Ecological site F134XY015AL
Northern Non-Acid Moderately Wet Floodplain - 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 has a broad but fairly local distribution within the MLRA. The site mainly occurs in portions of the Loess Hills (EPA Level IV Ecoregion: 74a) and the western edge of the Loess Plains (Ecoregion 74b) in western Kentucky, West Tennessee, and northwestern Mississippi. Farther to the south, a disjunct outlier of the site occurs near the boundary of the Loess Plains and Southern Rolling Plains (EPA Level IV Ecoregion: 74c) in southwestern Mississippi.

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
-East Gulf Coastal Plain Large River Floodplain Forest CES203.489
-South-Central Interior Small Stream and Riparian CES202.706 (NatureServe, 2012)
-Western Mesophytic Forest Region - Mississippi Embayment Section (Braun, 1950)

Ecological site concept

The Northern Non-acid Moderately Wet Floodplain is characterized by deep, somewhat poorly drained soils that formed in thick silty alluvium. This site occurs primarily on broader floodplains of large creeks and medium-sized rivers and secondarily on alluvial fans that drain areas of deep loess deposits. The distribution of the site is primarily associated with larger stream systems that drain the Loess Hills and the western edge of the Loess Plains. Soils have reactions that range from moderately acid to moderately alkaline throughout and are subject to flooding during winter to early spring. Flood duration is brief along the stream corridors of the Loess Hills but may extend to longer periods on broader floodplains of the Loess Plains. Flooding frequency ranges from none to frequent. Slopes range from 0 to 2 percent. Natural vegetation of the site consists of mixed bottomland hardwoods that typically include green ash, eastern cottonwood, sugarberry, elm, American sycamore, sweetgum, and pecan. Potential oaks of this site include Nuttall, overcup, swamp chestnut, water, willow, and pin. In some areas where soil reactions are neutral to moderately alkaline, faster growing hardwoods such as ash, cottonwood, and sugarberry may have a competitive advantage over oak and may dominate the overstory.

Associated sites

F134XY014AL	**Northern Non-Acid Floodplain - PROVISIONAL** This site occupies the higher and drier positions within floodplain and alluvial fan environments.
F134XY016AL	**Northern Non-Acid Wet Floodplain - PROVISIONAL** This site occurs on the lowest and wettest positions within floodplain and alluvial fan environments.

Similar sites

F134XY019AL	**Northern Moderately Wet Alluvial Flat - PROVISIONAL** This site is the "acid" counterpart to the Nonacid Moderately Wet Floodplain site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The distribution of the Northern Non-acid Moderately Wet Floodplain is primarily associated with portions of the MLRA that are blanketed with very thick loess deposits. In general, this area includes portions of the Loess Hills and the western edge of the Loess Plains. North to south, the site extends from the plains in western Kentucky to the border of the Southern Rolling Plains in southwestern Mississippi. Interestingly, there is a 135-mile disjunction between occurrences in northwest Mississippi to the southern-most sites near the Southern Rolling Plains.

Physiographic features of the site include: small to moderately broad floodplains; broader floodplains of large creeks; and alluvial fans. The site’s occurrence within small to moderately broad floodplains are generally associated with larger stream systems that drain the Loess Hills. Here, the site forms a close association with the Northern Non-acid Floodplain ecological site where it occurs on slightly lower and wetter positions within the respective floodplains. In areas of western Kentucky and Tennessee, this site occurs on broad floodplains of larger stream systems that head and flow along the transition of the Loess Hills and Loess Plains.

Alluvial fans of this site are fairly common, but they are mostly restricted to the interface of the Loess Hills and the edge or boundary of the Southern Mississippi Valley Alluvium (MLRA 131A) and secondarily on toeslopes, terraces, and the upland – floodplain interface of large streams and medium-sized rivers. Formation of this landform is generally the result of “water reworked” loess deposited onto the floodplain and terrace surfaces from the mouths of narrow draws and valleys of loess-covered slopes.

