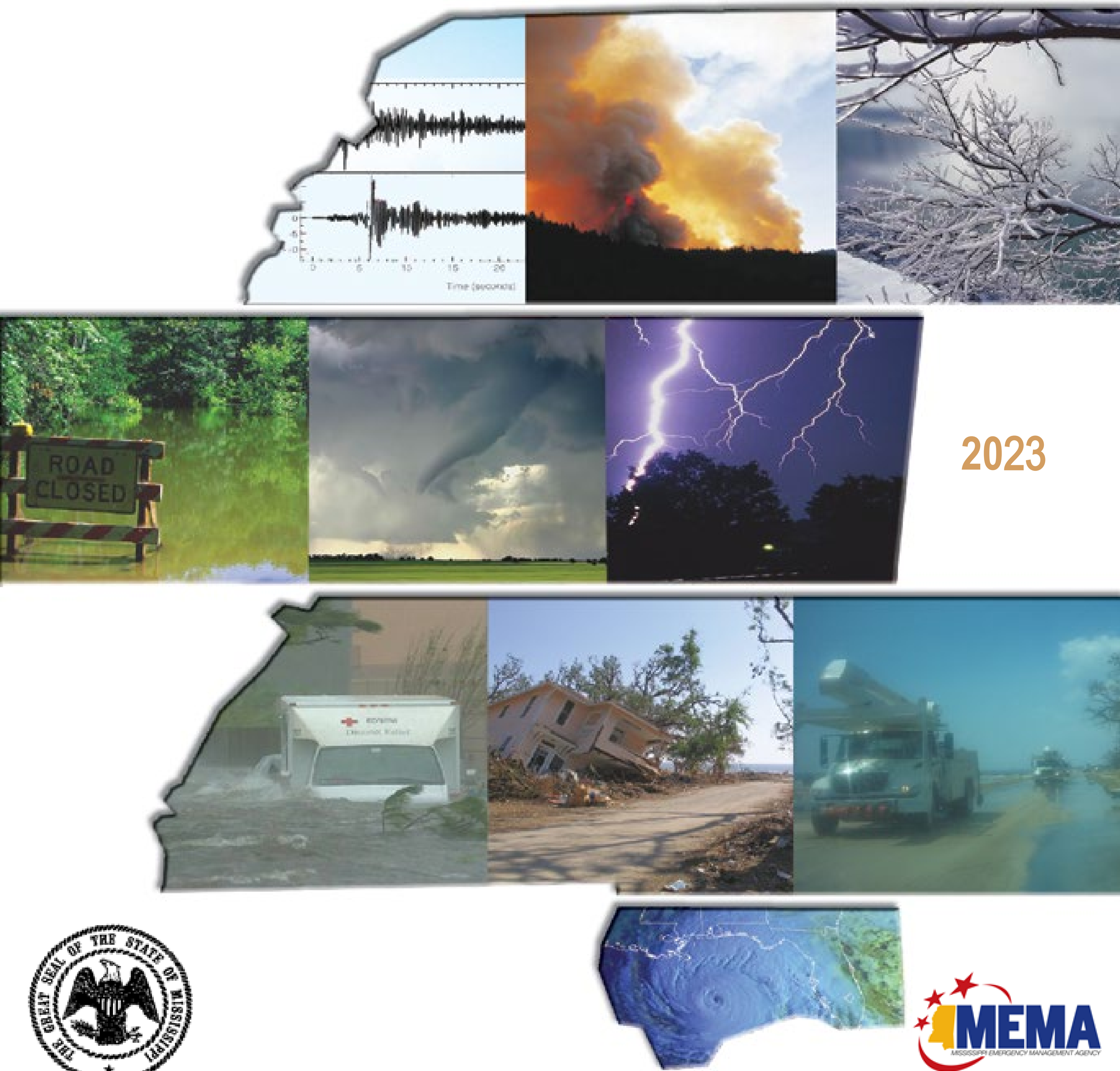
The State of Mississippi Standard Mitigation Plan



2023

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Executive Summary

On behalf of the State of Mississippi, the Governor's Office, and the Mississippi Hazard Mitigation Council, the Mississippi Emergency Management Agency is submitting this "State of Mississippi Standard Mitigation Plan" for review by the Federal Emergency Management Agency. This Plan is the result of a monumental effort from stakeholders, staff, and technical advisors to complete a document that updates the 2018 Standard Mitigation Plan. The Updated Plan addresses natural/manmade hazards throughout the state with the expressed purpose of "Saving lives and reducing future losses" in anticipation of future events.

Mississippi's Standard Mitigation Plan has been completed with a high degree of public participation. By developing new partnerships and strengthening existing ties with local, state, and federal agencies, the Plan reflects the needs of the entire State of Mississippi. Most importantly, the Plan mirrors the mindset of the people of Mississippi, which was learned by carefully listening to ideas and initiatives for hazard mitigation.

"Mitigation Actions" that can be implemented to complete projects that are technically feasible, cost effective, and environmentally sound are included within the Plan. It is a "living document" that will be constantly reviewed and updated thus reflecting current strategies and providing opportunities for evaluating the effectiveness of the projects and programs.

While this Plan is being reviewed by the Federal Emergency Management Agency, the State of Mississippi will prepare for full adoption of the plan. This will be accomplished with the following actions:

- The Mississippi Emergency Management Agency will review and respond to comments provided by the Federal Emergency Management Agency.
- The Mississippi Hazard Mitigation Council will review the record of the process and, at the appropriate time, will recommend the adoption of the Plan.
- The Office of the Governor, upon receipt of the Plan with the addressed comments and recommendations, and by Executive Order, will adopt the Plan for the State of Mississippi.

The Standard Plan, submitted to the Federal Emergency Management Agency in August 2023 in compliance with local, state, and federal requirements, is for the benefit of the people of the State of Mississippi. It is evidence of a great effort by all participants, and the contribution of those involved is greatly appreciated.

The State of Mississippi is continuing to work towards an upgrade from the Standard Plan to "Enhanced Status." This upgrade is an indication of the State's desire to continually improve efforts to mitigate hazards through projects and programs that benefit the people of our State.

The Mississippi Emergency Management Agency hereby submits this Standard Mitigation Plan for consideration by the Federal Emergency Management Agency.

1.0 Introduction

In the 2018 Mississippi State Hazard Mitigation Plan, the State identified the following hazards to be widely significant when carrying out its mission and commitment to saving lives and reducing future losses:

- Flooding
- Extreme Winter Weather
- Drought
- Earthquakes
- Wildfires
- Hurricanes
- Tornadoes
- Dam and Levee Failures
- Climate Change/Sea Level Rise
- Cyberterrorism

Fundamentally, the hazards will remain the same; however, Infectious Disease/Pandemic was added.

In accordance with the Code of Federal Regulations 44 (CFR 44), the Disaster Mitigation Act of 2000, and Section 322 of the Robert Stafford Disaster Relief Act, the State of Mississippi has completed this 2023 State of Mississippi Standard Mitigation Plan Update. The update continues to establish an effective framework in which state mitigation initiatives can be implemented to protect lives and property.

The 2007 Standard Mississippi Hazard Mitigation Plan cited the completion of a State of Mississippi Enhanced Hazard Mitigation Plan at the year's end. It was later determined that the State would be unable to complete the requirements of maintaining an enhanced plan due to its limited resources. The State is continuing to enhance its capabilities. However, the pursuit of an enhanced status was reevaluated again during the 2023 plan update. Although the State has improved in enhancing its capabilities, resources are still limited and fulfilling the requirements of an enhanced plan may prove difficult. As a result, the State will continue to enhance its capabilities to meet the goal of becoming an "Enhanced State." The State will continue to be efficient with its resources and use them to approach the mitigation strategies that are pertinent to Mississippi's safety.

The completion of the "2023 State of Mississippi Standard Mitigation Plan Update" is a pre-requisite for receiving Federal Disaster Assistance. The Disaster Assistance includes Hazard Mitigation Assistance that is available to the State of Mississippi, as well as local Tribes, cities, and counties. Participants of the 2023 Plan Update may be able to receive funds and use them to save lives and reduce future losses by planning for mitigation and implementation of strategies.

In 2007, Governor Haley Barbour established a State of Mississippi Hazard Mitigation Council by Executive Order. The Council was comprised of selected state agency officers, directors, and the executive directors of organizations representing counties and cities throughout the State. New members have been added to the Council since 2008. Vibrant, strong, and rich with ideas, the Council met quarterly to track completed mitigation strategies and actions, to brainstorm on new mitigation strategies, and to review current goals and initiatives. In the 2018 Plan Update, the Council decided to hold meetings twice yearly. A listing of agencies on the Council is available later in this document.

The Hazard Mitigation Council provides guidance in the development of the Plan. Nevertheless, the Council has not minimized the importance of sustaining an integrated and comprehensive approach to mitigation. Therefore, this work is an effort coordinated with State and local agencies, departments, focus groups, volunteer organizations, as well as technical committees, and representatives from Federal Emergency Management Agency in the development of the Plan. This has been accomplished by first reviewing and incorporating all local and regional hazard mitigation plans and the planning efforts of state and federal agencies. Then, the efforts of others were carefully incorporated to ensure that an effective coordination of all initiatives was central to the implementation of the plan.

The “2023 State of Mississippi Standard Mitigation Plan Update” has been completed with a high degree of public participation by stakeholders, agencies, and the general public. This was accomplished by developing a public participation process at the beginning of the planning process and effectively communicating the process as the project was developed. State Plan Surveys were posted to state agencies websites, emailed, and hand delivered to stakeholders, state partners, agencies, community-based organizations, businesses, nonprofits, and academia in an effort to increase public participation.

The “State of Mississippi Standard Mitigation Plan” is a “living document”. The Plan serves as a guide for hazard mitigation activities and provides a tool for implementing the most effective strategies. The Plan will be reviewed constantly as it is used, and this continuous improvement of the Plan will be reflected in updates and revisions, as needed, with a scheduled Plan Update to be completed at least every five years. Each section of the 2023 Mississippi Standard Hazard Mitigation Plan has been reviewed and/or updated to reflect changes from 2018, until now.

This Plan, through its strategy of saving lives and reducing future losses, will contribute to the sustainability of the State of Mississippi. This sustainability will provide a balance in the economic, social, and natural assets of the State resulting in a place that people want to be as they live, work, and play.

Summary of Changes

- Statistical information has been updated to reflect Mississippi at its current status.
- The narrative has been updated to reflect purposes set forth by the State of Mississippi.
- Section 1 has been reviewed. All figures, tables, and graphics have been updated to reflect any changes that have occurred since the 2018 plan update.
- Plan narrative updated showing 2023 State Plan Survey distributions.

1.1 State Characteristics

General Information

The State of Mississippi lies in the southern portion of the United States. Mississippi is the 32nd largest State in the United States with a total land area, including water, of the 46,823.98 square miles. According to the 2021 Census information, the State is 32nd among other states with a population of 2,961,279 a change of -0.7%. The name Mississippi is derived from Ojibwa, a Native American/Algonquin language which means "Great River". Mississippi is referred to as the "Hospitality State" and the "Magnolia State." These nicknames reflect the welcoming spirit of Mississippi's residents and the beautiful Magnolia Trees/flowers found here. The State is very diverse with each region exhibiting its own unique characteristics. Whether you are listening to the Blues in the Delta or relaxing on the beaches of the Mississippi Gulf Coast, Mississippi has a lot to offer.

Mississippi's 1st flag was adopted in an 1894 special session of the Mississippi Legislature. The next official flag was adopted on April 17, 2001, by voters in the State. In 2020, Mississippi's Legislature held a contest for the design of a new state flag. The flag was voted on and chosen by the people. The new flag became the Official State Flag on January 11, 2021.

The State of Mississippi is rich in natural, architectural, and artistic beauty. It is home to rolling hills in the northeast, the beautiful beaches of the Gulf Coast, and some of the richest farmland in the world in the Delta. It is home to famous artists, writers, and musicians such as Walter Anderson, William Faulkner, Eudora Welty, John Grisham, and B.B. King are just a few. Cultural events are held throughout the State which showcases our rich cultural heritage. Local Culture events include, but are not limited to: Blueberry festivals, downtown festivals, tomato festivals, seafood festivals, parades, and Founder's Day celebrations are just a few.

Table1.1.1 identifies the different state symbols of Mississippi.

Table 1.1.1: State Symbols

State Bird	Mockingbird
State Reptile	American Alligator
State Water Mammal	Bottlenose Dolphin
State Fish	Largemouth or Black Bass
State Land Mammal	White Tailed Deer/Red Fox
State Wildflower	Coreopsis
State Butterfly	Spicebush Swallowtail
State Insect	Honeybee
State Fossil	Pre-Historic Whale
State Stone	Petrified Wood
State Waterfowl	Wood Duck
State Shell	Oyster Shell
State Beverage	Milk
State Toy	Teddy Bear
State Flower/Tree	Magnolia
State Soil	Natchez Silt Loam
State Dance	Square Dance
State Language	English
State Grand Opera House	Grand Opera House of Meridian
State Song	"Go Mississippi"

The State Seal has been in use since Mississippi became a state in 1817.

The New Magnolia flag has a Magnolia Blossom in the center, a symbol long used to represent our state and the hospitality of of our citizens. The new flag is sleek and updated to represent the forward progression of Mississippi.

Source: Office of the Mississippi Secretary of State

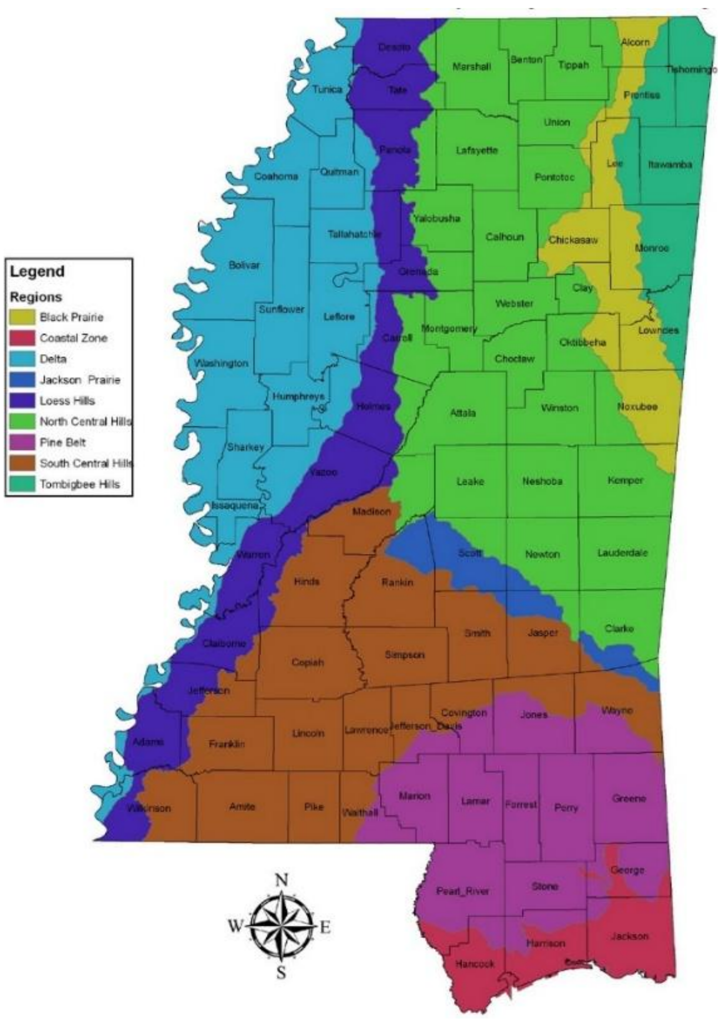
State Capitol

The Mississippi State Capitol is located is Jackson, Mississippi. Jackson, the capitol city, is home to the Governor, Lt. Governor, House of Representatives, and the State Senate. The existing Capitol Building, one of three Capitol Facilities built, was completed in 1903. The first building was completed in 1822 (it is no longer standing) and the second one in 1833, which is known as the Old Capitol. The Old Capitol Building was used from 1917 to 1959, and has served as the State Historical Museum from 1961 to present day. The first building, completed in 1850, was constructed to help ensure that Jackson would indeed be the capitol city. The present-day Capitol Building was designed by architect Theodore Link of St. Louis, Missouri. The architectural style is Beaux Arts. The focal point of the building is the 4,750 lights that illuminates four painted scenes and the rendition of a blind-folded lady which represents “Blind Justice.” The four painted scenes represent two Native Americans, a Spanish explorer, and a Confederate general. An eagle is perched atop the Capitol Dome and is made of solid copper overlain with gold leaf. The Mississippi Capitol is designated as a landmark building and is listed on the National Register of Historic Places.

Source: Mississippi Department of Archives and History; http://mdah.state.ms.us and Mississippi Legislature; http://billstatus.lls.state.ms.us

Geography

Figure 1.1.1:
State of Mississippi Physiographic Map



Mississippi is bordered by the states of Alabama, Tennessee, Louisiana, and Arkansas. A portion of the state boundary is delineated by the Mississippi River. The river is one of the largest water bodies in the continental United States. Other major water bodies within the state include the Pearl River, Big Black River, Yazoo River, Pascagoula River, and the Tombigbee River. An important fact about the state’s geography is that lakes make up 3 percent of the total area. These major lakes are actually reservoirs (Reservoirs are large natural or artificial lake that are used as water supply or as storage for excess water). The lakes/reservoirs are Sardis Lake, Grenada Lake, Arkabutla Lake, Enid Lake, and the Ross Barnett Reservoir.

The highest point in the state is Woodall Mountain in Tishomingo County. This landform has a total elevation of 806 feet above sea level. On the other hand, the lowest point in the state is the Gulf of Mexico, which is at sea level. The mean elevation for Mississippi is around 300 feet above sea level. The state can be divided into 9 physiographic regions- Black Prairie, Loess Hills, North and South-Central Hills, Pine Belt, the Delta, Coastal Zone, Black Prairie, and the Jackson Prairie. See Figure 1.1.1

Black Prairies: this region extends from the northeastern corner of the Noxubee County, northward to Alcorn County, and a small portion of Tishomingo County. The predominant soil type in this region is clay. The topography in the Black Prairie Region is flat.

Coastal Zone: this region covers portions of Pearl River, George, Hancock, Harrison, and Jackson Counties. The predominant soil type in this region is acidic soil and sand with areas of boggy soil that is high in organic matter. Flat plains are the general topography.

Delta: this region covers the area of the state that borders the Mississippi River from a portion of DeSoto County down to the northeast corner of Wilkinson County. Flat plains are the general topography of this region. The Delta soil is characterized as mildly acidic to mildly alkaline.

Jackson Prairie: this region extends from portions of Wayne County to northern Rankin County. The predominate soil types in this region are both acidic and non-acidic. The topography is somewhat rolling hills with areas of ridges and valleys.

Loess Hills: this region extends from DeSoto County southward to Wilkinson County. The predominant soil type in this region is both acidic and non-acidic. This part of the state is also considered to be the Brown Loam Region. The topography of this region is characterized by narrow ridges and steep-sided ravines.

North Central Hills: covers a large portion of Mississippi, this region extends from the northern portion of the State from Marshall County southward to Madison County, then southwestward to Wayne County. The soils in this region are mostly acidic. The topography is characterized by both ridges and valleys.

Pine Belt: this region covers either all or portions of Walthall, Jefferson Davis, Jones, Covington, Lamar, Forrest, Perry, Greene, Pearl River, Stone, Wayne, and Harrison counties. The soil is acidic. The topography includes rolling hills as well as areas of steep-sided ridges and valleys. This region is also known for its abundance of hardwood trees.

South Central Hills: extends from southern Madison County to Wayne County, and then southward to Wilkinson, Walthall, Amite, and Pike counties. The soil found here is primarily sandy loam. The topography includes rolling hills with broad valleys.

Tombigbee Hills: this region extends from Lowndes County northward to Tishomingo County. The soil is acidic and highly weathered. Topography in the Tombigbee Hills Region is characterized by numerous streams, ravines, and ridges. The region also contains the highest point in the state which is Woodall Mountain with an elevation of 806 feet above sea level.

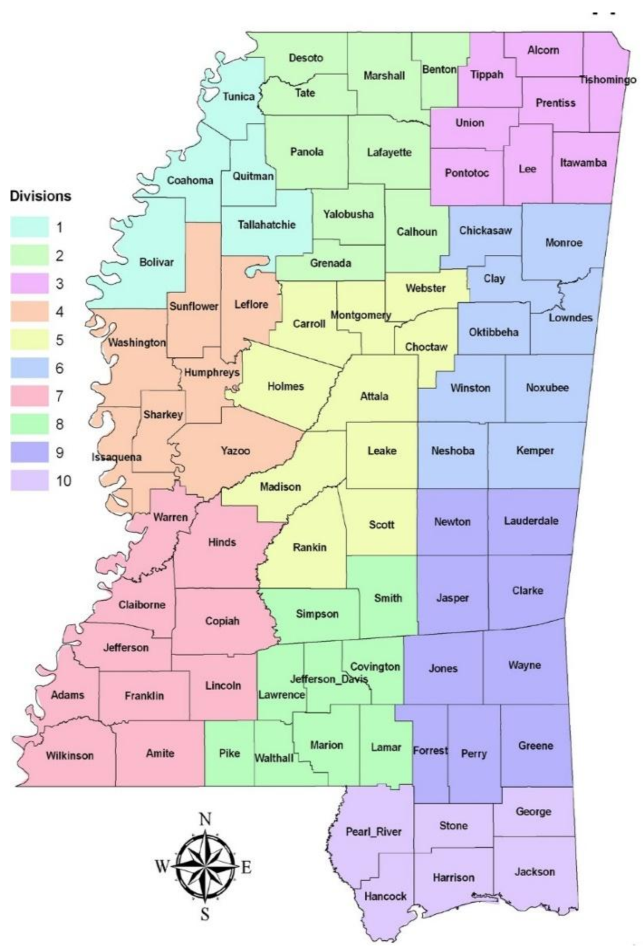
Data Sources: Mississippi State University Department of Geosciences – http//www.msstate.edu/dept/geosciences/faculty/brown
Delta State University Department of Biology and Environmental Sciences – http://www.marshdoc.com/physiiography/physiograph

Climate

The State of Mississippi is located in the humid subtropical climate region of the United States, which is characterized by long, hot summers, temperate winters, and rainfall that is evenly distributed throughout the year. The state is divided into 10 different climate zones; 1-Upper Delta; 2- North Central; 3- Northeast; 4- Lower Delta; 5- Central; 6- East Central; 7- Southwest; 8- South Central; 9- Southeast; and 10-Coastal. The normal mean annual temperatures range from 68 degrees along the coast to 62 degrees in the north. There have been occurrences where the temperature has dropped below 16 degrees and close to zero in some areas. Mississippians have also routinely witnessed temperatures reaching 100 degrees in many areas. The record for the highest temperature was Holly Springs, MS, on July 29, 1939, when the temperature reached 115 degrees. The lowest recorded to date was minus 19 degrees, on January 30, 1966, in Corinth, Mississippi.

Northern portions of the state receive approximately fifty inches of rainfall annually, with that number increasing toward the south to approximately sixty-five inches per year on the Gulf Coast. Traceable amounts of snow and sleet are typical in the northernmost counties. These northern counties have also experienced moderate to severe ice storms. A more detailed description of occurrences can be found in Section 3.5.

Figure 1.1.2
Climate Divisions of Mississippi



Recreation

The State of Mississippi is home to over 25 State parks (Figure 1.1.3), which are easily accessible to the public. Each park offers a variety of recreational activities such as boating, wildlife watching, fishing, hiking, and swimming. It was estimated by the Fish and Wildlife Service that anglers and hunters spend around $240 million a year and generate a total economic impact of approximately $1.5 billion. Both Mississippi residents and nonresidents participate in wildlife associated recreation in Mississippi. Accordingly, the MS Department of Wildlife and Fisheries estimates that 94 percent of licensed anglers fish in freshwater, 72 percent live in rural area, and 44 percent are women.

In a study by the U.S. Department of Commerce, almost $1.1 billion was contributed to the State's economy because of recreational activities. The Mississippi Department of Wildlife, Fisheries, and Parks oversees the state's parks and fisheries and operates 18 fishing lakes (Figure 1.1.4) that span 6,044 acres. The agency is also responsible for 38 Wildlife Management Areas reserved for public hunting. In addition to the substantial number of parks and wildlife related activities, they maintain parks across the state for residents and visitors.

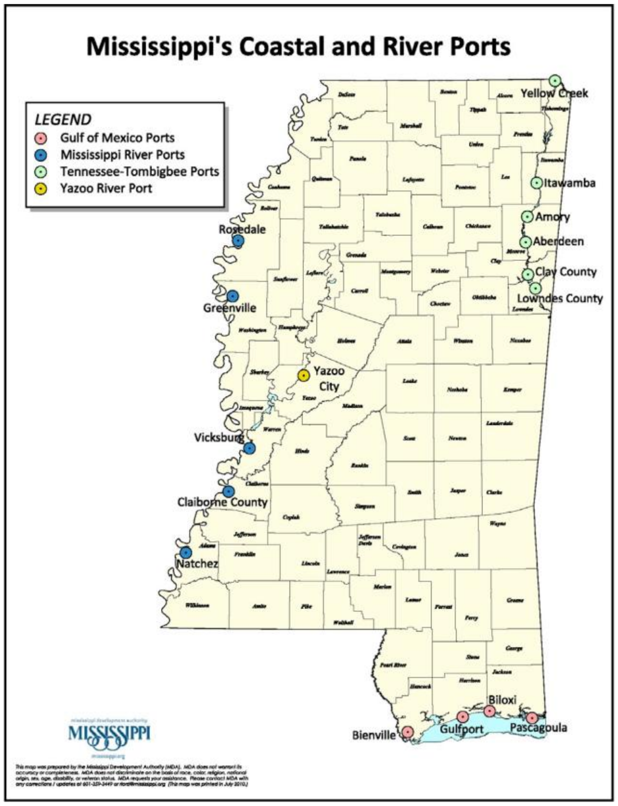
Golf also serves as the recreation of choice for residents as well as tourists and business travelers. The state has more than 150 public and private golf courses statewide. The location and climate of Mississippi makes golf one of the more popular forms of recreation. Many PGA sponsored events have been held in the state and have attracted top-ranked professionals. There are many other forms of recreational opportunities that exist other than the traditional forms. Among these are: disk golf, pickleball, paintball, sports, bicycling, and gambling. The State of Mississippi Tourism Board estimates that tourists spent an average of $6.25 billion in a six-year span.

Figure 1.1.3
Mississippi State Parks and Destinations

Figure 1.1.4
Mississippi Parks with Public Lakes

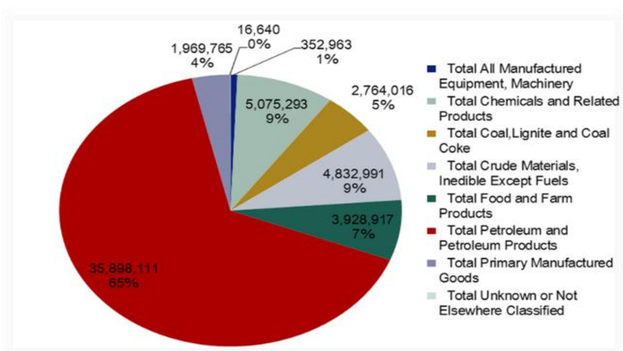
Transportation

Figure 1.1.5
Mississippi Coastal and River Ports



Source: Mississippi Department of Transportation: http://gomdot.com/ports
http://www.mdpt.state.ms.us http://artbabridgereport.org
Mississippi Development Authority-
Federal Highway Administration http://www.fhwa.dot.gov

Figure 1.1.6
Waterborne Commerce



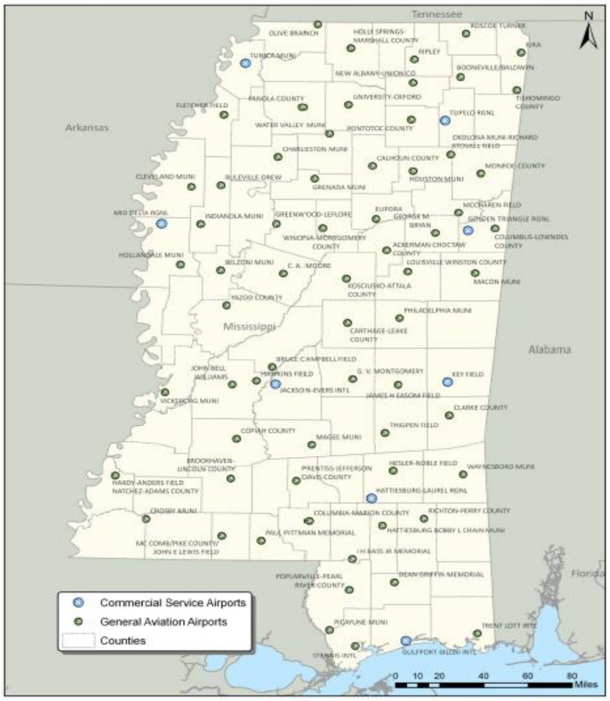
Source: Mississippi Department of Transportation
MS Core of Engineers; Waterborne Commerce of Mississippi

Mississippi's highway network includes approximately 73,500 miles and has more than 16,500 bridges under the jurisdiction of federal, state, and local governments. The state highway network's characteristics support the view of Mississippi as a rural state. The Mississippi Department of Transportation (MDOT) is the state agency responsible for the "higher order" of highway miles (interstates, freeways, and other principal arterials), and facilitate general overview/collaboration on highways connectivity with ports, airports, and railroads. The highway system typically handles more than 35 billion vehicle miles of travel annually and is ranked 28th in the nation. County-owned highways make up 72 percent of the state's highway network, while state and city owned highways balance (15 percent state, and 12 percent city). The remaining 1 percent of roadways in Mississippi fall under federal jurisdiction. While higher order highways comprise fewer highway miles than rural roadways, they carry the bulk of Mississippi's traffic.

Mississippi has 16 water ports (Figure 1.1.5). Of this total, only two are controlled by the State. All the others are privately owned and operated. The ports are located along the Mississippi River, near the Gulf of Mexico, and on the Tennessee-Tombigbee River. The ports contribute $5.4 billion in revenue and nearly $16 billion in gross state product. They also account for 16 percent of the state's economy. The ports located in the state generate around 125,000 direct and indirect jobs according to the Mississippi Department of Transportation. There are multiple things transported though Mississippi's waterways and ports (see Figure 1.1.6).

Mississippi is also home to 74 public use airports. Many of Mississippi's population lives within a one-hour drive of seven of the airports, which provides regularly scheduled passenger airline services. There are 8 commercial service airports that house large industries. The airports are used for a variety of reasons ranging from agriculture pesticide spraying, ambulance services, law enforcement, and aerospace operations. There are 6 aerospace manufacturers located on Mississippi's airport grounds for the easy runway access and taxiway services.

Figure 1.1.7
Mississippi Airports



Source: https://ms.gov.dociments/reports/Mississippi

In addition to economic benefits, Mississippi airports support numerous qualitive benefits. Qualitive benefits are related to the health, welfare, safety, and overall quality of life, that cannot be assigned a dollar amounts.
Some Examples are:

- Providing support to highway patrol and law enforcement.
- Facilitating emergency medical transport.
- Providing youth outreach programs.
- Conducting search and rescue
- Conducting disaster relief missions
- Supporting aerial surveying, photography, and utility inspection operations
- Supporting the US Military and other government organizations
- Supporting aviation-related higher education

They include:

- Airbus Helicopters
- Advanced Technologies
- Mississippi State University-RASPET Flight Research Laboratory
- Northrop Grumman **
- Aurora Flight Sciences **
- Stark Aerospace **

**Indicates they manufacture Unmanned Aerial Systems (UAS)

Mississippi airports also have a significant presence of aviation-related to military units. The largest Military Aviation presence is at the Jackson-Evers International Airport. The 172nd Airlift Wing is stationed there and they employee over 900 personnel with a payroll of $172 million in economic output. The Naval Special Warfare Command is stationed at Stennis Space Center (NASA), which employees over 150 personnel. Six Mississippi airports support 9 air ambulance bases across the State.

Advanced University Programs supply a steady influx of talented aviation workers specializing in polymer science (USM), aerospace engineering (MS State University), and jet engine mechanics. Cleveland Municipal Airport is the home to the flight school of Delta State University where students can receive a Bachelor or a Masters of Commercial Aviation Degree.

Mississippi's Airport System accounts for $2.5 billion in economic activity. It also supports around 20,000 employees with salaries totaling more than $722 million.

Population

The 2021 US Census estimated the population of Mississippi to be 2,961,279. This number indicates a -0.7 percent decrease from the 2010 figure of 2,982,785. The State of Mississippi is composed of 82 counties ranging in population from Issaquena County, the smallest with a total of 1,338 individuals to Hinds County, the largest with a population of 227,742. Hinds County comprises 7.94% of the state's total population, but has had a decline of 3.53 % since the 2010 census. Based on the 2020 Census, the state averages 63.1 people per square mile as compared to the United States with 93.8 people per square mile. The counties that are the most densely populated are DeSoto (399.19), Harrison (370.3), and Hinds (257.81).

The following is a breakdown of other population characteristics for the state:

- 42 cities have populations of 10,000 and above.
- 15 counties have populations of 50,000 and above.
- Four Metropolitan Areas, with the largest being the Memphis, Tennessee, and DeSoto County, MS, that has a population of 1,324,108 and a population density of 426.2. The Metropolitan Statistical Area (MSA) ranked 41st. The next largest is Biloxi-Gulfport-Pascagoula USA, with a population density of 237.
- The median age is 37.7 years.
- 48.7 percent of the population is male.
- 51.3 percent of the population is female.
- 76.5 percent of the population is 18 years or older, and 18.8 percent are 65 and older.
- The largest race is White/Caucasian at 58.8 percent followed by African American/Black at 38 percent.
- Per Capita income for 2020 was $25,444.
- The poverty rate in 2020 was 19.4 percent. This is higher than the national average of 11.4 percent.
- The average household size is 2.59 persons.

Mississippi is classified as a mostly rural state. Fifty-four percent of the state is classified as rural compared to 46 percent as urban. The definition of urban is those areas that are densely populated in and around large cities having a population over 50,000. Rural is defined as those areas outside of the city with a population under 2,500. There is a total of 129 Census Designated Places (CDP) in the State of Mississippi. There are 82 counties in Mississippi, of those 65 (79.3 percent) are considered rural.

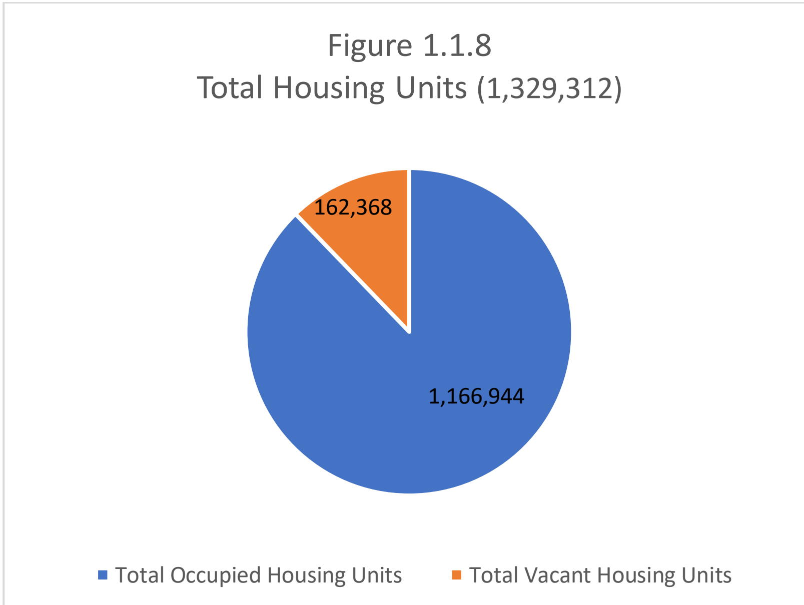
In order of size and based on 2020 US Census estimates, the populations of the top eight cities in Mississippi are:

• Jackson	149,761
• Gulfport	72,105
• Southaven	55,429
• Biloxi	49,241
• Hattiesburg	47,068
• Olive Branch	40,276
• Tupelo	37,667
• Meridian	34,424

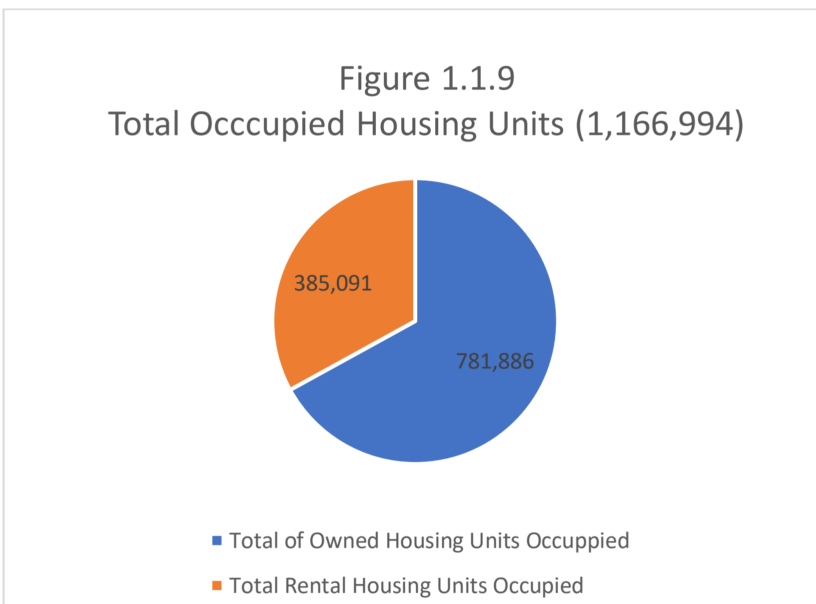
Source: www.extension.msstate.edu/food-and-heath/ruralhealth; http://mcnb.hrsa.gov/indes.html; http://worldmappopulationreveiw/populationbycounty/mississippi2022; https://www.census.gov/quickfacts/fact.table/MS

Housing

The total number of housing units in Mississippi based on the Mississippi Development Authority (2022) estimate was 1,329,312. Of this total, 86 percent or 1,166,944 were occupied. The total number of vacant housing units was 162,368 or 14 percent. This can be seen in Figure 1.1.8.



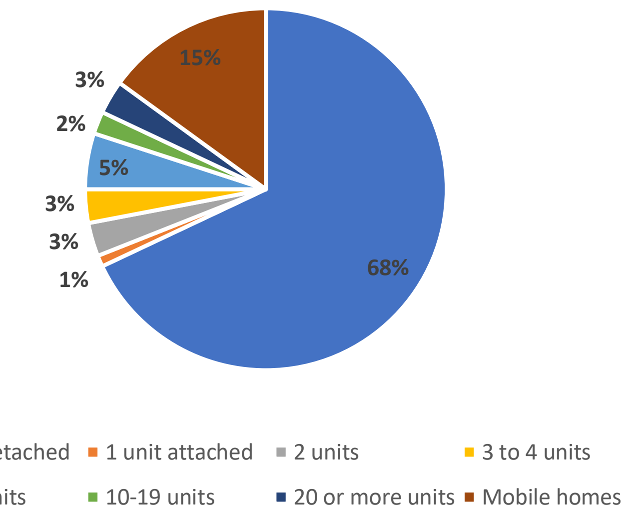
The total number of housing units in Mississippi as based on the Mississippi Development Authority (2022) estimates that there are 1,166,994 of occupied homes. Of the occupied homes, 385,091 or 33 percent are rental housing units, and 781,866 or 67 percent are owned housing units. This can be seen in Figure 1.1.9.



Source: for figures 1.1.8- 1.1.11 is the 2022 Mississippi Development Authority and the American Community Survey

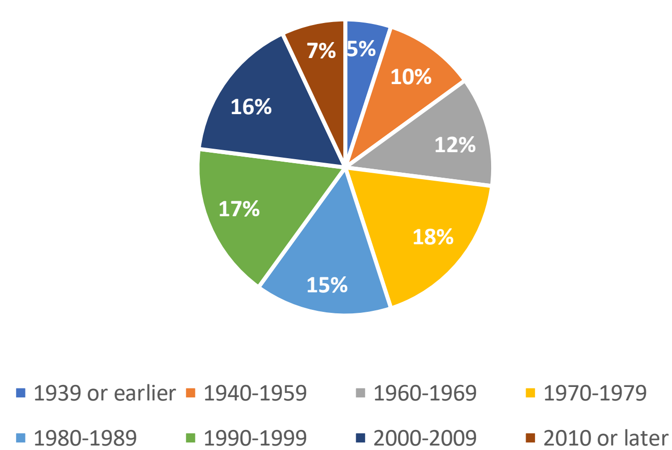
According to the 2020 American Community Survey, the total number of occupied housings increased from 1,274,719 to 1,329,312. Of this total, 68 percent are classified as one unit detached while the second most common type of housing was mobile home/other housing at 15 percent. It can be deduced from these numbers that most Mississippians live in single-family housing or in mobile home/other forms of housing. However, 5 percent live in those structures that are classified as having 10 or more units. This can be seen on Figure 1.1.10.

Figure 1.1.10
Occupied Housing Units by Year They Were Built



Most structures were built between the years of 1970-1999. These years accounted for 50 percent of the total. This was followed by those built between the years of 2000 or later with 23 percent of the total. This shows that even though the housing stock tends to be older, newer homes are being built which signals progress and growth. Less than 1 percent lack plumbing facilities. See Figure 1.1.11.

Figure 1.1.11
Occupied Housing Units by the Year They Were Built



Economy

The State of Mississippi is home to many different industries. The industries range from agriculturally based in the Delta to casino management on the Gulf Coast. The following list of the leading industries in the state.

Table 1.1.2

Industry Type	%		Industry Type	%
Health Care and Social Assistance	19%		Professional, Scientific, and Tech Services	4%
Retail Trade	15%		Construction	4%
Accommodations, Food Service, Arts and Entertainment	13%		Other Services (except Public Administration)	4%
Manufacturing	10%		Wholesale Trade	4%
Administration, Business Support, and Waste Management	6%		Utilities	2%
Educational Services	6%		Real Estate, Rentals, and Leasing	2%
Transportation/ Warehousing	5%		Agriculture, Forestry, Fishing, and Hunting	0.9%
Information	5%		Mining, Oil and Gas Extracting, and Quarrying	0.4%
(Precents are Rounded)			**Total Rounded Percent**	**100%**

Source: hhps://www.ibisworld.com/2021/Mississippi

Table 1.1.2 above indicates that 19 percent of Mississippi's employment is through the Health Care and Social Assistance. Health Care and Social Assistance, Retail Trade, and Accommodations, Food Service, Arts, and Entertainment employ 47 percent of Mississippians. Mississippi has a large manufacturing industry that makes up 10 Percent of Mississippi's employment. Mississippi has large manufacturing plants such as Nissan North America, Huntington Ingalls Industry, Tyson, Howard Industries, Toyota Motor Manufacturing, and Cooper Tire and Rubber. There are more names that could be added to the list as some of the leading employers in the state.

The industries with the largest revenue in the state are Hospitals (14 b), Petroleum and Refining (10.9 b), and Agricultural, Beef, Meat, Poultry, and Processing (8.3 b). Mississippi's GPD (Gross Domestic Product) by sector leaders are Manufacturing (18 b), Real Estate (12.5 b), and Retail Trade (8.5 b). The combined GDP for these three sectors are 44 percent of the state's GDP.

Amazon recently opened a 700,000 square foot fulfillment facility that brought more than 1000 full time jobs to the area (Amazon representatives state that this number could increase to 1500 during the holiday season). This plant is in Canton, MS, which is in Madison County (Nissan is also located in this area). This facility is the first in Mississippi to feature Amazon's Robotics Technology. It began production on July 24, 2022.

Many companies claim Mississippi as their home base or were started in Mississippi. Some of the industries are: Engle's Shipyard, Continental Tire, C-Spire, Sanderson Farms, and Pine-Sol are just a few. Corinth, Mississippi is one of the two places that National Geographic is printed. Mississippi is also home to more than 20 Aerospace and Defense companies, has more than 13,000 miles of interstate pipeline, is home to Grand Gulf Nuclear Power Plant, and has a NASA test site (Stennis Space Center).

Companies do not choose to locate in areas lacking skilled workforce. Mississippi offers industries a population of workers willing to be trained through various programs. According to the State Department of Education, in 2022, the State of Mississippi had an 88.4 percent high school graduation rate with an 8.5 percent dropout rate (The National Average Graduation Rate is 86 percent). Starting in the 9^{th} grade, Mississippi students can choose too either maintain the typical diploma track, or they can add an endorsement to their diploma. They could choose to get a distinguished academic or technical diploma endorsement (Students can also earn more than one endorsement).

These endorsements allow the students to take additional classes following their endorsement track. This gives the student's academic advantages and qualifies them for an automatic admission into any of the state's public universities. Each option prepares Mississippi students for the workforce, military, technical training, or college. The class of 2022 was the 1st graduating class in this program. Since its implementation, in 2018, graduation rates have continued to grow, and dropout rates have continued to decline. In 2014, the graduation rates in Mississippi was only 74.5 percent with a dropout rate of 13.9 percent. As you can see, Mississippi's students are being equipped to meet the needs of manufacturers and technical companies though adequate public education at the high school and college level.

Summary

The State of Mississippi is divided into many different regions, as determined by the climate and physiography. These regions face different threat levels of hazards related to these criteria. The topography ranges from the low-lying areas of the Mississippi Delta to the coastline of the Mississippi Gulf Coast. The Gulf Coast (Coastal Zone) is threatened annually by hurricanes. One of the worst disasters in the U.S. history occurred along the State's coastline in August 2005: Hurricane Katrina, which destroyed homes as well as entire communities. Almost 18 years later, many of these communities have still not fully recovered. Many areas of the Delta lie near the Mississippi River, which creates the ideal conditions for flooding after large amounts of rain. The State's climate is characterized by long, hot summers and temperate winters. While the amount of rainfall is typically evenly distributed flooding does occur. The long hot summers have led to occurrences of droughts in the past, and during the winter season, ice storms have occurred in the northern and central regions of the state.

The threat of any major hazard could greatly affect many of the state's industries. Among these are, but not limited to tourism (gaming, culturally based, and recreational), transportation (state's ports contribute around $5 billion annually to the economy), and manufacturing (10 percent of the state's industry). In addition, the state's recreational industry would suffer due to a major hazard. There are over 25 state parks in Mississippi and almost $1.1 billion dollars are contributed to the state's economy by these activities. In the aftermath of Katrina, the tourism and transportation industries were greatly affected by road and bridge closures, extensive damage to casinos, the permanent closure of some state parks, and countless other devastating impacts. The population of the state decreased from 2,982,785 to 2,961,279. This marked a decrease of 0.7 percent. Even with slight population decrease, the population continues to remain steady and the housing units available are up 6.7 percent and the vacancies are down to 9.7 percent. With the increase of housing, our population, and the changing weather patterns, the threat to the loss of life and property damage could rise as well. It is for this and the aforementioned reasons, that this plan considers the efforts of local governments and addresses all hazard-related issues, as well as their lasting impacts to the lives and landscape of Mississippi.

1.2: Plan Adoption

> ***44 CFR §201.4(c)(6): The State mitigation strategy shall include the following elements:***
>
> ***A Plan Adoption Process. The plan must be formally adopted by the State prior to submittal to FEMA for final review and approval.***

The State of Mississippi Standard Mitigation Plan meets the requirements of Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (commonly referred to as the Stafford Act-Public Law 93-288 as amended). Additionally, this plan meets the minimum planning requirements under 44 Code of Federal Regulations (CFR), Part 78 (Flood Mitigation Assistance).

It is intended that this plan also meet the requirements of the Disaster Mitigation Act of 2000 (DMA2K), Section

322. Section 322 of the Act requires that states, as a condition of receiving federal disaster recovery funds, have a mitigation plan in place that describes the planning process for identifying hazards, risks, and vulnerabilities; identifying and prioritizes mitigation actions; encouraging the development of local mitigation; and providing technical support for these efforts. In addition, the Act also requires local and Tribal governments to have mitigation plans.

The development and implementation of this strategy is authorized and/or required by the following state statutes:

Mississippi Emergency Management Law, Mississippi Code of 1972, Title 33-15, as amended.

Executive Order(s) by the Governor

The final draft of the State of Mississippi Standard Mitigation Plan was submitted to the Governor's Authorized Representative (GAR) for review and recommendation. From here it was sent to Governor Tate Reeves for Adoption by the State of Mississippi under the executive powers of the Governor in September 2023. The Promulgation Statement issued by Governor Reeves is presented on the subsequent page.

PROMULGATION STATEMENT

Transmitted herewith is the updated *Mississippi Hazard Mitigation Plan,* as required under Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted under Section 104 of the Disaster Mitigation Act of 2000 (Public Law 106-390).

This plan provides a significant opportunity to reduce Mississippi's disaster risk through the identification of hazards, an analysis of the risk, an assessment of vulnerability, and the recognition of strategies and specific mitigation activities that when implemented will eliminate or significantly reduce disaster losses.

Coupled with regional and community hazard mitigation plans, this plan serves as the mitigation platform in the emergency management framework of preparedness, response, recovery and mitigation.

This plan was developed in accordance with Federal hazard mitigation planning standards contained in 44 CFR 201.4. This plan will be updated as needed, but at least every five years, as required.

Therefore, by virtue of the authority vested in me, by the constitution of Mississippi and Title 33, Chapter 15, Mississippi Code of 1972, as amended. I hereby promulgate and issue the *Mississippi Hazard Mitigation Plan* as the official guidance for all concerned.

Tate Reeves
Tate Reeves
Governor

10/18/2023
Date

1.3: Assurances (Compliance with Federal Laws and Regulations)

44 CFR 201.4(c)(7): The State mitigation strategy shall include the following elements:

Assurances. The plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with CFR 13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in CFR 13.11(d).

44 CFR

Through the development and enforcement of this plan, the State of Mississippi will comply with all provisions in 44 Code of Federal Regulations:

I. Part 7, Nondiscrimination in Federally Assisted Programs.
II. Part 9, Floodplain Management and Protection of Wetlands.
III. Part 10, Environmental Considerations.
IV. Part 13, Uniform Administrative Requirements for Grants and Cooperative Agreements to States and Local Governments.
V. Part 14, Reserved
VI. Part 17, Government-Wide Debarment and Suspension and Government-Wide Requirements of Drug-Free Workplace.
VII. Part 18, New restrictions on lobbying.
VIII. Part 201, Mitigation Planning
IX. Part 206, Federal Disaster Assistance.
X. Subchapter B- Insurance and Mitigation
XI. Subchapter D- Disaster Assistance
XII. Subchapter F- Preparedness

Additionally, the laws listed below are provided as documentation that the State or any subsequent subgrantee (recipients) that receive federal grant funds will comply with all applicable State and Federal statutes and regulations. The State will manage and administer FEMA funding in accordance with applicable federal statutes and regulations, submitting all required reports, including timely submittal of quarterly financial and performance reports. The State will update the plan whenever necessary to reflect changes in Federal statutes and regulations or material changes in state law, organization, policy, or state agency operations.

The following provisions apply to the award of assistance:

Federal Law

I. Public Law 93-288, Disaster Relief Act of 1974, as amended by Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, Public Law 100-707 and further amended by Disaster Mitigation Act of 2000, Public Law 106-390.
II. Public Law 93-234, Flood Disaster Protection Act of 1973.
III. Public Law 103-181, Hazard Mitigation and Relocation Assistance Act of 1993.
IV. Public Law 98-502, Single Audit Act.
V. Public Law 81-920, Federal Civil Defense Act.
VI. Title 31 CFR Part 205.6, Funding Techniques.

Executive Orders

I. Executive Order 11988, Floodplain Management.
II. Executive Order 11990, Protection of Wetlands.
III. Executive Order 12612, Federalism.
IV. Executive Order 12699, Seismic Safety.
V. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population.

Office of Management and Budget

I. OMB Circular A-21, Cost Principles for Educational Institutions.
II. OMB Circular A-87, Cost Principles for State and Local Governments.
III. OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs
IV. OMB Circular A-102, Uniform Administrative Requirements for Grants and Cooperative Agreements with State and Local Governments.
V. OMB Circular A-110, Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and other Non-Profit Organizations.
VI. OMB Circular A-122, Cost Principles for Non-Profit Organizations.
VII. OMB Circular A- 133, Audits of Local Governments, and Non-Profit Organizations.

State Authorities

I. Mississippi Emergency Management Law, Mississippi Code of 1972, Title 33-15, as amended.
II. Other Applicable Mississippi Laws refer to “Compendium of Legislation” Mississippi Administrative Plan, Volume I to Mississippi Emergency Management Plan.
III. Executive Order(s) of the Governor
    - E. O. 252, August 11, 1977; Relocation of State Government.
    - E. O. 573, March 3, 1987; Mississippi Emergency Response Commission.
    - E. O. 653, 1990, et. Seq.; Emergency Management Responsibilities.
    - E. O. 985, 2007; Mississippi State Hazard Mitigation Council.

2.0 The Planning Process

Section 201.4 (a) of the CFR reads as follows, "The mitigation plan is the demonstration of the State's commitment to reduce the risks from natural hazards and serves as a guide for State decision markers as they commit resources to reducing the effect of natural hazards." Therefore, an effective planning process is the key to a strong mitigation strategy plan.

Mitigation planning can:

- Help communities become more sustainable and disaster resistant,
- be incorporated as an integral component of daily government business,
- help focus efforts on particular hazards by determining and setting priorities for mitigation planning, and
- save money by providing a forum for engaging in partnerships.

The Mississippi Emergency Management Agency has taken great care in developing and executing a mitigation plan that fully serves the citizens of the state of Mississippi. The following is documentation of the State's effort to save lives and property.

Summary of Changes- Documentation of the Planning Process

The entire section has been reviewed and updated. All tables and figures have been updated to reflect changes since the plan was updated in 2018.

2.1 Documentation of the Planning Process

> ***44CFR: 201.4(c) Plan Content. To be effective, the plan must include the following elements:***
>
> ***Description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.***

Mitigation Planning is…

Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation planning is a process for states and communities to identify policies, activities, and tools for implementing mitigation actions. The Mississippi Emergency Management Agency decided to continue with the following four basic steps or phases in updating its plan:

- organization of resources;
- assessment of risks;
- development of a mitigation plan; and
- implementation of the plan and monitoring progress.

Phase 1: Organization of Resources

In 2007, the State of Mississippi made a firm commitment to identify and organize its resources through the Mississippi Hazard Mitigation Council. Established by Governor Haley Barbour under Executive Order 985, the Council has played a major part in steering the State's Mitigation Strategy. The Council has served the people of Mississippi by providing a platform from which an integrated statewide plan could be developed to complete mitigation goals. The State continues to use this organization in the 2023 Hazard Mitigation Plan Update. The Council has in fact identified 2 extra members since its conception. The members of the Council are further discussed in a later section of this document.

The Council is comprised of citizens who were jointly selected by MEMA's executive staff and Governor Barbour in 2007 based upon the skills, knowledge, and abilities necessary for:

- forging partnerships from among a broad range of groups,
- integrating existing plans and planning efforts,
- identifying and articulating needs to state and federal officials, and
- providing continuity in statewide planning that seeks to achieve a common goal.

Governor Tate Reeves continues this commitment to hazard mitigation through the Mississippi Hazard Mitigation Council.

Phase II: Assessment of Risks

The State of Mississippi is diverse by nature and climate. From severe weather to wildfires and flooding to unstable dams, Mississippians have faced their share of disasters throughout the years. The plan developers began an assessment of risks by researching historical records and learning from past hazardous events. This history has been used to assist in the assessing of today's risks by using a Hazard Ranking Worksheet. From this process, the past documented events were profiled, and vulnerabilities identified. The plan developers then projected the estimated potential future losses.

The Hazard Ranking Worksheet operates like this: The probability of each hazard is determined by assigning a level, from one to four, based on the likelihood of the occurrence from historical data. The total impact value includes the affected area, primary impact, and secondary impact levels of each hazard. These levels are then multiplied by the importance factor to obtain a score for each category. The probability score is multiplied by the sum of the three impact categories to determine the total score for the hazard. Based on this total score, the hazards were then separated into four categories based on the hazard level they pose to the communities. Those four categories are:

- unlikely,
- possible,
- critical, and
- highly likely

This backbone of information forms the bases for MEMA's mitigation plan and helps to shape it in an economically feasible and environmentally sound manner.

Phase III: Development of a Mitigation Plan

Each phase of MEMA's planning process in developing Mississippi's Mitigation Plan is documented within this report. Statewide hazard mitigation goals and objectives have been developed by the Hazard Mitigation Council and presented to stakeholders, partnering agencies, and the general public for review and comment. Details of this process are included within the next section.

In addition, state capabilities have been identified and assessments have been made concerning current effectiveness. Alterations to existing plans based on the state's capabilities have been identified and analyzed and, if found deserving, have been included within the 2023 Hazard Mitigation Plan Update. Finally, funding sources have been considered and where applicable, factored into the final document's operational procedures.

Phase IV: Implementation of the Plan and Monitoring Process

Upon adoption of this plan, Mississippi's mitigation actions statewide will take on a more cohesive, stronger, and more easily recognized existence. Existing local and regional hazard mitigation plans will continue to move closer to statewide goals and objectives due to increased communications and understanding. Built in milestones for reviewing and tweaking the plan will help to ensure that stakeholders and the general public are afforded the opportunity for input. As the plan continually evolves, it will be altered to meet our ever-changing environment. This plan is part of a more unified and thus more effective and economically feasible strategy for saving lives and reducing future losses.

To help organize changes made from the 2018 to 2023 plan, a Table of Contents "Roadmap" for the 2018 to 2023 Update is provided in Appendix 7.2-A.

2.2: Coordination with Federal and State Agencies and Interested Groups in the Planning Process

44 CFR 201.4(b): Planning Process. An effective planning process is essential in developing and maintaining a good plan. The mitigation planning process should include coordination with other state agencies, appropriate federal agencies, and interested groups.

The State Hazard Mitigation Plan (The Plan) was prepared by the Mississippi Emergency Management Agency's (MEMA) Bureau of Mitigation Planning with assistance from numerous state agencies, organizations, and concerned citizens.

Early in the update process, multi-level involvement was achieved by engaging mitigation specialists from all areas of the state. MEMA chose this approach to achieve the most effective mitigation plan possible – one that works in tandem with municipal, local, state, and federal entities.

Hazard Mitigation Council

Governor Haley Barbour, being highly supportive of the State's mitigation strategies, executed Executive Order # 985, creating the Mississippi Hazard Mitigation Council. Mississippi's Hazard Mitigation Plan is a "living document", and has been reviewed and updated in meetings held by the Hazard Mitigation Council since January 2007.

The Council is effective in guiding mitigation goal and objectives for the State of Mississippi. Appointees to the council were carefully selected to provide representation from key state and local agencies capable of contributing resources, implementing mitigation actions, and integrating mitigation planning efforts. It is anticipated that the Hazard Mitigation Council will remain intact and continue to strengthen communities and working relationships by coordinating mitigation efforts between all levels of governmental agencies, academia, tribal agencies, private non-profit organizations, and the private sector for years to come. This in turn bolsters development, supports on-going maintenance, and improves planning efforts. It is expected that the Council will remain intact indefinitely and that it will continue to assist in:

- creating a vision for addressing future needs,
- accurately and quickly responding to economic and environmental changes,
- regularly evaluating the success of the state hazard mitigation plan, and
- providing necessary resources whenever possible for updating or changing goals and addressing new laws and regulations.

MEMA also established a well-rounded team of plan developers for the 2023 plan. Following the same format of the 2018 team, plan developers included state employees and a consulting agency to serve as plan developers for the 2023 Hazard Mitigation Plan. Through a series of emails, workshops, and meetings, many public entities have been involved in the planning process, and the mitigation actions of many stakeholders, emergency response organizations, and agencies have also been included in this plan. The State of Mississippi is therefore transitioning from many individualized mitigation strategies to a statewide planning effort.

Governor Barbour's executive order is presented on the following pages.

STATE OF MISSISSIPPI

Office of the Governor

EXECUTIVE ORDER NO. 985

MISSISSIPPI HAZARD MITIGATION COUNCIL

WHEREAS, there are significant opportunities to save lives and reduce future losses resulting from natural and human-caused hazards through hazard mitigation planning; and

WHEREAS, Public Law 106-390, known as the Disaster Mitigation Act of 2000 (DMA 2000), was signed into law by the President on October 10, 2000; and

WHEREAS, the DMA 2000 provides funding for disaster relief and recovery, and reinforces the importance of mitigation planning and disaster preparation; and

WHEREAS, the DMA 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) and is intended to facilitate cooperation between state and local authorities; and

WHEREAS, Section 322 of the DMA 2000 specifically addresses mitigation planning at the state and local level, identifies new requirements that allow HMGP funds to be used for planning activities, and increases the amount of HMGP funds available to states that have developed a comprehensive, enhanced mitigation plan prior to a disaster; and

WHEREAS, state governments have certain responsibilities for implementing Section 322 of the DMA 2000, including: preparing and submitting a standard or enhanced state mitigation plan; reviewing and updating the state mitigation plan every three years; providing technical assistance and training to local governments to assist them in applying for HMGP grants and in developing local mitigation plans; and reviewing and approving local plans if the state is designated as managing state and has an approved enhanced plan.

WHEREAS, the Enhanced Hazard Mitigation Plan can reduce or eliminate long-term risk to life and property from a hazard event; identify cost-effective and technically feasible mitigation measures that will reduce losses from future disasters in an environmentally sound manner; encourage long-term reduction of hazard vulnerability; build partnerships with sectors not previously involved; protect critical community facilities, reduce exposure to liability, minimize community disruption; facilitate funding priorities, especially following a disaster; and create more sustainable communities.

WHEREAS, establishing a Hazard Mitigation Council is in the best interest of the State of Mississippi;

NOW, THEREFORE, I, Haley Barbour, Governor of the State of Mississippi, by the authority vested in me by the Constitution and the Laws of this State, do hereby:

1. Direct that a Mississippi Hazard Mitigation Council ("Mitigation Council") be established and include representation from the following:

    a. Governor's Office;
    b. Mississippi Emergency Management Agency;
    c. Mississippi Department of Environmental Quality;
    d. Mississippi Department of Finance and Administration;
    e. Mississippi Department of Transportation;
    f. Mississippi Department of Public Safety;
    g. Mississippi Department of Marine Resources;
    h. Mississippi Levee Board;
    i. Mississippi Development Authority;
    j. Mississippi State Department of Health;
    k. Mississippi Department of Archives and History;
    l. Mississippi Municipal League;
    m. Mississippi Association of Supervisors;
    n. State Board for Community and Junior Colleges;
    o. Mississippi State Department of Education; and
    p. State Institutions of Higher Learning.

2. Declare that the Executive Director of MEMA shall serve as the Chairperson of the Mitigation Council.

3. Declare that MEMA's Executive Director may, as chairperson of the Mitigation Council, designate additional executive and non-executive branch personnel or quasi-governmental and non-governmental personnel to assist the Mitigation Council as needed for their expertise and counsel arises.

4. Declare that the Mitigation Council shall act as an advisory council in all matters related to Mississippi's Enhanced Hazard Mitigation Plan.

5. Require that the Mitigation Council review issues relating to the creation of Mississippi's Enhanced Hazard Mitigation Plan, as well as other mitigation efforts, as deemed appropriate by MEMA in cooperation with the Federal Emergency Management Agency (FEMA).

6. Direct that the Mitigation Council shall make recommendations for:

    a. An overall strategy for the adoption and use of Mississippi's Enhanced Hazard Mitigation Plan;
    b. Addressing potential technical, scientific, economic, security, privacy, and other issues related to the adoption of Mississippi's Enhanced Hazard Mitigation Plan;
    c. Identifying existing mitigation information resources, including funding sources, to support the development of Mississippi's Enhanced Hazard Mitigation Plan; and
    d. Supporting continuing, educational efforts to promote development of a population capable of being self-sustaining before, during and after a disaster event.

7. Direct all Executive branch departments, agencies, boards, and commissions and any other divisions of the Executive branch of state government, to fully cooperate with the Mitigation Council and provide staff support and any other assistance as requested.

8. Direct the Mitigation Council to meet periodically as needed to:

    a. Review Mississippi's Enhanced Hazard Mitigation Plan;
    b. Review statewide hazard mitigation goals and objectives; and
    c. Review priorities for categories of hazard mitigation projects.

9. Authorize the Mitigation Council to seek grants from government or private sources to achieve the goals and objectives set forth.

10. Deem that the Mitigation Council shall continue in existence until all of its objectives are achieved, unless otherwise directed by a future Executive Order.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Mississippi to be affixed.

DONE at the Capitol in the City of Jackson, the 17th day of May, in the year of our Lord two thousand seven and of the Independence of the United States of America, the two hundred and thirty-first.

HALEY BARBOUR
GOVERNOR

BY THE GOVERNOR:

SECRETARY OF STATE

Members of the Hazard Mitigation Council and the agencies and/or associations they represent are indicated in table 2.2.1.

Table 2.2.1
Mississippi's Hazard Mitigation Council

Agency	Representative
Office of the Governor	Governor
Mississippi Emergency Management Agency (MEMA)	Executive Director
Mississippi Department of Environmental Quality (MDEQ)	Executive Director
Mississippi Department of Finance and Administration (DFA)	Executive Director
Mississippi Department of Transportation (MDOT)	Executive Director
Mississippi Department of Public Safety	Commissioner
Mississippi Department of Marine Resources (DMR)	Executive Director
Mississippi Levee Board	Executive Director
Mississippi Development Authority (MDA)	Executive Director
Mississippi State Department of Health	State Health Officer
Mississippi Department of Archives and History	Executive Director
State Board for Community and Junior Colleges	Executive Director
Mississippi State Department of Education	Executive Director
State Institutions of Higher Learning (IHL)	Executive Director
Mississippi Municipal League (MML)	Executive Director
Mississippi Association of Supervisors (MAS)	Executive Director
Mississippi Department of Human Services	Executive Director
Mississippi Forestry Commission	Executive Director

Team Approach

Alongside the Council, the planning team for the Mississippi 2023 Update consisted of Allen Engineering and Science Planners, GIS/Hazus-MH specialist, data visualization specialist, MEMA Executive Staff, and MEMA mitigation planners.

On June 3, 2023, a project kick-off meeting for updating Section 3: Risk Assessment of the State Plan was held With Allen Engineering and Science Planner and MEMA Mitigation Planning Staff. The scope of work was discussed with emphasis on climate change, cyber-terrorism, and pandemics. On July 22, 2022, an email was sent to the State of Mississippi Hazard Mitigation Council notifying them that the update of the State plan had begun and that the Mitigation Planning Staff would be reaching out for input on the sections of the plan. Starting Oct. 21, 2222, the State Hazard Mitigation Plan Survey was sent out to the Mitigation Council, stakeholders, partners, and the general public. On November 17, 2022, an email was sent to state agencies providing 2018 mitigation capabilities and asking that they be updated. On February 2, 2023, the project profiles sheets were sent to the Mitigation Council requesting that they be updated. Starting on March 10, 2023, the Mitigation Council was asked to review the mission statement, goals, and objectives for changes and approval.

In this 2023 State Plan Update, mitigation planners compiled the FEMA approved local and regional plans that cover the entire State of Mississippi and provided them to the contractor. Results from the local and regional mitigation plans, council meetings, and an updated risk assessment were compiled to reflect natural hazard occurrences and risks.

On July 27, 2023 the Hazard Mitigation Council Hazard Identification (HIRA) presentation was conducted by Allen Engineering and Science and the process of updating the State Plan was discussed with the Mitigation Council. The New guidelines from FEMA for the mitigation plans were discussed as well as ways to implement them. A hazard identification exercise was conducted where hazards being profiled were ranked, as well as a review of the process for HIRA, and a determination of hazard ranking methodology was completed. MEMA's Mitigation Planning Bureau had previously issued the mission statement, goals, objectives, and state capabilities from the 2018 plan for the Council to review for update. The Council made the final determination on July 27, 2023 that the mission statement and the goals were still valid and would remain the same. One objective was added to Goal 1 and four objectives were modified (1.3, 1.9, 3.1, and 3.3).

Additionally, mitigation programs, table of mitigation actions, and funding sources were reviewed for update. Changes in state capabilities were reported. The reports are included in Section 4.2 of this document. From 2007 until now, members of the Council have continually updated project profiles and project information for their agencies over the 5-year period between plan updates.

During the plan development, experts from various private, state, and local entities statewide, as well as representatives from the Federal Emergency Management Agency (FEMA), were given the opportunity to participate in the planning process to increase integration with ongoing state hazard mitigation planning efforts. MEMA solicited participation from industry associations and volunteer agencies (Red Cross, Samaritan's Purse), as well as mitigation planners and specialists representing all levels of governments and numerous specialized areas. Table 2.3.2.1 lists the organization representatives. A status report of 2023 mitigation actions and local mitigation action analysis was provided along with educational materials. The purpose was to stimulate open discussion for updating existing mitigation actions, identifying lead agencies that might take ownership of particular actions, prioritizing the actions, and then developing a draft strategy for maintaining identified actions.

Communication – the Key to a Cohesive Plan

An intranet site was created on MEMA's mitigation management site, my.msema.org for managing and updating information concerning mitigation planning activities. Participants (including Hazard Mitigation Council, individuals with technical expertise, and the plan developers) that have mitigation projects can access and update their project profiles on this site. This has been a tremendous asset to the project managers and has continued throughout the 2023 Mississippi Hazard Mitigation Plan Update.

With the semi-annual meetings and a Summary of the Hazard Mitigation Council Meeting going out to all members, Council Members, Project Managers, and stakeholders were kept informed on the State Plan Developments. The Hazard Mitigation Council has agreed that future meetings will be held semiannually.

Public Participation and Outreach Efforts

Associations

Plan developers involved various hazard mitigation stakeholders in the planning process by attending various Mississippi based conferences and providing information and accepting comments for use in the development of the 2023 Hazard Mitigation Plan. Due to COVID, fewer conferences have been attended, but the conferences and objectives of each are listed in Table 2.2.2. Other outreach efforts include emails, phone calls, and person to person contact.

Table 2.2.2
Public Outreach

Conference/Activity	Date/Location	Purpose
MS Association of Supervisors	June 13-16, 2022 Biloxi, MS	State plan survey is placed on the MAS website for outreach and feedback.
Mississippi Municipal League	June 27 – 29, 2022 Biloxi, MS	MEMA's Mitigation survey is placed on the MML website for outreach and feedback.
MS Civil Defense Emergency Management Assoc	November 15-17, 2022 Philadelphia, MS	Informed of purpose and need for updating State of Mississippi Hazard Mitigation Plan and invited participation through state plan survey
Association of Floodplain Managers of MS	May 2-4, 2023 Natchez, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and invite participation through MEMA booth
MS Partners in Preparedness Conference	May 16-19, 2023 Biloxi, MS	MEMA staff invited participation through distributing state plan surveys for feedback
Building Association of MS	June 12-16, 2023 Natchez, MS	Informed of purpose and need for updating State of Mississippi Hazard Mitigation Plan and invited participation through state plan survey
Mississippi Emergency Management Agency	July 24 – Present Pearl, MS	Hazard Mitigation Plan placed on the MEMA Web- site for review and comment.

A survey designed to provide plan developers with information concerning hazard mitigation issues from the local perspective was made available to each conference. A copy of the survey is located in Appendix 7.2-C and the survey results are tabulated in section 4.3 of this report.

Jana Henderson, Office of Mitigation Director, presents at the Annual Floodplain Management (AFMM) Conference 2023

Annual Floodplain Management Conference 2023

Panola County EMA/FEMA HM CEO/Mitigation Planning Staff share booth on June 17, 2023. Mitigation for Kids provide parents, guardians, teachers, and children with tips, activities, and a story to help the whole family prepare for emergencies. (Sardis, MS)

Panola County Sheriff's Office Kids Academy held June 27, 2023, Mitigation for Kids Event

Business, Non-Profit and Professional Organizations

Because of the successes noted from reaching out to governmental associations, plan developers used the same strategy in 2023 to engage businesses, as well as non-profit and professional associations. Emails explaining the purpose and need of the mitigation plan and inviting participation in the process were sent to business associations listed for the State of Mississippi, as well as several churches and volunteer organizations. This was also sent to the 2023 president of the Mississippi Voluntary Organizations Active in Disasters (VOAD), who in turn forwarded it statewide to his constituency.

By capitalizing on the name recognition and trust generated by business leaders who partnered with MEMA, the agency's message was received much more readily by the business community. Thus, readership and response to emailed information tended to be higher and educational benefits, as well as increased participation in plan development. Individuals with the business community were asked to participate by submitting comments to MEMA concerning the goals of the statewide comprehensive mitigation plan.

In addition to an increase in participation from the business community, MEMA also reached out to VOAD leaders of the state. Members of the Red Cross, the United Way, and the Salvation Army were also notified to review and comment on the goals and objectives of the updated plan. The Building Officials Association of Mississippi, the Mississippi Municipal League, and the Mississippi Association of Supervisors are members of both the Mississippi Building Codes Council and the State Hazard Mitigation Council. The President of the Mississippi Building Codes Council was called on September 11, 2023 concerning update of the State Plan and being added as a partner for upcoming meetings. A survey of the State Plan goals and objectives and a link to the State Plan were sent out to the Mississippi Building Codes Council President for review and feedback, and to distribute to other council members. On September 15, 2023, a response was received regarding review of the State Plan stating that there were no comments.

Local, State, and Federal Agencies Engaged

While many of Mississippi's state agencies were invited to join the Mississippi Hazard Mitigation Council, others had never been personally invited to develop mitigation planning strategies. They were sent letters from the MEMA Executive Director urging their participation with the hope of strengthening their understanding and for future partnership opportunities.

In addition to open invitations to participate in the planning process, plan developers met with the following statewide agencies and/or organizations to review their mitigation plans and coordinate statewide activities. These outreach efforts included meeting with the following:

- Mississippi's Planning and Development Districts
- The Mississippi Department of Environmental Quality
- The United States Army Corps of Engineers
- The Center for Community Earthquake Preparedness
- The United Geological Survey and
- National Weather Service

Continuing the practice began in 2007, plan developers for the 2023 update sought to work more closely with federal agencies in the planning process. Input and guidance were sought from the Federal Emergency Management Agency (FEMA) – Region IV employees. FEMA responded by directing plan developers to various written materials available through the internet and provided input through one-on-one conversations, e-mails, and letters. A complete list of federal agencies that plan developers consulted is found in Section 2.3, in Table 2.3.2.1.

Meeting with the Mississippi Band of Choctaw Indians

MEMA Planning Staff have met with representatives of the Mississippi Band of Choctaw Indians (the Tribe) in Choctaw and Pearl, Mississippi on several occasions to discuss mitigation projects. The Tribe now has its own FEMA approved Hazard Mitigation Plan. The 2023 State Plan Survey was sent out requesting feedback and distribution.

Currently, the Tribe has a statutory framework (Known as Ordinance 50) that:

- Establishes the emergency management team of the Directors of the Fire Department, Police Department, the Health Department, and Facilities;
- provides equipment for facility building in each community designated as shelters (includes generators);
- significantly improves communications; and
- provides for a draft risk analysis.

Tribal mitigation activities resulting from review and evaluation of events that are either in the works or completed. They include:

- increased training opportunities;
- increased purchases of emergency related equipment;
- improved 'on the ground' communications for effective contact of first responders;
- recent acquisition of communication equipment that has been installed in all faculty buildings (radios); and
- evaluation of policies for addressing staff burnout, which will likely be implemented.

Opportunity for Public to Comment

Individuals participated in the second public involvement process via the internet. Information for review and comment were sent electronically for further dissemination statewide to the Mississippi Manufacturers Association, the Mississippi Department of Environmental Quality, the MS Department of Transportation, and the Mississippi Association of Supervisors, thus providing easy access for large segments of the population. Individuals that responded proved to be very interested and expressed a desire to participate in the current process as well as future planning efforts.

Other educational information about hazard mitigation planning, the mitigation strategy, and the mission statement that was developed jointly by the Hazard Mitigation Council and specialists statewide, was made available. The mission statement listed proposed goals and action steps for hazard mitigation and was available for review and comment. The public was invited to rank the proposed goals to provide suggestions for new or amended actions steps. Over 57 participated in this public involvement process. Information received is tallied on the subsequent page.

The public was provided the opportunity to comment on the plan during plan development. The plan was posted on Facebook, through email advertisements, flyers, and newspaper. Another opportunity for the public to comment will be available prior to the plan adoption as per FEMA requirement. Participants will be given the opportunity to comment and give feedback on the plan. Visitors will be invited to make suggestions and write questions on provided comment sheets. This type of public participation allows visitors to physically take part in the development process. Appendix 7.2-D contains a list of volunteer organizations, individuals, stakeholders, and partners who participated in the 2023 plan update. Appendix 7.2 E contains state agencies that participated in the 2023 plan update.

Mission: To develop and maintain a disaster-resilient, sustainable Mississippi through perpetual planning and review of a comprehensive statewide mitigation strategy.

The percentage indicates the importance of the objective per response. The results were obtained by the survey on the following page that lists the goals and objectives and the degree of importance.

Goal 1 – Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards.

		High	Medium	Low
Objective 1.1	Protect critical facilities, infrastructure, and systems.	92%	8%	0%
Objective 1.2	Reduce the number of at-risk and repetitive loss/ SRL properties.	49%	48%	3%
Objective 1.3	Reduce potential damage to future buildings and infrastructure and increase resilience to disasters.	62%	34%	3%
Objective 1.4	Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation.	46%	46%	8%
Objective 1.5	Identify needs and appropriate projects from post disaster damage assessments.	56%	41%	3%
Objective 1.6	Preserve, create, and restore natural systems to serve as natural mitigation functions.	49%	39%	12%
Objective 1.7	Protect historic and cultural resources.	42%	41%	17%
Objective 1.8	Provide state and local agencies with a statewide communications network with an Interoperable, highly reliable, fast access, public safety-grade communication system for use during events that threaten the health and welfare of the citizens of Mississippi.	80%	15%	5%
Objective 1.9	Promote State identified mitigation initiatives, such as saferooms, storm shelters, severe weather warning systems, emergency generators, and public outreach campaigns.	73%	20%	7%
Objective 1.10	Mitigate risk and reduce the number of high hazard potential dams.	34%	34%	31%

Goal 2 – Build and enhance the local mitigation capabilities

Objective 2.1	Support and provide guidance for local hazard mitigation planning and projects.	68%	29%	3%
Objective 2.2	Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning.	58%	34%	8%
Objective 2.3	Provide and promote technical assistance and training to local governments.	63%	36%	1%
Objective 2.4	Identify and provide financial incentives and funding opportunities.	64%	32%	3%

Goal 3 – Improve public education and awareness

Objective 3.1	Develop and improve outreach programs and materials to increase awareness to the public and private sector about climate adaptation principles, risk, and mitigation in Mississippi.	46%	46%	8%
Objective 3.2	Promote and utilize existing hazard mitigation education programs from federal, state, and non-profit sources.	54%	41%	5%
Objective 3.3	Develop tailored outreach strategies for vulnerable, underserved populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents.	58%	37%	5%

Goal 4 – Sustain and enhance a coordinated state mitigation program

Objective 4.1	Strengthen coordination, communication, capabilities, and partnerships with levels of government, the private sector, and non-profit organizations.	76%	19%	5%
Objective 4.2	Institutionalize hazard mitigation as integrated state policy.	49%	41%	9%
Objective 4.3	implement, monitor, and access the effectiveness of the mitigation strategy and promote successes.	56%	37%	8%

State Hazard Mitigation Plan Survey

Hazard Mitigation – any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Directions: Please read each Objective in the State of Mississippi Hazard Mitigation plan, and place an **X** in either **High**, **Medium**, or **Low**, based your thoughts of importance. ***Please answer questions 1 and 2 before completing the survey.***

1) Which county do you live in ? ____

2) What is your Agency and/or Occupation ? ____

Goals and Objectives		High	Medium	Low
Goal 1 – Minimize loss of life, injury, and damage to property, the economy, and the environment from Natural Hazards.				
Objective 1.1	Protect critical facilities, infrastructure, and systems.			
Objective 1.2	Reduce the number of at-risk and repetitive loss/SRL properties.			
Objective 1.3	Reduce potential damage to future buildings and infrastructure and increase resilience to disasters.			
Objective 1.4	Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation.			
Objective 1.5	Identify needs and appropriate projects from post disaster damage assessments.			
Objective 1.6	Preserve, create, and restore natural systems to serve as natural mitigation functions.			
Objective 1.7	Protect historic and cultural resources.			
Objective 1.8	Provide state and local agencies with a statewide communications network with an Interoperable, highly reliable, fast access public safety-grade communication system for use during events that threaten the health and welfare of the citizens of Mississippi.			
Objective 1.9	Promote State identified mitigation initiatives, such as safe rooms, storm shelters, severe weather warning systems, emergency generators, and public outreach campaigns.			
Objective 1.10	Mitigate risk and reduce the number of high hazard potential dams			
Goal 2 – Build and enhance the local mitigation capabilities.				
Objective 2.1	Support and provide guidance for local hazard mitigation planning and projects.			
Objective 2.2	Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning			
Objective 2.3	Provide and promote technical assistance and training to local governments.			
Objective 2.4	Identify and provide financial incentives and funding opportunities.			
Goal 3 – Improve public education and awareness.				
Objective 3.1	Develop and improve outreach programs and materials to increase awareness to the public and private sector about climate adaptation principles, risk, and mitigation in Mississippi.			
Objective 3.2	Promote and utilize existing hazard mitigation education programs from federal, state, and non-profit sources.			
Objective 3.3	Develop tailored outreach strategies for vulnerable underserved populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents.			
Goal 4 – Sustain and enhance a coordinated state mitigation program.				
Objective 4.1	Strengthen coordination, communication, capabilities, and partnerships with levels of government, private sector, and non-profit organizations.			
Objective 4.2	Institutionalize hazard mitigation as integrated state policy.			
Objective 4.3	Implement, monitor, and access the effectiveness of the mitigation strategy and promote successes.			

2.3: Integration with Other Planning Efforts, Programs, and Initiatives

44 CFR 201.4(b): The Plan must discuss how the planning process was integrated to the extent possible with other ongoing state planning efforts, as well as other FEMA mitigation programs and initiatives.

As jurisdictions have realized a limited number of resources, integration of programs, goals, and resources have become ever more necessary. From the initial 2004 Hazard Mitigation Plan to the 2007 Mitigation Plan until now, integration of programs and resources have significantly increased among local, state, and federal entities in the State of Mississippi. In addition to oversight of Hazard Mitigation Assistance, floodplain management, the Earthquake Program, and mitigation planning programs, MEMA follows and includes Mississippi Statutes in the hazard risk plans of the State Departments of Public Safety, Development Authority, Transportation, Insurance, Corrections, Environmental Quality, Health, Human Services, Wildlife, Fisheries and Parks, the Office of Administrative, Education, and the Public Service Commission. MEMA accomplishes many mitigation projects through collaboration. The Mississippi Development Authority partners with MEMA in joint funding of flood acquisition and drainage projects, and in storm shelter/saferoom projects. The Office of Geology in the Department of Environmental Quality and MEMA also partner in the NFIP Risk Map Program, while the Department of Transportation and MEMA partner in highway and bridge development to ensure the floodplain management component is addressed. The Dam Safety Division in the Department of Environmental Quality partners with MEMA in providing evaluation studies, inundation maps, and data to reduce risk to lives and property from high hazard dams.

Multi-jurisdictional and local mitigation plans comprise another part of the program. As such, the development process for the state plan takes into consideration the mitigation goals and objectives identified therein. MEMA routinely works with numerous state and federal agencies on various issues, included partnering are with the Mississippi Development Authority; the American Red Cross for emergency sheltering; Department of Environmental Quality, Dam Safety Division on issues of high hazard dams; Mississippi Departments of Transportation and Public Safety on emergency evacuation issues; and the Mississippi Department of Homeland Security on all threats to the citizens of this state. MEMA extends an open-door policy to federal and state agencies, regional planning and development districts, and local governments to build stronger, more cohesive mitigation efforts whenever possible.

2.3.1 Integration of Local Plans

MEMA is the primary state coordinating agency for all local emergency operations plans and hazard mitigation plans. The Mitigation Planning Bureau has the primary responsibility of working with regional and local governments in developing, reviewing, and updating multi-jurisdictional and local hazard mitigation plans. The Preparedness Plans Bureau has the primary responsibility of working with local governments in developing, reviewing, and updating local emergency operation plans.

As part of the state mitigation planning initiative, multi-jurisdictional and local mitigation plans are being developed in conjunction with counties and regions. These multi-jurisdiction plans address the mitigation issues and initiatives for unincorporated and incorporated jurisdictions. This helps ensure as many jurisdictions as possible remain involved in the mitigation planning process. The Local Hazard Mitigation Plan is normally a separate, stand-alone plan that represents a county or region. Any jurisdiction within a county may prepare a mitigation plan specific to that jurisdiction and separate from the county or regional mitigation plan.

Mississippi has 82 counties in the state, and all have a Comprehensive Emergency Management Plan (CEMP) in place. These plans are scheduled for review and/or update by MEMA every five years. In addition, approximately

15 incorporated cities maintain separate CEMPs. These plans are included in the five-year MEMA review/update process.

The local governments, the Mississippi Planning and Development Districts (PDD), and consultants are using the information contained in the State Hazard Mitigation Plan to develop multi-jurisdictional and local hazard mitigation plans. As the local hazard mitigation plans are developed, the information provided through those planning efforts will be available to MEMA for incorporation into the State Hazard Mitigation Plan. This cooperative effort contributes to the continuous improvement of all the plans as they are reviewed and updated every five years.

2.3.2 Integrating Planning Information with Other Mitigation Partners

MEMA's efforts to identify and engage mitigation partners continues to increase. New efforts include engaging traditional partners through unique public involvement outreach efforts. For example, to assist the Mississippi Hazard Mitigation Council, MEMA invited mitigation planners/specialists from local, state, and federal agencies, as well as the private sector, to participate in the State Hazard Mitigation Plan Update. Participants could go online and review and comment on the hazard mitigation plan. Table 2.3.2.1 lists those agencies/associations invited to participate in the development of the 2023 Standard Mitigation Plan Update.

Table 2.3.2.1

Name	Title	Organization
Allison Ingram	President	Association of Floodplain Managers of MS
Brian Measells	President	Building Officials Association of Mississippi
James M. Wilkinson	Director	Central US Earthquake Consortium
Brandon Bolinski	Hurricane Program Manager, Region IV	Federal Emergency Management Agency
Jadon O. Hunter	Floodplain Management and Insurance Branch Chief, Region IV	Federal Emergency Management Agency
Darlene Booker	Mitigation Planner, Risk Analysis Branch, Region IV	Federal Emergency Management Agency
Mary Comas	Chief Financial Officer	Federal Emergency Management Agency
Carl Mickalonis	Supervisory Community Planner, Region IV	Federal Emergency Management Agency
Gracia B. Szczech	Earthquake Program Manager, Region IV	Federal Emergency Management Agency
Stephen McCraney	Executive Director	Mississippi Emergency Management Agency
Clayton French	Deputy Director	Mississippi Emergency Management Agency
Jana Henderson	Mitigation Office Director	Mississippi Emergency Management Agency
Cody Fisher	Emergency Response and Preparedness	MS Department of Environmental Quality
Steve Champlin	Geospatial Resources Division Director/Flood Mapping	MS Department of Environmental Quality
William McKercher	Chief of the Dam Safety Division	MS Department of Environmental Quality
DiMaya Randle	Floodplain Bureau Director	Mississippi Emergency Management Agency
Malory White	Chief Communications Officer	Mississippi Emergency Management Agency
Alex Hopkins	Hazard Mitigation Grants Bureau Director	Mississippi Emergency Management Agency
Frank Hill	Hazard Mitigation Planning Bureau Director	Mississippi Emergency Management Agency
Katrina McLin	Earthquake Program Manager	Mississippi Emergency Management Agency
Andrew McMillin	Operations Bureau Director, Office of Response	Mississippi Emergency Management Agency
Bob Anderson	Executive Director	MS Department of Human Services
R. Bozeman	Director of Conservation Education/Public Outreach	Mississippi Forestry Commission
Stephen Wilkinson	Warning Coordinator Meteorologist, Weather Office	National Weather Service
Kurt Readus	State Conservationist	Natural Resource Conservation Service
Trent Baldwin	Project Chief, P. E.	United States Geology Survey
Chris L. Mullen	Professional Engineer, Associate Professor	University of MS, Department of Civil Engineering
Greg Easson	MS Mineral Resources Institute	University of Mississippi

Thomas L. Minyard	Hydrologist, P.E.	US Army Corps of Engineers, Lower MS Gulf
Bill Rodgers	President	Mississippi Building Code Council

MEMA's participation in the Mississippi Civil Defense/Emergency Management Association (MCDEMA) is another strong indication of the state's commitment to integrate statewide planning initiatives with local efforts. MCDEMA was originally organized by local Civil Defense Directors on May 21, 1961, to seek legislation and additional funding for local programs. Over the years, MCDEMA continued to grow. A new initiative, which began in 2006, is a partnership between MEMA and MCDEMA to engage emergency management professionals in Alabama in the first Bi-State Hurricane Conference. The MS-AL Bi-State Hurricane Conference proved to be successful and had its second meeting in Mobile, AL, in May of 2008. Another meeting followed on April 27-29, 2009, at the MS Coast Civic Center (Coliseum) in Biloxi, MS. In 2010, the meeting was held in the River Room Conference Center in Flowood, MS on June 10-11. In 2012, the Hurricane Conference involved three states, MS, AL, and Louisiana. It was held on the MS Gulf Coast. The Central Gulf Coast Hurricane Conference was held on June 23-24, 2015, in Mobile, Alabama with only Mississippi and Alabama participating. The 2023 National Hurricane conference was held April 3 – 6, 2023 in New Orleans, LA. The primary goal is to improve hurricane preparedness, response, recovery and mitigation in order to save lives and property. MEMA and MCDEMA enjoyed a close working relationship which expanded to educational, communication, and partnership opportunities with organizations at all levels of government. In 2023, the Mississippi State Department of Health, Mississippi Civil Defense Emergency Management Association Management Association, Mississippi Hospital Association, Mississippi Department of Environmental Quality, Mississippi Office of Homeland Security, Mississippi Department of Transportation, Mississippi Department of Marine Resources, Mississippi Fire Marshall Office, Mississippi Highway Patrol, Mississippi Military Department, Mississippi Department of Human Services, Mississippi State University Extension Service, Mississippi Emergency Management Agency, Mississippi Fire Academy, Mississippi Firefighters Association and the Mississippi Wireless Communication Commission hosted the 2023 Mississippi Partners in Preparedness (PIP) Summit. The PIP 2023 took place in Biloxi, Mississippi on May 16-19, 2023. The summit gave professionals involved all aspects of emergency preparedness and response the opportunity to network with peers throughout the State. Approximately 500+ participants attended.

Unfortunately, due of Covid 19, these types of conferences/summits have not been possible until recently. On Nov. 15-17, 2022, MCDEMA held a conference at the Pearl River Resort in Philadelphia, MS. This was one of the 1st conferences in several years. The Hurricane Conference was held on April 3-6, 2023 in New Orleans, LA. The AFMM Conference was held in Natchez, MS, May 2-4, 2023. The Partners and Preparedness Summit 2023 was held in Biloxi, MS on May 16 - 19, 2023.

Stephen McCraney, MEMA Executive Director, gives opening comments during the PIP Conference May 2023

Jim Craig, MSDH Senior Deputy, gives opening comments during the PIP Conference May 2023

Joe Spraggins, MDMR Executive Director, gives opening comments during the PIP Conference May 2023

MCDEMA has proven to be very effective in reaching stated goals, and it is anticipated, the annual conferences will continue into the foreseeable future.

In addition to working with FEMA in all aspects of hazard mitigation projects and plans, MEMA has worked with many planners to integrate mitigation steps into projects and plans. The Corp of Engineers, Natural Resource Conservation Service, and Economic Development Administration partnered with Leflore County, MEMA, FEMA, the Mississippi Development Authority, Central Mississippi Planning and Development District and the Greenwood/Leflore Economic Development Association to develop a storm water drainage plan and project that saved the major industry in this region. This achievement is significant in that it employs over 700 citizens within a 12-county area.

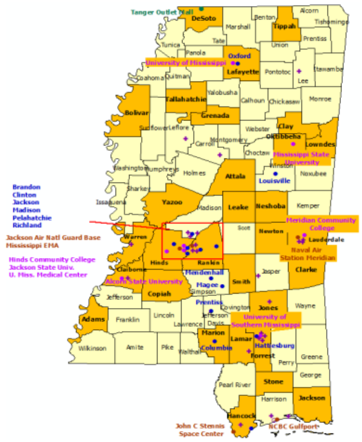
Some 335 Mississippi communities participate in the National Flood Insurance Program (NFIP) and 28 participate in the Community Rating System (CRS). All of these floodplain management activities are supported by the Association of State Floodplain Managers, the Building Officials Association of Mississippi, and the AFMM. The USCOE and MDEQ assist the state and local communities in establishing base flood elevations in areas that have not been studied.

The Mississippi Development Authority's (MDA) Community Development Block Grant Program (CDBG) has complemented the MEMA buyout program by removing homes and businesses from flood hazard areas throughout the state. Many local communities are unable to provide the non-Federal cost share. By working together, MEMA and MDA are assisting local communities in addressing flood risk areas and improving housing stock. The Mississippi Department of Environmental Quality (MDEQ) has worked with MEMA on endangered species, fish and wildlife management issues associated with flood buyouts, water management, and conservation questions. The Mississippi Department of Archives and History works with MEMA concerning the National Environmental Policy Act as it relates to historic issues.

The Mississippi Department of Insurance supports MEMA in promoting flood and earthquake insurance, preparedness, response, mitigation issues, and plans. The Mississippi Department of Environmental Quality (MDEQ) has worked with MEMA on flood buyouts, hazardous materials planning, earthquake mitigation, and dam safety plans and issues. The Mississippi Department of Transportation, the US Department of Transportation, and the Federal Highway Administration have worked with MEMA on flood buyouts, open space restriction issues, and earthquake planning and bridge retrofits. In addition to the state and federal transportation agencies, the Geological Survey, the Central US Earthquake Consortium (CUSEC), MDEQ, the Mississippi Department of Insurance, the American Society of Civil Engineers (ASCE), the Mississippi Society of Professional Engineers, the University of Mississippi Center for Community Earthquake Preparedness, the University of Memphis Center for Earthquake Research and Information (CERI), and the Earthquake Engineering Research Institute, New Madrid Chapter, work with MEMA on earthquake mitigation, including retrofits, public education, soil mapping, and seismic studies.

StormReady Communities

Figure 2.3.2.1: StormReady Communities



County Government Supporter
Community University

The National Weather Service (NWS) and the Mississippi Civil Defense and Emergency Management Association (MCDEMA) support the NWS Storm Ready Program in Mississippi with 30 counties, 14 communities, 8 universities, 1 commercial site, 5 government sites, and 25 supporters, as well as the many mitigation measures included in that program and its plans (Figure 2.3.2.1 and Charts 2.3.2.1). The State of Mississippi offers a safe room program called “A Safe Place to Go” encouraging homeowners to construct individual safe rooms at their residence. The State also provided funding for FEMA 361 and community saferooms. In August 2022 MEMA launched the Individual Safe Room Program to help residents in disaster-prone areas build safe rooms/storm shelters from severe weather. With the current grant funding $2.5 million covering application period August 1, 2022 – October 31, 2022, MEMA anticipates building over 600 safe rooms. MEMA has supported efforts to reduce injuries, fatalities, and damages from severe weather events by funding weather radios to local schools and call-down systems to local governments for distribution to high population concentrations such as schools, industries, and hospitals. MEMA’s Statewide Coordinator has worked for years to educate local, state, and national voluntary organizations through the Disaster Recovery Partnership and Volunteer Organizations Active in Disasters (VOAD), concerning the importance of Mitigation.

Chart 2.3.2.1: StormReady in Mississippi

Counties	Communities	Government	Commercial	Universities	Supporters
1) Adams	1) Bay St. Louis	1) Jackson Air National Guard Base	1) Tanger Outlet Mall	1)Alcorn State University	1) Anderson Regional Medical Center
2) Attala	2) Brandon	2) John C. Stennis Space Center		2) Hinds Community College	2) Anel Corporation
3) Bolivar	3) Clinton	3) Mississippi Emergency Management Agency (MEMA)		3) Jackson State University	3) Baptist Memorial Hospital-DeSoto
4) Claiborne	4) Columbia	4) Naval Air Station Meridian		4) Meridian Community College	4) Forrest General Hospital
5) Clarke	5) Hattiesburg	5) NCBC Gulfport		5) Mississippi State University	5) Forrest County School District
6) Clay	6) Jackson			6) University of MS	6) Greenwood-Leflore Hospital
7) Copiah	7) Louisville			7) University of MS Medical Center	7) Gulfport Premium Outlets
8) DeSoto	8) Madison			8) University of Southern MS	8) Hol-Mac Corp
9) Forrest	9) Magee				9) Keith Huber Corporation
10) Grenada	10) Mendenhall				10) Lamar County School District
11) Hancock	11) Oxford				11) MS Baptist Medical Center
12) Hinds	12) Pelahatchie				12) Mississippi State Hospital
13) Jackson	13) Prentiss				13) North MS State Hospital
14) Jones	14) Richland				14) Northpark Mall
15) Lafayette					15) Nucor Steel and General Recycling
16) Lamar					16) Petal School District
17) Lauderdale					17) Promise Hospital of Vicksburg
18) Leake					18) Rush Hospital
19) Lowndes					19) Simon Northpark Mall
20) Marion					20) Southeast Lauderdale High School
21) Neshoba					21) South-Central Regional Medical Center
22) Newton					22) Southern Lumber Company, Hermanville
23) Oktibbeha					23) Vertex Aerospace
24) Rankin					24) Veterans Administration Hospital
25) Smith					25) Wesley Medical Center
26) Stone					
27) Tallahatchie					
28) Tippah					
29) Warren					
30) Yazoo					

2.3.3 Mitigation Programs and Measures

The following is a synopsis of the State, FEMA, and other program initiatives that are integrated into the Standard Mitigation Plan and will be utilized in the accomplishment of the strategies developed in this plan and local mitigation plans. The State will manage and administer FEMA funding in accordance with applicable Federal statutes and regulations. New programs and initiatives will be added to this ongoing list in subsequent updates in compliance with 44 CFR 13.11(d).

44 CFR 13.11(d): State Plans.

Amendments. A state will amend a plan whenever necessary to reflect: (1) New or revised federal statutes or regulations or (2) a material change in any state law, organization, policy, or state agency operations. The state will obtain approval for the amendment and its effective date but need submit for approval only the amended portions of the plan.

Center for Community Earthquake Preparedness

During February of 1994, MEMA partnered with the Center for Community Earthquake Preparedness (CCEP) at the University of Mississippi to gain a more solid understanding of earthquake effects on structures. The final report, titled Evaluation of Earthquake Effects on Selected Structures and Utilities at the University of Mississippi: A Mitigation Model for Universities was produced in October of 1999. This project was designed to determine responses of selected buildings and facilities to regional seismic activity at or near moment-magnitudes of four, six, and eight; identify potential mitigation that would minimize loss of lives during a regional seismic event; identify sites of potentially severe property damage resulting from a regional seismic event; increase the pool of technical experts capable of performing earthquake evaluations; establish general recommendations for earthquake hazards mitigation; and keep the issue of potential consequences of seismic activity before the public and the University of Mississippi administration. As a result of the partnership developed during this time, MEMA continues to work closely with the CCEP to develop a profile on earthquakes in Mississippi, identifying the risk from regional earthquakes, assessing the vulnerability of regional earthquakes using HAZUS-MH, and identifying potential mitigation actions that could be implemented to mitigate the effects of earthquakes on the state, The partnership between MEMA and CCEP will continue, and information from both entities will be mutually integrated to benefit the state's efforts to mitigate potential risks posed by the seismic hazard in Mississippi.

MEMA is also a participant in the New Madrid Seismic Zone Catastrophic Response Planning Project. Partners in this effort include the following:

- DHS/FEMA Headquarters (Response, Recovery, Mitigation, Private Sector, Critical Infrastructure, etc.)
- FEMA Regions IV, V, VI, VII
- Other Federal agencies including USDOT, USGS, DHHS, DoD, and others
- CUSEC members states: AL, AR, IL, IN, KY, MS, MO, TN
- NORTHCOM
- Local Governments
- Business, industry, and voluntary organizations
- Catastrophic planning personnel assigned to support each participating FEMA region and state
- MAE Center, Sandia National Lab, George Washington University (ICDRM)

The mission of the Project is to increase the national readiness for a catastrophic earthquake in the New Madrid Seismic Zone (NMSZ). Specifically, this will be accomplished by developing a series of annexes or supplements to existing base plans for response and recovery or a series of major earthquakes in the NMSZ and integrating them into a single document with federal, regional, tribal, state, and local components. Additionally, the mission is to identify any issues that cannot be resolved based on current capabilities and to propose recommended courses of action for decision makers involved in the project.

Community Development Block Grants (CDBG)

Authorized to provide local match for the Hazard Mitigation Grant Program (HMGP), the Mississippi Development Authority is the grant recipient of the Community Development Block Grant (CDBG) funds on behalf of the State of Mississippi. The United States Congress allocated some $2 billion of CDBG funding for water, wastewater, electrical, homeowner grants, planning, and downtown revitalization. In some cases, CDBG funds can be used as part of the local share for HMGP, provided that the law does not preclude them.

The CDBG funds for homeowner grants were used to elevate homes that are now in new flood zones, as well as to upgrade homes to the new International Building Codes. Also, the funds will be used to buy-out property and thus hopefully change the use of the property from residential to green space and commercial uses.

Comprehensive Emergency Management Plans (CEMP)

The state, each county within the state (82 in all), and the MS Band of Choctaw Indians have a Comprehensive Emergency Management Plan (CEMP). The plan serves as the operations and administrative guide for disaster preparedness, response, and recovery efforts. Select mitigation strategies such as employment of saferoom/storm shelters, evaluation, retrofitting of critical facilities, and public alert warning systems are all a part of the CEMP.

The state plan and all country plans have been or are in the process of being updated by utilizing post- Katrina lessons learned, as well as incorporation of the guidelines contained in the National Response Framework.

Consolidated Plan for Housing and Community Development (CPHCD)

The Consolidated Plan for Housing and Community Development (CPHCD) is a requirement of the US Department of Housing and Urban Development (HUD) that consolidates the planning and application aspects of the Community Development Block Grant, Emergency Shelter Program, Home Investment Partnerships, and Housing Opportunities for Persons with AIDS formula programs. The CPHCD is a comprehensive planning document that identifies the state's overall needs for affordable and supportive housing and community development. In addition, the plan outlines a strategy to address those needs. The CPHCD development process represents an opportunity an opportunity to involve citizens and community groups in the process of assessing the state's overall housing and community development needs, establishing strategic priorities, and developing a plan to meet the state's identified housing and community development goals. The CPHCD is updated on a five-year cycle with action plans being developed annually. Identified hazard areas and information on vulnerable populations and structures identified within the mitigation plan will be integrated into the CPHCD to ensure that action plans developed to meet housing and community development needs are reflective of the mitigation goals identified within the mitigation plan.

State Emergency Response Commission

Mississippi Emergency Management Agency is designated by executive order to implement the Superfund Amendments and Reauthorization Act, Title III (Public Law 99-499). Personnel involved in this on-going planning effort coordinate with Local Emergency Planning Commissions (LEPC) statewide. There is a particular emphasis on human-caused hazards as a result of the use of misuse of hazardous materials.

Emergency Management Preparedness Grant (EMPG)

The EMPG provides funding for state and local emergency management programs to include the Natural Hazards Program and the State Hazard Mitigation Program. The EMPG is the backbone for funding local emergency management capability. Because of increased EMPG funding, all 82 counties now have active emergency management programs.

Community Wildfire Protection Plans (CWPP's) The Mississippi Forestry Commission (MFC) has responsibilities for statewide wildland fire suppression. MFC is

Is in the process of updating county level CWPP's by working with local Emergency Management Agencies. The Plans highlight goals and objectives to strengthen and support wildfire suppression, mitigation, outreach, and Education at the county level.

Federal Dam Safety Program

This FEMA program is administered/enforced by the Mississippi Department of Environmental Quality. Strategies for expanding dam safety are discussed in Section 4.4. Additional information on dam safety and relevant issues will be discussed in subsequent updates of the State of Mississippi's Standard Mitigation Plan.

Hazard Mitigation Assistance (HMA)

In 2008, the Federal Emergency Management Agency grouped together its grants programs and their requirements to form the Hazard Mitigation Assistance Program. HMA consist of the following programs:

- Hazard Mitigation Grant Program (HMPG)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- Building Resilient Infrastructure and Communities (BRIC)

This FEMA funded program serves as the main post-disaster mitigation utilized by the State of Mississippi. The following initiatives have been selected as high priority for current and future funding.

Retrofit of Critical Facilities – It is the intent of the Mitigation Bureau to assign a high priority to the retrofitting of critical facilities identified in state and local mitigation plans. Wind and flood events have proven to have the highest history of damage, although earthquake vulnerability analysis has identified cost-effective measures for both structural and non-structural mitigation. Climate change encompasses changes in weather conditions, increases and decreases in temperature, and shifts in precipitation. It is the intent of the Mitigation Bureau to help the State adapt to climate change.

Planning – It has long been policy of the Mitigation Bureau to assign funding priority to those communities that have identified eligible mitigation projects through a planning process. Therefore, the funding of mitigation plans is the top funding priority.

Saferooms – Extreme windstorms, such as tornados and hurricanes, pose a serious threat to buildings and their occupants in many areas of Mississippi. Even a structure built "to code," may not withstand extreme wind events. A shelter can be built in one of several places – beneath a concrete slab-on-grade foundation, or in an interior room on the first floor. To protect its occupants, an in-house shelter must be able to withstand the forces exerted by high winds and remain standing, even if the rest of the house is severely damaged. A saferoom or storm shelter is key to this plan's mitigation strategy to save lives. With changing risks of certain types of severe weather events, Mitigation purposes to advance risk reduction for populations most affected by hazard events.

Funds are available to the qualified homeowners from the HMGP administered by the Mitigation Bureau, through private lenders, and the Federal Housing Administration (FHA). Homeowners are requested to contact their local Emergency Management Agency for further information.

Repetitive Flood Loss Structures – These structures represent less than 4 percent of the insured structures in the state but have incurred over 25 percent of the total dollars paid on claims. A priority of the HMGP has been to identify these structures and fund cost-effective acquisition, elevation, localized drainage, or relocation of the structures.

Public Alert and Warning System – A special initiative funded through a five percent set aside and the tornado mitigation initiative allows the state to fund warning systems on college and university campuses where large numbers of student and faculty reside. This program is coordinated with local emergency managers.

Expanded Mitigation Strategies Planning Grant Pilot Guidance – The HMGP Expanded Mitigation Strategies Planning Grant Pilot will provide funds for eligible HMGP Applicants for identifying and planning feasible projects and incorporating those projects into their Local Mitigation Plans (LMPs). The mitigation planning process assists eligible applicants in setting short and long-range mitigation goals and objectives.

Mitigation Planning is a collaborative process whereby hazards affecting the community are identified, hazard vulnerability is assessed and analyzed, and consensus is reached on how to minimize or eliminate the effects of those hazards. Because LMP's are the foundation of a strong mitigation strategy, the Pilot will bridge the gap between mitigation planning strategies and the implementation of actual mitigation projects as part of the overall disaster recovery effort.

Rehabilitation of High Hazard Potential Dams Grant Program

FEMA's Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness.

Hazard Mitigation Assistance Program

The Hazard Mitigation Grant Program (HMGP) provides funding to State, local, tribal, and territorial (SLTT) government so they can rebuild in a way that reduces, or mitigates, future natural disaster losses in their communities. The program is authorized by Section 404 of the Stafford Act.

HMGP funding is authorized with a Presidential Major Disaster Declaration. A governor or tribal chief executive may request HMGP funding throughout the state, tribe or territory when submitting a disaster declaration. The amount of funding made available to the applicant is based on the estimated total Federal assistance. The formula generally gives 15% of the total federal assistance amount provided for recovery from the presidentially declared disaster and is determined by the FEMA-approved Hazard Mitigation Plan.

Hazard Mitigation Technical Assistance Program (HMTAP)

The state has utilized Technical Assistance Task Orders to develop local and county plans, conduct regional workshops on Pre-Disaster Mitigation, publish a Mitigation Success Stories book, conduct community mitigation capability assessments to include community assistance visits and contacts, and to evaluate critical facilities in the wake of Tropical Storm Isadore and Hurricane Lili in September 2002.

Homeland Security Plan

Finding from this plan were integrated with the Mississippi Emergency Operations Plan, with particular emphasis on human-caused hazards. The Homeland Security Plan development was closely coordinated with this Hazard Mitigation Plan.

National Flood Insurance Program (NFIP)

The US Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1068. The NFIP is a federal program that enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new and substantially improved construction in floodplains, the federal government will make flood insurance available within the community as a financial protection against flood losses. The insurance is designed to provide an insurance alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and contents caused by floods.

The NFIP authorizes the Community Assistance Program (CAP), the Community Rating System (CRS), the Increased Cost of Compliance Insurance Program (ICC), and the Risk Map Program, all of which serve as mitigation incentives for reducing the cost of flood losses.

For a county or municipality to participate in the NFIP, they must adopt a local flood damage prevention ordinance that requires jurisdictions to follow established minimum building standards in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings will be protected from damage by a 100-year flood event and that new development in the floodplain will not exacerbate existing flood problems or increase damage to other properties.

A key service provided by the NFIP is the mapping of identified flood hazards. Once completed, the Flood Insurance Rate Maps (FIRMS) are used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community. NFIP communities must adopt NFIP minimum floodplain management regulations and adopt the latest effective FIRM to be in compliance with the NFIP.

The Floodplain Management Bureau serves as the compliance/regulatory focused bureau with Mississippi Emergency Management Agency enforcing pre- and post-disaster hazard management policies. The bureau manages the Community Assistance Program-State Support Services Element providing oversight to the participating NFIP communities. These communities have the opportunity to utilize federal flood policies to protect their property and qualify for various grants and disaster assistance programs. Community officials are responsible for making substantial improvement/substantial damage determinations before structures are repaired or improved as part of the local floodplain management regulations. Development in SFHAs is regulated by issuing permits and enforcing local floodplain requirements, including substantial damage, for the repairs of damaged buildings.

After a disaster, the floodplain manager assists and support NFIP communities, including technical assistance and training to implement and enforce substantial damage requirements. FEMA developed the tool to assist state and local officials in estimating substantial damage for residential and non-residential structures per the National Flood Insurance Program requirements adopted by the communities.

Damage Estimates are a part of the National Flood Insurance Program (NFIP). If a community participates in the NFIP, part of the responsibility of the local participating community is to perform damage estimates. These estimates are performed using a FEMA Substantial Damage Estimate software program. This program is used by the Mississippi Emergency Management Agency's (MEMA) Office of Mitigation Floodplain Management (FPM) Bureau to assist local communities in determining damage estimates as it relates to the NFIP. The FPM Bureau is tasked with assisting local communities with the training and deployment of the SDE program. However, it is the local community's responsibility to perform and document the damage estimates for compliance with the NFIP.

Substantial damage is defined as damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damage condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Scope of Work for SDEs assistance by MEMA's FPM Bureau:

MEMA's FPM Bureau will assist any community with training and field work to ensure that the damage estimates by the community are compliant with the NFIP. The community must request assistance in writing to the FPM Bureau. After the request is made to the FPM Bureau, the information will be given to the Office of Mitigation Director. The community should be able to estimate the number of structures in the floodplain receiving damage from the event and pass it along to the FPM Bureau. At that point, the FPM Bureau and Office of Mitigation Director will make decisions on deployment. Any community requesting assistance from the FPM Bureau should be willing to have local individuals comprise the SDE teams and run the FEMA SDE program. If the damage if so widespread that the number of requests or the number of structures supersede the capacity of the FPM Bureau, then a meeting with the Office of Mitigation Director and the State NFIP Coordinator to determine the course of action.

Field Deployment Procedure:

- Review of Safety Requirements.
- Review of the site.
- Review of SDE program.
- Review of data collection and evaluation.
- Review of data entry.
- Review of the data not to be collected on the first survey.
- Review of the program with the SDE teams.
- Review Crisis Track
- Data collection is not about speed. About quality.

- Calibration of the SDE teams {Minimum of three structures).
- Point out differences in residential, non-residential and manufactured home.
- Choose Team leaders and points of contact.
- Data from all inspection teams from the first day should be reviewed. (Point out any issues).
- Data entry.

Equipment for SDE Teams:

- Flood maps for the area (Digital applications on smartphones is available).
- Teams to be comprised ideally of three-person teams (Minimum is two-person teams).
- Teams should have a local person on each team deployed to the field.
- Maps showing the area to be inspected (maps with addresses, Subdivision lot plats, and/or tax parcels).
- Digital Cameras
- GPS units
- Drone(s)
- Dry erase boards with markers and erasers.
- Safety Equipment (le. Boots, bug spray, snake protection, sunscreen, etc.).
- Field inspection forms.
- Each team must have a way of communicating with other teams and base of operations.
- Pens/pencils.
- Details list of area to be covered for each day.
- If using tablets, ensure that the equipment is charged and ready to function.
- Paper SDE forms must pack-up the tablets.

SDE Data Entry:

Prior to field deploying the MEMA FPM Lead should review Crisis Track and print a report for all structures that have received damage in the Special Flood Hazard Area. The structures that are listed in Crisis Track should be reviewed and have an SDE completed on them. Data entry should be performed by a local person after training on the program. It is best to have a one-point data entry source. Data entry will occur daily after the teams return from the field. FPM bureau person will stay with the data entry along with team leaders as the data is entered in the program. After each team filed inspection forms are entered in the program, the team leader can be dismissed. The FPM Bureau person will stay until all entries have been made for the day. The FPM bureau person will get a printed list of the day's inspections with percent damage to turn into the FPM Bureau team leader. The FPM team leader will compile the number of inspection and the percent damage into a report for the Office of Mitigation Director daily. All inspections to be determined between 50 and 60 percent damaged should be reevaluated by different filed teams. The local official should have a computer able to run the SDE software.

If using the tablet to run the software, FPM will export from tablet and import to local FPM computer of choice (may even print the reports for the local FPM. MEMA must retain a copy or the SDE inspections for follow-up of substantial damage.

Field inspection Teams:

SDE Field Inspection Teams should consist of three team members but no less than two members (two members responsible for measuring and one to record the data. All members should make the percent damage assessments.). All data collected must be clearly marked and written on filed inspection forms. Photos of structures should be clear with at least three photos at each location (addresses board, overall structure, water line if flooding, or damage to the structure. The drone should be utilized to assist with taking photos of the structure and fully assessing the structure for damage. At every inspection make for sure that you are clearly recognizable and give notice to property owner if applicable by knocking on doors and waiting for a response before proceeding. It is the responsibility of the filed team leader to maintain forms, equipment, and photos, etc. In areas that are still inaccessible, drone(s) should be used to view structures that are damaged and record the water lines.

Follow-up

FPM Specialists will have monthly follow-ups with local FPMs that have substantially damaged structures to ensure compliance within their area.

Community Assistance Program—State Support Services Element (CAP-SSSE)

The State's formal participation in the NFIP is through the FEMA funded Community Assistance Program (CAP). The CAP annual agreement provides partial funding for the state to establish and maintain an office responsible for providing NFIP technical assistance to state and local jurisdictions, for conducting NFIP compliance audits referred to as "Community Assistance Visits" and conduct training and public outreach/education. The Governor has designated MEMA as the state coordinating agency for the CAP program. The MEMA Floodplain Management Bureau Director serves as the state NFIP Coordinator.

In Mississippi, the CAP is implemented through a five-year, long-term plan and a one-year plan. These plans address NFIP compliance, public outreach/education, and mitigation of flood risk structures.

As of July 2023, there are 335 local communities participating in the NFIP. Of those 335 communities, 28 also participate in the Community Rating System (CRS) program. Mitigation capability assessments have been conducted in these communities to ensure that local administrators are trained to become Certified Floodplain Managers (CFM).

Participating NFIP communities (with low to moderate flood risk) receive compliance visits every five years. Most of these communities have adopted the State Model Ordinance and community leaders/administrators have attended regional workshops.

The NFIP State Coordinator has developed a Local Flood Protection Ordinance Handbook, a Quick Guide, for local administrators and a model Flood Damage Prevention Ordinance that exceeds the FEMA standards for riverine and coastal communities. These tools are available in hard copy and on the MEMA website. Statewide and regional NFIP workshops are conducted annually.

The Association of Floodplain Managers of Mississippi (AFMM) was established in 1999 and became a state chapter of the Association of State Floodplain Managers in 2001. In 2004 hosted the annual National Conference of the Association of State Floodplain Managers. Members of AFMM attaining their certification are now assisting the state with training and "peer to peer" assistance to other communities.

Increased Cost of Compliance (ICC)

ICC coverage provides the payment of an additional claim to help pay for the increased costs to comply with state and community floodplain management laws or ordinances after a flood, in which a building has been declared substantially damaged or repetitively damaged. When an insured building is damaged by a flood and the community declares the building to be substantially or repetitively damaged, this triggers the requirement to comply with its community floodplain management ordinance, ICC will help pay for the cost to floodproof (non-residential buildings only), relocate, elevate, or demolish a structure up to a maximum of $30,000. This coverage is in addition to the building coverage for the repair of actual physical damages from flood under the policy, but the total paid cannot exceed the maximum limit set by Congress for that type of building.

The maximum limit of $30,000 helps property owners insured under the NFIP to pay for a portion, or in some cases, all the costs of undertaking actions to protect homes and businesses from flood losses. In addition, an ICC claim payment can be used to complement and supplement funds under other mitigation programs such as the FMA and FEMA's HMGP, which assist communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings insured under the NFIP.

FEMA Risk MAP Program

The Risk MAP is the successor to FEMA's Map Modernization (Map Mod) program and expands the focus to include risk assessment, mitigation planning, and traditional hazard identification (flood mapping or DFIRM) activities. Risk MAP is meant to better inform communities as they make decisions related to reducing flood risk by implementing mitigation measures. Where Map Mod studies were county-wide based, Risk MAP studies are based on HUC-8 basins and may include portions or multiple counties and cities/towns. The initial 5-year Risk MAP program was funded for the years of FY2010 through FY2014. In addition to the traditional regulatory products (Flood Insurance Study (FIS), DFIRM, and DFIRM GIS Database), communities in a studied basin will receive new non-regulatory products which will include the following; Watershed Flood Risk Report, Watershed Risk Map, and Flood Risk GIS Database with changes since the last FIRM data, Multi-Frequency Flood Depth Grids, Percent Annual Chance of Flooding Data, percent chance of flooding over 30- years, and new HAZUS Annualized Risk Data.

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. Risk MAP provides high quality flood maps and information, tools to better assess the risk from flooding, planning, and outreach support to communities to help them take actions to reduce or mitigate flood risk. Each Risk MAP flood risk project is tailored to the needs of each community and may involve different products and services.

Flood Mitigation Assistance (FMA)

Flood Mitigation Assistance (FMA) grants provide funding to states, local communities, tribes, and territories to reduce or eliminate the risk of repetitive flood damage to buildings insured under the National Flood Insurance Program (NFIP). This program is authorized by Section 1366 of the National Flood Insurance Act.

FEMA distributes funds annually to develop community or individual flood mitigation projects. These grants address community flood risk for the purpose of reducing National Flood Insurance Program flood claim payments and to mitigate the risk of flooding to individual flood insured structures. In addition, funding is also used for technical assistance and management costs. As a requirement of the FMA program, all sub-applicants must be participating and in good standing with the NFIP.

Pre-Disaster Mitigation Program

The FEMA Pre-Disaster Mitigation (PDM) program makes federal funds available to state, local, tribal, and territorial governments to plan for and implement sustainable cost-effective measures designed to reduce the risk to individuals and property from future natural hazards, while also reducing reliance on federal funding from future disasters. This funding is offered in addition to funds provided through other FEMA grant programs for projects that will support growing mitigation needs nationwide.

Pre-Disaster Mitigation Loans for Small Businesses

The Small Business Administration published a Final Rule on its Pre-Disaster Mitigation Loan Program in the Federal Register on October 7, 2002. After November 1, 2003, a business must be located in a community with a FEMA- approved mitigation plan to be eligible for this program. Eligible small businesses may borrow up to $50,000 each fiscal year at a fixed interest rate of 4 percent per year or less for mitigation measures approved in the loan request. Businesses proposing mitigation measures must be located in a Special Flood Hazard Area. A written certification from a local emergency management official is required as part of the loan application to satisfy this requirement. This program will coordinate with the State of Mississippi Standard Mitigation Plan to provide capital necessary to fund hazard mitigation projects.

Natural Hazards Program

Located in Preparedness, Training, and Exercise Bureau of MEMA, the Natural Hazards Program Manager develops and coordinates the State Hurricane Program and the State Earthquake Program and coordinates the update of the Hurricane and Earthquake component of the plan.

Building Resilient Infrastructure and Communities

FEMA's Building Resilient Infrastructure and Communities (BRIC) competitive annual grant program supports state, local, tribal, and territorial governments as they implement hazard mitigation projects to reduce the risks from disasters and natural hazards. The program is authorized by the Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

The BRIC program aims to categorically shift the federal focus away from reactive disaster spending and toward proactive investment in community resilience. FEMA funds BRIC with a 6% set-aside from federal post- disaster grant funds, such as Public Assistance and Individual Assistance grants. As a competitive grant program, applicants can apply on a yearly basis.

FEMA's priorities for the FY 2022 BRIC program are to:

1) Incentivize natural hazard risk reduction activities that mitigate risk to public infrastructure and disadvantaged communities as referenced in Executive Order 14008 – Tackling the Climate Crisis at Home and Abroad;
2) Incorporate nature-based solutions, including those designed to reduce carbon emissions;

3) Enhance climate resilience and adaptation;
4) Increase funding for the adoption and enforcement of the latest published editions of building codes; and
5) Encourage mitigation projects that meet multiple program priorities.

Through BRIC, FEMA continues to invest in a variety of mitigation activities with an added focus on infrastructure projects benefitting disadvantaged communities, nature-based solutions, climate resilience and adaptation, and adopting hazard resistant building codes.

Management costs allow FEMA to provide financial assistance to reimburse the recipient and subrecipient for eligible and reasonable indirect costs, direct administrative costs, and other administrative expenses associated with a specific mitigation project or Capacity and Capability-Building (C&CB) activity. Management Costs can be submitted under the State/Territory Allocation, Tribal Set-Aside, and national competition.

The BRIC Program also offers non-financial Direct Technical Assistance (DTA) and encourages communities to participate. BRIC DTA gives full support to communities that may not have the resources to begin climate resilience planning and project solution design on their own. FEMA will give wide-ranging support to BRIC DTA communities including climate risk assessments, community engagement, partnership building, mitigation and climate adaptation planning, and BRIC program requests throughout the grant lifecycle.

Hazard Mitigation Grant Program Post Fire

The Hazard Mitigation Grant Post Fire Program provides funding to help communities implement hazard mitigation measures focused on reducing the risk of harm from wildfire. HMGP Post Fire funding is authorized under Sections 404 and 420 of the Stafford Act, and provides hazard mitigation grant funding to SLTT governments in areas receiving a Fire Management Assistance Grant (FMAG) declaration.

Fire Management Assistance Grants

The Fire Management Assistance Grant (FMAG) Program is available to states, local and tribal governments, for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands, which threaten such destruction as would constitute a major disaster.

Safeguarding Tomorrow Revolving Loan Fund Program

The Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act became law on Jan. 1, 2021 and authorizes FEMA to provide capitalization grants to states, eligible federally recognized tribes, territories, and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters.

The STORM Act amends the Stafford Act. FEMA's priorities for the Safeguarding Tomorrow Revolving Loan Fund (RLF) program are to: empower eligible entities; create innovative funding solutions; deliver equitable investments and increased access; reduce grant application complexity; and maximize administrative flexibility.

3.0: Risk Assessment

Overview of the Risk Assessment Process

Risk Assessment requires the collection and analysis of hazard-related data enabling state and local jurisdictions to identify and prioritize appropriate mitigation actions to reduce losses from potential hazards. This risk assessment provides an overview and analysis of vulnerable jurisdictions based on the most updated state and local risk assessment. The availability of data is limited; however, based on the best available data, this section profiles natural and man-made hazards that could affect the state, determines which jurisdictions and populations are most vulnerable, and estimates the potential loss of state facilities. Although the best available data is provided, due to the limitations regarding identification of vulnerable jurisdictions, impacts of climate change, and effects on probability of hazard events, Mitigation Actions MH-36 and C-2 were added to the 2023 Mitigation Actions in Sections 4 and to the project profiles.

This section of the plan was originally developed in 2004 with updates developed in 2007, 2010, 2013, 2018, and 2023. MEMA is the lead agency for the state in developing this plan and subsequent plan updates plus coordinates involvement from applicable state agency representatives through appointment to the State Hazard Mitigation Council (HMC).

The HMC thoroughly reviewed the identified hazards and their respective profiles. An appropriate amount of research was conducted for each hazard and incorporated with the findings in the 2023 plan. Primary sources and methodologies used for this plan update are listed below:

- Declared Events: state and federally declared events obtained from www.fema.gov/disasters.

- National Climatic Data Center (NCDC): database maintained by the National Weather Service tracks natural hazard events with information about dates, locations, and estimated damages. This database was improved since the 2018 plan and includes more categories of natural hazards. Data can be extracted statewide by county or zone - depending on the type of event at www.ncdc.noaa.gov/stormevents.

- HAZUS-MH: FEMA's loss estimation software utilizes a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information.

- National Flood Insurance Program (NFIP): The NFIP eliminated many of the reports used in previous plans. For this plan update, the NFIP Loss Statistics Report and the state of Mississippi repetitive flood claim and severe repetitive loss properties report dated March 2018 were used.

- Internet Research: The Internet and other online research tools used throughout this plan update.

- Local Mitigation Plans: Applicable data, including hazards identified as potential risks and rankings were summarized and tabulated throughout this section of the plan.

Identification of Critical Facilities and Infrastructure

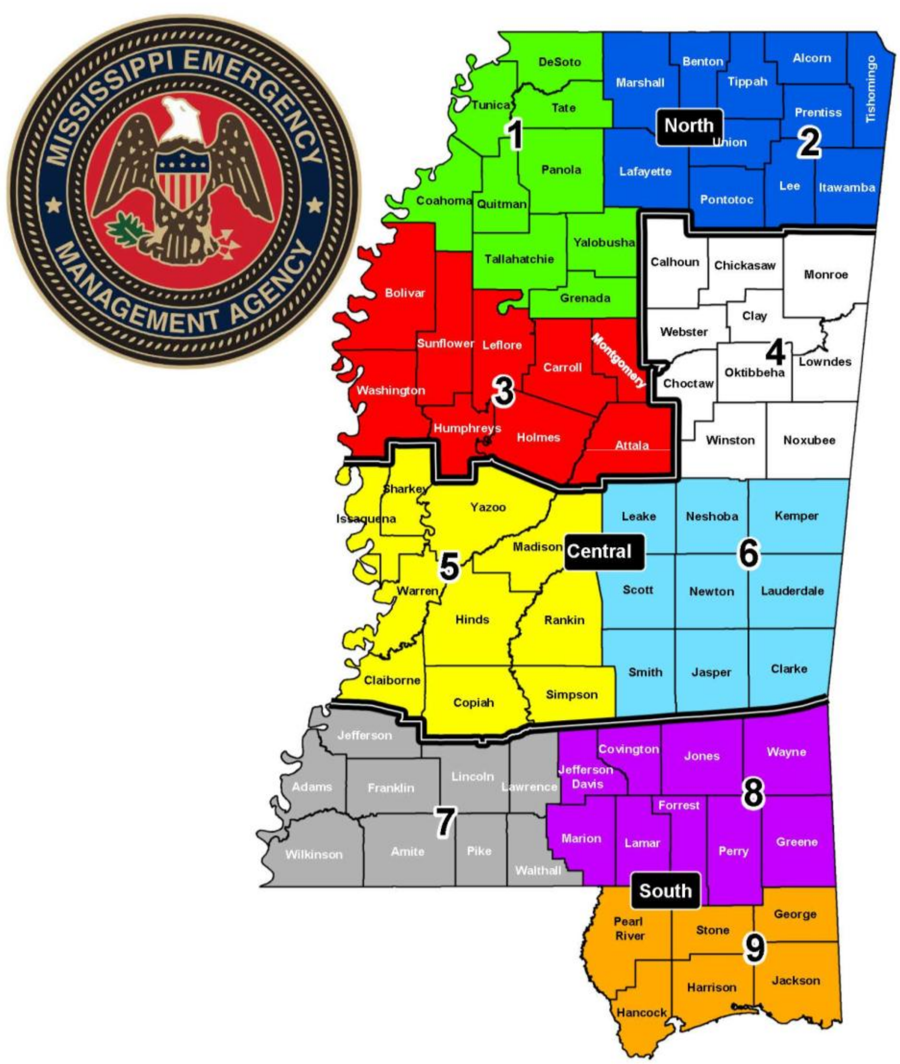
The state of Mississippi is nearing completion of its effort to geocode all state-owned property. The project was completed in 2014. For this plan update, the estimated losses for state facilities and infrastructure is based on data obtained for the 2023 update.

Local Mitigation Strategy Integration

As of this plan update, a total of 35 local mitigation plans are approved. These plans were developed for single jurisdictions, counties, university/community colleges, and regional plans (multi-county). Each approved plan was considered and integrated as appropriate into this plan update.

MEMA will coordinate the update of local mitigation plans into regional plans based on MEMA's established regions. This change is to unify mitigation planning throughout the state to improve integration and utilize resources (financial and assets) more efficiently.

Mississippi Emergency Management Agency District Map



2023 Summary of Changes

General Changes

The previous update involved conversion of the files from PDF format to Microsoft Word format, resulting in significant changes to document formatting. Efforts were made in this update to correct these formatting efforts. Significant effort was also made to clean up grammatical issues throughout the document.

Data-Related Changes

Hazard data is presented, where appropriate, by MEMA Region. The state intends to make this information more usable to local jurisdictions as they update their plans to a level based on the nine MEMA Regions. HAZUS runs for floods are provided in the appendix of this plan and can be requested by jurisdictions to review and develop their tables and references within their plans as they deem appropriate. A summary of the changes/updates made to each hazard within this section is provided below.

3.1 Identifying Hazards - Added presidential declarations with individual assistance paid to date, updated the hazards identified in the approved local plans and, updated relevant dates.

3.2 Profiling Hazards and Estimating Losses - Updated estimated losses and added explanation for HAZUS and flood mapping capabilities.

3.3 Tornado – Updated tables, updated previous event history, incorporated property values and loss estimates from Mississippi Tax Commission, plus expanded narratives and damage impacts for recent events. Identified vulnerability to lapse in radar coverage and updated information regarding mobile/manufactured housing. Updated relevant dates. Updated information on recent efforts by NOAA and others to improve early warning systems. Updated region-level data for all nine MEMA regions. Updated damage assessment data by county and by region.

3.4 Dam/Levee Failure - Updated event history, inventory of dams, status of EAPs and changes in classifications. Updated dam location map by MEMA region based on current MDEQ Dam Safety Division data.

3.5 Tropical Cyclone - Updated previous event history and state probabilistic and Katrina planning scenarios. Updated historic event maps. Updated vulnerable population data.

3.6 Flood – Updated river basin information. Updated event history and NFIP data. Updated SBA Declaration data. Updated RiskMAP and NFIP/CRS information.

3.7 Wild/Urban Fire - Updated information received from MFC with best available data. Added wildland fire maps. Updated dates and tables. Updated historic event tables.

3.8 Drought/Extreme Heat - Updated event history and added information on Keetch Byram Drought Index.

3.9 Winter Weather - Updated event history and expanded cold-weather related events and vulnerabilities. Updated presidential disaster declaration information.

3.10 Earthquake - Updated event history, effects on dams and incorporated HAZUS results.

3.11 Sea Level Rise/Climate Change – Revised the hazard description and profile. Revised sea level rise projections including charts and maps based on new data. Included map of critical facilities vulnerable to sea level rise. Included discussion of non-coastal impacts and vulnerabilities.

3.12 Cyberterrorism – Revised the hazard profile.

3.13 Non-Profiled Hazards - Updated information for severe weather and coastal erosion. Updated event tables.

3.14 Growth and Development Trends - Updated demographic information and maps. Expanded the discussion of social vulnerability incorporated new data from the Social Vulnerability Index.

3.15 Interdependency of Infrastructure - Updated section with the latest information from the State of Mississippi Infrastructure Report Card. Added the 2022 Jackson Water Treatment Plant incident. Added brief discussion of continuity of operations plans.

3.16 Infectious Disease and Pandemics – At the time of this HIRA update, the Mitigation Council has not officially declared infectious disease and pandemic as a hazard of concern. However, given the recent history and experience statewide with the COVID-19 pandemic, it was deemed necessary to draft a section addressing this particular hazard with the expectation that the section would be expanded as additional data becomes available.

Mitigation Recommendations

Several recommendations came out of the 2018 plan as it was being developed. These recommendations continue to be relevant for this plan update.

Tornado

Constructing safe rooms in mobile/manufactured housing complexes should be further explored. Encouraging developers to include a community safe room could reduce injury or loss of life to residents. Continued support in statewide and national efforts towards advancing early warning systems and technologies should be provided.

Dam/Levee

Provide funding to complete a study of the potential impacts of a breach on the Pearl River levee system. This system protects the greatest number of people and assets in the state which could cause significant economic implications.

Explore impacts to failures in states that border Mississippi. As the state realized in 2010 with the ice/snow runoff from the northern states into the Mississippi River, what happens upstream can and will create significant damage to the levee systems in Mississippi. Furthermore, flooding caused by dam/levee failures in Mississippi and their potential impacts across state borders is also necessary - which was the case when the dam at Percy Quin overflowed into Louisiana.

Suitable data showing the location of all levees and their potential interaction with related river systems does not exist, largely due to regulatory oversight differences between certified and non-certified levee structures. This lack of data prohibits Mississippi from understanding the true potential of levee failures.

3.1: Identifying Hazards

44 CFR 201.4(c)(5)(i)(ii) – The State mitigation strategy shall include the following elements: A Plan Maintenance Process that includes:

An established method and schedule for monitoring, evaluating, and updating the plan. A system for monitoring implementation of mitigation measures and project closeouts.

Introduction

Hazard identification is the process of is recognizing events threatening a particular planning area. An event becomes a hazard when it harms people, and property or interferes with commerce and human activity. Such events would include but are not limited to, hurricanes, floods, earthquakes, tornadoes, and other hazards affecting populated areas. Natural hazards harming the State in the past are likely to happen in the future. Consequently, the process of identifying hazards includes determining whether or not the hazard occurred previously. Approaches to collecting historical hazard data include researching newspapers and other records, conducting a review of planning documents and reports in all relevant hazard subject areas, gathering hazard-related GIS data, and engaging in discussions with relevant experts throughout the state.

A variety of sources were used to determine the full range of potential hazards within the state of Mississippi, including internet research and a careful evaluation of approved local mitigation plans. Even though a particular hazard may not have occurred in recent history in the state, it is important to consider all hazards potentially affecting the planning area during the hazard identification stage.

Mississippi is vulnerable to a wide variety of natural and man-made hazards threatening life and property and is typically in the top ten most vulnerable states in the nation due to risks from hurricanes, tornadoes, and other hazards.

Table 3.1.1 outlines each major disaster declaration that Mississippi has received over the last decade. This establishes the vulnerability and historic occurrences of hazards with which Mississippi regularly deals with. This table also includes Individual Assistance (IA) statistics, accurate as of March 26, 2023.

Table 3.1.1
FEMA Major Disaster Declarations and Individual Assistance (IA) 2002 – 2023

Date	Disaster Type	Disaster Number	Amount of IA
March 26, 2023	Severe Storms, Straight-Line Winds, Tornadoes	DR-4697	$11,654,059
October 22, 2021	Hurricane Ida	DR-4626	$10,531,002
May 4, 2021	Severe Winter Storms	DR-4598	None
December 31, 2020	Hurricane Zeta	DR-4576	$21,167,837
July 9, 2020	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	DR-4551	None
April 23, 2020	Severe Storms, Flooding, and Mudslides	DR-4538	None
April 16, 2020	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	DR-4536	7210690
April 5, 2020	COVID-19 Pandemic	DR-4528	$40,979,703
March 12, 2020	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	DR-4478	None
December 6, 2019	Severe Storms, Straight-line Winds, and Flooding	DR-4470	None
June 20, 2019	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	DR-4450	None
April 23, 2019	Severe Storms, Straight-line Winds, Tornadoes, and Flooding	DR-4429	$1,682,322
February 14, 2019	Severe Storms, Flooding, and Tornadoes	DR-4415	None
November 22, 2017	Hurricane Nate	DR-4350	None
May 22, 2017	Severe Storms, Tornadoes, Straight-line Winds and Associated Flooding	DR-4314	None
January 25, 2017	Severe Storms, Tornadoes, Straight-line Winds and Associated Flooding	DR-4295	$3,314,757
March 25, 2016	Severe Storms, Tornadoes, and Flooding	DR-4268	$8,144,330
January 4, 2016	Severe Storms, Tornadoes, Straight-line Winds and Associated Flooding	DR-4248	$2,903,899
December 23, 2014	Severe Storms, Tornadoes, and Flooding	DR-4205	None
April 30, 2014	Severe Storms, Tornadoes, and Flooding	DR-4175	$5,899,175
February 13, 2013	Severe Storms, Tornadoes, and Flooding	DR-4101	$3,241,008
August 29, 2012	Hurricane Isaac	DR-4081	$17,667,440
May 11, 2011	Flooding	DR-1983	$13,724,525
April 29, 2011	Severe Storms, Tornadoes, Straight-line Winds and Associated Flooding	DR-1972	$10,730,970

May 14, 2010	Severe Storms, Tornadoes, and Flooding	DR-1916	$1,320,029
April 29, 2010	Severe Storms, Tornadoes, and Flooding	DR-1906	$4,302,971
May 12, 2009	Severe Storms, Tornadoes, and Flooding	DR-1837	None
September 22, 2008	Hurricane Gustav	DR-1794	$7,176,481
May 28, 2008	Severe Storms and Tornadoes	DR-1764	$549,481
May 8, 2008	Severe Storms and Flooding	DR-1753	$1,598,082
August 29, 2005	Hurricane Katrina	DR-1604	$1,296,454,555
July 10, 2005	Hurricane Dennis	DR-1594	None
September 15, 2004	Hurricane Ivan	DR-1550	$8,514,433
May 23, 2003	Severe Storms, Tornadoes, and High Winds	DR-1470	$740,552
April 24, 2003	Severe Storms, Tornadoes, and Flooding	DR-1459	$18,270,790
November 14, 2002	Severe Storms and Tornadoes	DR-1443	$2,028,549
October 1, 2002	Tropical Storm Isidore	DR-1436	None

Source: FEMA Disaster Declarations-Mississippi

Hazard Identification Process

This section profiles the potential hazards posing the greatest threat to Mississippi. As part of the 2023 revision, a comprehensive list of hazards was compiled from the following sources that include, but were not limited to:

- Review of the 2018 State of Mississippi Standard Mitigation Plan
- Review and assessment of historical data from the NCDC. FEMA Disaster Declarations, USGS, NFIP, and various internet resources.
- Review of the local hazard mitigation plans

In addition to the sources above, hazard data and input were collected from direct communication with various agencies, discussions with the consultant team's in-house experts, historical records, and Internet searches

The screening process did not vary from the 2018 process. Working with the consultant, the HMC considered which hazards could realistically be addressed at the state level in terms of mitigation. The HMC still believes that many hazards are best addressed by the local mitigation plans. The HMC has not changed its position regarding the lack of a specific hazard profiled in this plan. Again, it does not mean the state will not provide adequate support to local jurisdictions in mitigating the effects of locally-specific hazards.

The HMC's position regarding hazard selection and profiling remains the same. Many of the hazards selected are related (*e.g.* flooding and tornadoes can develop during a coastal storm) because other hazards may result from a disaster event. In such instances, these hazards are not listed separately but concurrently.

Table 3.1.2 shows a summary of the hazard identification results for Mississippi, followed by the results of the hazards not included in this plan update. This table includes the hazard ranking and subsection where the hazard is addressed. Details of the hazard ranking and profiling process are provided following the identification tables.

Table 3.1.2
Summary of Hazards Selected

Hazard Type	Reasons for Inclusion	Section Reference
Flood	Almost 17% of the State's total land area is in a floodplain. Mississippi has the 5th largest floodplain in the U.S. Flash floods and other flood events occur regularly during rainstorms due to terrain and hydrology of the state of Mississippi. There have been numerous Disaster Declarations as a result of flooding in Mississippi.	Section 3.6
Tornado	Tornadoes are common disasters in Mississippi, with the most active season is from March through May. Recent tornado event trends indicate a shift from "Tornado Alley" in the Great Plains States to "Dixie Alley" in the Southeast magnifies the need for more research and a closer focus on mitigation.	Section 3.3
Tropical Cyclone	Hurricanes/tropical storms are common and devastating in Mississippi. Data indicates a trend toward more intense hurricanes.	Section 3.5
Wildfire	The State of Mississippi experiences wildfires regularly although they are typically experienced in more rural areas.	Section 3.7
Earthquake	Significant research indicates the potential for an impactful earthquake event in the future.	Section 3.10
Extreme Winter Weather	There have been more than 47 significant winter weather events between 1993 and 2009, with a reported $25 million in property damages and $5 billion in crop damages.	Section 3.9
Drought	Research indicates the possibility of inadequate water supply because prolonged drought conditions could impact the health of the population and jeopardize economic resources such as timber, livestock, and crops.	Section 3.8

Dam/Levee Failure	High-hazard dams require Emergency Action Plans which include Inundation mapping.	Section 3.4
Severe Weather (heavy rain, thunderstorm, strong wind, hail, and lightning)	Not typically a state-wide occurrence and is best addressed in local plans.	
Coastal Erosion	Coastal erosion is primarily caused by hurricanes and coastal flooding, which are addressed in their respective sections.	Section 3.11
Climate Change/Sea Level Rise	Climate change/sea level rise is an evolving hazard that is largely caused by increased levels of atmospheric carbon dioxide. Often considered a coastal issue, climate change has potential to create statewide impacts.	Section 3.11
Cyberterrorism	A widespread cyberterrorism attack could have significant impacts to government operations, commerce, and education systems.	Section 3.12
Pandemic	Challenges associated with the COVID-19 pandemic beginning in 2020 necessitate the inclusion of pandemic scenarios as a state-wide hazard of concern.	Section 3.16

Excluded Hazards

During the review of hazards included in the 2013 and 2018 plans, the HMC determined they would not change the process or how the hazards were categorized. Therefore, the hazard profiled and not profiled will remain the same in the 2023 HIRA update. Again, this decision was based on the belief they were not prevalent hazards within the State and would pose little or no threat to the state as compared to the other hazards. **Table 3.1.3** gives a brief description of those hazards and the reason for their exclusion.

Avalanches, landslides, and volcanos are recognized by FEMA as hazards prone to the U.S. but were not considered because they pose no threat to Mississippi.

Table 3.1.3
Summary of Hazards Excluded from Hazard Profiling

Hazard Type	Description	Reasons for Exclusion
Expansive soils	Expansive soils shrink when dry and swell when wet. This movement can exert enough pressure to crack sidewalks, driveways, basement floors, pipelines and even foundations.	67% of local mitigation plans identified expansive soils as a hazard to be profiled. The state has concluded that it does not pose a significant state-level threat. The decision was also partially based on the fact that the impacts to state-owned or critical facilities would be minimal.
Liquefaction	Liquefaction occurs in saturated soils when the space between individual particles is filled with water. This water exerts pressure on the soil particles which influences how tightly the particles themselves are pressed together. Before an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move in relation to each other.	Soils in the state are mostly compact. Presents a minor threat. No significant historical record of this hazard in the region.
Land subsidence	Occurs when large amounts of groundwater are withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rocks fall in on themselves.	Addressed in the earthquake section.
Tsunamis	A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides, or volcanic activity. In the deep ocean, the tsunami wave may only be a few inches high. The tsunami wave may come gently ashore or may increase in height to become a fast-moving wall of turbulent water several meters high.	MEMA participates in the National Tsunami Hazard Mitigation Program (NTHMP). There is no identified history of tsunamis in the Gulf. Mitigation would be similar to that for large hurricanes which are addressed.

Assessment of Local Mitigation Plans

The 2023 plan considers risks identified outside this process to be more aware of the hazards facing local jurisdictions. Chapter 5: Coordination of Local Mitigation Planning, covers in detail, hazards identified and addressed in the local plans. Generally, the hazards selected and profiled in this plan coincide with the highest-ranked local hazards.

All nine MEMA Districts decided to create District Regional Hazard Mitigation Plans instead of continuing with single jurisdictional plans. This review concluded that the nine hazards of concern - flood, hurricane, wildfire, tornado, extreme winter weather, earthquake, drought, severe weather, and dam/levee failure - are included in over 72% of the regional and local plans. Floods and tornadoes are common in all counties in Mississippi. For other hazards identified in local plans but not in the HMC ranking, a threshold was established. The HMC decided to continue with their decision from the prior plan update that if 45% or fewer of the local plans identified a particular hazard, it was deemed to pose no significant threat to the state. The results of the local hazard identification review are summarized in the table below.

A review of local plans revealed that severe weather (thunderstorms, hail, lightning, and high wind events) was identified and addressed by 48% of the local plans. The HMC continues to hold the position that this hazard is best addressed at the local level and is addressed under Section 3.13 Non-Profiled Hazards. As with the 2018 HIRA, components of these hazards are addressed in the tropical cyclone and tornado sections of this plan as applicable. This plan update will do the same.

Drought was addressed in 75% of the local plans and included as a limited profiled hazard as it can have statewide impacts, but is best mitigated by local practices. Coastal erosion is included as a non-profiled hazard and determined to pose no significant statewide threat to Mississippi and little or no threat to state-owned or critical facilities.

Hazards identified and addressed in local plans, but not included in this plan, will receive the support of the state mitigation program. These hazards include but are not limited to, sea level rise, saltwater intrusion, tsunamis, and expansive soils. Many of the coastal communities are in the process of conducting studies to understand the potential impacts of sea-level rise and those impacts should continue to be explored by the state.

Natural Hazards	Percent of Plans Included	Natural Hazards	Percent of Plans Included
Flood	98%	Expansive Soils	67%
Tornado	100%	Extreme Heat	46%
Hurricane	54%	Storm Surge	5%
Thunderstorm/High Wind/Lightning	48%	Erosion/Coastal Erosion	46%
Wildfire	98%	Tropical Storm/Coastal Storm	36%
Severe Winter Storm/Extreme Cold/Ice Storms	1%	Land Subsidence	37%
Earthquake	94%	Tsunami	2%
Drought	75%	Sea Level Rise	3%
Dam/Levee Failure	62%		

Hazard Ranking

For the 2023 HIRA update, the HMC elected to use the same methodology adopted during the last plan update. Again, since the hazard ranking methodology was used in the majority of approved local mitigation plans, the HMC wanted to continue with a consistent methodology that is reflective of the statewide evaluation of hazards. The basis for the ranking methodology used in this plan update is presented in **Table 3.1.4**.

Table 3.1.4
Hazard Ranking Methodology

RISK CHARACTERISTIC (VULNERABILITY)		SCORE
AREA IMPACTED (The percentage of the state at risk of an impact from each hazard)	No area in the state directly impacted	0
	Less than 25% of the state impacted	1
	Less than 50% of the state impacted	2
	Less than 75% of the state impacted	3
	Over 75% of the state impacted	4
HEALTH AND SAFETY CONSEQUENCES (The health and safety consequences that can occur)	No health and safety impact	0
	Few injuries or illnesses	1
	Few fatalities but many injuries or illnesses	3
	Numerous fatalities	4
PROPERTY DAMAGE	No property damage	0
	Few properties destroyed or damaged	1
	Few destroyed but many damaged	2

(The amount of property damage that can occur)	Few damaged and many destroyed	3
	Many properties destroyed and damaged	4
ENVIRONMENTAL DAMAGE (The environmental damage that can occur)	Little or no environmental damage	0
	Resources damaged with short-term recovery	1
	Resources damaged with long-term recovery	2
	Resources destroyed beyond recovery	3
ECONOMIC DISRUPTION (The economic disruption that can occur)	No economic impact	0
	Low direct and/or indirect costs	1
	High direct and low indirect costs	2
	Low direct and high indirect costs	3
	High direct and high indirect costs	4
FUTURE OCCURRENCE		**SCORE**
PROBABILITY OF FUTURE OCCURRENCE (The probability of a future occurrence)	**Unlikely:** Unknown but anticipated rare occurrence	1
	Low: 1 - 4 documented occurrences over the last 10 years	2
	Moderate: 5 - 7 documented occurrences over the last 10 years	3
	Highly Likely: 8 – 10 documented occurrences over the last 10 years	4
	Extremely Likely: More than 10 occurrences over the last 10 years	5

In keeping with the same process, the HMC studied each state-wide hazard and, based on data provided by the council members and planning team, considered the statewide implications each would present. Each risk characteristic including area impacted, health and safety consequences, property damage, environmental damage, and economic disruption, was assigned the same scoring value as dictated by the 2018 plan of 0-4, multiplied by a future occurrence value of 1-5 to determine the overall risk level. The sum of each risk characteristic value was added together and multiplied by the probability of future occurrence to determine each hazard's total risk rating score. The formula is as follows: vulnerability x probability of occurrence = risk. Below is the definition of each risk level and its total rating score value.

Risk Level	Total Rating Score
Low	**0-15**
A hazard with a LOW-RISK RATING is expected to have little to no impact on the state. The hazard poses minimal health and safety consequences to the state's residences and is expected to cause little to no property damage. The occurrence of a hazard with a LOW-RISK RATING is rare; however, due to other factors such as geographical location, it is still possible for such a hazard to occur and even cause significant damage based on the magnitude of the event.	

Moderate	16-30
A hazard with a MODERATE RISK RATING is expected to have a moderate impact on the state. The hazard poses minor health and safety consequences with minor injuries expected and few to no fatalities. The hazard may cause some property damage and few to no fatalities. The hazard may cause some property to be damaged or destroyed. The occurrence of a hazard with a MODERATE RISK RATING is likely at least once within the next 25 years.	
High	**31 or More**
A hazard with a HIGH-RISK RATING is expected to have a significant impact on the state. The hazard poses high health and safety consequences with numerous injuries and fatalities possible. The hazard may cause some significant property damage or destruction. A hazard with a HIGH-RISK RATING is expected to occur at least once within 12 months but can occur multiple times within a year.	

