Ecological site F134XY020AL
Northern Wet Alluvial Flat - PROVISIONAL

Accessed: 04/23/2024

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): 134X–Southern Mississippi Valley Loess

The Southern Mississippi Valley Loess (MLRA 134) extends some 500 miles from the southern tip of Illinois to southern Louisiana. This MLRA occurs in Mississippi (39 percent), Tennessee (23 percent), Louisiana (15 percent), Arkansas (11 percent), Kentucky (9 percent), Missouri (2 percent), and Illinois (1 percent). It makes up about 26,520 square miles. Landscapes consist of highly dissected uplands, level to undulating plains, and broad terraces that are covered with a mantle of loess. The soils, mainly Alfisols, formed in the loess mantle. Stream systems of the MLRA typically originate as low-gradient drainageways in the upper reaches that broaden rapidly downstream to wide, level floodplains with highly meandering channels. Alluvial soils are predominantly silty where loess thickness of the uplands are deepest but grade to loamy textures in watersheds covered by thin loess. Underlying the loess mantle are Tertiary deposits of unconsolidated sand, silt, clay, gravel, and lignite. Crowley's Ridge, Macon Ridge, and Lafayette Loess Plains are discontinuous, erosional remnants that run north to south in southeastern Missouri - eastern Arkansas, northeastern Louisiana, and south-central Louisiana, respectively. Elevations range from around 100 feet on terraces in southern Louisiana to over 600 feet on uplands in western Kentucky. The steep, dissected uplands are mainly in hardwood forests while less sloping areas are used for crop, pasture, and forage production (USDA-NRCS, 2006).

This site is of large extent in MLRA 134 with a core distribution in the Loess Plains (EPA Level IV Ecoregion: 74b) from western Kentucky to the Southern Rolling Plains (EPA Level IV Ecoregion: 74c) in southwestern Mississippi. The site extends into the adjoining Southern Coastal Plain, MLRA 133A to the east.

Classification relationships

All or portions of the geographic range of this site falls within a number of ecological/land classifications including:
-NRCS Major Land Resource Area (MLRA) 134 – Southern Mississippi Valley Loess (USDA-NRCS, 2006)
-Environmental Protection Agency's Level IV Ecoregion: Loess Plains, 74b (Griffith et al., 1998; Woods et al., 2002; Chapman et al., 2004)
-231H - Coastal Plains-Loess section of the USDA Forest Service Ecological Subregion (McNab et al., 2005)
-LANDFIRE Biophysical Setting 4514730 Gulf and Atlantic Coastal Plain Floodplain Systems (LANDFIRE, 2008)
- East Gulf Coastal Plain Small Stream and River Floodplain Forest CES203.559 (NatureServe, 2012)
- East Gulf Coastal Plain Large River Floodplain Forest CES203.489 (NatureServe, 2012)
-Western Mesophytic Forest Region - Mississippi Embayment Section (Braun, 1950)
-Low-gradient Riverine Wetlands (Wilder and Roberts, 2002)

Ecological site concept

The Northern Wet Alluvial Flat belongs to an intricate complex of floodplain ecological sites that developed from the fluvial dynamics of low-gradient, sinuous riverine systems. Soils that define the site are very deep, poorly drained, and formed in silty or loamy alluvium. Soil reactions range from very strongly acid to strongly acid throughout all horizons. Except for areas that remain ponded and flooded for the majority of the year, this site occupies the wettest and lowest position of the floodplain environment. Flooding ranges from rare to frequent during winter and spring,

and duration is brief to very long depending on stream and drainage basin size and flood magnitude. Outside of flood events, a seasonal high water table generally occurs at or within one foot of the surface during wet seasons. Slope gradients are mostly less than 1 percent but may range to 2 percent. On broader, complex floodplains, this site often first appears as shallow depressions, linear relict channels, and overwash channels within and across better drained portions of the floodplain. Deeper into the floodplain, this site often occupies broad areas and is often pocked with a complex of linear sloughs and backswamps. Natural vegetation is mainly comprised of hydrophytes, which often includes an overstory of willow oak, overcup oak, water hickory, green ash, and an occasional water tupelo and bald cypress in wetter spots. Understory cover is generally low to sparse and is often represented by planertree, Virginia sweetspire, buttonbush, lizard's tail, green arrow arum, and wetland obligate graminoids.

Associated sites

F134XY018AL	**Northern Alluvial Flat - PROVISIONAL**
F134XY019AL	**Northern Moderately Wet Alluvial Flat - PROVISIONAL**
F134XY021AL	**Northern Backswamp - PROVISIONAL**

Similar sites

F134XY302LA	**West Central Swales/Depressions Wet Flats - PROVISIONAL**
F134XY301LA	**West Central Flooded Swales And Depressions And Flood Plains - PROVISIONAL**
F134XY101MS	**Southern Rolling Plains Loess Drainways - PROVISIONAL** This site is the southern counterpart to the Northern Wet Alluvial Flat.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Northern Wet Alluvial Flat is broadly distributed across the largest physiographic subsection or ecoregion of the MLRA, the Loess Plains. West to east, this ecological site extends from the border of the Loess Hills (EPA Level IV Ecoregion: 74a), across the Loess Plains, and into portions of the Southeastern Plains (EPA Level III Ecoregion: 65) where loess continues to cap old fluvial terraces and broad valleys. North to south, the site extends from the plains in western Kentucky to the border of the Southern Rolling Plains in southwestern Mississippi. The latter forms the southern-most boundary of the site due to warmer average annual air temperatures, greater annual rainfall, and a transition to slightly warmer soils (Chapman et al., 2004).

