

# **Ecological site F131AY601MS**

## **Batture - Mississippi River Unprotected By Levee Sites**

Last updated: 6/10/2025

Accessed: 03/26/2026

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### **General information**

**Provisional.** A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

### **MLRA notes**

Major Land Resource Area (MLRA): 131A–Southern Mississippi River Alluvium

The Southern Mississippi River Alluvium (MLRA 131A) is the largest of 4 MLRAs within Land Resource Region O, the Mississippi Delta Cotton and Feed Grains Region. It occurs in portions of 7 states including Louisiana (32 percent), Arkansas (26 percent), Mississippi (26 percent), Missouri (12 percent), Tennessee (3 percent), Kentucky (1 percent), and Illinois (less than 1 percent). The MLRA is comprised of 29,555 square miles and extends roughly 650 miles from an area near Cape Girardeau, Missouri in the north to the MLRA's transition to the Gulf Coast Marsh (MLRA 151) in the south. Average elevations range from 330 feet in the north to sea level in the southern part of the area. For much of the north-south distance, the MLRA is bounded to the east by an abrupt rise in elevation of loess-capped bluffs and hills, the Southern Mississippi Valley Loess (MLRA 134). West of the Mississippi River, the boundary is less distinct except to the northwest where the MLRA abuts the Ozark Plateaus and Ouachita province (MLRAs 116A, 117, and 118A). South of the Ozark and Ouachita escarpment, the MLRA adjoins the Southern Mississippi River Terraces (MLRA 131D), which includes the fabled Grand Prairie and merges with the valleys of the Arkansas and Ouachita rivers (MLRA 131B) and the Red River (MLRA 131C). Occurring within or bordering the Southern Mississippi River Alluvium are three separate loess-capped, upland remnants: Crowley's Ridge, Macon Ridge, and Lafayette Loess Plain, which are western units of MLRA 134 (USDA-NRCS, 2006).

MLRA 131A is characterized by landscapes that were created and influenced by the current and earlier paths of the Mississippi River and its tributaries. Waters transporting the materials that formed the area originate from as far west as the east slope of the Continental Divide to the western edge of the Appalachian Divide in the east. This comprises a drainage basin of roughly 1,245,000 square miles and includes all or parts of

thirty-one U.S. states and two Canadian provinces (Elliott, 1932). The drainage basin of the Mississippi River roughly resembles a funnel which has its spout at the Gulf of America. Waters from as far east as New York and as far west as Montana contribute to flows in the lower extent of the river (USACE, 2017). The soils of these alluvial landscapes are very deep, dominantly poorly and somewhat poorly drained, and have textures that are mostly loamy or clayey. Principal soil orders are Alfisols, Vertisols, Inceptisols, and Entisols (USDA-NRCS, 2006).

The fluvial processes that shaped the area were highly dynamic, diverse, and complex. During the Pleistocene epoch, multiple continental glacial-interglacial cycles resulted in extreme fluctuations in river discharge and sediment loads. A braided river regime characterized the fluvial dynamics of the Mississippi River through much of the last glacial cycle (Autin et al., 1991; Rittenhour et al., 2007). Rapid aggradation of glacial outwash led to the development of prominent valley train features over a large portion of the area (Autin et al., 1991; Saucier, 1994; Aslan and Autin, 1999; Blum et al., 2000; Rittenhour et al., 2007). A changing climate, meltwater withdrawal, and sea-level change induced a transition from a braided river regime to a predominantly single-channeled, laterally migrating river system during the Holocene epoch (Rittenhour et al., 2007; Shen et al., 2012) – characteristics that continue today. Fluvial dynamics of the migrating river resulted in the development of broad meander belts, backswamp environments, and extensive deltaic complexes (Saucier, 1994; Klimas et al., 2011).

Tremendous expanses of bottomland hardwood forests once covered much of the area. Today, the land base is largely in agriculture production, and soybeans, cotton, corn, and rice are the principal crops with sugarcane rising in importance in the southernmost portion of the MLRA (USDA-NRCS, 2022).

Due to its size and biophysical variability, the technical team advised subdividing the MLRA into six subregions: Western Lowlands, St. Francis Basin, Yazoo Basin, Tensas Basin, Delta Plain, and Batture.

## **LRU notes**

For the purpose of ecological site concepts, the MLRA was separated by the technical team into 6 subregions based on various assemblages of data reviewed. The subregion where this site is delineated extends through the length of MLRA 131A, but it differs from other subregions because it is still hydrologically impacted by the regular flow of the Mississippi River and its tributaries. This subregion is locally known as “Batture” which is defined for the purposes of this Ecological Site as the alluvial land between the Mississippi River channel and the constructed levee system or other flood constricting natural features, such as natural levees or high bluffs. Individual levee systems have been present along the Mississippi River since the first Europeans settled the region in the early 18th century, but its design has changed many times since that first levee. The changes were brought about mainly by flooding, which in turn drove other factors such as costs and politics (Rogers, 2005).

