USDA Natural Resources
Conservation Service

Ecological site F134XY016AL
Northern Non-Acid 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 limited distribution in portions of the Loess Hills (EPA Level IV Ecoregion: 74a) and the western edge of the Loess Plains (Ecoregion 74b) in western Kentucky and West Tennessee.

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 Wet Floodplain is characterized by very deep, poorly drained and very poorly drained soils that formed in thick, silty alluvium derived from loess. This site occurs as depressional areas and flats on alluvial fans, old fluvial terraces, narrow stream floodplains, and broad floodplains of major streams and tributaries that drain the deep loess-capped uplands of the Loess Hills and the western edge of the Loess Plains. Soils have reactions that range from slightly acid to slightly alkaline. Flooding ranges from rare to frequent during winter, spring, and after heavy rainfall events. A seasonal high water table at or near the surface occurs throughout the wetter periods of most years, which contributes to the ponding of depressional areas. Native vegetation of the site consists of mixed bottomland hardwoods and an herbaceous ground cover that is dominated by wetland obligate species. Overstory components typically include green ash, black willow, sugarberry, elm, sweetgum, and pecan and cottonwood on better drain areas. Potential oaks of this site include Nuttall, overcup, water, and pin.

Associated sites

F134XY014AL	**Northern Non-Acid Floodplain - PROVISIONAL** This site occurs on the higher drier positions of nonacid floodplain and alluvial fan environments.
F134XY015AL	**Northern Non-Acid Moderately Wet Floodplain - PROVISIONAL** This site occupies the mid-point of the wet - dry gradient of nonacid floodplain and alluvial fan environments.

Table 1. Dominant plant species

Tree	Not specified

Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The distribution of the Northern Non-acid Wet Floodplain is strictly limited to portions of the MLRA that are blanketed with very thick loess deposits, which includes portions of the Loess Hills and the western edge of the Loess Plains. The soils of this site have been mapped only in portions of western Kentucky and West Tennessee.

This site is found within a number of geomorphic situations that include alluvial fans; narrow floodplains of low-gradient streams; broad, level to nearly level old fluvial terraces; and locally within broad, level stream valleys (outside of the active floodplain). 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 far greater than 10 feet - some areas possibly having depths to 90 feet. The site’s distribution appears to be most prominent and concentrated on floodplains of streams that head within deep loess landscapes and on alluvial fans that formed along the perimeter of the Loess Hills.

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

Alluvial fans of this site are fairly common, and they occur along the interface of the Loess Hills and the edge or boundary of the Southern Mississippi Valley Alluvium (MLRA 131A) and on toeslopes, terraces, and the upland – floodplain interface of large streams and medium-sized rivers within MLRA 134. 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. Here, the site occupies depressions and level surfaces in very close association with the other two nonacid ecological sites, the Northern Non-acid Floodplain and Northern Non-acid Moderately Wet Floodplain.

The site’s occurrence within and along small to moderately broad floodplains are generally associated with stream systems that drain the Loess Hills and/or head and flow along the transition of the Loess Hills and Loess Plains. Again, the site often occurs in close association with the aforementioned, drier nonacid sites; this site represents the wettest member of the “catena” of nonacid ecological sites.

One of the most interesting occurrences of the site is its presence on level to nearly level terraces and within broad, stream valleys. Locally, some “terrace units” comprise

depressions spanning several acres. These geomorphic situations are generally outside of the active, river or stream floodplain system, although some overland flow likely occurs from the flooding of nearby, small terrace streams. It is possible that some of these terrace units formed in thick loess deposits and not directly from alluvial processes.

The influence of aspect is negligible in this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Alluvial fan (3) Terrace
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to occasional
Elevation	79–122 m
Slope	0–2%
Ponding depth	0–38 cm
Water table depth	15–61 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 55 inches. 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 during most years. However, accumulations are generally less than 12 inches and melt within 3 to 5 days. Occasionally, winter precipitation consists of heavy freezing rain and sleet, and the area has experienced particularly destructive ice-storm events in the past. The average annual temperature is 59 degrees F. The freeze-free period averages 214 days, and the frost free period averages 192 days.

