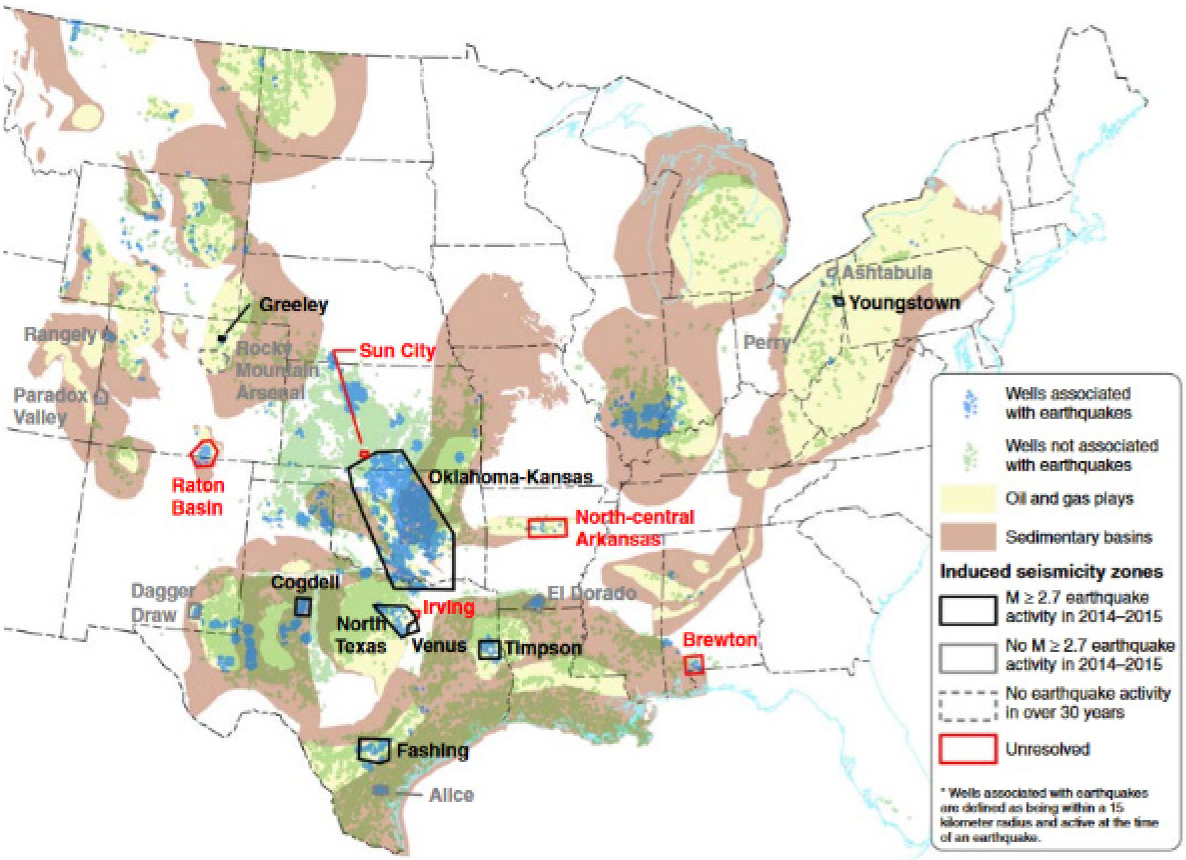

▲ **Figure 1.** Zones of induced seismicity defined in this report. Additional details about the zones are provided in Table 1. Information on oil and gas plays, sedimentary basins (U.S. Energy Information Administration, 2015), wells that are associated with earthquakes (Weingarten *et al.*, 2015), and the earthquake zones applied in this analysis. (Figure from Petersen *et al.*, 2016). The color version of this figure is available only in the electronic edition.

Future Conditions: Sinkholes

The geological bedrock and regolith underlying Louisiana will not change on human timescales, and the relatively small percentage of Louisiana's land area composed of carbonate bedrock points to a small hazard related to karst-induced sinkholes. Nevertheless, Autin (2002) emphasizes that uplift of the Five Islands of southwestern Louisiana is probably still active, leaving tectonic and geomorphic instability possible in the future. The hazard relative to sinkholes could change much more rapidly with land use change and the pressures of increased resource extraction and population growth. Vulnerability to sinkholes could also increase as a "side effect" to changes in the vulnerability to in other hazards. Neal (2020) expressed the concern that sinkhole-related mining accidents along the storage facilities for the U.S. National Petroleum Reserve, which is along the Louisiana and Texas coasts, could endanger national interests.

Furthermore, sea level rise contributes to saltwater intrusion, which contributes to the formation of salt domes, which—when mined extensively—can form sinkholes.

Even though geological changes are unlikely, other environmental modifications are connected with changes in sinkhole formation, including, according to Demir and Keskin (2020), anthropogenic effects. Nevertheless, it is important to note that geological factors such as groundwater leakage rates (i.e., Xiao and Li 2020) may also be important indicators of sinkhole formation, independent of climate change considerations. Sedimentation in sinkholes has also been used as an indicator of climate and sea level change (Hodell et al., 2005; van Hengstum et al., 2011; Kovacs et al., 2013; Gregory et al., 2017; Peros et al., 2017; Farley et al., 2018). Taminskas and Marcinkevicius (2002) pointed out that climate change may drive karstification that then in turn affects sinkhole formation. Panno et al. (2012) noticed that cave formation was affected by climate change in the Pleistocene. Linares et al. (2017) found that drought facilitates sinkhole formation in some karst settings, including northeastern Spain. Most recently, biological manifestations of climate change in sinkholes have been shown for vascular plants (Bátori et al., 2014; Kiss et al., 2020), bryophytes (Liu et al., 2019), and forests (Yang et al., 2019).

In light of the above factors, the annual probability estimate for areas overlying a salt dome is likely to increase somewhat by 2050. This is due to likely increasing population (and therefore, it is assumed, groundwater pumping) and human activities (including resource extraction, possibly from hydraulic fracture drilling), along with the destabilizing effects of global and regional sea level rise on coastal salt domes, are increasingly likely to generate additional accidental events. Considering these considerations, we project a 50 percent increase in the state's sinkhole hazard by 2050.

Sinkhole Risk Assessment:

Property loss due to sinkhole is calculated as

$$PL_{2050,i} = SL_{2050,i} + CL_{2050,i}$$

$$SL_{2050,i} = \left(SV_{2050,i} \times A_i \times H_{historical} \times F_{2050}\right)[R \times L_A + (1 - R) \times L_B]$$

$$CL_{2050,i} = CV_{2050,i} \times A_i \times H_{historical} \times F_{2050} \times R \times L_A$$

where

$PL_{2050,i}$ = projected annual preperty loss of census block i in 2050
$SL_{2050,i}$ = annual building/structure loss of census block i in 2050
$CL_{2050,i}$ = annual content loss of census block i in 2050
$SV_{2050,i}$ = building/structure value of census block i in 2050
$CV_{2050,i}$ = content value of census block i in 2050
A_i = percentage of area of census block i under saltdomes
$H_{historical}$ = historical hazard intensity
F_{2050} = hazard intensity in 2050
R = ratio between largest sinkholes to largest salt domes
L_A = 100 percent loss of SV and CV
L_B = 50 percent loss of SV

We consider the ratio of largest sinkhole incident area in Louisiana (although there were only two incidents) to the largest salt dome area to calculate the losses. Caution should be exercised in the interpretation of results because identification of which portion/part of salt domes will turn into sinkholes is highly uncertain.

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Future Conditions: Expansive Soil

The soil structure will remain largely unchanged on anthropogenic time scales. However, long-term changes in the freeze-thaw climatology and/or precipitation climatology could impact the stability of the soil structure for supporting construction (Tabassum and Bulut, 2023). The anticipated decrease in number of freezing-temperature days as temperature increases (Vose et al., 2017; their Figure 6.9), at least under the highest-CO2-emission scenario, would diminish the future expansive soil hazard due to a decrease in freeze-thaw expansion/contraction. However, the likelihood of an increasing number of extreme hot days (Vose et al., 2017; their Figure 6.9) and heavier precipitation by 2050 interrupted by lengthening dry periods (Wehner et al., 2017), albeit again under the highest-CO2-emission scenario, may overcompensate, causing a net increase expansion/contraction. The net effect of these forces leads to a projection of an increase in the expansive soil hazard of 15 percent by 2050 (Mostafiz et al., 2021).

Expansive Soil Risk Assessment:

Property loss due to expansive soil is calculated as

$$PL_{2050,i} = SP_i \times F \times I_{2020,i} \times \frac{P_{2050,i}}{P_{2020,i}} \times \frac{MC}{R}$$

where

$PL_{2050,i}$ = projected annual property loss of census block i in 2050
SP_i = average swelling potentiality of census block i
F = future hazard multiplication factor in 2050
$I_{2020,i}$ = total building inventory value of census block i in 2020
$P_{2050,i}$ = projected population of census block i in 2050
$P_{2020,i}$ = population of census block i in 2020
MC = maintainance cost of building against the expansive soils during its useful life span
R = average life span of a residential building

Wang's (2016) point-based SP was mapped based on data measured by Seed et al. (1962).

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C

Appendix C: Plan Maintenance and Plan Adoption

In order to achieve the stated goals mentioned in Chapter 4, this plan must remain relevant. To ensure this, the State must regularly review and evaluate the Plan based on current risks, conditions, and state priorities. This Appendix provides an overview of how the State will review, evaluate, and implement this Plan over the next five years.

This section also discusses the adoption of the plan as well as assurances that the State will manage FEMA funding according to applicable federal and statutes and regulations.
Overall, the section discusses methods that will be used to ensure that the plan is successfully implemented over time.

Specifically, This Appendix addresses the following requirements per the *State Mitigation Planning Policy Guide (2022):*

S17. **Is there a description of the method and schedule for keeping the plan current? [44 CFR §§ 201.4(c)(5)(i) and 201.4(d)]**

S18. **Does the plan describe the systems for monitoring implementation and reviewing progress? [44 CFR §§ 201.4(c)(5)(ii) and 201.4(c)(5)(iii)]**

S19. **Did the state provide documentation that the plan has been formally adopted? [44 CFR § 201.4(c)(6)]**

S20. **Did the state provide assurances? [44 CFR § 201.4(c)(7)]**

Plan Maintenance Purpose

The section of the Code of Federal Regulations (CFR) pertaining to State Mitigation Plans lists seven required components for each plan: a description of the planning process; risk assessments; mitigation strategies; a description of coordination of local mitigation planning; a method and system for plan maintenance; verification of plan adoption; and assurances of state compliance with the plan.

Monitoring, Evaluating and Updating the Plan UPDATING THE PLAN

By law, the Plan must be updated every five years prior to re-submittal to the Federal Emergency Management Agency (FEMA) for re-approval. The first part of this section describes the whole update process, including the responsible parties, methods to be used, evaluation criteria to be applied, and schedule for monitoring and evaluating the plan. This is followed by an explanation of how and when the plan will be periodically updated.

Responsible Parties

The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the state agency directly responsible for maintaining the plan. Within that agency, the State Hazard Mitigation Officer (SHMO) is the individual responsible for assuring that plan monitoring and evaluation are done in accordance with the procedures outlined in this section. The State Hazard Mitigation Planning Committee (SHMPC) is responsible for developing periodic updates to the plan.

Methods for Monitoring and Evaluating the Plan

On an annual basis (and as warranted by circumstances such as a major disaster declaration), GOHSEP will monitor the plan to assess the degree to which assumptions and underlying information contained in the plan may have changed. For example, GOHSEP will look for the following:

- **Changes in the information available to perform vulnerability assessments and loss estimates. For example, as parish and municipal risk assessments and plans are integrated into this Plan Update, GOHSEP will solicit feedback from parish and municipal emergency management directors about any changes in their real or perceived risks.**
- **Changes in laws, policies and regulations.**
- **Changes in state agencies and/or their procedures, including GOHSEP and the administration of grant programs.**

The results of these monitoring efforts will be made available via annual reports to the SHMPC as they are produced. Using the compiled results of ongoing monitoring efforts, the plan will be evaluated annually, generally starting in the month of January (unless circumstances indicate otherwise). GOHSEP will initiate evaluations by contacting state agencies identified as responsible parties in the Mitigation Action Plan, as well as other agencies and organizations that have been involved in developing the plan. GOHSEP and the SHMPC have the authority to determine if other organizations should also be involved in the process. The SHMPC will be encouraged to include other agencies/organizations which have specific technical knowledge and/or data pertaining to risks. The initial contacts will be made no later than December of each year for the first two years, in September in the third year, and again in January of the fourth year moving to aid in the updating of the State HM plan.

(in anticipation of the required Plan Update for FEMA re- approval). The initial contact will advise the appropriate agencies/organizations that the plan will be re-evaluated in the coming months and request their participation in the process. GOHSEP also has the authority to evaluate and update the plan at times other than those identified in this section under the following general conditions: (1) after a major disaster declaration; (2) at the request of the Governor; or (3) when significant new information regarding risks or vulnerabilities is identified.

Plan Evaluation Criteria

The factors that will be taken into consideration during periodic evaluations of the plan include the following:

1. **Changes in vulnerability assessments and loss estimations. The evaluation will include an examination of the analyses conducted for hazards identified in the plan and determine if there have been changes in the level of risk to the state and its citizens to the extent that the plan (in particular the strategies and prioritized actions the state is considering) should be modified.**

2. **Changes in laws, policies, or regulations. The evaluation will include an assessment of the impact of changes in relevant laws, policies, and regulations pertaining to elements of the plan.**

3. **Changes in state agencies or their procedures (in particular GOHSEP, which is responsible for maintaining the plan) that will affect how mitigation programs or funds are administered**

4. **Significant changes in funding sources or capabilities.**

5. **Progress on mitigation actions (including project closeouts) or new mitigation actions that the state is considering.**

Updating the Plan

Updates will follow the original planning process outlined in Chapter 1. The update process will entail a detailed and structured re-examination of all aspects of the original plan, followed by recommended updates. GOHSEP will lead the update process with assistance from the SHMPC. GOHSEP will present the recommendations to the SHMPC for consideration and approval. It is expected that the Governor will issue a letter of adoption for each update of the plan.

At a minimum, the plan will be updated and re-submitted to FEMA for re-approval every five years, as required by DMA 2000. The five-year update for FEMA re-approval requires that the SHMPC revisit all planning steps outlined in Chapter 1 to make sure the plan assumptions and results remain valid as a basis for further decision-making. The plan will also be subject to interim updates as significant changes or new information is identified. The degree to which the entire process is repeated will depend on the circumstances that precipitate the update. GOHSEP will initiate, coordinate, and lead all plan updates in conjunction with the SHMPC. The next two paragraphs describe the procedures for interim and five-year updates, respectively.

The nature of Plan Updates will be determined by the evaluation process described above. In general, GOHSEP will notify the SHMPC that the agency is initiating an interim Plan Update and describe the circumstances that created the need for the update (per the list in the Plan Evaluation Criteria section above). GOHSEP will determine if the SHMPC should be consulted regarding potential changes. If it is determined that the SHMPC should be involved, the nature of the involvement will be at the discretion of GOHSEP. When interim updates are completed absent the involvement of the SHMPC, GOHSEP will advise all SHMPC members via email that the plan has been updated and describe the nature of the update. In addition, GOHSEP will provide FEMA Region VI with a copy (although there is no requirement to have the plan re-approved by FEMA for interim updates).

As required by the DMA 2000, the plan will be updated every five years and re-submitted to FEMA for re-approval. In those years, the evaluation process will be more rigorous, and will examine all aspects of the plan in detail. It is anticipated that several meetings of the SHMPC will be required, and that the Governor's Authorized Representative will formally re-approve the plan prior to its submission to FEMA.
The following basic schedule will be undertaken for monitoring, evaluating and updating the plan:

- **At a minimum, monitoring activities by GOHSEP should be done on a quarterly basis.**

- **Notices regarding annual evaluations should be sent by GOHSEP to the SHMPC in December of the first two years of the plan and in September of the third year, with follow-up in the fourth year.**

> **The timetable for evaluations and updates for the first four years is expected to last up to four months (January–April), and up to twelve months for the update in the fifth year for re-submittal to FEMA (January – December)**

2024 Plan Update and Schedule Evaluation

For the current Update, the previously approved plan's method and schedule were evaluated to determine if the elements and processes still worked for this update. Based on this evaluation, the method and schedule remained the same except for a twelve-month period set for the five-year update, instead of a four-month period.

Plan Adoption

The Code of Federal Regulations requires that each state's hazard mitigation plan update be formally adopted by the state itself before it is submitted to the Federal Emergency Management Agency for final review and approval. This plan reproduces on the following page the statement of the plan's adoption by Jacques Thibodeaux, Director of the Governor's Office of Homeland Security and Emergency Management and the Governor's Authorized Representative for this action.

D

Appendix D: 2024 Community Rating System Strategy Update

1. INTRODUCTION

The University of New Orleans' Center for Hazards Assessment, Response and Technology (UNO-CHART) led the development of a statewide Community Rating System (CRS) Strategy for Louisiana as part of the 2019 State Hazard Mitigation Plan Update. UNO-CHART accomplished this work in partnership with the State of Louisiana and various stakeholders, including the State Hazard Mitigation Plan Committee, CRS Users groups, and local floodplain management officials.

The goals of the CRS Strategy are to identify resources available to Louisiana CRS communities, and to improve coordination among the various state and regional programs that can help communities implement elements of the CRS to reduce flood losses and protect natural floodplain functions.

In 2023, UNO-CHART was asked to review progress since the 2019 Mitigation Plan and update relevant data and the overall CRS Strategy. This Update has five sections:

The Introduction provides an overview of the CRS as implemented in Louisiana and the major changes in the program since the 2019 Strategy.

1. The CRS Activity Review looks at each activity and its elements, noting national and state participation rates and average points earned. This shows which elements are being implemented by the 39 Louisiana CRS communities and identifies some of the reasons why some elements are implemented more than others.

2. The Summary of Key Findings identifies which activities and elements are relatively easy to implement and which require more work but are worth the effort. This discussion shows where a state level effort would help communities implement more creditable activities and/or earn more credit.

3. Section 4, Resources, covers the agencies and organizations that may be able to assist CRS communities in the implementation of different activities.

4. The Next Steps are to disseminate the Strategy to all CRS communities and establish a CRS Priorities Committee. The Committee would prioritize the projects identified in Section 3 and work with the agencies and organizations identified in Section 4 to help guide the ways they can assist the communities.

The Community Rating System

The CRS is a voluntary program, which provides incentives for communities to implement floodplain management activities that exceed those required by the National Flood Insurance Program (NFIP). The goals of the CRS are to (1) reduce flood damage to insurable property; (2) strengthen and support all insurance aspects of the NFIP; and (3) encourage a comprehensive approach to floodplain management[2] .

[2] https://www.fema.gov/floodplain-management/community-rating-system

An incentive for communities to participate in the CRS is the provision of discounts on flood insurance premiums for local policyholders. A community earns points for each CRS activity completed; the number of points earned determines the amount of the flood insurance premium discount, as shown in Table 1.

Table 1 – CRS Premium Reductions

Credit Points	Class	Premium Reduction
4,500+	1	45%
4,000 – 4,499	2	40%
3,500 – 3,999	3	35%
3,000 – 3,499	4	30%
2,500 – 2,999	5	25%
2,000 – 2,499	6	20%
1,500 – 1,999	7	15%
1,000 – 1,499	8	10%
500 – 999	9	5%
0 – 499	10	0
https://www.fema.gov/floodplain-management/community-rating-system		

At the time of the 2019 Update, premium discounts were larger for policies on properties located within the Special Flood Hazard Area (SFHA). In 2021, the NFIP's new pricing approach, Risk Rating 2.0, eliminated this difference. Now, all policies receive the same discounts, regardless of location, which range from 5% for a Class 9 community to 45% for a Class 1.