Table 3.1.5 indicates the overall ranking established by the HMC using the method described above and followed by the definition of profiled, limited, and non-profiled hazards. The completed worksheet is provided in **Appendix 7.3.1-A**. The rankings provided below reflect results from the 2022 hazard identification risk assessment update, which incorporates the conderation of changing future conditions, and the HMC and planning team considerations. Pandemic is being included as a hazard of concern.

Table 3.1.5
Hazard Ranking

2022 Hazards Selected	Total Vulnerability	Future Occurrence	Total Risk Value	Risk Level
Tornado	18	5	90	Extremely Likely
Dam/Levee Failure	11	4	55	High
Tropical Cyclone (Hurricane/Tropical Cyclone)	19	4	57	High
Flood	14	5	70	Extremely Likely
Wildfire	9	2	18	Low
Drought	10	3	20	Moderate
Extreme Winter Weather	11	3	33	Moderate
Earthquake	13	1	13	Unlikely
Climate Change/Sea Level Rise	10	1	10	Unlikely
Cyberterrorism	12	1	12	Unlikely

Non-Profiled Hazards

The HMC chose not to select and rank severe storms, because they do not typically result in a statewide impact, require a state response, and should be mitigated at the local level. During a review of the plan and with 48% of local jurisdictions indicating severe storms (thunderstorms, high wind, lightning, and hail) were of significant concern, the state opted to expand the profile of this hazard under Section 3.13. In this section, a general discussion of vulnerability was added along with a history of events. Property damage, loss of life, and injuries that can be expected statewide are addressed generally. It is not possible to specifically address expected losses to critical or state-owned facilities with the limited data available.

Beach/Coastal erosion is also included as a non-profiled hazard and determined to pose no significant statewide threat to Mississippi and little or no threat to state-owned or critical facilities.

Infrastructure Interdependency

Reliance on built infrastructure in Mississippi is becoming increasingly important. Infrastructure elements such as roads, bridges, electrical grids, computer networks (the Internet), and similar components provide the economic and supply backbone upon which economic health and future growth rest. At best, failure of any one or all of these elements may result in substantial economic damage; and at worst, significant loss of life. Failure of one system (electrical) may cause cascading failures across multiple systems (water, wastewater, E911, etc.) with far-reaching consequences (large fires, disease, etc.). Complicating matters is the increasing fragility of infrastructure as components age, are threatened by severe weather and climate change, become terrorism targets, or simply fail due to an accident. Initial studies suggest the failure of infrastructure in Mississippi due to aging is a significant concern. Collaborative data sharing by those who investigate critical failure points and weaknesses in Mississippi's infrastructure systems is required.

3.2: Profiling Hazards

Hazard profiling involves a description of the physical characteristics of past hazards such as magnitude, duration, frequency, and probability. The hazard profiling also includes the consideration of changing future hazard events, including changes in location, range of anticipated intensities, frequency and duration. This stage of the hazard mitigation planning process involves creating base maps of the state and collecting and mapping hazard event profile information obtained from various federal, state, and local government agencies. The extent to which hazards are profiled is dependent upon the availability of data. Some hazard profiles provide significantly more information than others based on the amount of prior research and data production identified. It is standard practice to use the best and most current available information. The HMC and consultant team obtained statewide maps and data from a variety of sources. The hazard data were mapped to determine the geographic extent of the hazards in the State. The level of risk associated with each hazard was estimated and assigned a risk level of high, medium, or low (or variations thereof) depending on several factors that are unique to specific hazards.

3.2.1: Identifying Assets and Assessing Vulnerability

44 CFR 201.4(c)(5)(i)(ii) – The State risk assessment shall include the following elements:

An overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State-owned critical or operated facilities located in the identified hazard areas shall also be addressed.

The third step of the risk assessment process is identifying assets throughout the state projected to be impacted by each hazard type. Assets include state-owned structures or critical facilities such as hospitals, schools, and public infrastructure. An inventory of existing assets within the state was generated and mapped on a regional basis (Appendix 7.3.2-D-1 through D-14) to show their locations, and to determine the level of vulnerability to each hazard type.

State-Owned Facilities - The Mississippi Department of Finance and Administration (MDFA) was tasked with compiling a comprehensive list of state-owned facilities as defined by mitigation action 15 (Inventory of State-Owned Facilities) in the 2007 and 2010 plans. Funding was provided and the project was completed in 2016. Although the project is complete, this plan update also utilized the best available data provided by HAZUS results, version 4.1 for Hurricanes and Earthquakes. The HAZUS model for floods was run under version 4.2 because of a model update that was released in the middle of this planning process. This data is provided in Appendix 7.3.2-E and 7.3.2-F and includes an estimated number of facilities and the estimated replacement values. Most of the data provided includes accurate physical locations for all properties.

The state of Mississippi developed the following definitions for Critical Facilities and Critical Infrastructure, with guidance from FEMA publication 386-2 and 42 U.S.C. 5195c. These definitions intend to aid in the assessment of the vulnerability and operational necessity of facilities and systems within the state during the occurrence of a hazard event.

A Critical Facility is defined as any structure providing or housing critical services necessary to ensure the health and welfare of the population following a natural or man-made hazard event, including any facilities designated by local governments in their Hazard Mitigation Plan. Types of critical facilities are presented in detail in Appendix 7.3.2-A.

Critical Infrastructure is defined as systems so vital to the state of Mississippi that the incapacity of those systems would have a debilitating impact on security, economics, public health, safety, or any combination of those factors, including any infrastructure designated by local governments in their Hazard Mitigation Plan. Types of critical infrastructure are presented in detail in Appendix 7.3.2-B.

One component of assets, identified as Key Assets, is not identified and included in this plan. A Key Asset is defined as any system (private or publicly owned), whether physical or virtual, that provides the state critical services and/or historic significance, whose destruction could cause large-scale injury, death, or destruction of property and/or profoundly damage our state's prestige and confidence. Some of these key assets are also identified as critical facilities. Since the state has moved towards an all-hazards approach and man-made hazards are included, key assets are necessary as these facilities could be prone to man-made events that may cause adverse impacts to the state and local communities. Appendix 7.3.2-C provides the types of key assets that were identified for planning purposes.

These definitions were utilized to determine data collection criteria. All information included in the assessments of this plan is based on the best available data. These critical facilities, which were documented for this report, included all facilities listed as critical in existing local Hazard Mitigation Plans within the state. Under the definition, available data was also collected for facilities that, in the event of a disaster: provide shelter and/or resources for displaced individuals, provide safe and reliable production or treatment of essential services, provide essential communication between emergency personnel and the general public, provide crucial public safety, serve as a central facility that houses officials providing leadership and guidance for essential community operations, provide primary health care, accommodate inter-modal transportation providing evacuation and/or distribution of supplies.

Assessing Vulnerabilities - An asset is determined to be vulnerable if it is susceptible to damage from a hazard. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. A vulnerability analysis can also predict the extent of injury and damage resulting from a hazard event of a certain intensity in an area. The vulnerability assessment identifies the effects of hazards by estimating the relative exposure of the population, land development, and infrastructure to hazardous conditions, with particular attention paid to critical and state-owned facilities. This includes consideration of the indirect effects of hazards, which can be much more widespread and more damaging than the direct effects. For example, the loss of commerce due to road closures for an amount of time could significantly outweigh the cost of repairing the road. The assessment helps set mitigation priorities by allowing the state and its local jurisdictions to focus attention on areas most likely to be damaged or most likely to require an early emergency response during a hazard event.

3.2.2: Estimating Losses

> ***44 CFR 201.4(c)(2)(iii) – The State risk assessment shall include the following elements:***
>
> ***An overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State must estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.***

For the identified hazards ranked as the highest priority of concern by the HMC, losses were estimated for various hazard scenarios. For other identified hazards and where less data was available, an overall exposure analysis was conducted. The exposure analysis considers the overall value of assets in the hazard area or ranked county, whereas loss estimation calculates anticipated losses from specific hazard scenarios (e.g. 100-year flood or Magnitude 7.7 Earthquake).

Summary of Losses

Each hazard identified for inclusion in this plan is presented in separate sections with details regarding estimated damages sustained and future losses that might be realized based on various scenarios. In summary, the following table provides a comparison of damages sustained to property and crops for hazards tracked through the National Climatic Data Center (NCDC). The tables below have been updated to reflect the general category of hazards prone to Mississippi and include the totals presented in the last plan to compare to the current totals.

Property Damage

Hazard Type							
	Coastal Storms	Drought	Extreme Winter Weather	Flood	Severe Weather	Tornado	Year Totals
2007	$0	$2,650,000	$0	$4,190,000	$9,124,000	$6,995,000	**$22,959,000**
2008	$25,240,000	$0	$3,390,000	$41,638,000	$94,175,000	$146,930,000	**$311,373,000**
2009	$1,000	$0	$0	$10,432,000	$12,863,000	$23,669,000	**$46,965,000**
2010	$0	$500,000	$32,705,000	$15,885,000	$7,599,000	$365,713,000	**$422,402,000**
2011	$55,000	$0	$25,845,000	$1,027,000,000	$17,643,000	$872,937,000	**$1,943,480,000**
2012	$7,375,000	$0	$0	$6,874,000	$8,611,000	$9,804,000	**$32,664,000**
2013	$0	$0	$540,000	$4,204,000	$4,867,000	$43,287,000	**$52,898,000**
2014	$0	$0	$50,000	$6,311,000	$6,279,000	$196,959,000	**$209,599,000**
2015	$0	$0	$61,000	$2,528,000	$3,675,000	$13,865,000	**$20,129,000**
2016	$0	$1,740,000	$0	$20,461,000	$7,558,000	$6,889,000	**$36,648,000**
2017	$137,000	$0	$2,945,000	$13,301,000	$9,903,000	$30,150,000	**$56,436,000**
2018	$279,000	$0	$270,000	$9,758,000	$8,521,000	$8,330,000	**$27,158,000**
2019	$0	$0	$0	$10,028,000	$7,489,000	$37,902,000	**$55,419,000**
2020	$111,091,000	$0	$0	$6,838,000	$7,494,000	$99,203,000	**$224,626,000**

2021	$11,297,000	$0	$5,764,000	$13,210,000	$7,291,000	$7,590,000	**$45,152,000**
2022	$0	$0	$0	$105,000	$3,994,000	$6,293,000	**$10,392,000**
Event Totals	**$155,475,000**	**$4,890,000**	**$71,570,000**	**$1,192,763,000**	**$217,086,000**	**$1,876,516,000**	

Source: NCDC and *2023 Plan totals

Crop Damage

Hazard Type							
	Coastal Storms	**Drought**	**Extreme Winter Weather**	**Flood**	**Severe Weather**	**Tornado**	**Year Totals**
2007	$0	$778,900,000	$0	$150,000	$480,000	$0	**$779,530,000**
2008	$1,100,000	$0	$0	$42,805,000	$1,588,000	$7,045,000	**$52,538,000**
2009	$0	$0	$0	$2,950,000	$2,303,000	$652,000	**$5,905,000**
2010	$0	$27,200,000	$0	$50,000	$106,000	$24,380,000	**$51,736,000**
2011	$0	$0	$240,000	$2,702,000	$841,000	$14,315,000	**$18,098,000**
2012	$0	$0	$0	$0	$0	$0	**$0**
2013	$0	$0	$0	$0	$0	$0	**$0**
2014	$0	$0	$0	$0	$0	$10,190,000	**$10,190,000**
2015	$0	$8,844,000	$0	$0	$0	$0	**$8,844,000**
2016	$0	$4,440,000	$0	$0	$0	$0	**$4,440,000**
2017	$0	$0	$0	$0	$0	$4,210,000	**$4,210,000**
2018	$0	$0	$0	$0	$0	$300,000	**$300,000**
2019	$0	$0	$0	$0	$1,000	$2,918,000	**$2,919,000**
2020	$0	$0	$0	$0	$0	$24,102,000	**$24,102,000**
2021	$0	$0	$0	$15,000	$0	$0	**$15,000**
2022	$0	$0	$0	$0	$1,000	$232,000	**$233,000**
Event Totals	**$1,100,000**	**$819,384,000**	**$240,000**	**$48,672,000**	**$5,320,000**	**$88,344,000**	

HAZUS-MH

Computer models are utilized to examine the effects and consequences of disasters because alternative mechanisms for understanding these effects may prove impossible to safely replicate in the field. Simulation models typically ingest tremendous quantities of data about pre-event conditions and then alter the data according to a set of rules driven by empirical relationships (a Category 3 storm will cause a storm surge of 15') or mechanistic components using detailed numeric solutions (winds of 120 mph will increase surface water speeds due to friction, wind friction water will pile up against a coastline as shoreline depth decreases, accumulation of water will cause a storm surge of 15'). Alterations in the data provide the user with results that may be misinterpreted. Thus, two basic factors affect the accuracy and value of modeling results: a) the quality of data used to initialize the model; and b) the level of understanding and detail used to simulate processes affecting input data.

HAZUS-Multi-Hazard (HAZUS-MH) is a suite of modeling software driven by geographic information systems (GIS) software. HAZUS provides three levels of analysis based on the level of effort and expertise employed by the user (reference: http://www.fema.gov/HAZUS/HAZUS-multi-hazard-analysis-levels). Users can improve the accuracy of HAZUS loss estimates by furnishing more detailed data about the community or additional engineering expertise on the building inventory. The following describes the information and expertise needed for each level:

> Level 1: A basic estimate of earthquake, flood, and hurricane wind losses is produced based on national databases and expert-based analysis parameters included in the HAZUS software. This is commonly referred to as an "out-of-the-box" or "default" loss estimates. FEMA's Basic HAZUS-MH course (E313) enables a user to run Level 1 loss estimation. There may be exceptions for what is considered Level 1 based on unique conditions for a specific study region. For example, if available in HAZUS-compatible format, soil maps can play a significant role in enhancing the quality of an earthquake loss estimate in a particular region.
>
> Level 2: More accurate loss estimates are produced by including detailed information on local hazard conditions or by replacing the national default inventories with more accurate local inventories of buildings, essential facilities, and other infrastructure. Although there is no standard way to perform a Level 2 study, priority should be given to information that better defines the hazard. Sensitivity studies guide the user in focusing time and resources on the type of information required to improve the loss estimate for their study region. There are many professionals able to assist with a Level 2 analysis. These include geologists and hydrologists to improve hazard map data, GIS professionals to improve national default inventories, and engineers to improve the classifications of building types and vulnerabilities. Some background in loss estimation and experience in using HAZUS is normally required for a Level 2 analysis.
>
> Level 3: These state-of-the-art loss estimates utilize all of the hazard and inventory improvements included in a Level 2 study, plus expert adjustment of analysis parameters and use of advanced HAZUS capabilities, such as the Advanced Engineering Building Module (AEBM) and the Potable Water System Analysis Model (POWSAM). A Level 3 effort requires participation by earth scientists, structural engineers, land-use planners, and emergency managers to provide an accurate inventory and assessment of community vulnerability.

HAZUS model runs for Mississippi's State Hazard Mitigation Plan are typically conducted at Level 1, because each increasing level of modeling complexity requires substantial investments of time and effort. Basic Level 1 data input was derived from the 2000 Census and does not adequately reflect changes in population distribution, location of assets, and similar changes. Further, existing state-owned data sets, such as 2' or better resolution coastal elevation data, do not exist in a format easily consumed by HAZUS and are not used. Instead, the "canned" 30-m resolution National Elevation Dataset data are used. Significant time and effort is needed to combine and format local data for use by HAZUS. While HAZUS is an excellent modeling tool, re-running it every three years without improving the input baseline data simply churns out inaccurate and results that reflect a minimal level of change. In computer modeling terms, "garbage-in equals garbage-out".

This plan update strongly recommends an ongoing modeling effort with baseline data sets consistently updated throughout the hazard planning and mitigation process. Running models such as HAZUS should be separated from the funding of the State Hazard Mitigation Plan and performed in-house on an ongoing basis. This would allow the most current and accurate modeling efforts to be updated to the plan without restricting efforts because of time constraints and funding levels associated with this plan.

Flood Mapping

HAZUS and similar models rely predominantly upon FEMA D-FIRM and emerging RiskMap products for flood planning. As noted, Mississippi is heavily vested in updating and modernizing the flood mapping program. However, newer data sets that further improve flood estimates are available for many areas of the state and may be manipulated beyond the HAZUS modeling system.

The general process used is to create a regional digital elevation model from datasets using common resolutions. In this instance, the traditional 30-m National Elevation Dataset is replaced with a 2' resolution LIDAR data set to indicate bare-earth elevations. This base elevation data set is loaded and viewed in a capable 3D application such as ESRI's ArcScene.

Potential flood elevations are based on the current sea state as measured above Mean Sea Level (MSL) and are initially depicted by constructing a flat plane representative of the area of interest as shown in the illustration below. The plane is assigned an elevation equal to that of mean sea level.

The blue area in **Figure 3.2.1** depicts the area of interest for potential storm surge modeling along coastal Mississippi using Hurricane Katrina data. Hurricane Katrina produced the highest storm surge ever recorded on the U.S. coast at an astonishing 27.8 feet in Pass Christian, Mississippi. This exceeded the previous U.S. record of 22.8 feet, which also occurred at Pass Christian, during 1969's Hurricane Camille. According to the NHC Katrina final report, Hurricane Katrina brought a surge of 24 - 28 feet to a 20-mile stretch of the Mississippi coast. The entire 90 miles of coastline from eastern Louisiana to western Alabama received a storm surge characteristic of a Category 3 hurricane.

Figure 3.2.1
Storm Surge Map

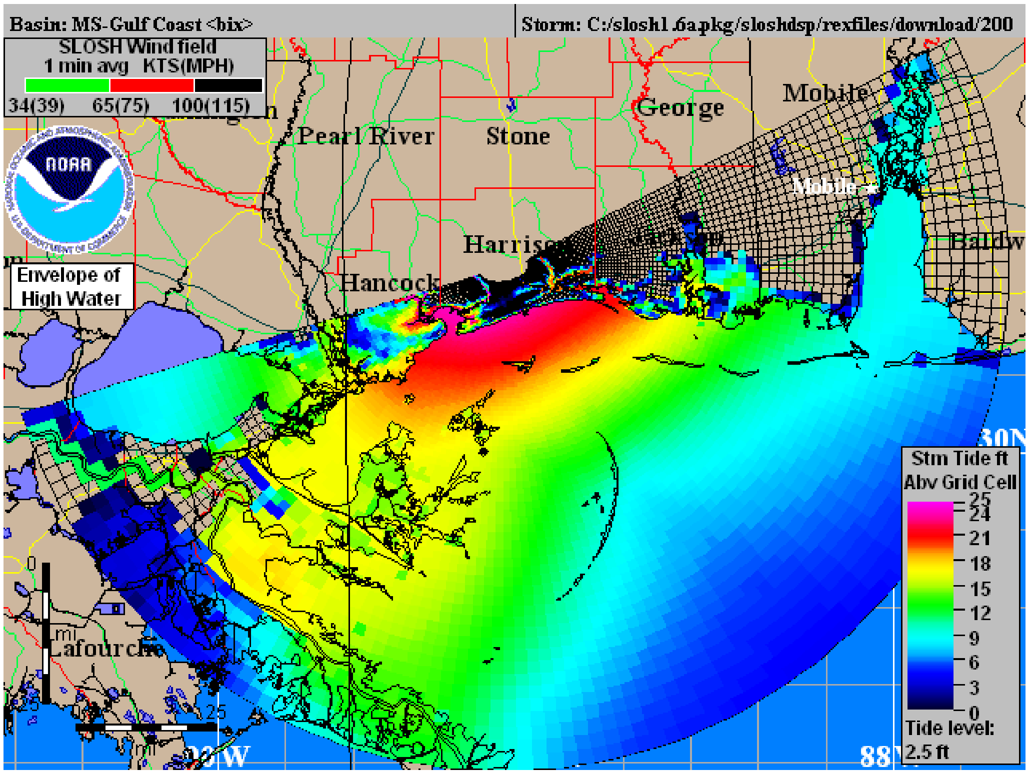
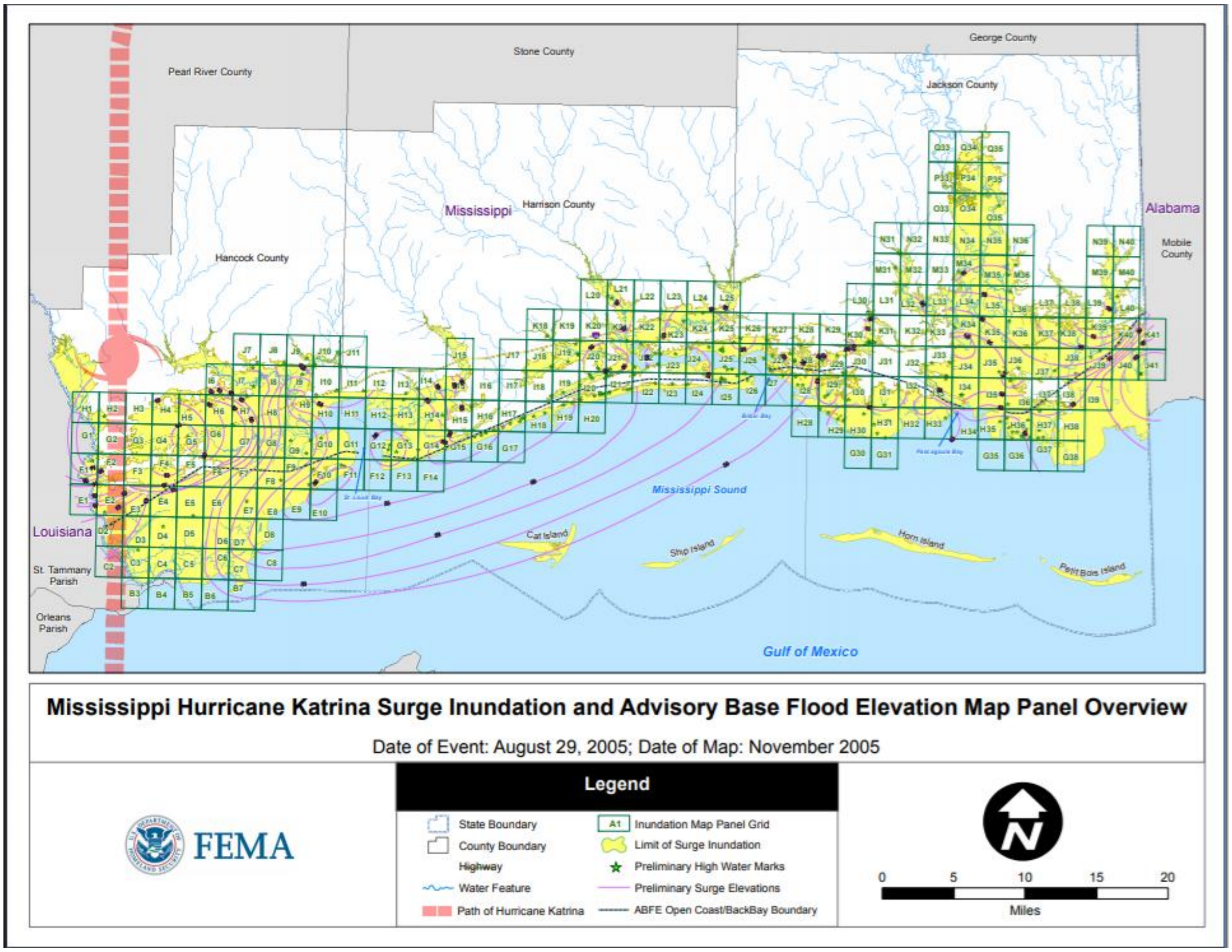


Figure 3.2.1 graphically depicts the results of a SLOSH module for Hurricane Katrina. This image does not show the height above mean sea level of the surge, but rather how high the surge was above the surface.

The plane is initially intersected in 3D space with the baseline elevation model. The intersection is compared with accepted shoreline locations thereby validating the basic modeling approach. The plane is then elevated in 1' increments and the resulting intersection is recorded for each potential flood elevation. This concept is illustrated in Figure 3.2.3 using Katrina's maximum inundation depth plus 20' to simulate extreme circumstances. The net result is a series of lines and polygons depicting locations likely to flood.

While more sophisticated modeling tools are available, they are not typically suitable for use with large geographies because they require extensive technical training and additional high-resolution data sets such as soil models and velocity of the flood waters. The above-described approach is lightweight, errs on the side of caution, and is a proven methodology that provides easy-to-interpret results as shown in Figure 3.2.4.

Figure 3.2.2
Katrina's Maximum Inundation



3.3: Tornado Assessment

Hazard Description

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud extending from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be more than one mile wide and 50 miles long. Some tornadoes are visible, while rain or nearby low-hanging clouds may obscure others. Occasionally, tornadoes develop so rapidly that little warning is possible. Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado

Most tornadoes touch down in a region known as Tornado Alley, bordered by the Dakotas to the north, the Gulf Coast to the south, the Rocky Mountains to the west, and the Appalachian Mountains to the east. Tornadoes in some areas have become so common that tour guides often charge thousands of dollars to lead groups on weeklong tornado-watching tours.

An emerging area of concern is referred to as Dixie Alley. Dixie Alley spreads from the Lower Mississippi Valley to the Upper Tennessee Valley, including Arkansas, Mississippi, Louisiana, Alabama, Georgia, and the Florida panhandle. This area is of particular concern because it includes Mississippi but also because of the apparent trend for tornadoes in this area to strike at night when local populations are not as aware of weather conditions as they would be during daylight hours.

Quick facts about tornadoes:

- They may strike quickly, with little or no warning.
- They may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel.
- Tornadoes typically move from the southwest to the northeast, but tornadoes have been known to move in any direction.
- The average forward speed of a tornado is 30 mph but may vary from stationary to 70 mph.
- Tornadoes can accompany tropical storms and hurricanes as they make landfall.
- Waterspouts are tornadoes formed over water.
- Tornadoes are most frequently reported east of the Rocky Mountains during the spring and summer months.
- Peak tornado season in the southern states is March through May; in the northern states, it is late spring through early summer.
- Tornadoes are most likely to occur between 3 pm and 9 pm but can occur at any time.

The most common and practical way to determine the strength of a tornado is to look at the resulting damages. From the damage, we can estimate the wind speeds. Before February 2007, the Fujita Scale was used to measure tornado severity (**Table 3.2.1**).

Tornadoes are also rated based on their wind speeds. An average tornado has maximum wind speeds of about 112 mph or less, measures around 250 feet in width, and travels approximately one mile before dispersing. Extreme tornado events may have 300 mph winds easily exceeding the 165 mph winds created by Hurricane Andrew.

The Enhanced Fujita Scale, or EF Scale (**Table 3.2.2**), was implemented by the National Weather Service in 2007 to rate tornadoes more consistently and accurately. The EF-Scale considers more variables than the original Fujita Scale (F-Scale) when assigning a wind speed rating to a tornado, incorporating 28 damage indicators such as building type, structures, and trees. For each damage indicator, there are 8 degrees of damage ranging from the beginning of visible damage to significant and devastating destruction. The original F-scale did not consider these additional variables.

Table 3.2.1
Fujita Scale

F-Scale Number	Intensity Phrase	Wind Speed	F-Scale Number	Intensity Phrase	Wind Speed
F0	Gale tornado	42 – 72 mph	F3	Severe tornado	158 – 206 mph
F1	Moderate tornado	73 – 112 mph	F4	Devastating tornado	207 – 260 mph
F2	Significant tornado	113 – 157 mph	F5	Inconceivable tornado	261 – 318 mph

Source: NOAA

Table 3.2.2
Enhanced Fujita Scale

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EFO	65-85	**Light damage.** Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage.** Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage.** Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; small to medium-sized projectiles generated; cars lifted off ground.
EF3	136-165	**Severe damage.** Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage.** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage.** Strong frame houses leveled off foundations and swept away; automobile-sized projectiles fly through the air more than 100 m (109 yd); high-rise buildings have significant structural deformation; incredible

Source: NOAA

Hazard Profile

The hazard profile for tornadoes in Mississippi was updated from the previously approved plan of 2018 to include current statistics regarding tornado activity.

According to the Storm Prediction Center, an average of 1,224 tornadoes touch down per year across the United States. The top 10 states for tornadoes as of the most recent (1997-2022) average are represented in the table below. The table from the previous plan is shown for comparison. Two things are interesting to note here. First, the geographic distribution of the top ten states is changing. Secondly, the average number of tornadoes per year is increasing. These facts point to trends worth considering, particularly in light of the potential impacts on Mississippi.

Top 10 Tornado States 1997-2022		
State	No. of Tornadoes	Ranking
Texas	135	1
Kansas	92	2
Oklahoma	75	3
Alabama	69	4
Mississippi	67	5
Illinois	64	6
Iowa	62	7
Missouri	57	8
Florida	53	9
Nebraska	52	10

Source: NOAA

Top 10 Tornado States 1991-2015		
State	No. of Tornadoes	Ranking
Texas	146.7	1
Kansas	92.4	2
Oklahoma	65.4	3
Florida	54.6	4
Nebraska	54.6	4
Illinois	54	5
Colorado	49.5	6
Iowa	49.2	7
Alabama	47.1	8
Missouri	46.7	9
Mississippi	45.1	10

From 1950 to 2022, Mississippi experienced 3,096 tornadoes, accounting for 504 fatalities and 6,887 injuries. This averages less than one fatality per tornado, but more than two injuries per event.

The fewest number of tornadoes recorded during one year in Mississippi was five in 1964. The greatest number of tornadoes in Mississippi recorded by the National Weather Service was 147 in 2019. Tornadoes are not as easily spotted in Mississippi as they are in the Midwest where flat land and few trees make tornadoes more visible. Densely populated counties and communities throughout Mississippi tend to record more sightings of tornadoes than rural and less populated areas. It should be noted that tornadoes are often associated with severe weather events such as thunderstorms. Due to the climate conditions in Mississippi, tornadoes can occur every month of the year, but have a greater frequency from February through May and November, typically during the change of seasons.

Education and Outreach

The state of Mississippi declared November as Tornado Awareness Month. This is done as part of the state's effort to educate the public on tornado safety. In addition, a statewide test of the tornado warning system is conducted in February in conjunction with Severe Weather Awareness Week. The purpose is to encourage schools, government agencies, and businesses throughout the state to test their tornado emergency procedures.

Maximum Tornado Threat

A review of past tornado occurrences reveals that Hinds and Rankin Counties continue to have the most recorded tornadoes from 1950 – 2023. The counties with the most recorded tornadoes are listed in the table below.

Top 10 Tornado Counties

Counties	No. of Tornadoes	Ranking
Hinds	91	1
Rankin	77	2
Harrison	71	3
Leake / Smith	60	4
Neshoba	56	5
Jackson / Warren	54	6
Jones / Madison	53	7
Simpson	52	8
Scott	48	9
Lauderdale / Yazoo	47	10

The following images depict damage from storm events with significant impacts on the State of Mississippi assets.

Damage caused by an EF-4 tornado that occurred in the Hattiesburg (Forrest County) area on Sunday, Feb. 10, 2013, impacting multiple facilities on the University of Southern Mississippi (USM) campus.

Aerial view from Marsh Hall
Source: USM

Elam Arms Dormitory
Source: USM

Shafer Center for Crisis Intervention
Source: USM

Jazz Station
Source: USM

Picture taken by Eric Roberts, courtesy of NWS
Laurel (Jones County) - December 2014

Picture taken by Teresa Mergens, courtesy of NWS
Columbia (Marion County) - December 2014

Picture taken by Haskel Burns, courtesy of NWS
Columbia (Marion County) - December 2014

Picture taken by John Carter, courtesy of NWS
Heidelberg (Jasper County) - December 2014

Picture credit: Tom Malmay, Malmay & Associates
Near Holly Springs (Marshall County) - December 2015

More Precise Tornado Warnings

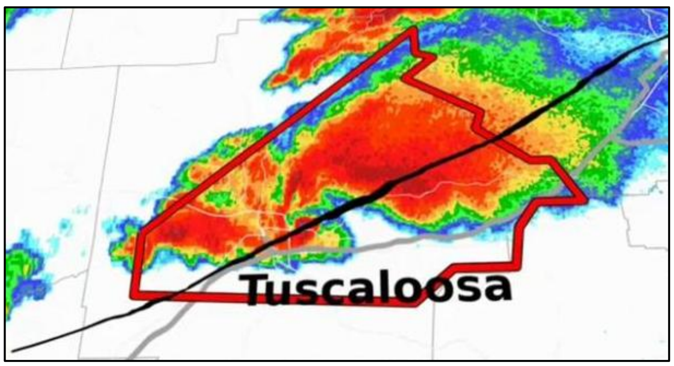
Tornado and severe thunderstorm warnings have not changed much in the passing decades. However, a NOAA research program is looking to improve lead time and the precision of warnings. An overhaul of the nation's weather warning process, including tornado warnings, currently in development aims to provide more precise warnings with increased lead time to help decision-makers and the general public respond accordingly.

The Forecasting a Continuum of Environmental Threats (FACET) program at NOAA's National Severe Storms Laboratory in Norman, Oklahoma, seeks to provide forecasters with a continuously-updating threat grid to supplement the current warning polygons. The current warning process has not changed much since the 1960s, except for the use of text-based bullet statements to more clearly highlight potential impacts (including the use of tornado and flash flood emergencies) and the use of focused storm polygons instead of warnings for whole counties.

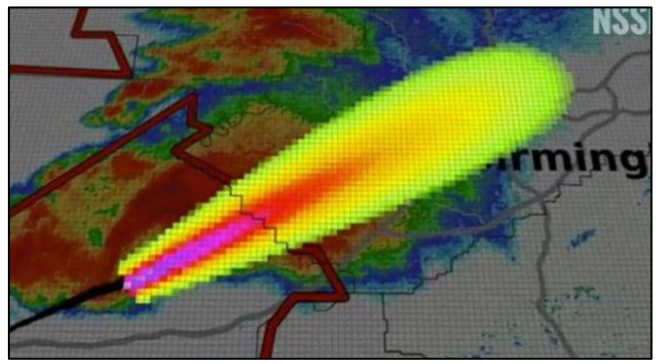
Tornado sirens and other alert systems provide limited early notification of approaching tornadoes. Even with new technologies offering “omnidirectional” signaling, tornado sirens may not provide adequate warnings to everyone potentially within a storm’s path. The graphical depiction of a warning is a polygon. If your location is in that polygon, taking shelter is highly recommended. However, false alarm challenges with tornado warnings are always an issue due to the limitations of Doppler radar detecting rotation near the ground. Early warning limitations combined with statistical data indicating frequent nighttime severe storm activity significantly increases the risk to human health and safety from severe storms and tornadoes in Mississippi.

This paradigm of warnings, together with dual-polarization of Doppler radar, severe storm research and a denser network of spotters has led to an average lead time of 13 minutes for tornado warnings. However, tornado warning polygons will always be larger than any actual tornado tracks due to uncertainty in the track of the parent thunderstorm when a warning is issued. Consider the infamous Tuscaloosa, Alabama, EF4 tornado during the April 27, 2011, super outbreak. While this warning technically was correct as a tornado was confirmed within the warned area and it likely saved lives, the fact remains that the large majority of the tornado-warned area was not hit by the tornado.

FACET seeks to provide a more precise probability threat map of a severe weather event, such as a tornado. This threat map, known as PHI or probabilistic hazard information, can ingest both conventional current data such as radar, satellite, and surface observations, as well as any high-resolution models, and can be adjusted in real-time by the forecaster. The PHI map more tightly represents the area of greatest threat, within the larger tornado warning.



Tornado warning (red polygon) and actual track (black line) of the Tuscaloosa, Alabama, EF4 tornado of April 27, 2011. Source: National Severe Storms Laboratory



Example of what a probability threat map from FACETs would look like for the April 27, 2011, Tuscaloosa, Alabama tornado. In this case, the dark red, and purple contours of the plume indicate the greatest likelihood of a tornado. Source: National Severe Storms Laboratory

FACET envisions the PHI maps and data could be used to prompt a "tornado threat increasing" alert when the PHI threat plume is pushing towards a given area but not yet close enough for a tornado warning, which would provide valuable lead time.

The benefits of more precise warnings with increased lead times are immense. However, this can only happen if the warnings are heeded. This is where the important component of social and behavioral science plays a role. FACET envisions the PHI maps and data could be used to prompt a "tornado threat increasing" alert when the PHI threat plume is pushing toward an area, but not yet close enough for a tornado warning, which would provide valuable extra lead time.

Incidentally, the PHI concept is not simply for tornado warnings. While the current focus is on hazards associated with thunderstorms such as tornadoes, hail, lightning, and flash flooding, this concept can also be extended to other hazardous weather, including winter weather.

The FACET program along with other NOAA initiatives such as Propagation, Evolution, and Rotation in Linear Storms (PERiLS) and Verification of the Origins of Rotation in Tornadoes Experiment (VORTEX) are further supported by the Tornado Observations Research and Notification Assessment for Development of Operations Act or the TORNADO Act that directs NOAA to maintain and improve the system by which the risks of hazardous weather and water events are communicated to the general public, to inform action and encourage response to prevent the loss of life and property. Through the TORNADO Act, Congress is directing NOAA to:

- Establish or direct an existing office to serve as a hazard risk communication office;
- Establish or maintain a research program to modernize the creation and communication of risk-based, statistically reliable, probabilistic hazard information to inform effective responses to hazardous weather and water events;
- Establish a pilot program to test the effectiveness of the implementation of the research conducted pursuant to this bill;
- Submit to Congress a strategic plan for developing and prioritizing the implementation of high-resolution probabilistic forecast guidance for tornadic conditions using a next-generation weather forecast and warning framework;
- Perform one or more post-storm surveys and assessments following each hazardous weather or water event that is of sufficient societal importance;
- Update, if necessary, the system for rating tornado severity; and
- Maintain the Vortex USA tornado research program.

It will be a few years before these probability threat maps accompany standard warnings issued by the National Weather Service. However, some aspects of FACETs/PHI will be rolled out at NOAA's Storm Prediction Center and the Weather Prediction Center in the near future.

Location/Past Occurrences

Mississippi is no stranger to tornado/severe weather threats and has had 34 Presidentially declared severe storm/tornado events since 1953. Declarations from 1991-2020 are shown in **Table 3.2.3**. Brief descriptions of significant events that occurred over the past ten years and summaries from the NCDC and FEMA on the impacts to people and property, plus the public assistance dollars obligated are provided in the summaries following the table.

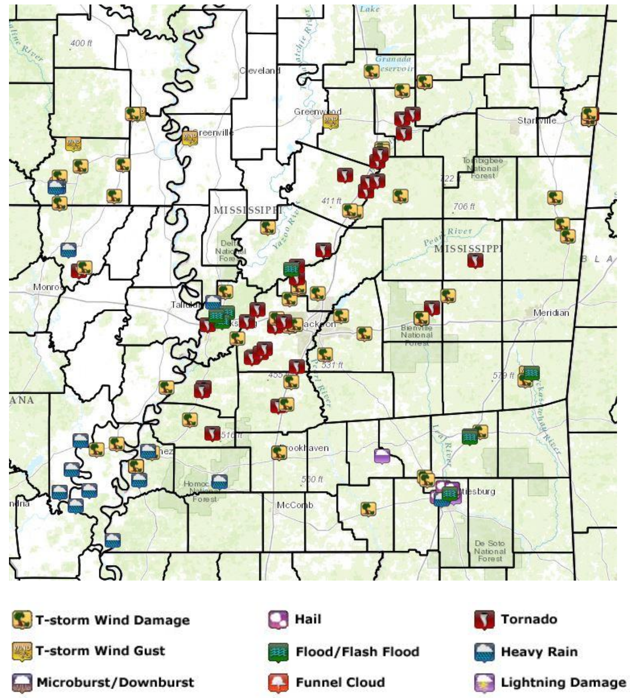
Table 3.2.3
Presidential Disaster Declarations - Tornado/Severe Weather

Declaration Number	Incident Period	No. of Counties Affected	Date of Major Declaration
DR-4478	January 10, 2020-January 11, 2020	13	March 12, 2020
DR-4470	October 26, 2019	19	December 6, 2019
DR-4450	April 13, 2019-April 14, 2019	9	June 20, 2019
DR-4429	February 22, 2019-March 29, 2019	24	April 23, 2019
DR-4415	December 27, 2018	11	February 14, 2019
DR-4314	April 30, 2017	9	May 22, 2017

DR-4295	January 20 – 21, 2017	4	January 25, 2017
DR-4248	December 23 – 28, 2015	12	January 4, 2016
DR-4205	December 23 – 24, 2014	1	January 7, 2015
DR-4175	April 28 – May 3, 2014	13	April 30, 2014
DR-4101	February 10 - 22, 2013	6	February 13, 2013
DR-1972	April 15 - 28, 2011	37	April 29, 2011
DR-1916	May 1 - 2, 2010	8	May 14, 2010
DR-1906	April 23 - 24, 2010	7	April 29, 2010
DR-1837	March 25 - 28, 2009	11	May 12, 2009
DR-1764	April 4, 2008	1	May 28, 2008
DR-1470	May 5 - 8, 2003	9	May 23, 2003
DR-1459	April 6 - 25, 2003	14	April 24, 2003
DR-1443	November 10 - 11, 2002	3	November 14, 2002
DR-1398	November 24 - December 17, 2001	17	December 7, 2001
DR-1360	February 16 - March 15, 2001	23	February 23, 2001
DR-1051	May 8 - 17, 1995	4	May 12, 1995
DR-968	November 21 - 22, 1992	9	November 25, 1992
DR-967	October 10, 1992	1	October 17, 1992
DR-939	March 9 - 10, 1992	4	March 20, 1992
DR-906	April 26 - May 31, 1991	32	May 17, 1991

Source: FEMA Disaster Declarations-Mississippi

DR - 4314 - April 30, 2017



During the early morning hours of April 30th, a squall line of severe thunderstorms developed across central Louisiana and pushed eastward across the National Weather Service Jackson, MS forecast area. The line intensified as it approached the Mississippi River and evolved into a Quasi-Linear Convective System (QLCS). Numerous tornadoes (29) developed along the line, with the most prolific damage occurring along the track of a large mesovortex which tracked from Claiborne County through western Hinds/Madison, eastern Yazoo, eastern Holmes, southeastern Carroll, Montgomery, and northwestern Webster counties.

This region is no stranger to tornadoes, squall lines, or tornado outbreaks. However, what occurred Sunday morning, April 30th, was rare. As the squall line of storms formed across central Louisiana, a mesoscale convective vortex (MCV) began to develop. This feature is on a smaller scale than traditional low-pressure areas and usually ranges in diameter between 20 to 50 miles. This particular MCV developed as a large cluster of storms merged with the evolving squall line. Intensifying downdrafts caused bowing segments in the line to surge out. Due to the strong ambient wind shear in place, strong updrafts along the bowing line became oriented more favorably with the underlying wind shear. As this occurred, smaller-scale circulations quickly developed. These circulations are called meso-vortices and are the features responsible for producing the tornadoes our region experienced. A feedback mechanism began at this point and the larger “parent” MCV was able to be maintained as it continued to modify the environment driving stronger wind shear which in turn supported strong, quickly developing meso-vortices as the system moved northeast. This all combined to support and maintain an efficient tornado-producing feature rarely seen. While hard to describe and visualize, this larger vortex was essentially on the ground and was generating smaller vortices that were rotating around the parent circulation. The result was substantially wide tornado paths, numerous tornadoes, and additional wind damage away from the tornadic vortices.

From a historical perspective, this event ranks 4th in the number of tornadoes (29) produced across the forecast area. Also of note, other similar efficient tornado-producing MCVs are quite hard to identify. Most recent are two that occurred during the early morning squall line from April 27, 2011. One was in central Mississippi (very near the recently impacted area), and the other was in northern Alabama. There are likely other instances of these systems in the past, but these likely occurred before Doppler Radar which is a tremendous tool in identifying the smaller scale meso-vortices and how the data aids the damage survey process.

In addition, strong straight-line winds occurred in some areas. A 71-mph wind gust was recorded at the Greenwood-Leflore Airport. Flash flooding was also reported in some areas including Vicksburg, Bentonia, Hattiesburg, and Laurel.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 9 • Deaths: 1 • Injuries: 0 • Estimated Property Damage: $15,510,000	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	$14,859,529.38	$12,693,708.75	$2,104,623.63

DR - 4295 - January 20-21, 2017

Petal, Miss Source: MS Army National Guard, Pfc. Christopher Shannon

Two rounds of severe weather impacted the ArkLaMiss region - one beginning shortly after midnight on early Saturday morning and continuing through shortly before daybreak and a second beginning during the evening hours and continuing until just before midnight Saturday night. During the early morning event, areas south of I-20 in Mississippi were impacted. Most notably, an EF-3 tornado tracked through Lamar and Forrest counties, killing four people in Hattiesburg and injuring over 50 others. In addition, trees and powerlines were downed and large hail was reported in other areas across south Mississippi. Heavy rainfall resulted in flash flooding in parts of Forrest, Marion, Jones, and Jefferson counties. An EF-2 tornado occurred in Lauderdale County near the Lauderdale community, injuring one. An EF-1 tornado occurred in Morehouse Parish tracking between Mer Rouge and Bonita. Also, a brief EF-0 tornado occurred near Hamburg in Ashley County. Wind damage was reported across parts of southeast Arkansas, southwest Mississippi, and East Mississippi. Meanwhile, large hail fell from central Louisiana through central and south Mississippi. Hail as large as 3.5" in diameter fell in Catahoula Parish.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 4 • Deaths: 4 • Injuries: 58 • Estimated Property Damage: $9,635,000	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	$8,910,037.31	$6,802,467.91	$2,107,569.40

DR - 4248 - December 23-28, 2015

Much above normal temperatures, with some record warmth, and high amounts of moisture in the region led to an active period of weather throughout December. With such warm and moist conditions in place, many upper disturbances and strong frontal systems sparked severe thunderstorms and tornadoes to develop across the region in December, with the strongest and most widespread tornado event in north Mississippi on December 23rd.

Prentiss County Source: National Weather Service

December 23, 2015 - This tornado touched down about a mile east of US Highway 61 and moved northeast, downing trees and power lines along the path. Damage in Bolivar County was rated EF-1 but the tornado continued into Coahoma County producing more significant damage farther northeast resulting in the EF-3 rating.

December 25, 2015 - A chicken house was damaged with a tin roof partially torn off along with trees downed. This damage occurred along County Road 529. Residents witnessed the tornado move through the area.

December 28, 2015 - This brief tornado touched down 2.5 miles southwest of Seminary and tracked to the northeast before crossing Seminary Sumrall Road where it destroyed a barn and snapped some trees. As it crossed the Road a shed was destroyed and more trees were uprooted and snapped. The tornado then crossed Tower Road and shortly after caused severe damage to a carport that fell on a vehicle. The tornado then crossed Seminary Mike Conner Road where it uprooted some trees. The tornado continued northeast at which point, several trailers were blown onto the highway and a fireworks stand was destroyed. Numerous trees were snapped in the area as the tornado crossed the highway. The tornado continued on the ground crossing Evergreen Church Road and Ray Harvey Road where it snapped more trees. In this area, it produced severe roof damage to a home and snapped trees.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 12 • Deaths: 11 • Injuries: 64 • Estimated Property Damage: $12,031,000	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	$5,548,643.40	$2,488,560.26	$3,060,083.14

DR - 4205 - December 23 - 24, 2014

During the afternoon of Dec 23rd, just enough ingredients came together to support numerous severe storms ahead of a cold front. Across the Lower Mississippi River Valley, peak heating contributed to decent instability in the developing warm sector in advance of the front. Sufficient low-level wind shear and strong winds aloft were also in place as a decent upper low was located to our north. This helped to support organized thunderstorm activity along with quite a few supercell storms.

A persistent storm tracked across the southeastern counties (near Columbia, Mississippi to Sumrall and Laurel to Heidelberg, and the Mississippi state line) and produced multiple tornadoes. Widespread damage occurred in southern Columbia, near Sumrall, Laurel, and areas in Marion, Jones, and Clarke counties. Five confirmed fatalities occurred, with three near Columbia in Marion County and two near Laurel in Jones County. Severe storms moved out of the region by late afternoon to early Tuesday evening. The front continued to track through the area through the evening of December 23rd.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
	Total PA Grants	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
• No of Counties Affected: 1 • Deaths: 5 • Injuries: 50 • Estimated Property Damage: $27,233,000	$2,966,616.03	$1,659,926.12	$1,270,103.91

DR - 4175 - April 28 - May 3, 2014

A powerful storm system brought a severe weather outbreak across a large portion of the country from April 27-30. This outbreak started across the Central Plains on the 27th and slowly migrated eastward over the following two days. A large tornado outbreak occurred across the Lower Mississippi River & Tennessee River Valleys on the 28th. The event ended on the 30th with additional severe weather and a historic flash flooding/heavy rain event along the Alabama and Florida gulf coasts where rainfall totals peaked between 15-25 inches.

Winston County / Source: WLBT

The tornado outbreak on April 28 produced significant impacts on the Jackson, Mississippi area. This event was driven by a classic severe weather pattern with a strong fast-moving jet stream and a deep surface cyclone over the central plains. These features helped to produce strong wind shear in the atmosphere which in turn combined with rich gulf moisture and set up a volatile atmospheric mix. Multiple supercell thunderstorms developed during the afternoon/evening and produced many instances of damaging wind and large hail along with multiple tornadoes. The most devastating tornado was the EF-4 which tore a path across NE Leake, the corners of Attala/Neshoba counties, and through the heart of Winston County where the city of Louisville was especially hard hit. This tornado was on the ground for 34.3 miles and resulted in 10 fatalities and multiple injuries. Other hard-hit counties included Lowndes, Rankin, Hinds, Scott, Newton, Montgomery, Warren, and Jones. Each of these counties experienced at least one tornado, some multiple tornadoes. Overall, 21 tornadoes were confirmed across the forecast area. Of these tornadoes, 3 were rated EF-3, 3 rated EF-2, 12 rated EF1, and 2 rated EF-0.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
	Total PA Grants	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
• No of Counties Affected: 13 • Deaths: 11 • Injuries: 145 • Estimated Property Damage: $157,059,000	$89,845,050.69	$21,767,778.80	$68,077,271.89

DR - 4101 - February 10 - 22, 2013

During the morning hours of Sunday, February 10, 2013, a line of severe thunderstorms moved into southeast Arkansas, northeast Louisiana, and central Mississippi, downing trees and power lines and destroying a barn near Silver City in Humphreys County. An approaching cold front, an unusually high amount of wind shear, and sufficient instability resulted in the severe weather outbreak.

As the storms continued to push eastward through the early afternoon, the cold front stalled. To the south and east of the line of storms, several supercell thunderstorms developed in the more unstable air mass over south Mississippi, with many of the storms exhibiting strong rotation on radar. Shortly after 4 pm, a tornado developed over southwest Marion County near the Pickwick community and tracked across the county into far western Lamar County before lifting.

The same storm that produced this tornado continued eastward across northern Lamar County, producing a large tornado that touched down west of Oak Grove, with EF-4 winds estimated at 170 mph. The tornado tracked through the West Hattiesburg area where emergency management reported 51 homes destroyed and 170 homes with major damage in Lamar County.

The tornado continued into Forrest County, tracking through the cities of Hattiesburg and Petal before ending in northwestern Perry County. Considerable damage occurred along the path of this storm before impacting the southeast corner of the University of Southern Mississippi campus. Numerous buildings were damaged in this area including several campus buildings and a large church. In Forrest County, emergency management reported 133 homes destroyed, 207 homes sustained major damage, and 63 injuries were reported. Scattered severe storms continued to affect the Pine Belt area through the remainder of Sunday evening and into the early morning hours of Monday, February 11, before finally moving out of the area.

In addition to severe winds, flash flooding was a major issue in several areas. From the 10th through the early morning hours of the 11th, heavy rainfall occurred over parts of southeast Mississippi, with five to seven inches of rainfall . Rainfall amounts of up to 3 1/2 inches occurred in the Jackson metro area, leading to considerable flash flooding.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 8 • Deaths: 0 • Injuries: 74 • Estimated Property Damage: $39,315,000.00	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	$4,451,913.70	$3,014,539.56	$1,437,374.14

DR - 1972 - April 15 - 28, 2011

An outbreak of tornadoes across Arkansas, Louisiana, and Mississippi began late on Tuesday, April 26th continuing into the early morning hours of Wednesday, April 27th. The event elevated again during the early afternoon of April 27th continuing into the early evening. The activity on April 26th began as supercell thunderstorms producing large hail and tornadoes across northeast Texas and portions of Arkansas before evolving into a squall line as it moved east.

This line of storms evolved as it moved across several states before dissipating. It produced wind damage as it pushed east and was responsible for 23 of the 32 tornadoes that occurred across the three-state area during this event. Of those 23, 12 were rated as strong (EF2, EF3) tornadoes.

On Wednesday (April 27th) the atmosphere became increasingly favorable for the production of additional severe storms by early afternoon. The driving force for the activity Wednesday afternoon was a low-pressure area at the surface that intensified during the day. The winds in the mid-level atmosphere increased to 80-

100 mph, causing the low-level winds to become stronger. The wind shear caused by the turning of the winds from southerly near the surface to westerly at higher elevations was rare for late April in the Deep South.

In addition, an abundance of low-level moisture returned to the area. Sunny skies during the morning interacted with the high levels of moisture, leading to an unstable air mass by early afternoon. The result was a rare mix of instability and wind shear. These ingredients, along with lift from an upper-level disturbance, led to the historic tornado outbreak of April 27, 2011.

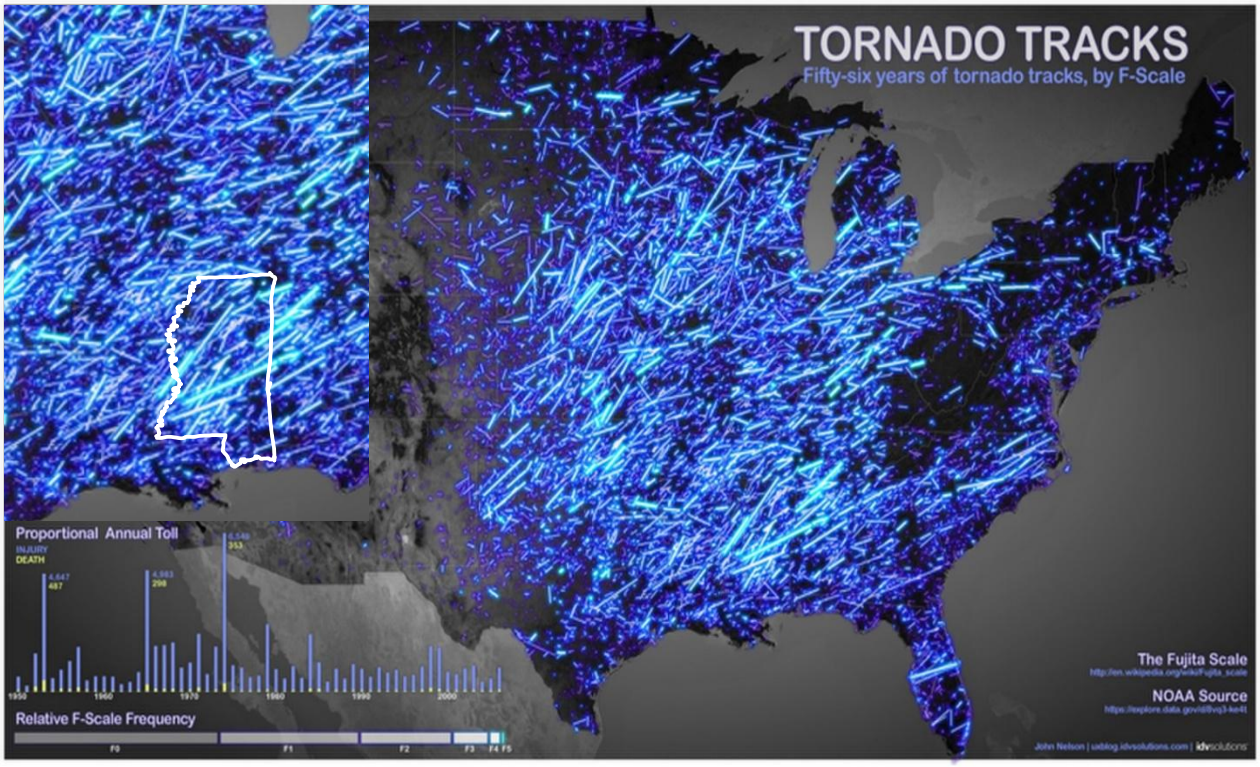
By early afternoon, several supercell thunderstorms developed across central and eastern Mississippi. These storms grew to supercell size and began producing tornadoes. The first tornado of the afternoon started in Neshoba County north of Philadelphia. This tornado ended up producing EF-5 damage and tracked for 29 miles across Neshoba, Kemper, Winston, and Noxubee Counties, causing severe damage inthe Town of Smithville.

Through the rest of the afternoon, multiple tornadoes developed, stemming from multiple supercell storms. Nearly all of the storms produced tornadoes. Another violent tornado impacted the Jackson forecast area and tracked across Smith, Jasper, and Clarke Counties continuing into Alabama with a total path length of 124 miles.

The loss of life during this event was significant. 321 people lost their lives, making this the second deadliest tornado outbreak in U.S. history. The March 18, 1925, Tri-State tornado outbreak was the first with 747 fatalities. This system produced the first EF-5 tornado in Mississippi since the Candlestick Park tornado on May 3, 1966, and marks the first time since statistics have been kept that two EF-5 tornadoes have been recorded on the same day in Mississippi. Four tornadoes had tracks over 100 miles across the southern states during this event, and all four were rated either EF-4 or EF-5.

<table>
<tr><th>Impact Summary</th><th colspan="3">Public Assistance Dollars Obligated
Declared Counties</th></tr>
<tr><td rowspan="2">• No of Counties Affected: 47
• Deaths: 32
• Injuries: 170
• Estimated Property Damage: $56,461,000</td><td>Total PA Grants</td><td>Emergency Work (Categories A-B)</td><td>Permanent Work (Categories C-G)</td></tr>
<tr><td>$22,811,869.44</td><td>$11,648,398.71</td><td>$11,163,470.73</td></tr>
</table>

Figure 3.2.1a
Recorded Tornado Events 1950 to 2017



Probability of Future Tornado Events

The National Weather Service is no closer to scientifically establishing a probability of future events in any one county or area. Tornadoes remain too random and unpredictable to accurately predict. Tornadoes have occurred in all of Mississippi's 82 counties. Current data indicates an average of 43 tornado events per year in Mississippi.

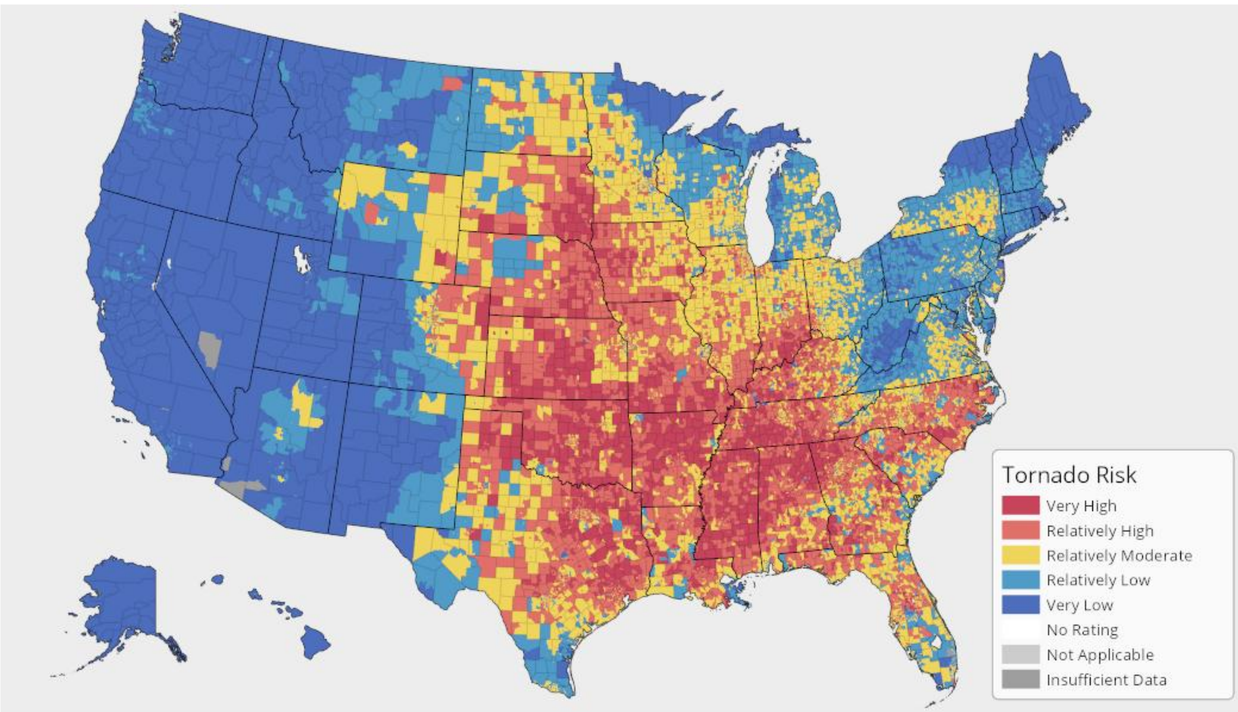
Assumptions from previous plan updates remain valid. Historic data indicates that more densely populated counties, such as Harrison, Hinds, Jackson, Jones, Rankin, and Smith have experienced a greater number of tornadoes. Based on historical data, the counties with the greatest number of past occurrences are those with the highest probability of reoccurrence.

The link between tornadoes and climate change is currently unclear. However, it is difficult to identify longterm trends in tornado records, which only date back to 1950 in the United States. Also, the population in many areas affected by tornadoes has grown, so it is possible that tornadoes in the early part of the 20th century occurred without anyone seeing them. Improved technology, such as advanced radar, also helps us "see" tornadoes that may not have been detected decades ago. Another problem lies with the physics associated with tornadoes. Researchers are working to better understand how the building blocks for tornadoes – atmospheric instability and wind shear – will respond to global warming. It is likely that a warmer, moister world would allow for more frequent instability. However, it is also likely that a warmer world would lessen chances for wind shear. Climate change also could shift the timing of tornadoes or the regions that are most likely to be hit, with less of an impact on the total number of tornadoes. Adding to the difficulty, tornadoes are too geographically small to be well simulated by climate models. Models can simulate some of the conditions that contribute to forming severe thunderstorms that often spawn tornadoes. It will remain challenging to estimate any climate change influence on tornadoes until scientists can improve their physical understanding of the processes that cause tornadoes and the observational record of tornado frequency.

Tornado Watches

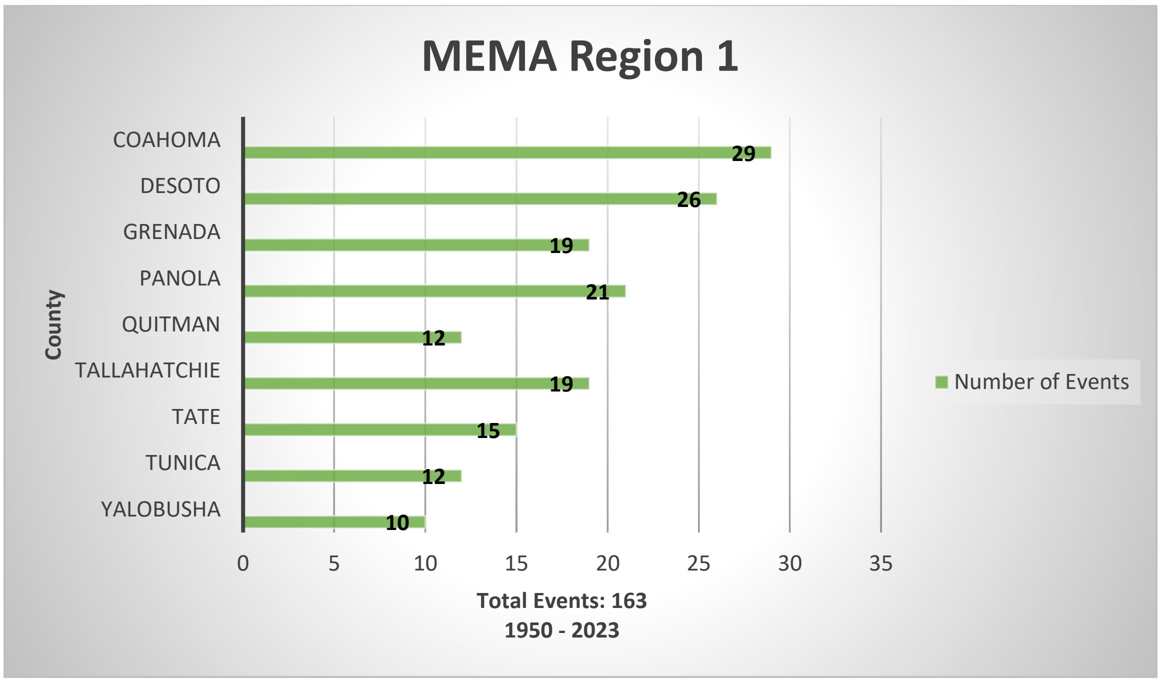
Figure 3.2.2. below further demonstrates Mississippi's vulnerability to potential tornado outbreaks. This graphic shows the national tornado risk index with Mississippi at a very high risk.

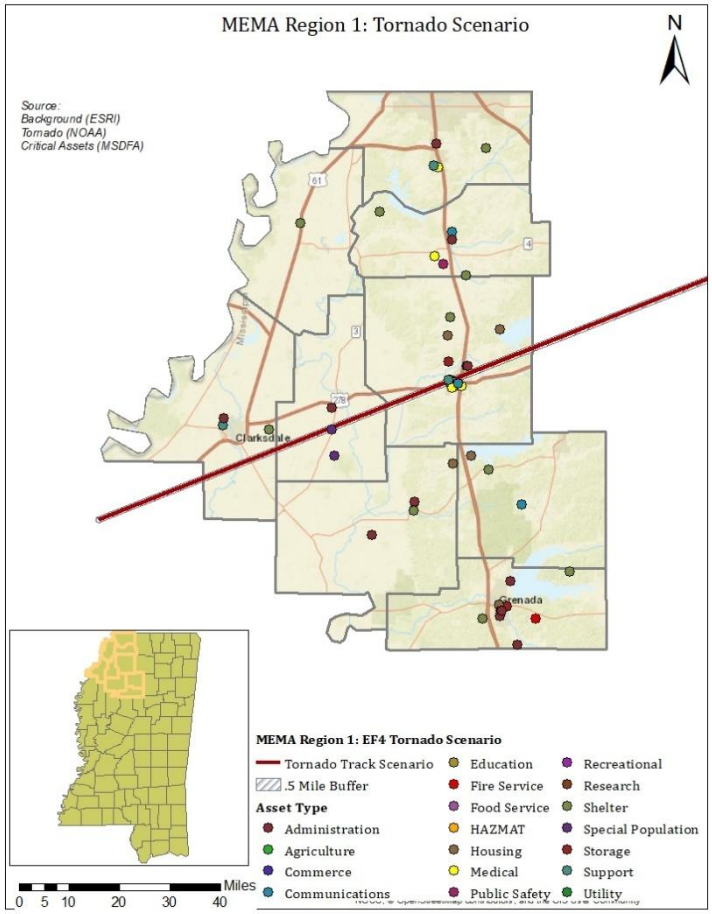
Figure 3.2.2
FEMA Tornado Risk Index

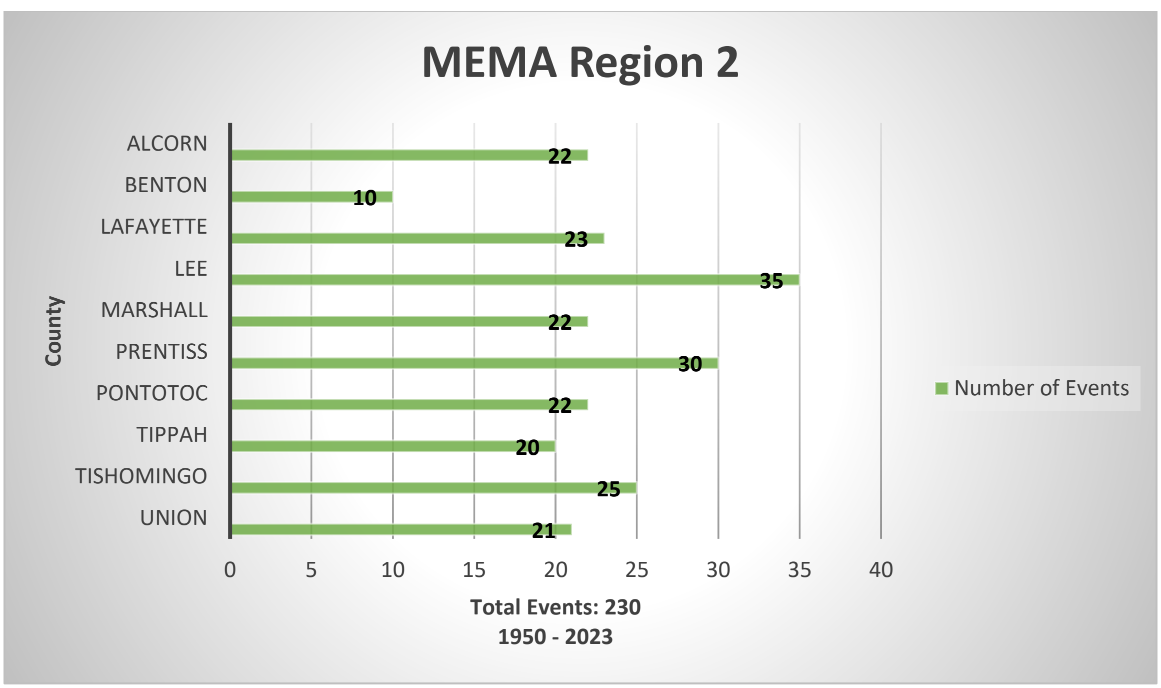


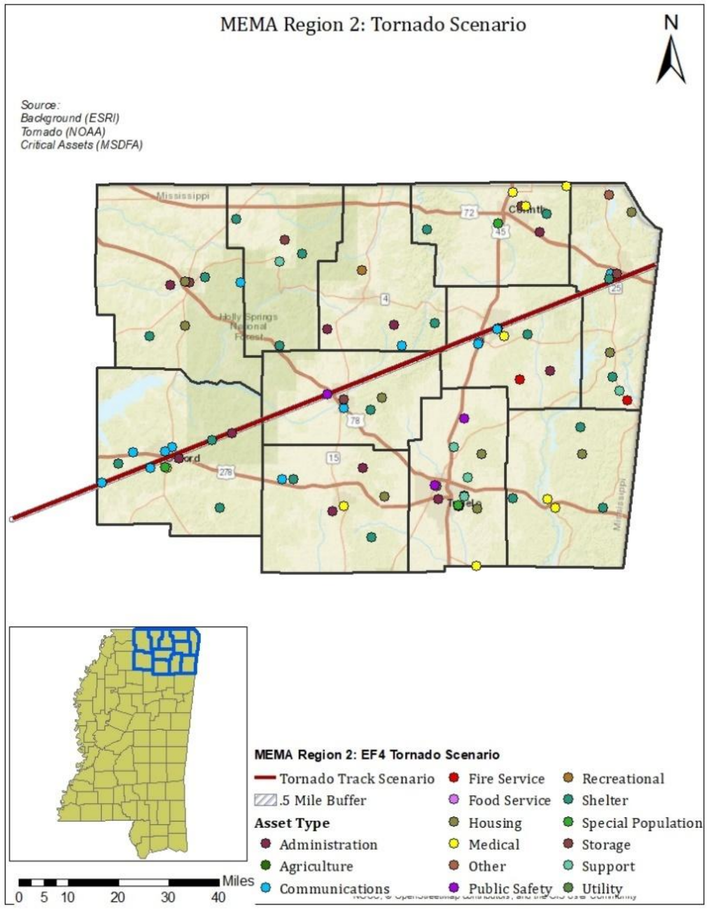
Events Per Region

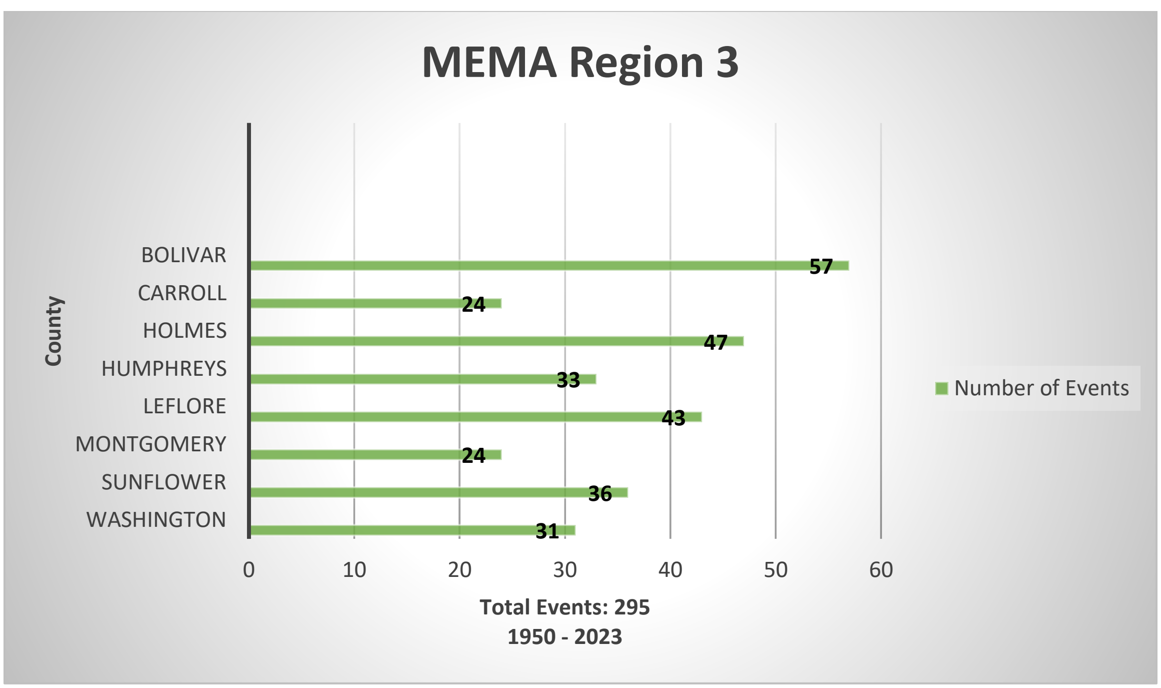
The following pages contain graphs depicting tornado events that have occurred in each MEMA Region. Each graph is accompanied by a regional map. An existing tornado track from the 1969 F4 just south of Jackson that killed more than 30 people was used. The historic track was shifted to intersect with critical assets typically near the center of each region. A half-mile buffer was added to the centerline of the track to encompass more of the anticipated damage swath. The resulting swath was analyzed with critical assets that intersect with the swath to produce the tabular data sheets.

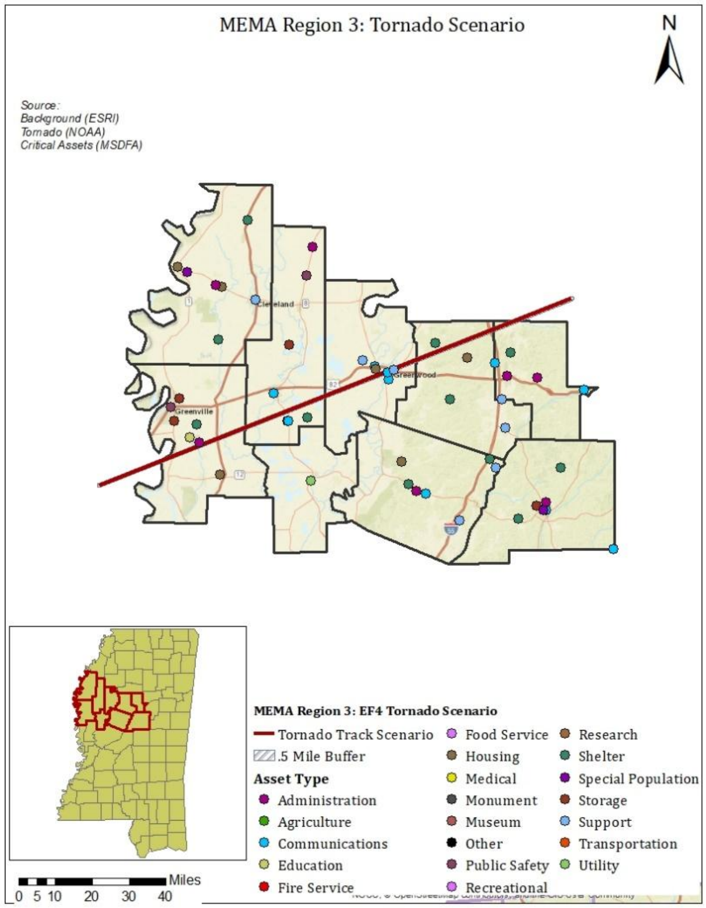

MEMA Region 1
County
COAHOMA
DESOTO
GRENADA
PANOLA
QUITMAN
TALLAHATCHIE
TATE
TUNICA
YALOBUSHA
29
26
19
21
12
19
15
12
10
0
5
10
15
20
25
30
35
Total Events: 163
1950 - 2023
Number of Events


MEMA Region 1: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
Clarksdale
Grenada
MEMA Region 1: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Commerce
Communications
Education
Fire Service
Food Service
HAZMAT
Housing
Medical
Public Safety
Recreational
Research
Shelter
Special Population
Storage
Support
Utility
0 5 10 20 30 40 Miles

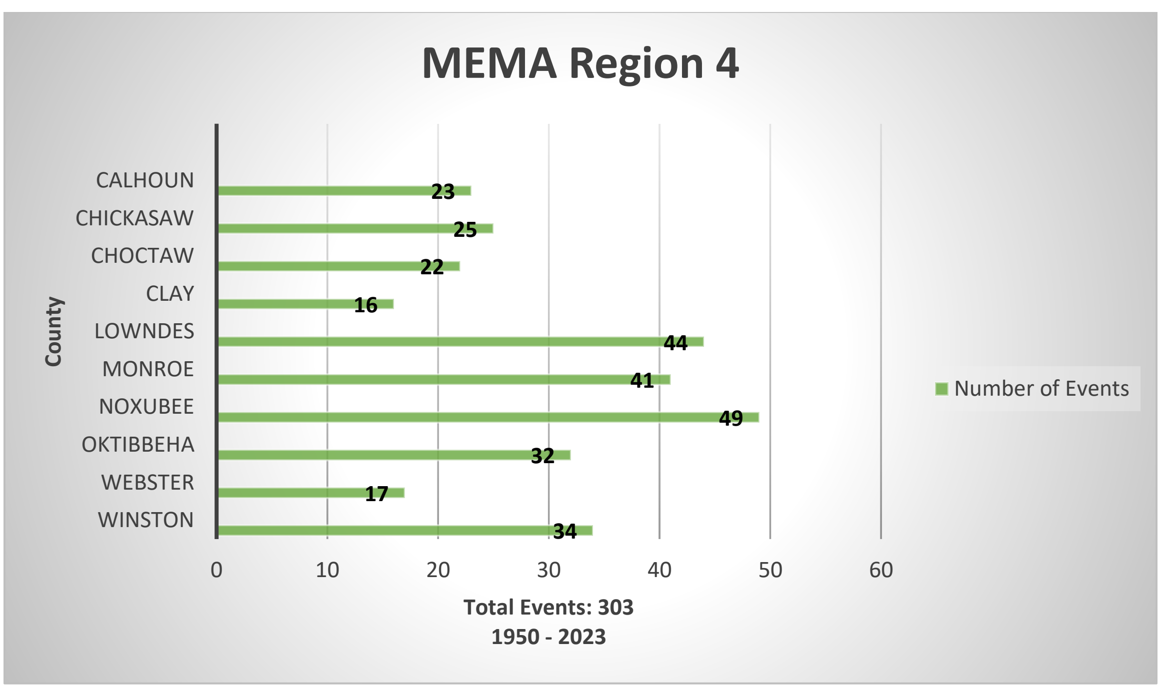

MEMA Region 2
County
ALCORN 22
BENTON 10
LAFAYETTE 23
LEE 35
MARSHALL 22
PRENTISS 30
PONTOTOC 22
TIPPAH 20
TISHOMINGO 25
UNION 21
0 5 10 15 20 25 30 35 40
Number of Events
Total Events: 230
1950 - 2023


MEMA Region 2: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
Mississippi
MEMA Region 2: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Communications
Fire Service
Food Service
Housing
Medical
Other
Public Safety
Recreational
Shelter
Special Population
Storage
Support
Utility
Miles
0 5 10 20 30 40

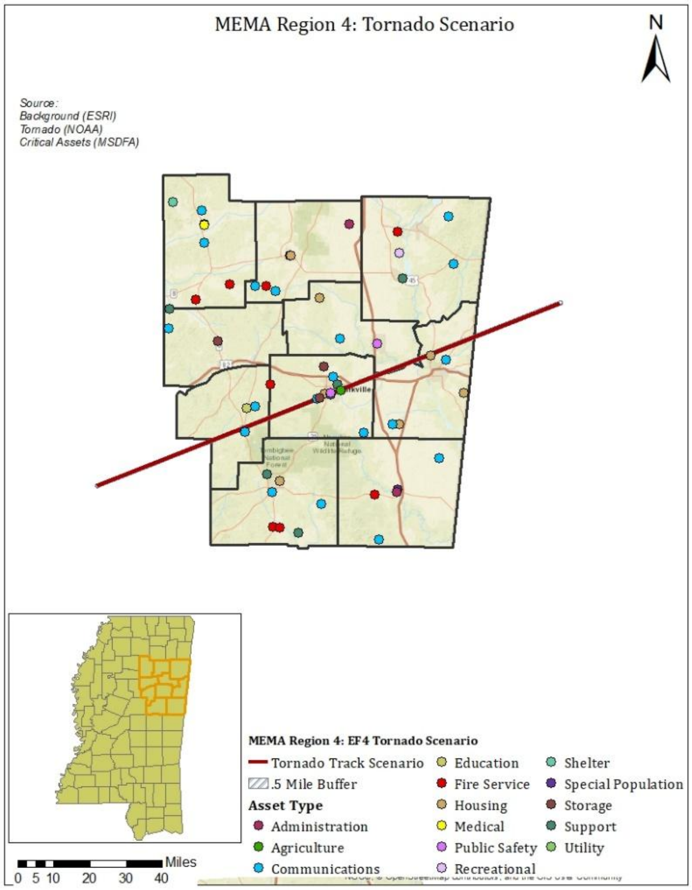

MEMA Region 3
County
BOLIVAR
CARROLL
HOLMES
HUMPHREYS
LEFLORE
MONTGOMERY
SUNFLOWER
WASHINGTON
57
24
47
33
43
24
36
31
0 10 20 30 40 50 60
Total Events: 295
1950 - 2023
Number of Events

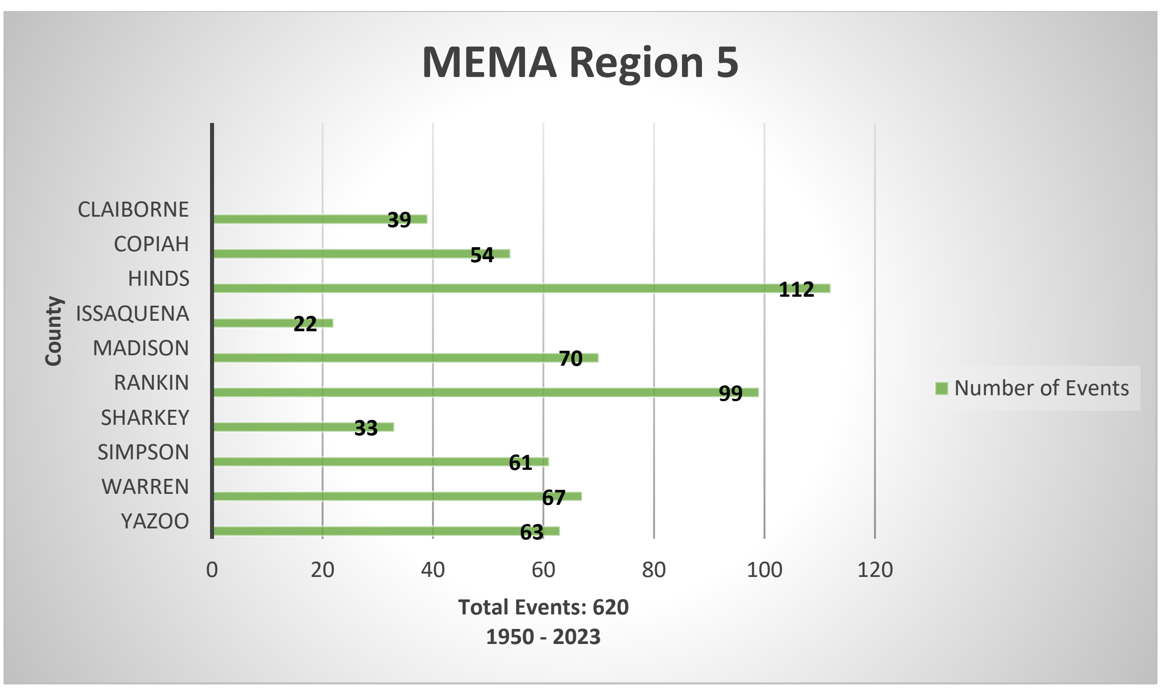


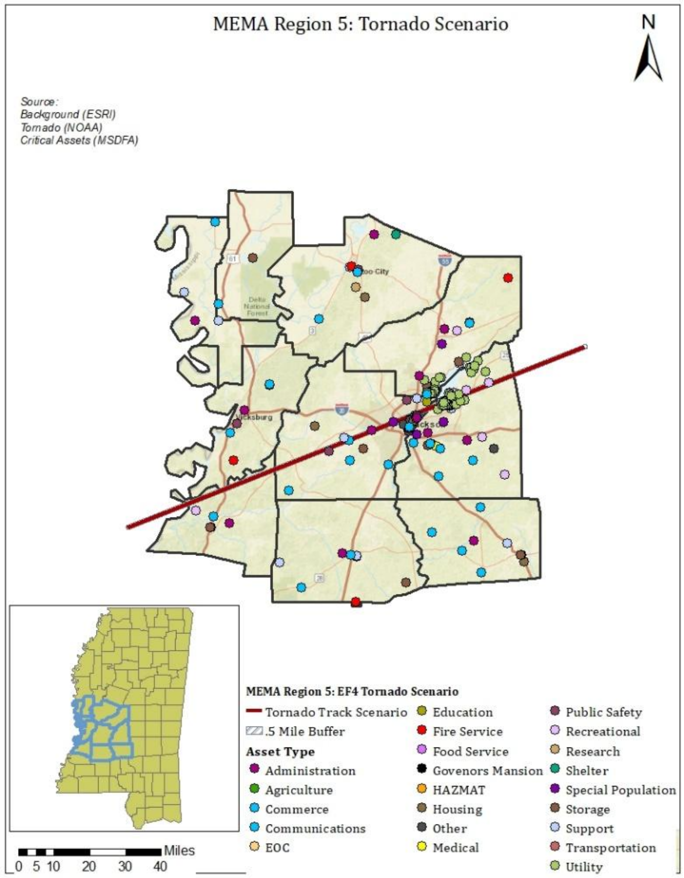
MEMA Region 3: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
Greenville
Greenwood
MEMA Region 3: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Communications
Education
Fire Service
Food Service
Housing
Medical
Monument
Museum
Other
Public Safety
Recreational
Research
Shelter
Special Population
Storage
Support
Transportation
Utility
Miles
0 5 10 20 30 40



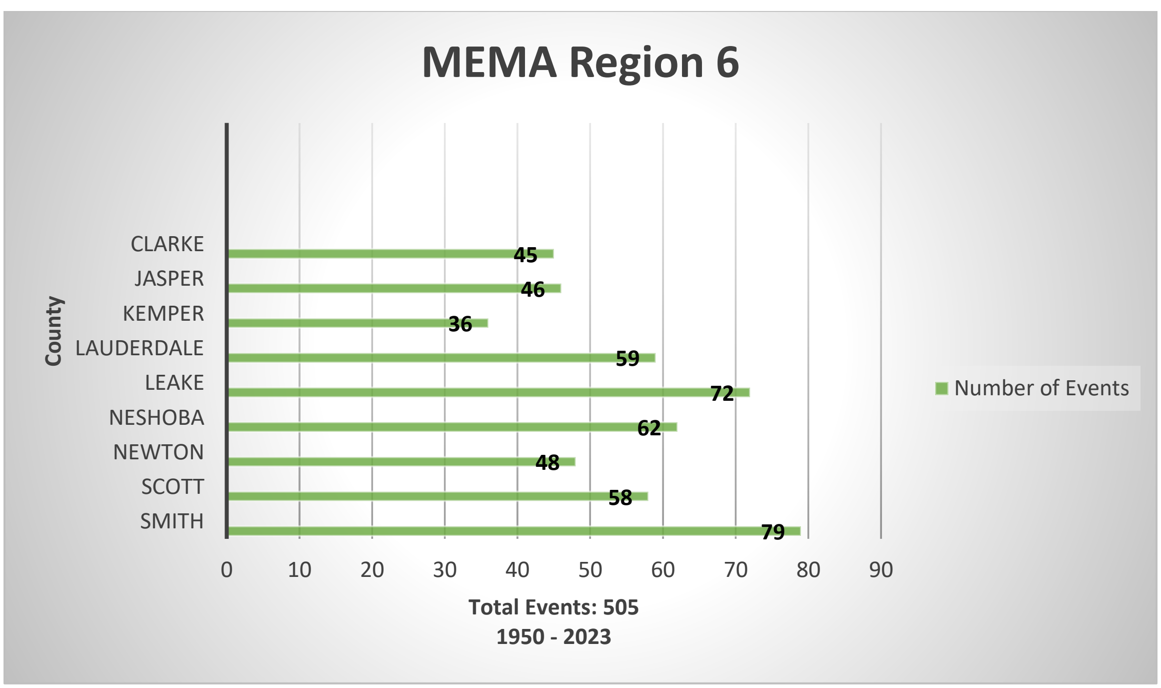
MEMA Region 4
County
CALHOUN 23
CHICKASAW 25
CHOCTAW 22
CLAY 16
LOWNDES 44
MONROE 41
NOXUBEE 49
OKTIBBEHA 32
WEBSTER 17
WINSTON 34
0 10 20 30 40 50 60
Number of Events
Total Events: 303
1950 - 2023


MEMA Region 4: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
MEMA Region 4: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Communications
Education
Fire Service
Housing
Medical
Public Safety
Recreational
Shelter
Special Population
Storage
Support
Utility
Miles
0 5 10 20 30 40

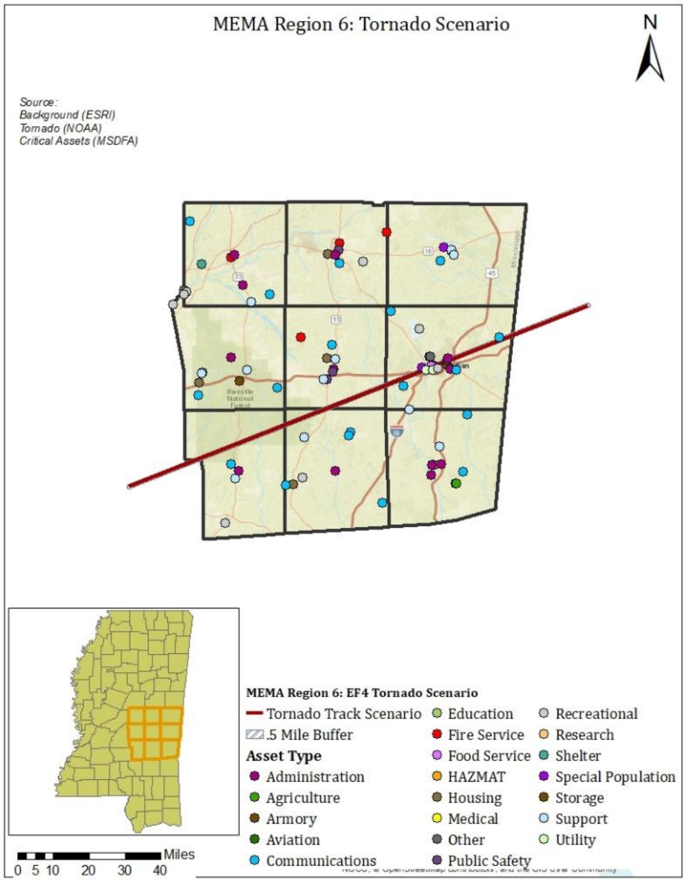

MEMA Region 5
County
CLAIBORNE 39
COPIAH 54
HINDS 112
ISSAQUENA 22
MADISON 70
RANKIN 99
SHARKEY 33
SIMPSON 61
WARREN 67
YAZOO 63
0 20 40 60 80 100 120
Number of Events
Total Events: 620
1950 - 2023

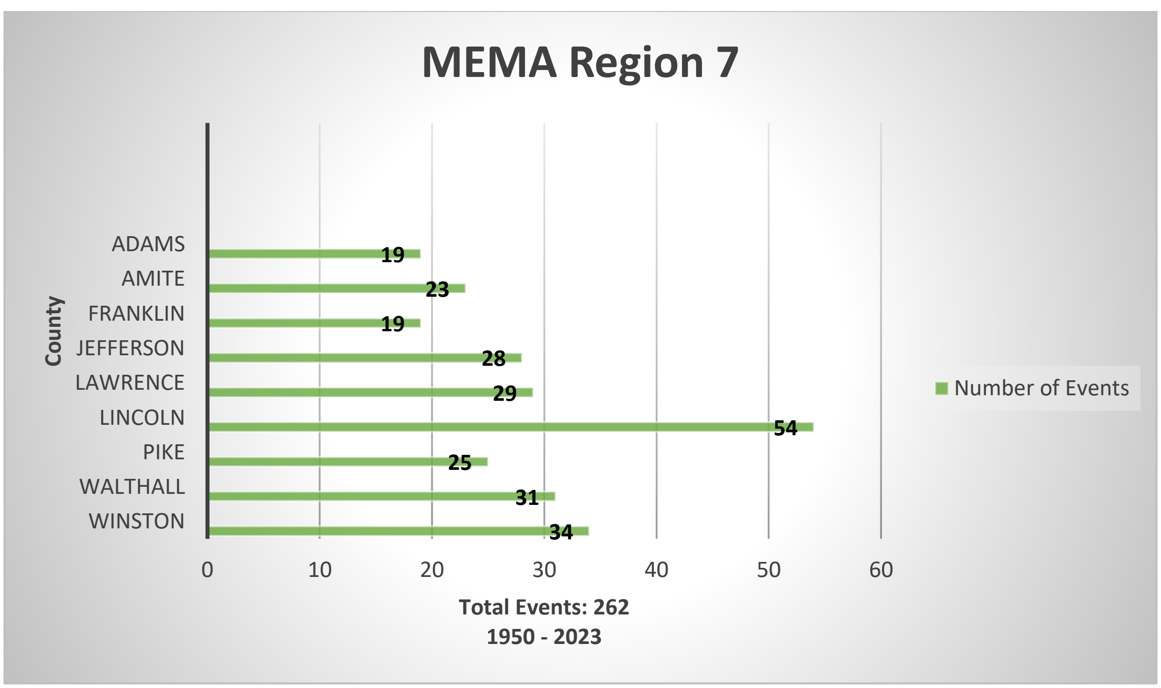


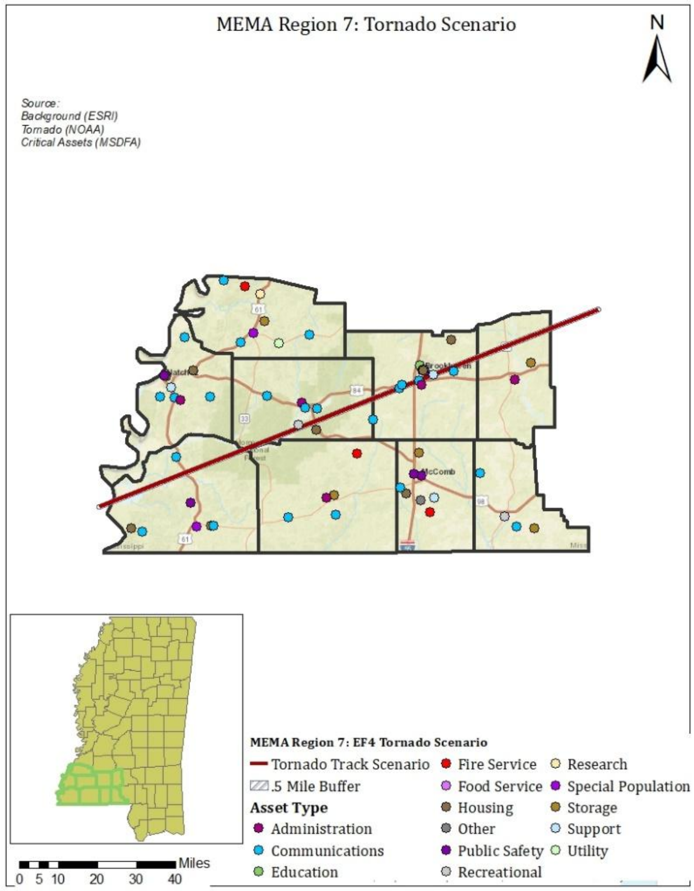
MEMA Region 5: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
MEMA Region 5: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Commerce
Communications
EOC
Education
Fire Service
Food Service
Govenors Mansion
HAZMAT
Housing
Other
Medical
Public Safety
Recreational
Research
Shelter
Special Population
Storage
Support
Transportation
Utility
Miles
0 5 10 20 30 40



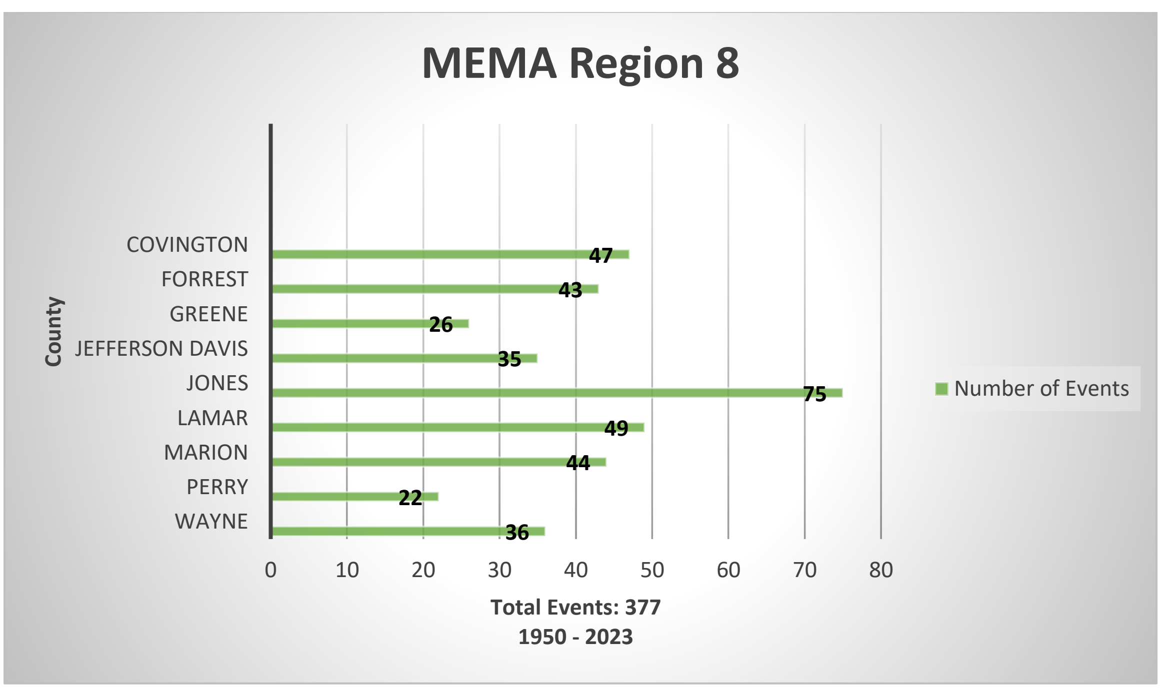
MEMA Region 6
County
CLARKE 45
JASPER 46
KEMPER 36
LAUDERDALE 59
LEAKE 72
NESHOBA 62
NEWTON 48
SCOTT 58
SMITH 79
0 10 20 30 40 50 60 70 80 90
Number of Events
Total Events: 505
1950 - 2023


MEMA Region 6: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
MEMA Region 6: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Agriculture
Armory
Aviation
Communications
Education
Fire Service
Food Service
HAZMAT
Housing
Medical
Other
Public Safety
Recreational
Research
Shelter
Special Population
Storage
Support
Utility
Miles
0 5 10 20 30 40

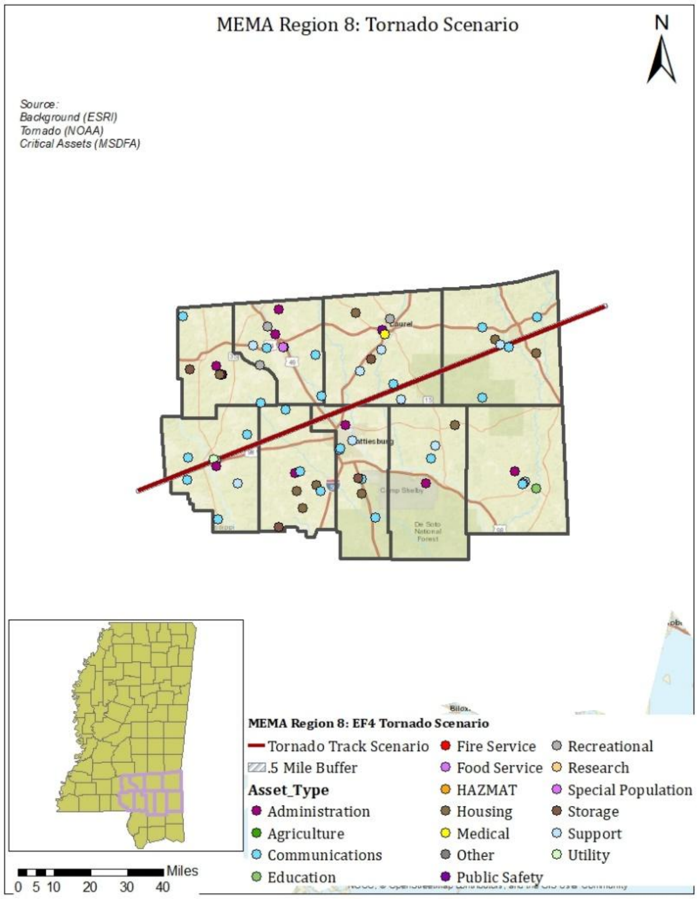

MEMA Region 7
County
ADAMS 19
AMITE 23
FRANKLIN 19
JEFFERSON 28
LAWRENCE 29
LINCOLN 54
PIKE 25
WALTHALL 31
WINSTON 34
0 10 20 30 40 50 60
Total Events: 262
1950 - 2023
Number of Events

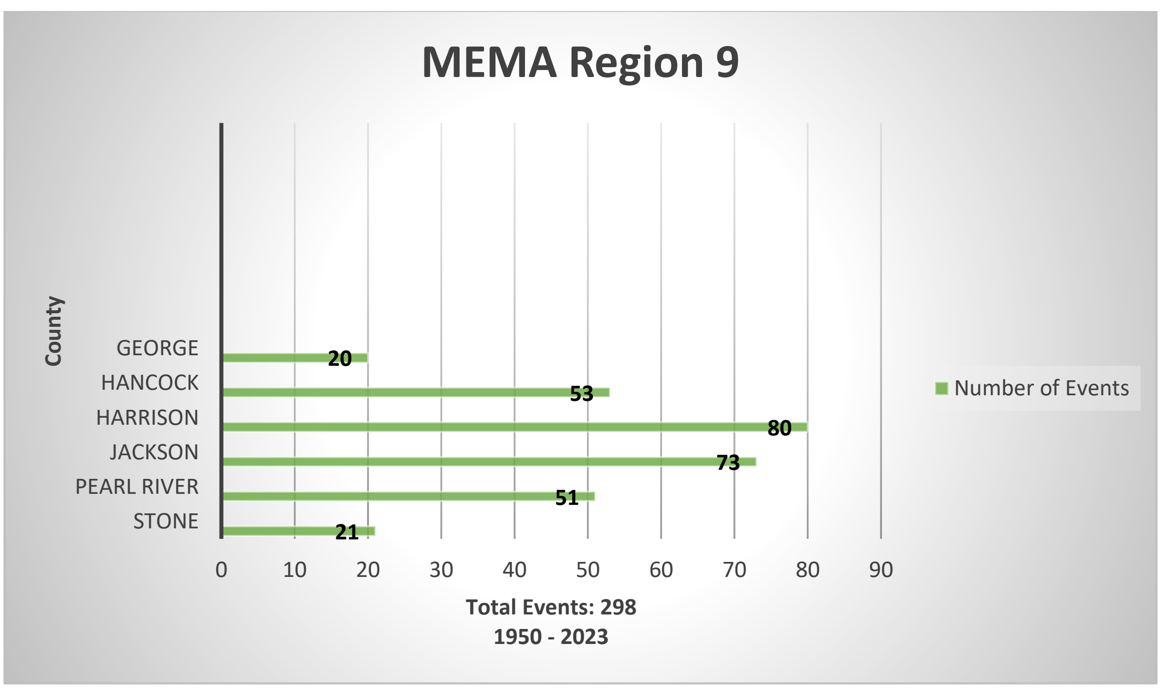


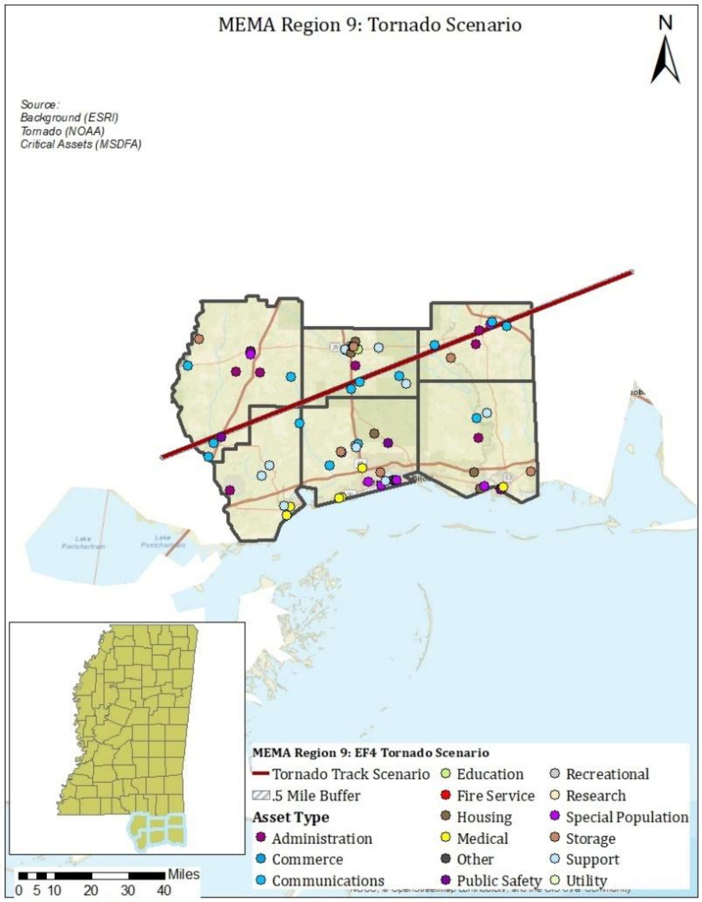
MEMA Region 7: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
MEMA Region 7: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset Type
Administration
Communications
Education
Fire Service
Food Service
Housing
Other
Public Safety
Recreational
Research
Special Population
Storage
Support
Utility
Miles
0 5 10 20 30 40



MEMA Region 8
County
COVINGTON 47
FORREST 43
GREENE 26
JEFFERSON DAVIS 35
JONES 75
LAMAR 49
MARION 44
PERRY 22
WAYNE 36
0 10 20 30 40 50 60 70 80
Total Events: 377
1950 - 2023
Number of Events


MEMA Region 8: Tornado Scenario
N
Source:
Background (ESRI)
Tornado (NOAA)
Critical Assets (MSDFA)
MEMA Region 8: EF4 Tornado Scenario
Tornado Track Scenario
.5 Mile Buffer
Asset_Type
Administration
Agriculture
Communications
Education
Fire Service
Food Service
HAZMAT
Housing
Medical
Other
Public Safety
Recreational
Research
Special Population
Storage
Support
Utility
Miles
0 5 10 20 30 40


MEMA Region 9
County
GEORGE
HANCOCK
HARRISON
JACKSON
PEARL RIVER
STONE
20
53
80
73
51
21
0
10
20
30
40
50
60
70
80
90
Number of Events
Total Events: 298
1950 - 2023



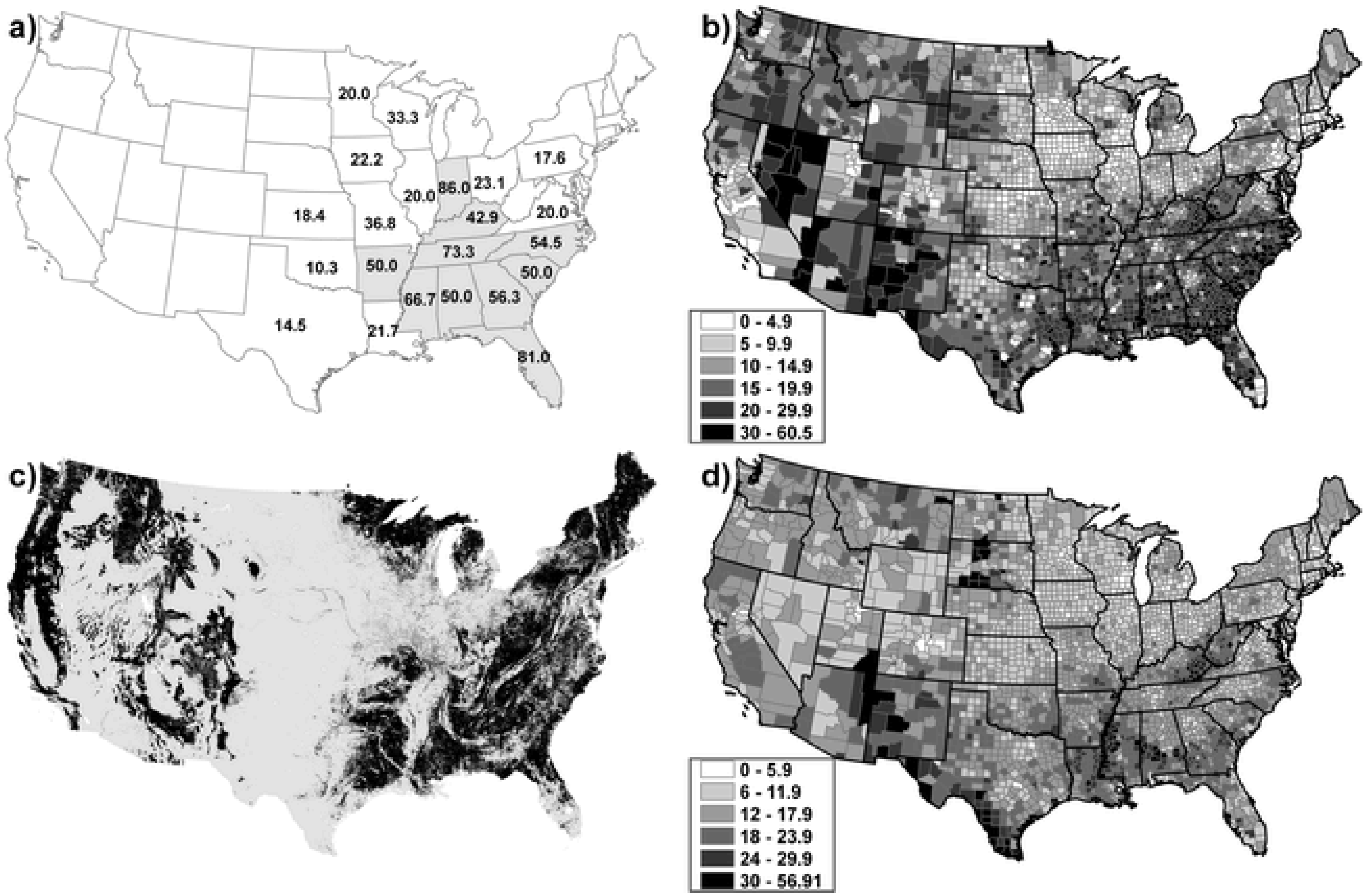
Assessing the Vulnerability of People to Tornadoes

Anyone occupying a structure that is not constructed as a storm shelter is vulnerable to the effects of tornadoes. However, occupants of mobile homes are at a statistically higher risk of tornado-related death or injury. According to a study at Michigan State University, there are roughly 9 million mobile homes in the United States. The United States averages well over 1,000 tornadoes per year. A 2008 Northern Illinois University study indicated that 45% of all fatalities during tornadoes occur in mobile homes, compared to 26% in traditional site-built houses

The study cited the prevalence of mobile homes in states such as Arkansas, Tennessee, Alabama, and Mississippi as a contributing factor to the high tornado-related fatality rate in the southeastern United States. **Table 3.2.4** illustrates the high percentage of mobile/manufactured housing throughout the state. Without appropriate warning or access to a tornado shelter, mobile home occupants can rapidly become involved in a life-threatening situation.

People who are outside of the siren warning area or with limited access to conventional communications such as telephones or weather radios, are also at risk. People with special needs and/or home-bound due to medical problems are especially vulnerable even to secondary effects of tornadoes including power outages.

Inadequate individual warnings and limited access to approved shelters during an event contribute to the number of fatalities resulting from tornadoes. People with mobility impairments, or the inability to hear or understand warnings, the very young, the elderly, and the handicapped are especially vulnerable to tornadoes. The following figure illustrates the unique vulnerabilities to tornadoes experienced by residents in the southeastern U.S. and particularly in Mississippi. Image (a) shows the percentage of night-time tornado fatalities by state from 1985-2005 with Mississippi at 66.7%. Image (b) illustrates the overall percentage of mobile homes by county. Image (c) shows forest cover and image (d) shows the percentage of county populations at or below the poverty level. These four factors combined contribute to an above-average high level of vulnerability of Mississippians to the devastating impacts of tornadoes.



(a) Percentage of nighttime tornado fatalities by state (illustrated for those states with greater than 10 tornado fatalities for 1985–2005; shaded states above the national average for nighttime tornado fatalities of 42.5%), (b) percentage of mobile homes by county (U.S. Census Bureau 2006), (c) forest cover (solid black) for the United States as determined by Advanced Very High Resolution Radiometer data (information online at http://nationalatlas.gov/articles/biology/a_forest.html), and (d) percent of county population in poverty (U.S. Census Bureau 2006).

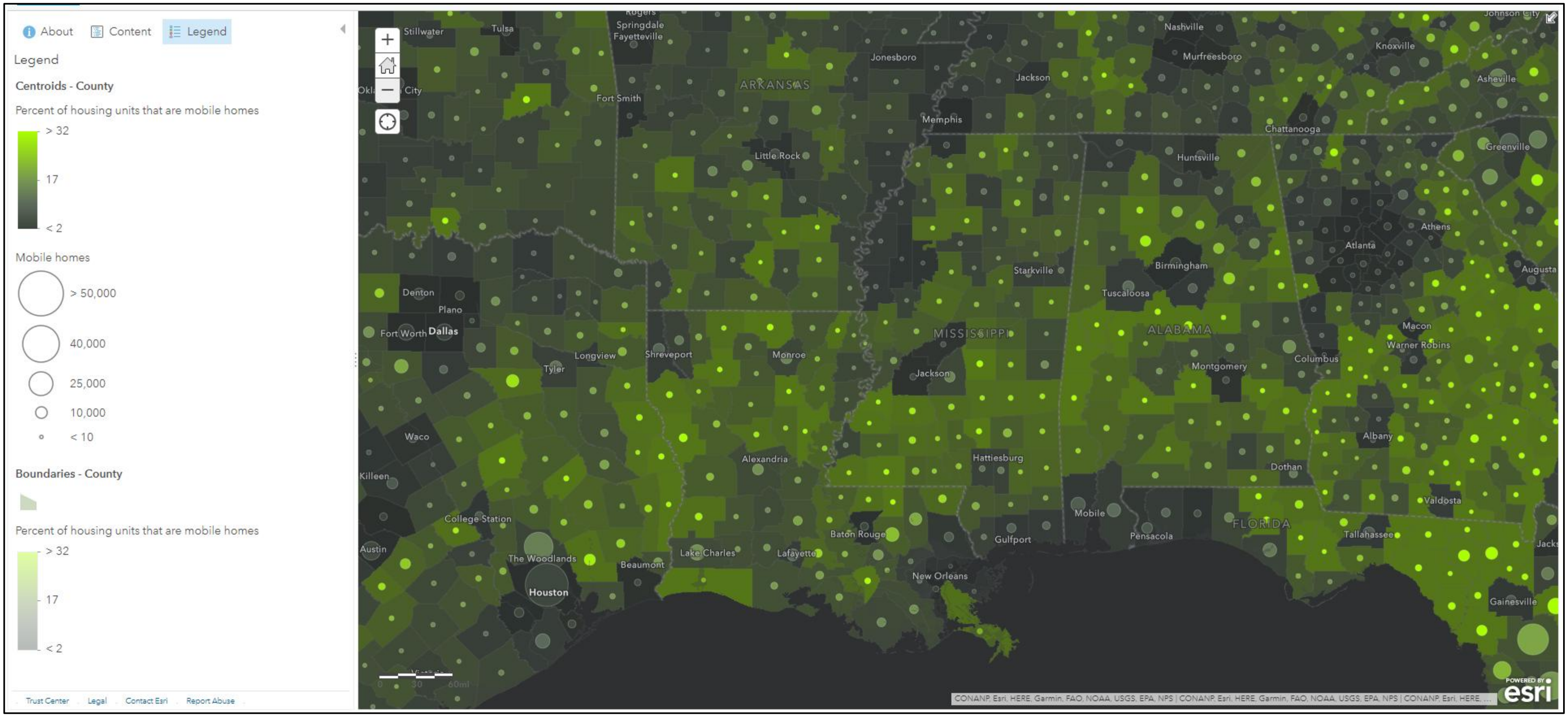
Table 3.2.4
Mobile/Manufactured Housing

County	Number of Mobile/ Manufactured Housing	Percentage of Total Housing		County	Number of Mobile/ Manufactured Housing	Percentage of Total Housing
MEMA Region 1 – 15,367						
Coahoma	996	8.7%		Tallahatchie	765	25.5%
DeSoto	2,995	7.3%		Tate	1677	20.1%
Grenada	1,459	14.6%		Tunica	826	22.3%
Panola	4,346	31.6%		Yalobusha	1,689	27.1%
Quitman	614	15.7%				
MEMA Region 2 – 25,844						
Alcorn	2,425	15.3%		Pontotoc	2,363	21.8%
Benton	709	20.5%		Prentiss	1,670	15.6%
Itawamba	2,116	21.6%		Tippah	1,681	19%
Lafayette	3,058	18.4%		Tishomingo	1,621	17%
Lee	4,667	14.6%		Union	1,961	18.3
Marshall	3,573	27%				
MEMA Region 3 – 12,633						
Attala	1,698	19.7%		Leflore	1,252	8.9%
Bolivar	1,867	12.5%		Montgomery	813	15%
Carroll	1,407	28.8%		Sunflower	715	7.3%
Holmes	2,265	36.8%		Washington	2102	8.6%
Humphreys	514	12.4%				
MEMA Region 4 – 18,739						
Calhoun	1,172	17%		Monroe	3,239	19.9%
Chickasaw	2,095	26.2%		Noxubee	1,457	27.9%
Choctaw	813	19.1%		Oktibbeha	2,876	16.6%
Clay	1,491	16.8%		Webster	716	16.5%
Lowndes	3,527	14%		Winston	1,353	16%
MEMA Region 5 – 27,748						
Claiborne	1,272	29.9%		Rankin	8920	19.6%
Copiah	2,487	22.4%		Sharkey	547	22.6%
Hinds	3,954	3.9%		Simpson	3,080	27.2%
Issaquena	265	30.2%		Warren	3,229	16%
Madison	2,140	7.4%		Yazoo	1854	18.5%

MEMA Region 6 – 23,340						
Clarke	2,248	27.8%		Neshoba	2,608	21.8%
Jasper	2,143	27.9%		Newton	2,152	23.2%
Kemper	1,991	26.3%		Scott	3,160	28.4%
Lauderdale	5,187	15.5%		Smith	2,024	28.9%
Leake	1,827	21.3%				
MEMA Region 7 – 17,406						
Adams	1,613	10.6%		Lincoln	3,327	23.7%
Amite	1,880	29.2%		Pike	3,302	19.7%
Franklin	1,146	27.8%		Walthall	1,692	26.4%
Jefferson	1,257	32.9%		Wilkinson	1,776	34.8%
Lawrence	1,413	24.8%				
MEMA Region 8 – 23,132						
Covington	2,454	30.4%		Lamar	2,456	15.9%
Forrest	3,050	10.2%		Marion	2,077	20%
Greene	1,529	30.9%		Perry	1,655	32.4%
Jefferson Davis	1,321	22.4%		Wayne	2,983	33%
Jones	5,607	20.8%				
MEMA Region 9 – 30,292						
George	1,862	24.8%		Jackson	6,572	12.7%
Hancock	3,953	18.8%		Pearl River	4,902	23.8%
Harrison	9,843	12.4%		Stone	3,160	28.4%
Total Mobile/Manufactured Housing Mississippi						**193,308**

Source: U. S. Census Bureau: 2020 Census and Selected Housing Characteristics

Figure 3.2.3
Mobile/Manufactured Housing



Loss of Life

Statistically speaking, Mississippi has experienced less than one death per tornado incident on average since 1950. However, even one loss of life resulting from a tornado event is too many. **Table 3.2.5** shows data by decade from 1950-2022 with the number of deaths and injuries caused by tornadoes in each reported period. The data indicates a downward trend in both deaths and injuries indicating that perhaps our efforts towards education and early warning innovations are working but it also highlights that there is work still to be done.

Because of the widespread nature of tornado-related damage, death and injury can come from a variety of causes including windblown debris, structural failure, etc. Mitigation through education, continued development of early warning systems, and development of more resilient housing codes will continue to provide increased protection to Mississippi residents against injury and death resulting from tornadoes.

Table 3.2.5
Tornado Events with Death/Injury

Timeframe	# of Events	Deaths	Death(s)/Event	Injuries	Injuries/Event
1950-1960	179	78	0.44	715	3.99
1961-1970	216	113	0.52	1089	5.04
1971-1980	365	143	0.39	2455	6.73
1981-1990	319	30	0.09	684	2.14
1991-2000	330	25	0.08	524	1.59
2001-2010	665	29	0.04	611	0.92
2011-2020	807	81	0.10	794	0.98
2021-2022	219	1	0.00	6	0.03

Vulnerability of Natural Resources

Trees and decorative vegetation are all subject to damage from tornadoes. The force of a tornado is powerful enough to uproot trees and vegetation and deposit the debris in standing water, resulting in a polluted drinking water supply. Tornadoes also can cause animals to migrate prematurely.

Streams can become clogged with wind-blown debris and downed trees, causing flooding and resulting in a slow recovery. Habitat for local wildlife may become destroyed, resulting in a reduction of species. If debris is not removed from the forest floor, it can become fuel for a wildfire.

However, as we have experienced over decades of storm events, natural systems tend to be resilient and have the capacity to regenerate under the right conditions.

Local Plan Integration Summary

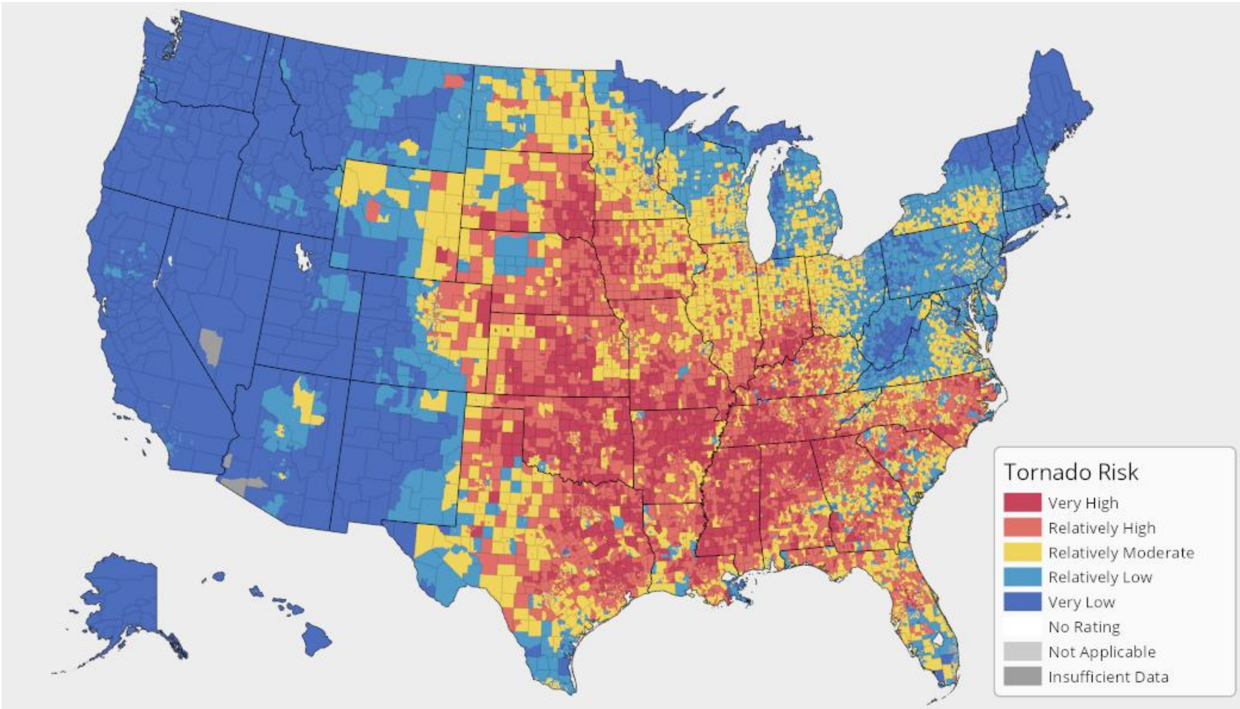
Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	--	--	9	6	--	--	9
2	--	1	11	7	--	--	9
3	--	4	5	8	--	5	10
4	--	--	11	9	--	--	6
5	--	2	42				

Probability of Future Occurrences

Given the history of tornado activity in Mississippi and the relatively recent migration of tornado activity from "Tornado Alley" to "Dixie Alley" and consideration of changing future conditions, the probability for future occurrences of tornadoes in all MEMA regions of Mississippi is high. This assumption is supported by FEMA tornado risk data indicating that Mississippi is a particularly high risk from tornadoes. According to the National Weather Service, the reason Mississippi is seeing more tornadoes now is due to the significant changew in the climate and atmosphere. Although the weather is constantly changing, it's hard to predict what will occur in the future specifically. Weather service officials said all parts of the state are at risk of being hit by tornadoes, but officials could not pinpoint what areas in the state are most likely to experience tornadoes. However, central Mississippi-including areas southeast of the Jackson metro area-is more likely to experience tornadoes than other parts of the state, officials said, *Clarion Ledger March 2023.* More concerning is the data outlined above regarding the high number of occupied mobile and manufactured housing in Mississippi, which places our citizens in a position of higher vulnerability to the devastating impacts of tornadoes.

FEMA Tornado Risk Index



Assessing Vulnerability by Jurisdiction Methodology and Potential Losses

The previous plans assessed each county's vulnerability to tornado events by utilizing a rating system devised to establish four ratings based on the following factors: the number of past tornado occurrences, the total valuation of private property in each county, the population density of each county, and historic tornado damage values. The sum of each of these ratings was used to determine an overall vulnerability rating for each county.

For the sake of consistency, this HIRA update used the same methodology as previous plan updates. Four factors are used, but they are not classified into groupings to assess a value. The value for each category is presented in Table 3.2.5 by MEMA Region.

The four factors are described in detail below with a summary of the results.

1. **Prior Events** - The total number of tornadoes reported is dependent on population density and weather radar coverage. For this plan, it is assumed that the overall frequency of tornadoes does not vary significantly across the state by any means other than seasonality. Southern portions of Mississippi appear to experience more tornadoes during the spring severe weather season whereas the northern portions experience their peak in the fall severe weather season.

   Summary of Prior Events: The number of events by county is provided in graph form in this section MEMA Region. Based on the frequency of occurrences and the unpredictable nature of tornadoes, all counties are considered at high risk.

2. **Private Property Values** - To compare the value of assets vulnerable to loss by tornado damage in each county, the state of Mississippi utilized assessment data from the Mississippi Tax Commission. The values were obtained from the "Mississippi State Tax Commission Annual Report Fiscal Year Ending June 30, 2022."

   The Annual Report provides private property assessments in two categories. These are "Real Property" and "Personal Property." The "Real Property" assessment represents the true value of all taxable land and improvements. The "Personal Property" assessment represents the value of the following: business inventories, furniture, fixtures, machinery, and equipment for non-residential property, mobile homes, and automobiles. To determine the Total Valuation of Property for each county, the "True Value" from the "Personal Property" assessment was added to the "True Value" from the "Real Property" assessment. This total private property valuation dollar value in itself is an indicator of the total value of each county's property (tangible assets). It is important to note that the Personal Property assessment only includes property reported for tax purposes and does not include furniture and fixtures located in non-institutional residential property.

   Summary of Private Property Values: The Total Property Valuation ranged from $152,402,798 in Issaquena County to $16,657,627,680 in DeSoto County.

3. **Tornado Damage Values** - Total damages of past tornadoes were determined to be an important factor in assessing vulnerability. The National Weather Service database listed past events plus damage estimates from those events. These damage estimates were approximated.

   Summary of Tornado Damage Values: Lawrence County still leads in greatest loss with $504,289,000 in damages. The least amount of damage was in Stone County with $660,050 in damages.

Table 3.2.5
Tornado Damage Assessment by MEMA Region

MEMA Region 1				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Coahoma	29	$1,281,819,396	$33,761,000	2.63%
DeSoto	26	$16,657,627,680	$47,484,000	0.29%
Grenada	19	$1,468,796,667	$1,768,000	0.12%
Panola	21	$1,796,569,774	$29,910,000	1.66%
Quitman	12	$339,144,059	$31,209,000	9.20%
Tallahatchie	19	$774,556,385	$32,053,000	4.14%
Tate	15	$1,502,243,741	$1,000,000	0.07%
Tunica	12	$1,268,273,374	$3,607,000	0.28%
Yalobusha	10	$653,257,897	$25,685,000	3.93%
Totals	**163**	**$25,742,288,973**	**$206,477,000**	**1%**

MEMA Region 2				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Alcorn	22	$1,892,868,559	$4,336,000	0.23%
Benton	10	$527,511,910	$3,526,000	0.67%
Itawamba	15	$1,113,829,300	$4,630,000	0.42%
Lafayette	23	$5,665,566,207	$62,367,000	1.10%
Lee	35	$7,656,356,564	$27,026,000	0.35%
Marshall	22	$3,021,602,136	$6,441,000	0.21%
Pontotoc	22	$1,419,619,312	$30,235,000	2.13%
Prentiss	30	$1,050,326,214	$4,373,000	0.42%
Tippah	20	$974,048,479	$4,361,000	0.45%

Tishomingo	25	$1,363,445,628	$8,380,000	0.61%
Union	21	$2,067,997,215	$27,598,000	1.33%
Totals	**245**	**$26,753,171,524**	**$183,273,000**	**1%**

MEMA Region 3				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Atalla	53	$898,157,024	$95,085,000	10.59%
Bolivar	57	$2,203,682,435	$21,082,000	0.96%
Carroll	24	$585,705,944	$3,922,000	0.67%
Holmes	47	$619,606,167	$70,451,000	11.37%
Humphreys	33	$400,510,216	$10,738,000	2.68%
Leflore	43	$1,809,878,876	$33,721,000	1.86%
Montgomery	24	$462,825,632	$7,449,000	1.61%
Sunflower	36	$1,293,123,052	$8,305,000	0.64%
Washington	31	$2,355,187,844	$11,078,000	0.47%
Totals	**348**	**$10,628,677,190**	**$261,831,000**	**2%**

MEMA Region 4				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Calhoun	23	$716,133,531	$2,000,000	0.28%
Chickasaw	25	$698,025,197	$7,845,000	1.12%
Choctaw	22	$1,408,300,532	$119,564,000	8.49%
Clay	16	$1,448,437,688	$4,406,000	0.30%
Lowndes	46	$6,540,634,794	$78,106,000	1.19%
Monroe	41	$2,043,921,479	$15,897,000	0.78%
Noxubee	49	$499,557,894	$7,410,000	1.48%
Oktibbeha	32	$3,240,127,681	$7,460,000	0.23%
Webster	17	$524,755,280	$6,865,000	1.31%
Winston	35	$1,046,472,849	$122,555,000	11.71%
Totals	**306**	**$18,166,366,925**	**$372,108,000**	**2%**

MEMA Region 5				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Claiborne	39	$395,679,089	$27,225,000	6.88%
Copiah	54	$1,294,921,200	$10,812,000	0.83%
Hinds	112	$12,474,623,347	$95,838,000	0.77%
Issaquena	22	$152,402,798	$3,800,000	2.49%
Madison	70	$13,389,673,314	$46,583,000	0.35%
Rankin	99	$13,402,856,152	$144,866,000	1.08%
Sharkey	33	$284,485,274	$28,299,000	9.95%
Simpson	61	$1,529,314,041	$27,754,000	1.81%
Warren	67	$3,861,953,833	$34,047,000	0.88%
Yazoo	63	$1,308,545,622	$149,036,000	11.39%
Totals	**620**	**$48,094,454,670**	**$568,260,000**	**1%**

MEMA Region 6				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Clarke	45	$802,268,604	$29,181,000	3.64%
Jasper	47	$1,169,425,568	$50,472,000	4.32%
Kemper	36	$1,342,016,691	$43,480,000	3.24%
Lauderdale	59	$4,476,058,443	$20,172,000	0.45%
Leake	72	$886,379,169	$66,874,000	7.54%
Neshoba	62	$1,332,316,058	$76,999,000	5.78%
Newton	48	$1,039,226,380	$19,980,000	1.92%
Scott	58	$1,574,862,203	$10,148,000	0.64%
Smith	79	$957,505,257	$52,068,000	5.44%
Totals	**506**	**$13,580,058,373**	**$369,374,000**	**3%**

MEMA Region 7				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Adams	19	$2,098,880,294	$7,006,000	0.33%
Amite	24	$746,894,457	$2,272,000	0.30%
Franklin	19	$366,835,205	$4,041,000	1.10%
Jefferson	28	$307,888,952	$2,816,000	0.91%
Lawrence	30	$851,755,517	$506,239,000	59.43%
Lincoln	54	$2,219,547,189	$11,472,000	0.52%
Pike	25	$2,090,820,554	$29,078,000	1.39%
Walthall	31	$609,236,530	$2,293,000	0.38%
Wilkinson	13	$408,676,307	$1,153,000	0.28%
Totals	**243**	**$9,700,535,005**	**$566,370,000**	**6%**

MEMA Region 8				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
Covington	47	$1,308,372,532	$66,415,000	5.08%
Forrest	43	$4,748,648,172	$45,084,000	0.95%
Greene	27	$711,963,409	$15,432,000	2.17%
Jefferson Davis	38	$490,566,790	$30,671,000	6.25%
Jones	75	$3,696,466,147	$85,161,000	2.30%
Lamar	49	$4,592,605,996	$25,113,000	0.55%
Marion	46	$1,164,500,611	$31,149,000	2.67%
Perry	22	$689,498,024	$1,088,000	0.16%
Wayne	36	$1,100,012,304	$27,602,000	2.51%
Totals	**383**	**$18,502,633,985**	**$327,715,000**	**2%**

MEMA Region 9				
County	**Event**	**Total Value of Property (2022 MS Department of Revenue)**	**Reported Property Damage (NCDC) 1950 - 2022**	**Percent of Property Damage**
George	20	$1,044,406,851	$1,552,000	0.15%
Hancock	53	$4,582,061,677	$27,450,000	0.60%
Harrison	80	$16,190,779,757	$64,093,000	0.40%
Jackson	73	$13,268,977,040	$3,568,000	0.03%
Pearl River	51	$2,882,458,402	$5,310,000	0.18%
Stone	21	$855,441,140	$660,050	0.08%
Totals	**298**	**$38,824,124,867**	**$102,633,050**	**0%**

Benefits of Mitigation

Warning Sirens

The Mississippi Emergency Management Agency partnered with the Federal Emergency Management Agency to improve tornado warning capabilities through participation in a storm siren grant program. This program required localities to provide minimum matching funds, document proposed sites. The program also required an estimate of the effective range and population to be warned should the project be funded. Funded entities were required to assume responsibility for the future maintenance of sirens funded through the program.

Safe Rooms

The State of Mississippi also offered a safe room program - "A Safe Place to Go" encouraged homeowners to construct individual safe rooms at their residences to protect their families. The program resulted in the development of more than 6,200 safe rooms. This program is no longer active as funding is unavailable.

The state also provided funding for FEMA 361 and Community Safe Rooms. With advanced notice, these safe rooms are opened for persons potentially vulnerable to tornadoes and other severe weather events.

3.4 Dam/Levee Failure Risk Assessment

Hazard Description

According to the Mississippi Department of Environmental Quality's Dam Safety Regulations, a dam is defined as - Any artificial barrier, including appurtenant works, constructed to impound or divert water, wastewater, liquid-borne materials, or solids that may flow if saturated. All structures necessary to maintain the water level in an impoundment or to divert a stream from its course will be considered one dam. A levee is defined as an embankment built to prevent the overflow of a river.

Dam Categories

The Surface Water and Dam Safety Divisions of the Office of Land and Water Resources, Mississippi Department of Environmental Quality (MDEQ) develop regulations related to dam safety for the state. Dams are categorized according to what lies downstream, as well as the expected impact of a dam failure. The following is taken from regulations for dams in Mississippi that describe the dam categories:

Low Hazard (Category III, or Class A) – A class of dam in which failure would at the most result in damage to agricultural land, farm buildings (except residences), or minor roads.

High Hazard (Category I, or Class C) – A class of dam in which failure may cause loss of life, serious damage to residential, industrial, or commercial buildings; or damage to, or disruption of, important public utilities or transportation facilities such as major highways or railroads. Dams that meet the statutory thresholds for regulation that are proposed for construction in established or proposed residential, commercial, or industrial areas will be assigned this classification unless the applicant provides convincing evidence to the contrary. The term "High Hazard" does not speak to the quality of the structure, but rather the potential for loss of life or damage to property downstream in case of a failure.

Significant Hazard (Category II, or Class B) - A class of dam in which failure poses no threat to life, but may cause 4 significant damage to main roads, minor railroads, or cause interruption of use or service of public utilities.

A full inventory of dams is provided as an appendix to this plan. The State ID in the inventory is the same as the NID identification number. All dams listed as within the jurisdiction of the State of Mississippi Dam Safety Program.

Hazard Profile

The hazard profile for dam failure in Mississippi includes current statistics regarding dam/levee failures and safety regulations that have been adopted by the State. According to the Mississippi Department of Environmental Quality - Dam Safety Division, there are 6,867 dams in Mississippi, of which 414 are classified as either high or significant hazard class (**Figure 3.4.1**). It should be noted that the number of dams currently in the MDEQ inventory is significantly increased from 2018 (3,833). The MDEQ Dam Safety Division has been working to more thoroughly identify and accurately classify all dams in the State. It is also important to note that of the 6,867 dams identified, 1,470 remain unclassified or are classified as "Further Investigation Needed". It is anticipated that the number of High Hazard and Significant Hazard dams will increase in coming years as these unclassified dams undergo further investigation.

As with other engineered systems, dams have a design lifetime. Private dams are likely to go without periodic maintenance essential to minimize failure. Despite a five-year inspection period for high-hazard dams, conditions may exist that have the potential to contribute to dam failure.

Catastrophic dam failure is characterized by the sudden, uncontrolled release of impounded water produced by either overtopping or a break in the dam. Lesser degrees of failure tend to lead up to or increase the risk of catastrophic failure. Catastrophic failure can often be avoided by frequent inspections, mitigation of adverse conditions, and routine maintenance.

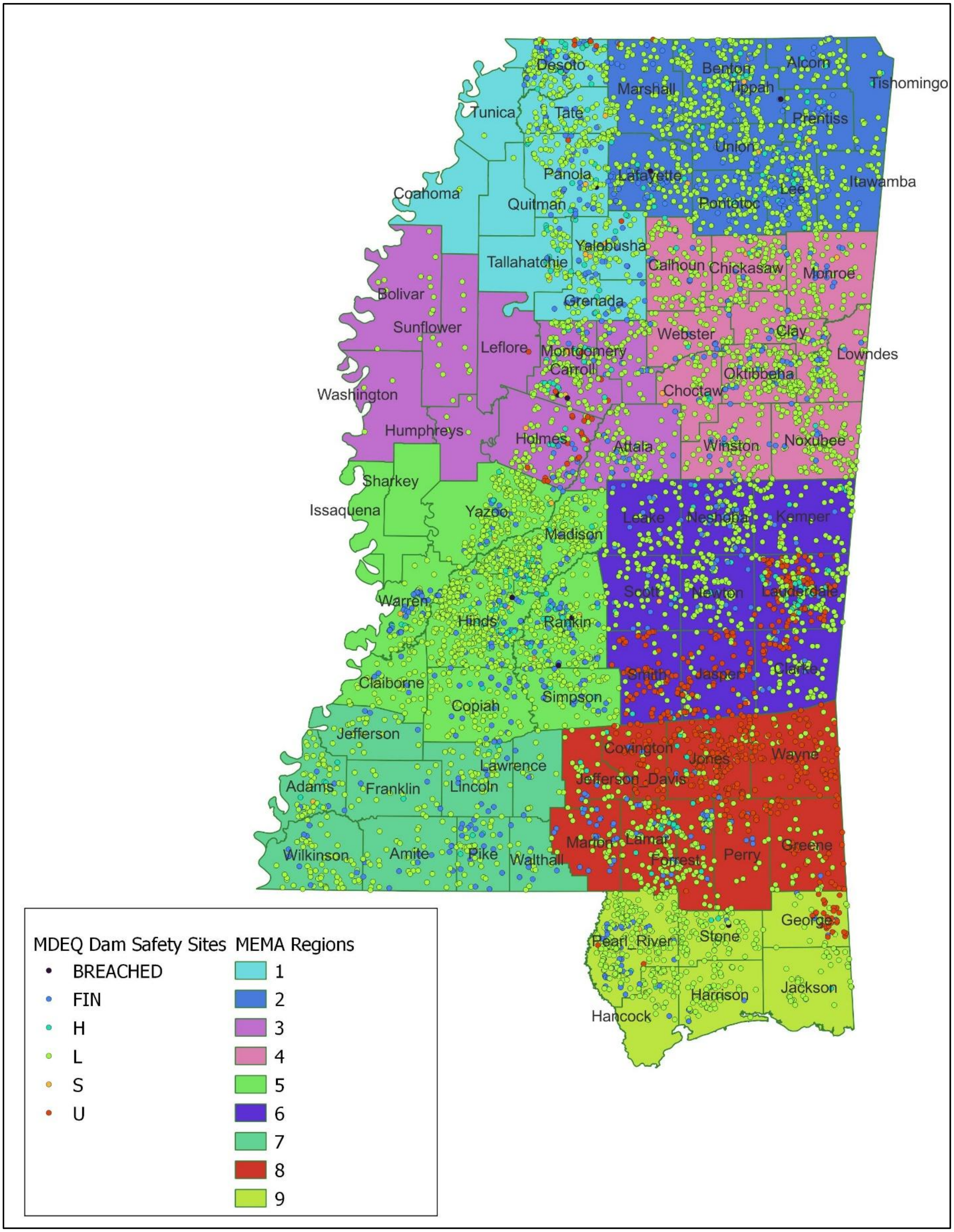
Mississippi's dam safety program is intended to minimize the risks posed by unsafe dams, the false sense of security that often arises from the presence of an upstream dam (no matter its function), and the tendency of localities and private landowners to develop areas that seem protected but that could be inundated if a dam fails.

Emergency Action Plans

Section 51-3-39 of the Mississippi Code of 1972 charges dam owners with responsibility for maintaining and operating their dams in a safe condition. Dam Safety Regulations adopted by the Mississippi Commission on Environmental Quality in 2004 require owners of High Hazard and Significant Hazard Dams to have their dams inspected by a registered professional engineer before March 2006. Additionally, the owners were required to prepare an Emergency Action Plan (EAP) for submission to MDEQ. Significant Hazard dams that may impact public infrastructure are also required to have EAPs in place.

The MDEQ Office of Land and Water Resources, Division of Dam Safety administers the state's dam safety program. This office conducts comprehensive file reviews and current hazard evaluations of all dams in their inventory. The Division's list of dams can be found in **Appendix 7.3.4-A**. This list includes dams consisting of at least 50 acres of surface drainage area. Any size dam can be determined to be "High Hazard".

Figure 3.4.1
Mississippi Dams



Source: MDEQ Dam Safety Division

Mississippi Floodplain Management

Mississippi has 5.2 million acres of high-risk flood zones, not counting the areas protected by certified levees. Mississippi has approximately 665 miles of major levees, which are generally located in the western border counties. All levees are constructed to provide a specific level of protection, such as the year or 500-year flood. The 500-year flood level plus the additional freeboard height is considered a minimum protection standard for levees protecting urban areas. If a flood occurs that exceeds that design, the levee will be overtopped or otherwise fail from saturation, leakage, etc. When this happens, the results are catastrophic. The threat of earthquakes also increases the risk of areas protected by levees.

Dam Failure vs Dam Incident

Dam incidents are events of engineering and safety interest that provide insight into the structural and functional integrity of dam systems and their operation. An incident does not necessarily result in a failure, but often failure is adverted by intervention. Since 2010, there have been 26 recorded incidents. There were 16 incidents at high or significant hazard dams, with three of those not being on the inventory at the time of the incident. At least eight incidents occurred at low hazard dams. At the time of the incident, two were not on the inventory. Since 2019, 47 incidents or failures have occurred. Of these incidents, 21 were categorized as failures, and 26 were categorized as incidents. Two of the dams were unclassified at the time of the incident, 17 were classified as High Hazard, 26 were classified as Low Hazard and 2 were classified as Significant Hazard dams.

Past Occurrences - Incidents

Robinhood #4 Dam Incident
Incident occurred on January 3, 2017 in Rankin County. Piping was caused by animals burrowing in the embankment.

Trace State Park Dam Incident
Incident occurred on November 26, 2016 in Pontotoc County. Major slide of working surface occurred.

Shahkoka Lake Dam Incident
Incident occurred on March 10, 2016 in DeSoto County. The incident is a result of sliding on the downstream slope.

Piney Woods Lake Dam Incident
Incident occurred on February 15, 2016 in Rankin County. This incident was a result of overtopping.

Delta Crest Lake Dam Incident
Incident occurred on February 1, 2016 in DeSoto County. This was a result of severe erosion under the primary spillway slab.

Oktibbeha County Lake Dam Incident
Incident occurred on January 29, 2016 as a result of a major slide on the upstream slope.

Truman Robert #1 Dam Incident
Incident occurred on November 20, 2015 in Forrest County. The incident occurred due to a failure of the CMP primary spillway.

Albritton Lake Dam Incident
Incident occurred on January 21, 2015 in Pearl River County. Failure of the abandoned CMP primary spillway is the

McCoy Lake Dam Incident
Incident occurred on April 15, 2014 in Simpson County. A slope failure incident led the owner to attempt a controlled breach.

Maximum Dam Failure Threat

The maximum threat to citizens of Mississippi from dam failure will not originate from state or privately-owned dams but from federal flood control structures such as the United States Corps of Engineers' Arkabutla, Sardis, Grenada, or Enid reservoirs. Simultaneous failure of these structures could occur due to an earthquake in the New Madrid Seismic Zone. It is also important to note that extensive flooding from states upstream that feed into the Mississippi River could also contribute to major flooding due to levee breaches. However, a scenario of a failure at Lake Arkabutla Dam is provided in the vulnerability assessment section.

When a dam has been designated as a High Hazard Dam Failure, Dam Safety Regulation, Title II: Part 7, Chapter 3, requires all owners of High Hazard and Significant Hazard Dams to have their dams inspected by a registered professional engineer at recurring intervals to be set by the division. All High Hazard dams must also have an Emergency Action Plan (EAP). EAPs may also be required for some Significant Hazard Dams. Guidelines for the inspections and the preparation of the EAPs can be accessed from the links located on MDEQ's website.

Past Occurrences – Dam Failure

Since 2013, MDEQ Dam Safety Division has recorded 41 breaches. **Table 3.4.2** shows all breaches that have occurred since 1982. It is important to note that some failures may not have been detected and reported.