The Mississippi River and Tributaries (MR and T) Project is a comprehensive flood control and navigation plan for the Lower Mississippi River and tributary streams. The MR&T was authorized under the Flood Control Act of 1928 and is the responsibility of the Mississippi River Commission (MRC). The project consists primarily of a system of levees, channel improvement works, and floodways. Currently, the river is entirely contained by either bluffs or levees from Cairo, IL to a point 90 river miles below New Orleans, except where major tributaries are confluent. This effort has been extremely successful in reducing or eliminating flooding over most of the historic floodplain and contributing to agricultural and urban development. Over one million acres of this remnant bottomland forest lies within the leveed floodplain of the Lower Mississippi River where most sites are still subject to annual flooding. Peak river flows typically occur in March, April, and May (Klimas, 1988).

The Ecological sites within the Batture region of MLRA 131A will be the most transient of all the sites of the MLRA. In the protected subregions, the landscape will maintain a progression of development, unless there are anthropogenic forces that alter it or there is a catastrophic river event that breaches the levee system. Landforms throughout the Batture have direct hydrologic connectivity to the Mississippi River and are subject to annual or near annual flooding, sedimentation, and potential modification. For instance, low elevation landforms that are frequently flooded and ponded are subject to and may receive sediment deposition of several feet, transforming the local area to conditions more similar to a natural levee or ridge ecological site. Conversely, a local natural levee or ridge landform could receive severe scouring impacts during a catastrophic flood event, resulting in a complete removal of the former elevated feature to one that becomes lower in elevation and subject to frequent flooding and ponding. In this dynamic environment, migration of the river channel to new pathways along with redistribution of sediments is a persistent possibility. There is a potential for a given ecological site at the local level to undergo rapid transformation and development to any of the sites that have been identified within the Batture.

When working within the Batture Subregion, onsite verification of the conditions of a given location is critical to planning. It has been witnessed by the Author of this site concept, flooding in a crop field due to current high flows of the Mississippi River. While at the same time seeing irrigation of the adjacent growing crops, due to dry conditions in the higher elevation areas of the field. It has also been noted by members of the technical team, where restoration plantings on ridge sites was converted to eroded swales, while adjacent shallow water areas were completely filled by sandy sediment creating ridges, from a single flooding event.

## **Classification relationships**

Major Land Resource Area (MLRA) and Land Resource Unit (LRU) (USDA-NRCS, 2006)  
MLRA 131A Southern Mississippi River Alluvium

EPA Level IV Ecoregion - 73a Northern Holocene Meander Belts, 73k Southern Holocene

## Meander Belts

The Natural Communities of Louisiana - (Louisiana Natural Heritage Program - Louisiana Department of Wildlife and Fisheries) - Forested Wetland, Bottomland Hardwood Forest, Batture

### Ecological site concept

This ecological site occurs within the undulating landscape between the active river and man-made levee or upland bluffs of adjacent MLRA's. Active flooding, overwash, scour and sedimentation by the Mississippi River will impact the site. These sites have been altered greatly by anthropogenic means; the hydrology, soils, and vegetation have been altered beyond what would have naturally occurred in the region. Due to these alterations by construction of flood protection levees, the ecological sites that would have occurred on these locations are no longer relevant. There will be similarities to the sites found on the protected side of the levees, however, the hydrology, sedimentation and erosion have overshadowed all other ecological processes.

This Site Concept is utilized when a soil is not well defined or too broadly mapped to fit into one of the more refined site concepts for the Batture of MLRA 131A. The general concepts of this ecological site are intended to direct users to the following detailed descriptions after onsite determinations:

131AY602 - Batture - Frequently Flooded Very Poorly Drained Poned Oxbow and Swale Forest

131AY603 - Batture - Frequently Flooded Wet Backswamp Flat Forest

131AY604 - Batture - Frequently Flooded Moderately Wet Low Ridge Forest

131AY605 - Batture - Frequently Flooded Natural Levee and Ridge Forest

131AY606 - Batture - Frequently Flooded Pointbars Sandbars and Splays

Of note, this site occurs within the “unprotected” or “batture lands” (i.e., the alluvial land between the river channel and the constructed levee system) side of the extensive Mississippi River levee system and is distinguished from similar landforms that are protected from current Mississippi flooding by constructed levees or natural features.

### Associated sites

|             |  |
|-------------|--|
| F131AY602MS | <b>Batture - Frequently Flooded Very Poorly Drained Poned Oxbow and Swale Forest</b> |
| F131AY603MS | <b>Batture - Frequently Flooded Wet Backswamp Flat Forest</b>                        |
| F131AY604MS | <b>Batture - Frequently Flooded Moderately Wet Low Ridge Forest</b>                  |
| F131AY605MS | <b>Batture - Frequently Flooded Natural Levee and Ridge Forest</b>                   |
| F131AY606MS | <b>Batture - Frequently Flooded Pointbars, Sandbars, and Splays</b>                  |

## Similar sites

|             |  |
|-------------|--|
| F131AY602MS | <b>Batture - Frequently Flooded Very Poorly Drained Poned Oxbow and Swale Forest</b> |
| F131AY603MS | <b>Batture - Frequently Flooded Wet Backswamp Flat Forest</b>                        |
| F131AY604MS | <b>Batture - Frequently Flooded Moderately Wet Low Ridge Forest</b>                  |
| F131AY605MS | <b>Batture - Frequently Flooded Natural Levee and Ridge Forest</b>                   |
| F131AY606MS | <b>Batture - Frequently Flooded Pointbars, Sandbars, and Splays</b>                  |