Characteristics of this region generally include undulating uplands, gently rolling hills, and irregular plains. Topographic relief of the Loess Plains is generally low, averaging about 30 to 70 feet. Upland slopes typically range from 0 to 20 percent with 1 to 8 percent being dominant. Elevations in the range of 300 to 400 feet are commonplace to the south but increase to nearly 600 feet in the north. In portions of western Kentucky and Tennessee, the undulating pattern of the plains is interrupted by dissected landscapes. Such areas tend to be hillier with steeper slopes and greater relief and appear to be concentrated along the borders of broader valleys and floodplains. As the plains continue eastward, starkness of the terrain becomes even more pronounced, which signals the transition of the Loess Plains to the thin loess-capped ridges, hills, and plateaus along the western edge of the Southeastern Plains. To the south, through much of Mississippi, the Loess Plains consists of a very thin east – west belt, compressed between the dissected Loess Hills and Mississippi Alluvial Plain to the west and the Coastal Plain to the east. The convergence of such contrasting ecoregions contribute to a very complex pattern of soils, landforms, and vegetation communities.

This site occurs on level to nearly level alluvial flats and within localized, shallow depressions that are often pocked throughout the better drained areas of narrow to broad floodplains. The site may also be viewed as a transitional zone between the "moderately wet alluvial flats" (which are defined by somewhat poorly drained soils) and the

wettest and most diagnostic feature of the southeastern floodplain, the cypress – tupelo backswamp. On complex, large floodplains that are still connected with their meandering channels, this site is often associated with oxbow lakes and linear sloughs. This site is seldom present in small, narrow floodplains, but where it does occur, it often forms linear bands that are parallel to the stream's course.

The influences of aspect are negligible in this site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Flood plain (3) Depression
Flooding duration	Very long (more than 30 days)
Flooding frequency	None to frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	75–500 ft
Slope	0–2%
Ponding depth	0–45 in
Water table depth	0–12 in
Aspect	Aspect is not a significant factor

Climatic features

This site falls under the Humid Subtropical Climate Classification (Koppen System). The average annual precipitation for this site from 1980 through 2010 is 56 and ranges from 53 in the north to 58 inches in the south. Maximum precipitation occurs in winter and spring and precipitation decreases gradually throughout the summer, except for a moderate increase in midsummer. Rainfall often occurs as high-intensity, convective thunderstorms during warmer periods but moderate-intensity frontal systems can produce large amounts of rainfall during winter, especially in the southern part of the area. Snowfall generally occurs in the north during most years. However, accumulations are generally less than 12 inches and typically melt within 3 to 5 days. South of Memphis, winter precipitation sometimes occurs as freezing rain and sleet. The average annual temperature is 60 degrees F and ranges from 58 in the north to 64 degrees F in the south. The freeze-free period averages 222 days and ranges from 206 days in the north to 252 days in the south. The frost free period averages 197 days and ranges from 191 in the north to 224 days in the south.

The broad geographic distribution of this site north to south naturally includes much climatic variability with areas farther south having a longer growing season and increased precipitation. These climatic factors likely lead to important differences in overall plant productivity and key vegetation components between the southern and northern portions of this site. As future work proceeds, the current distribution of this site will likely be revised with a "central" site interjected between the northern and southern extremes of this MLRA.

Table 3. Representative climatic features

Frost-free period (average)	197 days
Freeze-free period (average)	222 days
Precipitation total (average)	56 in