Table 3.4.2
Dam Failures 1982 – 2022

Date	County	Structure Name	Cause of Failure
August 2022	Rankin	Easthaven Lake Dam	Flooding/Overtopping
August 2022	Hinds	Raymond Sewage Lagoon	Backslope erosion
August 2022	Rankin	Jones Lake Dam	Flooding/Overtopping
June 2021	Pearl River	MS04059	Unknown
June 2021	Carroll	Pellucia Creek WS Lake	Headcutting at auxiliary spillway
June 2021	Holmes	Black Creek WS Lake	Headcutting at auxiliary spillway
June 2021	Lafayette	Lake Tara Dam	Piping
May 2021	Winston	Lake Tiak O'Khata Dam	Seepage/Sloughing
April 2021	Madison	JF Jackson Lake Dam	Conduit/Infrastructure Collapse
April 2021	Stone	Hall Lake Dam	Pipe corrosion/piping failures
April 2021	Pearl River	Covered Bridge Lake Dam	Blocked spillway/overtopping/head cutting
April 2021	Marshall	Brown Lake Dam	Head cutting
April 2021	DeSoto	Fogg Road Dam	Overtopping, spillway blockage (beaver dam)
April 2021	Pearl River	Albritton Lake Dam	Overtopping caused by blocked conduit causing downstream slope erosion.
March 2021	Lauderdale	Highway 19 NOI	Overtopping/erosion
March 2021	Panola	Klepzig Lake Dam	Auxiliary spillway failure from beaver activity.
March 2021	Hinds	Linda Drive	Downstream slope seepage
July 2020	Madison	Lake Cavalier	Downstream slope erosion

Date	County	Structure Name	Cause of Failure
April 2020	Leake	MS06876	Overtopping/Erosion
April 2020	Rankin	Southern Acres Lake	Headcutting
February 2020	Itawamba	Biddle Lake Dam	Overtopping/Erosion
February 2020	Smith	Jennings Lake Dam #1	Spillway blockage (beavers)
February 2020	Madison	Lake Cavalier	Downstream slope erosion
February 2020	Yazoo	Springridge Place Dam	Spillway blockage lead to overtopping which caused scouring and erosion on the backslope.
February 2020	Leake	Blanche Street Pond Dam	Piping
February 2020	Leake	Bilbro Lake Dam	Overtopping
February 2020	Smith	Jennings Lake Dam #2	Overtopping caused by spillway blockage
January 2020	Lauderdale	Lakemont Lake Dam	Erosion around spillway
January 2020	Hinds	Holmes Lake Dam	Piping
January 2020	Lauderdale	Murphy Road Dam	Erosion and slope stability issues
January 2020	Oktibbeha	Oktibbeha County Lake	Surface erosion on downstream slope
January 2020	DeSoto	Dunn Lake Dam	Tree damage on the dam from a tornado
January 2020	Adams	Southwood Lodge Lake	Extreme headcut through spillway and overtopping
January 2020	Adams	Robins Lake Dam	Flooding/Overtopping
July 2019	Holmes	Black Creek WS Lake	Headcutting at auxiliary spillway
April 2019	Lauderdale	Mirror Lake Dam	Pipe separation causing internal erosion
February 2019	Lafayette	Audubon Pond Dam	Pipe separation causing internal erosion
February 2019	Panola	Hotopia Creek WS Lake	Insufficient spillway capacity
January 2019	Madison	MS06004	Unknown
December 2018	Jones	Flowers Lake Dam	Piping
December 2018	Jones	Francis Lowery Lake Dam	Slope erosion
September 2018	Carroll	Abiaca Creek WS 34-09	Beaver activity
September 2018	Carroll	Abiaca Creek WS 34-29	Animal burrowing
March 2018	Rankin	NOI	Piping
February 2018	Lauderdale	Reed Lake Dam	Piping
February 2018	Rankin	Piney Woods Lake Dam	Overtopping
January 2018	Forrest	Shelby Thames Lake Dam	Piping
June 2017	Wayne	Lirette Lake Dam	Unknown.
June 2017	Jones	Flowers Lake Dam	The primary spillway conduit which was made of 8' diameter fuel tanks partially collapsed and water exited the pipe and eroded the center of the embankment above the conduit
June 2017	Jones	Flowers Lake Dam	The primary spillway conduit which was made of 8' diameter fuel tanks partially collapsed and water exited the pipe and eroded the center of the embankment above the conduit
May 2017	Lamar	Gumpond Road Dam	Seepage/piping through animal burrows
May 2017	Pearl River	Catfish Lake Dam	Overtopping
May 2017	Smith	Vowell Lake Dam	Slide occurs in the center of the crest and downstream slope
April 2017	Forrest	Sharra Lake Dam	Partial failure of concrete chute spillway

Date	County	Structure Name	Cause of Failure
January 2017	Franklin	Gayle Evans Lake Dam	Spillway erosion
March 2016	Smith	Vowell Lake Dam	Piping around the primary spillway pvc and a slide that formed on the downstream slope of the dam
March 2016	Winston	Lake Tiak O Khata Dam	New area of seepage/piping
March 2016	Hinds	Regency Estates Lake Dam	During heavy rains, the reservoir filled to top of dam and began eroding around the siphon pipe causing significant damage
March 2016	Marion	Regency Estates Lake Dam	During heavy rains, the reservoir filled to top of dam and began eroding around the siphon pipe causing significant damage
February 2016	Rankin	Piney Woods Lake Dam	Overtopping cause large slide on the downstream slope at an area between the left abutment and the middle of the dam.
February 2016	Desoto	Delta Crest Subdivision Lake Dam	Piping/severe erosion under the primary spillway
January 2016	Oktibbeha	Oktibbeha County Lake Dam	Slide on the upstream slope near the right abutment
January 2016	Jones	Lonesome Pines Lake Dam	Piping approximately half way down downstream slope
December 2015	Itawamba	Biddle Lake Dam	Overtopping
November 2015	Forrest	Truman Roberts Number 1 Dam	Failure of primary spillway conduit (corrugated metal pipe)
November 2015	Hinds	Latham Pond Dam	Overtopping of a breach section constructed by the owner
July 2015	Pontotoc	Trace State Park Lake Dam	Major slide on the downstream slope just to the left of the outlet
May 2015	Monroe	Clark Lake Dam	Erosion around the primary spillway culvert in the left abutment (refer to picture taken in the file)
March 2015	Tate	Senatobia Lake Subdivision Dam	Failure of the primary spillway (cmp) that was previously filled with concrete
June 2014	Webster	Savannah Lake Dam	Through piping that began to headcut
April 2014	Warren	Silver Creek Dam	Headcut back through the earthen spillway during a large rain event
April 2014	Scott	Whiteway Farms Dam	Severe seepage through dam that will eventually lead to failure if the seepage areas are not repaired. At the time of inspection, seepage was estimated at 20-30 gpm but it did not appear that piping was occuring.
March 2014	Hancock	St Regis Paper Company Lake Dam	The area received 3-5" of rainfall which led to activation of the spillway with large flows that started a series of headcuts in the spillway channel.
October 2013	Lamar	Lake Serene North	Piping under the spilllway slab. Further investigation is taking place.
May 2013	Forrest	Noi	Corrosion and piping around riser and conduit

Date	County	Structure Name	Cause of Failure
May 2013	Jackson	Spring Lake Dam	Owner attempted to rebuild dam. Construction breached during heavy rain
January 2013	Adams	Robbins Lake Dam	Dam overtopped after a large rain event. Crest of dam was damaged and a large hole scoured out along the edge of the crest.
January 2013	Desoto	MF Harris Pond Dam	Seepage caused by trees and animal burrows
December 2012	Madison	Madison Baptist Fellowship Dam	Seepage due to animal burrows
August 2012	Pike	Percy Quinn	Large slides developed with seepage. Did not lead to uncontrolled release of pool.
August 2012	Wayne	Unknown	Failure around conduit. Exact cause unknown.
August 2012	Pearl River	Portie Dam	Heavy rains from Hurricane Isaac caused the dam to overtop and significant water backed up onto owners' property. A slide occurred near the center of the dam. A superficial crack formed on the dam.
August 2012	Pike	Percy Quinn	Large slides developed with seepage. Did not lead to uncontrolled release of pool.
August 2012	Lamar	Lake Serene Southeast Dam	Large slide on downstream face of dam. Did not lead to uncontrolled release of pool.
January 2010	Jones	Lake Getaway	A plane of weak clay, failure to mix layers well during construction and poor maintenance
April 2005	Hinds	Dennery Lake	Seepage, piping, biological growth caused section near center of dam to erode away
2005	Desoto	Allen Subdivision Lake	Animal penetration, causing dam to breach
June 2004	Hinds	Lake Dockery	Animal penetration. Dam failed near center. Controlled breach continued at the failed section
2004	Lamar	Bennett York	Dam owner attempted to lower water level by controlled breach but lost control
May / June 2004	Hinds	Lake Dockery	Piping
April 2004	Pearl River	Dove Lake	Piping
March 2004	Lamar	Big Bay Lake	Piping
February 2004	Yazoo	Dr. Freeman Lake	Piping
February 2004	Simpson	Peacock Lake	Overtopping
September 2003	Warren	Lake Forrest	Piping
July 2003	Lamar	Emmit Graves	Piping
May 2003	Lauderdale	Wild Duck Lake	Piping
April 2003	Lauderdale	Lake Evelyn	Piping
January 2003	Madison	Andover South	Piping
December 2002	Lafayette	Royal Oaks	Piping
October 2002	Harrison	Windy Hills Lake	Piping along primary spillway conduit
September 2002	Madison	Andover South	Piping
September 2002	Pike	Lake Dixie Springs	Overtopping
August 2002	Lauderdale	State Hospital Lake	Poor overall condition

Date	County	Structure Name	Cause of Failure
July 2002	Lafayette	Horseshoe Lake	Massive slides, erosion on downstream slope, leading to dam breach
April 2002	Carroll	Billups Dam	Piping
March 2002	Lauderdale	Lake Tom Bailey	Deterioration for primary concrete spillway
February 2002	Panola	Unnamed Dam	Piping along primary spillway leading to dam breached
January 2002	Lauderdale	John Kasper Lake	Excessive seepage leading to dam breach
July 2001	Lamar	Bridgefield	Massive slides on downstream face leading to dam breach
May 2001	Madison	Francis Calloway	Piping leading to dam being breached
May 2001	Madison	Robinson Springs	Overtopping
March 2001	Lamar	West Lake First Addition	Piping leading to dam being breached
January 2001	Hinds	Turtle Lake	Piping leading to dam being breached
September 2000	Warren	Lake Haven	Animal penetration
April 2000	Hinds	Whites Lake	Piping/Breached
May 1995	Lauderdale	Vise Lake Dam	Sand boils - problem with longevity of dam
January 1995	Panola	Lake Village Dam	Spillway Failure
November 1994	Hinds	Spring Lake	Spillway Failure
April 1994	Desoto	Strickland Lake	Breached by Regulators
July 1993	Jones	Indian Springs Lake	Breached
December 1991	Benton	Porter Creek	Breached
June 1989	Leflore	Abiaca Creek	Breached
April 1984	Hinds	Lakeview Lake	Breached
April 1984	Hinds	Lake Larue	Breached by Design
March 1984	Lauderdale	Dalewood Shores	Minor Breach
March 1984	Panola	Pine Lake	Breached
March 1984	Forrest	Burketts Creek	Breached
March 1984	Forrest	West Lake	Overtopped
March 1984	Rankin	Ross Barnett Reservoir	Sandbags on Levee
May 1983	Hinds	Jackson County Club	Breached
May 1983	Leake	State Highway 35	Overtopped
April 1983	Leflore	Pelucia Bayou	Breached
April 1983	Pearl River	Anchor Lake	Breached
April 1983	Adams	Robins Lake	Breached
April 1983	Hancock	Boy Scout Camp	Breached
April 1983	Lamar	Lake Serene	Spillway Out
December 1982	Leflore	Pelucia Bayou	Overtopped

Source: MDEQ Dam Safety Division

Dam Failures

MF Harris Dam Failure
Failure occurred on January 10, 2013 in DeSoto County. Seepage caused by trees and animal burrows.

Silver Creek Dam Failure
Failure occurred on April 6, 2014 in Warren County. Headcut back through the earthen spillway during a large rain event.

Truman Roberts Number 1 Dam Failure
Failure occurred on November 20, 2015 2013 in Forrest County. Failure of primary spillway conduit (corrugated metal pipe)

Gayle Evans Lake Dam Failure
Failure occurred January 19, 2017 in Franklin County. Failure occurred due to spillway erosion.

Flowers Lake Dam Failure

Failure occurred on June 6, 2017 in Jones County. The primary spillway conduit which was made of 8' diameter fuel tanks partially collapsed and water exited the pipe and eroded the center of the embankment above the conduit

Probability of Future Dam Failure Events

In each subsequent plan update, the probability of dam failure was considered high due to the State's reduced inspection capabilities, potentially resulting in a series of dam failures. Through subsequent plan updates, MDEQ has continued to update policies, regulations, and data relative to dams in Mississippi. These policy improvements allow the state to more effectively track each known location and monitor conditions more closely to better understand when and where failures are likely to occur. Dam breach evaluations have been completed for some, but not all high hazard dams. As further analysis are completed, those studies will be utilized. Inundation maps, studies, and reports are available to dam owners as part of the existing Emergency Action Planning efforts for the agency.

All inundation mapping in Mississippi is completed using the same methodology – sunny day top of dam failure for risk data and inundation modeling.

While the structural weakness of a dam is apparent from outside observation, sudden dam failure that occurs during normal operations, with the water level at full supply and the water released causing the largest change in flows is called a sunny day failure. It may be caused by foundation failure, earthquakes, or another such event. This scenario normally refers to internal erosion (piping) failure. There are ways to evaluate the imminent failure of a structure, but these do not always provide the information needed to foretell future events. State policies that have been promulgated to provide for a periodic inspection period require five-year inspections for "high hazard" dams.

Additionally, climate change could add to the overall challenges of dam failures. Scientists have said for years that a warming atmosphere could lead to more intense and frequent storms in many regions and as a result, could potentially compromise dams and levees. While researching for this section of the plan, the Flowers Lake Dam Failure Failure occurred on June 6, 2017 in Jones County. The primary spillway conduit which was made of 8' diameter fuel tanks partially collapsed and water exited the pipe and eroded the center of the embankment above the conduit common thread among all scientists is that it is most difficult to predict the actual damages/failures that could occur as a result of climate changes. While it is true that weather patterns have changed, it is still difficult to point out that climate change is the singular reason why dams and levees have the potential of being compromised.

Levee Failures

The Great Flood of 1927 unleashed a series of catastrophic events along the banks of the Mississippi River. The flooding was a result of heavy rainfall across the Central U.S. starting in August 1926 and continuing through the spring of 1927. The weather system stalled over the Midwest resulting in record rainfalls for the region. The region's expanding tributaries caused the Mississippi River to overflow in eleven states from Illinois to Louisiana. That same system brought heavy rainfall to the Yazoo-Mississippi Delta, an alluvial plain located in northwest Mississippi.

After several months of heavy rain, the Mississippi River reached record levels, causing a levee to break in Illinois on April 16th. On April 21st, the levee in Mounds Landing, Mississippi breached. This levee lay below the confluence of the Mississippi and Arkansas Rivers, approximately 12 miles north of Greenville, Mississippi. Greenville was flooded the next day. The combination of record rainfalls and the levee breach caused over one million acres of Mississippi land to be inundated with ten feet of water. The entire levee system collapsed soon after the initial levee breach at Mounds Landing. The Mississippi Delta received some of the worst damage, with water as high as 30 feet in some areas. It took nearly two months for flood waters in the Delta to recede. Figure 3.4.2 on the following page is a map showing the inundated area. The map also shows the levee breaks that occurred along the Mississippi River. Finally, in August 1927 that the last of the floodwaters flowed into the Gulf of Mexico.

This 1927 flood resulted in significant impacts on people and property in the Midwest and Southeast United States, including:

- The loss of more than 246 lives,
- flood damage to hundreds of cities, towns, and villages,
- displacement of over 700,000 people,
- inundation of over 1,800 square miles,
- The loss of 1.5 million farm animals,
- Economic losses amounting to many hundreds of millions of dollars,
- Suspension of interstate freight and passenger traffic,
- Disruption of telegraph and telephone communications,
- Disruption of the United States postal service, and
- A significant disruption of industry and commerce.

As a result of this disaster, on May 15, 1928, Congress passed a general flood control act that allowed the federal government to assume the cost and oversight of levee construction and outlined the policy of the federal government assuming the construction of levees necessary for the protection of the valley.

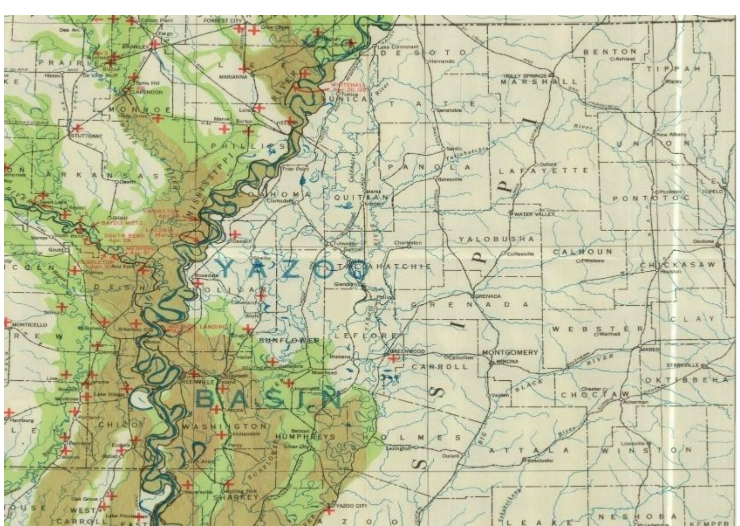
The 1927 flood resulted in property damage estimated at $350 million, equivalent to approximately $5 billion today. Economic losses were estimated at $1 billion (1927 dollars), which was equivalent to almost one-third of the federal budget at that time.

Some examples of levee failures along the Mississippi River before the General Flood Control Act of 1928 are recounted by Walter Sillers below:

- In 1882, the entire line of levees in Bolivar County, about 85 miles, seemed to snap in a hundred places in one night, during a terrible storm on the night of February 28th, and the whole county was under water.
- A section of the levee a mile long caved into the river just south of the town of Prentiss in 1865, and other levees, north and south, in Bolivar County, either caved in or broke; and as the stage of water was high for that day, a disastrous overflow swept over the country, drowning stock, sweeping away fences, destroying crops, and carrying destruction and disaster in its wake.
- A private levee along Lake Vermillion from Lake Beulah to Neblett's Landing was adopted as a part of the main levee system, instead of the abandoned levee. Despite all the work and care given to the levee proper, there were many breaks in it – 1867, 1882, 1874, and 1897. A break occurred in the Catfish Point Levee in 1890, causing the entire Point with its improved plantations to be thrown outside the levee and abandoned. The most disastrous of all was in 1912 in which the water was the highest on record and caused a disastrous break in the levee four miles below Beulah.
- In 1922, the closure of the Cypress Creek levees on the Arkansas side of the Mississippi River raised the flood line to the extent that carries the water over the top of the Mississippi Levees from Kentucky Ridge to Mound Landing, causing a desperate struggle and a vast expenditure of money to top it off and hold it against the increased flood line of the river.
- In 1926, Bolivar County was operating under the second Flood Control Act of 1923, under which act all the levee boards contributed one-third of the cost of construction of the levees and maintained the works after they were constructed.

The Mississippi River Flood of 1927 was the nation's greatest natural disaster. The National Safety Council estimated deaths in the Yazoo-Mississippi Delta at 1,000. In Mississippi, it directly affected an estimated population of 185,495. A total of 41,673 homes were flooded; 21,836 buildings were destroyed; 62,089 buildings were damaged; 2,836 work animals, 6,873 cattle, 31,740 hogs, and 266,786 poultry were drowned. An entire crop year was lost. A major outcome of the 1927 flood, which had an impact in eleven states, was the National Flood Control Act of 1928 passed by the U. S. Congress.

Figure 3.4.2



Greenville, MS (Washington Co.) – April 30, 1927

Cary (Sharkey Co.) – May 1, 1927

Downtown Greenville, MS (Washington Co.) – April 30, 1927

Egremont (Sharkey Co.) – May 2, 1927

Onward (Sharkey Co.) – May 2, 1927

Valley Park (Issaquena) – May 2, 1927

Source: National Museum of African American History and Culture

Assessing Vulnerability to Dam Failure

Dam and levee failures have the potential to result in loss of life and property. However, loss of life is the primary concern in assessing vulnerability to dam and levee failure. For this reason, a dam is classified as a high hazard if only one life is at-risk due to inundation in the event of a failure. Structures of all types are vulnerable to damage if waters are released due to dam or levee failure. In many cases, a dam or levee failure results in property damage that may not be returned to pre-incident levels.

Each year, there are several dam failures in Mississippi, and probably an equal number of dams are breached under controlled conditions to avoid the possibility of a sudden failure. Some dam failures in the state have caused significant property damage. However, it is important to note that there have been no fatalities in Mississippi attributable to a dam failure.

The Mississippi Dam Safety Program can present potential policies related to mitigation and reduction of risks related to dam failures for evaluation by local leaders, but with the small staffing level for the Dam Safety Program, the drive to implement and adopt those policies must be made at the local level. Opportunities for implementating HHPD mitigation actions through local capabilities are limited. As Mississippi Dam Safety conducts training across the state, local jurisdictions can be informed of the benefits of including capabilities and HHPD mitigation actions in their plan. Dam failure mitigation action 11 is being added to address limitations.

Damages from Flooding as a Result of Dam Failure

Flooding, while a by-product of a dam or levee failure, is the primary force causing injury, death, and property damage. Damages due to flooding will affect both man-made and natural systems.

Vulnerability of People

Dam classifications are subject to change over time as development downstream increases the potential risk of a dam failure. Homeowners generally are not able to conduct routine site inspections of a dam potentially impacting their property and may not detect warning signs of an imminent failure.

When water is released from a breached dam, its course and destination can become unpredictable. The National Weather Service will generally issue a Flash Flood Warning in the event of a dam failure. A dam failure's effect on property, human health and welfare, and public infrastructure represents widespread vulnerabilities because of the number of existing dams in the state.

The State of Mississippi has not completed a summary of potential significant economic or social impacts downstream of high-hazard dams. This information is not available at this time. Additionally, the State of Mississippi has not completed a comprehensive summary of all locations and size of Populations at Risk (PAR) and potential impacts to institutions and critical infrastructure/facilities/community lifelines from all highhazard potential dams. This information is not available at this time. Dam failure mitigation actions 12 and 13 are being added to address limitations.

Vulnerability of Natural Resources

Water that is impounded loses its dissolved oxygen. When a dam empties into a watercourse, fish in the watercourse suffocate and die as a result of a lack of biologically dissolved oxygen. Silt is often at the bottom of a dam impoundment and will enable water-borne bacteria and microbes to grow in an environment free of the cleansing action of sunlight. Mining operations utilize dams to impound tailings and may include processed water, process chemicals, and portions of unrecovered minerals, all of which are toxic to aquatic and human life. This does not imply that dams are a hazard to people and the environment, but water-borne minerals and water without aeration need to remain impounded behind a dam.

Due to the flat nature of Mississippi's topography, Mississippi presents little to no risk from landslides on adjacent features having an impact on dam structures leading to failure. Wildfires also present little risk given that all dams in the State are earthen embankment structures with mostly metal or concrete components. Smaller, low-hazard dams may have PVC or other plastic components, but the impacts from a release caused by wildfire would be minimal. Upstream flooding potential would only be anticipated within the design lakebed. Emergency action plans for each dam indicate if they have homes located below the top of dam to provide warnings to those homes as needed.

Assessing Vulnerability by County

When assessing vulnerability, all dams must be considered, regardless of hazard classification. Any residential structure built in an inundation area of a dam may justify a change in the dam's classification. Information obtained for the 2023 update indicates that 62 of Mississippi's 82 counties contain high or significant hazard dams reflecting an increase of four counties from the 2018 update. To date, there are approximately 6,872 inventoried dams in the State of Mississippi. The breakdown of hazard types is as follows:

Overall inventory of Dams		
	2018	**2023**
High Hazard Dams	361	361
Significant Hazard Dams	59	53
Unclassified Hazard Dams	828	665
Low Hazard Dams	3,564	4,916
Further Investigation Needed	49	881
Total	**5,300**	**6,876**

A county summary by MEMA Region is provided in **Table 3.4.3** and Table **3.4.4**. lists the top ten counties in the total number of dams. Significant work from the MDEQ Dam Safety Division has increased the total number of dams in the State's inventory. The table below depicts the differences from the 2018 plan update to the 2023 plan update.

Total Number of Dams per Region		
District	**2018**	**2023**
1	575	596
2	846	947
3	290	443
4	498	937
5	1,215	1,357
6	740	927
7	168	371
8	435	741
9	533	557
Total	**5,300**	**6,876**

Table 3.4.3
Dam Inventory by County/MEMA Region

MEMA District 1												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
Coahoma	0	0	2	0	0	2	0	0	2	0	0	2
DeSoto	1	21	112	0	51	185	1	24	120	5	54	204
Grenada	0	3	32	0	22	*57*	0	3	32	0	20	55
Panola	1	9	95	1	23	129	1	9	95	1	23	129
Quitman	0	0	1	0	0	1	0	0	1	0	0	1
Tallahatchie	2	10	32	0	2	46	1	11	35	0	2	49
Tate	1	4	65	0	8	78	1	4	65	0	8	78
Tunica	0	0	1	0	0	1	0	0	1	0	0	1
Yalobusha	3	7	50	3	13	76	3	8	53	1	12	77
Total	**8**	**54**	**390**	**4**	**119**	**575**	**7**	**59**	**404**	**7**	**119**	**596**

MEMA District 2												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
Alcorn	0	1	27	0	8	36	0	2	43	0	6	51
Benton	0	4	62	16	0	82	0	3	88	0	4	95
Itawamba	0	0	30	24	1	55	0	0	54	0	7	61
Lafayette	1	14	94	4	35	148	1	12	98	1	35	147
Lee	0	14	66	38	21	139	0	17	104	0	26	147
Marshall	0	0	79	0	14	93	0	0	85	2	15	102
Pontotoc	1	7	42	53	0	103	1	8	77	0	17	103
Prentiss	0	3	13	7	6	29	1	4	37	0	12	54
Tippah	3	4	50	10	5	72	2	7	68	0	11	88
Tishomingo	0	2	4	0	1	7	0	2	15	0	1	18
Union	1	4	33	44	0	82	1	4	65	0	11	81
Total	**6**	**53**	**500**	**196**	**91**	**846**	**6**	**59**	**734**	**3**	**145**	**947**

MEMA District 3												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
Atalla	1	2	44	6	1	54	1	1	88	0	14	104
Bolivar	0	0	14	0	0	14	0	0	14	0	0	14
Carroll	4	23	86	0	5	118	4	24	114	4	5	151
Holmes	1	5	39	2	9	56	1	4	64	16	12	97
Humphreys	0	0	4	0	0	4	0	0	4	0	0	4
Leflore	0	0	0	1	0	1	0	0	0	1	0	1
Montgomery	0	2	22	2	2	28	0	2	48	0	7	57
Sunflower	0	0	12	0	0	12	0	0	12	0	0	12
Washington	0	0	3	0	0	3	0	0	3	0	0	3
Total	**6**	**32**	**224**	**11**	**17**	**290**	**6**	**31**	**347**	**21**	**38**	**443**

MEMA District 4												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
Calhoun	0	4	52	0	0	56	0	4	79	0	10	93
Chickasaw	2	1	65	0	2	70	2	1	88	0	10	101
Choctaw	0	4	5	0	0	9	1	4	37	0	5	47
Clay	0	0	40	0	9	49	1	0	66	0	9	76
Lowndes	0	2	49	0	5	56	0	2	86	0	13	101
Monroe	1	0	52	0	24	77	1	0	77	0	16	94
Noxubee	2	0	32	0	0	34	1	1	123	0	8	133
Oktibbeha	1	1	73	0	0	75	1	1	134	0	25	161
Webster	0	1	21	0	0	22	0	2	40	0	8	50
Winston	0	1	44	0	5	50	0	2	67	0	12	81
Total	**6**	**14**	**433**	**0**	**45**	**498**	**7**	**17**	**797**	**0**	**116**	**937**

MEMA District 5												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
Claiborne	0	1	20	20	0	41	0	1	43	0	5	49
Copiah	0	4	26	3	1	34	0	3	62	0	22	87
Hinds	3	34	183	136	3	359	3	26	285	0	38	352
Madison	10	30	208	48	10	306	5	31	262	0	26	324
Rankin	2	30	94	49	19	194	3	26	131	0	38	198
Simpson	0	2	32	12	7	53	0	2	58	0	18	78
Warren	1	7	28	11	4	51	1	6	46	0	38	91
Yazoo	2	4	153	1	17	177	2	7	153	0	16	178
Total	**18**	**112**	**744**	**280**	**61**	**1215**	**14**	**102**	**1040**	**0**	**201**	**1357**

MEMA District 6												
	2018						2023					
County	S	H	L	U	FIN	Total	S	H	L	U	FIN	Total
Clarke	0	0	59	15	9	83	0	0	61	15	7	83
Jasper	1	3	21	20	2	47	2	2	27	70	3	104
Kemper	1	3	42	34	1	81	1	3	72	0	4	80
Lauderdale	2	32	87	98	4	223	1	26	104	95	3	229
Leake	2	0	18	6	2	28	2	0	47	0	10	59
Neshoba	1	2	56	45	11	115	0	3	89	0	23	115
Newton	1	3	51	34	5	94	0	3	77	0	14	94
Scott	1	2	29	9	1	42	1	2	65	0	11	79
Smith	0	3	14	10	0	27	0	3	16	64	1	84
Total	**9**	**48**	**377**	**271**	**35**	**740**	**7**	**42**	**558**	**244**	**76**	**927**

MEMA District 7												
	2018						2023					
County	S	H	L	U	FIN	Total	S	H	L	U	FIN	Total
Adams	0	5	33	1	2	41	1	6	49	0	6	62
Amite	0	0	15	0	2	17	0	0	36	0	12	48
Franklin	0	1	11	0	4	16	0	1	18	0	3	22
Jefferson	0	0	18	0	0	18	0	0	25	0	3	28
Lawrence	0	0	10	0	2	12	0	0	13	0	4	17
Lincoln	0	1	13	0	0	14	0	2	43	0	8	53
Pike	0	0	6	0	6	12	0	3	33	0	17	53
Walthall	0	0	6	0	2	8	0	0	14	0	7	21
Wilkinson	0	0	29	0	1	30	0	0	58	0	9	67
Total	**0**	**7**	**141**	**1**	**19**	**168**	**1**	**12**	**289**	**0**	**69**	**371**

MEMA District 8												
	2018						2023					
County	S	H	L	U	FIN	Total	S	H	L	U	FIN	Total
Covington	1	1	5	15	0	22	1	1	11	37	2	52
Forrest	1	7	68	2	12	90	1	8	3	68	15	95
Greene	2	0	26	0	2	30	2	0	32	33	2	69
Jefferson Davis	0	2	20	3	3	28	0	2	28	0	6	36
Jones	0	6	21	40	2	69	0	7	30	131	4	172
Lamar	0	14	84	2	21	121	0	10	94	2	15	121
Marion	0	2	12	1	7	22	0	2	29	0	22	53
Perry	0	0	20	0	5	25	0	1	20	16	5	42
Wayne	0	0	28	0	0	28	0	0	28	73	0	101
Total	**4**	**32**	**284**	**63**	**52**	**435**	**4**	**31**	**275**	**360**	**71**	**741**

MEMA District 9												
	2018						2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**	**S**	**H**	**L**	**U**	**FIN**	**Total**
George	1	0	18	0	4	23	0	0	21	28	4	53
Harrison	0	1	56	0	2	59	0	1	64	0	3	68
Hancock	0	1	63	0	3	67	0	1	56	0	2	59
Jackson	0	1	37	0	1	39	0	1	37	0	0	38
Pearl River	1	3	207	2	37	250	1	2	206	2	35	246
Stone	0	3	90	0	2	95	0	3	88	0	2	93
Total	**2**	**9**	**471**	**2**	**49**	**533**	**1**	**8**	**472**	**30**	**46**	**557**

Source: MDEQ Dam Safety Division (S – Significant Hazard; H – High Hazard; L – Low Hazard; U – Unclassified; FIN – Further Investigation Needed)

Table 3.4.5
Top Ten Counties in Total Number of Dams

County	S	H	L	U	FIN	Total
Hinds	3	26	285	0	38	352
Madison	5	31	262	0	26	324
Pearl River	1	2	206	2	35	246
Lauderdale	1	26	104	95	3	229
DeSoto	1	24	120	5	54	204
Rankin	3	26	131	0	38	198
Yazoo	2	7	153	0	16	178
Jones	0	7	30	131	4	172
Oktibbeha	1	1	134	0	25	161
Carroll	4	24	114	4	5	151

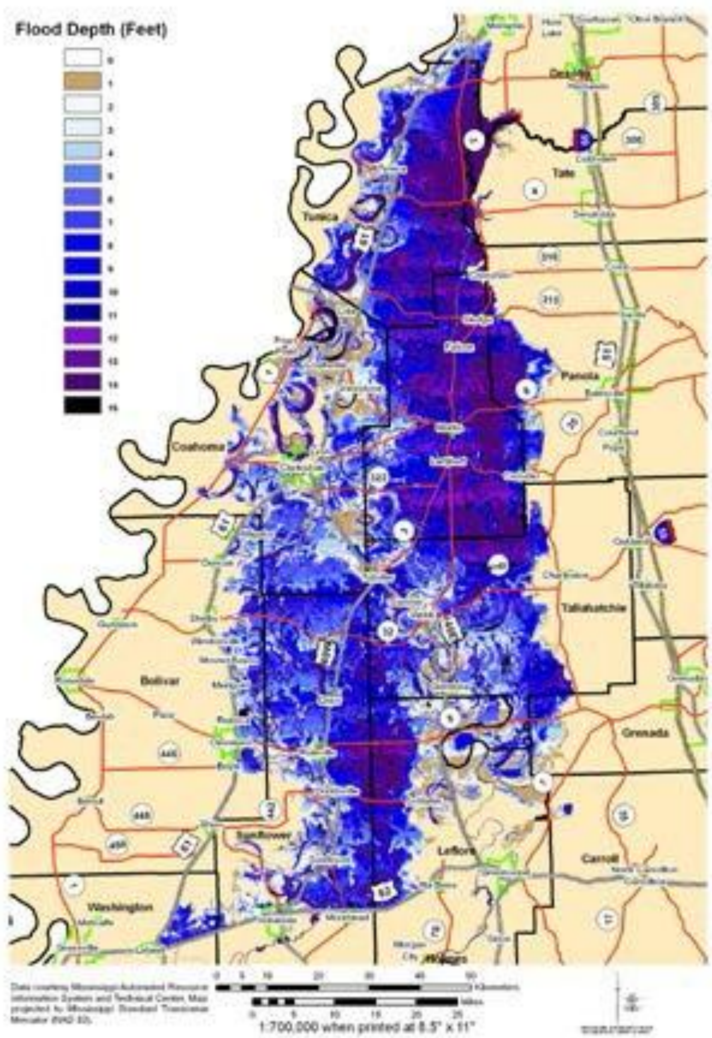
Source: MDEQ Dam Safety Division

When assessing the categories of the dams, in addition to the standard Significant, High, and Low, there is Unclassified, and Further Investigation Needed (FIN). **FIN** means that the dams are unclassified and need additional analysis or field checks. **U** signifies that the dam is unclassified. There were a group of dams under MDEQ purview that failed from 2017 – 2022. Outside engineers were hired to conduct assessment reports for inspections.

Lake Arkabutla Dam Failure Scenario

To assess dam failure, a multi-county scenario was developed. The scenario remains the same as the previous plans (2010, 2013, and 2018). The failure of Lake Arkabutla Dam is still considered the worst-case scenario. The Lake Arkabutla Dam failure scenario indicates that water from a dam failure originating in Desoto County and ending in Leflore County would take 45 days to travel to the Sunflower River and would result in significant damage to private and public properties. Because the movement of water would be slowed in its journey to the Sunflower River, there would be sufficient warning to people downstream to enable evacuation. Although it may be difficult to predict in specifics, it is estimated that deaths could be in the hundreds because of the length of time water would public infrastructure including potential evacuation routes. The disruption to business and the costs of recovery would range in billions of dollars. Figure 3.4.3 depicts flooding that could be expected as a result of a Lake Arkabutla Dam Failure.

Figure 3.4.3
Lake Arkabutla Dam Failure Scenario



Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	1	8	-	6	-	9	-
2	11	-	-	7	1	8	-
3	2	6	1	8	1	5	-
4	10	-	-	9	6	-	-
5	35	12	-				

Probability of Future Occurrence

Given the forty-year history of dam failures illustrated in **Table 3.4.2**, combined with the overall state of aging infrastructure, and consideration that climate change could add to the overall challenges of dam failures, the probability of future dam failures in Mississippi is high. However, many of the failures that have occurred over the years have not resulted in significant damage or loss of life. Recent improvements in documentation and inspection policies and procedures combined with a strong State emphasis on the development and maintenance of emergency action plans all serve to mitigate the potentially harmful impacts of dam failures. While it is clear that the State still has much to accomplish concerning dam safety, much has been accomplished in recent years to minimize the risks and vulnerabilities associated with dams in Mississippi. The conclusion is that the risk of failure is ever-present but the vulnerabilities are decreasing through the implementation of mitigation measures.

GRANT PROGRAMS

Mississippi HHPD 2019 and 2020 Summaries 2019

- Ross Barnett Reservoir Dam- Pearl River Valley Water Supply District (PRVWSD)
- Black Creek Cooling Water Pond Dam – Jackson County Port Authority (JCPA) 2020
- Lynn Cartlage Lake Dam – Forrest County

The Lynn Cartlage lake Dam, locally referred to the Longleaf Acres Dam, is being rehabilitated through the FEMA High Hazard Potential Dam Program. The rehabilitation actions include adding soil to the backslope of the dam to increase the width and make the dam easier to operate and maintain, resize the spillways to increase the capacity to pass water during extreme weather events and add wave wash protection to the front face of the dam to fortify against erosion damage and reduce the risk of failure. All structures around the dam are constructed above the top of dam elevation, so there is no concern with upstream flooding potential. With the resized spillway capacity, risk from a cascading storm event will be substantially reduced since the structure is modified to meet Probable Maximum Precipitation requirements for a High hazard structure. Since this is a recreational lake and not used for mining or coal ash storage, there are no environmental impacts anticipated from a potential dam breach. There are residual risk concerns for downstream lives and property in the event the dam potentially fails and breaches in the future, but the rehabilitation activities are reducing the potential risk and Forrest County has maintained an Operation and Maintenance Plan for the dam to ensure appropriate monitoring and maintenance with be performed for the structure to minimize those risks to the maximum extent practicable. The inundation map above represents a sunny day, top of dam failure analysis performed using HEC-RAS modeling software. There are 10 homes in the inundation footprint that are projected to receive flood waters above the finished floor elevation. At 2.5 persons per home, this represents a Population at Risk (PAR) of 25. The resulting release from a potential dam failure is projected to overtop the downstream the 4-lane State Highway 49, but the depth of flow would not be considered substantial enough to cause long term damage to the infrastructure.

Mississippi NDSP Grant Activities

Inspections
Condition Assessment
Emergency Action Plans
Outreach Activities – Meetings and Workshop
Training Events for Staff

3.5 Tropical Cyclone Risk Assessment

Hazard Description

Tropical Cyclones are naturally occurring events that produce damaging high winds, storm surge flooding, tornadoes, and torrential rainfall capable of causing inland flooding. The Atlantic hurricane season begins on June 1 and ends on November 30, but hurricanes have developed outside of the designated season. Mississippi has been subject to winter and spring extra-tropical storms driving higher than normal tides from southerly and southeasterly winds. The Mississippi Coast has also experienced tropical depressions and tropical storms which have caused higher-than-normal tides, storm surges, and gusting winds.

FEMA defines coastal storms as causing “increases in tidal elevations (called storm surge), wind speed and erosion, caused by both extra-tropical events and tropical cyclones.” FEMA defines hurricanes as “tropical cyclones characterized by thunderstorms and defined wind circulation.” These winds “blow in a large spiral around a calm center called the eye.”

The following terms are used to describe tropical storms and hurricanes:

Tropical Wave: A trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere.

Tropical Depression: A tropical cyclone in which the maximum sustained surface wind speed (using the U.S. 1-minute average) is 33 kt (38 mph or 62 km/hr.) or less.

Tropical Storm: A tropical cyclone in which the maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 34 kt (39 mph or 63 km/hr.) to 63 kt (73 mph or 118 km/hr.).

Hurricane: A tropical cyclone in which the maximum sustained surface wind (using the U.S. 1-minute average) is 64 kt (74 mph or 119 km/hr.) or more.

Hurricane wind intensity is measured by the Saffir-Simpson Scale based on a 1-5 rating of a hurricane’s sustained wind speed at the time of measurement. This is used to give an estimate of the potential property damage expected along the coast from a hurricane's landfall. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous and require preventative measures. Wind speed is the determining factor in the scale. All winds are described using the U.S. 1-minute average. Previously, storm surge was described by the Saffir-Simpson Scale, but is no longer included.

The following excerpt from the National Hurricane Center explains the revised definition of the Saffir-Simpson Hurricane Scale and the separation of storm surge from storm category followed by an explanation of the need to revise the new range of wind speeds:

> Earlier versions of the Saffir-Simpson Hurricane Scale incorporated central pressure and storm surge as components of the categories. The central pressure was used during the 1970s and 1980s as a proxy for the winds as accurate wind speed intensity measurements from aircraft reconnaissance were not routinely available for hurricanes until 1990. Storm surge was also quantified by category in the earliest published versions of the scale dating back to 1972. However, hurricane size (extent of hurricane-force winds), local bathymetry (depth of near-shore waters), topography, the hurricane’s forward speed, and angle to the coast also affect the surge that is produced. For example, Hurricane Ike (with hurricane-force winds extending as much as 125 miles from the center) in 2008 made landfall in Texas as a

Category 2 hurricane and had peak storm surge values of about 20 ft. In contrast, Hurricane Charley (with hurricane-force winds extending at most 25 miles from the center) struck Florida in 2004 as a Category 4 hurricane and produced a peak storm surge of only about 7 ft. These storm surge values were substantially outside of the ranges suggested in the original scale. Thus, to help reduce public confusion about the impacts associated with the various hurricane categories as well as to provide a more scientifically defensible scale, the storm surge ranges, flooding impact, and central pressure statements were removed from the Saffir-Simpson Hurricane Scale, and only peak winds are employed in the revised version.

The Saffir-Simpson Hurricane Wind Scale (SSHWS) underwent a minor modification in 2012 to resolve the awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph. This change does not alter the category assignments of any storms in the historical record, nor will it change the category assignments for future storms.

Table 3.5.1 depicts the revised Saffir-Simpson Scale by category, associated wind speeds, and expected damages from a particular event.

Table 3.5.1
Saffir-Simpson Hurricane Wind Scale

Category	Previous Range	New Range	Effects on Land
One	74-95 mph	No change	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roofs, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallow-rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
Two	96-110 mph	No Change	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
Three	111-130 mph	111-129 mph	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.

Category	Previous Range	New Range	Effects on Land
Four	131-155 mph	130-156 mph	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with the loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks or months.
Five	Greater than 155 mph	Greater than 157 mph	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center. Revised 2012

Storm Surge

Hazard Description

The National Hurricane Center defines a storm surge as an abnormal rise of water generated by a storm over and above the predicted astronomical tides. Storm surge should not be confused with storm tide, which is defined as the water level rise due to the combination of storm surge and the astronomical tide. This rise in water level can cause extreme flooding in coastal areas particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more in some cases (Figure 3.5.1).

Storm surge is produced by water being pushed toward the shore by the force of the winds moving cyclonically around the storm. The impact of storm surge on the low pressure associated with intense storms is minimal in comparison to the water being forced toward the shore by the wind.

The maximum potential storm surge for a particular location depends on many different factors. Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size (radius of maximum winds-RMW), angle of approach to the coast, central pressure (minimal contribution in comparison to the wind), and the shape and characteristics of coastal features, such as bays and estuaries (Figure 3.5.2).

Other factors impacting storm surge are the width and slope of the continental shelf. A shallow slope will potentially produce a greater storm surge than a steep shelf. For example, a Category 4 storm hitting the Louisiana coastline, which has a very wide and shallow continental shelf, may produce a 20-foot storm surge; while, the same hurricane in a place like Miami Beach, Florida, with the continental shelf dropping off very quickly, might see an 8 or 9-foot surge.

Figure 3.5.1
Storm Surge vs. Storm Tide
(Source: NHC)

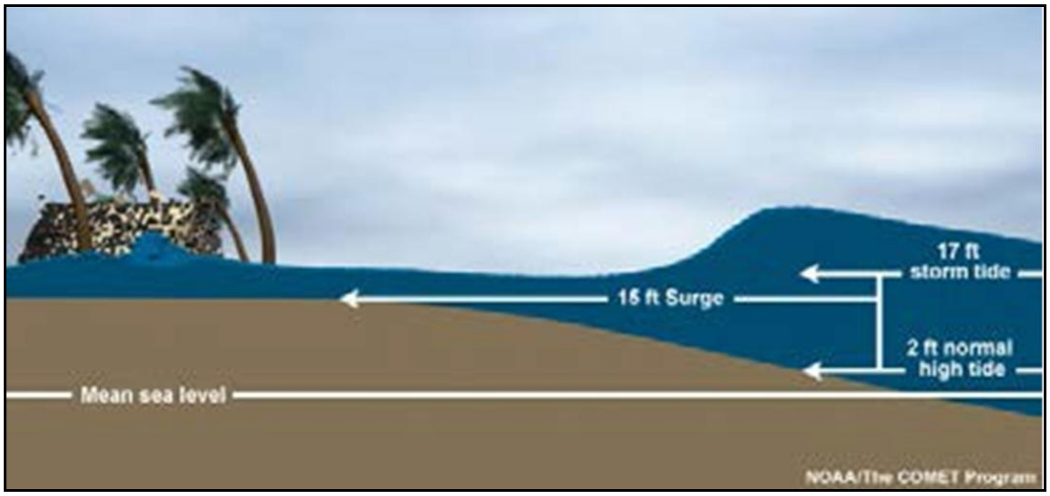


Figure 3.5.2
Wind and Pressure Components of Hurricane Storm Surge
(Source: NHC)

Hazard Profile

Location

The Gulf Coast of Mississippi is located in a high-hazard area for hurricanes and storm surges and is one of the more densely populated areas of the state. According to the 2020 U.S. Census, approximately 397,926 residents reside in the coastal counties of Hancock, Harrison, and Jackson. The second tier of counties is comprised of George, Pearl River, and Stone. These counties, located immediately upland from the coastal counties, had a combined population of 98,828 in 2020. The combined total population of all six counties was 496,754 or approximately 17% of the State's population. The effects of Hurricane Katrina, which made landfall in August 2005, caused drastic population shifts as people sought shelter in non-coastal areas. As housing was built and employment centers and schools were rebuilt many residents returned to their homes. In 2010, the population of these six counties was 466,900, reflecting a population increase of 29,854 (6.4%) residents. This population increase reflects significant redevelopment in the years following Hurricane Katrina.

The three coastal counties are at very high risk from the direct impact of a hurricane or tropical storm. Residents of the three upland counties are at high risk from strong winds, rain damage, flooding, severe storms, and tornadoes generated by hurricanes and tropical storms.

Storm surge is potentially the most devastating factor associated with hurricanes. Within the boundaries of the first-tier counties, properties adjacent to areas affected by tides, particularly areas south of U.S. Highway 90, are the most susceptible to damage from storm surges with heavy flooding as the most common result. In extreme cases, such as Hurricanes Camille and Katrina, the incoming wall of water and wind destroyed well-built buildings along the immediate coastline.

Hurricanes also significantly impact the medium-risk, and more inland counties of Clarke, Covington, Forrest, Greene, Jasper, Jefferson Davis, Jones, Lamar, Lauderdale, Marion, Perry, Pike, Rankin, Simpson, Smith, Walthall, and Wayne. All of these counties have the potential to experience the effects of high winds, rain damage, severe storms, and flooding. Hurricane effects have also impacted lower-risk counties as far north as Hinds and Lauderdale in central Mississippi. As an example, disaster declarations from Hurricane Katrina providing Individual Assistance were issued for 49 of Mississippi's 82 counties. Disaster declarations providing for public assistance were issued for all 82 counties.

Hurricanes that move northeast across the Louisiana Delta or move inland between Mobile, Alabama, and Panama City, Florida, usually are less damaging because these storms are located on the "weak side" of the storm. Even if a hurricane/tropical storm does not make landfall, the Mississippi Gulf Coast can suffer the damaging effects of high tide, rain, and wind from hurricanes and tropical storms that move in from the Gulf of Mexico.

Shelter Requirements

The State of Mississippi has implemented a statewide sheltering program to build FEMA 361 community safe rooms to house displaced households or those seeking shelter from impending storms. Below is a summary of the progress made to date on the construction and capacity of these saferooms. This information will assist in evaluating the expected shelter requirements outlined in the scenarios presented in this plan update. The number of facilities and capacity for the FEMA 361 safe rooms includes 32 facilities that are currently under construction with the capacity to house approximately 21,245 persons.

Mississippi Safe Room Program

Safe Room Type	County	No. of Facilities	Est. Capacity
Individual	Statewide	10,918	28,824
FEMA 361	Adams, Copiah, Desoto, Forrest, George, Hancock, Harrison, Jackson, Jones, Lafayette, Lamar, Lauderdale, Lincoln, Monroe, Neshoba, Pearl River, Pike, Rankin, Stone, Tate, Tunica, and Wayne	72	52,337
Community	Attala, Calhoun, Chickasaw, Holmes, Itawamba, Lafayette, Lamar, Lauderdale, Lee, Leflore, Lowndes, Madison, Monroe, Panola, Pontotoc, Prentiss, Smith, Tallahatchie, Tippah, Union, Wayne, Winston, and Yalobusha	183	Undetermined

Education and Outreach

Hurricane Preparedness Week occurs each year during the last week in May. For more information on hurricane awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. on weekdays.

The state also participates in state, regional, and national hurricane and all-preparedness conferences. During these conferences, public and private agencies have an opportunity to receive education and training to further their efforts in preparing for and responding to future events.

Past Occurrences

Since 1965 Mississippi has been struck by 17 hurricanes and 18 tropical storms/depressions. **Tables 3.5.2 and 3.5.3** reflect the history of hurricanes and tropical storms/depressions from 1965 to 2022 in Mississippi followed by storm surge events in **Table 3.5.4**. **Figures 3.5.3 to 3.5.5** are also provided by category to show the tracks of these storms as they entered the Gulf of Mexico.

Table 3.5.2
Hurricane/Tropical Storm Events
Presidential Disaster Declarations- Mississippi

Event/Declaration Number	Incident Period	Number of Counties Affected	Major Declaration Declared
Hurricane Ida DR-4626	August 28, 2021-September 1, 2021	82	October 22, 2021
Hurricane Zeta DR-4576	October 28, 2020-October 29, 2020	8	December 31, 2020
Hurricane Nate DR-4350	October 6-10, 2017	5	November 22, 2017
Hurricane Isaac DR-4081	August 26 – September 11, 2012	49	August 20, 2012
Hurricane Gustav DR-1794	August 28 – September 8, 2008	22	September 22, 2008
Hurricane Katrina DR-1604	August 29 – October 14, 2005	82	August 29, 2005
Hurricane Dennis DR-1594	July 10-15, 2005	41	July 10, 2005
Hurricane Ivan DR-1550	September 13-20, 2004	44	September 15, 2004
Tropical Storm Isidore DR-1436	September 23 – October 6, 202	10	October 1, 2002
Tropical Storm Allison DR-1382	June 6-13, 2001	8	June 21, 2001
Hurricane Georges DR-1251	September 25-October 5, 1998	13	October 1, 1998
Hurricane Elena DR-741	August 29 – September 4, 1985	4	September 4, 1985
Hurricane Frederic DR-599	September 13, 1979	13	September 13, 1979
Hurricane Camille DR-271	August 18, 1969	20	August 18, 1969
Hurricane Betsy DR-210	September 25, 1965	No County Information	September 25, 1965

Table 3.5.3
Mississippi Hurricane & Tropical Storm History
Non-Declared Events

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Storm (unnamed)	6/19/2021	Hancock, Harrison, Jackson, Pearl River	0	0	$120,000
Tropical Storm/Hurricane Delta	10/9/2020	Harrison, Walthall, Amite, Hancock, Wilkinson, Pike	0	2	$5,050,000
Hurricane Sally	9/16/2020	Hancock, Harrison, Jackson	0	0	$0

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Hurricane Laura	8/27/2020	Adams, Jefferson, Washington, Warren, Bolivar, Covington, Jones, Smith	0	0	$121,000
Hurricane Barry	7/13/2019	Hancock, Harrison, Jackson, Amite, Wilkinson	0	0	$0
Hurricane Michael	10/8/2018	Hancock, Harrison, Jackson	0	0	$0
Tropical Storm Gordon	9/4/2018	Forrest, Jones, Clarke, Jasper, Carrol, Smith, Scott, Covington, Grenada, Winston, Noxubee, Montgomery, Carroll, Grenada, Holmes, Leflore	0	0	$396,100
Tropical Storm Nate	10/8/2017	George, Wayne	0	0	$150,000
Hurricane Nate	10/7/2017	Hancock, Harrison, Jackson	0	0	$0
Tropical Storm Cindy	6/21/2017	Hancock, Harrison, Jackson	0	0	$0
Tropical Storm Isaac	8/28/2012	Adams, Amite, Claiborne, Copiah, Covington, Forrest, Franklin, Hancock, Harrison, Hinds, Issaquena, Jackson, Jefferson, Jefferson Davis, Jones, Lamar, Lawrence, Lincoln, Marion, Pearl River, Pike, Rankin, Simpson, Smith, Walthall, Wilkinson, and Warren	1	2	$7,375,000
Tropical Storm Lee	9/2/2011	Amite, Hancock, Harrison, Jackson, Pearl River, Pike, and Wilkinson	0	0	$55,000
Tropical Storm Ida	11/9/2009	Forrest, Hancock, Harrison, and Pearl River	0	0	$0
Tropical Storm Ike	9/11/2008	Hancock, Harrison, and Jackson	0	0	$0
Tropical Storm Gustav	9/2/2008	Adams, Claiborne, Copiah, Forrest, Franklin, Jefferson, Jefferson Davis, Lamar, Lawrence, Lincoln, and Marion	0	0	$5,850,000
Tropical Depression Rita	9/25/2005	Coahoma and Tunica	0	0	$10,000
Hurricane Rita	9/24/2005	Adams, Bolivar, Carroll, Claiborne, Copiah, Franklin, Hinds, Holmes, Humphreys, Issaquena, Jefferson, Jefferson Davis, Lawrence, Leflore, Lincoln, Madison, Marion, Rankin, Sharkey, Simpson, Sunflower, Warren, Washington, and Yazoo	0	0	$485,000

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Depression Dennis	7/11/2005	Calhoun, Chickasaw, Itawamba, Lee, and Union	0	0	$35,000
Hurricane Cindy	7/5/2005	Hancock, Harrison, Jackson, and Pearl River	0	0	$9,000,000
Tropical Storm Cindy	7/5/2005	Forrest, George, Greene, Lamar, and Stone	0	0	$200,000
Tropical Storm Arlene	6/10/2005	Clarke, Clay, Hancock, Harrison, Jackson, Kemper, Lauderdale, Lowndes, Noxubee, and Oktibbeha	0	0	$445,000
Tropical Storm Matthew	10/9/2004	Hancock, Harrison, and Jackson	0	0	$20,000
Tropical Storm Ivan	9/16/2004	Chickasaw, Itawamba, Lee, and Monroe	1	0	$30,000
Tropical Storm Bill	6/30/2003	Clarke, Covington, Forrest, Hancock, Harrison, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Marion, Newton, Pearl River, and Smith	0	0	$1,200,000
Hurricane Lili	10/3/2002	Adams, Amite, Attala, Carroll, Covington, Hancock, Harrison, Hinds, Jackson, Jasper, Leake, Leflore, Madison, Pearl River, Pike, Scott, Smith, Walthall, Warren, Washington, Wilkinson, and Yazoo	0	0	$13,900,000
Tropical Storm Hanna	9/14/2002	Hancock, Harrison, and Jackson	0	0	$0
Tropical Storm Bertha	8/4/2002	Hancock, Harrison, and Jackson	0	0	$50,000
Tropical Storm Hermine	9/19/1998	Hancock, Harrison, Jackson, and Pearl River	0	0	$85,000
Tropical Storm Earl	9/2/1998	Hancock, Harrison, and Jackson	0	0	$0
Hurricane Danny	7/17/1997	Hancock, Harrison, and Jackson	0	0	$0
Hurricane Opal	10/4/1995	Hancock, Harrison, and Jackson	0	1	$75,000
Hurricane Erin	8/20/1995	Greene, Perry, and Wayne	0	0	$100,000

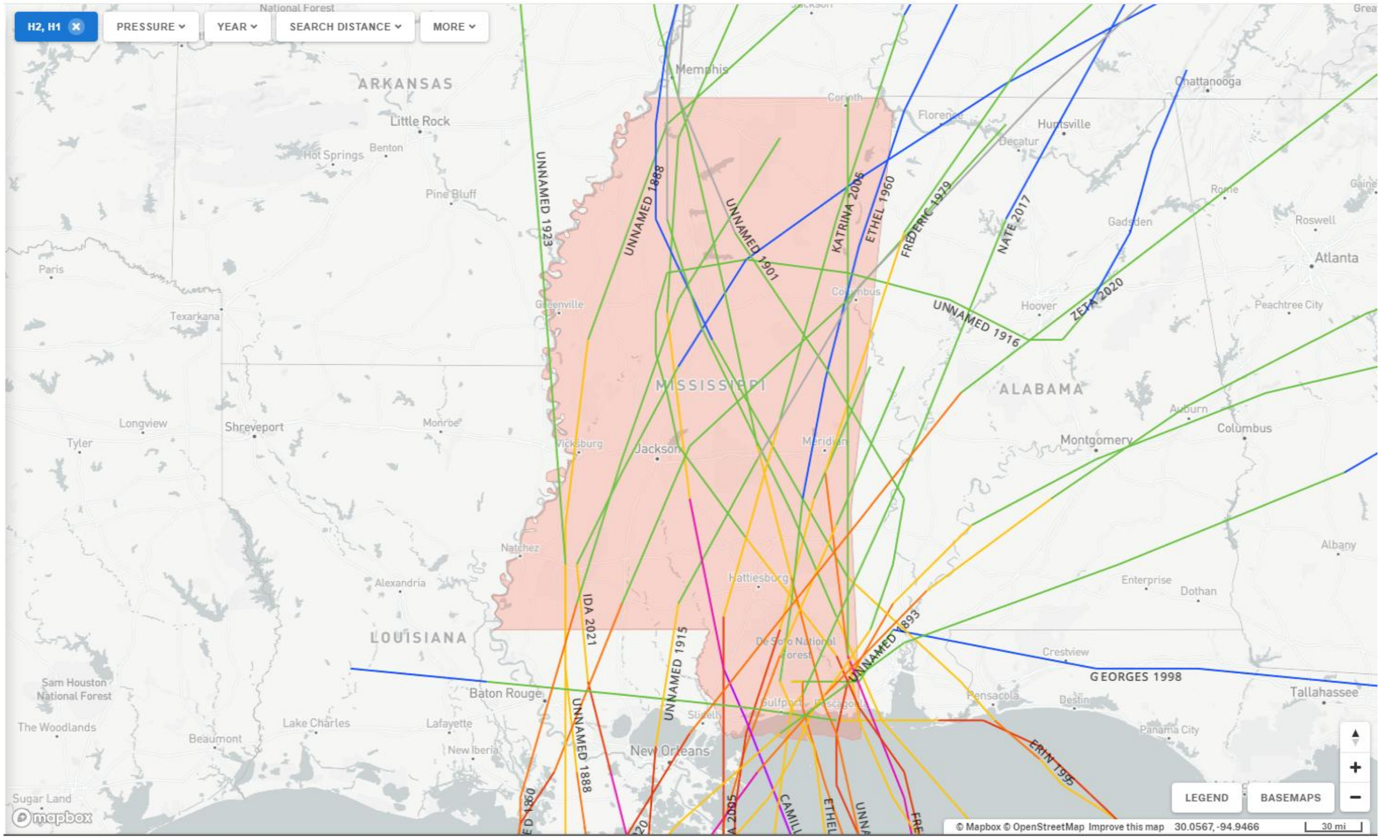
Source: NCEI

Table 3.5.4
Storm Surge History

Date	County	Property Damage ($)		Date	County	Property Damage ($)
8/28/2021	Hancock	$0		8/28/2012	Jackson	$600,000
	Harrison	$0			Harrison	$2,100,000
	Jackson	$0			Hancock	$2,100,000
6/19/2021	Hancock	$0		9/2/2011	Jackson	$10,000
	Harrison	$0			Hancock	$10,000
	Jackson	$0			Harrison	$10,000
10/28/2020	Hancock	$10,000,000		9/11/2008	Harrison	$0
	Harrison	$10,000,000			Jackson	$0
	Jackson	$0			Hancock	$0
10/10/2020	Hancock	$0		9/1/2008	Hancock	$1,250,000
	Harrison	$200,000			Harrison	$750,000
9/22/2020	Hancock	$0			Jackson	$500,000
	Jackson	$0		8/29/2005	Hancock	$3,380,000,000
9/15/2020	Hancock	$0			Harrison	$5,630,000,000
	Harrison	$0			Jackson	$2,250,000,000
	Jackson	$0		7/5/2005	Hancock	$500,000
7/11/2018	Hancock	$0			Harrison	$300,000
	Harrison	$0			Jackson	$200,000
	Jackson	$0		10/9/2004	Hancock	$15,000
10/8/2018	Hancock	$0			Harrison	$15,000
	Jackson	$0		9/15/2004	Harrison	$400,000
6/20/2017	Jackson	$0			Jackson	$1,200,000
	Harrison	$0			Hancock	$400,000
	Hancock	$0		6/30/2003	Jackson	$250,000
10/7/2017	Jackson	$0			Hancock	$500,000
	Harrison	$0			Harrison	$250,000
	Hancock	$0		10/13/2001	Hancock	$0
				2/15/1998	Harrison	$250,000
					Hancock	$500,000
					Jackson	$250,000
Total Estimated Property Damage				**$11,292,560,000**		

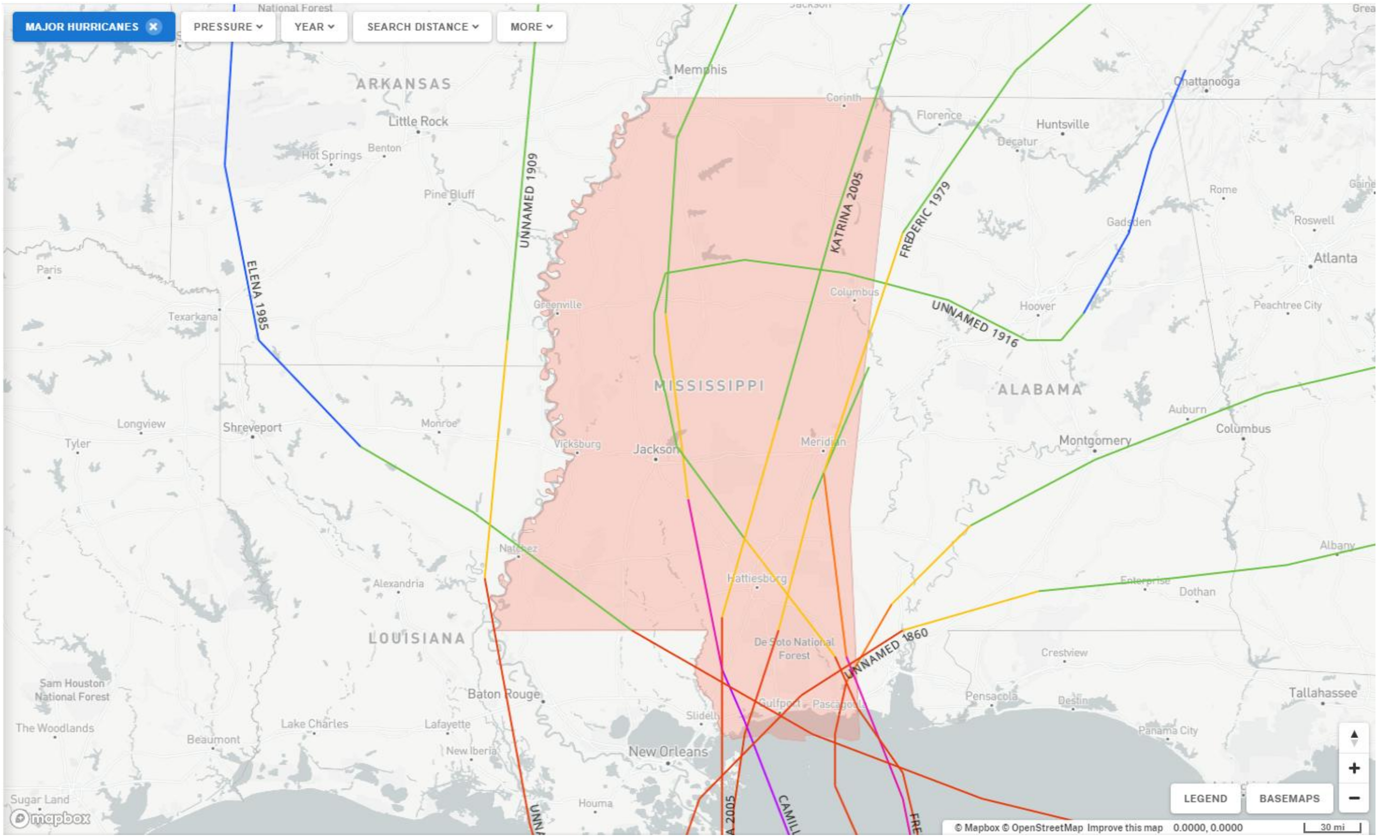
Source NCEI

Figure 3.5.3
Category 1 and 2 Historical Hurricanes
1852-2023



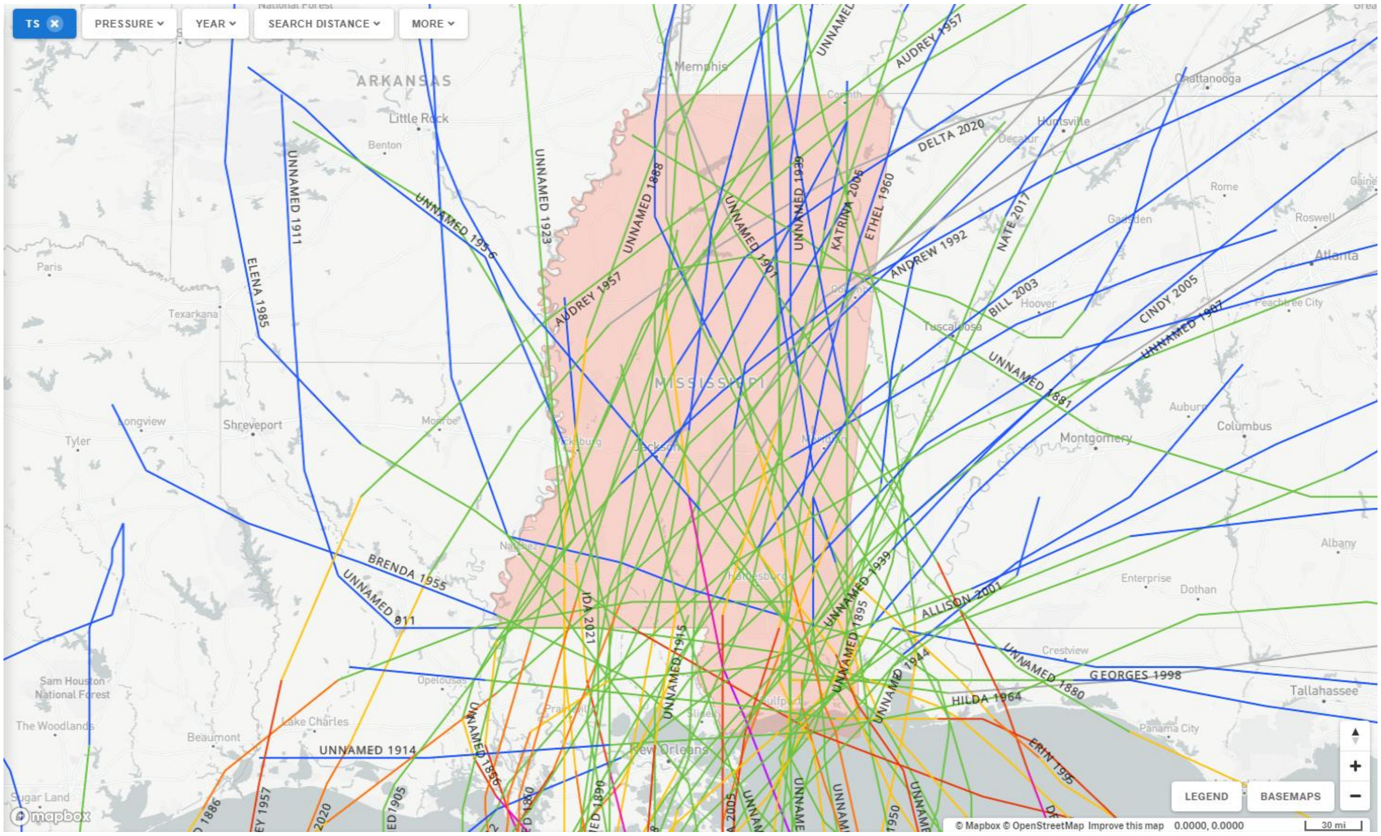
Source: www.csc.noaa.gov/hurricanes

Figure 3.5.4
Category 3, 4, and 5 Historical Hurricanes
1852-2023



Source: www.csc.noaa.gov/hurricanes

Figure 3.5.5
Historical Tropical Storms
1852-2023



Source: www.csc.noaa.gov/hurricanes

Summaries of the Presidentially declared disaster events that have occurred over the past ten years are provided below. The summaries also include data from the NCEI and FEMA on the impacts on people and property and the public assistance dollars obligated.

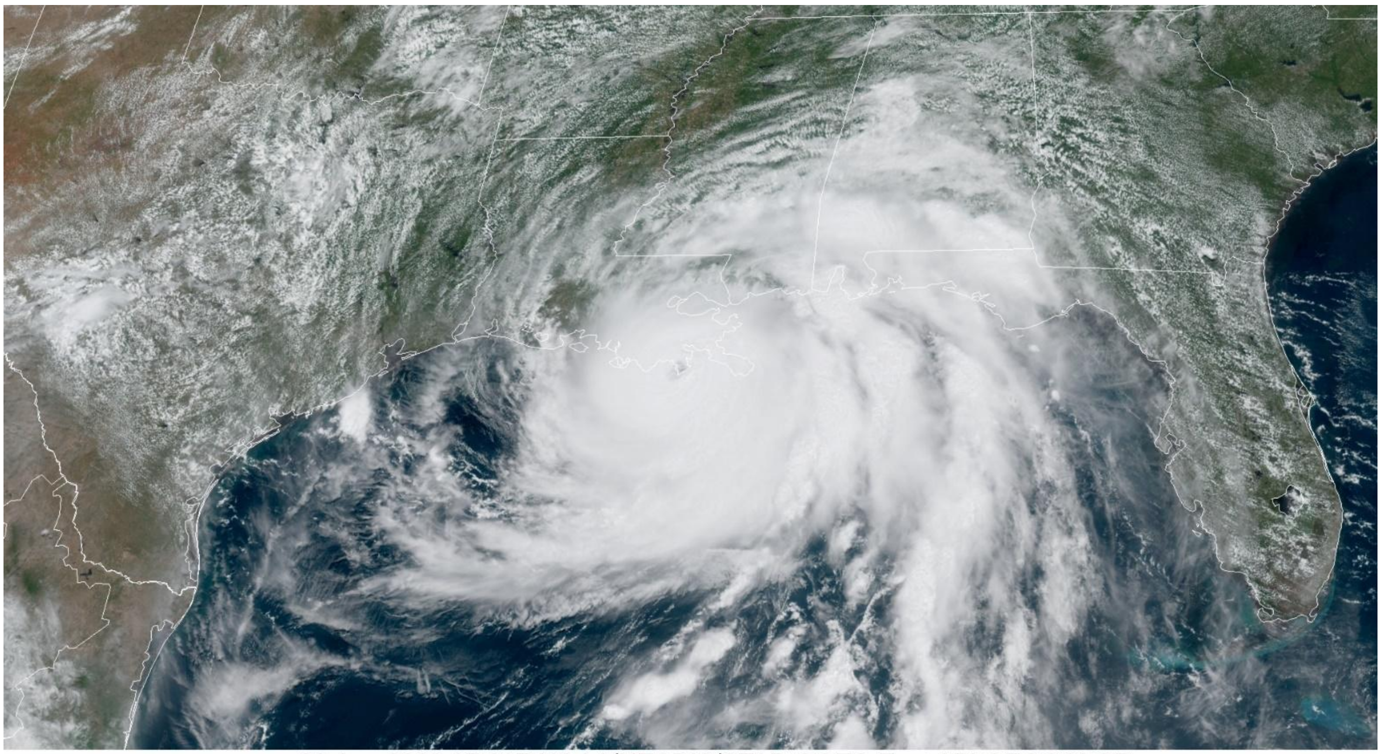
August 28, 2021 – Hurricane Ida

The ninth named storm, fourth hurricane, and second major hurricane of the 2021 Atlantic hurricane season, Ida originated from a tropical wave in the Caribbean Sea on August 23rd. On August 26th, the wave developed into a tropical depression, which organized further and became Tropical Storm Ida later that day, near Grand Cayman. On a northwestward track, Ida intensified into a hurricane on August 27, just before moving over western Cuba. A day later, the hurricane underwent rapid intensification over the Gulf of Mexico as it passed over a warm core eddy and reached major hurricane strength. It was just under 72 hours from tropical depression formation to category 4 strength with 150 mph winds. Ida remained at its peak intensity of 150 mph winds and a minimum central pressure of 929 millibars as it made landfall near Port Fourchon midday on August 29th. It didn't weaken to a tropical storm until it reached the Louisiana/Mississippi border. Ida produced over a dozen tornadoes and light to moderate wind damage across southwestern and coastal Mississippi. Around 100,000 residents were without power. Around 100 homes were damaged, and 6 were destroyed. Storm surge inundation ranged from a few feet in Jackson County to 7 feet in Harrison County.

Hurricane Ida caused approximately $10 million worth of damage.

Counties Affected	82
Deaths	0
Injuries	0
Estimated Property Damage	$11,280,000
Total Public Assistance Grants	$28,226,619
Emergency Work (Categories A-B)	$6,564,339
Permanent Work	$20,036,952

Satellite image of Hurricane Ida



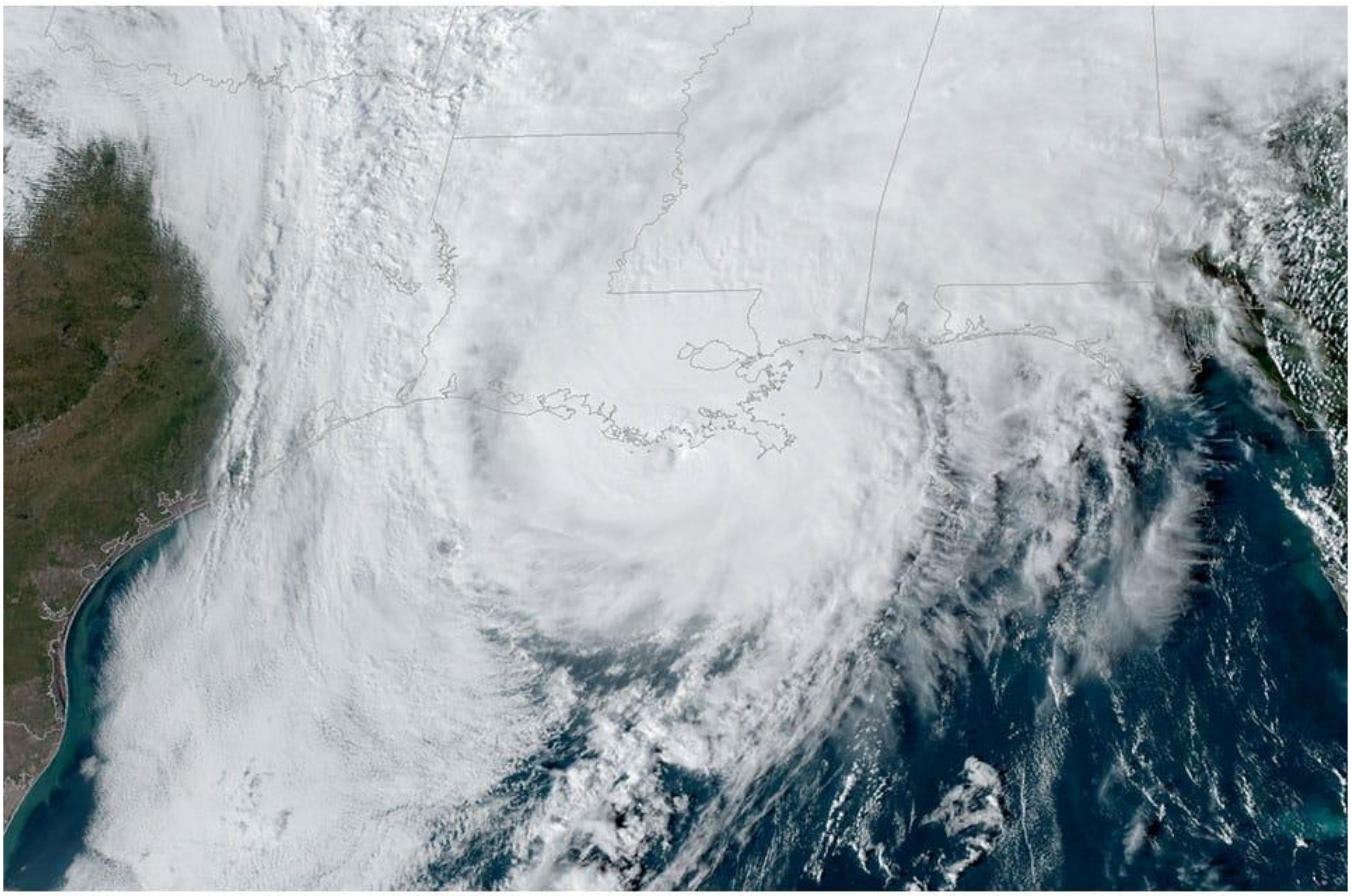
29 Aug 2021 17:01Z NOAA/NESDIS/STAR GOES-East ABI GEOCOLOR

October 28, 2020 – Hurricane Zeta

Hurricane Zeta formed in the northwestern Caribbean on the afternoon of October 24th and became the twenty-seventh named storm and eleventh hurricane of the 2020 Atlantic hurricane season. Before landfall, Zeta reached sustained wind speeds of 110 mph and became a Category 2 hurricane. Zeta produced extensive wind damage across coastal Mississippi with measured sustained winds up to 81 mph and gusts up to 104 mph. Thousands of power poles were downed and thousands of homes experienced minor damage. Storm surge ranged from a few feet to several feet. There were 2 fatalities and 75 injuries. Hurricane Zeta caused approximately $90 million worth of damage. Zeta was the record-tying sixth hurricane to make landfall in the United States and the record-fifth named storm to strike Louisiana in 2020.

Counties Affected	8
Deaths	1
Injuries	0
Estimated Property Damage	$125,150,000
Total Public Assistance Grants	$115,522,249
Emergency Work (Categories A-B)	$55,348,969
Permanent Work	$55,202,714

Satellite image of Hurricane Zeta



November 22, 2017- Hurricane Nate

Hurricane Nate originated in the Western Caribbean and was an unusually fast-moving storm, which caused widespread destruction and casualties in Central America. Hurricane Nate moved through the Yucatan Channel and into the Gulf of Mexico on October 7, 2017. The next day, Hurricane Nate made landfall near the mouth of the Mississippi River in Louisiana. After crossing the marshland of the delta, Hurricane Nate made its second U.S. landfall in Biloxi, Mississippi. Hurricane Nate caused a storm surge along the coastline, as well as rip currents, hurricane-force winds, and beach erosion.[i]

Counties Affected	6
Deaths	0
Injuries	0
Estimated Property Damage	$125,000
Total Public Assistance Grants	$986,297
Emergency Work (Categories A-B)	Not Available
Permanent Work	Not Available

Source: NCEI and FEMA

Satellite image of Hurricane Nate

August 28, 2012–Hurricane Isaac

Hurricane Isaac entered the Gulf of Mexico as a tropical storm on August 26, 2012, moving northwest after crossing Haiti, Cuba, and the Florida Straits. Isaac moved slowly north-northwest over the eastern Gulf. Isaac strengthened into a hurricane on the morning of the 28th when it was 75 miles south-southeast of the mouth of the Mississippi River. Isaac made landfall in Plaquemines Parish as a Category 1 Hurricane near the Southwest Pass of the Mississippi River on the evening of the 28th. A second landfall occurred near Port Fourchon the following morning. The storm weakened to a tropical storm on the afternoon of the 29th about 50 miles west southwest of New Orleans and weakened further to a tropical depression on the afternoon of the 30th near Monroe, Louisiana.

Even though Isaac was of hurricane status from near the mouth of the Mississippi River into southeast Louisiana, only tropical storm force winds were recorded on land areas of Mississippi. The maximum sustained wind in south Mississippi was 46 knots or 53 mph measured at the Gulfport- Biloxi-Airport during the early afternoon of August 29th. A portable weather station (Weatherflow Inc) near Gulfport measured a 48-knot gust, or 55 mph, late on the morning of August 29. A maximum wind gust of 58 knots or 67 mph was recorded at the NOAA NOS Bay Waveland station and Gulfport (Weatherflow Inc) late on the morning of Aug 29. The long duration of tropical-storm-force winds downed some trees and power lines across the region.

The minimum sea level pressure measured from a land station was 995.9 mb at the NOAA-NOS station at Bay-Waveland station during the early morning of Aug 29th. A storm tide ranged from approximately 5 feet in Jackson County to nearly 10 feet in Hancock County closer to Isaac's center. These values are approximately 3 to 8 feet above normal astronomical values. Storm surge flooding impacts were the greatest in Hancock County. Persistent rain bands affected south Mississippi, especially the coastal sections, and produced heavy rainfall over three days. 10 to 20 inches of rainfall was common across the region. A cooperative observer near Pascagoula recorded the maximum reading of 22.20 inches of rain. Heavy rainfall produced both flash flooding and later moderate-to-major river flooding. Record crests were observed on the Wolf River near Landon (August 31) and Gulfport (September 1), and the East Hobolochitto River near Caesar (Aug 31). Storm surge and high tides restricted the outflow of the rivers near the coast and lakes exacerbating flooding of low-lying areas along rivers and bayous near the coast as they emptied into the Gulf. There were two weak tornadoes documented that occurred along the Mississippi coast, resulting in minor property damage

Overall, impacts from Isaac resulted in millions of dollars in damages in south Mississippi and one direct fatality. Much of the damage in the coastal counties of Hancock, Harrison, and Jackson was related to storm surge on the coast, flash flooding, or river flooding. The chart below provides a summary of the reported impacts on people and property damage from NCEI and the dollars obligated to date for public assistance through FEMA.

Counties Affected	49
Deaths	1
Injuries	2
Estimated Property Damage	$7,375,000
Total Public Assistance Grants	$37,002,798
Emergency Work (Categories A-B)	$23,061,498
Permanent Work	$13,941,300

Source: NCEI and FEMA

Satellite image of Hurricane Isaac

September 1, 2008- Hurricane Gustav

Hurricane Gustav made landfall as a Category 2 hurricane near Cocodrie, LA on the morning of September 1, 2008. Gustav continued to move northwest and weakened to a Category 1 storm over south-central Louisiana later that day. The highest wind gust recorded in south Mississippi was 74 mph at the Gulfport-Biloxi International Airport while the highest sustained wind of 54 mph was recorded at the Waveland Yacht Club. No official wind observations were available in far southwest Mississippi; however, hurricane-force wind gusts may have occurred. Rainfall varied considerably, ranging from around 4 to 10 inches. Gustav produced mainly light wind damage across coastal Mississippi, although more significant and concentrated damage occurred in southwest Mississippi closer to the track of the center of the storm. Widespread power outages occurred in southern Mississippi.

Counties Affected	22
Deaths	0
Injuries	0
Estimated Property Damage	$19,370,000
Total Public Assistance Grants	$33,702,564
Emergency Work (Categories A-B)	$19,932,178
Permanent Work	$12,657,491

Source: NCEI and FEMA

Satellite image of Hurricane Gustav

August 28, 2005 - Hurricane Katrina

Hurricane Katrina was one of the most destructive hurricanes on record to impact the coast of the United States. It was one of the worst natural disasters in the history of the U.S., resulting in catastrophic damage and numerous casualties along the Mississippi coast. Damage and casualties resulting from Hurricane Katrina extended as far east as Alabama and the panhandle of Florida. Post-event analysis by the National Hurricane Center indicates that Katrina weakened slightly before making landfall as a strong Category 3 storm during its initial landfall in lower Plaquemines Parish. The storm continued a north-northeast track with the center passing about 40 miles southeast of New Orleans with a second landfall occurring near the Louisiana and Mississippi border as a Category 3 storm with maximum sustained winds estimated at 121 mph. Katrina continued to weaken as it moved north-northeast across Mississippi during the day but remained at hurricane strength 100 miles inland.

Damage across coastal Mississippi was catastrophic. The storm surge associated with Hurricane Katrina approached or exceeded the surge associated with Hurricane Camille (1969) and impacted a wider area. Almost total destruction was observed along the immediate coast in Hancock and Harrison Counties with storm surge damage extending north along bays and bayous to Interstate 10. Thousands of homes and businesses were destroyed by the storm surge. Hurricane-force winds caused damage to roofs, power lines, signage, downed trees, and some windows were broken by wind and wind-driven debris in areas away from storm surge flooding. Wind damage was widespread with fallen trees causing damage to houses and power lines. Excluding losses covered by the National Flood Insurance Program (NFIP), insured property losses in Mississippi were estimated at $9.8 billion. Uninsured and insured losses combined were estimated to exceed $100 billion across the Gulf Coast.

Satellite image of Hurricane Katrina

The NCEI reports that tide gauges were destroyed by Hurricane Katrina; therefore, storm surge was determined by post-storm high water marks. It was estimated that the storm surge along Harrison County was between 19 and 25 feet. 23 feet was recorded at the Hancock County EOC operations area in Waveland, and the high-water mark measured on the Jackson County EOC building in Pascagoula was 16.1 feet. Total rainfall amounts generally ranged from 10 to 16 inches across coastal and south Mississippi with much lower amounts observed over southwest Mississippi. The highest observed rainfall was 11 inches at Stennis Space Center and near Picayune. To help understand the total effects of this catastrophic event, a storm surge, and HAZUS final wind field figures are presented as **Figures 3.5.6 and 3.5.7**.

Counties Affected	82
Deaths	238
Injuries	Undetermined
Estimated Property Damage	$80,000,000,000
Total Public Assistance Grants	$3,237,615,391
Emergency Work (Categories A-B)	$1,170,007,750
Permanent Work	$1,885,105,865

Source: NCEI and FEMA

Figure 3.5.6
Hurricane Katrina Storm Surge Map

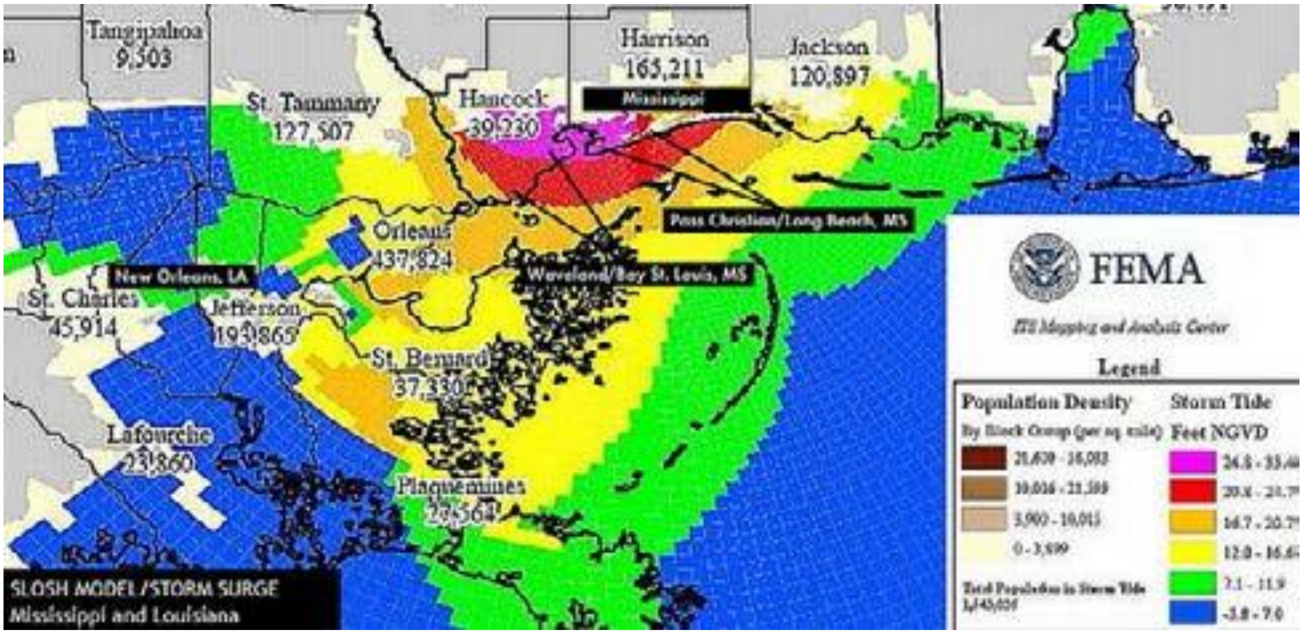
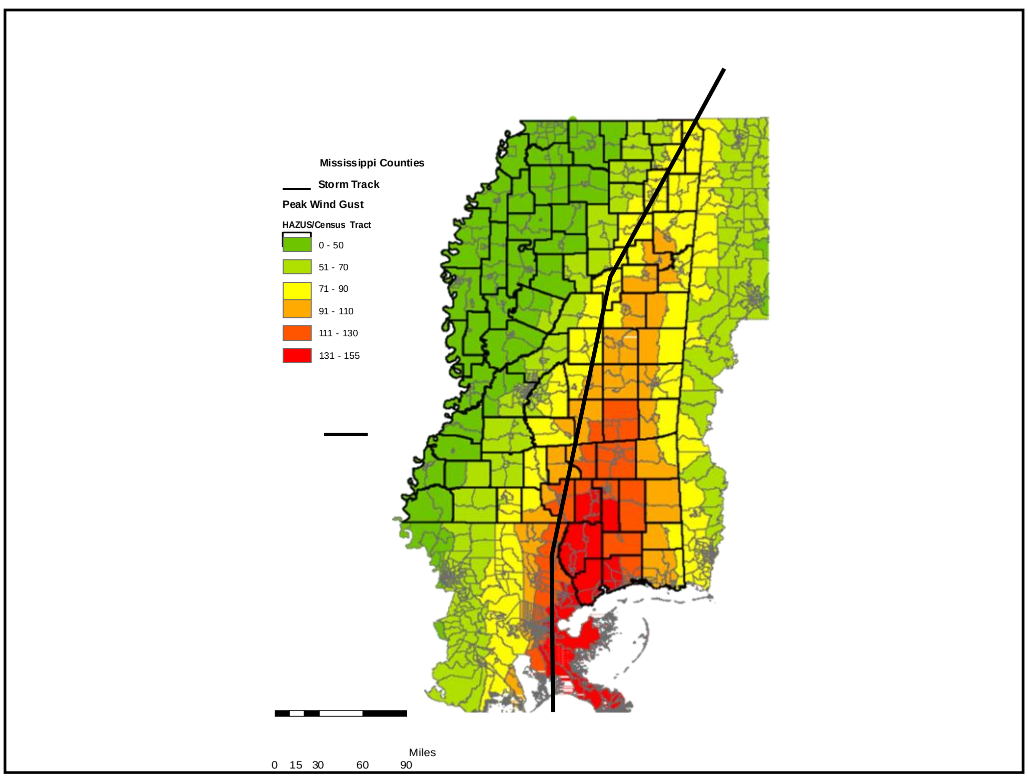


Figure 3.5.7
Hurricane Katrina Peak Gust by Census Track
HAZUS and Wind Field

Peak Gust by Census Track
HAZUS Final Wind Field



July 10, 2005 – Hurricane Dennis

Hurricane Dennis entered the Gulf of Mexico as a hurricane. After crossing over Cuba, Dennis moved into the central Gulf of Mexico and strengthened to a Category 4 hurricane on July 10th. Hurricane Dennis weakened to a Category 3 hurricane before making landfall along the western Florida panhandle. The Mississippi Gulf Coast experienced some tropical weather from Hurricane Dennis. The highest wind gusts over land in Mississippi were reported at Keesler Air Force Base at 46 mph. The highest wind gusts over water adjacent to Mississippi was 52 mph from a buoy located 22 miles south-southeast of Biloxi. Rainfall on the Mississippi Gulf Coast was reported to be less than 2 inches. The lowest reported pressure on the Mississippi Gulf Coast was 994.2 mb, and the highest reported tide was 4 feet MMSL at Waveland (NCEI: Event Details). Harrison County received public assistance under a Presidential Disaster Declaration.

Counties Affected	41
Deaths	0
Injuries	0
Estimated Property Damage	$2,550,000
Total Public Assistance Grants	$1,707,563
Emergency Work (Categories A-B)	$1,735,639
Permanent Work	$0

Source: NCEI and FEMA

Satellite image of Hurricane Dennis

September 16, 2004, Hurricane Ivan

Hurricane Ivan made landfall near Gulf Shores, Alabama as a Category 3 hurricane on the morning of September 16, 2004. The storm caused extensive damage in Coastal Alabama and Florida. Harrison and Hancock Counties experienced tropical storm force winds. A wind gust of 78 mph was captured at Point Cadet in Biloxi. The lowest pressure reported on the Mississippi Gulf Coast was 975.6 mb at the Jackson County Emergency Operations Center. Keesler Air Force Base captured a low pressure of 982.9 mb about two hours later. The highest storm surge on the Mississippi Gulf Coast was at the mouth of the Pascagoula River and was 3.72 ft NGVD. A Presidential Disaster Declaration was made, providing individual assistance to residents of Harrison County and public assistance to local governments in Harrison County.

Counties Affected	44
Deaths	1
Injuries	0
Estimated Property Damage	$9,720,000
Total Public Assistance Grants	$14,403,026
Emergency Work (Categories A-B)	$10,113,755
Permanent Work	$4,289,274

Source: NCEI and FEMA

Satellite image of Hurricane Ivan

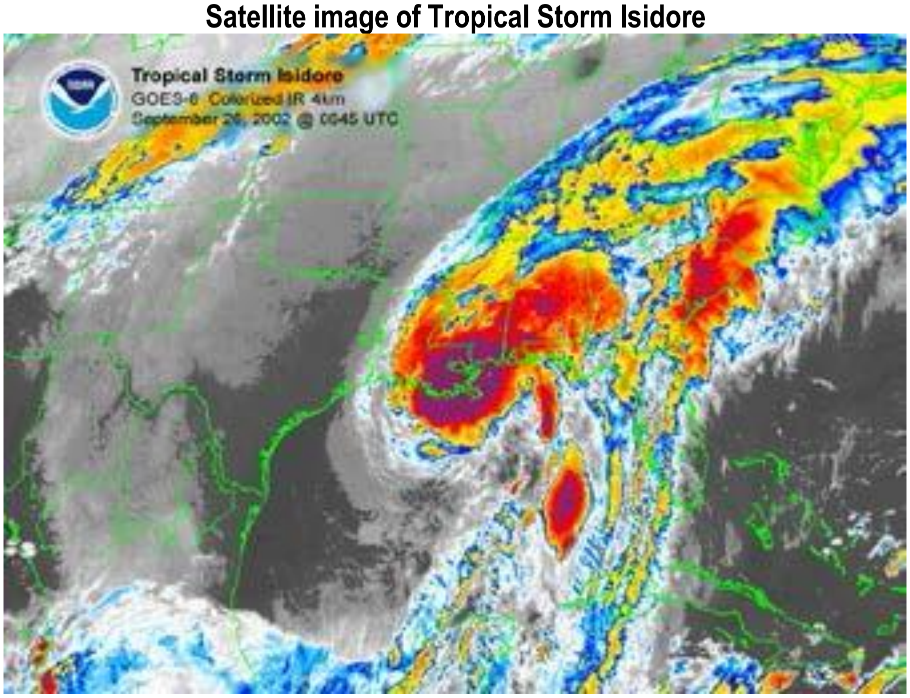
September 26, 2002-Tropical Storm Isidore

Tropical Storm Isidore made landfall near Grand Isle, LA during the early morning of September 26, 2002. The tropical storm moved north across southeast Louisiana and by the evening was located in central Mississippi, where it was downgraded to a tropical depression. Tropical Storm Isidore had a large circulation with tropical-storm-force winds extending several hundred miles from its center. Tide levels were generally 4 to 7 feet above normal, with locally higher levels across much of coastal Mississippi. Significant beach erosion occurred along the coast and on the barrier islands. The maximum storm surge reading on the Mississippi Coast was 7.61 feet NGVD at the Corps of Engineers tide gage at Gulfport Harbor, and 6.86 feet NGVD in Biloxi Bay at Point Cadet. There were two fatalities on the Mississippi Coast related to the tropical storm; one direct and another indirect. Rainfall amounts associated with Isidore were generally 5 to 8 inches and resulted in some river flooding and flash flooding. Approximately 2,500 homes in Hancock County and 1,400 homes in Harrison County were flooded as a result of the storm surge, with river flooding and flash flooding causing some of the flood damage.

Counties Affected	10
Deaths	1
Injuries	0
Estimated Property Damage	$25,500,000
Total Public Assistance Grants	$6,784,617
Emergency Work (Categories A-B)	$999,661
Permanent Work	$5,784,956

Source: NCEI and FEMA

Satellite image of Tropical Storm Isidore



Probability of Hurricane Future Events

Researchers have studied the probability of a tropical cyclone landfall and guest calculations for 17 regions from Brownsville, Texas to Eastport, Maine. A web page that displays this information has been created as a joint project between the Tropical Meteorology Project at Colorado State University, Fort Collins, Colorado, and the GeoGraphics Laboratory at Bridgewater State College, Bridgewater, MA. (http://hurricanepredictor.com/County.aspx). A warmer atmosphere and warmer ocean are increasing the likelihood that Atlantic hurricanes will be more intense (have stronger winds), intensify more rapidly, produce more rainfall, and move more slowly.

Tables 3.5.5 and 3.5.6 break down the probability by coastal county for 2023 and the next 50-year period.

Table 3.5.5
2023 Hurricane Landfall Probability

Probability	George	Hancock	Harrison	Jackson	Pearl River	Stone
Probability of 1 or more named storms making landfall	7.4%	6.1%	8.0%	8.9%	7.5%	7.2%
Probability of 1 or more hurricanes making landfall	3.7%	3.1%	4.0%	4.4%	3.8%	3.6%
Probability of 1 or more intense hurricanes making landfall	1.7%	1.4%	1.8%	2.0%	1.7%	1.6%
Probability of tropical storm force (>= 40 mph) wind gusts	50.7%	50.7%	50.7%	50.7%	50.7%	50.7%
Probability of hurricane force (>=75 mph) wind gusts	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%
Probability of intense hurricane force (>= 115 mph) wind gusts	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%

Source: http://hurricanepredictor.com/County.aspx

Table 3.5.6
50-Year Hurricane Landfall Probability

Probability	George	Hancock	Harrison	Jackson	Pearl River	Stone
Probability of 1 or more named storms making landfall	88%	82.7%	90.3%	92.5%	88.6%	87.4%
Probability of 1 or more named hurricanes making landfall	64.2%	57.3%	67.6%	71.4%	65%	63.4%
Probability of 1 or more intense hurricanes making landfall	36.9%	31.8%	39.7%	42.9%	37.6%	36.3%
Probability of tropical storm force (>= 40 mph) wind gusts	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
Probability of hurricane force (>=75 mph) wind gusts	99.6%	99.6%	99.6%	99.6%	99.6%	99.6%
Probability of intense	82.3%	82.3%	82.3%	82.3%	82.3%	82.3%

Probability	George	Hancock	Harrison	Jackson	Pearl River	Stone
hurricane force (>= 115 mph) wind gusts						

Source: http://hurricanepredictor.com/County.aspx

Assessing Vulnerability

In assessing Mississippi's vulnerability to damage and loss of life from hurricanes and tropical storms, at the top of the list is the loss of life and property due to flooding. Mississippi's citizens are vulnerable to hurricanes. The very young, the elderly, and the handicapped are especially vulnerable to harm from hurricanes. Not only are residents' homes vulnerable to hurricanes, but also public buildings, infrastructure, and natural resources are all subject to damage. In some cases, the damage to natural resources cannot be restored to pre-incident levels.

Damages from Flooding Due to Hurricanes

Torrential rains from hurricanes and tropical storms can produce extensive urban and riverine flooding. Winds from these storms located offshore can drive ocean water up the mouth of a river, compounding the severity of inland overbank flooding.

In addition to the combined destructive forces of wind, rain, and lightning, hurricanes can cause a "surge" in the ocean, which can raise the sea level as high as 25 feet or more in the strongest hurricanes. This "storm surge" also can have the opposite effect, in that the sea level can be lowered to below mean sea level at the backside of a hurricane. This phenomenon causes more destruction as storm surge waters are sucked back out to sea. For more information on flood-related losses from hurricanes see the flood section of the risk assessment.

Vulnerability of People to Hurricanes

For those who are unable to evacuate for medical reasons, there should be provision to take care of special-needs patients and those in hospitals and nursing homes. Many of these patients have specific pharmaceutical needs or require intensive medical care. There is a need to provide ongoing treatment for these vulnerable citizens, either on the coast or by air evacuation to upland hospitals. The stress from disasters such as a hurricane can result in immediate and long-term physical and emotional health problems among victims.

According to U.S. Census Bureau 2020 American Community Survey, there were 6,969 non-institutionalized persons residing in Hancock County with various disabilities. There were 35,003 in Harrison County and 24,816 in Jackson County. The types of disabilities include hearing, vision, cognitive, ambulatory, self-care, and/or independent living difficulties. Together these counties accounted for a total of 66,788 persons with disabilities who may need assistance in evacuating from a major hurricane.

Total population vulnerability in the high-risk counties has increased for Jackson and Harrison Counties and decreased for Hancock County. **Table 3.5.7** compares the 2012 and 2020 populations.

Table 3.5.7
Vulnerable Populations in High-Risk Counties Updated

County	City	2012 Population	2020 Population
Jackson	Pascagoula	3,524	3,202
	Moss Point	3,370	2,449
	Gautier	2,955	2,673
	Ocean Springs	3,066	3,141
	Jackson County (unincorporated area)	10,136	13,351
Jackson County Totals		**23,051**	**24,816**
Harrison	Biloxi	5,605	5,986
	Gulfport	10,417	11,372
	Pass Christian	680	996
	D'Iberville	1,232	2,239
	Long Beach	2,017	2,383
	Harrison County	6,470	12,027
Harrison County Totals		**26,421**	**35,003**
Hancock	Bay St. Louis	1,655	1,929
	Waveland	1,446	970
	Diamondhead	1,055	1,189
	Hancock County (unincorporated areas)	2,933	2,881
Hancock County Totals		**7,089**	**6,969**

Source: Based on 2012 and 2020 U.S. Census American Community Survey 5-Year Estimates. Total population includes cities and unincorporated areas

The need for efficient evacuation by Gulf Coast residents in their personally-owned vehicles has been expedited, utilizing the National Weather Service's storm surge model Sea, Lake, and Overland Surges from Hurricanes (SLOSH) Model. Modelers examined the population density of each coastal county, the capability of evacuation roads to handle evacuees, and the topography (which areas would flood first in the event of a hurricane) to establish evacuation zones. These zones identify who should leave and in what order based on which areas are most vulnerable to storm surge. This assignment of evacuation zones enables residents to assess their vulnerability to a hurricane, given their location. Local officials can then call for an evacuation of the particular zone when the need exists.

The model, developed in 2000, has been effectively implemented in the evacuation of people in their vehicles. If used on a timely basis, and given sufficient warning, this SLOSH model is effective in saving lives in the Gulf Coast counties of Hancock, Harrison, and Jackson.

The Mississippi Department of Transportation's (MDOT) Statewide Traffic Management Center (TMC) provides coordinated and timely management of all traffic conditions. In addition to keeping citizens safer and more informed during routine travel, the TMC provides improved emergency event coordination and incident management compared to previous years.

The TMC has enhanced MDOT's ability to respond to traffic-flow impediments resulting from adverse weather, debris in the roadway, and the presence of hazardous materials. MDOT utilizes 260 traffic cameras located throughout the state to accomplish this. Once an incident is detected, the operations staff initiates an appropriate response by coordinating closely with other state and local agencies and disseminating real-time information to emergency responders and the public. In addition, the TMC has helped staff establish close working relationships with similar TMC's in border states to more efficiently coordinate regional responses.

When the Traffic Engineering Desk at the Mississippi Emergency Management Agency (MEMA) is operational, the TMC is capable of relaying incident information to contribute to MEMA's situational awareness. A similar working relationship exists with state and local law enforcement agencies to address any impediments to the flow of traffic during emergencies, especially during evacuation events.

Contraflow is the practice of turning traffic flow in one direction on controlled-access routes during times of emergency evacuation. It was first implemented in Mississippi during Hurricane Katrina. The purpose of contraflow is to quickly and efficiently assist the state of Louisiana in evacuating the greater New Orleans area by reversing southbound lanes of I-55 and I-59 to northbound flow. Contraflow is only implemented when requested by Louisiana and approved by the Governor of Mississippi. After Hurricane Katrina, MDOT's post-disaster evaluation indicated that changes should be made to contraflow to improve operations. The primary improvement included extending the termination point of the I-59 contraflow to just south of Hattiesburg. During Hurricane Katrina, I-59 contraflow in Mississippi extended from the Mississippi/Louisiana state line to just south of Poplarville. Contraflow for I-55 begins in Louisiana and extends into Mississippi to just south of Brookhaven. An evacuation and contraflow map with primary and alternate evacuation routes is provided in Appendix 7.3.5-A.

Loss of Life from Hurricanes

In general, loss of life and property due to high winds is confined to the coastal area. This loss of life is due to wind-borne glass, building materials, and limbs and shrubs. Upland losses can be attributed to rain damage and flooding as well as tornadoes. Flooded road crossings in upland and coastal areas frequently pose significant risks to the motoring public.

Most deaths due to hurricanes are flood-related. Both coastal and inland flooding are common occurrences with hurricanes and tropical storms. The death toll from Mississippi hurricanes amounts to 391 persons. This includes 238 persons who died in Hurricane Katrina, 152 who died in Hurricane Camille, and two who died in Hurricane Georges. Ninety percent of the deaths in hurricanes involve water-related or flooding deaths. The remaining deaths are due to the impacts of wind and wind-borne projectiles.

Effective warnings and timely evacuation from coastal areas inundated by storm surge have shown a dramatic reduction in deaths. Evacuation ensures that nobody remains present in the hazard area.

Vulnerability of Natural Resources to Hurricanes

Natural resources are particularly vulnerable to hurricanes. The erosion of the coastline is considerable due to the impact of wind, waves, and debris in a hurricane event. Beaches need to be replenished with appropriate materials to reduce erosion. Storm surge and subsequent erosion of the shoreline lead to the loss of property. The Barrier Islands - Cat, Horn, Petit Bois, and Ship protect the Mississippi Gulf Coast but have experienced damage from earlier events and are at risk of being permanently lost. Inland rivers and lakes can become clogged with wind-blown debris and trees, thus slowing recovery from a hurricane. Obstructions, if not removed, can create conditions favorable for flooding.

Trees that are blown down to the forest floor quickly become a target for infestation from insects that may spread to healthy trees. Water quality may suffer due to unwanted debris and vegetation blown in from a hurricane. Potential debris from fallen trees affected by hurricanes and tornadoes that often accompany them can create wildfires when the area dries sufficiently to allow for burning through lightning or human.

According to research conducted by the U.S.G.S - Historical Changes in the Mississippi-Alabama Barrier-Island Chain and the Roles of Extreme Storms, Sea Level and Human Activities (Robert A. Morton), the islands off the coast of Mississippi are seeing a decline in land mass. These islands provide not only storm protection but also have a high social value for their recreational offerings.

Figures 3.5.8 to 3.5.11 are provided to show the location of the barrier islands and the changes in their land mass between 1847 to 2007.

Figure 3.5.8
Mississippi Barrier Islands

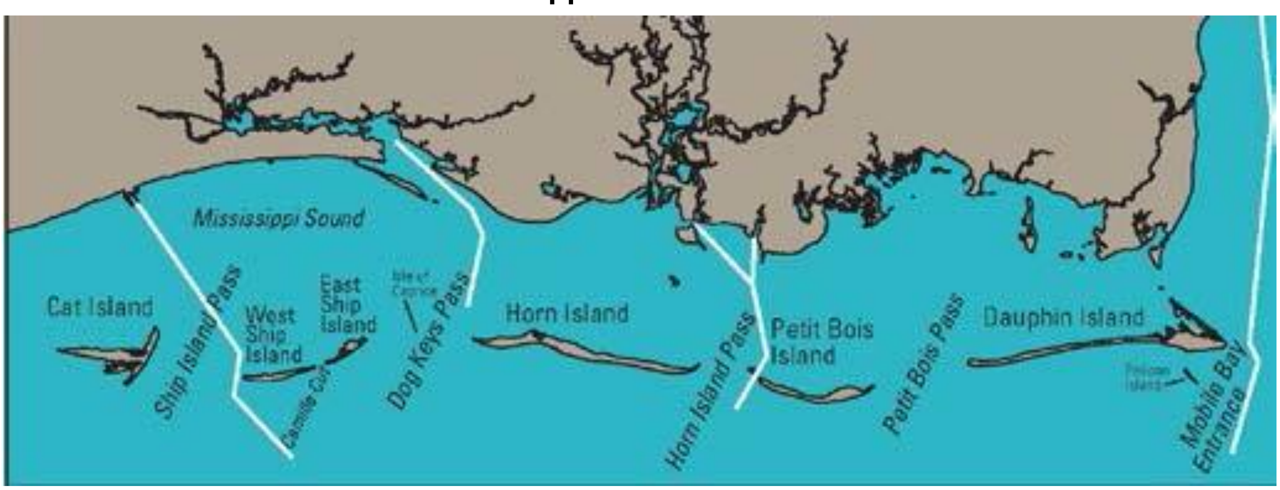
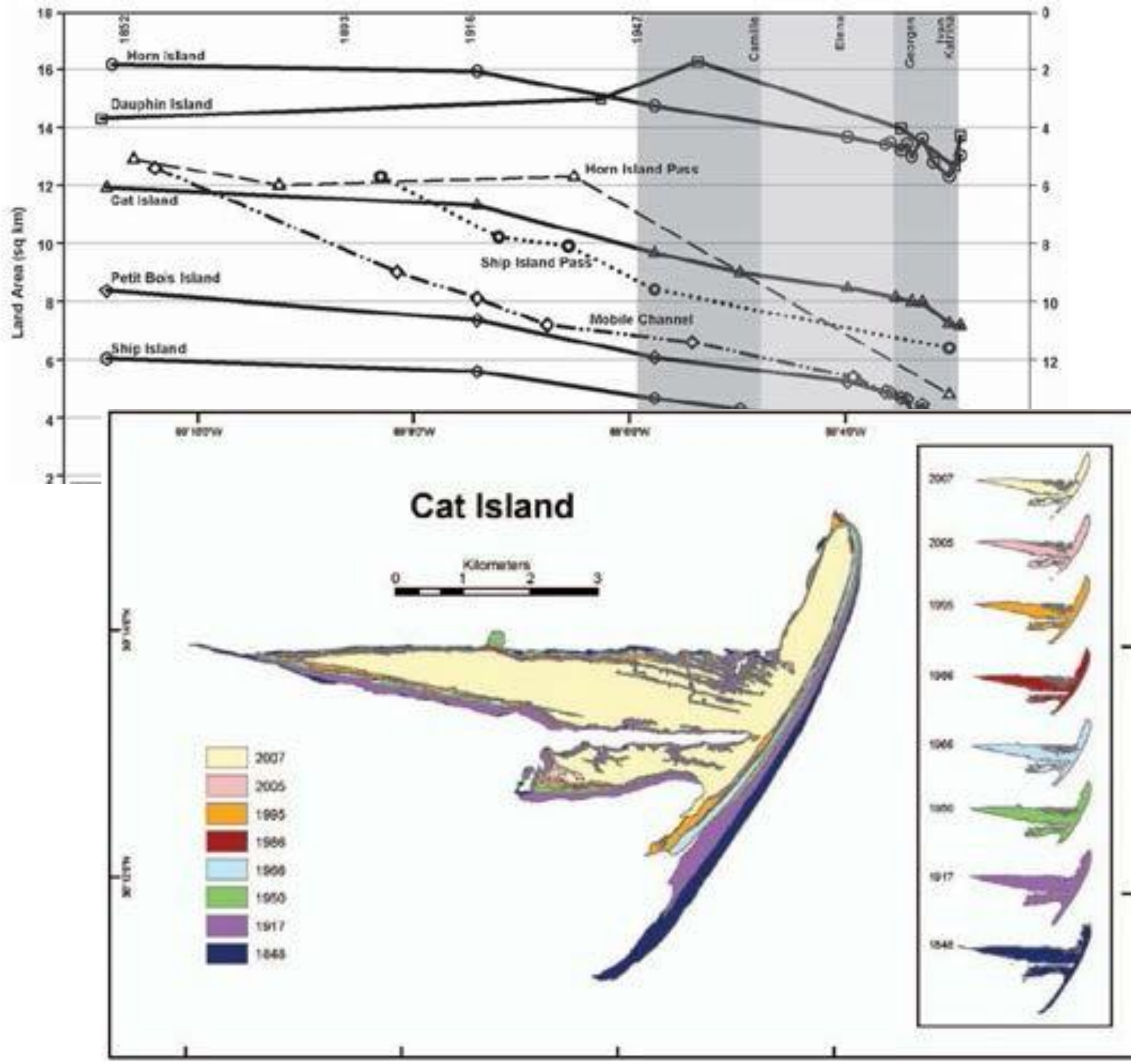
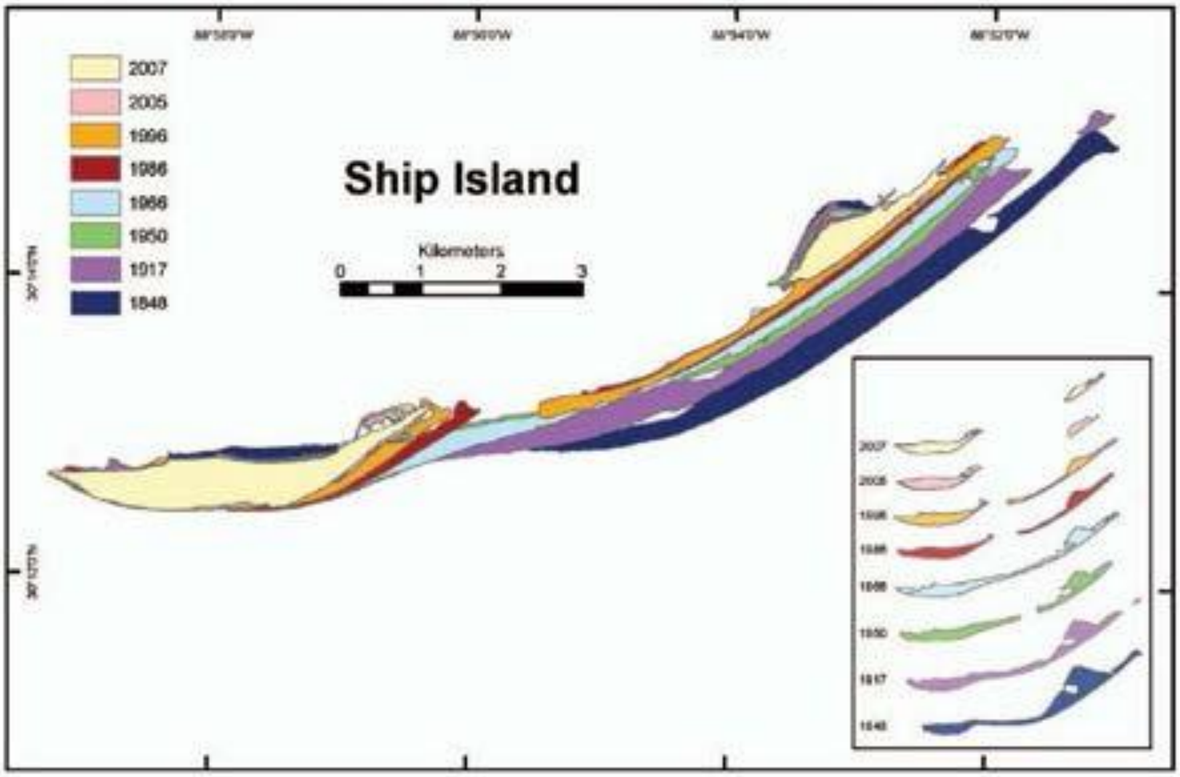
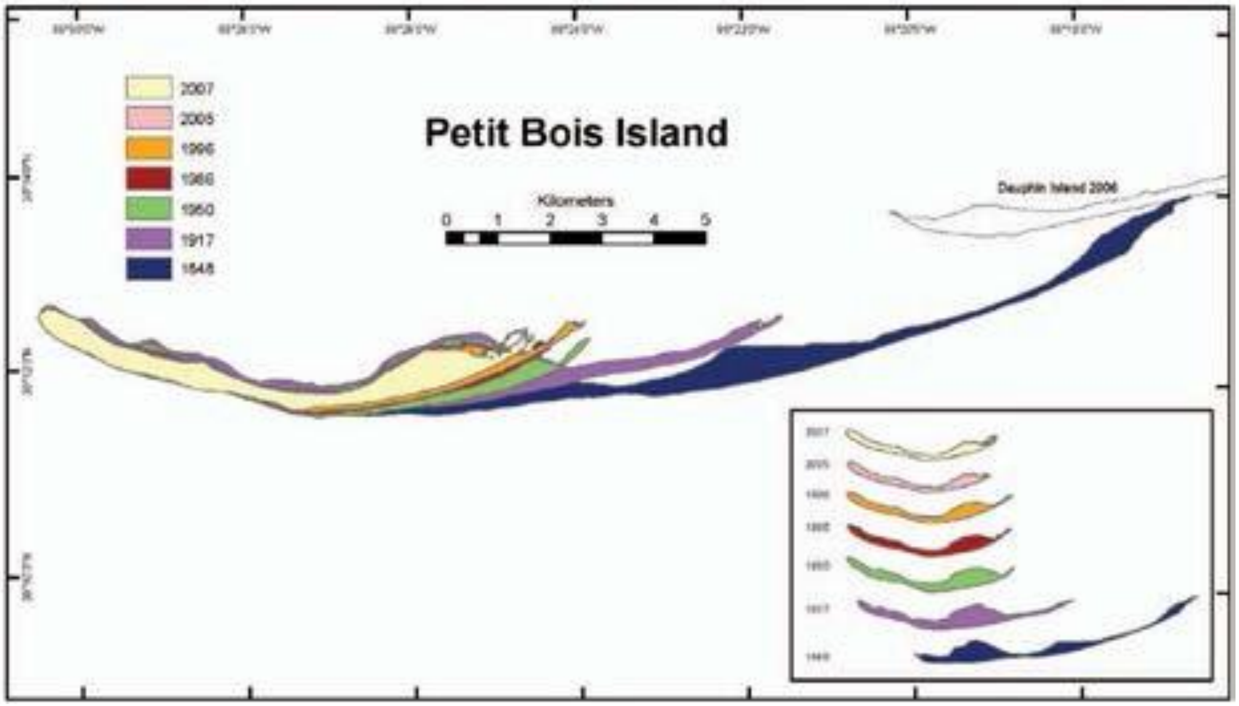


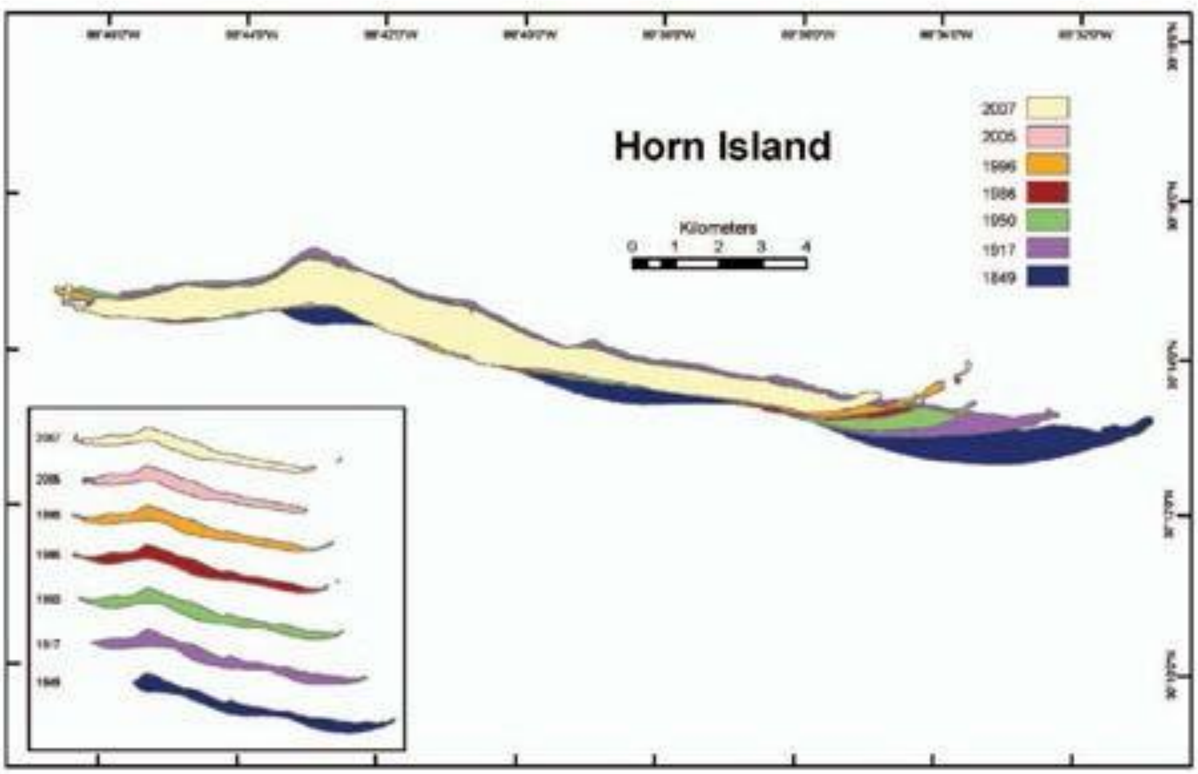
Figure 3.5.9
Historical Land-Loss Trends




Ship Island
2007
2005
1996
1986
1966
1950
1917
1848
Kilometers
0
1
2
3

Figures 3.5.11
Petit Bois and Horn Islands





Vulnerability of Private Improvements to Hurricanes

Homes, businesses, and manufactured homes are especially vulnerable to the effects of a hurricane and the winds, rain, and tornadoes generated by a hurricane. The effects of storm surge can flatten a house.

Although hurricane winds can exert tremendous pressure against homes, a large fraction of hurricane damage is not from the wind itself, but from airborne missiles such as tree limbs and branches, signs and signposts, roof tiles, metal siding, and other pieces of buildings, including entire roofs in major storms. This wind-borne debris penetrates doors and windows and allows the force of the wind to act against interior walls and ceilings not designed to withstand such forces, thus blowing the building apart.

Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	9	-	-	6	-	-	9
2	11	-	-	7	-	-	9
3	9	1	-	8	-	8	6
4	-	10	-	9	-	-	6
5	-	43	4				

Note: Some regions were specific to tropical storms

Assessing Vulnerability by Jurisdiction

Table 3.5.8 provides information on the coastal and inland counties that have been declared in previous hurricanes/tropical storm events to establish frequency and vulnerability to hurricane/tropical storm damage. In Camille and Katrina, for example, central Mississippi counties, as well as coastal counties, received damage. These incidents cover the period from 1969 to 2022. The counties are sorted with those with the greatest number of declarations listed first to the least.

Table 3.5.8
Counties Declared in Hurricane/Tropical Storm Events

County	Camille DR-271	Frederic DR-599	Elena DR-741	Georges DR-1251	T.S. Allison DR-1382	T.S. Isidore DR-1436	Ivan DR-1550	Dennis DR-1594	Katrina DR-1604	Gustav DR-11794	Isaac DR-4081	Nate DR-4350
Hancock	X	X	X	X	X	X	X	X	X	X	X	X
Harrison	X	X	X	X	X	X	X	X	X	X	X	X
Jackson	X	X	X	X	X	X	X	X	X	X	X	X
Pearl River	X	X	X	X	X	X	X	X	X	X	X	
George	X	X		X	X	X	X	X	X	X	X	X
Forrest	X	X		X			X	X	X	X	X	
Greene	X	X		X		X	X	X	X		X	X
Jones	X	X		X	X		X	X	X		X	
Stone	X	X				X	X	X	X	X	X	X
Lamar	X			X	X		X	X	X		X	
Perry	X	X		X			X	X	X		X	
Wayne	X	X		X			X	X	X		X	
Covington	X	X					X	X	X		X	
Jefferson Davis				X			X	X	X	X	X	
Marion	X			X			X		X	X	X	
Pike					X	X	X		X	X	X	
Amite						X	X		X	X	X	
Clarke		X					X	X	X		X	
Copiah						X	X		X	X	X	
Jasper	X						X	X	X		X	
Lauderdale	X						X	X	X		X	
Rankin	X						X	X	X		X	
Simpson	X						X	X	X		X	
Smith	X						X	X	X		X	
Walthall	X						X		X	X	X	
Adams	X						X		X	X	X	
Claiborne							X		X	X	X	
Franklin							X		X	X	X	
Hinds							X	X	X		X	
Jefferson							X		X	X	X	
Kemper							X	X	X		X	
Lawrence							X		X	X	X	
Lincoln							X		X	X	X	
Neshoba							X	X	X		X	
Newton							X	X	X		X	
Noxubee							X	X	X		X	
Scott							X	X	X		X	
Wilkinson							X		X	X	X	

County	Camille DR-271	Frederic DR-599	Elena DR-741	Georges DR-1251	T.S. Allison DR-1382	T.S. Isidore DR-1436	Ivan DR-1550	Dennis DR-1594	Katrina DR-1604	Gustav DR-11794	Isaac DR-4081	Nate DR-4350
Winston							X	X	X		X	
Attala								X	X		X	
Clay							X	X	X			
Lowndes							X	X	X			
Leake								X	X		X	
Madison								X	X		X	
Monroe							X	X	X			
Oktibbeha							X	X	X			
Warren							X		X		X	
Calhoun								X	X			
Carroll								X	X		X	
Chickasaw									X		X	
Choctaw									X		X	
Grenada									X		X	
Holmes									X		X	
Issaquena									X	X		
Itawamba								X	X			
Lee								X	X			
Montgomery									X		X	
Pontotoc								X	X			
Washington									X	X		
Webster								X	X			
Yazoo									X		X	
Alcorn									X			
Benton									X			
Bolivar									X			
Coahoma									X			
Desoto									X			
Humphreys									X			
Lafayette									X			
Leflore									X			
Marshall									X			
MS Choctaw Indian Reservation											X	
Panola									X			
Prentiss									X			
Quitman									X			
Sharkey									X			
Sunflower									X			
Tallahatchie									X			
Tate									X			
Tippah									X			
Tishomingo									X			
Tunica									X			
Union									X			
Yalobusha									X			
Hurricane Betsy, 1965, is not included as historical data is not available.												

Assessing Vulnerability by Jurisdiction Methodology/HAZUS-MH Modeling

HAZUS-MH hurricane loss modeling capabilities were used to quantify expected losses to the state and differentiate vulnerability by region. HAZUS-MH can model specific hypothetical or historical scenarios and probabilistic scenarios. Scenario results represent the expected damage from a single hurricane event, while probabilistic scenario results represent the range of probable losses estimated from a 1,000-year simulation of expected hurricane activity. The direct economic loss results for a probabilistic analysis include annualized loss estimates. Annualized losses are the total losses summed over the entire simulation period divided by 1,000 years.

As noted in the previous information on the location of past hurricanes and tropical storms, Mississippi's highest risk of impact is in the coastal counties of Jackson, Hancock, and Harrison. As demonstrated by past events, the impact diminishes as storms move inland, but as witnessed with Katrina, even inland counties can experience damage from hurricanes. Katrina's storm track served as the pattern for the 2018 deterministic scenario.

State Probabilistic Scenario

To identify potential losses from a hurricane event, a probabilistic scenario was developed from HAZUS-MH. This analysis evaluates the statistical likelihood that a specific event will occur and what losses and consequences will result. Provided in the tables below are the estimated average yearly losses annualized losses) and the expected distribution of losses (return period). **Appendix 7.3.5-B** contains the detailed HAZUS reports.

Table 3.5.9
Summary Impacts by Building Occupancy Type- 100-year Return

Occupancy	Exposure	Percentage of Total
Residential	$210,772,463	75.14%
Commercial	$43,001,230	15.33%
Industrial	$11,641,553	4.15%
Agriculture	$1,383,000	0.49%
Religious	$7,032,841	2.51%
Government	$2,358,594	0.84%
Education	$4,328,839	1.54%
Totals	**$280,518,520**	**100%**

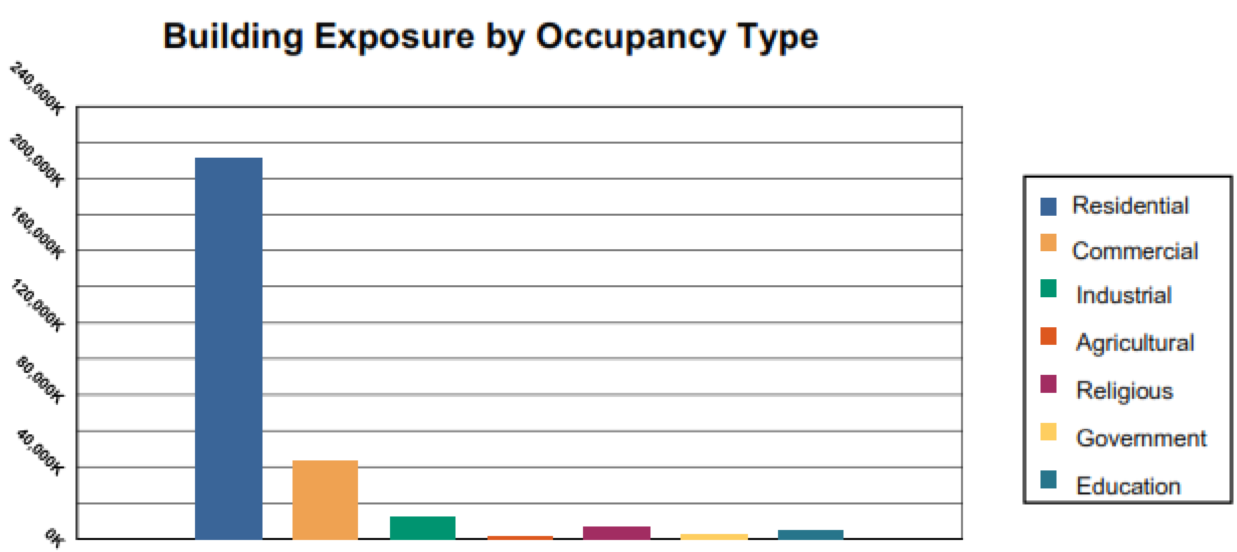
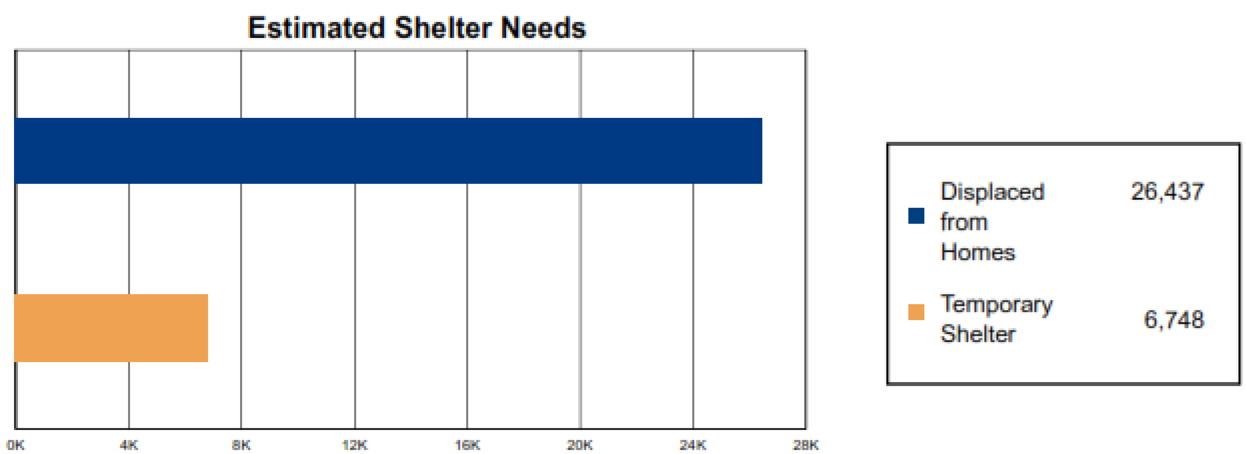


Table 3.5.10
Expected Number of Buildings Damaged by Occupancy: 100-Year Event

Occupancy	None	Minor	Moderate	Severe	Destruction
Residential	5,139	41	47	80	32
Commercial	61,225	1,072	1,176	1,459	96
Industrial	2,463	37	41	67	1
Agriculture	2,929	40	45	78	1
Religious	15,390	230	237	407	15
Government	8,670	117	128	201	7
Education	1,071,652	23,678	18,646	13,512	12,854
Totals	1,167,468	25,214	20,320	15,803	13,006

HAZUS estimates the number of households that are expected to be displaced from their homes due to the hurricane and the estimated amount of people that may require temporary shelter. The model estimates 26,437 households to be displaced due to the hurricane. Of these, 6,748 people will seek temporary shelter in public shelters.

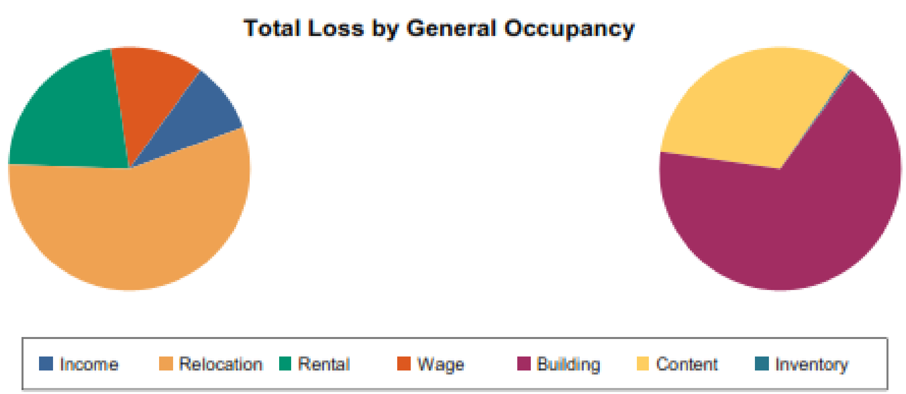


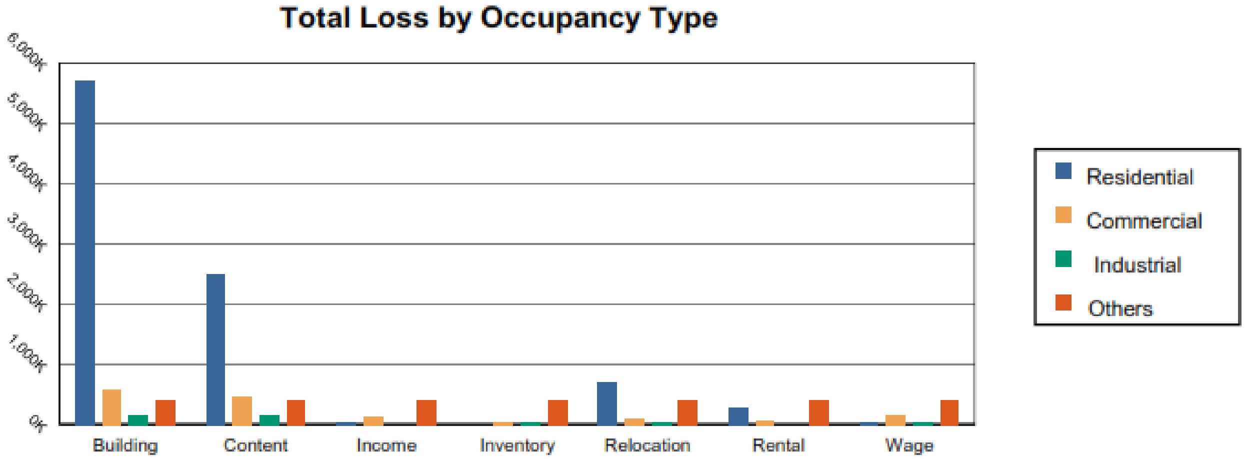
Building-related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include temporary living expenses for those people displaced from their homes because of a hurricane.

HAZUS estimates the total property damage losses at $11,318,000. Three percent of the estimated losses were related to business interruption. The largest loss was sustained by residential occupancies which made up over 81% of the total loss.

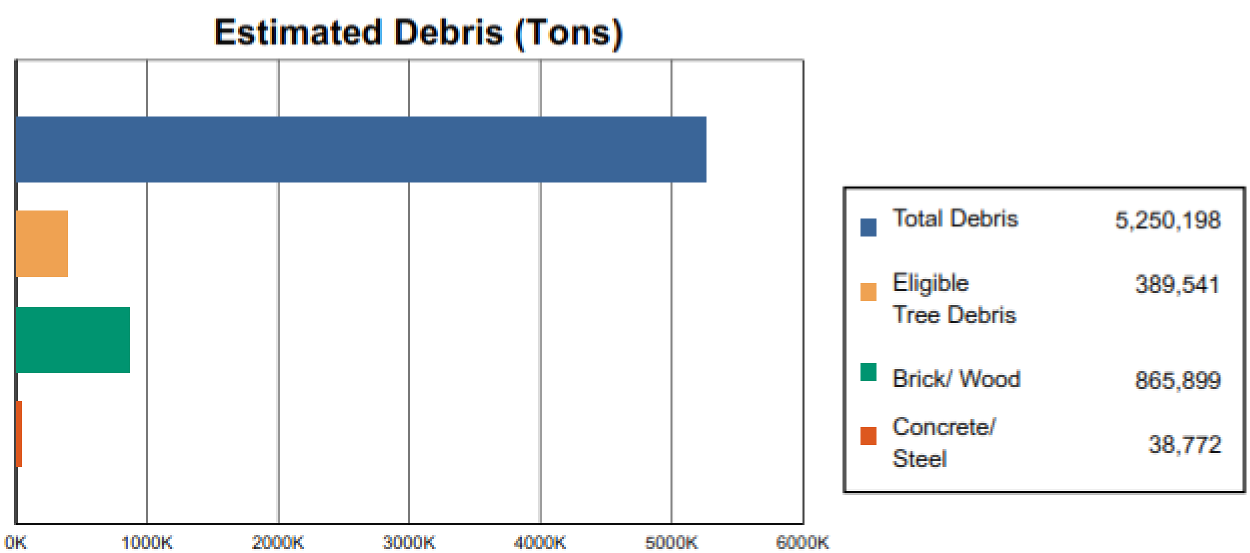
Table 3.5.11
Building Related Economic Loss Estimates: 100-Year Event

Occupancy	Property Damage	Business Interruption Loss	Total
Residential	$8,173,663	$993,814	$9,167,477
Commercial	$1,023,023	$397,982	$1,421,005
Industrial	$329,989	$20,048	$350,038
Others	$321,839	$57,799	$379,639
Totals	$9,848,515	$1,469,644	$11,318,160





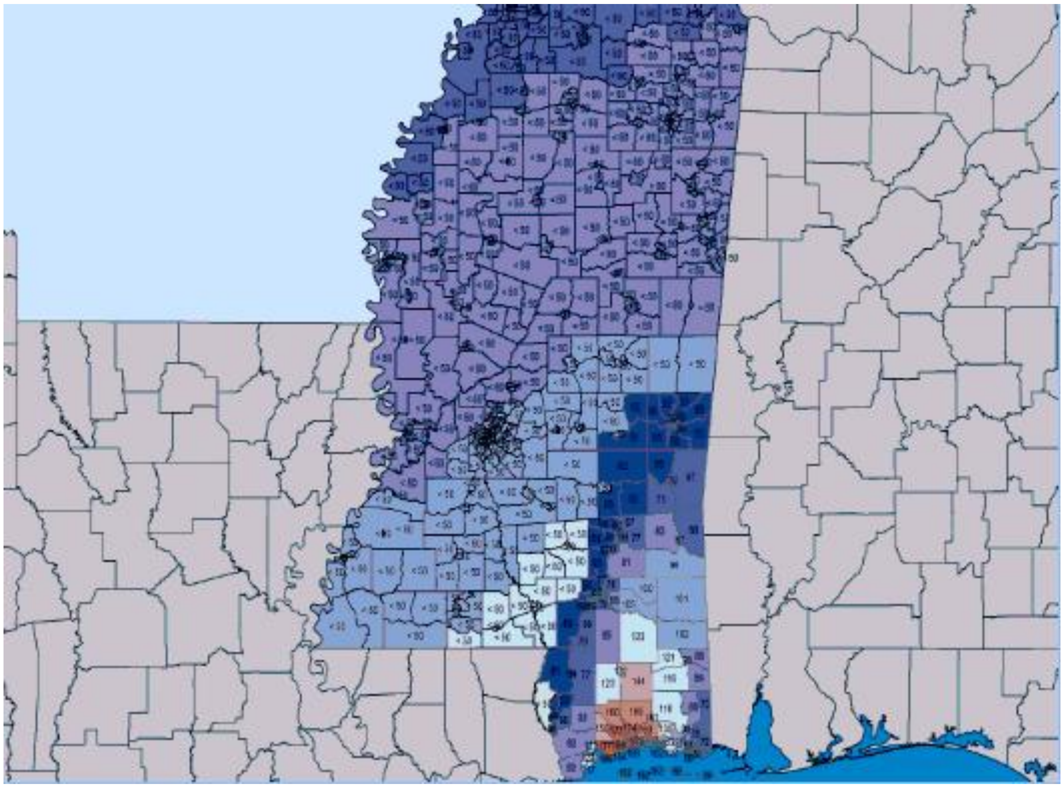
HAZUS estimated the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: brick/wood, reinforced concrete/steel, eligible tree debris, and other tree debris. The model estimates that a total of 5,250,918 tons of debris will be generated. Of the total amount, 3,957,811 tons (75%) is other tree debris. Of the remaining, brick/wood comprises 67% of the total, reinforced concrete/steel comprises 3%, and the remainder is comprised of eligible tree debris.



Peak Windspeed Forecast

Figure 3.5.12 illustrates the frequency of anticipated peak sustained wind speeds associated with tropical cyclones making landfall in Mississippi. These data were derived us HAZUS-MH probability estimates.

Figure 3.5.12
Peak Windspeed Forecast
100-Year Event



Hurricane Katrina Scenario (500-Year Event)

HAZUS General Description

This scenario is based on 47,705.34 square miles and contains 605 census tracts. There are over 1,046,000 households with a total population of 2,844,658 people (2000 Census Bureau data). An estimated 1,282,000 buildings are included in this scenario with a total replacement value (excluding contents) of $159,417,000 (2006 dollars). Approximately 92% of the buildings (and 72% of the building value) are associated with residential housing. Appendix 7.3.5-C contains the detailed HAZUS reports for all 82 counties.

General Building Stock

HAZUS estimates that there are 1,282,365 buildings included in this scenario which have an aggregate total replacement value of $159,417,000 (2006 dollars). Table 3.5.12 presents the relative distribution of the value concerning the general occupancies for all 82 counties followed by the expected damages by occupancy in **Table 3.5.13.**

Table 3.5.12
Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	$114,980,081	72.1%
Commercial	427,348,654	17.2%
Industrial	$7,456,047	4.7%
Agricultural	$898,946	.06%
Religious	$4,652,775	2.9%
Government	$1,527,107	1.0%
Education	$2,553,782	1.6%
Total	**$159,417,392**	**100.0%**

HAZUS estimates that about 34,770 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the state. There are an estimated 1,792 buildings that will be destroyed.

Table 3.5.13
Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	Count	%	Count	%	Count	%	Count	%	Count	%
Agriculture	5,232	91.83	225	3.94	136	2.39	89	1.56	15	.27
Commercial	55,971	89.68	3,720	5.96	2,169	3.47	545	0.87	9	0.01
Education	2,030	91.58	111	4.99	59	2.64	17	0.79	0	0.00
Government	2,629	92.71	126	4.45	62	2.19	18	0.64	0	0.00
Industrial	14,647	90.22	947	5.83	488	3.01	150	0.92	3	0.02
Residential	1,069,831	90.28	84,384	7.12	25,535	2.15	3,491	0.29	1,764	0.15
Total	**1,157,666**		**89,929**		**28,621**		**4,356**		**1,792**	

Essential Facility Damage

In this scenario, the state had 111 hospitals with 17,989 hospital beds available for use. On the day of the hurricane, the number of beds was reduced to 3,064 beds (73%). After one week, 80% of the beds will be in service with 89% operational after 30 days. Table 3.5.15 presents the expected damage to essential facilities statewide.

Table 3.5.14
Expected Damage to Essential Facilities

		Number of Facilities		
Classification	Total	Probability of at least Moderate Damage >50%	Probability of Complete Damage >50%	Expected Loss of Use < 1 Day
EOCs	37	0	0	37
Fire Stations	399	0	0	399
Hospitals	111	38	8	85
Police Stations	368	0	0	368
Schools	1,288	38	0	1,014

Shelter Requirements

It is estimated that 5,486 households could be displaced due to the scenario of a Katrina-like event. Of these, 1,520 people (out of a total population of 2,844,658) will seek temporary shelter in public safe rooms. Table 3.5.15 provides an individual county detail for MEMA Regions 9, and 8; county totals are given for Regions 7, 6, and 5 with no shelter requirements indicated for Regions 1-4.

Table 3.5.15
Shelter Requirements by MEMA Region

MEMA Region/County		No. of Displaced Households	No. of People Needing Shelter
9	George	22	6
	Hancock	510	135
	Harrison	3,339	918
	Jackson	292	72
	Pearl River	263	71
	Stone	108	30
Total Region 9		**4,534**	**1,232**
8	Covington	17	6
	Forrest	500	163
	Greene	6	2
	Jefferson Davis	8	3
	Jones	76	23
	Lamar	228	58
	Marion	44	13
	Perry	34	10
	Wayne	3	0
Total Region 8		916	278
County Total Region 7		8	3
County Total Region 6		27	7
County Total Region 5		1	0

Building-Related Losses

The following building-related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were $3,139,000 with 3% of the estimated losses related to business interruption. By far, the largest loss was sustained by the residential occupancies which made up over 81% of the total loss. A summary of the statewide impact of the losses associated with the building damage is provided below followed by Table 3.5.17 which provides detailed county data for MEMA Regions 6-9.

Table 3.5.16
Statewide Building-Related Economic Loss Estimates

(thousands of dollars)

Property Damage					
Area	**Residential**	**Commercial**	**Industrial**	**Others**	**Total**
Building	$1,646,525	$205,475	$25,778	$40,066	$1,917,844
Content	$573,726	$109,495	$15,960	$18,897	$718,077
Inventory	0	$2,416	$3,655	$558	$6,630
Subtotal	**$2,220,250**	**$317,387**	**$45,393**	**$59,521**	**$2,641,552**
Business Interruption Loss					
Income	$3,955	$26,365	$453	$2,724	$33,497
Relocation	$212,726	$55,033	$2,955	$11,588	$282,303
Rental	$99,385	$25,054	$429	$1,171	$126,039
Wage	$9,322	$30,528	$745	$13,861	$54,457
Subtotal	**$325,388**	**$136,980**	**$4,583**	**$29,344**	**$496,295**
Total Losses	**$2,545,639**	**$454,367**	**$49,976**	**$88,865**	**$3,138,847**

Table 3.5.17
MEMA Region/County Building-Related Economic Loss Estimates

MEMA Region/ County		Total Property Damage	Total Business Interruption	Total Losses
9	George	21,167	2,592	23,759
	Hancock	237,561	47,245	284,807
	Harrison	1,339,646	287,667	1,627,312
	Jackson	211,836	29,376	1,627,312
	Pearl River	140,822	25,456	166,277
	Stone	47,659	9,552	57,212
8	Covington	15,365	1,996	17,361
	Forrest	205,234	42,356	247,589
	Greene	6,751	611	7,363
	Jefferson Davis	6,597	544	7,143
	Jones	61,853	9,519	71,371
	Lamar	111,468	21,618	133,08
	Marion	29,969	5,262	20,061
	Perry	17,498	2,562	20,061
	Wayne	7,661	569	8,230
7	Adams	87	0	87
	Amite	1,048	0	1,048
	Franklin	361	0	361
	Jefferson	67	0	67
	Lawrence	5,233	250	5,482
	Lincoln	4,475	86	4,561
	Pike	10,220	913	11,132
	Walthall	7,448	1,000	8,448
	Wilkinson	91	0	91
6	Clarke	6,280	351	6,631
	Jasper	7,188	549	7,737
	Kemper	2,674	125	2,799
	Lauderdale	33,733	2,914	36,647
	Leake	1,869	1	1,870
	Neshoba	5,177	330	5,507
	Newton	6,008	343	6,350
	Scott	4,231	247	4,479
	Smith	7,890	339	8,230
5	Simpson	8,297	505	8,802
	Claiborne	47	0	47
	Copiah	2,280	12	2,293
	Hinds	11,774	9	11,784
	Issaquena	0	0	0
	Madison	3,752	2	3,754

MEMA Region/ County		Total Property Damage	Total Business Interruption	Total Losses
	Rankin	12,307	118	12,425
	Sharkey	0	0	0
	Warren	24	0	24
	Yazoo	19	9	19
4	County Totals	30,924	1,259	32,193
3	County Totals	726	0	726
2	County Totals	8,199	3	8,201
1	County Totals	33	0	33

Debris Generation

HAZUS estimates that 12,098,123 tons of debris will be generated from this Katrina scenario. Of the total amount, 10,979,123 tons (91%) is other tree debris. The remaining 1,119,000 tons include 33% of brick/ wood and the remainder is eligible tree debris. A summary of the statewide impact of debris being generated by this scenario is provided below followed by Table 3.5.18 with county-specific data for MEMA Regions 6-9 with county totals for Regions 2-5 (Region 1 did not report any debris generation).

