Ecological site F134XY018AL
Northern Alluvial Flat - PROVISIONAL

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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): 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, 2006).

This site is of large extent in MLRA 134 with a maximum distribution and occurrence 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)
-Western Mesophytic Forest Region - Mississippi Embayment Section (Braun, 1950)

Ecological site concept

The Northern Alluvial Flat is characterized by deep, well drained to moderately well drained soils that formed in silty or loamy alluvium. Soil reactions range from very strongly acid to strongly acid in all horizons. This site occurs exclusively on better drained portions (higher positions) of narrow to broad floodplains and along stream corridors. Specific landforms associated with the site include natural levees, rises, and the better drained flats that often border the riverfront or levee position. 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 event. Slopes are variable and dependent on floodplain position; dominant slopes of the flats are 0 to 2 percent but range up to 5 percent on natural levees. The native vegetation of this site is the fabled, southern bottomland hardwood forest. The better drainage capabilities of the soil provide an incredible medium for supporting exemplary examples of upland and lowland species co-occurring within single stands. Overstory components often include cherrybark oak, white oak, willow oak, water oak, Shumard's oak, swamp chestnut oak, tuliptree, American beech, American sycamore, sweetgum, sugar maple, red maple, silver maple, eastern cottonwood, hickories, elm, river birch, and green ash.

Associated sites

F134XY019AL	**Northern Moderately Wet Alluvial Flat - PROVISIONAL**
F134XY020AL	**Northern Wet Alluvial Flat - PROVISIONAL**

Similar sites

F134XY102MS	**Southern Rolling Plains Loess Stream Terrace - PROVISIONAL** This site appears to be the southern counterpart to the Northern Alluvial Flat.
F134XY204AL	**Western Alluvial Flat - PROVISIONAL** Western counterpart

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Northern Alluvial Flat provisional site 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 ecological site occurs on the better drained positions of narrow to broad floodplains and along upland stream corridors. Specific landforms associated with the site include natural levees, rises, and the better drained flats that often border the riverfront or levee position.

The influences of aspect are negligible in this site.

Table 2. Representative physiographic features

Landforms	(1) Natural levee (2) Alluvial flat (3) Rise
Flooding duration	Very long (more than 30 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	100–650 ft
Slope	0–5%
Water table depth	18–50 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 inches 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 the Northern Loess Interfluve 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