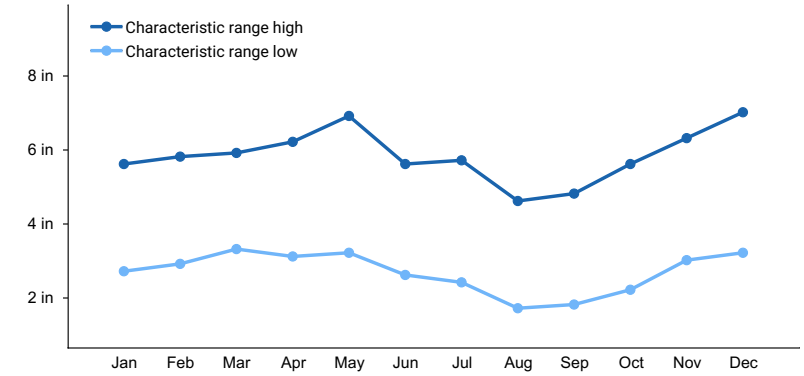


Figure 1. Monthly precipitation range

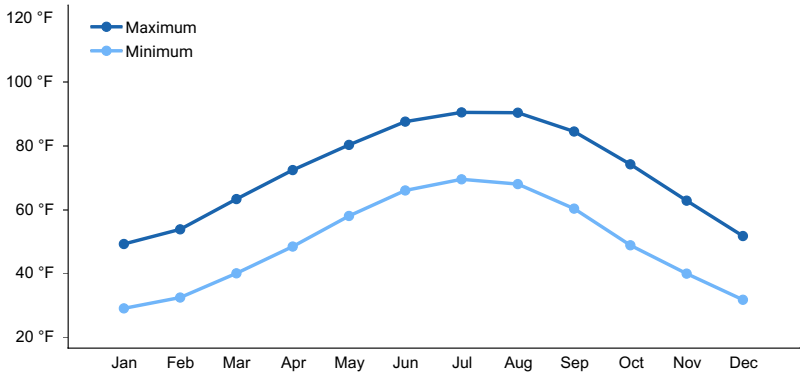


Figure 2. Monthly average minimum and maximum temperature

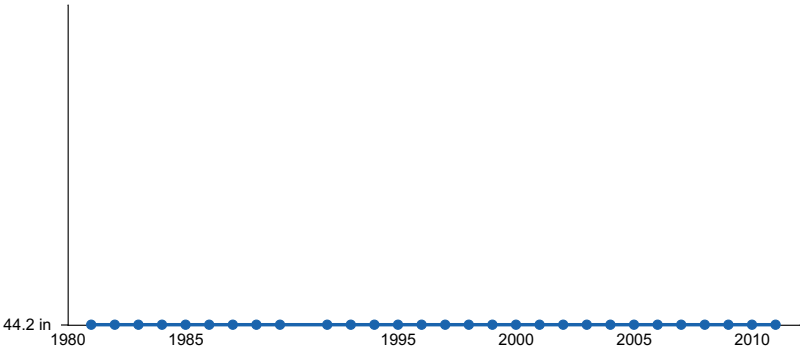


Figure 3. Annual precipitation pattern

Climate stations used

- (1) LOVELACEVILLE [USC00154967], Paducah, KY
- (2) OAKLEY EXP STN [USC00226476], Raymond, MS
- (3) COLLIERVILLE [USC00401950], Collierville, TN
- (4) COVINGTON 3 SW [USC00402108], Covington, TN
- (5) DRESDEN [USC00402600], Dresden, TN
- (6) MURRAY [USC00155694], Murray, KY
- (7) HOLLY SPRINGS 4 N [USC00224173], Holly Springs, MS
- (8) LEXINGTON [USC00225062], Lexington, MS
- (9) MILAN EXP STN [USC00406012], Milan, TN
- (10) BARDWELL 2 E [USC00150402], Bardwell, KY
- (11) GILBERTSVILLE KY DAM [USC00153223], Gilbertsville, KY
- (12) BATESVILLE 2 SW [USC00220488], Batesville, MS
- (13) CANTON 4N [USC00221389], Canton, MS
- (14) GRENADA [USC00223645], Grenada, MS
- (15) SENATOBIA [USC00227921], Coldwater, MS
- (16) VICKSBURG MILITARY PK [USC00229216], Vicksburg, MS

- (17) BOLIVAR WTR WKS [USC00400876], Bolivar, TN
- (18) UNION CITY [USC00409219], Union City, TN
- (19) PADUCAH [USW00003816], West Paducah, KY
- (20) JACKSON INTL AP [USW00003940], Pearl, MS
- (21) BROOKPORT DAM 52 [USC00110993], Paducah, IL
- (22) YAZOO CITY 5 NNE [USC00229860], Yazoo City, MS
- (23) NEWBERN [USC00406471], Newbern, TN

Influencing water features

This site occurs within floodplains of small to large stream systems. Overland flooding occurs over a large percentage of the site's distribution. Flood duration is highly variable and directly dependent upon stream size and watershed position. Narrow floodplains of small streams are typically "flashy" and may flood occasionally to frequently but flooding duration is generally brief. Sites associated with larger streams and large drainage basins may flood frequently and have very long flood duration. Soils of this site are poorly drained and represent the majority of the hydric soils within a given floodplain system. The plant species associated with this site are generally obligate and facultative wetland species. Particularly problematic situations pertain to channelized and leveed stream systems, which deleteriously affects connectivity between the stream and floodplain environment (includes geomorphology, soils, and vegetation communities).

Soil features

Please note that the soils listed in this section of the description 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 134 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 listed in the Supporting Information section of this description to determine if another site may be a better fit for your area of interest.

This site is characterized by very deep, poorly drained soils that formed in silty or loamy alluvium. These level to nearly level soils are typically on wide floodplains but also occur on the wettest position of narrow, stream floodplains. The site is subject to flooding during winter to early spring. Flood duration ranges from brief to very long depending on stream and drainage basin size and flood magnitude. The seasonally high water table is typically less than 12 inches, which often lasts well into the growing season. Soil reactions generally range from strongly acid to very strongly acid.

The principal soils associated with this site include the Rosebloom (Fine-silty, mixed, active, acid, thermic Fluvaquentic Endoaquepts), Waverly (Coarse-silty, mixed, active, acid, thermic Fluvaquentic Endoaquepts), and Bibb (Coarse-loamy, siliceous, active, acid, thermic Typic Fluvaquents) series. Rosebloom soils formed in silty alluvium and have a fine-silty particle-size class. Waverly soils also formed in silty alluvium but have a coarse-silty particle-size class. Bibb soils formed in stratified loamy and sandy alluvium.