Figure 1 – CRS Series and Activities*

300 Public Information Activities
- 310 Elevation Certificates
- 320 Map Information Service
- 330 Outreach Projects
- 340 Hazard Disclosure
- 350 Flood Protection Information
- 360 Flood Protection Assistance
- 370 Flood Insurance Promotion

400 Mapping and Regulations
- 410 Flood Hazard Mapping
- 420 Open Space Preservation
- 430 Higher Regulatory Standards
- 440 Flood Data Maintenance
- 450 Stormwater Management

500 Flood Damage Reduction Activities
- 510 Floodplain Management Planning
- 520 Acquisition and Relocation
- 530 Flood Protection
- 540 Drainage System Maintenance

600 Warning and Response
- 610 Flood Warning and Response
- 620 Levees
- 630 Dams

This new pricing approach brought a second change to the distribution of CRS premium reductions. Before its implementation, Preferred Risk Policies (PRPs), which are policies for structures not in the SFHA, were not eligible for CRS premium discounts because they already had lower premiums than other policies. These policies were eliminated under the new pricing approach. Accordingly, now all NFIP policies receive the full CRS class premium discount, although they do not all get it right away. Other changes brought by the new pricing approach are explained in Section 1.2. Major Changes to the CRS since 2019.

***National Flood Insurance Program Community Rating System Coordinator's Manual, FIA-15/2017**

The CRS is made up of four series of activities, numbered from 300 to 600. Each series includes several activities, for a total of 19 (Figure 1), and each activity includes several elements, for a total of 94.

The 2017 CRS Coordinator's Manual explains how a community earns points. With a few exceptions, communities can select which elements they want to pursue for credit. The communities then provide the documentation that shows how they

Louisiana CRS Communities:

Forty-seven Louisiana communities are currently or have been in the CRS. They are listed in Table 2, with those no longer participating noted as Class 10.

The number of participating communities and their insurance coverage reported in the 2019 Update and in 2023 are summarized in Table 3.

Table 2 – Louisiana CRS Communities

Community	Class	Users Group
Ascension Parish	7	CRAFT
Baker, City of	9	
Bossier City, City of	9	
Caddo Parish	8	
Calcasieu Parish	8	R & S
Carencro, City of	7	RAIN
Central, City of	7	CRAFT
Covington, City of	8	FLOAT
Denham Springs, City of	8	CRAFT
Deridder, City of	10	
East Baton Rouge Parish	7	CRAFT
French Settlement, Village of	10	
Gonzales, City of	8	CRAFT
Gretna, City of	6	JUMP
Harahan, City of	10	JUMP
Houma, City of	7	FLOAT
Jean Lafitte, Town of	7	JUMP
Jefferson Parish	5	JUMP
Kenner, City of	6	JUMP
Lafayette Parish	7	RAIN
Lafayette, City of	7	RAIN
Lafourche Parish	10	FLOAT
Lake Charles, City of	10	R & S
Livingston Parish	10	
Lutcher, Town of	8	
Mandeville, City of	6	FLOAT
Monroe, City of	10	
Morgan City, City of	8	
Orleans Parish	7	FLOAT
Ouachita Parish	9	
Port Vincent, Village of	10	
Rayne, City of	9	RAIN
Ruston, City of	8	
Scott, City of	7	RAIN
Shreveport, City of	8	
Slidell, City of	6	FLOAT
Sorrento, Town of	9	
St. Charles Parish	7	FLOAT
St. James Parish	8	FLOAT
St. John The Baptist Parish	7	FLOAT
St. Tammany Parish	7	FLOAT
Tangipahoa Parish	8	FLOAT
Terrebonne Parish	7	FLOAT
Walker, Town of	8	CRAFT
West Baton Rouge Parish	8	
Westwego, City of	7	JUMP
Zachary, City of	8	CRAFT
As of 4/1/2023	R & S = RAIN and SWIFT	
Users Groups are discussed on page 5		

The 2019 Update listed 314 communities in Louisiana that participated in the NFIP. Of those, 43 (14%) participated in the CRS at that time. As shown in Table 3, the CRS numbers have dropped slightly. The number of NFIP flood insurance policies has also decreased. This is happening across the country due to the increase in the cost of NFIP premiums and the availability of more private flood insurance policies, many of them less expensive, although they do not necessarily provide the same level of coverage.

However, it is important to note that the State has consistently maintained a high level of CRS participation compared to the nation. While 12% of Louisiana NFIP communities participate in the CRS, only 6% of communities nationally in the NFIP are also in the Community Rating System.

To encourage a community to participate in the CRS, the benefits of participation need to be shown. One of the easiest benefits of the CRS to show is how many people or properties will be helped with lower insurance premiums. Therefore, communities with a large number of flood insurance policies are more likely to join[3].

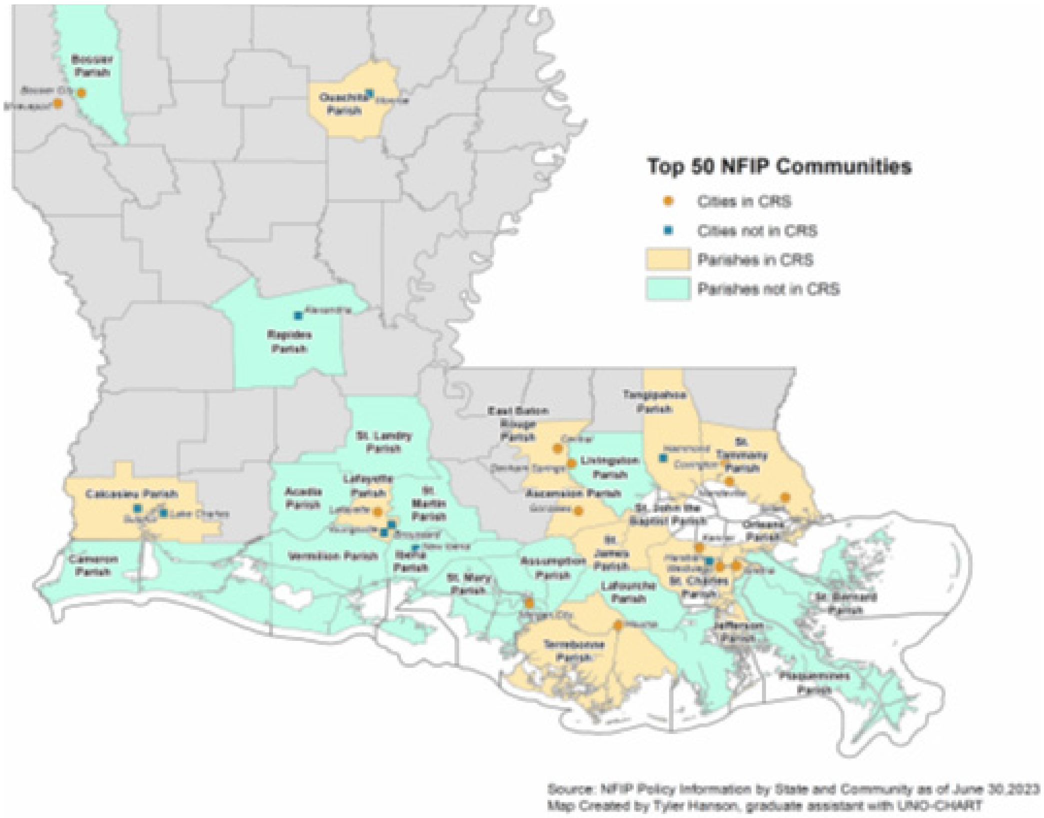
This is supported by Figure 2, which shows the 50 communities with the most NFIP policies in Louisiana. Thirty of these communities (60%) are in or have been in the CRS. Of the top 25 communities by number of policies, 21 (84%) are in or have been in the CRS. The map also shows that most of the communities in the top 50 are in the southern region of the state, where the coastal and riverine floodplains are larger and cover more populated areas.

Table 3 – Participation Changes Since the 2019 Update

	2019	2023
Communities		
In the NFIP	314	318
In the CRS	43	39
Percent in the CRS	14%	12%
NFIP Policies		
Total in the state	489,260	467,250
% in CRS communities	85%	69%
Annual savings	$29.4 mil	$29.5 mil

3 Data on communities in the NFIP can be found at https://www.fema.gov/openfema-data-page/nfip-community-status-book-v1. Data on CRS communities can be found at https://www.fema.gov/floodplain-management/community-rating-system#participating.

Figure 2 – Top 50 NFIP Communities Map

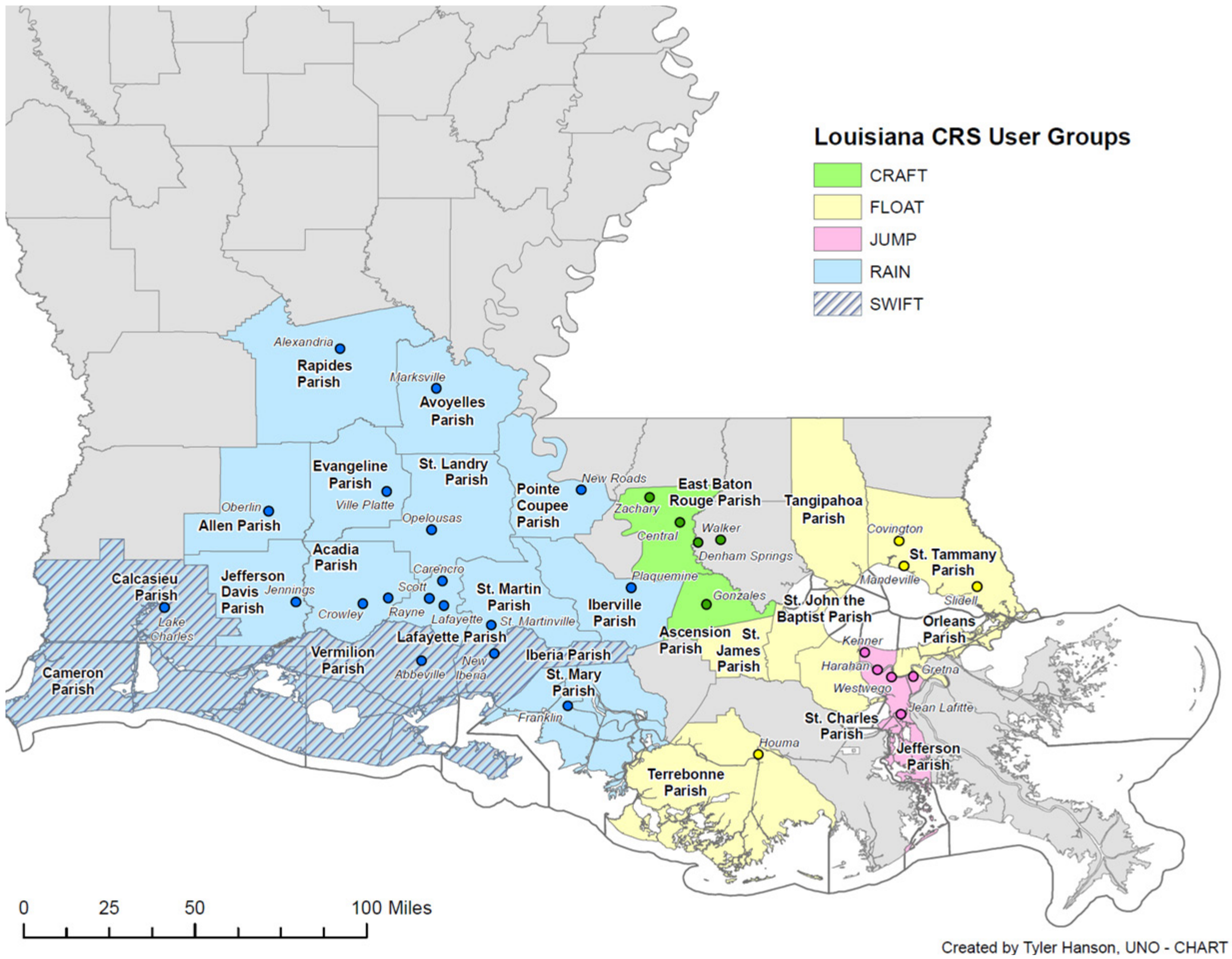


CRS Users Groups:

CRS communities are encouraged to form and join users groups. These are informal arrangements of neighboring cities and parishes who meet regularly to discuss CRS activities and sometimes implement multijurisdictional activities. Often, meetings focus on how one or more member communities qualified for a credit. There are five users groups in Louisiana as shown in Figure 3. Membership includes both CRS and non-CRS communities, as they are helpful for communities considering joining. Currently 29 of the 39 communities that participate in the CRS also participate in a users group. These are noted in Table 2.

The first three groups, CRAFT, FLOAT, and JUMP have been active the longest. Their work is reflected in the 2023 numbers and points data reported in the 2019 Update. RAIN is a newly established group so their work has not yet impacted community scores (see page 10, “CRS Data for this Strategy Update,” for an explanation of why it takes several years for scores to be reflected in the available database). SWIFT is currently inactive and has been for several years.

Figure 3. Louisiana Users Groups Map



Major Changes to the CRS Since 2019

There have been two major changes to the program since the 2019 CRS Strategy Update was prepared. The first was the release of the Addendum to the 2017 CRS Coordinator's Manual that took effect on January 1, 2021. The major changes in the Addendum included two new prerequisites for obtaining certain CRS classes and four new ways to earn credit. Only one element was eliminated, 430 SMS - State mandated regulatory standards, and only one Louisiana community earned that credit.

The second program change resulted from the introduction of Risk Rating 2.0[4]. This is a new methodology to determine NFIP flood insurance premiums based on a property's individual risk. It relies on different criteria and data than what has been used over the previous 50 years. The new rating methodology was implemented in phases beginning on October 1, 2021; it has been fully implemented as of April 1, 2023.

4 For more information on Risk Rating 2.0, refer to https://www.fema.gov/flood-insurance/risk-rating

The new rating system has three impacts on the CRS:

1. Until 2022, a flood insurance policy's declaration page clearly showed the CRS Discount as the appropriate percentage of the listed premium. Now, the calculation of the CRS discount is not as clear on the declaration page. A renewal policy for a property in a Class 7 community may show a 6%, 11%, or some other amount depending on whether other discounts (such as pre-FIRM[5] rating) are in effect. Over time, the other discounts are phased out as premiums increase each year. When a policy reaches the "full risk premium," the full CRS discount will be shown. It can take several years for many policies to reach "full risk premium".

2. Previously, the CRS benefit was different for properties inside the SFHA compared to those outside of the SFHA. The benefit was greater for properties in the SFHA because that area has the greatest flood hazard and most of a community's floodplain management activities are focused there. Under the new pricing approach, there is no differentiation between properties in or out of the SFHA. All properties in a community receive the full discount when they are at their full risk premium, e.g., 15% for a Class 7 community.

3. The premium dollar savings in each community was easy to obtain and understand. The information encouraged communities to join, to earn more CRS credit, and to preserve existing credited activities. The new methodology cannot produce the same information, partly because of the problems noted here. As a result, the premium dollar savings data currently available are based on the old system and are not an accurate statement of the true savings.

While the new pricing approach means more people benefit from a community's CRS discount, it is also harder to see the full discount on a policy's declaration page and the premiums for most renewed policies are increasing. The cost of flood insurance is considered the primary reason for the decrease in the number of NFIP policies since 2019 (as shown in Table 3). As a result it has been difficult for some local officials to show their constituents the benefits of joining or staying in the CRS.

The long term impact of the above changes remains to be seen.[6] In the meantime, the day-to-day operations and verification procedures follow the provisions of the 2017 CRS Coordinator's Manual credit criteria and the 2021 Addendum.

5 This Strategy includes CRS terms like "pre-FIRM" and "ISO/CRS Specialist." These terms can be found in Section 120, Glossary, of the CRS Coordinator's Manual. The CRS Coordinator's Manual can be downloaded from http://crsresources.org/manual.

6 The confusion and consternation over these changes to the NFIP have been sufficient to warrant lawsuits requesting FEMA to stop or defer implementation of Risk Rating 2.0.

Methods and Findings

2019 Strategy: The team developed and implemented a survey for local and state floodplain management officials to identify: (1) the types of assistance needed to implement CRS activities (CRS communities) and (2) the obstacles to enter the CRS for non-CRS communities. UNO-CHART conducted the survey in two phases with the assistance of the Louisiana Department of Transportation and Development (LA DOTD) Public Works and Water Resources Division and the Louisiana Floodplain Management Association (LFMA).

With the assistance of the Insurance Services Office, Inc. (ISO), FEMA's CRS management contractor, team members analyzed CRS data for communities across the State of Louisiana. This analysis provided the team with a baseline for further data collection and recommendations.

As this strategy is part of the State's Hazard Mitigation Plan Update, the project team also surveyed members of the Mitigation Plan Update Committee. As the committee is composed of local, regional, and state entities, the survey results contributed to the list of potential resources for CRS communities. The survey also served as an education and outreach opportunity, allowing the agencies to become more familiar with specific CRS tasks – especially those in which they may be able to provide support.

Another important task in the development of this strategy was an inventory of state agencies. This allowed the project team to identify programs that can assist communities with floodplain management activities. The team also had the opportunity to reach out to other stakeholders including CRS Users Groups, participants at the 2018 Association of State Floodplain Managers (ASFPM) Annual Conference, and the 2018 LFMA Summer Workshop.

Finally, the team reviewed CRS programs in other states, as well as other states' CRS strategies and outside reports.

2024 Strategy Update: The objective of this 2024 Update is to see what has changed since 2019 and to identify the key factors that made those changes. The bulk of the initial work has been to use FEMA CRS data, such as community participation and points earned for the various activities and elements, to identify what changed.

Next, the team spoke to several stakeholders to determine what caused those changes. In some cases, such as a new credit introduced in the 2017 CRS Coordinator's Manual, the cause was easy to determine. In others, interviews with the affected local officials provided the answers.

The findings are provided in the next two sections of this Strategy Update: a review of the changes by activity and recommendations for CRS communities and supporting stakeholder organizations on how to improve local participation and the number of points earned.

2. CRS ACTIVITY REVIEW

As noted earlier, Figure 1 identifies the four Series and 19 Activities that make up the CRS from a community's perspective. CRS participation and points are reviewed at the activity level in this section. Each activity has from one to 14 elements, the level where the credits are identified, and how the points are calculated. Activities are identified by number, such as Activity 310 (Construction Certificate Management) while their elements are identified by the acronyms that are used in the credit calculation formulas, such as ECPO, maintaining FEMA Elevation Certificates on Post-FIRM buildings.

Each activity has a related table that shows the national and state rates of participation for each element. The average points for nationwide and Louisiana communities are also shown. The change in the Louisiana participation levels and points since the last Update are included. What these numbers mean and why they may be high or low is discussed in the "Participation" and "Points" sections after each activity's table. The last section for each activity includes the "Key Findings."

CRS Data for this Strategy Update: The following pages review the 2023 CRS participation rates and average points and compare the numbers with those reported in the 2019 Update. The data from the 2019 Update came from FEMA's May 1, 2017, CRS database. For ease of use, the CRS data in the 2019 CRS Strategy Update are referred to as 2019 data. The 2024 Update data are as of April 1, 2023.

In the 2019 Update, there were 42 communities in the CRS; in 2023, there are 39. In the interim, four communities left the program because they no longer met all the program prerequisites. One community, the City of Covington, joined after 2019.

Credit criteria and scoring formulas are in the 2017 CRS Coordinator's Manual which is revised periodically. The 2017 CRS Coordinator's Manual is the most recent and was used in the 2019 CRS Strategy and this Update. As noted above, some changes were made by the 2021 Addendum.