As emphasized earlier, the physical features that appear to be most important to the distribution of this site are landscapes blanketed in very deep loess. Most of the upland areas that are associated with this site are thought to support loess depths greater than 10 feet. The site’s distribution appears to be most prominent and concentrated on floodplains of streams that head within deep loess landscapes.

This site is noticeably absent on the active floodplains of the larger rivers and streams that head in watersheds of thinner loess deposits. However, this site does sporadically occur as alluvial fans on the terraces and floodplains of the latter as they flow through the deep loess country prior to joining the Mississippi River. Such situations form an interesting mixture of non-acid and acid alluvium within close proximity and association.

The influence of aspect is negligible in this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain (3) Terrace
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	46–122 m
Slope	0–2%
Ponding depth	0 cm
Water table depth	36–84 cm
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 55 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 61 degrees F and ranges from 60 in the north to 64 degrees F in the south. The freeze-free period averages 229 days and ranges from 215 days in the north to 252 days in the south. The frost free period averages 205 days and ranges from 194 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)	205 days
Freeze-free period (average)	229 days
Precipitation total (average)	1,422 mm

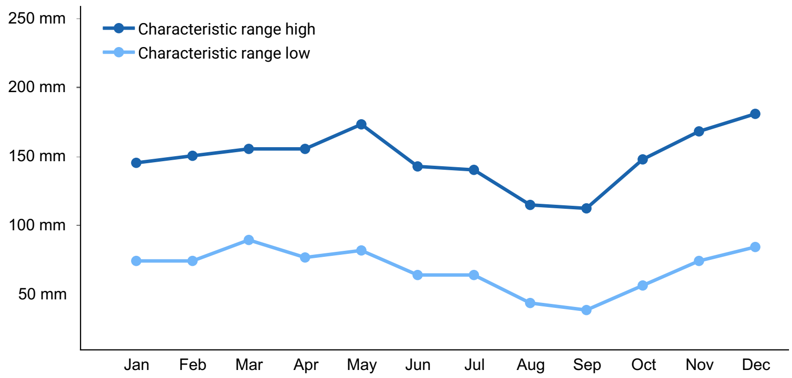

Figure 1. Monthly precipitation range

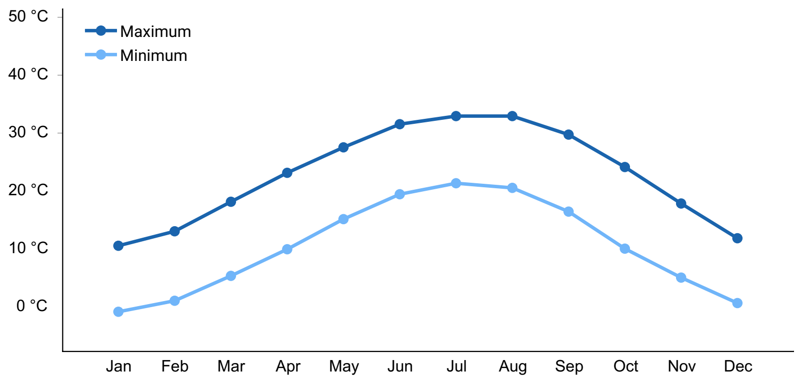

Figure 2. Monthly average minimum and maximum temperature

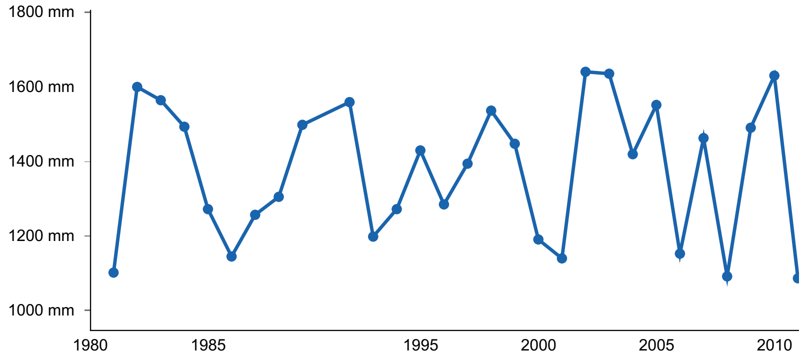

Figure 3. Annual precipitation pattern

Climate stations used

- (1) BARDWELL 2 E [USC00150402], Bardwell, KY
- (2) CANTON 4N [USC00221389], Canton, MS
- (3) RIPLEY [USC00407710], Ripley, TN
- (4) UNION CITY [USC00409219], Union City, TN
- (5) MEMPHIS [USW00093839], Millington, TN
- (6) LOVELACEVILLE [USC00154967], Paducah, KY
- (7) SENATOBIA [USC00227921], Coldwater, MS
- (8) NEWBERN [USC00406471], Newbern, TN
- (9) HERNANDO [USC00223975], Hernando, MS
- (10) OAKLEY EXP STN [USC00226476], Raymond, MS
- (11) DYERSBURG III GOLF [USW00003809], Dyersburg, TN
- (12) LEXINGTON [USC00225062], Lexington, MS
- (13) VICKSBURG MILITARY PK [USC00229216], Vicksburg, MS
- (14) YAZOO CITY 5 NNE [USC00229860], Yazoo City, MS
- (15) JACKSON INTL AP [USW00003940], Pearl, MS

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 large drainage basins may flood frequently with much longer flood duration. Soils of this site are somewhat poorly drained and the wettest soils associated with this site often supports both obligate wetland and facultative wetland species. Particularly problematic situations pertain to channelized and leveed stream systems, which deleteriously affects connectivity with associated soils and the vegetation community.