Table 3. Representative climatic features

Frost-free period (average)	192 days
Freeze-free period (average)	214 days

Precipitation total (average)	1,397 mm

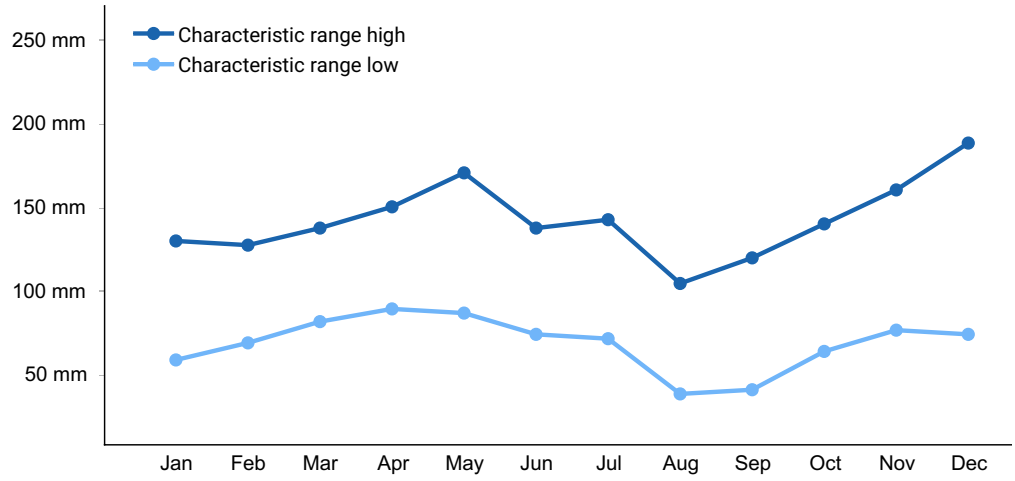

Figure 1. Monthly precipitation range

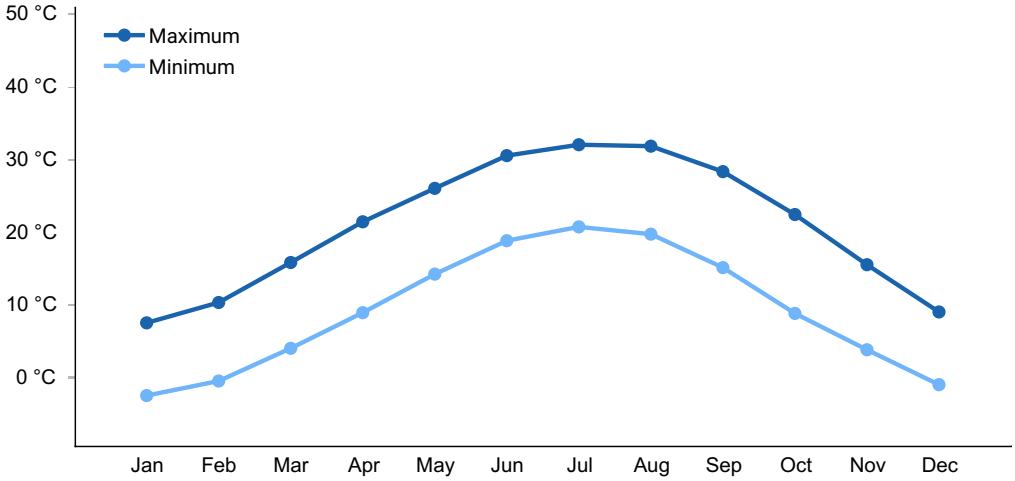

Figure 2. Monthly average minimum and maximum temperature

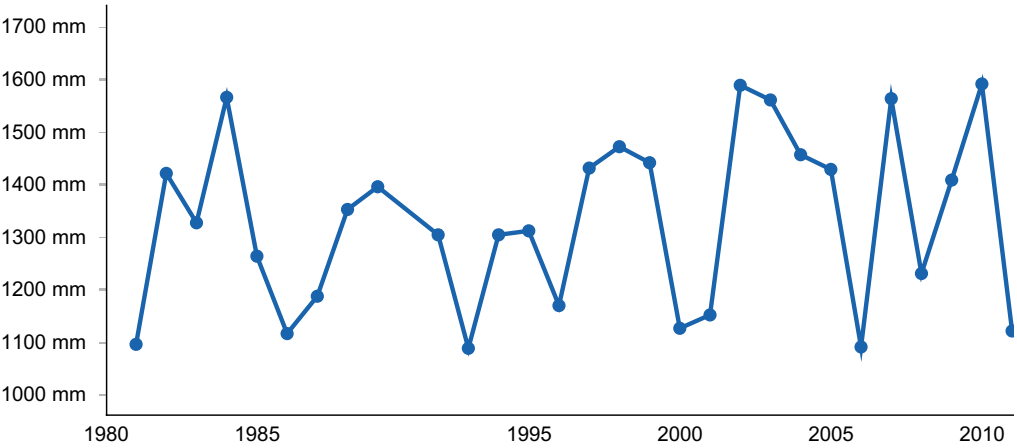

Figure 3. Annual precipitation pattern

Climate stations used

- (1) BARDWELL 2 E [USC00150402], Bardwell, KY

- (2) RIPLEY [USC00407710], Ripley, TN
- (3) UNION CITY [USC00409219], Union City, TN
- (4) COVINGTON 3 SW [USC00402108], Covington, TN
- (5) LOVELACEVILLE [USC00154967], Paducah, KY
- (6) NEWBERN [USC00406471], Newbern, TN
- (7) DYERSBURG III GOLF [USW00003809], Dyersburg, TN

Influencing water features

This site occurs on depressions and level to nearly level surfaces of alluvial fans, terraces, and floodplains of small to large stream systems. Overland flooding and runoff occurs over a large percentage of the site's distribution. Flood duration is highly variable and directly dependent upon flood source, including stream size and watershed position. Narrow floodplains of small streams are typically "flashy" and may flood occasionally to frequently but flooding duration is generally brief. Sites associated with larger streams and large drainage basins may flood frequently and have long flood durations. A seasonal water table generally occurs within 12 inches of the soil surface. Soils of this site are poorly drained to very poorly drained. The plant species associated with this site include obligate and facultative wetland species.

Soil features

Please note that the soils listed in this section of the description may not be all inclusive. There may be additional soils that fit the site's concepts. Additionally, the soils that provisionally form the concepts of this site may occur elsewhere, either within or outside of the MLRA and may or "may not" have the same geomorphic characteristics or support similar vegetation. Some soil map units and soil series included in this "provisional" ecological site were used as a "best fit" for a particular soil – landform catena during a specific era of soil mapping, regardless of the origin of parent material or the location of MLRA boundaries. Therefore, the listed soils may not be typical for MLRA 134 or a specific location, and the associated soil map units may warrant further investigation in a joint ecological site inventory – soil survey project. When utilizing this provisional description, the user is encouraged to verify that the area of interest meets the appropriate ecological site concepts by reviewing the soils, landform, vegetation, and physical location. If the site concepts do not match the attributes of the area of interest, please review the Similar or Associated Sites listed in the Supporting Information section of this description to determine if another site may be a better fit for your area of interest.

This site is characterized by very deep, poorly drained to very poorly drained soils that formed in alluvial material derived from loess. These level to nearly level soils are on narrow to broad floodplains, terraces, 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 brief to long depending on geomorphic position, stream and drainage basin size, and flood magnitude. A seasonal high water table generally occurs at or near the soil surface. The potential for surface water runoff is very low to negligible and

available water capacity is high to very high. A key property of these soils is that reactions may range from slightly acid to moderately alkaline. Higher pH of these soils are hypothesized to support greater plant productivity than their acid, floodplain counterparts.

The principal soils associated with this site include the Dekoven (Fine-silty, mixed, superactive, thermic Typic Endoaquolls) series, and secondary soils consist of a few areas mapped as the Birds (Fine-silty, mixed, superactive, nonacid, mesic Typic Fluvaquents) series.

Dekoven soils are somewhat unique in the northern portions of MLRA 134 as it represents one of a few examples of thermic soils possessing a mollic epipedon – depth of which is approximately 0 to 22 inches (Ap, A horizons). Dekoven soils diagnostically possess a cambic horizon 22 to 60 inches below the surface (Bg horizon).

Conversely, Birds soils have an ochric epipedon 0 to 22 inches from the surface (Ap and ACg horizons) and lack a cambic horizon, although in some areas these soils have been described as having weak or moderate blocky structure through the middle part of the series control section. An additional difference is that Birds soils are classified as having a mesic soil temperature regime (USDA-NRCS, 2016), and the mapped occurrences in Tennessee represent the southern-most points of the soils' distribution. (This series was mapped in two West Tennessee counties during the 1960s and warrant revisiting.)