Statewide Summary of Debris Generation (in tons)				
Brick, Wood and Other	**Reinf. Concrete and Steel**	**Eligible Tree Debris**	**Other Tree Debris**	**Total**
369,224	1,963	747,813	10,979,123	12,098,123

Table 3.5.18
MEMA Region/County Debris Generation

MEMA Region/ County		Brick, Wood , and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
9	George	3,022	3	14,894	340,564	358,483
	Hancock	34,941	268	57,758	584,794	677,761
	Harrison	177,734	1,236	146,861	800,204	1,126,035
	Jackson	30,5711	84	58,891	494,667	583,707
	Pearl River	20,936	127	56,891	889,281	967,235
	Stone	7,337	52	31,254	685,186	723,829
County Region 9 Totals		**274,541**	**1,770**	**366,043**	**3,794,696**	**4,437,050**
8	Covington	2,589	2	14,311	257,730	274,632
	Forrest	34,778	100	54,230	569,558	658,666
	Greene	1,046	0	12,453	350,928	364,427
	Jefferson Davis	1,102	0	8,408	201,782	211,292
	Jones	10,191	5	32,042	451,469	493,708

	MEMA Region/ County	Brick, Wood , and Other	Reinf. Concrete and Steel	Eligible Tree Debris	Other Tree Debris	Total
	Lamar	17,378	77	44,388	608,394	670,237
	Marion	5,210	5	21,052	430,211	456,478
	Perry	2,872	3	25,330	727,625	755,830
	Wayne	945	0	11,637	340,081	352,663
County Region 8 Totals		**76,111**	**192**	**223,851**	**3,937,778**	**4,237,933**
7	Adams	0	0	0	0	0
	Amite	37	0	1,450	46,894	48,381
	Franklin	5	0	544	17,599	18,148
	Jefferson	0	0	0	0	0
	Lawrence	535	0	5,795	155,733	162,063
	Lincoln	400	0	3,566	72,680	76,646
	Pike	1,354	0	7,534	111,876	120,764
	Walthall	1,415	1	8,590	192,624	202,630
	Wilkinson	0	0	285	9,219	9,504
County Region 7 Totals		**3,746**	**1**	**27,764**	**606,625**	**638,136**
6	Clarke	694	0	10,009	255,369	266,072
	Jasper	950	0	11,260	292,087	304,297
	Kemper	251	0	6,707	216,857	223,815
	Lauderdale	4,476	0	20,645	268,414	293,535
	Leake	92	0	1,478	38,999	40,569
	Neshoba	455	0	4,330	91,059	95,844
	Newton	687	0	5,888	144,566	151,141
	Scott	379	0	3,765	94,916	99,060
	Smith	825	0	9,490	255,305	265,620
County Region 6 Totals		**8,809**	**0**	**73,572**	**1,657,572**	**1,739,953**
5	**County Totals**	**2,479**	**0**	**21,802**	**311,702**	**335,983**
4	**County Totals**	**3,135**	**0**	**25,385**	**524,149**	**552,669**
3	**County Totals**	**19**	**0**	**978**	**28,025**	**29,022**
2	**County Totals**	**384**	**0**	**8,415**	**118,578**	**127,377**

Assessing the Vulnerability of State Facilities/Estimating Potential Losses

Methodology for Assessing Vulnerability of State Facilities

The methodology and HAZUS runs for assessing the vulnerability of state facilities were updated for the 2018 plan. State plan developers used the HAZUS-MH Level 1 scenario to assess the vulnerability of State-owned critical or operated facilities located in hurricane-hazard areas.

The HAZUS-MH scenario provided damage states and loss estimates for government buildings. As stated in the section on Critical Facilities and Infrastructure at the beginning of the risk assessment, Critical Facilities are addressed under the category of Essential Facilities.

The HAZUS-MH scenarios returned a probability of expected damages to essential facilities. In the absence of damage and loss information for the HAZUS-MH categories as noted above, plan developers decided to total the value of the overall State asset inventory for each region to show the vulnerability.

With the limitations noted below, the table provides a clear picture of the losses that could be sustained from a 100-year event. Apparent in the data is the very high vulnerability of state-owned or operated facilities in the three coastal counties and the diminishing vulnerability of such as the storms moved northward.

Data Limitations:

For the category of government buildings, HAZUS-MH does not distinguish between federal, state, or local ownership or building operation. Nor does it distinguish between federal, state, local, or private ownership in the three other categories of facilities addressed in the assessment. Therefore, all facilities regardless of ownership are included in the assessment.

The state of Mississippi does not have a comprehensive list of state-owned or operated buildings, critical facilities, and infrastructure sorted by county that could be input into HAZUS-MH to conduct a Level 2 analysis. During the 2018 update state facilities data was available in tabular form from MEMA, but did not include XY coordinates, and thus could not be incorporated into HAZUS-MH.

100-Year Event:

Before the hurricane, the region had 17,989 hospital beds available for use. On the day of the hurricane, the model estimates that 15,513 hospital beds (only 86%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, 90% of the beds will be in service. By 30 days, 96% will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

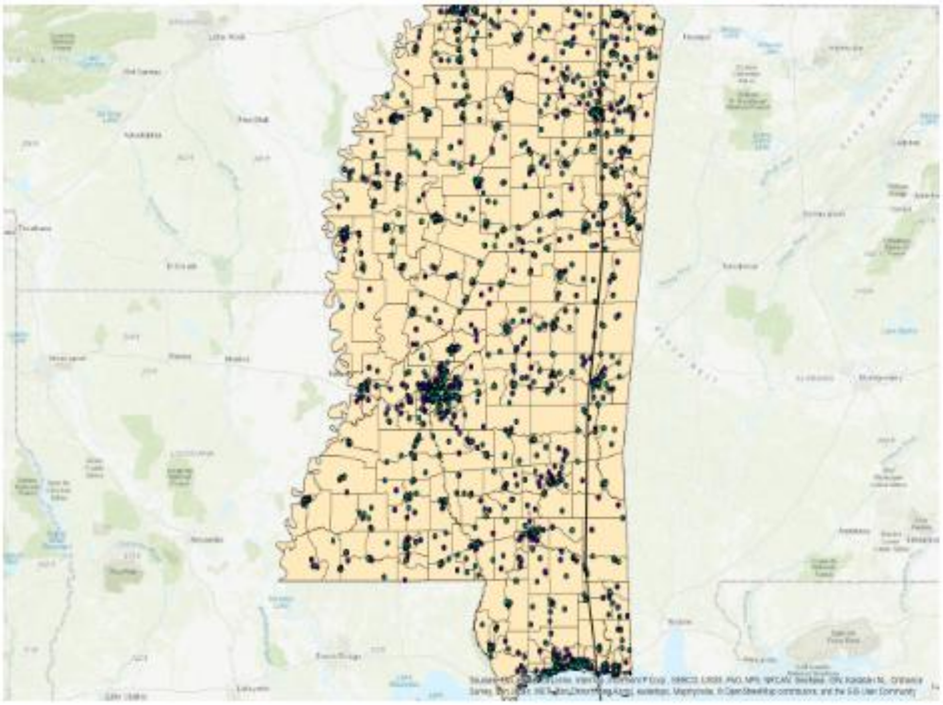


Table 3.5.19
Expected Damages to Essential Facilities

Classification	Facilities			
	Total	Probability of at Least Moderate Damage <50%	Probability of at Least Complete Damage >50%	Expected Loss of Use < 1-Day
EOCs	37	0	0	37
Fire Stations	399	15	0	390
Hospitals	111	12	4	100
Police Stations	368	8	0	362
Schools	1,288	73	0	1,184

Table 3.5.20
Summary of Potential Losses to Essential Facilities

Region	Number of Buildings with Available Replacement Values	Total Replacement Value (as available)
MEMA Region 1	171	$57,356,843
MEMA Region 2	331	$156,546,716
MEMA Region 3	552	$256,299,605
MEMA Region 4	134	$27,175,900
MEMA Region 5	1,335	$2,648,653,307
MEMA Region 6	918	$813,681,823
MEMA Region 7	247	$79,618,031
MEMA Region 8	455	$286,676,990
MEMA Region 9	268	$215,287,139

3.6: Flood Risk Assessment

Hazard Description

Floods are the most frequently occurring natural disaster and occur when an overflow of water submerges land that is usually dry. Floods and the associated water-born debris have the potential to cause injury, death, and damage to the built and natural environments.

A flood is any general or temporary condition of partial or complete inundation of normally dry land from the overflow of inland or tidal waters or the unusual and rapid accumulation or run-off of surface waters from any source.

Flooding is a natural and inevitable occurrence. Floods occur seasonally with general or torrential rains associated with tropical storms that later drain into river basins and fill them with an abundance of water. Rivers, lakes, and other water bodies have always overflowed their normal beds to inundate nearby land. The land adjacent to these bodies of water is called the floodplain. The more serious effect of flooding occurs at the intersection of the floodplain and the built environment. When the floodplain contains manmade structures and either temporary or permanent habitation, the results can be devastating. There are generally four leading causes/ types of flooding. Mississippi is vulnerable to each as explained in the following section.

River (Riverine or Stream) Flooding:

Riverine floods occur along rivers, streams, or channels primarily when there is heavy or prolonged rainfall. Other contributing factors include (1) the elimination of ground cover on drainage slopes as a result of tree cutting or wildfires, land development, or overgrazing; (2) the simultaneous arrival of flood crests from major tributaries; and (3) blocked drainage by items such as debris; dams or inadequately sized drainage structures. Floods from these sources can be "flash" or rapid but are usually more gradual and have a longer duration than flash floods. Riverine floods occur in all nine major drainage basins in Mississippi.

Flash Flooding (Rapid):

Flash floods are a result of heavy, localized rainfall, possibly from slow-moving intense thunderstorms that cause small creeks, streams, and rivers to overflow. They are most common when rain falls on areas with steep slopes or built-up areas where impervious surfaces, gutters, and storm sewers speed up the flow of run-off. The torrential nature of flash floods makes this hazard particularly lethal, especially in or near rivers and streambeds, city streets, coastal areas, and narrow valleys which contribute to the development of rapid water movement. Rapid or flash flooding occurs in all nine major drainage basins in Mississippi.

Coastal (Tidal) Flooding:

All waterbodies and waterways bordering the Mississippi Sound, such as bays, and estuaries, lakes, rivers, and streams are prone to tidal effects/flooding. Coastal lands, such as sand bars, barrier islands, and deltas provide a buffer zone to help protect human life and real property relative to the sea. These natural features function very similarly to floodplains and provide a buffer zone along rivers or other bodies of water. Coastal floods usually occur as a result of abnormally high tides or tidal waves, storm surge, and heavy rains in combination with high winds, tropical storms, or hurricanes.

Storm surge is caused by high water from the wind and the low air pressure differences that accompany a storm. Storm surge is not a tidal wave or sudden rush of water; rather it is more of a gradual increase in water surface elevation. A surge can be as high as 20 feet above normal water levels, flooding normally dry areas far inland. A storm surge is generally associated with a tropical storm or hurricane. Most of the fatalities and damage caused by a tropical storm or hurricane are the result of surge and their associated flooding, not high winds. The effects of coastal flooding can be worsened due to erosion. Coastal dunes and beaches provide natural protection by causing waves to break close to the shore, but these features can be worn down, exposing areas farther inland to storm damage. Tidal flooding occurs within three basins in Mississippi the Lower Pearl River, Coast Streams, and Pascagoula River Basins.

Drainage

Drainage flooding occurs primarily in urban or developed areas when the volume of run-off exceeds the capacity of drainage systems. Flooding of this nature can be the result of increased development, inadequate drainage, riverine flooding, flash flooding, or a combination of these. The potential for drainage flooding is directly proportional to the percentage of impervious surfaces in a given area. Drainage flooding occurs in all nine major drainage basins in Mississippi.

Hazard Profile

Mississippi is situated in a region where water is a bountiful natural resource, coming in third behind Hawaii and Louisiana as the "wettest" state in the union considering the average amount of precipitation over the State's area. The statewide average of above 59 inches over nearly 31 million acres produces a volume greater than 144 million acre-feet of water delivered to the state annually, providing both surface water and groundwater in abundance. Though Mississippi has no natural large inland lakes, flood control dams in the Yazoo-Tallahatchie basin and water supply reservoirs at Jackson and Meridian have formed large lakes in the north, and these have added to the fishing and recreational resources of the State.

Flood season in Mississippi is considered to occur primarily from November through June (the period of greatest rainfall), while March and April are the months of greatest flood frequency. The first six months of the year is the season of high flows in the Mississippi River. Seasonal flooding along the Mississippi River and its tributaries often occur in the late winter and early spring as melting snow makes its way south from the northernmost reaches of the Mississippi River. In other rivers and streams, flooding sometimes occurs during the summer from persistent thunderstorms, or in the late summer and early fall from the heavy rains associated with tropical storms originating in the Gulf of Mexico.

Local overflows occur on many streams three or four times a year in association with extended rainy periods and associated saturated soil conditions. Severe general flooding occurs about once in two years from upstream runoff. The only important contribution to the Mississippi River within the state is from the Yazoo Basin. A system of levees prevents major damage from Mississippi River floods.

Flash flooding and heavy rain events have posed significant threats to many communities throughout the state. The aging drainage infrastructure and increases in development in urban areas have increased the amount of runoff into area drainage systems. Natural conveyances that were once narrow enough to jump over are now wider creating exit points for water to drain out of its banks and into developed areas. As road and bridge improvements are made and larger culverts and catch basins are engineered, a more comprehensive look downstream is necessary to ensure that those improvements will not contribute to flooding in downstream regions that have not benefited from drainage improvements.

Education and Outreach

Flood Awareness Week occurs in March. For more information on flood awareness call the MEMA Public

Information number (866-519-6362) between 8 a.m. and 5 p.m. on weekdays.

Mississippi's Coastal Hazard Outreach Strategy Team (C-HOST) is a regional outreach team that was established on March 5, 2008. The Team strives to deliver the general floodplain management messaging so that residents are educated about flood hazards, flood insurance, flood protection measures, and the National Flood Insurance Program (NFIP). Education and outreach information is provided at http://chost.stormsmart.org.

Severe Storms and Flooding, Clarksdale 2016

Mississippi River Flooding, Vicksburg 2011

Hurricane Isaac Flooding, 2012

Location - River Basins

The state of Mississippi is located within the Gulf of Mexico drainage area. The nine river basins within the state include the:

- Big Black River Basin
- North Independent Streams
- South Independent Streams
- Coastal Streams Basin
- Pascagoula River Basin
- Tennessee River Basin
- Lower Pearl River Basin
- Yazoo River Basin
- Tombigbee River Basin

The state is primarily concerned with the risk associated with the floodplains found within the basins listed above. Local governments focus their risk assessments on the tributaries and secondary streams associated with the primary rivers located within their respective jurisdictions.

The state recognizes the importance of watershed planning and regional planning when implementing flood mitigation solutions. The identified basins and their member counties are listed on the subsequent pages. The assignment of a county to a basin was based solely upon the placement of the majority of the county's landmass within the appropriate basin boundary.

North Independent River Basin

The North Independent Basin encompasses portions of Alcorn and Tippah counties. Flood losses associated with this basin are due primarily to the Hatchie, Tuscumbia, and Little Hatchie Rivers, Muddy Creek, South Tippah Creek, and their tributaries.

County	Total Area in Square Miles
Alcorn	401.3
Tippah	459.9
Totals	**861.2**

Tennessee River Basin

The Tennessee River Basin encompasses portions of Tishomingo County. Flood losses associated with this basin are due primarily to the Tennessee and Tombigbee Rivers, Bear Creek, Yellow Creek, and their tributaries.

County	Total Area in Square Miles
Tishomingo	444.6

Yazoo River Basin

The Yazoo River Basin encompasses portions of the twenty-five counties listed below. Flood losses associated with this basin are due primarily to the Yazoo, Sunflower, Coldwater, and Tallahatchie Rivers and their associated tributaries.

County	Total Area Sq Miles	County	Total Area Sq Miles
Benton	408.5	Marshall	709.6
Bolivar	905.7	Panola	704.9
Calhoun	587.8	Pontotoc	500.9
Carroll	634.3	Quitman	406.4
Coahoma	583	Sharkey	434.8
Desoto	496.6	Sunflower	707.1
Grenada	449.2	Tallahatchie	651.9
Holmes	764	Tate	410.8
Humphreys	431.1	Tunica	480.7
Issaquena	441.4	Union	416.8
Lafayette	679.1	Washington	761.2
Leflore	606.2	Yalobusha	494.8
		Yazoo	933.9
		Totals	**12,773**

Tombigbee River Basin

The Tombigbee River Basin encompasses portions of the ten counties listed below. Flood losses associated with this basin are due primarily to the Tombigbee, Luxpalila, and the Buttahatchee Rivers, the Bull Mountain, Mattubby, and Yellow Creeks and their associated tributaries.

County	Total Area in Square Miles	County	Total Area in Square Miles
Chickasaw	504.2	Lowndes	516.5
Clay	416	Monroe	772.1
Itawamba	540.5	Noxubee	700
Kemper	767.01	Oktibbeh	461.8
Lee	453.1	Prentiss	418.2
		Totals	**55,49.4**

Big Black River Basin

The Big Black River Basin encompasses portions of the seven counties listed below. Flood losses associated with this basin are due primarily to the Big Black and the Bogue Chitto Rivers, the Deer, Black Poplar, and Mulberry Creeks and their associated tributaries.

County	Total Area in Square Miles
Attala	736.9
Choctaw	419.7
Hinds	877.1
Madison	741.7
Montgomery	407.1
Warren	618.7
Webster	423.2

Totals	4224.4

Pearl River Basin

The Pearl River Basin encompasses portions of the eleven counties listed below and the Pearl River Valley Water Supply District. Flood losses associated with this basin are due primarily to the Pearl, Strong, and Yockanookany Rivers and the Hobolochitta, Little, Richland, Pelahatchie, Culley, Bogue Chitto, Nanih Waiya, and Big Slough Creeks and their associated tributaries.

County	Total Area in Square
Jefferson Davis	409
Lawrence	435.6
Leake	585.2
Lincoln	588
Marion	548.4
Neshoba	571.5

County	Total Area in Square Miles
Rankin	805.9
Scott	610.2
Simpson	590.3
Walthall	404.3
Winston	610
Totals	6,158.4

South Independent River Basin

The South Independent Basin encompasses portions of the eight counties listed below. Flood losses associated with this basin are due primarily to the Mississippi, Buffalo, Homochitto Rivers, Bayou Pierre, and the Second and St. Catherine Creeks and their associated tributaries.

County	Total Area in Square Miles
Adams	486.4
Amite	731.6
Claiborne	501.4
Copiah	779.2

County	Total Area in Square Miles
Franklin	566.7
Jefferson	527.2
Pike	410.7
Wilkinson	687.8
Totals	4691

Pascagoula River Basin

The Pascagoula River Basin encompasses portions of the 15
counties listed below. Flood losses associated with this basin are due primarily to the Pascagoula, Escatawpa, Chickasawhay, and Leaf Rivers, the Bogue Homa, Thompson, Tallahala, Tallahoma, Okatoma, Long, Okatibbee, and Sowashee Creeks and their associated tributaries.

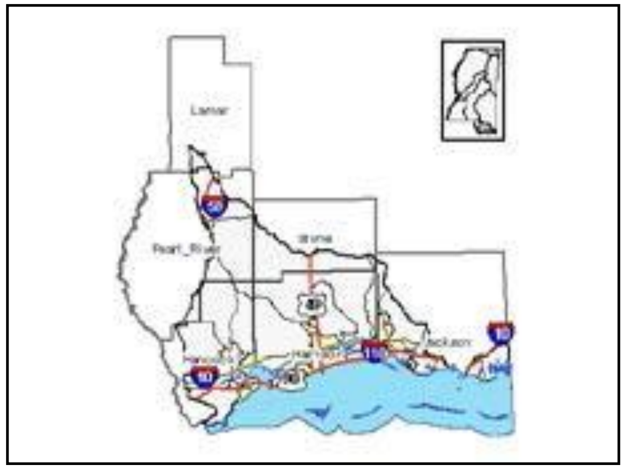
County	Total Area in Square
Clarke	693.4
Covington	414.8
Forrest	470
George	483.6
Greene	718.7
Jackson	1,043.3
Jasper	677.3
Jones	699.6

County	Total Area in Square
Lamar	500.3
Lauderdale	715.2
Newton	579.4
Perry	650.1
Smith	637.1
Stone	448
Wayne	813.4
Totals	9544.2

Coastal River Basin

The Coastal River Basin encompasses portions of Hancock, Harrison, and Pearl River Counties. Flood losses associated with this basin are due primarily to the Wolf, Jourdan, Biloxi, Little Biloxi, and Tchautacabouffa Rivers, Rotten Bayou, Bayou La Croix, Bernard Bayou, Brickyard Bayou, Turkey, and Tuxachanie Creeks, and their associated tributaries.

County	Total Area in Square Miles
Hancock	552.4
Harrison	975.9
Pearl River	818.7
Totals	**2,347**



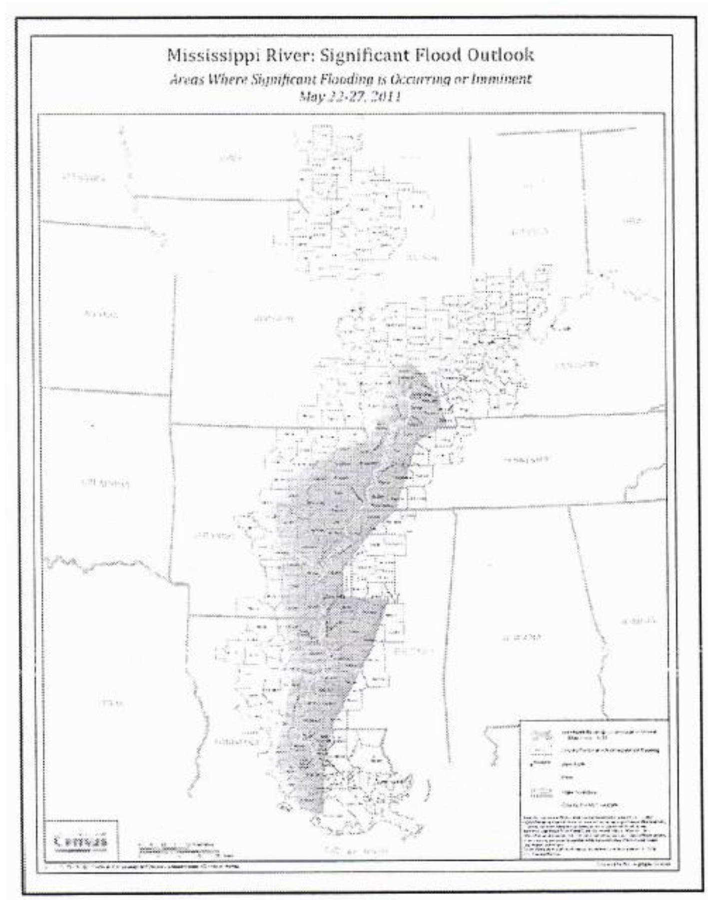
Mississippi River Basin

The Mississippi River Basin encompasses small portions of the eleven counties listed in the table below. The flood losses associated with this slice of terrain adjacent to the Mississippi River are often structures known as “fish camps.” These structures are secondary homes or weekend homes. A large percentage of the state’s repetitive loss structures are thought to consist of such structures, which are constructed on the “wet side” of the levee system. The analyses of the counties will be included in the appropriate basin that contains the largest landmass as indicated.

County	River Basin
Adams	South Independent River
Bolivar	Yazoo River
Claiborne	South Independent River
Coahoma	Yazoo River
Desoto	Yazoo River
Issaquena	Yazoo River
Jefferson	South Independent River
Tunica	Yazoo River
Warren	Big Black River
Washington	Yazoo River
Wilkinson	South Independent River

Historic Flood Events

Mississippi River Flood 2011



The Mississippi River floods in April and May of 2011 were among the largest and most damaging recorded along the U.S. waterway in the past century, comparable in extent to the major floods of 1927 and 1993. In April 2011, two major storm systems deposited record levels of rainfall on the Mississippi River watershed. When that additional water combined with the springtime snowmelt, the river and many of its tributaries began to swell to record levels. Areas along the Mississippi River experiencing flooding included Illinois, Missouri, Kentucky, Tennessee, Arkansas, Mississippi, and Louisiana. President Barack Obama declared the western counties of Kentucky, Tennessee, and Mississippi federal disaster areas. On May 14, the Morganza Spillway was opened for the first time in 37 years. This action deliberately flooded 4,600 square miles (12,000 km2) of rural Louisiana to minimize the flood's impacts on Baton Rouge and New Orleans.

The flood event resulted in nearly 400 deaths across seven states. Thousands of homes were ordered evacuated, including over 1,300 in Memphis, Tennessee, and more than 24,500 in Louisiana and Mississippi, though some people disregarded mandatory evacuation orders. The flood crested in Memphis on May 10 and artificially crested in southern Louisiana on May 15, a week earlier than it would have if spillways had not been opened. The United States Army Corps of Engineers stated that an area in Louisiana between Simmesport and Baton Rouge was expected to be inundated with 20-30 feet (6.1- 9.1 m) of water. Baton Rouge, New Orleans, and many other river towns were threatened, but officials stressed that they expected to avoid catastrophic flooding in those major cities.

The storm system continued through the second half of April and spawned was responsible for one of the largest tornado outbreaks in U.S. history. The unprecedented rainfall from these four storms, combined with springtime snow melt from the Upper Midwest created the perfect situation for a 500-year flood along the Mississippi.

Mississippi Summary:

In Tunica County, nine casinos located on stationary river barges were closed for most of May. The hotel portions of the casinos are located on the adjacent, low-lying land, and began to flood with the rising waters with inundation levels reaching 6 feet in surrounding areas. Near Vicksburg, Highway 465 in Warren and Issaquena counties was closed on May 3 due to high flood waters. North-south access to and from Vicksburg was cut off for more than two weeks. U.S. Highway 61 between Vicksburg and Port Gibson was closed due to backwater flooding along the Big Black River on May 12; it reopened on June 1. Another portion of U.S. Highway 61 near Redwood was closed due to backwater flooding along the Yazoo River on May 13 and was closed until June 3.

In anticipation of major flooding, the U.S. federal government issued disaster declarations for 14 counties along the Mississippi River including Adams, Bolivar, Claiborne, Coahoma, Desoto, Humphreys, Issaquena, Jefferson, Sharkey, Tunica, Warren, Washington, Wilkinson, and Yazoo. Mississippi Governor Haley Barbour urged holdouts to head for higher ground, saying “The biggest danger is that they choose not to evacuate assuming there’ll be someone to rescue them,” noting that emergency teams could be endangered as well. “More than anything else save your life and don’t put other people at risk who might have to come in and save your lives.”

The Flood of 2011 set new record stages at Vicksburg and Natchez. The peak streamflow at Vicksburg, 2,310,000 cubic feet per second (65,000 m3/s), exceeded the estimated peak streamflow of the Great Mississippi Flood of 1927, 2,278,000 cu ft/s (64,500 m3/s), and the measured peak streamflow of the 1937 flood, 2,080,000 cu ft/s (59,000 m3/s). The Project Design Flood predicts that a flowrate at Vicksburg of 2,710,000 cubic feet per second (77,000 m3/s) would still be within the limits of the downstream capacities, meaning that the May 17 - May 18 peak flow was about 85% of the acceptable flowrate for Vicksburg.

Hurricane Katrina 2005

On August 29, 2005, Hurricane Katrina made landfall resulting in widespread flash flooding across the state. The 26 counties impacted by this event included: Newton, Scott, Neshoba, Leake, Kemper, Winston, Attala, Noxubee, Oktibbeha, Choctaw, Lowndes, Clay, Forrest, George, Greene, Lamar, Perry, Stone, Wayne, Marion, Prentiss, Covington, Jefferson Davis, Jones, Jasper, and Smith. This storm dropped five to eight inches of rain over a six to ten-hour period. This rainfall event caused many county roads and other secondary roads to remain flooded for some time with several forced road closures. Additionally, several roads had small sections washed out due to their locations in low-lying areas near creeks and creek bottoms.

125-year event Central Mississippi 2003

On April 6, 2003, many counties in Mississippi experienced a 125-year rainfall event. Much of Mississippi north of Interstate 20 and extending west and east across the entire state were impacted. The 16 counties impacted included: Hinds, Scott, Rankin, Yazoo, Grenada, Leflore, Lee, Warren, Choctaw, Madison, Leake, Winston, Newton, Neshoba, Lauderdale, and Kemper. Rainfall totals averaged 7 to 12 inches in 18 hours. River flooding quickly became a major issue. Pelahatchie Creek experienced a 100-year flood event. The Chunky River at Chunky set a new record. This river flooded a portion of Interstate 20 which had to be closed for a few hours. The Chickasawhay River at Enterprise also set a record. In addition to the flash flooding, river flooding caused major damage to homes and numerous roads.

Easter Flood on the Pearl River 1979

The flood of record on the Pearl River in 1979 affected about 500 people, contributed to the deaths of four people, and resulted in an estimated $400 million in property damages. A worst-case scenario today would equal or double those numbers.

Mississippi River Flood 1927

The flood of record within the state occurred on the Mississippi River in 1927. At that time, the flood resulted in 246 deaths, left 650,000 homeless, and caused $284.1 million in property damages.

Other Flood Events

- 2014 – Severe Storms, Tornadoes, and Flooding
- 2012 - Hurricane Isaac
- 1973 - Mississippi River
- 1969 - Hurricane Camille
- 1961 - Pearl River
- 1948 - Tombigbee River
- 1892 - Tombigbee River

The below information was obtained from the NOAA website, unless otherwise stated. The flood depth information was limited, so the events recorded were best available data, attempting to describe the extent of flooding.

Tallahatchie County, June 9, 2020, Tropical Storn Cristobal moved through the region. This system brought some heavy rain and flash flooding to parts of the Mid-south including north Mississippi and southwest Tennessee. Heavy rain caused flash flooding in Charleston. Water was deep enough on North Market Street to cover the hood of a car.

Panola County, April 12, 2020, A warm front pushed north through the Mid-South earlier in the day with heavy rain and some flash flooding along with a few severe storms. The most extensive damage was in Phillips County, Arkansas and Coahoma County, Mississippi. In Como, Panola County, an apartment complex was extensively flooded. Sandbags were required. Depth of water was about 6 inches.

February 17, 2020, weeks of heavy rain inundated a large portion of the southern U.S. In Jackson, MS hundred of residents either washed their homes flood over the weekend or worried their residence would soon be drenched as the Pearl River crested at 36.8 feet, its third-highest ever recorded-behind only 1979 and 1983, according to *USA Today.*

In Holmes County, July 21, 2019, a strong thunderstorm produced flash flooding. Several roads were washed out throughout the county. One foot of water entered businesses along Depot Street in Lexington. The emergency manager reported 1 foot of water entering businesses along Depot Street in Lexington.

In Forrest County on July 14, 2019, tropical storm Barry brought severe storms and flash flooding to the region. Jackson Avenue was closed in the City of Petal due to about 2 feet of water on the street.

In Warren County, April 13, 2019, during the late afternoon and into the evening and overnight, a strong spring system pushed across the Lower Mississippy Valley region and brought widespread severe weather, a regional tornado outbreak, and flash flooding. Multiple inches of rain fell quickly. One foot of water was over Highway 3 at the Yazoo and Warren County line. Water was moving rapidly across all lanes. Multiple areas of the roadway were under water.

In Neshoba, Scott County, February 20, 2019, heavy rain and thunderstorms developed as a frontal system stalled along the coast and a series of disturbances moved through the region. Some locations received 10 to over 15 inches of rain, resulting in significant flooding. Water was over frog level road, and the fairgrounds were flooded with water up to the cabin porches. Front street flooded with several inches of water over the road. Water covered the roadway at US Highway 80 and Old Highway 80.

Perry County, June 3, 2018 flashing flooding caused several folks to be displaced by flood waters. A resident reported that it got up to an inch deep in his home. Floors got soaked, according to *WDAM.com*.

Under provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, (PL 93 – 288 as amended) and its predecessor, the Disaster Relief Act of 1970 (PL 91-606), 29 floods have resulted in federally declared "Major Disasters" since 1984. (**See Table 3.6.1**).

Table 3.6.1
Federal Disaster Declarations Flooding 1987 – 2023

Note: The FEMA website does not have record of flood-specific disaster declarations from 2017-2023. However, there are other declarations such as for hurricances where flooding was a factor but was not the primary driver for the declaration. Those declarations have been covered in other sections of the HIRA.

Date Declared	Description	Disaster Declaration	Funds Extended	
			Public Assistance (Dollars Obligated)	Individual Assistance Dollars Approved)
Nov 2017	Hurricane Nate	DR-4350	$171,409	Not Available
May 2017	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4314	$14,859,529	Not Available
Jan 2017	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4295	$8,910,037	$3,336,215
Mar 2016	Severe Storms and Flooding	DR-4268	$8,833,631	$8,144,330
Jan 2016	Severe Storms, Tornadoes, Straight-line Winds, and Flooding	DR-4248	$5,548,643	$2,903,900
Apr 2014	Severe Storms, Tornadoes, Flooding	DR-4175	$90,521,861	$5,899,175

Date Declared	Description	Disaster Declaration	Funds Extended	
			Public Assistance (Dollars Obligated)	Individual Assistance Dollars Approved)
Feb 2013	Severe Storms, Tornadoes, Flooding	DR-4101	$606,727	$2,974,219
Aug 2012	Hurricane Isaac	DR-4081	$29,319,162	$17,315,143
May 2011	Mississippi Flooding	DR-1983	$7,933,540	$13,724,525
May 2010	Severe Storms, Tornadoes, and Flooding	DR-1916	$11,262,731	$1,320,029
April 2010	Severe Storms, Tornadoes, and Flooding	DR-1906	$5,913,852	$4,302,971
May 2009	Severe Storms, Floods	DR-1837	$2,721,893	$0
Sept 2008	Hurricane Gustav	DR-1794	$33,693,136	$7,176,481
April 2008	Severe Storms	DR-1764	$4,713,231	$549,481
March 2008	Severe Storms	DR-1753	$0	$1,598,082
Aug 2005	Hurricane Katrina	DR-1604	$3,243,443,388	$1,296,454,555
July 2005	Hurricane Dennis	DR-1594	$1,735,639	$0
Sept 2004	Hurricane Ivan	DR-1550	$14,403,029	$8,514,433
April 2003	Severe Storms	DR-1459	$6,031,462	$18,270,709
Oct 2002	Tropical Storm Isidore and Hurricane	DR-1436	$6,784,617	$0
Nov 2001	Severe Storms	DR-1398	$5,519,322	Not available
June 2001	Tropical Storm Allison	DR-1382	$1,804,361	Not available
April 2001	Severe Storms	DR-1365	$2,855,253	Not available
Sept 1998	Hurricane Georges	DR-1251	$32,124,060	Not available
June 1997	Mississippi River Floods	DR-1178	$264,979	Not available
May 1995	Response 1995	DR-1051	$996,257	Not available
May 1991	April – May Floods	DR-906	$7,390,442	Not available
Feb 1990	January – March Floods	DR-859	$7,901,304	Not available
March 1987	Severe Storms, Floods	DR-7687	Not available	Not available

Source: Federal Emergency Management Agency
Total dollars for PA and IA through December 2017

There are 82 counties within the state; all of which suffered at least one event since 1950. The number of instances for each of the counties by MEMA Region is indicated in Table 3.6.2.

Table 3.6.2
Mississippi Flood History January 1950 – October 2022 By County/MEMA Region

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
MEMA Region 1	Coahoma	23	0	0	$2,088,000
	Desoto	77	2	0	$11,084,000
	Grenada	64	0	0	$4,721,000
	Panola	30	1	1	$1,565,000
	Quitman	7	0	2	$2,762,000
	Tallahatchie	19	0	0	$3,246,000
	Tate	26	2	7	$478,000
	Tunica	14	2	0	$1,002,000,000
	Yalobusha	11	0	0	$258,000
Total Region 1 Totals		271	7	10	**$1,028,202,000**
MEMA Region 2	Alcorn	38	1	0	$5,671,000
	Benton	6	0	0	$762,000
	Itawamba	17	0	0	$295,000
	Lafayette	28	0	0	$1,620,000
	Lee	59	0	0	$1,359,000
	Marshall	20	1	0	$1,142,000
	Pontotoc	29	0	0	$370,000
	Prentiss	24	0	0	$423,000
	Tippah	20	0	0	$1,587,000
	Tishomingo	16	3	0	$1,054,000
	Union	31	0	0	$1,417,000
Total Region 2 Totals		288	5	0	**$15,700,000**
MEMA Region 3	Attala	29	0	0	$2,738,000
	Bolivar	52	0	0	$6,452,000
	Carroll	29	0	0	$1,336,000
	Holmes	27	0	0	$13,579,000
	Humphreys	22	0	0	$2,139,000
	Leflore	38	0	0	$3,417,000
	Montgomery	27	0	1	$1,057,000
	Sunflower	45	0	0	$3,373,000
	Washington	61	0	0	$18,863,000
Total Region 3 Totals		330	0	1	**$52,954,000**

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
MEMA Region 4	Calhoun	25	0	0	$326,000
	Chickasaw	15	0	0	$318,000
	Choctaw	21	0	0	$1,222,000
	Clay	23	0	0	$1,274,000
	Lowndes	54	0	0	$7,255,000
	Monroe	29	0	0	$1,751,000
	Noxubee	24	0	0	$646,000
	Oktibbeha	45	0	0	$2,121,000
	Webster	24	0	1	$2,046,000
	Winston	32	0	0	$1,354,000
Total Region 4 Totals		292	0	1	$18,313,000
MEMA Region 5	Claiborne	19	0	0	$1,284,000
	Copiah	31	0	0	$2,489,000
	Hinds	178	0	0	$32,604,000
	Issaquena	10	0	0	$2,163,000
	Madison	104	0	0	$54,947,000
	Rankin	217	1	0	$44,341,000
	Sharkey	20	0	0	$1,748,000
	Simpson	38	0	0	$563,000
	Warren	72	0	0	$22,069,000
	Yazoo	59	1	0	$20,319,000
Total Region 5 Totals		748	1	0	$182,527,000
MEMA Region 6	Clarke	41	0	0	$4,735,000
	Jasper	40	0	0	$4,042,000
	Kemper	16	0	0	$1,605,000
	Lauderdale	83	0	0	$56,048,000
	Leake	41	0	0	$11,179,000
	Neshoba	44	0	0	$2,222,000
	Newton	54	0	0	$32,361,000
	Scott	55	1	0	$53,384,000
	Smith	41	0	0	$692,000
Total Region 6 Totals		415	1	0	$166,268,000
MEMA Region 7	Adams	42	0	0	$4,231,000
	Amite	8	0	0	$990,000
	Franklin	29	0	0	$2,860,000

MEMA Region	County	Number of Events	Deaths	Injuries	Property Damage
	Jefferson	18	0	0	$3,865,000
	Lawrence	32	0	0	$2,360,000
	Lincoln	44	0	0	$6,795,000
	Pike	13	0	0	$985,000
	Walthall	8	0	0	$1,260,000
	Wilkinson	12	0	0	$7,265,000
Total Region 7 Totals		206	0	0	**$30,611,000**
MEMA Region 8	Covington	52	0	0	$3,181,000
	Forrest	136	1	0	$9,502,000
	Greene	31	0	0	$659,000
	Jefferson	18	0	0	$3,865,000
	Jones	130	0	0	$10,874,000
	Lamar	90	0	0	$12,616,000
	Marion	79	0	0	$25,502,000
	Perry	34	0	0	$1,993,000
	Wayne	31	0	0	$1,241,000
Total Region 8 Totals		601	1	0	**$69,433,000**
MEMA Region 9	George	35	3	7	$2,342,000
	Hancock	56	0	0	$3,396,000,000
	Harrison	90	2	0	$5,647,000,000
	Jackson	51	0	0	$2,257,000,000
	Pearl River	23	0	0	$4,035,000
	Stone	43	0	0	$223,000
Total Region 9 Totals		298	5	7	**$11,306,600,000**
Total		3,449	21	19	**$12,870,608,000**

Source: NCEI Database with the following parameters: coastal flood, flash flood, flood, heavy rain, lakeshore flood, storm surge/tide

Probability of Future Flood Events

Based on available historical data, floods occur within the state of Mississippi multiple times per year resulting in a calculated probability of reoccurrence of 3.21 annually. Approximately one in six acres in Mississippi is found within the FEMA-designated floodplain.

The Flood Insurance Studies (FIS) and their accompanying Flood Insurance Rate Maps (FIRMs) provide a means to identify the probability of future flood events. The utilization of the flood profiles for each river and stream, a summary of discharge tables, and floodway data tables allow each community's future event probability to be identified. The flood levels that can be predicted consist of the 10-year, 50-year, 100-year, and 500-year Base Flood Elevation (BFE) depths.

The effects of a changing climate were considered. Floods are lasting longer and carrying more water than before. Another means of prediction of future events is the examination of past events, as this also establishes a probability of recurring floods or repetitive flooding. There have been 29 federally declared disasters in Mississippi since 1987 (Table 3.6.1) and 19 Small Business Administration (Table 3.6.3) flood declarations. Each event contained some measure of the four types of flooding identified in the flood hazard description of this plan. These statistics place the state of Mississippi within the top tier of disaster-prone states.

Research shows that many inland areas in the United States are flooding more often. Heavy rainfall caused by climate change as well as human alteration and tampering of the land are the main drivers for this. Global warming/climate change is shifting rainfall patterns, making heavy rain more frequent in many areas of the country. With human alteration of the land - like the engineering of rivers, the destruction of natural protective systems, and increased construction on floodplains - many parts of the United States are at greater risk of experiencing destructive and costly floods. Although not as frequent as inland flooding, coastal surge has occurred 13 times within the past 20 years resulting in a probability of reoccurrence of .65 annually; while, coastal flooding has occurred 11 times within the past 12 years resulting in a probability of reoccurrence of 92% annually.

Table 3.6.3
Number of Counties Designated in SBA Declared Flood Events Since 1998

Disaster Designation	Initial Date of Declaration	Number of Counties
SBA MS-00130	December 2020	4
SBA MS-00134	December 2020	8
SBA AL-00115	December 2020	4
SBA AL-00111	September 2020	3
SBA TN-00124	August 2020	1
SBA MS-00129	July 2020	11
SBA MS-00126	May 2020	5
SBA MS-00127	May 2020	29
SBA MS-00125	April 2020	15
SBA MS-00124	April 2020	24
SBA MS-00121	March 2020	10
SBA MS-00123	March 2020	13
SBA MS-00120	February 2020	3
SBA MS-00118	January 2020	6
SBA MS-00116	December 2019	3
SBA MS-00117	December 2019	19
SBA MS-00113	November 2019	7
SBA MS-00110	September 2019	14
SBA TN-00107	June 2019	2

Disaster Designation	Initial Date of Declaration	Number of Counties
SBA MS-00112	June 2019	9
SBA AR-00104	June 2019	2
SBA MS-00111	April 2019	29
SBA MS-00109	February 2019	11
SBA MS-00108	January 2019	10
SBA LA-00087*	January 2019	4
SBA TN-00106*	May 2017	6
SBA MS-00102*	May 2017	8
SBA MS-13543	April 2013	5
SBA MS-13492	February 2013	10
SBA MS-13439	January 2013	7
SBA MS-13273	September 2013	22
SBA MS-12938	November 2011	7
SBA MS-00029	May 2009	7
SBA MS-00033	April 2009	18
SBA MS-00034	March 2009	82
SBA MS-00028	March 2009	4
SBA MS-00026	August 2008	63
SBA MS-00020	May 2008	9
SBA MS-00021	March 2008	12
SBA MS-00009	November 2006	13
SBA (Flooding)	April 2005	18
SBA (Flooding)	August 2004	2
SBA (Flooding)	August 2003	7
SBA (Flooding)	August 2001	1

Source: U.S. Small Business Administration.

*Included counties in neighboring states

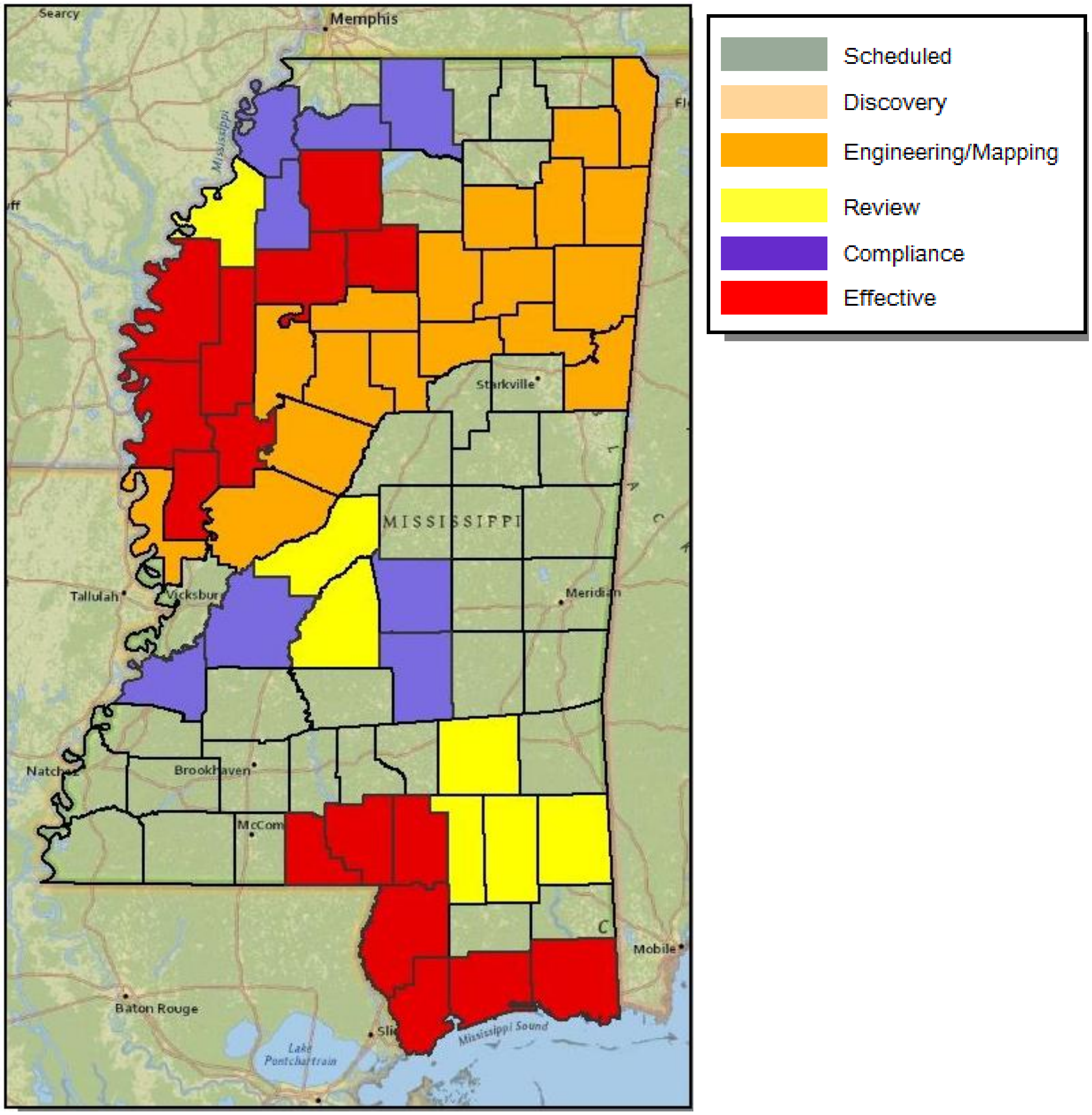
FEMA RiskMAP Program in Mississippi

Beginning with FEMA FY2010 funding, the state of Mississippi and FEMA flood mapping shifted from the original FEMA Map Modification Program where DFIRM work was based on county-wide projects to the new RiskMAP Program. The primary difference between the RiskMap and Map Mod programs is that DFIRM work is now based on HUC-8 basins (for example Big Sunflower Basin) which include all or parts of multiple counties under RiskMAP. In addition to the regulatory products (Flood Insurance Study (FIS), DFIRM, and DFIRM GIS Database), communities in a studied basin will receive new non-regulatory products which will include the following; Watershed Flood Risk Report, Watershed Risk Map, and Flood Risk GIS Database with Changes Since Last FIRM data, Multi-Frequency Flood Depth Grids, Percent Annual Chance of Flooding data, Percent Chance of Flooding over 30-Years and new HAZUS Annualized Risk data. This data can be used in day-to-day floodplain management, and mitigation work and can be incorporated into hazard planning. All new DFIRM work will use Lidar elevation data where available.

New preliminary FIRMs and Flood Insurance Study (FIS) reports were completed for several counties since the last plan update:

County	Year	County	Year
• Hancock	2019	• Desoto	2021
• Pearl River	2019	• Marshall	2021
• Lamar	2019	• Quitman	2021
• Marion	2019	• Tate	2021
• Walthall	2019	• Tunica	2021
• Itawamba	2019	• Panola	2021
• Monroe	2019	• Tallahatchie	2021
• Scott	2021	• Yalabusha	2021
• Smith	2021	• Bolivar	2021
• Claiborne	2021	• Humphreys	2021
• Hinds	2021	• Sharkey	2021
• Benton	2021	• Sunflower	2021
• Coahoma	2021	• Washington	2021

The following map shows the status of the Mississippi Flood Risk Mapping, Assessment, and Planning status as of April 22, 2021.



Source: https://geology.deq.ms.gov/floodmaps/Projects/RiskMAP/

National Flood Insurance Program (NFIP)

Mississippi has 363 communities that have federally identified Special Flood Hazard Areas (SFHA) or floodplains. These areas indicate the water surface elevation resulting from a flood that has a one percent or greater chance of being equaled or exceeded in any given year.

330 Mississippi communities are members of the National Flood Insurance Program (NFIP), including 4

communities (Carrollton, Coahoma, Courtland, and Renova) that are in the emergency plan. Additionally, 32 communities also participate in the Community Rating System (CRS). Details on the communities that participate in the program are found in Appendix 7.3.6-A. To show the forward progress being made by communities, **Table 3.6.4** provides a summary of the community participation in the NFIP and CRS communities since the 2007 State of Mississippi Standard Hazard Mitigation Plan.

Table 3.6.4
NFIP and CRS Community Participation

State Plan Year	NFIP Communities	Emergency Plan	CRS Communities
2023	391		33
2018	330	4	32
2013	329	4	31
2010	305	15	23
2007	276	4	19

Mississippi continues to rank high in the nation for NFIP claims payments. **Table 3.6.5** details the ten Mississippi counties with the greatest total NFIP claims payments through February 2018. Details on flood insurance policies by county can be referenced in **Appendix 7.3.6-B**. Data current through 2022 is redacted and does not accurately reflect a true update for the period from 2019-2022.

Table 3.6.5
NFIP Loss Statistics Top 10 Counties January 1978 to February 2018

County	Total Losses	Closed Losses	Open Losses	Closed w/o Payment Losses	Total Payments
Harrison	11,395	12,777	12	2,376	$1,281,229,535
Hancock	9,646	8,572	14	1,060	$737,684,695
Jackson	10,650	9,121	26	1,503	$703,296,088
Hinds	4,195	3,399	32	764	$59,269,645.97
Washington	1,849	1,515	25	309	$33,696,394
Warren	2,765	2,418	1	346	$30,876,258
Bolivar	1,300	1,135	4	161	$22,411,146
Wilkinson	1,871	1,592	1	278	$20,595,214
Pearl River	730	568	1	161	$13,509,714
Forrest	1,746	1,379	1	366	$9,754,712.47

Source: bsa.nfipstats.html (NFIP Policy and Loss by Community February 2018)

The State's Floodplain Manager and local jurisdictions maintain detailed data on properties classified as repetitive flood loss properties or severe repetitive loss properties that include specific addresses and homeowner information. This information is protected under the Privacy Act of 1974 and is not included as an appendix item with this plan update (contact the State Floodplain Manager for details).

Repetitive Loss Property Analysis

The reduction of losses related to repetitive loss structures is a high priority for Mississippi and for the U.S. Repetitive loss properties strain the National Flood Insurance (NFIP) Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. At least two of the claims must be more than ten days apart.

A repetitive loss property is also defined by the following when considering the Pre-Disaster Mitigation Program (PDM):

- A property covered under a contract for flood insurance made available under the NFIP; and has incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and
- At the time of the second incidence of flood-related damage, the contract for flood insurance contains an increased cost of compliance coverage.

Table 3.6.6 illustrates the number of properties and payments received for Mississippi's top 10 repetitive loss counties. The table ranks counties by repetitive loss dollars paid between 1978 and February 2016 and is sorted by the highest total payments received. The top three counties with repetitive losses continue to be the coastal counties of Harrison, Hancock, and Jackson. Figure 3.6.5 illustrates the number of properties by county. Additional details by county are also provided by MEMA Region later in this section.

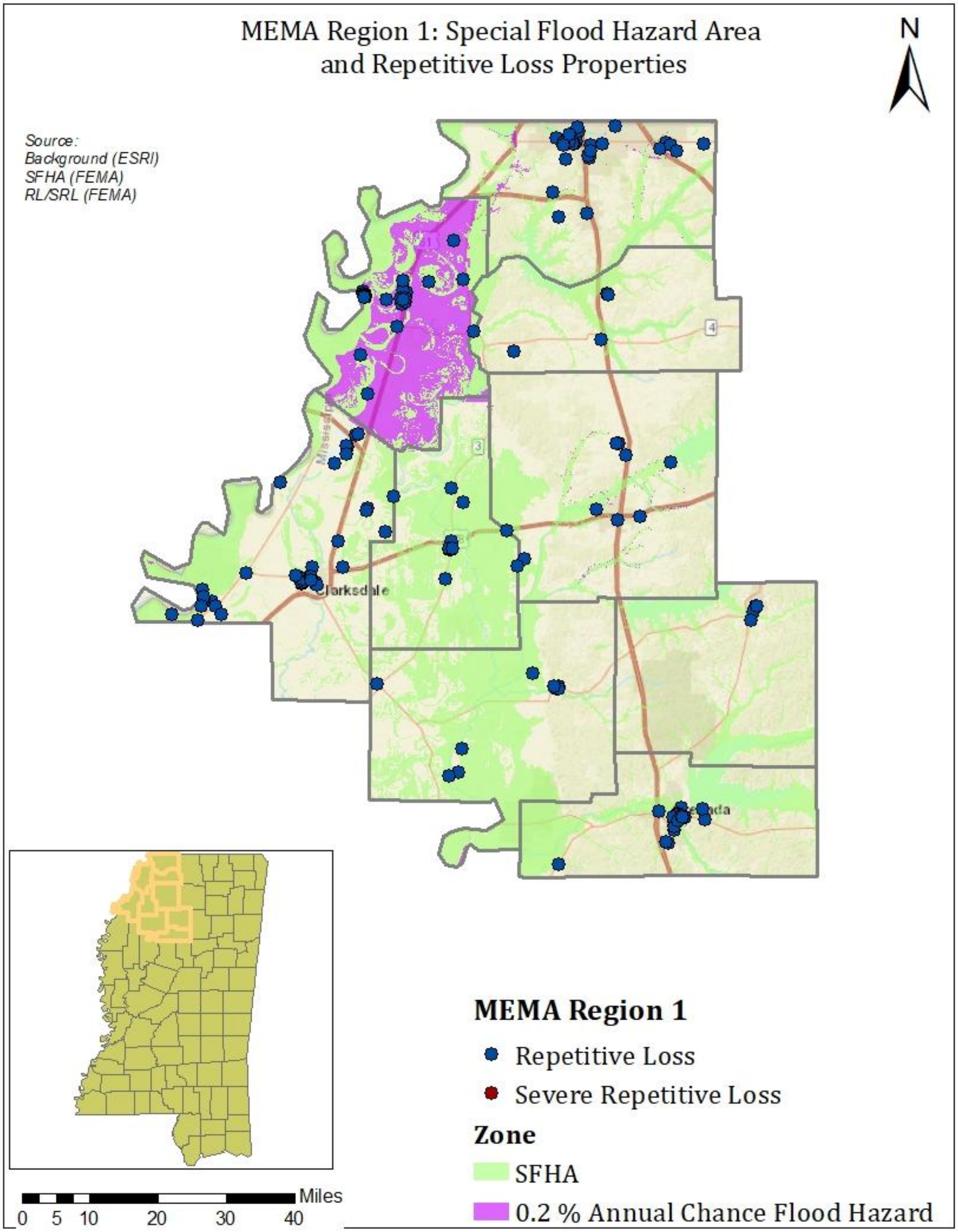
Table 3.6.6
Repetitive Loss (RL) Flood Claims by County (1978-2016)

County	No. of RL Properties	No. of Insured Properties	No. of Mitigated Properties	Flood Claims	Total Property Value	Total Payments
Harrison	1,290	427	674	222	$11,203,151,307*	$197,852,894
Jackson	1,260	509	379	3,144	$233,383,062*	$175,661,475
Hancock	1,036	442	428	2,683	$166,055,374*	$121,615,790
Hinds	443	190	18	1,117	$64,181,531*	$24,239,035
Warren	393	18	247	1,418	$79,757,122*	$21,019,934
Washington	191	29	26	631	$21,485,272*	$15,307,508
Wilkinson	190	15	94	774	$34,089,945*	$12,893,255
Pearl River	82	23	18	260	$13,881,972*	$5,921,890
Rankin	94	32	26	237	$21,464,455*	$5,324,565
Forrest	205	26	130	551	$18,920,148*	$4,322,726

Source: State Floodplain Manager NFIP List as of February 2016
*Property values listed for condominiums were removed due to inaccuracy.

Below is a series of figures, which show the repetitive loss and severe repetitive loss structures located within the special flood hazard area (SHFA) per MEMA Region.

Figure 3.6-1 MEMA Region 1 Special Flood Hazard Area (SHFA) and Repetitive Loss


MEMA Region 1: Special Flood Hazard Area
and Repetitive Loss Properties
N
Source:
Background (ESRI)
SFHA (FEMA)
RL/SRL (FEMA)
Clarksdale
MEMA Region 1
Repetitive Loss
Severe Repetitive Loss
Zone
SFHA
0.2 % Annual Chance Flood Hazard
Miles
0 5 10 20 30 40

Structures

Figure 3.6-2 MEMA Region 2 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

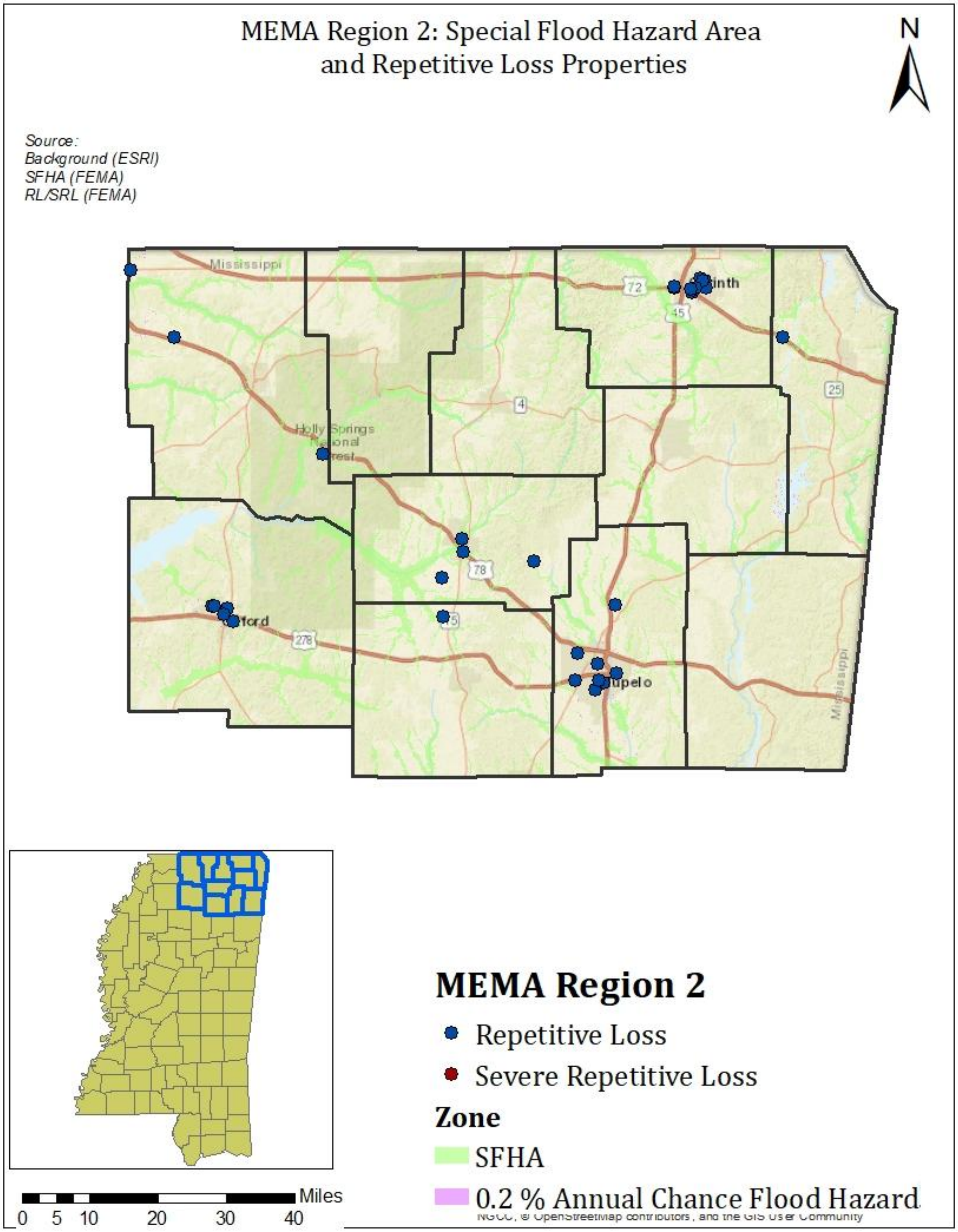


Figure 3.6-3 MEMA Region 3 Special Flood Hazard Area (SHFA) and Repetitive Loss

Structures

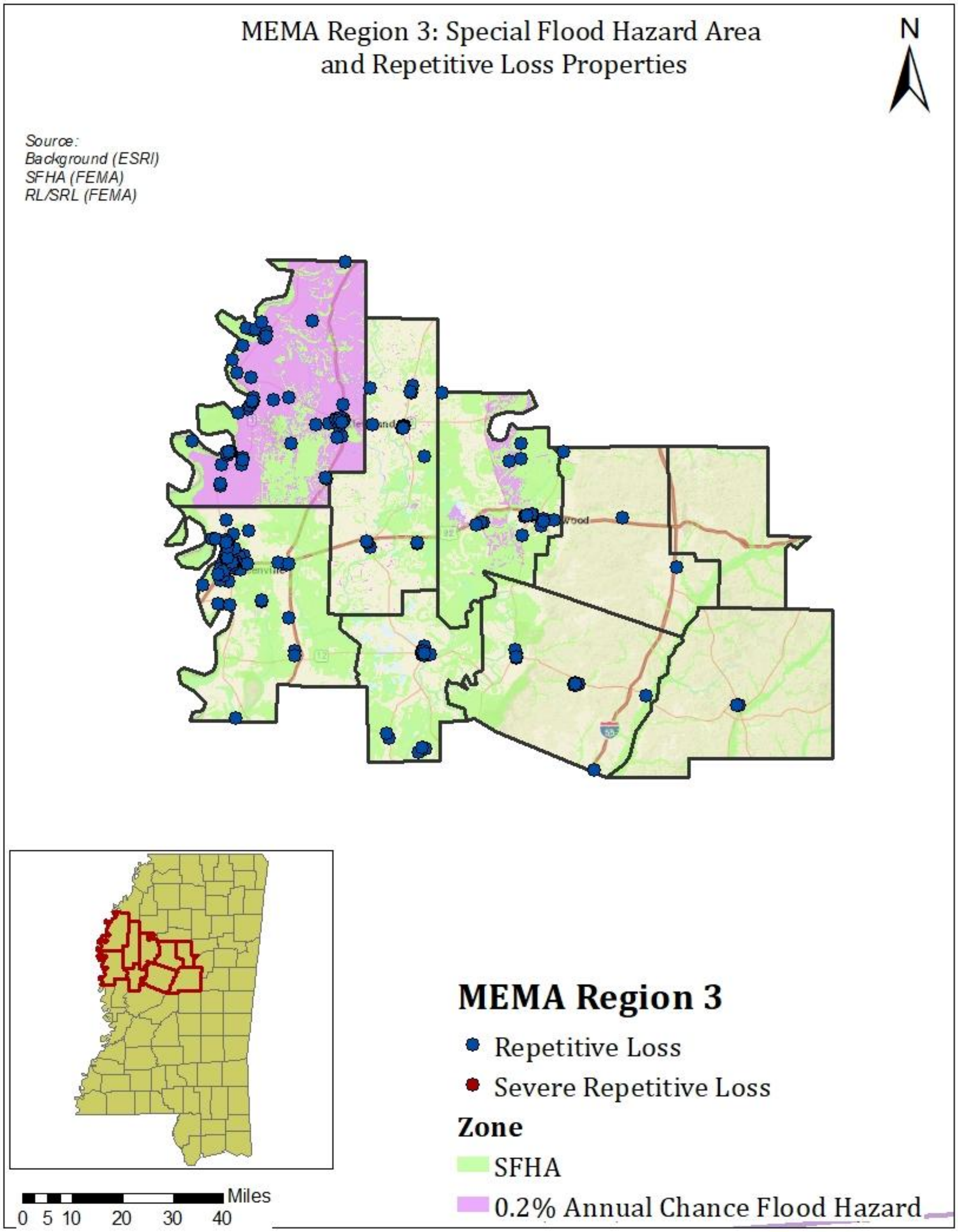

MEMA Region 3: Special Flood Hazard Area
and Repetitive Loss Properties
N
Source:
Background (ESRI)
SFHA (FEMA)
RL/SRL (FEMA)
MEMA Region 3
Repetitive Loss
Severe Repetitive Loss
Zone
SFHA
0.2% Annual Chance Flood Hazard
Miles
0 5 10 20 30 40

Figure 3.6-4 MEMA Region 4 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

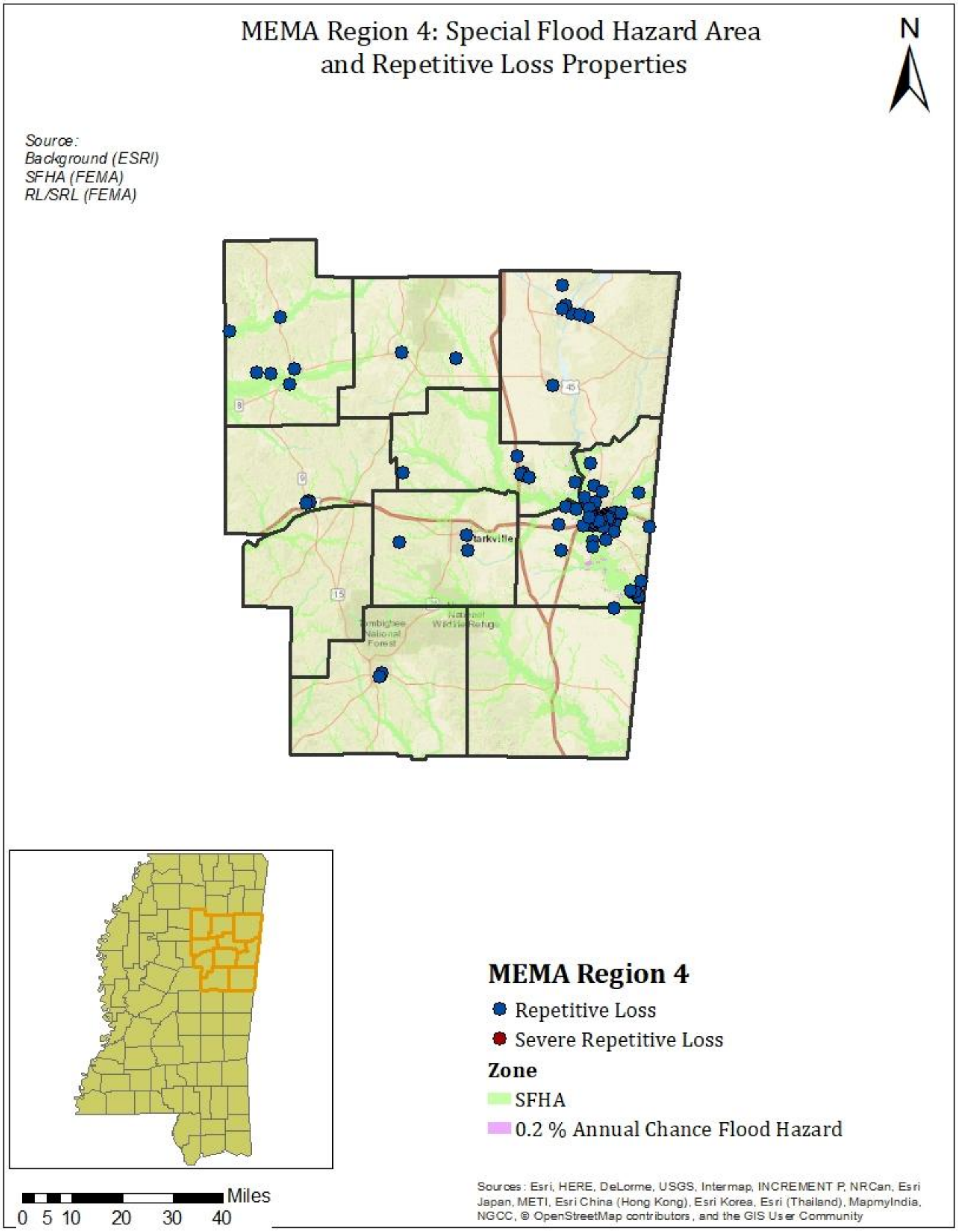

MEMA Region 4: Special Flood Hazard Area
and Repetitive Loss Properties
N
Source:
Background (ESRI)
SFHA (FEMA)
RL/SRL (FEMA)
MEMA Region 4
Repetitive Loss
Severe Repetitive Loss
Zone
SFHA
0.2 % Annual Chance Flood Hazard
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Miles
0 5 10 20 30 40

Figure 3.6-5 MEMA Region 5 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

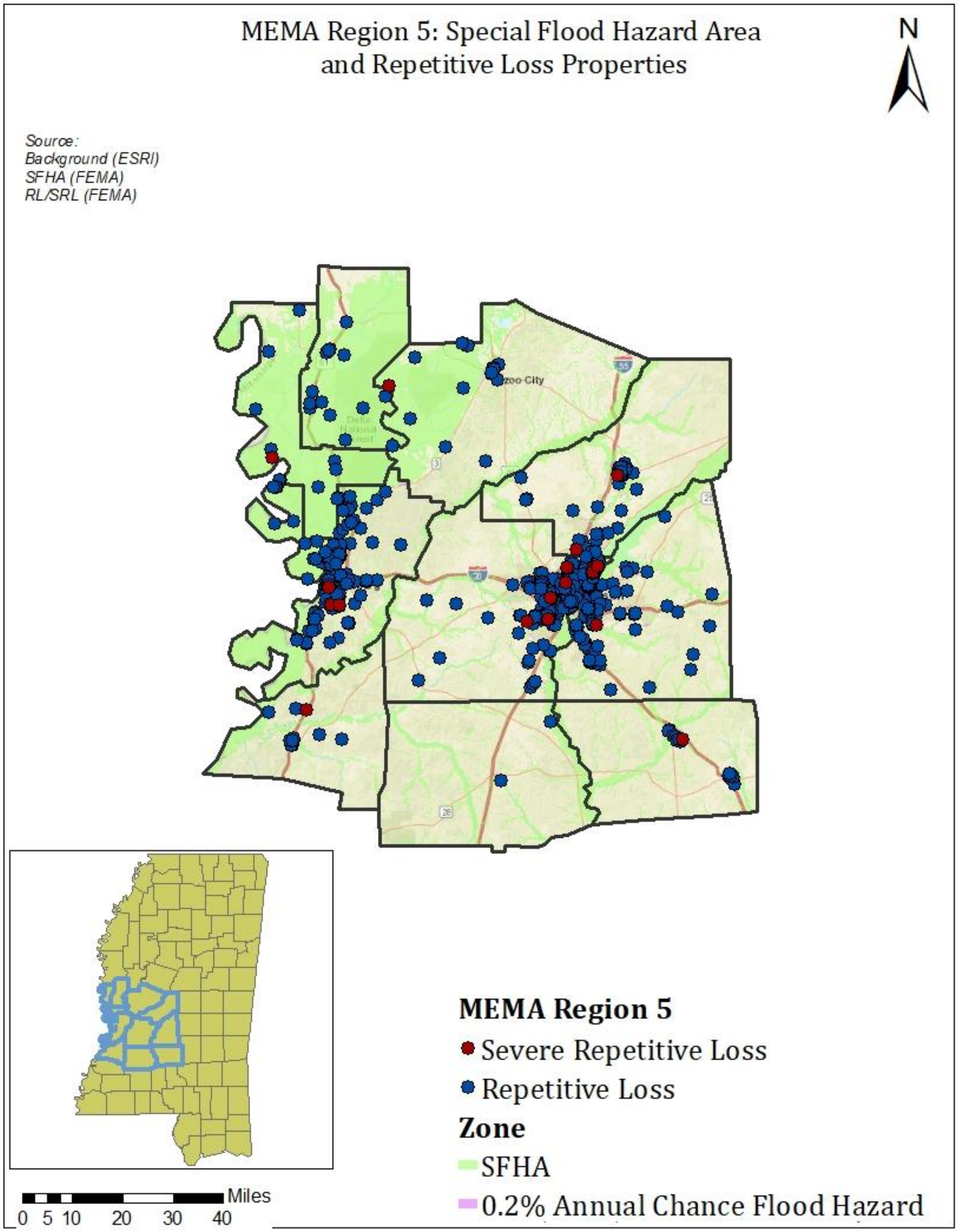


Figure 3.6-6 MEMA Region 6 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

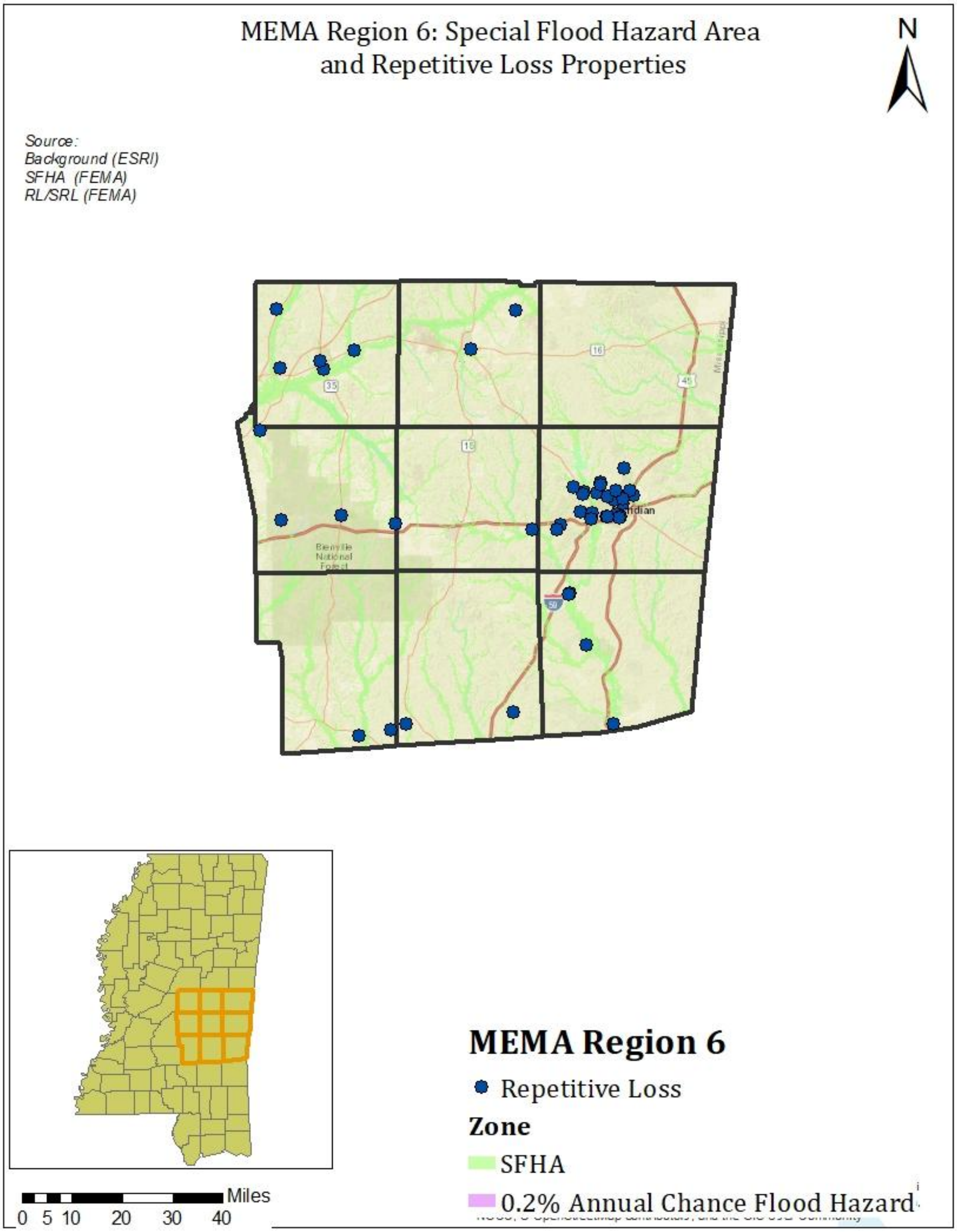


Figure 3.6-7 MEMA Region 7 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures

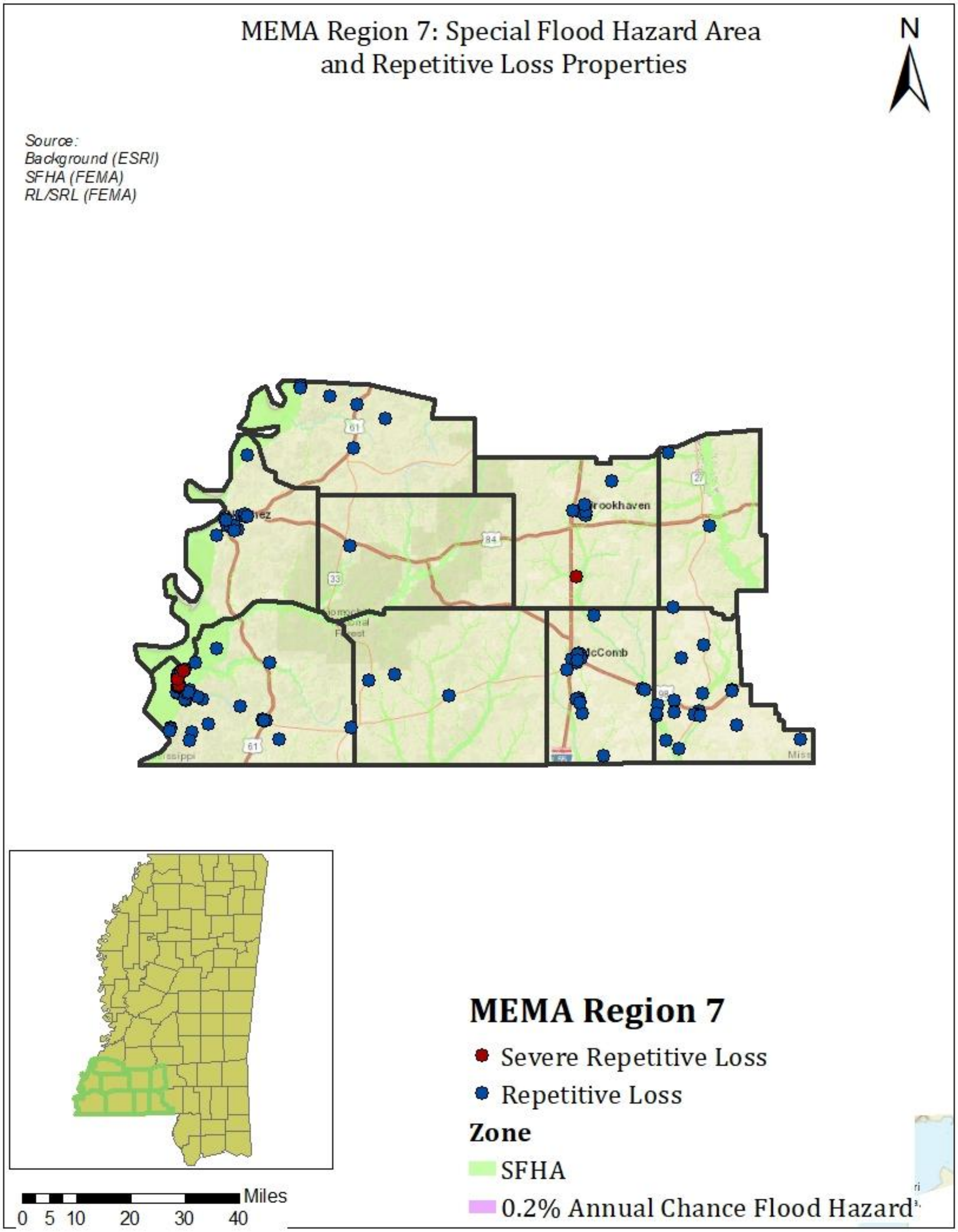
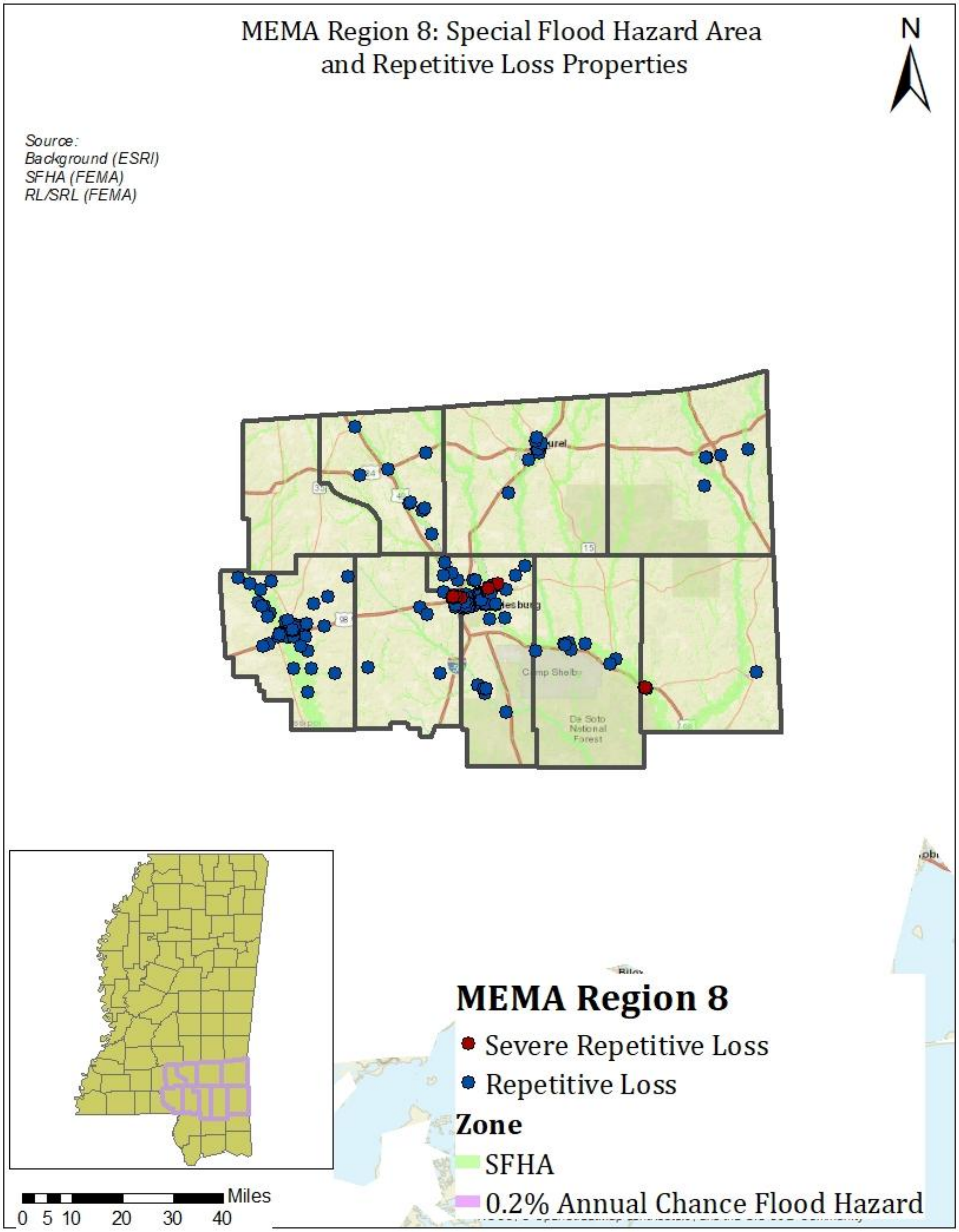


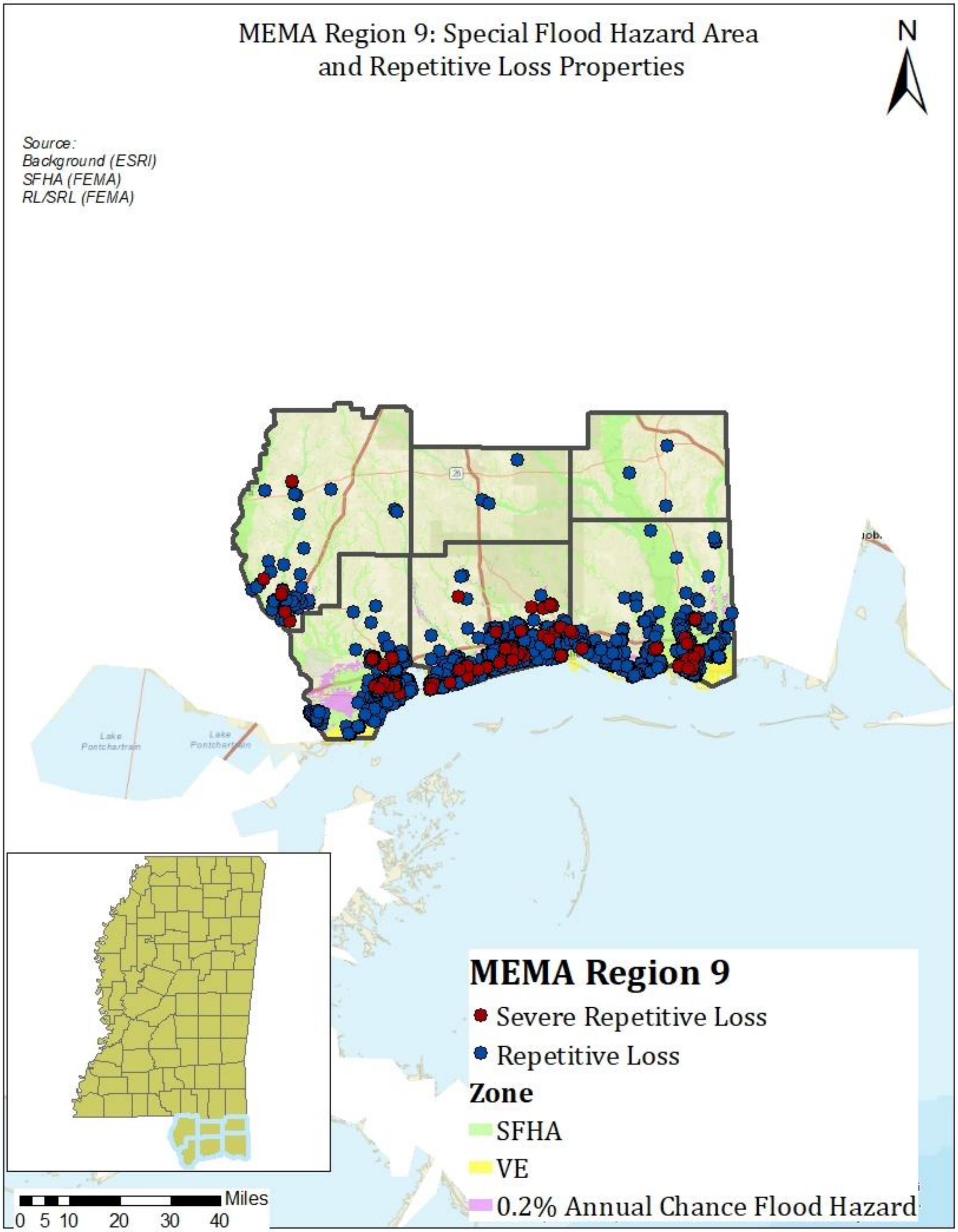
Figure 3.6-8 MEMA Region 8 Special Flood Hazard Area (SHFA) and Repetitive Loss

Structures



MEMA Region 8: Special Flood Hazard Area
and Repetitive Loss Properties
N
Source:
Background (ESRI)
SFHA (FEMA)
RL/SRL (FEMA)
Camp Shelby
De Soto
National
Forest
MEMA Region 8
Severe Repetitive Loss
Repetitive Loss
Zone
SFHA
0.2% Annual Chance Flood Hazard
Miles
0 5 10 20 30 40

Figure 3.6-9 MEMA Region 9 Special Flood Hazard Area (SHFA) and Repetitive Loss Structures


MEMA Region 9: Special Flood Hazard Area
and Repetitive Loss Properties
N
Source:
Background (ESRI)
SFHA (FEMA)
RL/SRL (FEMA)
Lake Pontchartrain
Lake Pontchartrain
MEMA Region 9
Severe Repetitive Loss
Repetitive Loss
Zone
SFHA
VE
0.2% Annual Chance Flood Hazard
Miles
0 5 10 20 30 40

Severe Repetitive Loss Property Analysis

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss. Severe repetitive loss (SRL) is defined as "

A property covered under a contract for flood insurance made available under the NFIP; and

Has incurred flood-related damage

- For which four or more separate claims payments (including building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or
- For which at least two separate claims payments (including only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Table 3.6.7 illustrates the number of properties and the payments received for Mississippi's top 10 severe repetitive loss counties. The table ranks counties by severe repetitive loss dollars paid between 1978 and February 2016 and is sorted by the highest total payments received. The top three counties with repetitive losses continue to be the coastal counties of Harrison, Hancock, and Jackson. and Figure 3.6.6 illustrates the number of properties by county. Additional details by county are also provided by MEMA Region later in this section.

Table 3.6.7
Mississippi's Severe Repetitive Loss Summary by County
(Ranked by Total Payment)

County	No. of SRL Properties	No. of Insured Properties	Flood Claims	Total Property Value	Total Payments (Bldg and Contents)
Harrison	51	1*	222	$9,844,971	$11,635,104
Jackson	31	4*	194	$6,057,105	$5,393,976
Hancock	27	0*	93	$4,237,655	$5,368,404
Hinds	15	0*	53	$1,446,339	$1,418,565
Washington	5	2*	22	$806,287	$1,232,560
Lamar	8	0*	48	$1,177,548	$969,758
Wilkinson	6	1*	32	$669,905	$814,558
Warren	2	1*	9	$341,911	$217,869
Bolivar	2	0*	7	$40,876	$84,548
Claiborne	1	0*	10	$25,603	$80,549

Source: State Floodplain Manager NFIP List as of February 2016
*All other structures listed as SDF

MEMA Region Repetitive Loss/Severe Repetitive Loss Summary

Added to this section in 2013, and updated in 2018, is a summary of the repetitive and severe repetitive loss properties by MEMA Region. As shown in the tables, a comparison of the 2009, 2011, and 2016 NFIP reports is provided to show progress made - including the number of mitigated properties to date. A summary of the number of NFIP communities is displayed. The counties that have added communities are highlighted in bold font.

MEMA Region 1

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Coahoma	15	42	51	133	0	5	0	18
Desoto	14	0	40	107	0	0	1	8
Grenada	14	49	63	153	0	13	0	32
Panola	7	7	8	19	0	0	0	0
Quitman	21	20	22	62	0	1	0	4
Tallahatchi	9	9	11	24	0	0	0	0
Tate	1	2	6	12	0	0	0	0
Tunica	77	65	79	206	1	10	0	43
Yalobusha	8	8	9	17	0	0	0	0
Totals	**166**	**202**	**289**	**733**	**1**	**29**	**1**	**105**

County	No. of NFIP Communities	No. of Mitigated Properties
Coahoma	7	13
Desoto	6	0
Grenada	2	9
Panola	7	3
Quitman	6	1

County	No. of NFIP Communities	No. of Mitigated Properties
Tallahatchie	6	0
Tate	3	0
Tunica	2	14
Yalobusha	4	0
Totals	**43**	**40**

MEMA Region 2

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Alcorn	0	7	0	14	0	0	0	0
Benton	0	0	0	0	0	0	0	0
Itawamba	0	0	0	0	0	0	0	0
Lafayette	0	3	6	11	0	0	0	0
Lee	4	7	10	28	0	1	1	5
Marshall	1	1	1	3	0	0	0	0
Pontotoc	1	1	1	2	0	0	0	0
Prentiss	0	0	0	0	3	0	0	0
Tippah	0	0	0	0	0	0	0	0
Tishomingo	1	1	1	2	0	0	0	0
Union	3	2	5	8	0	1	0	2
Totals	**10**	**22**	**24**	**68**	**3**	**2**	**1**	**7**

County	No. of NFIP Communities	No. of Mitigated Properties
Alcorn	5	0
Benton	3	0
Itawamba	3	0
Lafayette	4	0
Lee	10	3
Marshall	4	0

County	No. of NFIP Communities	No. of Mitigated Properties
Pontotoc	7	0
Prentiss	2	0
Tippah	6	0
Tishomingo	7	0
Union	4	0
Totals	**55**	**3**

MEMA Region 3

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Attala	0	0	1	2	0	0	0	0
Bolivar	155	108	210	631	2	48	2	228
Carroll	4	4	4	8	0	0	0	0
Holmes	11	12	12	27	0	0	0	0
Humphreys	40	31	46	161	2	10	1	61
LeFlore	29	27	27	71	0	2	0	8
Montgomer	0	0	0	0	0	0	0	0
Sunflower	19	16	20	72	1	4	0	21
Washington	152	115	191	631	14	48	8	250
Totals	**410**	**313**	**511**	**1,603**	**19**	**112**	**11**	**568**

County	No. of NFIP Communities	No. of Mitigated Properties
Attala	5	0
Bolivar	16	20
Carroll	4	0
Holmes	8	0
Humphreys	5	1

County	No. of NFIP Communities	No. of Mitigated Properties
Leflore	6	1
Montgomery	4	0
Sunflower	8	4
Washington	6	26
Totals	**62**	**52**

MEMA Region 4

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Calhoun	5	4	5	15	0	1	0	7
Chickasaw	1	1	1	2	0	0	0	0
Choctaw	0	0	0	0	0	0	0	0
Clay	8	8	9	26	0	0	0	0
Lowndes	125	109	123	389	2	14	2	79
Monroe	12	9	11	33	1	3	1	11
Noxubee	0	0	0	0	0	0	0	0
Oktibbeha	2	2	2	7	0	0	0	0
Webster	5	4	5	16	0	1	0	6
Winston	2	2	2	4	0	0	0	0
Totals	**160**	**139**	**158**	**474**	**3**	**19**	**3**	**103**

County	No. of NFIP Communities	No. of Mitigated Properties
Calhoun	7	0
Chickasaw	5	0
Choctaw	5	0
Clay	2	0
Lowndes	4	18

County	No. of NFIP Communities	No. of Mitigated Properties
Monroe	6	0
Noxubee	4	0
Oktibbeha	3	0
Webster	2	0
Winston	2	0
Totals	**40**	**18**

MEMA Region 5

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Claiborne	79	48	82	294	7	32	1	162
Copiah	2	2	3	6	0	0	0	0
Hinds	388	365	438	1,102	15	46	15	157
Issaquena	128	93	134	402	3	39	1	137
Madison	40	64	72	351	0	6	3	46
Rankin	47	68	93	237	0	0	0	0
Sharkey	20	16	25	68	2	9	2	25
Simpson	27	26	30	108	0	4	1	38
Warren	191	321	393	1,418	6	60	3	299
Yazoo	9	15	25	64	0	0	0	0
Totals	**931**	**1,018**	**1,295**	**4,050**	**33**	**196**	**26**	**864**

County	No. of NFIP Communities	No. of Mitigated Properties
Claiborne	2	14
Copiah	5	1
Hinds	11	18
Issaquena	2	16
Madison	7	34

County	No. of NFIP Communities	No. of Mitigated Properties
Rankin	10	25
Sharkey	4	0
Simpson	5	3
Warren	2	247
Yazoo	5	6
Totals	**53**	**364**

MEMA Region 6

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Clarke	3	4	17	49	0	0	0	0
Jasper	1	0	3	7	0	1	0	3
Kemper	0	0	0	0	0	0	0	0
Lauderdale	24	26	26	73	0	1	0	4
Leake	4	4	4	8	0	0	0	0
Neshoba	0	0	0	0	0	0	0	0
Newton	1	1	1	2	0	0	0	0
Scott	3	3	2	4	0	0	0	0
Smith	0	0	0	0	0	0	0	0
Totals	**36**	**38**	**53**	**143**	**0**	**2**	**0**	**7**

County	No. of NFIP Communities	No. of Mitigated Properties
Clarke	6	2
Jasper	5	0
Kemper	3	0
Lauderdale	3	11
Leake	5	0

County	No. of NFIP Communities	No. of Mitigated Properties
Neshoba	4	0
Newton	6	0
Scott	6	0
Smith	3	0
Totals	**41**	**13**

MEMA Region 7

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Adams	11	16	29	72	0	0	0	0
Amite	0	0	3	8	0	0	0	0
Franklin	0	0	2	3	0	0	0	0
Jefferson	9	6	12	40	0	3	0	17
Lawrence	2	1	14	53	1	1	0	11
Lincoln	3	3	2	6	0	0	0	0
Pike	10	12	2	4	0	3	1	16
Walthall	19	16	2	5	0	3	0	8
Wilkinson	204	116	189	774	3	86	6	440
Totals	**258**	**170**	**255**	**965**	**4**	**96**	**7**	**492**

County	No. of NFIP Communities	No. of Mitigated Properties
Adams	2	5
Amite	3	0
Franklin	4	0
Jefferson	2	6
Lawrence	4	6

County	No. of NFIP Communities	No. of Mitigated Properties
Lincoln	2	2
Pike	4	2
Walthall	2	2
Wilkinson	4	93
Totals	**27**	**116**

MEMA Region 8

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
Covington	11	11	11	27	0	0	0	0
Forrest	71	191	204	551	2	6	4	43
Greene	0	2	1	2	0	0	0	0
Jefferson Davis	0	0	0	0	0	0	0	0
Jones	12	12	13	36	0	0	0	0
Lamar	36	19	39	198	6	19	8	128
Marion	83	77	91	288	2	14	0	73
Perry	11	9	12	29	0	2	0	6
Wayne	3	3	5	19	0	0	0	0
Totals	**227**	**324**	**376**	**1,150**	**10**	**41**	**12**	**250**

County	No. of NFIP Communities	No. of Mitigated Properties
Covington	4	0
Forrest	3	129
Greene	4	0
Jefferson Davis	3	0
Jones	5	0

County	No. of NFIP Communities	No. of Mitigated Properties
Lamar	5	2
Marion	2	10
Perry	4	1
Wayne	3	0
Totals	**33**	**142**

MEMA Region 9

County	Repetitive Loss				Severe Repetitive Loss			
	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims	No. of Properties 2009	No. of Properties 2011	No. of Properties 2016	No. of Flood Claims
George	1	1	3	7	0	0	0	0
Hancock	727	818	1,036	2,683	39	70	28	231
Harrison	724	1,085	1,290	3,985	72	125	51	557
Jackson	947	965	1,260	3,144	26	95	33	394
Pearl River	61	61	82	260	6	10	7	44
Stone	1	1	2	4	0	0	0	0
Totals	**2,461**	**2,931**	**3,674**	**10,083**	**143**	**300**	**119**	**1,226**

County	No. of NFIP Communities	No. of Mitigated Properties
George	2	0
Hancock	4	428
Harrison	6	674

County	No. of NFIP Communities	No. of Mitigated Properties
Jackson	5	379
Pearl River	4	17
Stone	2	0
Totals	**23**	**1,498**

Assessing Vulnerability by Jurisdiction / Estimating Potential Losses

Methodology

This plan updated the HAZUS runs for flood from the 2013 plan, using the most recent version of the program available. All HAZUS runs were generated by MEMA Region for the applicable hazards.

The HAZUS-MH flood analysis was a significant undertaking for the state. Producing a HAZUS-MH flood run is very computer-resource intensive. Processing a MEMA Region takes a significant amount of time from start to finish, depending on the size of the counties, density of the stream network, and density of census blocks. In some cases, the Regions had to be divided into separate runs and then analyzed on a regional level once complete.

HAZUS-MH produces a flood polygon and flood depth grid that represents the base flood. While not as accurate as official flood maps, such as digital flood insurance rate maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program.

Flood damage is directly related to the depth of flooding. For example, a two-foot-deep flood generally results in about 20 percent damage to the structure (which translates to 20 percent of the structure's replacement value). HAZUS-MH takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). The HAZUS-MH reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes in HAZUS-MH include agriculture, commercial, education, government, industrial, religion, and residential. Damage percent classes are grouped by ten percent increments: 1-10 percent, 11-20 percent, etc., up to 50 percent. Buildings that sustain more than 50 percent damage are considered to be "substantially" damaged

The HAZUS-MH methodology provides the number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. Building damage can also cause additional losses to a community as a whole by restricting the building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by HAZUS-MH using a methodology based on the building damage estimates.

Data Limitations

Default HAZUS-MH data was used to develop the loss estimates. Thus, the potential losses derived from HAZUS-MH, the best available data, may contain some inaccuracies. The state facility list contained an insufficient number of attributes to be fully integrated into HAZUS-MH.

The damaged building counts generated by HAZUS-MH are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. The HAZUS-MH "Building Damage Count by General Building Type" report includes this disclaimer:

> "Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduce uncertainty into the building count results. Please use these results with suitable caution."

The counts of buildings at risk collected from flood insurance policy data and biennial reports could potentially provide a more realistic estimate of the actual numbers of buildings in the base-flood hazard areas (see the Flood Insurance Claims Analysis that follows), but the information in the biennial reports could contain errors as well.

HAZUS-MH can analyze additional impacts, including what type of infrastructure could be affected and how severely. Project files for each county are available for use by local governments and the state if more details on the impacts discussed here, or information about other impacts, such as vehicle losses, agricultural losses, utility system losses, essential facility impacts, and transportation impacts, are desired.

Vulnerable Jurisdictions

This analysis is intended to enable the state to estimate where flood losses could occur and the degree of severity, regionally, using a consistent methodology. The computer modeling helps quantify risk along known flood hazard corridors such as along the Mississippi and Pearl rivers. In addition, flood losses are estimated for certain lesser streams and rivers where the flood hazard may not have been previously studied.

HAZUS-MH impact analyses were run for direct economic losses for buildings and societal impacts (displaced people and shelter needs) to see which regions ranked the highest on these risk indicators (these losses and impacts are illustrated in the maps and tables that follow). Using GIS, HAZUS-MH flood results were mapped to show flood loss potential and how it varies across the state. The primary indicators used to assess flood losses were:

- direct building losses combined with income losses,
- loss ratio of the direct building losses compared to overall building inventory, and
- population displaced by the flood and shelter needs.

Figure 3.6-10 Mississippi Assets Located in the MEMA Region 1 Special Flood Hazard Area (SHFA)

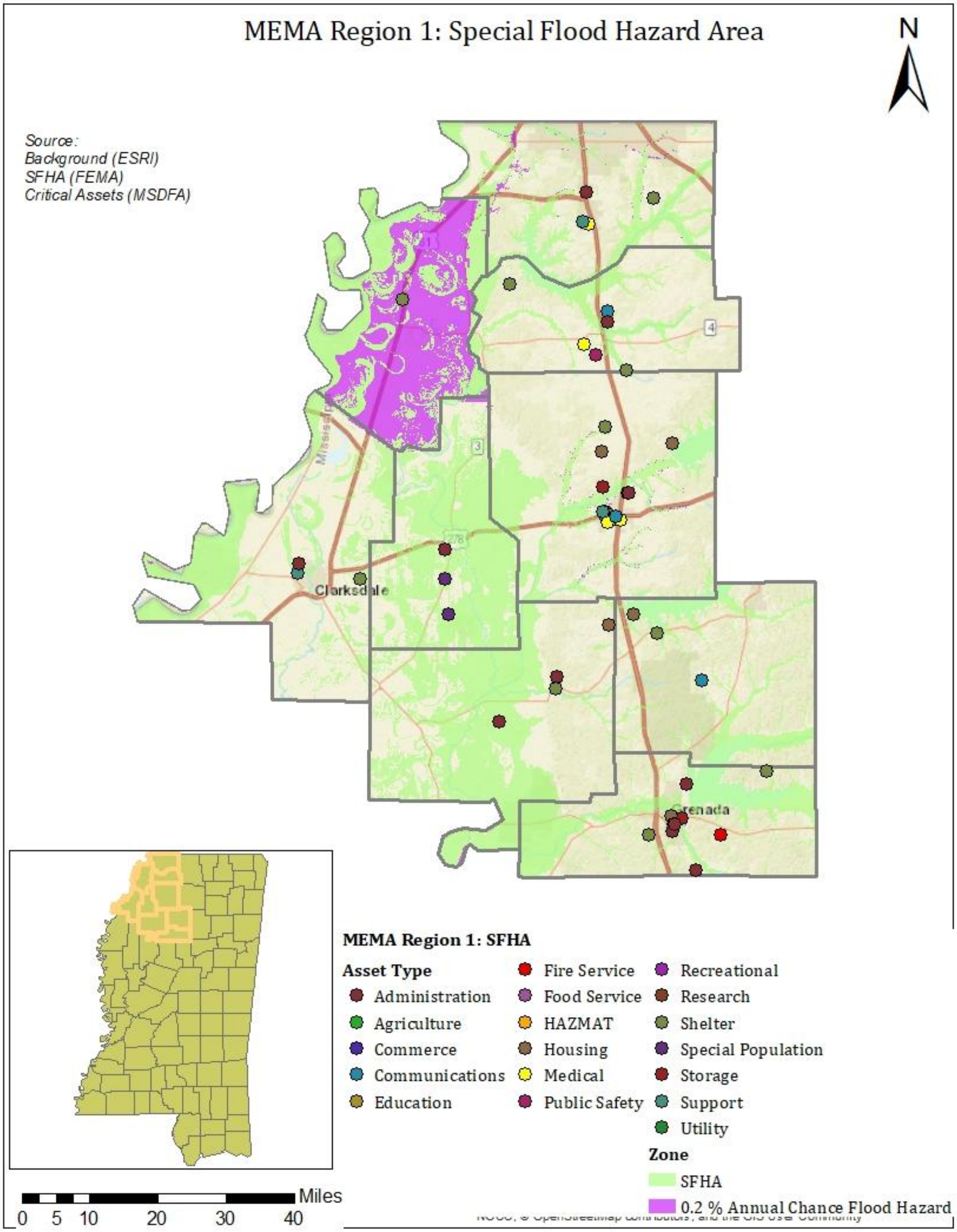


Figure 3.6-11 Mississippi Assets Located in the MEMA Region 2 Special Flood Hazard Area (SHFA)

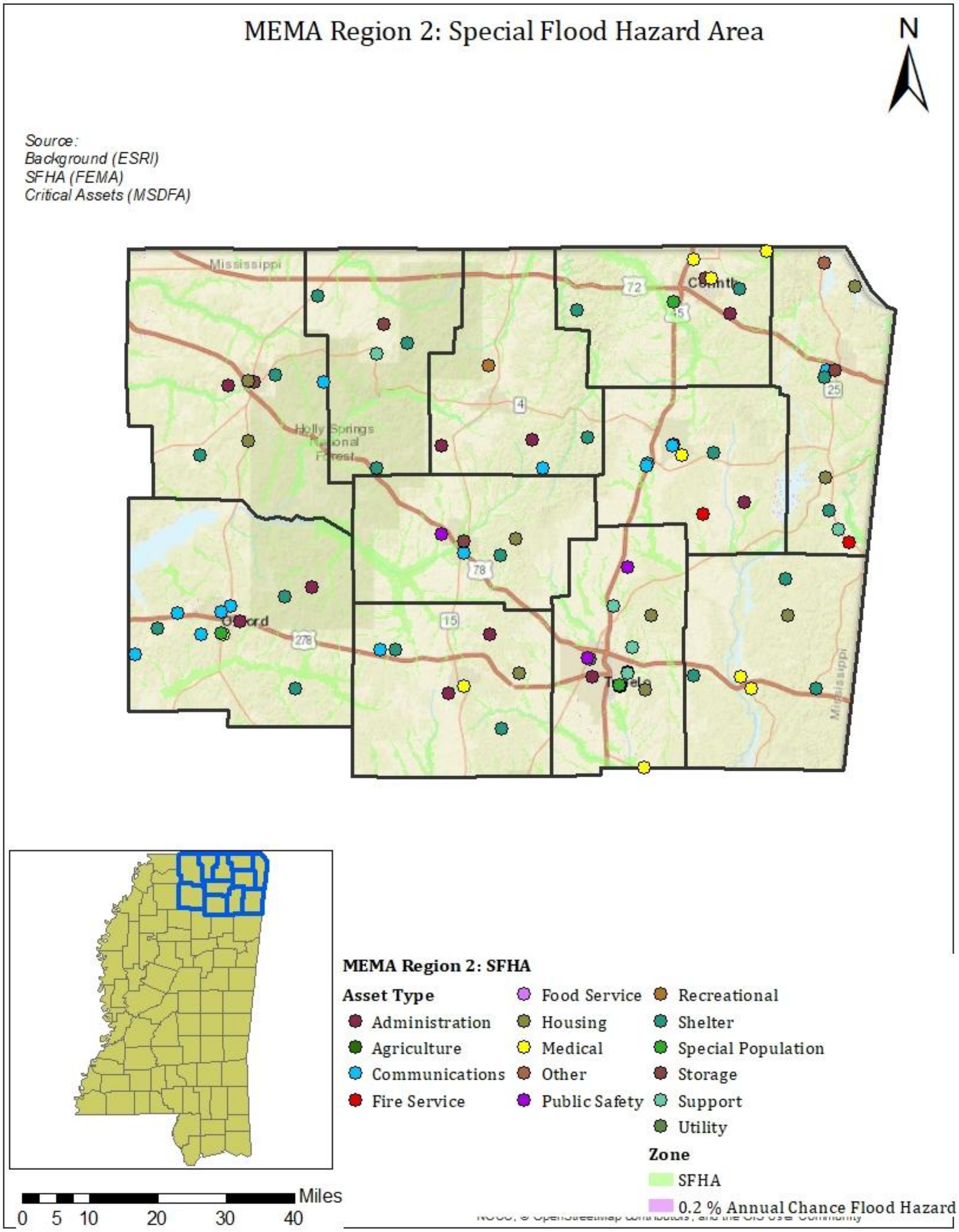


Figure 3.6-12 Mississippi Assets Located in the MEMA Region 3 Special Flood Hazard Area (SHFA)

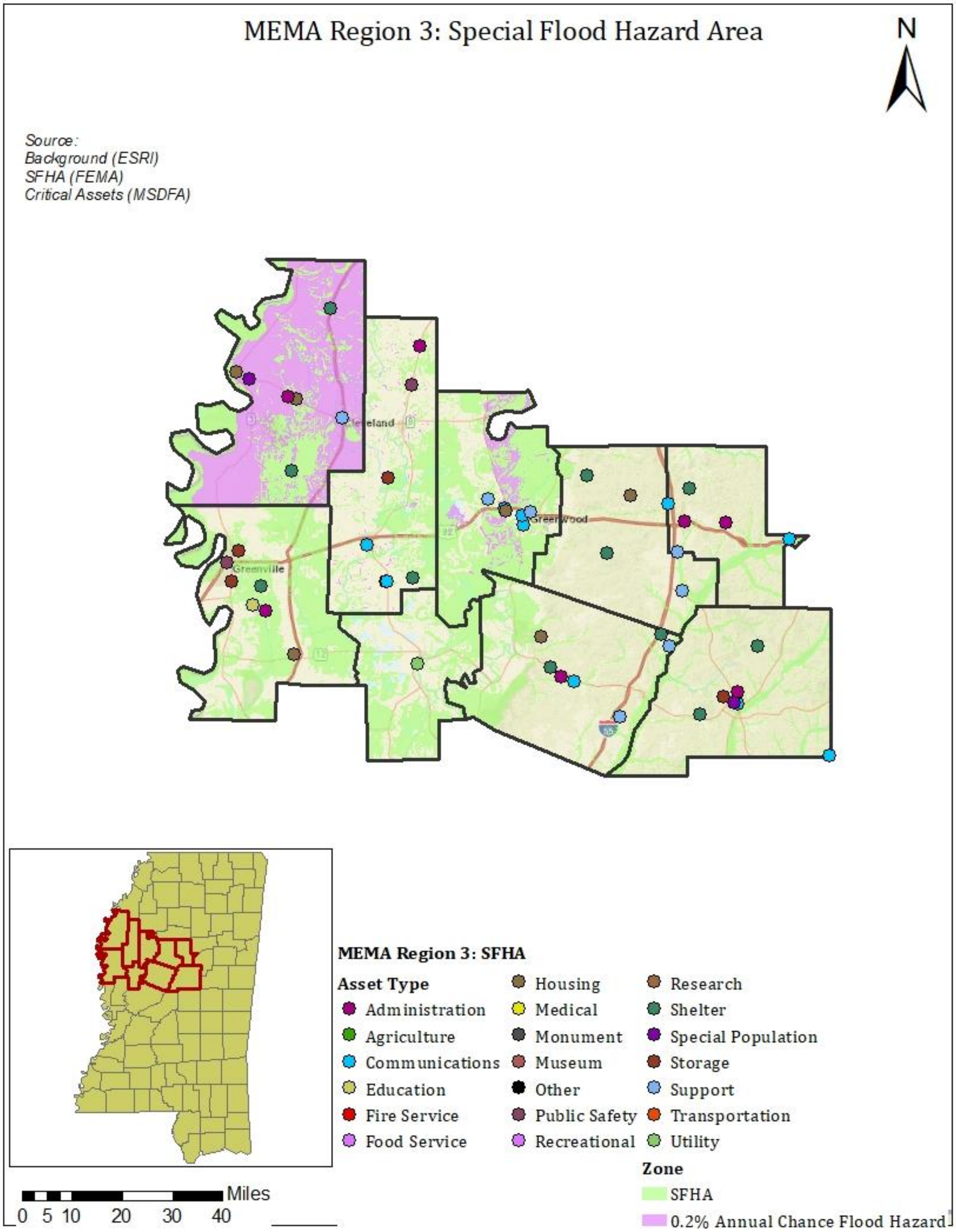
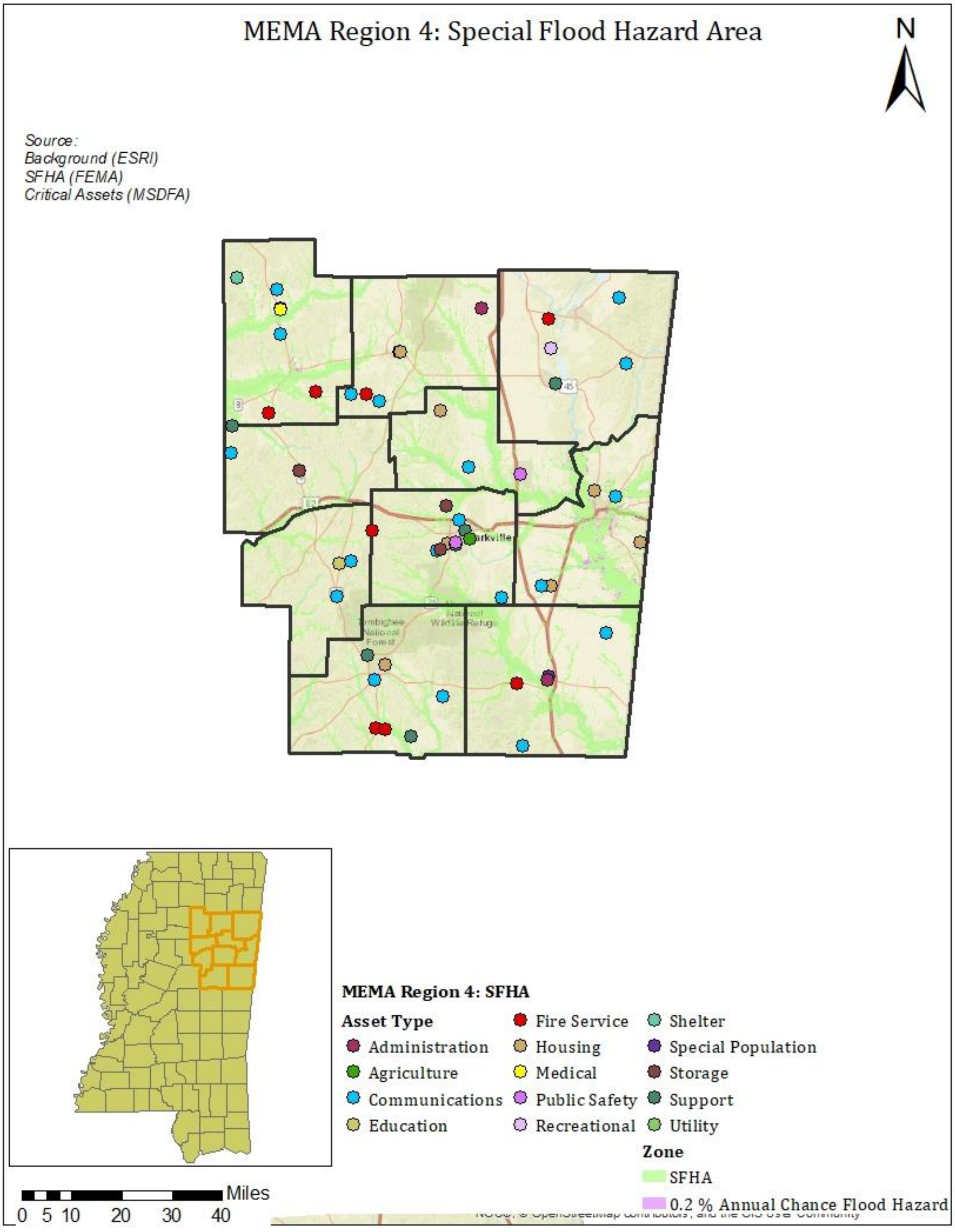


Figure 3.6-13 Mississippi Assets Located in the MEMA Region 4 Special Flood Hazard Area (SHFA)



MEMA Region 4: Special Flood Hazard Area
N
Source:
Background (ESRI)
SFHA (FEMA)
Critical Assets (MSDFA)
MEMA Region 4: SFHA
Asset Type
Administration
Agriculture
Communications
Education
Fire Service
Housing
Medical
Public Safety
Recreational
Shelter
Special Population
Storage
Support
Utility
Zone
SFHA
0.2 % Annual Chance Flood Hazard
Miles
0 5 10 20 30 40

Figure 3.6-14 Mississippi Assets Located in the MEMA Region 5 Special Flood Hazard Area (SHFA)

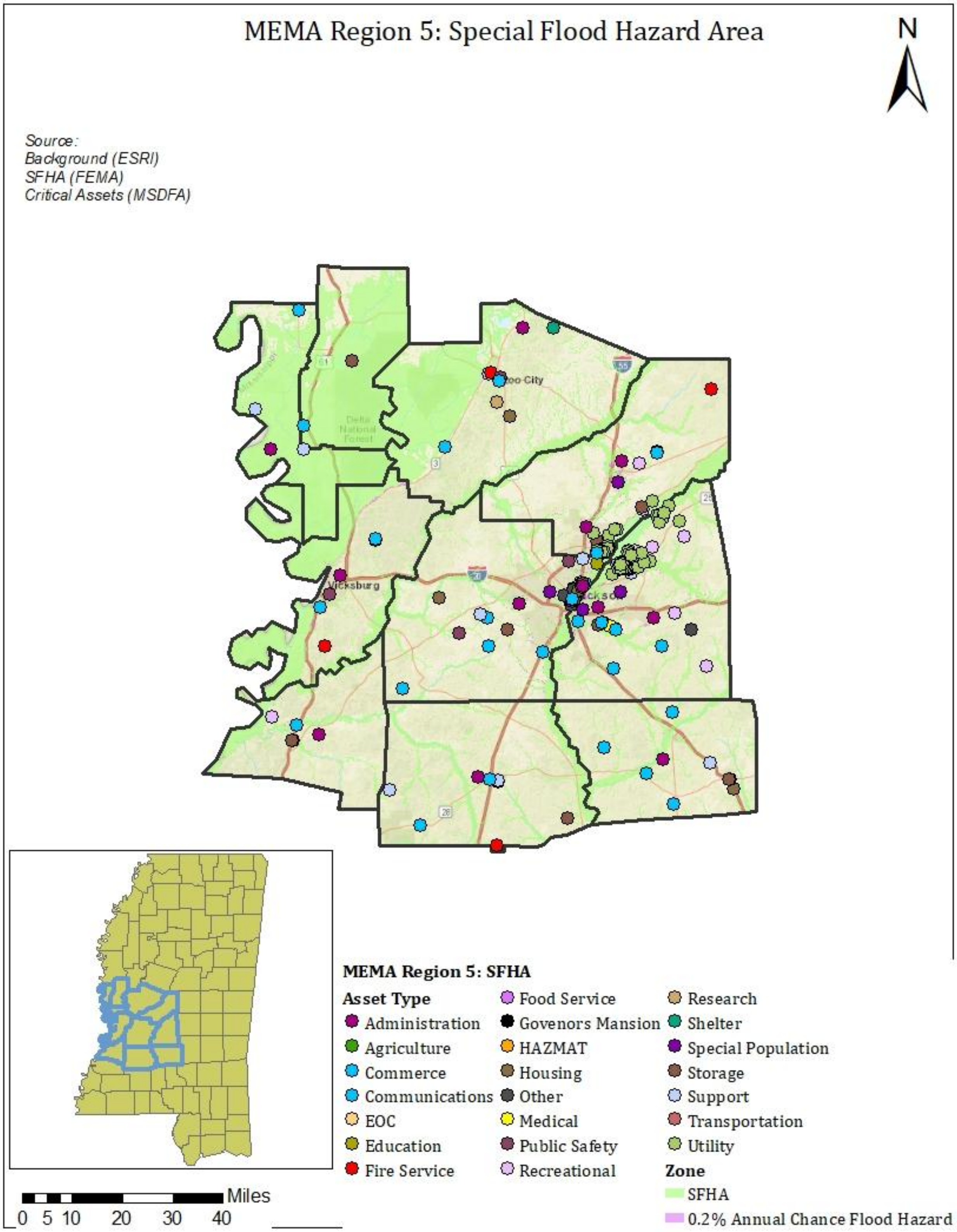


Figure 3.6-15 Mississippi Assets Located in the MEMA Region 6 Special Flood Hazard Area (SHFA)

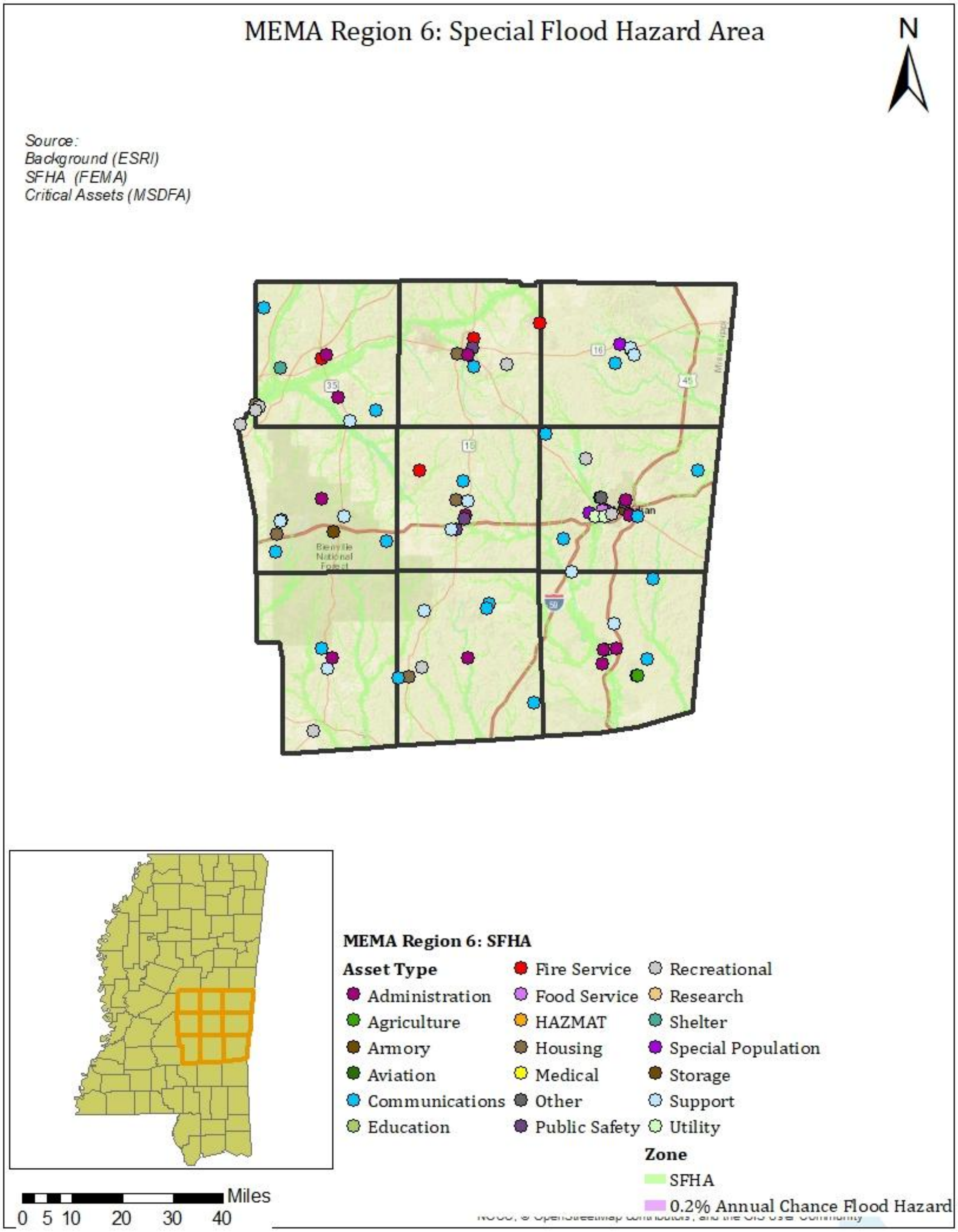


Figure 3.6-16 Mississippi Assets Located in the MEMA Region 7 Special Flood Hazard Area (SHFA)

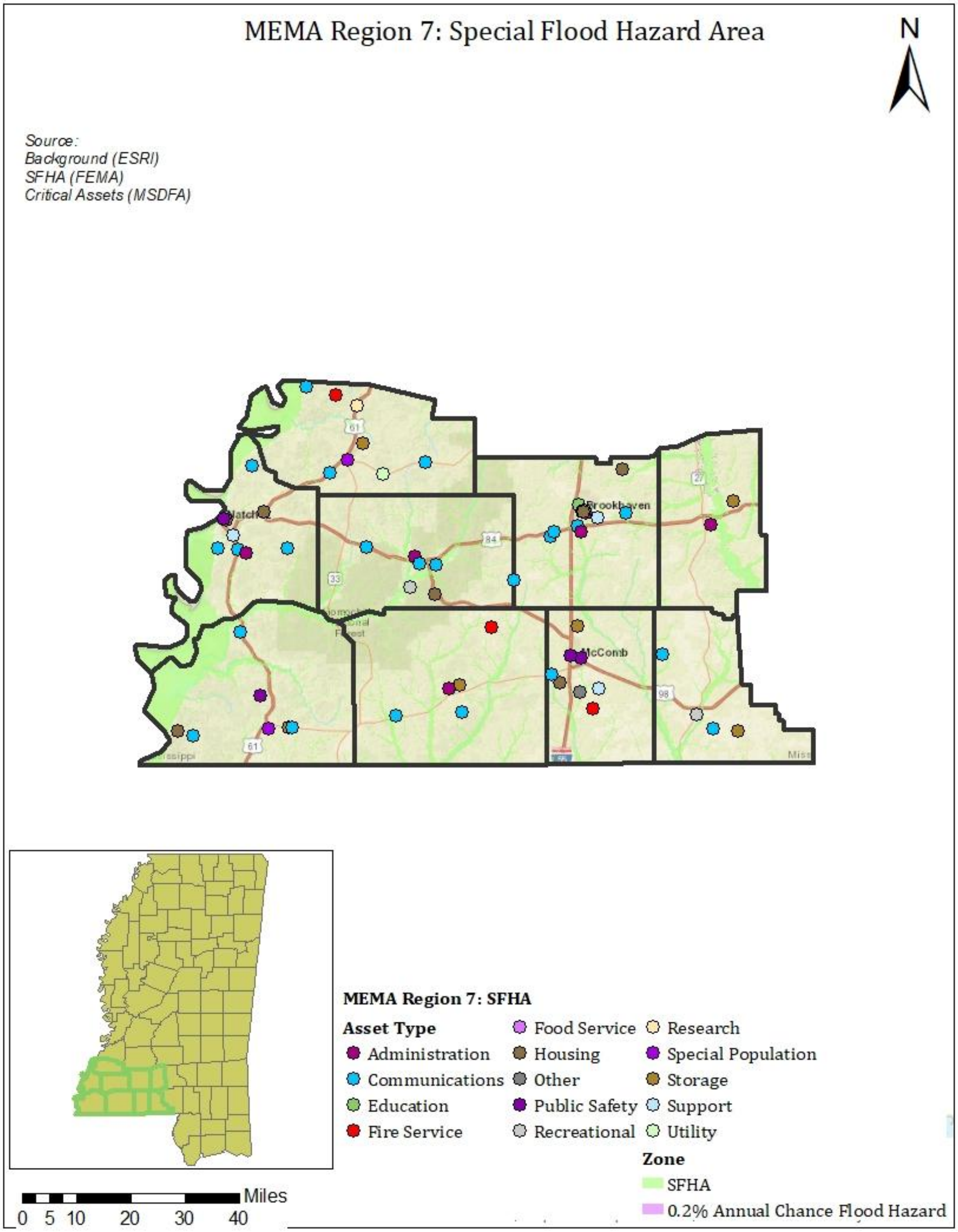


Figure 3.6-17 Mississippi Assets Located in the MEMA Region 8 Special Flood Hazard Area (SHFA)

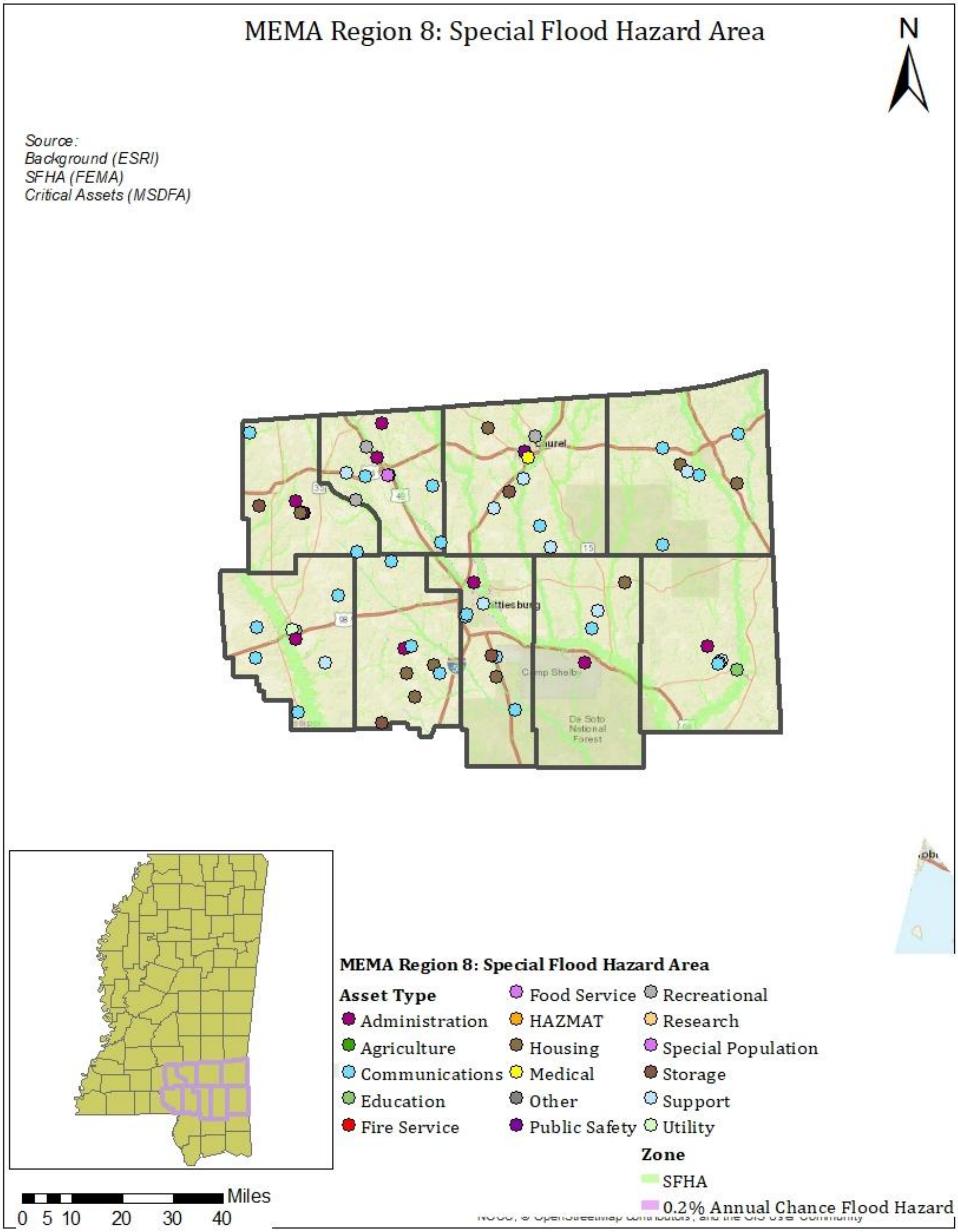

MEMA Region 8: Special Flood Hazard Area
N
Source:
Background (ESRI)
SFHA (FEMA)
Critical Assets (MSDFA)
Laurel
Hattiesburg
Camp Shelby
De Soto National Forest
MEMA Region 8: Special Flood Hazard Area
Asset Type
Administration
Agriculture
Communications
Education
Fire Service
Food Service
HAZMAT
Housing
Medical
Other
Public Safety
Recreational
Research
Special Population
Storage
Support
Utility
Zone
SFHA
0.2% Annual Chance Flood Hazard
0 5 10 20 30 40
Miles

Figure 3.6-18 Mississippi Assets Located in the MEMA Region 9 Special Flood Hazard Area (SHFA)

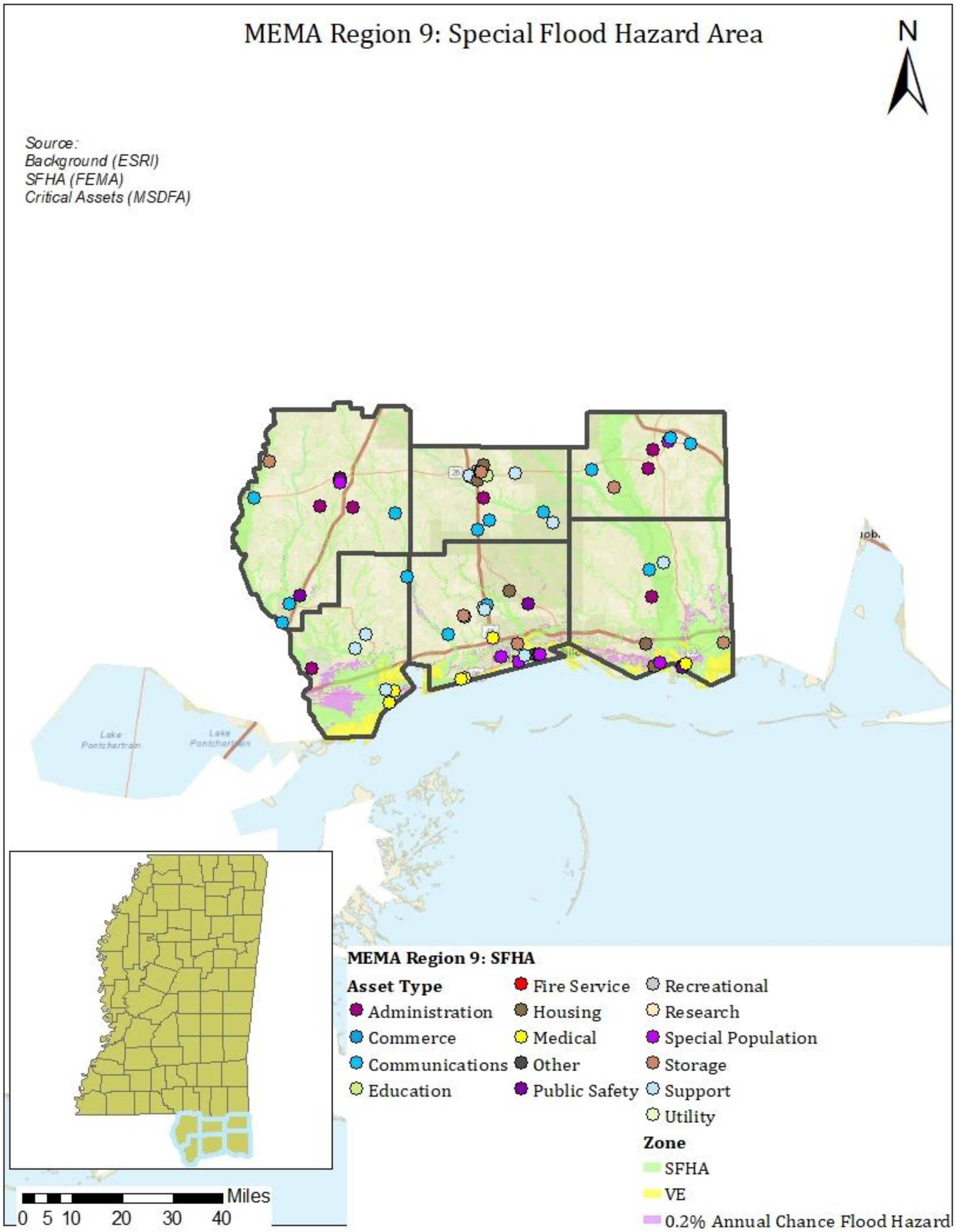


Table 3.6.8
HAZUS-MH 100-Year Flood Loss Estimation
Results: Building and Income Loss by Region

Region	Total Building Loss	Total Business Interruption	Total Building Related Economic Loss
Region 1	$2.239B	$2.408B	$4.647B
Region 2	$4.463B	$4.375B	$8.838B
Region 3	$454.83M	$461.70M	$916.53M
Region 4	$1.32B	$878.36M	$2.200B
Region 5	$2.681B	$3.334B	$6.016B
Region 6	$846.46M	$722.62M	$1.569B
Region 7	$769.26M	$457M	$1.226B
Region 8	$981.64M	$770.5M	$1.752B
Region 9	$1.368B	$953.88M	$2.322B

The displaced population is based on the inundation area. Individuals and households will be displaced from their homes even when the home has suffered little or no damage either because they were evacuated (i.e., a warning was issued) or there was no physical access to the property because of flooded roadways. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family and friends within the immediate area. Age plays a secondary role in shelter use in that some individuals will go to a public shelter even if they have the financial means to go elsewhere. These will usually be younger, less established families, and elderly families (HAZUS-MH User's Manual). HAZUS-MH does not model flood casualties given that flood-related deaths and injuries typically do not have the same significant impact on the medical infrastructure as those associated with earthquakes. **Table 3.6.9** compares the potential impacts of floods on Mississippi citizens in the MEMA Regions. Detailed results for all regions can be referenced in **Appendix 7.3.6-C**.

Table 3.6.9
Flooding Impacts on Populations
(Ranked by Displaced People)

County	Number of households	Number of people needing shelter
Region 1	3,193	379
Region 2	3,615	305
Region 3	2,383	390

County	Number of households	Number of people needing shelter
Region 4	3,289	555
Region 5	5,345	1,219
Region 6	2,255	123
Region 7	1,413	84
Region 8	2,506	178
Region 9	4,281	465

Local Critical Facility Floodplain Analysis

Critical facilities have been inventoried and geolocated where possible by region and are presented in **Appendix 7.3.2-D**. Information regarding the facility type and location was available, but valuations were not. The statewide HAZUS-MH-derived base-flood layer was overlaid, using GIS, on the geolocated critical facilities. The number and types of facilities located in a possible flood hazard area were summarized by Region in **Table 3.6.10**. Critical facilities included are emergency operations centers, fire stations, hospitals, police stations, and schools. These results are for general planning purposes only as there could be errors in the location of critical facilities as well as errors in HAZUS-MH modeled flood hazard boundaries noted previously.

Table 3.6.10
Critical Facilities Potentially Within a Base-Flood Hazard Area

Region	Number of Facilities at Risk
Region 1	217
Region 2	272
Region 3	233
Region 4	218
Region 5	404
Region 6	201
Region 7	153
Region 8	210
Region 9	295

Flood Insurance Claims Analysis

As previously stated in the flood profile section, Mississippi is rich in water resources that contribute to flooding issues for residential, commercial, and essential facilities. With more than 5.2 million acres of floodplain (of a total landmass of 30,989,376 acres), Mississippi has the 5th largest floodplain in the United States.

A summary of the residential and other facilities building replacement values at risk by region is provided in **Table 3.6.11**.

Table 3.6.11
Summary of At-Risk Properties by Region

Region	Residential Building Replacement Value at Risk	Other Building Replacement Value at Risk	Regional Building Exposure
MEMA Region 1	$2,665,644	$721,734	$3,387,378
MEMA Region 2	$4,136,077	$1,455,228	$5,591,305
MEMA Region 3	$2,054,352	$696,868	$2,751,220
MEMA Region 4	$2,877,659	$858,361	$3,736,020
MEMA Region 5	$6,362,345	$3,016,825	$9,379,170
MEMA Region 6	$2,970,405	$905,737	$3,876,142
MEMA Region 7	$2,017,177	$503,921	$2,521,098
MEMA Region 8	$9,127,035	$3,202,774	$12,329,809
MEMA Region 9	$18,096,969	$3,742,043	$21,839,012
Totals	$50,307,663	$15,103,491	$65,411,154

Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High
1	-	1	8
2	1	11	-
3	1	7	2
4	-	2	9
5	10	13	24

MEMA Region	Low	Medium	High
6	-	-	9
7	-	-	9
8	2	2	6
9	-	-	6

Probability of Future Occurrence

Factors such as climate change, sea level rise, and increased urbanization have the potential to increase flooding potential, particularly in coastal and urbanized areas of the State. Coastal communities in Mississippi have begun to experience more frequent "nuisance flooding" or inundation of areas during high tides that in years past were not affected by tidal influences. As impervious surfaces are added to urbanized areas and opportunities for stormwater infiltration are minimized, chances for flash flooding are increased. Generally speaking, in Mississippi we are seeing population shifts that are making our urban areas more urban and our rural areas more rural. In other words, there is a trend towards internal migration from less populated areas to more populated areas, thereby increasing the demand for development and potentially increasing the percentage of impervious surfaces in Mississippi's urban regions. Climate change, like most natural shifts, is occurring gradually and with those changes, we will see gradual increases in flooding frequency and intensity. Floods are also often associated with other hazard events such as hurricanes that are also increasing in frequency and intensity. Based on the historical record, the potential for continued climate change, and increased development caused by population shifts, the probability of future flooding in Mississippi is high but will likely be higher in specific areas of the State such as the Jackson Metro Area and the Coastal region.

Assessing Vulnerability of State Facilities / Estimating Potential Losses

Methodology

The state of Mississippi Department of Finance and Administration's Bureau of Buildings, Grounds, and Real Property provided the number and value of state-owned buildings located in floodplains. Plan developers know of no building located in a floodplain that is operated, but not owned, by the state.

Specific data on building elevation, location, and vulnerability to flooding of varying depths were not available. Without such data, it was not possible to accurately determine any degree of building damage and potential loss. Theoretically, each building has the potential for total loss. The same data from the 2010 plan was used since the statewide inventory project is not completed. A percentage of loss, instead of total exposure, was applied to estimate potential losses. Damage is directly related to the depth of the flooding. Based on FEMA's depth-damage curves used in their benefit-cost models it can be inferred that a two-foot flood equates to roughly 20 percent loss of the structure value. For purposes of this plan, the value of 20 percent of the building value is the estimate of the potential loss.

Data Limitations

HAZUS-MH does not distinguish between federal, state, or local ownership or operation in its inventory data on bridges. Therefore, all bridges regardless of ownership are included in the assessment. At this time the state of Mississippi does not have a comprehensive list of state-owned or operated infrastructure, including bridges, sorted by region and keyed to a location in floodplains. Without such data, plan developers determined that the HAZUS-MH default inventory data was the "best available data" even though all facilities are represented in the data, not just state-owned or operated infrastructure.

Because of their potential vulnerability, bridges were chosen to represent infrastructure in the loss estimates. Due to time constraints only bridges, not all state-owned infrastructure, were addressed using HAZUS-MH inventory data. Additionally, the estimate of potential losses to bridges was limited to the top ten of the fifty most vulnerable communities. Vulnerable highways were noted but not included in the loss estimates.

The state has developed an ongoing strategy to address these data limitations for plan updates. That strategy is included in the mitigation strategy section of the plan.

Table 3.6.12 serves as a summary of the potential losses to state-owned structures within the state of Mississippi. Details by region are provided in Appendix 7.3.2-E. This analysis was completed based on information provided by MEMA and outside of the HAZUS-MH model.

Table 3.6.12
Summary of Potential Losses to State-Owned Facilities

Region	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	Number in Special Flood Hazard Area (SFHA)	Value in Special Flood Hazard Area (SHFA)	Estimated Flood loss (value x 20%)
MEMA Region 1	171	$57,356,843	2	$1,850,051	$35,636,281
MEMA Region 2	331	$156,546,716	0	$0	$0
MEMA Region 3	552	$256,299,605	55	$6,518,567	$1,303,713
MEMA Region 4	134	$27,175,900	0	$0	$0
MEMA Region 5	1,335	$2,648,653,307	52	$182,070,707	$36,414,141
MEMA Region 6	918	$813,681,823	12	$3,351,986	$670,397
MEMA Region 7	247	$79,618,031	0	$0	$0
MEMA Region 8	455	$286,676,990	17	$2,412,581	$482,516
MEMA Region 9	268	$215,287,139	16	$13,410,827	$2,682,165

Table 3.6.13 serves as a summary of the potential losses to state-owned bridges. The bridges are located along state highways that serve as important transportation and evacuation routes. These bridges transverse portions of the state's delineated floodplains and are susceptible to flood damage. Additionally, portions of the roadways themselves are subject to inundation and 'overtopping' by events greater than a 100-year flood.

Included with HAZUS-MH is a database of bridges called the National Bridge Inventory, which was developed by the Federal Highway Administration. One of the database items includes a "scour index" that is used to quantify the vulnerability of bridges to scour during a flood. Bridges with a scour index between 1 and 3 are considered "scour critical," or a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition. A query of the database was performed that identified the scour critical bridges. Out of 4,037 state-owned bridges in Mississippi, 225 met these criteria. The potential loss could include the replacement value of the structure if flooding resulted in a bridge collapse. These are bridges that could benefit from mitigation projects or be thoroughly inspected following a flood event. There were no changes to this table for the 2013 or 2018 plan update.

Table 3.6.13
Exposure and Flood Vulnerability of State Bridges by County (Values in thousands of dollars)

County	Bridge Count	Value	Scour Critical	County	Bridge Count	Value	Scour Critical
Adams	16	$59,354.35	0	Issaquena	8	$12,409.80	0
Alcorn	72	$99,883.86	0	Itawamba	74	$152,459.10	9
Amite	41	$33,621.93	1	Jackson	56	$649,903.65	2
Attala	46	$39,324.78	11	Jasper	42	$28,508.17	1
Benton	54	$60,391.36	4	Jefferson	11	$6,913.09	0
Bolivar	28	$22,534.88	2	Jeff. Davis	21	$20,112.19	2
Calhoun	63	$45,618.08	4	Jones	91	$135,897.51	8
Carroll	43	$43,183.27	7	Kemper	48	$61,903.86	0
Chickasaw	51	$36,397.28	9	Lafayette	72	$64,338.53	1
Choctaw	20	$14,146.20	2	Lamar	34	$38,973.09	2
Claiborne	19	$55,342.46	1	Lauderdale	141	$208,051.89	1
Clarke	70	$65,280.27	12	Lawrence	17	$22,141.20	2
Clay	25	$54,115.41	3	Leake	54	$79,850.72	3
Coahoma	28	$29,869.61	0	Lee	131	$204,006.54	23
Copiah	49	$43,717.27	0	Leflore	32	$45,578.98	0
Covington	40	$39,545.24	7	Lincoln	60	$61,895.46	1
Desoto	72	$119,180.45	1	Lowndes	90	$191,660.50	6
Forrest	56	$80,733.65	2	Madison	82	$101,987.37	4
Franklin	35	$52,053.90	0	Marion	51	$67,208.34	2
George	27	$55,277.87	2	Marshall	85	$117,323.02	4
Greene	28	$101,453.50	1	Monroe	76	$188,235.90	1
Grenada	48	$51,207.33	4	Montgomery	57	$53,470.84	1
Hancock	26	$145,699.13	0	Neshoba	41	$34,011.07	1
Harrison	82	$460,275.88	1	Newton	70	$64,145.34	3
Hinds	185	$399,360.16	6	Noxubee	24	$39,135.99	3
Holmes	79	$84,795.11	9	Oktibbeha	35	$34,457.36	2
Humphreys	8	$23,971.50	0	Panola	75	$78,814.52	1
Pearl River	70	$90,247.62	3	Tate	39	$53,338.10	2
Perry	36	$64,396.78	3	Tippah	26	$25,323.31	2
Pike	54	$58,800.65	3	Tishomingo	33	$78,274.19	3

Exposure and Flood Vulnerability of State Bridges by County
(Values in thousands of dollars)

County	Bridge Count	Value	Scour Critical	County	Bridge Count	Value	Scour Critical
Pontotoc	54	$42,949.87	6	Tunica	17	$11,849.09	0
Prentiss	45	$49,366.41	3	Union	65	$73,748.68	3
Quitman	29	$21,578.69	0	Walthall	27	$26,061.52	1
Rankin	112	$212,858.86	3	Warren	61	$122,148.99	1
Scott	42	$35,451.42	2	Washington	35	$35,864.93	1
Sharkey	16	$14,459.88	0	Wayne	30	$42,152.86	2
Simpson	38	$29,888.20	3	Webster	29	$31,583.84	1
Smith	25	$26,402.18	4	Wilkinson	19	$65,158.54	0
Stone	22	$31,987.16	2	Winston	40	$33,227.70	0
Sunflower	23	$29,934.05	0	Yalobusha	67	$54,624.90	5
Tallahatchie	29	$27,133.10	0	Yazoo	65	$111,103.38	0
Totals					**4037**	**$6,579,643.64**	**225**

Twenty state-owned or -operated (maintained) highways are important to the movement of people and freight and are potentially at risk of flooding because all of them have segments that traverse floodplains. These highways are:

Interstate 55	U.S. Highway 98
Interstate10	U.S. Highway 84
Interstate 20	State Highway 18
Interstate 59	State Highway 80
U.S. Highway 90	State Highway 1
U.S. Highway 45	State Highway 302
U.S. Highway 82	State Highway 25
U.S. Highway 61	State Highway 49
U.S. Highway 72	State Highway 63
U.S. Highway 78	State Highway 11

3.7: Wildfire Risk Assessment

Hazard Description

A wildfire is any fire that burns uncontrollably in a natural setting (such as grasslands, forests, and brushland). Wildfires can be either man-made or natural. In Mississippi, most fires are man-made, with arson being the most prevalent cause, followed by the burning of debris. Nationwide, nearly 9 out of 10 wildfires are human-caused and many could be prevented with proper care. To reduce the number of human-caused wildfires in Mississippi, burn bans are issued by each County Board of Supervisors and approved by the Mississippi Forestry Commission (MFC). The typical cause of naturally occurring wildfires is lightning.