It is important to note that not all the community credit information is based on the most recent documents. A community's credits are reviewed and confirmed at a verification visit by the ISO/CRS Specialists on behalf of FEMA. Most communities are visited every five years, but communities with larger program premium discounts may be visited on a three-year cycle. After the visit, it may take up to six months for the community to supply all the information requested by the ISO/CRS Specialist. It takes additional time for the more technical elements to be reviewed by a separate technical reviewer. The resulting verification report is then double checked by ISO and submitted to FEMA. FEMA publishes the verified community CRS classifications twice a year, at least three months before they take effect to give insurance agents the time needed to process renewals.

This extensive verification process means that it may take up to two years for the results of a verification visit to take effect and be listed in the CRS database. Accordingly, most of the data in this report, taken from the April 2023 database, do not reflect the changes brought by the 2021 *Addendum.*

300 Series: Public Information Activities

310 Construction Certificate Management

Elements: This activity was substantially revised in the 2021 Addendum to the 2017 CRS Coordinator's Manual. The first element, EC – Elevation Certificates, provided credit for maintaining FEMA Elevation Certificates on all new and substantially improved buildings in the SFHA from the date of joining the CRS and onwards. Maintaining elevation certificates is a prerequisite for participation, along with a list of new permits is required for annual recertification. The credit was based on the percentage of Certificates that were maintained and that were correctly completed.

The 2021 Addendum expanded the title to CCMP – Construction certificate management procedures as it also includes other floodplain-related construction certificates, such as the V Zone design and Floodproofing Certificates. The credit is now "for maintaining written procedures that address the collection, review, correction, maintenance, and the public accessibility of the required floodplain-related construction certifications." While there is no adjustment in CCMP points for missing or incorrect certificates, the community must have a correct rate of 90% to remain in the CRS.

The other two credits in Activity 310, ECPO – Elevation Certificate on post-FIRM buildings and ECPR – Elevation Certificate on pre-FIRM buildings are now for maintaining all required construction certificates for buildings built before the community joined the CRS.

Figure 4 – FEMA Elevation Certificate


ELEVATION CERTIFICATE

The 2019 FEMA Elevation Certificate has four pages of data completed by a licensed surveyor, two pages of photos, and 10 pages of instructions. The 2019 Certificate was replaced in 2023 to reflect changes under Risk Rating 2.0.

Activity 310 (Construction Certificate Management)							
Elements	Participation *			Points *			
	US Pct.	LA Pct.	** LA Change	Max	US Avg.	LA Avg.	** LA Change
EC – Elevation Certificates ***	84%	100%	0%	38	32	31	-2
ECPO – Elev. Certificates on post-FIRM bldgs	9%	8%	-18%	48	30	19	+9
ECPR – Elev. Certificates on pre-FIRM bldgs	2%	3%	+3%	30	13	0	0
Activity total	96%	100%	0%	116	36	33	-2

* All participation and points values are as of 4/1/2023.
** All Louisiana change values are from 2019 to 2023 . Louisiana change values are calculated by subtracting 2023 values from the 2019 values, with a negative value indicating a decline from the 2019 Update.
*** The Participation data include both EC and the new CCMP while Points data are only for EC.

Participation: As noted under "CRS Data for this Strategy", there is up to a two year time lag from when an element is verified and when the results appear in FEMA's CRS database. Because of this, the 2023 database included the new CCMP credit for only five communities. The other 34 communities in the database were still receiving the 2017 Manual's EC credit and that is the basis for the comparison of points since 2019. In effect, all Louisiana CRS communities are receiving credit for EC or CCMP, which is expected as that is a prerequisite for being in the CRS.

The number of communities that receive credit for maintaining Post-FIRM Elevation Certificates went from 26% (7) in the 2019 Strategy to 8% (3) in 2023. The loss of the credit was due to the communities being unable to produce the data needed for the impact adjustment (see "Impact Adjustments" following the discussion on 420 Open Space Preservation).

There are few communities in the nation and none in Louisiana receiving the credit for pre-FIRM buildings, primarily because the certificates were not needed for permitting and did not provide an insurance premium benefit for buildings eligible for the "subsidized" pre-FIRM rates.

Points: The drop of two points for EC is negligible but it is interesting to see an increase of nine points for ECPO when fewer communities are receiving the credit. One reason may be that the six communities that no longer get the credit had an average score of only nine points – they may not have felt the effort was worth the credit, although they could continue to earn the points for the Certificates already credited.

Key Findings: The first element in Activity 310, EC/CCMP, is a requirement for participation in the CRS, so it gets plenty of attention and communities must score well. The second and third element, ECPR and ECPO, are limited to certificates on buildings constructed before the community joined the CRS, which in some cases was at least 20 years ago. As reflected in the state and national participation rates, there is little that a state-level program can do to improve participation or points for this activity.

320 Map Information Service

Elements: This activity's credit is for providing information from the Flood Insurance Rate Map (FIRM) and other sources. The activity's seven elements are listed in the table. MI1, reading the FIRM, is a prerequisite for any credit under this activity.

Participation: In 2019, all of the Louisiana CRS communities earned this credit; currently, all but one community is receiving credit. One reason for the high participation rate is that most communities were already reading their FIRMs for inquirers. The participation rate is lower for providing other types of map information. For example, few communities have mapped special flood-related hazards, such as areas subject to subsidence or other special hazards that do not exist in Louisiana, such as ice jams and tsunamis.

There are two reasons for high participation rates for this activity. the increase in participation. First, there have been federal, state, and local studies that have produced additional information and/or made the data easily accessible to local officials. Second, communities can relatively easily find these and other existing maps and incorporate them into their map information service. Examples include their repetitive loss area maps prepared for the CRS participation prerequisite (good for MI6) and the US Natural Resources Conservation Service's National Wetland Inventory[7] maps (good for MI7).

In other cases, the creditable data can be produced by the community's GIS staff. For example, overlaying the SFHA on a contour map of the community can produce a map showing flood depths that would qualify for MI4 credit. Of the 18 communities receiving MI4 credit in 2023, 13 (72%) are in either the FLOAT or CRAFT users groups, although those two user groups did not address Activity 320 as a group.

Activity 320 (Map Information Service)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
MI1 – Providing basic information from the FIRM	89%	97%	-3%	30	30	30	+1
MI2 - Additional FIRM information	60%	23%	+18%	20	20	20	0
MI3 – Flood problems not shown on the FIRM	29%	10%	+5%	20	20	20	0
MI4 – Flood depth data	30%	46%	+35%	20	20	20	0
MI5 – Special flood-related hazards	9%	0%	-5%	20	20	0	-20
MI6 – Historical flood information	55%	49%	+38%	20	20	20	0
MI7 – Natural floodplain functions	47%	36%	+36%	20	20	20	+20
Activity total	89%	97%	-3%	90	78	62	+27
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

[7] National Wetlands Inventory | U.S. Fish & Wildlife Service (fws.gov)

Points: The credits for each element are the maximums listed – there is no partial credit. The maximum credit for the activity, 90 points, means that the activity max is reached by having credit for MI1 (the prerequisite) and only three of the other six elements. While community participation and total points have increased since 2019, there is still room for more credit – only 14 communities are getting the max 90 points, and the state average is 16 points below the national average.

Key Finding: The main reason for the increases in participation for MI2, 3, 4, 6 and 7 is likely due to local staff effort to access and utilize additional flood-related maps. The "easiest" three optional elements to implement are MI4, 6 and 7, which are currently the ones with the most Louisiana participation (MI1 is not counted as it is mandatory for any credit).

This is a good example of the CRS offering more points for an improved or expanded public information service that is well within most communities' capabilities. Continuing such efforts can result in the maximum credit for all the communities.

330 Outreach Projects

Elements: This activity credits projects that provide information to the public. There are four elements, the first two credit the method of dissemination and the number of topics covered. Dissemination methods range from having handouts in public places, sending information to the public, and sending specific information to target audiences, with the last being worth the most points. The maximum credit is provided if all six of the credited topics listed in Figure 5 are covered.

Figure 5 - Credited Outreach Project Topics

1.	Know your flood hazard
2.	Insure your property for your flood hazard
3.	Protect people from the hazard
4.	Protect your property from the hazard
5.	Build responsibly
6.	Protect natural floodplain functions

OP - Outreach projects are disseminated throughout the year. FRP - Flood response projects are developed in advance, but distributed during or after a flood, when people are most interested in flood response and recovery information.

Credit for OP and FRP projects can be increased if the community develops them as part of a Program for Public Information (PPI). PPI projects are prepared by a committee with representation from local officials, the target audiences and stakeholder organizations, following a prescribed planning process that identifies and focuses on the community's needs. PPI projects can cover more than the six regular topics and the PPI process allows for more target audiences. Projects can also receive additional bonus points if they are implemented by stakeholder organizations identified in the PPI.

Activity 330 (Outreach Projects)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
OP – Outreach projects	96%	100%	0%	200	110	140	+92
FRP – Flood response preparations	16%	21%	+16%	50	42	31	+25
PPI – Program for Public Information	12%	49%	+44%	100	77	51	+14
STK – Stakeholder	10%	36%	+31%	50	21	21	+8
Activity total	100%	100%	0%	350	116	145	+97
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: The first element, OP – Outreach projects, has a very high participation rate, partly because so many communities already implement outreach projects, such as handouts in government buildings and materials included in utility bills. Participation in the other three elements is much lower nationally and, in the State, likely because most communities were not already doing them.

Louisiana's participation rates for all four elements are higher than the national rates. Nineteen of the 39 (49%) CRS communities have their own or participate in parish or regional PPIs, up from five in the 2019 Strategy. The PPIs include attention to stakeholder organizations, with a corresponding increase in the STK - Stakeholder credit. It is important to note that all 19 communities getting PPI and STK credit are in the first three users groups.

Points: As with the participation rate, the average points for OP and the activity as a whole are greater than the national averages. The Louisiana average points for each of the four elements increased since 2019 by a total of nearly 100 points. This is one activity where attention given by the users groups brings clear results: 19 communities receive PPI credit and all of them are in one of the first three users groups. The average score for Activity 330 in 2023 is 195 for the users group communities and 80 for the rest of the communities.

Key Finding: Every CRS community is interested in, and getting credit for, outreach projects. Only those in users groups are getting PPI and STK credit. As with other public information efforts, the needed ingredients are primarily staff time and knowledge of the credit criteria. The last three elements in Activity 330 (Outreach Projects) would be good candidates for a technical assistance program to provide guidance to community staff.

340 Hazard Disclosure

Elements: This activity credits various methods of advising people that a property is in the SFHA or has been flooded. It is most effective before a person unknowingly buys a property subject to flooding, so the most credit is for the real estate agent disclosure (DFH). There is also credit for real estate agents giving a brochure to house hunters (REB), credit for other ways to disclose the hazard (ODR, e.g., laws requiring landlords to tell renters), and credit for providing information on other flood-related hazards (DOH) such as subsidence or part of the property being a wetland.

Activity 340 (Hazard Disclosure)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
DFH – Real estate agent disclosure of SFHA	4%	10%	+10%	25	25	10	+10
ODR – Other disclosure requirements	81%	100%	0%	25	12	17	+1
REB – Real estate brochure	22%	54%	+12%	12	9	10	+2
DOH – Disclosure of other hazards	1%	0%	0%	8	8	0	0
Activity total	84%	100%	0%	80	15	23	+4
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: As seen in the table above, getting real estate agents to be active in hazard disclosure can be difficult and only 4% of the communities in the CRS get DFH credit. However, 62 of the 73 (86%) communities receiving DFH credit nationally are in four coastal states where the flood hazard is well known: California, Florida, Massachusetts, and Louisiana.

The four Louisiana communities with DFH credit have received it in the last five years. They are all parishes in users groups, they have all prepared Programs for Public Information that include disclosure messages, and they also REB credit.

There is a potential for every community to receive up to 37 points for the two elements, dependent on the cooperation of real estate agents, DFH and REB. Feedback from real estate agents states that a key reason they may not want to get involved is that they are not experts on flood hazards. This concern can be allayed by using the community's map information service, credited under Activity 320. If the service includes information on flood-related hazards (MI5), it could be coordinated with materials that would qualify for DOH – Disclosure of other hazards.

Per Louisiana Revised Statute § 9:3196-3200, sellers are required to complete the Louisiana Residential Property Disclosure statement which discloses whether a property is in a wetland, has been flooded, is in a flood zone, has a flood insurance policy, and/or has an elevation certificate. This is why 100% of the state's communities receive some ODR credit.

FEMA considers Louisiana a model for strong state disclosure requirements and included the disclosure statement in its guidebook.[8] However, the requirement is for sellers and not specifically for real estate agents. Only four communities (all parishes) are receiving credit for real estate agents' actions. It would be beneficial to investigate the role of real estate offices in advising sellers and buyers about the state requirements to see if communities would also qualify for DFH and REB credit.

Points: The table for Activity 340 shows that most communities did not earn a lot of credit for Activity 340 in 2019 and the points did not increase much over the next five years. The four communities with DFH credit receive an average of 38.5 points. The other 35 communities have an average of 21.3 points, of which 15 come from the state law that provides everyone ODR credit.

Key Findings: If local real estate agents are supportive, it may not be difficult for every commu-nity to receive DFH and REB credit. Some lessons could be learned from the four parishes that have done this. The cities in the four parishes receiving DFH and REB credits should capitalize on what real estate agents are doing in their area, coordinate with the real estate organizations, and apply for the credit. The same goes for the other parishes and cities in those users groups.

A state or regional-level initiative with the state and regional real estate associations could also be productive if local agencies are advised and supported by others in their profession.

350 Flood Protection Information

Elements: While Activity 330 credits disseminating messages to the public, Activity 350 credits having resources for people who take the initiative to look for more information. Two resources are credited: the local public library (LIB) and the community's website (WEB). More points are allocated for the website because it is easier to access and can include or link to many different sources of information.

8 "Flood Risk Disclosure - Model State Requirements for Flood Risk Disclosure during Real Estate Transactions" (FEMA, 2022) found at https://www.fema.gov/sites/default/files/documents/fema_state-flood-risk-disclosure-best-practices_07142022.pdf

Activity 350 (Flood Protection Information)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
LIB – Library	84%	90%	+11%	10	8	8	+1
LPD – Locally pertinent documents in library	62%	62%	+15%	10	8	8	+5
WEB – Website	83%	90%	+11%	105	40	41	+20
Activity total	92%	95%	+6%	125	48	50	+24
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: As the table above shows, participation in this activity is very high – 95% of the State's CRS communities are earning credit. With additional information and examples of what qualify as locally pertinent documents, more communities would likely earn LPD – Locally pertinent documents credit.

Points: The communities getting both library credits are getting close to the maximum now. While the state average credit increased by 20 points since 2019, it is still only 39% of the maximum possible points. Also, community scores vary greatly - the range of credit is 8 to 90 points with four communities earning no credit.

The average score for this activity is 55 for users group communities and 36 for those not in one of the first three users groups.

Key Findings: More communities could and should get more credit for putting locally pertinent documents, such as their FIRM, floodplain management ordinance, and hazard mitigation plan, in their public library. A list of examples might facilitate pursuit of this credit.

The big points, however, are found in expanding local websites. Often just providing links to appropriate state or regional webpages qualify for WEB credit points. Again, just having more examples publicized might provide sufficient help and motivation for many local CRS Coordinators.

360 Flood Protection Assistance

Elements: While Activities 330 and 350 credit making information available to the public, 360 credits site-specific advice and assistance provided by a knowledgeable person. This is usually a local permit, local building, or public works official but could be someone else who works for the parish or a regional agency.

The first element, **PPA** – Property protection advice, is for providing one-on-one advice to a resident or property owner on topics such as retrofitting a house or yard to reduce flood damage. If the advice is given after the advisor visits the site, additional points are provided under PPV – Protection advice provided after a site visit.

Under FAA - Financial assistance advice, often a different office provides advice or assistance on sources of financial assistance, such as state and federal grants or private organizations like Habitat for Humanity. The last element, TNG - Training provides credit if the person giving the assistance has successfully completed one or more of the Emergency Management Institute's courses on retrofitting or grants.

Activity 360 (Flood Protection Assistance)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
PPA – Property protection advice	46%	59%	+17%	40	28	33	+8
PPV – Advice after a site visit	43%	56%	+19%	45	33	38	+8
FAA – Financial assistance advice	8%	23%	+23%	15	11	12	+12
TNG – Training	2%	3%	-2%	10	5	7	+3
Activity total	46%	59%	+17%	110	59	74	+22
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: Louisiana communities are participating in Activity 360 at a level 13% higher than the national rate and their numbers have increased by 17% over the last five years. Nineteen of the 22 communities in the first three users groups are receiving this credit while only four of the other 17 non-users group communities are receiving 360 credit.

Points: Similarly, communities are improving their programs, resulting in more points, again well above the national numbers. Further, the 19 users group communities have an average score of 78 while the other four communities have an average of 55.

Key Findings: More communities are meeting with and helping their residents and property owners. However, there are 44% of the CRS communities not earning this credit and the average points are still only two-thirds of the maximum possible, so there is room for improvement.

370 Flood Insurance Promotion

Elements: The 2017 *CRS Coordinator's Manual* has three elements in Activity 370 that follow a prescribed planning process: assess the community's flood insurance coverage (FIA), develop a plan to improve it (CP), and implement the plan (CPI). The first two elements are prerequisites for the following elements. The fourth element, providing direct technical assistance (TA) on flood insurance topics, is separate from the planning elements.

The 2021 *Addendum* added three new elements, but the April 2023 database does not show any communities receiving these new credits, so they are not included in the activity table on the next page.

The new elements in the 2021 *Addendum* are:

- **FIB -** Flood insurance brochures: Up to 25 points for including flood insurance information with building permits or other direct distribution.
- **FIM -** Flood insurance meeting: Up to 40 points for a community town hall meeting or open house to promote flood insurance.
- **SCE -** State-required continuing education: Up to 15 points for a state

Activity 370 (Flood Insurance Promotion)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
FIA – Flood insurance assessment	14%	41%	+36%	15	15	15	0
CP – Coverage plan	6%	36%	+36%	15	15	15	+15
CPI – Plan implementation	6%	28%	+28%	60	57	53	+53
TA – Technical assistance	5%	15%	+15%	20	15	15	+15
Activity total	18%	46%	+41%	110	40	62	+47
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: Activity 370 was added to the CRS in the 2013 CRS Coordinator's Manual. Since 2019, 36% of the state's CRS communities have advanced in the process and most are getting credit for their plan (CP) and implementing it (CPI).

As a result, Louisiana has a much higher participation rate than the country as a whole. This is true for all four elements and reflects the State's need for flood insurance coverage and the high level of public interest in it. Seventeen of the 18 communities receiving credit for this activity are in one of the first three users groups. All 17 communities receiving credit for the assessment and the plan are also getting 330 PPI credit. This is not surprising as the planning process and tracking of projects is the same for both and the assessment, plan, and implementation can all be part of a PPI.

The exception to the PPI dependence is the last element, TA. It is dependent on a local insurance expert, usually an insurance agent or agency, agreeing to perform the service. Only six communities receive this credit: four in the Jefferson Parish users group, St James Parish, and West Baton Rouge Parish (the only community receiving any 370 credit that is not in a users group).

Points: As with the rate of participation, Louisiana's average points are higher than the national average. The first two elements, FIA and CP, are 15 points each, with no partial credit. CPI - Plan implementation credit is scored similar to outreach projects in Activity 330, with projects that are considered more effective getting more points. There is more diversity here – for the 17 communities credited with a plan, the points for plan implementation range from zero to 60. All of the Jefferson Parish users group (JUMP) communities earned the maximum points for the first three elements and four of them fell only five points short of maxing out on the entire activity.

The State's average points are a little more than half the maximum and 59% of the communities are not getting any credit. These facts, coupled with the three new elements which can provide up to 80 more points, show that there is a lot of room for more credit in Activity 370.

