Ecological site F131AY606MS
Batture - Frequently Flooded Pointbars, Sandbars, and Splays

Last updated: 6/10/2025
Accessed: 08/30/2026

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; Rittenour 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 will be the most unstable of the Batture sites. It occurs on point bar and crevasse splays. The texture of the surface soils ranges from loamy sand to sand and are generally excessively drained. Overflows from the Mississippi River frequently cover the soils for long periods in spring and early summer. The sandy deposits when dry will move by wind but are frequently flooded so they are often reworked by the river. Species composition will include sandbar willow (Salix interior), black willow (Salix nigra), and eastern cottonwood (Populus deltoides). It is often found adjacent to the river and will have little to no surface accumulation of litter or organic matter. 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 flooding by constructed levees or natural features.

Associated sites

F131AY604MS	**Batture - Frequently Flooded Moderately Wet Low Ridge Forest** Could be found adjacent to this site where a low ridge is and no longer subject to frequent flooding.
F131AY605MS	**Batture - Frequently Flooded Natural Levee and Ridge Forest** Could be found adjacent to this site where a high natural levee or ridge is and no longer subject to frequent flooding.

Similar sites

F131AY407LA	**Tensas Basin - Pointbars, Sandbars, and Splays** This site will be in a similar landscape position within the protected side of the levee in the Tensas Basin of the MLRA.
F131AY505LA	**Delta Plain - Pointbars Sandbars and Splays** This site will be in a similar landscape position within the protected side of the levee in the Delta Basin of the MLRA.

Table 1. Dominant plant species

Tree	(1) *Salix nigra* (2) *Salix interior*
Shrub	(1) *Xanthium strumarium* (2) *Eupatorium serotinum*
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 > Bar (2) Alluvial plain > Flood plain (3) Alluvial plain > Point bar
Runoff class	Medium to very high

Flooding duration	Extremely brief (0.1 to 4 hours) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	0 – 90 m
Slope	0 – 10 %
Water table depth	150 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)	190-220 days
Freeze-free period (characteristic range)	230-250 days
Precipitation total (characteristic range)	1,320-1,400 mm
Frost-free period (actual range)	190-220 days
Freeze-free period (actual range)	220-250 days
Precipitation total (actual range)	1,320-1,420 mm
Frost-free period (average)	210 days

Freeze-free period (average)	240 days
Precipitation total (average)	1,370 mm

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

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. This site is typically adjacent to the River, is impacted by surface water, and from internal flow.

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.

The modal soil series for this site is Crevasse. Additional soils included in the concept are Bruno and Udipsamments.

The texture of the surface soils ranges from loamy sand to sand. The soils are mostly nearly level to gently sloping (0 to 5 percent slopes). Overflows from the Mississippi River frequently inundate the soils for long periods in spring and early summer. The soils are excessively drained, and moderate to rapid permeability, with neutral reaction, that formed in alluvium.

The 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 soils have low fertility. Water and air move through this soil at a rapid rate. Water runs off the surface slowly, and the soil dries quickly after rains. A seasonal high water table generally occurs 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 water level is up. 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 are mildly alkaline. These soils can be flooded when in the point bar positions and protected in the levee breech positions.

Bruno (sandy, mixed, thermic Typic Udifluvents) soil series occurs on pointbars and sandbars. Slopes range from 0 to 5 percent.

Figure 8. Soil profile of pointbar accretion in Batture.

Table 4. Representative soil features

Parent material	(1) Alluvium

Surface texture	(1) Fine sand (2) Fine sandy loam (3) Loamy fine sand (4) Loamy sand (5) Sand (6) Sandy loam (7) Silt loam
Drainage class	Excessively drained
Permeability class	Moderate to rapid
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (Depth not specified)	4.06 – 8.89 cm
Soil reaction (1:1 water) (Depth not specified)	6.8 – 7.9
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

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.

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Klimas 1988 provides a description of a unique feature that would fit this site concept, he states. "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 pioneer stands are even-aged black willow stands, and on older, higher sites, black willow is found."

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Other references

Aslan, A. and W.J. Autin. 1999. Evolution of the Holocene Mississippi River floodplain, Ferriday, Louisiana: Insights on the origin of fine-grained floodplains. Journal of Sedimentary Research 69: 800-815.

Aslan, A., W. J. Autin, and M. D. Blum. 2005. Causes of river avulsion: insights from the late Holocene avulsion history of the Mississippi River, USA. Journal of Sedimentary Research, 75(4), 650-664.