Prescribed burning, also known as controlled burning, is the deliberate use of fire under specified and controlled conditions. Prescribed burns are used by forest management professionals and individual landowners to accomplish one or more of the following tasks:

- **Fuel reduction:** The reduction of accumulated grass, weeds, pine needles, and hardwood leaves that worsen the effects of wildfires in young stands and hinder the regeneration of older stands.

- **Hardwood control:** Prevents hardwood trees from competing with pines for nutrients and moisture, impeding visibility and access through the stands, and interfering with natural regeneration in land areas that are better suited for growing pines.

- **Site preparation:** Reduces the number of small-diameter hardwoods and exposes mineral soil before harvest cutting.

- **Wildlife habitat improvement:** Prescribed burns in young stands encourage fresh, low vegetation for wildlife, remove heavy brush, and encourage the growth of annual plants.

- **Disease control:** Prescribed burns conducted to reduce fuel before thinning trees may help control disease.

- **Harvest cutting area improvement:** Reducing brush growing low to the ground before harvesting trees increases visibility and expedites the marking and cutting of the selected trees. This form of prescribed burning can lower costs for the landowner and the logging professional.

Wildfires are very common in many places around the world. Fires are particularly prevalent in summer, autumn, and droughts when fallen branches, leaves, grasses, and scrub can dry out and become highly flammable. Some experts believe global warming is increasing the intensity and frequency of droughts in many areas, thus creating more intense and frequent wildfires.

Wildfires tend to be most common and severe during years of drought and occur on days of strong winds. With extensive urbanization of wildlands, these fires often involve the destruction of suburban homes located in the wildland-urban interface, a zone of transition between developed areas and undeveloped wildlands.

On occasion, wildfires cause large-scale damage to private or public property, destroying many homes and causing deaths, particularly when they reach urban fringe communities. Wildfires are extremely dangerous, however, the impacts of wildfires can be minimized through the incorporation of basic best management practices.

It is important to understand what constitutes an urban fire and how they impact mitigation planning for local jurisdictions. Urban fires may be created by electrically-related structural and vehicle fires, incendiary arson, unattended cooking fires, smoking materials, heating devices, fuel systems, sparks, hazardous material spills, and spontaneous combustion.

The adjective class rating presented in **Table 3.7.1** is a method of normalizing rating classes across different fuel models, indices, and station locations. It is based on the primary fuel model cataloged for the station, the fire danger index selected to reflect staffing levels and climatological class breakpoints. This information is provided by local station managers. About 90% use the Burning Index (BI); others use Energy Release Component (ERC). Staffing class breakpoints are set by local managers from historical fire weather climatology.

Table 3.7.1
Adjective Class Rating

Fire Danger Rating and Color Code		Description
Low (L)	Dark Green	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting
Moderate (M)	Light Green or Blue	Fires can start from most accidental causes, but except for lightning fires in some areas, the number of accidental starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur but is not persistent. Fires are not likely to become serious and control is relatively easy
High (H)	Yellow	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH)	Orange	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics, such as long-distance spotting and fire whirlwinds when they burn into heavier fuels
Extreme	Red	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur

(E)		from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens

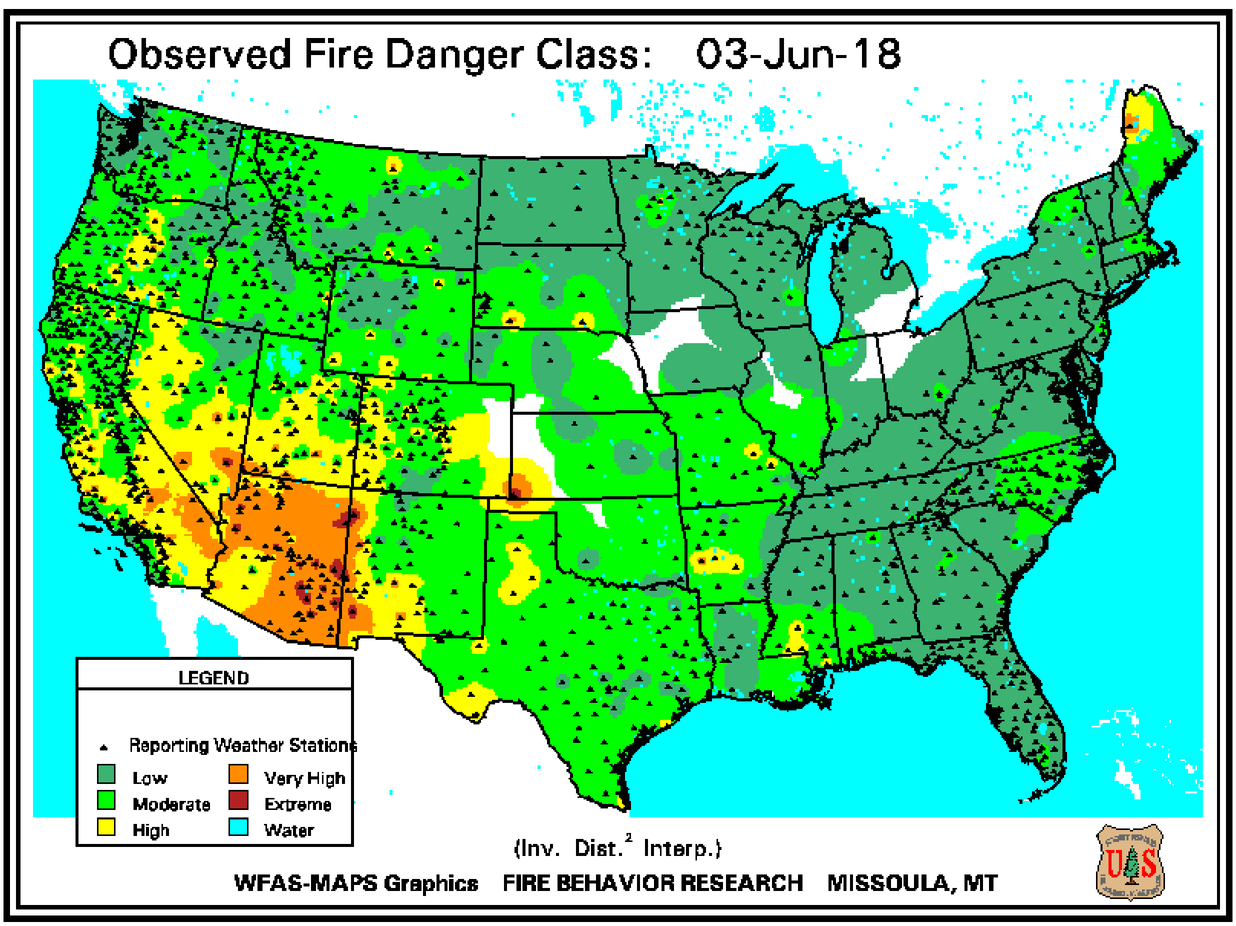
Source USFS WFAS

Fire managers in the south also use the Keetch-Byram Drought Index (KBDI) a mathematical system for relating current and recent weather conditions to potential/expected fire behavior. This system, originally developed for the southeastern United States, is based primarily on recent rainfall patterns and was specifically developed to equate the effects of drought with potential fire activities.

A full discussion on the KBDI is provided in **Section 3.8 – Drought**.

Figure 3.7.1 provides data on observed fire dangers as reported through various weather stations. For the period reflected, a majority of Mississippi is in a low danger class while the southern counties experience a moderate danger class.

Figure 3.7.1
Adjective Class Rating



Hazard Profile

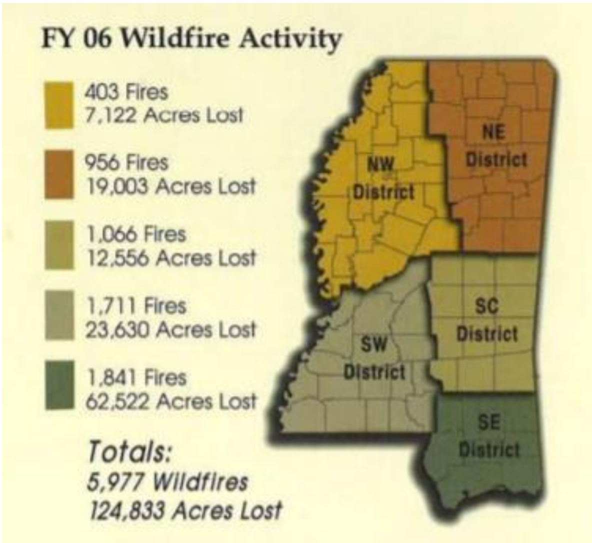
Wildland/Urban Interface

According to the MFC 2022 Annual Report, the MFC responded to and suppressed 1,442 wildfires that burned 40,212 acres. MFC Wildland Firefighters saved 966 structures threatened by wildfire activity while 33 structures were damaged or destroyed. The average wildfire size was 28 acres.

Table 3.7.2
FY21 Wildfires by Cause

Cause	Wildfires	Acres Burned
Debris Burning	676	15,796
Undetermined	346	12,398
Incendiary	304	10,226
Equipment Use	37	543
Lightning	5	101
Smoking	7	90
Campfire	3	11
Railroad	1	4
Total	**1,442**	**40,212**

As the population in rural areas increases, so do the issues facing the Wildland-Urban Interface (WUI). The WUI is the development of residential and commercial areas adjacent to or commingled with vegetative areas. More than half of the homes in Mississippi are part of a WUI. As further development in forested areas occurs this number increases. Wildfires in urban areas threaten human life, structures, and wildland resources. As shown in **Figure 3.7.2**, the WUI is broken into two categories including intermix and interface. Intermix defines housing and commercial development mixed with wildland vegetation. The interface describes housing and commercial development in proximity to wildland vegetation. **Figure 3.7.2** further describes the non-WIU vegetated areas, which are broken out into two categories including no housing and very low housing density. It also demonstrates the non-vegetated or agricultural areas. It is also broken into three groups consisting of low and very low housing density, medium and high housing density, and water. Figure 3.7.3 represents housing density, **Figure 3.7.4** represents Wildland Vegetation Cover and **Figure 3.7.5** shows the land cover in Mississippi.



Historically, it is important to note that Hurricane Katrina triggered public interest and concern for forests in Mississippi that required rapid responses from the scientific community. A uniform systematic sample of 3,590 ground plots were established and measured in 687 days immediately after the impact of Hurricane Katrina on the Gulf Coast. The hurricane damaged an estimated 521 million trees with more than 2.5-cm dbh and killed approximately 54 million trees statewide. Sixty-nine percent of tree mortality occurred in 17 counties in southeastern Mississippi, and 45% of trees killed were loblolly pine trees. Total tree mortality was less than 1% of the statewide population.

Figure 3.7.2
Wildland Urban Interface

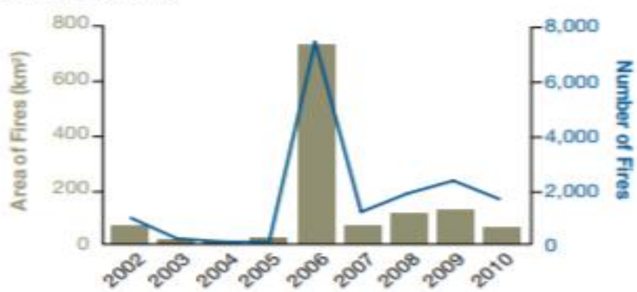
Population and Geography Overview

Census Data	Number	%
Population	2,967,297	
Housing units	1,274,719	
Seasonal use	28,867	2

Land Ownership	Area (km²)	%
Public-Federal	4,293	3
Public-State	3,058	2
Public-Local	0	0
Private	116,172	94

Land Cover	Area (km²)	%
Forest	47,776	39
Shrubland/herbaceous	16,246	13
Planted/cultivated	31,532	26
Developed	7,563	6
Water/wetland	20,195	16
Others	211	0
Total area	123,523	

Wildfire History



WUI in Numbers (see legend)

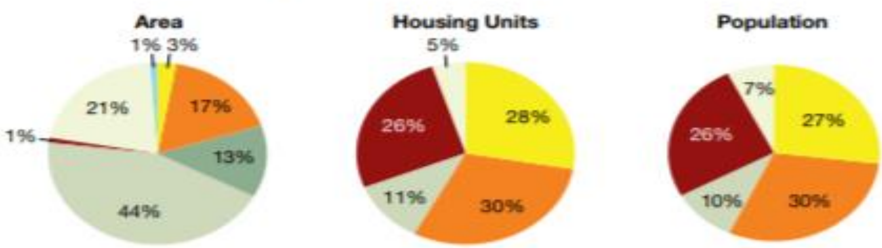


Figure 3.7.4
Wildland Urban Interface

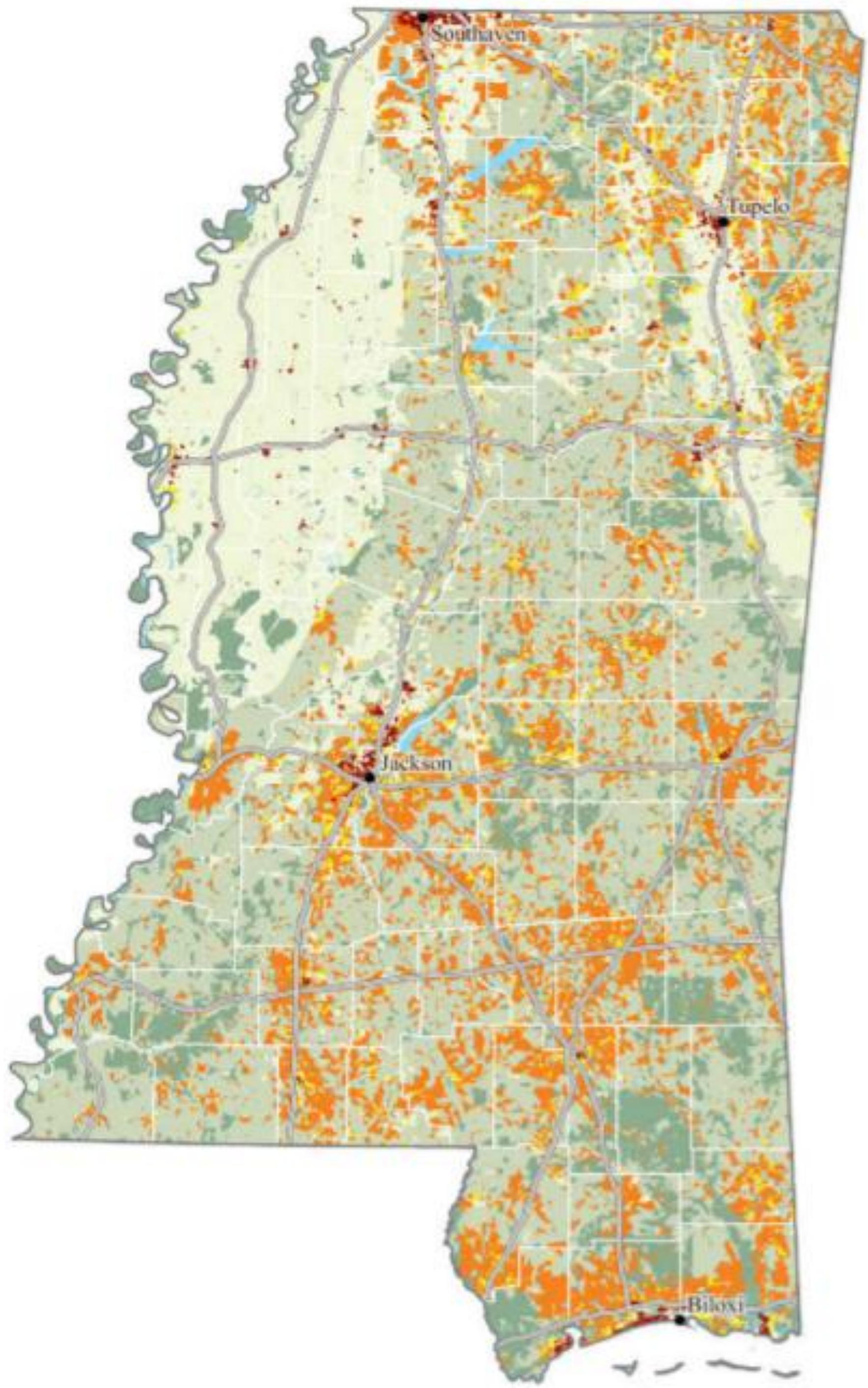


Figure 3.7.3
Wildland Urban Interface

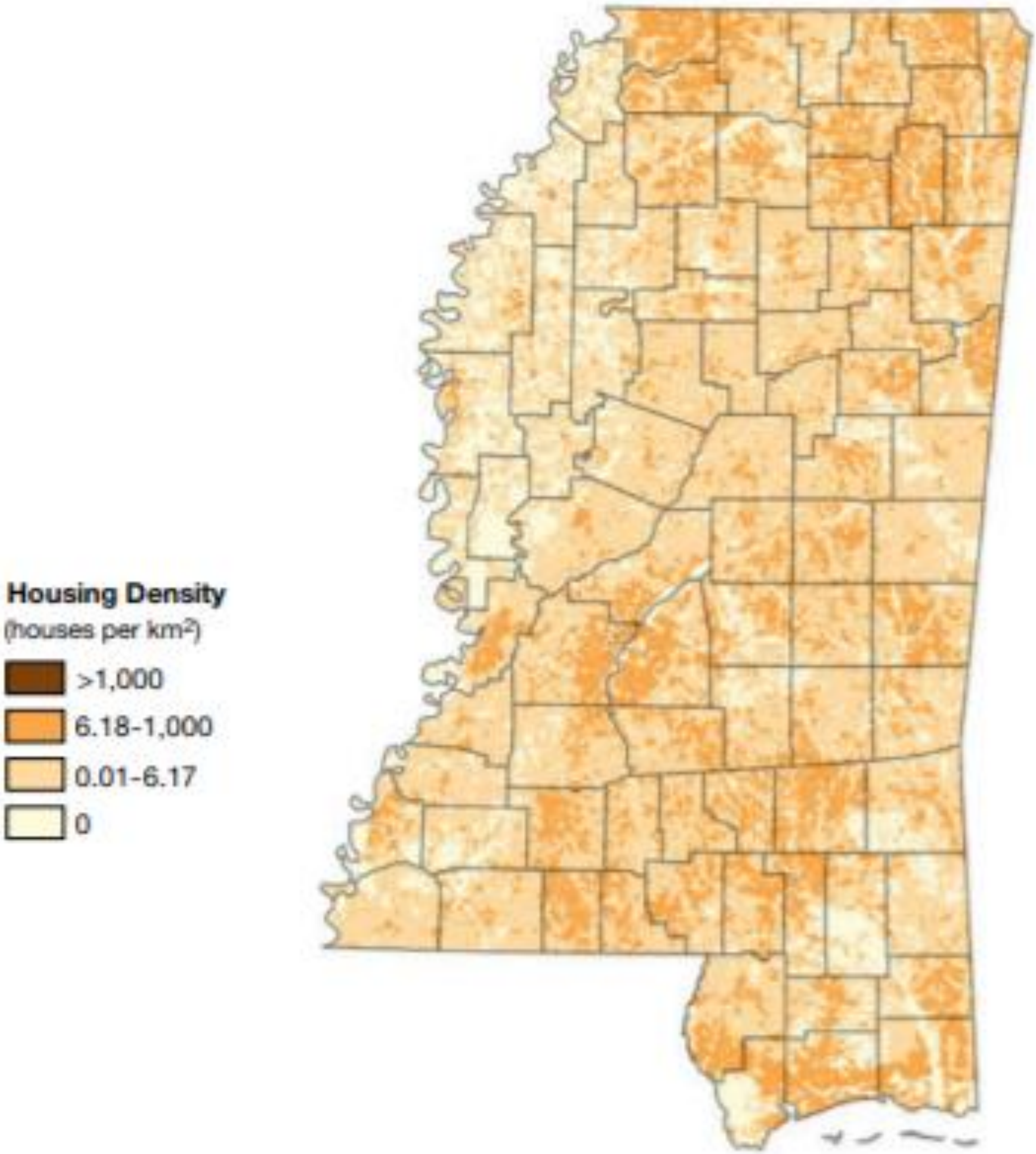
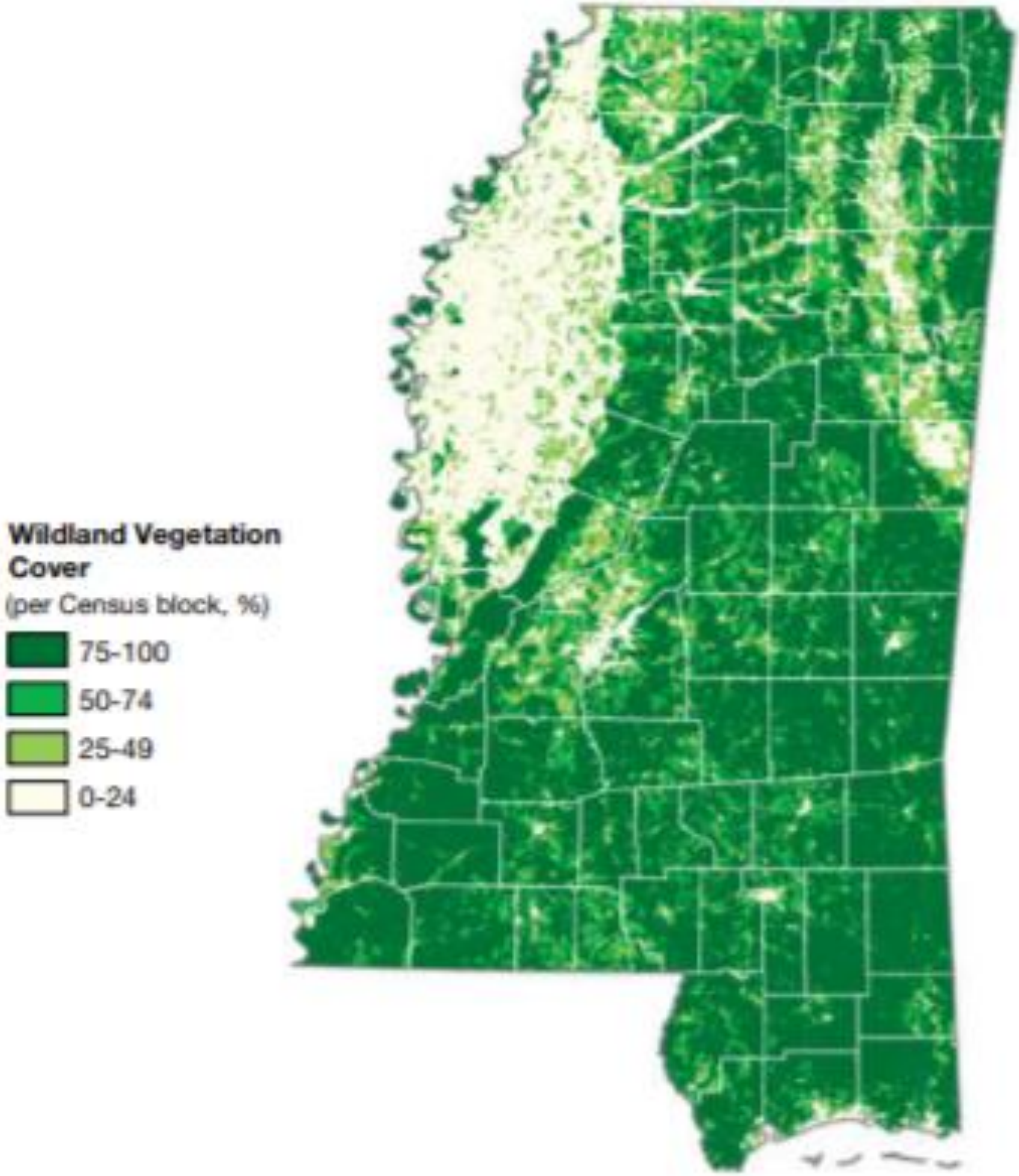
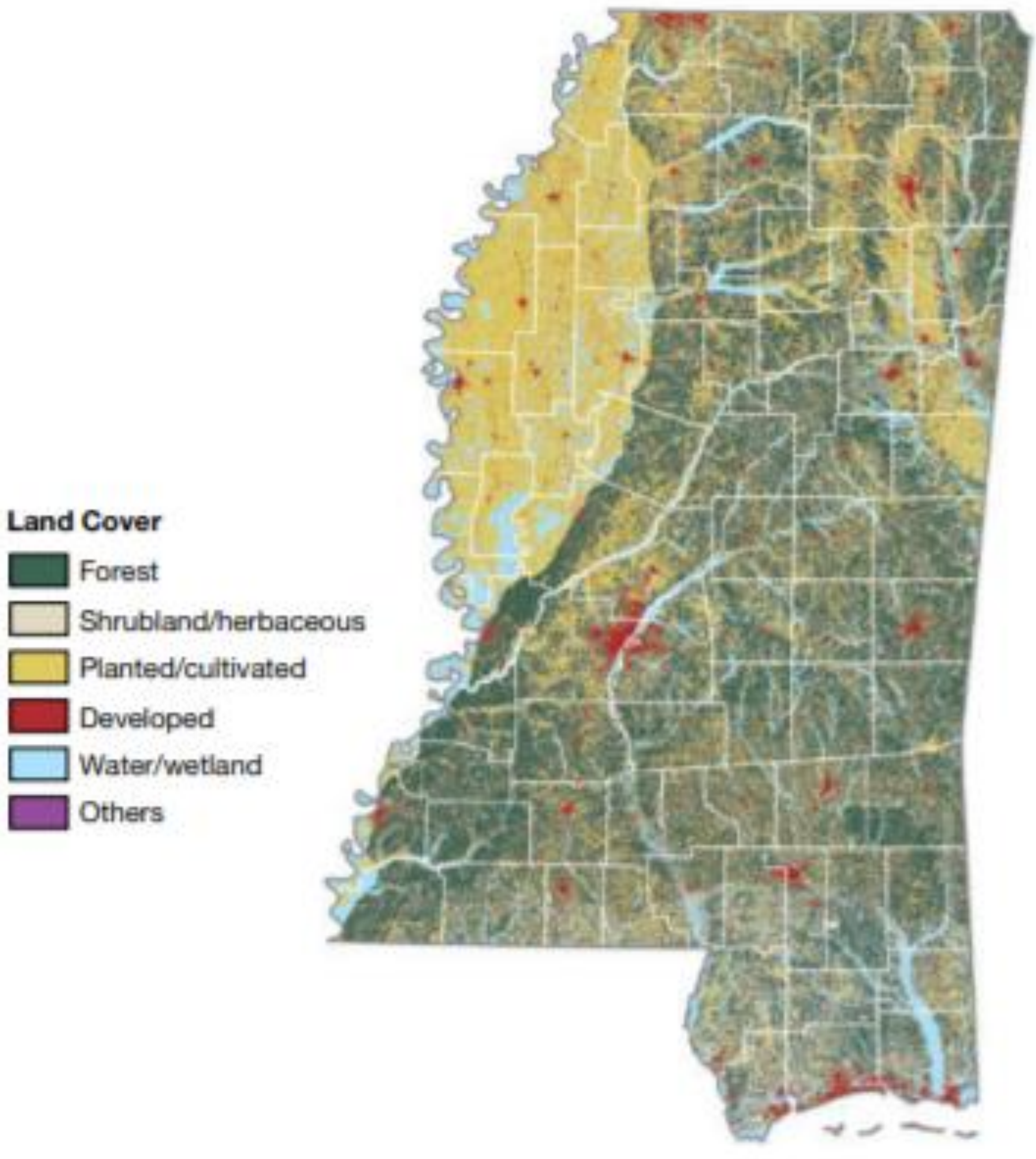


Figure 3.7.5
Wildland Urban Interface




Land Cover
Forest
Shrubland/herbaceous
Planted/cultivated
Developed
Water/wetland
Others

Education and Outreach

Forest Information

The MFC's Forest Information Department provides support to all MFC programs through the development of displays, exhibits, brochures, and other informational material. The department is the point of contact for media relations and is responsible for maintaining the MFC Web site (www.mfc.ms.gov), producing the agency's newsletter, annual report, and MFC News. The Forest Information Department utilizes social media to help carry the MFC message. Accounts were developed on Facebook and YouTube at no cost to the agency. Other social media outlets are being considered and will be activated if MFC determines they can further assist the Commission in providing relevant and timely information to the people of Mississippi.

The website, www.mfc.ms.gov is accessible to the public and employees. During periods of high fire danger, the website is used to provide public service information, including daily fire reports and news releases.

The Commission provides the following weather and fire information on the website:

- The Fire Danger Rating (USDA Forest Service Wildland Fire Assessment System)
- The Current Weather Forecast
- The Fire Danger Rating and Color Code
- The Keetch-Byram Drought Index
- The MFC Daily Fire Situation Report
- A link to the Southern Area Coordination Center (SACC)
- The National Weather Service Enhanced Radar
- The satellite image Loop for the United States
- The NWS Enhanced Radar Image Loop for Lower Mississippi Valley Sector
- The NWS Fire Weather Report

Public Outreach

The MFC's Public Outreach/Conservation Education Department maintains an active outreach program designed to educate citizens about forestry and related issues, as well as the agency's mission and services. Local outreach activities such as civic club presentations, forestry field days, and visits to school groups are conducted across the state to reach individuals at the community level. In FY17, $105,283 was distributed to state and local governments, non-profit groups, and educational institutions through the Urban and Community Forestry Challenge Grant Program. Public Outreach Officers provide customized presentations and displays for schools, community organizations, and events based on the following topics:

- Wildfire Prevention
- Smokey Bear Appearances
- Fire Wise
- Forest Health

• Forest Stewardship
• General MFC Information
• Best Management Practices
• Underserved Landowner Outreach Program
• Urban and Community Forestry

MFC has consulted with over 234 adult and youth programs boasting at least 193,8008 participants. This number does not include the participants from the MS State Fair, MS Wildlife Extravaganza, or the MS Garden and Patio Show.

Consult www.mfc.ms.gov/public-outreach for information on other MFC outreach efforts.

Fire Wise

Fire Wise is an educational program for homeowners and community leaders. This program is for anyone living in, or connected to, the wildland/urban interface. Information is available to assist in the design, construction, landscaping, and maintenance of a home or community to better withstand a wildfire without the aid of firefighting resources on the scene. Firewise literature can be found on the MFC website at www.mfc.ms.gov/firewise.

Fire Wise Workshops are also conducted throughout the state. These one-day workshops are free of charge and bring together citizens, businesses, and community leaders, getting them involved in planning, financing, building, sustaining, and protecting communities in the wildland/urban interface. Participants learn about the reason homes burn, various wildland fuel reduction techniques, and ways to assess the fire danger of their homes. The dates for Fire Wise Workshops can be found on the MFC website. There are currently seventeen communities and VFDs designated as Firewise Sites:

Table 3.7.2
Fire Wise Communities

Community	County	Year
Batesville	Panola	2013
Booneville	Prentis	2015
Yazoo City	Yazoo	2015
Ethel	Atalla	2012
Gloster	Amite	2009
Iuka	Tishomingo	2013
Jacinto Volunteer Fire Department, Jacinto Community	Alcorn	2015
Lake Hillsdale, Lumberton	Pearl River	2009
Noxapater	Winston	2011
Pelahatchie	Rankin	2015
Sardis	Panola	2014

Community	County	Year
Scooba	Kemper	2013
Snow Lake Shores	Benton	2007
Decatur	Newton	2014
Kossuth	Alcorn	2014
Leakesville	Greene	2015
Wiggins	Stone	2015

Underserved Landowner Program

The Underserved Landowner Outreach Program is a joint project between the MFC, Alcorn State University, and the USDA Forest Service. The program offers assistance to underserved landowners in Mississippi and has three primary goals:

- To provide outreach support and technical assistance to underserved landowners
- To encourage young people to seek careers in forestry
- To work with Alcorn State University to develop and/or enhance projects of mutual forestry interest

Urban and Community Forestry Program

The Urban and Community Forestry Division provides assistance and training to urban areas in the development of community forestry programs. Support is offered for counties and municipalities regarding the development of tree ordinances, hazardous tree inventories, and urban forest management plans. The Urban Forestry Program also provides technical advice to builders regarding tree preservation during construction and provides homeowners with advice regarding insects, diseases, and other urban forestry issues.

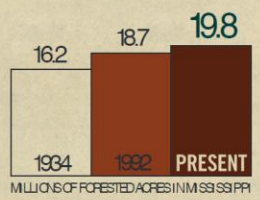
The Urban and Community Forestry Challenge Grant Program is a grant through the USDA Forest Service for administration, demonstration projects, and educational programs. The purpose of the Urban and Community Forestry Challenge Grant Program is to aid in the development of long-term, self-sustaining urban and community forestry programs. The goal of the Urban and Community Forestry Challenge Grant Program is to inspire or enhance local or statewide urban and community forestry programs.

Mississippi Forest Facts

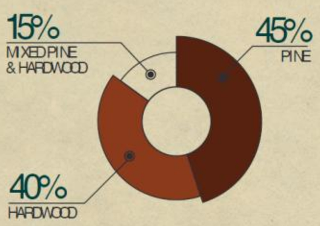
Mississippi Forestry Association, Mississippi Institute for Forest Inventory, and Mississippi State University compiled the following information to help Mississippians gain an understanding of the hazards wildfires pose to lives, homes, other structures, the forestry industry, and the state's economy.

Acreage and Ownership

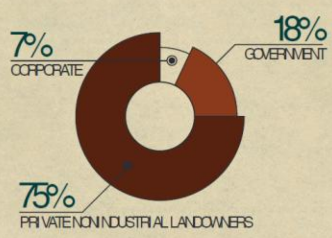
AREA OF COVERAGE



TIMELINE OF GROWTH



FOREST BY COVER TYPE



WHO OWNS MISSISSIPPI'S FORESTS

Employment and Wage Summary

FORESTRY AND FORESTRY-RELATED EMPLOYMENT:

5% ACCOUNTS FOR NEARLY 5% OF ALL JOBS IN MISSISSIPPI

$12.3 BILLION FORESTRY AND FOREST PRODUCT INDUSTRY

ALMOST **70,000** TOTAL JOBS IN MISSISSIPPI

$3.4 BILLION WAGES PAID OUT

Forestry and the Economy

Timber is a very important part of Mississippi's economy.

- The value of timber harvesting in Mississippi has averaged in excess of $1 billion per year over the past 20 years.
- Mississippi forests provide recreational opportunities, encourage tourism, and create environmental benefits such as excellent water quality, cleaner air, improved wildlife habitat, and the storage of atmospheric carbon.
- Promoting sustainable forest management, reforestation after harvest, and keeping forests productive have strategic long-term benefits for Mississippi.

Mississippi is "First in Forestry"

Thanks to MFA...

- State funded green buildings must equally recognize all forest certification programs.
- Mississippi was the first state in the nation to establish a reforestation tax credit, helping landowners with expenses associated with the stewardship of forest land and encouraging them to replant after harvest. Mississippi Forestry Association and its partners worked with the state legislature to increase the tax credit's lifetime limit from $10,000 to $75,000.
- Mississippi ranks number one in the nation in the number of Certified Tree Farms under the American Tree Farm System.

Mississippi Forest Facts is published by Mississippi Forestry Association, msforestry.net. Statistics were compiled by the Mississippi Forestry Commission and Mississippi State University.

Location

The Mississippi Forestry Commission is divided into four MFC Districts, shown in **Figure 3.7.6**. The MFC tracks wildfires by district and causes (Table 3.7.3). Averaging over 700 fires annually during the last three years, the Southeast District maintains the highest frequency of wildfires in the state. The areas with minimal amounts of historic wildfire events are along the Mississippi River. Except for one district in the northeast section of the state, Mississippi's three southernmost districts continue to experience the highest average number of wildfires. This trend is most apparent following major coastal storms when forest floor litter is greatest.

Figure 3.7.6
Mississippi Forestry Commission
Service Areas and Regions

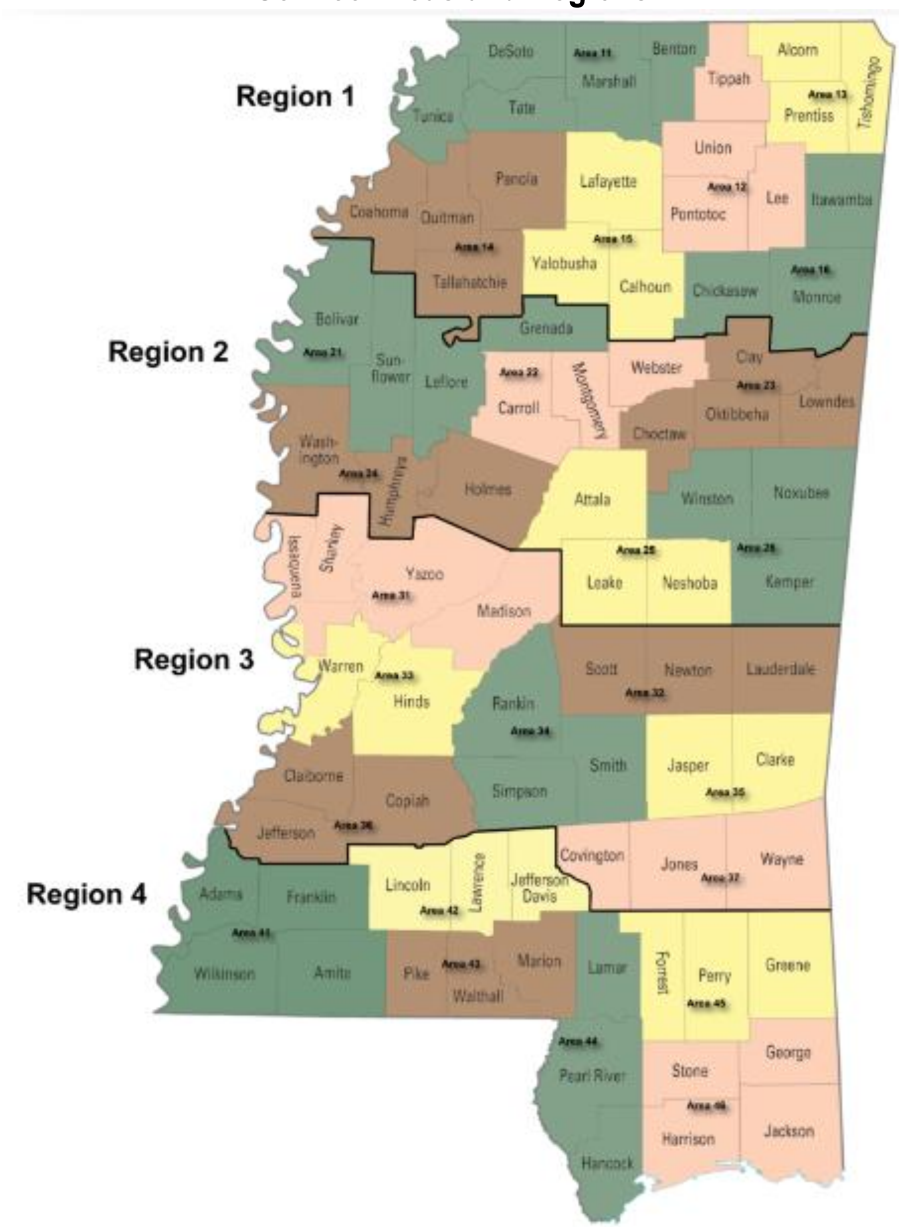


Figure 3.7.7


Mississippi Forestry Commission Central Dispatch Regions
To report a wildfire or obtain a burning permit, call the Central Dispatch number for your area:
Northwest Dispatch
1-877-226-5414
Bolivar Panola
Carroll Quitman
Coahoma Sunflower
DeSoto Tallahatchie
Grenada Tate
Holmes Tunica
Humphreys Washington
Leflore Yalobusha
Montgomery
Northeast District
1-800-681-8760
Alcorn Marshall
Attala Monroe
Benton Neshoba
Calhoun Noxubee
Chickasaw Okitbbeha
Choctaw Pontotoc
Clay Prentiss
Itawamba Tippah
Kemper Tishomingo
Lafayette Union
Leake Webster
Lee Winston
Lowndes
Southwest Dispatch
1-888-823-3473
Adams Lincoln
Amite Madison
Claiborne Marion
Copiah Pike
Franklin Rankin
Hinds Sharkey
Issaquena Simpson
Jefferson Walthall
Jefferson Davis Warren
Lawrence Wilkinson
Yazoo
South Central Dispatch
1-800-736-9115
Clarke Newton
Covington Scott
Jasper Smith
Jones Wayne
Lauderdale
Southeast Dispatch
1-800-240-5161
Forrest Jackson
George Lamar
Greene Pearl River
Hancock Perry
Harrison Stone

Figure 3.7.6

Mississippi Forestry Commission Administrative Districts

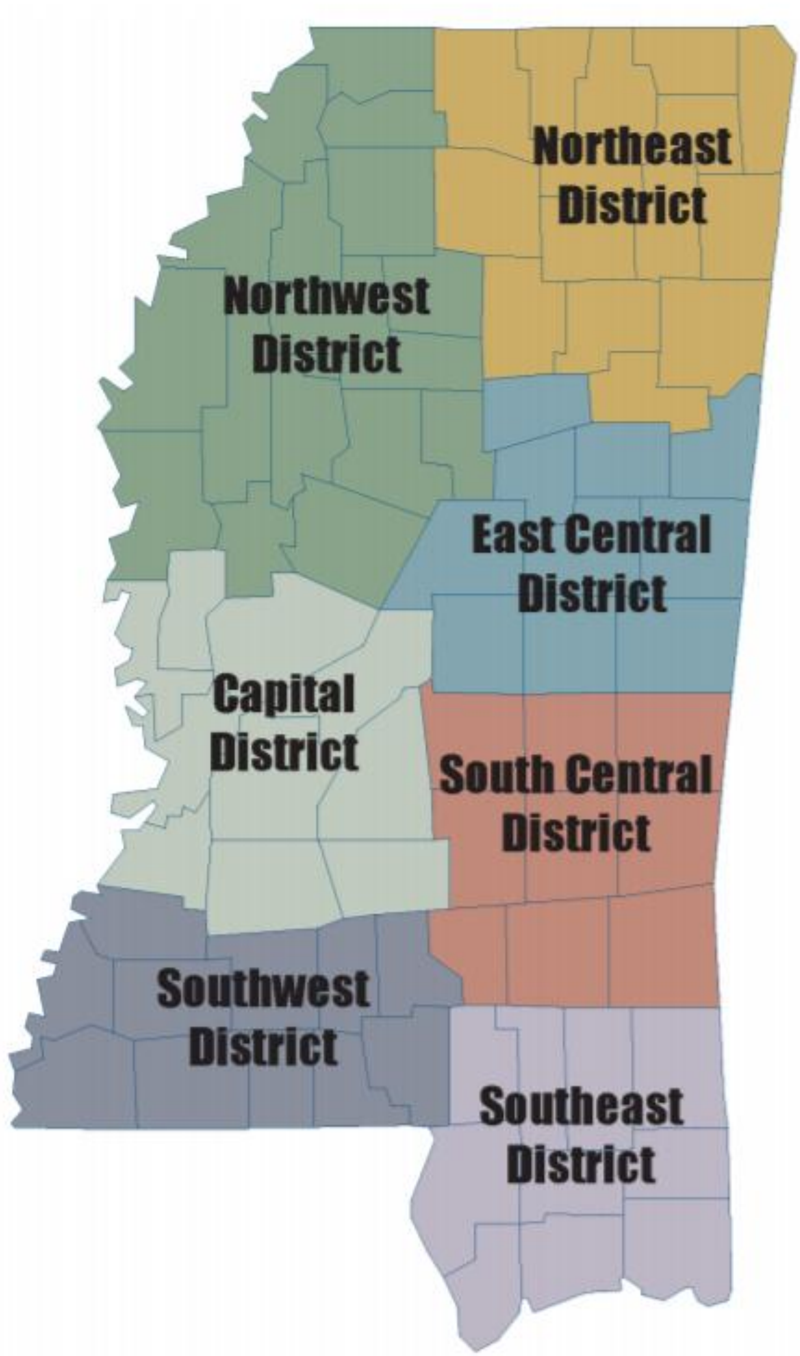


Table 3.7.2
Top 10 States for Wildfires Ranked by Number of Fires

Rank	State	Number of Fires
1	California	9,280
2	Texas	5,576
3	North Carolina	5,151
4	Montana	2,573
5	Florida	2,262
6	Oregon	2,202
7	Georgia	2,139
8	Minnesota	2,065
9	Washington	1,863
10	Arizona	1,773
11	Oklahoma	1,727
12	Missouri	1,531
13	Pennsylvania	1,350
14	Idaho	1,332
15	Utah	1,085
16	Alabama	1,040
17	Wisconsin	1,040
18	Colorado	1,017
19	North Dakota	946
20	**Mississippi**	**922**

Source: National Interagency Fire Center

With 100 state parks, national parks and forests, wildlife management areas, and wildlife refuges in 63 counties, Mississippi is number 20 in the top 20 states for Wildfires in 2021 (Table 3.7.2).

Past Occurrences

Burning debris causes an average of 871 fires each year in Mississippi (2010 - 2022) and is the leading cause of wildfires in the State. The second leading cause of wildfires in Mississippi is arson, averaging about 805 fires a year.

Other man-made causes of wildfires in Mississippi include railroads, children, smoking, and other miscellaneous causes. Individually these elements do not pose a serious threat to Mississippi's natural resources but combined they account for approximately 347 or 14% of fires annually.

As shown in **Table 3.7.3**, lightning strikes make up a small percentage of wildfires in Mississippi. Contributing to an average of 25 wildfires ignited annually, lightning-ignited wildfires are not considered a serious hazard to the state.

Table 3.7.3
Mississippi Wildfire by Cause (2010 – 2022)

Cause of Fire	2022 No. of Fires	2022 No. Acres Burned	2021 No. of Fires	2021 No. Acres Burned	2020 No. of Fires	2020 No. Acres Burned	2019 No. of Fires	2019 No. Acres Burned	2018 No. of Fires	2018 No. Acres Burned
Incendiary/Arson	304	10,266	208	5,477	253	10,182	179	5,340	173	3,651
Debris Burning	676	15,796	329	3,935	279	3,622	191	3,061	353	3,413
Lightning	5	101	3	210	1	10	3	4	1	1
Campfire	3	11	1	1	3	60	2	25	1	32
Smoking	7	90	3	16	10	30	2	2	2	12
Equipment	37	543	12	135	24	135	9	45	22	148
Railroads	1	4	1	4	0	0	3	14	2	11
Children	0	0	3	14	2	113	0	0	2	9
Miscellaneous	0	0	193	5,141	225	7,139	102	1,695	231	3,752
Undetermined	346	12,398	169	4,318	1	35	0	0	9	175
TOTALS	**1,379**	**33,574**	**922**	**19,251**	**798**	**21,326**	**491**	**10,186**	**796**	**11,204**

Cause of Fire	2017 No. of Fires	2017 No. Acres Burned	2016 No. of Fires	2016 No. Acres Burned	2015 No. of Fires	2015 No. Acres Burned	2014 No. of Fires	2014 No. Acres Burned
Incendiary/Arson	655	12,963	325	11,772	740	10,923	850	14,457
Debris Burning	816	10,180	743	6,747	780	8,276	828	7,788
Lightning	10	92	16	320	8	50	14	1,015
Campfire	10	119	8	17	4	90	3	7
Smoking	19	107	20	170	6	18	17	190
Equipment	72	844	69	1,641	40	544	36	397
Railroads	3	12	5	66	4	13	2	30
Children	7	16	13	45	10	66	22	162
Miscellaneous	658	8,246	717	10,592	119	2,704	156	1,824
Re-ignition	0	0	0	0	45	712	0	0
Undetermined	68	995	0	0	0	0	0	0
TOTALS	**2,318**	**33,574**	**1,916**	**31,370**	**1,756**	**23,396**	**1,928**	**25,870**

Cause of Fire	2013 No. of Fires	2013 No. Acres Burned	2012 No. of Fires	2012 No. Acres Burned	2011 No. of Fires	2011 No. Acres Burned	2010 No. of Fires	2010 No. Acres Burned
Incendiary/Arson	680	9,125	758	11,452	1,706	29,240	728	11,005
Debris Burning	584	5,678	773	5,735	1,713	15,230	731	6,612
Lightning	25	478	21	275	47	641	10	147
Campfire	7	16	3	31	9	155	1	3
Smoking	7	39	22	110	37	279	14	34
Equipment	27	222	51	297	115	949	311	254
Railroads	4	102	9	141	8	66	2	3
Children	7	79	12	6	20	241	9	125
Miscellaneous	133	1,828	154	1,366	249	2,710	108	503
Re-ignition	0	0	62	585	238	5,279	38	427
TOTALS	**1,474**	**17,567**	**1,865**	**20,056**	**4,142**	**54,790**	**1,672**	**19,113**

Potential Damages from Wildfires

Agriculture is Mississippi's number one industry, employing roughly 260,000 people, approximately 17% of the state's workforce, either directly or indirectly. Additionally, agriculture contributes $7.4 billion in income to the State's economy. This does not include the $2.7 billion annual economic impact from hunting, fishing, and other natural resource-related enterprises.

Approximately 37,100 farms are active on nearly 10.9 million acres of land in Mississippi. Mississippi also includes 19.7 million acres of forest land; 14,000 miles of streams; and 640,000 acres of ponds and lakes. On average, Mississippi farms cover 264 acres and are spread across every region of the state with the highest concentration of cropland located in the Delta.

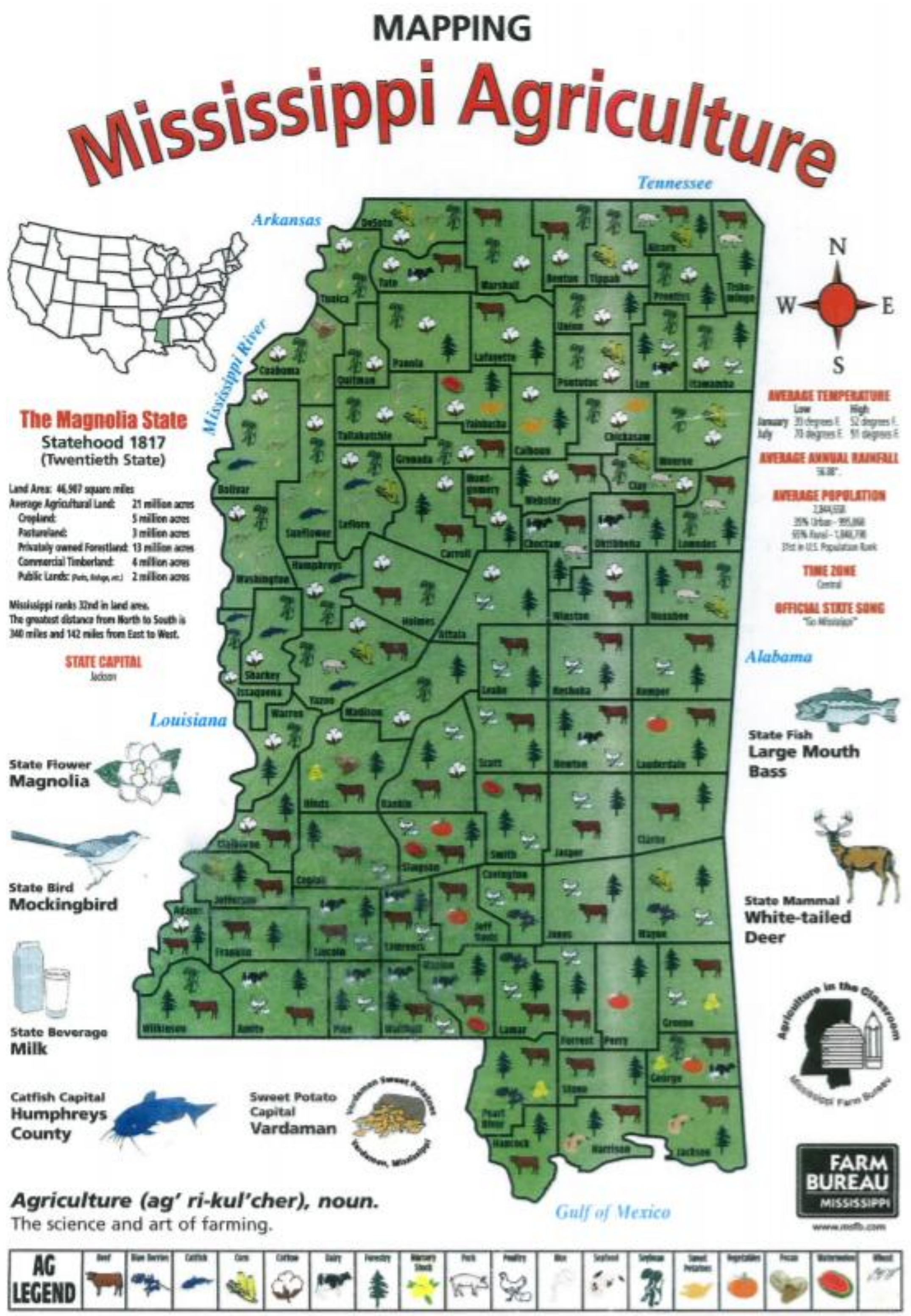
Table 3.7.4 lists Mississippi's top ten crops. As shown by the map **in Figure 3.7.5**, agriculture makes a significant impact in all of Mississippi's 82 counties.

Table 3.7.4
Mississippi's Top Ten Crops

Rank	Agricultural Crop	2017 Revenue	Rank	Agricultural Crop	2017 Revenue
1	Poultry/Eggs	$2.8 billion	6	Cattle & Calves	$285 million
2	Forestry	$1.4 billion	7	Catfish	$181 million
3	Soybeans	$1.1 billion	8	Sweet Potatoes	$123 million
4	Cotton	$562 million	9	Hogs	$117 million
5	Corn	$337 million	10	Hay	$116 million

Source: Mississippi Department of Agriculture and Commerce

Figure 3.7.5
2017 Mississippi Agricultural Map



The best available data to calculate job and wages for direct impact were those based on 2014 data. The 2013 plan indicated that in 2010, the Forest Industry Sector provided over 36,000 jobs and paid $1.6 billion in wages to Mississippi. In 2014, there were increases in all areas except for Miscellaneous Forest Products. The Forestry Industry Sector provided over 40,000 jobs and paid more than $1.9 billion in wages as indicated in Table 3.7.5.

Table 3.7.5
Mississippi Forest Industry's
Direct Impact on Job and Wages

Forest Industry Sector	Wages Paid (in Millions)	Jobs	Wages Paid (in Millions)	Jobs
Miscellaneous Forest Products	$31.29	505	$32.91	449
Logging	$500.39	10,634	$244.35	5,734
Solid Wood Products	$447.63	9,071	$391.06	8,443
Wood Furniture	$622.55	16,178	$654.90	17,882
Pulp and Paper	$313.21	3,770	$309.24	3,623
TOTALS	**$1,915.07**	**40,158**	**$1,632.46**	**36,131**

Probability of Future Events

Fire is a natural part of a healthy ecosystem. However, as development increases, an increase in the number of wildfires is likely. (See **Figure 3.7.2**) Mississippi may be able to decrease future wildfire events through continued education and outreach. Making well-informed decisions when recreating outdoors can reduce wildfire occurrences in the state. Increasing manpower to fight and deter arson can also lower Mississippi's threat of future wildfires. Mississippi averaged 700 fires annually in the last three years. Wildfires are changing because of the environment. A changing environment means higher temperatures and drier conditions, creating conditions which are prime for wildfires spreads. Changes in the environment have already increased wildfire risk across the United States, doubling the number of acres burned and increasing the duration of wildfire season by over 3 months. Changing weather patterns can also result in changes in wild direction, blowing wildfires into areas, or allowing them to spread to areas, where they may not have done before. Making well-informed decisions when recreating outdoors can reduce wildfire occurrences in the state. Increasing manpower to fight and deter arson can also lower Mississippi's threat of future wildfires. The overall probability for the state is medium with consideration of changing future conditions.

Assessing Vulnerability

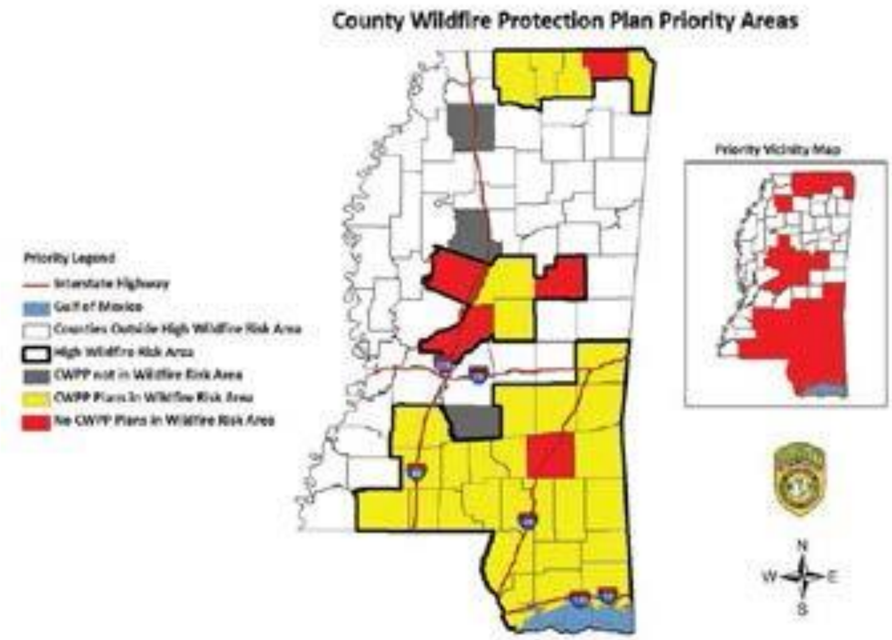
The state of Mississippi has not added any new County Wildfire Protection Plans since the last plan update. As a result, the analysis of the state's vulnerability that led to the information in this section will remain the same.

An assessment of Mississippi's vulnerability to wildfires is dependent on the proximity of development to natural wildland areas. The most common means of assessing wildfire threat is to quantify the amount of development in proximity to or within wildland areas. The best available information for assessing the wildfire threat to Mississippi is contained in the Southern Wildfire Risk Assessment (SWRA). Using that data, the state of Mississippi used funding received after Hurricane Katrina to prepare County Wildfire Protection Plans (CWPPs) for the 15 lower counties in Mississippi. Following that initial effort, the state prepared CWPPs for 19 high-occurrence counties, making a total of 34 counties with prevention plans (**Table 3.7.6**). The Mississippi Forestry Commission has a copy of these completed plans. The CWPPs will also be incorporated into the update of local hazard mitigation plans as they are developed. These CWPPs contain valuable initiatives for improved safety and economic security. Counties are encouraged to move toward their implementation. (See **Figure 3.7.6**).

Table 3.7.6
County Wildfire Protection Plans

County	Plan Date	County	Plan Date
Amite	September 2008	Lawrence	September 2009
Attala	September 2008	Leake	July 2008
Benton	September 2009	Lincoln	September 2008
Carroll	September 2008	Marshall	September 2008
Clarke	September 2009	Panola	September 2008
Copiah	September 2009	Pearl River	December 2007
Covington	October 2008	Perry	October 2008
Forrest	October 2008	Pike	September 2009
George	December 2007	Simpson	September 2009
Greene	October 2008	Smith	September 2009
Hancock	October 2008	Stone	December 2007
Harrison	December 2007	Tippah	September 2008
Jackson	December 2007	Tishomingo	September 2008
Jasper	July 2008	Walthall	September 2008
Jefferson Davis and Marion	October 2008	Wayne	October 2008
Lamar	October 2008	Winston	September 2008
Lauderdale	August 2008		
Source: Mississippi Forestry Commission			

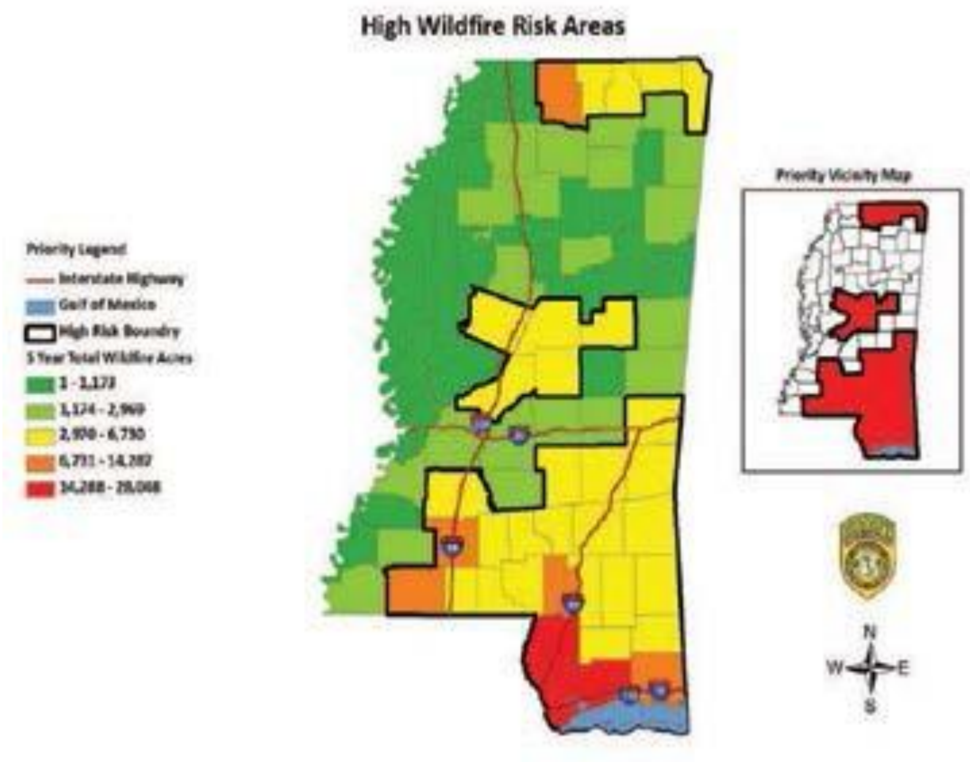
Figure 3.7.6
Forestry Commission 2017



The development of *Mississippi's Statewide Forest Resource Assessment and Forest Resource Strategy Plan* was completed and approved by the U.S. Forest Service in 2010. It was fully implemented in FY2011. To date, this information has not changed. This plan is a comprehensive analysis of forest-related conditions, trends, threats, and opportunities; as well as strategies to address them. Wildfire fuel reduction strategies in the plan include

- Identify at-risk communities and high fire-occurrence areas
- Increase the Number of Certified Prescribed Burn Managers (CPBMs)
- Increase the number of prescribed-burn acres annually in high-risk areas identified in the 34 CWPPs (**Figure 3.7.7**)
- Use current land owner burn assistance programs to reduce fuel loading from invasive species plants
- Continue to provide funding to ensure plans are completed in the remaining counties
- Provide equipment to volunteer fire departments for use in controlling non-forest fires inside and outside the WUI.
- Identify locations of MFC tractor/plow units and volunteer fire departments.

Figure 3.7.7



Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	1	7	-	6		9	
2	1	11	-	7	1	4	4
3	9	1	-	8	3	8	2
4	11	-	-	9		6	
5	27	10	10				

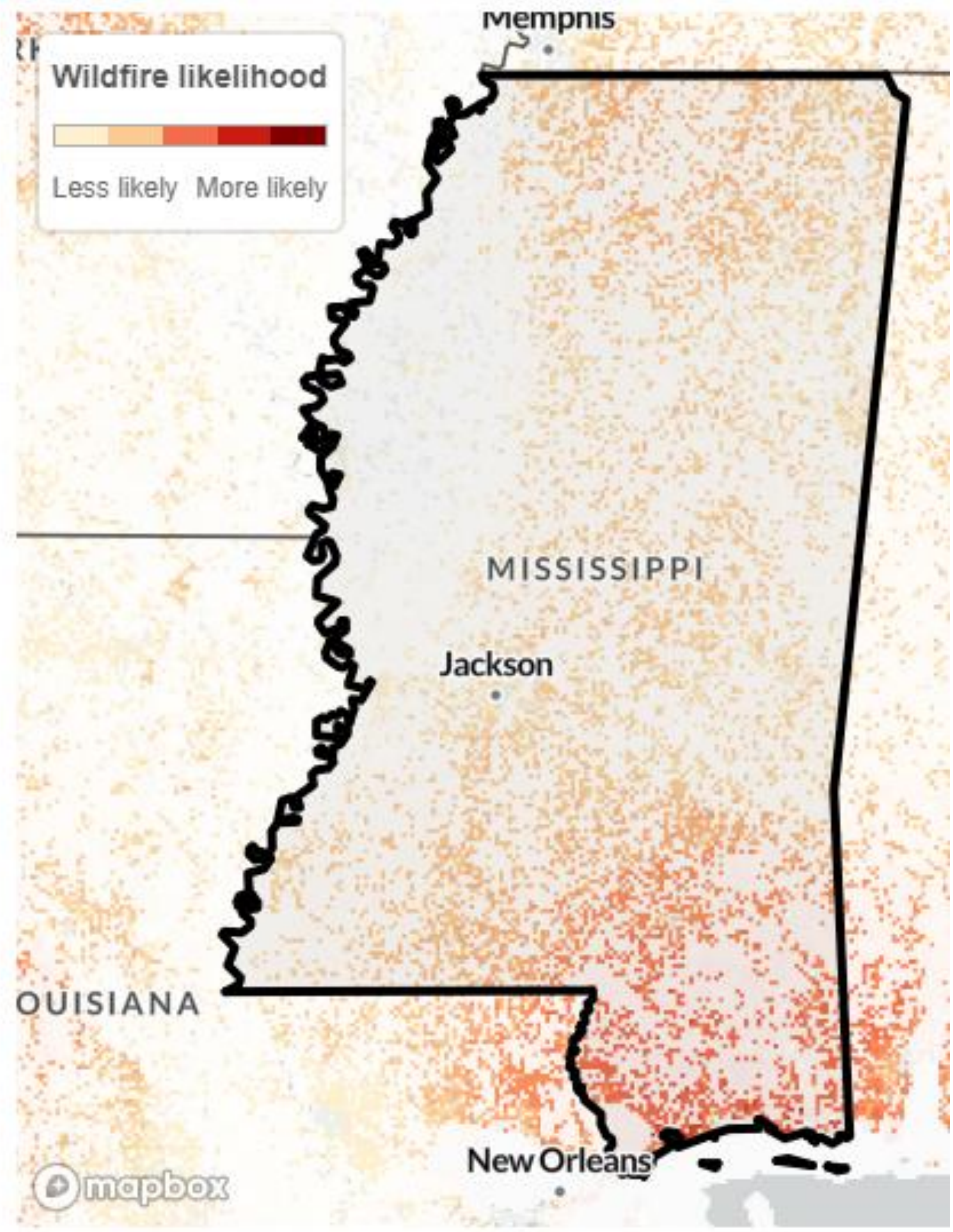
Probability of Future Occurrence

The overwhelming majority of wildfires are caused by human actions through arson, debris burning, or other human activities. By its very nature, human activities are very difficult to predict. While it may be difficult to predict when fires may occur, the severity or impact of wildfires will be more significant during months with less precipitation when ignitable materials such as vegetative debris, limbs, and leaves are much drier. The overall probability for the State is medium with consideration of changing future conditions and simply based on the unpredictable nature of factors that cause wildfires. However, continued use of management methods such as prescribed burning is an effective tool to minimize the impacts of wildfires, control their rapid spread, and aid in suppression.

Exposure Analysis of Critical Facilities

The state of Mississippi developed a definition for "critical facilities and infrastructure" as discussed in **Section 3.0**. Location data for these facilities were collected from various state agencies to determine which facilities are at risk of various hazards. The critical facility categories deemed most pertinent to wildfire risk are Emergency Operations Centers, Fire Stations, Police Stations, Medical and Power Facilities, and Red Cross shelters and facilities. The following maps have been created to demonstrate this per region.

Figure 3.7.8 Wildfire Likelihood (Populated Areas)[1]



1 U.S. Forest Service www.wildfirerisk.org

Figure 3.7.9 Wildfire Likehood (All Lands)

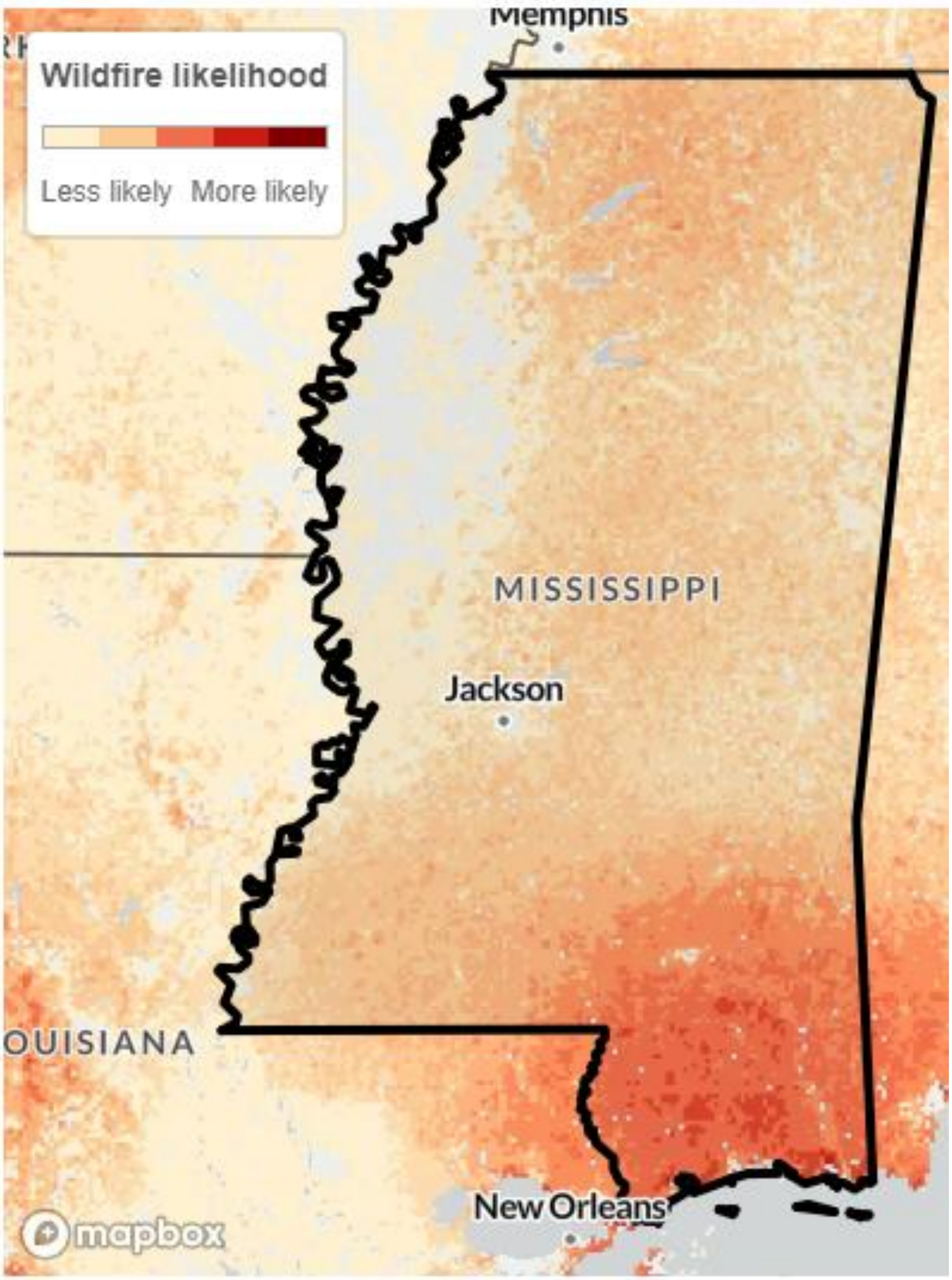
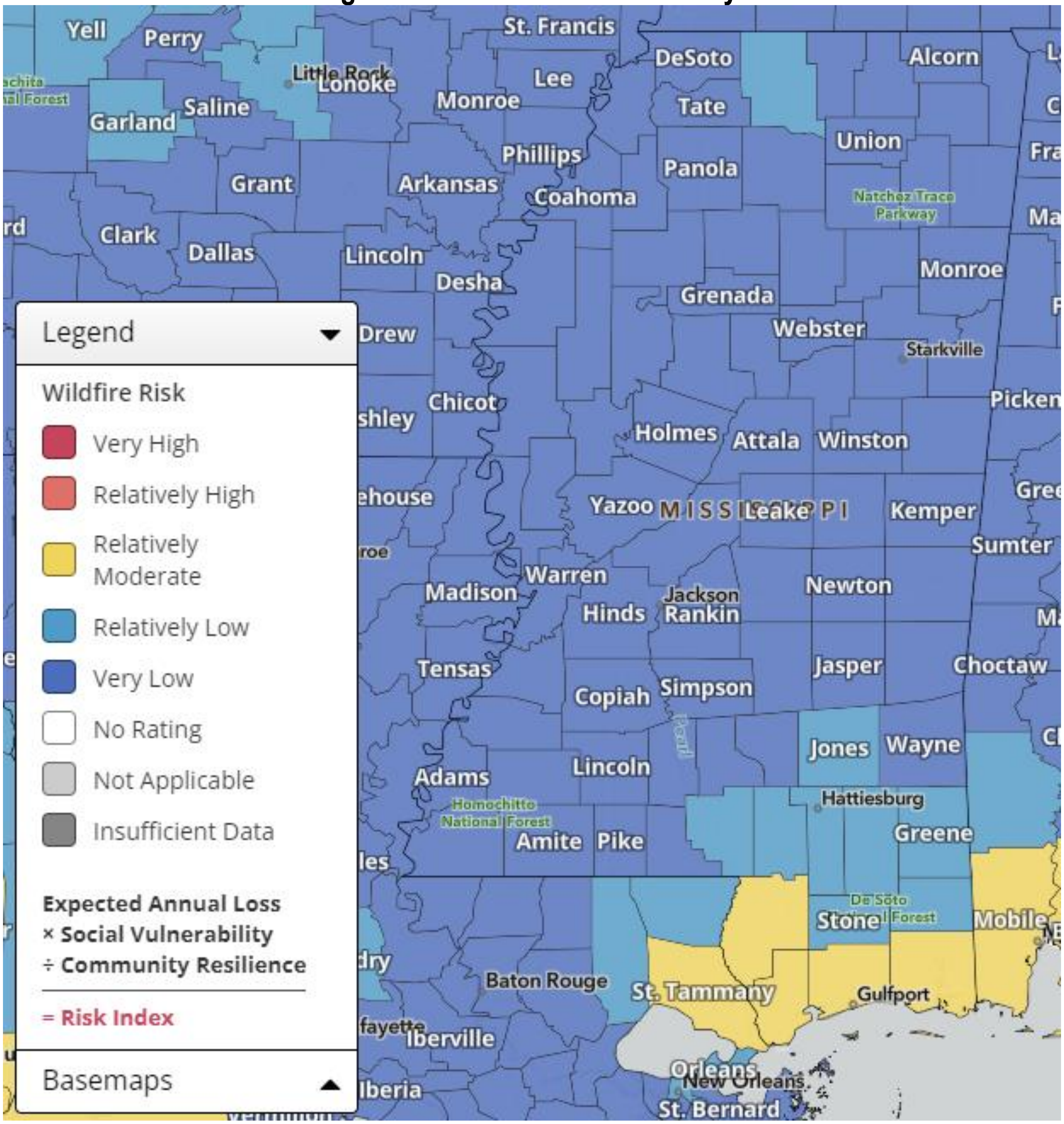
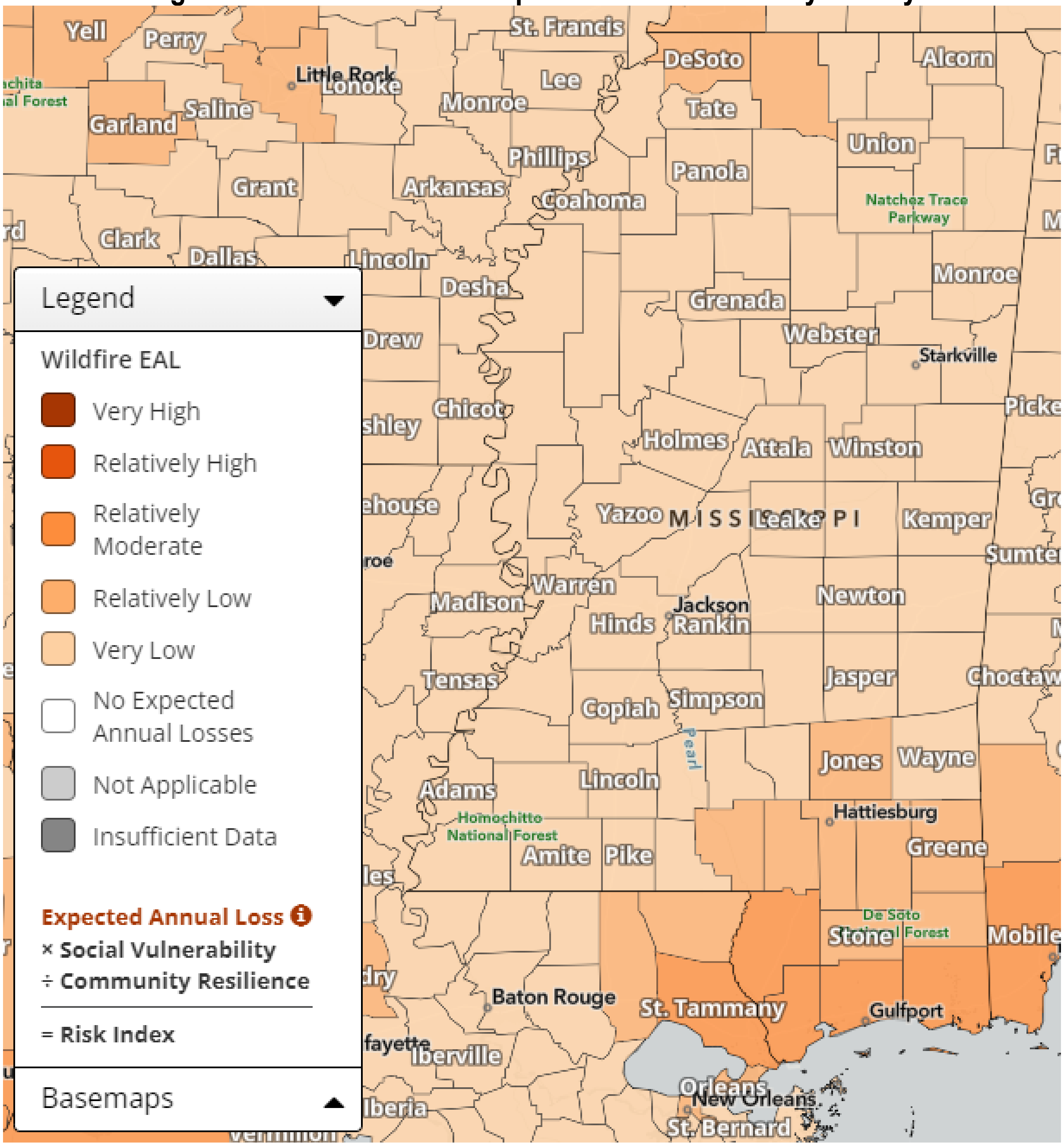


Figure 3.7.10 Wildfire Risk County[2]



FEMA National Risk Index, www.hazards.fema.gov

Figure 3.7.11 Wildfire Risk Expected Ammual Loss by County



3.8: Drought Risk Assessment

Hazard Description

Based on the local plan roll-up of identified and ranked hazards, limited options for state-level mitigation, and lack of historical need for state-level response, it was concluded that drought does not pose a serious statewide threat capable of being addressed by this plan. Droughts can and do, however, occur in Mississippi.

According to the National Oceanic and Atmospheric Administration (NOAA), drought is defined as a period of unusually dry weather persisting long enough to cause serious problems, such as crop damage and/ or water supply shortages. The severity of the drought depends upon the degree of moisture deficiency and the duration of the drought.

Drought occurs under differing conditions, based on these reference points:

> *Meteorological* drought is defined as a period of substantially diminished precipitation duration and/or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which the actual moisture supply at a given place consistently falls below the average moisture supply.
>
> *Agricultural* drought occurs when there is inadequate soil moisture to meet the needs of a particular crop during a given time. Agricultural drought usually occurs after or during meteorological drought, but before hydrological drought, and can affect livestock and other dry-land agricultural operations.
>
> *Hydrological* drought refers to deficiencies in surface and subsurface water supplies from lack of precipitation. It is measured as stream flow, snowpack, lake, reservoir, and groundwater levels. There is usually a delay between a lack of rain or snow and less measurable water in streams, lakes, and reservoirs. Therefore, hydrological measurements tend to lag behind other drought indicators.
>
> *Socio-economic* drought occurs when physical water shortages start to affect the health, well-being, and quality of life of people, or when drought starts to affect the supply and demand of an economic product.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water demands by humans, livestock, crops, and vegetation. The severity of drought can be aggravated by other climatic factors, such as prolonged high winds and low relative humidity. Due to its multi-dimensional nature, drought is difficult to define in exact terms and also poses difficulties in terms of comprehensive risk assessments.

In 1965, Wayne Palmer developed an index to "measure the departure of the moisture supply." This index was based on the supply-and-demand concept of the water balance equation, taking into account more than merely the precipitation deficit at specific locations. The objective of the Palmer Drought Severity Index (PDSI) was to provide a measurement of "standardized" moisture conditions so comparisons using the index could be made between locations and between periods. While Palmer's indices are water balance indices that consider water supply (precipitation), demand (evapotranspiration), and loss (runoff), another commonly used drought index, the Standardized Precipitation Index (SPI), is a probability index considering only precipitation. Therefore, for this plan, drought will be analyzed using the PDSI.

The PDSI varies between -4.0 and +4.0. Weekly Palmer Index values are calculated for the Climate Divisions during every growing season and are available from the Climate Prediction Center. Mississippi could expect to experience the entire range of drought severity and classification. **Table 3.8.1** lists the Palmer Drought Severity Index.

Table 3.8.1
Palmer Drought Severity Index

Index Value	Classification	Index Value	Classification
4.00 or more	Extremely wet	-0.50 to -0.99	Incipient dry spell
3.00 to 3.99	Very wet	-1.00 to -1.99	Mild drought
2.00 to 2.99	Moderately wet	-2.00 to -2.99	Moderate drought
1.00 to 1.99	Slightly wet	-3.00 to -3.99	Severe drought
0.50 to 0.99	Incipient wet spell	-4.00 to less	Extreme drought
0.49 to -0.49	Near Normal		

Source: http://drought.unl.edu/whatis/indices.htm

Another means of analyzing drought is the Keetch-Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. This system, originally developed for the southeastern United States, is based primarily on recent rainfall patterns.

The KBDI drought index system is the most widely used by fire managers in the south. It is also one of the only drought index systems specifically developed to equate the effects of drought with potential fire activities.

The result of this system is a drought index number ranging from 0 to 800 accurately describing the amount of moisture missing. A rating of zero defines the point of no moisture deficiency and 800 is the maximum drought possible.

These numbers correlate with potential fire behavior as follows:

- 0 - 200: Soil moisture and large-class fuel moistures are high and do not contribute much to fire intensity. Typical of the spring dormant season following winter precipitation.

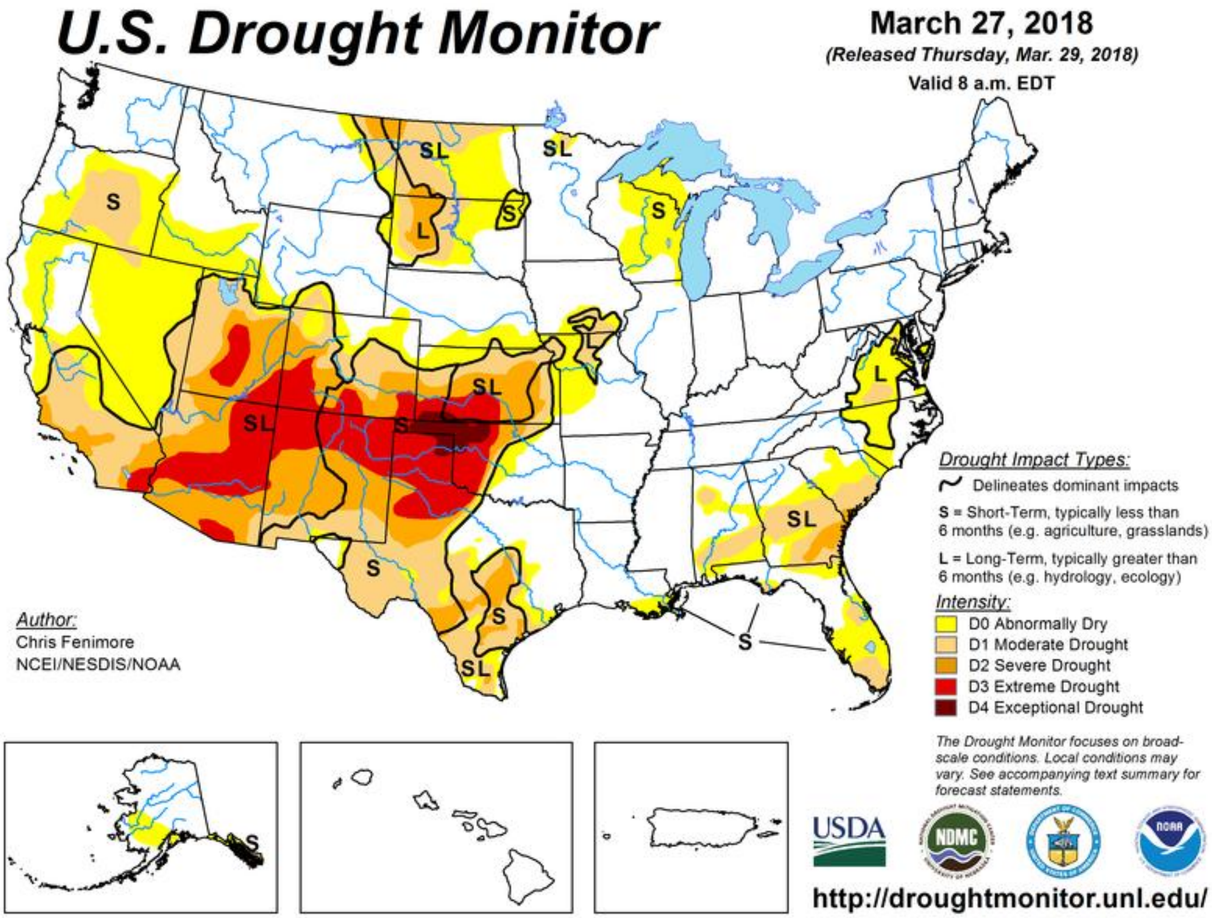
- 200 - 400: Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity.

- 400 - 600: Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively.

- 600 - 800: Often associated with more severe drought with increased wildfire occurrence. Intense, deep-burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Figure 3.8.1 provides another illustration of drought potential by using the Keetch-Bryam index for a similar period as the U.S. Drought Monitor. These figures indicate fire intensity significantly increased due to lower litter and duff layers drying out.

Figure 3.8.1
Keetch-Byram Drought Index Data
for the United States March 27, 2018

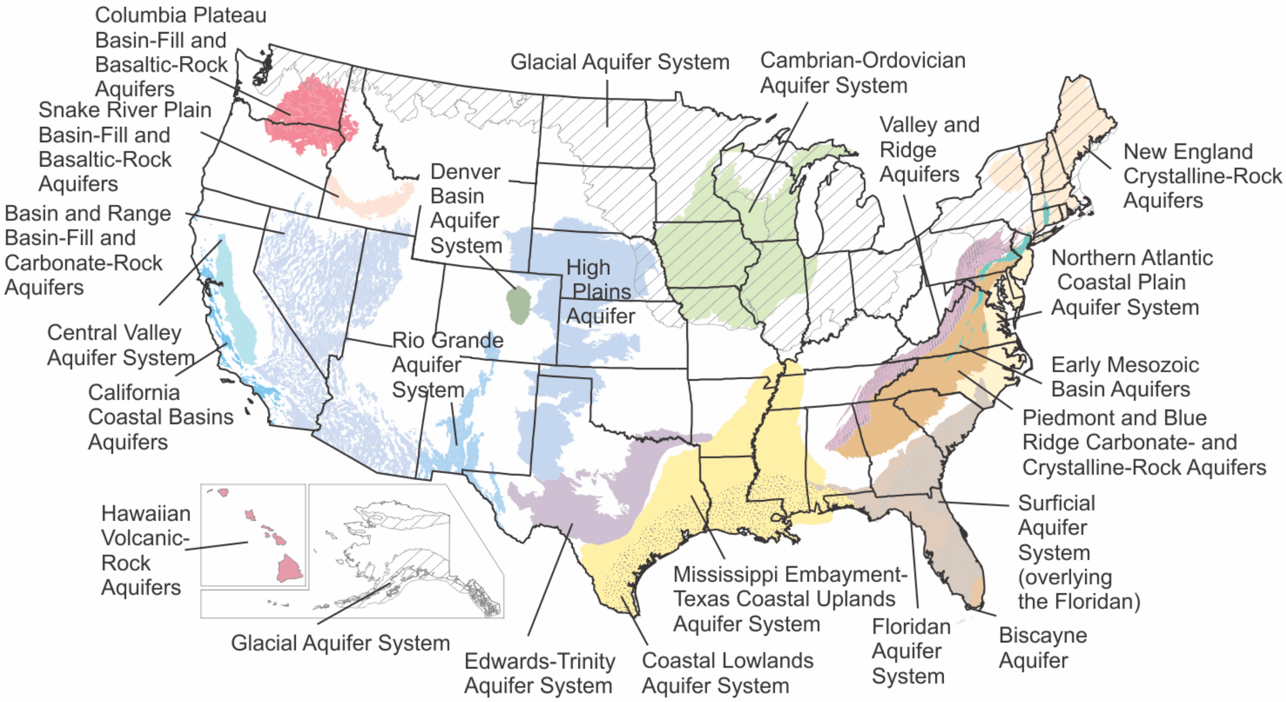


(Source: USDA)

Location and Extent

Drought is not a location-specific hazard. All areas of Mississippi are vulnerable to drought. Figure 3.8.2 shows the location of the Mississippi Embayment of the Texas Coastal Uplands Aquifer System and the Coastal Lowlands Aquifer System, which provide water to the majority of the state of Mississippi.

Figure 3.8.2
United States Aquifer System



(Source: USGS)

Severe, prolonged drought could have negative and lasting impacts on residents, agriculture, industry, and infrastructure of Mississippi. When available water tables decline, and potable water becomes harder to obtain. The residents, commuting population, and visitors are exposed to greater health risks. Any water-dependent functions in the state are exposed to potential loss of or failure to function.

Previous Occurrences

As during the time of the last plan update, current conditions across Mississippi at the time of this document publication showed the state outside any drought condition zone, with the PDSI indicating moisture conditions throughout the state ranging from near normal to extremely moist (Source: U.S. Drought Portal, U.S. Drought Monitor). Historically, Mississippi is the third wettest state in the nation (behind Hawaii and Louisiana), with an average rainfall of 59.23’ per year (source NCDC). Since the forecast period is a snapshot of current or foreseeable conditions over a reasonably long planning period, seasonal weather trends and the use of the

U.S. Drought Monitor can provide indicators of oncoming drought conditions. Table 3.8.2 provides an account by county, of estimated property and crop damages caused by drought.

Table 3.8.2
Past Occurrences Drought

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Tate, Coahoma, Tunica	12/1/2022	12/20/2022	$0	$0	0	0	D2
Tate, Tunica, Coahoma	11/1/2022	11/30/2022	$0	$0	0	0	D2
Tate, Coahoma, Tunica	10/25/2022	10/31/2022	$0	$0	0	0	D2
Alcorn, Lee, Pontotoc, Union, Tichomingo, Chickasaw, Monroe, Itawamba, Prentiss, Tippah, Benton	8/1/2022	8/16/2022	$0	$0	0	0	D2
Benton, Monroe, Chickasaw, Itawamba, Lee, Pontotoc, Union, Prentiss, Tichomingo, Alcorn, Tippah	7/5/2022	7/31/2022	$0	$0	0	0	D2
Warren, Issaquena	12/1/2021	12/31/2021	$0	$0	0	0	D2
Lee, Monroe, Chickasaw, Itawamba	4/1/2017	4/4/2017	$0	$0	0	0	D2
Lee, Chickasaw, Itawamba, Monroe	3/1/2017	3/31/2017	$0	$0	0	0	D2
Chickasaw, Itawamba, Lee, Monroe	2/21/2017	2/28/2017	$0	$0	0	0	D2
Chickasaw, Monroe, Itawamba	1/1/2017	1/24/2017	$0	$0	0	0	D2

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Neshoba, Forrest, Jasper, Lauderdale, Hinds, Clarke, Simpson, Kemper, Newton, Scott, Copiah, Leake, Claiborne, Winston, Madison, Rankin, Warren, Chocktaw, Yazoo, Atalla, Montgomery, Holmes, Pontotoc, Union, Prentiss, Tishomingo, Carroll, Sharkey, Issaquena, Humphreys, Sunflower, Alcorn, Tippah, Calhoun, Yalobusha, Tallahatchie, Washington, Leflore, Grenada, Webster, Noxubee, Quitman, Panola, Lafayette, Marshall, Benton, Oktibbeha, Lee, Monroe, Itawamba, Chickasaw, Clay, Lowndes, Wayne, Stone, Greene, Perry, George, Jones, Covington, Jefferson, Smith	12/1/2016	12/31/2016	$0	$2,000,000	0	0	D2
DeSoto, Tate, Tunica, Jefferson Davis, Leflore, Sunflower, Covington, Forrest, Franklin, Adams, Issaquena, Washington, Sharkey, Lincoln, Jefferson, Bolivar, Lawrence, Marion, Lamar	11/15/2016	11/30/2016	$0	$800,000	0	0	D2
Alcorn	11/8/2016	11/30/2016	$0	$0	0	0	D2-D3
Marshall, Tippah, Benton, Jones, Wayne, Stone, Perry, Greene, George, Hinds, Smith, Jasper, Clarke, Grenada, Scott, Kemper, Newton, Attala, Winston, Choctaw, Oktibbeha, Noxubee, Tishomingo, Coahoma, Quitman, Tallahatchie, Panola, Yalobusha, Lafayette, Union, Prentiss, Clahoun, Chickasaw, Pontotoc, Lee, Itawamba, Monroe, Lauderdale, Montgomery, Webster, Clay, Lowndes, Hinds, Rankin, Simpson, Claiborne, Holmes, Madison, Leake, Neshoba, Copiah, Humphreys, Warren	11/1/2016	11/30/2016	$1,500,000	$0	0	0	D2-D3

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Smith, Copiah, Claiborne, Clarke, Simpson, Jones, Jasper	10/25/2016	10/31/2016	$0	$210,000	0	0	D2
Prentiss, Warren, Yazoo, Hinds, Rankin, Humphreys, Tishomingo	10/18/2016	10/31/2016	$0	$200,000	0	0	D2
Calhoun, Union, Webster, Scott, Newton, Lauderdale, Leake, Neshoba, Kemper, Madison, Carroll, Grenada, Winston, Noxubee, Oktibbeha, Choctaw, Attala, Holmes, Montgomery	10/11/2016	10/31/2016	$0	$680,000	0	0	D2-D3
Monroe, Coahoma, Yalobusha, Lafayette, Panola, Tallahatchie, Quitman, Clay, Lowndes, Perry, Wayne, Lee, Itawamba, Pontotoc, Chickasaw	10/1/2016	10/31/2016	$0	$100,000	0	0	D2-D3
Quitman, Pontotoc, Coahoma	9/27/2016	9/30/2016	$0	$0	0	0	D2
Lowndes, Panola, Monroe, Chickasaw, Itawamba, Lee, Yalobusha, Tallahatchie, Lafayette, Clay	9/1/2016	9/30/2016	$0	$90,000	0	0	D2
Lafayette	8/9/2016	8/31/2016	$0	$0	0	0	D2
Oktibbeha, Tishomingo, Prentiss, Pontotoc, Calhoun, Chickasaw, Lee, Monroe, Itawamba, Yalobusha, Tallahatchie, Panola, Clay, Madison, Montgomery, Grenada, Carroll, Holmes, Lowndes, Leflore, Webster	8/1/2016	8/16/2016	$0	$330,000	0	0	D2
Leflore, Pontotoc, Panola, Madison, Clay, Holmes, Montgomery, Webster, Carroll	7/26/2016	7/31/2016	$210,000	$0	0	0	D2-D3
Lee, Prentiss	7/12/2016	7/31/2016	$0	$0	0	0	D2
Grenada, Tallahatchie, Yalobusha, Chickasaw, Calhoun, Monroe, Itawamba, Tishomingo	7/5/2016	7/31/2016	$30,000	$0	0	0	D2-D3
Coahoma	11/1/2015	11/12/2015	$0	$0	0	0	D2-D1
Calhoun, Tunica, Newton, Noxubee, Oktibbeha, Lamar, Covington, Jones, Jasper	10/15/2015	10/29/2015	$0	$7,000	0	0	D2
Yalabousha	10/8/2015	10/29/2015	$0	$0	0	0	D2

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Grenada, Lincoln, Jefferson, Marion, Adams, Lawrence, Franklin, Jefferson Davis, Neshoba, Winston, Choctaw	10/6/2015	10/27/2015	$0	$11,000	0	0	D2-D3
Coahoma, Tallahatchie, Bolivar, Sharkey, Issaquena, Warren, Claiborne, Carroll, Montgomery, Sunflower, Leflore, Humphreys, Holmes, Yazoo, Madison, Attala, Scott, Smith, Hinds, Rankin, Leake, Simpson, Copiah, Washington	10/1/2015	10/31/2015	$0	$25,600	0	0	D2
Issaquena, Bolivar, Washington, Montgomery, Carroll, Claiborne, Warren, Sharkey	9/15/2015	9/30/2015	$0	$3,200,000	0	0	D2
Leake, Sunflower, Leflore, Humphreys, Holmes, Yazoo, Madison, Attala, Scott, Smith, Rankin, Simpson, Copiah	9/1/2015	9/30/2015	$0	$5,600,000	0	0	D2
Tunica, Tallahatchie, Quitman, Panola, Yalobusha	9/17/2013	9/24/2013	$0	$0	0	0	D2
Coahoma	9/3/2013	9/24/2013	$0	$0	0	0	D2
DeSoto	11/1/2012	11/20/2012	$0	$0	0	0	D2-D1
Tunica, Tate, DeSoto, Marshall, Lafayette, Panola, Quitman, Coahoma	10/1/2012	10/16/2012	$0	$0	0	0	D3-D1
Tallahatchie, Tunica, Tate, Coahoma, Quitman, Panola, DeSoto, Marshall, Benton, Lafayette	9/1/2012	9/30/2012	$0	$0	0	0	D2
DeSoto, Coahoma, Tallahatchie, Quitman, Panola, Benton, Marshall, Tunica, Tate	8/1/2012	8/31/2012	$0	$0	0	0	D3
Marshall, Benton	7/10/2012	7/31/2012	$0	$0	0	0	D1-D2
Tunica, Tate, DeSoto, Coahoma, Quitman, Tallahatchie, Panola	7/1/2012	7/31/2012	$0	$0	0	0	D2-D3
DeSoto, Tunica, Coahoma, Quitman, Tallahatchie, Panola, Tate	6/19/2012	6/30/2012	$0	$0	0	0	D2
Yalobusha, Quitman, Coahoma, Tallahatchie	4/1/2011	4/30/2011	$0	$0	0	0	D2
Yalobusha, Quitman, Tallahatchie	3/22/2011	3/31/2011	$0	$0	0	0	D1-D2

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Coahoma	3/1/2011	3/31/2011	$0	$0	0	0	D2
DeSoto, Coahoma, Tunica	2/1/2011	2/8/2011	$0	$0	0	0	D2-D1
DeSoto, Coahoma, Tunica	1/1/2011	1/31/2011	$0	$0	0	0	D2
DeSoto, Coahoma, Tallahatchie, Tunica	12/28/2010	12/31/2010	$0	$0	0	0	D2
Tate, Calhoun, Yalobusha, Quitman, Panola, Tallahatchie, Monroe, Chickasaw, Coahoma, Tunica, DeSoto	11/1/2010	11/30/2010	$0	$0	0	0	D2
DeSoto, Monroe, Chickasaw, Calhoun, Yalobusha, Tallahatchie, Tate, Panola	10/12/2010	10/31/2010	$0	$0	0	0	D2
Newton, Lowndes, Lincoln, Leflore, Leake, Lawrence, Lauderdale, Kemper, Jone, Jefferson, Issaquena, Humphreys, Clarke, Carroll, Bolivar, Attala, Adams, Grenada, Franklin, Forrest, Copiah, Clay, Sharkey, Tunica, Quitman, Coahoma, Claiborne, Choctaw, Scott, Rankin, Holmes, Hinds, Yazoo, Winston, Neshoba, Montgomery, Webster, Oktibbeha, Madison, Washington, Warren, Sunflower, Smith, Simpson, Noxubee	10/1/2010	10/31/2010	$0	$20,500,000	0	0	D2-D3
Sharkey, Issaquena, Bolivar, Quitman, Washington, Sunflower, Coahoma, Tunica	9/1/2010	9/30/2010	$0	$2,500,000	0	0	D2
Tunica, Quitman	8/3/2010	8/31/2010	$0	$0	0	0	D2
Sunflower, Coahoma, Washington, Sharkey, Issaquena, Bolivar	8/1/2010	8/31/2010	$0	$2,500,000	0	0	D2-D1
Coahoma, Issaquena, Bolivar, Sunflower, Washington, Sharkey	7/27/2010	7/31/2010	$0	$1,700,000	0	0	D2
Issaquena, Bolivar, Sunflower, Washington, Sharkey	7/15/2010	7/31/2010	$0	$1,700,000	0	0	D2-D3

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Tishomingo, Tippah, Tate, Tallahatchie, Quitman, Prentiss, Pontotoc, DeSoto, Coahoma, Chickasaw, Calhoun, Benton, Alcorn, Panola, Monroe, Marshall, Lee, Lafayette, Itawamba, Yalobusha, Union, Tunica	10/1/2007	10/31/2007	$0	$0	0	0	D2-D0
Panola, Monroe, Marshall, Lee, Lafayette, Itawamba, DeSoto, Tishomingo, Tippah, Tate, Chickasaw, Benton, Alcorn, Prentiss, Union, Tunica, Pontotoc	9/1/2007	9/30/2007	$0	$0	0	0	D4-D2
Clarke, Kemper, Lowndes, Oktibbeha, Noxubee, Winston, Neshoba, Newton, Lauderdale, Clay	8/6/2007	8/26/2007	$0	$1,600,000	0	0	Severe
Monroe, Marshall, Lee, Tippah, Tate, Prentiss, Pontotoc, Benton, Alcorn, Union, Tunica, Tishomingo, Lafayette, Itawamba, DeSoto, Chickasaw, Panola	8/1/2007	8/31/2007	$0	$0	0	0	D3-D4
Itawamba, Pontotoc, Panola, Monroe, Chickasaw, Calhoun, Marshall, Lafayette, Benton, Alcorn, Lee, Yalobusha, Union, Tishomingo, Tippah, Tallahatchie, Prentiss, Attala, Noxubee, Lowndes, Leflore, Oktibbeha, Choctaw, Webster, Montgomery, Clay, Carroll, Winston, Jones, Clarke, Hinds, Rankin, Scott, Newton, Madison, Yazoo, Jasper, Smith, Issaquena, Sharkey, Lauderdale, Kemper, Simpson, Copiah, Claiborne, Warren, Neshoba, Leake, Lamar, Marion, Lincoln, Lawrence, Forrest, Franklin, Jefferson, Jefferson Davis, Covington, Humphreys, Holmes	7/1/2007	7/31/2007	$2,650,000	$0	0	0	D2-D3

County Affected	Begin Date	End Date	Property Damage	Crop Damage	Injuries	Deaths	Mag
Lee, Pontotoc, Panola, Monroe, Tippah, Tallahatchie, Prentiss, Yalobusha, Union, Tishomingo, Benton, Alcorn, Itawamba, Chickasaw, Marshall, Calhoun, Lafayette, Jefferson, Marion, Lowndes, Scott, Noxubee, Winston, Attala, Kemper, Lauderdale, Rankin, Hinds, Leake, Neshoba, Yazoo, Madison, Sharkey, Holmes, Humphreys, Issaquena, Newton, Lamar, Carroll, Montgomery, Lawrence, Lincoln, Clay, Oktibbeha, Franklin, Forrest, Webster, Choctaw, Claiborne, Copiah, Smith, Leflore, Grenada, Jones, Warren, Covington, Jefferson Davis, Simpson, Jasper, Clarke	6/1/2007	6/30/2007	$0	$0	0	0	D2-D4

Source: NCDC 2018

Drought in Mississippi

Mississippi is situated in a region where water is an abundant natural resource. Statewide annual average precipitation is 56 inches, ranging from 51 inches in the north to nearly 64 inches near coastal regions. However, this precipitation is highly variable, and this climatic variability has led to the present arrangement of agricultural and forestry activities, urban and industrial water supply types, and other land use patterns and resource use considerations.

While droughts can occur at any time of the year in Mississippi, in general they occur during the late summer and early fall seasons. Row crops, poultry, and pasture productivity are often extensively reduced during periods of late summer drought, with pricing consequences that can last for months. In addition to the disruption of crop growth, the lack of rainfall is also a precursor to wildfires. During a drought in the fall season, leaf litter and dry brush and grasses lead to enhanced fuel loads and more opportunities for wildfire activity.

NIDIS supports eight regional Drought Early Warning Systems (DEWS) throughout the United States. In addition, NIDIS supports states outside these regions, like Mississippi, by delivering drought early warning information through Drought.gov; investing in drought research to address key scientific and societal needs; and supporting the development of new tools and products that serve the entire nation.[1]

[1] www.drought.gov/states/mississippi

September 2023

Rain has often been hard to come by in many recent weeks in Coastal Mississippi. This has allowed for our drought to get worse and worse. In parts of Coastal Mississippi, the drought has now reached the worst level possible: 'exceptional.' That's what the latest update from the U.S. Drought Monitor shows.

"Exceptional drought is the most severe drought with the worst conditions on record. It would only be expected to occur once or twice within a 100-year period," according to the National Drought Mitigation Center.

There may not be much relief in sight. The weather pattern over the next seven to ten days has only low rain chances in Coastal Mississippi, according to the weather page. One week ago, the drought was 'extreme' in Coastal Mississippi. But, it was not quite yet 'exceptional.' Then, as of September 21, the 'extreme' drought has intensified to an 'exceptional' drought across parts of Coastal Mississippi.

September 21st's update shows an 'exceptional' drought in Harrison County and southern Stone County. Pretty much the entire rest of Coastal Mississippi is under an 'extreme' drought. For the month of September, rainfall has been below normal in the Gulfport-Biloxi area with only two inches of rain when there should be almost four.

But for January 1 to September 21 2023, rainfall has been extremely low compared to normal for the Gulfport-Biloxi area. There have only been about 25 inches of rain when there should be over 49 inches. That's a deficit of more than 20 inches.

August was the driest month of the year by far with hardly any rain all month. It was also Gulfport-Biloxi's 2nd driest August since 1893. And when you compare to all months since 1893, which is over 1,000 months, August 2023 was the 64th driest month on record.

If the year ended today on September 21, then 2023 would be the driest year ever recorded for Gulfport-Biloxi since 1893. However, typically an additional 12 inches of rain is expected between October, November, and December. If we actually get around 12 additional inches of rain by December's end, that would put us at about 38 inches of rain for the year total. This would still be in the top 3 driest years since 1893.[2]

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[2] www.wlox.com

Extreme Heat

Extreme Heat is defined as summertime temperatures that are much hotter and/or humid than average. Because some places are hotter than others, this depends on what is considered average for a particular location at that time of year. Humid and muggy conditions can make it seem hotter than it really is.

Extreme Heat often results in the highest number of annual deaths among all weather-related hazards. In most of the United States, extreme heat is defined as a long period (2 to 3 days) of high heat and humidity with temperatures above 90 degrees. In extreme heat, evaporation is slowed and the body must work extra hard to maintain a normal temperature. This can lead to death by overworking the human body.

Mississippi is located in the humid subtropical climate region, characterized by temperate winters; long, hot summers; and rainfall that is fairly evenly distributed through the year. However, the state is subject to periods of both drought and flood, and the climate rarely seems to bring "average" conditions. More typical would be an expectation of "feast or famine" with regard to weather events as the climate delivers energy and moisture in subtropical latitudes between a large landmass to the north and the Gulf of Mexico to the south.

Prevailing southerly winds provide moisture for high humidity and potential discomfort from May through September. Normal mean annual temperatures range from 62F in the north to 68F along the coast. Temperatures routinely exceed 100F at many places in the state each year and drop to zero or lower an average of once in five years in the state. In essence, Mississippi has a climate characterized by absence of severe cold in winter but by the presence of extreme heat in summer. The ground rarely freezes and outdoor activities are generally planned year-round. Cold spells are usually of short duration and the growing season is long. Rainfall is plentiful, but so are dry spells and sunshine. Table 3.8.3 describes the extreme heat temperatures.

According to data gathered from NCDC or the National Centers for Environmental Information (NCEI), 239 events were reported between November 1, 1950 and November 30, 2017, which is a total of 24,502 days. Although Mississippi is prone to extreme heat, based on this information there is a less than 1% chance that this hazard will occur. As result, the State feels this hazard will be better served on the local level and will not profile any further. **Table 3.8.3** describes past occurrences.

Table 3.8.3
Extreme Temperatures

Month	Maximum Temps (°F)	*Year*	Place
January	89	1950	Duckhill
February	91	1918	Yazoo City
March	96	1929	Macon
April	97	1987	Greenville
May	104	1951	Hattiesburg
June	111	1936	Greenwood
July	115	1930	Holly Springs
August	110	2000	Oakley/Vicksburg
September	111	1925	Pontotoc
October	100	1954	Canton
November	92	1935	Monticello
December	87	1984	Picayune
August	108	2000	Wiggins
August	105	2000	Beaumont
August	106	2000	Calhoun City/Jackson
August	106	2000	Coldwater/Magnolia
August	100	2007	Lafayette Co.
August	112	2007	Hernando
August	105	2010	Bolivar/Washington/Jefferson Counties
July	100	2011	Benton Co.

Excessive Heat Occurrences
from January 1980 to April 2023

Counties Affected	Begin Date	End Date	Direct Deaths	Direct Injuries	Indirect Deaths	Indirect Injuries	Property Damage	Crop Damage
DeSoto, Tallahatchie, Quitman, Panola, Tate, Coahoma, Tunica	7/25/2022	7/28/2022	0	0	0	0	0	0
DeSoto, Lee, Monroe, Itawamba, Tishomingo, Prentiss, Alcorn, Chickasaw, Pontotoc, Union, Tippah, Benton, Calhoun, Yalobusha, Lafayette, Panola, Marshall, Tate	7/20/2022	7/21/2022	0	0	0	0	0	0
Tunica, Tallahatchie, Quitman, Coahoma	7/19/2022	7/21/2022	0	0	0	0	0	0
Marshall, Lee, Monroe, Itawamba, Tishomingo, Prentiss, Alcorn, Chickasaw, Pontotoc, Union, Tippah, Benton, Calhoun, Lafayette	7/6/2022	7/9/2022	0	0	0	0	0	0
Quitman, Coahoma, Tate, Tunica, DeSoto, Yalobusha, Tallahatchie, Panola	7/5/2022	7/9/2022	0	0	0	0	0	0
Lee, Itawamba	6/13/2022	6/13/2022	0	0	0	0	0	0
Tunica, Chickasaw, Calhoun, Quitman, Coahoma, Marshall, Tate, Yalobusha, Tallahatchie, Panola, Monroe, DeSoto	6/12/2022	6/13/2022	0	0	0	0	0	0
Coahoma, Tallahatchie, Quitman	8/22/2021	8/24/2021	0	0	0	0	0	0
Lafayette, Monroe, Calhoun, Chickasaw, Yalobusha, Itawamba, Lee, Pontotoc, Panola, Tunica, Tate, DeSoto, Marshall	7/30/2021	7/30/2021	0	0	0	0	0	0
Coahoma, Tallahatchie, Quitman	7/29/2021	7/31/2021	0	0	0	0	0	0

Counties Affected	Begin Date	End Date	Direct Deaths	Direct Injuries	Indirect Deaths	Indirect Injuries	Property Damage	Crop Damage
Chickasaw, Yalobusha, Tippah, Tate, Union, Tunica, Tishomingo, Tallahatchie, Quitman, Prentiss, Pontotoc, Panola, Lafayette, Itawamba, Monroe, Marshall, Lee, DeSoto, Coahoma, Calhoun, Benton, Alcorn	8/12/2019	8/13/2019	0	0	0	0	0	0
Tunica, DeSoto, Coahoma	7/17/2019	7/17/2019	0	0	0	0	0	0
DeSoto, Tallahatchie, Panola, Quitman, Coahoma, Tate, Tunica	7/20/2018	7/20/2018	0	0	0	0	0	0
Coahoma	7/13/2018	7/16/2018	0	0	0	0	0	0
Coahoma	6/30/2018	6/30/2018	0	0	0	0	0	0
Coahoma	6/28/2018	6/28/2018	0	0	0	0	0	0
DeSoto	7/21/2017	7/23/2017	0	0	0	0	0	0
Tunica, DeSoto, Tallahatchie, Panola, Quitman, Coahoma, Tate	8/5/2016	8/5/2016	0	0	0	0	0	0
DeSoto, Tallahatchie, Panola, Quitman, Coahoma, Tate, Tunica	8/4/2016	8/4/2016	0	0	0	0	0	0
DeSoto, Coahoma	7/22/2016	7/22/2016	0	0	0	0	0	0
DeSoto, Coahoma, Tunica	6/16/2016	6/16/2016	0	0	0	0	0	0
Pontotoc, Union, Tippah, Benton, Prentiss, Tishomingo, Alcorn, Tunica, Coahoma, Quitman, Tallahatchie, Panola, Tate, DeSoto, Marshall, Lafayette, Yalobusha, Calhoun, Chickasaw, Monroe, Itawamba, Lee	7/20/2012	7/20/2012	0	0	0	0	0	0
Monroe, Lee, Union, Marshall, Union, Quitman, Coahoma, Tunica, DeSoto, Tate, Tallahatchie, Panola, Yalobusha, Lafayette, Calhoun, Pontotoc, Chickasaw	8/7/2011	8/7/2011	0	0	0	0	0	0

Counties Affected	Begin Date	End Date	Direct Deaths	Direct Injuries	Indirect Deaths	Indirect Injuries	Property Damage	Crop Damage
Prentiss, Yalobusha, Pontotoc, Panola, Monroe, Marshall, Lee, Lafayette, Itawamba, DeSoto, Coahoma, Chickasaw, Calhoun, Benton, Alcorn, Union, Tunica, Tishomingo, Tippah, Tate, Tallahatchie, Quitman	8/3/2011	8/4/2011	0	0	0	0	0	0
Alcorn, Yalobusha, Union, Tunica, Tishomingo, Tippah, Tate, Tallahatchie, Quitman, Prentiss, Pontotoc, Panola, Monroe, Marshall, Lee, Lafayette, Itawamba, DeSoto, Coahoma, Chickasaw, Calhoun, Benton	7/10/2011	7/12/2011	0	0	0	0	0	0
Chickasaw, Marshall, Tate, DeSoto, Tunica, Panola, Calhoun, Lafayette, Yalobusha, Tishomingo, Prentiss, Alcorn, Benton, Tippah, Pontotoc, Union, Lee, Itawamba, Monroe	8/21/2010	8/21/2010	0	0	0	0	0	0
Coahoma, Tallahatchie, Quitman	8/19/2010	8/21/2010	0	0	0	0	0	0
Lee, Lafayette, Itawamba, Coahoma, Chickasaw, Calhoun, Benton, Alcorn, Yalobusha, Union, Tunica, Tishomingo, Tippah, Tate, Tallahatchie, Quitman, Prentiss, Pontotoc, Panola, Monroe, Marshall	8/13/2010	8/15/2010	0	0	0	0	0	0
DeSoto	8/10/2010	8/15/2010	0	0	0	0	0	0
Jackson, Monroe, Itawamba, Prentiss, Tishomingo, Alcorn, Tippah, Benton	8/2/2010	8/2/2010	1	0	0	0	0	0

Counties Affected	Begin Date	End Date	Direct Deaths	Direct Injuries	Indirect Deaths	Indirect Injuries	Property Damage	Crop Damage
Tunica, Chickasaw, Yalobusha, Lee, Pontotoc, Union, Lafayette, Tate, Marshall, DeSoto, Tallahatchie, Panola, Quitman, Coahoma, Jones, Clarke, Claiborne, Choctaw, Carroll, Attala, Adams, Bolivar, Washington, Jefferson, Simpson, Sharkey, Scott, Rankin, Oktibbeha, Noxubee, Newton, Neshoba, Lowndes, Jefferson Davis, Jasper, Humphreys, Issaquena, Montgomery, Marion, Madison, Webster, Warren, Sunflower, Smith, Yazoo, Winston, Holmes, Hinds, Forrest, Lincoln, Leflore, Covington, Copiah, Clay, Grenada, Franklin, Leake, Lawrence, Lauderdale, Lamar, Kemper	8/1/2010	8/5/2010	5	1	0	0	0	0
Harrison	7/30/2010	7/30/2010	2	0	0	0	0	0
Benton, Alcorn, Tunica, Calhoun, Chickasaw, Coahoma, DeSoto, Itawamba, Tishomingo, Union, Yalobusha, Lafayette, Prentiss, Tallahatchie, Quitman, Tate, Tippah, Marshall, Lee, Monroe, Panola, Pontotoc	8/5/2007	8/25/2007	1	0	0	0	0	0

Probability of Future Occurrences

Forecasting limitations make estimating the probability of drought unrealistic within the context of this plan. Given statewide drought indices and as determined by the U.S. seasonal drought outlook, the probability of future drought conditions is considered to be moderate However, it is important to note the seasonal drought outlook is forecast through December 2024 (**Figure 3.8.3 & 3.8.4**), a much shorter timeframe than the five-year planning horizon of this plan. Continuous monitoring of drought indices and forecasts is recommended.

Figure 3.8.3
U.S. 12-Month
Temperature Outlook

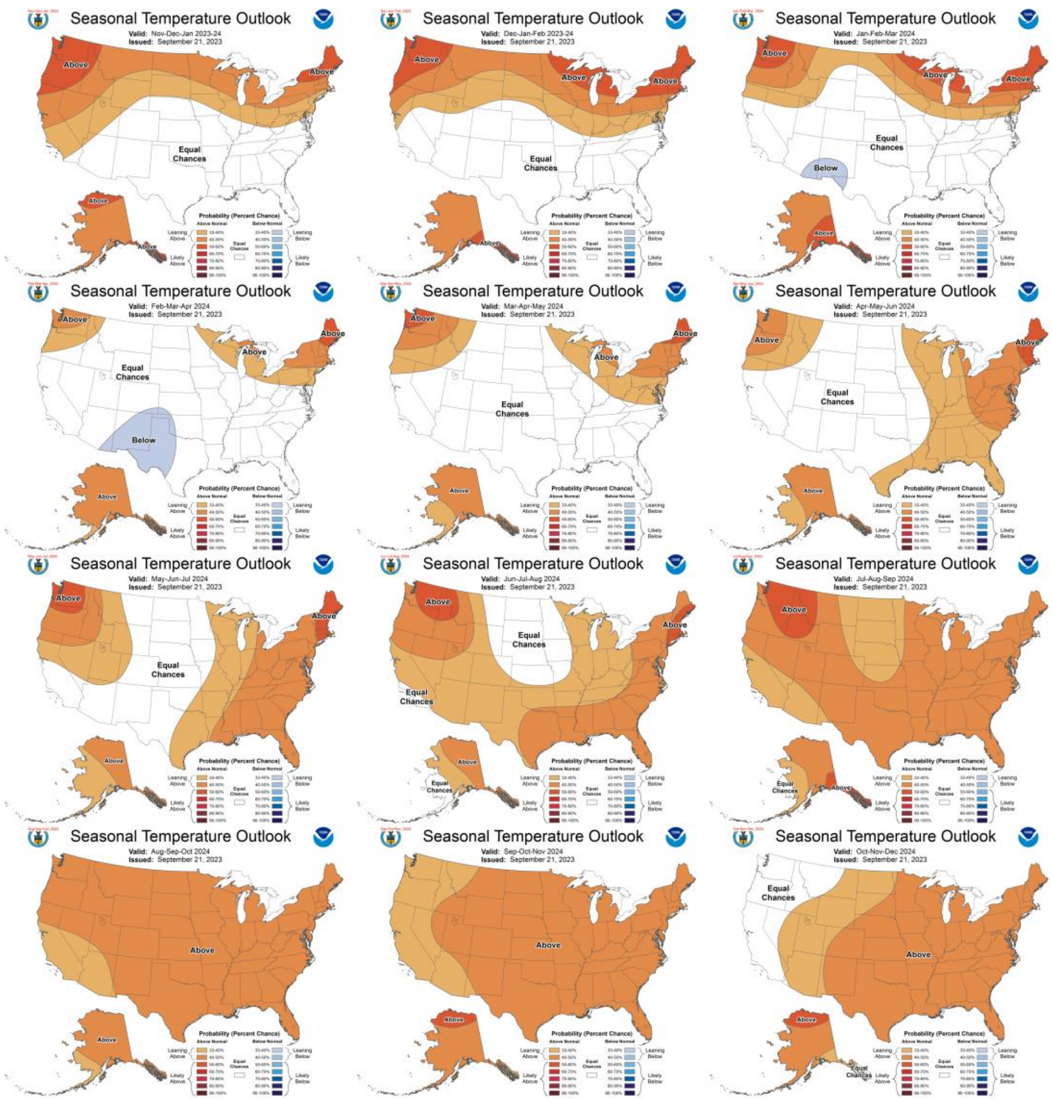
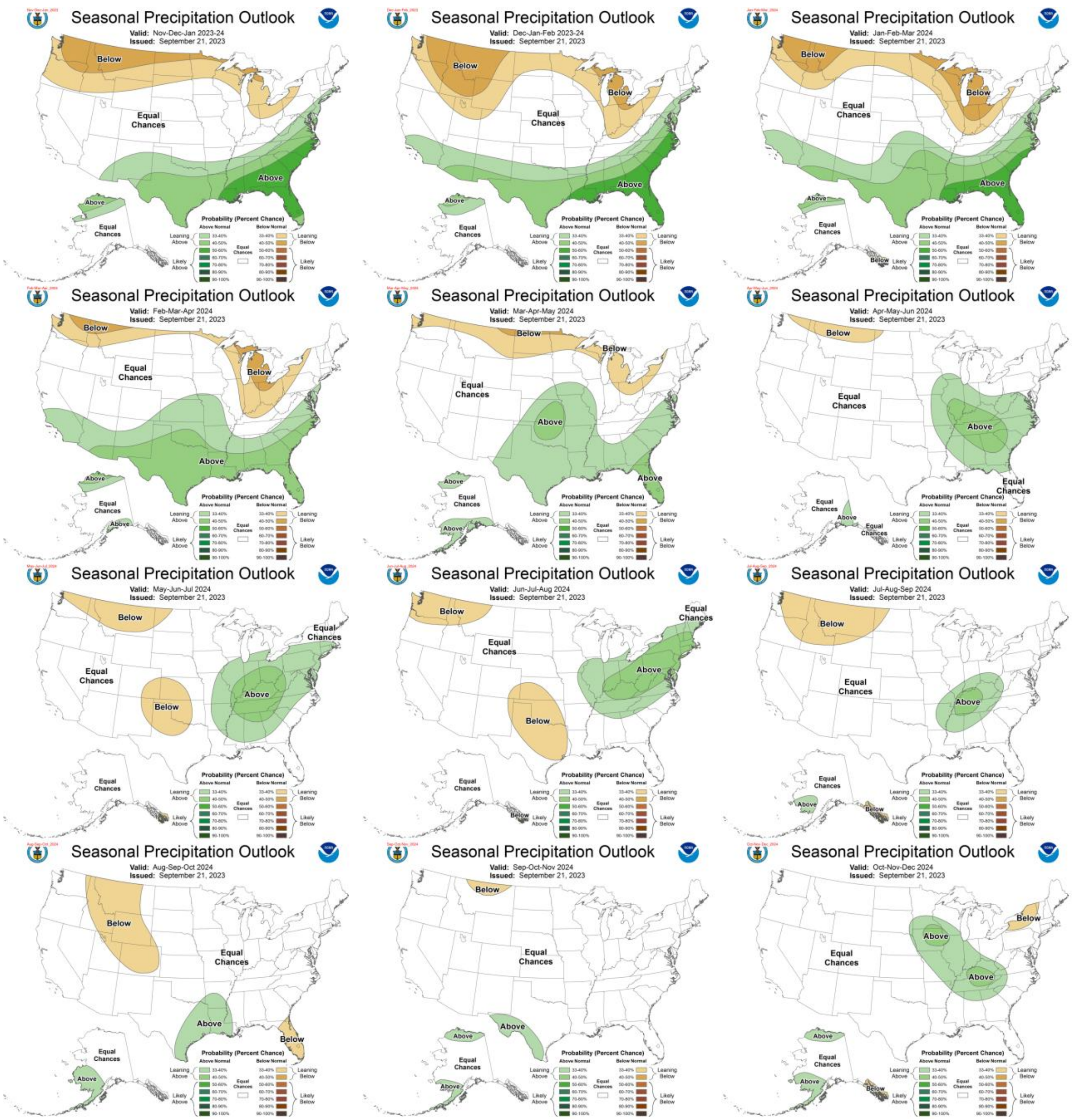


Figure 3.8.4
U.S. 12-Month
Precipitation Forecast

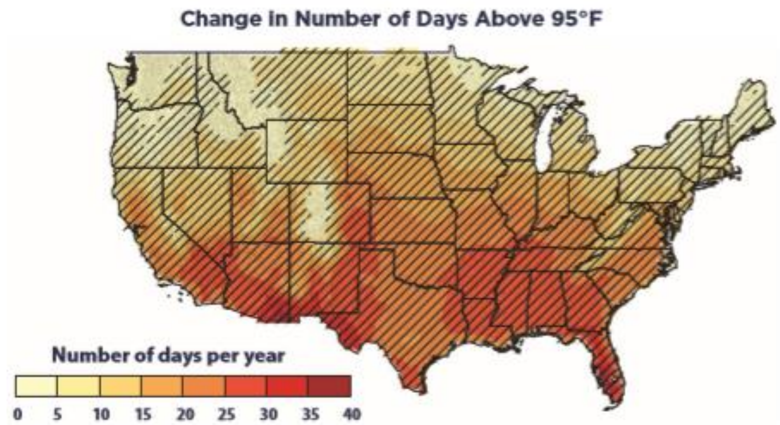


Source: National Weather Service Climate Prediction Center

According to the CDC, extreme heat events will become more common, severe and last longer as indicated below. The maps compare the differences in extreme heat between the recent past (1980–2000) and the mid-21st century (2041–2070) in a projected scenario with high greenhouse gas emissions. Hatched areas indicate confidence that the projected changes are significant and consistent among models. Source: USGCRP, 2016

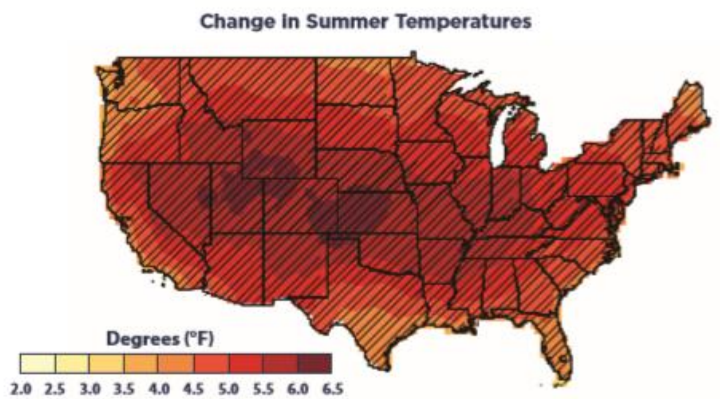
Become More Common

As climate change continues, there will be more hot days each year. For instance, someone in Tampa, Florida, may experience up to 40 more days a year where the temperature is over 95°F.



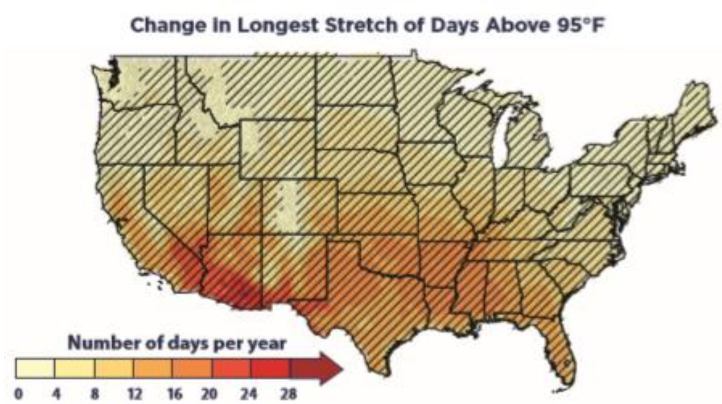
Become More Severe

Rising average summer temperatures will make the hottest days even hotter than they used to be, especially in the central United States. For example, someone in Wichita, Kansas, may experience summers that are 6°F hotter than in the recent past.



Last Longer

Consecutive days of extreme heat are projected to last even longer in the future. For example, someone in Tucson, Arizona, may experience a stretch of days with temperatures above 95°F that is 28 days longer than the longest stretch of such days in the recent past.



Climate change increases the odds of worsening drought in many parts of the United States and the world in the decades ahead. Regions such as the U.S. Southwest and even in regions that may not see changes in precipitation, warmer temperatures can increase water demands and evaporation, putting greater stress on water supplies. Recent U.S. droughts have been the most expansive in decades. At the peak of the 2012 drought, an astounding 81% of the contiguous United States was under at least abnormally dry conditions.

Warmer temperatures can amplify the impacts of drought. Increased temperatures enhance evaporation from soils, making periodic droughts worse than they would be under cooler conditions. Droughts can persist through a “positive feedback,” where very dry soils and diminished plant cover can further suppress rainfall in an already dry area.

Vulnerability Assessment

The vulnerability assessment remains the same as the last plan update. Again, it is very difficult to quantify the vulnerability of any given area to droughts or to assess inventories of at-risk property for estimating exposure or losses. The intense agricultural land use areas are the most vulnerable. Drought would have a negligible impact on state-owned and critical facilities and public safety and deemed not to pose a serious statewide threat that could be addressed by this plan. For that reason, this plan defers local vulnerability assessments.

Being that Mississippi is primarily an agricultural state, the most obvious primary impact of drought in Mississippi remains crop damage. This can and has resulted in significant secondary impacts such as economic losses. Drought can also create conditions that promote the occurrence of other natural hazards such as wildfires and wind erosion. While dry conditions increase the likelihood of wildfires, low-flow conditions decrease the quantity and pressure of water for use by firefighters. The likelihood of flash flooding is increased if a period of severe drought is followed by a period of extreme precipitation.

Environmental drought impacts include human and animal habitats and hydrologic units. During periods of drought, the amount of available water decreases in lakes, streams, aquifers, soil, wetlands, springs, and other surface and subsurface water sources. This decrease in water availability can affect water quality by altering the salinity, bacteria, turbidity, temperature, and pH levels. Changes in any of these levels can have a significant effect on the aquatic habitat of numerous plants and animals found throughout the state.

Low water flow may result in decreased sewage flows and subsequent increases in contaminants in the water supply. Decreased availability of water decreases the drinking water supply and the food supply. This disruption can work its way up the food chain within a habitat. Loss of biodiversity and increases in mortality can lead to increases in disease and endangered species.

Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	1	8	-	6		9	
2	1	11	-	7		9	
3	1	9		8		6	3
4	-	9	1	9		6	
5		44	3				

3.9: Extreme Winter Weather Risk Assessment

Hazard Description

The National Weather Service defines a winter storm as having three factors: cold air, moisture, and lift. These three factors acting together create conditions suitable for a winter storm. Below are definitions for winter weather events that could impact the State of Mississippi:

Snow Flurries: Light snow falling for short durations. No accumulation or light dusting is all that is expected.

Snow Showers: Snow falling at varying intensities for brief periods. Some accumulation is possible.

Sleet: Raindrops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists.

Freezing Rain: Rain that falls onto a surface with a temperature below freezing. This causes it to freeze on surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Even small accumulations of ice can cause a significant hazard.

Wind Chill: The combination of wind and temperature that serves as an estimate of how cold it feels to exposed human skin. Wind chill values below -19 degrees are considered dangerous.

Winter Storm Warning: Issued when hazardous winter weather in the form of heavy snow, heavy freezing rain, or heavy sleet is imminent or occurring. Winter Storm Warnings are usually issued 12 to 24 hours before the event is expected to begin.

Winter Storm Watch: Alerts the public to the possibility of a blizzard, heavy snow, heavy freezing rain, or heavy sleet. Winter Storm Watches are usually issued 12 to 48 hours before the beginning of a Winter Storm.

Winter Storm Outlook: Issued before a Winter Storm Watch. The Outlook is given when forecasters believe winter storm conditions are possible and are usually issued 3 to 5 days in advance of a winter storm.

Wind Chill Warning: Issued when wind chill temperatures are expected to be hazardous to life within several minutes of exposure.

Wind Chill Advisory: Issued when wind chill temperatures are expected to be a significant inconvenience to life with prolonged exposure and, if caution is not exercised, could lead to hazardous exposure.

Winter Weather Advisories: Issued for accumulations of snow, freezing rain, freezing drizzle, and sleet which will cause significant inconveniences and, if caution is not exercised, could lead to life-threatening situations.

Winter storms in the south typically consist of light snow (snow flurries with little to no accumulation), freezing rain (rain that falls when ground temperatures are below freezing), or sleet (transparently frozen or partially frozen raindrops).

Hazard Profile

The hazard profile for extreme winter weather in Mississippi was updated from the previously approved plan of 2018 to include current statistics regarding winter activity throughout the state.

Maximum Winter Storm Threat

Severe winter storms can cause economic losses to the state of Mississippi. Hampered transportation routes caused by closed or blocked roads can prevent the movement of essential economic goods by airports and waterways. An intense cold weather system during the winter of 1989–1990 brought about a widespread emergency in Central Mississippi. Unlike previous winter emergencies, this crisis occurred because manufacturers and product brokers were unable to gain access to essential transportation systems, such as pipelines, trucks, and rail tankers that move heating fuel (propane). This lack of fuel had a cascading effect on the domestic and manufacturing economies

Extreme winter weather in 2010 caused a similar disruption to the Central Mississippi economy. According to the National Weather Service (NWS), the winter of 2009-2010 was characterized by below-normal temperatures across the state of Mississippi. In Jackson, it was the fourth-coldest winter since temperature records were first collected in 1896. It was also the ninth-snowiest winter in Jackson, with one snowfall of 5.5 inches recorded by the NWS Forecast Office. In January, prolonged sub-freezing temperatures caused the massive failure of water mains throughout Jackson and the Central Mississippi region, creating problems for residents and causing emergency conditions at hospitals, police precincts, businesses, restaurants, communications systems, and state facilities. (See a recap of this event under the heading "Prolonged Sub-Freezing Temperatures – January 2010" in this section.)

Timber, a vital asset to the state's economy, was severely impacted by the February 1994 ice storm (FEMA-1009-DR-MS). Damage to public facilities, coupled with $1.3 billion from timber losses – resulted in one of the costliest disasters of this type in the State. Not only did the downed timber create a problem from potential wildfires, but. collapsed roofs and downed power lines resulted in the loss of heating, lighting, water, and sewer systems.

Other secondary problems included flooding from melting ice, snow, and rainfall on heavily glazed and saturated surfaces. Icy, snow-covered areas can create conditions leading to increased accidents involving drivers and walkers. Downed power lines can create a risk of electrocution to residents and electric power workers. Finally, frozen and broken water lines in homes are not only costly to repair but create additional hazards from electrocution.

Education and Outreach

Severe Weather Awareness Week occurs in February and is set each year in coordination with the National Weather Service. For more information on severe weather awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. on weekdays.

Location/Past Occurrences

The NCDC improved its data for winter-weather events by enhancing classifications and reassessing the events from 1996 to current. The data for the years 1993 and 1994 were brought forward from the 2010 plan, but the data was not available through NCDC to verify any changes. **Table 3.9.1** was updated from the previous plan to reflect the new categories and number of events reported.

Table 3.9.1
Summary of Mississippi Winter Storm Events
1996-2022

	Incident Type (Events Recorded)					
Year	Heavy Snow	Ice Storm/Sleet	Winter Storm	Winter Weather	Total Property Damage ($)	Total Crop Damage ($)
2022	3	2	4	5	$0	$0
2021	2	4	3	5	$9,699,000	$0
2020	0	0	0	0	$0	$0
2019	0	0	0	0	$0	$0
2018	1	0	2	3	$270,000	$0
2017	0	22	0	14	$2,125,000	$0
2016	0	0	3	10	$0	$0
2015	0	0	0	2	$0	$0
2014	18	8	2	8	$0	$0
2013	28	24	0	18	$540,000	$0
2012	0	0	0	0	$0	$0
2011	41	71	44	29	$25,845,000	$240,000
2010	40	4	35	46	$12,695,000	$0
2009	24	0	6	23	$0	$0
2008	52	10	14	42	$3,390,000	$0
2007	0	0	0	19	$0	$0
2006	0	10	22	0	$1,372,000	$0
2005	0	0	0	0	$0	$0
2004	7	2	11	0	$408,700	$0
2003	3	4	0	0	$148,000	$0
2002	6	0	0	16	$30,000	$0
2001	0	0	0	0	$0	$0
2000	37	16	3	0	$1,415,000	$0
1999	0	0	0	0	$0	$0
1998	0	53	21	0	$16,699,000	$0
1997	16	0	0	0	$50,000	$0
1996	3	30	32	0	$3,500,000	$0
1995	0	0	0	0	$0	$0
1994	0	1	0	0	$500,000	$5,000,000,000
1993	0	1	0	0	$0	$0

Table 3.9.2 summarizes the number of incidents recorded by NCDC for winter weather events in Mississippi by MEMA Regions.

Table 3.9.2
Summary of Events by MEMA Region/County
1996-2022

County	No. of Events	Total Property Damage	Total Crop Damage	County	No. of Events	Total Property Damage	Total Crop Damage
MEMA Region 1				**MEMA Region 2**			
Coahoma	29	$37,000	$0	Alcorn	34	$27,100	$0
DeSoto	44	$33,000	$0	Benton	41	$25,100	$0
Grenada	20	$3,271,000	$0	Itawamba	24	$23,000	$0
Panola	27	$27,000	$0	Lafayette	29	$22,000	$0
Quitman	26	$31,000	$0	Lee	24	$43,000	$0
Tallahatchie	20	$30,000	$0	Marshall	42	$24,100	$0
Tate	36	$24,100	$0	Pontotoc	27	$27,000	$0
Tunica	41	$34,000	$0	Prentiss	27	$1,232,000	$0
Yalobusha	25	$30,000	$0	Tippah	39	$24,100	$0
				Tishomingo	28	$32,100	$0
				Union	30	$27,100	$0

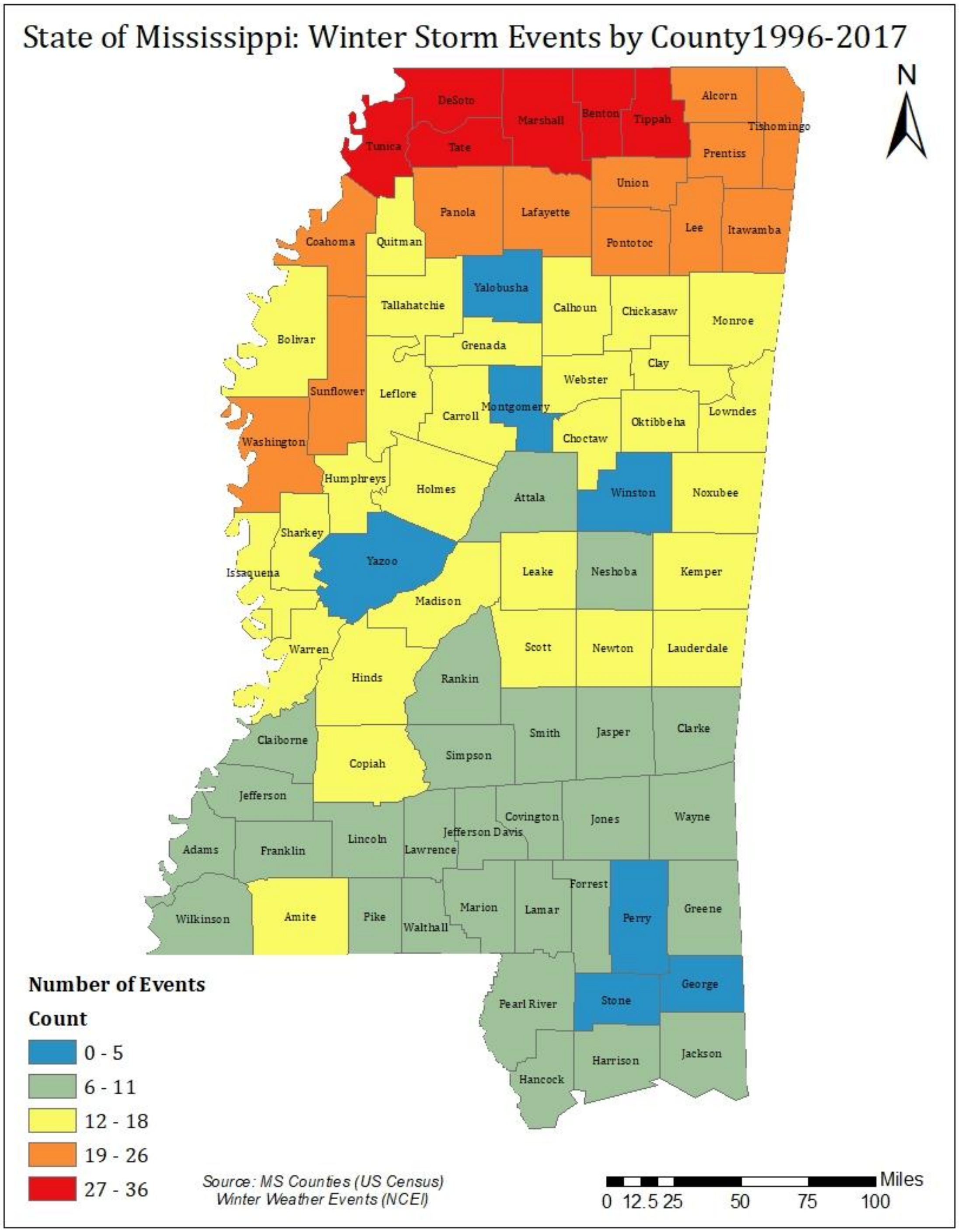
County	No. of Events	Total Property Damage	Total Crop Damage	County	No. of Events	Total Property Damage	Total Crop Damage
MEMA Region 3				**MEMA Region 4**			
Atalla	21	$1,553,000	$0	Calhoun	21	$26,000	$0
Bolivar	34	$2,257,000	$0	Chickasaw	21	$26,000	$0
Carroll	19	$1,680,000	$0	Choctaw	22	$1,721,000	$0
Holmes	21	$1,304,000	$0	Clay	18	$1,065,000	$0
Humphreys	20	$1,190,000	$0	Lowndes	20	$1,293,000	$0
Leflore	22	$4,116,000	$0	Monroe	22	$26,000	$0
Montgomery	19	$1,438,000	$0	Noxubee	22	$1,243,000	$0
Sunflower	28	$2,540,000	$0	Oktibbeha	24	$2,463,000	$0
Washington	27	$2,437,000	$0	Webster	23	$1,636,000	$0
				Winston	22	$1,834,000	$0

County	No. of Events	Total Property Damage	Total Crop Damage	County	No. of Events	Total Property Damage	Total Crop Damage
MEMA Region 5				**MEMA Region 6**			
Claiborne	15	$1,318,000	$0	Clarke	11	$735,000	$0
Copiah	17	$1,565,000	$0	Jasper	13	$1,280,000	$0
Hinds	20	$3,558,000	$0	Kemper	20	$1,220,000	$0
Madison	20	$2,552,000	$0	Lauderdale	20	$2,560,000	$0
Rankin	20	$2,839,000	$0	Leake	19	$1,758,000	$0
Simpson	14	$1,570,000	$0	Neshoba	16	$1,650,000	$0
Warren	20	$2,859,000	$0	Newton	17	$1,815,000	$0
Yazoo	22	$2,288,000	$0	Scott	17	$1,545,000	$0
				Smith	15	$1,725,000	

County	No. of Events	Total Property Damage	Total Crop Damage	County	No. of Events	Total Property Damage	Total Crop Damage
MEMA Region 7				**MEMA Region 8**			
Adams	16	$1,563,000	$0	Covington	11	$1,775,000	$40,000
Amite	14	$0	$0	Forrest	8	$320,000	$0
Franklin	13	$220,000	$800,000	Greene	8	$0	$0
Jefferson	13	$1,065,000	$20,000	Jefferson Davis	12	$1,416,000	$0
Lawrence	12	$1,385,000	$0	Jones	12	$1,505,000	$40,000
Lincoln	13	$2,085,000	$20,000	Lamar	6	$315,000	$0
Pike	8	$0	$0	Marion	8	$405,000	$0
Walthall	8	$0	$0	Perry	6	$0	$0
Wilkinson	10	$0	$0	Wayne	11	$10,000	$0

County	No. of Events	Total Property Damage	Total Crop Damage	County	No. of Events	Total Property Damage	Total Crop Damage
MEMA Region 9							
George	4	$0	$0	Jackson	5	$0	$0
Hancock	5	$0	$0	Pearl River	6	$0	$0
Harrison	5	$0	$0	Stone	4	$0	$0

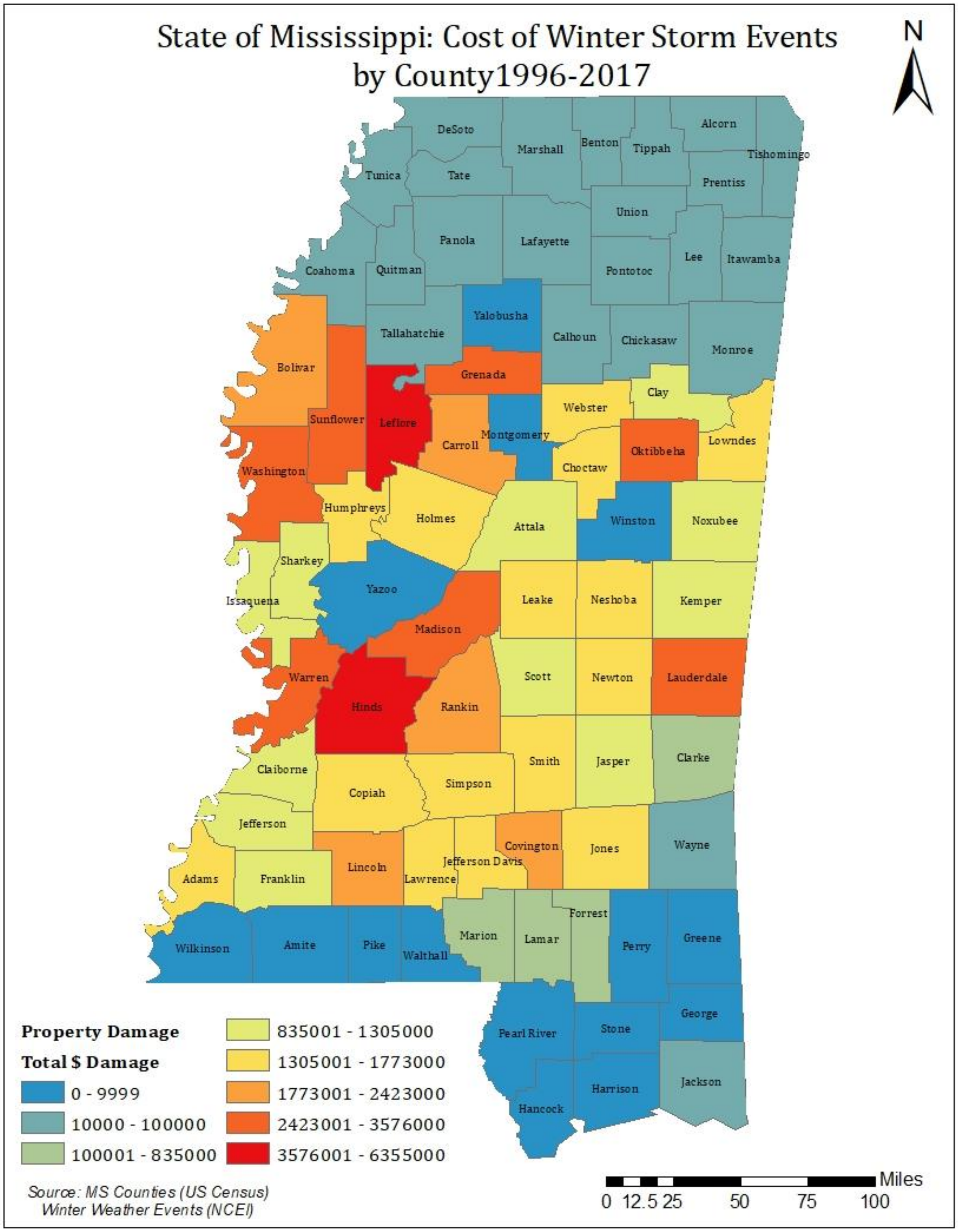
The following maps (**Figures 3.9.1 and 3.9.2**), "Winter Storm Events by County 1996 – 2017" indicate which counties were impacted by winter storms documented in **Table 3.9.2**. As illustrated on the map, event occurrence follows a geographic pattern. Winter storms occur most frequently in the northern counties with the frequency of occurrence diminishing in a southward pattern.