**Table 1. Dominant plant species**

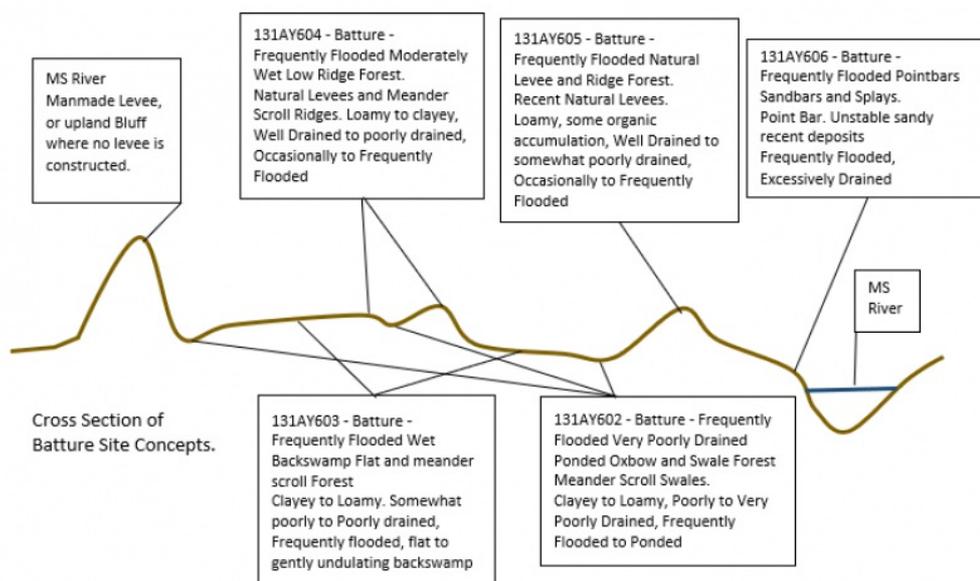
|            |  |
|------------|--|
| Tree       | (1) <i>Salix nigra</i><br>(2) <i>Populus deltoides</i> |
| Shrub      | Not specified  |
| Herbaceous | Not specified  |

## Physiographic features

Site concepts of the Batture subregion emphasize the extreme hydrologic drivers of them. The sites differ from the natural system due to increased frequency and duration of flooding as a result of confining the river to a narrowed floodplain. Within the Batture subregion there are open pastures and crop fields that can receive beneficial added nutrients and sediments from the flooding, but during extreme events can lose this sediment by erosion from the river's currents. These flooding forces not only can remove recent sediment but can also scour the land's surface, leaving large gullies, as well as uprooting trees and causing similar erosion in forested areas.

A landscape profile shows the undulating nature of the landscape (Figure 1) between the constructed levees, and the surface elevation within the Batture may be higher than outside the levee system. This higher elevation could be attributed to the continuous accretion of material from flooding.

The additional sediment deposition on these sites has substantially altered them from their historical state. Most of the historic site soils are buried by the current soil surface, so to describe a historic landscape position is not beneficial. These sites potentially could be described as hardwood stands with relatively frequent inundation or flooding due to the proximity to the river channel over a gradient of species composition from the relatively bare soil surface of sandy material, through low frequently flooded backswamp positions to the higher natural levees.



**Figure 1. Batture Subregion typical cross section from the constructed levee to the Mississippi River Channel. Diagram notes the Ecological Sites as they would fit across the landscape.**

**Table 2. Representative physiographic features**

|                    |   |
|--------------------|---|
| Landforms          | (1) Alluvial plain > Backswamp<br>(2) Alluvial plain > Natural levee<br>(3) Alluvial plain > Meander scroll |
| Runoff class       | Low to high   |
| Flooding duration  | Extremely brief (0.1 to 4 hours) to very long (more than 30 days)   |
| Flooding frequency | None to frequent  |
| Ponding duration   | Brief (2 to 7 days) to very long (more than 30 days)  |
| Ponding frequency  | None to frequent  |
| Elevation          | 15–107 m  |
| Slope              | 0–33%   |
| Water table depth  | 0–84 cm   |
| Aspect             | Aspect is not a significant factor  |