Key Finding: Once again, there is a great increase in participation and points for a public information activity due to the local government's initiative and energy. The higher scoring examples underline the benefit of coordinating an activity with other, similar activities to facilitate implementation.

400 Series: Mapping and Regulations

410 Floodplain Mapping

Elements: There are six elements which credit different aspects of providing new data for floodplain management purposes. NS - New study credit is for augmenting the data provided by FEMA in a Flood Insurance Study (FIS), usually data in unstudied areas. NS points are multiplied by a value that reflects how much of the study was funded by FEMA. LEV - Leverage of 1.0 means the study had no FEMA funding and full credit is provided. A leverage value of less than 1.0 means the community cost shared with FEMA, usually to have a FIS cover more areas of interest. The credit for NS is adjusted based on the LEV value.

Some states mandate a state review (SR) of data before it is used for regulatory purposes. Louisiana is not one of those, so there is no SR credit. Some states and communities have flood study standards higher (HSS) than FEMA's Flood Insurance Study criteria and/or a more restrictive floodway standard (FWS) than FEMA's allowable one foot rise. The sixth element is for mapping a special flood-related hazard (MAPSH), such as coastal erosion or subsidence, provided the study is used in regulating development in those hazard areas.

Activity 410 (Floodplain Mapping)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
NS - New study	9%	8%	-3%	350	174	39	N/A
LEV - Leverage	10%	13%	+2%	1	1	1	N/A
SR - State review	15%	0%	0%	60	22	0	N/A
HSS - Higher study standards	3%	0%	0%	200	43	0	N/A
FWS - Floodway standard	12%	0%	0%	140	117	0	N/A
MAPSH - Special hazards mapping	2%	0%	0%	100	43	0	N/A
Activity total	28%	8%	-29%	850	78	39	N/A
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: Nationally not many communities receive credit for the various elements and no Louisiana communities receive credit for four of the six elements. New studies are expensive, so the national rate is only 9%, essentially the same as Louisiana's 8%. SR and FWS elements are limited to seven states that have state mapping regulations.

Obtaining new studies is dependent on gaps in a community's flood insurance study and local funding to fill those gaps. Of the five communities that received this credit in 2019 and 2023, four are parishes – the type of community most likely to want more detailed data that are not provided by FEMA in less developed areas and to have the resources to conduct such studies.

Points: In 2019, three Louisiana communities received an average of 66 points for NS. In 2023, three communities received an average of 39 points for NS and LEV, but two of the three were new. One community received new maps that did not qualify and the other could no longer document the credit.

Key Finding: Floodplain mapping is site-specific and each community's needs are often unique. Because of these factors, there are no models or templates that can help communities qualify for most of the credits in Activity 410. As a result, mapping can be a very expensive undertaking. The key conclusion is that this activity is usually worth pursuing only if the community already has new maps or maps prepared under the credited HSS - Higher study standards.

420 Open Space Preservation

Elements: The basic credit in Activity 420 is for the first element, OSP - Open space preservation. The next four elements provide extra credit if the preserved open space also has a deed restriction (DR), is preserved in or restored to its natural state (NFOS), and/or is also subject to one of the special flood related hazards (SHOS) or coastal erosion (CEOS). The last one, CEOS, was added in the 2017 CRS Coordinator's Manual, so it was not reflected in the 2019 database used in the 2019 CRS Strategy Update and no Louisiana communities have earned the credit.

Activity 420 (Open Space Preservation)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
OSP - Preserved open space	90%	92%	+3%	1,450	427	243	+40
DR - Deed restriction	26%	5%	+5%	50	6	1	1
NFOS - Natural functions open space	41%	41%	+4%	350	43	47	+13
SHOS - Special hazards open space	1%	0%	0%	150	67	0	0
CEOS – Coastal erosion open space	**	0%	0%	750	**	0	0
OSI - Open space incentives	16%	21%	+10%	250	30	8	-7
LZ - Low density zoning	12%	0%	0%	600	204	0	0
NSP - Natural shoreline protection	1%	0%	0%	120	39	0	0
Activity total	92%	95%	0%	2,870	471	259	+52
** Data not in the national database. All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

The last three elements are not related to the first five. OSI - Open space incentives credits regulatory incentives that encourage developers to set aside floodprone areas as open space (if the regulations mandated set asides, the areas would qualify for OSP credit). LZ - Low density zoning (one building on a minimum of five acres) does not keep parcels open but provides a flood damage prevention benefit and receives fewer points than OSP. NSP - Natural shoreline protection credits keeping riverine and lake shorelines in their natural states, which means no hardened banks.

Participation: Most communities have some preserved open space within their corporate limits, such as a public park, so most get some OSP credit. Most deed restrictions on open space lands are from federal funding requirements. Federal funds are typically used to purchase and clear properties with floodprone buildings on them, resulting in a deed restriction on each individual parcel. When the impact adjustment is factored in (see next page), the final points are very small. As a result, many communities do not bother with collecting the needed documentation for every parcel to be credited.

NFOS - Natural functions open space areas are more prevalent in many undeveloped areas of Louisiana and 41% of the communities are getting credit for keeping them open. Of the 16 communities getting the credit, 12 (75%) are in the first three users groups.

Few Louisiana communities have the types of special hazards that warrant the SHOS credit or have the prerequisite development regulations for those hazards. While more Louisiana communities face coastal erosion hazards, it is likely that they do not have the qualifying development regulations.

OSI can be relatively easy to adopt or to include in a land use plan. Interestingly, of the eight communities receiving OSI credit, six are parishes, i.e., those communities with more room for development outside the SFHA. It is likely that more communities have such ordinances or do not realize the full range of credits, from 10 points for encouraging floodplain open space in the land use plan up to 250 points for very restrictive rules.

It is surprising that no communities are getting LZ credit. There are surely some parishes with requirements for lots in the floodplain to be five acres or larger. Often this is accomplished with zoning districts for agricultural areas.

NSP credit requires prohibiting armoring channel banks, dredging, and other channel, beach, or sand dune alterations. Because so many communities rely on man-made drainage ditches, there are not many opportunities for this credit.

Points: While Louisiana has essentially the same percentage of communities receiving OSP and NFOS credits as the national averages, the points for OSP are lower, reflecting the fact that the preserved areas are a smaller percentage of their floodplain. Because of the impact adjustment, the few OSP properties that have a deed restriction produce relatively little credit. The points for NFOS are only slightly higher than the national average.

Louisiana communities have some incentives for developers to set aside vacant floodprone areas, but a review of the database confirms that they are not very strong. The good news is that the State's average points for OSP and OSI are rising.

Figure 17-9. A zoning ordinance can designate wetlands and floodprone areas for agricultural, conservation, or other uses that suffer minimal damage from a flood.

Source: Louisiana Floodplain Manage-ment Desk Reference, p. 17-19

Key Findings: The fact that 92% of Louisiana communities receive credit for the most important element, OSP, shows that staff are aware of the credit and know how to document it. They may find more qualifying properties as they prepare for each verification visit. The same should apply to receiving NFOS credit. It is hard for most communities to obtain sufficient credit for DRor SHOS.

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IMPACT ADJUSTMENTS

The credit calculations for several activities include an impact adjustment. This step adjusts the points based on how much of the floodplain or what portion of the community's floodplain buildings are impacted by the element. Here's an example from Activity 420 Open Space Preservation:

The credit points for preserving areas as open space are modified by the impact adjustment that reflects the ratio of the area of the creditable parcels to the area of the community's Special Flood Hazard Area. For example two communities may each have 50 acres that qualify for 1,450 points as preserved open space (OSP).

The community with 100 acres of SFHA receives a total of 1,450 x 50/100 = 725 points while the community with 1,000 acres in its SFHA receives a total of 1,450 x 50/1,000 = 72.5 points. It is not the total acreage that counts but how much of the community's SFHA is impacted.

Because of the impact adjustment, some communities do not apply for or fully document creditable elements that have small impact adjustment ratios. An example is a community that purchased and cleared 20 houses from the SFHA. The area affected would be 20 quarter-acre lots or a total of five acres. If the SFHA is, say, 250 acres, the impact adjustment for the deed restrictions on those 20 parcels would be 5/250 = 0.02. The final credit would be 50 x 0.02 = 1 point.

On the other hand, the impact adjustment for Activity 520 (Acquisition and Relocation) is based on the number of buildings in the SFHA. If the same community had only 40 buildings in the SFHA and it cleared 20 of them, the impact adjustment ratio would be 0.5 and the credit would be 1,900 x 0.5 = 950 points.

While the concept of the impact adjustment makes sense and is easy to explain, some problems have been noted in implementation. For example, undevelopable portions of the SFHA do not have to be counted. The community can and should mark up its floodplain map to exclude areas such as lakes and national forests.

It has been reported that one community did not eliminate undevelopable water and land, resulting in the area of the SFHA being twice as large as the area of the developable portion of the SFHA. Because the ratio's denominator was twice what it should be, the credit would have been half of what the community actually deserved. Luckily this particular case was caught by the ISO/CRS Specialist, but the community had to recalculate and document the credit.

There are other fine points in the impact adjustment procedures that are not so obvious and easy to catch and correct. The national guidance document is six years old and does not address Louisiana issues, such as whether bayous are treated as water or developable land. Accordingly, state-specific guidance, training or technical assistance on impact adjustments and the credit calculation formulas would result in higher and more accurate scores for Louisiana communities.

There is potential for substantial credit for CEOS, OSI, LZ, and NSP. This is especially true for most parishes because they have sparsely developed areas where it is easier to qualify for the last two elements. A program to provide communities with more information and examples of qualifying programs and regulations could prove helpful. The higher percentage of users group communities earning NFOS credit shows that sharing information can facilitate getting credit for open space elements.

430 Higher Regulatory Standards

Elements: Because there are so many ways to regulate development to reduce the potential for flood damage, this activity has the most elements of any CRS activity. The elements cover a wide range of regulatory tools and standards. Their names are generally self-explanatory.

Activity 430 (Higher Regulatory Standards)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
DL - Development limitations	39%	26%	+15%	1,330	73	107	+37
FRB – Freeboard	88%	72%	+30%	500	108	86	+34
FDN - Foundation protection	28%	28%	+28%	80	30	35	+35
CSI - Cumulative substantial improvements	34%	18%	-8%	90	41	64	+4
LSI - Lower substantial improvements	6%	3%	-2%	20	11	19	-1
PCF - Protection of critical facilities	21%	5%	+5%	80	30	20	+20
ENL - Enclosure limitations	12%	15%	+10%	390	54	102	-112
BC - Building code	89%	100%	0%	100	63	53	+1
LDP - Local drainage protection	81%	87%	-2%	120	16	30	+12
MHP - Manufactured home park	4%	8%	+8%	15	15	15	+15
CAZ - Coastal A Zone regulations	5%	0%	0%	500	183	0	0
SHR - Special hazards regulations	3%	0%	0%	100	71	0	0
OHS - Other higher standards	13%	0%	-5%	100	99	0	-25
SMS - State mandated standards	60%	0%	-3%	20	11	0	-5
RA - Regulations Administration	69%	82%	+14%	67	17	16	+4
Activity total	100%	100%	0%	2,462	220	272	+138
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation and Points: These two topics are covered together for each element.

An important point to note is that most of these elements have an impact adjustment that eliminates areas credited under Activity 420 (Open Space Preservation). The rationale is that development regulations have no impact in areas that will not be developed. As a result, most communities do not receive the maximum credits for these elements in Activity 430.

DL - Development limitations: The first element credits prohibiting fill, buildings, and/or storage of materials in the SFHA. It is difficult for most communities to enact regulations restrictive enough to qualify for this credit. However, 26% of Louisiana communities get the credit and have an average score that is 34 points higher than the national average.

Most of the credited communities require compensatory storage, which provides 130 points before the impact adjustment.

FRB – Freeboard: FRB is a requirement to protect new buildings to a level higher than the base flood elevation. While fewer communities get credit in Louisiana than the national average, 72% of the state's CRS communities are getting some credit. Further, participation increased by 30% since 2019. The higher the protection, the greater the credit. One foot of freeboard equates to 100 points before the impact adjustment; two feet warrant 225 points, etc. Of the 28 communities that earn the credit, eight require more than one foot of freeboard. As with the participation rate, Louisiana's average credit is lower than the national average. But the participation rate should increase to 100% due to the recent addition of one foot of freeboard in the state building code. Per the 2021 Addendum, one foot of freeboard is now a prerequisite for Class 8

FDN - Foundation protection: This element requires foundations to be engineered or otherwise designed to protect against differential settling, scour and erosion. All 11 communities receiving this credit require buildings to be built on compacted fill that is protected from erosion and scour. This is a good standard that may be implemented by conscientious builders anyway. However, CRS credit is for adoption of an explicit requirement that is enforced and recorded.

CSI - Cumulative substantial improvements: CSI is designed to stop an all-too-common practice that gets around the substantial improvement requirement: getting a permit for a relatively small improvement project, finishing the project, applying for another permit for the next small project, and repeating the practice. The result can be a relatively new house that does not meet the requirements for new houses.
The 18% of the Louisiana CRS communities that earn CSI credit require all the pieces that add up to a credit of 80 or the maximum 90 points but the impact adjustment reduces the average to 64 points. Note that this is still 50% higher than the national average.

LSI - Lower substantial improvements: The NFIP required substantial improvement threshold is when the value of the improvement or repair project equals or exceeds 50% of the market value of the building. LSI credits lowering that threshold to have smaller projects trigger the mandate to bring an existing building up the new building standards. It is not a common practice nationally and only one Louisiana community earns CRS credit for it.

PCF - Protection of critical facilities: "Critical facilities" include places vital to the community, such as hospitals, nursing homes, and utilities, as well as properties that if flooded would make conditions worse, such as hazardous materials sites. It is recognized that such facilities warrant a protection level higher than the base flood elevation. This element encourages communities to prohibit critical facilities from hazardous areas or (for fewer points) to protect them from at least the 500-year (0.2% chance) flood. While 21% of the nation's CRS communities have some higher standards to protect critical facilities, only two Louisiana CRS communities are getting this credit. The max of 80 points is for prohibiting critical facilities from the 500-year floodplain. The national and state average points of 30 and 20 respectively, reflect that the max credit is too tough a standard for most communities.

ENL - Enclosure limitations: The problem with enclosed lower areas under elevated buildings is that the owner can modify the areas out of sight from permit officers. Especially when the lowest floor is eight feet or more above grade, there is a great temptation to convert what was permitted as a floodable area to a finished family room or even an apartment. ENL credits regulations that either prohibit walls under elevated buildings (max 240 points), limit enclosed areas to 300 square feet (100 points), or require a nonconversion agreement from the owner (max 90 points).

Figure 17-2. This coastal building suffered extensive damage to the enclosed lower area.

One Louisiana community adopted the full credit standard for 240 points and four adopted the 300 square feet limitation. These are tough standards but very effective in preventing human-caused flood damage. As a result, the state average is almost twice the national average.

BC - Building code: The International Building Code is the standard for United States communities. It includes a variety of flood protection standards and ensures a higher quality of construction. Partly because of a state mandate enacted after Hurricane Katrina, Louisiana has a higher participation rate than the national average.

There are two parts to scoring BC:

- **BC1:** Every community gets 48 out of 50 possible points for adopting the State-required provisions of the International Code.
- **BC2:** Credit is based on the community's Building Code Effectiveness Grading Schedule (BCEGS) classification. BCEGS is a voluntary program which measures the effectiveness of the community's administration and enforcement of the adopted code. BC2 scores range from zero for 26 communities to 40 for one community (St. John the Baptist Parish).

Improving scores for BC is dependent on improving the community's code administration and getting a new BCEGS rating. A prerequisite for a Class 6 is for the community to maintain a BCEGS rating 5/5 or better; the prerequisite for a Class 4 is a BCEGS rating of 4/4 or better.

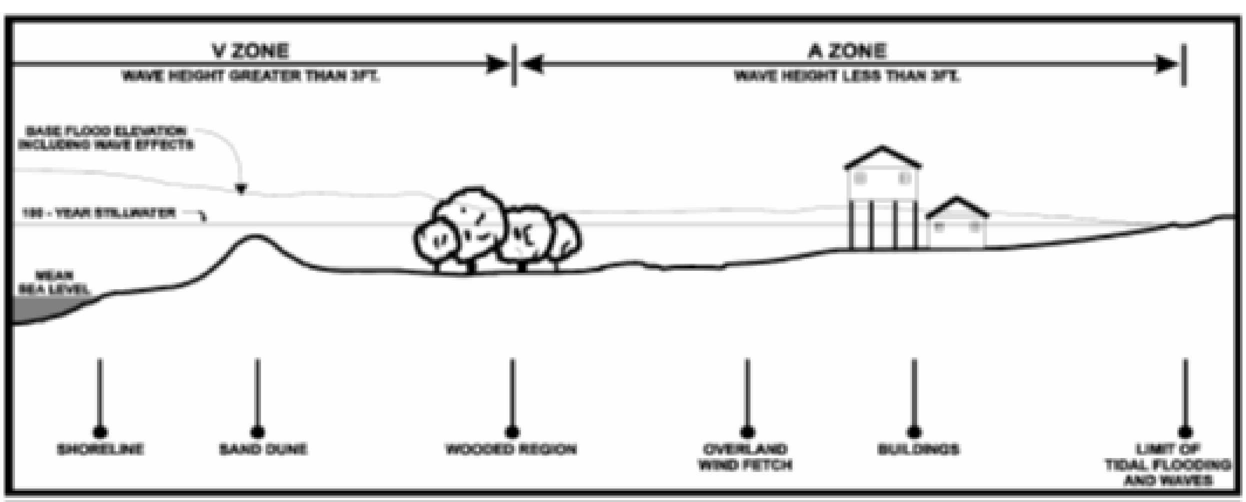
LDP - Local drainage protection: Communities in flat Louisiana have recognized the importance of addressing local drainage. In some areas, rain will fill up a depression and flood buildings, especially buildings on slab foundations with the lowest floor close to grade. As a result, most Louisiana communities have adopted one or both of two simple requirements for new buildings: buildings on fill must have positive drainage away from the building and/or the lowest floor must be a designated height above the crown of the nearest street or the highest adjacent grade. Note that this credit is dependent on the standard being enforced throughout the community; it is not limited to the floodplain.

Thirty-four Louisiana CRS communities (87%) get LDP credit, but they range from 10 points for only having positive drainage (17 communities) to the maximum possible of 120 points for requiring the lowest floor to be three feet above the street (one community – Gretna). Recognition of the local drainage hazard and adoption of these standards has resulted in an average State score that is almost twice the national average.

MHP - Manufactured home park: The NFIP regulations only apply to manufactured home parks or subdivisions built after the community's floodplain management ordinance was adopted. New manufactured homes placed in an existing park did not have to be protected to the base flood elevation. Instead they would have to be elevated at least three feet above grade, exposing them to flood damage where the base flood is more than three feet deep.

MHP credit is for treating new or substantially improved manufactured homes in existing parks the same as new "stick built" buildings. The low participation rate is likely due to the requirement that the community must already have at least one existing manufactured home park where the base flood elevation is more than three feet. Louisiana has twice the participation rate of the national average. All communities get the same credit -15 points.

CAZ - Coastal A Zone regulations: Coastal floodplains, where the wave heights during the base flood are calculated to be as high as three feet, are mapped as V Zones (see graphic, below). V Zones are subject to additional regulatory standards, including a requirement that the area below the elevated first floor must be kept open or be enclosed by breakaway walls.



Source: Louisiana Floodplain Management Desk Reference, p. 7-4

Studies and NFIP claims have shown that coastal waves less than three feet high can cause considerable damage. Coastal A Zones can be defined by the community or can be mapped by FEMA and designated with a line called the Limit of Moderate Wave Action or LiMWA. If a community enforces the V Zone standards in this area, it can receive CAZ credit.