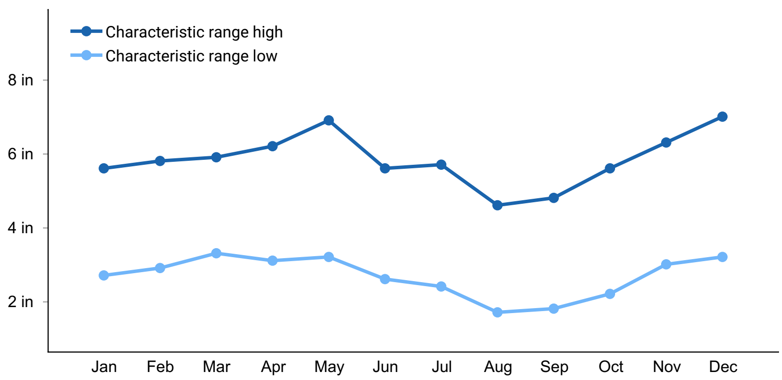

Figure 1. Monthly precipitation range

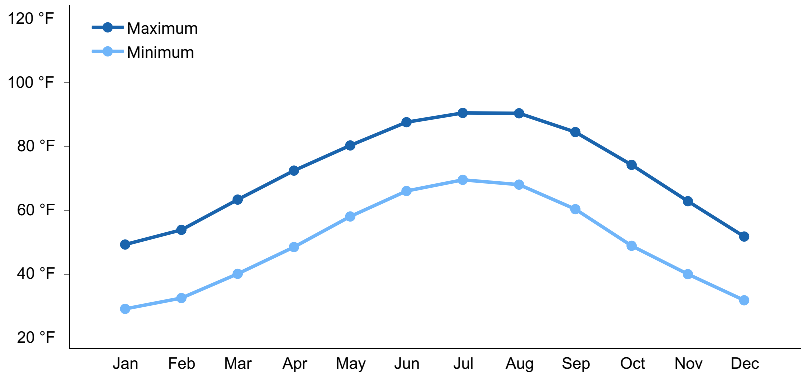

Figure 2. Monthly average minimum and maximum temperature

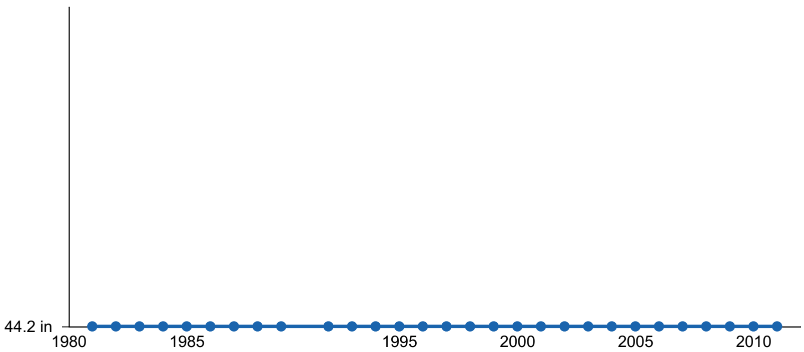

Figure 3. Annual precipitation pattern

Climate stations used

- (1) BATESVILLE 2 SW [USC00220488], Batesville, MS
- (2) GRENADA [USC00223645], Grenada, MS
- (3) LEXINGTON [USC00225062], Lexington, MS
- (4) COLLIERVILLE [USC00401950], Collierville, TN
- (5) COVINGTON 3 SW [USC00402108], Covington, TN
- (6) LOVELACEVILLE [USC00154967], Paducah, KY
- (7) MURRAY [USC00155694], Murray, KY
- (8) HOLLY SPRINGS 4 N [USC00224173], Holly Springs, MS
- (9) DRESDEN [USC00402600], Dresden, TN
- (10) MILAN EXP STN [USC00406012], Milan, TN
- (11) BARDWELL 2 E [USC00150402], Bardwell, KY
- (12) GILBERTSVILLE KY DAM [USC00153223], Gilbertsville, KY
- (13) CANTON 4N [USC00221389], Canton, MS
- (14) OAKLEY EXP STN [USC00226476], Raymond, MS
- (15) VICKSBURG MILITARY PK [USC00229216], Vicksburg, MS
- (16) YAZOO CITY 5 NNE [USC00229860], Yazoo City, MS
- (17) BOLIVAR WTR WKS [USC00400876], Bolivar, TN
- (18) PADUCAH [USW00003816], West Paducah, KY
- (19) JACKSON INTL AP [USW00003940], Pearl, MS
- (20) BROOKPORT DAM 52 [USC00110993], Paducah, IL
- (21) SENATOBIA [USC00227921], Coldwater, MS
- (22) NEWBERN [USC00406471], Newbern, TN
- (23) UNION CITY [USC00409219], Union City, 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 flood duration is generally brief. Sites associated with larger streams and drainage basins may flood frequently with much longer flood duration. However, regardless of flood frequency and duration, the soils of this site are well drained to moderately well drained and are not hydric. On floodplains of larger stream systems, the water table may fluctuate between 1.5 to 2.5 feet of the surface for much of the time during winter and early in spring in most years. Of note, very few plant species on these soils classify as wetland obligates. Although this site receives surface flooding, most of the vegetation would be categorized as facultative wetland and/or have no wetland status.

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.

The soils of this site are very deep, well drained to moderately well drained that formed in silty or loamy alluvium. These level to nearly level soils are on flood plains and along streams of varying sizes. They are subject to flooding during winter and early in spring, have slow runoff, and are moderately permeable. Flood duration ranges from brief to very long depending on stream and drainage basin size and flood event. In floodplain environments, slopes range from 0 to 2 percent but may extend slightly higher to approximately 5 percent on natural levees. Soil reactions generally range from strongly acid to very strongly acid.