Snowfall in Mississippi occurs in the northern and central areas, but rarely in the southern areas. Snow in the northern counties is most frequent from December to March, with accumulations lasting only one or two days.

Figure 3.9.1

Figure 3.9.2


State of Mississippi: Cost of Winter Storm Events by County1996-2017
N
DeSoto
Marshall
Benton
Tippah
Alcorn
Tishomingo
Tunica
Tate
Prentiss
Union
Panola
Lafayette
Lee
Itawamba
Coahoma
Quitman
Pontotoc
Yalobusha
Tallahatchie
Calhoun
Chickasaw
Monroe
Bolivar
Grenada
Clay
Webster
Sunflower
Leflore
Montgomery
Carroll
Lowndes
Oktibbeha
Choctaw
Washington
Humphreys
Holmes
Attala
Winston
Noxubee
Sharkey
Yazoo
Issaquena
Leake
Neshoba
Kemper
Madison
Warren
Scott
Newton
Lauderdale
Hinds
Rankin
Smith
Jasper
Clarke
Claiborne
Simpson
Copiah
Jefferson
Covington
Jones
Wayne
Jefferson Davis
Lincoln
Adams
Franklin
Lawrence
Forrest
Marion
Lamar
Greene
Perry
Wilkinson
Amite
Pike
Walthall
George
Pearl River
Stone
Jackson
Harrison
Hancock
Property Damage
Total $ Damage
0 - 9999
10000 - 100000
100001 - 835000
835001 - 1305000
1305001 - 1773000
1773001 - 2423000
2423001 - 3576000
3576001 - 6355000
Source: MS Counties (US Census)
Winter Weather Events (NCEI)
Miles
0 12.5 25 50 75 100

Cold weather, including extreme cold and wind chill, impact Mississippi causing property damage and deaths. These events also impact aging infrastructure, as in 2010, which is described in the historical events section. **Table 3.9.3** and **Figure 3.9.3** provide details of these events and the counties impacted.

Table 3.9.3
Cold-Related Events

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
Winter Storm	February 1, 2023	2	DeSoto, Tunica	0	$0
Ice Storm	February 1, 2023	7	Panola, Quitman, Tippah, Benton, Coahoma, Marshall, Tate	0	$0
Ice Storm	January 31, 2023	6	Tate, Quitman, Panola, Tippah, Benton, Marshall	0	$0
Winter Storm	January 30, 2023	2	DeSoto, Tunica	0	$0
Cold/Wind Chill	December 23, 2022	22	Tunica, DeSoto, Tate, Quitman, Marshall, Coahoma, Panola, Alcorn, Lafayette, Benton, Tippah, Tishomingo, Union, Prentiss, Calhoun, Pontotoc, Itawamba, Yalobusha, Tallahatchie, Lee, Monroe, Chickasaw	0	$0
Extreme Cold/Wind Chill	December 23, 2022	22	Tunica, DeSoto, Tate, Quitman, Marshall, Coahoma, Panola, Alcorn, Lafayette, Benton, Tippah, Tishomingo, Union, Prentiss, Calhoun, Pontotoc, Itawamba, Yalobusha, Tallahatchie, Lee, Monroe, Chickasaw	0	$0
Winter Weather	March 11, 2022	23	Tunica, Quitman, Coahoma, Tallahatchie, Yalobusha, Monroe, Chickasaw, Calhoun, Leflore, Yazoo, Humphreys, Attala, Webster, Montgomery, Carroll, Choctaw, Grenada, Oktibbeha, Lowndes, Noxubee, Kemper, Winston, Neshoba	0	$0
Winter Storm	March 11, 2022	14	Marshall, Panola, Tate, DeSoto, Alcorn, Prentiss, Pontotoc, Union, Tippah, Lafayette, Benton, Tishomingio, Lee, Itawamba	0	$0
Heavy Snow	March 11, 2022	3	Bolivar, Sunflower, Washington	0	$0
Winter Weather	February 3, 2022	2	Coahoma, Bolivar	0	$0
Ice Storm	February 3, 2022	2	DeSoto, Tunica	0	$0

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
Winter Weather	January 16, 2022	5	Montgomery, Clarke, Union, Lafayette, Jasper	0	$0
Winter Storm	January 16, 2022	9	DeSoto, Prentiss, Alcorn, Benton, Tippah, Marshall, Panola, Tate, Tishomingo	0	$0
Heavy Snow	January 16, 2022	10	Scott, Madison, Attala, Neshoba, Newton, Choctaw, Winston, Lauderdale, Kemper, Smith	0	$0
Winter Weather	January 15, 2022	2	Yazoo, Holmes	0	$0
Heavy Snow	January 15, 2022	2	Leake, Rankin	0	$0
Winter Weather	January 2, 2022	9	Alcorn, Tishomingo, Webster, Choctaw, Winston, Oktibbeha, Clay, Noxubee, Kemper	0	$0
Winter Weather	February 17, 2021	2	Jefferson Davis, Lawrence	0	$10,000
Winter Storm	February 17, 2021	30	Bolivar, Sharkey, Sunflower, Washington, Warren, Yazoo, Jefferson, Leflore, Claiborne, Webster, Madison, Issaquena, Montgomery, Humphreys, Oktibbeha, Attala, Leake, Carroll, Holmes, Choctaw, Grenada, Clay, Lowndes, Pontotoc, Union, Itawamba, Lee, Monroe, Chickasaw, Calhoun	0	$2,085,000
Ice Storm	February 17, 2021	15	Adams, Lincoln, Hinds, Franklin, Copiah, Rankin, Smith, Simpson, Scott, Jasper, Noxubee, Newton, Kemper, Neshoba, Lauderdale	0	$1,400,000
Heavy Snow	February 17, 2021	15	Tunica, DeSoto, Tate, Coahoma, Quitman, Panola, Lafayette, Marshall, Yalobusha, Benton, Tallahatchie, Tishomingo, Alcorn, Tippah, Prentiss	0	$1,200,000
Winter Weather	February 16, 2021	5	Kemper, Lauderdale, Clarke, Lowndes, Noxubee	0	$0
Cold/Wind Chill	February 16, 2021	5	Marshall, Tate, Tunica, DeSoto, Benton	0	$0
Winter Weather	February 15, 2021	1	Forrest	0	$15,000
Winter Storm	February 15, 2021	11	Copiah, Lincoln, Lawrence, Scott, Simpson, Bolivar, Winston, Smith, Newton, Kemper, Lowndes	0	1,850,000
Sleet	February 15, 2021	26	Adams, Franklin, Claiborne, Jefferson, Warren, Hinds,	0	$1,300,000

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
			Madison, Yazoo, Issaquena, Sharkey, Holmes, Neshoba, Leake, Attala, Humphreys, Rankin, Washinton, Leflore, Choctaw, Sunflower, Carroll, Montgomery, Grenada, Clay, Oktibbeha, Webster		
Ice Storm	February 15, 2021	9	Marion, Jefferson Davis, Covington, Jasper, Jones, Lauderdale, Clarke, Noxubee, Lamar	0	$128,500
Winter Weather	February 14, 2021	11	Sharkey, Issaquena, Grenada, Yazoo, Rankin, Copiah, Leake, Choctaw, Carroll, Montgomery, Webster	0	$0
Winter Storm	February 14, 2021	22	Tunica, Tate, DeSoto, Coahoma, Pontotoc, Lee, Benton, Union, Yalobusha, Tippah, Panola, Calhoun, Lafayette, Tallahatchie, Quitman, Marshall, Monroe, Itawamba, Prentiss, Tishomingo, Alcorn.	0	$0
Sleet	February 14, 2021	8	Adams, Franklin, Warren, Madison, Hinds, Leflore, Humphreys, Holmes	0	$380,000
Winter Weather	February 11, 2021	19	Quitman, Marshall, Tate, Washington, Holmes, Leflore, Warren, Claiborne, Adams, Yazoo, Madison, Rankin, Hinds, Webster, Leake, Oktibbeha, Winston, Holmes	0	$39,000
Ice Storm	February 10, 2021	7	DeSoto, Coahoma, Tunica, Sunflower, Bolivar	0	$30,000
Winter Weather	January 10, 2021	20	Lincoln, Smith, Lawrence, Simpson, Franklin, Lauderdale, Tunica, Calhoun, Monroe, Itawamba, Chickasaw, Lee, Union, Pontotoc, Yalobusha, Lafayette, Tallahatchie, Panola, Quitman, Tate	0	$0
Heavy Snow	January 10, 2021	33	Adams, Warren, Claiborne, Copiah, Jefferson, Hinds, Madison, Rankin, Leflore, Grenada, Sunflower, Yazoo, Scott, Leake, Holmes, Humphreys, Bolivar, Washington, Issaquena,	0	$0

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
			Neshoba, Sharkey, Attala, Newton, Carroll, Oktibbeha, Choctaw, Winston, Montgomery, Kemper, Noxubee, Lowndes, Clay, Webster		
Cold/Wind Chill	December 12, 2019	1	Lauderdale	1	$0
Winter Weather	November 14, 2018	6	Coahoma, Tunica, Tippah, Benton, Marshall, DeSoto	0	$0
Extreme Cold/Wind Chill	January 17, 2018	1	Yazoo	1	$0
Winter Weather	January 16, 2018	59	Benton, Marshall, Prentiss, Union, Tishomingo, Alcorn, Tippah, Yalobusha, Tallahatchie, Quitman, Coahoma, Humphreys, Yazoo, Webster, Carroll, Sharkey, Hinds, Choctaw, Jefferson, Claiborne, Clay, Leake, Madison, Franklin, Oktibbeha, Neshoba, Rankin, Winston, Scott, Newton, Lowndes, Noxubee, Lee, Monroe, Chickasaw, Itawamba, Pontotoc, Calhoun, Copiah, Lauderdale, Kemper, Simpson, Adams, Smith, Jasper, Lincoln, Covington, Amite, Wilkinson, Clarke, Pearl River, Jones, Marion, Stone, George, Harrison, Forrest, Hancock, Jackson	0	$0
Winter Storm	January 16, 2018	7	Tate, Tunica, Panola, Lafayette, Wayne, Perry, Greene	0	$0
Sleet	January 16, 2018	3	Bolivar, Sunflower	0	$60,000
Heavy Snow	January 16, 2018	14	Washington, Bolivar, Leflore, Issaquena, Holmes, Grenada, Warren, Attala, Montgomery, Lawrence, Jefferson Davis, Walthall, Pearl River, Lamar	0	$210,000
Winter Storm	January 15, 2018	1	DeSoto	0	$0
Winter Weather	January 12, 2018	7	Lafayette, Panola, Quitman, Tunica, Union, Tishomingo, Prentiss	0	$0
Winter Storm	January 12, 2018	6	DeSoto, Marshall, Tate, Benton, Tippah, Alcorn	0	$0
Winter Weather	December 31, 2017	11	Chickasaw, Choctaw, Clay, Jasper, Lowndes, Monroe,	0	$0

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
			Montgomery, Newton, Oktibbeha, Rankin, Webster		
Heavy Snow/Winter Storm	December 7, 2017	48	Adams, Amite, Attala, Choctaw, Claiborne, Clarke, Clay, Copiah, Covington, Forrest, Franklin, Greene, George, Hancock, Harrison, Hinds, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Lincoln, Lowndes, Madison, Marion, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pike, Rankin, Scott, Simpson, Smith, Stone, Walthall, Warren, Wayne, Wilkinson, Winston, Yazoo	1	$820,000
Winter Storm/Sleet/ Winter Weather/Ice Storm	January 6, 2017	36	Adams, Alcorn, Amite, Benton, Claiborne, Clarke, Copiah, Covington, DeSoto, Franklin, Hinds, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lauderdale, Lawrence, Leake, Lincoln, Madison, Marshall, Neshoba, Newton, Noxubee, Rankin, Scott, Simpson, Smith, Tate, Tippah, Tunica, Warren, Wayne, Winston	0	$2,125,000
Winter Storm/Winter Weather	January 22, 2016	13	Benton, Coahoma, DeSoto, Lafayette, Marshall, Panola, Pontotoc, Quitman, Tallahatchie, Tate, Tippah, Tunica, Union	0	$0
Winter Storm/Sleet	March 4-5, 2015	46	Attala, Alcorn, Benton, Bolivar, Calhoun, Carroll, Chickasaw, Claiborne, Clay, Choctaw, Coahoma, DeSoto, Grenada, Hinds, Holmes, Humphreys, Issaquena, Itawamba, Lafayette, Lee, Leflore, Lowndes, Madison, Marshall, Montgomery, Monroe, Oktibbeha, Panola, Pontotoc, Prentiss, Quitman, Sharkey, Sunflower,	0	$0

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
			Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Union, Warren, Washington, Wayne, Webster, Winston, Yalobusha, Yazoo		
Winter Storm/Heavy Snow	February 25, 2015	42	Alcorn, Attala, Benton, Bolivar, Calhoun, Carroll, Chickasaw, Choctaw, Clay, Coahoma, DeSoto, Grenada, Holmes, Humphreys, Issaquena, Itawamba, Lafayette, Lee, Leflore, Lowndes, Marshall, Montgomery, Monroe, Noxubee, Oktibbeha, Panola, Pontotoc, Prentiss, Quitman, Sharkey, Sunflower, Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Winston, Washington, Webster, Union, Yalobusha, Yazoo	0	$0
Winter Weather	February 23, 2015	5	Bolivar, Hinds, Madison, Warren, Washington	0	$39,000
Winter Weather	February 20, 2015	25	Alcorn, Benton, Bolivar, Calhoun, Chickasaw, Coahoma, DeSoto, Hinds, Itawamba, Lafayette, Lee, Marshall, Monroe, Panola, Prentiss, Pontotoc, Quitman, Rankin, Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Union, Yalobusha	0	$19,000
Winter Storm	February 16, 2015	8	Alcorn, Benton, DeSoto, Marshall, Tate, Tippah, Tishomingo, Tunica	0	$0
Winter Weather	January 9, 2015	1	Pike	0	$0
Winter Weather	November 13, 2014	1	Marshall	0	$0
Winter Storm/Winter Weather	March 3-4, 2014	4	Amite, DeSoto, Tunica, Wilkinson	0	$0
Winter Weather/Ice Storm	February 11, 2014	22	Adams, Alcorn, Calhoun, Chickasaw, Claiborne, Humphreys, Issaquena, Itawamba, Jefferson, Lafayette, Lee, Monroe, Prentiss, Pontotoc, Sharkey, Tippah, Tishomingo, Union, Warren, Washington, Yalobusha, Yazoo	0	$50,000

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
Winter Weather	February 2-4, 2014	1	Tunica	0	$0
Winter Storm/Sleet/Heavy Snow/Winter Weather	January 28, 2014	27	Adams, Amite, Claiborne, Clarke, Copiah, Covington, Franklin, Greene, Hancock, Harrison, Hinds, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Lauderdale, Lawrence, Newton, Pearl River, Pike, Rankin, Scott, Simpson, Smith, Walthall, Wayne	0	$0
Winter Weather	Jan 23-24, 2014	8	Amite, Hancock, Harrison, Jackson, Pearl River, Walthall, Wilkinson	0	$0
Winter Weather	December 6-7, 2013	8	DeSoto, Coahoma, Marshall, Panola, Quitman, Tate, Tippah, Tunica	0	$0
Ice Storm	January 13-17, 2013	50	Alcorn, Attala, Bolivar, Benton, Carroll, Chickasaw, Choctaw, Claiborne, Clay, Copiah, Grenada, Hinds, Holmes, Humphreys, Issaquena, Itawamba, Jefferson Davis, Kemper, Lafayette, Lauderdale, Leake, Leflore, Lowndes, Madison, Marshall, Monroe, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Prentiss, Pontotoc, Quitman, Rankin, Scott, Sharkey, Simpson, Smith, Sunflower, Tallahatchie, Tippah, Tishomingo, Union, Warren, Washington, Webster, Winston, Yalobusha, Yazoo	0	$540,000
Cold/Wind Chill	Jan 1-14, 2010	47	Adams, Attala, Bolivar, Carroll, Choctaw, Claiborne, Clarke, Clay, Covington, Copiah, Forrest, Franklin, Grenada, Hinds, Holmes, Humphreys, Issaquena, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Leflore, Lincoln, Lowndes, Madison, Marion, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Rankin, Scott, Sharkey, Simpson, Smith, Sunflower,	3	$15,180,000

Event Type	Date	No. of Events	Counties Affected	Deaths	Property Damage
			Warren, Washington, Webster, Winston, and Yazoo		
Cold/Wind Chill	Dec 25, 2004		Itawamba	1	$0
Cold/Wind Chill	Jan 24, 2003	1	Monroe	1	$0
Extreme Cold/ Wind Chill	Dec 31, 2000	1	Lafayette	1	$0
Cold/Wind Chill	Dec 18, 1996	8	Amite, Hancock, Harrison, Jackson, Pearl River, Pike, Walthall, and Wilkinson	0	$0
Cold/Wind Chill	Feb 1-2, 1996	10	Amite, Desoto, Hancock, Harrison, Jackson, Pearl River, Pike, Walthall, Wilkinson, and Yalobusha,	3	$100,000
Total				**10**	**$18,873,000**

As previously stated, Mississippi is susceptible to winter weather events causing deaths and significant property and crop damage. Table 3.9.4 identifies two presidentially declared events in 1994 and 1998, followed by brief descriptions of each. The 2010 and 2017 cold weather events, described in the historical events section, caused damage to water lines serving residents, and city and state agencies and crippled the city of Jackson. There have been no declarations since December 1998.

Table 3.9.4
Presidential Disaster Declarations – Winter Weather

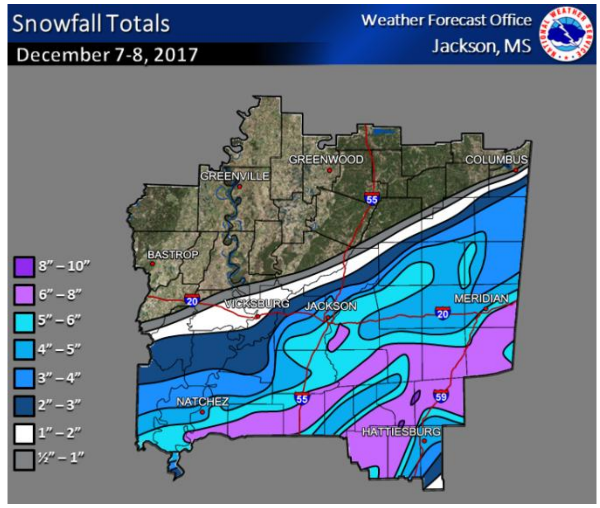
Declaration Number	Incident Period	No. of Counties Affected	Date of Major Declaration
DR-4598	February 11-19, 2021	36	May 4, 2021
DR-1265	December 23 – 26, 1998	33	January 25, 1999
DR-1009	February 9 – 14, 1994	26	February 18, 1994

Historical Events

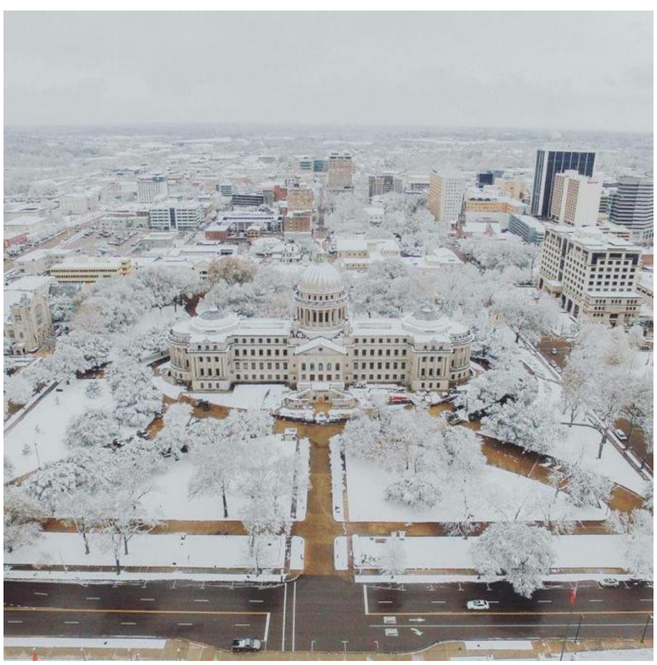
February 2021 Winter Storm

A weak disturbance on Sunday resulted in a seeder/feeder process and a period of light snow across much of the area with up to an inch falling. Bands of occasionally moderate sleet pushed across north Mississippi into southeast West Tennessee on Sunday evening, February 14th. The main mid-level trough rapidly strengthened and became negatively titled as it approached the Mid-South during the morning hours of Monday, February 15th. Precipitation rapidly developed over the Lower Mississippi Valley and spread northeast into the Mid-South by sunrise. Strong lift and deep moisture through the dendritic growth zone resulted in heavy winter precipitation during the morning hours before the system lifted to the northeast by mid-afternoon. Mainly snow fell across east Arkansas, the Missouri Bootheel, and Northwest Tennessee. A warm layer aloft, due to the rapidly strengthening nature of the system, resulted in a period of heavy sleet from northwest Mississippi into the Memphis area through southwest Tennessee before precipitation changed to all snow. A mixture of sleet, snow, and a little freezing rain fell across northeast Mississippi. Four to seven inches of snow and sleet fell across areas west of a Tunica, MS to Somerville, TN to Union City, TN line. One to three inches of sleet and some snow fell to the southeast of this line.

December 8, 2017 Snow



Just three days before the winter storm, temperatures were in the upper 60s and lower 70s across much of the area ahead of a series of arctic cold fronts. The first arctic front moved through the area during the day on December 5th and ushered in a cooler and drier airmass in its wake as temperatures dropped into the 40s with dewpoints in the upper 20s. A second reinforcing arctic cold front moved through the ArkLaMiss region during the day on December 7th and brought another shot of drier and colder air. A modified continental polar airmass became locked in across the region with a 1035 mb high centered over the Southern Plains. As the stronger upper-level flow and support pulled away from the southeastern United States, the two arctic cold fronts slowed and eventually stalled over the northern Gulf of Mexico, helping to establish a strong quasi-stationary front. Further aloft, the synoptic pattern leading up to the winter storm was characterized by an upper-level longwave trough centered over the Northern Plains and Great Lakes with multiple shortwave troughs rotating through the Inter-Mountain West and Four Corners region. On the morning of December 7th, a stout shortwave trough was located over the Four Corners and was forecast to eject into the Southern Plains, thus setting the stage for a significant winter storm across the Deep South.



Source: JWS Photo: Zander Williamson

Strong upper-level divergence and ascent ahead of the advancing shortwave trough overspread the northern Gulf of Mexico in the vicinity of the stalled baroclinic zone and helped to induce surface cyclogenesis. The nose of a strengthening jet streak moved into southern Texas as the shortwave progressed into central Texas on the evening of December 7th. The resulting force for ascent allowed heavy snowfall to begin accumulating in many locations across the Deep South of Texas throughout the evening. This snowfall spread across south and east Texas and into Louisiana and Mississippi through the early morning hours of December 8th. Strong isentropic ascent on top of the sloped boundary, working in concert with exceptional upper-level divergence in the right entrance region of an impressive 180 kt jet, allowed heavy snowfall to spread across a large portion of central and southern Mississippi. While surface temperatures were above freezing, evaporation and dynamical cooling due to a dry sub-cloud layer allowed surface temperatures to drop into the low 30s, and heavy snow began accumulating quickly as higher snowfall rates overspread the area through the morning hours. While the heaviest snow accumulations were limited to grassy and elevated surfaces, decent slushy accumulations were able to build on roadways, especially during the highest snowfall rates. Snowfall gradually tapered off from west to east through the day with snow ending in the Jackson metro by mid-morning and eventually ending in the south and east portion of the forecast area by mid-afternoon. The highest storm total snowfall amounts were focused along and southeast of a line from Brookhaven to Meridian where higher snowfall rates were realized in an area of banded snowfall that occurred in the presence of conditional symmetric instability.

The highest snowfall total was 8”, which was reported in two different locations (see totals below) and was part of a heavy swath of widespread 6-7.5” from Brookhaven to Meridian where the aforementioned snow banding occurred. Elsewhere, totals dropped off gradually to the north with 4-6” in the Jackson metro. The official snowfall measurement at the NWS Jackson office was 5.1”, which was high enough to rank as the 7th snowiest day of all time and the largest snowfall since 1982. In Meridian, the total was 5” and was the 3rd highest daily snowfall on record and the largest daily snowfall since 1993. For Hattiesburg, the event's total snowfall was 4.1”

January 6, 2017, Winter Weather

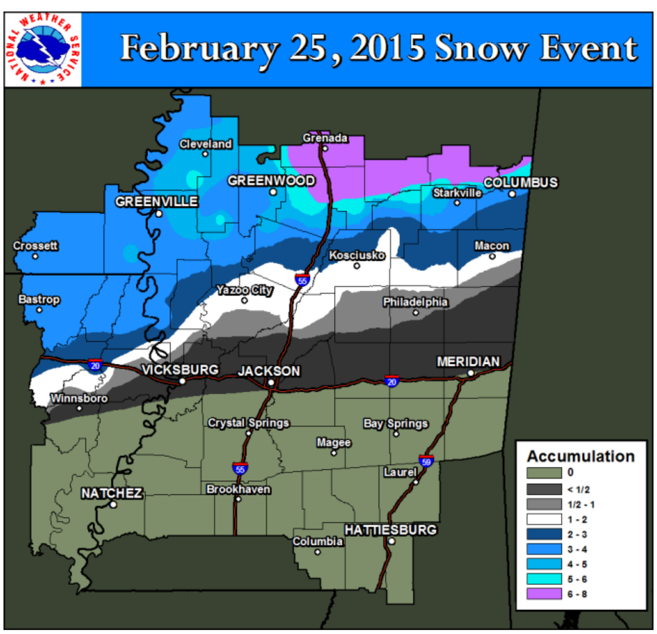
A complex weather pattern eventually evolved into a widespread winter weather event across the area on January 6th, 2017. A strong surface high, near 1030mb, was building in the central and southern Plains. On Tuesday, January 2nd, 2017 temperatures were more seasonal but included severe weather and tornadoes., Over the two days, strong surface high pressure with much cooler air gradually filtered in. The strongest push of high pressure and colder air began to enter the region on Friday morning.

A sharp contrast in temperatures existed across the area from the lower Mississippi Valley into the Gulf of Mexico as a stalled frontal boundary stayed situated along the coast. This helped the cold air stay locked in place over the area, with temperatures near freezing Friday morning. In addition, a strong upper-level disturbance was helping to promote lift and an area of snowfall moving through the Oklahoma/Arkansas region by early Friday morning. This system mostly stayed to the north of the region. As the upper disturbance approached, moisture began to overrun the cold air below by early Friday morning. This moisture gradually spread across the entire region by mid-morning. The atmosphere contained a deep melting layer, so that as the snow fell, it completely melted. Because of the below-normal air temperatures, the ground caused most of the precipitation to fall in the form of sleet and freezing rain. By early Friday morning, sleet began to fall over northeast Louisiana, spreading to the north and east into most of the ArkLaMiss region by mid-morning to late afternoon.

The main disturbance and lift occurred in the mid-to-late afternoon and the heaviest sleet production occurred during the late afternoon. Temperatures were hovering in the low 30s to upper 20s while precipitation was falling. The persistence of cold temperatures throughout the afternoon caused significant sleet accumulation, especially from Franklin Parish in Louisiana, southeast towards Adams County in Louisiana, over to Warren County in Mississippi, throughout the Jackson Metro area, east along I-20 towards Lauderdale County, and as far north as Noxubee County. Heavy sleet occurred throughout this region, with some areas approaching a 1/2 to 1 inch of sleet. In some areas of northeast Mississippi, the temperatures were cold enough for the precipitation to change to snow. With cold ground and road temperatures, significant icing and accumulation began to affect roadways throughout portions of northeast Louisiana, central, east, and northeast Mississippi, especially along the Interstate 20 corridor. This led to significant icing on roadways and bridges, leading to major traffic issues. Many accidents occurred across the region, causing temporary closures of several primary roadways. In addition, the Jackson International Airport had to be shut down due to icy runways. The disturbance gradually moved east, allowing the precipitation to taper off and move out by late evening.

The strong surface high-pressure system strengthened to near 1040mb, leading to much colder air through the weekend. This resulted in hard freeze conditions with highs barely reaching the freezing mark, especially across central and northern areas of the State. A snowpack existed over central Arkansas, northern Mississippi, and southern Tennessee. Northerly winds over that snowpack helped to lock in even colder air and single-digit wind chills over most of the area. Some areas in the Mississippi Delta stayed below freezing for over 60 hours. These conditions over the next several nights kept the winter weather conditions around through the weekend, with icy roadways for the next couple of days into Saturday, January 7th, and Sunday, January 8th.

February 25, 2015 Snow Event



Multiple rounds of wintry weather had occurred before this snowfall event. A cold front had moved through the region four days earlier on February 21st with a cold airmass in its wake. Several waves of upper-level disturbances moved through Mid-South, over the next three days. The night of the 22nd brought mostly rain to the region but some light icing occurred in the far northern Delta early on the 23rd. A second, more potent disturbance, moved through Central Mississippi during the afternoon and evening hours on the 23rd. This brought a stronger icing event in locations generally along and north of I-20, causing some power outages and accidents.

With the cold remaining in place, the final round of wintry weather moved in on the morning of February 25th. A strong upper-level disturbance moved across the region, which induced a low-pressure system to move east across the northern Gulf of Mexico. With the cold air already entrenched over the region, this brought the moisture and atmospheric lift necessary to generate precipitation. The precipitation started as rain and freezing rain, with some light icing reported across the ArkLaMiss Region. As the atmosphere cooled through the late morning, the rain began to change to snow across southeast Arkansas, northeast Louisiana, and the Mississippi Delta. The line from rain to snow slowly progressed from northwest to southeast across northern portions of the ArkLaMiss region. By the time the change in conditions occurred near the I-20 corridor, the precipitation was moving off to the east into Alabama.

Those who experienced snow north of I-20 saw several heavier bursts, which led to some high snowfall totals. The highest totals were generally along and north of the Highway 82 corridor. Locations from Grenada to northern Lowndes County saw the highest amounts in our county warning area, with totals ranging from six to eight inches. Those who experienced the higher precipitation totals also dealt with trees being weighed down by the heavy snow. This led to snapping trees and numerous power outages.

January 28, 2014, Winter Storm

Temperatures on January 27th were in the upper 40s in the northwest Delta to the mid-50s to low 60s in southeastern Mississippi. However, a large upper trough was diving southeast, bringing an arctic front and 1032mb surface high pressure into the ArkLaMiss. Temperatures dropped rapidly in the evening as very dry air filtered into the region, with dewpoints falling into the single digits. The large spread between the surface and dewpoint temperature would plan an important role in the winter weather event on January 28th. As the upper trough deepened and strong upper-level winds began to move over the region, an upper-level low center over northern Mexico to the southwestern United States began to merge with the strong upper-level system and moistened the mid-levels of the atmosphere across the region. Temperatures were only in the low to mid-20s throughout the ArkLaMiss Region as the precipitation began to fall. Areas along and north of a line from around Natchez to just south of Meridian began to observe precipitation that initially fell as sleet but gradually transitioned to snow in just a few hours as temperatures cooled in the mid-levels of the atmosphere and the lower atmosphere saturated from falling precipitation and evaporative cooling. Due to a warm layer in the mid-levels of the atmosphere, mixed precipitation occurred from south of a line near Natchez to south of Meridian. The deep melting layer caused precipitation to remain as sleet throughout most of the afternoon south of that line. These areas had a prolonged period of sleet before finally transitioning over to snow in the mid to late afternoon hours. All precipitation moved out of the region by around 6-8 pm on the evening of January 28th.

In total, areas north of the mixed precipitation line had more significant snowfall. This was a heavy confined band of precipitation that dropped off quickly closer to the Jackson metro with areas in southeastern Rankin County having the highest snowfall totals. This area had 2-4 inches of snowfall, with a maximum of 4 inches in the Puckett area. Snow tapered off quickly near the Interstate 20 corridor with only ½ inch to 1 inch of snowfall. Snow accumulation extended into north central Mississippi up to the Highway 82 corridor near Indianola, and eastward towards Macon but only a light dusting occurred in these regions. South of the mixed precipitation line, significant icing and sleet occurred in the region with upwards of 1-3 inches of sleet and snow. The significant icing occurred far into southern Marion, Lamar, and Forrest counties.

Significant icing occurred on the roadways and led to multiple accidents and issues with travel. There was an extended hard freeze, with temperatures dropping into the low teens and single digits regionwide on the morning of January 29th. This kept lingering snow and sleet accumulations frozen and made travel hazardous, especially along and south of the Interstate 20 corridor. Temperatures only climbed into the low to mid-30s on January 29th before falling back into the teens overnight on January 30th. The region finally warmed above freezing in the mid to late morning hours of January 30th.

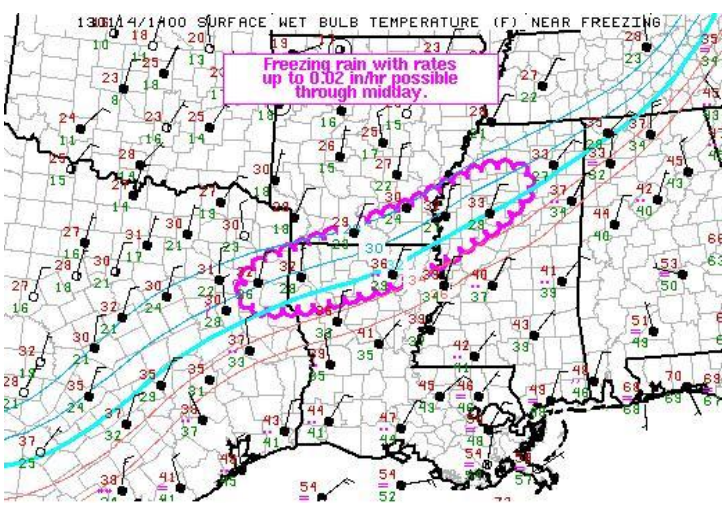
January 14-17, 2013 Snow and Ice

A near record-long duration of wet weather brought widespread flooding and two winter storms to the ArkLaMiss Region from January 6th through January 17th. Three key ingredients allowed this very active weather pattern to take shape.

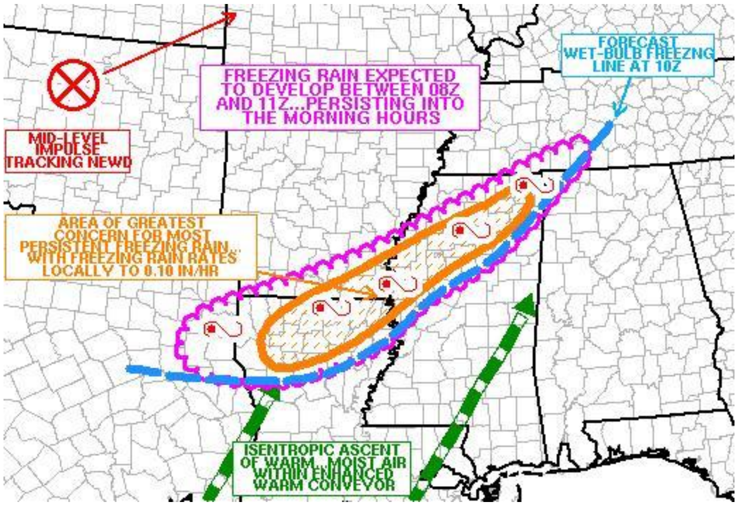
- An unseasonably strong and warm high-pressure center developed over the South Atlantic states. The clockwise flow around this high-pressure center trapped tropical moisture and transported it northward through the Lower Mississippi Valley.
- An upper-level trough took up residence over the western states and this created an upper-level southwest flow. Such upper-level patterns are favorable for heavy rain in our region because they focus very moist air along stalled fronts.
- The northern stream sent a series of cold fronts southward to the Gulf Coast. The cold air behind the front supported ice and snow, and the frontal lift allowed for multiple rounds of heavy rainfall that led to flooding.

Ice Storm – January 14-16, 2013

A strong cold front brought a shallow and very chilly air mass southward into the ArkLaMiss the night of January 13th. The cold air undercut relatively mild air aloft, thus setting the stage for freezing rain over northwest portions of the ArkLaMiss Region. A couple of episodes of moderate freezing rain accompanied by thunder occurred in this time frame with temperatures hovering near or just below 32 deg F.



These weather maps from the Storm Prediction Center, analyzed during the ice storm, depict the general set-up and potential area for heavier ice accumulation.



Just as the ice storm was ending in the Mississippi Delta, an upper-level low was moving steadily east toward the region and this ultimately brought the heavy snow that fell over much of the ArkLaMiss Region.

Heavy Snow – January 17, 2013

Very cold air associated with an upper-level low-pressure system made conditions more favorable for snow in the early morning hours of Thursday, January 17th. A strong lift caused widespread light to moderate rain to develop during the evening of January 16th as surface temperatures held just above freezing. Late that night rain transitioned briefly to sleet before switching to all snow across the State.

Two main occurrences of freezing rain caused icing over portions of northeast Louisiana, southeast Arkansas, and northwestern portions of central Mississippi - one during the daytime hours of January 14th and another during the daytime and evening hours of January 15th. In many areas, temperatures remained below freezing during this entire period. Because of consistently low temperatures, there was no melting between the two icing events. The above ice accumulation map represents the greatest reported total ice accumulation across the affected region. Some locations experienced cumulative amounts over the 2-to-3-day period. The greatest accumulation of approximately 1/2" of ice was in a corridor from near Bastrop, LA to Cleveland, MS. Most icing occurred on elevated surfaces, such as trees and other vegetation, cars, utility lines, and bridges. However, there was also some icing on roadways, resulting in several traffic accidents.

Snowfall totaled approximately 2-3" from the I-55 corridor between Grenada and Jackson eastward to the Alabama state line. Because of the nature of this system, there were multiple north-to-south oriented snow bands, creating significant variations in snow accumulations over short distances. For instance, there were snow accumulation amounts as great as 3.5" along the Pearl River in the Jackson area, while accumulations of as little as 1" were reported just to the west in Raymond and as little as 1.5" just to the east in Goshen Springs. The greatest reported snowfall accumulation in the NWS Jackson forecast area occurred under a heavier snow band over portions of Webster, Choctaw, western Clay, and western Oktibbeha counties. Approximately 6 inches of snow was reported just to the east of Ackerman.

Prolonged Sub-Freezing Temperatures – January 1-14, 2010

The Central Mississippi water supply failure of January 2010 is an example of how both metropolitan and rural areas can be affected by cold weather events. In the days leading up to January 11, 2010, Central

Mississippi experienced 11 straight nights of sub-freezing temperatures and six nights of temperatures of 20 degrees or less. From the evening of January 7 to the morning of January 10, temperatures remained below 32 degrees. By January 10, the Jackson, Mississippi water supply system began losing pressure, and when the daily high temperature reached 48 degrees on January 11, it became apparent Jackson and several other Central Mississippi communities would experience major water-pressure problems due to water main breaks.

On January 11, Governor Haley Barbour issued an emergency declaration that was eventually expanded to include all affected areas. The state's Emergency Operations Center was partially activated on January 13 to help cities and counties with the ongoing crisis. Staff specializing in public works, engineering, logistics management, and public health went on 12-hour shifts. The Mississippi Emergency Management Agency delivered bottled water to the affected areas.

The City of Jackson's water system sustained 80 major breaks resulting in the loss of 22 million gallons of water throughout the city. That number eventually reached 150 broken water mains with an unknown quantity of lost water. According to news reports, the City of Jackson reported up to 200,000 residents were without water. Adding to the problems, an electrical fire took a city water treatment plant offline and further diminished the city's capacity to pump water. Many Jackson residents were without water for more than 24 hours. The cities of Madison, Ridgeland, Hattiesburg, and Greenville offered water crews to help patch the leaks, and the city of Pearl furnished water for two of Jackson's largest hospitals.

On January 7, portions of Jackson and Byram, south of Jackson, were placed on a boil water notice that remained in effect until January 24. On January 11, the entire Jackson water system, including most of the metropolitan area, was placed under a boil water notice that lasted seven days. These requirements, combined with a lack of water pressure, caused multiple problems including business, restaurant, and school closures, relocation of two police precincts, and adjournment of the Mississippi Legislature, which was in session at the Capitol in Jackson. For locations that remained in operation, flushing toilets and other hygienic measures became a problem. The Jackson Convention Complex was forced to provide water and restroom facilities for a 400-person Affordable Housing Conference. Fire departments delivered water to jails and other critical facilities. Portable toilets were in such demand that vendors had to go out of state to supply the crisis.

AT&T, which operates switching centers for its cell and landlines and other providers that utilize the company's infrastructure, including emergency communications systems, found it necessary to park water-filled tanker trucks outside its facilities to cool equipment and provide fire protection. A National Guard tanker provided 5,000 gallons of water to cool computers for several state agencies providing essential services.

The Mississippi State Department of Health (MSDH) went into emergency mode. Tasked with providing engineers for Emergency Support Function (ESF) #3 of the State's Comprehensive Emergency Management Plan (CEMP), the MSDH also began emergency procedures to protect the health and safety of the public. That task included providing extra staff to sample and test potable water supplies from affected communities and inspect food service providers such as restaurants, shelters, clinics, and schools to ensure safe operation. The department temporarily closed some restaurants until they could adjust to emergency operation requirements.

State Agencies Impacted

On Sunday, January 17 the boil-water alert was canceled for most of the city, ending a week of crises unequaled in recent Jackson history. This event left behind a legacy of business losses, school days to be made up, huge potholes to be repaired where water crews accessed system breaks, and a large budgetary problem for the City of Jackson. Mitigation of future problems for Jackson's aging water main system was projected to cost over $75 million. With tax revenues in decline, the City's water supply problem was significant.

Affected Cities and Counties

The following numbers of residents of Central Mississippi cities and counties were affected by the January 2010 water supply emergency:

> Emergency: Jackson (200,000); Lauderdale County (14,000); Port Gibson (10,500); Marks (2,300); Walnut (500); Vicksburg (250); Wayne County (150); Tunica County (number not available); Carroll County (number not available).

DR-1265 – December 23-26, 1998

A crippling ice storm struck Arkansas, Louisiana, and Mississippi on the evening of December 22, 1998, bringing freezing rain and sleet to the three-state region. Much of the fall and early winter season of late 1998 was very mild, but a strong surge of shallow arctic air drove southward and ended the unseasonable warmth. A moist southwest flow above the cold air brought several upper-level disturbances. The combination of cold air and moisture caused periods of freezing rain and sleet until Christmas morning.

Almost two inches of ice accumulated on power lines, causing outages for up to seven days. Tree and power line damage was moderate to severe from northeast Louisiana to northcentral Mississippi. Due to more foliage than usual on trees, the extra weight of ice accumulation caused large oaks and maples to split in half. Travel was severely hampered for several days with motorists stranded at airports, bus stations, and truck stops.

Counties in Mississippi affected by the storm included Leake, Lee, Leflore, Lowndes, Monroe, Montgomery, Neshoba, Noxubee, Oktibbeha, Pontotoc, Prentiss, Sharkey, Sunflower, Tallahatchie, Tishomingo, Union, Warren, Washington, Webster, Winston, Yalobusha, and Yazoo.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 33 • Deaths: 0 • Injuries: 0 • Estimated Property Damage: $16,699,000	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	$6,970,269	$2,590,192	$4,349,918

DR-1009 – February 9-14, 1994

In 1994, a damaging ice storm with freezing rain accumulations of three to six inches occurred across north Mississippi, southeast Arkansas, west Tennessee, northwest Alabama, north Louisiana, and extreme northeast Texas between February 9th and 11th. In Mississippi, the ice storm was the worst since 1951, with total damage estimates exceeding $300 million and a federal disaster declaration for 26 counties.

According to Mississippi Power Company estimates, 500,000 persons in roughly 200,000 homes were without electricity and 175,000 homes had no water as a result of freezing conditions. Twenty percent of Mississippians lost power for at least one day. Approximately 300 water systems were also affected for a week or more with over 300,000 customers subjected to boil water advisories.

The United States Department of Agriculture studied forest damage in the storm-affected area. There were 2.1 million acres of forest land in northeast Mississippi within the 3.7-million-acre study area. Less than 1 percent of the forest land was untouched by some degree of damage. Net loss to live-tree volume, due to probable mortality, amounted to 16.5 percent of hardwoods and 15.3 percent of softwoods. The majority of volume loss occurred in areas that received about 25 percent mortality to the forest resource.

Mississippi counties included in the federal disaster declaration included: Alcorn, Benton, Bolivar, Calhoun, Chickasaw, Coahoma, Desoto, Grenada, Itawamba, Lafayette, Lee, Leflore, Marshall, Panola, Pontotoc, Prentiss, Quitman, Sunflower, Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Union, Washington, and Yalobusha.

Impact Summary	Public Assistance Dollars Obligated Declared Counties		
• No of Counties Affected: 26 • Deaths: 0 • Injuries:0 • Estimated Property Damage: $500,000 • Estimated Crop Damage: $5,000,000,000	**Total PA Grants**	**Emergency Work (Categories A-B)**	**Permanent Work (Categories C-G)**
	Unknown		

Source: NCDC Source: FEMA

Winter Storm Events Before 1993

The National Weather Service, NCDC, has created a consistent database of winter events since 1993; however, there were many severe storms before this period. The chart below plus two specific events presents some of the significant historical winter storms in Mississippi.

Significant Historical Snow Storms 1940 – 2017

Year	Area	Inches
January 2017	Central and North Mississippi	2.5
January 2016	Central and North Mississippi	8
January 2015	Central and North Mississippi	1
January 2014	North and Central Mississippi	2
January 2013	North Mississippi	8
January 2012	Central Mississippi	4
January 2011	Adams County	3
January 2010	North Mississippi	6
January 2009	North Mississippi	7
January 2008	North Mississippi	10
January 2007	Central and South Mississippi	8
January 2006	North Mississippi	3
January 2005	Central and South Mississippi	9
January 2004	Chico and Bolivar County	6
January 2003	Covington, Jefferson Davis, and western Jones Counties,	5
January 2002	South Mississippi	4.5
March 1993	Mississippi	6
1974	Gulf Coast	5
1967 – 1968	Tate County	25.2
1966	Bolivar County	23
1960	Hinds County	9.1
1940	Hinds County	10.6

January 28 – February 5, 1951: Approximately $50 million in damages was incurred in Mississippi. Twenty-two people died in the storm throughout Mississippi, Louisiana, and Arkansas.

January 11 – 15, 1982: An ice storm centered in the northern and eastern parts of the state, caused heavy damage in 44 counties and affected 25% of the state's nurseries. One death was reported.

Probability of Future Winter Storm Events

Portions of Mississippi north of Interstate 20 are most likely to receive an ice storm, heavy snow, or winter storm activity. Based on data from the NCDC, winter events occur as early as mid-December and as late as mid-March. In the past 20 years, Mississippi recorded some magnitude of winter weather except for the years 1995, 1999, 2001, 2005, and 2012. Over the last five years 2018-2023, Mississippi has experienced almost annual events, particularly in the northern portions of the State. Based on this data with consideration of changing future conditions, the State of Mississippi has a 25% probability of experiencing a winter weather event in any given year.

Additionally, there is growing scientific evidence suggesting that human-caused global warming is causing rapid changes in the Arctic, which in turn is altering the atmosphere, which is causing wavy patterns to form more frequently in the jet stream. It can also allow frigid Arctic air to spill into the USA, creating especially cold winter weather. In sum, these freezes are made more likely by rising global temperatures, and as they rise further, such extremes may well become more common.

The jet stream plays a key role. Jet streams are bands of fast-moving air currents about five to seven miles above Earth's surface. The polar jet stream influences weather in North America, and in turn it is influenced by changes in the Arctic due to human-caused global warming. The Arctic is the fastest-warming part of the planet, in large part because sea ice is disappearing so rapidly. White ice is reflective, but dark oceans are not. When sea ice sitting on top of the ocean melts, the Arctic surface becomes less reflective, absorbing more sunlight, which in turn melts more ice in what's known as a "positive feedback." Because the colder Arctic is warming faster than the warmer area to its south (e.g. North America), the temperature difference between the regions is shrinking.

Assessing Vulnerability

An assessment of Mississippi's vulnerability to winter storms reveals that warnings are often not regarded or taken seriously enough. Preparedness for a winter storm is just as important as preparing for other hazards. As is the case with other natural hazards, the young, the elderly, persons with special needs, and persons with disabilities are vulnerable to winter storms. Officials also suggest that institutions housing these individuals develop a plan to include preparedness for lack of electricity, water, and fuel for heating.

Public buildings are not as vulnerable to winter storms as other forms of infrastructure such as electric transmission lines and utility poles that can all be weighed down by ice and freezing rain. During the 1994 ice storm, 8,000 utility poles were downed by the weight of ice, 4,700 miles of power lines were downed, and 491 water systems were affected, leaving 741,000 customers without water

Vulnerability of People to Winter Storms

The public warning systems tasked with alerting the general public of an impending storm are media outlets such as the National Weather Service and NOAA weather radios. Other less traditional means of communicating alerts include social media outlets such as Twitter, Facebook, and Instagram often provide alerts and other news critical for preparation in advance of a hazardous event.

Persons whose medical conditions require regular visits by home health care workers, and children living in those households make up the special needs group whose lives are most in danger when a power failure occurs. These citizens must rely on neighbors and relatives for contact, supplies, and assistance throughout the event.

Roads are often blocked by trees downed by heavy ice, and road and bridge conditions may prevent home healthcare workers from reaching their patients until emergency personnel can clear roads and offer transport by ambulance. Any unnecessary automobile or pedestrian travel during icy conditions by citizens not involved in emergency assistance increases the burden on emergency personnel during these crises.

Loss of Life from Extreme Cold in Mississippi

Although the National Weather Service does not record cold-related deaths along with winter storm event statistics, the following information collected by the Mississippi State Department of Health, Bureau of Health Statistics, provides an understanding of recorded deaths in Mississippi due to extreme natural cold. **Table 3.9.5** below summarizes cold-related deaths over 28 years from 1984 to 2011, the last year for which data was available. During that time, a total of 175 deaths from this cause occurred, an average of 6.25 deaths per year. Information on the location of the deaths was not available.

Table 3.9.5
Loss of Life Due to Excessive Cold

Year	Exposure to Excessive Natural Cold
2019	1
2018	1
2017	1
2016	0
2015	0
2014	0
2013	0

Vulnerability of Natural Resources to Winter Storms

Trees, crops, and decorative vegetation are subject to damage from winter storms. Ice storm damage documented by the National Weather Service in 1994 caused damage to over 3.7 million acres of commercial forestland. The value of damaged timber was estimated at $27 million. The state's pecan crop was reduced by 25% over the following five-to-ten years at an estimated cost of $5.5 million per year.

Fallen timber and tree limbs during winter storms provide a possibility of wildfires later in the year. Forestry Commission officials and private landowners minimize the severity of wildfires by cutting and sawing fallen timber and debris to prevent the spread of fire.

Vulnerability of Private Improvements to Winter Storms

The weight of snow and ice accumulation can affect the structural integrity of roofs. Cars and passengers are vulnerable when driving on icy or wet roads and surfaces. Decorative trees and shrubs can be expensive to replace when damaged or destroyed by freezing conditions or the weight of ice or snow.

Businesses within affected areas are vulnerable to power outages and may be unable to open for business and may lose income as a result of the closure. Communications facilities, such as telephone lines, microwave, and cellular telephone repeater towers have been temporarily or permanently damaged in past events. The failure of nine fiber optic lines, 26 local telephone exchanges, and several cellular telephone repeater towers was caused by vulnerability to ice and snow accumulations as documented in the FEMA-1009-DR-MS (February 18, 1994) Hazard Mitigation Team Report.

Assessing Vulnerability by Jurisdiction Methodology

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1	1	8	-	6	-	9	-
2	-	12	-	7	9	-	-
3	5	3	-	8	15	-	-
4	-	1	10	9	6	-	-
5	-	44	7				

Past damages are a significant indicator of vulnerability. However, county-by-county damage information was not available for winter storm damages. The National Weather Service provides a single dollar amount for all counties impacted by a particular winter storm event. It is inaccurate to average this amount across the impacted counties. **Tables 3.7.1 and 3.7.3** provide the estimated damage losses by event/year.

The data collected by NWS reflects what is known by the state since the northern part of the state is more significantly impacted by winter storms than the southern part of the state.

Exposure Analysis

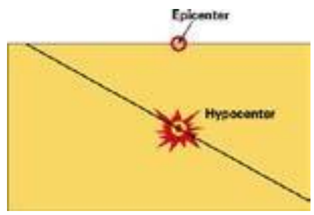
The following section consists of three exposure analyses, using three different sets of data. Exposure analyses are different from loss estimates because they present facilities and structures that may be exposed to winter storms, but do not attempt to estimate the dollar amount of damages resulting from a winter storm event. Loss estimations are discussed in the Potential Losses section following the exposure analyses.

Exposure Analysis of State-Owned Facilities

As previously discussed in this section, state-owned facilities are equally at risk of extreme winter weather events (including power outages associated with this type of event). These events can occur anywhere and with any severity.

3.10: Earthquake Risk Assessment

Hazard Description

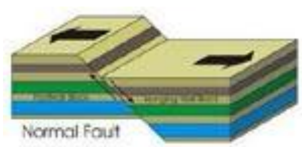


The United States Geographic Survey (USGS) defines an earthquake as a sudden motion or trembling of the earth caused by an abrupt release of stored energy beneath the earth's surface. A description of technical terms associated with earthquakes is provided below:

Epicenter - The epicenter is the geographic location directly above the hypocenter on the earth's surface. Ideally, the epicenter and the highest Modified Mercalli Intensity Scale (MMI) values on the isoseismic map coincide; however, this relationship is not always consistent.

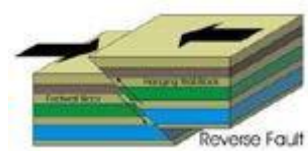
Modified Mercalli Intensity Scale - The size of an earthquake can be expressed in several ways, the most commonly used are the various magnitude scales and the Modified Mercalli Intensity Scale (MMI). There are several intensity scales, but the MMI is most commonly used in this country. The intensity scales differ from magnitude scales in that they measure the effects of seismic waves as they are perceived by people in the "felt" area of the earthquake. The first question, for example, is usually "Did you feel the earthquake?" If the answer is "yes" then a set of questions are asked that will help the interviewer determine the level of intensity at that site (referred to as site intensity). Intensity levels vary from an MMI intensity level I, where the earthquake was not felt to an MMI value of XII which is described as total damage.

Hypocenter - The hypocenter is the location in the subsurface where the rupture took place.

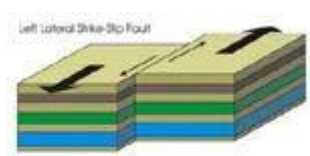


Fault - Faults can be defined as a rupture in subsurface geological materials where there is relative movement on the opposing sides of the rupture. The origin of this movement is stress built up in the earth's crust from plate movement or other geological forces.

Normal Fault -. A normal or gravity fault is one where a fault block has moved downward as gravity moves a fault block down along an inclined fault plane.



Reverse Fault - A reverse fault is the opposite of a normal fault where a fault block has moved up an inclined fault plane, opposite of the movement that would be expected if gravity were the main force acting on the block.



Strike Slip Fault - A strike-slip fault is one where the movement is largely horizontal and oriented in the same direction as the fault trends. Normal faults are the result of an extension of the earth's crust, reverse faults are a result of a shortening or compression of the earth's crust and strike-slip faults result from forces acting horizontally.

Fault Plane - The rupture along which the movement of the fault blocks takes place can be a sharp planar feature, referred to as a fault plane. In this case, the direction the fault blocks moved (up, down, or sideways) can be fairly straightforward.

Fault Zone - It is also common for the movement of fault blocks to take place across a zone consisting of multiple fault planes with small individual displacements. This zone of displacement is referred to as a fault zone and it can be a few inches wide or it can consist of a series of large faults and may be measured in miles.

Isoseismal Map - Typically, site intensities are plotted on a map, and similar intensities are grouped. The groupings are separated by lines referred to as isoseismal and the map itself is referred to as an isoseismal map. Intensities are always denoted by Roman numbers to distinguish them from magnitude values which are always in Arabic numerals. The assigned intensity value for any particular earthquake represents the highest MMI value assigned in the felt area.

Liquefaction - Liquefaction is an earthquake-related hazard involving geological conditions that pose a potential hazard to structures. Liquefaction is a complex process resulting in soils losing their bearing strength (i.e. they act more like a liquid than a solid) due to seismic-induced vibrations. The major concern is that during an earthquake the liquefaction soils become "liquid" and move laterally away from the foundation of buildings causing foundation failure or causing them to topple over.

Peak Ground Acceleration (PGA) - The maximum level of vertical or horizontal ground acceleration caused by an earthquake. The PGA is typically expressed as a percent of the acceleration due to gravity.

Magnitude - There are several magnitude scales. All are different from intensity scales as they measure completely different aspects of the earthquake *i.e*. the strength of the earthquake source (Reiter, 1990). Reiter (1990, p. 34) also defines the difference between intensity and magnitude stating that "... magnitude is determined by quantitatively analyzing instrumental recordings utilizing specific, explicitly defined formulas ..." Magnitude scales were originally devised in 1934 for use in California. This scale came to be known as the Richter or Local Magnitude Scale. A comparison of magnitude and intensity is shown in the chart below followed by abbreviated descriptions for each intensity level.

Magnitude	Modified Mercalli Intensity*
1.0-2.0	I
2.0-3.0	II
3.0-4.0	III
4.0	IV
4.0-5.0	V
5.0-6.0	VI
6.0	VII
6.0-7.0	VIII
7.0	IX
7.0-8.0	X
8.0	XI
8.0 or Greater	XII

*Based on a typical maximum Modified Mercalli Intensity Scale as defined below Source: USGS Earthquake Hazards Program

Intensity Scale
I. Not felt except by a very few under especially favorable conditions.
II. Felt only by a few persons at rest, especially on upper floors of buildings.
III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.
IV. Felt indoors by many, outdoors by a few during the day. At nights, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation is like a heavy truck striking building. Standing motor cars rocked slightly.
V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects over-turned. Pendulum clocks may stop.
VI. Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage is slight.
VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII. Damage slight – especially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX. Damage considerable in specially-designed structures; well-designed, frame structures thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII. Damage total. Lines of sight and level are distorted. Objects are thrown in the air.

Hazard Description

Earthquakes originating in Mississippi are not the only threat; those originating in surrounding states have also affected Mississippi in the past. The greatest potential threat to Mississippi from earthquakes is from a strong event in the New Madrid Seismic Zone (NMSZ). The earthquakes of 1811-1812, which originated along the NMSZ, shook many areas in Mississippi, reaching as far south as the Gulf Coast. The vibrations from these earthquakes were so powerful they rang church bells in Boston, Massachusetts more than 1,000 miles away.

Although the NMSZ is the primary seismic activity source for the Southeastern United States, there are other potential earthquake sources in Mississippi. The USGS has recorded more than 40 earthquakes originating within the boundaries of Mississippi since 1911. Though none of these Mississippi-centered earthquakes have inflicted severe damage, they should not be disregarded.

One area of notable earthquake activity is in east-central Mississippi in Lauderdale and Clarke counties. This area is not well known, but it has produced more than 14 earthquakes in the past 30 years, according to data gathered by the Mississippi Department of Environmental Quality (MDEQ). Most of these events occurred within Clarke County.

The White River Fault Zone (WRFZ) is another notable seismic zone that was identified in 1944. The Charleston earthquake of 1931 in Tallahatchie County, Mississippi may have been centered along this fault. This is the largest recorded Mississippi-centered earthquake with a magnitude of 5.0. The WRFZ runs from Grenada, Mississippi northward approximately 280 miles to Newport, Arkansas. Many of Mississippi's epicenters are in the northwest quadrant of the state; some may be associated with the WRFZ. The WRFZ is an area that should be assessed as a significant seismic hazard.

Earthquakes do not occur solely from naturally active faults. Volcanoes and oil and gas production are also potential sources of earthquakes. Mississippi has not experienced volcanic activity in the modern era; therefore, this impact is minimal. Oil and gas production is common in Mississippi and might produce small earthquakes with minimal hazard impacts.

Education and Outreach

The Great Central U.S. ShakeOut is an annual opportunity to practice how to be safer during significant earthquakes: "Drop, Cover, and Hold On." The ShakeOut has also been organized to encourage individuals, communities, schools, and organizations to review and update emergency preparedness plans and supplies and to identify a sheltering space to prevent damage and injuries. Registration for this event is located at www.shakeout.org.

The ShakeOut website also includes numerous educational resources such as 20 Cool Facts about the New Madrid Seismic Zone which summarizes a few significant facts about the series of large earthquakes that struck the NMSZ of southeastern Missouri, northeastern Arkansas, and adjacent parts of Tennessee and Kentucky from December 1811 to February 1812.

History of Mississippi Earthquakes

Historically, not many earthquakes are centered in Mississippi. As seen in **Table 3.10.1** many earthquakes that originated in Mississippi had a magnitude of 3.5 or less. Damage typically begins to occur when an earthquake reaches a magnitude of 4.0 or greater. Nevertheless, every earthquake is unique and potentially dangerous. Since the 2013 plan update, there were four events in 2015. **Table 3.10.1** shows earthquakes that have originated and impacted Mississippi.

Table 3.10.2 shows representative earthquakes originating in other states but have been powerful enough for residents of Mississippi to feel the effects. Based on the best available data, there appear to be no changes or seismic activity since the last plan update. **Table 3.10.3** provides seismic activity for Mississippi's neighboring states during those years. It is not known if any effects of this activity were felt in Mississippi. **Figure 3.10.1** shows the epicenter distribution of events originating in and near Mississippi.

Table 3.10.1
Mississippi Earthquakes

Date	Latitude	Longitude	Magnitude	City/Town
December 24, 2022	34.67	-88.51	2.5	Booneville
August 9, 2019	32.53	-90.03	2.8	Madison
January 8, 2019	33.19	-90.93	3.7	Hollandale
August 17, 2015	32.54	-90.12	2.6	Madison
June 29, 2015	32.56	-90.07	3.2	Canton
May 3, 2015	32.58	-90.11	3.0	Canton
May 3, 2015	32.58	-90.07	3.2	Canton
August 30, 2013	32.99	-88.46	2.0	Farmington
October 10, 2012	34.33	-90.52	2.3	Jonestown
July 30, 2012	32.54	-88.64	1.6	Meridian Station
July 27, 2012	32.56	-88.64	2.1	Meridian Station
May 10, 2008	34.35	-88.83	3.1	Sherman
October 26, 2002	34.03	-90.68	3.1	Duncan
August 11, 2002	34.34	-90.17	2.8	Batesville
May 10, 2008	34.35	-88.83	3.1	Sherman
October 26, 2002	34.03	-90.68	3.1	Duncan
August 11, 2002	34.34	-90.17	2.8	Batesville
February 25, 1999	34.1	-89.87	2.9	Oakland
August 11, 1996	33.58	-90.87	3.5	Meltonia
September 25, 1984	34.06	-89.82	Not available	Long Branch
February 5, 1983	34.70	-88.37	2.9	Cairo
October 12, 1980	34.26	-89.13	Not available	Turnpike
June 9, 1978	32.09	-88.58	3.3	Quitman
November 4, 1977	33.83	-89.28	3.4	Calhoun City
October 23, 1976	32.20	-88.73	3.0	Meridian
September 9, 1975	30.66	-89.25	2.9	Riceville
May 25, 1973	33.94	-90.63	Not available	Lombardy
January 1, 1973	33.78	-90.62	3.5	Ruleville
June 29, 1967	33.55	-90.81	Not available	Shaw
June 4, 1967	33.55	-90.84	4.4	Shaw
October 22, 1964	31.23	-89.56	Not available	Pine Grove
June 1, 1962	34.98	-90.18	Not available	Walls
September 27, 1956	31.9	-88.50	Not available	Shubuta

February 1, 1955	30.4	-89.10	Not available	Gulfport
June 28, 1941	32.4	-90.9	Not available	Vicksburg
December 17, 1931	33.8	-90.1	4.6	Oxberry
November 13, 1927	32.8	-90.20	Not available	Linwood
October 28, 1923	34.9	-88.10	Not available	Eastport
March 27, 1923	34.6	-89.8	Not available	Barr
March 31, 1911	34	-91.8	4.7	Tutwiler

Source: USGS

Table 3.10.2
Earthquakes Affecting Mississippi 2006 - 1812

Date	Origin	Magnitude	Maximum Intensity	Intensities Reported in MS	Counties Affected
September 10, 2006	253 miles SSW of Apalachicola, FL	6	VI	I, II, III, IV	Alcorn, Bolivar, Covington, Desoto, Forrest, George, Hancock, Harrison, Hinds, Jackson, Jones, Lauder- dale, Lee, Marion, Pearl River, Rankin, Scott, Walthall, Warren, and Webster
June 2, 2005	10 miles NNW of Dyersburg, TN	4	III	I	Alcorn, Desoto, Tate, Tishomingo, Tunica, and Yalobusha
May 1, 2005	15 miles WSW of Blytheville, AR	4.1	VI	I, II, III	Bolivar, Tate and Tunica
February 10, 2005	22 miles WSW of Blytheville, AR	4.1	V	I, II, III	Alcorn, Benton, Coahoma, Desoto, Itawamba, Jones, Lafayette, Lee, Marshall, Pontotoc, Prentiss, Tate, Tippah, Tishomingo, Tunica, and Union
November 7, 2004	25 miles SW of Tuscaloosa, AL	4	V	I, II, III, IV	Clay, Coahoma, Desoto, Lauderdale, Leake, Oktibbeha, Monroe, Newton, and Scott
April 29, 2003	8 miles ENE of Fort Payne, AL	4.6	V	I, II, III, IV	Alcorn, Chickasaw, Clay, Desoto, Hancock, Harrison, Itawamba, Lafayette, Lauderdale, Lee,

					Lowndes, Monroe, Oktibbeha, Panola, Prentiss, Tate, Tishomingo, and Yalobusha
March 29, 1972	New Madrid Seismic Zone	Not available	IV	I, II, III, IV	Bolivar, Desoto, and Panola
1811-1812	New Madrid Seismic Zone	7.8 - 8.1	XI	Not available	Affected counties as far as the Gulf Coast

Source: USGS and MDEQ Office of Geology

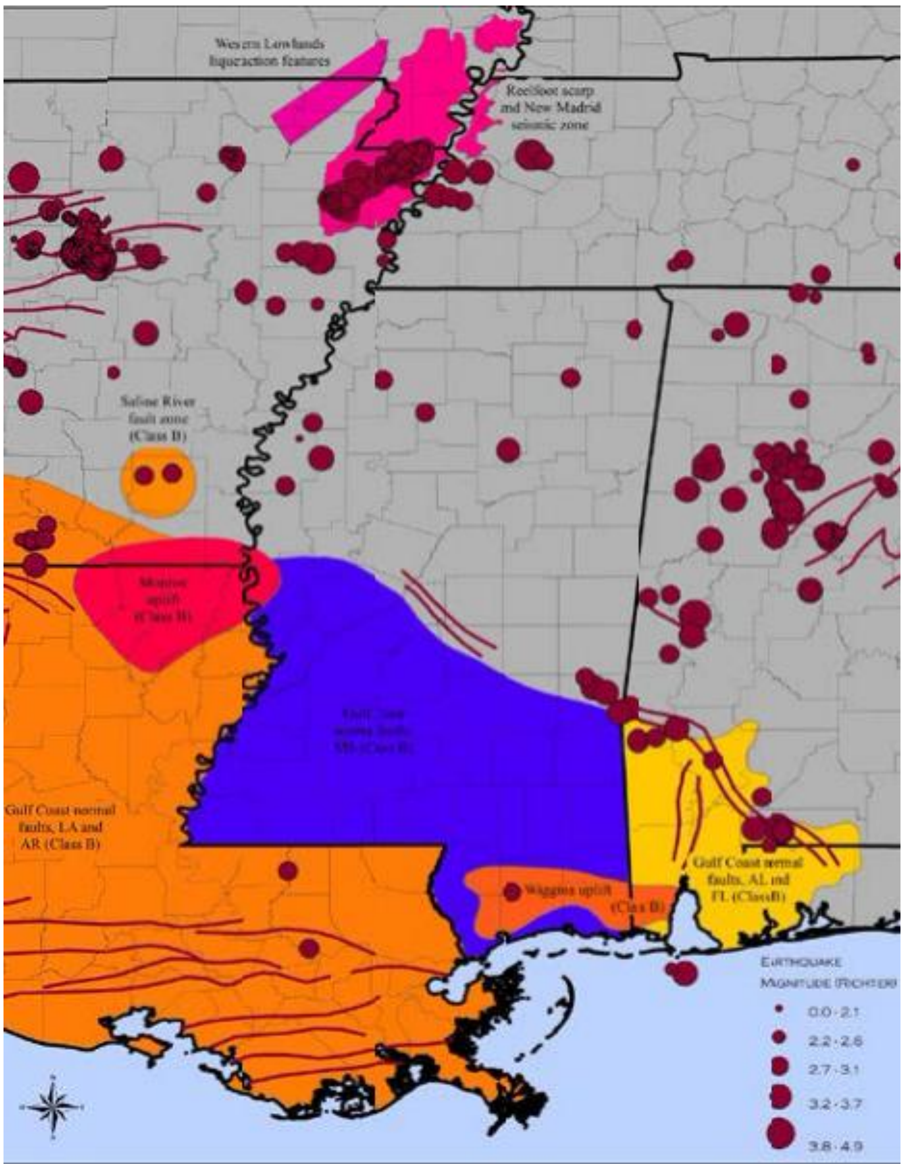
Table 3.10.3
Seismic Activity in Neighboring States
2010 – 2023

Year	State	Occurrences	Range of Magnitudes
2023	Tennessee	5	2.5-2.78
2022	Tennessee	9	2.5-3.21
2021	Tennessee Alabama	9 2	2.5-4.3 2.6-3.1
2020	Arkansas Tennessee Alabama	2 16 5	2.8 2.5-3.8 2.5-3.8
2019	Tennessee Alabama	20 5	2.5-3.69 2.5-3.1
2018	Alabama Tennessee	17 4	1.7 – 2.7 1.5 – 2.4
2017	Arkansas	75	.05 – 3.6
2016	Arkansas Tennessee	49	.09 – 2.8
2015	Arkansas Tennessee	64 5	1.3 – 2.5 2.5 – 3.5
2014	Arkansas Tennessee	126 5	1.3 – 2.7 2.5 – 3.1
2013	Arkansas Tennessee	181 1	1.5 – 3.2 2.6

2012	Arkansas Alabama Tennessee Arkansas	9 5 2 175	2.1 – 3.9 1.7 – 2.7 2.0 – 2.5 2.2 – 4.1
2011	Alabama Arkansas	8 70	1.8 – 3.5 1.8 – 4.0
2010	Alabama Louisiana	5 1	2.6 – 3.2 3

Source: USGS

Figure 3.10.1
Regional Earthquakes, Normal and Quaternary Faults and Fault Areas



Summary of Previous Events

Although the number of earthquakes known to have been centered within Mississippi's boundaries is small, the state has been affected by numerous shocks located in neighboring States. In the winter of 1811 and 1812, the NMSZ generated a sequence of earthquakes that lasted for several months and included three very large earthquakes estimated to be between magnitude 7 and 8. The three largest 1811-1812 earthquakes destroyed several settlements along the Mississippi River, caused minor structural damage as far away as Cincinnati, Ohio, and St. Louis, Missouri, and were felt as far away as Hartford, Connecticut, Charleston, South Carolina, and New Orleans, Louisiana. In the New Madrid region, the earthquakes dramatically affected the landscape. They caused bank failures along the Mississippi River, landslides along Chickasaw Bluffs in Kentucky and Tennessee, and uplift and subsidence of large tracts of land in the Mississippi River floodplain. One such uplift related to faulting near New Madrid, Missouri, temporarily forced the Mississippi River to flow backward. In addition, the earthquakes liquefied subsurface sediment over a large area and at great distances resulting in ground fissuring and violent venting of water and sediment. One account of this phenomenon stated that the Pemiscot Bayou "blew up for a distance of nearly fifty miles."

The 1811-1812 New Madrid sequence consisted of three large earthquakes:

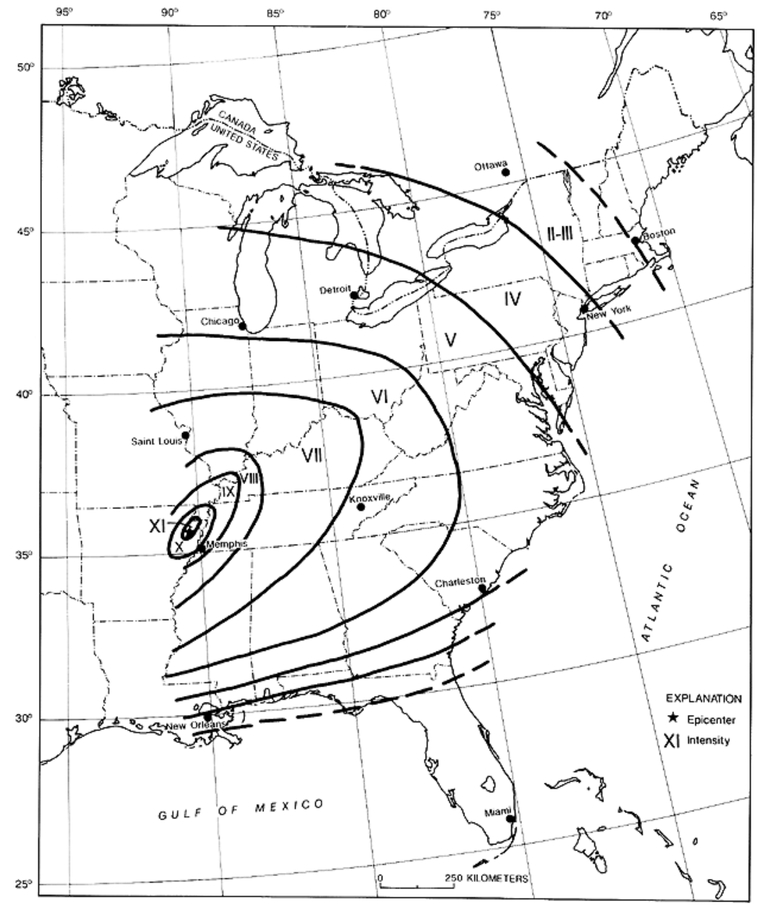
1. M-7.5 on December 16, 1811
2. M-7.3 on January 23, 1812
3. M-7.5 on February 7, 1812

According to some reports, the earthquakes of 1811-12 made the land roll like waves. There are letters and descriptions which tell how the land "rocked." The story of the first steamer trip down the Ohio and Mississippi Rivers has many times been told including anecdotes related to the Roosevelts on board finding themselves rocked and tossed about on the agitated waters.

A 19th-century print of New Madrid earthquake chaos. (Granger Collection, NYC)

Source: The Smithsonian

Figure 3.10.2
Isoseismal Map 1811 – 1812
(Isoseismal map for the Arkansas earthquake of December 16, 1811, 08:15 UTC (first of the 1811-1812 New Madrid series). – USGS)



The earliest and strongest earthquake reported in Mississippi occurred on December 16, 1931, at about 9:36 p.m. in Charleston. In the area of maximum intensity, the walls and foundation of the agricultural high school cracked, and several chimneys collapsed (intensity –VI-VII). At Belzoni, plaster fell and several chimneys were damaged (intensity VI). In Tillatoba, one chimney toppled and a vase was thrown to the floor (intensity VI). At Water Valley, several chimneys were damaged (intensity VI). The shock was perceptible over a 65,000-square-mile area including the northern two-thirds of Mississippi and adjacent portions of Alabama, Arkansas, and Tennessee.

On February 1, 1955, an earthquake was felt by many people along a 30-mile strip of the Mississippi Gulf Coast. In Gulfport, houses shook, windows and dishes rattled, and deep rumbling sounds were heard by many (intensity V). In Biloxi, several persons were alarmed and a rumbling noise was heard. Similar effects were noted at Mississippi City and Pass Christian. The tremor was reported by many persons in Bay St. Louis, where buildings creaked, and loose objects and windows rattled.

In June 1967, two earthquakes occurred about 18 miles northeast of Greenville, Mississippi. The first, on June 4, measured a magnitude of 3.8 on the Richter Scale and was felt over approximately 25,000 square miles. The region affected by this tremor included the northwest quadrant of Mississippi and parts of Arkansas, Louisiana, and Tennessee. A few instances of cracked plaster were reported in the epicentral region. One resident near the epicenter reported a ground crack 1/4 to 1/2-inch-wide and 39 feet long on his lawn.

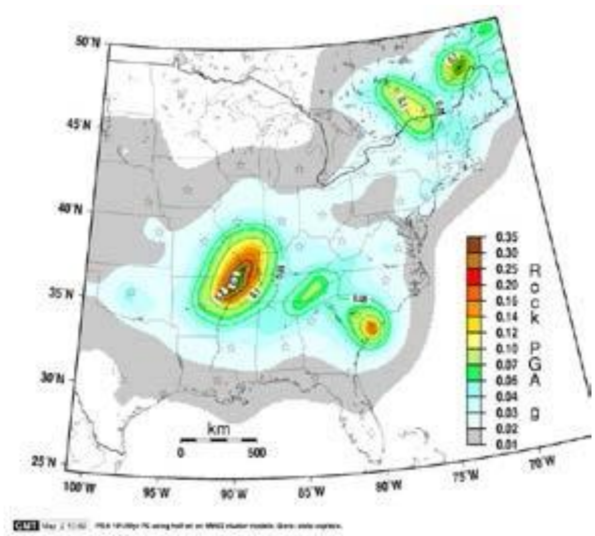
On June 29, a second earthquake occurred in the same region with a magnitude of 3.4. The shocks were limited to parts of Bolivar, Sunflower, and Washington Counties.

Another earthquake felt in Mississippi occurred on March 29, 1972. This shock, which was centered in the New Madrid, Missouri region, reached a peak intensity of IV in Mississippi at Hillhouse, Mineral Wells, and Pleasant Grove. Intensity I to III effects were noted in Horn Lake.

Potential Damages from Earthquakes

The potential for an earthquake to produce damage depends on many factors, such as the condition or construction of the affected structures, soil characteristics, and earthquake characteristics. Earthquake characteristics include magnitude, peak ground acceleration, and distance from the epicenter. The epicenter of an earthquake is located on the ground surface directly above the focus, or the location, where the earthquake begins. In most cases, the damage incurred by an earthquake is greatest near the epicenter and decreases with distance. Peak Ground Acceleration (PGA) is the maximum acceleration of a particle during an earthquake. More simply, PGA is the measure of the strength of the ground movement. An earth- quake's PGA is greatest near its epicenter, which explains why earthquake damage is greatest near the epicenter. Figure 3.10.3 provides the PGA potential for a ten percent in 50-year rupture of the New Madrid Fault along with the frequency at which the ground will shake. **Figures 3.10.4-a-b** on the subsequent page provide spectral acceleration for one and five-hertz ruptures.

Figure 3.10.3
Peak Ground Acceleration Rupture of the New Madrid Fault
10% in 50 Years Probability
The acceleration is measured as a percent of the acceleration due to gravity (g's)



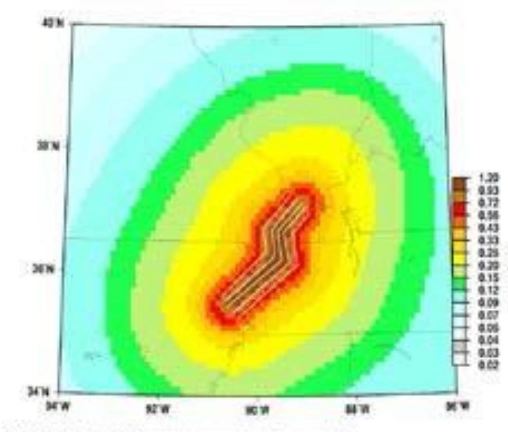
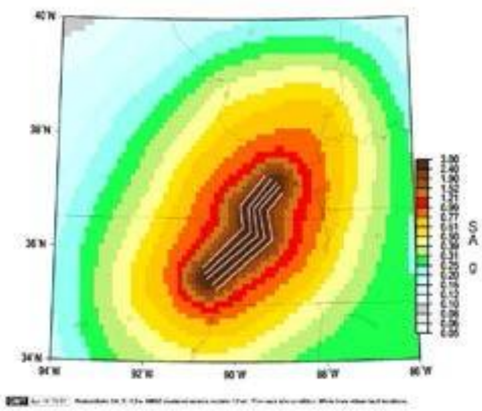


Figure 3.10.4-a
Spectral Acceleration at one Hz
Rupture of the New Madrid Fault
2% in 50 Years Probability

Figure 3.10.4-b
Spectral Acceleration at five Hz Rupture of the New Madrid Fault 2% in 50 Years Probability

Hz: Hertz, or cycles per second (frequency of ground shaking) SA measured in g's



Seismic waves may also create other earthquake-related hazards such as liquefaction and slope failure. Liquefaction occurs when loose sand and silt that is saturated with water is shaken by earthquake energy. The mixture takes on the qualities of a liquid when shaken and can result in a lack of structural support and eventual failure of a structure built upon the liquid-like soil. In Mississippi, liquefaction is more likely to occur where there is a significant floodplain. The rivers with significant floodplains located in seismic areas of concern in Mississippi include the Mississippi River, Yalobusha River, Yocona River, Tallahatchie River, and Coldwater River. As shown in **Table 3.10.4**, counties were evaluated based on their location within the aforementioned floodplains and seismic zone. This data has not been updated since the last plan. The liquefaction potential listed in the table references the HAZUS scenario for liquefaction potential in each county. Since the liquefaction data has not changed, the HAZUS scenario will remain the same.

Slope failure during a seismic event can result in extensive damage. The areas most likely to experience slope failure during an earthquake are the bluffs that bound the Mississippi River floodplain, river banks, steep slopes in the Bluff Hills, levees, earth-filled embankments, and transportation embankments.

Table 3.10.4
High Liquification Hazard by County

County	Seismic Source[1]	Geographic Area of Concern[2]	Liquefaction Potential
Benton	NMSZ	CRFP, WoRFP	Very High, Very Low
Bolivar	NMSZ	MRFP	Very High
Carroll	NMSZ, WRFZ	MRFP	Very High, Very Low
Coahoma	NMSZ, WRFZ	MRFP	Very High
DeSoto	NMSZ, WRFZ	MRFP, CRFP	Very High, Very Low
Grenada	NMSZ, WRFZ	MRFP, YaRFP	Very High, Very Low
Holmes	NMSZ	MRFP	Very High, Very Low
Humphreys	NMSZ	MRFP	Very High
Issaquena	NMSZ	MRFP	Very High
Lafayette	NMSZ, WRFZ	TRFP	Very High, Very Low
Leflore	NMSZ, WRFZ	MRFP, YaRFP	Very High
Marshall	NMSZ, WRFZ	CRFP	Very High
Panola	NMSZ, WRFZ	MRFP, TRFP, YRFP	Very High, Very Low
Quitman	NMSZ, WRFZ	MRFP, CRFP, TRFP, YRFP	Very High
Sharkey	NMSZ, WRFZ	MRFP	Very High
Sunflower	NMSZ, WRFZ	MRFP	Very High
Tallahatchie	NMSZ, WRFZ	MRFP, CRFP	Very High, Very Low
Tate	NMSZ, WRFZ	MRFP, CRFP	Very High, Very Low
Tunica	NMSZ, WRFZ	MRFP, CRFP	Very High
Union	NMSZ	TRFP	Very High, Very Low
Washington	NMSZ	MRFP	Very High

[1]NMSZ = New Madrid Seismic Zone

WRFZ = White River Fault Zone

[2]CRFP = Coldwater River Floodplain

MRFP = Mississippi River Floodplain

TRFP = Tallahatchie River Floodplain

WoRFP = Wolf River Floodplain (Major River originating in Tennessee)

YaRFP = Yalobusha River Floodplain

YRFP = Yocona River Floodplain

Earthquake Effects on Dams

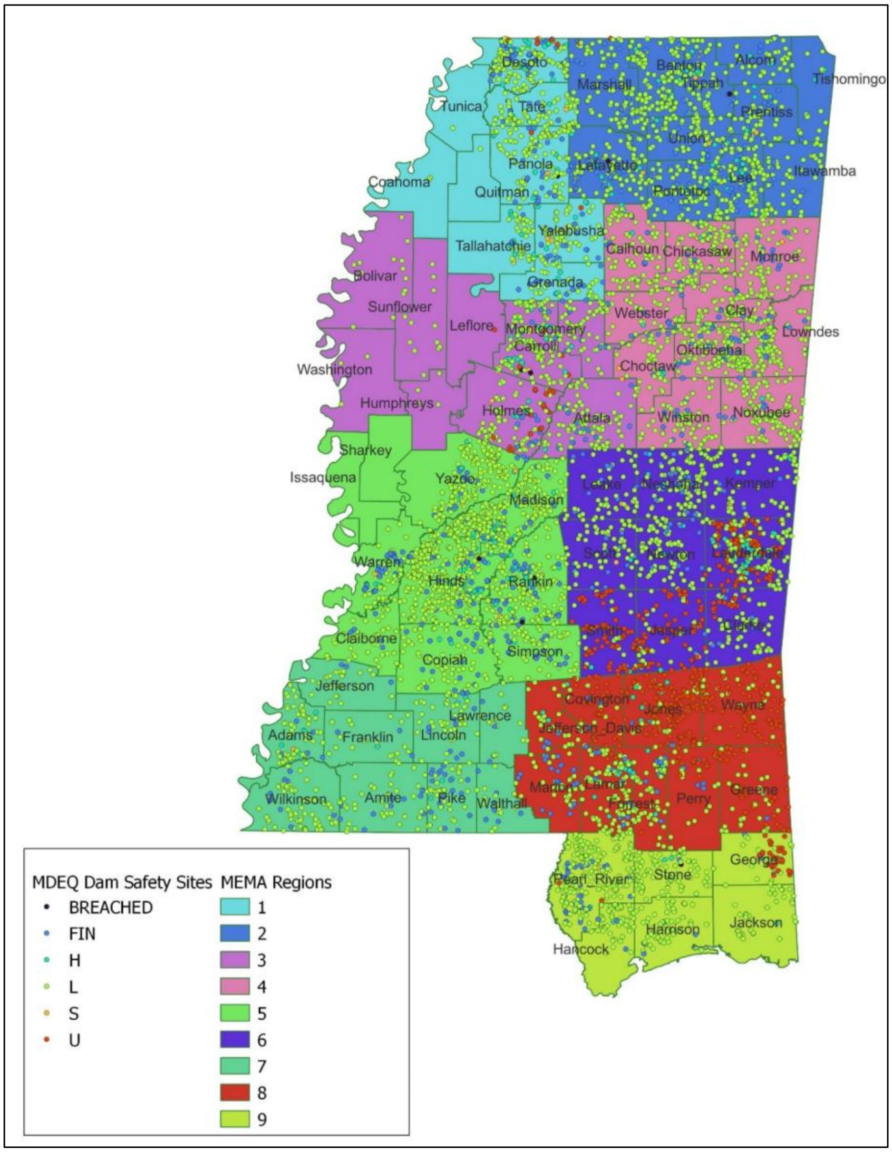
A review of the potential impacts of earthquakes for the 2023 plan update, revealed that the vulnerability of dams to the effects of earthquakes should continue to be addressed. To assess this potential threat, the inventory of dams for MEMA Regions 1 and 3 is provided in **Table 3.10.5** (the complete inventory of dams for all counties is provided in **Section 3.4**). These counties are located in areas that experienced impacts from previous tremors or are geographically susceptible to future impacts. **Figure 3.10.4** overlays the significant and high-hazard dams with the historic seismic recordings.

Table 3.10.5
Dam Inventory in Relation to Earthquake Prone Counties

MEMA District 1						
	2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**
Coahoma	0	0	2	0	0	2
DeSoto	1	24	120	5	54	204
Grenada	0	3	32	0	20	55
Panola	1	9	95	1	23	129
Quitman	0	0	1	0	0	1
Tallahatchie	1	11	35	0	2	49
Tate	1	4	65	0	8	78
Tunica	0	0	1	0	0	1
Yalobusha	3	8	53	1	12	77
Total	**7**	**59**	**404**	**7**	**119**	**596**

MEMA District 3						
	2023					
County	**S**	**H**	**L**	**U**	**FIN**	**Total**
Atalla	1	1	88	0	14	104
Bolivar	0	0	14	0	0	14
Carroll	4	24	114	4	5	151
Holmes	1	4	64	16	12	97
Humphreys	0	0	4	0	0	4
Leflore	0	0	0	1	0	1
Montgomery	0	2	48	0	7	57
Sunflower	0	0	12	0	0	12
Washington	0	0	3	0	0	3
Total	**6**	**31**	**347**	**21**	**38**	**443**

Figure 3.10.5
Significant and High Hazard Dam Locations



Bridge Retrofit Program

The Mississippi Department of Transportation (MDOT) conducts biennial inspections of all bridge structures. In anticipation of a future earthquake resulting from activity in the New Madrid Fault, it also monitors and inspects bridges that it has "retrofitted," or upgraded, to perform better as a result of newer technology developed to address a seismic event. The bridge retrofit program is concentrated on primary and secondary access routes in Northwest Mississippi. Retrofit activities consist basically of securing bridge caps to piers, thus increasing the probability of the structure will remain standing after an earthquake. Today, all new bridges are constructed using earthquake-resistant technology. **Table 3.10.6** provides a listing of bridges in Northwest Mississippi that have been upgraded to seismic retrofit.

Table 3.10.6
Bridges Retrofitted in Northwest Mississippi

Bridge ID	Feature Inspection	County	Highway
10932	Creek	Desoto	US 51
10941	Lake Cormorant	Desoto	US 61
10950	Coldwater River	Desoto	US 78
10951	Coldwater River	Desoto	US 78
10970	Horn Lake Creek	Desoto	SR 302
10983	Coldwater River	Desoto	SR 305
13155	Barrow Creek	Marshall	US 78
13156	Barrow Creek	Marshall	US 78
13167	Spring Creek	Marshall	US 78
13172	Spring Creek	Marshall	US 78 13173
14612	Canal & Shands Bottom Road	Tate	I-55
14615	Hickahala Creek	Tate	I-55
14616	Hickahala Creek	Tate	I-55
14617	Hickahala Relief	Tate	I-55
14618	Hickhala Relief	Tate	I-55
14621	Coldwater River	Tate	I-55
13156	Barrow Creek	Marshall	US 78
13167	Spring Creek	Marshall	US 78
13172	Spring Creek	Marshall	US 78 13173
14612	Canal & Shands Bottom Road	Tate	I-55
14615	Hickahala Creek	Tate	I-55
14616	Hickahala Creek	Tate	I-55
14617	Hickahala Relief	Tate	I-55
14618	Hickhala Relief	Tate	I-55
14621	Coldwater River	Tate	I-55
14622	Coldwater River	Tate	I-55
14631	Coldwater River	Tate	SR 3
14633	Arkabutla Canal	Tate	SR 3
13634	CNIC RR	Tate	SR 3
15413	Johnson Creek	Desoto	US 61

Probability of Future Events

The Central U.S. does not have as many earthquakes as the Western U.S. As a result, statistically valid data are not yet available for determining the probabilities of future earthquake events in this region. The USGS has stated that there are marked differences in determining probabilities of future earthquakes in California as opposed to along the NMSZ. On the west coast, locations of future earthquakes can be anticipated based on measurements of land deformation. Such predictions are much more difficult with earthquakes along the NMSZ. The NMSZ generates very little surface deformation over time; therefore, as seismic events occur along the New Madrid, data are collected and probabilities can be calculated. According to a study by the Center for Earthquake Research and Information (CERI) at the University of Memphis in 2002, the probability of a repeat of the 1811-1812 earthquakes in 50 years is 7-10%. In the same study, the probability of a magnitude 6.0 or greater earthquake within 50 years was estimated to be 25-40%. Since its admission into the Union in 1817, Mississippi has had only four earthjquakes of intensity V or greater within its borders. Although the number of earthquakes known to have been centered within Mississippi's boundaries is small, the State has been affected by numerous shocks located in neighboring States. In consideration of climate change**,** The connection between earthquakes and climate change is slightly less straightforward, and certainly less influential. Most earthquakes occur when tectonic plates within the Earth's crust change or move. Many things can lead to this, but where climate change comes into play is once again related to water. Earthquakes can be triggered or prevented by variability in stress on a fault between tectonic plates. Stress on these faults is impacted by surface water from rain or snow. When there is heavier rainfall, this precipitation and any subsequent flooding increases stress and decreases seismicity. When the season dries up and there's less water, the weight on the Earth's crust decreases and this can lead to microseismicity.

Local Plan Risk Assessment Summary

Below is a summary of the risk classification identified in the individual local mitigation plans, which includes all corresponding municipalities and Disaster Resistant University Plans by MEMA Region (Numbers reflect individual entity risk classifications rather than individual plans as entity classifications vary within plans):

MEMA Region	Low	Medium	High	MEMA Region	Low	Medium	High
1		2	7	6	9	-	-
2	1	-	11	7	9	-	-
3	8	2	-	8	7	-	-
4	10	1	-	9	4	-	-
5	43	2	1				

Vulnerability Assessment

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to predict earthquake losses on a regional scale. These loss estimates are used primarily by local, state, and regional officials to mitigate the risks from earthquakes and to prepare for emergency response and recovery. The earthquake loss estimates provided in this report were based on a region that includes all of Mississippi's counties.

The geographical size of the region is 47,651.55 square miles and contains 664 census tracts. There are over 1.117 million households in the region which has a total population of 2.93 million people (2022 Census Bureau data).

Commented [JE1]: Check the numbers

There are an estimated 1,241 thousand buildings in the region with a total building replacement value (excluding contents) of 280,518 (millions of dollars). Approximately 92.00 % of the buildings (and 75.00% of the building value) are associated with residential housing. The replacement value of the transportation and utility lifeline systems is estimated to be 95,370 and 27,142 (millions of dollars), respectively.

Results of the Earthquake Impact Assessment

Mississippi NMSZ Scenario

The HAZUS information estimates that about 72,788 buildings will be at least moderately damaged. This is over 6.00 % of the buildings in the region. There are an estimated 14,407 buildings that will be damaged beyond repair.

A NMSZ event in the southwest region of the NMSZ has the potential to cause intense shaking in Mississippi's northern counties. As a result, 25 counties are identified as critical and most of the damage incurred by the state of Mississippi is expected to occur in this set of counties. These 25 critical counties are highlighted in Figure 16 and are listed below:

- ✓ Alcorn
- ✓ Benton
- ✓ Bolivar
- ✓ Calhoun
- ✓ Chickasaw
- ✓ Coahoma
- ✓ DeSoto
- ✓ Grenada
- ✓ Itawamba
- ✓ Lafayette
- ✓ Lee
- ✓ Marshall
- ✓ Monroe
- ✓ Panola
- ✓ Pontotoc
- ✓ Prentiss
- ✓ Quitman
- ✓ Sunflower
- ✓ Tallahatchie
- ✓ Tate
- ✓ Tippah
- ✓ Tishomingo
- ✓ Tunica
- ✓ Union
- ✓ Yalobusha

Buildings in the northern portion of Mississippi are expected to incur moderate damage, with limited cases of complete damage confined to the critical counties listed above. 13,991 buildings are estimated to incur complete damage, all of which are in the 25 critical counties. Approximately 55,000 of the 58,000 moderate and severe damage cases occur in critical counties. Table 3.10.7 illustrates the distribution of building damage by occupancy type. Nearly all complete and moderate to severe damage is expected to affect residential structures, leaving 45,000 of the one million residential structures in Mississippi damaged.

As with many other NMSZ states, wood frame buildings and mobile homes are the most common structural systems. Less common in Mississippi are buildings constructed in the Unreinforced Masonry (URM) method. In Mississippi, approximately 7.5% of the total building inventory is URM construction. Nearly 71% of all complete damage occurs in mobile homes. Approximately 37% of all moderate damage is attributed to wood frame buildings, as shown in Table 3.10.8. It is also relevant to note that while steel, concrete, and precast (concrete) structures are a much smaller portion of the building inventory in Mississippi, approximately 9% of each of these building types experiences at least moderate damage, while 63% of mobile homes incur extensive damage.

Table 3.10.7
NMSZ Event Building Damage by Occupancy Type
for the State of Mississippi

General Occupancy Type Damage			
General Occupancy Type	**Total No. of Buildings**	**Moderate to Severe Damage**	**Complete Damage**
Single-Family	834,634	54,383	562
Other Residential	177,552	15,747	10,317
Commercial	51,200	4,585	2,169
Industrial	12,470	1,087	717
Other	15,928	1,436	643
Total	**1,091,784**	**77,238**	**14,408**

Table 3.10.8
NMSZ Event Building Damage by Building Type
for the State of Mississippi

Building Damage by Building Type					
Building Type	**None**	**Slight**	**Moderate**	**Extensive**	**Complete**
Wood	835,196	53,218	14,221	1,791	317
Steel	21,795	1,568	2,311	2,370	2,320
Concrete	6,143	495	536	420	335
Precast	6,218	425	551	405	306
Reinforced Masonry	2,577	141	180	138	94
Unreinforced Masonry	75,870	8,023	5,821	2,221	844
Mobile Home	144,006	13,367	14,689	12,726	10,193
Total	**1,091,784**	**77,237**	**38,309**	**20,071**	**14,409**

HAZUS indicates that the northernmost counties in Mississippi are vulnerable to damage and functional losses to essential facilities. Statewide, over 58 schools may potentially experience moderate damage, and over 1,151 may be damaged beyond the ability to function normally on the day after the earthquake, as shown in Table 3.10.9. Nearly all of these potentially damaged schools are located in Desoto, Tunica, Tate, Marshall, and Benton Counties. Lafayette, Union, Tippah, Alcorn, and Prentiss Counties may potentially experience substantial functional loss to schools immediately after the earthquake. There are potentially 27 moderately damaged fire stations and nearly 353 not functioning the day after the earthquake. Approximately, 103 hospitals will be potentially unable to function after the earthquake. Not only will this region be without medical care services for those injured by the earthquake, but care for existing patients will likely require transport to fully functioning facilities outside the critical counties.

On the day of the earthquake, the model estimates that only 14,695 hospital beds (82.00%) will be available for use by patients already in the hospital and those injured by the earthquake. After one week, 91.00% of the beds will be back in service. After 30 days, 97.00% will be operational.

The model also estimates that northwestern Mississippi transportation infrastructure will potentially experience damage. Table 3.10.10 illustrates that there are over 13,692 bridges statewide. Of this number, 347 bridges will potentially experience at least moderate damage and 13,359 bridges will not be functional the day after the earthquake. Most of these non-functional bridges are in Desoto, Tunica, Tate, and Marshall Counties. Five airports in northwest Mississippi will potentially incur at least moderate damage, though they are expected to remain fully functional. In some cases, damage to structures may not affect the functionality of the facility. Using airports as an example, some portion of the facility may be damaged, though enough of the facility's structure would remain undamaged so that the facility can remain operational, despite some damage to one portion of the facility.

Table 3.10.9
NMSZ Event Essential Facilities Damage
for the State of Mississippi

Essential Facilities Damage & Functionality				
Essential Facility Type	**Total No. Facilities**	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% on Day 1**
Hospitals	111	3	0	103
Schools	1,288	58	0	1,151
EOCs	37	1	0	34
Police Stations	368	13	0	330
Fire Stations	399	27	0	353

Table 3.10.10
NMSZ Event Highway Bridge Damage
for the State of Mississippi

Highway Bridge Damage Assessments				
	Total No. of Bridges	**At Least Moderate Damage (Damage >50%)**	**Complete Damage (Damage >50%)**	**Functionality >50% on Day 1**
Total No. of Bridges for State	**13,692**	**347**	**0**	**13,359**

Table 3.10.11
NMSZ Event Communication Facilities Damage
for the State of Mississippi

Communication Damage Assessments				
	Total No. of Communication Facilities	At Least Moderate Damage (Damage >50%)	Complete Damage (Damage >50%)	Functionality >50% on Day 1
Total State	**299**	**0**	**0**	**299**

The HAZUS model predicts that utility infrastructure will likely experience substantial losses, especially in the northwestern-most critical counties. Potential damage to communication infrastructure is shown in Table 3.10.11, which illustrates that nearly 300 communication facilities(mostly in Desoto and Tate Counties), would be at least moderately damaged. However, the model does indicate that damage to these facilities is not severe enough to cause a substantial loss of functionality.

There are approximately 1.117 million households in the State of Mississippi and nearly 42,000 of those would potentially be without potable water the day after the earthquake. In addition, 33,000 would not have electricity. Approximately 39,000 households would have potable water service restored after a week and approximately 6,000 households would have electricity restored in that same time. A lack of potable water service for an extended period may force some families to leave their homes, even if the home is not significantly damaged.

Table 3.10.12
NMSZ Event Utility Service Interruptions
for the State of Mississippi

Utility Service Interruptions Number of Households without Service						
	No. Households	Day 1	Day 3	Day 7	Day 30	Day 90
Potable Water	1,046,434	41,790	40,256	39,782	28,749	0
Electric Power		32,601	18,416	6,452	1,276	44

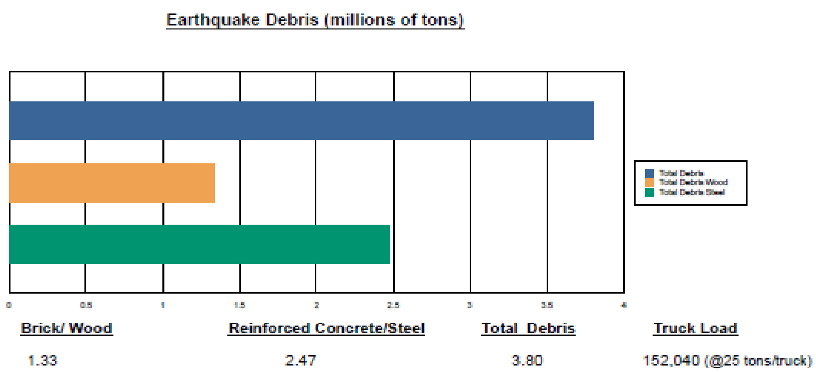
Social Impact and Direct Economic Loss

This section provides social impacts and direct economic losses for Mississippi from the scenario developed in the NMSZ Catastrophic Event Planning project. Induced damage is also included in this section and is quantified by various types of debris resulting from infrastructure damage. Social impacts include displaced residents, temporary shelter populations, various food, medical and housing requirements for sheltered populations, and casualties. Lastly, direct economic losses include estimates of building, transportation, and utility losses plus building loss ratios.

Mississippi New Madrid Seismic Zone Scenario

HAZUS estimates the amount of debris that will potentially be generated by the earthquake. The model sorts the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to manage the debris. The model estimates that a total of 3.80 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 35.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 152,040 truckloads (at 25 tons/truck) to remove the debris generated by the earthquake.

Figure 3.10.6
Debris Totals



HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates that 2,705 households will be displaced due to the earthquake. Of these, 2,085 people (out of a total population of 2,967,297) will seek temporary shelter in public shelters, as shown in Table 3.10.12. To care for this sheltered population, 2.7 million square feet of space are required, with 334,000 square feet reserved just for sleeping.

Table 3.10.12
NMSZ Event Shelter Requirements
for the State of Mississippi

Displaced and Shelter Seeking Population			
	Total Population	Displaced Population	Shelter Seeking Population
Total Nos. of State	**2,967,297**	**2,705**	**2,085**

Structural damage to buildings and infrastructure would potentially lead to approximately 1,000 injuries throughout the State of Mississippi. Over 75% of all injuries would be minor (Level 1) and 25% would potentially require delayed or immediate medical attention (Levels 2 & 3, respectively). Table 3.10.13 shows that 574 fatalities would potentially result in the modeling scenario.

The total economic loss estimated for the earthquake would potentially reach $9,206.92 million, including building and infrastructure losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

Potential building losses are divided into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. Business interruption losses are the losses associated with the inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

HAZUS estimates the total building losses at $8,791 million. 24% of the estimated losses were related to potential business interruptions in the region. The largest potential loss would be sustained by the residential occupancies which made up over 33 % of the total loss.

Table 3.10.13
NMSZ Event Casualties
for the State of Mississippi

Worst Case Casualties (2:00 PM)					
Severity Level	Level 1 (Green)	Level 2 (Yellow)	Level 3 (Red)	Level 4 (Black)	Total
Total State	**7,351**	**2,041**	**301**	**574**	**10,267**

Table 3.10.14
NMSZ Event Total Direct Economic Losses
for the State of Mississippi

Total Direct Economic Losses		
System	Inventory Value	Total Direct Economic Loss
Buildings	$6,675,238,000	$2,116,211,000
Transportation	$95,370,000	$159,500,000
Utility	$27,142,090	$255,980,000
Total	**$129,187,328,000**	**$417,596,211,000**

Transportation and Utility Lifeline Losses

For the transportation and utility infrastructure systems, HAZUS only computes the direct repair cost for each component. HAZUS does not predict losses for business interruption due to infrastructure outages. Tables 3.10.15 and 3.10.16 provide a detailed breakdown of the expected lifeline losses.

Figure 3.10.7
Transportation System Economic and Loss Ratio
(Millions of Dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	77,061.57	$0.00	0.00
	Bridges	10,003.59	$128.54	1.28
	Tunnels	0.00	$0.00	0.00
	Subtotal	**87,065.00**	**$128.50**	
Railways	Segments	4,469.84	$0.00	0.00
	Bridges	6.09	$0.02	0.33
	Tunnels	0.09	$0.00	0.00
	Facilities	71.90	$1.00	1.39
	Subtotal	**4,548**	**$1.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0**	**$0.00**	
Bus	Facilities	25.02	$0.81	3.25
	Subtotal	**25**	**$0.80**	
Ferry	Facilities	5.32	$0.02	0.46
	Subtotal	5	**$0.00**	
Port	Facilities	413.38	$6.56	1.59
	Subtotal	**413**	**$6.60**	
Airport	Facilities	617.76	$22.53	3.65
	Runways	2,695.44	$0.00	0.00
	Subtotal	**3,313**	**$22.50**	
	Total	**95,370.00**	**$159.50**	

Figure 3.10.8
Utility System Economic and Loss Ratio
(Millions of Dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Portable Water	Pipelines	0.00	$0.00	0.00
	Facilities	481.20	$0.97	0.20
	Distribution Lines	2,313.70	$0.00	0.00
	Subtotal	**2,794.85**	**$0.97**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	18,964.40	$216.28	1.14
	Distribution Lines	1,388.20	$0.00	0.00
	Subtotal	**20,352.55**	**$216.28**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	51.00	$0.48	0.93
	Distribution Lines	925.50	$0.00	0.00
	Subtotal	**976.42**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.90	$0.00	0.04
	Subtotal	0.85	**$0.00**	
Electrical Power	Facilities	2,992.00	$38.02	0.46
	Subtotal	**2,992.00**	**$38.02**	
Communication	Facilities	25.40	$0.23	1.59
	Subtotal	25.40	$0.23	0.91
	Total	**27,142.09**	**$255.98**	

3.11: Climate Change/Sea Level Rise Risk Assessment

Hazard Description

The National Aeronautics and Space Administration (NASA) defines climate change (often referred to as global warming) as a long-term change in the average weather patterns that have come to define the Earth's local, regional, and global climates. The Wood's Hole Oceanographic Institution defines sea level rise as an increase in the ocean's surface height relative to the land in a particular location. Sea level rise is generally considered symptomatic of climate change or global warming. Two major factors typically influence sea levels on a regional or global basis. First, the warming of the ocean causes it to expand. This effect, confined mostly to the ocean's top 2,300 ft (701 m), is called thermal expansion or thermosteric expansion. Second, the melting of glaciers and other bodies of ice causes the total mass of water in the oceans to increase.

The heat energy causing both thermal expansion and ice melting comes from the warming of the atmosphere, which is primarily believed to be influenced in recent decades by human activities. Retention of liquid water on the continents by damming of rivers, for example, makes a small negative contribution to sea-level rise by withholding some water from the oceans.

Hazard Profile

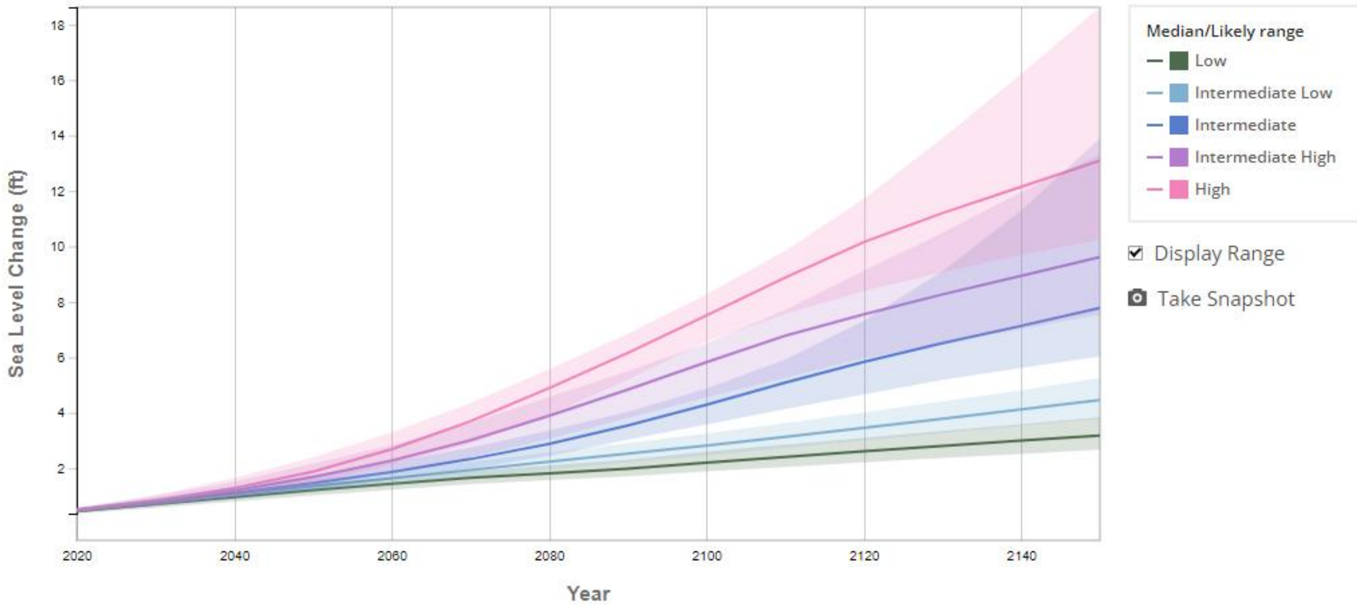
Scientists agree that the changes in climate that we are seeing today are largely caused by human activity and that climate change is driving increases in sea levels. Sea levels started rising in the late 1800s, and soon after we started burning coal, gas, and other fossil fuels for energy. When burned, these high-energy fuel sources send carbon dioxide up into the atmosphere. Carbon dioxide absorbs heat from the sun and traps it, warming the atmosphere and the planet.

As the planet gets warmer, the sea levels rise for two reasons. First, warmer temperatures cause ice on land like glaciers and ice sheets to melt, and the meltwater flows into the ocean to increase the sea level. Second, warm water expands and takes up more space than colder water, increasing the volume of water in the sea.

The Intergovernmental Panel on Climate Change (IPCC), a key body that publishes the scientific consensus on global warming, has suggested that average global sea levels have risen by around .12 inches annually since the early 1990s. That number is expected to increase in the coming decades as the effects of climate change continue, leading to an increase of somewhere between 2.5 feet and 6.2 feet by 2100, according to an analysis of IPPC projections published in the journal *PNAS* (Proceedings of the National Academy of Sciences).

In the late 1800s, after two or three thousand years of stability, the sea level began to rise steadily at about 0.07 inches per year. From 1993 to 2007, the rate of sea-level rise increased to about 0.12 inches per year. Recent data compiled by The Water Institute indicates that sea levels specific to the Gulf of Mexico and the Mississippi Gulf Coast may be increasing at a rate faster than that indicated in earlier IPCC reports. **Figure 3.11.1** illustrates a variety of projected sea level increase scenarios through the year 2140 at the Bay Waveland Yacht Club located in Bay St. Louis, Mississippi.

Figure 3.11.1
Sea Level Projections 2020-2140
Bay Waveland Yacht Club, Mississippi



In addition, **Figure 3.11.2** illustrates the potential impacts of an additional 3' of sea level rise on the Mississippi Gulf coast.

Figure 3.11.2
3' of Sea Level Rise
Mississippi Gulf Coast

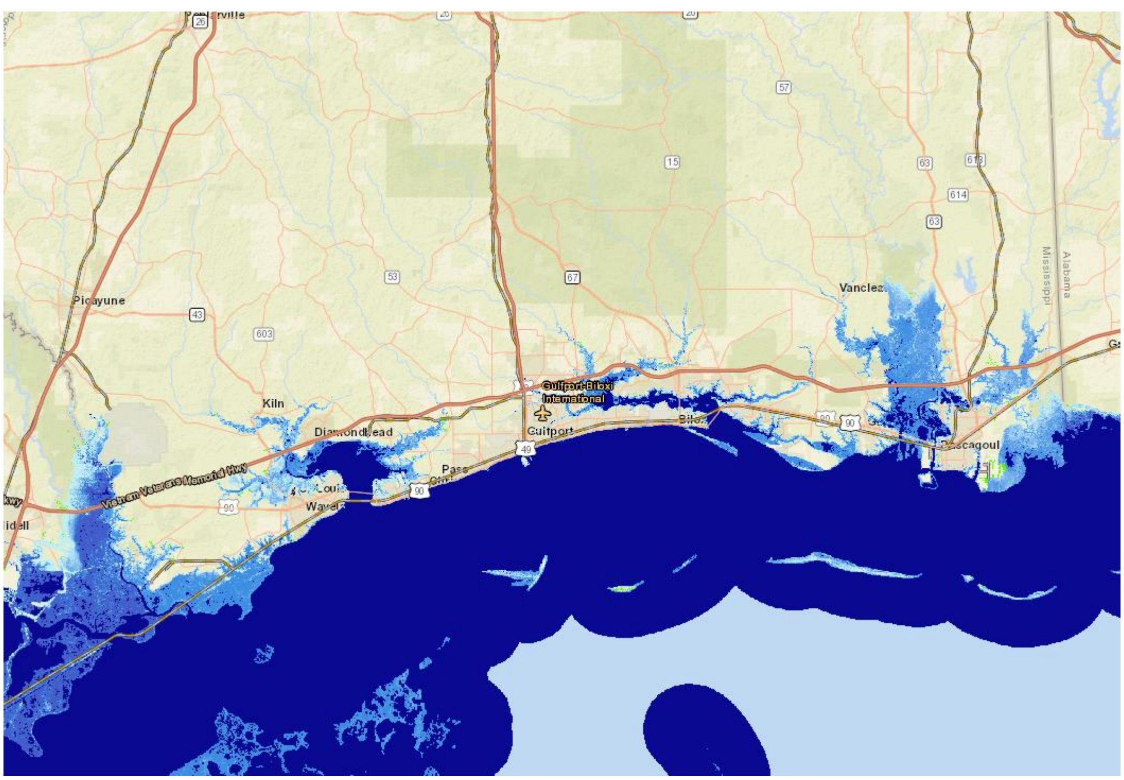
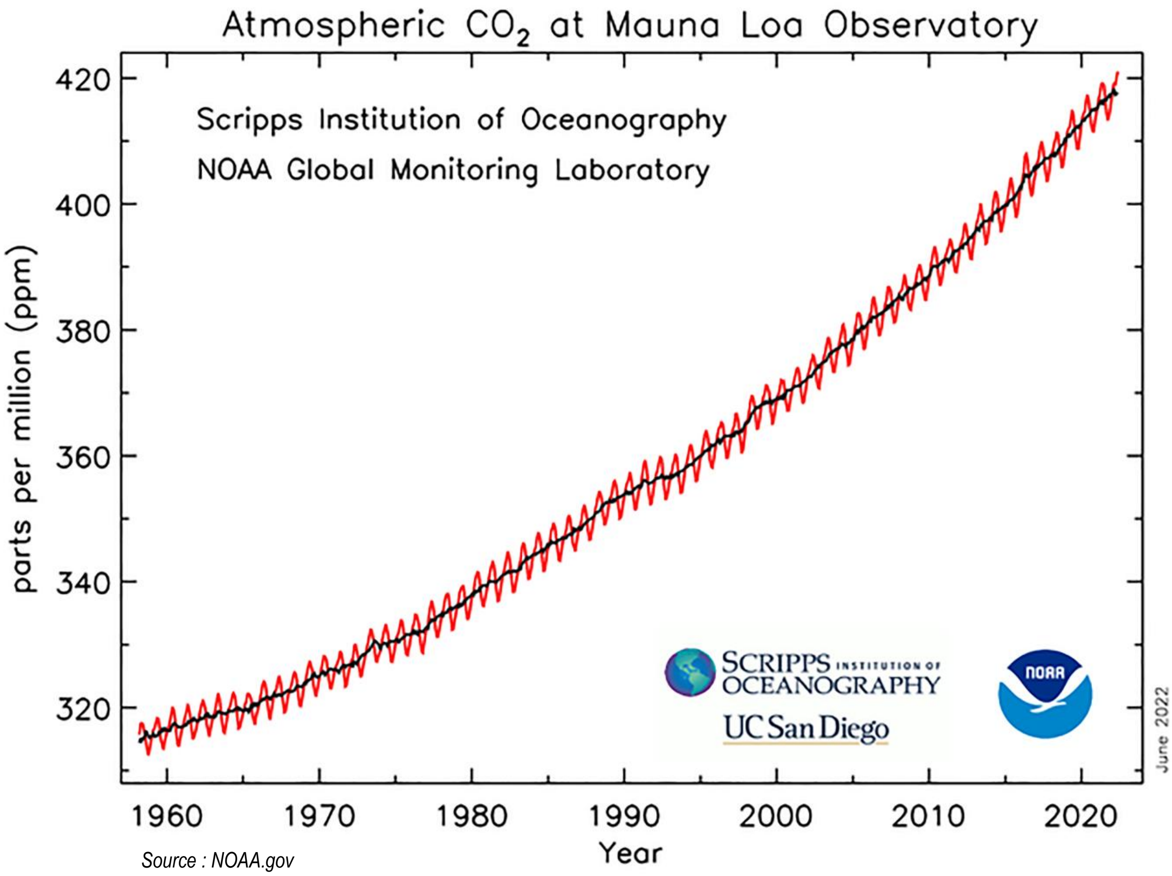


Figure 3.11.3
Carbon Dioxide Emissions



Source : NOAA.gov

Figure 3.11.3 depicts measurements of carbon dioxide in the atmosphere since 1958. The amount of carbon dioxide (CO2) in the atmosphere has been measured at Mauna Loa Observatory in Hawaii since the 1950s. There has been a steady rise in carbon dioxide since the measurements began, and you can see the rise and fall yearly due to plants growing and absorbing CO2 every spring and summer. In 2015, the annual growth rate jumped by 3.05 parts per million, the largest year-to-year increase in their 56 years of measurements.

Some scientists surmise that over the past 20,000 years or so, sea levels have increased approximately 400 feet. As the climate warmed as part of a natural cycle, the ice melted, and glaciers retreated until ice sheets remained only at the poles and at the peaks of mountains. Early on, the sea rose rapidly, sometimes at rates greater than 10 feet per century, and then continued to increase in periods of rapid sea level rise until about 7,000 years ago. Then, the climate stabilized and sea level rise slowed, holding largely steady for most of the last 2,000 years, based on records from corals and sediment cores. Now, however, sea levels are on the rise again, rising faster than it has in the past 6,000 years**.** The oldest tide gauges and coastal sediment preserved beneath swamps and marshes show that sea levels began to rise around 1850, which is consistent with the time people started burning coal to propel steam engine trains. The climate likely started warming as a part of a natural cycle, but the accelerated warming in the last two hundred years is due to a rise in atmospheric carbon dioxide. The resulting rise in sea level is likely twice what we would have seen without the increase in greenhouse gasses due to human activities.[1]

Currently, the global sea level is 5 to 8 inches higher on average than it was in 1900. Between 1900 and 2000, the global sea level rose between 0.05 inches and 0.07 inches per year on average. In the 1990s, that rate jumped to around 0.12 inches per year. In 2016 the rate was estimated to be 0.13 inches per year and the rate is expected to increase by the end of the century. Scientists with the IPCC predict that sea levels will rise approximately 0.10 inches for every degree (°F) that climate change warms the planet. What scientists do not know is how long it will take for the sea level to catch up to the temperature increase. Whether it takes another 200 or 2000 years largely depends on how quickly the ice sheets melt. Even if global warming were to stop today, sea levels would continue to rise.

Location and Extent

As climate change and sea levels increase, storms and flooding will happen more frequently. The closer the sea is to communities, the greater the risk is for these impacts to affect areas of human habitation and activity. Flooding over roads, which is already becoming more common in some places during high tides, can affect the safety of motorists and prevent the passage of emergency vehicles.

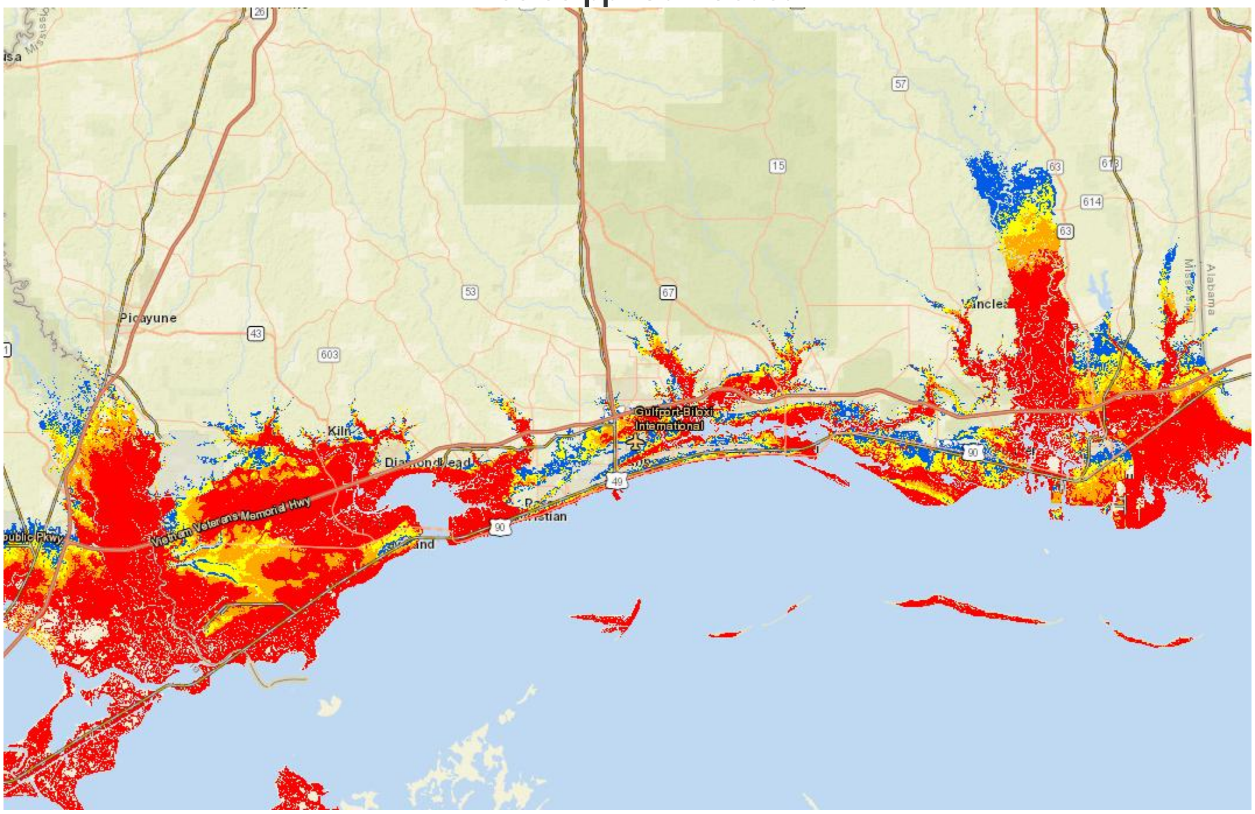
A 2014 Reuters analysis found that before 1971, water reached flood levels no more than five days every year (on average) in several U.S. east coast cities. Since 2001, however, that number has risen to 20 days or more (on average). These tidally and seasonally influenced events are currently considered a nuisance. However, as they become more frequent and increase in intensity, these inconveniences will have more dramatic impacts on the economy, people's lives, and daily activities.

Sea level rise will also increase the impact of storm surges associated with hurricanes and other tropical systems, causing the surges to increase and potentially rather farther inland. As the ocean warms from climate change, it will provide more energy to hurricanes, potentially making them stronger. Data from NOAA indicates that hurricanes may increase in intensity from 2 to 11 percent over the next century.

Figure 3.11.4 shows the potential impacts of storm surge from a Category 3 hurricane and **Figure 3.11.5** illustrates the existing impacts of high tide flooding without the consideration of additional sea level increases.

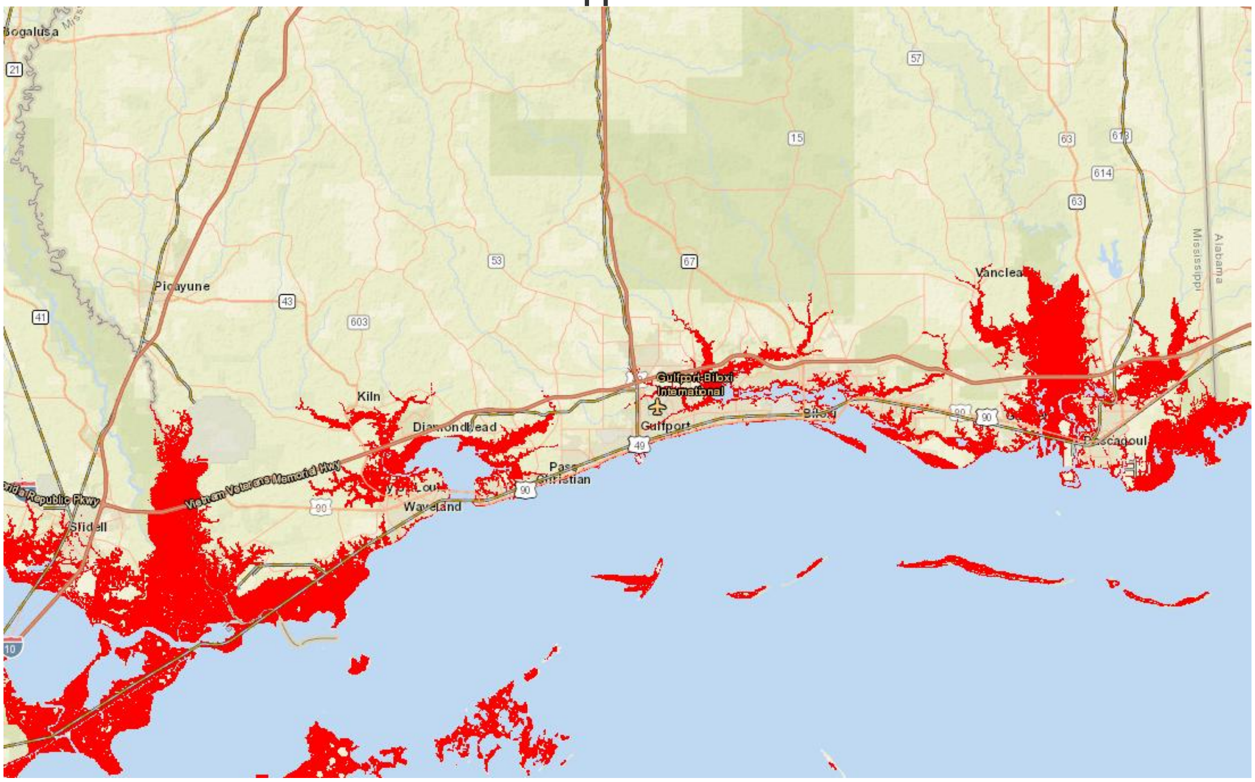
[1] Sea Level Rise by The Ocean Portal Team; Reviewed by Dr. Joshua K. Willis, NASA-JPL; Dr. Andrew Kemp, Tufts University; and Dr. Benjamin H. Strauss, Climate Central.

Figure 3.11.4
Category 3 Storm Surge
Mississippi Gulf Coast



Source: Coast.noaa.gov

Figure 3.11.5
High Tide Flooding
Mississippi Gulf Coast



Source: Coast.NOAA.gov

Previous Occurrences

Since studies show that sea level rise increases coastal flood risk, that global warming contributes to sea level rise, and that global warming effectually multiplies flood risk. We can conclude then we can logically attribute the increases in frequency and intensity of storm events to sea level rise/climate change.

As sea levels rise, dangerous storm surges will become more frequent and powerful and coastal flooding will become more frequent. Storm surges already present the biggest danger associated with hurricanes. During Hurricane Katrina in 2005, storm surges of 10 to 28 feet destroyed buildings in Louisiana and Mississippi, flooded parts of New Orleans, and were responsible for approximately 1,200 fatalities.

Probability of Future Occurrences

Predicting future climate change-related sea level rise is difficult because scientists do not know how quickly the planet will respond to the warming climate.

The IPCC is the International United Nations group tasked with summarizing climate change research every few years. Their 2013 report projected that the sea level will rise by 2 to 3 feet by the year 2100 if we do not slow our carbon dioxide emissions by using less energy or the use of renewable energy. However, more recent and more local projections indicate that sea levels in the northern Gulf of Mexico (directly affecting the Mississippi Gulf Coast) could increase from between 2.2 to 7.5 feet by the year 2100. This projected sea level rise is enough to pose a significant threat to critical resources and infrastructure along the Mississippi Gulf Coast. Even if we reduce our emissions, the report predicts that by the year 2100 sea levels will rise by 1 to 2 feet, enough to cause significant increases in coastal flooding and erosion.

Vulnerability Assessment

Because of its relatively flat topography, Coastal Mississippi is potentially more susceptible to sea level rise than other coastal regions with more relative topographic increases. The majority of the people, property, and infrastructure potentially affected by sea level rise in Mississippi are in Jackson, Hancock, and Harrison counties. Within the State of Mississippi, some $1.5 billion in property values plus more than 14,500 people living in more than 8,000 homes sit on 131 square miles of land less than 6 feet above the local high tide line. The exposure of populations with high social vulnerability is disproportionately high, 50% greater than would be expected by chance alone. Of the exposed high-vulnerability population, more than 60% live in just one zip code, in Bay St. Louis. Compared to 6 feet, more than double the total property, population, and housing sit on land below 10 feet: $3.7 billion and nearly 44,000 people living in more than 22,000 homes, across 227 square miles.[2]

Based on estimates gathered by Climate Central, nonresidential buildings and infrastructure are at risk as well. All told, 386 miles of roads lie on land below 6 feet in the state; 2 museums; 2 schools; 9 houses of worship; 2 power plants; and 57 EPA-listed sites, screened to include mostly hazardous waste sites, facilities with significant hazardous materials, and wastewater generators. At 10 feet, these numbers amount to 898 miles of road, 4 museums, 6 schools, 60 houses of worship, 2 power plants, and 112 EPA-listed sites.

Figure 3.11.6 shows the Coastal Flood Hazard Composite including areas prone to flooding from one or more of the following hazards:

- High tide flooding,
- High-risk flooding (1% A and V Zones),
- Storm surge for Category 1-3 hurricanes, and
- Sea level rise scenarios for 1-3 feet.

The map also shows critical facilities and infrastructure potentially at risk from these hazards including fire stations, public safety facilities, hospitals, and schools.

Discussions of climate change often center around coastal environments. However, climate change impacts will also potentially affect other elements of life in Mississippi including inland flooding and river transportation, agricultural production, forest resources, and human health. Vicksburg, Natchez, and Port Gibson are vulnerable to high water levels on the Mississippi River. Since 1958, the amount of precipitation during heavy rainstorms has increased by 27% in the Southeast, and this trend is likely to continue. Climate change-induced droughts create a different set of challenges. During severe droughts in the Mississippi River Watershed, low flows can restrict commercial navigation. For example, low water levels in 2012 forced the

[2] Mississippi and the Surging Sea a Vulnerability Assessment with Projections for Sea Level Rise and Coastal Flood Risk, published by Climate Central.

U.S. Army Corps of Engineers to reduce allowable barge sizes on the Mississippi River and close the river at Greenville for more than a week, delaying approximately 100 barges.

Changing climates will potentially have both harmful and beneficial effects on farming. The number of hot weather days (>95 degrees F) will likely increase. Hotter summers may reduce yields of corn. However, higher concentrations of atmospheric carbon dioxide increase crop yields, and the fertilizing effect is likely to offset the harmful effects of heat on soybeans, cotton, wheat, and peanuts – if enough water is available. Higher temperatures are also likely to reduce livestock productivity because heat stress disrupts the animals' metabolism.

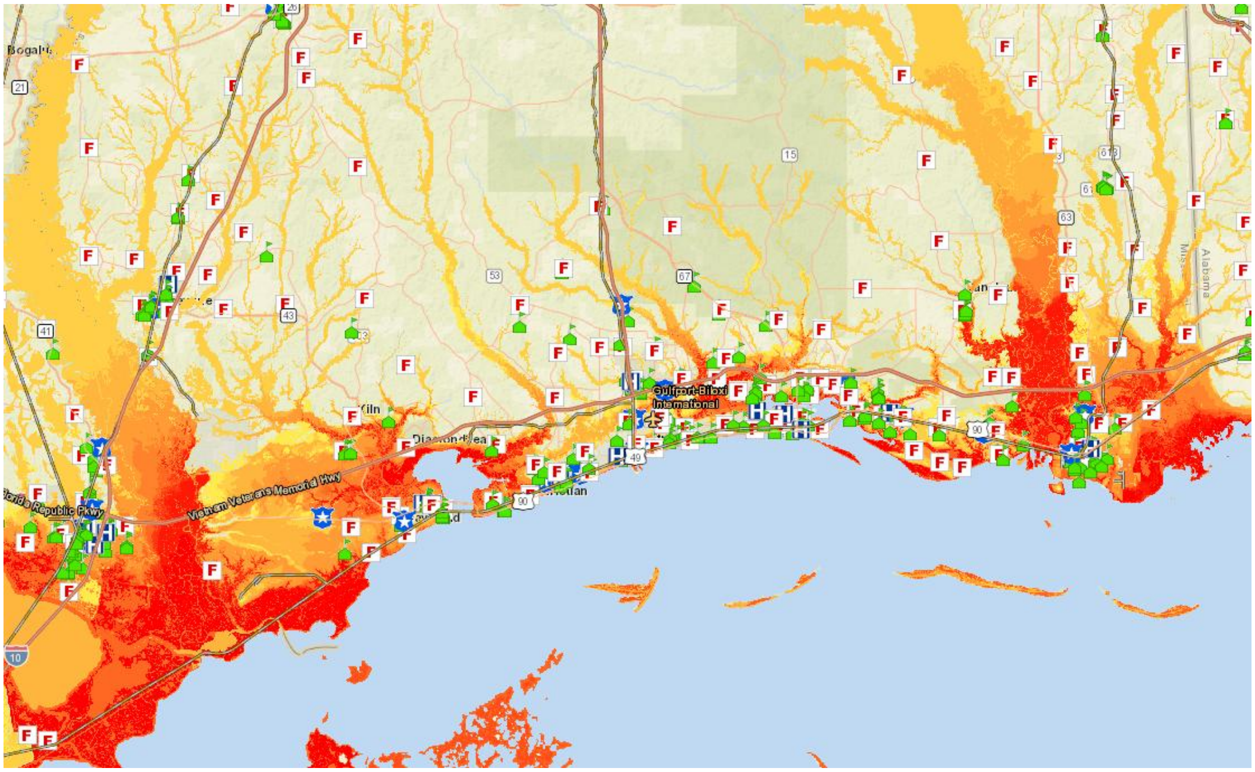
Higher temperatures and changes in rainfall are unlikely to significantly reduce forest cover in Mississippi, although the composition of trees in the forests may change. More frequent droughts would reduce forest productivity and increase potential damage from insects and diseases. As the climate warms, forests in southern Mississippi are likely to have more oaks and white pines, and fewer loblolly and longleaf pines.

Hot days can be unhealthy, and even dangerous to human populations. Children, the elderly, the sick, and the poor are particularly susceptible to the effects of prolonged high temperatures. Heat stroke, dehydration, and impacts on cardiovascular and nervous systems are all human impacts from long-term exposure to extreme heat.

Local Plan Risk Assessment Summary

At the time of this update, none of the local or regional plans have addressed climate change as part of their most recent updates. Sea level rise was addressed at a very low number.

Figure 3.11.5
Coastal Flood Hazard Composite
At-Risk Critical Facilities



Source: coast.NOAA.gov

Impacts of Climate Change

With increasing global surface temperatures, the possibility of more droughts and increased intensity of storms will likely occur. As more water vapor is evaporated into the atmosphere, it becomes fuel for more powerful storms to develop. Tropical storms become more severe due to warmer ocean water temperatures. More heat in the atmosphere and warmer ocean surface temperatures can lead to increased wind speeds in tropical storms. Rising sea levels expose higher locations not usually subjected to the power of the sea and to the erosive forces of waves and currents. Changes in climate not only affect average temeratures, but also extreme temperatures, increasing the likelihood of weather-related natural disasters. If global climate change causes the global average temperature to rise, there will be less cold weather, and a greater probability of hot and record hot weather. An increase in average temperature combined with increased variance will have little effect on cold weather, but hot weather will be more common and record hot weather will increase greatly. Below are some of the regional impacts of global change forecast by the Intergovernmental Panel on Climate Change:

- North America: Decreasing snowpack in the western mountains; 5-20 percent increase in yields of rain-fed agriculture in some regions; increased frequency, intensity and duration of heat waves in cities that currently experience them.

Floods

The connection between floods and climate change comes down to a few ways that climate change is impacting water. First, higher temperatures lead to increased levels of evaporation, creating denser clouds that hold more water. This eventually leads to heavier precipitation that can cause flooding. Second, more frequent and intense storms such as hurricanes can lead to floods. Finally, higher sea levels due to melting glaciers can also prompt coastal flooding. Floods can also be exacerbated by how humans manage waterways and spur urbanization.

The flooded Mississippi River surrounds the homes on Abel Island near Guttenberg, Iowa, on Tuesday, April 25, 2023. (Stephen Gassman/Telegraph Herald via AP)
The cities, villages and farms along America's most famous river are in flood mode again.

Floods are already the most common and costly weather disasters in the United States. They will get much worse as climate change accelerates snow melt and produces more intense rainstorms. Unfortunately, these adverse impacts are increasing while dams and levees are aging and suffering from deferred maintenance.

The average flood-control dam in the United States was built nearly 60 years ago, while the average levee is past 50. Engineers built most of these structures to remain reliable for only 50 years. Virtually none were designed to handle the size and intensity of today's floods

.

Storms

Storms are impacted by climate change in the same way that some floods are, via the effect that higher temperatures have on evaporation and subsequent precipitation. With clouds holding increased amounts of water vapor, more powerful storms develop.

Earthquakes

The connection between earthquakes and climate change is slightly less straightforward, and certainly less influential. Most earthquakes occur when tectonic plates within the Earth's crust change or move. Many things can lead to this, but where climate change comes into play is once again related to water. Earthquakes can be triggered or prevented by variability in stress on a fault between tectonic plates. Stress on these faults is impacted by surface water from rain or snow. When there is heavier rainfall, this precipitation and any subsequent flooding increases stress and decreases seismicity. When the season dries up and there's less water, the weight on the Earth's crust decreases and this can lead to microseismicity.

Extreme Temperatures

Climate change can lead to both extreme high temperatures and extreme low temperatures. The connection with extreme high temperatures is more intuitive — greenhouse gases are being trapped in the atmosphere and this leads to warming. However, the connection to extreme low temperatures can be harder for some people to make. Lower temperatures in some regions are a result of the polar vortex being warmer, causing it to weaken and dip down further than it normally would, bringing with it colder temperatures. This is further exacerbated by impacts to the jet stream that change the pattern of where and when hot and cold temperatures typically occur. These two combined have led to hotter summers and harsher winters in some areas.

Droughts

On the other side of the water spectrum are droughts, though they result from the same process. Droughts are a natural part of the climate cycle, but climate change is making them more frequent, severe, and prolonged. While higher levels of evaporation lead to eventual severe rainfall, in some regions, this shift means drier conditions due to the loss of the evaporated water, which can lead to drought and dried out soils and vegetation. With climate change, places that are traditionally dry are becoming drier through the higher levels of evaporation and places that are traditionally wet are becoming wetter through the higher levels of rainfall that result.

Wildfires

Although there is no direct relationship between climate change and fire, researchers have found strong correlatons between warm summer temperatures and large fire years, so there is general consensus that fire occurrence will increase with climate change. Wildfires are a consequence of the drier conditions caused by climate change in some areas. The wildfire season is much longer than in previous years and the number of wildfires per season has tripled. Severe heat and drought provide fuel for fires through drier soils and vegetation that is more flammable. Additionally, due to warmer temperatures, snowpacks are melting earlier, meaning that forests are drier for longer periods of time and increasingly at risk of fires.

Dams and Levees

Faced with major floods every other year along some stretches of the Upper Mississippi, which has historically had fewer levees than the lower part of the river, many floodplain managers have built up levees and flood walls, even though doing so will only make the problem worse in the long-term, *Chicago Review Press*. According to the *European Geosciences Union*, the projected alterations due to climate change are likely to affect different factors driving dam risk. The global effect can be assessed through the integration of the various projected effects acting on each aspect of the risk, from the input hydrology to the calculation of the consequences of the flood wave on population and assets at risk. This will provide useful information for dam owners and dam safety practitioners in their decision-making process.

This focus is on the dam safety hydrological impacts of climate change, which means that floods are the main load component to which the dam–reservoir system is subjected.

It is worth mentioning that risk impacts of climate change are conditioned by climatic but also by non-climatic drivers, such as population increase, economic development, or water management adaptation. In certain cases, these non-climatic drivers may have a significant influence in the dam risk calculation and have been considered in the research.

Moreover, climate change can impact both normal components (such as the population exposure downstream of the dam) and extreme components (such as the flood events) of risk, which can be captured by using the proposed risk analysis approach.

3.12: Cyberterrorism Risk Assessment

Hazard Description

A cyber-attack is a malicious, intentional attempt to breach the information technology (IT) infrastructure of an individual or organization. The State of Mississippi defines a cyberterrorism incident as any adverse premeditated, politically, financially, or maliciously motivated attack against information systems. A cyberterrorism event can impact one or more State or local government departments and divisions' information assets in the following ways:

- Unauthorized use
- Malicious coding
- Application system failures
- Security breaches
- Backdoor trojans
- Malware
- Denial of service
- Network system failures
- Loss of data
- Injection of Structured Query Language (SQL)
- Phishing
- Ransomware

Incidents often target specific types of data including:

- Financial data
- Databases
- Login credentials
- IT services
- Client or constituent lists
- Email addresses
- IT Infrastructure
- Personal data

The motives behind cyberterrorism attacks can vary. Some of the motives behind cyber attacks may include:

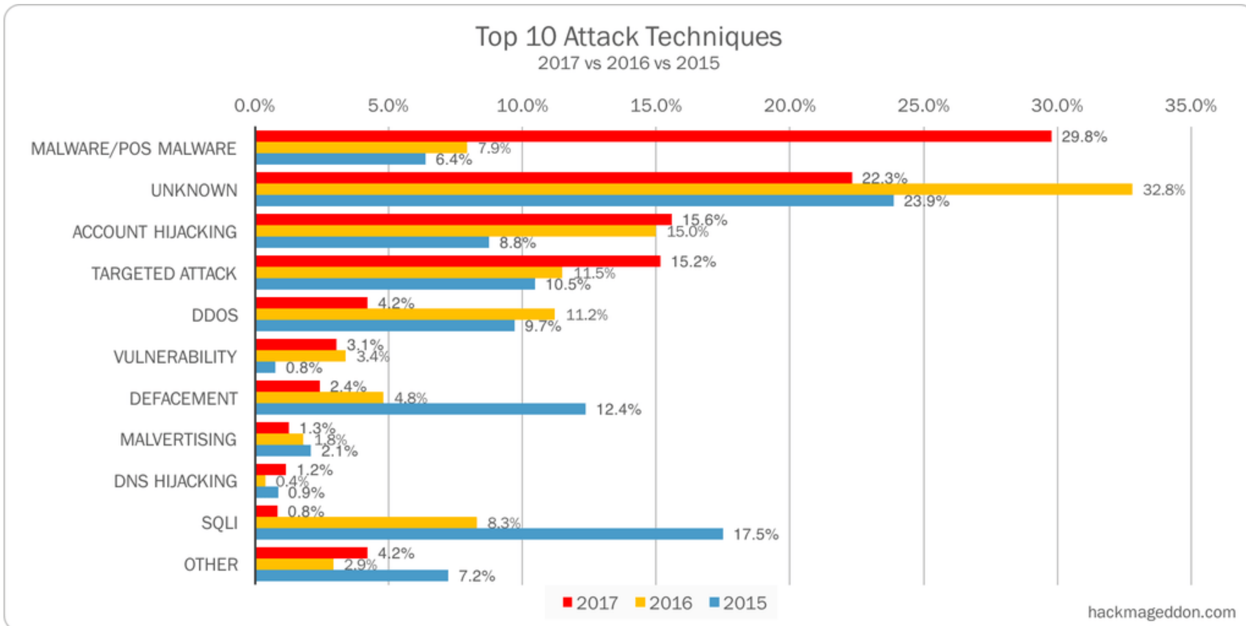
- To make a political or social point
- For the intellectual challenge
- Cyberwarfare
- Financial gain
- To gain a (business) advantage
- Revenge

Hazard Profile

The U.S. Department of Homeland Security identifies cyber incidents in two broad categories including data breaches and physical infrastructure failures. Both categories represent the potential for vulnerabilities to essential financial, communications, information, and security systems. A data breach includes any situation including those listed above, in which a person, organization, or agency gains unauthorized or illegal access to personal, sensitive, or confidential information. A cyber-induced physical infrastructure failure could disable multiple essential functions, isolating communities and restricting access to energy, food, clean water, and other emergency services.

The Cybersecurity and Infrastructure Security Agency (CISA) leads the national effort to understand, manage, and reduce risk to our cyber and physical infrastructure. CISA Region 4 includes Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee and provides support, preparation, response, and recovery efforts for hazards impacting critical infrastructure in those states.

Figure 3.11.3
Top 10 Techniques



Source: *Hackmageddon.com*

Location and Extent

The cyberterrorism hazard is not geography-based. Attacks can originate from any computer to affect any other computer in the world. If a system is connected to the Internet or operating on a wireless frequency, it is susceptible to exploitation. Targets of cyberterrorism can be individual computers, networks, organizations, business sectors, or governments. Financial institutions and retailers are often targeted to extract personal and financial data that can be used to steal money from individuals and banks.

When a cyber security incident occurs, the State of Mississippi's Office of Homeland Security uses the following factors to evaluate its severity:

- Nature of the attack
- Criticality of systems that are (or could be) made unavailable
- Value of the information compromised (if any)
- Number of people, agencies, or functions impacted
- Business considerations
- Public relations
- Effects on the State's entire IT enterprise

Cyberterrorism may range from the infection of a single machine by a common computer virus to a large-scale, organized incident that cripples an organization or infrastructure.

Previous Occurrences

Even though there has been no disruption of services within the State government, Mississippi is no stranger to similar types of cyberterrorism attacks. In 2017, a Lebanese national executed a distributed denial of service (DDOS) attack on a Ridgeland business. The hacker utilized a computer in Lebanon to extort payments from the Ridgeland business while conducting computer attacks to interfere with its computer business and operations. This type of act is considered a denial-of-service attack, where an attacker attempts to prevent legitimate users from accessing information or services, preventing one from accessing email, websites, online accounts (banking, etc.), or other services that rely on the affected computer.

Even as this plan is being updated, the City of Atlanta has been held hostage by a ransomware attack for 6 days and counting. So far, the hackers are asking $51,000 in Bitcoin to unlock the city's systems. Luckily, emergency services such as 911 calls and control of wastewater treatment have been exempt from the attack.

To date, most experts believe this is one of the most sustained, coordinated, and consequential cyberterrorism attacks ever mounted against a major American city. The assault on Atlanta, the core of a metropolitan area of about 6 million people, represented a serious escalation from other recent cyberattacks on American cities, like the one last year in Dallas where hackers gained the ability to set off tornado sirens in the middle of the night.

Actions are taken by the Department of Information Technology Services to mitigate security risks presented by, for example, blocking IP address ranges, identifying vulnerable servers, performing scans as necessary, opening Help Desk tickets to scan/check machines, etc. Losses can include loss of productivity, financial theft, and the exposure of secure information. To date, no specific losses from cyberterrorism that have affected the State are available.

Probability of Future Occurrences

As is the case for any large governmental organization, the State of Mississippi will continue to be impacted and compelled to respond to cyberterrorism in the future. The nature of these attacks is projected to evolve in sophistication over time. The State has taken a proactive position in its cyber security efforts and is expected to remain vigilant in its efforts to prevent attacks from occurring and/or disrupting business operations. The reality remains that many computers and networks in organizations of all sizes and industries around the United States will continue to suffer intrusion attempts daily from viruses and malware that are passed through websites and emails.

Vulnerability Assessment

To understand risk, the State will continue to evaluate what assets are exposed or vulnerable in the identified hazard area. For the cyberterrorism hazard, the entire State of Mississippi is exposed to this hazard. Therefore, all assets in the State (population, structures, critical facilities, and lifelines), as described in the State's profile section are exposed and potentially vulnerable to a cyberterrorism attack.

Because it is difficult to predict targets of cyberterrorism, assessing vulnerability to the hazard is also difficult. All populations who directly use a computer or those receiving services from automated systems are vulnerable to cyberterrorism. Although all individuals in the State of Mississippi are vulnerable to an attack, certain types of attacks would impact specific segments of the population. If the cyberterrorism attack were to target the State's power or utility grid, individuals with medical needs would be impacted the greatest. Unfortunately, these populations are most vulnerable because many of the life-saving systems they rely on require power. Also, if an attack occurred during months of extreme heat or winter weather, the State's elderly population (those 65 years of age and older) would be vulnerable to the effects of the lack of climate control. These individuals would require shelter or admission to a hospital.

3.13: Other Significant Hazards

As noted in **Section 3.1.6**, this State Plan also considers risks identified outside of the process used in selecting hazards for analysis. **Section 5**, Coordination of Local Mitigation Planning, covers in detail hazards identified and addressed in all local plans.