As seen in the Activity 430 table, no Louisiana communities are getting this credit.

SHR - Special hazards regulations: The preferred way to address areas subject to the flood-related special hazards such as tsunamis and subsidence is to preserve the areas as open space and not allow new buildings (which is credited in Activity 420 (Open Space Preservation)). Where that is not feasible, the CRS credits higher standards for new buildings that address the impact of the hazards. As with CAZ, there are no Louisiana communities receiving this credit and only 3% of the nation's CRS communities are getting it.

OHS - Other higher standards: This is a place holder for regulatory standards that are not credited elsewhere in the CRS Coordinator's Manual. Thirteen percent of the nation's CRS communities are earning credit for something, but no Louisiana CRS communities are at this time.

SMS - State mandated standards: This element was deleted by the 2021 Addendum. At the time, only one community was getting the credit and it was for only five points. Therefore, its elimination does not adversely impact the program in Louisiana.

RA - Regulations Administration: This credit is for a community's program to meet certain administrative standards and/or for staff having been trained or certified. Louisiana has seen a 14% increase in community participation with average scores close to the national average. Most of the points have been for staff training and off-site storage of permit records. The average of 16 out of a maximum possible 67 points shows there is plenty of room for improvement.

The maximum credit for training (RA1) is 25 points. The state average is half that; nine communities get no credit; and only three communities are receiving the maximum for training (or for having a Certified Floodplain Manager review all permits in the floodplain).

Key Findings: For most of the higher regulatory standards, Louisiana has a lower participation rate than the national rate. On the other hand, the average scores for Louisiana communities are higher than the national averages for six of the 12 credited elements.

The 22 communities in the first three users groups have a higher average total score for Activity 430, 236 points, compared to 199 points for the 17 communities in the rest of the state. However, unlike many of the 300-series activities, there was no element where most of the participating communities were in those three users groups.

Three general conclusions are drawn from the data.

1. While there are now 14 elements that credit higher regulatory standards, some are more effective than others in preventing flood damage to new and existing buildings. The participation rates show that some of these are already part of many Louisiana CRS communities' programs. These include:

    FRB - Freeboard,
    BC1 - Adopting the International Building Code,
    LDP - Local drainage protection (LDP), and
    RA - Regulations administration.

2. Other standards are similarly effective, but not many Louisiana communities are getting credit for them. This is in spite of the fact that average Louisiana scores for several of them are above the national averages. These elements can be very important in preventing damage from future floods and may warrant efforts to qualify more communities for these credits or for more points:

    FDN - Foundation protection,
    CSI - Cumulative substantial improvements,
    PCF - Protection of critical facilities,
    ENL - Enclosure limitations for buildings more than four feet above grade,
    BC2 - the Building Code Effectiveness Grading Schedule scores, and
    RA - more training on regulations administration topics.

3. As with Activity 420 (Open Space Preservation), Activity 430 has an element specifically for coastal areas that provides very high maximum points. In 420, it is CEOS - Coastal erosion open space (max 750 points) and in 430 it is CAZ - Coastal A Zone regulations (max 500 points). The maximum points are high because the coastal flood hazard is high, and these elements can reduce flood losses in those areas. Even so, no Louisiana community is earning either credit.

440: Flood Data Maintenance

Elements: The objective of Activity 440 is to ensure that key floodplain management regulatory data sets are kept current. The first element, AMD - Additional map data, addresses keeping FIRMS up to date. Most communities do this using GIS mapping. The second element, FM - FIRM maintenance, credits preserving copies of all the past FIRMs, amendments, and revisions.

BMM - Benchmark maintenance encourages a local system to ensure that elevation reference marks, which are vital to determining building and ground elevations, are available for surveyors. The last element, EDM - Erosion data maintenance, supports a similar program that maintains reference marks that track coastal erosion.

Activity 440 (Flood Data Maintenance)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
AMD - Additional Map Data	96%	95%	0%	160	115	100	+6
FM - FIRM maintenance	51%	64%	+11%	15	12	11	0
BMM - Benchmark maintenance	35%	28%	+17%	27	23	23	-4
EDM - Erosion data maintenance	1%	0%	0%	20	12	0	0
Activity total	97%	100%	+5%	222	127	109	+7
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: Louisiana CRS communities have participation rates close to the national average. The high level of support for AMD, usually with GIS platforms, is impressive.

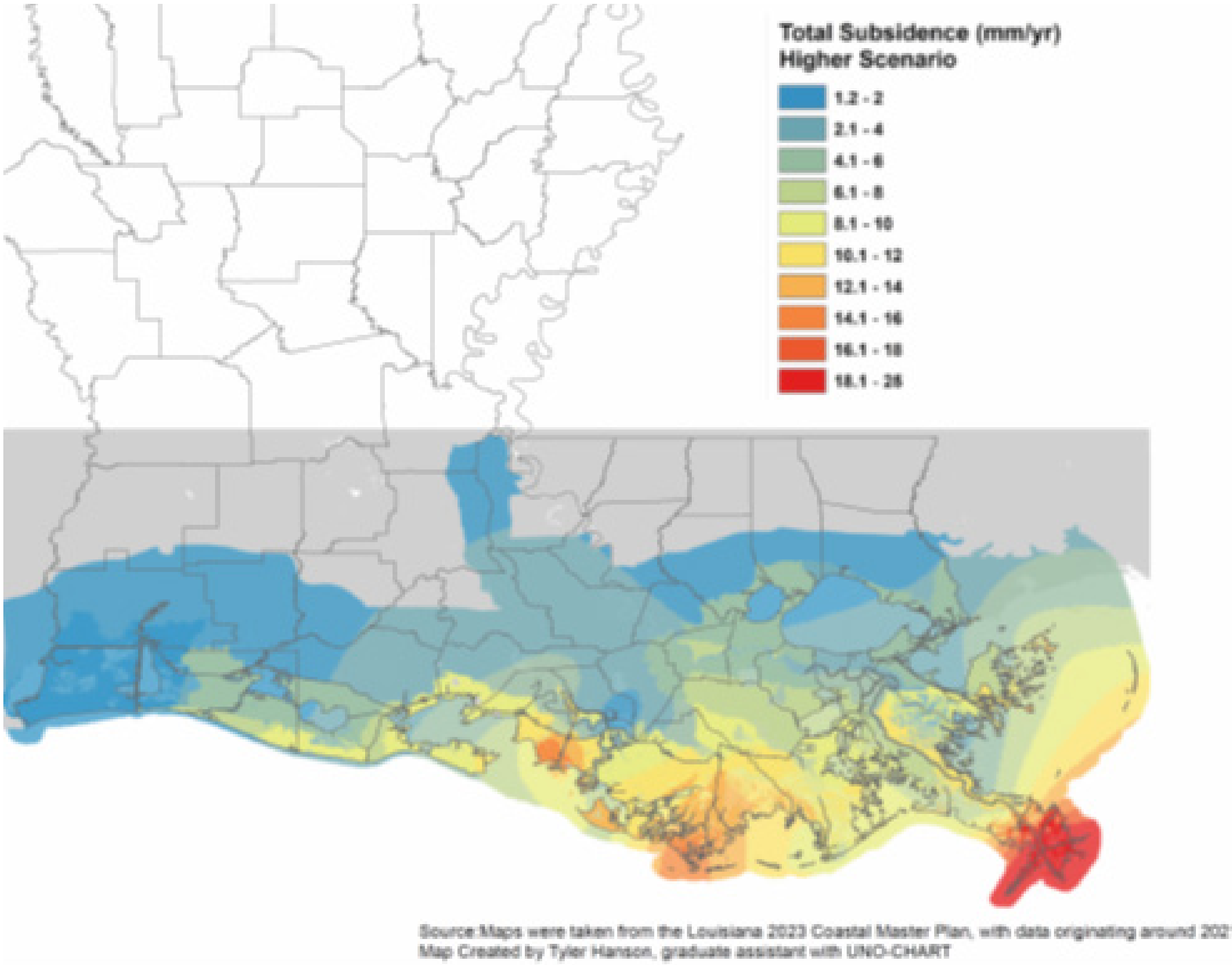
More participation in BMM would be useful, given that many communities are subject to subsidence, where this element is even more important. As with some other elements, participation is much higher in communities in the first three users groups – all 11 communities getting BMM credit participate in those groups.

Points: As with participation, Louisiana credits are close to the national averages. There is always room for improvement, especially for AMD.

Key Finding: As these elements are staff-dependent, credit points for Additional Map Data can be increased if staff have the time and resources.

Similarly, the remaining 72% of the CRS communities can receive BMM credit if they are given the resources needed to establish and maintain a program. Such a program would be particularly useful to communities subject to subsidence, where unchecked elevation reference marks can sink and become unusable. The areas affected are shown on the map in Figure 6.

Figure 6. Areas subject to subsidence



450: Stormwater Management

Elements: As with some other activities, this one starts with credit for a basic program that is also a prerequisite for other elements. SMR – Stormwater management regulations credits key regulatory standards that new developments need to meet to minimize increasing runoff on other properties. The regulations are enforced community-wide, not just in the SFHA.

Communities with SMR credit are encouraged to develop a watershed master plan (WMP) that replaces some of the community-wide requirements with standards that address the specific condi-tions in sub-watersheds, including runoff conditions based on expected future development.

Activity 450 (Stormwater Management)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
SMR - Stormwater management regulations	45%	49%	+12%	380	119	57	-2
WMP - Watershed master plan	6%	0%	0%	315	121	0	0
ESC - Erosion and sedimentation control	76%	79%	0%	40	18	14	+3
WQ - Water quality regulations	62%	44%	+12%	20	20	20	0
Activity total	90%	85%	+1%	755	110	56	+12
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

The last two elements, ESC – Erosion Sediment Control and WQ – Water Quality regulations, address the water quality impacts of runoff from new developments. These programs are usually set by the state's environmental agency, often independently from the floodplain manager's focus on water quantity.

Participation: Louisiana CRS participation rates are close to the national averages for this activity. It is somewhat surprising that given the drainage problems that come with very flat land, more communities are not getting the SMR credit and no community is getting WMP credit. One reason for the latter is the high cost of preparing a watershed master plan.

Another surprise is the relatively low rate of participation in the two water quality credits. In many states, every CRS community receives ESC credit because of state rules under the National Pollutant Discharge Elimination System (NPDES).

Points: As with the participation rate, Louisiana communities should earn more points for their stormwater management regulations. The 2021 Addendum brought a change that should increase the credit for SMR and WMP, especially for cities. Previously, the impact adjustment for these two elements was based on how much of the watershed(s) was subject to the regulatory standards.

Municipalities that do not have regulatory authority outside their corporate limits would have relatively low scores because their program does not impact most of their watershed. Now, the impact adjustment is based on how much of the community is regulated. As a result, municipalities that regulate all development in their corporate limits will get full credit.

Key Finding: It is suspected that most communities in the state have some level of stormwater management regulations, although it may go by a different name. Given the change in the impact adjustment, there is a new reason for communities to review their ordinances to identify what qualifies or what changes are necessary to qualify for SMR, ESC, and WQ credits.

500 Series: Flood Damage Reduction Activities

510: Floodplain Management Planning

Elements: Three types of plans are credited in Activity 510. The first element, FMP – Floodplain management planning, credits a comprehensive review of the community's flooding problem(s) and a full range of mitigation options that could be implemented to prevent and reduce flood damage, including structural flood control and non-structural floodplain management measures. In recent years, the credit criteria have been incorporated into parish-wide hazard mitigation plans and all participating communities in the parish receive the same scores.

The second element, RLAA – Repetitive loss area analyses, credits more focused plans to reduce flood damage in repetitive loss areas. The third element, NFP – Natural floodplain functions plan, provides credit for adopting plans that protect one or more natural functions within the community's SFHA.

The 2021 Addendum added a fourth element to Activity 510: SDP – Substantial damage management plan which credits a community plan to prepare for substantial damage estimates and determinations after a flood. As of the April 2023 database, only one community in the country had received this new credit.

Activity 510 (Floodplain Management Planning)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
FMP - Floodplain management planning	73%	92%	+3%	382	191	157	+10
RLAA - Repetitive loss area analyses	4%	10%	+10%	140	132	102	+102
NFP - Natural floodplain functions plan	8%	3%	+3%	100	25	15	+15
Activity total	74%	92%	+3%	622	197	168	+21
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: Louisiana has close to a 100% participation rate for FMP plans, well above the national average. One reason for this is the coordinated and cooperative parish-wide mitigation plans that incorporate the CRS planning criteria. For half of the CRS communities getting this credit, (18 of 37), the city scores for FMP are the same as the parish scores. The other communities may have worked together but received different scores for a variety of reasons.

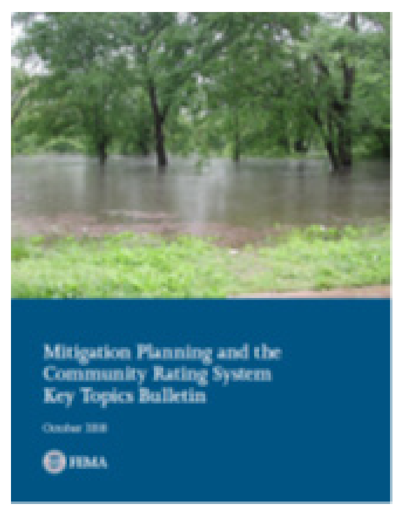
Communities with 50 or more repetitive loss properties are required to prepare and adopt a floodplain management or hazard mitigation plan that addresses repetitive loss areas or prepare and adopt a Repetitive loss area analysis for those areas. The requirement impacts 47 Louisiana communities, of which 24 are currently in the CRS. Historically, most communities have used the former approach to save time and money.

No Louisiana communities were getting RLAA credit five years ago. While 10% of the State's CRS communities are getting it now, it is still an unexpectedly low participation rate given that most Louisiana communities have some number of repetitive loss properties. UNO/CHART has also prepared model RLAAs in different areas of the state, so there are many good examples. [9]

The table on the previous page shows that natural floodplain functions plan (NFP) participation is relatively low nationwide and even lower in Louisiana. The 2021 Addendum introduced a new way to obtain this credit through assessments and plans that address threatened and endangered species. Jefferson Parish participated in the pilot program and is the first community in the country to be approved for the full 100 points. Its plan is one of three national models available to help communities.

Points: Although point totals are higher than five years ago, the average points for all three elements in Louisiana are well below the national averages. However, for the 18 communities credited with parish-wide hazard mitigation plans, the average score for FMP in 2023 was 186. For the other 19 communities, the average for FMP was 131, another reason for cities and their parishes to work together on hazard mitigation/floodplain management planning.

Key Finding: Because these plans need to be updated every five or ten years, it should not be hard for the planners to adjust the planning process to increase the points during their communities' next rounds of updates. There is even FEMA guidance on how to do this.



FEMA now has a guide on how to prepare a mitigation plan that accounts for CRS credit.

[9] **Need link to CHART's repetitive loss area analyses**

[10] **https://crsresources.org/files/500/fsa-example_floodspeciesassessmentplan_jefferson_parish_12_2020.pdf**

While the repetitive loss planning requirement can be met with a thoughtful process for an FMP plan, such an approach misses the benefits of the additional RLAA credit for a more focused plan that addresses specific chronic flood problems.

The new way to receive credit for a natural floodplain functions plan by doing a relatively simple assessment first and then determining if a plan would be useful should be considered by all communities. Not only would there be more CRS credit earned, the plan will identify how steps to protect threatened and endangered species can also strengthen a local floodplain management program. Communities could also use some guidance to learn about and implement the newest element – the substantial damage management plan.

520: Acquisition and Relocation

Elements: This activity credits removing insurable buildings from the floodplain. There are five elements, each a different way to calculate credit for a different type of building. The basic credit is bAR – Buildings acquired or relocated. Clearing a repetitive loss building (bRL) or a critical facility (bCF) is worth twice the basic credit and removing a severe repetitive loss building (bSRL) gets three times the credit.

Participation: The Activity 520 table below shows that participation by Louisiana communities is two to three times the national rates. This is likely due to the many floods the state has suffered and the resulting availability of FEMA and HUD post-disaster mitigation grants.

Points: There are two ways to calculate the points. Option 1 totals the points up to a maximum of 190. Option 2 has an impact adjustment with the maximum being the activity max of 2,250. Option 1 is used when there is a relatively small number of buildings acquired or relocated. The table shows the average number of buildings for each element, not the points.

Activity 520 (Acquisition and Relocation)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	* US Avg.	* LA Avg.	LA Change
bAR - Buildings acquired or relocated	22%	44%	+3%	**	54	6	-3
bRL - Buildings on the repetitive loss list	15%	46%	+5%	**	10	8	-1
bSRL - Severe Repetitive Loss properties	6%	31%	-7%	**	6	5	+1
bCF - Critical facilities	0%	0%	0%	**	0	0	0
bVZ - Buildings in V or coastal A Zones	1%	0%	0%	**	14	0	0
Activity total	28%	56%	+8%		176	74	-5

All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.
* The database does not provide credit points per element. Instead, it shows the number of buildings per element, which is what is shown here.
** There are no maximum points for each element, only the maximum for the activity as a whole. The "Activity total" line does show points.

One may wonder how the points could decrease when the buildings are gone, and the property must remain open. What decreased was the average. As more communities applied for this credit over the last five years, the new ones had lower counts or lower scores, bringing down the averages.

Note that the "average points" are not points but the average number of buildings credited under each element. Louisiana communities that have applied for credit have fewer creditable buildings than national applications. While larger numbers would bring in better CRS scores, it would require substantial funds to purchase or relocate many more buildings.

Key Finding: Given the time and cost of acquiring and clearing property, CRS credit is not likely to be a motivator for acquisition and relocation projects. Assistance for this activity should focus on the documentation requirements. As communities clear more buildings from floodprone areas, they can apply for 520 credit and/or document the additional work for additional points.

530: Flood Protection

Elements: The CRS Coordinator's Manual shows three elements for Activity 530, but there are actually three steps in calculating the points for protecting one building at a time. The credit factors are the technique used (TU)(e.g., elevating the building (TUE) is worth more than dry floodproofing (TUD) because it is more dependable), how much better protected the building is (FPI)(e.g., more points for protecting a building to the 500-year flood elevation), and the value of protecting the building (e.g., a critical facility is counted as two buildings). The resulting points for each building are added to get the activity total.

Activity 530 (Flood Protection)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA
Change							
Retrofitted buildings	12%	28%	+2%	1,600	64	86	+29
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: As noted for Activity 520 - Acquisition and Relocation, Louisiana has had more floods and hurricanes than other states, so it has received more mitigation funds than most other states. That money has been put to good use on clearing buildings out of the floodplain (520) or protecting them on site (530).

While 56% of the CRS communities are getting 520 credit, only 28% are getting 530 credit even though there have been more buildings elevated than acquired.

Points: Unlike 520, the average credit for this activity in Louisiana is higher than the national average. It jumped ahead since 2019. The major reason for the higher average in 2023 is that communities already getting credit added more properties to their lists. Ten communities in the first three users group have applied for this credit compared to one in the rest of the state. They have averaged 93 points compared to the one community's 12 points.

Key Finding: Unlike acquiring floodprone buildings, this activity credits actions that individual property owners can fund for their own protection. Many do, often with cost sharing from FEMA or other mitigation funding programs. Therefore, unlike Activity 520, implementation is not dependent on community funding or a lot of staff time. A good deal of credit can be obtained by documenting the elevation and other retrofitting projects that have been conducted in the community.

540: Drainage System Maintenance

Elements: Drainage maintenance is very important in flat areas like much of Louisiana. If a channel is obstructed, normal flows can run over banks and flood many properties. Activity 540 provides credit for a formal, written program that conducts inspections of the system at least annually and can track follow up to correct problems found. Such a program is credited under the first element, CDR – Channel debris removal. Additional points for the maintenance program are provided for paying special attention to problem sites (PSM), such as more frequent inspections or monitoring them during a storm.