Principal soils associated with this site formed in silty alluvium, and they include Ariel (Coarse-silty, mixed, active, thermic Fluventic Dystrudepts), Cascilla (Fine-silty, mixed, active, thermic Fluventic Dystrudepts), Collins (Coarse-silty, mixed, active, acid, thermic Aquic Udifluvents), Leverett (Coarse-silty, mixed, active, thermic Haplic Glossudalfs), Oaklimeter (Coarse-silty, mixed, active, thermic Fluvaquentic Dystrudepts), and Vicksburg (Coarse-silty, mixed, active, acid, thermic Typic Udifluvents) series. Ariel soils are well drained, course-silty, and have a cambic horizon and a buried genetic horizon. Cascilla soils are well drained and are fine-silty in the 10- to 40-inch particle-size control section. Collins soils are moderately well drained, and the 10- to 40-inch control section has from 5 to 18 percent clay. Sand content is as much as 30 percent but less than 15 percent is coarser than very fine sand for Collins soils. Leverett soils are well drained and have an argillic horizon in addition to glossic (tongues of albic material in the argillic horizon) and haplic features (tongues of albic material extending through the upper 20 inches of the argillic horizon). Oaklimeter soils are moderately well drained with clay content in the particle size control section of 7 to 18 percent. Vicksburg soils are well drained and have bedding planes that occur from approximately 7 to 44 inches (C1, C2 horizons). Vicksburg soils do not have fragments of diagnostic horizons below the Ap horizon and is structureless.

Secondary soils of this site formed in loamy alluvium and they include Iuka (Coarse-loamy, siliceous, active, acid, thermic Aquic Udifluvents), Jena (Coarse-loamy, siliceous, active, thermic Fluventic Dystrudepts), and Ochlockonee (Coarse-loamy, siliceous, active, acid, thermic Typic Udifluvents) series. Iuka soils are moderately well drained and formed in stratified loamy and sandy alluvium. Clay content of the 10 to 40-inch control section is 10 to 18 percent. Some pedons have thin gravelly or sandy strata and some pedons have textures of sandy clay loam or clay loam at depths below 40 inches. Thin bedding planes of contrasting textures are common throughout in most pedons. Jena soils are well drained and formed in thick loamy sediments on recent alluvial plains. Bedding planes and weak horizontal stratification are evident throughout the soil. Ochlockonee series often occur on natural levees, are well drained, and formed in loamy and sandy alluvium. Buried soil horizons are present in most pedons below a depth of 25 inches. Some pedons have gravelly strata below a depth of 40 inches (USDA-NRCS, 2016).

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Fine sandy loam (3) Sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–8.7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5–5.9
Subsurface fragment volume <=3" (Depth not specified)	0–14%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site occurs on broad, level floodplains and on narrow floodplains of smaller stream environments. Landforms include natural levees, the first alluvial flat landward of natural levees, and the higher mounds or rises on wet alluvial flats. The moderately well to well drain soils of this site create an incredible medium for supporting a rich association of deciduous broad-leaved hardwoods, typically referred to as southern bottomland hardwoods. Where disturbances have been minimal (e.g., gap-scale or single tree senescence), a continuous canopy of hardwoods typically develops.

The better drainage capabilities of the soil provide an incredible medium for supporting exemplary examples of upland and lowland species co-occurring within single stands. Overstory components often include oaks, hickories, elm, beech, sycamore, cottonwood and a number of additional hardwoods. Canopy height ranges from 80 upwards to 150 feet and basal area is typically within 100 to 210 square feet per acre (LANDFIRE, 2008). Unlike the wetter, lower portions of the floodplain, water moves off this site first, which can contribute to a dense understory layer of shrubs, saplings, midstory components, and vines. Herbaceous cover may range from sparse to dense depending on shade or presence of canopy gaps.

The dominant 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. 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 flood event. Flood durations of small streams are typically brief and “flashy”, while those of larger systems can range from brief to very long depending on drainage basin size and flood event. 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.

Forest stand disturbances vary in both size and type. 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.