## Climatic features

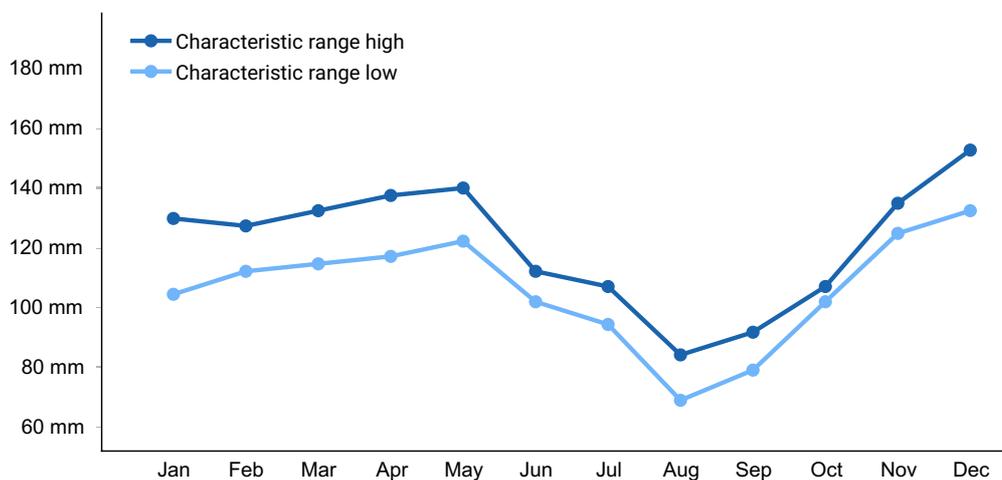
The climate of MLRA 131A is classified as humid subtropical (Koppen System), which is typified by mostly mild winters; long, hot summers; and no routinely recurring wet or dry season (Smith and Klimas, 2002; NCDC, 2018).

In the warmer season (and throughout much of the year), winds from the south convey moisture from the gulf leading to humid, subtropical conditions that are favorable for afternoon thunderstorms. These storms produce an average of about 25 percent of the

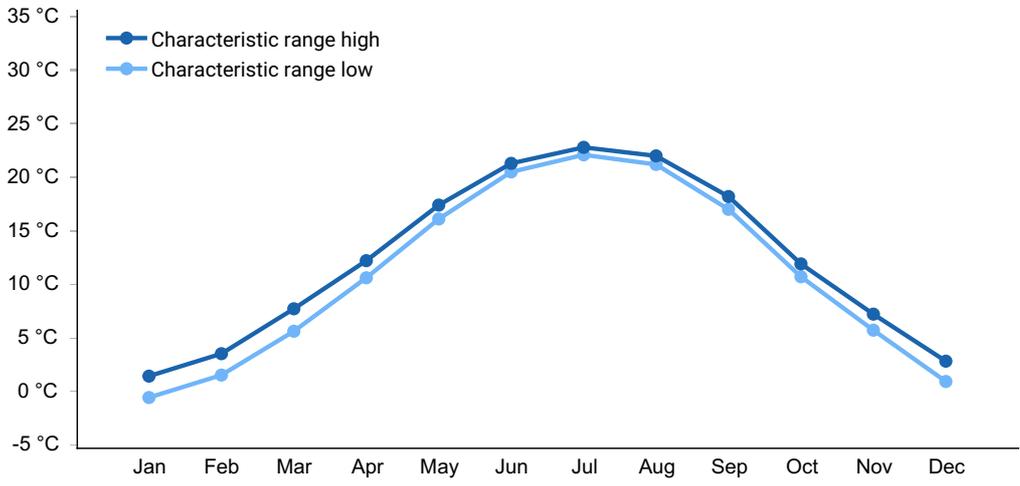
area's annual precipitation and are at times accompanied by locally destructive winds. An additional hazard of concern during late summer through early fall is the tropical cyclone. While most impacts from hurricanes and tropical storms are confined along the coastal zone, heavy rainfall, severe flooding, and high winds can occur well into the Batture Subregion when such systems pass through the area. To the extreme, the region is susceptible to the effects of a strong Bermuda high during the summer, which can cause devastating drought conditions for weeks and even months in some years.

**Table 3. Representative climatic features**

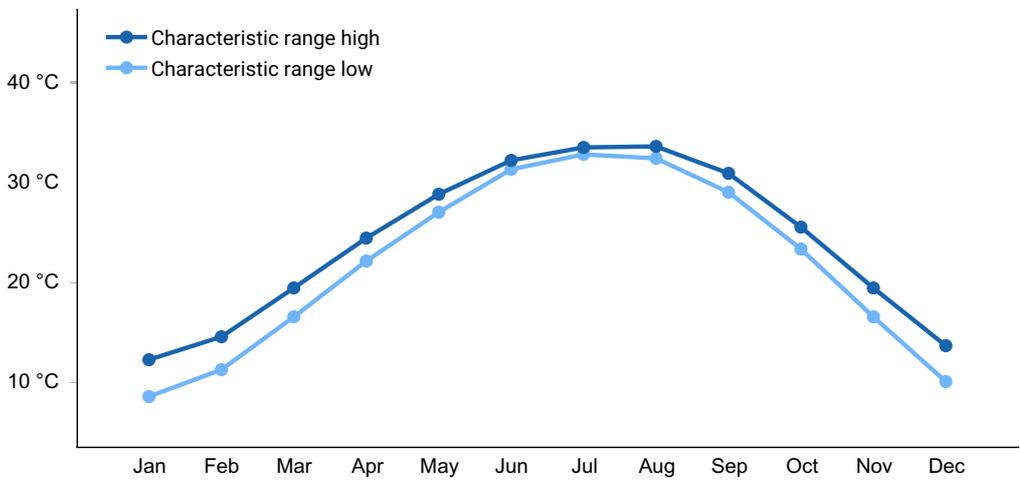
|  |                |
|--|----------------|
| Frost-free period (characteristic range)   | 192-221 days   |
| Freeze-free period (characteristic range)  | 225-248 days   |
| Precipitation total (characteristic range) | 1,321-1,397 mm |
| Frost-free period (actual range)           | 186-223 days   |
| Freeze-free period (actual range)          | 218-251 days   |
| Precipitation total (actual range)         | 1,321-1,422 mm |
| Frost-free period (average)                | 206 days       |
| Freeze-free period (average)               | 236 days       |
| Precipitation total (average)              | 1,372 mm       |