As seen by its name, CDR focuses on debris, i.e., minor problems that can be removed relatively quickly. There is separate credit under CIP – Capital improvements program for written and funded capital improvement programs to correct major problems. Stream dumping regulations (SDR) credits ordinances to prevent dumping trash and other materials in a channel that make more work for the maintenance crews. The last element, SBM – Storage basin maintena) is like CDR, but it is for storage basins rather than channels.

Activity 540 (Drainage System Maintenance)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
CDR - Channel debris removal	28%	51%	-41%	200	153	135	-41
PSM - Problem site maintenance	25%	38%	+12%	50	49	49	+8
CIP - Capital improvements program	16%	23%	-19%	70	33	29	+1
SDR - Stream dumping regulations	21%	33%	-41%	30	24	25	+3
SBM - Storage basin maintenance	7%	0%	-5%	120	74	0	-120
Activity total	35%	51%	-28%	470	203	201	-22
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: The last five years have seen a decrease in the State's participation rates for all elements except problem site maintenance. Sixteen of the 36 communities receiving credit in 2019 received no credit in 2023. This is likely due to a change in the 2017 CRS Coordinator's Manual that limited the credit to natural channels. Many Louisiana communities have extensive networks of man-made drainage ditches that are no longer counted after 2019.

If the community has an inspection program that is credited under SDR, it can receive credit for its stream dumping regulations. Because of the CDR prerequisite, the same 16 communities went to zero credit for SDR in 2023. At least five of them also went to zero for CIP credit.

While four of the elements are dependent on staff and regulations, a capital improvements program is usually based on an engineering study, which can be expensive. To maintain the credit, the community must fund capital projects on a regular basis.

Points: The 41 point drop in CDR is likely due to the 2017 CRS Coordinator's Manual revision. There is an impact adjustment for CDR and SBM that reflects how much of the system in developed areas is covered by the program. Eliminating manmade ditches from credit could have resulted in fewer components in the developed areas in the communities' program.

The "-120" in the last column stands out, but it simply means that the only two communities in the State that were getting storage basin maintenance credit are no longer getting it. This was not related to the 2017 Manual's changes. The two communities opted to focus their efforts on other CRS credits.

Key Finding: While the State participation rates for the first four elements are well above the national averages, every community should pursue this credit. Not only is drainage system maintenance important in the typical Louisiana terrain, but most communities also have a maintenance program. Often, they only need to formalize it with an inventory and written procedures.

Technical assistance with the records and mapping the affected channels and basins and with adopting and enforcing SDR regulations would help improve participation and points for all the elements except for the capital improvement program, which requires funding. However, if a community already has such a program, it may simply need to document it for CIP credit.

600 Series: Warning and Response

610: Flood Warning and Response

Elements: This is the first of the three 600 series activities. It addresses the "natural" floods along rivers, lakes, and the oceans. The other two address floods caused by levee and dam failures.

All three activities have a similar set of four elements that follow the usual chronological progress in response to the hazard. In 610 they are:

- **A.** **A flood threat recognition system (FTR) predicts flood elevations and arrival times at specific locations within the community**
- **B.** **Emergency warning dissemination (EWD) to the public**
- **C.** **Flood response operations (FRO), i.e., specific tasks to reduce or prevent threats to health, safety, and property**
- **D.** **Critical facilities planning (CFP) that coordinates flood warning and response activities with operators of critical facilities**

610 has two more elements that provide credit for qualifying under National Weather Service programs – SRC – StormReady and TRC – TsunamiReadyCommunity.

Activity 610 (Flood Warning and Response)							
Elements	Participation			Points			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
FTR - Flood threat recognition system	21%	23%	+23%	75	73	74	+70
EWD - Emergency warning dissemination	21%	23%	+23%	75	69	69	+69
FRO - Flood response operations plan	21%	23%	+23%	115	82	97	+97
CFP - Critical facilities planning	21%	23%	+23%	75	30	25	+25
SRC - StormReady community	10%	13%	+13%	25	25	25	+25
TRC - TsunamiReady community	1%	0%	0%	30	30	0	0
Activity total	21%	15%	+15%	395	266	285	+285
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: In 2019, no community in Louisiana was getting credit for Activity 610. Since then, nine communities have qualified, four of them in Jefferson Parish. For any credit, the community must have a program that receives credit for the first four elements. This explains why they have the same participation rates of 23%. Of the five communities receiving SRC credit, four are in Jefferson Parish. Jefferson Parish is a great example of the benefit of developing floodplain management programs in cooperation with its municipalities.

Points: The credits for the six communities compare favorably with the national averages. Except for CFP, they also compare favorably with the maximum possible points.

Key Finding: Preparing a CRS-credited flood warning and response plan requires a lot of work from the emergency manager and the floodplain manager. It can be a significant undertaking, but it pays off with the early evacuation and emergency building protection measures that it facilitates. While technical assistance can help, most of the work must be done by local staff. Because most emergency management agencies are at the parish level, it makes the most sense to prepare them for the parish with appropriate attention to municipalities.

Figure 7. StormReady Parishes in the CRS

Caddo
Calcasieu
East Baton Rouge
Jefferson
Lafayette
Orleans
Ouachita
St. Charles
St. Tammany
Tangipahoa
Terrebonne
West Baton Rouge

There is an apparent correlation between credit for Activity 610 and the StormReady Community designation. The latter indicates a heightened interest in the type of flood warning and response work credited in 610. There are 24 parishes and one city (Lake Charles) with the StormReady designation, including 12 of the 16 parishes in the CRS (listed in figure 7). These communities might be good candidates for tackling the preparations needed for 610 credit. There are no TsunamiReady communities in Louisiana.

620: Levees

Elements: As with 610, 620 has four elements that follow the flood response timeline: be alerted to a potential flood (LFR), warn the public (LFW), conduct emergency operations (LFO), and address critical facilities (LFC).

Activity 620 has one more element than 610. That element is also a prerequisite for the other elements in 620: have a written levee maintenance program (LM). Note that there are no LM credit points for levees that are recognized as providing protection from the base flood on a Flood Insurance Rate Map. This is because a maintenance program is already required for the map recognition, i.e., it is a minimum requirement of the NFIP. However, a community still needs to provide all the relevant LM documentation to receive credit under the other elements.

Activity 620 (Levees)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
LM - Levee maintenance	1%	0%	0%	95	78	0	0
LFR - Levee failure threat recognition system	1%	0%	0%	30	21	0	0
LFW - Levee failure warning	1%	0%	0%	50	26	0	0
LFO - Levee failure response operations	1%	0%	0%	30	20	0	0
LCF - Levee failure critical facilities	1%	0%	0%	30	10	0	0
Activity total	1%	0%	0%	235	111	0	0
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: There are only six CRS communities in the country receiving this credit, none of them are in Louisiana. A key reason for this is that most levee programs are operated by levee districts, not by a city or parish, and it is often hard to expect districts to devote time and resources to help a community obtain CRS credit.

Points: Louisiana communities receive no points for this activity.

Key Finding: This situation is unfortunate as few states are as dependent as Louisiana is on large and safe levees. Time and effort spent developing one creditable model program might pay off if it helps other communities and levee districts. Such models have been quite useful in other activities, such as model ordinance language and mitigation plans.

630: Dams

Elements: As with 620 Levees, this activity has the same four warning and response elements. The fifth element is credit for the state's dam safety program (SDS). It is provided only to those communities that would be affected by a flood from the failure of a high-hazard-potential dam, i.e., a dam that should be regulated by the state's program.

Activity 630 (Dams)							
Elements	**Participation**			**Points**			
	US Pct.	LA Pct.	LA Change	Max	US Avg.	LA Avg.	LA Change
SDS - State dam safety program	33%	10%	-6%	45	37	45	0
DFR - Dam failure threat recognition system	1%	0%	0%	30	22	0	0
DFW - Dam failure warning	1%	0%	0%	35	15	0	0
DFO - Dam failure response operations	1%	0%	0%	30	12	0	0
DCF - Dam failure critical facilities	1%	0%	0%	20	7	0	0
Activity total	33%	33%	+17%	160	38	45	0
All participation and points values are as of 4/1/2023. All Louisiana change values are from 2019 to 2023. Louisiana change values are calculated by subtracting 2023 values from 2019 values, with a negative value indicating a decline from 2019.							

Participation: While one-third of the nation's CRS communities are getting credit for their state's dam safety program, only four in Louisiana are: Ouachita, Caddo, and St. Tammany Parishes and Mandeville. This may be due to (1) the requirement that they must be downstream of a high-hazard-potential dam (which is easier for a parish to determine) or (2) a lack of knowledge of their exposure to such a hazard.

No Louisiana communities are getting credit under the other four elements. Some may have a dam failure warning and response program, but either it has not been submitted for credit or it is known to not meet all the credit criteria.

Points: Communities do not determine the points for their SDS credit; the state's program does. Louisiana's state program receives the maximum credit of 45 points.

Key Finding: A statewide map of the high-hazard-potential dams and their impact areas might help additional communities receive the state dam safety credit.

Dam failure inundation maps and warning and response plans for the facility are required as a condition of federal permits for certain dams. A review might find a dam operator willing to assist in preparing a model program, which also heavily depends on the level of involvement of the community's (usually the parish's) emergency manager.

3. SUMMARY OF THE KEY FINDINGS

The long term goals of the CRS strategy are to increase the resources available to Louisiana CRS communities and to improve coordination among the various state and statewide or regional programs that can help communities reduce flood losses and protect natural floodplain functions. By implementing creditable CRS activities and elements, flood losses will be reduced, and natural floodplain functions will be better protected.

The CRS is a tool to reach long term goals. To make the tool more effective, this Strategy Update focuses on how to improve participation and increase points in the CRS. In effect, by improving use of the tool, Louisiana communities will reach greater goals.

Element types: The previous section and the key findings identify what has worked (i.e., where communities earn credit) and what facilitates getting the credit. This state-wide level summary catalogs the CRS elements under five types which are based on how hard it is to earn the credit:

A. Elements that most communities are already getting. These are either mandated elements, elements that most communities were already doing, or elements that are easy for most communities to start. Adopting and implementing the International Building Code (430 BC1) is an example of a mandated element.

B. Elements where a little staff time and effort can obtain a good score. These are often called "low hanging fruit" in that the points are easy to earn for most communities. Many of the elements in the 300 series of public information fall under this type.

C. Elements that require more work, but the benefits of implementation are worth the extra effort. Examples are some of the higher regulatory standards that can take a lot of time and effort to explain and get adopted and the 600 series of emergency management plans. These can have a major impact on the protection of new and substantially improved buildings and on life safety during a flood.

D. Elements a community should pursue if it has already done most of the work. Usually the CRS credit alone does not warrant the time and expense necessary to do the job. Buyouts and the credits under Activity 520 Acquisition and Relocation fall under this type.

E. Elements where only a few communities qualify (e.g., a coastal credit that is not available for inland communities) so a state-level effort may not be warranted.

Not every element fits cleanly into one of these five types and some elements are not categorized at all, primarily because they are viewed as too difficult or not relevant for most Louisiana communities.

Here are this Strategy Update's recommendations for each type of CRS element.

A. **Elements that most communities are already getting credit for**. The following elements are currently being implemented by at least 90% of the CRS communities in the State.

- ***310 Construction Certificate Management***
  - **EC - Elevation Certificates after CRS application**
- **320 Map Information Service**
  - **MI1 - Providing insurance information from FIRM**
- **330 Outreach Projects**
  - **OP - Outreach projects**
- **340 Hazard Disclosure**
  - **ODR - Other disclosure requirements**
- **350 Flood Protection Information**
  - **LIB - Library**
    - **LPD - Locally pertinent documents**
  - **WEB - Website**
- **420 Open Space Preservation**
  - **OSP - Preserved open space**
- **430 Higher Regulatory Standards**
  - **FRB - Freeboard**
  - **BC - Building code**
  - **LDP - Local drainage protection**
- **440 Flood Data Maintenance**
  - **AMD – Additional Map Data**
- **510 Floodplain Management Planning**
  - **FMP - Floodplain management planning**

B. Elements where a little staff time and effort can obtain a good score. State-level support would provide information or text templates, instructions on what is needed to get the credit, links to good examples, and where to get help.

320 Map Information Service: All but one Louisiana community is getting 320 credit. All are earning MI1 credit, which is Type A because it is a prerequisite to getting more credit. Four of the remaining elements are considered Type B because it is relatively easy to get the map information and expand the service to tell people about it:

- **MI2 LiMWA/floodway info/CBRS area**
- **MI4 Flood depth data**
- **MI6 Historical/repetitive flood information**
- **MI7 Natural floodplain functions**

Seventeen communities are currently getting the maximum credit of 90 points. The rest have scores ranging from zero to 70. Adding one, two, or three elements from MI2, 4, 6 and 7 would give all communities the maximum credit points of 90.

330 Outreach Projects: Outside the JUMP users group, no community is getting the maximum credit for OP – Outreach projects. Thirty-one of the 39 CRS communities are getting no credit for FRP flood response preparations. In short, all communities could use more examples or language to use in outreach projects.

350 Flood Protection Information: Participation and credit points for all three elements could be improved with lists of publications that could augment what is in the public library and with ideas, examples, and links for local websites. Other than the possible cost of printing publications, the work is all staff time.

420 Open Space Preservation: If the community has collected the property information needed for OSP – Open space preservation, documentation for NFOS – Natural functions open space credit for a parcel can be relatively simple, such as an existing report or a letter from a naturalist or other professional.

440 Flood Data Maintenance: The average Louisiana points for AMD – Additional map data is 100 out of 160. Most of the ways to get credit include GIS layers that can be easy to obtain. Examples are layers showing previous FIRMs, areas with natural floodplain functions, such as wetlands, and the 500-year floodplain boundaries.

FM – FIRM maintenance requires collecting and keeping all FIRMs, floodway maps, and Flood Insurance Studies that have been published for the community. If the community cannot find them all, digital copies may be available on FEMA's Map Service Center or with help from the LSU AgCenter FloodMaps Portal. DOTD may also have copies of historical FIRMs.

510 Floodplain Management Planning: The new credit for NFP natural floodplain functions plan is for a two-step process. The first step is an assessment that a lay person can do in a day or two. It is worth 15 points and is considered "low hanging fruit." The real benefit is that the assessment supports the decision whether to pursue a plan worth 85 points. Several Louisiana communities are earning the assessment credit and Jefferson Parish's plan is a national model.

C. Elements where more work is required, but the benefits of implementation may be worth that effort. Activities and elements that require working with another local office are listed here, even though there may not be a lot of effort needed on the part of the CRS Coordinator.

State-level support would be to provide instructions on what is needed to get the credit, information or text templates, links to good examples, and/or where to get help. In several cases, instructions and templates have been published by FEMA, such as the PPI guidance. Additional assistance for this group of elements would include a source of advice who can also review a community's work while it is underway. For some elements, there are ISO technical reviewers who can provide this service.

330 Outreach Projects: The PPI – Program for Public Information and STK – Stakeholder credits require staff effort and an advisory committee. The product can boost other credits totaling 100 points or more. The PPI is also an activity that can be done, and has been done, at the Parish or users group level, reducing the workload on individual communities' staff.

340 Hazard Disclosure: A program worthy of DFH – Disclosure of the flood hazard, REB -Real estate brochure, and DOH – Disclosure of other hazards credit could be developed in cooperation with the area Boards of Realtors. The entire state is covered by such Boards whose members should want to support full disclosure of the hazards facing the properties they help sell.

360 Flood Protection Assistance: This activity requires the time of a staff member who is knowledgeable about property protection measures. This person also needs to work well with people. Assuming property owners take that person's advice, there can be a significant reduction in flood damage to buildings subject to flooding and drainage problems. The workload can be reduced by sharing it with other communities, such as having an agreement with the parish to provide the service.

370 Flood Insurance Promotion: Preparing the FIA – Flood insurance assessment, CP – Coverage improvement plan, and CPI – Coverage plan implementation are similar to preparing and implementing a PPI and are often included in PPIs, so the level of effort is similar. Providing TA – Technical assistance is like providing 360 technical assistance, except that it needs to be done by an expert in flood insurance. As with 360, this element would benefit by sharing the work with other communities in the

[11] https://crsresources.org/files/500/fsa-example_floodspeciesassessmentplan_jefferson_parish_12_2020.pdf

parish or users group.

420 Open Space Preservation: Three elements in this activity can be credited with a bit of work, including working with other offices and recommending revising an ordinance. OSI - Open space incentives standards range from encouraging floodplain open space in the community's land use plan (10 points) to transfers of development rights (70 points) to requiring subdivisions to set aside the floodplain as open space (250 points).

Staff work would also be required to research the zoning and subdivision ordinances and, if needed, draft and support an ordinance revision. Similar work would be needed for researching and drafting the LZ – Low density zoning ordinance language, which provides up to 600 points. Most parishes have open space or agricultural zoning districts that require at least 5 acres minimum lot sizes. Much of the work would be comparing the zoning map to the floodplain map, which could be done by the GIS office.

As with the two previous examples, a community may already have something on the books that effectively protects natural shorelines. NSP credit would require identifying the natural shorelines along the streams, lakes, and the Gulf and determining if there are existing regulations to preserve them as natural. The inventory work could already have been done as part of the community's credit for its channel and debris removal program (540 – CDR).

430 Higher Regulatory Standards: As noted under Activity 430, the following elements can be very effective in preventing damage from future floods. However, fewer than one-third of the State's CRS communities are getting credit for them, even though the average Louisiana scores for several of them are above the national averages.

- **FDN - Foundation protection,**
- **CSI - Cumulative substantial improvements,**
- **PCF - Protection of critical facilities,**
- **ENL - Enclosure limitations for buildings more than four feet above grade,**
- **BC2 - the Building Code Effectiveness Grading Schedule scores**

The staff work required for these ordinance provisions would be similar to what's described for the 420 elements on the previous page. However, they are less likely to be found in existing codes and it is more likely that work would be needed to draft and adopt new regulations. Again, such regulations would be worth it as they clearly would improve protection of new and existing buildings from flood damage, and they are not specifically included in the NFIP minimum requirements.

440 Flood Data Maintenance: One element in this activity requires some staff work but a great deal of coordination with others, in this case, surveyors. A BMM – Benchmark maintenance program involves identifying qualifying elevation reference marks, making their location known to surveyors, and taking appropriate steps if any are found missing or disturbed. Surveyors will readily see the advantages of such a program and should be willing to cooperate.

450 Stormwater Management: As with the regulatory credits in 420 and 430, credit for SMR – Stormwater management, ESC – Erosion and sediment control, and WQ – Water quality regulations requires a review of existing ordinances. At one time or another, most communities have adopted such provisions. If the current standards do not qualify, appropriate ordinance language would be needed. This work would need to be closely coordinated with (and preferably done by) the community's engineer and/or surface water management office. In addition to lots of CRS points, the full benefit is from fewer drainage problems, better management of runoff during storms, and cleaner runoff.

510 Floodplain Management Planning: Most CRS communities are getting credit for the first element, FMP – Floodplain management planning, but the state average of 157 is 34 points below the national average and 225 points below the maximum credit of 382. Higher scores are possible – 14 Louisiana communities are getting over 200 points for FMP and Terrebonne Parish/City of Houma is getting over 300 points. Higher points are possible if the typical hazard mitigation planning process includes attention to key flood provisions that are discussed in FEMA's *Mitigation Planning and the Community Rating System Key Topics Bulletin.*

Most communities are not getting credit for the other two elements, RLAA – Repetitive loss area analysis and NFP – Natural floodplain functions plan. These are standalone activities that are not usually incorporated into mitigation planning or a community's land use or compre-hensive planning. Completing each requires staff or a consultant's time, but no advisory committee. The easier Type A Floodplain Species Assessment can also help determine if a Floodplain Species Plan should be pursued for NFP credit.