An additional disturbance factor that rarely occurs on this site today but is thought to have been an important historical influence is fire. This supposition is drawn from the presence of a single species: cane. Cane grows readily on this site and historically, extended across many floodplains of the Southeast (Gagnon, 2009). The sheer presence of this species alone in the historic community suggests disturbance beyond flooding alone. Fire may have been an important disturbance factor in the pre-settlement bottomland community (see Gagnon and Platt, 2008; Gagnon, 2009), which suggests that the structure of this site may have been more open where dense canebrakes existed. However, any vestige of that system is long past. Those areas that have been allowed to revert naturally are now best characterized as closed-canopied, bottomland hardwoods.

The principal land use, today, is agriculture production with some areas in pasture and/or forage production. The fertile soils of the broader floodplains are almost exclusively cropland where channelization and levee construction have occurred. Timber production is also a significant land use, which occurs in both narrow drainageways and locally in broader floodplains. Timberland may be the dominant land use along streams and larger floodplains that have not been channelized or leveed.

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.

Theoretically, channelized and/or leveed streams and associated floodplains exist in an altered hydrologic condition or state. True reference conditions may not be achievable for sites where the natural hydrodynamics have been altered. However, the collective effects of channelization and leveeing on soils and vegetation communities are still under review and are not adequately represented in this provisional site. Future studies and projects should help elucidate these impacts and provide a more accurate reflection of the vegetation states associated with this site.