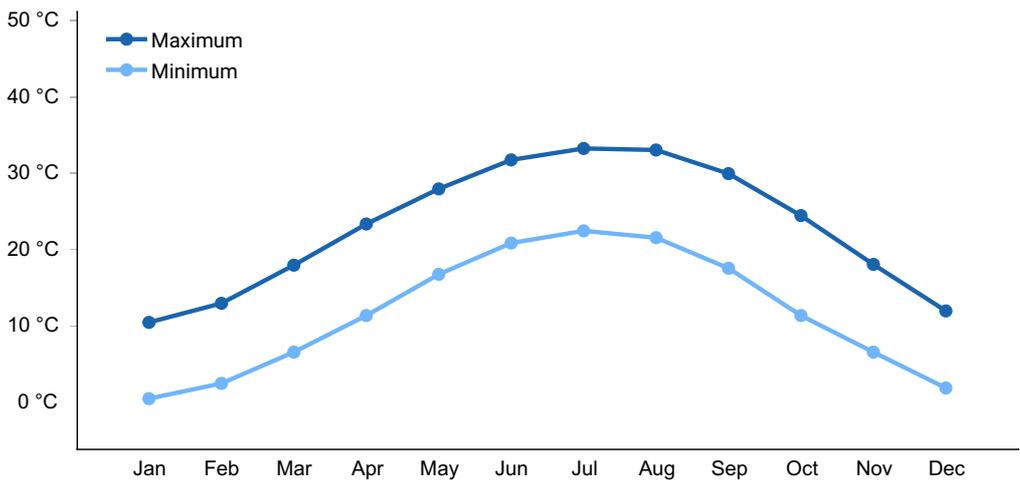
**Figure 2. Monthly precipitation range**



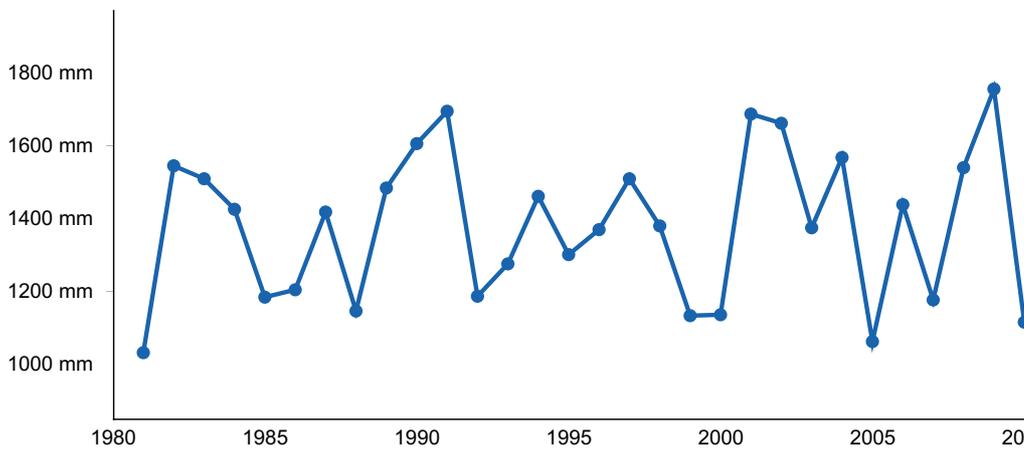
**Figure 3. Monthly minimum temperature range**



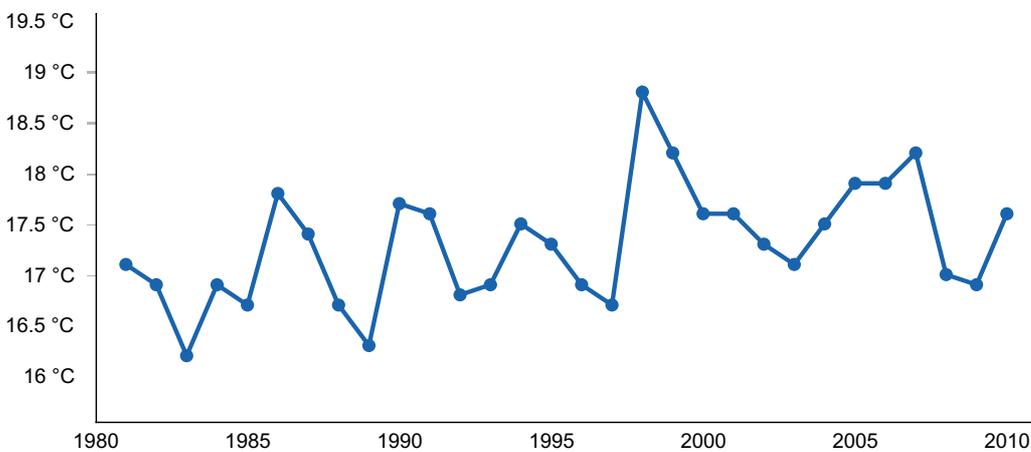
**Figure 4. Monthly maximum temperature range**