Continuing with the process established during the last plan update, the Hazard Mitigation Council chose not to select and rank severe storms which include thunderstorms, lightning, hail, and high wind events. This category of hazard does not typically cause an impact requiring a state response and would typically be mitigated at the local level. However, during a review of the plan, and the fact that 48% of local jurisdictions indicated severe weather (thunderstorms, lightning, hail, high wind) were of significant concern, the state opted to expand the hazard profile and assessment in this section. A general discussion of vulnerability, histories of events, and calculations of probabilities are included for thunderstorms, wind, lightning, and hail, which are all captured under Severe Weather. Property damage, loss of life, and injuries expected statewide on an annual basis are also addressed. It was not possible to specifically address expected losses to critical facilities or state-owned facilities with the limited data available.

It was determined that hazards initially ranked and identified by over 45 percent or fewer of local jurisdictions as hazards of concern do not pose a significant state-level threat to Mississippi. Those hazards are illustrated in **Table 3.13.1** below:

Table 3.13.1
Hazards Identified by Jurisdictions in Local Plans

Hazard Type	No. of Jurisdictions Profiling Hazard	Percent of Plans
Severe Weather (thunderstorms, lightning, hail, high wind)	115	48%
Expansive Soils	84	67%
Extreme Heat	61	51%
Coastal Erosion	0	46%
Erosion	60	46%
Land Subsidence	46	37%
Tsunami	3	2%
Storm Surge	6	5%
Sea Level Rise/Climate Change	6	3%

As noted earlier in the chapter, hazards identified and addressed in local plans, but not included in this plan, will receive the support of the state mitigation program. Examples of state support of local hazard mitigation plans are the severe weather siren and saferoom programs. These mitigation programs address multiple hazards by alerting the public and providing shelter from tornadoes and the types of events described in this Section.

Severe Storms

Hazard Description

Severe storms caused by cold fronts and daytime heating of the atmosphere can occur at any time in Mississippi. These storms have the potential to produce tornadoes, high winds, lightning, hail, and heavy rain. This Section focuses on the most common of these occurrences including thunderstorms, high (straight-line) wind events, hail, and lightning.

Thunderstorms are defined by the National Weather Service (NWS) as local storms (accompanied by lightning and thunder) produced by a cumulonimbus cloud, often accompanied by gusty winds, heavy rain, and hail. Non-severe thunderstorms rarely extend over two hours. The NWS considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado. Severe thunderstorms are distinguished by stronger winds and heavier rain than normal thunderstorms. Severe storms have the potential to produce damaging hail, spawn tornadoes, and initiate flash flooding. Thunderstorms may occur as single systems, in clusters, or as straight-line formations. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time.

High winds are associated with sustained or gusting winds of significant strength to cause risk or damage to crops, vegetation, buildings, or infrastructure. High winds are typically associated with weather frontal systems and are often associated with other severe weather events, such as hail and lightning.

High winds can damage property by carrying projectile debris or breaking building envelopes as the wind buffets weak points around doors, windows, and roof structures. Wind speed can increase as it passes between closely situated buildings through a Venturi effect increasing the potential for damage.

The National Weather Service recognizes and defines three levels of wind events:

- Wind Advisory – Sustained winds of 30 mph or more or gusts of 45 mph or greater for one hour or longer.
- High Winds – Sustained winds of 40 mph or greater for at least one hour, or frequent gusts of wind of 58 mph or greater.
- Extreme Wind Warnings – Sustained winds of 115 mph or greater during a land-falling hurricane.

Winds and related damages can also be defined through the Beaufort Wind Scale as shown in **Table 3.13.2.** Damaging wind events in the State of Mississippi typically occur as tornadoes, straight-line wind events, and severe thunderstorms. Depending on the type of wind event, the damage sustained can range from extremely localized to widespread and from moderate to devastating. The potential impacts of a severe wind event depend on the specific characteristics of the storm but can include broken tree branches and uprooted trees; downed power, cable, and telephone lines; damaged radio, television, and communication towers; damaged and torn-off roofs; blown out walls and garage doors; overturned vehicles; destroyed homes and businesses; and serious injury and fatalities. Downed trees and power lines can fall across roadways, block key access routes, and often result in extended power outages.

Table 3.13.2
Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Wind Effects On Water	On Land
0	Less than 1	Calm	Sea surface is smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind is felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaves begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps, waves 13-19 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against the wind
8	34-40	Gale	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	91-47	Strong Gale	High waves (23-32 ft), the sea begins to roll, dense streaks of foam, and spray may reduce visibility	Slight structural damage occurs, stale blows off roofs
10	48-55	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees are broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover the sea, and visibility becomes more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white and driving spray, visibility greatly reduced	

Lightning is a visible electrical discharge produced by a thunderstorm. The discharge may occur within or between clouds, between the cloud and air, or between a cloud and the ground. Lightning is created by static electrical energy and can generate enough electricity to set buildings on fire and electrocute people.

Lightning can strike anywhere and anytime thunderstorms are in the area. Almost all lightning occurs within 10 miles of the parent thunderstorm, but in rare cases, it can strike as much as 50 miles away. There are two major categories of lightning:

- Cloud Flashes – Cloud flashes sometimes have visible channels extending into the air around the storm but not striking the ground. This is further defined as cloud-to-air, cloud-to-cloud, or intra-cloud lightning.
- Ground Flashes – Lightning channels that travel from cloud to ground or ground to cloud. There are two categories of ground flashes: natural and artificially initiated/triggered. Artificially initiated lightning includes strikes on tall structures, airplanes, rockets, and towers on mountains. Artificially initiated lightning travels from the ground to a cloud while natural lightning travels from cloud to ground.

Hail is defined by the National Weather Service (NWS) as showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud. NWS Studies of thunderstorms indicate two conditions are required for hail to develop: sufficiently strong and persistent up-draft velocities and an accumulation of liquid water in a super-cooled state in the upper parts of the storm. Hailstones are formed as water vapor in the warm surface layer rises quickly into the cold upper atmosphere. The water vapor is frozen and begins to fall; as the water falls, it accumulates more water vapor. This cycle continues until there is too much weight for the updraft to support and the frozen water falls too quickly to the ground to melt along the way.

The size of hailstones is best determined by measuring their diameter with a ruler. In the absence of a ruler, hailstone size is often visually estimated by comparing its size to known objects. **Table 3.13.3** provides a reference of commonly used objects for this purpose.

Table 3.13.3
Hail Size Chart

Hail Diameter Size	Description	Hail Diameter Size	Description
¼”	Pea	1 ¾”	Golf Ball
½”	Marble	2”	Hen Egg
¾”	Penny	2 ½”	Tennis Ball
$^{7}/_{8}$”	Nickel	2 3/4 “	Baseball
1” (severe)	Quarter	3”	Large Apple
1 ¼”	Half Dollar	4”	Softball
1 ½”	Ping Pong Ball/Walnut	4 ½”	Grapefruit

Source: National Weather Service

Location and Extent

While severe storm events are typically isolated to relatively small areas, historical records indicate that the entire state is vulnerable to severe thunderstorms. Trends in the data do not indicate if portions of the state are more vulnerable than others. Based on available data during this update process, the Hazard Mitigation Council draws the same conclusion - every county is vulnerable.

To demonstrate the extent and location of severe wind and hail, **Figures 3.13.1** and **3.13.2** reflect the location of historic events (2000 to 2023). A summary of historic occurrences and the probability of future impacts is also presented.

Figure 3.13.1
Severe Winds

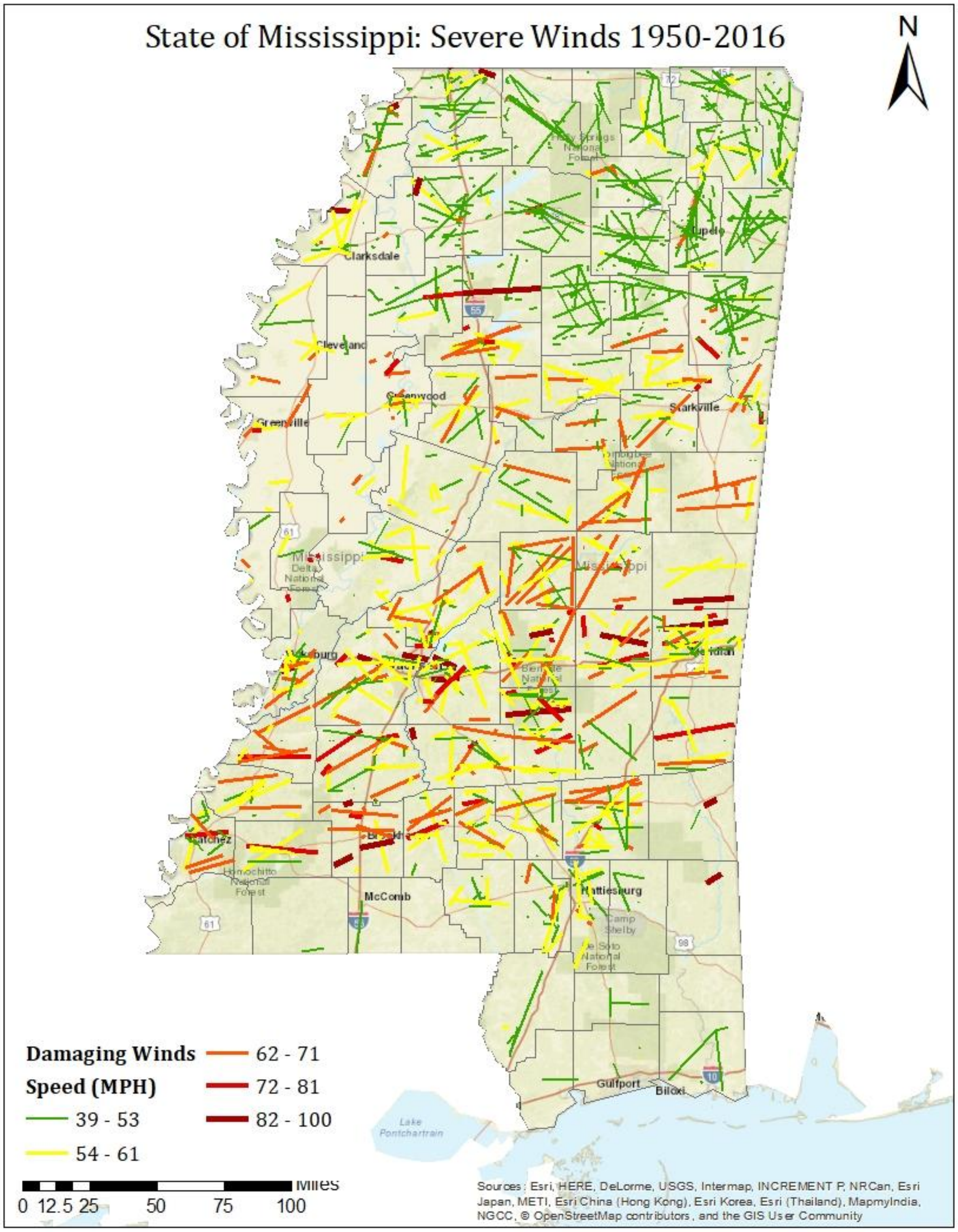
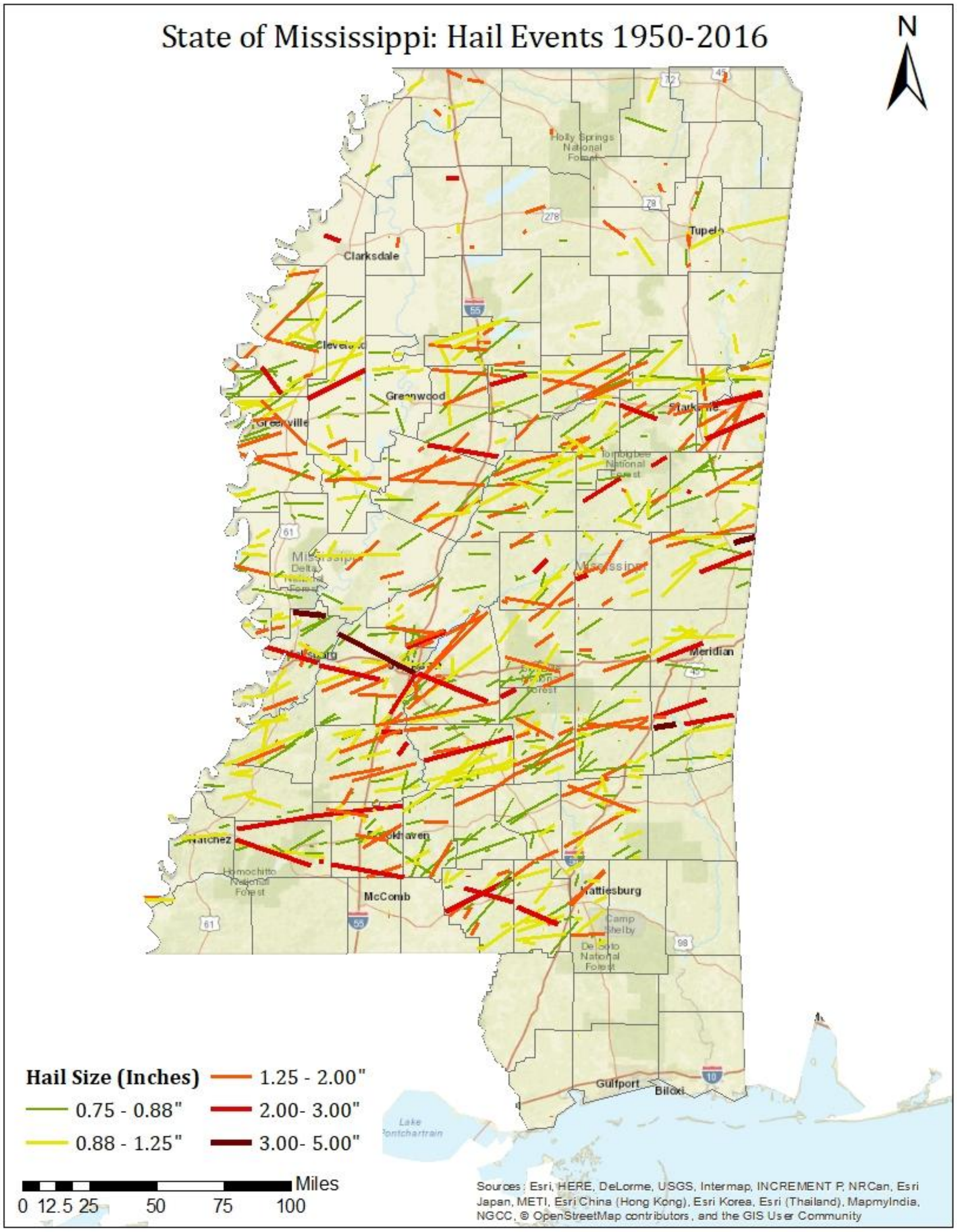


Figure 3.13.2
Hail



Previous Occurrences

High Wind, Thunderstorm Winds, and Strong Wind Events

High winds, thunderstorm winds, and strong winds are geographically undefined. Every year these events have the potential to occur in all Mississippi counties. The specific number of events and their corresponding effects are recorded in the NCDC database. Events from the past 15 years are presented. Based on the sheer number of incidences, each county is susceptible to winds of any type. It is still the assertion of the Hazard Mitigation Council that mitigation activities should be identified at the local planning level. It is important to note that the three categories of winds are profiled in **Tables 3.13.2, through 3.13.4**.

Table 3.13.2
High Wind Events 2002 – 2023

Year	No. of Events	No. of Counties Affected	Death	Injury	Property Damage ($)	Crop Damage ($)
2023	21	21	0	0	$182,000	$0
2022	1	1	0	0	$0	$0
2021	0	0	0	0	$0	$0
2020	0	0	0	0	$0	$0
2019	0	0	0	0	$0	$0
2018	0	0	0	0	$0	$0
2017	4	4	0	0	$50,000	$0
2016	0	0	0	0	$0	$0
2015	0	0	0	0	$0	$0
2014	0	0	0	0	$0	$0
2013	3	2	0	0	$30,000	$0
2012	0	0	0	0	$0	$0
2011	8	8	0	0	$500,000	$485,000
2010	0	0	0	0	$0	$0
2009	15	15	0	0	$490,000	$0
2008	23	23	0	0	$1,074,000	$0
2007	0	0	0	0	$0	$0
2006	0	0	0	0	$0	$0
2005	0	0	0	0	$0	$0
2004	0	0	0	0	$0	$0
2003	0	0	0	0	$0	$0
2002	20	19	0	0	$115,000	$0
Totals	**95**		**0**	**0**	**$2,441,000**	**$485,000**

Source: NCDC 2023

Table 3.13.3
Thunderstorm Wind Events 2002 – 2023

Year	No. of Events	No. of Counties Affected	Death	Injury	Property Damage ($)	Crop Damage ($)
2023 Through June	46	22	0	2	$492,850	0
2022	543	79	0	8	$5,220,800	$32,000
2021	395	78	3	2	$7,138,600	$0
2020	550	79	2	6	$7,640,000	$1,000
2019	530	74	2	5	$5,790,000	$0
2018	537	78	0	4	$8,029,600	$0
2017	437	75	1	0	$8,686,000	$0
2016	473	73	0	3	$6,579,000	$0
2015	362	69	1	1	$2,662,000	$0
2014	424	74	1	7	$5,859,000	$0
2013	261	75	0	5	$4,394,000	$0
2012	518	74	1	12	$6,437,000	$0
2011	697	81	4	5	$20,272,000	$356,000
2010	489	74	0	0	$5,898,000	$106,000
2009	519	78	2	6	$11,721,025	$2,303,000
2008	829	79	0	5	$104,354,000	$9,698,000
2007	416	78	0	2	$7,050,000	$480,000
2006	403	76	0	10	$46,968,000	$30,000
2005	411	75	1	7	$19,445,000	$1,280,000
2004	420	78	1	9	$3,330,000	$0
2003	552	77	0	0	$12,059,050	$0
2002	414	75	0	0	$11,115,000	$0
Totals	**7,625**		**12**	**72**	**$276,829,075**	**$14,253,000**

Source: NCDC 2023

Table 3.13.4
Strong Wind Events 2002 – 2023

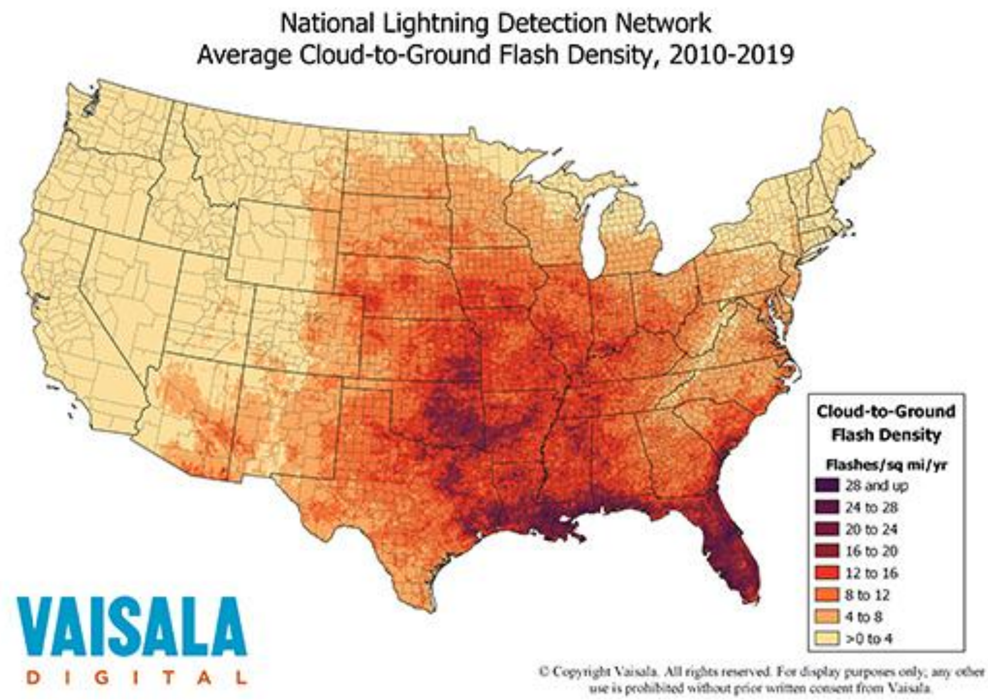
Year	No. of Events	No. of Counties Affected	Death	Injury	Property Damage ($)	Crop Damage ($)
2022	22	19	0	0	$138,200	$2000
2021	5	5	0	0	$12,000	$0
2020	17	15	0	0	$235,000	$0
2019	25	17	1	0	$517,000	$0
2018	9	7	0	0	$117,000	$0
2017	33	4	0	1	$617,000	$0
2016	17	13	0	0	$3,000	$0
2015	46	22	0	0	$365,600	$0
2014	14	11	0	0	$184,500	$0
2013	16	13	0	0	$108,500	$0
2012	40	23	1	0	$1,066,000	$0
2011	21	15	0	0	$144,000	$0
2010	15	12	0	0	$127,000	$0
2009	31	27	0	0	$985,200	$0
2008	29	21	0	0	$1,036,000	$200
2007	19	16	0	0	$179,110	$0
2006	18	14	0	0	$253,600	$0
2005	0	0	0	0	$17,000	$0
2004	4	3	0	0	$0	$0
2003	4	4	0	0	$165,000	$0
2002	0	0	0	0	$0	$0
Totals	**385**		**2**	**1**	**$6,270,710**	**$2,200**

Source: NCDC 2023

Lightning

Lightning, once one of nature's most prevalent killers, is claiming far fewer lives in the United States, mostly because we have learned to get out of the way. More people are subscribing to, “When the thunder roars, get indoors.” According to NOAA, in the United States, an average of 27 people were killed each year by lightning over the last decade. People struck by lightning often report a variety of long-term and debilitating symptoms, including memory loss, attention deficit, sleep disorder, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and an inability to sit for long periods.

Figure 3.13.4



Records found in the NCDC database (**Table 3.13.5**) indicate that 14 reported fatalities and 19 reported injuries in Mississippi were caused by lightning in the past 16 years (2010 to 2019). It should be noted not all lightning events are reported, therefore the context should be considered when applying further analysis. The main point is that each county is susceptible to lightning, and further analysis and mitigation activities should be identified at the local plan level. The table below provides a summary of the events from 2002 to 2022 and their impact.

Table 3.13.5
Lightning Events 2002 – 2022

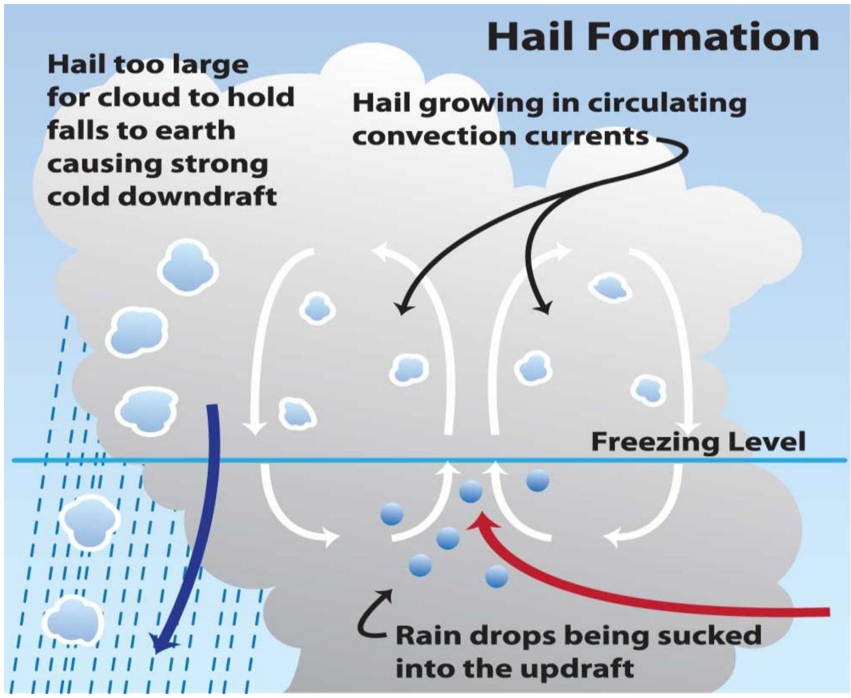
Year	No. of Events	No. of Counties Affected	Death	Injury	Property Damage ($)	Crop Damage ($)
2022	7	5	0	0	$541,000	$0
2021	6	6	0	7	$140,000	$0
2020	5	4	0	0	$123,000	$0
2019	10	8	0	0	$315,000	$0
2018	18	12	0	4	$1,221,000	$0
2017	8	7	0	2	$550,000	$0
2016	15	11	3	1	$942,000	$0
2015	13	11	0	0	$648,600	$0
2014	8	8	1	0	$220,000	$0
2013	9	8	0	0	$334,000	$0
2012	26	14	0	1	$1,943,000	$0
2011	24	18	1	2	$1,403,000	$0
2010	17	13	0	1	$1,849,000	$0
2009	15	11	1	3	$254,000	$0
2008	24	17	1	1	$990,000	$7,000
2007	13	12	0	0	$975,000	$0
2006	20	14	2	4	$1,080,000	$2,000
2005	21	16	2	0	$4,696,000	$0
2004	12	11	1	3	$145,000	$0
2003	12	8	0	1	$388,000	$0
2002	16	12	2	0	$115,250	$0
Totals	**299**		**14**	**30**	**$18,872,850**	**$9,000**

Source: NCDC 2023

Hail

Many strong severe storms produce hail, with more frequent hailstorms occurring in the late spring and early summer. Hail forms when thunderstorm updrafts are strong enough to carry water droplets well above the freezing level. This freezing process forms a hailstone, which can grow as additional water freezes onto it. Eventually, the hailstone becomes too heavy for the updrafts to support it and it falls to the ground. **Figure 3.13.5** illustrates how hail is formed.

Figure 3.13.6
Hail Formation



Source: NASA

Large hail has the potential to cause serious injury. Hail can be smaller than a pea and as large as a softball. Larger hailstones can cause significant damage to vehicles, glass surfaces (*e.g.* skylights and windows), roofs, plants, and crops. The size of hailstones is a direct result of the severity and size of the storm. The land area affected by individual hailstorms is not much smaller than a parent thunderstorm, an average of 15 miles in diameter around the center of a storm.

Hail measuring between 0.75 and 1 inch in diameter is the most common occurrence. There were a few incidences where hail reached 2 and 2.75 inches in diameter. Thousands of hail incidents have been reported since 1950 according to the NCDC and as shown in **Figure 3.13.2**. Not all hail events are reported so the context should be considered when applying further analysis. All of Mississippi's counties are susceptible to hail, and further analysis and mitigation activities should be identified at the local plan level. A summary of the events from 2002 to 2023 as reported to the NCDC and their impacts is listed in **Table 3.13.5**.

Table 3.13.5
Hail Events 2002 – 2023

Year	No. of Events	No. of Counties Affected	Death	Injury	Property Damage ($)	Crop Damage ($)
2023-June	12	9	0	0	$3,000	0
2022	142	55	0	0	$37,167,500	$7,000
2021	82	40	0	0	$509,000	$0
2020	108	47	0	0	$2,859,000	$0
2019	65	39	0	0	$228,000	$0
2018	82	45	0	0	$319,000	$10,000
2017	128	53	0	0	$634,000	$0
2016	209	66	0	0	$404,800	$0
2015	93	29	0	0	$101,600	$0
2014	183	65	0	0	$2,469,000	$0
2013	146	61	0	1	$557,019,000	$0
2012	202	63	0	0	$812,500	$0
2011	368	74	0	1	$3,050,000	$0
2010	290	67	0	0	$1,354,000	$50,000
2009	323	76	0	0	$157,000	$4,000
2008	469	78	0	0	$2,014,000	$0
2007	223	74	0	0	$321,250	$80,000
2006	344	78	0	0	$17,767,000	$6,600,000
2005	447	75	0	2	$29,743,000	$600,000
2004	153	59	0	0	$41,750	$0
2003	363	76	0	0	$3,423,000	$0
2002	136	61	0	0	$230,440	$0
Totals	**4,568**		**0**	**4**	**$660,627,840**	**$7,351,000**

Source: NCDC 2023

Severe Storm Vulnerability

Typically, damage associated with these hazards includes structural fires, broken glass, damaged vehicles or siding, personal injuries, and fatalities. Wind damages typically include broken branches, uprooted trees, damaged roofs, structural damage, and destruction of small structures.

People, buildings, and property are at risk from the effects of high winds and lightning. Buildings, automobiles, and infrastructural components (such as electrical feed lines) can suffer damage from high wind and lightning; outdoor populations are vulnerable to injury or death from lightning. High winds can cause debris to strike people, animals, buildings, and property, which may result in significant injuries, fatalities, and property damage.

Critical infrastructure associated with power transmission, telecommunications, and road signage is vulnerable to hail. Older manufactured homes are particularly susceptible to hail events due to construction methods (vinyl siding, lesser gauge metal roofs). People and animals have the potential to be impacted by hail if they are caught outdoors with no protection.

Although no specific areas of the state have a higher risk of being affected by severe storms than others, several factors contribute to a particular area's vulnerability to damage. Certain characteristics of an area or a structure, increase its resistance to damage from high wind events, lightning, and hail. Many of these factors are specific to the location or the structure in question. More densely populated areas may experience more damage from hail, whereas more rural areas are potentially more vulnerable to fire from lightning because of longer response times for fire suppression. For these reasons, the State of Mississippi feels it is important to include these hazards in local mitigation plans, as they are most effectively mitigated at that level.

Coastal/Beach Erosion

Hazard Description

As defined by NOAA, coastal erosion is a process whereby large storms, flooding, strong wave action, sea level rise, and human activities, such as inappropriate land use, alterations, and shore protection structures, erode the beaches and bluffs along the U.S. coasts. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences.

In the U.S., coastal erosion is responsible for roughly $500 million per year in coastal property loss, including damage to structures and loss of land. To mitigate coastal erosion, the federal government spends an average of $150 million every year on beach nourishment and other shoreline erosion control measures.[1] In addition to beach erosion, more than 80,000 acres of coastal wetlands are lost annually—the equivalent of seven football fields disappearing every hour of every day. The aggregate result is that the United States lost an area of wetlands larger than the state of Rhode Island between 1998 and 2009.[3]

While coastal erosion affects all regions of the United States, erosion rates and potential impacts are highly localized. Average coastline recession rates of 25 feet per year are not uncommon on some barrier islands in the southeast. In a single event, severe storms can remove even wider beaches. In undeveloped areas, these high recession rates are not likely to cause significant concern, but in some heavily populated locations, one or two feet of erosion may be considered catastrophic.

The Gulf of Mexico is impacted by the development of oil, gas, and mineral resources. The Gulf accounts for over 95% of the U.S.'s outer continental shelf oil and gas production, and processes over two-thirds of the nation's oil imports. Invasive species are a serious threat to native biota in many gulf coast ecosystems, and aquatic nuisance species pose severe economic problems; interfering with transportation, energy production, reservoir capacity, and recreational uses. The effect of oil breaches on coastal erosion is determined by how much oil reaches the coastal regions and how long it remains. Oiled plants can die, along with roots that bind and stabilize the soil, leading to erosion.

Location and Extent

The issue of beach erosion applies to three counties in Mississippi: Hancock, Harrison, and Jackson. Each of these counties had comprehensive beach maintenance and protection programs in place for many years.

These programs utilized locally budgeted funds and were occasionally supplemented with state and federal funds. Hurricane Katrina damaged many of the beaches as well as the beach protection facilities.

Researchers from the USGS Woods Hole Coastal and Marine Science Center are studying the influence of wave action and sediment supply on wetland vulnerability and ecosystems. Over 6.5 months, the group developed a time-lapse video showing lateral erosion of a salt marsh in the Grand Bay National Estuarian Reserve, which is part of an embayment near the City of Pascagoula. The results were 1.5 meters of erosion from wave action, which is a rate of more than three meters, or ten feet, per year.[2]

The United States Army Corps of Engineers completed an investigative report identifying major restoration and mitigation projects. This project received a supplemental appropriation for implementation and is being tracked as Mississippi Mitigation Action – Hurricane 6, USACOE Mississippi Coastal Improvements Program. The Mississippi Department of Marine Resources serves as the lead agency for beach erosion initiatives and is represented on the State Hazard Mitigation Council.

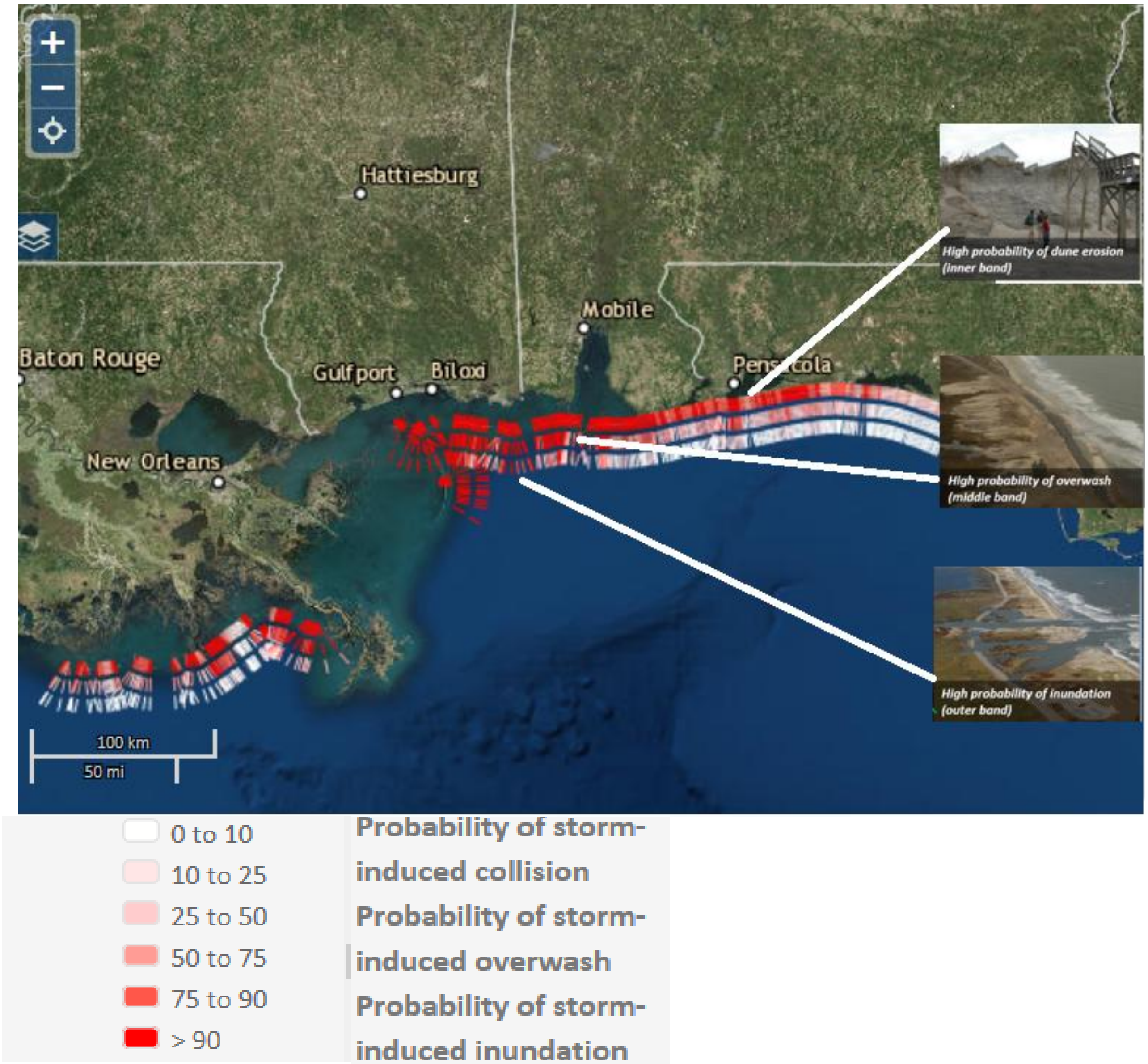
The Mississippi Department of Marine Resources (DMR) Coastal Preserves Program was developed in 1992 by the authority of the Wetlands Protection Act. The Coastal Preserves Programs' objective is to acquire, protect, and manage sensitive coastal wetland habitats along the Mississippi Gulf Coast, therefore ensuring the ecological health of Mississippi's coastal wetland ecosystems. The state currently has title to approximately 30,000 acres of the designated 72,000 acres of crucial coastal wetland habitat within Mississippi's 20 coastal preserve sites.

Probability of Future Occurrences

The USGS National Assessment of Coastal Change Hazards provides an interactive map that displays hurricane-induced coastal erosion hazards for sandy beaches along the U.S. Gulf of Mexico and Atlantic (Florida to New York) coastlines. The analysis is based on a storm-impact scaling model that uses observations of beach morphology combined with sophisticated hydrodynamic models to predict how the coast will respond to the direct landfall of category 1-5 hurricanes. Hurricane-induced water levels resulting from both surge and waves are compared to beach and dune elevations to determine the probabilities of three types of coastal change: collision (dune erosion), overwash, and inundation.

Probabilities of coastal erosion hazards are based on estimating the likelihood that the beach system will experience erosion and deposition patterns consistent with collision, overwash, or inundation regimes. The regimes are calculated by using values of dune morphology and mean and extreme water levels for each 1-kilometer section, such that the probability of collision occurs when extreme water levels reach the dune toe; overwash when extreme water levels reach the dune crest; and inundation when mean water levels reach the dune crest. Sections with no dune toe (berms instead of dunes) do not have a defined probability of collision. In consideration of climate change, more storms and higher seas from climate change create more winds, waves, and floods, leading to coastal erosion. Hurricanes can wash away sandy barrier islands, leaving coastlines and islands unprotected from future storm surges. Waves and winds can carry away beach sand little by little, shrinking scenic beaches and exposing human infrastructure to tides and storms.

Figure 3.13.4
Hurricane Nate Assessment of Potential Coast Change Impacts- 2017
(Source: USGS)



Comparing the 12-month forecast from the 2013 plan to the Hurricane Nate coast change impacts from 2017, there is a noticeable increase in collision, overwash, and inundation along the Gulf Coast.

Source: **John Fitzhugh** jcfitzhugh@sunherald.com

A family walks Thursday, June 22, 2017, on the boardwalk near Hewes Avenue in Gulfport where the beach has eroded to the seawall. A project to replenish the beach in Harrison County will start in October.

[1] U.S. Climate Resilience Toolkit. Retrieved 04.27.18 from, https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion
[2] U.S.G.S. Rapid Salt-Marsh Erosion in Grand Bay, Mississippi. Retrieved 04.19.18, from https://www.usgs.gov/media/videos/rapid-salt-marsh-erosion-grand-bay-mississippi

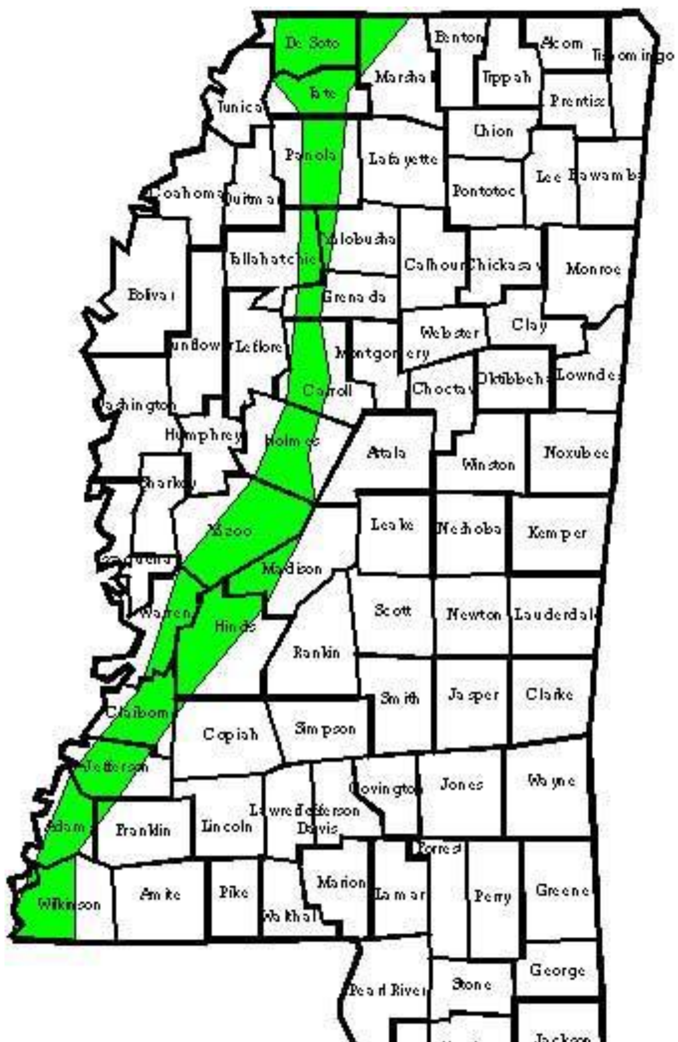
Expansive Soils

Hazard Description

Expansive soil is a clay soil that is prone to large volume changes (swelling and shrinking) that are directly related to changes in water content. Soils with a high content of expansive minerals can form deep cracks in drier seasons or years; such soils are called vertisols. Soils with smectite clay minerals, including montmorillonite and bentonite, have the most dramatic shrink-swell capacity.

The mineral make-up of this type of soil is responsible for the moisture retaining capabilities. All clays consist of mineral sheets packaged into layers and can be classified as either 1:1 or

2:1. These ratios refer to the proportion of tetrahedral sheets to octahedral sheets. Octahedral sheets are sandwiched between two tetrahedral sheets in 2:1 clays, while 1:1 clays have sheets in matched pairs. Expansive clays have an expanding crystal lattice in a 2:1 ratio; however, there are 2:1 non-expansive clays.



Natchez Silt Loam- Mississippi State Soil

In 1988, the Professional Soil Classifiers Association of Mississippi selected Natchez silt loam soil to represent the soil resources of the State. These soils exist on 171,559 acres (.56% of state) of landscape in Mississippi.

The Natchez soils formed in very deep loess; material under a woodland environment and a climate that was warm and humid. These soils have natural fertility and desirable tilth but usually occur on slopes that limit their use to trees. In areas where slopes are less, pasture and row crops are grown and the soil is very productive when good management is applied.

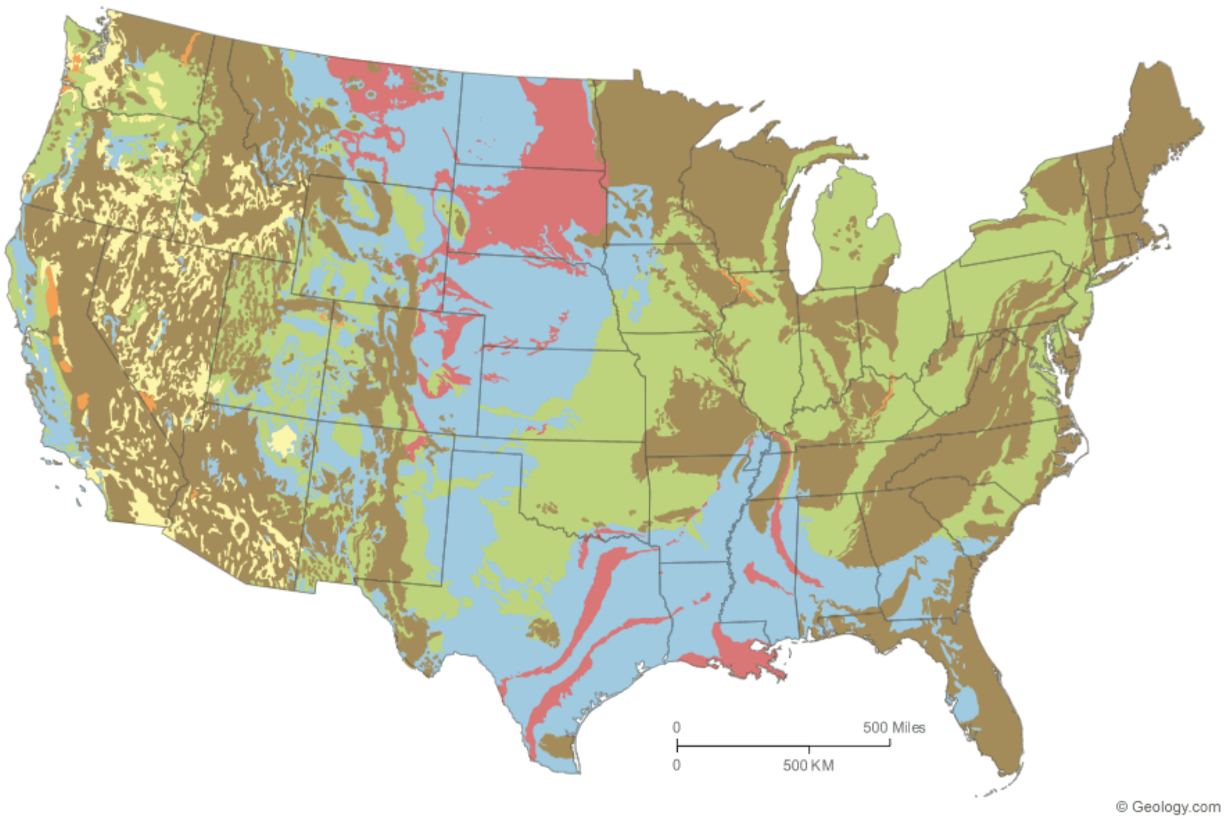
A typical Natchez soil profile consists of a 3 inch top soil of dark grayish brown silt loam and to 8 inches, a subsurface of brown silt loam, a yellowish brown and dark yellowish brown silt loam subsoil to 36 inches and a substratum that is yellowish brown, and dark yellowish brown silt loam down to 80 inches

Soil Family Classification: Coarse-silty, mixed, superactive, thermic Typic Eutrudepts:

Natchez soils are in the Inceptisols soil order. Inceptisols soils have developed in relatively young material that have an Ochric epipedon overlying a Cambic horizon. This soil is developed in very deep wind blown loess that is rich in weatherable minerals. The term coarse-silty indicates that the subsoil has less than 18 percent clay with less than 15 percent sand coarser than very fine. The term mixed suggests that no one mineral is over 60 percent. Thermic refers to an average annual soil temperature between 15-22 degrees C(59-72 degrees F) and differs more than 5 degrees C between winter and summer at50 cm (20 inches) below the surface.

Natchez soils are on strongly sloping to very steep hillsides in the highly dissected parts of the bluff hills that border the Mississippi Delta floodplains. They formed in silty loess material that ranges from strongly acid to neutral in the upper part and neutral to slightly alkaline in lower parts. Average annual precipitation is 52 inches. Average annual air temperature is 63 degrees F. The soil has developed in the upper Pleistocene age material.
Below is the USGS expansive soils map that shows the current condition of soils in the United State. Particularly as it relates to the State of Mississippi, less than 50% of the soil that predominantly encompasses the State comprises of areas that are underlain by soils with clays as high swelling potential. Even though more than 50% of the local plans profiled this hazard, it is still the position of the State this hazard is handled best at the local letter. To this date, there is very little data to support whether any state facilities have been affected by expansive soils. As a result, the State will not move forward with fully profiling this hazard.

USGS Expansive Soils Maps



Over 50 percent of these areas are underlain by soils with abundant clays of high swelling potential.

Less than 50 percent of these areas are underlain by soils with clays of high swelling potential.

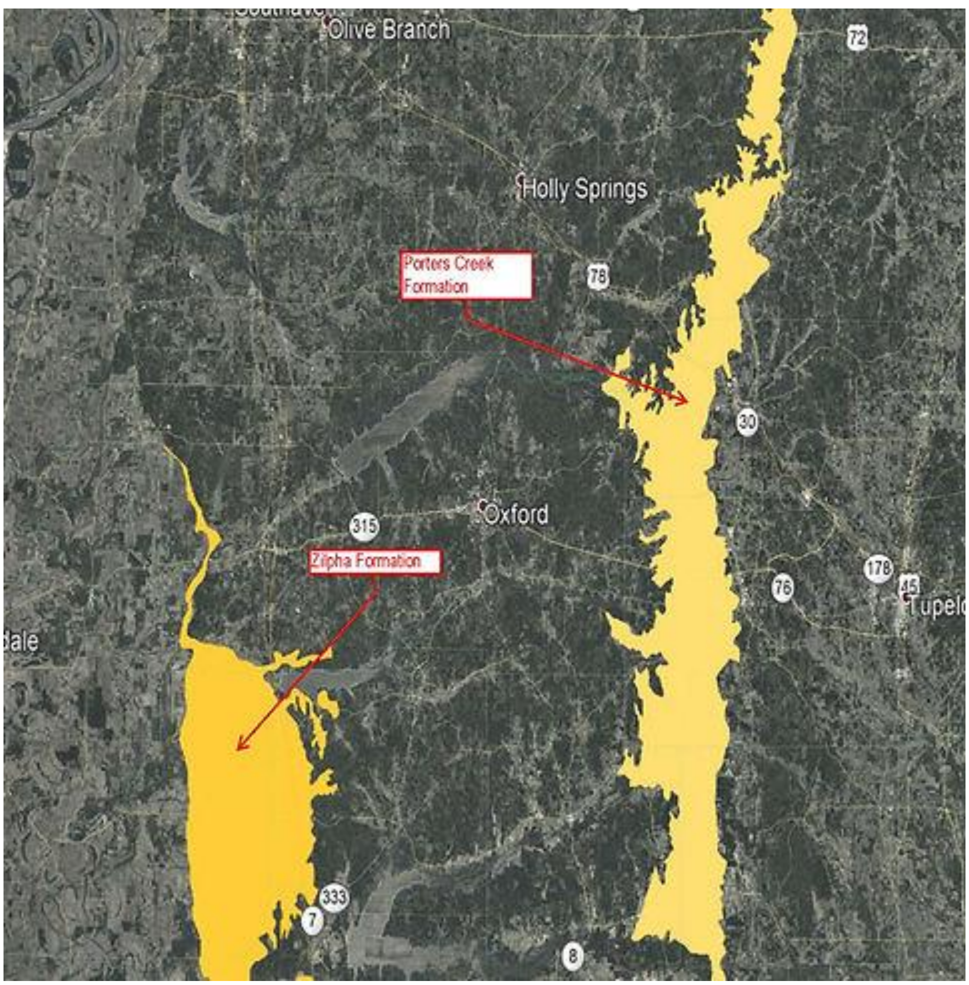
Over 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.

Less than 50 percent of these areas are underlain by soils with abundant clays of slight to moderate swelling potential.

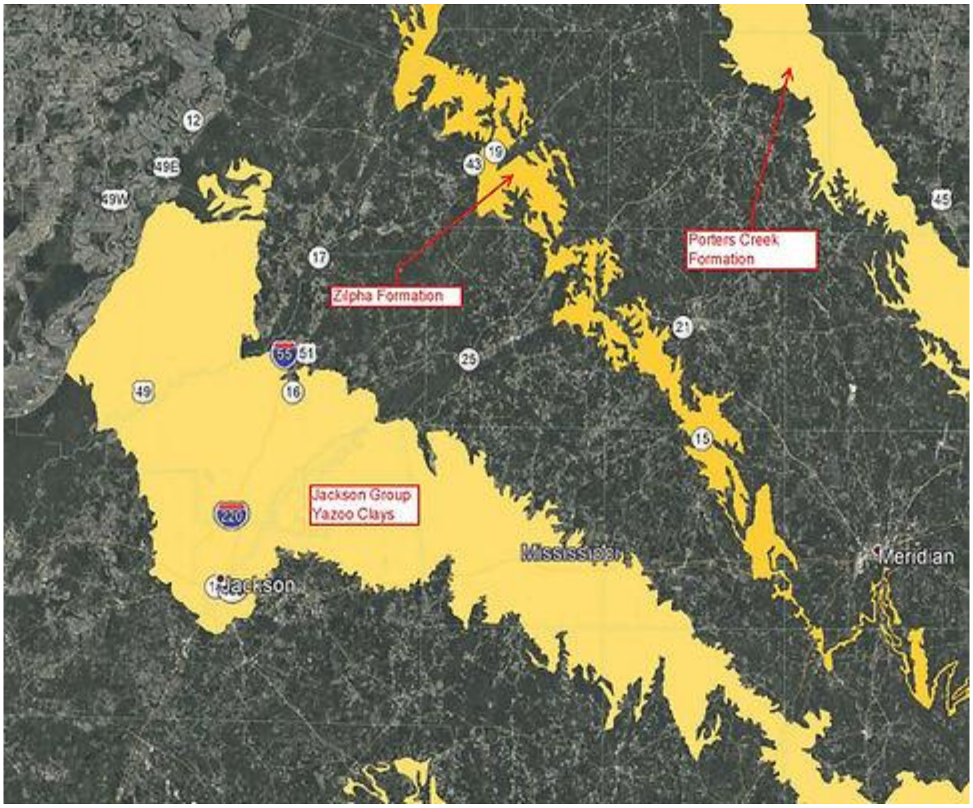
These areas are underlain by soils with little to no clays with swelling potential.

Data insufficient to indicate the clay content or the swelling potential of soils.

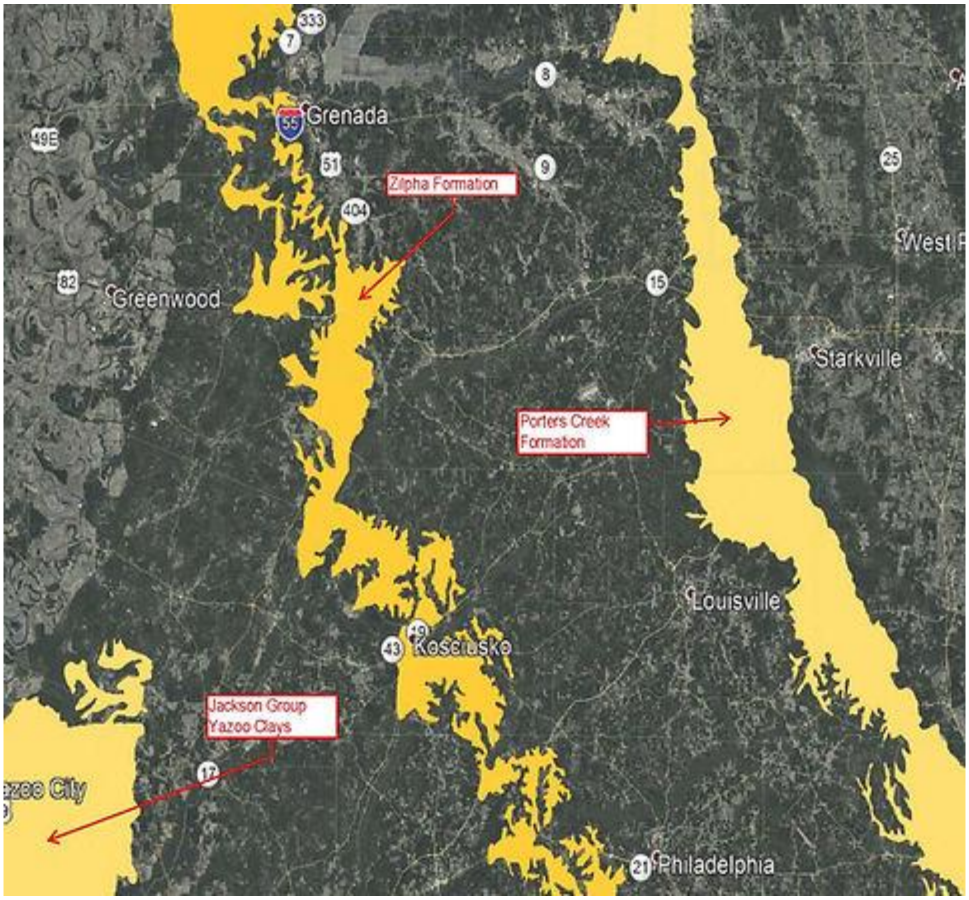
Expansive Clay in Mississippi: Expansive clays are located throughout the state of Mississippi in both small and large deposits. Anyone who has ever heard of "Gumbo" in the Mississippi Delta, well that is expansive clay. However, the Mississippi Department of Transportation
another not unlike a magnet. The charge is not very strong, thus can be broken relatively easily by water molecules inserted between the clay plates. During saturation, as more water is wedged between the clay plates, the plates are pushed apart. The net result is an overall increase in volume of the soil matrix that we recognize as expansion, or clay heave. This process works in reverse during drying, resulting in shrinkage. Expansive, or High Plasticity clay, has the physical properties defined by the Unified Soils Classification System (USCS)
(MDOT) SOP has identified certain types of soils as having a high volume change. These are the Yazoo, Porters Creek, Zilpha, and Hattiesburg/Pascagoula Formations. Again there is the potential for localized deposits of expansive clay to be present at pretty much any location within our state, but the formations listed by MDOT contain predominately expansive materials. The figure below present general locations of the problematic formations. (*Source ABTS Consultants)*



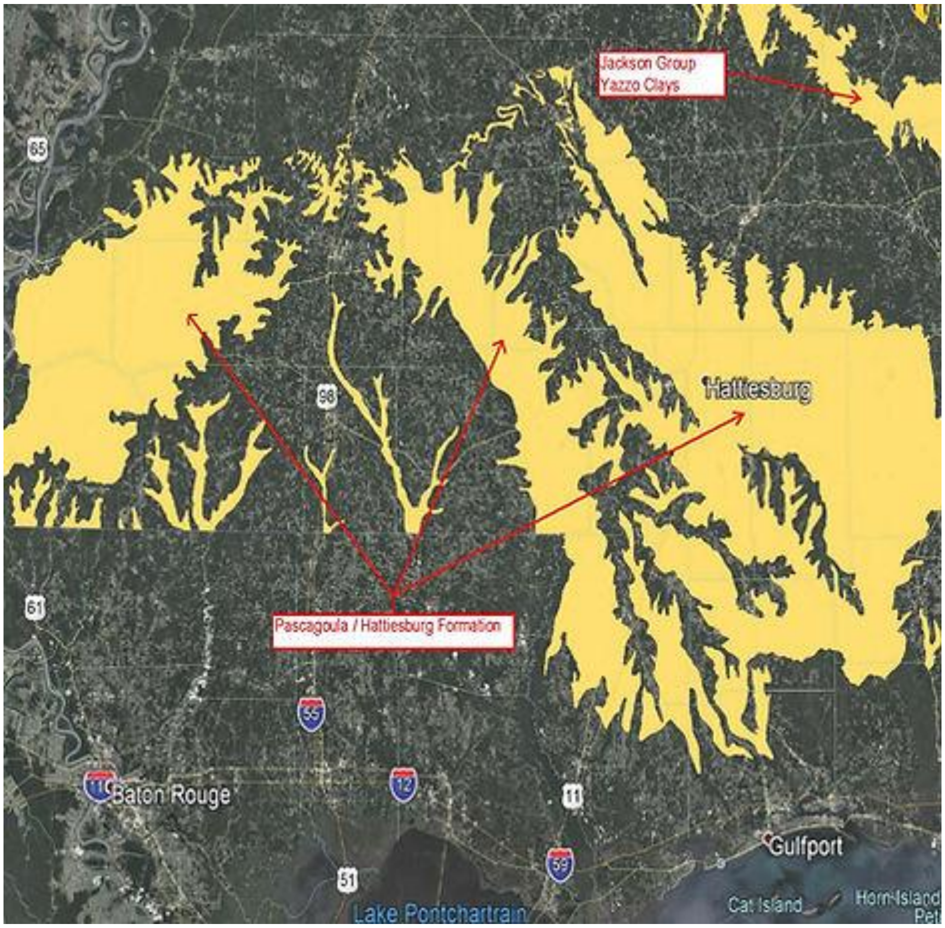
Zilpha and Porters Creek Formations in North Mississippi



Jackson Group, Zilpha and Porters Creek Formations in Central Mississippi



Jackson Group, Zilpha, Porters Creek Formations in Central/North MS

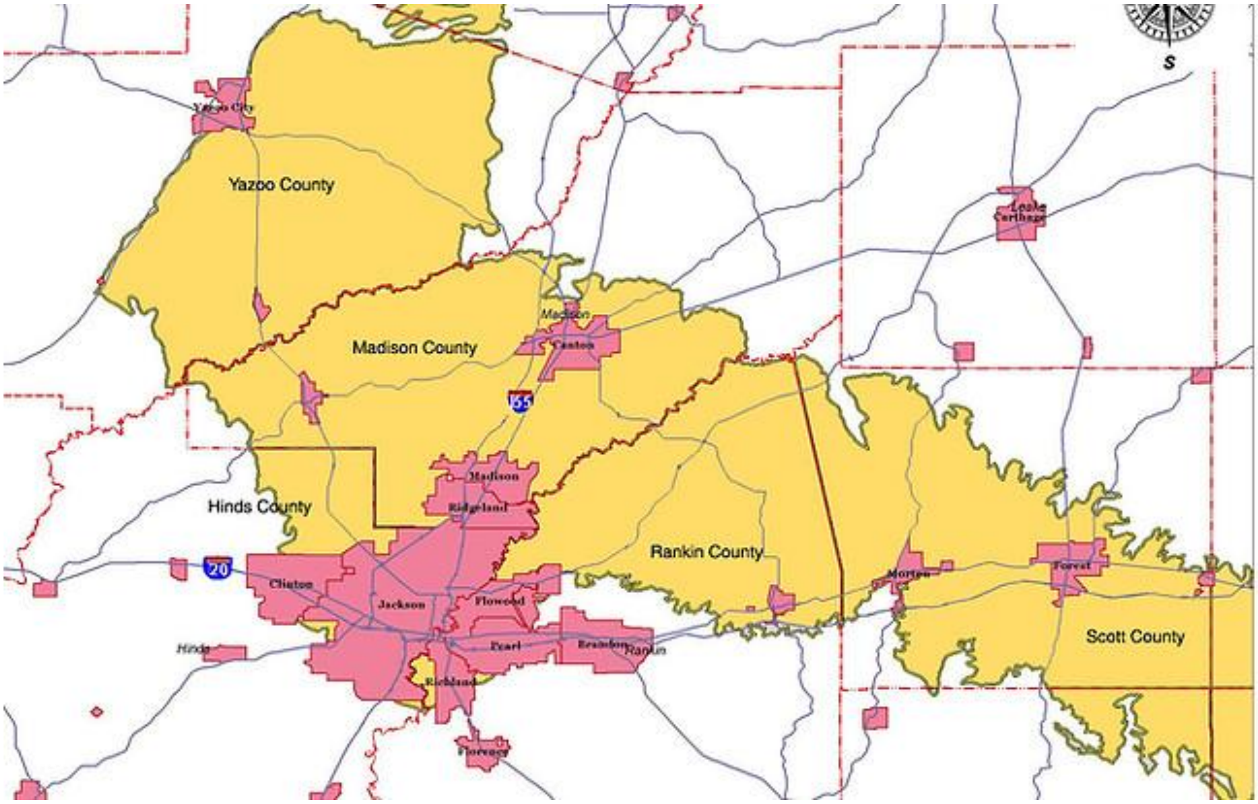


Hattiesburg / Pascagoula Formation in South Mississippi

What is Yazoo Clay: Generally the most problematic expansive clay in the greater Jackson Metro and Central Mississippi region is that of the Yazoo Formation of the Jackson Geologic Group, or Yazoo clay.

The figure below detailing and mapping the location and extent of the Yazoo clay was provided in State Study 151 perfromed by the USACE. The Yazoo clay is identified as the yellow shaded areas with city boundaries identified as red shaded areas. The formation runs entirely beneath the cities of Jackson, Flowood, Madison, Ridgeland, Flora, Bentonia

Canton, Sandhill, Morton, and Forest, and beneath most of the cities of Clinton, Flowood, Richland, and Yazoo City. The formation generally tapers off to the north just south of Eden and just north of Canton and Sandhill, to the west just east of Sartartia and Yazoo City, to the south about half way between Richland and Byram, and extends to the southeast in a narrow band across Morton, Pelahatchie, Forest, Lake, Pachuta, Shubuta, and Matherville, across the Mississippi state line into the western portions of Alabama beginning to taper offaroudn Melvin and Gilberton and near Cullomburg and



State Study 151 and 236

Frankville. The Yazoo clay is an Eocene Age (56 million to 33.9 million years ago) deposit formed in a marine environment. The Yazoo clay mineralogoy consists of smectite (probably montmorillonite), which is considered to be a very active type of clay. The thickness of the Yazoo Clay is about 400 feet at its maximum and reduces to less than 12 inches along the northern edge of the outcrop. Yazoo Clays are over-consolidated and generally deposited in three zones. The uppermost zone consists of highly weathered silty clay that extends to depths that range from less than

12 inches to about 10 to 15 feet. The silty clay is considered minimally expansive with a relatively low shrink/swell potential and is not present in some locations. Beneath the silty clay is highly plastic weathered clay, or "Yazoo Clay". This is the zone/material that is responsible for most local shrink/swell related foundation issues. The depth of the weathered clay generally extends to about 30 to 40 feet below the ground surface. Underlying the weathered clay is unweathered, blue-gray clay, sometimes referred to as "Blue Yazoo Clay". This deepest zone has not been exposed to the effects of natural weathering and extends to a depth of about 400 feet.

How Can Expansive Clay Affect My Foundation: If you are looking to build or buy a home, especially in the cruicial areas outlined above, expansive clay is a concern. Shallow expansive clay beneath a residential foundation can be detrimental to the long term performance of the structure. Once source has cited that of the approximate 250,000 new homes built on expansive soil each year, approximately 60% experience damage, and 10% experience significant damage. Another source has cited the annual damage to homes in the US from expansive soils is estimated to be on the order or $1,000,000,000.00.

As noted, expansive Yazoo clay exhibits a particularly high degree of volumetric change as its soil moisture content increases or decreases, relative to other expansive clays in the region. These changes in soil moisture are generally caused by but are not limited to; prevailing seasonal weather, irrigation, utilities, and vegetative root systems. The expansion/shrinkage will be realized by new grade-supported foundations as upward and downward movement, or heave and settlement.

Once a slab-on-grade has been constructed, the presence of the slab generally limits fluctuation in soil moisture in the more central areas of the slab. The critical zone generally extends from the foundation perimeter to a distance of about 8 to 10 feet inward from the slab edge. Most of the soil moisture fluctuation, and thus movement, will occur within this zone. As the soil along the perimeter of a foundation wets (expands) and dries (shrinks), the edges of the foundation will move accordingly. As the perimeter soils dry, foundation edges drop resulting in a pattern of movement termed “center lift”. As the perimeter soils wet, the foundation edge rises resulting in a pattern of movement termed “edge lift”. The result of one or a combination of these patterns of movement can be distress to the supported elements of the home that can lead to cracks and un-level floor slabs.

If the presence of shallow expansive clay is not discovered and addressed properly prior to new construction, it will likely be felt by the structure throughout its serviceable life. Once movement is activated, very little can be done to permanently arrest it. The local Yazoo clay can experience volume increases of over 200%, and generate up to 25,000 pounds per square foot of swell pressure. Given the typical house generally weighs between 200 to 375 pounds per square foot, depending upon the number of stories, the net result is the expansive Yazoo clay under swelling conditions can exert as much as 50 times the upward pressure on a foundation as the load of the foundation imparts to the ground. This is similar, though not to nearly the same degree, as other expansive clays in Mississippi. In other words it is very easy for the Yazoo clay, or other expansive clays, to lift and shift the foundation elements of a house. True to form the Yazoo clay can undergo significant shrinkage if subjected to drying as well. Cases I have seen locally have exhibited foundation movement up to 10 to 12 inches and more in extreme cases, with movement of 3 to 5 inches not uncommon. A lot of money can be spent on "foundation repair" and leveling slabs, however despite what you may be told, there is very little that can be done to arrest the shrink/swell movement of the clay once it has started. This is primarily because the movement is typically cyclic with changing seasonal weather and it is very difficult at best to prevent moisture fluctuation in soil.

The problems associated with the presence of expansive clay can be addressed, and effective engineering can significantly reduce the potential impact of the expansive soils on foundations to tolerable levels. However, the presence of the expansive material must first be verified by effective subsurface exploration.

3.14: Growth and Development Trends

44 CFR 201.4(c)(3)(i) – [The State risk assessment shall include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events.

Update Requirement 201.4(d): The plan must be reviewed and revised to reflect changes in development.

As part of the plan update process, trends in growth and development were analyzed to determine how changing development and socioeconomic trends could influence loss and vulnerability, especially in Mississippi's hazard-prone areas. Estimated and projected populations, population density, housing units, and housing unit density were studied at the state, regional, and county levels. Specific counties and regions of the state that experienced significant changes are discussed in this section, as well as the long-term effects of Hurricane Katrina on population and housing units. A special section on social vulnerability is also included. State-owned assets and locations are identified in **Section 3.2.1** and the appendices.

Population

Mississippi is a relatively sparsely populated state. According to the 2020 U. S. Census among the 50 states, Mississippi ranked 35th in population and housing density; 38th in population density; and 44th in the population growth rate between 2010 and 2020. The state has 46,906 square miles and a population of 2,240,057, according to the 2022 U.S. Census population estimates. Historic population figures from the decennial census illustrate Mississippi's growth trends for the past six decades (see **Table 3.14.1**). Table **3.14.2** presents certain "quick facts" about the demographics of the state.

Table 3.14.1
Mississippi's Population Growth

Census	Total Population	Percent Change
2022 (Estimate)	2,940,057	-0.92%
2010	2,967,297	4.00%
2000	2,848,753	10.50%
1990	2,575,475	2.18%
1980	2,520,638	13.70%
1970	2,216,994	1.79%
1960	2,178,000	--

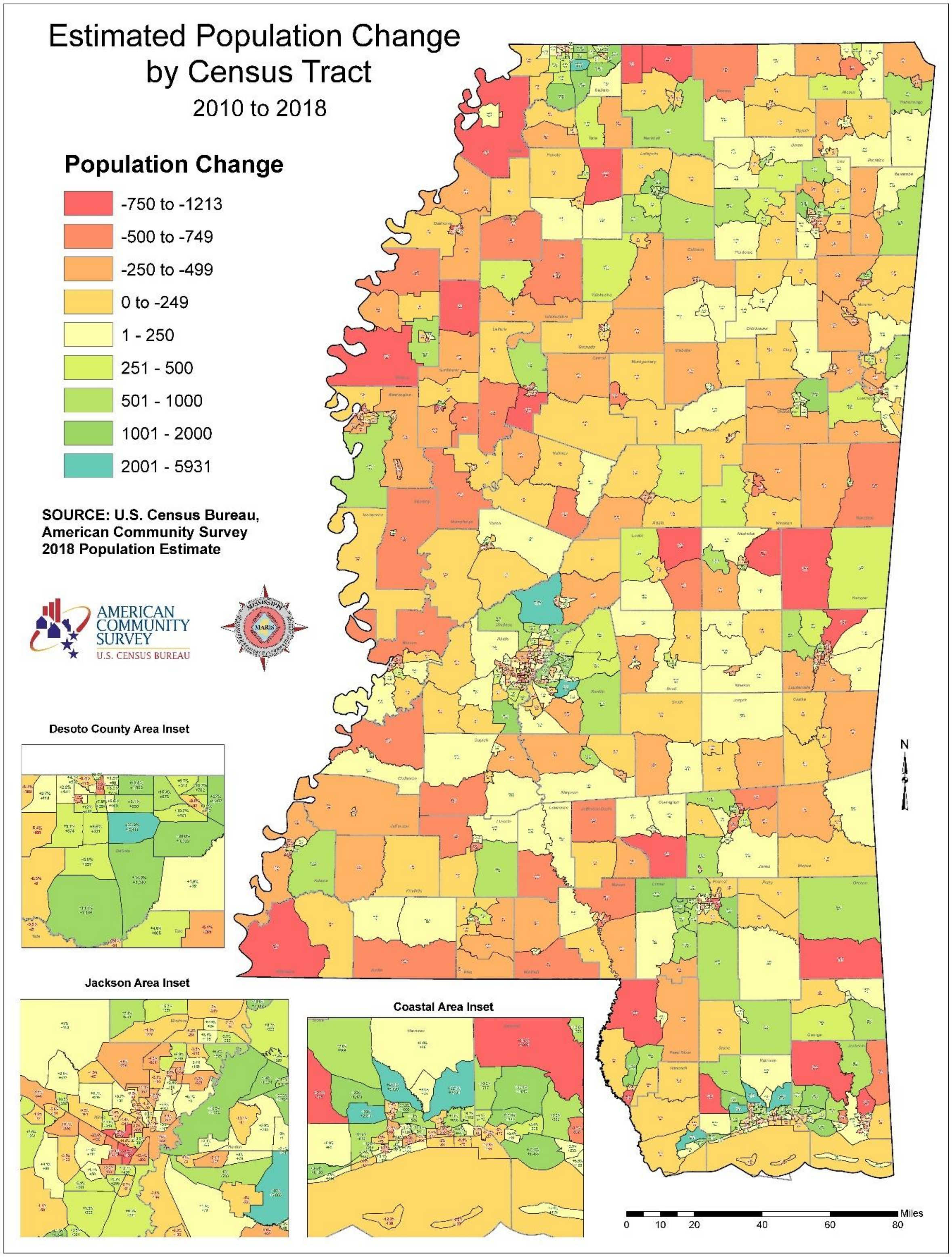
Table 3.14.2
Mississippi's Quick Facts

Population, 2022 estimates	2,940,057
Population, 2010	2,967,297
Population, percentage change, 2010-2022	-0.92%
Persons per square mile, 2020	63.1
Number of Incorporated Cities, Towns, and Villages	298
Number of Counties	82
Urban / Rural Population	49.4/50.6%
Counties with a Population of 100,000 or Greater	6
Counties with a Population of 50,000 – 99,000	9
Counties with a Population of 10,001 – 49,000	51
Counties with a Population of 10,00 or less	16

Source: U.S. Bureau of Census

Between 2010 and 2020, 20 of Mississippi's 82 counties had an increase in population, and 8 of these increased by ten percent or more. This growth was concentrated primarily in four areas of the state. These growth areas included the Gulf Coast and Pine Belt Regions in the southeast, the Jackson Metro Region in central Mississippi, and DeSoto County in the extreme northwest corner of the State. The State also appears to be experiencing significant growth in the Lee County/Tupelo area. This growth is likely driven by an increase in industrial development in the region. **Figure 3.14.1** illustrates the growth by county in Mississippi from 2010-2018.

Figure 3.14.1
Mississippi Growth by County 2010-2018



Mississippi's ten most populated counties are listed in **Table 3.14.3** and the ten least populated counties are listed in **Table 3.14.4**. Counties declining or increasing in population are listed in **Table 3.14.5**; those increasing or declining by the greatest numbers and percentages are listed in **Tables 3.12.6** and illustrated in **Figure 3.14.1**. A demographic worksheet by county is provided in **Appendix 7.3.12-A** with complete information on all counties.

Table 3.14.3
Ten Most Populous Counties
2022 Census Estimates

Ranking/County		2022 Population	Ranking/County		2022 Population
1.	Hinds	217,730	6.	Madison	111,113
2.	Harrison	211,044	7.	Lee	82,959
3.	DeSoto	191,723	8.	Forrest	78,110
4.	Rankin	158,979	9.	Lauderdale	70,904
5.	Jackson	144,975	10.	Jones	66,569

Source: U.S. Bureau of Census

Table 3.14.4
Ten Least Populous Counties
2020 Census

Ranking/County		2022 Population	Ranking/County		2022 Population
1.	Kemper	8,654	6.	Humphreys	7,333
2.	Wilkinson	8,143	7.	Jefferson	7,087
3.	Choctaw	8,037	8.	Quitman	5,701
4.	Franklin	7,642	9.	Sharkey	3,448
5.	Benton	7,550	10.	Issaquena	1,273

Source: U.S. Bureau of Census

Sixty-five counties experienced a population decline between 2010 and 2020 and 16 counties experienced a double-digit decline. The Delta region of the state, located in the western portion of the state and extending to within fifty miles of Memphis, TN, was most affected by declining populations.

Table 3.14.5
Counties with the Greatest Population Loss/Gain
2010 - 2020

County	Population Loss 2010 - 2020
Covington	-1,217
Clarke	-1,193
Wayne	-1,192
Copiah	-1,153
Tunica	-1,035
Jasper	-1,016
Benton	-1,006
Lawrence	-1,000
Claiborne	-793
Perry	-732

Source: U.S. Census Bureau

County	Population Gain 2010 - 2020
DeSoto	30,599
Harrison	26,830
Rankin	18,508
Madison	17,158
Lamar	11,663
Lafayette	9,954
Jackson	6,170
Oktibbeha	5,259
Forrest	3,868
Hancock	3,645

Source: U.S. Census Bureau

Table 3.14.6
Mississippi's Population Growth 2010-2020
(Loss/Gain by Percentage)

County	% Change	County	% Change
Coahoma	-17.41%	DeSoto	16.36%
Quitman	-17.08%	Lafayette	14.36%
Washington	-16.17%	Lamar	14.36%
Humphreys	-16.14%	Madison	11.85%
Wilkinson	-15.33%	Harrison	11.14%
Sharkey	-14.86%	Rankin	9.44%
Sunflower	-14.64%	Hancock	8.84%
Leflore	-14.08%	Pontotoc	8.01%
Holmes	-13.81%	George	7.82%
Tunica	-12.74%	Union	6.36%

Source: U.S. Census Bureau

Figure 3.14.1
Counties Population Loss and Gain Percent 2000 – 2020

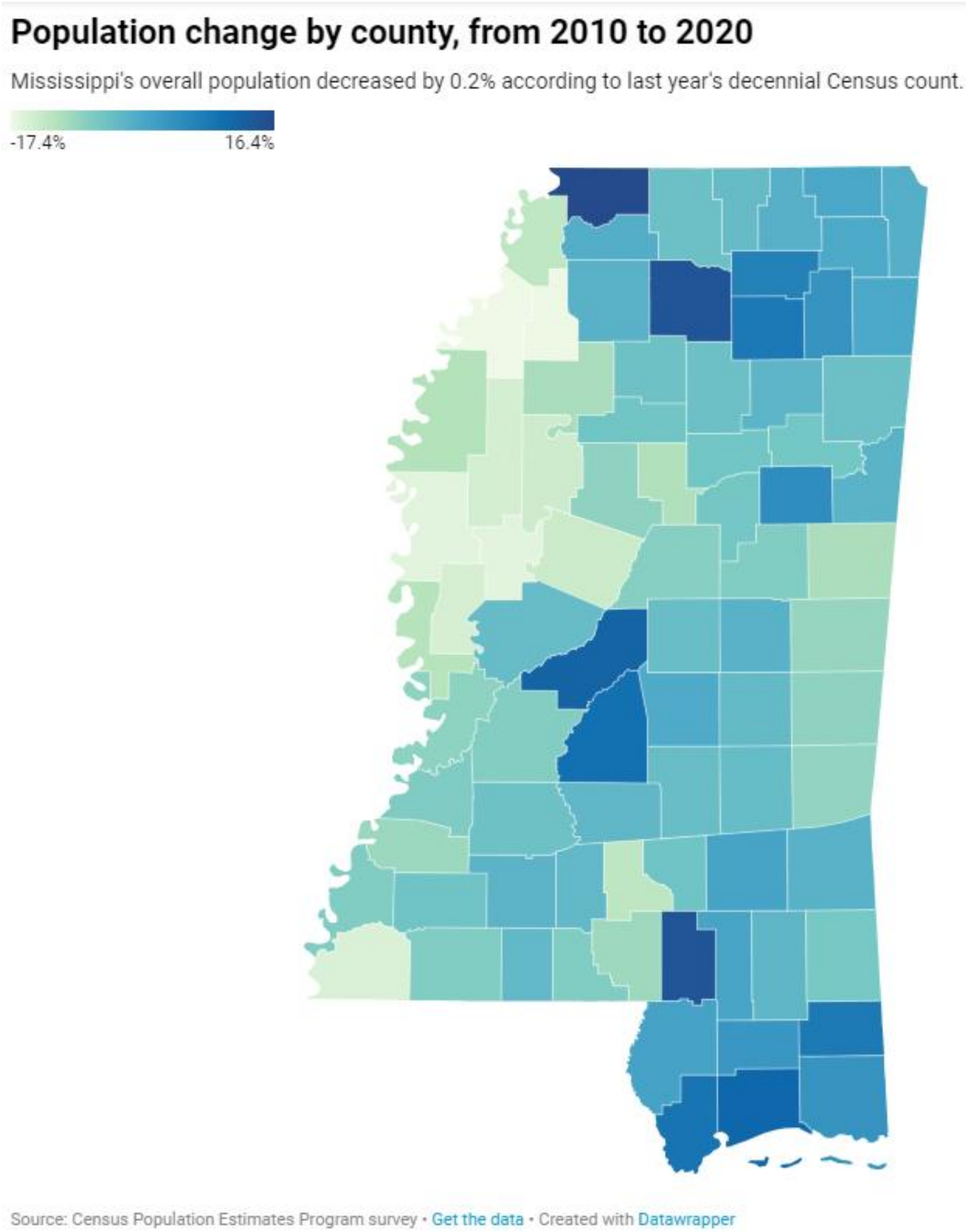


Table 3.14.7
Mississippi Population Projections
2025 - 2050

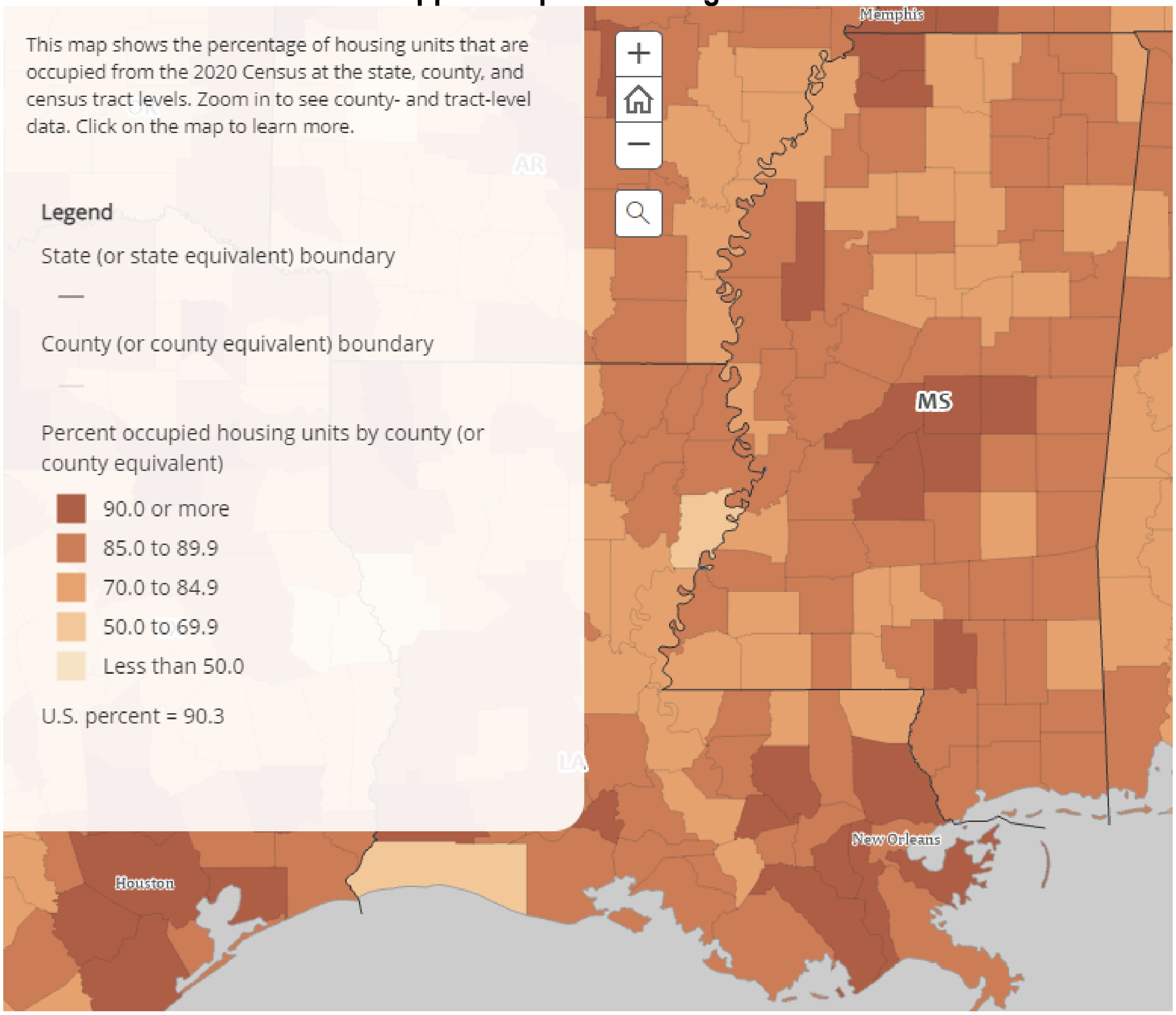
Year	Projected Population	Percent Change
2022 (Estimate)	2,940,057	-
2025	3,095,026	5.27%
2030	3,104,159	0.30%
2035	3,099,766	-0.14%
2040	3,082,567	-0.55%
2045	3,078,363	-0.14%
2050	3,064,588	-0.45%

Source: State Data Center of Mississippi: https://sdc.olemiss.edu/population-projections/

Housing Units

The total number of housing units is another indicator of growth or decline and helps identify the geographical location of new development occurring based on increases within discrete areas. Housing increases in Mississippi have been consistent with population growth patterns and have primarily occurred in the Coastal Region, the Pine Belt, the Jackson Metro Area, and the DeSoto County Region of the State.

Figure 3.14.5
Mississippi Occupied Housing Units 2020



Social Vulnerability

Social vulnerability refers to the negative effects on communities, families, and individuals caused by external stresses on human health. These stresses may include natural or human-caused hazards or disease outbreaks. Reducing social vulnerability has the potential to decrease both human suffering and economic loss in the aftermath of significant hazard events. The Centers for Disease Control (CDC) Social Vulnerability Index uses 16 U.S. Census Bureau variables to help local officials identify communities that may need support before, during, or after disasters.

Variables included in the development of the Social Vulnerability Index include the following:

- Socioeconomic Status:
  - Below 150% poverty

  - Unemployed
  - Housing cost burden
  - No high school diploma
  - No health insurance
- Household Characteristics
  - Aged 65 or older
  - Aged 17 or younger
  - Persons with disabilities
  - Single-parent households
  - English language proficiency
- Racial and Ethnic Minority Status
- Housing Type and Transportation
  - Multi-unit structures
  - Mobile homes
  - Crowding
  - No vehicle
  - Group quarters

These variable are combined into a dataset viewable in map form (See **Figure 3.14.8)** that illustrate by county or by census tract those areas particularly susceptible to social vulnerabilities.

Social vulnerability is partially a product of social inequalities – those social factors and forces that create the susceptibility of various groups to harm, and in turn affect their ability to respond and bounce back (resilience) after the disaster, (Susan L. Cutter, Bryan J. Boruff, and W. Lynn Shirley, 2003. "Social Vulnerability to Environmental Hazards," Social Science Quarterly 84(1):242-261.)

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The raw data from the Social Vulnerability Index ranks communities on three values including their Risk Rating, their Social Vulnerability Index Rating, and their Resiliency Rating. The Risk Rating or Risk Value represents the average loss in dollars to buildings, population, and/or agriculture each year to a community based on the community's Social Vulnerability and Community Resilience. The Social Vulnerability Index Rating is a consequence-enhancing risk component and community risk factor that represents the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. The Resilience Rating is a consequence reduction risk component and community risk factor that represents the ability of a community to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions. The following table provides a state-wide ranking by county based on these three rankings. Generally speaking, counties with a better overall Social Vulnerability Index rating will score low on the Risk Rating, low on the Social Vulnerability Rating, and high on the Resilience Rating. **Figure 3.14.8** illustrates each Mississippi County's relative ranking on the Social Vulnerability Index.

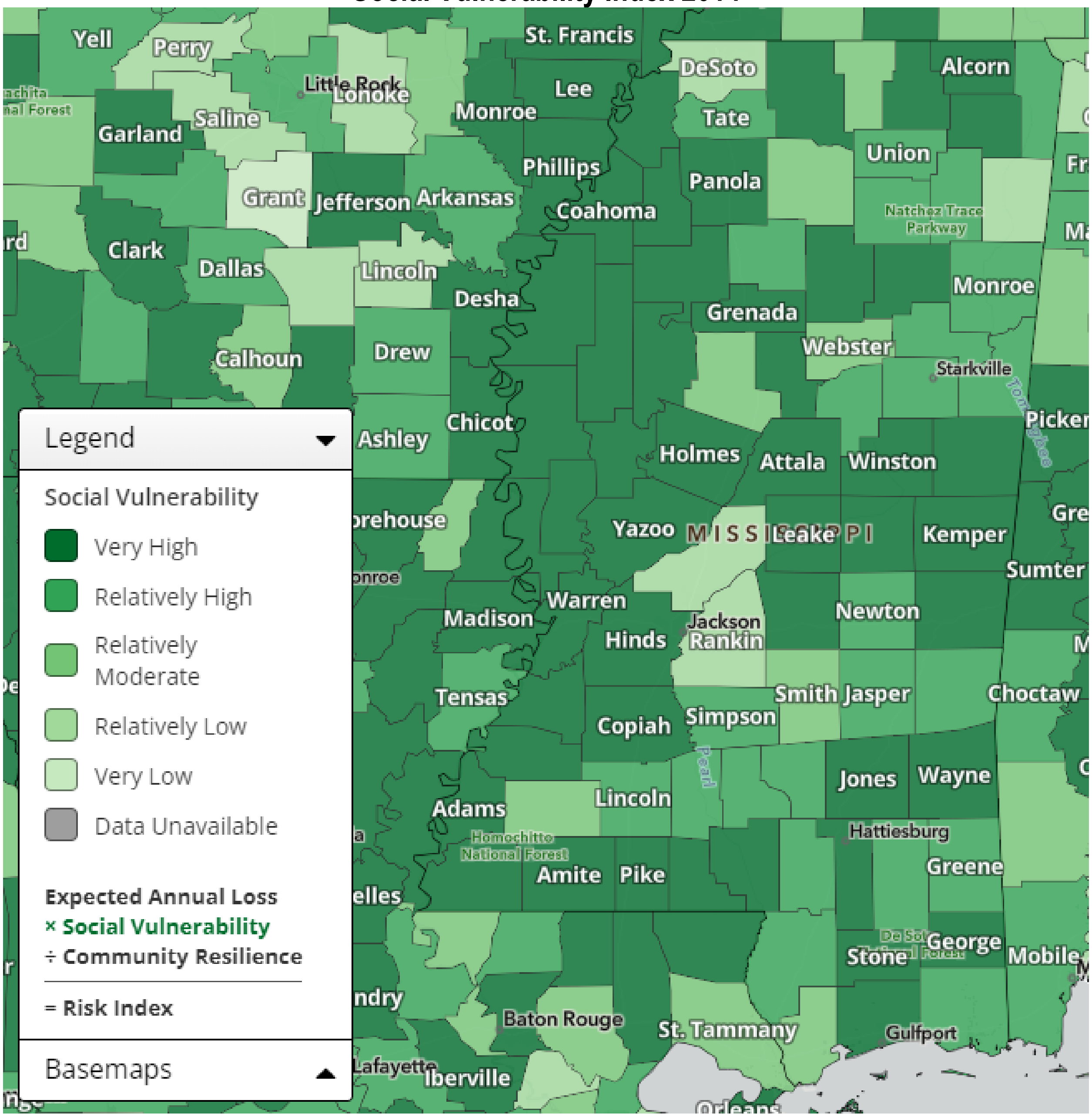
Table 3.14.13
Social Vulnerability Index Rankings

County	Risk Rating	Social Vulnerability Index Rating	Resilience Rating
Adams	Relatively Low	Very High	Relatively Low
Alcorn	Relatively Low	Very High	Relatively Low
Amite	Relatively Low	Very High	Very Low
Attala	Very Low	Very High	Relatively Low
Benton	Very Low	Relatively Moderate	Very Low
Bolivar	Relatively Low	Very High	Relatively Low
Calhoun	Very Low	Very High	Very Low
Carroll	Very Low	Relatively Moderate	Relatively Low
Chickasaw	Relatively Low	Very High	Very Low
Choctaw	Very Low	Relatively High	Very Low
Claiborne	Very Low	Very High	Very Low
Clarke	Relatively Low	Relatively High	Relatively Low
Clay	Very Low	Relatively High	Relatively Moderate
Coahoma	Relatively Low	Very High	Relatively Moderate
Copiah	Relatively Low	Very High	Very Low
Covington	Relatively Low	Relatively High	Very Low
DeSoto	Relatively Moderate	Relatively Low	Relatively Moderate
Forrest	Relatively Moderate	Very High	Relatively Moderate
Franklin	Very Low	Relatively Moderate	Relatively Low
George	Relatively Moderate	Very High	Relatively Low
Greene	Relatively Low	Relatively High	Very Low
Grenada	Relatively Low	Very High	Relatively Moderate
Hancock	Relatively Moderate	Relatively Moderate	Relatively High
Harrison	Relatively High	Very High	Relatively High
Hinds	Relatively Moderate	Very High	Relatively High
Holmes	Relatively Low	Very High	Very Low
Humphreys	Very Low	Very High	Very Low
Issaquena	Very Low	Very High	Very Low
Itawamba	Very Low	Relatively Low	Relatively Low
Jackson	Relatively High	Relatively High	Relatively High
Jasper	Relatively Low	Relatively High	Relatively Low
Jefferson	Very Low	Very High	Very Low
Jefferson Davis	Very Low	Relatively High	Very Low
Jones	Relatively Moderate	Very High	Relatively Low
Kemper	Very Low	Very High	Very Low
Lafayette	Relatively Low	Relatively Moderate	Relatively High
Lamar	Relatively Low	Relatively High	Relatively Moderate
Lauderdale	Relatively Moderate	Very High	Relatively Moderate
Lawrence	Very Low	Relatively High	Very Low

County	Risk Rating	Social Vulnerability Index Rating	Resilience Rating
Leake	Relatively Low	Very High	Very Low
Lee	Relatively Low	Relatively High	Relatively High
Leflore	Relatively Low	Very High	Relatively Low
Lincoln	Relatively Low	Relatively High	Relatively Low
Lowndes	Relatively Low	Relatively High	Relatively Moderate
Madison	Relatively Moderate	Relatively Low	Very High
Marion	Relatively Low	Very High	Very Low
Marshall	Relatively Low	Very High	Very Low
Monroe	Relatively Low	Relatively High	Relatively Moderate
Montgomery	Very Low	Very High	Relatively Low
Neshoba	Relatively Low	Very High	Relatively Low
Newton	Relatively Low	Relatively High	Relatively Low
Noxubee	Very Low	Very High	Very Low
Oktibbeha	Relatively Low	Relatively High	Relatively Moderate
Panola	Relatively Low	Very High	Relatively Low
Pearl River	Relatively Moderate	Relatively High	Relatively Low
Perry	Relatively Low	Relatively High	Very Low
Pike	Relatively Low	Very High	Relatively Low
Pontotoc	Relatively Low	Relatively High	Relatively Low
Prentiss	Very Low	Very High	Relatively Low
Quitman	Very Low	Very High	Very Low
Rankin	Relatively Moderate	Relatively Low	Relatively High
Scott	Relatively Low	Very High	Very Low
Sharkey	Very Low	Very High	Relatively Low
Simpson	Relatively Low	Relatively High	Relatively Low
Smith	Relatively Low	Relatively Moderate	Very Low
Stone	Relatively Low	Very High	Relatively Low
Sunflower	Relatively Low	Very High	Very Low
Tallahatchie	Very Low	Very High	Very Low
Tate	Relatively Low	Relatively High	Relatively Low
Tippah	Relatively Low	Very High	Relatively Low
Tishomingo	Very Low	Relatively High	Relatively Low
Tunica	Relatively Low	Very High	Relatively Moderate
Union	Very Low	Relatively High	Relatively Moderate
Walthall	Relatively Low	Very High	Very Low
Warren	Relatively Low	Very High	Relatively High
Washington	Relatively Moderate	Very High	Relatively Low
Wayne	Relatively Low	Very High	Very Low
Webster	Very Low	Relatively Moderate	Relatively Low
Wilkinson	Very Low	Very High	Very Low
Winston	Relatively Low	Very High	Relatively Low

County	Risk Rating	Social Vulnerability Index Rating	Resilience Rating
Yalobusha	Very Low	Relatively High	Relatively Low
Yazoo	Relatively Low	Very High	Very Low

Figure 3.14.8
Social Vulnerability Index 2014



Source: FEMA National Risk Index: https://hazards.fema.gov/nri/map#

Summary

Mississippi is a relatively sparsely populated state. According to the 2020 U. S. Census among the 50 states, Mississippi ranked 35th in population and housing density; 38th in population density; and 44th in the population growth rate between 2010 and 2020. The state has 46,906 square miles and a population of 2,240,057, according to the 2022 U.S. Census population estimates.

Growth patterns in Mississippi are similar to those in other states with the most pronounced growth being in counties close to major cities or within Metropolitan Statistical Areas. Examples include Rankin and Madison counties within the Jackson MSA, adjacent to the capital city, and Desoto County within the Memphis MSA. Areas located close to universities such as Lamar County (University of Southern Mississippi) and Lafayette County (Mississippi State University) also show significant growth. Coastal counties including Pearl River, Stone, Hancock, Harrison, and Jackson also experienced positive population growth. Population growth is often concentrated along economically desirable coastal areas that are at high risk of coastal flooding or storm surge.

Between 2010 and 2020, 20 of Mississippi's 82 counties had an increase in population, and 8 of these increased by ten percent or more. This growth was concentrated primarily in four areas of the state. These growth areas included the Gulf Coast and Pine Belt Regions in the southeast, the Jackson Metro Region in central Mississippi, and DeSoto County in the extreme northwest corner of the State. The State also appears to be experiencing significant growth in the Lee County/Tupelo area. This growth is likely driven by an increase in industrial development in the region. Counties that experienced a loss of population are primarily located in the Mississippi Delta region where the economic base has historically been heavily reliant on agriculture.

Recent natural disasters heightened interest in consistent building codes, flood control, stormwater control, and the protection of wetlands. Concepts related to community resilience and sustainable development, especially in the most populous counties, gained momentum. FEMA recently completed new flood maps for Mississippi and all six gulf coast counties adopted building codes including hurricane-resistant construction standards. Manufactured homes, mobile homes, and recreational vehicle areas are considered vulnerable. There are also concentrations of older homes that remain a concern.

Future growth is expected to be modest at a rate of about 0.72% annually through 2050. It is expected areas that have experienced the most significant growth during the first decade of this century will continue to lead the state with some "spill-over" into adjacent areas.

3:15: Infrastructure Interdependencies

Background

In recent years, critical infrastructure and other essential services that are necessary for our communities to function properly have become increasingly interconnected and interdependent. This critical infrastructure includes energy (electric power, natural gas, fuels); telecommunications, transportation (rail, road, maritime); water and wastewater; banking and finance; emergency services; government services; healthcare systems; food production; dams and levees; and manufacturing and distribution. To a large degree, this trend toward increased connectivity has been created by our growing reliance on digital systems for the management and operation of our infrastructure. This interconnectivity and the resulting interdependencies exist at multiple levels and in increasing levels of complexity. They extend beyond communities, states, and nations, with the potential for unexpected vulnerabilities with significant consequences.

Management of critical infrastructure during post-disaster recovery needs to be supported by a comprehensive recognition that the recovery of infrastructure can be affected by the interdependencies that exist between different systems. A fundamental characteristic of these interdependencies is that the failure of one infrastructure system can result in the failure of other interdependent infrastructures, leading to a cascade of failures. Although governments, emergency, and business continuity practitioners are beginning to focus on interdependencies, we remain limited in our understanding of them, the vulnerabilities they create, and how to prevent or lessen their impacts. Disruptions in one infrastructure can cascade, ultimately affecting more than one infrastructure, affecting essential government services, businesses, and individuals in an entire region with far-reaching health and human safety, economic, environmental, and national security consequences.

Examples of Infrastructure Dependencies and Interdependencies

Water and wastewater systems, are dependent on a wide range of infrastructures and other essential services, including electricity to power pumps and control systems, petroleum for transportation of repair and maintenance personnel, communications to handle the ordering of chemicals and other supplies and equipment and direct operations, all modes of transportation for supply and shipping, and financial systems to support billing, payments, and other business services. Likewise, electric power utilities depend on natural gas, coal, and petroleum to fuel generators, as well as on road and rail transportation to deliver fuels to the generators, water for cooling and to reduce emissions, and telecommunications to monitor system status and system control, e.g., Supervisory Control and Data Acquisition (SCADA) systems and energy management systems.

Similarly, other types of infrastructure depend on water and electric power and other infrastructure services.

- Computers, process control, telecommunications, and other systems that run infrastructures depend on water for cooling. Water systems may require electric power for operating pumps and need logistics and transportation for supplying water treatment chemicals.

- Natural gas fuels generators in the electric power system. Electric power in turn may be required to operate the systems that are essential for delivering gas (e.g., control systems, storage operations, and compressor stations).

- A substation in an electrical distribution system can provide electric power to a key telecommunication switching center, and rail transportation depends on electric power for signaling, crossing protection, monitoring, and other terminal operations. Under certain conditions, failure or loss of power in a substation directly affects operations at a telecommunication switching center.

- The telecommunications center, in turn, supports SCADA systems for natural gas and oil pipelines, as well as electric power, water, and transportation systems that support electric power.

- Agriculture and food processing, warehousing and distribution, and manufacturing are dependent on all forms of infrastructure including electricity for processes and refrigeration, communications for shipping and logistics; transportation for shipping materials and products, and financial systems to support purchasing of materials and sales of goods.

When infrastructure failures occur and repair crews and replacement components are needed, service providers also depend on other infrastructures, including telecommunications, information technology, fuel, and transportation systems Other dependencies, because of their location or exposure to the environment, are not physically linked but are coupled. A common utility corridor consisting of overhead or underground electric power transmission and distribution lines, underground pipelines, and telecommunications cables illustrates such dependencies. Multiple infrastructure assets are often co-located. Transmission lines for electricity and telecommunications often share the same support systems. Water and wastewater lines often run parallel to one another. The proximity of these systems has the potential to increase vulnerabilities and the potential for simultaneous outages created by hazard events.

Another type of dependency can exist in complex systems without a direct link. The failure of a substation, for example, can lead to the reconfiguration of the electric network, which, in turn, can overload a similar substation within the system if the demand exceeds capacity. In such cases, a direct link usually does not exist, and the failure occurs only when certain conditions are imposed (e.g., maximum load conditions). Natural hazards, such as earthquakes or extreme weather conditions, show how threats can affect multiple infrastructures at the same time. Such threats also reveal interdependencies that can complicate or delay response and mitigation or recovery of a particular infrastructure from an incident. Similar circumstances were experienced in the aftermath of Hurricane Katrina. Water infrastructure was intentionally kept offline in many locations because the power had not been restored to sewer pumps and lift stations. Allowing water systems to operate without pumps and lift stations to effectively convey wastewater would have resulted in significant environmental and human health impacts. Once the power to lift stations was restored, both water and wastewater systems returned to normal functionality.

Mississippi Infrastructure Summary

While the nation's infrastructure earned a "C-" in the 2021 Infrastructure Report Card, Mississippi faces infrastructure challenges of its own. The 2020 Mississippi Infrastructure Report Card gives Mississippi a "D+". Mississippi's infrastructure challenges are directly related to aging infrastructure, lack of routine maintenance, inconsistent data collection, and limited funding. These challenges directly impact the quality of life in Mississippi and potentially threaten commerce in the State.

The 2020 Mississippi Infrastructure Report Card reveals the following:

- There are 73 public-use airports with a five-year demand of $350 million for capital improvements and large maintenance projects. Rising costs of construction resulting in a greater dependence on external funding equates to an estimated $175 million shortfall over the next five years.
- 1,603 (9.4%) of the State's 17,072 bridges are structurally deficient. It is estimated that approximately $1.6 billion is needed for bridge repairs or replacement throughout the State.
- 71% of the state-regulated dams have an Emergency Action Plan. 36% of state-owned dams are in poor or unsatisfactory condition with approximately $1.21 needed to repair all of Mississippi's non-federally owned dams.
- $2.035 billion in wastewater infrastructure needs over the next 20 years.
- Mississippi has over 77,000 miles of public roads, with 43% in poor condition.
- $561 per motorist per year in costs from driving on roads in need of repair.

Historic and Recent Infrastructure Incidents

Jackson, Mississippi Water Treatment Plant Failure – August-September 2022

Flooding from the Pearl River in late August 2022 caused a failure of the O.B. Curtis Water Treatment Plant in the City of Jackson resulting in approximately 150,000 residents of the City without access to safe drinking water. On August 29, 2022, Governor Reeves declared a state of emergency and President Biden declared a federal disaster to trigger federal aid. The lack of water forced many stores and restaurants in Jackson to close, while local schools and universities moved to virtual learning. Most of the City's hospitals have independent water supplies and were not affected by the crisis. As of 2023, concerns still exist in the City over the quality of the drinking water with many residents continuing to boil water or use bottled water. Full system repair costs are estimated at $1 billion and to date, the City has received approximately 60% of that amount through a variety of federal grant sources.

Water Main Breaks – Winter 2017/2018

At the end of 2017 and the beginning of 2018, an unusually severe winter weather event in Mississippi caused problems for Jackson's infrastructure, resulting in a citywide emergency declaration from the Public Works director. At the beginning of the event, there were 32 "significant" water main breaks across the city. A final count of water main breaks confirmed that the year's total was 231 breaks. In a single day, 25 breaks occurred, surpassing the previous high of 22. The city's water treatment plants were operating at maximum capacity because of a quickly dwindling water supply from the breaks. Due to the frozen pipes and inadequate water pressure, Jackson Public Schools were closed for approximately 10 days.

Bridge Closures

On April 10, 2018, Governor Phil Bryant ordered the closing of over 100 deficient Mississippi bridges after receiving a warning letter from the U.S. Department of Transportation. Governor Bryant declared a state of emergency, closing 83 bridges on April 10, 2018. Since then, the number increased to 106. The bridges were inspected and deemed unsafe by the Mississippi Office of State Aid and Road Construction and the federal National Bridge Inspection Standards. Independent consultants were conducting bridge inspections around the state for almost a year. It was part of an action plan created by the Federal Highway Administration and state agencies. The bridges will remain closed until brought up to code.

Recommendations - Mitigation Approach

The challenge of comprehensively understanding infrastructure interdependencies presents an opportunity for innovative approaches to mitigation to ensure operational continuity following hazard events affecting Mississippi. Widespread and prolonged service disruptions can result in significant regional economic and psychological impacts that have the potential to impact commerce and result in the relocation of residents in affected communities. At the same time, economic constraints pose additional challenges for states, localities, and stakeholder organizations, which have limited manpower, funds, and technical expertise to assess and identify appropriate mitigation actions related to all-hazards vulnerabilities from interdependencies.

Regardless of the affecting hazard event, there is a need for a comprehensive, state-wide strategy to improve the resilience of our infrastructure and other essential services to ensure the resilience of the communities that depend on them. This all-hazards, multi-jurisdiction, cross-sector approach to preparedness and resilience includes detection, prevention, mitigation, response, recovery/restoration, training, exercises, and community outreach. It requires utilities and other service providers to examine external linkages that affect their operations and business continuity. It also necessitates bringing together public, private, and non-profit stakeholders with state and federal partners in collaboration to share information and understand and address regional vulnerabilities and consequences posed by infrastructure interdependencies.

As we prepare for the future, we must utilize new approaches, materials, and technologies to ensure our infrastructure is more resilient, allowing for a quick recovery from significant weather and other hazard events; and sustainable, allowing for communities to improve the “triple bottom line” with clear economic, social, and environmental benefits. Specific strategies and approaches to consider that will improve communities’ resilience and sustainability concerning infrastructure interdependence may include:

- Development of active community resilience programs for severe weather and seismic events to establish communications systems and recovery plans to reduce impacts on the local economy, quality of life, and environment.

- Consideration of emerging technologies and shifting social and economic trends when developing new and upgrading existing infrastructure, such as autonomous vehicles, distributed power generation and storage, and larger.

- Improved land use planning at the local level to consider the function of existing and new infrastructure, the balance between the built and natural environments, and population trends in communities of all sizes.

- Support for research and development into innovative new materials, technologies, and processes to modernize and extend the life of infrastructure, expedite repairs or replacement, and promote cost savings.

- Encourage the development of continuity of operations plans for primary infrastructure operators, local businesses, and government entities on all levels to aid in recovery efforts and to assist these entities in their efforts to return to normal operations as quickly as possible following a disaster event.

3.16: Infectious Disease/Pandemic

Hazard Description[1]

According to the National Center for Biotechnology Information, pandemics are large-scale outbreaks of infectious diseases that can increase morbidity and mortality over a wide geographic area and cause significant economic, social, and political disruptions. Evidence suggests that the likelihood of pandemics has increased in the modern era due to increased global travel and population integration, urbanization, changes in land use, and greater exploitation of the natural environment. It is anticipated that these trends will continue and intensify. The most recent pandemic impacting Mississippi was the COVID-19 pandemic. The following sections will discuss risks, impacts, mitigation, and knowledge gaps generally, as well as a general timeline of the COVID-19 pandemic and its impacts on the State of Mississippi.

Risks

- Pandemics have occurred throughout history and appear to be increasing in frequency, particularly because of the increasing emergence of viral diseases from animals.
- Pandemic risk is driven by the combined effects of spark risk (where a pandemic is likely to arise) and spread risk (how likely it is to diffuse broadly through human populations).
- Some geographic regions with high spark risk, including Central and West Africa, lag behind the rest of the globe in pandemic preparedness.
- Probabilistic modeling and analytical tools such as exceedance probability (EP) curves are valuable for assessing pandemic risk and estimating the potential burden of pandemics.
- Influenza is the most likely pathogen to cause a severe pandemic. EP analysis indicates that in any given year, a 1 percent probability exists of an influenza pandemic that causes nearly 6 million pneumonia and influenza deaths or more globally.

Impacts

- Pandemics can cause significant, widespread increases in morbidity and mortality and have disproportionately higher mortality impacts on low to moderate-income regions.
- Pandemics can cause economic damage through multiple channels, including short-term fiscal shocks and longer-term negative shocks to economic growth.
- Individual behavioral changes, such as fear-induced aversion to workplaces and other public gathering places, are a primary cause of negative shocks to economic growth during pandemics.
- Some pandemic mitigation measures can cause significant social and economic disruption.

[1] National Center for Biotechnology Information: Disease Control Priorities: Improving Public Health and Reducing Poverty: 3rd Edition: https://www.ncbi.nlm.nih.gov/books/NBK525302/

Mitigation

- Pathogens with pandemic potential vary widely in the resources, capacities, and strategies required for mitigation. However, there are also common prerequisites for effective preparedness and response.
- The most cost-effective strategies for increasing pandemic preparedness, especially in resource-constrained settings, consist of investing to strengthen core public health infrastructure, including water and sanitation systems; increasing situational awareness; and rapidly extinguishing sparks that could lead to pandemics.
- Once a pandemic has started, a coordinated response should be implemented focusing on the maintenance of situational awareness, public health messaging, reduction of transmission, and care for and treatment of the ill.
- Successful contingency planning and response require surge capacity—the ability to scale up the delivery of health interventions proportionately for the severity of the event, the pathogen, and the population at risk.
- For many poorly prepared countries, surge capacity likely will be delivered by foreign aid providers. This is a tenable strategy during localized outbreaks, but global surge capacity has limits that likely will be reached during a full-scale global pandemic as higher-capacity states focus on their populations.
- Risk transfer mechanisms, such as risk pooling and sovereign-level catastrophe insurance, provide a viable option for managing pandemic risk.

Knowledge Gaps

- Spending and costs specifically associated with pandemic preparedness and response efforts are poorly tracked.
- There is no widely accepted, consistent methodology for estimating the economic impacts of pandemics.
- Most data regarding the impacts of pandemics and the benefits and costs of mitigation measures come from high-income countries (HICs), leading to biases and potential blind spots regarding the risks, consequences, and optimal interventions specific to low to moderate-income regions.

Mississippi Covid-19 Timeline[2]

The following table provides an overview of the COVID-19 events specific to Mississippi through the availability of the first vaccinations in the State:

Date	Event
1/21/2020	U.S. confirms first COVID-19 case
3/4/2020	MS creates the MS Coronavirus Preparedness and Response Committee
3/11/2020	MS confirms first COVID-19 case
3/11/2020	WHO declares a global pandemic
3/14/2020	MS declares a state of emergency
3/17/2020	MS Legislative session suspended

[2] Mississippi Free Press: https://www.mississippifreepress.org/9913/mississippcovid-19-timeline

3/18/2020	Jackson suspends in-house dining in restaurants
3/19/2020	Public schools close in Mississippi
3/19/2020	MS confirms first death
3/24/2020	Hospital & nursing home visits suspended
4/1/2020	MS confirmed cases surpass 1,000
4/1/2020	MS issues shelter-in-place order
4/3/2020	Shelter-in-place begins
4/27/2020	Shelter-in-place ends, Safter At Home order begins
5/7/2020	Restaurants/bars reopen
5/12/2020	MS begins County-specific orders for high-risk counties
6/24/2020	MSDH reports the 1,000th death
7/13/2020	Mask mandates take effect, elective surgeries end
8/5/2020	Statewide mask mandate goes into effect
11/12/2020	Jackson runs out of ICU beds
12/15/2020	First Mississippi vaccinations made available

Table 3.16.1
Mississippi COVID-19 Impacts
Cases and Deaths by County[3]

County	Cases	Deaths
Adams County	8,703	153
Alcorn County	12,937	177
Amite County	3,907	71
Attala County	6,893	126
Benton County	2,851	51
Bolivar County	11,810	194
Calhoun County	5,626	79
Carroll County	3,101	59
Chickasaw County	7,070	105
Choctaw County	2,932	37
Claiborne County	2,594	50
Clarke County	4,913	112
Clay County	6,279	104
Coahoma County	8,302	139
Copiah County	9,350	131
Covington County	8,790	124
DeSoto County	62,050	595

[3] USAfacts.org

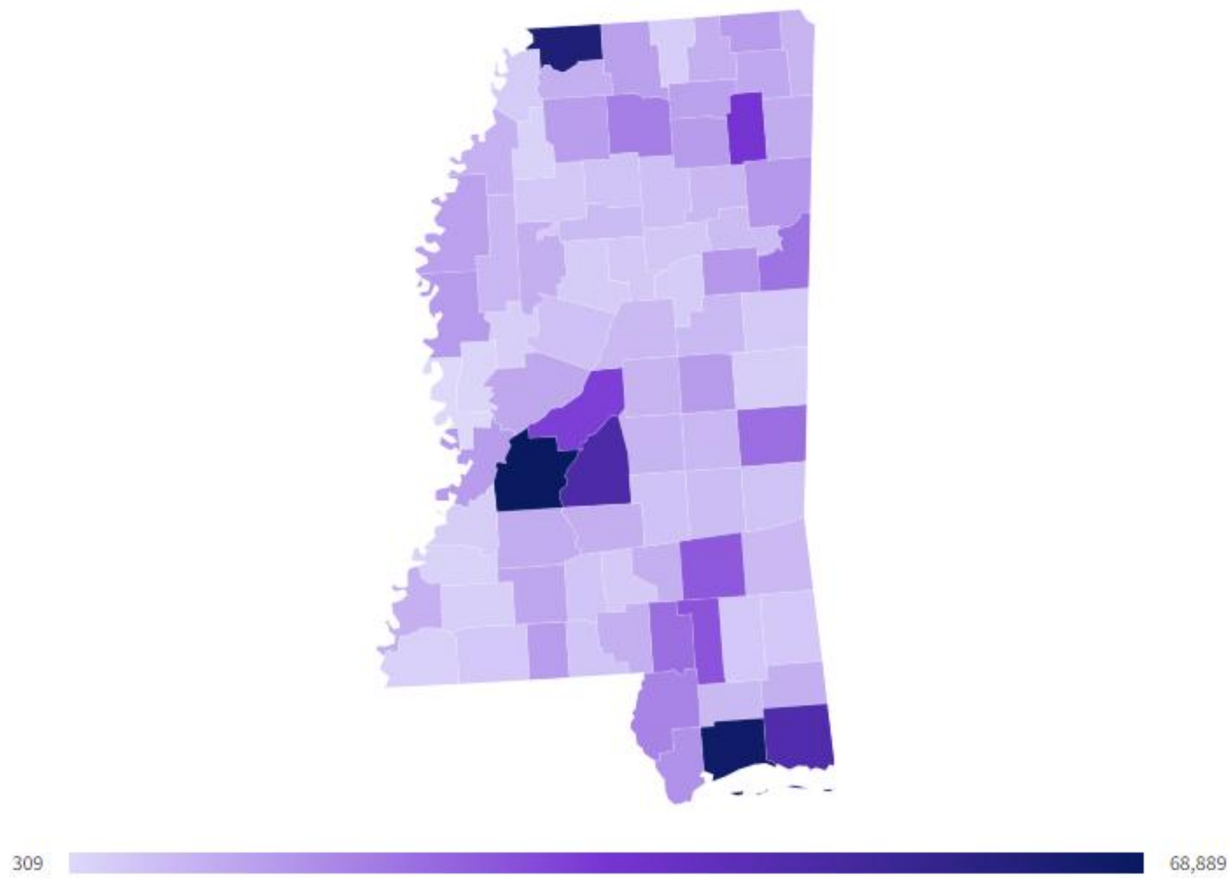
County	Cases	Deaths
Forrest County	27,776	331
Franklin County	2,383	40
George County	8,828	92
Greene County	3,927	61
Grenada County	6,500	142
Hancock County	15,056	164
Harrison County	66,683	720
Hinds County	68,889	868
Holmes County	5,285	108
Humphreys County	2,440	51
Issaquena County	309	9
Itawamba County	9,554	153
Jackson County	46,292	505
Jasper County	6,208	86
Jefferson County	1,807	40
Jefferson Davis County	3,709	57
Jones County	26,729	316
Kemper County	2,676	53
Lafayette County	19,058	192
Lamar County	22,343	173
Lauderdale County	22,295	393
Lawrence County	4,587	62
Leake County	7,755	128
Lee County	34,499	336
Leflore County	8,725	184
Lincoln County	10,578	166
Lowndes County	21,511	259
Madison County	32,279	357
Marion County	8,872	155
Marshall County	12,159	196
Monroe County	13,989	233
Montgomery County	3,730	85
Neshoba County	12,943	248
Newton County	7,156	108

County	Cases	Deaths
Noxubee County	3,651	52
Oktibbeha County	13,885	173
Panola County	12,540	183
Pearl River County	17,966	290
Perry County	3,807	66
Pike County	12,917	197
Pontotoc County	12,987	161
Prentiss County	10,393	119
Quitman County	1,843	35
Rankin County	47,543	533
Scott County	7,956	123
Sharkey County	1,179	28
Simpson County	8,750	164
Smith County	5,104	72
Stone County	6,769	82
Sunflower County	7,188	138
Tallahatchie County	3,912	72
Tate County	8,772	161
Tippah County	9,010	118
Tishomingo County	7,816	123
Tunica County	3,078	50
Union County	11,785	136
Walthall County	4,739	85
Warren County	12,897	219
Washington County	13,169	215
Wayne County	7,031	92
Webster County	4,102	76
Wilkinson County	1,947	47
Winston County	6,825	105
Yalobusha County	4,856	63
Yazoo County	10,360	118
	1,000,415	13,474

Figure 3.16.1 below illustrates the cumulative distribution of cases in Mississippi by county. An analysis of the map indicates the heavier distribution of cases in regions of the State with the greatest population

densities including the coastal region, the Pine Belt, the Jackson Metro area, and the DeSoto County Metro area. The five counties with the highest reported number of cases include (in order): Hinds, Harrison, DeSoto, Rankin, and Jackson Counties. These same counties also reported the highest death rates.

Figure 3.16.1
Mississippi COVID-19 Impacts
Cumulative Cases by County[4]



Mississippi COVID-19 Economic Impacts

Many of us know anecdotally that COVID-19 had a significant economic impact on Mississippi. Companies went out of business, jobs were lost, and, people were not engaging in the economy as they would under normal circumstances. The following provides some highlights of the economic impacts:

- Mississippi's economy contracted 1.8% in 2020 as measured by real gross domestic product (GDP). That percentage change in real GDP ranked 10th among all states but was considerably less than the decrease in the U.S. real GDP in 2020 of 3.4%.

[4] USAfacts.org

- Payroll employment in Mississippi decreased by 4.3% in 2020, similar to the decrease experienced in employment during the Great Recession of 2009.
- The State's Accommodation and Food Services sector employment dropped 13.1% in 2020, the largest decrease among all major employment sectors.
- The total number of people in the labor force in Mississippi decreased 1.6% in 2020 and the labor force participation rate fell to 55.1%, down from 56% in 2019.[5]

Likelihood of Occurrence and Vulnerability

As indicated in the opening paragraph of this section, increases in global travel and population integration, urbanization, changes in land use, and greater exploitation of the natural environment are all variables at least partially responsible for the increasing likelihood of the recurrence of a global pandemic similar to what we experienced with COVID-19. During COVID, we experienced the tendency of the virus to mutate and adapt to our collective attempts at control and eradication. This phenomenon indicates that the next pandemic we experience may be vastly different from COVID. It may transmit differently and affect different population groups, leaving little in the way of mitigation options. The most cost-effective strategies for increasing pandemic preparedness consist of investing to strengthen core public health infrastructure, including water and sanitation systems; increasing situational awareness, public health messaging, and rapidly extinguishing sparks that could lead to pandemics. Successful contingency planning and response require surge capacity – the ability to scale up the delivery of health interventions proportionately for the severity of the event, the pathogen, and the population at risk.[6]

[5] What has the COVID-19 pandemic done to Mississippi's Economy?: J. Corey Miller, State Economist; February 28, 2022

[6] National Center for Biotechnology Information: Disease Control Priorities: Improving Public Health and Reducing Poverty: 3rd Edition: https://www.ncbi.nlm.nih.gov/books/NBK525302/

Assessment of Local Mitigation Plans

The 2023 plan considers risks identified outside this process to be more aware of the hazards facing local jurisdictions. **Chapter 5: Coordination of Local Mitigation Planning**, covers in detail, hazards identified and addressed in over 44 local plans. Generally, the hazards selected and profiled in this plan coincide well with the highest-ranked local hazards.

A review of the 44 local hazard mitigation plans was conducted to determine which hazards are of concern to local communities. This review concluded that the nine hazards of concern – flood, hurricane, wildfire, tornado, extreme winter weather, earthquake, drought, severe weather, and dam/levee failure – are included in over 59% of the local plans. All local jurisdictions are concerned about tornados, floods, and wildfires; and for other hazards identified in local plans but not in the HMC ranking, a threshold was established. If 45% or fewer of the local plans identified the hazard, it was deemed to pose no significant threat at a state-wide level. The results of the local hazard identification review are summarized in the table below.

Natural Hazards	Percent of Plans Included	Natural Hazards	Percent of Plans Included
Flood	98%	Dam/Levee Failure	62%
Tornado	100%	Expansive Soils	67%
Hurricane/Tropical Storm	54%	Extreme Heat	46%
Thunderstorms/High wind/Hail/Lightning	48%	Storm Surge	5%
Wildfire	98%	Erosion	46%
Severe Winter Storms/Extreme Cold/Ice Storms	1%	Land Subsidence	37%
Earthquake	94%	Tsunami	2%
Drought	75%	Sea Level Rise/Climate Change	3%

A review of local plans revealed severe weather (thunderstorms, hail, lightning, and wind) was identified and addressed by 48% of the local plans. This hazard is best addressed at the local level and is addressed under Section 3.13 Non-Profiled Hazards. In addition, components of these hazards are addressed in the tropical cyclone and tornado section of this plan as applicable.

Drought was addressed in 75% of the local plans and included as a limited profiled hazard as it can have statewide impacts but is best mitigated by local practices. In some cases, drought was profiled in combination with extreme heat. Erosion is included as a non-profiled hazard and determined to pose no significant statewide threat to Mississippi and little or no threat to state-owned or critical facilities. Expansive soils were identified and addressed by 67% of the local plans. It was determined that this hazard is best addressed at a local level.

4.0 Comprehensive State Hazard Mitigation Program

It is essential that State and local mitigation policies are directed to reduce or eliminate the risk of future devastation and the corresponding impact on the citizens of the State of Mississippi. This can only be accomplished by establishing workable goals and objectives that integrate the efforts of state and local governments into one cohesive mitigation strategy that also takes full advantage of public-private partnerships.

Development of a sound mitigation strategy provides a focus that assists State and local governments in identifying priorities and channeling limited resources toward critical mitigation projects. This process helps government at all levels make the most effective use of available resources. “Local governments” include any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and an rural community, unincorporated town or village, or other public entity. Eligible governmental entities would also include all institutions, authorities, bodies or boards created under Federal, state or local authority to manage, oversee or regulate for a public purpose such as, but not limited to, special water/sewer districts, levee boards, floodplain management authorities, and agricultural or forestry boards.

The State of Mississippi will enhance its ability to complete its goals and objectives by taking maximum advantage of the mitigation resources available, both present and future, to reduce the impact of natural and human caused disasters on the citizens and infrastructure. The State will also vigorously pursue methods to augment existing state and local programs by involving other opportunities, such as public-private partnerships. Involvement of a wide range of participants in mitigation efforts, increases the feasibility of implementing mitigation projects as resources become available.

The State will provide, promote, and support education and training on the benefits of a comprehensive statewide hazard mitigation program for state agencies, local governments, and private enterprises. Throughout the process, Mississippi’s citizens will remain a priority. With a comprehensive overview of the hazards that threaten Mississippi, goals and objectives have been developed to mitigate potential losses from those hazards.

Summary of Changes – 2023 Comprehensive State Hazard Mitigation Program

In updating the 2004 State of Mississippi Hazard Mitigation Plan, a total of 60 local plans were reviewed. An additional 32 approved local hazard mitigation plans were reviewed for the 2010 plan. For the 2013 plan update, a total of 104 local hazard mitigation plans were reviewed. For the 2018 plan update, a total of 34 local plans were reviewed. For the 2023 plan update, a total of 44 local plans were reviewed, which included college plans. The overall decrease in local plans is due to the state moving more toward regional hazard mitigation plans. This section was updated with a commitment to improve on ways to reduce losses from natural/manmade hazards and to adequately reflect changes in development. A summary of changes is listed below:

Goals and Objectives (section 4.1) – Goals and objectives are described based on the updated hazard identification risk assessment and reconsideration of goals and objectives from the previously approved plan. One new objective was added to Goal 1. A total of 4 objectives had wording updated. The goals and objectives of local plans were reviewed. All tables and graphics/figures were updated with new data.

State Capabilities (section 4.2) – State agencies reviewed their capabilities and provided updates describing how their means and resources can aid mitigation efforts. Any obstacles and/or challenges related to capabilities and possible solutions have been added. All information was updated based on agency responses. The Mitigation Programs Table was reviewed and updated.

Local Capabilities Assessment (section 4.3) – Local capabilities were reviewed, analyzed, and evaluated for effectiveness and for improvement. All tables and graphics/figures were updated with new data.

Mitigation Measures (section 4.4) – Eight new mitigation projects were added. These actions are noted as "New Mitigation Actions for 2023" in Table 4.4.2. Six projects were completed. All tables and graphics/figures were updated with new data.

Table 4.5.1 has been updated from the 2018 plan to include funding sources that are still active for the "2023 Plan Update".

4.1 Goals and Objectives

44 CFR 201.4(c)(3)(i) – The State mitigation strategy shall include the following elements:

A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:

A description of State goals to guide the selection of activities to mitigate and reduce potential losses.

This section describes the mission, goals, and objectives of the Mississippi State Hazard Mitigation Plan and the process used to update the goals and objectives in the 2023 update planning process. The state is tracking progress toward accomplishing the plan goals and improving alignment with local mitigation strategies (goals, objectives, and actions). The framework of the state's mitigation strategy has four parts: mission, goals, objectives, and actions, which are defined as the following:

- The mission is a philosophical or value statement that states the purpose and primary function of the plan.
- The goals describe the overall direction that the State will take to reach their mission.
- The objectives link the goals and actions and help organize the plan for efficient implementation and evaluation.
- The actions describe the activities or projects used to support the accomplishment of the goals and mission.

During the 2023 update process, the Hazard Mitigation Council reviewed the mission statement, the goals, and objectives from the previously approved 2018 hazard mitigation plan. The Hazard Mitigation Council determined that the mission statement would be remain the same. The goals remain valid and were reaffirmed, and one objective would be added to Goal 1. A total of 4 objectives had wording added. The 2023 mission, goals, and objectives are the following:

Mission: To develop and maintain a disaster-resilient, sustainable Mississippi though perpetual planning and review of a comprehensive statewide mitigation strategy.

Goal 1 – Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards.

Objective 1.1 Protect critical facilities, infrastructure, and systems

Objective 1.2 Reduce the number of at-risk, repetitive loss, and SRL properties

Objective 1.3 Reduce potential damage to future buildings and infrastructure and Increase resilience to disasters.

Objective 1.4 Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation

Objective 1.5 Identify needs and appropriate projects from post disaster damage assessments

Objective 1.6 Preserve, create, and restore natural systems to serve as natural mitigation functions

Objective 1.7 Protect historic and cultural resources

Objective 1.8 Provide State and local agencies with a statewide communications network with an interoperable, highly reliable, fast access, and a public safety-grade communication system for use during events that threaten the health and welfare of the citizens of Mississippi.

Objective 1.9 Promote State identified mitigation initiatives, such as saferooms, storm shelters, severe weather warning systems, emergency generators, and public outreach campaigns.

Objective 1.10 Mitigate risk and reduce the number of high hazard potential dams.

Goal 2 – Build and enhance local mitigation capabilities.

Objective 2.1 Support and provide guidance for local hazard mitigation planning and projects.

Objective 2.2 Encourage the adoption, improvement, and enforcement of local codes, ordinances, and Land use planning.

Objective 2.3 Provide and promote technical assistance and training to local governments.

Objective 2.4 Identify and provide financial incentives and funding opportunities.

Goal 3 – Improve public education and awareness.

Objective 3.1 Develop and improve outreach programs and materials to increase awareness to the public and private sector about climate adaptation principles, risk, and mitigation in Mississippi.

Objective 3.2 Promote and utilize existing hazard mitigation education programs from state, federal, and nonprofit sources.

Objective 3.3 Develop tailored outreach strategies for vulnerable, underserved populations, such as tourists, disabled persons, children, the elderly, non-English speakers, and low-income residents.

Goal 4 – Sustain and enhance a coordinated state mitigation program.

Objective 4.1 Strengthen coordination, communication, capabilities, and partnerships with all levels of government, the private sector, and nonprofit organizations.

Objective 4.2 Institutionalize hazard mitigation as integrated state policy.

Objective 4.3 Implement, monitor, and assess the effectiveness of the mitigation strategy and promote successes.

Process for Updating Goals and Objectives

The goals and objectives of the 2004 plan were a compilation of previous goals and objectives from the Mississippi 409 plan, as well as those being implemented through other state agencies involved in the mitigation planning process. As part of the 2007 plan update, the goals and objectives from the 2004 plan were reviewed and revised to addressed current and anticipated future conditions. On April 22, 2010 the Hazard Mitigation Council met to assess the goals and objectives from the previously approved 2007 hazard mitigation plan. The Council determined that the goals and objectives still remain valid and would not be changed in the 2010 update. On January 23, 2013, the Hazard Mitigation Council met to assess the goals and objectives from the 2010 hazard mitigation plan. The Mitigation Council determined that the goals and objectives still remain valid and would remain the same for the 2013 plan hazard mitigation plan. On March 8, 2018, the Hazard Mitigation Council met to assess the goals and objectives from the 2013 hazard mitigation plan. The Mitigation Council determined that the goals remain valid, but one objective would be added to Goal 1. Starting March 10, 2023, the Hazard Mitigation Council reviewed the mission, goals, and objectives from the 2018 hazard mitigation plan. A final determination was made on July 27, 2023, that the mission statement and goals remained valid, but one objective was added to Goal 1, and additions would be made to four objectives. The review for the 2023 update was based on the following:

- The updated statewide risk assessment, which includes changes in growth and development, recent state and federal declared events, enhanced vulnerability assessments, and analysis of local risk assessments;
- Assessment of changes and challenges in state and local capabilities since the 2018 plan;
- Types and status of mitigation actions from the 2018 state plan;
- Analysis of the similarities and differences of the state mitigation plan goals with local mitigation plan goals and objectives; and
- The development of a more integrated strategic plan framework for aligning goals, objectives, and actions.

As a result of this review, the Hazard Mitigation Council mission statement, goals, and objectives for the 2023 State Hazard Mitigation Plan were determined.

The key issues identified in the statewide risk assessment and the analysis of local risk assessments can be found in Section 3 Risk Assessment. Information on the changes in state and local mitigation capabilities is summarized in Sections 4.2 State Capability Assessment and 4.3 Local Capability Assessment. The following section describes how the local mitigation plan goals and objectives were reviewed and considered during the 2023 update. Section 4.4 Mitigation Actions includes detailed and updated mitigation measures designed to meet the designated goals and objectives. Progress on these actions is evaluated in Sections 4.4 and Section 4.5 Effective Use of Available Mitigation Funding.

Review of Local Goals and Objectives

The Hazard Mitigation Council analyzed the goals and objectives of FEMA-approved local hazard mitigation plans in Mississippi to assess their consistency with state goals and objectives. The analysis involved calculating the percentage of local plans (out of a total of 44 plans) that have a similar goal or objective to each of the goals and objectives in the 2023 Mississippi State Hazard Mitigation Plan. The data collection involved some interpretation because many local goals and objectives addressed multiple issues. The results of the analysis are presented in Table 4.1.1

Table 4.1.1: Local/Regional Plans with a Goal or Objective Similar to State Plan Goals and Objectives

2018 Mississippi State Mitigation Goals (G) and Objectives (O)	Local/Regional Plans with Similar Goal	Local/Regional Plans with Similar Objectives	Local/Regional Plans with Similar Goal or Objectives	Relation to 2023 Updated Goals and Objectives
G1 Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards	95%	12%	100%	Goal is the Same
G2 Build and enhance local mitigation capabilities	86%	64%	76%	Goal is the Same
G3 Improve public education and awareness	67%	31%	95%	Goal is the Same
G4 Sustain and enhance a coordinated State mitigation program	81%	24%	88%	Goal is the Same
O1.1 Protect critical facilities, infrastructure, and systems	57%	79%	100%	Objective is the Same
O1.2 Reduce the number of at-risk and repetitive loss properties	17%	67%	67%	Objective is the Same
O1.3 Reduce potential damage to future buildings and infrastructure and increase resilience to disasters.	36%	36%	60%	Objective wording has changed.
O1.4 Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation.	10%	67%	67%	Objective is the Same
O1.5 Identify needs and appropriate projects from post disaster damage assessments	2%	14%%	14%	Objective is the Same
O1.6 Preserve, create, and restore natural systems to serve natural mitigation functions	2%	2%	5%	Objective is the Same
O1.7 Protect historic and cultural resources	5%	2%	7%	Objective is the Same
O1.8 Provide State and local agencies statewide communications with an interoperable, highly reliable, fast access, public safety-grade communication system for use during events that threaten the health and welfare of the citizens of Mississippi.	5%	19%	24%	Objective is the Same
O1.9 Promote State identified mitigation initiatives, such as saferooms, storm shelters, severe weather warning systems, emergency generators, and public outreach campaigns.	7%	79%	83%	Objective wording has changed.
O1.10 Mitigate risk and reduce the number of high hazard dams**.**	0%	1%	1%	New Objective
O2.1 Support and provide guidance for local hazard mitigation planning and projects.	64%	76%	83%	Objective is the Same
O2.2 Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning.	10%	29%	29%	Objective is the Same
O2.3 Provide and promote technical assistance and training to local governments.	5%	26%	31%	Objective is the Same
O2.4 Identify and provide financial incentives and funding opportunities.	5%	17%	19%	Objective is the Same
O3.1 Develop and improve outreach programs and materials to increase awareness to the public and private sector about Climate adaptation principles, risk, and mitigation in Mississippi.	69%	64%	79%	Objective wording has changed
O3.2 Promote and utilize existing hazard mitigation education programs from state, federal, and nonprofit sources.	2%	12%	12%	Objective is the Same
O3.3 Develop tailored outreach strategies for vulnerable, underserved populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents.	0%	10%	10%	Objective wording has changed
O4.1 Strengthen coordination, communication, capabilities, and partnerships with all levels of government, the private sector, and nonprofit organizations	10%	48%	50%	Objective is the Same
O.4.2 Institutionalize hazard mitigation as integrated State policy	2%	2%	5%	Objective is the Same
O.4.3 Implement, monitor, and assess the effectiveness of the mitigation strategy and promote successes	67%	67%	81%	Objective is the Same

The State goals most represented in local plans are Goal 1 and Goal 3. State Goal 1: Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards. When compared to local goals and objectives, The percentage of local plans had a goal or objective to minimize loss from natural hazards was 100%.

Ninety-five percent of local plans have a goal similar to State Goal 3: Improve public education and awareness. In addition, the state objective 1.1: Protect critical facilities, infrastructure, and systems received the highest percentage of similar goals or objectives in local plans (100 percent). While 1.6 Preserve, create, and restore natural systems to serve as natural mitigation functions, 1.7 Protect historic and cultural resources, and 4.2 Institutionalize hazard mitigation as integrated state policy, had the lowest percentages of all the objectives (each were less than 10 percent).

The Hazard Mitigation Council also analyzed other goals and objectives that occur commonly in local plans; some differ from State goals and objectives. Table 4.1.2 lists common goals and objectives in local plans and the percent of plans that contain the similar goal or objective.

Protect/improve critical facilities was the issue most common in local plans. Objective 1.1 in the state plan also addresses this issue. Promoting local hazard mitigation plans was a frequent goal or objective in local plans (88 percent). Eighty-eight percent of local/DRU plans seek to Improve or retrofit, is close to State Objective 1.2. Involving and/or educating public officials in natural hazards mitigation and Improve communication systems share common issues with State Goal 3 and Objective 3.1. Objective 3.2 and Objective 4.1 share common issues.

Table 4.1.2: Other Goals and Objectives Common in Local and Regional Plans

Common Goals and Objectives in Local and Regional Plans	*Percentage of Local and Regional Plans with Goal or Objective*
Protect/ improve critical facilities	95%
Promote local hazard mitigation plans	88%
Improve emergency response operations	36%
Increase local capacity for mitigation and emergency management	67%
Involve and/or educate public officials in natural hazards mitigation	81%
Enhance public warning and information systems	69%
Monitor effectiveness of measures and initiatives	64%
Identify and address repetitive loss properties	57%
Reduce damage to future buildings and infrastructure	74%
Increase property acquisitions	2%
Integrate mitigation in land use planning	7%
Promote the National Flood Insurance Program	19%
Encourage jurisdictions to implement and share GIS system	5%
Improve and retrofit	88%
Protect business continuity and economic vitality	33%
Improve sheltering capabilities	33%
Plan for continuity of local government operations	31%
Plan for vulnerable populations	14%
Develop or improve storm water/drainage programs	12%
Improve communications systems	79%
Support State identified initiatives	2%
Improve evacuation capabilities	7%
Seek funding for mitigation	19%
Increase community resilience to disasters	80%
Reduce number of high hazard dams	1%
Enhance the number of emergency generators	1%
Enhance public outreach campaigns for vulnerable and underserved	86%
Increase awareness of climate adaptation principles	0%

4.2 State Capabilities

44 CFR 201.4(c)(3)(ii) – The State mitigation strategy shall include the following elements: ***A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:*** ***A discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas.***

4.2.1 State Policy and Programs

The State of Mississippi authorizes local governments to regulate development in flood-prone hazard areas. The State has not assumed authority to oversee development in flood-prone or hazard areas. Similarly, while the State has passed enabling legislation for local governments to zone and to adopt building codes, it has not sought the authority to do so.

All state agencies with state-owned or leased buildings that are located in a special flood hazard area are required to carry the maximum amount of flood insurance. The premiums are paid out of the agencies operating budget.

State funding capabilities for hazard mitigation projects: mitigation projects require a non-federal match of 25% or more. Mitigation projects do not have a State identified funding source. Projects throughout the State are implemented with a non-federal match from budgeted funds, CDBG funds or in-kind match. The applicant or sub-grantee will be provided administrative and technical assistance to implement a proposed project. Administrative and management cost are available to the state and local governments that participate in federal mitigation grant programs.

The following are eligible federal funds available to contribute to the 75 / 25 local matches for overall funding:

- U.S. Department of Housing and Urban Development Community Development Block Grant Funds,
- Appalachian Regional Commission Funds
- Indian Health Service Funds
- Increased Cost of Compliance (ICC) to fund elevation, relocation, demolition, and floodproofing costs,
- Small Business Administration funds, and
- Federal Housing Administration loan funds.

Each State agency from the 2023 plan was afforded the opportunity to review their mitigation capabilities from the existing standard plan and provide updates to their current agency capabilities. This was accomplished by personal contact with agencies represented at the Hazard Mitigation Council meetings and by email.

For those agencies who were not physically present at these events, an email which included a copy of their 2018 capability response, instructions as to how to evaluate their capabilities, and a request for them to review and update their capability response. The agencies who did not have changes are noted as no change from the 2018 submittal in the agency capabilities listed below.

Mississippi Emergency Management Agency (MEMA)

Authority for mitigation: Miss. Code 1972, Annotated. 33-15-7 Et. Seq.

The Office of Mitigation is responsible for coordinating disaster loss reduction programs, initiatives, and policies throughout the State of Mississippi. Disaster loss reduction measures are carried out through disaster reduction programs, initiatives, and policies through the development of State and local Hazard Mitigation plans and the implementation of strategies identified in the plans.

The Office of Mitigation administers the Hazard Mitigation Grant program, the National Flood Insurance Program's Community Assistance Program and Risk Map Program, the Flood Mitigation Assistance Program, and the Pre-Disaster Mitigation program, and Severe Repetitive Loss Program. The Office of Mitigation's Staff has grown from six to currently thirteen personnel. Floodplain Management, Grants and Planning Staff are assigned to all six districts in the state. Mitigation Office Staff have been extensively trained in Benefit Cost Analysis, Grants Management, National Flood Insurance Program, Plan Review, CAV, CAC, environmental, project application review, HAZUS and NEMIS Entry.

The Mitigation Grants Bureau administers hazard mitigation grants to State and local governments. These grants include mitigation planning grants, drainage projects, acquisition of high-risk flood structures, retrofitting critical facilities, warning systems, saferooms and storm shelters, and other cost-effective measures identified in the State and local government's Hazard Mitigation Plan. The Mitigation Grants Bureau has developed a web site, https://my.msema.org that allows local governments/eligible applicants to submit applications online.

The Mitigation Planning Bureau within the Bureau of Mitigation is responsible for maintaining and updating the State of Mississippi Standard Hazard Mitigation Plan, which documents statewide hazard risk and the capability to mitigate the risk. The Planning Bureau also works with other state agencies, regional planning authorities, and local governments in the development of mitigation plans and strategies. The Mitigation Plans Bureau also provides technical assistance and training to local governments and state agencies in the development of their local hazard mitigation plans and keeps the local governments apprised of any new advances or policy changes in hazard mitigation planning.

The Floodplain Management Bureau serves as the only compliance/regulatory focused bureau within the Agency. It is charged with the management of the Community Assistance Program – State Support Services Element (CAP-SSSE) which consists of providing oversight for the 335 participating National Flood Insurance Program (NFIP) communities and the 28 Community Rating System (CRS) members within the state.

A compliant community membership in the NFIP provides both the citizens and their communities with the opportunity to utilize the federal flood policies to protect their property and qualify for various grant and disaster assistance programs. As of October 2022, this program has resulted in 52,901 individual flood insurance policies that equate to an insured flood damage coverage of $14.2 billion dollars. There have been 65,275 claims paid since 1978, in the amount of $3.1 billion dollars. The average yearly premium in Mississippi is $777.95

The Bureau's staff conducts an average of 60 Community Assistance Visits (CAV) and compliance inspections per year. These inspections ensure the compliance of the communities with the NFIP, which enables them to participate in the five Hazard Mitigation Assistance (HMA) programs, the State's Hazard Mitigation Planning process, and the various disaster assistance programs administered by the federal government. Additionally, there is an average of 11 FPM training sessions or workshops conducted per year, as well as numerous technical assistance actions to State and local associations and to community governments.

The FPM Bureau is tasked with coordinating the agency's portion of the Risk Map Program. Risk Map expands traditional flood mapping to include risk assessment and mitigation planning. Risk Map is meant to better inform communities as they make decisions related to reducing flood risk by implementing all mitigation actions. This project calls for 4 meetings: Discovery, Flood Risk Review, Resilience, and Final/COO and Public. This bureau will support meeting for technical information. If flood map work occurs in the community, then the FPM will help by guiding local official with map adoption. The FPM Bureau will assist MDEQ on performing project outreach activities.

The Floodplain Management Bureau continues to conduct specialized training for state and local officials, such as offering the national Certified Floodplain Manager examination as a tool to both increase the professionalism and knowledge base within the floodplain management field. Since the inception of the CFM program within the United States, there have been many Mississippians certified as floodplain managers.

Department of Agriculture and Commerce

(No change from the 2018 submittal)

Authority for Mitigation: Miss. Code 1972, Annotated. 69-1-1 (19720 Et. Seq.

The Department performs a regulatory function in the areas of sanitary inspections of grocery stores; agriculture theft; meat inspection; fruit and vegetable inspection; feed, seed, fertilizer and soil and plant inspection; weights and measure. The Department operates a seed testing laboratory, a metrology laboratory, and a grain moisture testing laboratory. The mitigation function of the agency is to ensure a sanitary food supply where the Department has authority.

Department of Archives and History

Authority for mitigation: Miss. Code 1972, Annotated. 39-5-1.

This agency has custody of and maintains care of all state records and material pertaining to the history of Mississippi. It also administers the State Records Management Program. It aids mitigation by supplying information on the frequency and severity of past disasters and the effectiveness of recovery efforts. It also supplies historical information on sites of proposed mitigation projects. Archives and History is a first response agency and is responsible for responding after a disaster to retrieve and stabilize record recovery for government offices. According to Federal Section 106 Review – Archives and History is required to make comment on debris removal on any project involving federal funding. The agency is collaborating with MEMA to develop a GIS data system in order to have that data (what is in place/existing) prior to a disaster.

Department of Audit

Authority for mitigation: Miss. Constitution, 1890. Art. V, 134.

The State Auditor's Office conducts training of local governments and state agencies regarding the proper purchasing of emergency equipment, hazard mitigation equipment, and grant monitoring. Additionally, the State Auditor's Office aids mitigation by providing information on the state's physical and financial resources and their locations.

Information Technology Services

(No change from 2018 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 25-53-5.

This agency is responsible for: the cost-effective acquisition of data processing equipment and services for use by state agencies; computer communication facilities to provide necessary services to state government; engaging in the long-term planning of equipment acquisition for state agencies, and training state personnel in the use of equipment and programs. Information Technology Services (ITS) aids mitigation by maintaining communication and information networks and ensuring adequately trained personnel to operate them.

As a member of the Mississippi Coordinating Council for Remote Sensing (RS) and Geographic Information Systems (GIS), ITS maintains the Mississippi Geospatial Clearinghouse, which is designed to house the Mississippi Digital Earth Model (MDEM). The MDEM is comprised of the following GIS data layers: Geodetic Control, Elevation and Bathymetry, Orthoimage, Hydrography, Transportation, Government Boundaries, and Cadastral. The Mississippi Geospatial Clearinghouse will be accessible to local governments, state and federal agencies, planning and development districts, and private entities in support of disaster mitigation, planning, and recovery.

Mississippi Development Authority

(No change from the 2018 submittal)

Marketing and Communications Division

Authority for mitigation: Miss. Code 1972, Annotated 33-15-2

Timely communication during and after a disaster to prevent loss of life and to mitigation public danger and property damage. Specifically, mitigation of business-related damage.

The MDA Communications Director serves also as the State's CIO/Public Information Officer (PIO) acting as a key member of the agency's emergency response team to perform essential functions including handling all media inquiries, organizing press conferences and press releases, and responding to information inquiries from Mississippi businesses and industries.

Under MEMA ESF 11 and 15, the PIO coordinates where appropriate with the Joint Information Center at MEMA and may provide communication support to MEMA during and after a disaster. When needed, the agency may activate a call center. Mitigation and minimization of damage through timely communication is a key objective of this function.

Community Services Division

Authority for mitigation: Miss. Code 1972, Annotated. 57-1-5 (1984 supplement).

Administration of Community Development Block Grant (CDBG) Program funding for the non-Federal share of mitigation projects.

The Community Services Division creates a climate favorable to community growth and development. It administers the Community Development Block Grant Program (CDBG) and aids mitigation by funding the non-Federal share of hazard mitigation projects.

Department of Environmental Quality

Authority for mitigation: Miss. Code 1972, Annotated. 49-2-9 Et. Seq.

The Department of Environmental Quality promulgates rules and regulations; receives and expends state and federal funds, conducts studies on alternate uses of natural resources; and responds to incidents that threaten them. It aids mitigation by protecting the state's natural resources and regulating their use. MDEQ and MEMA serve as State Technical Partners in the Risk MAP Program and as active participants in the Mississippi Digital Earth Model and Remote Initiative.

Senate Bill 2822 provides funding and parameters for the Mississippi Municipality & County Water Infrastructure Grant Program Act (MCWI), which is derived from the American Rescue Plan Act (ARPA). MDEQ will produce Rules and Regulations as to the administration of the program and funds received by counties and municipalities designated for the development and enhancement of new water, wastewater, and storm water to increase the resiliency of infrastructure in Mississippi. Additionally, MDEQ has expanded ability to respond and collaborate with our State and Federal Partners in natural disaster related impacts such has debris disposal management, dam safety, hazardous material management and wastewater treatment system recovery.

Department of Marine Resources

Authority for Mitigation: Miss Code 1972, Annotated. 49-15-11 (1972)

This agency aids hazard mitigation through (1) buyout programs, (2) preservation, creation, restoration, and enhancement activities, (3) education and outreach programs, and (4) our Mississippi Coastal Preserves Program. With buyouts, we partner with federal and state agencies, environmental organizations, and the private sector to identify susceptible, repetitive-loss properties and move them into public ownership through donation, purchase, or other means. These partnerships also facilitate our preservation, creation, restoration, and enhancement programs. The State currently holds title to more than 41,000 acres of sensitive coastal that are managed by the Coastal Preserves Program. In addition to the state-owned lands within the coastal preserves, the USFWS managers 3,000 acres at the Grand Bay National Wildlife Refuge, and the National Park Service, the Gulf Islands National Seashore manages 6,486 acres within Cat, Ship, Horn, and Petit Bois Islands. Collectively, this includes 51,256 acres of preservation land within three counties of Mississippi.