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

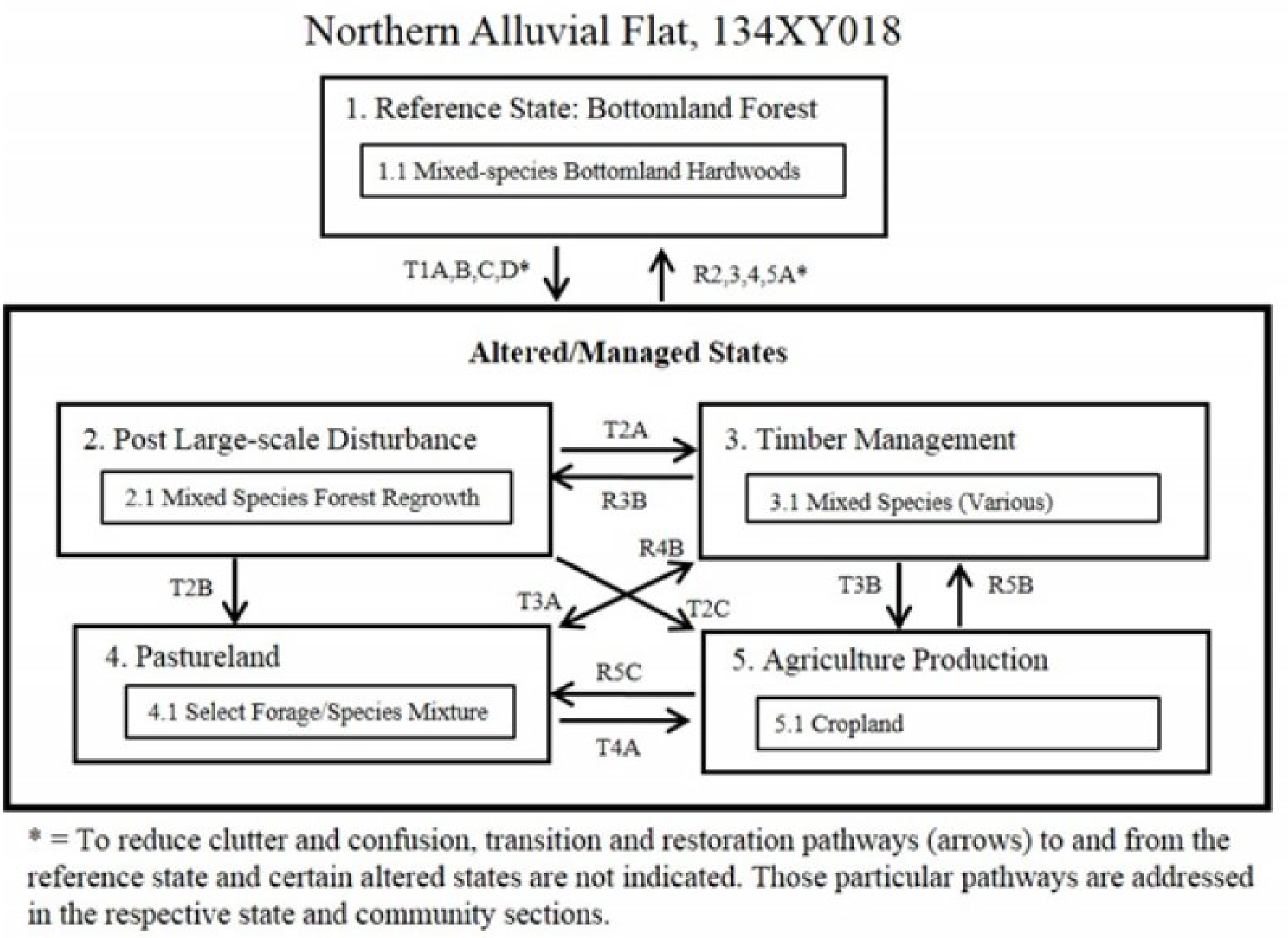

Figure 5. STM - Northern Alluvial Flat

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 soil drainage MUST be restored before returning to true reference conditions (State 1)

Figure 6. Legend - Northern Alluvial Flat

State 1
Bottomland Forest

The pre-settlement plant community of this ecological site was largely removed more than 150 years ago, and there are no extant examples of that community. Following decades of land-use impacts, the plant community that returned in areas initially set aside for protection include a broad range of broad-leaved trees commonly referred to as bottomland hardwoods. The higher positions of this site coupled with better drainage provide excellent site potential.

Community 1.1
Mixed Species 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 often found within protected areas. Overstory composition of the natural levees and better drained alluvial flats include cherrybark, willow oak, water oak, swamp chestnut oak, Shumard's oak, sweetgum, American sycamore, green ash, various hickories, eastern cottonwood, river birch, red maple, silver maple, boxelder, black walnut, pecan, in addition to occasional occurrences of American beech, tuliptree, and white oak. Loblolly pine is an additional component of the community to the south in Mississippi. In addition to smaller individuals of the preceding canopy trees, the subcanopy or mid-story stratum is often represented by American hornbeam, hophornbeam, and pawpaw. Vegetation characteristic of the small to tall shrub strata include spicebush, pawpaw, and giant cane.

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, wildfire, silvicultural clearcuts, and particularly destructive ice storms. 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. Composition and condition of the forest stand prior to a major disturbance may dictate, in large part, future composition of the regenerating stand. Although colonization by new species is expected soon after the disturbance, many of the pre-existing overstory components are anticipated to occupy position in the new, developing stand – their presence arising mainly from stump or root sprouts, advance regeneration, and germination from the seed bank (Oliver and Larson, 1990).

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 include sweetgum, American sycamore, eastern cottonwood, ash, oaks, hickory, elm, walnut, hackberry, sugarberry, boxelder, tuliptree, loblolly pine (southern sites), along with the residual shade-tolerant species of maple, beech, and American hornbeam. For stands that were highly altered prior to the disturbance (e.g., high-graded), intensive management may be necessary in order to establish a desired composition. Management actions may include controlling undesirable species mechanically and chemically and planting the desired species.

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 approaches is an option to use disturbance mechanisms (e.g., TSI, etc.) to reduce competition and achieve maximum growth potential of the desired species. Inherently, these various approaches result in different community or "management phases" and possibly alternate states. The decision to represent these varying approaches and 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. One limitation of this site is periodic flooding. Management activities may need to be restricted to drier times of the year.