**Figure 5. Monthly average minimum and maximum temperature**



**Figure 6. Annual precipitation pattern**



**Figure 7. Annual average temperature pattern**

## Climate stations used

- (1) ST JOSEPH 3 N [USC00168163], Newellton, LA
- (2) STONEVILLE EXP STA [USC00228445], Leland, MS
- (3) CARUTHERSVILLE [USC00231364], Caruthersville, MO
- (4) TUNICA 2 N [USC00228998], Tunica, MS

## Influencing water features

These sites are influenced by the whole of the Mississippi River watershed above their current location. They are directly impacted by flooding on a regular basis.

## Soil features

Please note that the soils listed in this section may not be all-inclusive. There may be additional soils that fit the site's concepts. Additionally, the soils that provisionally form the concepts of this site may occur elsewhere, either within or outside of the MLRA and may or "may not" have the same geomorphic characteristics or support similar vegetation. Some soil map units and soil series included in this "provisional" ecological site were used

as a “best fit” for a particular soil – landform catena during a specific era of soil mapping, regardless of the origin of parent material or the location of MLRA boundaries. Therefore, the listed soils may not be typical for MLRA 131A or a specific location, and the associated soil map units may warrant further investigation in a joint ecological site inventory – soil survey project. When utilizing this provisional description, the user is encouraged to verify that the area of interest meets the appropriate ecological site concepts by reviewing the soils, landform, vegetation, and physical location. If the site concepts do not match the attributes of the area of interest, please review the Similar or Associated Sites of this description to determine if another site may be a better fit for your area of interest.

There is no one modal soil series for this site as this site is composed of miscellaneous areas of “Riverwash”, loamy udorthents, and "Alluvial soils". "Alluvial land" or "Alluvial soils" is a miscellaneous land type. No official series were described. It was originally mapped as unclassified alluvial soils. It lies between the Mississippi River and its levees. It consists of mainly nearly level, poorly drained to excessively drained soils that are forested and frequently flooded. The dominant soils are of the Commerce, Crevasse, Robinsonville, Newellton, Sharkey and Tunica series. The soils, however, were mapped together and are shown on the detailed map as one unit Alluvial land.

The texture of the surface soils ranges from loamy sand to clay. Though the soils are mostly nearly level (0 to 3 percent slopes), there are more strongly sloping areas along stream escarpments. Overflows from the Mississippi River frequently cover the soils for long periods in spring and early summer.

Commerce (fine-silty, mixed, superactive, nonacid, thermic Fluvaquentic Endoaquepts) soils are very deep, somewhat poorly drained soils that formed in loamy alluvium on the intermediate backslope positions on natural levees and on low ridges of meander scrolls in recent Mississippi River meander belts. Dominant slope gradient is between 0 and 2 percent, but may range to a high of 3 percent on undulating meander scroll ridges. Permeability is moderate to slow, and runoff is medium to slow. Commerce soils can have a perched saturated zone above the clayey layers at 1.5 to 4 feet below the surface in winter through spring and also have saturated layers beneath them. Reaction in Commerce soils are slightly to moderately alkaline from the surface through the subsoil.

Crevasse (mixed, thermic Typic Udipsamments) soil series occurs on splays, mainly along natural levee breaks, and recently deposited sediment on point bars along the main channel of the Mississippi River and its tributaries. Slopes range from 0 to 5 percent. Crevasse soil has low fertility. Water and air move through this soil at a rapid rate. Water runs off the surface slowly. This soil dries quickly after rains. A seasonal high water table is at a depth of about 3.5 to 6.0 feet during November through March, however, it is strongly influenced by river levels and will be higher when the river level is up. This soil has low shrink-swell potential. Adequate water is not available to plants during dry periods in summer and in the fall of most years. The surface layer is very strongly acid, the upper part of the underlying material is slightly acid, and the middle and lower parts of the underlying material are mildly alkaline. These soils can be flooded when in the point bar

positions and protected in the levee breach positions.

Newellton (clayey over loamy, smectitic over mixed, superactive, nonacid, thermic Fluvaquentic Epiaquepts) occurs on lower positions on younger, more recent natural levees. Newellton soils are transitional soils that formed with a 14- to 20-inch clay cap overlying loamy sediments on summits of low recent natural levees and meander scroll ridges, as well as the toe slopes of higher recent natural levees and meander scroll ridges before grading into the clayey backswamps and swales. Newellton soils are somewhat poorly drained, with slow permeability in the upper clayey horizons, and moderate or moderately slow permeability in the lower loamy horizons. Runoff is medium to high, depending on steepness of slope (up to 5 percent). These soils are wet in the surface layers and wet in the loamy layers below a depth of 1 to 3 feet during winter and spring. The clayey subsoil is not saturated for significant periods of time. Reaction ranges from moderately acid to moderately alkaline throughout the profile.