Secondary soils of this site include the Amagon (Fine-silty, mixed, active, thermic Typic Endoaqualfs) and Tichnor (Fine-silty, mixed, active, thermic Typic Endoaqualfs) series. Amagon soils formed in loamy alluvium and have more than 15 percent sand coarser than very fine in the upper 20 inches of the argillic horizon. Tichnor soils formed in silty alluvium and have less than 15 percent sand in the Btg horizon (USDA-NRCS, 2016). Of note, both Amagon and Tichnor soils have been mapped in portions of MLRA 134, but they are generally associated with broad, floodplains and terraces of the Southern Mississippi Alluvium (MLRA 131A). They are included here based on their mapped locations within broad floodplains of the Southern Mississippi Valley Loess.

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay loam (3) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.9–8.3 in
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	4.6–5.5
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

This site occurs on level to nearly level alluvial flats and within localized, shallow depressions that are often embedded within the better drained areas of narrow to broad floodplains. The site may also be viewed as a transitional zone between the “moderately wet alluvial flats” (which are defined by somewhat poorly drained soils) and the wettest and most diagnostic feature of the southeastern floodplain, the cypress – tupelo backswamp. For many of the smaller floodplains, this site corresponds to the lowest and wettest position of the system. Within complex, large floodplains that are still connected with their meandering channels, this site is often associated with oxbow lakes, linear sloughs, backswamps, and the moderately wet flats previously mentioned.

A key characteristic of this site pertains to a distinct gradation of soil wetness. When viewed from the perspective of a soil catena, this site lies on or near the wettest end of the floodplain moisture gradient. The only site wetter is the backswamp system that remains flooded or ponded for the greater part of the year. Where the latter exists, this site is generally present along the margins of that landform. The wetness gradient associated with this site is reflected in the plant community it supports. Species intolerant of anaerobic conditions do not occur in this site and are mainly replaced by plants more tolerant of low oxygen environments.

Overstory components may include willow oak, overcup oak, water hickory, green ash, and an occasional water tupelo and bald cypress in wetter spots. The understory and ground cover is generally low to sparse but may be represented by scattered occurrences of planertree, Virginia sweetspire, buttonbush, lizard’s tail, green arrow arum, and wetland obligate graminoids. The lowest and wettest spots may remain bare of vegetation throughout much of the growing season in unusually wet years.

The ecological processes associated with this site include periodic flooding, stand disturbances at varying scales, and natural, stream migration. Given the site’s landform position, periodic flooding is a common and important process of the system. With the exception of back-lying swamps (includes oxbows and sloughs), this site remains flooded and/or ponded for the longest period during the flooding cycle or a given flood event. The effects of flooding can enhance fertility of the soil environment via deposition of new alluvium but can also impact the site by scouring and/or depositing excessive materials. Flood duration is highly variable and directly dependent upon stream size and magnitude of the event. Flood durations of small streams are typically brief and “flashy”, while those of larger

systems can range from long to very long depending on drainage basin size and flood magnitude. The collective effects of the hydrodynamics within this system naturally lead to migration or movement of the stream across its connected landscape, the floodplain. Low-gradient streams generally meander and frequently change course leading to the erosion of a portion of the floodplain with the concomitant deposition and creation of new point bars, levees, and alluvial flats (Wharton et al., 1982; Hodges, 1997; LANDFIRE, 2008).

Forest stand disturbances vary in both size and type for this site. Disturbances range from gap-scale (single tree to small group) to stand-initiating events that are greater than one acre (per Johnson et al., 2009). Smaller gaps or forest openings may result in the release of suppressed understory components, but the greatest response is often ingrowth or expansion of the surrounding canopy (Oliver and Larson, 1990). Understories of long-term, non-disturbed portions of the stand (i.e., complete canopy closure) are typically comprised of shade-tolerant woody and herbaceous species. Larger gaps often consist of heavy, downed woody debris and a dense concentration of shrubs, forbs, vines, and released saplings and young trees. Types of disturbances may include wind, severe ice storms, and beaver. The influence of the latter is perhaps the most dramatic as local hydrologic regimes are dramatically altered leading to wetter soils, different vegetation communities, and a different suite of ecological processes.

The type of succession following a disturbance depends on a number of factors including: the rate of deposition vs. no deposition and flooding or ponding duration (e.g., beaver influences). Heavy deposition onto this site following a stand initiating disturbance may result in the development of a completely different community – one associated with better drained soils (Hodges, 1997). On the extreme end, disturbances resulting in long-term flooding or inundation may result in overstory decline and death. This is very typical of beaver-influenced wetland complexes. Where beaver-induced flooding occurs, overstory decline and death is often followed by a burst in vegetation succession that proceeds through a series of community transformations from open-water to herbaceous – scrub-shrub, and eventually forested wetland. If flooding or inundation remains, a completely different community may develop – one more typical of early successional backswamp systems or long-term, open water stagnation. The latter represents an extreme case where human-altered floodplains intentionally or unintentionally retains water annually with no seasonal drawdown (drawdowns may be natural or designed water control structures).

The type of land use activity and management on this site is generally dependent on flooding frequency and duration. Areas that frequently flood and have long to very long flooding durations are generally in timberland. More intensive land uses such as cropland and pastureland are primarily relegated to areas that occasionally flood and/or have been channelized and leveed (i.e., protected). Due to severe wetness limitations, cropland and pastureland are either not suited or poorly suited for this site (USDA-NRCS, 1997), however many areas continue to be managed for both uses.