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, somewhat poorly drained soils that formed in silty alluvium. These level to nearly level soils are on narrow to broad floodplains and on alluvial fans and have moderate permeability. The site is subject to flooding during winter to early spring with flood durations that range from extremely brief to long depending on stream and drainage basin size and flood magnitude. A seasonally high water table generally occurs from 1 to 2 feet of the surface, however some sites may experience water table depths as little as 0.5 feet. The potential for surface water runoff is low to negligible and available water capacity is high to very high. A key property of these soils is that reactions may range from moderately acid to moderately alkaline. Higher pH of these soils are hypothesized to support greater plant productivity than their acid, floodplain counterparts.

Principal soils of this site include the Convent (Coarse-silty, mixed, superactive, nonacid, thermic Fluvaquentic Endoaquepts), Wakeland (Coarse-silty, mixed, superactive, nonacid, mesic Aeric Fluvaquents), and McRaven (Coarse-silty, mixed, active, nonacid, thermic Aeric Endoaquepts) series.

Convent soils have a cambic horizon (Bg horizons) and have bedding planes or thin strata within 20 inches of the soil surface. Additionally, saturation reduction and redoximorphic features begin at 16 inches below soil surface (Bg2 horizon).

Wakeland soils lack a cambic horizon and the zone of redoximorphic depletions range from 7 to 60 inches (Cg horizons). Additionally, Wakeland soils are classified as having a mesic soil temperature regime. (The Wakeland series was mapped in portions of the MLRA during the 1960s and warrant revisiting.)

McRaven soils formed in silty alluvial sediments that overlie a buried silty soil; depth to the latter ranges from 20 to 50 inches. The buried soil has a well-defined polygonal pattern formed by coarse prisms that are separated by gray seams. The cambic horizon has been described from a depth of approximately 6 to 80 inches (Bw, Bgc, 2Bgcxb1, 2Bgcxb2, 2Bgcxb3 horizons). McRaven soils are of minor extent, occurring along the southern-most portions of the site (USDA-NRCS, 2016).

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Loamy

Drainage class	Somewhat poorly drained
Permeability class	Moderate
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	21.08–21.84 cm
Calcium carbonate equivalent (0-101.6cm)	0–3%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.5–7
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The distribution of the Northern Non-acid Moderately Wet Floodplain is primarily restricted to portions of the MLRA that are covered by a very thick mantle of loess. Development of this site is greatest within and along the edges of the highly dissected Loess Hills and western boundary of the Loess Plains. Based on the distribution of soils, occurrence of this site is primarily located in the northern half of the MLRA, however a small extension of nonacid soils occur in the extreme southern end of the site in Mississippi.