Robinsonville (coarse-loamy, mixed, superactive, nonacid, thermic Typic Udifluvents) soils are very deep, well drained soils that formed in loamy alluvium on natural levees and meander scroll ridges in recent Mississippi River meander belts. Dominant slope gradient is between 1 and 3 percent with the many undulating meander scroll ridges. Permeability is moderate to moderately rapid and runoff is slow. Robinsonville soils have a water table between 4 to 6 feet deep. Reaction in the Robinsonville soils in the surface ranges from moderately through slightly acid, with the subsoil ranging from slightly acid through moderately alkaline. Robinsonville soils have less than 18 percent clay in the particle size control section.

Sharkey (very-fine, smectitic, thermic Chromic Epiaquepts) soils are very deep, poorly drained, and have a perched water table at the surface during wet periods of the year, generally winter into spring. They formed in clayey alluvium on level to concave surfaces. Sharkey soils are often mapped on multiple landforms and positions including broad level backswamps, natural levee toeslopes, meander scroll swales, and abandoned channels. Dominant slope gradient is between 0 and 1 percent but may range to a high of 3 percent. Permeability is slow, and runoff is slow to very slow with some areas receiving overland flow from adjacent sites. The seasonally high water table perches at the surface to 15 cm (6 in). These soils are flooded and ponded frequently up to very long durations. The subsoil stays moist in normal years but will dry out enough to form intersecting slickensides.

**Table 4. Representative soil features**

|                 |  |
|-----------------|--|
| Parent material | (1) Alluvium                                 |
| Surface texture | (1) Clay<br>(2) Loamy sand<br>(3) Silty clay |
| Drainage class  | Poorly drained to excessively drained        |

|  |                    |
|--|--------------------|
| Permeability class                                       | Very slow to rapid |
| Soil depth   | 203 cm             |
| Surface fragment cover <=3"                              | 0%                 |
| Surface fragment cover >3"                               | 0%                 |
| Available water capacity<br>(Depth not specified)        | 4.06–20.32 cm      |
| Calcium carbonate equivalent<br>(Depth not specified)    | 0–3%               |
| Electrical conductivity<br>(Depth not specified)         | 0–3 mmhos/cm       |
| Sodium adsorption ratio<br>(Depth not specified)         | 0–1                |
| Soil reaction (1:1 water)<br>(Depth not specified)       | 4.8–6.5            |
| Subsurface fragment volume <=3"<br>(Depth not specified) | 0%                 |
| Subsurface fragment volume >3"<br>(Depth not specified)  | 0%                 |

## Ecological dynamics

The Batture subregion has a long history of various land uses and landform modifications. Today, more than 90% of this area remains wooded, mainly with oak, gum, cottonwood, cypress, pecan, and willow. The few cleared areas are used for corn, cotton, soybeans, and pasture.

Klimas (1988) conducted one of the most complete and exhaustive treatments of the Batture of any researcher within the Mississippi River Valley. The following is a summarization of his direct observations as reported in the 1988 report, mostly provided verbatim with minor updates to current taxonomy and grammatical edits.

Tree species characteristic of the leveed floodplain segment between Baton Rouge and Memphis include Nuttall oak (*Quercus texana*) and cedar elm (*Ulmus crassifolia*). Silver maple (*Acer saccharinum*), bitternut hickory (*Carya cordiformis*), shellbark hickory (*Carya laciniosa*), and black walnut (*Juglans nigra*) are largely restricted to sites north of Memphis.

Shrub density and diversity vary primarily with soil moisture (shrub concentrations can be quite low in some cypress-tupelo or overcup oak-water hickory forest types or in swales) soil development or lack of disturbance. New bar deposits and heavily sedimented areas rarely support shrubs. The richest shrub communities are found in late-successional sweetgum-oak stands where species such as northern spicebush (*Lindera benzoin*),

possumhaw (*Ilex decidua*), and pawpaw (*Asimina triloba*) are common understory components.

Vine abundance and diversity tend to be greatest at mid-successional stages (sycamore-sweetgum-elm and hackberry-elm-ash). Most black willow and cypress-tupelo stands have few vines. Many vine species considered valuable for wildlife such as greenbrier (*Smilax* spp.) and grape (*Vitis* spp.) are largely restricted to the central and northern portions of the study area, although eastern poison ivy (*Toxicodendron radicans*) is ubiquitous, occurring in nearly all habitats.