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	21.08–21.34 cm
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.7–7
Subsurface fragment volume <=3" (Depth not specified)	0–2%

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 restricted to the northern half of the MLRA of western Kentucky and West Tennessee.

This site occurs in a number of geomorphic situations that include small to broad floodplains, level to depressional surfaces on terraces, and alluvial fans. The site's occurrence within small to moderately broad floodplains are generally associated with stream systems that originate and drain the Loess Hills and the western edge of the Loess Plains. Here, the site forms a close association with the Northern Non-acid Floodplain and Northern Non-acid Moderately Wet Floodplain ecological sites. The principal difference among the three is that the poorly to very poorly drained soils of this site occur on the lowest and wettest positions within the respective floodplains. Alluvial fans of this site are fairly common and occur along the interface of the Loess Hills and the edge or boundary of the Southern Mississippi Valley Alluvium (MLRA 131A) and 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 on the extreme wet end 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) have mostly dropped out and are replaced by plants more tolerant of anaerobic conditions. Overstory components generally include green ash, black willow, sugarberry, silver maple, elm, sweetgum, shellbark hickory and pecan and cottonwood on rises. Potential oaks of this site include Nuttall, overcup, water, and pin, with Nuttall oak typically occupying slightly higher positions within the site. In the northern extent of this site in western Kentucky, swamp white oak is an additional component of the community.

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 in areas that have not been artificially drained and channelized or leveed.

Perhaps the largest and most significant alteration to this site has been channelization and levee (or spoil bank) construction, along with drainage networks of ditching and tile systems. Such hydrologic alterations have become the norm for floodplains and low-lying areas in this MLRA. This action results in a disconnection between the stream - floodplain environment and the longevity of seasonal wetness, which interrupts and alters the ecological processes and functions of the system as a whole. From a production perspective, these actions have often resulted in bountiful crop production, especially on the moist, fertile soils of 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 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