Community 3.1
Mixed Species (Various)

This phase represents the prevailing compositional diversity of hardwood species occurring on this site. Components of the system that are often in greatest demand are the oaks. Oaks that respond incredibly well on this site include cherrybark, Shumard's, northern red, swamp chestnut, willow, water, and occasionally white oak. However, managing for oaks alone on this highly productive site may be time, labor, and cost prohibitive. Managing for a mixed diversity of hardwoods (including oaks) is the option representative of this management phase. In addition to oaks, species responding well on this site include tuliptree, sweetgum, ash, elm, walnut, sycamore, and cottonwood. Another option in southern portions of the site is management for loblolly pine, which generally consists of conversions to a pine monoculture. There are a variety of silvilcultural methods for achieving this management state including both uneven-aged approaches (e.g., group selection) and even-aged actions (e.g., clearcut). Finding the appropriate approach for a given stand and environment necessitates close consultation with trained, experienced, and knowledgeable forestry professionals. If there is a desire to proceed with this state, it is strongly urged and advised that professional guidance be secured and a well-designed silvicultural plan developed in advance of any work conducted.

State 4
Grassland/Pastureland

This state is representative of sites that have been converted to and maintained in pasture and forage cropland, typically a grass – legume mixture. For pastureland, planning or prescribing the intensity, frequency, timing, and duration of grazing can help maintain desirable forage mixtures at sufficient density and vigor (USDA-NRCS, 2010; Green et al., 2006). Overgrazed pastures can lead to soil compaction and numerous bare spots, which may then become focal points of accelerated erosion and colonization sites of undesirable plants or weeds. Establishing an effective pasture management program can help minimize the rate of weed establishment and assist in maintaining vigorous 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.

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. Cool season forage may include tall fescue, orchardgrass, white clover, and red clover, and warm season forage often consists of bermudagrass, bahiagrass, and annual lespedeza. Several additional plants and/or species combinations may be desired depending on the objectives and management approaches and especially, local soils. The soils of this site generally have few limitations that restrict their use (Capability Class I). If active management (and grazing) of the pastureland is stopped, this phase will transition to "old field" conditions, which is the transitional period between a predominantly open, herbaceous field and the brushy stage of a newly initiated stand of trees.

State 5
Crop Production

Upon settlement, the fertility of the soils led to rapid land clearing and crop production. Today, crops that are often established include cotton, corn, soybean, and small grains.

Community 5.1
Cropland

Corn, soybean, small grains, 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 silvilcultural 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.

Transition T1D
State 1 to 5

Actions include mechanical removal of vegetation and stumps; herbicide treatment of residual plants; and preparation for crop establishment.

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). It should be noted that a return to reference conditions requires that the natural hydrodynamics must be restored to the system. Exceptional conservation measures may be implemented in hydrologically altered systems, but the connectivity between the stream and its associated floodplain remains disconnected.

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.

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.

Transition T2C

State 2 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for crop establishment.

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.

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, severe wildfire, and silvicultural management (even-aged).

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.

Transition T3B
State 3 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for crop establishment.

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. LANDFIRE models (2008) suggest that over 80 years is required for a return to a late development community and this pathway is highly dependent upon species present in the developing stand in addition to the appropriate level and type of disturbance (e.g., periodic flood regime, presence/absence of catastrophic wind events, etc.). Significant efforts may be required before a return to reference conditions is achieved (e.g., exotic species control, appropriate re-connectivity between stream and floodplain, potential artificial regeneration of community components, etc.).

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 crop establishment.

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. LANDFIRE models (2008) suggest that over 80 years is required for a return to a late development community and this pathway is highly dependent upon species present in the developing stand in addition to the appropriate level and type of disturbance (e.g., periodic flood regime, presence/absence of catastrophic wind events, etc.). Significant efforts may be required before a return to reference conditions is achieved and may never fully reach perceived reference conditions (e.g., exotic species control, appropriate connectivity between stream and floodplain, potential artificial regeneration of community components, etc.).

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.

Restoration pathway R5C
State 5 to 4

Seedbed preparation and establishment of desired forage/grassland mixture.

Additional community tables

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Contributors

Barry Hart

Approval

Matthew Duvall, 3/20/2025

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	05/10/2025
Approved by	Matthew Duvall
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:

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:**

17. **Perennial plant reproductive capability:**