As with other credits in this section, the payoff from these three planning efforts is a more effective local program that reduces the impacts of repetitive flooding and protects threatened and endangered species habitat, both of which strengthens a community's overall floodplain management program.

540 Drainage System Maintenance: Four of the five elements in this activity are mostly staff efforts to prepare and implement a formal program to inspect and maintain drainage channels and storage basins. This program must be closely coordinated with, and preferably prepared by public works or drainage staff. The required implementation and record keeping is mostly done by public works or drainage staff.

Most communities have such staff and at least an unwritten program. For CRS credit, the bulk of the work is formalizing and documenting what is done. If the existing program does not warrant a lot of points, community staff can discuss the benefits of the CRS standards and upgrade the existing program to meet those national standards.

SDR – Stream dumping regulations should be tackled like other regulatory provisions: review existing ordinances and, if something is missing, draft and help adopt ordinance revisions.

600-series Warning and Response: The three activities in the 600 series have the lowest Louisiana community participation rates. Obtaining credit under any of them requires a commitment on the part of the community's emergency manager. In many parishes, the parish emergency manager is effectively responsible for the cities' programs.

Preparing a flood, levee failure, or dam failure warning and response plan can be a major undertaking. However, there are examples and once a flood response plan is completed, the other two are easier to develop because they build on the procedures of the first.

Dam and levee response plans have the additional need to work with, and depend on, the owners of the dams and levees that would impact the community if they failed. This can be difficult because most agencies that own and manage dams are outside of the local government structure and the dam and its owner may be some distance upstream, even in the next parish or state.

Despite these challenges, all three credits are worth pursuing as they can have a major impact on life safety and property damage from future floods. There are good examples that can help with flood response and dam safety response planning, but one is not known for levee failure warning and response.

Training credits are provided in Activities 360 Flood Protection Assistance (TNG) and 430 (RA). The easiest way to get these credits is to attend the noted free classes at FEMA's Emergency Management Institute (EMI). The benefits of having a trained staff go well beyond CRS premium discounts.

There is also an EMI class on the Community Rating System (E0278). Attendance at that class would help staff become more familiar with all the credits in the program and how the other attendees' communities are addressing them. Sometimes, this class may be field deployed to Louisiana or a nearby state.

D. Elements worthwhile if most of the work has already been done. Usually the CRS credit alone does not warrant the time and expense necessary to pursue these credits if the community starts from scratch. But, if there already is an ongoing program, it may not take much to collect what is needed to document the credit. Experience has shown that most of such programs need some tweaking to meet all the credit criteria.

State-level support would be to provide national examples and contact information for Louisiana communities that are getting the credit.

310 Construction Certificate Management: If the community required FEMA Elevation Certificates before they were required, staff could collect them and submit them for ECPO post-FIRM or ECPR pre-FIRM credit.

410 Floodplain Mapping: NS – New study and LEV – Leverage credit are provided for non-FEMA studies that the community uses in its permit program. This includes studies that FEMA reviewed and incorporated into its FIS and FIRM. "Non-FEMA" studies can include mapping and studies done by the Corps of Engineers or other entity, not just the community.

450 Stormwater Management: As noted, three of the four elements are Type C and can be credited with just staff work. The fourth, WMP – Watershed master plan, requires a hydrological and hydraulic engineering study of the streams in the watershed(s) that drain into the community. These are usually considered affordable only if done as part of a master plan to identify where channel improvements, flood control structures, etc. are warranted. One may have been done at the parish or larger scale and the community is not aware of or does not use it. Some digging would discover if such a master plan has been done, but note that it must meet certain credit criteria, such as addressing at least the 25-year storm.

520 Acquisition and Relocation: The CRS credit points alone do not warrant the expenditures to acquire and clear floodprone buildings. But even if only a few buildings have been cleared, they are worth 3 points each under the Option 1 credit calculation alternative. Repetitive loss and severe repetitive loss properties are worth 6 points and 9 points each, respectively. Getting these points depends on collecting the records that show a parcel that had a building on it is preserved as a vacant lot (which also documents credit for Activity 420 Open Space Preservation).

530 Flood Protection: The same approach as in 520 applies to Activity 530. Under Option 1, each building in the floodplain that was elevated voluntarily (not because the community was enforcing its NFIP requirements) is worth 2.4 points.

540 Drainage System Maintenance: As with Activity 450, all but one of the elements can be credited if staff can do the required work. The exception is CIP – Capital improvements program. As noted in the activity discussion, "a capital improvements program is usually based on an engineering study, which can be expensive. To maintain the credit, the community must fund capital projects on a regular basis." If one has been done and the community is committed to implementing it, it should go for the credit.

E. **Elements where only a few communities can qualify.** There are some elements that apply only in certain situations but that can be worth hundreds of points. No Louisiana communities are receiving these credits; many may not qualify (e.g., inland communities cannot get the coastal credits) and/or it may take some work to qualify. In these cases, further discussions should be held to determine the work needed and the level of interest in the few communities that would benefit.

Coastal communities: Coastal areas may qualify for 420 open space and 430 regulatory credits: CEOS – Coastal erosion open space and CAZ – Coastal A Zone regulations. The maximum points warrant investigating the possibilities – 750 and 500 points, respectively. The first step is to identify which coastal communities are interested. One place to start is to identify which communities currently have V Zones on their FIRMs.

Communities with subsidence: A community with a subsidence problem would benefit from the following activities and elements:

- **320 MI5 special flood-related hazards map information (max 20 points)**
- **420 SHOS special flood-related hazards open space (max 150 points)**
- **430 SHR special flood-related hazards regulations (max 100 points)**
- **440 BMM benchmark maintenance (max 27 points)**

While some of the point totals seem high, those in 420 and 430 are subject to the impact adjustment that accounts for how much of the SFHA is subject to subsidence. There are general maps of the state showing subsidence areas that would be a good place to start to identify which communities might be interested.

Communities protected by levees: If there is interest from those communities with levees, a pilot model program involving a levee district and the communities would be worth preparing.

On the following pages is a matrix that shows which elements are considered worth the most attention, their maximum points, and their type. The last column identifies offices or organizations that might be able to provide assistance or who are vital to implementing the element and would need close coordination. In the latter case, sometimes the other office just needs a copy of the *CRS Coordinator's Manual* credit criteria to see how they fit in.

Table 4. Elements Recommended for Attention

Series/Activity Element		Max Pts	Type					Assistance/Coordination
			A	B	C	D	E	
300 Series: Public Information Activities								
310 Construction Certificate Management *								
EC	Elevation Certificates after CRS **	38	A					
ECPO	Elevation Certificates, post-FIRM bldgs.	48				D		
ECPR	Elevation Certificates, pre-FIRM bldgs.	30				D		
320 Map Information Service								
MI1	Providing basic information on the FIRM	30	A					
MI2	LiMWA/floodway info/CBRS area	20		B				Community GIS
MI3	Other flood problems not on the FIRM	20						
MI4	Flood depth data	20		B				Community GIS
MI5	Special flood-related hazards	20					E	Community GIS
MI6	Historical/repetitive flood information	20		B				Community GIS
MI7	Natural floodplain functions	20		B				Community GIS
330 Outreach Projects								
OP	Outreach projects	200	A	B				Public Information Officer
FRP	Flood response preparations	50		B				Emergency manager
PPI	Program for Public Information bonus	100			C			P-UG, ISO technical reviewer
STK	Stakeholder bonus	50			C			P-UG, ISO technical reviewer
340 Hazard Disclosure								
DFH	Real estate agent disclosure of SFHA	35			C			Area Board of Realtors
ODR	Other disclosure requirements	25	A					
REB	Real estate brochure	12			C			Area Board of Realtors
DOH	Disclosure of other hazards	8			C			
350 Flood Protection Information								
LIB	Library	10	A	B				Parish or regional library system
LPD	Locally pertinent documents in the library	10	A	B				Parish or regional library system
WEB	Website	105	A	B				Webmaster
360 Flood Protection Assistance								
PPA	Property protection advice	40			C			P-UG
PPV	Advice after a site visit	45			C			P-UG
FAA	Financial assistance advice	15			C			P-UG
TNG	Training	10			C			
370 Flood Insurance Promotion								
FIA	Flood insurance assessment	15			C			P-UG, ISO technical reviewer
CP	Coverage plan	15			C			P-UG, ISO technical reviewer
CPI	Plan implementation	60			C			
TA	Technical assistance	20			C			P-UG

* Name changed in 2021 Addendum to Construction Certificate Management
UG – help or a cooperative effort could be pursued with the parish or users group
TYPES:
A. Elements that most communities are already getting credit for
B. Elements where a little staff time and effort can obtain a good score
C. Elements where more work is required
D. Elements worthwhile if most of the work has already been done
E. Elements where only a few communities can qualify

Table 4. Elements Recommended for Attention

Series /Activity Element		Max Pts	Type A	B	C	D	E	Assistance/Coordination
400 Series: Mapping and Regulations								
410 Floodplain Mapping								
NS	New study	350						
LEV	Leverage	N/A				D		
SR	State review	60				D		
HSS	Higher study standards	200						
FWS	Floodway standard	140						
MAP	Special hazards mapping	100						
420 Open Space Preservation								
OSP	Preserved open space	1,450	A		C			
DR	Deed restriction	50						
NFO	Natural functions open space	350		B				Parks or naturalist office, Nature
SHO	Special hazards open space	150					E	
CEO	Coastal erosion open space	750					E	
OSI	Open space incentives	250			C			Community planning
LZ	Low density zoning	600			C			Community zoning
NSP	Natural shoreline protection	120			C			Public works/drainage
430 Higher Regulatory Standards								
DL	Development limitations	1,330	A	B				
FRB	Freeboard	500		B				
FDN	Foundation protection	80			C			
CSI	Cumulative substantial improvements	90			C			
LSI	Lower substantial improvements	20			C			
PCF	Protection of critical facilities	80	A					
ENL	Enclosure limits	240			C			
BC	Building code *	100			C			Building official
LDP	Local drainage protection	120	A	B				
MHP	Manufactured home park	15	A	B				
CAZ	Coastal A Zone regulations	500	A	B				
SHR	Special hazards regulations	100			C			
TSR	Tsunami hazard regulations	50			C			
CER	Coastal erosion regulations	370			C			
OHS	Other higher standards	100			C			
SMS	State-mandated standards	20			C			Dropped in the 2021 Addendum
RA	Regulations administration	67			C			
440 Flood Data Maintenance								
AMD	Additional map data	160	A	B				Community GIS
FM	FIRM maintenance	15		B				Community GIS
BMM	Benchmark maintenance	27			C		E	Community, local surveyors
EDM	Erosion data maintenance	20					E	

* A for BC1 (adoption), C for BC2 (BCEGS)
TYPES:
A. Elements that most communities are already getting credit for
B. Elements where a little staff time and effort can obtain a good score
C. Elements where more work is required
D. Elements worthwhile if most of the work has already been done
E. Elements where only a few communities can qualify

Table 4. Elements Recommended for Attention

Series/Activity	Element	Max Pts	Type A	Type B	Type C	Type D	Type E	Assistance/Coordination
450 Stormwater Management								
SMR	Stormwater management regulations	380			C			Community planning, engineer
WMP	Watershed master plan	315				D		Community engineer
ESC	Erosion and sedimentation control	40			C			
WQ	Water quality regulations	20			C			
500 Series: Flood Damage Reduction								
510 Floodplain Management Planning								
All	Acquisition and relocation of buildings	382	A		C			Parish planning or emergency
RLAA	Repetitive loss area analysis	140			C			Community planning/public works
NFP	Natural floodplain functions plan **	100		B	C			ISO technical reviewer
520 Acquisition and Relocation								
All	Acquisition and relocation of buildings	2,250				D		
530 Flood Protection								
PB(R)	Retrofitted buildings	1,600				D		
PB(S)	Structural flood control & drainage	1,000				D		
540 Drainage System Maintenance								
CDR	Channel debris removal	200			C			Public works/drainage
PSM	Problem site maintenance	50			C			Public works/drainage
CIP	Capital improvements program	70				D		Public works/engineering
SDR	Stream dumping regulations	30			C			
SBM	Storage basin maintenance	120			C			Public works/drainage
600 Series: Warning and Response								
610 Flood Warning and Response								
FTR	Flood threat recognition system	75			C			Emergency management
EWD	Emergency warning dissemination	75			C			Emergency management
FRO	Flood response operations plan	115			C			Emergency management
CFP	Critical facilities planning	75			C			Emergency management
SRC	Storm Ready community	25						National Weather Service
TRC	TsunamiReady community	30						National Weather Service
620								
LM	Levee maintenance	95			C		E	Levee district
LFR	Levee failure threat recognition	30			C		E	Levee district, emergency mgmt.
LFW	Levee failure warning	50			C		E	Levee district, emergency mgmt.
LFO	Levee failure response operations	30			C		E	Levee district, emergency mgmt.
LCF	Levee failure critical facilities	30			C		E	Levee district, emergency mgmt.

** B for FSA, C for FSP

Types: A. Elements that most communities are already getting credit for
B. Elements where a little staff time and effort can obtain a good score
C. Elements where more work is required
D. Elements worthwhile if most of the work has already been done
E. Elements where only a few communities can qualify

Table 4. Elements Recommended for Attention

Series /Activity Element		Max Pts	Type					Assistance/Coordination
			A	B	C	D	E	
630 Dams								
SDS	State dam safety program	45		B				LA DOTD dam safety program
DFR	Dam failure threat recognition	30			C			Dam operator, emergency mgmt.
DFW	Dam failure warning	35			C			Dam operator, emergency mgmt.
DFO	Dam failure response operations	30			C			Dam operator, emergency mgmt.
DCF	Dam failure critical facilities	20			C			Dam operator, emergency mgmt.

** B for FSA, C for FSP

Types: A. Elements that most communities are already getting credit for

B. Elements where a little staff time and effort can obtain a good score

C. Elements where more work is required

D. Elements worthwhile if most of the work has already been done

E. Elements where only a few communities can qualify

4. RESOURCES

The previous sections review the individual credited elements in the CRS, identifying those with the greatest potential for implementation. The objectives are to identify those elements that are more attainable and to help communities do them. Section 3 identifies the types of assistance that would be most productive. This Section 4 reviews the potential agencies and organizations that could help CRS communities improve their programs.

This section builds on a survey conducted for the 2019 CRS Strategy that identified key state agencies that could assist with CRS activities. That work also contacted a variety of local, state, federal and private agencies and organizations. The information gathered was updated for this Strategy.

Where to start: There are four levels of assistance for community CRS staff:

1. The ISO/CRS Specialist should be the first person to contact with questions about an activity. The Specialist can clarify what is needed and can identify other communities that have good programs.

2. The next level of help is from fellow community officials. These can be neighboring communities or the parish government. Not only do parishes normally have more full time staff devoted to the CRS and CRS credited activities than the smaller cities, but many activities are also, or could be, implemented parish-wide.

   The success of the users group communities discussed earlier in the Strategy underlines the effectiveness of local officials helping each other. Users groups seemed particularly useful in the 300-series of public information activities.

3. The third level is the other staff members in the community who would be involved in implementing an activity or element. In many cases, implementation is already their responsibility. Examples are public works staff who do drainage system maintenance (540) and the emergency manager (600 series). They need to be part of the design of a new program as well as implementation.

4. Finally, there are state agencies and organizations who can provide a lot of technical assistance. They are identified in the following pages.

Facilitating coordination and cooperation: The first three levels of assistance would be through one-on-one discussions with the CRS Coordinator. There should be continuous communication and coordination with these offices over the years.

Getting technical assistance from a state level agency or organization could be more difficult, especially if each community is expected to find the right person to talk to. It would also be difficult for the agency or organization if they got calls from 39 different CRS Coordinators who explain what they need in 39 different ways. Finally, it would be good to provide feedback to the agency or organization on how helpful they have been.

Currently, at the state level there is a NFIP State Coordinator and a CRS Coordinator in the Louisiana Department of Transportation and Development's Public Works and Water Resources Division. This Strategy proposes the CRS Coordinator be a focal point for state level assistance to CRS communities.

It is proposed that a "CRS Priorities Committee" of interested community representatives (e.g., one from each users group plus others from other areas) be established, possibly through LFMA. The committee would prioritize assistance needs and work with the state CRS Coordinator to contact the priority offices and explain what communities may ask for. The state CRS Coordinator would report on progress and lessons learned back to the state Hazard Mitigation Plan Update Committee.

The CRS Priorities Committee, in cooperation with the state CRS Coordinator, could also identify training needs and even organize training sessions, webinars, and/or materials that would help communities in general or in support of specific elements. These would complement the training currently given by ISO through a series of one-hour webinars that cover general topics, such as annual recertification procedures and many activity-specific topics *(https://crsresources.org/training).*

Technical Assistance by CRS Activity: This section identifies potential sources of assistance by CRS activity. Contact information for the identified state level agencies and organizations follows the activity reviews.

As noted in the 2019 Strategy, "During this process, the research team found that missions and resources often change over the years. What an agency does today may change over time. Therefore, this section only summarizes what could be done." That caveat applies to this Strategy Update, too.

Activity 310 Elevation Certificates

The Louisiana Society of Professional Surveyors could assist in training surveyors on completing Elevation Certificates. This would be especially helpful now as a new version of the FEMA Elevation Certificate has just been released.

Activity 320 Map Information Service

The first contact should be with the community's GIS office, which may already have layers or paper maps that would meet the needs of one or more of the non-FIRM credits. Additional maps or layers for the community may be available from the US Army Corps of Engineers (e.g., levees, historical flood levels), the US Fish and Wildlife Service (e.g., the National Wetlands Inventory), and the National Oceanic and Atmospheric Administration (coastal hazards, coastal erosion data). Other communities, such as users group members, can provide guidance based on experience with flood depth data, special flood-related hazards, historical and repetitive flood information, as well as natural floodplain functions.

Activity 330 Outreach Projects

Outreach projects: The first stop is the community's public information officer, if there is one. Checking with other community departments often finds a sizable number of flyers and other public information materials that are related to one of the six credited topics (see Figure 5, page 14).

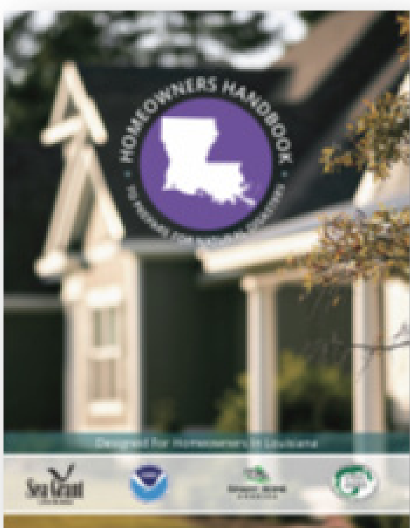
The emergency manager is often the key contact for outreach projects that would qualify under FRP – Flood response preparations. This is an element where other communities' experiences would be most helpful. Collecting, organizing, and disseminating good examples could be a task for a users group or the CRS Priorities Committee.