Our education and outreach programs are through partnerships with local academic institutions, other state and federal agencies, and the private sector. We focus on environmental conservations, sustainable development, and sound environmental stewardship. The Clean and Resilient Marina Program calls for the "promotion and expansion of resilient and environmentally responsible operations and best management practices at marinas." It builds on the Gulf of Mexico States' Proven Clean Marina Certification Programs. This improved program Complements Clean Marina practices already in place and provides additional recommendations to strengthen local marinas' ability to withstand natural and man-made disasters.

Department of Public Safety

(No change from 2018 submittal)

Authority for mitigation: Miss. Code 1972

The Department of Public Safety (DPS) aids mitigation by enforcing traffic laws and regulations on Mississippi highways and roads. It issues and renews driver's licenses, furnishes qualified personnel to take part in investigations, and provides assistance to communities during emergencies and disasters.

This department also houses the Office of Homeland Security. The Mississippi Office of Homeland Security assists by providing funding to state and local agencies. This funding is used to purchase preparedness equipment, provide training and certification to first responders, develop plans and standard operation guidelines for agencies and response teams, and to exercise and evaluate these response plans.

DPS also works with MDOT and Louisiana State Police during emergencies to provide logistical and security support consistent with contraflow operations on our Interstates. DPS also now has the capability to feed and fully support our first responders when deployed to a disaster area. DPS has also added an additional helicopter designated to assist in search and rescue operations as well as having a heavy lift capability.

Department of Wildlife, Fisheries, And Parks

Authority for mitigation: Miss. Code 1972, Annotated. §49-1-29; §49-4-1, Et. Seq.

The Department of Wildlife, Fisheries and Parks aids in hazard mitigation through its conservation and protection of wildlife habitats, and freshwater and estuarine fisheries and ecosystems.

Institutions of Higher Learning

Authority for mitigation: Miss. Code 1972, Annotated. 37-101-1.

Mississippi Institutions of Higher Learning, through its eight universities, which includes The University of Mississippi Medical Center (UMMC), provides capabilities in support of state hazard mitigation in a variety of ways. IHL contributes to statewide hazard mitigation efforts through education and research. IHL enrolls approximately 90,000 students and graduates close to 20,000 per year. Many of the over 2,100 funded research projects help prepare Mississippi to respond to future challenges, including preventing and responding to hazards.

IHL directly participates in Mississippi Emergency Management's preparation and response efforts, serving important roles with Mississippi's State Comprehensive Emergency Management Plan. In addition to UMMC's important roles with ESF 8 Public Health and Medical Services, IHL also supports ESF 6 Mass Care-Human Service. IHL maintains a Disaster Response Plan which assists universities to coordinate and supply resources when and where needed. In addition to physical resources, like temporary housing, expertise and human resources, like emergency responders or translators, are available.

Universities possess many capabilities that mitigate hazards. The following are a few recent examples. In response to the pandemic, and with MEMA's coordination, university staff and students were able to provide much needed respirators to hospitals. Universities prevent and respond to risks of violence on campuses through education, the provision of counseling services, the creation of assessment and response teams, and through law enforcement training. IHL participates in the NFIP flood insurance program, and as part of its larger property insurance program, benefits from routine engineer inspections across its campuses. Cyber security improvements, and related educational programs, mitigate the risk of cyber incidents and prepare the state's cybersecurity workforce. Universities maintain disaster resistant university plans, which coordinate with local stakeholders. These plans include rapid communication and notification systems to warn students, faculty, and staff about impending threats from severe weather or security concerns. IHL has disaster mitigation contracts in place that include preferred-client status so as to expedite deployment. Universities provide numerous courses and programs in disaster response, cyber security, risk management, leadership, and many disciples that aid preparation and response to hazards. Universities train staff to respond to emergencies and some have implemented designated best available areas of refuge.

The four research universities collaborate on important research into risks to coastal communities such as the BP oil spill, national defense, and climate change. An IHL Board of Trustees initiative on energy efficiency has saved universities more than $200 million and improved the sustainability of university campuses. In regard to hazards posed by climate change, universities engage in numerous initiatives, research, and programs. Examples include sustainability programs, energy efficiency investments, shoreline, water quality, water security, and irrigation efficiency work, crop productivity research, recycling and cleanup programs, and transportation management initiatives. Extension services reach all areas of Mississippi.

Mississippi Insurance Department

(No change from 2018 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 83-1-1 Et. Seq.

The Insurance Department executes all laws relative to insurance companies, corporations, associations, and their agents and adjusters. It aids mitigation by licensing and regulating manufacturers and dealers of mobile homes; enforcing the LP gas inspection program; and administering the Standard Fire Code. The State Fire Marshal's office is located in the Department of Insurance.

Since 2005, the following changes have been created, made, or supported by the Mississippi Insurance Department (MID) which support hazard mitigation:

- The creation and continued progress of the MID Hurricane Katrina Mediation Program which can now be used to mediate future disaster claims.
- The creation and continued progress of the MID Hurricane Katrina Arbitration Program which may also be used in arbitration of future claims.
- The development and continued use of a Flood Insurance Outreach program.
- The development and continued use of an updated Storm Preparedness web site.
- Support from MID and the State Fire Marshal's office of the state legislation which created the Building Codes Council which advocates stronger building codes for coastal communities.
- Regulation which now requires the licensing of public adjusters in Mississippi
- Policy holder Bill of Rights regulation which will assist consumers in completely understanding homeowner policy coverage
- Working with Governor's office in securing CDBG grant funds to assist funding for the Mississippi Windstorm Underwriting Association, which will aid in lowering premium costs for both homeowner's and businesses
- Championed passage of the Wind Pool Bill which sets in place future state funding for the program

*NOTE: The State Fire Academy, a sub-agency of the Mississippi Insurance Department, submitted its plans separately.

Mississippi Library Commission

Authority for mitigation: Mississippi Code 1972, Annotated, 39-3-107.

The Library Commission gives advice to libraries and communities on establishing and maintaining libraries; accepts and uses funds to establish, stimulate, increase, improve, and equalize library services; adopts rules/regulations relative to the allocation of state aid funds to public library systems; and operates a library to support libraries, state government, and the public. The agency's mission statement is "The Mississippi Library Commission is committed-through leadership, advocacy, and service – to strengthening and enhancing libraries and library services for all Mississippians."

To accomplish this mission, the Library Commission:

1. Operates a secure, state-of-the-art 62,000 sq. ft. facility at 3881 Eastwood Drive in Jackson, MS.
   The five-story building, of poured concrete and steel, includes: one below-ground level; wired and wireless high-speed Internet connectivity; a natural gas-powered generator to support basic functions, including data center, in power outages; 100+ windows throughout the building that open; meeting rooms equipment with distance learning capabilities and kitchen facilities; computer training facilities; public access computers; large parking lots; large, open research facilities; and a state-of-the-art data center to support Internet services to Mississippi public libraries & the agency's networking needs.
2. Operates a large library with traditional and electronic information resources and a highly qualified research staff to respond to requests for information and in-depth research; provides interlibrary loan services for specific titles and loans materials on a short-term and long-term basis to libraries, state government, and the general public; serves as the only library for the blind and physically disabled in the state; Is the only patents and trademarks library in the state; is a depositor for federal publications and the depository of all publicly released publications of state government.
3. Provides consulting services to library staffs, trustees, and local governments on establishing and maintaining library services.
4. Provides grant funds, federal and state, to public libraries.
5. Works with public libraries statewide.

   People have access to public library services in all 82 MS counties. All 236 public libraries are managed by trained, dedicated staff with local community knowledge, skills to assist the public and high-speed Internet capabilities available through multiple public access computers. Most have meeting room facilities with kitchen facilities, large reading rooms, comfortable seating, study tables, etc.
6. Is a member of the statewide cultural alliance comprised of the MS Arts Commission, the MS Department of Archives & History, the MS Humanities Council, and the Library Commission.

   The purpose of the alliance is to coordinate responses in case of an emergency; to encourage local cooperation among cultural organizations (i.e. libraries, museums, visual & performing arts groups, etc.); to secure funds, supplies, manpower, and facilities to protect cultural heritage such as local histories, city & county records, art works, buildings, etc. before and after a disaster.

In case of an emergency the Library Commission:

- Serves as clearinghouse for evacuated or stranded public library employees and public library systems to ensure communication outside disaster area.
- Provides public library systems with access to remote office space/equipment/supplies to ensure business continuity.

- Secures and delivers needed resources (supplies, equipment, labor, library materials, etc.) to affected libraries.
- Identifies and seeks outside funding and assistance.
- Connects affected libraries with funders, opportunities, suppliers, vendors, counselors, etc.
- Advocates for libraries at local, state, and national levels on:
    - Central community roles of libraries including communications; connectivity; comfortable, safe environment; staff trained to assist; meeting facilities; etc.
    - Funding needs.
    - Role of libraries as early responders in times of disaster.
- Modifies rules & regulations to accommodate affected libraries & libraries serving the affected public (evacuees, law enforcement, military, relief workers, volunteers, etc.).
- Serves as spokesperson with state, national, and international media.
- Seeks speaking opportunities to tell library story and story of lessons learned.
- People turn to libraries in times of emergency for information, for access, for comfort, and for a place of refuge. After Katrina, this fact was validated as evacuees sought shelter further inland or returned to affected areas.
- Supports work of libraries serving the affected public in many ways including:
    - Reestablishing public library service as quickly as possible.
    - Setting up alternate ways to deliver services through temporary facilities, donated bookmobiles, information kiosks, satellite Internet connectivity, etc.
    - Using trained library staff to assist people, relief workers, city/county government, etc.
    - Serving as communication centers; volunteer coordination centers; relief centers and early responders.
    - Expanding library hours to accommodate people in need;
    - Issuing library cards to anyone temporarily living in community;
    - Designating library computers for relief-efforts-only to for completion of FEMA and insurance forms online, to contact friends and family, and to search for assistance;
    - Offering free photocopy and fax services.
    - Using library facilities to accommodate relief workers and relief efforts; serving as relief centers for water/ice, blue tarp distribution, makeshift shower facilities, food stamp card distribution, etc.

The Mississippi Library Commission and the Mississippi library community have a great deal to contribute to mitigation before and after an emergency. The library garners public trust: despite being a public institution, it is not perceived as “the government”. People turn to libraries in times of emergency for information, for access, for comfort, and for a place of refuge. After Hurricane Katrina, this fact was validated as evacuees sought shelter further inland or returned to affected areas. Several factors make libraries ideal as early responders to emergencies: the library staff is trained to assist the public; libraries have multiple points-of-access to high-speed connectivity, which facilitates communication; and in many instances, the facilities can accommodate larger groups of people.

Mississippi Automated Resource Information Systems (MARIS)

Authority for mitigation: Miss. Code 1972, Annotated. 57-13-23.

Mitigation capability: MARIS stores, processes, extracts, and disseminates useful information on the state's natural and cultural resources. The Policy Committee is made up of representatives from 22 state agencies. The agency aids mitigation by developing and promoting use of uniform standards for geographic information systems used in state agencies.

Mississippi Department of Transportation

(No change from the 2018 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 65-1-13.

The following is a brief description of the Mississippi Department of Transportation's (MDOT) on-going Hazard mitigation capabilities.

1. Construction, reconstruction and maintenance of transportation facilities vital to evacuation, response, and re-entry. This includes but is not limited to seismic retrofitting of bridges, the upgrading of traffic control devices after destruction, construction of transportation facilities to avoid flood prone areas whenever possible, and other precautionary design work – including wetlands mitigation – which reduces risk before, during and after an emergency.
2. Education and communication outreach programs to include information provided to the general public concerning Contraflow, pet evacuation, and general preparedness.
3. Training for MDOT response personnel at all levels for a wide range of natural and man-made hazards.
4. In-house emergency coordination staff increased from 4 in 2005 to 15 today; this group is MDOT's ESF-1 representative at the State Emergency Operations Center.
5. Maintenance of a Comprehensive Emergency Transportation Response Plan which is updated regularly.
6. Emergency preparedness for a 72-hour window of self-sufficient after a disaster. This is accomplished through improvements made to emergency supplies, storage facilities, acquiring sufficient fuel reserves, as well as housing, food and water for transportation emergency workers.
7. Improvements in communication capabilities through the purchase of additional satellite radio units to serve as redundant communications backup. In addition, a mobile communications platform and a command/control center have been made operational.
8. Evaluation of standard operating procedures in all areas, but specifically within procurement to enable the agency to function more efficiently and quickly in the purchase of emergency supplies.
9. Provision of remote traffic sensing, which will aid in traffic management during evacuations and re-entries.
10. Development of partnerships with various state, federal and/or local agencies to save lives and reduce future losses. These include:
    a) The GIS Coordinating Council in the development of the Mississippi Digital Earth Mapping Initiative.
    b) Key emergency response agencies to aid in providing fuel. These agencies include the Mississippi Emergency Management Agency, Mississippi Department of Health, and Wildlife, Fisheries and Parks.

11. Acquiring travel trailers to provide housing accommodations for transportation emergency workers during extended events.
12. Placement of three Mobilization Centers in northwest Mississippi to provide for command/control and serve as a base of operations to support earthquake emergency response activities.

Mississippi Authority for Educational Television (d/b/a Mississippi Public Broadcasting)

Authority for mitigation: Miss. Code 1972, Annotated. 37-63-1 Et. Seq.

Mitigation capability: Mississippi Public Broadcasting (MPB) is a public service agency, providing the citizens of the state with educational, public service and Informative programming that enlightens and inspires. MPB serves the people of Mississippi as the primary source for statewide emergency information, utilizing its network of radio and television transmitters and towers. During a disaster, MPB supports MEMA with technical and production staff for press conferences and emergency alerts to give out vital information so citizens know where to go for food, water, and or shelter. MPB works with the Mississippi Department of Transportation to identify MPB FM frequencies on evacuation routes. When a mandatory evacuation is ordered, MPB provides updates via its statewide radio network. In the event of a state of emergency, MPB Radio will broadcast crucial information if a need for information exists. That is one aspect of what MPB provides to the citizens of Mississippi.

Mississippi Forestry Commission

Authority for Mitigation: Miss. Code 1972, Annotated § 49-19-3(b).

The Mississippi Forestry Commission, by statute, has the responsibility “To take such action so as to provide and maintain the organized means, as deemed necessary and expedient, to prevent, control and extinguish forest fires…”

Established in 1926, the Mississippi Forestry Commission (MFC), protects the state’s valuable forest resources from wildfire, manages approximately 485,000 acres of forested 16th Section Public School Trust Lands. The MFC also delivers quality forest management services and assistance to both rural and urban landowners. Their mission is to provide active leadership in forest protection, forest management, forest inventory, and effective forest information distribution, necessary for Mississippi's sustainable forest-based economy. There are approximately 19.2 million forested acres in Mississippi.

The MFC has apportioned Mississippi into four (4) administrative regions, each with full complements of staffed bulldozer/plow units utilized to suppress wildfires. Their Operations Center and aviation resources provide the capability of coordinating wildland fire mitigation efforts. The commission uses the Incident Command System when engaged in wildland fire suppression efforts (and other natural disaster response situations) to determine where the MFC’s resources are needed to support mitigation and recovery efforts.

The Public Information and Outreach Department provides the capability to inform and educate the public and private sectors. It also supports all Mississippi Forestry Commission program areas by providing information dissemination, educational presentations, and public relations support. A variety of mass media delivery methods are used in order to reach the public in the most effective manner. The MFC’s Firewise Coordinator and outreach officers are actively engaged in promoting how individuals and communities can take measures to protect life and property from wildfires.

Office of The Attorney General

(No change from the 2018 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. VI, 173.

The Attorney General's Office has a staff of attorneys to represent state agencies and officials in the areas of litigation, opinion processing, governmental affairs, public integrity investigations, and public interest advocacy. It aids mitigation by interpreting state law and providing legal counsel to state agencies.

Office of the Governor

Authority for mitigation: Miss. Constitution, 1890. Art. V, 116; Miss. Code 1972 Ann. §7-5-1; Miss. Code 1972 Ann.§33-15-1 *et seq*; Miss. Code 1972 Ann. §33-15-403; and other authority.

The Office of the Governor contributes and coordinates mitigation efforts as the Constitutional Office of Chief Executive of the State of Mississippi in various ways including "general direction and control of the Emergency Management Agency… [;]" emergency management of the state and MEMA's promotion of the state's emergency preparedness; the authority to enter reciprocal aid agreements with other states and federal government; sponsoring and developing mutual aid plans and agreements between political subdivisions of the state; and other mitigation efforts as authorized by law.

The recent past under these authorities, the Governor created the Governor's Commission on Recovery, Rebuilding and Renewal response to Hurricane Katrina. The Governor created the Office of Recovery and Renewal within the Governor's Office which was later codified as the Office of Disaster Assistance Coordination within the Office of the Governor. Miss. Code 1972 Ann. §33-15-403.

Office of the Lieutenant Governor

(No change from the 2018 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. V, 128.

The Lieutenant Governor will preside over the Senate, rule on points of order, assign bills to committees, nominate standing committees of the senate, and appoint all select and conference committees as passed by the Senate. An ex officio member of the Senate Rules Committee and member of the Legislative Budget Committee. May vote only in the case of a tie, may speak from the floor while the Senate is in Committee of the Whole, and signs all finally adopted bill and resolutions.

Public Service Commission

(No change from 2018 submittal)

Authority for Mitigation: Miss. Code 1972, Annotated. 77-1-1 (1990).

The duty and responsibility of the Public Service Commission is to regulate communication, electric, gas, water and sewer utilities that are under the supervision and regulation of the commission. Primary mitigation responsibility is to ensure that the facilities constructed or acquired are required for the convenience, safety and necessity of the public. The Public Service Commission also helps to identify threats to public utilities by natural hazards.

Soil and Water Conservation Commission

(No change from the 2018 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 69-27-2 (1984 supplement)

This agency is responsible for coordinating the programs of soil and water conservation districts. It aids mitigation by securing cooperation and assistance from Federal and other State agencies. The agency studies, evaluates, and classifies land use problems and needs; distributes funds, and manages the agricultural and non-point source pollution program. The Commission's contribution to hazard mitigation is to develop an awareness and to mitigate local pollution problems.

Mississippi Community College Board

Authority for mitigation: Miss. Code 1972, Annotated. 37-4-3 (1986 supplement).

Mississippi Community College Board (MCCB) through the fifteen community colleges, contributes to statewide mitigation efforts through assigned supporting roles in the Mississippi Comprehensive Emergency Management Plan (CEMP). Here, MCCB provides mitigation support to Emergency Support Function (s): #6, Mass Care, Emergency Assistance, Temporary Housing, and Human Services; and #8, Public Health and Medical Services, and Ebola Virus Disease Incident mitigation. The support or assistance is provided through resources, facilities, and/or other assistance requested.

The community college instructions further contribute to hazard mitigation through their educational programs to prepare for and overcome natural disasters. This is accomplished through community service programs and career technical programs in the various districts. Due to the many locations statewide, community colleges also provide facilities for the delivery of shelter and supplies to victims. Community colleges strive to promote, strengthen, and coordinate emergency response in order to better identify and support state mitigation efforts.

State Department of Health

(No change from the 2018 submittal)

Authority for Mitigation: Miss. Code 1972, Annotated. 41-3-15 (1972).

Providing protection to the public from threats to health and safety from unsanitary conditions relating to food, drinking water and sewage, unnecessary exposure to radiation and unhealthy and unsafe conditions in health care facilities, childcare facilities, and the workplace. Helps identify threats to potable water supply caused by natural hazards.

State Fire Academy

(No change from 2018 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 45-11-7 (1988 supplement).

The Fire Academy trains and educates persons engaged in municipal, county, and industrial fire protections and trains local law enforcement officers in arson investigation.

The Fire Academy is in compliance with the National Incident Management Systems (NIMS) under the Presidential Directive. Also, the Academy offers NIMS courses state-wide to all emergency response personnel through a federally funded grant.

Water Development Districts

(No change from 2018 submittal)

Pat Harrison Water Management District, Pearl River Valley Water Supply District and Tombigbee River Valley Water Management District

Authority for mitigation: Miss. Code 1972, Annotated. 51-13-103, 51-15-103, 51-9-105.

These watershed management districts are responsible for regulating the waters within their jurisdictions in order to conserve, protect, and develop them to provide adequate, sanitary water supply, control flooding, and ensure irrigation water when needed.

Board of Animal Health

(No change from the 2018 submittal)

Authority for Mitigation: Miss. Code of 1972, Annotated. § 69-15-1.

To deal with all contagious and infectious diseases of animals in the opinion of the Board as may be prevented, controlled, or eradicated with power to make, promulgate, and enforce such rules so as to prevent the introduction and spread of those diseases.

Department of Finance and Administration

Authority for mitigation: Miss. Code 1972, Annotated. 33-15-307(5)

The Department of Finance and Administration (DFA) is responsible for managing and administering state finances and programs. Its primary mitigation responsibility is to ascertain if amounts requisitioned by the Mississippi Emergency Management Agency (MEMA) from the Disaster Assistance Trust Fund are within the limits set forth in statute and transfer appropriate amounts from the Working Cash Stabilization Fund to the Disaster Assistance Trust Fund. DFA also administers the Disaster Recovery Fund and the Emergency Aid to Local Government Loans and Grant Program, provides administrative support to the Governor's Authorized Representative (GAR)/MEMA in connection with the Special Community Disaster Loan Program (SCDL). DFA provides daily support to MEMA insofar as routine and extraordinary fiscal, budget and procurement activities.

4.2.2 Evaluation of Mitigation Actions and Activities

The Hazard Mitigation Council will review the mitigation actions and activities included in the 2023 Plan on a semiannual basis. The evaluation process will include updates on such items as timeline, funding source, responsible entity, and project status. In addition, the Council will also review current programs and initiatives listed in Table 4.2.2.1 (Details of these programs are outlined in Section 2.3.3 of this Plan). Any desired or necessary changes to the mitigation actions or programs will be communicated to MEMA and other stakeholders.

TABLE 4.2.2.1
Mitigation Programs

Center for Community Earthquake Preparedness	Emergency Management Preparedness Grant	Hazard Mitigation Assistance Program (HMGP)	Natural Hazards Plan
Community Development Block Grants	Forestry-Disaster Hazard Mitigation and Preparedness Plan	Homeland Security Plan	Building Resilient Infrastructure and Communities (BRIC)
Comprehensive Emergency Management Plans	Federal Dam Safety Program	National Flood Insurance Program	HMGP Post-Fire Assistance
Consolidated Plan for Housing and Community Development	Hazard Mitigation Assistance	Flood Mitigation Assistance (FMA)	Fire Management Assistance Grants (FMAG)
State Emergency Response Commission	Rehabilitation of High Hazard Potential Dams (HHPD)	Pre-Disaster Management (PDM)	Safeguarding Tomorrow Revolving Loan Fund Program

As events dictate; such as a pre- and post-disaster review and other situations that may affect the progress of the mitigation actions, the Council will conduct additional meetings. The Council may determine new actions and/or funding opportunities that may develop upon the course of events. The Council will communicate to MEMA any necessary changes they deem necessary.

The Administrative Plan for the Hazard Mitigation Grant Program (Section 404) defines applicant eligibility criteria, describes the application process, and outlines the resources and procedures for management of Hazard mitigation Grant Program (HMGP) projects and their associated program funding. Although the HMGP funding is disaster declaration-dependent, many mitigation projects are identified through the local hazard mitigation plans and may be implemented with available funding as determined by the State. The Administrative Plan provides the process in which to manage post-disaster programs. The State will manage and administer FEMA funding in accordance with applicable Federal statutes and regulations.

4.2.3 Hazard Management Capabilities

A summary of obstacles, challenges and proposed solutions for state capabilities and potential strategies for overcoming challenges are provided below. Changes since the previous plan approval have been addressed. In reference to building codes, the State of Mississippi law authorizes local governments to undertake these activities, but does not require them to do so. The State continues to encourage communities to adopt codes and ordinance. Some state agencies responded stating that no obstacles or challenges were identified in capabilities, including the Office of the Governor and Mississippi Department of Finance and Accounting, and others provided challenges in the area of funding and staff shortage, including the Mississippi Department of Marine Resources.

MEMA has responded to the challenges that numerous disasters brought to Mississippi by increasing their hazard management capabilities. For example, construction of a state-of-the-art facility to house their headquarters. This facility provides the resources necessary in preparing and responding to impending disasters. MEMA also recognized the need for additional, trained staff to accommodate the increase in mitigation projects. To assist local governments and eligible applicants in completing mitigation applications online, a "Notice of Intent" should be sent to mitigationgrants@mema.ms.gov. A MEMA Mitigation Specialist will contact the local government. An HMPG grant application must be completed by the local government to be considered for funding. MEMA submits the project to FEMA for review and approval. If approved, MEMA receives FEMA mitigation funds to reimburse local governments for approved projects. A complete description of MEMA's and other state agencies capabilities can be reviewed in Section 4.2.1.

Institutions of Higher Learning responded stating that challenges or obstacles to hazard mitigation involve the need for resources and increased funding. While IHL is positioned well to adapt to many challenges through its educational programs, challenges posed by inflation and economic pressures result in higher costs for facility construction and preventative maintenance, insurance, payroll, energy, and the cost of doing business generally. One such challenge involves IHL seeking funds to support pay in order to be competitive when compared to regional averages.

Mississippi Authority for Educational Television (d/b/a Mississippi Public Broadcasting) response states that there are many needs the agency faces to keep the citizens informed, enlightened, and entertained. MPB has an infrastructure need of over $23 million. Equipment at all eight of its tower sites need to be replaced including replacing old transmitters, microwaves, and tower repairs. The legislature has appropriated $2 million per year over the past three years. It's not clear if that funding will continue year to year. MPB will request additional funding each year.

MARIS response states that currently the only obstacle is an ongoing shortage due to 2020 passing of a senior staff member. Work is underway to refill the position with a legislative ask this Fall. The ability to host and deliver data is unaffected. Only the ability to process new incoming data is negatively affected.

Mississippi Department of Environmental Quality responds challenges and solutions stating that MDEQ has identified several internal and external factors that will influence the agency's ability to achieve its targeted capabilities. The agency has been strategically planning for these possibilities and will, as it has in the past, strive to meet these challenges proactively.

Before discussing specific influential factors, it is important to note that, while MDEQ has been able to meet the required capabilities in the past, our ability to continue to meet the goals has become increasingly difficult. Financial challenges coupled with high staff turnover rates over the last several years have resulted in the agency operating on very lean staffing levels. As it relates to the factors below, any additional fiscal or workforce setback could greatly affect our ability to meet the targeted capabilities, and more importantly, jeopardize our ability to meet the agency's core mission.

A. Internal Factors

i. Recruitment and Retention of Professional Staff

The single most significant internal or external factor that could jeopardize MDEQ's success in achieving its targeted performance goals is the agency's ability to recruit and retain qualified engineers, scientists, information technology, and other specialized professionals. In FY2022, 107 of the 348 MDEQ employees on staff have less than five years of service (30.75% of agency employees). In FY 2014, 79 (20% of agency employees) had less than five years of service. Additionally, only 10.34% of our current staff have 10 to 15 years of experience. Historically, the Agency maintained approximately 20% in the 10 to 15 year-range. To keep pace with the ever-changing requirements of today's regulatory and business landscapes, MDEQ staff must be on the cutting edge of environmental science and engineering, as well as information technology, which supports the core efforts of the agency. The staff must be able to completely understand and act upon new and changing federal regulations, new developments in environmental science, and new technologies when they write permits, ensure compliance, and explore opportunities to benefit Mississippi. It is imperative that MDEQ have technically proficient staff in place, appropriate for the expanding opportunities in the state's economy.

Over the past few years, significant private sector job growth and salary increases have strained the agency's ability to recruit and retain technical staff. MDEQ's challenge to offer competitive compensation has drastically affected its efforts to successfully compete with private industry and other governmental organizations who are offering higher salaries. For example, since June 2021 MDEQ has lost 30 employees for annual salary increases ranging from $5,000 to $75,000. MDEQ is aggressively recruiting statewide holding on-campus interviews and attending career fairs, but it is growing more difficult to hire people who are willing to make the commitment to state service, especially in high demand fields such as engineering, science, and information technology.

New Employees: MDEQ has, for some time now, served as a training ground for college graduates who leave for better opportunities in the private sector, many times within the first two years of employment. This "revolving door" has cost the agency monetarily and jeopardizes the continuity of valuable expertise. Additionally, management has become increasingly challenged by a developing pattern of expending significant agency resources to train new staff only to have them leave just as a high degree of productivity is achieved.

More importantly, staffing turnover adversely affects the regulated community. Industry leaders remind us regularly that they need MDEQ to have trained staff who can address the highly technical issues they face regarding ever-changing federal regulations.

Retirement-eligible Employees: Retirements in recent years have spiked due to more staff retiring as soon as they become eligible. Relative to past trends, fewer senior staff are remaining employed at the agency beyond 25 years, with many seeking a "second career" in the private sector. Accordingly, retaining institutional knowledge is a struggle. Over the last several years, the agency sustained major losses in upper and mid-level management personnel due to retirements.

MDEQ currently has a total of 348 employees. Between 2016 and 2021, MDEQ has lost 161 employees to resignations and 100 employees to retirement (261 total employees). This equates to 46% of MDEQ's 348 employee workforce. In addition, over 18% of our current workforce is retirement eligible, and 36.5 % of our current workforce can retire within the next five years. These trends are not sustainable for training and retaining highly technical staff.

ii. Loss of Institutional Knowledge

Historically, MDEQ has seen turnover from both ends of the workforce: retirees and entry-level employees. Over the last several years, MDEQ experienced heavy losses in both upper and mid-level management to retirements and resignations. The significant loss of institutional knowledge held by individuals in their respective areas, combined with the trickledown effect of replacing them and our difficulty in hiring and retaining qualified staff, are taking a toll on our ability to meet the performance goals as well as our obligations to EPA. We continue to lose programmatic knowledge faster than we can replace it, compromising our ability to meet our performance goals.

iii. Managing Limited Resources to Meet Expectations

Over the past several years, there has been an unprecedented convergence of new environmental regulations, emerging science and growing public awareness and participation. MDEQ is committed to public transparency and open communication, and staff is required to be responsive to public questions and input. For example, the permitting process includes a period of time for public comments, and public meetings are often held. With the growing access to information, people, both individually and in organized groups, are more involved than ever. As a public agency, MDEQ expects and welcomes public participation. However, managing the agency's limited resources to meet the public's expectations for more, detailed information is a growing challenge. In addition, staff is spending more time preparing for the possibility of challenges and correcting misinformation that is spread through rumors and the internet.

B. External Factors

i. Regulatory Workload

When new federal regulations are proposed or existing federal regulations change, the demands on MDEQ staff increase significantly. When the EPA proposes a new rule, or changes an existing rule, MDEQ staff must carefully research and determine the potential impact on Mississippi, engage with the people and industries that might be impacted, provide education and compliance assistance to affected industries, and be prepared to revise or completely rewrite portions of the Mississippi regulations. MDEQ staff must be experts in environmental science and engineering and also be highly competent communicators to adequately safeguard Mississippi's interests.

MDEQ has to administer ever-expanding and changing regulatory programs including tightening of National Air Ambient Quality Standards (NAAQS) under the Clean Air Act; the re-defining of Waters of the U.S. (WOTUS) under the Clean Water Act; the Stream Protection Rule under the Surface Mining and Reclamation Program; and new electronic documentation and data management requirements. Managing such mandates at the state level requires a great deal of work by MDEQ staff and, the cost of maintaining competent staff continues to increase. While the agency actively prepares for potential impacts of new or changing federal regulations, their scope and timing is uncertain. MDEQ is committed to being a leader in new technologies, technical assistance, outreach, transparency, sound engineering, and applied science, but federal regulations and environmental issues are continually evolving. MDEQ needs the resources to be prepared to address these complex issues.

i. Manmade and Natural Disasters

MDEQ has specific Emergency Support Functions in the Mississippi Comprehensive Emergency Management Plan, including being the Primary Agency for Oil and Hazardous Materials. MDEQ also plays a major role as a Support Agency for nine other functions in the Plan such as Public Works and Engineering, which include Dam Safety, Debris Management, and Wastewater. While statewide media attention is directed at the agency when there is a large event like a hurricane or the *Deepwater Horizon* incident, MDEQ's role in manmade and natural disasters is an ongoing job. MDEQ maintains 24-hour on-call response capabilities throughout the state for a variety of events that include: highway responses, maritime responses, train derailments, industrial releases, fish kills, and dam failures. MDEQ's role in the response to disasters and in the recovery afterwards continues to grow. It is difficult to predict how and when these events will occur and what MDEQ resources and expertise will be needed. During large-scale events, response capacity of the Emergency Response staff may be exceeded and staff from a variety of departmental roles may be called away from their primary responsibilities to assist. This, in turn, affects the Agency's ability to timely and efficiently deal with day-to-day operations.

In addition, MDEQ staff members respond when unprecedented severe weather events create widespread flooding and tornados. These events further demonstrate the importance of the dam safety and debris disposal programs. Severe weather events create an increased waste-disposal need throughout the state, which leads to landfills being filled with debris that was not anticipated. Meanwhile, the state's inventory of High Hazard dams has increased because of the growth in downstream development throughout the state. The failure of these dams would threaten lives and property. Finally, as local economies are more and more connected to communities throughout the world, Mississippi must be prepared to respond to pandemics while being able to continue core government functions.

The agency is uniquely qualified to provide the technical expertise needed to protect health and welfare and the environment in the time of manmade and natural disasters but must also be able to provide necessary staffing in such situations. Predicting the unprecedented is nearly impossible, but MDEQ is committed to living up to its reputation of responding to disasters of all different kinds without sacrificing its core responsibilities.

C. Internal Management Systems

MDEQ utilizes staff and technology to ensure that the operation of its environmental programs and its internal operations are effective, efficient, and ethical.

MDEQ uses information and project management systems whereby assigned work can be readily and continuously tracked. These systems provide accountability through management tools designed to assist managing workloads. Managers can evaluate a group's or an individual's cycle times, productivity, commitments, schedules, and other pertinent information. Numerous Standard Operating Procedures (SOPs) and checklists have been developed to ensure that state and federal requirements are met and best practices are used in an efficient and effective manner. Files are maintained to ensure accountability and transparency, and data is backed up to an offsite location in the event recovery is needed. For federally-delegated programs, MDEQ participates with EPA in various federal oversight evaluation programs, including program performance audits, such as the State Review Framework, which evaluate program effectiveness and consistency.

MDEQ programs undergo periodic reviews of financial records and for program compliance. These reviews/audits can be conducted by federal entities, the Office of the State Auditor, or independent audit firms.

MDEQ's Office of Administrative Services oversees the department's finances, financial reporting, risk management, and internal auditing, subject to strict accounting principles, as well as specific contracting and procurement rules and procedures.

D. Potential Solutions

As many of the obstacles that MDEQ faces in meeting its capabilities relates to budgetary constraints, the Agency can only operate with what funds have been appropriated. As meeting capabilities becomes too difficult to achieve with state personnel, hiring contract labor is one potential solution. Additionally, MDEQ may be able to lean on Federal partners (EPA and USCG) to assist in meeting those capabilities.

The Mississippi Library Commission responds on obstacles/challenges related to the capability to perform these duties would be:

- Lack of funding for any emergency supplies
- Potentially lack of staff to fulfill large needs
- Potentially lack of power, internet, water if emergency was at MLC

Potential to overcome challenges:

- Adequate emergency funding
- Emergency procurement guidance/exception
- Volunteers

Mississippi Department of Wildlife, Fisheries, and Parks provided the below challenges in meeting their capabilities:

- State Government competing with the private sector in recruiting and retaining employees. This is especially difficult in areas where the skillset requires specific education in the areas of Wildlife and Fisheries.
- Unprecedented challenges in recruiting, hiring and retaining Law Enforcement Officers.

The Mississippi Department of Archives and History responds to challenges stating that things that could cause delay or inability of MDAH to perform these functions may include, but not limited to, funding, staffing, disasters which prevent completion of the assignment, supplies, laws or regulations which prevent, delay or prohibit the execution of the assistance efforts.

The Mississippi Department of Health capability obstacles/challenges and solutions are provided below:

- Staffing
- Communication
- Aging Infrastructure
- Funding

Proposed Solutions:

- Increased collaboration/coordination among internal stakeholders (Departments within the Office Health Protection).
- Increased utilization of available notification systems (Juvare).
- Seek legislative support for possible fee increases, seek additional grant opportunities for funding opportunities.

4.3: Local Capabilities Assessment

> ***44 CRF 201.4(c)(3)(ii) – The State mitigation strategy shall include the following elements:***
>
> ***A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:***
>
> ***A general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.***

The local capability assessment provides a general description of local mitigation capabilities in Mississippi, including examples of successful policies and programs, and an analysis of the effectiveness of these capabilities based on local evaluations. Local capabilities are the existing programs and policies through which local governments implement mitigation actions to reduce potential disaster losses. The assessment concludes with a discussion of challenges and opportunities to implementing and strengthening local capabilities.

Methodology

The State analyzed the local capabilities identified in FEMA-approved local hazard mitigation plans in Mississippi to provide an updated general description of local mitigation capabilities and to assess the challenges and opportunities to improving local capabilities. Additional information on the effectiveness of local mitigation capabilities and opportunities and challenges for building local capabilities was gathered through a survey distributed State Hazard Mitigation Council and partners, all county emergency managers, tribal agencies, and stakeholders responsible for economic development, land use and development, housing, health and social services, infrastructure, natural and cultural resources, agencies providing fundamental services in the community, colleges and universities, private entities, private nonprofits, port authorities and utility businesses.

Local Policies, Programs, and Capabilities

Planning, building, zoning, floodplain management, and fire codes are functions of local government. State law authorizes local governments to undertake these activities, but does not require them to do so. Regulations and their enforcement will vary between communities throughout the state. The effectiveness of local mitigation policies, programs, and capabilities is directly related to the level of adoption and degree of enforcement. The State has encouraged communities to adopt codes and ordinances and has provided Model A and Model B-E ordinances for this purpose. Through mitigation planning, local governments can identify the strengths and weaknesses in their mitigation capabilities and implement strategies to improve these. A general description of the types of local mitigation capabilities in Mississippi follows.

Land Use Planning

Authority: Miss Code 1972, Annotated. 17-1-11 et. Seq.

Title 17, Chapter 1 permits municipal and county governments to adopt zoning regulations for the purpose of ensuring the most appropriate use of community lands and to provide for the preparation, adoption, amendment, extension, and carrying out of a comprehensive plan for the purpose of bringing about coordinated physical development in accordance with present and future needs. Chapter 1 also authorizes the establishment of local planning commissions to advise municipal and county governments in matters pertaining to physical planning, subdivision of land, zoning ordinances, building set back lines, and enforcement of regulations. Title 17 further authorizes any two or more counties or municipalities to establish regional planning commissions composed of representatives from the participating counties and municipalities. Regional planning commissions are established to advise local governments on problems related to acquisition, planning, construction, development, financing, control, use, improvement, and disposition of buildings and other structures, facilities, goods, and services.

No local land use plans are mandated by state law. State law does specify that the city or county legislative body must legally adopt a comprehensive plan to put it into effect. The state also requires that the zoning be based upon and consistent with the legally adopted plan. If a local government chooses to develop and adopt a comprehensive plan, the law does specify a list of elements that must be included, but no natural hazards element is required.

Building, Fire, and Other Codes

Authority: Miss. Code 1972, Annotated. 19-5-9.

Title 19, Chapter 5 authorizes certain counties to adopt, as minimum standards, building codes published by a nationally recognized code group.

Authority: Miss Code 1972, Annotated. 21-19-25.

Under Title 21, Governing authorities of any municipality are authorized to adopt building, plumbing, electrical, gas, sanitary, and other codes to protect the public health, safety, and welfare.

Authority: Miss Code 1972, Annotated. 21-19-21.

Title 21, Chapter 19 authorizes municipal authorities to pass fire safety regulations relating to structures and buildings used as residences or businesses. Chapter 19 further permits local authorities to inspect all buildings and land and take down, remove, or rehabilitate, at the owner's expense, properties found to be unsafe with respect to fire hazard.

Mississippi does not adopt or enforce a statewide building code for all structures, nor does it mandate a code for residential construction. It is up to local jurisdictions to adopt and enforce building codes.

House Bill 1406, passed in 2006, creates the Mississippi Building Code Council. It also requires five coastal counties, Jackson, Harrison, Hancock, Stone, and Pearl River, and the municipalities located there, to enforce all the wind and flood mitigation requirements prescribed by the 2003 International Residential Code and the 2003 International Building Code. The Mississippi Building Codes Council adopted the 2003 International Building Code and 2003 International Residential Code for the state, but does not require local jurisdictions to adopt building codes, but requires that they use the International Codes if they do adopt codes.

Local Emergency Management

Authority: <u>Miss Code 1972</u>, Annotated. 33-15-17

Local governments are authorized to establish organizations for emergency management with a director having responsibility for the organization's administration and operation. Local emergency management organizations may be composed of a single county or municipality or two or more counties or municipalities. Local emergency management organizations are further authorized to enter into mutual aid agreements with other public and private agencies in the state.

Authority: <u>Miss Code 1972</u>, Annotated. 2 1-19-23.

The Statewide Mutual Aid Compact, or SMAC, began in 1995 by MEMA to provide a more effective use of resources in times of disaster. It provides a way for cities and counties to request and receive help from each other when local resources are exhausted. SMAC provides a mechanism for assistance to come from different parts of the state. It addresses the issues of liability, compensation, direction and control in a uniform manner. SMAC allows members of the compact to have a mutual aid agreement with both the state and other compact members.

All 82 counties and the Mississippi Band of Choctaw Indians (MBCI) in Mississippi now have a full or part-time emergency management program as well as a designated emergency management or civil defense director. In accordance with **Title 33, Chapter 15 Mississippi Code of 72, Annotated**, each county will develop an emergency management plan and program that is coordinated and consistent with Mississippi's CEMP. All 82 counties' Comprehensive Emergency Management Plan (CEMP) are on file with the Mississippi Emergency Management Agency (MEMA).

Water Management and Flood Control Districts

Authority: <u>Miss Code 1972</u>, Annotated. 51-29-1 et. Seq.; 51-31-1 Et seq.

Counties may form drainage districts for the purpose of developing, maintaining, and improving drainage systems to prevent flood-related damage.

Authority: <u>Miss Code 1972</u>, Annotated. 51-35-101 Et seq.

Counties may form flood control districts for the purpose of cooperating with the federal government in the construction, maintenance, and operation of dams, reservoirs, and other flood control projects.

Authority: <u>Miss Code 1972</u>, Annotated. 51-35-301.

Municipalities of 100,000 or more and urban counties of 100,000 or more and adjacent areas are authorized to establish urban flood and drainage districts.

Authority: <u>Miss Code 1972</u>, Annotated. 51-8-1 Et seq.

Chapter 8 authorizes the formation of master water management districts composed of two or more existing drainage or water management districts, parts of existing districts, or territory not included in any district. Formation of a master water management district is contingent on the approval of a certain percentage of landowners within the proposed district. Master water management districts may cooperate with federal agencies in projects designed to prevent flood damage, improve drainage, and foster conservation of water resources.

Flood Insurance

Authority: Miss. Code 1972, Annotated 43-41-11.

The National Flood Insurance Program (NFIP) has identified flood hazards in Mississippi communities. Presently, 81 counties, one water supply district (Pearl River Valley), and 253 municipalities participate in the NFIP, for a total of 335 "communities". Authority was granted at the local level by the state legislature to administer the NFIP using the local government's "police power" to regulate land use.

Mississippi continues to rank high in the nation for NFIP payments. The State Floodplain Manager and local jurisdictions maintain detailed data on properties classified as repetitive flood claims or severe repetitive flood loss. These structures strain the National Flood Insurance (NFIP) Fund. The State of Mississippi is committed to mitigate its repetitive and severe repetitive loss properties, to that end the state plan has previously been amended to take advantage of the SRL Program with the 90/10 share cost. The State encourages communities to restrict development in flood prone areas by implementing stricter building codes, zoning and ordinances. The State places a higher priority for applications inclusive, but not limited to, developing a floodplain management program, restricting development in flood prone areas, acquiring flood prone properties, elevating structures that have been deemed repetitive loss and severe repetitive loss structures, and flood proofing businesses that meet the criteria of repetitive loss and severe repetitive loss structures. The State of Mississippi does not adopt or enforce a statewide building code for all structures, nor does it mandate a code for residential construction. It is up to local jurisdictions to adopt and enforce building codes.

Tables of Community Mitigation Capability Assessment

Table 4.3.1 and Table 4.3.2 in the previously approved 2018 Mississippi Hazard Mitigation Plan displayed local capabilities related to existing planning and policy mechanisms. The tables provided statuses for each county and city on the following capabilities:

- National Flood Insurance Program (NFIP) participation
- Number of Flood Insurance Policies within NFIP participating jurisdictions
- Community Rating System (CRS) participation
- Comprehensive/master/general plan
- Hazard mitigation plan
- Residential building code
- Commercial building official
- Building Code Effectiveness Grading System (BCEGS) rating for residential buildings
- Building Code Effectiveness Grading System (BCEGS) rating for commercial buildings
- Zoning code
- Subdivision regulations
- Community Wildfire Protection Plan
- Continuity of Operation Plan
- Open Space Management Plan

- Stormwater Management Plan
- Disaster Recovery Plan
- Fire code rating

During the 2023 update process, information was collected from the FEMA approved local hazard mitigation plans and was used to update the table and provide additional information on capabilities. These fields were updated, and additional information was collected on CRS participation and rating and building code type. Some local plans did not provide information on each of these capabilities. Table 4.3.1 displays the number of counties and cities that reported whether they had each capability or not, and of those counties and cities, the percent with each capability.

Table 4.3.1
Mitigation Capabilities of Counties and Cities Identified in Local Plans

Capability	Counties		Cities	
	Number Reporting	Percent with Capability	Number Reporting	Percent With Capability
Comprehensive Plan	82	100%	246	82%
Building Code	16	20%	141	47%
Building Official	19	23%	91	30%
Zoning Ordinance	19	23%	106	35%
Subdivision Ordinance	23	28%	128	43%
Floodplain Ordinance*	81	99%	250	83%
Community Wildfire Protection Plan	4	5%	8	3%
Continuity of Operation Plan	40	49%	41	14%
Open Space Management Plan	11	13%	24	8%
Stormwater Management Plan	11	13%	56	19%
Disaster Recovery Plan	5	6%	1	.03%
Fire Code	1	1%	48	16%

*Adoption of floodplain ordinance is assured based on participation in the NFIP, as calculated from the NFIP Community Status Book Report, November 15, 2022.

As shown in Table 4.3.1, an overall percentage of cities vs counties capabilities are about equal. Comprehensive emergency management plans and floodplain ordinances are the capability, of those tracked, that the highest percentage of counties (99.5 percent) and cities (82.5 percent) have in place. In approved local plans that identified whether building codes had been adopted or not, 20 percent of counties and 47 percent of cities had adopted building codes.

All 82 counties have adopted comprehensive emergency management plans, and all counties have FEMA-approved hazard mitigation plans at the time of this assessment. By reviewing and incorporating these local hazard mitigation plans with the state plan, a more comprehensive approach to reducing future losses from natural hazards is implemented. All levels of government can effectively prepare for, respond and recover from emergency and disasters.

Table 4.3.2 shows the changes in local participation in the NFIP, CRS, and BCEGS from 2018 to 2022. The NFIP Participation total for communities increased by 4 communities. BCEGS Rating increased from 45 cities and counties to 47 cities and counties.

Table: 4.3.2
Change in Select Capabilities since the 2018 Plan

Capability	2018	2022
NFIP Participation Total	330	334
NFIP Participation Suspended	0	0
NFIP Not in Program with Hazard Area Identified	35	33
CRS Participation	32,0 retrograde	32,3 retrograde
BCEGS Rating	45 cities and counties	47 cities and counties

NFIP Community Status Book Report as of November 15, 2022; CRS report current as of April 1, 2022.

Effectiveness of Local Mitigation Capabilities

At the MEMA District Meetings with local emergency management directors and meetings with the local, the Mitigation Planning Staff distributed a paper state plan survey. The survey was also emailed or mailed to Building Association members, Floodplain Managers, State of Mississippi Mitigation Council, local colleges, tribal agencies, businesses, private nonprofits, hospitals, churches, local officials, stakeholders, partners, and citizens. The survey was also placed on state agencies websites. The survey was designed to gather information about options on the effectiveness of local mitigation capabilities. Fifty-five completed surveys were evaluated. It is important to note that this data is limited by the small sample size.

The survey asked respondents to give their opinion on the level of effectiveness of different types of local capabilities (e.g., tools, policies, programs) for implementing mitigation actions in their community or region. Respondents ranked local capabilities on a scale from one to four, with one being the least effective and four being the most effective. The capability among those listed, which was ranked as the most effective by the highest number of respondents (46 percent) was emergency operations plan. This was followed by public information/education and building code (31 percent), comprehensive plan (30 percent), local/regional emergency planning committee (28 percent), floodplain ordinance NFIP (26 percent). The capability in which the most respondents (9 percent) ranked as least effective for mitigation was subdivision ordinance. Figure 4.3.1 shows the average ranking of each capability.

Figure 4.3.1:
Average Ranking of Effectiveness of Local Capabilities

Capabilities	Effectiveness on a Scale from One to Four
Emergency Operation Plan	46%
Public Information/Education Programs	31%
Building Code	31%
Comprehensive Plan	30%
Local/Regional Emergency Planning Committee	28%
Floodplain Ordinance/NFIP	26%
Geographic Information Systems (GIS) Program	22%
Capital Improvement Plan	15%
Zoning	13%
Stormwater Management Plan/Ordinance	13%
Subdivision Ordinance	9%

Challenges and Opportunities for Improving Local Capabilities

Survey respondents were asked five open-ended questions about 1) the manmade hazards that concern you, 2) the challenges or weaknesses in hazards mitigation capabilities in their region, 3) the opportunities for improvement in local capabilities, 4) the increase or decrease in natural hazard frequency, duration, and intensity, and 5) the steps local government can take to reduce or eliminate the risks of future hazard damages. The most common response to the question about manmade hazards of concern was terrorism (CBRNE, chemical, biological, radiological, nuclear, and explosives). It was followed by active shooter, then hazardous waste spills. The most common response to the question about challenges or weaknesses was lack of funding. Some responses were general and others were specific to storm shelters, individual saferooms, notification, training, and equipment. It was followed by communication and lack of staffing. The most common response to the question about improvement opportunities for local capabilities was funding. It was followed by education and communication.

Collaboration with all agencies, resource and information sharing, ability to hire emergency response personnel, improvement in infrastructure, improvement in new construction, identification of risks, state and federal support for water system, and leadership understanding what hazard mitigation mean and being familiar with their plan were also listed as improvement opportunities by respondents.

The most common response to the question in the last 10 years, have you noticed an increase or decrease in the frequency, duration, and intensity of any of the following hazards was tornado. It was followed by flooding and severe storms. The most common response to the question what steps you think local government can take to reduce or eliminate the risks of future hazard damages in your neighborhood or business was obtain funding for safe houses and shelters. It was followed by institute multiple ways to contact public during severe weather event.

Based upon the survey data and the analysis of local programs, policies, and capabilities from local plans and state resources, the following challenges and opportunities for strengthening local capabilities were identified:

Intergovernmental Assistance and Coordination

Support from the state and the federal government is critical to improving local mitigation capabilities. Training and workshops may be the most important types of assistance the state and federal government can provide, particularly related to planning and program grant applications and in developing effective mitigation projects.

Coordination with other Planning Efforts

Some local plans describe other planning projects that implement mitigation measures. These include watershed plans and coastal impact assistance plans. Coordination with these other planning efforts can improve local governments' capabilities through accomplishing multiple objectives and leveraging additional funding sources.

Adoption and Enforcement of Codes and Ordinances

Codes and ordinances may be the greatest opportunity and challenge for local governments. One of the last 3 editions of International Building Code and International Residential Code mandated statewide for jurisdictions and any other codes by the Mississippi Building Code Council. However, there was an opt-out clause for municipalities for 120 days after the law became effective on August 1, 2014. As of April 2015, over 2/3 of cities and over 1/2 of counties had chosen to adopt these requirements.

Many hazard mitigation plans emphasize the importance of land use planning and regulations for mitigation. Many also comment on the unlikelihood of getting them adopted due to the rural nature of their area and the perceived stigma attached to zoning by many rural residents. Several plans describe the difficulty in inspecting buildings and enforcing codes due to lack of staffing and funding capabilities.

An example of an implementation program that has been successful is in Pearl River County, Mississippi. After Hurricane Katrina, Mississippi Legislature mandated the adoption of the International Building Code and International Residential Code in five coastal counties including Pearl River County. The cities of Picayune and Poplarville have also adopted building codes. They are working toward consolidating building permits and inspections as a mitigation tool to ensure uniform enforcement of standards for construction in flood hazard zones, wind construction standards, and building codes. The three jurisdictions and the Lower Pearl River Valley Foundation contributed funding for a comprehensive and coordinated step-by-step guide to implement the International Building Codes countywide to protect lives and minimize damage to property.

Regional Hazard Mitigation Plans

The State has nine regional hazard mitigation plans to cover the majority of jurisdictions in the State. This has proven to be more efficient with the available funding. This has proven to be more cost effective and efficient. Regional planning efforts offer an opportunity to coordinate land use issues to prevent one jurisdiction from adversely affecting the other and to integrate the mitigation plan with other regional plans.

Contractors go through the state bidding process. The lowest bid is selected, provided that there are no issues. There is a total of nine regional hazard mitigation plans in the state. There are jurisdictions that chose to opt out of the regional hazard mitigation plans, but they are covered under county, multi-jurisdiction or single jurisdiction hazard mitigation plans. Planning and technical resources are available to the local governments

Floodplain Management

The state and many local governments recognize floodplain management and the NFIP as highly effective location mitigation capabilities and as primary opportunities to strengthen local capabilities. The State can do this through continuing to enhance its program that provides information and support for new communities to participate in the NFIP and CRS and for existing participants to promote and enforce their floodplain management programs.

Mitigation Grants

The Mississippi Emergency Management Agency's Office of Mitigation is responsible for coordinating disaster loss reduction programs, initiatives and policies throughout the state. Disaster loss reduction measures are carried out through the development of state and local hazard mitigation plans and the implementation of those plans.

The Office of Mitigation administers hazard mitigation grant programs to state and local governments, qualifying nonprofits and tribal organizations. Grant programs include the post-disaster Hazard Mitigation Grant Program, the Flood Mitigation Assistance Program, the Pre-Disaster Mitigation Program and the Severe Repetitive Loss Grant Program, which funds the mitigation of high loss insured properties through the National Flood Insurance Program. The following listed projects are eligible for mitigation funding: 1) hazard mitigation, 2)retrofit of critical facilities, 3) acquisition, elevation, relocation or drainage improvements of repetitive flood loss structures, 4) minor localized flood reduction projects, 5) construction or upgrade of general population shelters, 6) enhancement of development codes and standards, 7) saferooms and storm shelters, 8) generators for critical facilities, and 9) warning systems. The State notifies potential applicants via applicant briefings. The applicants submit a notice of intent to the Mitigation Grants Bureau and the applicant is notified of approval or denial of the notice of intent.

Local Funding

Funding for mitigation planning and projects remains one of the greatest challenges for improving local capabilities. Local plans indicate that most local governments use federal funds for mitigation and have met match requirements through in-kind services or their general operating fund. A dedicated tax revenue source for mitigation is difficult to implement as tax increases are unpopular with the public. A tax designated to targeted, tangible benefits, such as funding an emergency manager position and/or an advance warning system, may be more acceptable to the public. The state can improve local success with federal funding programs by efficiently managing the programs and providing assistance to local governments with applications, ideas for meeting match requirements, and continued eligibility.

One approach that communities are using to overcome the funding obstacle is improving integration with other local plans and programs, such as capital improvement plans and storm water management programs, to help achieve mitigation through other community objectives. Improved public education and awareness of hazard vulnerabilities and mitigation options also may help to garner more funding for mitigation through tax dollars and private sources. The best time to implement this approach is often in the window of opportunity after a disaster.

Impact of Hurricane Katrina

Many local plans were written prior to Hurricane Katrina. Several updates have occurred, including most jurisdiction being covered under regional hazard mitigation plans . Since Hurricane Katrina, the following changes have been made:

- Intergovernmental agency communication has improved.
- Additional emergency generators to operate critical facilities during and after a disaster.
- Increased emergency sheltering capabilities.
- Redundancy on local communications.
- Hardening of emergency shelters.
- Widening of road systems and development of unincorporated areas to smart codes.
- Hardening infrastructure, sewer systems, etc.
- Adoption of higher standards for reconstruction to create more disaster-resistant structures.

4.4: Mitigation Measures

44 CFR 201.4(c)(3)(iii) – State plans shall include an identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.

The State of Mississippi through the Mississippi Standard Mitigation Plan has identified and prioritized mitigation measures. These measures are grouped by the following types:

- Dam and Levee Failure
- Earthquake
- Flood
- Tropical Cyclone (Hurricane/Tropical Cyclone)
- Multi-Hazard
- Tornado
- Wildfire
- Extreme Winter Storm
- Drought
- Climate Change/Sea Level Rise
- Cyberterrorism
- Infectious Disease/Pandemic

These measures are classified in the following strategies:

- Prevention
- Property Protection
- Public Education and Awareness
- Technical Assistance
- Natural Resource Protection
- Emergency Services
- Structural Projects

After each profile was identified, prioritized and classified, it was evaluated against the goals and objectives adopted by the Hazard Mitigation Council as described in Section 4.1. In order to warrant a mitigation action profile, the project had to address one or more of the goals and tie specifically to an objective within the goal. The Hazard Mitigation Council determined that the goals from the 2018 plan remained valid and were consistent with the hazards and vulnerabilities identified in the 2023 plan update. Listed below is a recap of the goals reassessed and adopted by the Hazard Mitigation Council for the 2023 update.

- Goal 1 – Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards
- Goal 2 – Build and enhance local mitigation capabilities
- Goal 3 – Improve public education and awareness
- Goal 4 – Sustain and enhance a coordinate state mitigation program

Table (4.4.2) gives updated information about these measures with each measure uniquely identified by the following parameters:

Project Number – Each measure is numbered within each type.

Type – Each measure is listed by type of hazard with general measures or those addressing more than one hazard listed by type "multi-hazard".

Project Name – Each measure has been given a name that briefly describes the measure.

Agency – A State agency with primary responsibility has been identified even though more than one Federal, State or Local agency may be involved. Each agency identified is a member of the Mississippi Hazard Mitigation Council.

Funding Strategy – A primary funding source has been identified. Additional funding sources may be utilized to supplement the primary funds. Section 4.5 provides information regarding the funding sources including type of assistance and agency/contact in Table 4.5.1. The table has been updated from the 2018 plan to include programs not identified or available in the 2018 plan. These programs include the reference "2023 Plan Update" in the Program/Activity column.

Completion – The year of completion has been identified. Some measures are completed on an annual basis, meaning continuous or occurring every year. Table 4.4.1 identifies the mitigation strategies and the status of each project from the 2018 plan, and Table 4.4.2 identifies the updated 2023 mitigation strategies.

Priority – Each measure has been ranked as high, medium or low priority. The basis of the rankings is identified below:

- High – Activities for which funding sources are readily available or are vital to the state's reconstruction or recovery efforts.
- Medium – Assigned to activities that are identified as long-range in nature or for which funding is not presently available but may be in the relatively near future.
- Low – Assigned to activities for which there is no clear method of funding, or may not ever be funded, and are not critical to the state's reconstruction and recovery efforts.

Status – Projects noted in Table 4.4.1 with an ongoing status mean that the action is being completed, but the project has not ended. The project continues each year as funding is available.

Table 4.4.2 is not intended to capture all the pertinent data regarding the mitigation action. Project profile/progress reports are provided in Appendix 7.3.1, which gives additional data including goals and objectives referenced in Section 4.1. These project profile/progress reports serve as an interactive information sheet to communicate the latest information regarding the mitigation action. The project managers update project profile/progress reports showing the current status and progress made in the implementation of a mitigation project. Appendix 7.3.1 and Section 5.3 Funding Priority and Prioritizing Alternatives also describe prioritization process for mitigation actions.

During the 2023 update of the state hazard mitigation plan, the hazard mitigation council reviewed the actions in the previous plan to provide status updates and to identify actions completed or not completed. Table 4.4.1 provides a summary of the results. Six projects were completed; no projects were deleted. Table 4.4.2 provides the updated actions for the 2023 plan. Eight mitigation projects were added and are noted in Table 4.4.2 as “New Action for 2023”. There were no changes in priorities.

The mitigation tables and project profiles will be used interchangeably to assist with implementation of the projects. The sorted tables include a summary of each mitigation action. Details are given in the project profiles which include the goals and objectives of each mitigation profile. MEMA maintains a Mitigation Action Notebook that includes updated information as it is available. This information is being incorporated into each of the 67 project profiles, which are updated with information from MEMA and other lead agencies.

Local Mitigation Actions

The state has developed a database of all FEMA-approved hazard mitigation plans. Because of the large size of the database, it is not incorporated as part of the State Hazard Mitigation Plan, but is available at Mississippi Emergency Management Agency.

The database allows the state to link state actions to local actions and to help identify new state actions. For instance, the state has an action to promote the National Weather Service’s StormReady certification program for local communities. The database can be used to quickly identify which local governments have identified mitigation actions related to the StormReady program.

The state also plans to use this database as part of a more comprehensive system of prioritizing local projects for funding, tracking those projects that have been funded, and monitoring the effectiveness of implemented local projects. As local hazard mitigation plans are approved, the identified mitigation actions will be added to the database, so that it remains current. The hazard mitigation plans in this database contain actions that have been identified and prioritized by local governments based upon their unique processes for determining actions that are technically feasible, cost effective, and environmentally sound. Prior to any funding from state or federal sources, more detailed benefit-cost analysis of actions will occur during the project development and grant application phases.

For the 2023 plan update, each local hazard mitigation plan was reviewed. The State of Mississippi Hazard Mitigation Council used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to analyze the cost-effectiveness of each State project. Mitigation actions were screened for implementation with consideration that they must comply with federal and state requirements. Each project was reviewed to determine if it was cost-effective environmentally sound, and technically feasible. The updated projects resulted from a number of council meetings. Some projects have been more effective than others. Based upon progress of mitigation actions and capabilities, updated risk assessment, and review of mitigation priorities, effective mitigation actions have been identified and prioritized. The high hazard potential dam mitigation actions were prioritized based on assessments and studies to determine which proposed projects will reduce the most risk to lives and property downstream. Further information on prioritization is forthcoming, pending FEMA rollout. For the 2023 update, eight new mitigation actions were added.

Table 4.4.1:
Status of Mississippi Mitigation Actions from 2018 Plan

Project No.	Type	Strategy	Project Name	Agency	Project Cost ($)	Funding Strategy	Completion	Prio rity	Status
1	Dam Safety	Prevention	Permitting New Dams and Regulatory Compliance	MDEQ	$332,500	Budget	Annual	H	Ongoing status
2	Dam Safety	Outreach and Education	Public Education and Outreach	MEDQ	$17,500	Budget	2021	H	Ongoing status
3	Dam Safety	Prevention	Inundation Maps/EAPs for High Hazard Watershed Dams	MDEQ	$80,000	Budget	2022	H	Ongoing status
5	Dam Safety	Structural	Repair and Rehab Dams	MDEQ	$1,000,000	Private	Annual	H	Ongoing status
7	Dam Safety	Prevention	Enforce Implementation of 2006 Dam Safety Legislation	MDEQ	$250,000	Budget	2022	H	Ongoing status
9	Dam Safety	Technical Assistance	Information Management for Inundation Area Vulnerabilities	MDEQ	$100,000	HMGP	Annual	H	Complete
10	Dam Safety	Prevention	Probable Maximum Precipitation Update Study	MDEQ	$500,000	HMGP	2023	H	Ongoing status
1	Earthq uake	Technical Assistance	Review and Update HAZUS-MH Data Base	MEMA	$70,000	HMGP	2021	H	Ongoing funding shortfall
2	Earthq uake	Prevention	HAZUS-MH Project Implementation for Local Initiatives	MEMA	$10,000,000	HMGP	2023	H	Ongoing status
3	Earthq uake	Technical Assistance	Compile New Soil Evaluations	MDEQ	$40,000	Budget	2022	M	Ongoing status
5	Earthq uake	Technical Assistance	HAZUS-MH Update with Pipeline Locations	MEMA	$10,000	Budget	2021	M	Ongoing delayed funding shortfall
6	Earthq uake	Outreach and Education	Partnership Programs for Collaborating Programs with other States	MEMA	$10,000	Budget	2022	H	Ongoing status
10	Earthq uake	Technical Assistance	Monitor State of Comprehensive Infrastructure Retrofit	MDOT	$1,000,000	Budget	2022	H	Complete
11	Earthq uake	Technical Assistance	Information Management System for Critical Infrastructure	MDEQ	$50,000	HMGP	2022	H	Ongoing status
1	Flood	Outreach and Education	Map Modernization: New Firm Adoption by Communities	MEMA	$20,000	CAP	Annual	H	Ongoing status
4	Flood	Technical Assistance	Community Rating System: Program Implementation	MEMA	$7,000	CAP	2023	M	Ongoing status
5	Flood	Property Protection	Repetitive Loss/Severe Repetitive Loss Structures: Target Group Mitigation	MEMA	$10,000,000	FMA	2023	M	Ongoing status

6	Flood	Technical Assistance	NFIP Implementation: Model Ordinance Adoption	MEMA	$7,000	CAP	2023	M	Ongoing status
7	Flood	Outreach and Education	NFIP Implementation: Floodplain Management Workshops	MEMA	$7,000	CAP	2023	M	Ongoing status
8	Flood	Technical Assistance	NFIP Implementation Certified Floodplain Manager Accreditation	MEMA	$7,000	CAP	2023	H	Ongoing status
9	Flood	Outreach and Education	NFIP Implementation: State Floodplain Management Association	MEMA	$7,000	CAP	2023	M	Ongoing status
11	Flood	Technical Assistance	NFIP Implementation: Community Assistance Contact and Visit	MEMA	$7,000	CAP	2023	H	Ongoing status
12	Flood	Outreach and Education	NFIP Implementation Education and Outreach	MEMA	$7,000	CAP	2023	H	Ongoing status
13	Flood	Technical Assistance	Assessing Vulnerability by Jurisdiction	MEMA	$100,000	FMA	2023	H	Ongoing status
15	Flood	Technical Assistance	Information Management System for Critical Infrastructure	MEMA	$100,000	FMA	2023	H	delayed lack of staff/funding
16	Flood	Structural	Community Assistance for Flood Warning Systems	MEMA	$1,000,000	FMA	2023	H	Ongoing pending funding
21	Flood	Property Protection	Continue to Support floodproofing and hardening of water/wastewater systems	MDEQ	$100,000,000	CDBB	2023	H	Ongoing status
23	Flood	Technical Assistance	Support updating of storm water ordinances to address future development	MEMA	$7,000	CAP-SSSE	2022	H	Ongoing status
24	Flood	Technical Assistance	Support Local Capital Improvement Infrastructure Planning	MDEQ	$7,000	CAP-SSSE	2022	H	Ongoing status
26	Flood	Technical Assistance	GI Inventory of Hazardous Waste/Materials Storage Facilities	MDEQ	$150,000	HMGP	2023	H	Ongoing status
28	Flood	Technical Assistance	Provide HAZUS flood runs to each county	MEMA	$7,000	Budget	2023	H	Complete
30	Flood	Technical Assistance	Develop a comprehensive GIS based inventory of levees	MDEQ	$50,000	PDM	2020	H	Ongoing status
31	Flood	Property Protection	Implement Flood Mitigation projects	MEMA	$10,000,000	USACE, BRIC, FMA	2023	H	Ongoing status
2	Hurricane	Outreach and Education	Public Information Forums and Fairs Statewide	MEMA	$7,000	Budget	Annual	H	Ongoing status
4	Hurricane	Technical Assistance	Local Review of Building Codes and Flood Protection Ordinances	MEMA	$7,000	Budget	2023	H	Ongoing status
5	Hurricane	Technical Assistance	State Modernization Team Review of Coastal Flooding	MEMA	$50,000	CAP	2020	H	Ongoing status

6	Hurricane	Structural	USACOE Mississippi Coastal Improvements Program	MDMR	$160,000,000	USACE	2023	H	Ongoing status, delayed
7	Hurricane	Structural	USACOE Mississippi Coastal Comprehensive Plan	MDMR	$3,000,000	USACE	2023	H	Ongoing status, delayed
11	Hurricane	Structural	Implement Regional Utility Systems	MDEQ	$200,000,000	CDBG	2023	H	Ongoing status
12	Hurricane	Structural	Support Mitigation with Natural Barriers	MDMR	$100,000,000	USACE	2023	H	Ongoing status, funding shortfall
14	Hurricane	Structural	Construction of Gulf Coast Regional Office/First Responders' Building	MDOT	$3,963,128	Budget	2023	H	Complete
2	Multi-Hazard	Outreach and Education	HMA Grant Application Training	MEMA	$7,000	Budget	2023	H	Ongoing status
4	Multi-Hazard	Outreach and Education	"Storm Ready" Community Education	MEMA	$27,000	Budget	Annual	H	Ongoing status
6	All Hazard	Technical Assistance	Develop Local Hazard Mitigation Planning	MEMA	$7,000	HMGP	Annual	H	Ongoing status
9	Multi-Hazard	Emergency Services	Provide Auxiliary Power Source for All Critical Facilities	MEMA	$10,000,000	HMGP	2023	H	Ongoing status
11	Multi-Hazard	Technical Assistance	Coordinated Emergency Action Plans for Health Care Facilities	MSDH	$400,000	Budget	Annual	H	Ongoing status
13	Multi-Hazard	Resources Protection	Wet Debris Management for Access, Water Quality and Environmental	MDMR	$10,000,000	USACE	2023	H	Ongoing delayed due to funding
15	Multi-Hazard	Technical Assistance	Complete/enhance inventory of state owned/operated facilities	MDFA	$500,000	HMGP	2023	H	Complete
18	Multi-Hazard	Emergency Services	Increase Shelter Capacity in each County	MEMA	$2,300,000	HMGP	Annual	H	Ongoing
20	Multi-Hazard	Technical Assistance	Prepare information Management System for Plan Updates for 2023	MEMA	$20,000	Budget	Annual	H	Ongoing
21	Multi-Hazard	Prevention/ Property Protection	Track Project Implementation Progress for Mitigation Actions	MEMA	$20,000	Budget	Annual	H	Ongoing
22	Multi-Hazard	Resources Protection	Develop GIS Database for Archives and History on Cultural Resources	MDAH	$100,000	HMGP	2020	H	Ongoing
25	Multi-Hazard	Structural	Encourage Use of Non-Hazardous Materials in Critical Facilities	MDEQ	$7,000	Budget	Annual	H	Complete
26	Multi-Hazard	Outreach and Education	Yearly Information Meetings for Medical Community	MSDH	$50,000	Budget	2020	M	Ongoing
27	Multi-Hazard	Technical Assistance	Sheltering needs assessment	MDHS	$50,000	HMGP	2023	H	Ongoing
29	Multi-Hazard	Prevention	Mitigation Grants to Eligible Applicants for	MEMA	$196,836	HMGP	Annual	H	Ongoing

			Emergency Warning Systems						
30	Multi-Hazard	Structural	Individual Assistance for “Safe Room” Program	MEMA	$500,000	HMGP	2023	H	Suspended at this time.
32	Multi-Hazard	Structural	FEMA 361 Safe Rooms and Continuity of Government Shelters	MEMA	$20,000,000	HMGP	2020	H	Ongoing
1	Sea Level Rise	Outreach and Education	Education and Outreach for Coastal MS on impacts of Sea Level Rise	MEMA	$5,000	Budget	2023	L	Ongoing
1	Tornad o	Technical Assistance	Implement Wind Retrofit Projects	MEMA	$29, 888,707	Budget	2022	M	Ongoing
7	Tornad o	Outreach and Education	Public Outreach and Education for Homebuilders and Developers	MEMA	$7,000	Budget	2022	H	Ongoing
1	Wildfire	Outreach and Education	FireWise Program Workshops	MFC	$100,000	USFC	Annual	H	Ongoing
2	Wildfire	Technical Assistance	Community Wildfire Protection Plans	MFC	$100,000	USFC	Annual	H	Ongoing
3	Wildfire	Outreach and Education	Train Local VFD’s in FireWise	MFC	$500,000	USFC	Annual	H	Ongoing
4	Wildfire	Outreach and Education	Communication and Partnership Initiatives with VFD’s	MFC	$100,000	USFC	Annual	H	Ongoing
5	Wildfire	Technical Assistance	Information Management for Areas at Risk Based on County Wildfire Plans	MFC	$350,000	USFC	Annual	H	Ongoing
2	Winter Storm	Outreach and Education	Public Education and Outreach	MEMA	$7,000	Budget	Annual	H	Ongoing

Table 4.4.2: Mississippi Mitigation Actions 2023 – 2028 Sorted by Type

Project No.	Type	Strategy	Project Name	Agency	Project Cost ($)	Funding Strategy	Completion	Priority
1	Dam Safety	Prevention	Permitting New Dams and Regulatory Compliance	MDEQ	$332,500	Budget	Annual	H
2	Dam Safety	Outreach and Education	Public Education and Outreach	MDEQ	$17,500	Budget	2028	H
3	Dam Safety	Prevention	Inundation Maps/EAPs for High Hazard Watershed Dams	MDEQ	$80,000	Budget, HHPD	2028	H
5	Dam Safety	Structural	Repair and Rehab Dams	MDEQ	$1,000,000	HHPD, Private	Annual	H
7	Dam Safety	Prevention	Enforce Implementation of 2006 Dam Safety Legislation	MDEQ	$250,000	Budget	2028	H
10	Dam Safety	Prevention	Probable Maximum Precipitation Update Study	MDEQ	$500,000	HMGP	2028	H

11	Dam Safety	Prevention	**New Action for 2023** Increase Capacity of the State Dam Safety Program	MDEQ	200,000	HMGP, Budget, HHPD, USACE	Annual	H
12	Dam Safety	Prevention	**New Action for 2023** Provide tools to assist Dam Safety Personnel help those that could be impacted by dam failure	MDEQ	100,000	HHPD, Budget	Annual	H
13	Dam Safety	Outreach and Education	**New Action for 2023** Advise Communities living upstream and downstream of dams on Planning and Evacuation Procedures	MDEQ	100,000	Budget	Annual	H
1	Earthquake	Technical Assistance	Review and Update HAZUS-MH Data Base	MEMA	$70,000	HMGP	2028	H
2	Earthquake	Prevention	HAZUS-MH Project Implementation for Local Initiatives	MEMA	$10,000,000	HMGP	2028	H
3	Earthquake	Technical Assistance	Compile New Soil Evaluations	MDEQ	$40,000	Budget	2028	M
5	Earthquake	Technical Assistance	HAZUS-MH Update with Pipeline Locations	MEMA	$10,000	Budget	2028	M
6	Earthquake	Outreach and Education	Partnership Programs for Collaborating Programs with other States	MEMA	$10,000	Budget	2028	H
11	Earthquake	Technical Assistance	Information Management System for Critical Infrastructure	MDEQ	$50,000	HMGP	2028	H
1	Flood	Outreach and Education	Map Modernization: New Firm Adoption by Communities	MEMA	$20,000	CAP	Annual	H
4	Flood	Technical Assistance	Community Rating System: Program Implementation	MEMA	$7,000	CAP	2028	M
5	Flood	Property Protection	Repetitive Loss/Severe Repetitive Loss Structures: Target Group Mitigation	MEMA	$10,000,000	FMA	2028	M
6	Flood	Technical Assistance	NFIP Implementation: Model Ordinance Adoption	MEMA	$7,000	CAP	2028	M
7	Flood	Outreach and Education	NFIP Implementation: Floodplain Management Workshops	MEMA	$7.000	CAP	2028	M
8	Flood	Technical Assistance	NFIP Implementation Certified Floodplain Manager Accreditation	MEMA	$7,000	CAP	2028	H
9	Flood	Outreach and Education	NFIP Implementation: State Floodplain Management Association	MEMA	$7,000	CAP	2028	M
11	Flood	Technical Assistance	NFIP Implementation: Community Assistance Contact and Visit	MEMA	$7,000	CAP	2028	H
12	Flood	Outreach and Education	NFIP Implementation Education and Outreach	MEMA	$7,000	CAP	2028	H
13	Flood	Technical Assistance	Assessing Vulnerability by Jurisdiction	MEMA	$100,000	FMA	2028	H
15	Flood	Technical Assistance	Information Management System for Critical Infrastructure	MEMA	$100,000	FMA	2028	H
16	Flood	Structural	Community Assistance for Flood Warning Systems	MEMA	$1,000,000	FMA	2028	H

21	Flood	Property Protection	Continue to Support floodproofing and hardening of water/wastewater systems	MDEQ	$100,000,000	CDBB	2028	H
23	Flood	Technical Assistance	Support updating of storm water ordinances to address future development	MEMA	$7,000	CAP-SSSE	2028	H
24	Flood	Technical Assistance	Support Local Capital Improvement Infrastructure Planning	MDEQ	$7,000	CAP-SSSE	2028	H
26	Flood	Technical Assistance	GI Inventory of Hazardous Waste/Materials Storage Facilities	MDEQ	$150,000	HMGP	2028	H
30	Flood	Technical Assistance	Develop a comprehensive GIS based inventory of levees	MDEQ	$50,000	PDM	2028	H
31	Flood	Property Protection	Implement Flood Mitigation projects	MEMA	$10,000,000	USACE, BRIC, FMA	2028	H
2	Hurricane	Outreach and Education	Public Information Forums and Fairs Statewide	MEMA	$7,000	Budget	Annual	H
4	Hurricane	Technical Assistance	Local Review of Building Codes and Flood Protection Ordinances	MEMA	$7,000	Budget	2028	H
5	Hurricane	Technical Assistance	State Modernization Team Review of Coastal Flooding	MEMA	$50,000	CAP	2028	H
6	Hurricane	Structural	USACOE Mississippi Coastal Improvements Program	MDMR	$160,000,000	USACOE	2028	H
7	Hurricane	Structural	USACOE Mississippi Coastal Comprehensive Plan	MDMR	$3,000,000	USACOE	2028	H
11	Hurricane	Structural	Implement Regional Utility Systems	MDEQ	$200,000,000	CDBG	2028	H
12	Hurricane	Structural	Support Mitigation with Natural Barriers	MDMR	$100,000,000	USACOE	2028	H
2	Multi-Hazard	Outreach and Education	HMA Grant Application Training	MEMA	$7,000	Budget	2028	H
4	Multi-Hazard	Outreach and Education	"Storm Ready" Community Education	MEMA	$27,000	Budget	Annual	H
6	All Hazards	Technical Assistance	Develop Local Hazard Mitigation Planning	MEMA	$7,000	HMGP	Annual	H
9	Multi-Hazard	Emergency Services	Provide Auxiliary Power Source for All Critical Facilities	MEMA	$10,000,000	HMGP	2028	H
11	Multi-Hazard	Technical Assistance	Coordinated Emergency Action Plans for Health Care Facilities	MSDH	$400,000	Budget	Annual	H
13	Multi-Hazard	Resources Protection	Wet Debris Management for Access, Water Quality and Environmental	MDMR	$10,000,000	USACOE	2028	H
18	Multi-Hazard	Emergency Services	Increase Shelter Capacity in each County	MEMA	$2,300,000	HMGP	Annual	H
20	Multi-Hazard	Technical Assistance	Prepare information Management System for Plan Updates for 2013	MEMA	$20,000	Budget	Annual	H
21	Multi-Hazard	Prevention/Property Protection	Track Project Implementation Progress for Mitigation Actions	MEMA	$20,000	Budget	Annual	H
22	Multi-Hazard	Resources Protection	Develop GIS Database for Archives and History on Cultural Resources	MDAH	$100,000	HMGP	2028	H

26	Multi-Hazard	Outreach and Education	Yearly Information Meetings for Medical Community	MSDH	$50,000	Budget	2028	M
27	Multi-Hazard	Technical Assistance	Sheltering needs assessment	MDHS	$50,000	HMGP	2028	H
29	Multi-Hazard	Prevention	Mitigation Grants to Eligible Applicants for Emergency Warning Systems	MEMA	$196,836	HMGP	Annual	H
30	Multi-Hazard	Structural	Individual Assistance for "Safe Room" Program	MEMA	$500,000	HMGP	2028	Suspended at this time
32	Multi-Hazard	Structural	FEMA 361 Safe Rooms and Continuity of Government Shelters	MEMA	$20,000,000	HMGP	2028	H
33	Multi-Hazard	Emergency Services	**New Action for 2023** MSDH Standby Power /System (Generator) Project-Phases I-III	MSDH	$6,595,706.25	HMGP	2024	H
34	Multi-Hazard	Technical Assistance	**New Action for 2023** Shelter Capacity Assessment	MDHS	$50,000	HMGP	2025	H
35	Multi-Hazard	Structural	**New Action for 2023** MEMA HMGP Saferooms	MEMA	$2,575,000	HMGP	2028	H
36	Multi-Hazard	Technical Assistance	**New Action for 2023** Assist in obtaining vulnerability jurisdiction, climate change, and probability data for future State Plan HIRA updates	MEMA	$10,000	Budget, HMGP	2028	H
1	Sea Level Rise	Outreach and Education	Education and Outreach for Coastal MS on impacts of Sea Level Rise	MEMA	$5,000	Budget	2028	L
2	Climate Change	Technical Assistance	**New Action for 2023** Funding for tools that provide climate projection data and effects on State assets and population vulnerability	MEMA	$20,000	Budget, HMGP	2028	H
1	Tornado	Technical Assistance	Implement Wind Retrofit Projects	MEMA	$29,888,707	Budget	2028	M
7	Tornado	Outreach and Education	Public Outreach and Education for Homebuilders and Developers	MEMA	$7,000	Budget	2028	H
1	Wildfire	Outreach and Education	FireWise Program Workshops	MFC	$100,000	USFC	Annual	H
2	Wildfire	Technical Assistance	Community Wildfire Protection Plans	MFC	$100,000	USFC	Annual	H
3	Wildfire	Outreach and Education	Train Local VFD's in FireWise	MFC	$500,000	USFC	Annual	H
4	Wildfire	Outreach and Education	Communication and Partnership Initiatives with VFD's	MFC	$100,000	USFC, U&CF	Annual	H
5	Wildfire	Technical Assistance	Information Management for Areas at Risk Based on County Wildfire Plans	MFC	$350,000	USFC, CFP	Annual	H
2	Winter Storm	Outreach and Education	Public Education and Outreach	MEMA	$7,000	Budget	Annual	H

TOTAL PROJECT COSTS **$ 681,293,249.25**

4.5: Funding Sources

44 CFR 201.4(c)(3)(iv) – The State mitigation strategy shall include the following elements:

A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:

Identification of current and potential sources of Federal, State, local or private funding to implement mitigation activities.

As a result of Hurricane Katrina, the State of Mississippi received $434 million in Hazard Mitigation Assistance (HMA) funds and $4 billion in Community Development Block Grant (CDBG) funds to mitigate the effects. Since Hurricane Katrina made landfall, Mississippi has had 30 smaller federally declared disasters. The remaining Katrina funds and the HMA funds from the more recent declared disasters will continue to fund the mitigation initiatives that began because of Hurricane Katrina.

Statewide Initiatives

The following statewide initiatives were funded through HMGP funds:

- The Statewide Generator Initiative – provides funding for generators for critical facilities.
- The Statewide College/University and Municipality Siren Initiative – provides funding for warning systems on junior and senior colleges as well as funding for counties and cities.
- The Statewide Saferoom/Storm Shelter Initiative – provides funding for individual and community storm shelters so that during a tornado or severe thunderstorm, the citizens of Mississippi have a safe place to go.
- Public Outreach Campaigns

The State under MEMA's guidance, has funded in addition to the statewide initiatives, the following projects:

- Acquisition Projects
- Drainage Projects
- Planning Grants
- Retrofits and enhancement of development codes and standards
- Standards Projects
- Elevation
- Repetitive Flood Loss Structures

Under the Flood Mitigation Assistance, the State has provided funding for the following:

- Acquisition Projects
- Planning Grants

MEMA has also provided funding for my.msema.org, a web-based program that allows eligible applicants to submit project applications online.

The State Hazard Mitigation Plan Update is being funded under the Pre-Disaster Mitigation Program (PDM)/Building Resilient Infrastructure and Communities (BRIC).

As can be seen from a review of the successful mitigation projects in Mississippi, it is very typical to leverage projects with multiple sources of funding. Table 4.5.1 provides a matrix that addresses the current and potential sources of funding for federal/state/local hazard mitigation programs, activities, and initiatives. The matrix identifies the program activity, type of assistance, and the responsible agency and point of contact.

The following “Programs/Activities” are addressed in the matrix on the following pages:

- General Emergency grants, loans, and assistance;
- Floods/Flood Control grants, loans, and assistance;
- Earthquake grants, loans, and assistance;
- All-Hazard Mapping grants, loans, and assistance;
- Ancillary Flood & Natural Resource Projects grants, loans, and assistance;
- Basic and Applied Research/Development grants, loans, and assistance;
- Other Planning Information, including Demographics, Societal Data, Transportation, Agricultural, Industrial, and Other Commercial Economic Statistics;
- Business Continuity Planning;
- Grants, loans, and technical assistance in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) Facilities and equipment needs in primarily low income rural areas.

This table has been updated from the 2018 plan to include programs/activities that were not defined or available and are designated with the notation of 2023 Update.

Table 4.5.1
Funding Sources

Program / Activity	Type of Assistance	Agency & Contact
General Emergency Grants, Loans & Assistance	**Pre/Post Disaster Mitigation, Relief, Recovery, Training, & Technical Assistance**	
Hazard Mitigation Grant Program	Provides grants to states and communities for the implementation of long-term hazard mitigation measures following a major disaster declaration.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Disaster Mitigation Planning and Technical Assistance	Provides technical and planning assistance for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces	Department of Commerce (DOC), Economic Development Administration (EDA) www.doc.gov/eda N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
USDA Smith-Lever Special Needs Funding **(2023 Plan Update)**	Grants to State Extension Services at 1862 Land-Grant institutions to support education-based approaches to addressing emergency preparedness and disasters.	USDA Housing and Environmental Health (800) 414-1226
Pre-Disaster Mitigation	Provides funding and technical assistance to communities and states to implement pre-disaster mitigation projects and planning.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Building Resilient Infrastructure and Communities (BRIC) **(2023 Plan Update)**	BRIC is FEMA's new mitigation grant program, replacing the Agency's prior pre-disaster (PDM) grant program. It gives states, local communities, tribes and territories funding to address future risks to natural disasters, including ones involving: wildfires, drought, hurricanes, earthquakes, extreme heat, and flooding. BRIC also offers help to communities in the form of non-financial Direct Technical Assistance that can provide holistic hazard mitigation planning and project support.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
USACE Planning Assistance to States (PAS) **(2023 Plan Update)**	Funds plans for the development and conservation of water resources, dam safety, flood damage reduction and floodplain management.	U.S. Army Corps of Engineers Chief Planning Division (978) 318-8737

Emergency Management I Mitigation Training	Offers training in disaster mitigation, preparedness, planning.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Post-Disaster Economic Recovery Grants and Assistance	Provides grant funding to assist in the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	Department of Commerce (DOC), Economic Development Administration (EDA) N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426
Cares Act Economic Recovery Corps and Equity Impact Investments Programs **(2023 Plan Update)**	Designed to provide support to underserved communities across the country in their efforts to develop successful economic development plans and projects. The program adds human capital to local organizations focused on improving economic resilience and competitiveness in distressed regions across the county and provides technical assistance to enable organizations serving underserved populations and communities to participate in economic development planning and projects.	Department of Commerce (DOC), Economic Development Administration (EDA) N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426
Coronavirus Aid, Relief, and Economic Security (CARES) Act **(2023 Plan Update)**	The EDA has published an Addendum to its Fiscal Year 2020 Public Works and Economic Adjustment Assistance Notice of Funding Opportunity making funds in CARES Act available to eligible grantees in communities impacted by the coronavirus pandemic.	Department of Commerce (DOC), Economic Development Administration (EDA) N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426
Development Infrastructure Grant Program (DIP)	DIP is a grant program that is available to fund publicly owned infrastructure. Funding from this program can be used by municipalities and counties to assist with the location or expansion of businesses. Usage of the funds must be directly related to the construction, renovation, or expansion of industry.	Mississippi Development Authority CDBG Program Tel: (601) 359-3179
Job Protection Grant Program	Provides “at risk” industries that have been operating in the state for at least three years and that have lost jobs or are at risk to lose jobs because such jobs have been outsourced. Funding from this program can be used by “at risk” industries that retain jobs in Mississippi and improve productivity.	Mississippi Development Authority CDBG Program Tel: (601) 359-3552
Mississippi Rail Grant Program (RAIL)	RAIL is designed for making grants to railroads to finance projects to promote economic growth in the state of Mississippi. Funding for this program is derived from appropriations or funds otherwise made available by the State Legislature.	Mississippi Development Authority-Financial Resources Tel: (601) 359-2498
Community Disaster Loan Program	Provides funds to any eligible jurisdiction in a designated disaster area that has suffered a substantial loss of tax and other revenue.	FEMA (800) 621-3362 www.fema.gov
Rural Business Enterprise Grants (RBEG)	The RBEG supports the development of small and emerging private business enterprises in rural areas (less than 50,000 population) It creates jobs and	U.S. Department of Agriculture (USDA) State Office (601) 965-4316

	stimulate rural economics by providing real estate improvements, equipment, and working capital.	
Economic Development Initiative (EDI) Program	Provides grants to communities and counties for the purpose of providing infrastructure to support economic development.	HUD National Office Community Planning and Development Office of Economic Development (800) 998-9999
Rural Business Opportunity Grants (RBOG)	Provides technical assistance, business development, and planning in rural communities with exceptional need	U.S. Department of Agriculture (USDA) State Office (601) 965-4316
Rural Impact Fund Grant Program	Provides grants to construct or improve public infrastructure to promote job creation in rural areas.	Mississippi Development Authority-Financial Resources Tel: (601) 359-3179
Small Municipalities and Limited Population Counties Grant Program	Provides grants to promote economic growth by improving public infrastructure.	Mississippi Development Authority-Financial Resources Tel: (601) 359-3179

Program / Activity	Type of Assistance	Agency & Contact
Water Resources, Flood Control, Pollution Abatement, and Soil Conservation Programs	Acts as local sponsor for member counties on federal projects and programs associated with water resources, flood control, pollution abatement, and soil conservation. Provides limited financial assistance on such projects	Pearl River Basin Development District (601) 354-6301
Capital Improvements Revolving Loan (CAP) Program	Makes loans to counties or municipalities to construct or improve public infrastructure.	Mississippi Development Authority Tel: (601) 359-3179
Mississippi Economic Redevelopment Program	Provides funding to counties or municipalities to remediate and develop an environmentally contaminated site.	Office of the Governor (601) 359-3150
Delta Regional Authority Grant Program	Helps economically distressed communities in the DRA area to leverage other funds focused on improving infrastructure, transportation, and business development.	Mississippi Development Authority Office of Strategic Initiatives (601) 359-6656
Appalachian Regional Commission	Provides matching funds for communities in the ARC area for making infrastructure improvements to encourage economic development and a higher quality of life.	Mississippi Development Authority Appalachian Regional Office (662) 844-1184
Fire Management Assistance Grant Program	Provides assistance for mitigation, management, and control of fires which threaten such destruction as would constitute a major disaster.	FEMA (770) 220-5200 https://www.fema.gov/fire-management-assistance-grant-program

Reimbursement for Firefighting on Federal Property	Provides reimbursement to states and localities only for direct costs and losses over and above normal operating costs.	FEMA (800) 621-3362 www.fema.gov
Dry Fire Hydrant Program	Assists communities within the district through funding assistance to increase rural fire protection where dry fire hydrants are constructed at known water sources to fill up the equipment tanks of a rural fire department.	Pat Harrison Waterway District (601) 264-5951
Program / Activity	**Type of Assistance**	**Agency & Contact**
Mosquito Control Grant Program	Provides funding to counties and communities in the Go Zone for the start-up or enhancement of an existing mosquito control program.	Mississippi Department of Health Office of Epidemiology (601) 576-7725
Transportation Enhancement Program	Provides funding for various activities that enhance existing or historic transportation facilities including environmental mitigation of run-off pollution	Mississippi Department of Transportation Office of Intermodal Planning (601) 359-7025
Public Library Capital Improvement Subgrant Program	Provide grants to public libraries for capital improvements, renovation and/or repair of existing facilities	Mississippi Library Commission (800) 647-7542
Public Assistance Program (Infrastructure)	Provides grants to states and communities to repair damaged infrastructure and public facilities and to help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Community Development Block Grant (CDBG) Program State-Administered Public Infrastructure Grants	Public Facilities: Provides grants to counties and municipalities to improve infrastructure to eliminate an existing health threat to residents, primarily of low- and moderate-income households. (Includes water and sewer facilities, flood and drainage facilities, fire protection, roads and bridges.) Economic Development: Provides grants to counties and municipalities to provide infrastructure on behalf of a business/industry that commits to job creation or job retention.	Mississippi Development Authority CDBG Program Community Services Division Tel: (601) 359-3179
Community Development Block Grant (CDBG) Program	Provides grants to entitled cities to improve public infrastructure, primarily benefiting low- and moderate-income persons.	US Department of Housing and Urban Development (HUD) Entitlement Communities Division Office of Block Grant Assistance (202) 708-1577

Entitlement Communities Program	Entitlement Communities include Jackson, Hattiesburg, Pascagoula, Moss Point, Biloxi, and Gulfport.	State Field Office Community Planning and Development (601) 965-4700, ext. 3140
Program / Activity	**Type of Assistance**	**Agency & Contact**
Community Development Block Grant Mitigation Funds (CDBG-MIT) **(2023 Plan Update)**	Provides assistance to eligible applicants in areas impacted by recent disasters to carry out strategic and high-impact activities to mitigation risks and reduce future losses.	U.S. Department of Housing and Urban Development T: 202-708-1112 MEMA, Office of Mitigation Tel: (601) 933-6362
Disaster Recovery Initiative	Provides grants to fund gaps in available recovery assistance after disasters (including mitigation).	HUD State Field Office Community Planning and Development (601) 965-4700, ext. 3140 HUD National Office Community Planning and Development Office of Block Grant Assistance (202) 708-3587, ext. 4538 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Public Housing Modernization Reserve for Disasters and Emergencies	Provides funding to Public Housing Agencies for development, financing, and modernization needs resulting from natural disasters (including elevation, flood proofing, and retrofit).	HUD Director, Office of Capital Improvements: (202) 708-1640 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grant **(2023 Plan Update)**	Provides an opportunity for the Department of Transportation to invest in road, rail, transit and port projects that promise to achieve national objectives.	U.S. Dept of Transportation Office of Infrastructure Finance & Innovation Tel: 202-366-0301 www.transportation.gov/RAISEgrants@dot.gov
Indian Housing Assistance (Housing Improvement Program)	Provides grants and technical assistance to substantially eliminate sub-standard Indian housing.	Department of Interior (DOI) – Bureau of Indian Affairs (BIA) Division of Housing Assistance, Office of Tribal Services: (202) 208-3100
Section 504 Loans for Housing	Offers repair loans, grants and technical assistance to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards	US Department of Agriculture (USDA) – Rural Housing Service (RHS) State RHS Field Office (601) 965-4325 (800) 548-0071 Or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323

Section 502 Loan and Guaranteed Loan Program	Provides loans, loan guarantees, and technical assistance to very low and low-income applicants to purchase, build, or rehabilitate a home in rural area	USDA – RHS State RHS Field Office (601) 965-4325 (800) 548-0071 Or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Farm Ownership Loans	Provides direct loans, guaranteed/insured loans, and technical assistance to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other needed improvements	USADA-Farm Service Agency (FSA) FSA State Field Office (601) 965-4300 Or FSA National Office (601) 720-3865
Safeguarding Tomorrow Revolving Loan Fund Program **(2023 Plan Update)**	The STORM Act authorizes FEMA to provide capitalization grants to states, eligible federally recognized tribes, territories and the District of Columbia to establish revolving loan funds that provide hazard mitigation assistance for local governments to reduce risks from natural hazards and disasters.	Federal Emergency Management Agency If an eligible entity is interested in assistance with their capitalization grant application, they should contact the team at FEMA-STORMRLF@fema.dhs.gov
Program / Activity	**Type of Assistance**	**Agency & Contact**
HOME Investments Partnerships Programs	Provides grant funding to States, local governments and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342 Mississippi Home Corporation 735 Riverside Dr, Jackson, Ms 39202 (601) 718-4636 (601) 718-4613
Self-Help Homeownership Opportunity Program (SHOP)	Provides grants to non-profit organizations to purchase home sites and improve infrastructure needed for volunteer-based homeownership programs for low-income families	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342
Homeownership Zone (HOZ) Program	Provides grants to communities to reclaim vacant and blighted properties, to increase homeownership and to promote economic revitalization	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342
Rural Development Assistance – Housing	Provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	USDA – RHS State RHS Field Office (601) 965-4325 (800) 548-0071 Or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323

Rural Development Assistance – Utilities	Provide direct and guaranteed rural economic loans and business-enterprise grants to address utility issues and development needs	USDA-Rural Utilities Service (RUS) Program Support National Headquarters (202) 720-9540 State Rural Development Office (601) 965-5460
Rural Development Assistance – Community Facilities Loans and Grants Program	Provides grants and loans in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) facilities and equipment needs in rural communities and primarily in low income areas	USDA – RHS State RHS Field Office (601) 965-4325 (800) 548-0071 Or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Program / Activity	**Type of Assistance**	**Agency & Contact**
Rural Community Fire Protection	Provides grants for rural fire projects, truck acquisition, or other assistance.	Mississippi State Fire Marshal (601) 359-1061 (888) 648-0877
Section 108 Loan Guarantee Program	Provides loan guarantees to public entities for community and economic development (including mitigation measures).	HUD State Field Office Community Planning and Development (601) 965-4757 HUD National Headquarters Section 108 Office (202) 708-1871
Program/Activity	**Type of Assistance**	**Agency & Contact**
Floods/Flood Control Grants, Loans & Assistance	**Floods/Flood Control Technical/Planning Assistance and Program Support**	
National Flood Insurance Program	Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.	FEMA Region IV NFIIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Flood Mitigation Assistance	Provides grants to States and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program. Requires flood mitigation plan to be developed by the applicant.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Flood Control Planning Assistance	Provides technical and planning assistance for the preparation of	Department of Defense (DOD) US Army Corps of Engineers (USACE)

	comprehensive plans for the development, utilization, and conservation of water and related land resources.	Floodplain Management Staff of Appropriate Regional Office: N. MS – Memphis District: (901) 544-3401 C. MS – Vicksburg District: (601) 631-5126 S. MS – Mobile District: (334) 690-2495
Floodplain Management Services	Provides technical and planning assistance at the local, regional, or national level needed to support effective floodplain management.	Department of Defense (DOD) US Army Corps of Engineers (USACE) Floodplain Management Staff of Appropriate Regional Office: N. MS – Memphis District: (901) 544-3401 C. MS – Vicksburg District (601) 631-5126 S. MS – Mobile District (334) 690-2495 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Works Projects Grants Flood Control and Water Management	Assists communities within the district to eliminate long and short-term flooding and drainage problems.	Pat Harrison, Waterway District (601) 264-5951
Land Protection	Provides technical assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property.	USDA – Natural Resource Conservation Service (NRCS) Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 863-3911
Earthquake Grants, Loans & Assistance	**Earthquake Mitigation, Relief, Recovery, Technical/Planning/Training Grant/Loan Assistance and Program Support.**	
National Earthquake Hazard Reduction Program	Provides technical and planning assistance for activities associated with earthquake hazards mitigation	FEMA, Dept. of the Interior (DOI), U.S. Geological Survey (USGS), National Institute of Standards and Technology FEMA Region IV NFIP & Mitigation Earthquake Program Manager (770) 220-5426 MEMA, Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org

Geological Survey Program	Acquires, maintains and manages basic geological data; identifies and evaluates geological hazards. The Geological Survey program assists citizens, industry, and government in the wise use of the state's minerals, land, and water resources.	Mississippi Department of Environmental Quality Office of Geology (601) 961-5500
Other Earthquake Hazards Reduction Programs	Provides training, planning and technical assistance under grants to States or local jurisdictions.	FEMA Region IV NFIP & Mitigation Earthquake Program Manager (770) 220-5426 DOI-USGS Earthquake Program Coordinator (888) 275-8747 Central U.S. Earthquake Consortium (901) 544-3570 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
Program / Activity	**Type of Assistance**	**Agency & Contact**
All-Hazard Mapping Grants, Loans & Assistance & Technical Assistance	**All-Hazard Analysis & Mapping of Flood Plains, Watersheds, Earthquake Areas, At-Risk Populations.**	
National Flood Insurance Program: Flood Mapping:	Offers flood insurance rate maps and flood plain management maps for all NFIP communities;	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org
National Flood Insurance Program: Technical Mapping Advisory Council	Offers technical guidance and advice to coordinate FEMA map modernization efforts for the National Flood Insurance Program.	DOI-USGS National Mapping Division (888) 392-8545 MDEQ Office of Geology and Geospatial Resources Division Remote Sensing and GIS (601) 961-5506 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org

Stream Gaging and Flood Forecasting Network	Operates a network of over 7,200 stream gaging stations that provide data on river flood characteristics and issues flood warnings and river forecasts to reduce flood damages.	USGS National Office of Surface Water (703) 648-5977 USGS State Office (601) 933-2900 National Weather Service Office of Hydrology (301) 427-9855
Mapping Standards Support	Provides expertise in mapping and digital data standards to support the National Flood Insurance Program	DOI-USGS USGS National Mapping Division (888) 392-8545 MDEQ Office of Geology Geospatial Resources Division (601) 961-5506
Program / Activity	**Type of Assistance**	**Agency & Contact**
National Earthquake Hazards Reduction Program	Provides seismic mapping for U.S.	DOI-USGS Earthquake Program Coordinator (703) 648-6785 FEMA, Region IV Mitigation Division Earthquake Program Manager (770) 220-5426 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6800 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
Ancillary Flood & Natural Resource Projects Grants, Loans & Assistance	**Watershed Management, Clean Water, Conservation, Environmental, Forestry, Grant/Loan Assistance, Technical Aid, and Program Support**	
Natural Resources Financial Assistance	Assist communities with funding for projects that protect the natural environment.	USDA National Resources Conservation Service (833) 663-8732 MDEQ Tel: (601) 961-5158
Environmental Quality Incentives Program (EQIP)	Provides technical, educational, and loan and grant assistance to encourage environmental enhancement Air Pollution Control Environmental Services Hazardous Substance Emergency Relief Hazardous Waste Brownfields Pilot Projects, Fees and Taxes, Leaking Underground Storage Tank Cleanup, Natural Resources Damage Assessments, Petroleum Storage Tank Cleanup, Voluntary Cleanup Program Financial Incentives Solid Waste Management Technical Assistance Water Pollution Control State Construction Wastewater Grant Program State Revolving Loan Fund (SRF)	NRCS EQIP Program Manager (202) 720-8851 www.nrcs.usda.gov NRCS State Office (601) 965-5196 Or NRCS County Offices Mississippi Department of Environmental Quality (601) 961-5171
Clean Water Act Section 319 Grants	Provides grants to designated states and tribal agencies to implement their approved non-point source management	US Environmental Protection Agency (EPA) Office of Water Chief, Non-Point Source Control Branch

	programs, including support for nonpoint source programs such as technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs.	(202) 566-1155 Mississippi Department of Environmental Quality (601) 961-5171
Clean Water State Revolving Funds	Provides loans at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	EPA, Office of Water State Revolving Fund Branch (202) 260-7359 A list of Regional Offices is available upon request
Water and Waste Disposal Loans and Grants **(2023 Plan Update)**	Funding is used to build, repair, and improve public water systems and waste collection and treatment systems.	USDA Rural Development 601-863-3862 www.rd.usda.gov
Program / Activity	**Type of Assistance**	**Agency & Contact**
Wetlands Protection – Development Grants	Provides grants to support the development and enhancement of State and tribal wetlands protection programs.	EPA National Wetlands Regional Office are available at https://www.epa.gov/wetlands/forms/contact-us-about-wetlands Or EPA Region IV Chief, Wetlands Section (404) 562-9405 Mississippi Department of Environmental Quality (601) 961-5171
Watershed Protection, Flood Prevention, and Soil and Water Conservation Program	Provides technical and financial assistance for installing works of improvement to protect, develop, and utilize land or water resources in watersheds under 250,000 acres.	US Department of Agriculture (USDA) – National Resources Conservation Service (NRCS) Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851
Watershed Surveys and Planning Small Watershed Protection Act (PL 566)	Provides surveys and planning studies for appraising water and related resources and formulating alternative plans for conservation use and development. Provides grants and advisory counseling services to assist with planning and implementing improvement.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 863-3947
Emergency Watershed Protection Program	Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by natural hazard events.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 863-3947

Wetlands Reserve Program	Provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 863-3947
Project Modifications for Improvement of the Environment	Provides for ecosystem restoration by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (212) 264-7813
Aquatic Ecosystem Management and Restoration	Provides direct support for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) (212) 264-7813
Coastal Zone Management Program	The Office of Ocean and Coastal Resource Management (OCRM) provides federal funding and technical assistance to better manage our coastal resources.	NOAA Office for Coastal Management 2234 South Hobson Ave Charleston, SC 29405-2413
Program / Activity	**Type of Assistance**	**Agency & Contact**
Beneficial Uses of Dredged Materials	Provides direct assistance for projects that protect, restore, and create aquatic and ecologically related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) (212) 264-7813
National Cooperative Soil Survey	Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.	USDA-NRCS Soil Survey Division (202) 720-4593
Land Acquisition	Acquires or purchases easements on high-quality lands and waters for inclusion into the National Wildlife Refuge System	DOI-Fish and Wildlife Service (FWS) Southeast Region Division of Realty (404) 679-7199
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for conservation purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Dept. of Agriculture (USDA) – Farm Service Agency (FSA) Farm Loan Programs National Office (202) 720-3467 State Field Office (601) 965-4300
Federal Land Transfer / Federal Land to Parks Program	Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space.	DOI-National Parks Service (NPS) Federal Lands to Parks Office Southeast Region (404) 507-5689

		Federal Lands to Parks Leader NPS National Office: (202) 354-6915
Partners for Fish and Wildlife	Provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	DOI – FWS Southeast Regional Ecological Services (404) 679-7138 State Field Office (601) 965-4900
Forest Tree Seedlings	Produces and distributes quality seedlings to assure forest regeneration and to sustain Mississippi's forest resources.	Regeneration Forester Mississippi Forestry Commission (601) 359-1386
Mississippi Reforestation Tax Credit	Promotes reforestation on private, non-industrial lands. A Mississippi Tax Credit on up to 50% of the cost of approved hardwood and pine reforestation practices.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us
Program / Activity	**Type of Assistance**	**Agency & Contact**
Forest Health	Assists timber owners in forest pest management by conducting forest pest surveys and evaluation. Recommendations on practices to salvage lumber, reduce and prevent damage from pests, will be provided to landowners upon request.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us
Forest Land Enhancement Program	Promotes long-term sustainability of private, no-industrial forestlands. Cost-share assistance is available.	Contact your County Forester
Landowner Services	Offers a variety of forest management services to private non-industrial owners of relatively small acreages. Most technical assistance and forestry advice is free to the landowner. Direct services, such as plowing fire lanes, tree planting, and timber-marking are available for a fee.	Contact your County Forester
Forest Resource Development Program	Provides financial assistance to eligible landowners for establishing and improving a crop of trees. This program helps offset a landowner's expense by sharing the cost implementing one or more forestry practices.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us/landownerassistance

Conservation Contracts	Assists debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	USDA-FSA Farm Loan Programs FSA National Office: (202) 720-3467 FSA State Office (601) 965-4300
Historic Preservation Fund Grants	Provides grants to assist communities in carrying out historic preservation activities.	DOI-National Park Service Mississippi Department of Archives and History (601) 576-6940
The Foundation Directory	Provides annual source of information about grants & loans from federal and private sources. Available for a fee.	The Foundation Center (800) 424-9836 www.foundationcenter.org
Federal and Foundation Assistance Monitor	Provides semi-monthly reports on federal and private grants. Available for a fee	CD Publications 8204 Fenton Street Silver Springs, MD 20910 Tel: (301) 588-6380 www.cdpublications.com
Program / Activity	**Type of Assistance**	**Agency & Contact**
Environmental Grantmaking Foundations	**Provides a comprehensive list of foundations that support environmental nonprofit activities and programs. Available for a fee.**	
Environmental Grantmaking Foundations	Provides a comprehensive list of foundations that support environmental nonprofit activities and programs. Available for a fee.	Resources for Global Sustainability, Inc. Cary, North Carolina (800) 724-1857
Basic & Applied Research/Development Grants, Loans & Assistance	**Research and Educational Assistance Information, Grants / Loans and Technical Assistance**	
Center for Integration of Natural Disaster Information	Develops and evaluates technology for information integration and dissemination	Department of Interior (DOI) US Geological Survey (USGS) (888) 275-8747 www.usgs.gov
Hazard Reduction Program	Provides funding for research and related educational activities on hazards	National Science Foundation (NSF), Directorate for Engineering, Division of Civil and Mechanical Systems (703) 292-8360
Decision, Risk, and Management Science Program	Provides funding for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)	NSF Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision,

		Risk, and Management Science Program (DRMS) (703) 292-7263 www.nsf.gov/sbe.drms
Societal Dimensions of Engineering, Science, and Technology Program	Provides funding for research and related educational activities on topics such as ethics, values, and the assessment, communication, management, and perception of risk	NSF Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program (703) 292-7279
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	Research into basic and applied earth and building sciences	NSF Directorate for Geosciences Division of Earth Sciences (703) 292-8550
Program / Activity	**Type of Assistance**	**Agency & Contact**
Other Planning Information, Including Demographics Societal Data, Transportation, Agricultural, Industrial & Other Commercial Economic Statistics	**Low and/or No Cost Information Helpful for Determining At-Risk Populations and Potential Economic Damages & Information to Help Determine Avoidance of Losses.**	
Demographics, Societal Statistics and Economic Statistics	Provides free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e. statistics, maps, reports, etc.), State Government, etc. Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information provided in those subject areas.	U.S. Census Bureau Washington, D.C. 20233 General telephone inquiries: (800) 923-8282 www.census.gov Bureau of Economic Analysis (BEA) 1441 L Street NW Washington, D.C. 20230 Public Information Office (202) 606-9900 BEA Order Desk (800) 704-0415 Bureau of Labor Statistics Division of Information Services 2 Massachusetts Avenue, N.E. Room 2860 Washington, D.C. 20212 (800) 877-8339 (202) 691-5200

		www.bls.gov
University of Mississippi Center for Population Studies	Disseminates U.S. Census data, provides technical assistance in the collection and analysis of Census and other demographic and social data, and undertakes research on population issues.	University of Mississippi College of Liberal Arts Center for Population Studies (662) 915-7288
Program / Activity	**Type of Assistance**	**Agency & Contact**
National Climactic Data	Maintains the largest active archive of national weather data, produces numerous climate publications, and responds to data requests	U.S. Dept. of Commerce National Climactic Data Center (828) 271-4800
State Climactic Data **(2023 Plan Update)**	Provides current weather information and forecasts, maintains an active archive of weather data for the state, and responds to data requests	Office of the Mississippi State Climatologist Dr. Mike Brown (662) 325-0600

5.0: Local Mitigation Planning

A key element of the Disaster Mitigation Act of 2000 is the strengthening of interactions between the state and local communities, particularly in coordination of implementation strategies. It is thought that most significant mitigation occurs at the local level. Thus, it is beneficial to all concerned to make sure that local plans are as effective in identifying hazards and developing action plans.

The Mitigation staff at Mississippi Emergency Management Agency works with counties and local jurisdictions to encourage and support local hazard mitigation planning. By developing the State Hazard Mitigation Plan, MEMA is assisting communities in updating local mitigation strategies by initiating a number of activities designed to integrate objectives consistent at both the State and local levels. These activities include funding and technical support, as well as educational opportunities.

Summary of Changes

Technical Support (Section 5.1) Planning Assistance for Local Governments were updated. Recipients, funding source and amounts were updated. Technical Assistance for Local Governments were updated. Recipients, funding source and amounts changed. CAV's and CAC numbers were updated along with applicant briefings conducted 2013-2018.

Removal of Methodology and Analysis of Local Plans (Section 5.2) Vulnerability Assessment Methodology by Planning and Development District (Table 5.2.1) Updates To Severe Repetitive Loss Property Analysis and Repetitive Loss Amounts

5.1: Local Mitigation Planning Coordination

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section of the Coordination of Local Mitigation Planning that includes the following:

A description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

Funding Support

The State has met its goal to have an approved hazard mitigation plan. The State has regional plans, county plans, single jurisdictional plans, and DRU plans. The majority of the local jurisdictions are covered by regional hazard mitigation plans. The State will continue the process to support the development of local mitigation plans through funding and technical assistance as follows:

Mississippi local communities continue to develop and implement a regional district hazard mitigation plan. Many of these communities have existing regional mitigation plans that are being updated to ensure that the effective implementations of mitigation initiatives are realized.

Also, these plans are being updated to identify potential utilization of funds for projects in these communities. MEMA assists with the planning application and meets with locals to determine scope of work. Once funding is awarded, the contract goes through the state bidding process. The State share of funding has been maintained at 90% and the Local share at 10% of the total cost.

Technical Support

Technical Support is provided to local jurisdictions, Planning and Development Districts (PDD), and contractors in developing hazard mitigation plans and identifying mitigation action strategies. Support is provided to local governments in applying for assistance through various funding sources. This support is provided primarily by the MEMA Mitigation Bureau and FEMA Region IV.

The Hazard Mitigation Grant Program (HMA), Building Resilient Infrastructure and Communities (BRIC), and Pre-Disaster Mitigation Program PDM) funding are currently being used to develop plans for the local jurisdictions. The State continues to use the FEMA Technical Assistance Program for funding the National Flood Insurance Program, Hazard Mitigation Grant Program, and Hazard Mitigation Planning training workshops for local governments as needed and requested.

MEMA Mitigation Planning has conducted many Applicants' Briefings in support of federally declared disasters since 2013 plan update. MEMA is also a member of Mississippi Civil Defense/Emergency Management Association (MCDE- MA), Building Officials Association of Mississippi (BOAM), and an affiliate of the Mississippi Municipal League (MML) and the Mississippi Association of Supervisors (MAS). MEMA representatives attend the annual and semi-annual meetings of these organizations and provides updates on all mitigation activities taking place throughout the state. MEMA's Floodplain Management Specialist conducts an average of 60 Community assistance visits (CAV) and compliance inspections per year.

Planning Assistance for Local Governments					
Recipients	Program Type	Amount ($)	Recipients	Program Type	Amount ($)
District 1	State	$0 Updated by MEMA Mitigation Planning	DRU-Alcorn State	State	$33,000.00
District 2	State	$74,746.00	DRU-MS Valley	State	$16,000.00
District 3	State	$57,700.00	DRU-Ole Miss	State	$55,000.00
District 4	State	$74,824.00	DRU-MUW	State	$33,000.00
District 5	State	$46,000.00	DRU-MS State	State	$15,000.00
District 6	State	$67,888.00	DRU-MS Delta CC	State	$33,000.00
District 7	State	$73,406.00	DRU-East Central CC	State	$30,000.00
District 8	State	$64,784.00			
District 9	State	$79,991.94			
MBCI Hazard Mitigation Plan	State	$30,000.00			
DRU-Jackson State	State	$10,000.00			

Mitigation Assistance for Local Governments	
Class	Recipient of Training
FPM 101 Workshop	AFMM Conference
L273 Workshop	Pearl, MS
FPM 101 Workshop	Byram, MS
RSDE/EC Workshop	State Farm Insurance Agents
CEO Briefing	Louisville, Hattiesburg, Columbia
Planning Workshop	Hinds County, MS
Planning Workshop	Panola County, MS
Planning Workshop	Oktibbeha County, MS
Planning Workshop	Lafayette County, MS
Planning Workshop	Harrison County, MS

5.2: Local Plan Integration

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section on the Coordination of Local Mitigation Planning that includes the following:

A description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.

Review and Approval of Local Plans

Federal mandate 44 CFR Sec. 201.4 requires that states and local jurisdictions must have an approved mitigation plan in order to receive grant funding. Once a local jurisdiction has applied for and received grant funding for a local hazard mitigation plan, they have one year in which to complete it. Applicants are not eligible to receive mitigation grant funds unless their plan has been approved. During plan development, technical assistance is provided by MEMA upon request, in addition to any plans training already provided.

The Mitigation Planning Bureau of MEMA reviews all local hazard mitigation plans based on the FEMA local plan review tool. MEMA and FEMA planners developed a plan review methodology to expedite the plan review process. As a result, the State now has over 336 jurisdictions with approved hazard mitigation plans. Once MEMA receives a plan from a local jurisdiction, MEMA planners will review the plan within 30-45 days of receipt and either return the local plan for required revisions or forward the plan to FEMA for final review.

Plans that pass the state review are forwarded to the FEMA Region IV Mitigation Division for conditional approval. Once the local jurisdiction(s) adopts the plan, the State forwards the adoption resolution(s) to FEMA for final approval. FEMA encourages the adoption of local hazard mitigation plans within 90-days of the federal approval.

For local plans that do not pass State review and require additional work, MEMA's Mitigation Planning Bureau provides a review tool with explanations of the actions and or changes that must occur in order to bring the plan into compliance with FEMA planning guidance and the Code of Federal Regulations (CFR). Furthermore, each jurisdiction is provided technical assistance through the Mitigation Planning Bureau Director and the two mitigation planners assigned to the regions within the State. Eighteen months prior to plan expiration, local jurisdictions are notified to begin looking at the plan update process and made aware of any available funding sources. The local jurisdictions are again notified at twelve, six and three months before plan expiration.

There are some barriers to updating, adopting mitigation plans, and implementing approved local plans. At this time July 2023, two regional hazard mitigation plans have expired. Seven college hazard mitigation plans have expired, and one single jurisdiction hazard mitigation plan has expired. The Mitigation Planning Bureau will continue to send plan expiration notices in a timely manner. However, contract negotiation issues, timeliness of project completion, plans requiring extensive revisions, local share funding issues, leadership turnover are some barriers, and COVID-19 effects from 2020 to 2022. Plan and jurisdiction coverage data and trends across the state do not appear to apply. Barriers occur across the State. Some communities are slow to adopt their hazard mitigation plan. The Mitigation Planning Bureau will continue to contact communities that need to adopt through letters, calls, and emails. The Mitigation Planning Bureau has implemented more frequent contact with jurisdictions that have not adopted the plans. The Mitigation Planning Bureau will continue to use this review and educational process to assist local jurisdiction leaders in developing and updating plans and implementing approved plans initiate plan update earlier. The Mitigation Planning Bureau will continue to educate mitigation council members of responsibilities upfront and the need to continue plan implementation regardless of changes in leadership.

Methodology and Analysis of Local Plans

The plan developers analyzed the risk assessments of FEMA-approved local hazard mitigation plans in Mississippi to assess their consistency with the state plan's risk assessment and to determine if the ranking of the state's hazards should be revisited and if any additional hazards should be profiled in the state plan. As of July 7, 2023, 336 (85.93%) jurisdictions have FEMA approved plans. The 9 regional plans were reviewed to determine which hazards each county was vulnerable to and to what degree (city-level plans were examined for consistency with the county-level determinations, but information presented is summarized to the county level).

Linking Local Plans to the State Plan

During the 2023 plan update process, the State gathered information from local plans to integrate this data into the State plan. The Hazard Mitigation Council reviewed and summarized information from the local plans on the following categories:

- Hazard identification and risk assessment
- Goals and objectives
- Local capabilities
- Mitigation actions

The process in 2023 involved reviewing all of the district-level plans and capturing the information related to the four categories above in spreadsheets for further review and comparison purposes. The process to coordinate and look at the local and tribal plans, gather data, and integrate this data into the State plan took 90 days to complete. (For more details on this process, and how the information was collected and incorporated, see Section 3.0 Risk Assessment, Section 4.1 Hazard Mitigation Goals and Objectives, Section 4.3 Local Capability Assessment, and Section 4.4 Mitigation Actions.)

This information was used to inform the planning process and to reassess the plan for the following purposes:

- To improve the alignment of the state mitigation strategy with local goals, objectives, and actions;
- To update the statewide risk and vulnerability assessments;
- To identify and promote initiatives proven successful at the local level;
- To review state initiatives to determine if they meet the overall mitigation needs of the state and to change those that have not produced anticipated results; and
- To link local action with the state's mitigation strategy.

New and updated plans will be incorporated into the state plan during the five-year update cycle. Should state priorities change, these plans may be incorporated sooner.

The Mitigation Planning Bureau of MEMA makes a copy of the State plan, which includes the risk assessment and a summary of state prioritized strategies available to each local community. A copy of the plan is also available on the MEMA website. It was evident in the local plan review that some jurisdictions did incorporate information from the State plan's risk assessment and goals and objectives into their local plan. Upon approval of the 2023 plan update, the State would like to further promote the use of the updated risk assessment and mitigation strategy in local government mitigation planning by sharing data on the MEMA website.

This 2023 update reflects the successful integration of the plans from all 82 counties in the state. MEMA has encouraged local governments to participate in regional district plans, county plans, single jurisdictional plans, and DRU plans to maximize the number of communities covered by mitigation plans and to help develop more coordinated, regional approaches to mitigation. MEMA's priority is getting all counties to a FEMA approved plan status and ensuring timely updates of the local jurisdictions' plans. As local plans are updated, the local governments will be encouraged to develop more tailored actions to their specific community. MEMA's priority will be facilitating the completion of remaining local plans, followed by technical assistance on plan implementation and updates.

5.3: Prioritizing Local Technical Assistance

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section on the Coordination of Local Mitigation Planning that includes the following:

Criteria 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.

Funding Priority

The state has established the following types of projects for funding priority:

- Hazard Mitigation Planning.
- Retrofit of critical facilities and critical infrastructure.
- Repetitive flood properties and severe repetitive flood loss areas.
- Projects that would result in a general improvement of regional or local mitigation capability.
- State Identified Mitigation Initiatives such as saferooms and storm shelters, severe weather warning systems for universities and colleges, and severe weather notification systems for local communities, some emergency generators, and public outreach campaigns.
- Post-disaster identified mitigation needs.
- Other projects initiatives identified in the state and local mitigation plan.

Prioritizing Alternatives

STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to select and prioritize the most appropriate mitigation alternatives for the plan. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on the state's capabilities. Appendix 7.3.1 provides additional information regarding the review and selection criteria for alternatives

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.

Prioritization of Communities / Jurisdictions for Planning Grants

This section provides a description of the criteria by which the State will prioritize communities and local jurisdictions that would receive planning grants under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Building Resilient Infrastructure (BRIC), Pre-Disaster Mitigation (PDM), and other available funding programs.

Federal and State funding for mitigation planning will be limited, and in some instances, may not be available. There will always be more requests for mitigation planning funds than there will be available funds. Approval of funds for mitigation planning will be based on the availability of funds and the determination as to whether the requesting jurisdiction has demonstrated the desire and ability to complete the plan and follow through on the strategies identified in the plan. This desire to comply with the initiatives in the local mitigation plan should not be dependent on the availability of state or federal funds. Local jurisdictions should develop mitigation plans based on their unique capabilities and needs.

In an effort to allow some flexibility in the distribution of mitigation planning funds, the following general guidelines have been developed. These guidelines are not all inclusive and compliance with all of the issues listed below may not be required for approval of a planning grant.

- The community must meet the criteria for the specific source of funds referenced in Section 5.1 (Funding Support).
- MEMA will consider its past experience in dealing with the community on other grants (such as disaster grants, mitigation projects, etc.).
- MEMA may contact the Mississippi Development Authority (MDA) Community Development Block Grant (CDBG) program, other State agencies/departments, and/or Planning Organizations to check on their past experiences with the requesting community.
- The State and local risk assessment will be reviewed to determine the susceptibility of the community to natural and human caused disasters.
- MEMA will review previous presidential disaster declarations to determine the number of times the requesting community has been impacted by declared disasters and the magnitude of damages resulting from those disasters. This review would consider impact on community infrastructure, as

well as families and businesses.

- MEMA will also consider the number of non-declared disasters that have impacted the community. This review would consider impact on community infrastructure, as well as families and businesses.
- MEMA will consider whether or not the community participates in the National Flood Insurance Program (NFIP).
- MEMA will consider the number of insured, repetitive loss structures in the community.
- MEMA will also consider the community's status as a small-impoverished community and communities with special developmental pressures, if applicable.
- The community has identified natural disaster hazards in areas under its jurisdiction

Prioritization of Non-Planning Grants

This section provides a description of the criteria by which the State will prioritize communities and local jurisdictions that would receive non-planning grants under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Building Resilient Infrastructure (BRIC), Pre-Disaster Mitigation, and other available funding programs.

- The extent and nature of the hazards to be mitigated;
- The degree of commitment of the local government to reduce damages from future natural disasters;
- The degree of commitment of the local government to support the hazard mitigation measures to be carried out using the technical and financial assistance;
- The extent to which the hazard mitigation measures to be carried out using the technical and financial assistance contribute to established State/Local mitigation goals and priorities;
- The extent to which prioritized, cost-effective mitigation activities that produce meaningful and definable outcomes are clearly identified;
- If the local government has submitted a mitigation plan, the extent to which the activities identified under paragraph (5) above are consistent with the mitigation plan;
- The opportunity to fund activities that maximize net benefits to society;
- The extent to which assistance will fund activities in small-impoverished communities;
- The extent of development pressure particularly in those areas experiencing unexpected growth as a result of the post-Katrina evacuation and relocations;
- Communities with the highest risk; and
- Small and Impoverished Community Provisions

As used in pre-disaster mitigation, a small-impoverished community means a community of 3,000 or fewer individuals that is economically disadvantaged, as determined by the State. Additional criteria may be determined by FEMA. The President may increase the federal cost share to 90% of the total cost of mitigation activities carried out by small-impoverished communities; however, all other requirements will be the same as any other community participating in pre-disaster mitigation activities.

In order for a project to be considered for funding, it has to have a benefit cost ratio of a minimum of 1.0 that is technically feasible and cost-effective in accordance with FEMA requirements. Only projects that meet this criterion along with the other bulleted elements listed above are considered eligible, this ensures that the benefits are maximized from the projects. In accordance with the Hazard Mitigation Plan and the Administrative Plan, the Hazard Mitigation Council approves projects that meet the goals and objectives of the state plan and based also on the recommendations of the State Hazard Mitigation Officer. Mississippi Gulf Coast communities have received more grant funding than the other areas of the state because of the higher risks associated with the coastal area.

Mississippi is classified as a mostly rural state. Seventy-nine percent of the state is classified as rural and twenty-one percent urban. At the time of this plan update, the Hazard Mitigation Council is unaware of any significant development pressures within the state's communities. None of the communities have identified any development pressures in their local plans and was not addressed in the state plan. Should the state's communities identify any development pressures in the future, they will be addressed at the appropriate time.

The State of Mississippi amended its plan to participate in FEMA's Severe Repetitive Loss Program to take advantage of the 90/10 cost share to help mitigate RL properties. The state is committed to mitigating these properties.

Evaluation of Prioritizing Planning and Non-Planning Grants

The Hazard Mitigation Bureau's Administrative Plan for the Hazard Mitigation Grant Program provides an evaluation process for approval of grant applications as stated in Section VI – Program Administration. In addition, this plan presents a process to ensure benefits are maximized according to a cost benefit review of proposed projects.

Repetitive and Severe Repetitive Loss

Section 3 provides details about hazard assessments in Mississippi and appropriate mitigation actions to increase safety and reduce losses. One of the most revealing facts is the repetitive and severe repetitive losses that occur to structures and infrastructures. Mitigation Actions have been identified to address these repetitive and severe repetitive losses. These actions were developed from an historical, as well as a vulnerability, perspective.

The National Flood Insurance Program shows 63,994 policies with a total coverage of 15,671,951,500. Total claims since 1978 is 61,136 and a total paid since 1978 is 3,039,248,331 and over $332 million repetitive losses paid with 1,423 repetitive loss properties mitigated. The State of Mississippi has shown to a high priority on assisting local communities in reducing future losses through defined mitigation actions. Our goal is to continue to increase the mitigation of repetitive and severe repetitive loss properties. The State of Mississippi is committed to mitigate its repetitive and severe repetitive loss properties; to that end we have previously amended the state plan to take advantage of the SRL Program with the 90/10 share cost. With that being said, the State of Mississippi does not adopt or enforce a statewide building code for all structures, nor does it mandate a code for residential construction. It is up to local jurisdictions to adopt and enforce building codes.

- We do encourage communities to restrict development in flood prone areas by implementing stricter building codes, zoning and ordinances.
- Placed and continue to place higher priority for applications inclusive of, but not limited to, developing a floodplain management program, restricting development in flood prone areas, acquiring flood prone properties, elevate structures that have been deemed repetitive loss and severe repetitive loss structures, and flood proofing businesses that meet the criteria of repetitive loss and severe repetitive loss structures.

Hurricane Katrina mitigated a large number of repetitive loss properties, the exact number is unknown at this time and the state is continuing to make mitigating RL properties a priority.

6.0: Plan Maintenance Process

A formal process is required to ensure that the Plan will remain an active and relevant document. This section, Plan Maintenance, includes a schedule for monitoring and evaluating the Plan annually, and for revising the Plan every five years. It describes how the Hazard Mitigation Council and individual member institutions will receive public input throughout the process. Finally, this section explains how institutions will transform the mitigation strategies outlined in this plan into existing planning mechanisms.

Summary of Changes-2023 Plain Maintenance

- Plan Monitoring, Evaluating, and Updating (Section 6.1.1 thru 6.1.3) updated.
- Some projects were deleted and others were added. Sixty-nine projects remain.
- Staffing (Section 6.2.3) Updates were added and additional staff included.

6.1: Monitoring, Evaluating, and Updating the Plan

44 CFR 201.4(c)(5)(i)(ii) – The State mitigation strategy shall include the following elements: A Plan Maintenance Process that includes:

An established method and schedule for monitoring, evaluating, and updating the plan. This is a system for monitoring implementation of mitigation measures and project closeouts.

6.1.1 Plan Monitoring, Evaluating, and Updating

The Mississippi Hazard Mitigation Council participants will review the goals, objectives, and action items listed in the plan on a semi-annual basis. They shall be responsible for communicating any desired or necessary changes to the Mississippi Emergency Management Agency and other stakeholders. The Hazard Mitigation Council will convene semi-annual meetings to conduct the following activities:

- Review existing action items to determine appropriateness of funding;
- Identify issues that may not have been identified when the plan was developed;
- Prioritize potential mitigation projects using the methodology described in the plan; and
- Assist in development of funding proposals for priority action items.

The project status will be evaluated and such items as timeline, funding source, and responsible entity will be reviewed for update. The Mississippi Emergency Management Agency Office of Mitigation will be responsible for updating the plan on a five-year cycle. If there are needed changes, a memorandum describing needed changes and progress on implementation, will be provided annually to MEMA, FEMA Region IV, and the Hazard Mitigation Council.

The State of Mississippi Hazard Mitigation Plan will be evaluated at each semi-annual Hazard Mitigation Council Meeting. This will provide an opportunity for effective utilization of the Plan and will involve stakeholders from State agencies with responsibility for mitigation actions and projects. The mitigation council meetings will involve a review of mitigation actions and projects, review of any major disaster occurrence to determine the need for plan refocus, and review every five years before submission to FEMA for approval.

6.1.2 Plan Evaluation

In addition to semi-annual reviews, the Hazard Mitigation Council and each participating agency will perform a more comprehensive review of the Plan every two years, or as deemed necessary by the Council and MEMA. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, and success of coordination efforts. They will then evaluate the content of the plan using the following questions:

- Are these programs effective?
- Have there been any changes in development that affect our mitigation priorities?

- Do our goals, objectives, and action items meet STAPLE/E criteria?
- Are our goals, objectives, and action items relevant, given any changes in our Agency?
- Are our goals, objectives, and action items relevant given any changes to State or Federal regulations and policy?
- Is there any new data that affects the risk assessment portion of the Plan?

The Hazard Mitigation Council meets semi-annually. During our semi-annual meetings, the following occurred:

- Review updates of risk assessment data and findings, as well as new events and data
- Discuss methods of continued public and stakeholder participation, and
- Document successes in mitigation strategy's goals and lessons learned based on actions that were accomplished during the past two years.

Any resulting updates or changes will be included in the Plan. Again, the Hazard Mitigation Council and the Mississippi Emergency Management Agency Office of Mitigation will be responsible for making any changes and will provide the updates via a memorandum, as described earlier, and will keep files of changes needed for the five-year re-submittal.

The 2023 Standard Mitigation Plan contains project profiles. These profiles are reviewed and updated by all State agencies that have assigned projects using the State's intra-site. During the semi-annual Hazard Mitigation Council meetings, these projects were discussed and evaluated for progress to make sure that projects remained relevant and viable. There are currently 69 viable projects.

The 2018 State Plan contained 67 projects. Based on evaluation and feedback of the 2013 plan mitigation actions/projects, projects that were found too redundant or obsolete were combined or deleted. However, with losses and gains, the projects remained at 67 viable projects.

The process for monitoring the mitigation actions has been modified. A tabular summary of all projects referenced to a profile will be available and will detail each mitigation action. The monitoring process will be organized in an information management system, which will be maintained and updated by MEMA. The new process will provide for efficient and effective updates of the mitigation actions. Since the Hazard Mitigation Council will now meet semi-annually, review of the mitigation action will result in timely updates.

6.1.3 Plan Updates

The Hazard Mitigation Council is responsible for making updates to the Plan, and the Agency participants are responsible for the content of the updates. The council meets semi-annually and will continue to contribute input and periodically reporting on agency projects. The Agencies will provide institutional-level updates to the Plan when necessary. At the time of review, the following key questions will be addressed:

- Are the plan goals still applicable?
- Are there new partners or stakeholders who should be targeted for involvement?
- Do existing actions need to be re-evaluated or re-prioritized for implementation?
- Are the actions still appropriate given current resources?
- Have changes in construction and development influenced the effects of hazards?

- Are there new studies or data available that would enhance the risk assessment?
- Have the Agencies been affected by any disasters, and did the plan accurately address the impacts of the events?

The Plan will be submitted for review to MEMA and FEMA every five years.

6.1.4 Implementation through Existing Programs

The multi-institutional participants can use the Plan as a baseline of information on the natural hazards that impact their institutions.

6.1.5 Continued Public Involvement

The public, as well as State and Local communities, will be directly involved in reviewing and updating the Plan. The Hazard Mitigation Council and its representatives should solicit feedback from the public during monitoring, evaluating, and updating the Plan as described above. The State Plan is accessible on our MEMA website for the public to view and give feedback to the state plan.

6.2: Monitoring Progress of Mitigation Actions and Assessments of Mitigation Actions

44 CFR 201.4(c)(5)(iii) – The State mitigation strategy shall include the following elements: A Plan Maintenance Process that includes:

A system for reviewing progress on achieving goals as well as activities and projects identified in the Mitigation Strategy.

The plan maintenance process should include:

- A system for monitoring implementation of mitigation measures and project closeouts.
- A system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.

6.2.1 Monitoring Implementation of Mitigation Measures and Project Closeouts

Mississippi Emergency Management Agency (as grantee) recognizes the responsibilities laid out in 44 CFR 206.438(a): The State, serving as grantee, has primary responsibility for project management, accountability of funds as indicated in 44 CFR part 13, and is responsible for ensuring that sub-grantees meet all program and administrative requirements.

The State Hazard Mitigation Grant Administrative Plan outlines the administrative procedures that the state employs for meeting these requirements.

6.2.2 Progress Review for Mitigation Goals and Objectives

In order for any program to remain effective, the goals and objectives of that program must be reviewed periodically. That review should address, as a minimum, the following issues:

- Are the established goals and objectives realistic? Take into consideration available funding, staffing, and state/local capabilities, and the overall State mitigation strategy.
- Has the State clearly explained the overall mitigation strategy to local governments?
- Are proposed mitigation projects evaluated based on how they help the State and/or local government meet overall mitigation goals and objectives?
- How have approved mitigation projects complemented existing State and/or local government mitigation goals and objectives?
- Have completed mitigation projects generated the anticipated cost avoidance or other disaster reduction result?

A thorough and realistic evaluation of the benefits of a mitigation project may be delayed until the area of the project is impacted by another disaster. The lack of realized benefits from a completed mitigation project may result in the disapproval or modification of similar projects in the future. At the same time, mitigation projects that have proven their worth may be repeated in other areas of the State.

Based on the results of the review/evaluation mentioned above, the State may need to adjust its goals and objectives to meet the current and future mitigation needs of the State and local governments. A semi-annual mitigation status report will be prepared by the MEMA Mitigation Planning Bureau. This report will be provided to the MEMA Director for review and distribution, as needed. The report will address, as a minimum, the following items:

- Mitigation goals, objectives and strategies
    - ➢ Brief description of the project
    - ➢ Linkage of the project with goals and objectives
    - ➢ Linkage of project with strategies.
    - ➢ Linkage of the project with funding priorities
- Completed mitigation projects
    - ➢ Affected jurisdiction
    - ➢ Brief description of the project
    - ➢ Source of funding
    - ➢ Brief summary of any problem areas, with proposed solution
    - ➢ Brief summary of effectiveness (cost-avoidance) of project, if available
- Mitigation projects in progress
    - ➢ Affected jurisdiction
    - ➢ Brief description of the project
    - ➢ Source of funding
    - ➢ Brief summary of project status
    - ➢ Anticipated completion date

- Pending (under review) mitigation projects
    - Affected jurisdiction
    - Brief description of the project
    - Source of funding
    - Brief summary of project status

6.2.3 Staffing

The Mississippi Emergency Management Agency will implement the State Plan and administer the mitigation programs by utilizing the following positions:

Mitigation Office Director

The Mitigation Office Director has overall management responsibility for the program and is responsible for ensuring that the state properly carries out its Section 404 and Section 406 responsibilities subsequent to a Presidential Disaster Declaration. In this regard, the Mitigation Office Director will monitor the activities of the mitigation staff and the State Hazard Mitigation Team and provide oversight on mitigation issues. Responsibilities include, but are not limited to:

- Ensuring the Administrative Plan is updated, outlining how the state will administer the Hazard Mitigation Grant Program and other applicable hazard grant programs.
- Ensuring that the State Hazard Mitigation Plan is active and identifies potential hazard mitigation projects, as well as establishes priorities among those projects.
- Ensuring that all potential applicants are notified of the program and receive the assistance to which they are entitled.
- Ensuring that a proper initial application and any necessary supplemental applications including SF-424's, are submitted in a timely fashion to the FEMA Region IV Director.
- Ensuring that technical assistance is provided to potential applicants and/or eligible sub-grantees.
- Ensuring that adequate procedures are developed for the distribution of financial assistance to eligible sub-grantees by the technical assistance staff.
- Ensuring development of a system to monitor completion of approved projects in federally required time frames.
- Ensuring that a system exists to monitor sub-grantee accounting systems and is in compliance with 44 CFR parts 13 and 14.
- Ensuring that appropriate state agencies are on the State Hazard Mitigation Team and are involved as necessary with the hazard mitigation process.
- Ensuring participation of the appropriate local agencies in the administration and implementation of the hazard mitigation process.
- Coordinating with the GAR on all policy/regulatory issues. Reviewing and making

appropriate recommendation to the GAR regarding appeals, cost overruns/underruns and all other program issues is also included.

- Process and provide recommendations to senior-level government officials regarding approval and funding of mitigation grant applications received from local governments.

Administrative Assistant

The Administrative Assistant performs skilled clerical work and provides secretarial services for mitigation staff. This work involves making independent decisions concerning the procedure or process to be followed and the actions to be taken. Examples of tasks performed include, but are not limited to:

- Supervising and participating in the receipt and processing of correspondence, preparing coding and typing of personnel, purchasing, supply, financial, and other documents; and the checking and posting of program transactions.
- Organizing work and coordinating workflow; establishing priorities, setting deadlines and reviewing work for adequacy, accuracy, timeliness, and conformance with instructions and standard practices.
- Receiving visitors and answering calls, ascertaining the purpose of calls and visits, and furnishing information from knowledge of agency policies, rules and procedures.
- Assist the Office Director and Bureau Directors to ensure that positive and correct communication is given as it relates to the agency and office.
- Maintain all Mitigation Grant Project files and all correspondences.
- Organize and schedule meetings and appointments.

Financial Grants Specialist

- The financial grants specialist works closely with the grant specialist during Kick-off meetings.
- Process grant reimbursements for the sub-applicants.
- Work closely with the grants specialist to process the grant closeouts.
- Work closely with the Mitigation Grants Bureau Director and Support Services to process and complete the monthly, quarterly and annual mitigation grants financial reports by their respective deadlines.
- Maintain hardcopy of project files.

NFIP State Coordinator/ Floodplain Management Bureau Director

The National Flood Insurance Program (NFIP) State Coordinator is responsible for the direction, evaluation, oversight, planning, and promotion of the 330 + local floodplain management programs within the state of Mississippi. Work also involves advising MEMA staff of floodplain management requirements; as they pertain to emergency preparedness, response, and recovery actions. Successful oversight of the local communities' floodplain management programs enables the MEMA hazard mitigation assistance, mitigation planning, public assistance, and individual assistance bureaus to effectively administer their programs.

The FPM Bureau is the only compliance/regulatory focused staff element within MEMA. Accordingly, its compliance and enforcement actions include frequent contacts/inspections with state and local officials, public agencies; community and civic groups, etc. Other duties include, but are not limited to the following:

- Planning and conducting the Agency's portion of the Risk MAP initiative.
- Oversight of the 28 Community Rating System (CRS) communities within the state.
- Advising and assisting local officials on floodplain management and NFIP training, workshops, conferences, and emergency test exercises.
- Planning and participating in floodplain management and NFIP training, workshops, conferences, and emergency test exercises
- Making public appearances before civic and community groups to promote the floodplain management program.
- Corresponding with local officials, government agencies, federal floodplain management representatives, etc., and preparing reports as required.
- Assisting local communities throughout the state in preparation of flood damage prevention ordinances, pamphlets, training, and education documents.
- Coordinate damage estimates for the Special Flood Hazard Area.
- Coordinate and support both Community Assistance Visits (CAV) and Community Assistance Contact (CAC) visits performed by Floodplain Management Specialists throughout the state.
- Reviewing local regulations and FPM programs for compliance with federal regulations.
- Providing staff to the State Emergency Response and FPM programs for compliance with federal regulations.
- Providing staff to the Emergency Response and to the logistics element within the State Emergency Operations Center during times of state emergencies and activations.

Floodplain Management Specialist

The duties of the Floodplain Management Specialist include providing regulatory and programmatic oversight, technical assistance, and floodplain management training to communities within an assigned district (of counties) that participate in the NFIP. All actions are based on the 44 CFR 60.1 – 60.3, Executive Order 11988, and other Federal/State regulations. Other duties include, but are not limited to the following:

- Providing technical assistance with local community governments.
- Conducting Community Assistance Visits (CAV) and Community Assistance Contact (CAC) actions per FEMA and MEMA guidelines.
- Responsible for inputting and tracking all floodplain management actions through the use of the FEMA community Information System (CIS)
- Responsible for inputting and tracking all actions through the use of the FEMA Community Information System (CIS).
- Assisting the State Coordinator in facilitating the Risk Map which includes delivery, review, and adoption of new Digital Flood Insurance Rate Maps (DFRIMS).
- Notifying appropriate officials of meetings through correspondence.
- Provide ordinance and mapping assistance to local communities.
- Facilitating the DFIRMS adoption process by the community.
- Coordinating and scheduling "Discovery" and any other follow-up meetings with local communities.
- Conduct workshop and floodplain management training and procure training site locations.
- Providing floodplain review letter for request received
- Provide Substantial Damage Estimates Assistance per request from community

Mitigation Grants Bureau Director

The Mitigation Grants Bureau Director is responsible for the grants program coordination, implementation and administration. The Grants Bureau Director will ensure that the necessary work is performed to deliver the Mitigation Grant Programs to eligible sub-grantees. In addition to assisting the Office Director in all aspects of mitigation, the Mitigation Grants/Plans Bureau Director's responsibilities include, but are not limited to:

- Develop the Administrative Plan which outlines how the State will administer the Hazard Mitigation Grant Program and implement the plan in a Presidential Disaster Declaration.
- Develop and implement a process for identifying potential hazard mitigation projects and setting priorities among those projects.
- Provide policy guidance to internal and external partners as it relates to the interfacing of HMPG and Public Assistance to local emergency management partners.
- Maintain a management system for hazard mitigation activities and products.

- Notify potential applicants of the program and brief them, with appropriate handout material on elements of the program.

- Coordinate with Federal, State and local officials to ensure that they understand the involvement of the Hazard Mitigation effort in the Public Assistance program.

- Provide technical assistance to potential applicants and /or eligible sub-grantees in developing and submitting applications and in completing projects.

- Implement departmental procedures to monitor the status of approved projects, for processing extension requests and appeals, and for closing out completed projects

- Coordinate with the Administrative and Finance Bureau staff in monitoring sub-grantee accounting systems to meet requirements of Code of Federal Regulations (CFR) 44 Part 13 and Part 14.

- Participate in floodplain and planning meetings as well as other meetings with internal and external partners.

- Helping update the State Hazard Mitigation Plan.

- Conduct site visits to monitor progress and provide technical assistance.
- Assist the Mitigation Office Director in conducting mitigation conferences and / or public meetings.

Grants Management Specialist

The Grants Management Specialist is responsible for program coordination, implementation and administration. The specialist will accomplish the necessary work required to deliver the Hazard Mitigation Grant Program to eligible sub-grantees. In addition to assisting the Bureau Director of Grants in all aspects of mitigation, the Grants Specialist responsibilities include, but are not limited to:

- Developing the Administrative Plan, this outlines how the State will administer the Hazard Mitigation Grant Program, and implementing the plan in a Presidential Disaster Declaration.

- Developing and implementing a process for identifying potential hazard mitigation projects and for setting priorities among those projects.

- Maintaining a management system for hazard mitigation activities and products.

- Notifying potential applicants of the program and briefing them, with appropriate handout material, on elements of the program.

- Coordinating with Federal, State and local officials to ensure that they understand the involvement of the Hazard Mitigation effort in the Public Assistance program.

- Providing technical assistance to potential applicants and/or eligible sub-grantees in developing and submitting applications and in completing projects.

- Implementing departmental procedures to monitor the status of approved projects for processing extension requests and appeals, and for closing out completed projects.

- Coordinating with the Administrative & Finance Bureau staff in monitoring sub-grantee accounting systems to meet requirements of Code of Federal Regulations (CFR) 44 Part 13 and Part 14.

- Helping update the State Hazard Mitigation Plan.
- Conducting site visits to monitor progress and provide technical assistance.
- Work closely with both floodplain management specialists and mitigation planning specialists to provide adequate technical assistance during application development and subsequent submittal.
- Assisting the Mitigation Office Director in conducting mitigation conferences and or public meetings.

Mitigation Planning Bureau Director

The Bureau Director, Mitigation Plans, formulates, controls, and directs the Mitigation Planning Bureau's operations in regard and in compliance with mandates by the Federal Emergency Management Agency. These duties include the following:

- Supervising the activities of the Planning Bureau Staff in performing specific functions and duties.
- Performing a variety of administrative tasks consisting of fiscal management, strategic planning, legal compliance, and required reports.
- Review hazard mitigation plans that are being developed and assist local communities ensuring that the plans meet the FEMA criteria.
- Serving as liaison to various government agencies, other public/private agencies, and/or the general public in matters related to hazard mitigation planning.
- Coordinating plans and budgets with other Bureau Directors to ensure that they meet the stated goals of the office and the agency.
- Coordinating with FEMA on any necessary training requirements and/or providing technical assistance for the local communities concerning mitigation planning.
- Coordinate with the Office of Mitigation Director and the Grants Bureau Director to establish a budget for the state hazard mitigation plan.
- Submitting reports to the Office of Mitigation in reference to any accomplishments and/or any deviations from bureau-stated goals.
- Liaison with other state agencies and stakeholders to establish a state hazard mitigation council.
- Develop the state hazard mitigation plan using FEMA mandated guidelines.
- Updating and overseeing the update of the state hazard mitigation plan.

Mitigation Planner

The Mitigation Planner assists the Bureau Director in formulating and controlling the Mitigation Planning Bureau's operations in regard and in compliance with mandates by the Federal Emergency Management Agency. In addition, the Mitigation Planner's duties include the following tasks:

- Performing specific functions and duties including a variety of administrative tasks consisting of strategic planning, legal compliance, and required reports.
- Serving as liaison to various government agencies, other public/private agencies,

and/or the general public in matters related to hazard mitigation planning.

- Reviewing plans and assisting local communities, consultants and other state agencies to ensure that developed plans meet or exceed FEMA standards.
- Reviewing and monitoring plan updates.
- Coordinating with FEMA on any necessary training requirements and/or providing technical assistance for local communities concerning mitigation planning.
- Submitting reports to the Office of Mitigation in reference to any accomplishments and/or any deviations from division-stated goals.
- Using FEMA mandated guidelines, assisting the Bureau Director with development and update of the state hazard mitigation plan.
- Overseeing and procuring training sites and venues.
- Facilitating mitigation planning training with local officials and state agencies. Coordinating administrative requirements for workshops and training seminars.
- Attending conferences to furnish various audiences with programmatic advice and assisting with planning matters.
- Liaison with other state agencies and stakeholders to assist in establishing a state hazard mitigation council.
- Enhancing public understanding of mitigation planning programs through presentations.

Project Specialist/Safe Room Coordinator

The Mitigation Safe Room Coordinator is responsible for safe room program coordination, implementation and administration. The Safe Room Coordinator will ensure that appropriate documentation is provided to reimburse eligible applicants. In addition to assisting the Office Director in all aspects of mitigation, the Mitigation Safe Room Coordinator responsibilities include, but are not limited to:

- Supervise and coordinate the activities of the individual safe room/storm shelter program.
- Review and process safe room applications.
- Conduct follow-up to obtain additional information from applicants.
- Conduct inspection visits.
- Review documentation for reimbursement.
- Contact applicants to begin installation process.
- Assists the Floodplain Bureau when necessary.

An up-to-date copy of the plan will reside within the Mississippi Emergency Management Agency web site, and on a homepage devoted to Hazard Mitigation and Emergency Preparedness. Annual and biennial status memorandums will also be posted there.

A copy of the Plan will be publicized and available for review at the Mississippi Emergency Management Agency offices and additional copies of the plan will be catalogued and made available at pertinent State Agencies. The existence and locations of these copies will also be posted on the Mississippi Emergency Management Agency web site. The site will contain contact information for members of the Hazard Mitigation Council to which the public may direct comments and concerns. All public feedback will be forwarded to the appropriate institution for review.

In addition to these activities, many of the educational and outreach activities will support continued public involvement in the Plan implementation process.