Autin, W.J., S.F. Burns, B.J. Miller, R.T. Saucier, and J.I. Snead. 1991. Quaternary geology of the Lower Mississippi Valley. p. 547-582. In R.B. Morrison (Editor). Quaternary Nonglacial Geology: Conterminous U.S. Geological Society of America. The Geology of North America, Volume K-2. Boulder, CO.

Autin, W. J. 1996. Pleistocene stratigraphy in the southern Lower Mississippi Valley. Engineering Geology, 45(1), 87-112.

Blum, M.D., M.J. Guccione, D.A. Wysocki, P.C. Robnett, and E.M. Rutledge. 2000. Late Pleistocene evolution of the lower Mississippi River valley, southern Missouri to Arkansas. Geological Society of America Bulletin, 112(2), 221-235.

Broadfoot, Walter M. 1976. Hardwood suitability for and properties of important midsouth soils. Res. Pap. SO-127. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 84 p.

Brown, D. A., V. E. Nash, A. G. Caldwell, L. J. Bartelli, R. C. Carter, and O. R. Carter. 1970. A monograph of the soils of the southern Mississippi River Valley alluvium. Southern Cooperative Series Bulletin, 178, 112.

Chapman, S.S, G.E. Griffith, J.M. Omernik, J.A. Comstock, Beiser, M.C., and D. Johnson. 2004. Ecoregions of Mississippi, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. US Fish and Wildlife Service FWS/OBS, 79(31), 131.

Cowdrey, A. E. 1977. Land’s End: A history of the New Orleans District. US Army Corps of Engineers, and Its Lifelong Battle with the Lower Mississippi and Other Rivers Wending Their Way to the Sea.

Daigle, J.J., G.E. Griffith, J.M. Omernik, P.L. Faulkner, R.P. McCulloh, et al. 2006. Ecoregions of Louisiana (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,000,000).

Elliott, D.O. 1932. The Improvement of the Lower Mississippi River for Flood Control and Navigation. Volume 1. U.S. Waterways Experiment Station, Vicksburg, MS.

Ezell, A.W. 2016. Evaluating high-graded hardwood stands. Publication-Cooperative Extension Service, Mississippi State University (USA).

Fisk, H. N. 1944. Geological investigation of the alluvial valley of the lower Mississippi River: US Dept. Army, Mississippi River Comm.

Foti, T., C. Klimas, J. Pagan, and A. Keister. 2011. Potential natural vegetation of the Mississippi Alluvial Valley: Tensas Basin, Northeastern Louisiana. U.S. Fish and Wildlife Service, Lower Mississippi Valley Joint Venture; Vicksburg, MS.

Gardiner, E. S., and J. M. Oliver. 2005. Restoration of bottomland hardwood forests in Lower Mississippi Aluvial Valey, USA. In: Stanturf, JA; Madsen, P. eds. Restoration of boreal and temperate forests. Restoration of bottomland hardwood forests in the Lower Mississippi Alluvial Valley, USA Boca Raton, FL: CRC Press. 235-251.

Grigar, J., J.L. Hatfield, and R. Reeder, 2018. Transitional no-till: What is it and how does it differ from ‘true’no-till?. Crops and Soils 51, no. 6:28–36.

Kemp, K. 2000. The Mississippi Levee System and the Old River Control Structure. Available online: http://www.tulane.edu/~bfleury/envirobio/enviroweb/FloodControl.htm. Accessed 11/2018

Klimas, C.V. 1988. Forest vegetation of the leveed floodplain of the lower Mississippi River. Lower Mississippi River Environmental Program Report 11. US Army Corps of Engineers. Vicksburg, Mississippi.

Klimas, C., J. Pagan, T. Foti, and B. Tirpak. 2011. Potential natural vegetation of the Mississippi Alluvial Valley: Yazoo Basin, Mississippi. U.S. Fish and Wildlife Service, Lower Mississippi Valley Joint Venture; Vicksburg, MS.

Lentz, G. H. 1928. Summary of First Year's Hardwood Investigations in Louisiana. US Forest Service and Louisiana Division of Forestry

Lentz, G. H. 1929. Summary of First Year's Hardwood Investigations in Louisiana. Journal of Forestry, 27(5), 486-494.