There are a few areas that have been set aside in the public and/or private interest (e.g., parks, refuges, natural areas, and forest preserves), and those areas are now heavily forested. With no example of the pre-settlement plant community remaining intact, reference conditions of this site have been arbitrarily chosen to reflect the native plant species that most frequently occur and that influence the overall structure and characteristics of maturing stands. Locations that offer an opportunity to examine these “surrogate” reference conditions are relegated to those public and private land holdings.

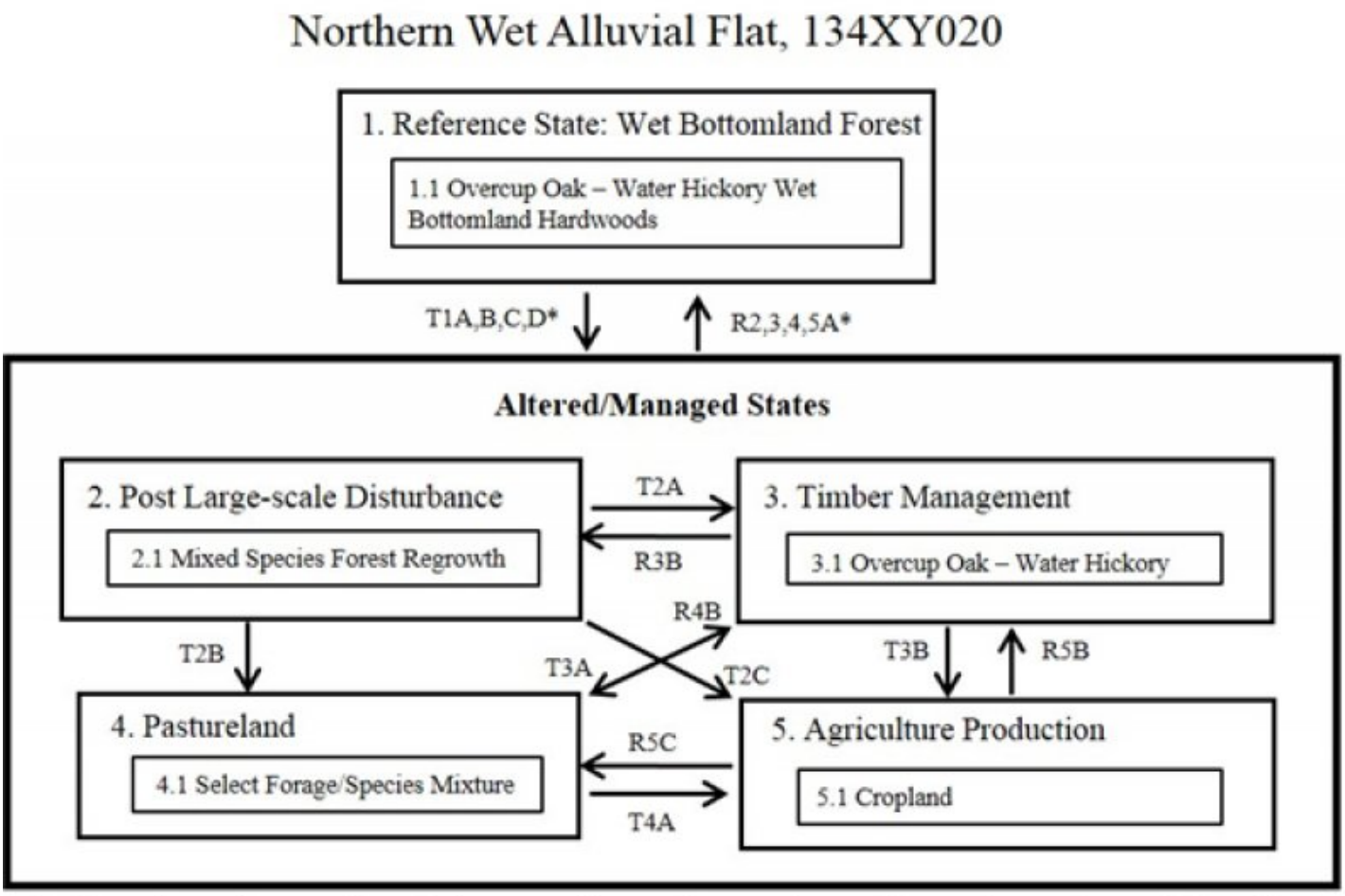
Perhaps the largest and most significant alteration to this site has been channelization and levee (or spoil bank) construction. Such hydrologic alterations have become the norm for floodplains in this MLRA. This action results in a disconnection between the stream - floodplain environment, which interrupts and alters the ecological processes and functions of the system as a whole. For this very reason, reference conditions of this site are modeled after and representative of mature stands occurring in unmodified, low-gradient riverine floodplains.

Following this narrative, a “provisional” state and transition model is provided that includes the “perceived” reference state and several alternative (or altered) vegetation states that have been observed and/or projected for this ecological site. This model is based on limited inventories, literature, expert knowledge, and interpretations. Plant communities will differ across MLRA 134 due to natural variability in climate, soils, and physiography. Depending on objectives, the reference plant community may not necessarily be the management goal.