This site occurs in a number of geomorphic situations that include small to broad floodplains and alluvial fans. The site's occurrence within small to moderately broad floodplains are generally associated with larger stream systems that drain the Loess Hills. Here, the site forms a close association with the Northern Non-acid Floodplain ecological site. The principal difference between the two is that the somewhat poorly drained soils of this site occur on slightly lower and wetter positions within the respective floodplains. In areas of western Kentucky and Tennessee, this site occurs on broad floodplains of larger stream systems that head and flow along the transition of the Loess Hills and Loess Plains. Alluvial fans of this site are fairly common, but they are mostly restricted to the interface of the Loess Hills and the edge or boundary of the Southern Mississippi Valley Alluvium (MLRA 131A) and secondarily on old fluvial terraces and active floodplains of large streams and medium-sized rivers.

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 in the middle of the classic floodplain moisture gradient. This gradient is also reflected in the plant community. Species requiring drier conditions (e.g., tuliptree, American beech, and walnut) begin dropping out and are replaced by plants more tolerant of anaerobic conditions. Overstory components generally include a broad range of hardwood species that may consist of eastern cottonwood, green ash, sweetgum, American sycamore, sugarberry, bitternut hickory, and several oak species including Nuttall, water, willow, overcup, and cherrybark, the latter restricted to micro-highs or drier positions within the site. Understory density and cover is typically lower than better drained sites and ground cover may consist of a mixture of facultative wetland and wetland obligate species, depending on local conditions.

This ecological site is provisionally separated from similar floodplain sites that have acid soils. It is hypothesized that the nonacid reactions and active to superactive cation exchange capacity collectively contributes to very high productivity of these soils. The central factor believed to contribute to these important properties is the deep loess soils that cover the upland landscapes. The eroded loess collects on the low-lying floodplains and alluvial fans that ultimately define this site. On the most favorable sites, potential productivity (i.e., site index) of individual trees can be impressive. Site indices (represents 50 years of growth; cottonwood, 30 years) of some bottomland hardwoods on this site (e.g., American sycamore) are estimated to range from 110 to 130 feet (Broadfoot, 1976).

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 a minor land use, especially within protected areas but may be more common on floodplains that have not been channelized or leveed.

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.

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 the 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