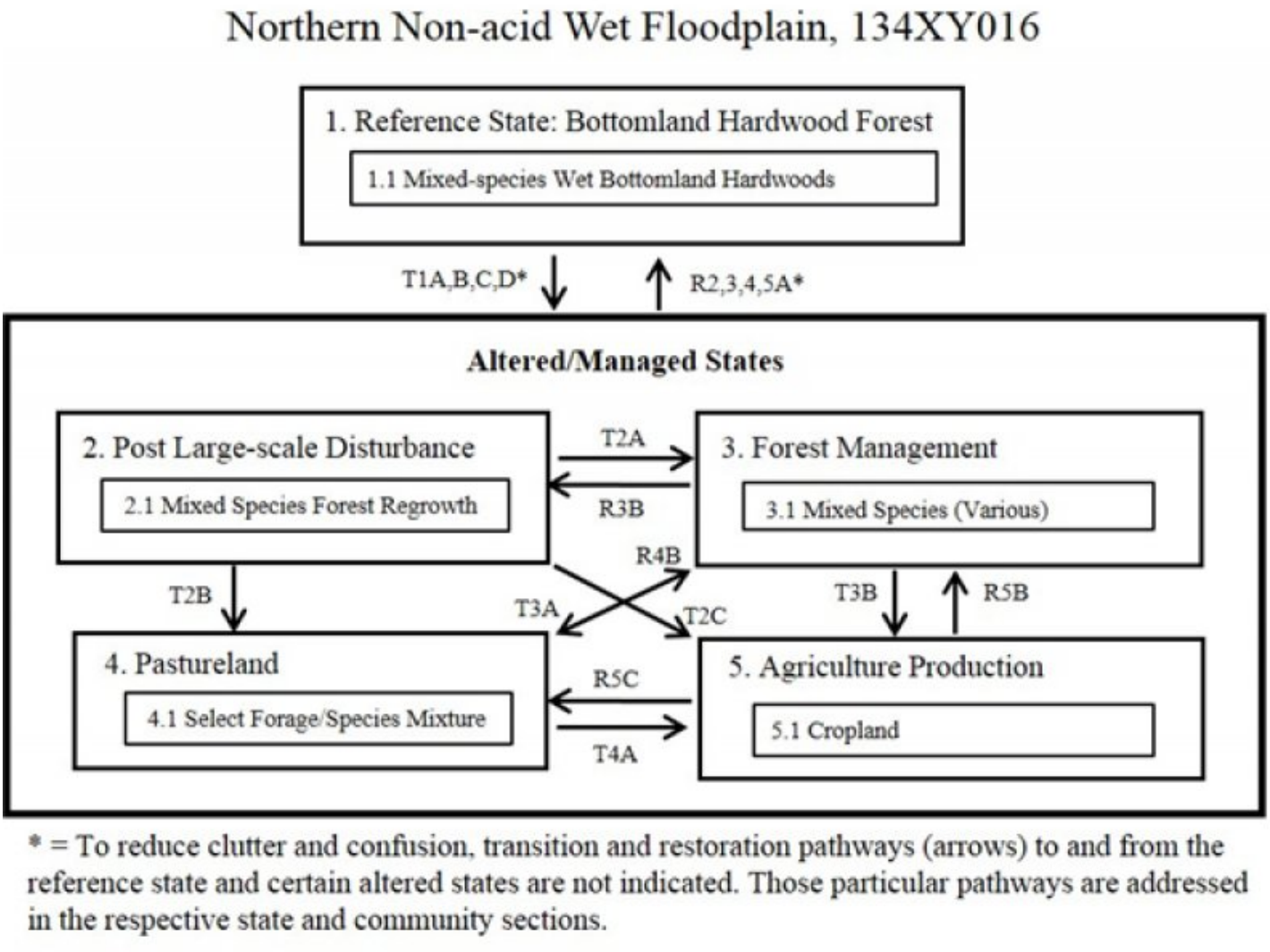

Figure 5. STM - Northern Nonacid Wet Floodplain

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 Wet Floodplain

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 soil wetness compared to the better drained positions on the alluvial fans, terraces, and floodplains. Species that occur on the drier natural levees, flats, and the upland drainageways of the Loess Hills (e.g., American beech, white oak, tuliptree, and walnut) have dropped out and are replaced by species more tolerant of hydric conditions. 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 Wet Bottomland Hardwoods

This community phase represents the successional stage, composition, and structural complexity of stands supporting perceived reference conditions. Today, this community is representative of maturing stands (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, shellbark hickory, pecan, sugarberry, green ash, American elm, water oak, willow oak, Nuttall oak, persimmon, and an understory component of American hornbeam, pawpaw, 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, pin oak, Drummond’s maple, and silver maple. To the north in western Kentucky, swamp white oak is a component of the community. Within larger canopy gaps, black willow may colonize and proliferate larger forest openings. Typical wetland herbaceous species of the site include lizard’s tail, Virginia dayflower, swamp dock, and several species of sedges. The rare, obligate wetland short-stemmed iris has been found on the soils 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 black willow, sweetgum, American sycamore, eastern cottonwood, ash, oaks, hickory, elm, sugarberry, boxelder, along with the residual shade-tolerant species of Drummond's 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. However, seasonal wetness may contribute to high seedling mortality.

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. 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 to severe limitations to silviculture practices on this site due to seasonal flooding and/or wetness (equipment limitations). Management activities may need to be restricted to drier times of the year. The nonacid reactions, high to very high available water capacity, and superactive cation exchange capacity collectively contributes to high productivity of these soils. Therefore, plant competition on this site could be problematic

and intensive management may be needed to produce the desired species.

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 Nuttall, pin, water, overcup, and swamp white oak to the north. 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. 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 moderate to severe limitation of this site (Capability Class 2w and 3w), which may affect the type of forage that can be established. Additionally, management activities may have to be restricted to drier periods of the year. 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 soils of this site are capable of producing high forage yields when adequately fertilized and properly managed; lime is generally not needed. Forage species reportedly suited for this site include hybrid and common bermudagrass, tall fescue, orchardgrass, and cool and warm season legumes such as white 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, which may initially consist of a black willow thicket.

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 have been established include cotton, corn, soybean, and grain sorghum. Winter wheat is generally not suited for this site due to seasonal wetness (USDA-NRCS, 2004).

Community 5.1
Cropland

Soybean, corn, cotton, and grain sorghum are a few of the crops grown on this site. This site does have moderate to severe 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. However, seasonal wetness and periodic flooding present management limitations. 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). 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 crop establishment (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, no levees, and no drainage system). 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 (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 crop establishment (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, fields, and depressional areas where streams have been channelized and leveed and/or ditched and tiled 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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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	05/21/2025
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):**

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

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

Additional:

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

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:**