The environmental and biological characteristics of this site are complex and dynamic. As such, the following diagram suggests pathways that the vegetation on this site might take, given that the modal concepts of climate and soils are met within an area of interest. Specific locations with unique soils and disturbance histories may have

alternate pathways that are not represented in the model. This information is intended to show the possibilities within a given set of circumstances and represents the initial steps toward developing a defensible description and model. The model and associated information are subject to change as knowledge increases and new information is garnered. This is an iterative process. Most importantly, local and/or state professional guidance should always be sought before pursuing a treatment scenario.

State and transition model



* = To reduce clutter and confusion, transition and restoration pathways (arrows) to and from the reference state and certain altered states are not indicated. Those particular pathways are addressed in the respective state and community sections.

Figure 5. STM - Northern Wet Alluvial Flat

Pathway	Practice
T1A, R3B,	large-scale stand initiating disturbance (wind, ice, clearcut; State 2)
T1B	beginning point uneven-aged stand; goal of timber management; timber stand improvements; group selection; single tree harvest (State 3)
T1C, T2B, T3A, R5C	mechanical removal of vegetation; herbicide application; seedbed preparation; planting desired species at appropriate rate (State 4)
T1D, T2C, T3B, T4A	removal of vegetation (mechanical/chemical); preparation for cultivation (State 5)
T2A, R4B, R5B	beginning point even-aged stand; potential planting; competitor control – herbicide/mechanical; TSI (State 3)
R2A, R3A, R4A, R5A	natural succession over time; may require exotic plant control and reestablishment of missing species; NOTE: any former alteration to hydrology MUST be restored before returning to true reference conditions (State 1)

Figure 6. Legend - Northern Wet Alluvial Flat

State 1
Wet Bottomland Forest

This ecological site is associated with one of the most charismatic, but yet, impacted and altered, ecological systems in the MLRA, the low-gradient riverine systems of the Loess Plains. The majority of the low-gradient streams in the ecoregion have been greatly modified by channelization and levee construction. Therefore, a very narrow suite of reference sites are available for observation and study. This state is considered representative of the wet alluvial flats within unmodified stream and river floodplains. Vegetation associated with this site exhibits signs of hydric conditions and the dominant components of the system are generally wetland obligates and facultative wetland species. The vegetation that characterized the drier flats and higher landforms within floodplain system have mostly dropped out and are replaced by species more tolerant of anoxic conditions.

Community 1.1
Overcup Oak – Water Hickory Wet Bottomland Hardwoods

This community phase represents the successional stage, composition, and structural complexity of stands supporting perceived reference conditions. Today, this community is representative of maturing stands (late development) often found within protected areas (i.e., public lands). Overstory composition of this site may vary due to local conditions and land use and disturbance histories. In general, overstory components of mature stands consist of overcup oak, willow oak, water hickory, and occasional stems of bald cypress and water tupelo on the lowest and wettest spots. Filtering into this site are a few stems that generally occur on the adjoining higher and slightly drier, moderately wet alluvial flat, such as sweetgum, green ash, Nuttall oak, and American hornbeam. Ground cover is often sparse in the lowest and wettest portions of the flat, but in canopy gaps and areas where the canopy is thin, understory vegetation may consist of planertree, Virginia sweetspire, buttonbush, swamp privet, lizard’s tail, green arrow arum, Virginia dayflower, ditch stonecrop, smallspike false nettle, netted chain fern, sweet woodreed, catchfly grass, redtop panic grass, savanna panicgrass, and several additional wetland forbs and graminoids.

State 2
Post Large-scale Disturbance Forest

This state is characterized by the regeneration or regrowth of a pre-existing forest stand following a major, stand-replacing disturbance. Scale of the disturbance is at the stand level and is greater than one acre in size (Johnson et al., 2009). Potential types of disturbances include catastrophic windstorms, silvicultural clearcuts, particularly destructive ice storms, and long-term inundation from altered hydrology (e.g., beaver). For impacts other than permanent inundation, the resulting even-aged stand (or single-cohort) is set on a new course of development, which is highly dependent upon several critical factors including: the composition and structure of the stand prior to the disturbance; the degree or intensity of the disturbance; size and configuration of the disturbed area; and distance to seed sources (Oliver and Larson, 1990). If the site has become flooded and inundated throughout the growing season (altered hydroperiod), a new series of successional stages and ecological processes may occur that transition this site to a stage more similar to an early successional backswamp site. Under the new hydroperiod, soils are ponded throughout much or all of the year and the corresponding vegetation community becomes more characteristic of a marsh and eventually, a young swamp. If deposition is exceedingly slow in the newly inundated environment, flooded/ponded conditions may prevail over a long period of time, eventually leading to dominance by components of the Backswamp ecological site, which is generally a bald cypress – water tupelo association. However, if deposition rates are fast, eventually the dominant components of this site may return following a series of successional transitions (e.g., from open water to herbaceous – scrub-shrub to young forested wetland). The length of time for this transition to take place ultimately depends on deposition rates, composition of the site through each successional stage, and eventual colonization by the species associated with this site (Hodges, 1997). Depending on the type and severity of the disturbance, many years may be required before a return to reference conditions occurs on this floodplain site.