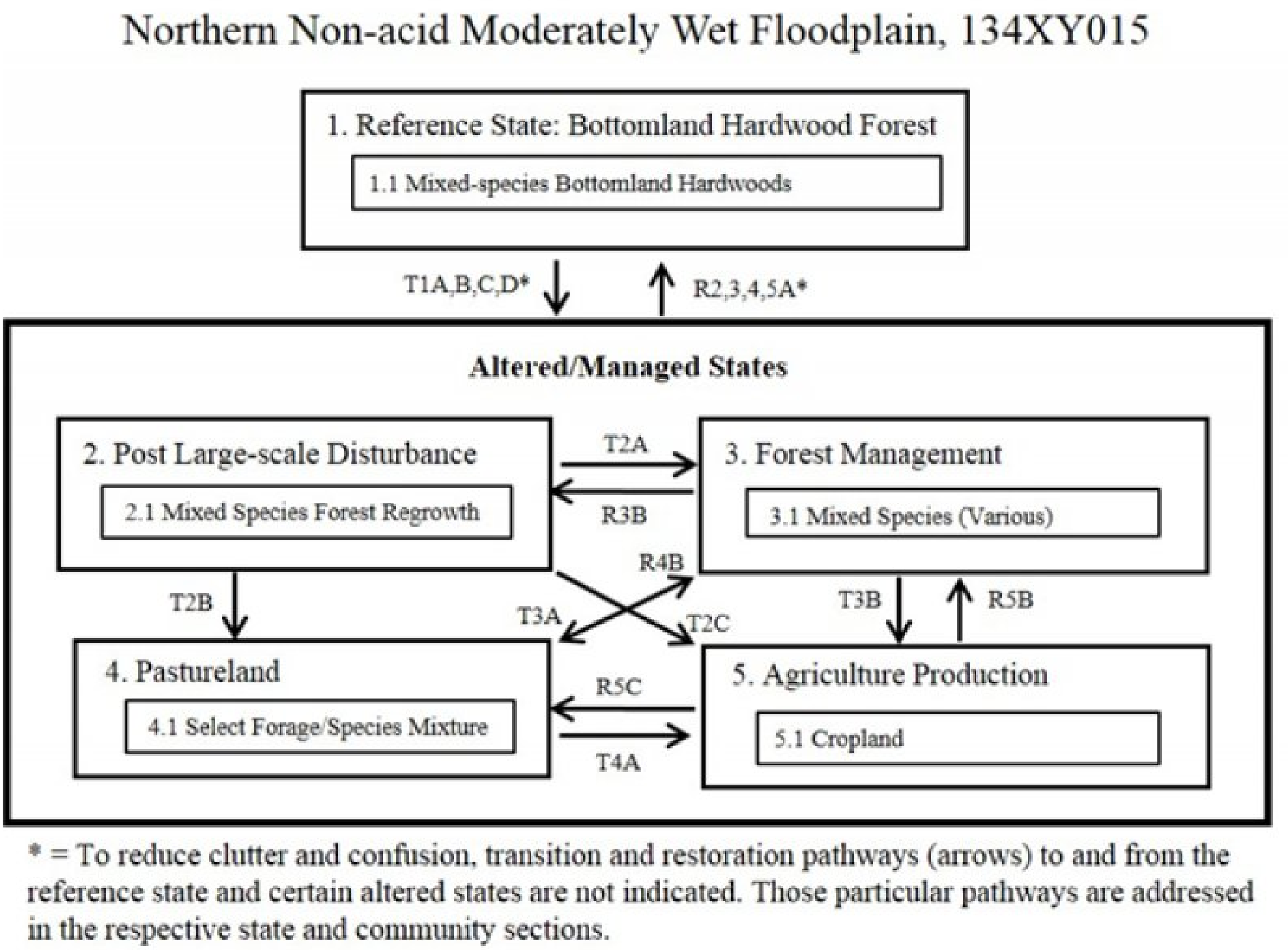

Figure 5. STM - Northern Non-acid Moderately Wet Floodplain

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 Nonacid Moderately Wet Floodplai

State 1
Bottomland Hardwood Forest

The pre-settlement plant community of this ecological site was largely removed more than 100 years ago, and there are no extant examples of that community. Following decades of land-use impacts, the plant community that returned in areas include several species of broad-leaved deciduous trees commonly referred to as bottomland hardwoods. Vegetation associated with this site exhibits signs of increasing soil wetness compared to the better drained areas of the floodplain. Species that occur on the drier natural levees and flats and throughout the narrow drainageways of the Loess Hills (e.g., American beech, white oak, tuliptree, and walnut) generally begin to drop out or their abundance decreased. A shift toward species more tolerant of wet conditions (or increased anaerobic conditions) typically occurs. Given the nonacid soils and the close proximity to the broad floodplains of the Southern

Mississippi River Alluvium (MLRA 131A), community composition of this site may be more similar to the nonacid, somewhat poorly drained soils of that MLRA than to the acid alluvial counterpart elsewhere in MLRA 134.

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 (i.e., late development). Overstory composition of this site may vary due to local conditions. Where soils are a little drier and conditions more conducive, tree species may consist of eastern cottonwood, sweetgum, American sycamore, hickory, sugarberry, green ash, American elm, swamp chestnut oak, water oak, willow oak, cherrybark oak, Nuttall oak, Shumard's oak, red maple, and an understory component of American hornbeam and cane. This pattern may shift where water remains on a local area for longer periods. Species having a greater presence under local, wetter conditions may include overcup oak, water hickory, bald cypress, and water elm. The latter suite of species are more indicative of "wet" alluvial flats, which occur as inclusions on broader floodplains of this site.