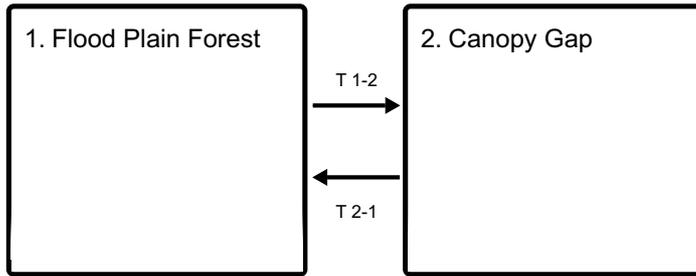
Ground-cover vegetation varies seasonally as well as with successional stage, soil moisture, and latitude. Many sites support an early summer flora dominated by one or several herbaceous species such as bedstraw (*Galium aparine*), Canadian woodnettle (*Laportea canadensis*), oneseed bur cucumber (*Sicyos angulatus*), or dayflower (*Commelina* spp.) By late summer most areas have a much more diverse ground cover, often including widespread species such as jumpseed (*Polygonum virginianum*), aster (*Symphyotrichum* spp.), sedge (*Carex* spp.), and a wide variety of vines. Total ground cover tends to be lowest in cypress-tupelo, overcup oak-water hickory, and sweetgum-oak stands, probably because of excessive moisture in the first two and a lack of light due to dense understory and overstory cover in the latter. Mid-successional stages (e.g. sycamore-sweetgum-elm, hackberry-elm-ash and cottonwood-willow types) often have a very dense ground cover, except where a dense subcanopy, usually of sugarberry (*Celtis laevigata*), has developed.

Certain special habitats tend to show consistent patterns of forest community structure and diversity. Overall species richness is often high near the confluence of tributary streams and the Mississippi River. Overcup oak (*Quercus lyrata*) and bald cypress (*Taxodium distichum*) are commonly associated with oxbow lakes, and other oak (*Quercus*) species are often present. Similarly, floodplain stands near bluffs frequently have a diverse tree flora. Such locations are habitats that support swamp chestnut oak (*Quercus michauxii*) and are the primary locations for cherrybark oak (*Quercus pagoda*), bitternut hickory (*Carya cordiformis*), shellbark hickory (*Carya laciniosa*), and black walnut (*Juglans nigra*). Diversity is particularly high on tributary and bluff-associated locations that show no evidence of having been cleared for agriculture. Where farming has occurred in the past, these areas frequently include water oak (*Quercus nigra*) and sweetgum (*Liquidambar styraciflua*) as major components.

River islands are unique habitats in several respects. They show the direct influence of the river in that they are geomorphically dynamic. Accretion zones on the downstream end of islands show classic patterns of forest community zonation. New deposits often support dense stands of sandbar willow (*Salix interior*), black willow (*Salix nigra*), and eastern cottonwood (*Populus deltoides*). Interior to these younger pioneer stands are even-aged mostly black willow stands, and on older, higher sites, mostly black willow is found.

# State and transition model

## Ecosystem states



**T 1-2** - Wind or water Force causing canopy gaps.

**T 2-1** - Regeneration of natural species.

## State 1

### Flood Plain Forest

The Batture subregion of MLRA 131A includes the landscape directly impacted by current Mississippi River. This Ecological Site Concept is developed to capture all soils mapping that is too broad or inconsistent to be linked to a specific Ecological site. If this Ecological site is linked to a soil component the mix of hardwood species that would be found on the location can only be determined by an onsite investigation.

## State 2

### Canopy Gap

This state consists of forest canopy openings that are created by catastrophic disturbances, allowing sunlight to reach understory strata and ground surfaces. Depending on local conditions and disturbance regime and intensity, a continuum or range of successional stages and community structure (physiognomy) is represented. Provisionally, this state includes seral stages ranging from recent disturbances that consist mainly of sparse herbaceous cover over mostly bare soil to the regeneration of woody species among a dense herbaceous cover (early stand initiation stage) to the initial stem exclusion stage where woody growth overtops and shades out the herbaceous stratum. In future ecological site development efforts, multiple community phases that describe the composition and progression from one stage to the next may be warranted for specifying management strategies and actions.

## Transition T 1-2

### State 1 to 2

Wind or water force causing canopy gaps.

## Restoration pathway T 2-1

## State 2 to 1

Regeneration of natural species.

### Other references

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## **Acknowledgments**

We would like to express our appreciation to the MLRA 131A Technical Team for their assistance and input in the development of this document. With special recognition of Tom Foti, Arkansas Natural Heritage Program and Henry Langston, Arkansas Dept. of

Transportation for their time, travel and knowledge assisting members of the team with field reconnaissance of several sites and assistance in verifying ecological factors. Emile S. Gardiner, Research Forester, Forest Service, Center for Bottomland Hardwoods Research, for nautical support and locating batture locations to improve the understanding of the dynamics of the batture region. Charles Klimas for the body of work and inventory of the Batture region of the Mississippi River that provided much of the data utilized to develop these site concepts.

## Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

|   |                   |
|---|-------------------|
| Author(s)/participant(s)                    |                   |
| Contact for lead author                     |                   |
| Date  | 03/26/2026        |
| Approved by                                 | Charles Stemmans  |
| Approval date                               |                   |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

---

6. **Extent of wind scoured, blowouts and/or depositional areas:**

---

7. **Amount of litter movement (describe size and distance expected to travel):**

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are**

expected to show mortality or decadence):

---

14. **Average percent litter cover (%) and depth ( in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**

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