Community 2.1
Mixed Species Forest Regrowth

Large blowdowns such as straight-line winds and tornadoes may have a major influence on composition and successional patterns of hardwood stands (Hodges, 1998). Soon after overstory removal, numerous species may colonize large openings and influence the dynamics of the site. Initial colonizers are often forbs, graminoids, and vines that may have existed in the seed bank, were forest floor components prior to disturbance, or transported into the site via flood waters, wind, and/or animals. Overstory species anticipated to occur during the stand-initiation

stage may include dense growths of black willow in addition to the lower-growth forms of swamp privet, buttonbush, and water elm. As the black willow stand breaks up after roughly 30 years, a return to the overcup oak – water hickory association may occur, if deposition rates remain slow. However, a return to the reference community may not occur if deposition rates suddenly increase. The stand may transition to an American elm – green ash – sugarberry association under the latter scenario. If long-term inundation of the site occurs, succession through the black willow and scrub-shrub may eventually lead to colonization and dominance by the bald cypress – water tupelo association (Hodges, 1997). For stands that were highly altered prior to the disturbance (e.g., high-graded and/or high concentration of exotic species), intensive management may be necessary in order to establish a desired composition. Management actions may include controlling undesirable species mechanically and chemically and planting species that match the soil – site dynamics.

State 3
Timber Management

This state represents the breadth of forest management activities on this site. Various management or silvicultural methods can lead to very different structural and compositional results within a managed stand. The range of methods are diverse and include even-aged (e.g., clearcut and shelterwood) and uneven-aged (single tree, diameter-limit, basal area, group selection, etc.) approaches. Included within these methods is an option to reduce competition and achieve maximum growth potential of the desired species. Inherently, these approaches result in different community or “management phases” and possibly alternate states, depending on local floodplain dynamics. The decision to represent these varying management strategies into a single state and phase at this time hinges on the need for additional information in order to formulate definitive pathways, management actions, and community responses. Forthcoming inventories and description iterations of this site will provide more detail on this state and associated management phases. A limitation of this site is periodic to frequent flooding over long to very long durations. Management activities may need to be adjusted to drier times of the year.

Community 3.1
Overcup Oak – Water Hickory

This phase represents the prevailing composition and/or association of the species occurring on this site. In general, this wet site is not very productive and species richness is generally low. Because tree diversity is low, any of the regeneration methods mentioned above may result in regeneration of the overcup oak – water hickory association. During dry cycles or on slightly drier positions within the site, green ash and Nuttall oak may serve as additional merchantable species. Clearcutting, patch cutting, and shelterwood approaches may be preferred for maintaining a high overcup component. However, the single tree harvesting method may select against overcup over time due to its intolerance for shade (Meadows and Stanturf, 1997), which could lead to unintentional high-grading.

State 4
Pastureland

This state is representative of sites that have been converted to and maintained in pasture. This state is generally restricted to areas that occasionally flood for brief to long periods and along protected areas (i.e., channelized and leveed). Planning or prescribing the intensity, frequency, timing, and duration of grazing will be very important on this wet site. Wetness is a limitation for this management option. Overgrazing on this site can lead to soil compaction, numerous bare spots, and deep muck and muddy conditions that effectively reduces or destroys plant establishment and productivity. Establishing an effective pasture management program can help minimize degradation of the site and assist in maintaining growth of desired forage. An effective pasture management program includes: selecting well-adapted grass and/or legume species that will grow and establish rapidly; maintaining proper soil pH and fertility levels; using controlled grazing practices; mowing at proper timing and stage of maturity; allowing new seedings to become well established before use; and renovating pastures when needed (Rhodes et al., 2005; Green et al., 2006). It is strongly advised that consultation with State Grazing Land Specialists and District Conservationists at local NRCS Service Centers be sought when assistance is needed in developing management recommendations or prescribed grazing practices. Of note, the flooding and wetness limitations on this site will severely limit the type of forage suited for this site. An alternative land use and management strategy of this site warrants consideration.

Community 4.1
Select Forage/Species Mixture

This community phase represents commonly planted forage species on pasturelands and haylands. The suite of plants established on any given site may vary considerably depending upon purpose, management goals, usage, and soils. Most systems include a mixture of grasses and legumes that provide forage throughout the growing season. However, wetness is a severe limitation of this site, which will seriously affect the type of forage established. Additionally, management activities to maintain the desired forage will be limited due to seasonally wet conditions. Suggestions for non-native forage and seed mixtures on this wet site are not provided at this time. Standard forage mixtures that are routinely established may fail on this site. However, the location of the site coupled with seasonal wetness of the soil creates exceptional conditions (habitat) for a number of native sedges, rushes, and grasses, which will seed quickly and form thick cover (thatch) in wetter spots of pastures and hayfields. Of caution, not every native species suited for this site is palatable and some may be very toxic (e.g., spotted water hemlock).

State 5
Agriculture Production

This site has severe flooding and wetness limitations for cropland production. The state is provisionally included here mainly due to its occurrence within small, occasionally flooded areas and within protected floodplains. Planting is often delayed which limits the types of crops that can be established.

Community 5.1
Cropland

Suitable crops may be soybean and cotton.

Transition T1A
State 1 to 2

This pathway represents a large-scale, stand replacing disturbance, which may be caused by a catastrophic windstorm (e.g., straight-line winds, tornado), ice storm, severe fire, or a silvicultural clearcut. For this stressor to occur, most or all of the overstory must be removed or destroyed. A few residual trees may persist, but overall, the disturbance must be intensive enough, at least one acre or larger (Johnson et al., 2009), that a new, even-aged stand is created.