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, sugarberry, boxelder, along with the residual shade-tolerant species of red maple 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
Forest 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 and conversion to a pine monoculture. 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 results 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. There are moderate limitations to silviculture practices on this site due to seasonal flooding and/or wetness (equipment limitations) and the high productivity of the soils. Management activities may need to be restricted to drier times of the year. The nonacid reactions, high to very high available water capacity, and active to superactive cation exchange capacity collectively contributes to very high productivity of these soils. Therefore, plant competition on this site may be severe and intensive management may be needed to produce highly desirable species such as oak. Broadfoot (1976) warns that if surface layers have reactions above pH 7.5, then the site should be considered “unsuitable” for planting oaks.

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 well on the drier portions of this site include cherrybark, Nuttall, Shumard’s, swamp chestnut, willow, and water. However, managing for oaks alone on this 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 sweetgum, ash, elm, sycamore, and cottonwood. On the most favorable sites, potential productivity (i.e., site index) of individual trees can be impressive. Site indices (represents 50 years of growth; cottonwood, 30 years) of green ash, cottonwood, cherrybark oak, Nuttall oak, water oak, willow oak, sweetgum, and sycamore reportedly approach heights of 95, 108, 110, 108, 105, 104, 110, and 118 feet, respectively (Broadfoot, 1976). There are a variety of silvicultural 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. As an additional precaution, this site has seasonal limitations to timber management due to flooding and wetness issues. It is strongly advised to refrain from management activities when the soils are saturated.

State 4
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. However, wetness is a limitation of this site, which may affect the type of forage established and management activities during wet seasons and after heavy rain events (Capability Class 2w). The deep, nonacid soils of this site have high to very high available water capacity and is suited to most commonly grown forage plants. The possible exception may be bahiagrass and crimson clover (per Pastureland Suitability Group, 2a for Mississippi). The soils of this site produce high forage yields when adequately fertilized and properly managed; lime is generally not needed. Forage species suited for this site include hybrid and common bermudagrass, dallisgrass, tall fescue, orchardgrass, and cool and warm season legumes such as white clover, red clover, and annual lespedeza. Several additional plants and/or species combinations may be desired depending on the objectives and management approaches. As a precaution, the location of this site and the 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. 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
Agriculture Production

The major limitations to agriculture production is seasonal wetness and occasional flooding, particularly of unprotected areas. Some areas may have artificial drainage systems established. Crops that are often established include cotton, corn, soybean, and small grains.

Community 5.1
Cropland

Soybean, corn, cotton, milo, and small grains are a few of the crops grown on this site. This site does have some seasonal wetness limitations, which may restrict the types of crops grown in addition to management activities relegated to drier periods.

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 (State 2).

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 (i.e., clearcut; State 3).

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 (State 4).

Transition T1D
State 1 to 5

Actions include mechanical removal of vegetation and stumps; herbicide treatment of residual plants; and preparation for cultivation (State 5).

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., natural channel and no levees). 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 (State 1).

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 (State 3).

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 (State 4).

Transition T2C
State 2 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for crop establishment (State 5).

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 (State 1).

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 (i.e., even-aged; State 2).

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 (State 4).

Transition T3B
State 3 to 5

Actions include mechanical removal of vegetation and stumps, herbicide treatment of residual plants, and preparation for cultivation (State 5).

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 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 (State 1).

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 (State 3).

Transition T4A
State 4 to 5

Actions include mechanical removal of vegetation and stumps; herbicide treatment of residual plants; and preparation for crop establishment (State 5).

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.). Floodplains where streams have been channelized and leveed, in addition to fields that had tile drainage systems established, must have the natural hydrology restored BEFORE reference conditions are achieved (State 1).

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 (State 3).

Restoration pathway R5C
State 5 to 4

Seedbed preparation and establishment of desired forage/grassland mixture (State 4).

Additional community tables

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Contributors

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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):**

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:**