Brochures and publications from any agency can receive credit, if they have a message on one or more of the six credited outreach project topics. Here are two good examples from various state sources

Louisiana Sea Grant

Homeowners Handbook to Prepare for Natural Hazards

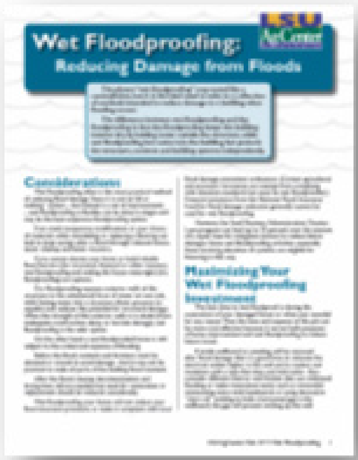
https://www.laseagrant.org/sglegal/publications/other/ homeowners-handbook



LSU AgCenter

Wet Floodproofing handout

https://www.lsuagcenter.com/topics/ family home/hazards and threats/publications /wet-floodproofing


Wet Floodproofing: Reducing Damage from Floods

Considerations

Maximizing Your Wet Floodproofing Investment

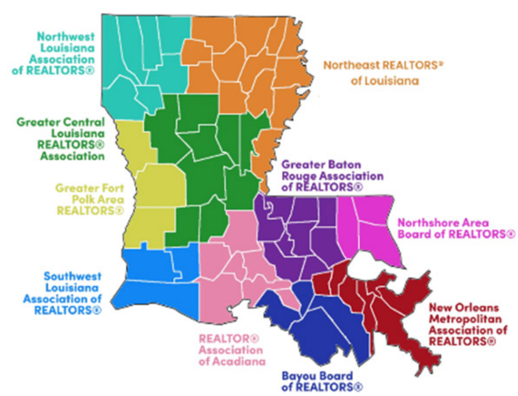
Program for Public Information: CRS users groups can be very helpful in organizing, implementing and sharing templates related to Programs for Public Information. The users group or the parish could be sponsors or hosts for multi-jurisdictional PPIs.

The ISO PPI technical reviewer can answer questions and review a draft, even a partial draft, to help reassure the local authors that they are on the right track. All questions and requests for an ISO technical reviewer go through the community's ISO/CRS Specialist.

Stakeholder activities deserving of STK credit are identified as part of preparing the PPI.

Activity 340 Hazard Disclosure

All CRS communities receive credit for state laws that require sellers to disclose whether a property is in a wetland, has been flooded in the past, or is located in a flood zone. The ISO/CRS Specialist can provide information on the latest credited laws.



Communities, PPI committees, or users groups should contact their regional real estate associations to determine what they are already doing and/or to mutually develop new activities or materials to advise house hunters about flood hazards. Because CRS credit is dependent on all real estate agencies in the area participating, contact should be made with the area Board of Realtors®. At the state level the best place to start is with Louisiana Realtors®, who can pass the word to member boards.

Activity 350 Flood Protection Information

Library: Publications from any organization that cover topics pertinent to the local flood situation or natural floodplain functions in the area can receive LPD credit. Users groups or the CRS Priorities Committee could develop lists of the best references to be included in local libraries that would be credited under LIB and LPD.

Website: As with library references, users groups or the CRS Priorities Committee could develop lists of qualifying local websites and links to other agency and organization sites that would qualify for individual credits. Examples include:

- LADOTD maintain a website with information helpful - http://floods.dotd.la.gov
- UNO-CHART's website has a "Disaster Toolkit" with lots of information that communities can link to for information on protecting property (https://www.uno.edu/chart/disaster-toolkit).
- Louisiana State University's Ag Center has information on property protection (http://www.lsuagcenter.com/topics/family_home).
- LaHouse Resource Center (lsuagcenter.com)
- The National Weather Service has several useful websites:
    - https://www.nhc.noaa.gov/?atlc – shows the status of hurricanes and tropical storms
    - https://water.weather.gov/ahps/region.php?rfc=lmrfc – shows coastal and river gages, including river gages that will provide flood level predictions
    - https://www.spc.noaa.gov/ – the Storm Prediction Center has information on inland thunderstorms, tornadoes, hail and other weather hazards.
- Communities that do not have their own FIRMs online can link to http://maps.lsuagcenter.com/floo maps/. FEMA has a similar site at its Map Service Center, https://msc.fema.gov/portal/home.
- The National Oceanic and Atmospheric Administration's Digital Coast details future flood hazards (https://coast.noaa.gov/digitalcoast).
- https://www.floodsmart.gov is a good source for links on flood risk and flood insurance.

Activity 360 Flood Protection Assistance

All elements: The best training for implementing this activity is the Emergency Management Institute's retrofitting course, E0279 Retrofitting Flood-Prone Residential

Buildings, or the home study version, IS0279. There is another home study course, IS0280 Overview of Engineering Principles and Practices for Retrofitting Flood- Prone Residential Structures. Information about these courses can be found at *https://www.firstrespondertraining.gov/frts/npccatalog.* Completing these courses also results in points for the TNG advisor training element.

Financial assistance advice: Communities can obtain the information needed for FAA credit from the agencies that provide the financial assistance. These include GOHSEP, CPRA, and the Division of Administration's Office of Community Development (OCD). FEMA grants are managed through GOHSEP and HUD community development grants are managed by OCD. A master list of federal, state, and private sources of financial assistance would be a good project for the CRS Priorities Committee.

Activity 370 Flood Insurance Promotion

Credit for the first three elements is dependent on preparing a document that follows the Program for Public Information model, so most communities include what is needed in their PPI. See Activity 330 for relevant sources of assistance.

As noted, the 2021 Addendum created three more elements for this activity. A conference session, webinar, or other venue would be helpful to explain these new credits to communities and insurance agencies. Such a project would be most appropriate for a users group or the CRS Priorities Committee.

Upon request, the Louisiana Department of Insurance (LDI) can provide brochures and assist with local presentations on flood insurance in support of this activity. Other useful materials are available from FEMA's FloodSmart website, *https://www.floodsmart.gov.*

Activity 410 Floodplain Mapping

A review of the Engineering Methods and the Bibliography and References sections of the community's Flood Insurance Study will show what agencies assisted in floodplain mapping. These sections will identify whether an agency other than FEMA provided mapping data. Where that is the case, the community may be able to obtain NS – New Study credit for the earlier work.

DOTD and the Water Institute are partners in FEMA's Cooperating Technical Partnership (CTP) Program.

Activity 420 Open Space Preservation

Open space preservation: Local and state parks, school district open areas, and private golf courses can all qualify for open space credit. Often the owning agencies can provide materials that can document the property's natural floodplain functions.

The Water Institute and LSU's Coastal Sustainability Studio may also provide support for this activity.

Deed restrictions: Properties purchased or improved with funding support from FEMA and other agencies often have deed restrictions that the community should have. If they cannot be found, the funding agencies may have copies.

Natural functions open space: Nonprofit organizations that own or work on protecting natural floodplain functions can help with documentation. An example is the Nature Conservancy, which has taken its own initiatives to help communities map areas that are creditable under the CRS. *(https://www.nature.org/en-us/about-us/where-we-work/united-states/louisiana)* See also *https://www.nature.org/en-us/about-us/where-we-work/priority-landscapes/gulf-of-mexico/stories-in-the-gulf-of-mexico/community-rating-system-flood-risk.*

Other groups that could help include the LA Department of Wildlife and Fisheries and the Audubon Society. FEMA has created FRESH Map (Flood Risk and Endangered Species Habitat Mapping Tool) which shows areas within the range or critical habitat of threatened and endangered species *(https://www.fema.gov/floodplain-management/wildlife-conservation/fresh-mapping-tool).*

Regulatory credits: Two of Activity 420's elements are for land use regulation – OSI – Open space incentives and LZ – Low density zoning. The community's planning and/or zoning offices would know whether there are such regulations on the books. Developing model regulatory language would be an appropriate task for the CRS Priorities Committee and could be incorporated into the new floodplain management desk reference that will be out soon.

Activity 430 Higher Regulatory Standards

As with the 420 regulatory credits, the community's planning, zoning, and building code offices would know what is currently enforced. All communities receive BC – Building Code credit for adopting the Louisiana State Uniform Construction Code. The ISO/CRS Specialist knows the specific provision and how to document the credit.

Examples of creditable ordinance language could be developed by the CRS Priorities Committee and DOTD. The language could also be put in DOTD's model ordinance and even in the Louisiana State Uniform Code. Otherwise users group members and neighboring communities could share the language they have that earn 430 credit.

Activity 440 Flood Data Maintenance

Map credits: The community's GIS office is the first point of contact for AMD – Additional map data and FM – FIRM maintenance. Both credits should receive a sizable number of points with a little work to ensure the credit criteria are met.

The first place to look for past FIRM panels is on FEMA's Flood Map Service Center website, https://msc.fema.gov/portal/home. If they are not there, DOTD may have copies of old Flood Insurance Rate Maps. Another possible source is the parish. Benchmark maintenance: BMM requires documenting the location and status of qualifying elevation reference marks in the community. Start with the community's engineering or public works offices to see what they have. Other entities that would know of local benchmarks include DOTD district engineer offices (http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Mgmt _Finance/HR/Pages/Contacts_Districts.aspx), local surveying firms and other offices that need to use benchmarks. There are also the National Geodetic Survey, the Louisiana Geological Survey, and the Louisiana Society of Professional Surveyors.

Activity 450 Stormwater Management

Stormwater management regulations: These stormwater management regulations would be drafted and enforced by the community's engineering and/or planning offices. They usually emerge during reviews of proposed subdivisions and other large developments.

Water quality regulations: Both ESC – Erosion and sediment control and WQ – Water quality regulations are usually adopted to meet state water quality standards. If the planning and engineering offices are not familiar with them, see if a city or parish environmental protection or surface water management office could help.

While there are agencies and organizations that could help with drafting creditable ESC and WQ language, such as the Louisiana Department of Environmental Quality and the Louisiana Environmental Action Network *(https://leanweb.org/)*, a single state-wide model for each would be more useful than expecting every community to draft their own version. Preparing model ordinance language would be an appropriate assignment for the CRS Priorities Committee.

Section 503 Repetitive Losses

Resources that can help communities meet these CRS prerequisites can be found in the 2024 Mitigation Plan's Appendix E: Repetitive Loss Strategy.

Activity 510 Floodplain Management Planning

Floodplain management plan: Most plans that qualify for FMP credit are parish-wide or city hazard mitigation plans. A model plan would not work because most parishes have mitigation plans that have been accepted by GOHSEP and FEMA. They are not going to start over just to fit in a different model. Therefore, a more useful tactic would be to advise the mitigation planners about incorporating CRS credited provisions in the next update. The best guide for this would be FEMA's "Mitigation Planning and the Community Rating System Key Topics Bulletin"

(https://www.fema.gov/sites/default/files/2020-06/fema-mitigation-planning-and-the-community-rating-system-key-topics-bulletin_10-1-2018.pdf).

Once a community or parish tries this recommended approach, the participants should document the lessons learned and share them state-wide.

Repetitive loss area analysis: Unlike other floodplain management plans, RLAAs are reports that focus on a community's repetitive loss area(s) and recommend specific mitigation measures that can range from elevating a house to constructing drainage improvements to a flood warning program. RLAAs can vary greatly for each area. There is a guide to the planning process at *https://crsresources.org/files/500/rlaa-guide-2017.pdf.*

UNO-CHART has prepared more repetitive loss area analyses (RLAA) than any other organization in the country. These can be useful templates for others. Most are located online at floodhelp.uno.edu *[Need CHART link].*

Natural floodplain functions plan: It is recommended that staff start with a review of local plans to see if they would qualify. These can be plans developed by the community or by another agency or organization with property or interest in one or more natural floodplain functions in the community.

Staff can also investigate the credit that came out with the 2021 *Addendum*, preparing a Floodplain Species Assessment (FSA) and, if the Assessment concludes one would be beneficial, preparing a Floodplain Species Plan (FSP). The Assessment can be prepared by a lay person following guidance published at

https://www.fema.gov/sites/default/files/documents/fema_fsa-preparing-flood-species-assessment-plan.pdf.

Substantial damage management plan: SDP is a new credit in the 2021 *Addendum*. As with the new credits in Activity 370, a conference session, webinar, or other venue would be helpful to explain the new credit to communities. Such a project would be most appropriate for the CRS Priorities Committee.

Activity 520 Acquisition and Relocation

There are funds and technical assistance available for acquiring and clearing floodprone buildings at GOHSEP, CPRA, and OCD. As a Type D activity (worthwhile if most of the work has already been done), this Strategy focuses on receiving CRS credit for what has been done by the local community development, planning or public works department. The ISO/CRS Specialist can readily explain the required documentation.

Activity 530 Flood Protection

This Strategy recommends the same approach as for 520, above; instead of explaining how to design and fund a building elevation or drainage improvement project, efforts should focus on helping the community earn credit for those properties that have been protected by a creditable measure. The ISO/CRS Specialist can readily explain the required documentation.

Activity 540 Drainage System Maintenance

This activity is designed and managed locally, with the cooperation and support of the local public works or drainage office. Users groups have been helpful with this activity by sharing procedures, records, and similar aspects of a maintenance program. UNO-CHART helped the City of Covington prepare a model program which can be found at *[Need CHART link].* It needs a little updating to reflect the latest credit criteria.

Stream dumping regulations: SDR should be approached like the other regulatory elements – check the community's current ordinances. If they don't qualify, draft and work for adoption of a new ordinance or amendment. Note that full credit requires a publicity effort that explains the rules.

The CRS Priorities Committee could collect regulatory and publicity examples from communities and review them with ISO to prepare model ordinance and model publicity language that would fit Louisiana's needs and receive the maximum credit.

Activity 610 Flood Warning and Response

The most important player in this activity is the community's (or the parish's) emergency manager. Without his/her support, the credit should not be pursued.

Flood warning and response guidance comes from the CRS, but agencies such as GOHSEP, and organizations like the Louisiana Emergency Preparedness Association *(https://lepa.org)* could provide training and more localized templates. Working with the Association could also help develop interest on the part of their members and be an important assignment for the CRS Priorities Committee.

StormReady/TsunamiReady: These programs are managed by the National Weather Service. If a community meets the activity credit criteria and is designated as a StormReady or TsunamiReady by the Weather Service, the credit is provided. The requirements for the designations are found at *https://www.weather.gov/StormReady* and *https://www.weather.gov/TsunamiReady.*

Activity 620 Levees

As with Activity 610, the most important player in this activity is the community's (or the parish's) emergency manager. If there's no interest on his/her part, the credit should not be pursued.

The second most important player is the organization responsible for the levee(s) that protects the community. In some cases, this may be a city or parish department, like public works. But in most cases, especially where a levee protects more than one community, it is a separate district that does not report to the community's government. It can be a challenge for the district, the emergency manager, and the CRS Coordinator to work together to develop a program that qualifies for 620 credit, especially if it appears that the levee district and the emergency manager do all the work and the community reaps the flood insurance discount benefit.

There are no known model programs. Given the importance of levees to the survival of so many Louisiana communities, a state-wide example would be well worth developing. Unlike other state-wide examples, it would take some work developing a new program for what would be a large levee district. DOTD or CHART might want to seek funding for such a project.

At a minimum, if there is a CRS community interested in piloting a program for credit, the Association of Levee Boards of Louisiana *(https://albl.org)* should be approached to see if there might be interest on its or its members' part to assist.

Activity 630 Dams

State dam safety credit: It is likely that more than the current three CRS communities getting this credit deserve the points. The key is whether the community is downstream of, and impacted by a failure of, a high-hazard-potential dam.

There are three approaches to helping communities with determining and documenting this credit:

1. Develop instructions on how to access the dam failure inundation maps.
2. Ask either the NFIP or the dam safety office in DOTD to make the determination as a public service to inquirers. Since there would be no more than 39 inquiries, it may be more cost effective to provide the service than to develop and explain procedures that would apply to every situation.
3. Ask someone, such as a volunteer, to check the maps for each interested community and provide the documentation.

Dam failure warning and response plan: Developing a local plan for the other four elements in 630 has the same challenges as getting 620 Levees credit. No Louisiana communities and only three CRS communities in the country are getting these credits.

If there is community interest in a state-wide example or model, DOTD's Dam Safety Program staff and the Louisiana Emergency Preparedness Association may consider options to determine the workload and benefits to all parties.

Table 4. Elements Recommended for Attention

Agency/Organization	Acronym	Relevant CRS Activities
LA DOTD Water Resources		All, 410
ISO/CRS Specialist		All
Louisiana Floodplain Management Association	LFMA	All
UNO – Center for Hazards Assessment, Response & Technology	CHART	330, Users Groups
Governor's Office of Homeland Security and Emergency Preparedness	GOHSEP	360, 510, 520, 530, 610, 620, 630
Association of Levee Boards of Louisiana		620
Audubon Society		420, 510
Board of Realtors		340
Coastal Protection and Restoration Authority	CPRA	360, 520, 530
DOTD Dam Safety		630
DOTD District Engineers		440
FEMA – Emergency Management Institute	EMI	350, 430
FloodSmart.gov		350, 370
LA Department of Wildlife and Fisheries		420, 510
Louisiana Department of Environmental Quality		450
Louisiana Department of Insurance	LDI	370
Louisiana Emergency Preparedness Association		610, 620, 630
Louisiana Environmental Action Network		450
Louisiana Geological Survey		440
Louisiana Sea Grant		330
Louisiana Society of Professional Surveyors		310, 440
Louisiana State Uniform Construction Code Council	LSUCCC	430
Louisiana State University AgCenter		330, 350
LSU's Coastal Sustainability Studio		420
National Geodetic Survey		440
National Oceanic and Atmospheric Administration	NOAA	320, 350
National Weather Service	NWS	350, 610
Office of Community Development	OCD	360, 520, 530
The Nature Conservancy		420
The Water Institute of the Gulf	TWIG	410, 420
US Army Corps of Engineers		320
US Fish and Wildlife Service	US FWS	320, 420

Note: it is hoped that reviewers can identify additional agencies and organizations that they have had experience with.

5. NEXT STEPS

This Strategy Update reviews what has changed and what has improved since the 2019 Strategy in Section 2. In Section 3, it identifies those CRS activities, elements, and credits that take a little effort (Type B), that take more work but are worth the effort (Type C), that are worthwhile where most of the work has already been done (Type D), and that warrant further investigation to determine if enough communities would benefit from assistance on them. The findings are summarized in Table 4 on pages 49 – 51. Section 4 reviews the best way to approach each credit and what agencies and organizations can help.

Any community can use this Strategy as a guide to improve their CRS program. However, a joint, coordinated effort to support CRS communities is recommended. This effort would be organized and led by the proposed CRS Priorities Committee in coordination with the DOTD CRS Coordinator.

Here are the recommended actions to take once this Strategy is adopted.

1. **Action**: Disseminate this Strategy to all CRS communities and to communities interested in the CRS. It has a lot of useful information on the CRS and on the agencies and organizations that can help.
   - Responsible office: GOHSEP/Hazard Mitigation/DOTD
   - Timetable: Once this Strategy is adopted

2. **Action:** Establish the CRS Priorities Committee. Include a call for volunteer members with the dissemination of the Strategy to CRS communities.
   - Responsible office: DOTD CRS Coordinator and LFMA
   - Timetable: Two months after this Strategy is adopted

3. **Action:** Identify the activities and elements listed in Section 2 that would benefit from assistance ranging from links to websites, outreach projects, and resources to direct technical assistance. Prioritize them for attention. Circulate the priority list among CRS communities for feedback.
   - Responsible office: DOTD & CRS Priorities Committee
   - Timetable: Within three months of establishment

4. **Action:** Contact the relevant agencies and organizations for the top priority activities and elements and help them prepare appropriate levels of assistance to the communities. All proposed models and templates should be reviewed by ISO to ensure they deserve the expected credit.
   - Responsible office: CRS Priorities Committee
   - Timetable: Within six months of establishment

5. **Action:** Establish a library of templates and good examples of local programs.
   - Responsible office: DOTD CRS Coordinator
   - Timetable: Within six months of adoption of this Strategy

6. **Action:** Disseminate information on the assistance available to the CRS communities. Keep a running record of the assistance available and provided.
   - Responsible office: DOTD CRS Coordinator / CRS Priorities Committee
   - Timetable: Ongoing

7. **Action:** Seek feedback from community CRS staff on what services they used and their recommendations on how to improve the services. This could be done at an appropriate forum such as the annual conference of LFMA.
   - Responsible office: DOTD CRS Coordinator, CRS Priorities Committee, LFMA
   - Timetable: Once a year