Transition T1B
State 1 to 3

This pathway consists of prescribed silvicultural activities specifically designed to meet stand compositional and production objectives. Activities may include release cuttings through a combination of low and high thinning, mechanical and chemical control of competition, and artificial regeneration (i.e., planting) of sites with low oak presence. A variety of silvicultural methods may be employed including group selection, single tree selection harvests (all classes/condition; avoid “high-grading”), or even-age management (clearcut).

Transition T1C
State 1 to 4

Actions required to convert forests to grassland or forage production include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants. Caution: there are severe flooding and wetness limitations to this site and pastureland, as a land use, is generally considered to be poorly suited. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Transition T1D
State 1 to 5

Actions include mechanical removal of vegetation and stumps; herbicide treatment of residual plants; and

preparation for planting. Warning: there are severe flooding and wetness limitations to this site and cropland, as a land use, is considered unsuited (USDA-NRCS, 1997). (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Restoration pathway R2A
State 2 to 1

This pathway represents a return to reference conditions through natural succession, if the disturbance occurred within a reference community. Depending upon objectives and stand condition, management activities to aide recovery may include exotic species control and silvicultural treatment that benefits oak regeneration and establishment (e.g., TSI practices such as crop tree release, low thinning, and cull removal). This pathway will occur only under the natural hydrologic regime (i.e., naturally meandering channel with NO levees). It should be noted that a return to reference conditions requires that the natural hydrodynamics must be restored to the system. (Of note, exceptional conservation measures may be implemented in hydrologically altered systems, but the natural ecological processes and functions between the stream and its associated floodplain remains disconnected and all resulting actions remain in an altered state.)

Transition T2A
State 2 to 3

This pathway represents the development of an even-aged stand that is prescribed to meet compositional and production objectives. However, severe flooding and seasonal wetness may dictate management actions.

Transition T2B
State 2 to 4

Actions required to convert forests to pasture or forage production include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants. However, periodic flooding and seasonal wetness may dictate management actions. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Transition T2C
State 2 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for planting. Caution: this site is generally poorly suited or unsuited for agriculture production. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Restoration pathway R3A
State 3 to 1

Natural succession over a period of time may transition a former timber-managed stand to one supporting reference conditions. Some question remains whether a return to reference conditions will occur in every situation, especially since some components may have been selectively culled from the stand. Management activities to aide recovery may include exotic species control and silvicultural treatment. Floodplains where streams have been channelized and leveed must have the natural hydrology restored BEFORE reference conditions are achieved.

Restoration pathway R3B
State 3 to 2

This pathway represents a large-scale, stand-initiating disturbance, which effectively removes most or all of the pre-existing overstory. Disturbances may include a catastrophic windstorm, silvicultural management (even-aged), and long-term flooding or inundation (e.g., beaver-influences).

Transition T3A
State 3 to 4

Actions required to convert forests to pasture or forage production include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants. However, periodic flooding and seasonal wetness may dictate management actions. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Transition T3B
State 3 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for planting. Caution: this site is generally poorly suited or unsuited for agriculture production. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Restoration pathway R4A
State 4 to 1

This pathway represents natural succession back to perceived reference conditions. The period required for this transition to take place likely varies by location and is dependent upon local site conditions. Many years may be required before a return to the late development reference community occurs and the rate or time period of return is directly dependent on many variables. Significant efforts may be required before a return to reference conditions is achieved (e.g., exotic species control, appropriate connectivity between stream and floodplain, potential artificial regeneration of community components, etc.). Floodplains where streams have been channelized and leveed must have the natural hydrology restored BEFORE reference conditions are achieved.

Restoration pathway R4B
State 4 to 3

This pathway represents prescribed management strategies for transitioning abandoned pastureland to managed woodland. Activities may include artificial regeneration of and management for desired species and exotic species control.

Transition T4A
State 4 to 5

Actions include mechanical removal of vegetation and stumps; herbicide treatment of residual plants; and preparation for planting. Caution: this site is generally poorly suited or unsuited for agriculture production. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Restoration pathway R5A
State 5 to 1

This pathway represents natural succession back to perceived reference conditions. The period required for this transition to take place likely varies by location and is dependent upon local site conditions. Many years may be required before a return to the late development reference community occurs and the rate or time period of return is directly dependent on many variables. Significant efforts may be required before a return to reference conditions is achieved (e.g., exotic species control, appropriate connectivity between stream and floodplain, potential artificial regeneration of community components, etc.). Floodplains where streams have been channelized and leveed must have the natural hydrology restored BEFORE reference conditions are achieved.

Restoration pathway R5B
State 5 to 3

This pathway represents prescribed management strategies for transitioning abandoned cropland to managed woodland. Activities may include artificial regeneration of and management for desired species and exotic species control. Depending on location and watershed size, floodplains supporting this site may be subjected to frequently flooding for very long durations. In general, timberland management on this site has some seasonal and wetness limitations.

Restoration pathway R5C
State 5 to 4

Seedbed preparation and establishment of desired forage/grassland mixture. However, periodic flooding and seasonal wetness may dictate management actions. (This pathway is generally relegated to smaller stream systems and/or protected floodplains.)

Additional community tables

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Contributors

Barry Hart

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	
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):

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

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

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

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

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

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

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

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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):**

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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):**

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:**

17. **Perennial plant reproductive capability:**