McKnight, J.S., D.D. Hook, O.G. Langdon, and R.L. Johnson. 1981. Flood tolerance and related characteristics of trees of the bottomland forests of the southern United States. In Developments in Agricultural and Managed Forest Ecology. 11, pp. 29-69. Elsevier. https://www.srs.fs.usda.gov/pubs/ja/1980/ja_1980_mcknight_001.pdf (accessed 12 Oct. 2018)

[NCDC] National Climatic Data Center. 2018. Climate of Mississippi. Available https://www.ncdc.noaa.gov/climatenormals/clim60/states/Clim_MS_01.pdf. (Accessed: 22 May 2018).

Putnam, J. A., and H. Bull. 1932. The trees of the bottomlands of the Mississippi River Delta Region. US Department of Agriculture, Forest Service, Southern Forest Experiment Station, Occasional Paper, 27, 207.

Rittenhour, T.M., M.D. Blum, and R.J. Goble. 2007. Fluvial evolution of the Lower Mississippi River Valley during the last 100 k.y. glacial cycle: Response to glaciation and sea-level change. Geological Society of America Bulletin 119(5-6): 586-608.

Rogers, D. 2005. Evolution of the levee system along the Lower Mississippi River. University of Missouri-Rolla: Rolla, MO, USA. https://web.mst.edu/~rogersda/levees/Evolution%20of%20the%20Levee%20System%20Along%20the%20Mississippi.pdf. Accessed 10/2018.

Saucier, R. T. 1974. Quaternary geology of the lower Mississippi Valley (No. 6). Arkansas Archeological Survey.

Saucier, Roger T. 1994. Geomorphology and Quaternary Geologic History of the Lower Mississippi Valley, Volumes I & II. U.S. Army Corps of Engineers, Vicksburg, MS. (Available online: http://biotech.law.lsu.edu/climate/mississippi/sausier/sausier.htm)

Schumm, S. A., and W. J. Spitz. 1996. Geological influences on the Lower Mississippi River and its alluvial valley. Engineering Geology, 45(1-4), 245-261.

Shen, Z., T.E. Tornqvist, W.J. Autin, Z.R.P. Mateo, K.M. Straub, and B. Mauz. 2012. Rapid and widespread response of the Lower Mississippi River to eustatic forcing during the last glacial-interglacial cycle. Geological Society of America Bulletin 124(5-6): 690-704.

Smith, R.D. and C. Klimas. 2002. A regional guidebook for applying the hydrogeomorphic approach to assessing wetland functions of selected regional wetland subclasses, Yazoo Basin, Lower Mississippi River Alluvial Valley. ERDC/EL TR-02-4, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Theriot, R. F. 1992. Flood tolerance of plant species in bottomland forests of the southeastern United States. Ph.D. diss. University of Florida. Available online: http://ufdc.ufl.edu//AA00003281/00001

Turner, S., J. Welch, and N. Musso. 2010. The Atchafalaya National Heritage Area, Selected Level 0 Cultural Landscape Assessments. Suzanne Turner Associates LLC. Available online: http://www.atchafalaya.org/ckfinder/userfiles/files/CLA-Final.pdf

Tye, R. S., and J. M. Coleman. 1989. Depositional processes and stratigraphy of fluvially dominated lacustrine deltas: Mississippi delta plain. Journal of Sedimentary Research, 59(6).

[USACE] U.S. Army Corps of Engineers. 2004. Louisiana Coastal Area Comprehensive Coastwide Ecosystem Restoration Study. U.S. Army Corps of Engineers, New Orleans, LA. Available online: https://www.lca.gov/Library/ProductList.aspx?Prodtype=0&folder=1118.

[USACE] United States Army Corps of Engineers. 2017. The Mississippi Drainage Basin. U.S. Army Corps of Engineers, New Orleans District Website. Available: https://www.mvn.usace.army.mil/Missions/Mississippi-River-Flood-Control/Mississippi-River-Tributaries/Mississippi-Drainage-Basin/ (Accessed: 2017).

[USACE] U.S. Army Corps of Engineers. Atchafalaya Basin Project, Brochure, http://www.mvn.usace.army.mil/Portals/56/docs/PAO/Brochures/AtchafalayaBasinProject.PDF (accessed 12 Oct. 2018)

[USDA-NRCS] United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. US Department of Agriculture Handbook, 296.

[USDA, SCS] USDA, Soil Conservation Service. 1968. Soil Survey Interpretations for Woodland in the Southern Mississippi Valley Alluvium Area of LA MS AR TN MO and KY, Progress Report.

[USDA-NRCS] United States Department of Agriculture, Natural Resources Conservation Service. 2022. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture, Agriculture Handbook 296.

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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	08/30/2026

Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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

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

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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:**
