USDA Natural Resources
Conservation Service

Ecological site F115XC020IL
Loamy Floodplain Forest

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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): 115X–Central Mississippi Valley Wooded Slopes

This MLRA is characterized by deeply dissected, loess-covered hills bordering well defined valleys of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers and their tributaries. It is used to produce cash crops and livestock. About one-third of the area is forested, mostly on the steeper slopes. This area is in Illinois (50 percent), Missouri (36 percent), Indiana (13 percent), and Iowa (1 percent) in two separate areas. It makes up about 25,084 square miles (64,967 square kilometers).

Most of this area is in the Till Plains section and the Dissected Till Plains section of the Central Lowland province of the Interior Plains. The Springfield-Salem plateaus section of the Ozarks Plateaus province of the Interior Highlands occurs along the Missouri River and the Mississippi River south of the confluence with the Missouri River. The nearly level to very steep uplands are dissected by both large and small tributaries of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers. The Ohio River flows along the southernmost boundary of this area in Indiana. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to undulating. Karst topography is common in some parts along the Missouri and Mississippi Rivers and their tributaries. Well-developed karst areas have hundreds of sinkholes, caves, springs, and losing streams. In the St. Louis area, many of the karst features have been obliterated by urban development.

Elevation ranges from 90 feet (20 meters) on the southernmost flood plains to 1,030 feet (320 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 150 feet (15 to 45 meters) in the steep, deeply dissected hills bordering rivers and streams. The bluffs along the major rivers are generally 200 to 350 feet (60 to 105 meters) above the valley floor.

The uplands in this MLRA are covered almost entirely with Peoria Loess. The loess can be more than 7 feet (2 meters) thick on stable summits. On the steeper slopes, it is thin or does not occur. In Illinois, the loess is underlain mostly by Illinoian-age till that commonly contains a paleosol. Pre-Illinoian-age till is in parts of this MLRA in Iowa and Missouri and to a minor extent in the western part of Illinois. Wisconsin-age outwash, alluvial deposits, and sandy eolian material are on some of the stream terraces and on dunes along the major tributaries. The loess and glacial deposits are underlain by several bedrock systems. Pennsylvanian and Mississippian bedrock are the most extensive. To a lesser extent are Silurian, Devonian, Cretaceous, and Ordovician bedrock. Karst areas have formed where limestone is near the surface, mostly in the southern part of the MLRA along the Mississippi River and some of its major tributaries. Bedrock outcrops are common on the bluffs along the Mississippi, Ohio, and Wabash Rivers and their major tributaries and at the base of some steep slopes along minor streams and drainageways.

The annual precipitation ranges from 35 to 49 inches (880 to 1,250 millimeters) with a mean of 41 inches (1,050 millimeters). The annual temperature ranges from 48 to 58 degrees F (8.6 to 14.3 degrees C) with a mean of 54 degrees F (12.3 degrees C). The freeze-free period ranges from 150 to 220 days with a mean of 195 days.

Soils The dominant soil orders are Alfisols and, to a lesser extent, Entisols and Mollisols. The soils in the area have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They are shallow to very deep, excessively drained to poorly drained, and loamy, silty, or clayey.

The soils on uplands in this area support natural hardwoods. Oak, hickory, and sugar maple are the dominant species. Big bluestem, little bluestem, and scattered oak and eastern redcedar grow on some sites. The soils on flood plains support mixed forest vegetation, mainly American elm, eastern cottonwood, river birch, green ash, silver maple, sweetgum, American sycamore, pin oak, pecan, and willow. Sedge and grass meadows and scattered trees are on some low-lying sites. (United States Department of Agriculture, Natural Resources Conservation Service, 2022)

LRU notes

The Central Mississippi Valley Wooded Slopes, Northern part (Land Resource Unit (LRU) 115XC) encompasses the Wyaconda River Dissected Till Plains, Mississippi River Hills, and Mississippi River Alluvial Plain (Schwegman et al. 1973; Nelson 2010). It spans three states – Illinois (73 percent), Iowa (6 percent), and Missouri (21 percent) – comprising about 13,650 square miles (Figure 1). The elevation ranges from 420 feet above sea level (ASL) along the Mississippi River floodplains to 885 feet on the upland ridges. Local relief varies from 10 to 20 feet but can be as high as 50 to 100 feet along drainageways and streams and the bluffs on the major rivers reaching 250 feet above valley floors. Wisconsin-aged loess covers the uplands, while Illinoian glacial drift lies directly below. The loess and drift deposits are underlain by several bedrock systems, including the Cretaceous, Pennsylvania, Mississippian, Silurian, Devonian, and Ordovician Systems. Wisconsin outwash deposits and sandy eolian material occur along stream terraces of major tributaries (USDA-NRCS 2006).

The vegetation across the region has undergone drastic changes over time. At the end of the last glacial episode – the Wisconsinan glaciation – the evolution of vegetation began with the development of tundra habitats, followed by a phase of spruce and fir forests, and eventually spruce-pine forests. Not until approximately 9,000 years ago did the climate undergo a warming trend which prompted the development of deciduous forests dominated by oak and hickory. As the climate continued to warm and dry, prairies began to develop approximately 8,300 years ago. Another shift in climate that resulted in an increase in moisture prompted the emergence of savanna-like habitats from 8,000 to 5,000 years before present (Taft et al. 2009). During the most recent climatic shifts, forested ecosystems maintained footholds on steep valley sides and wet floodplains. Due to the physiography of the MLRA, forests were the dominant ecosystems and were affected by such natural disturbances as droughts, wind, lightning, and occasional fire (Taft et al. 2009).

Classification relationships

USFS Subregions: Central Dissected Till Plains (251C)Section; Western Mississippi River Hills (251Ce), Mississippi River and Illinois Alluvial Plains (251Cf), Eastern Mississippi River Hills (251Ci), Galesburg Dissected Till Plain (251Cj), and Wyaconda River Dissected Till Plain (251Cm) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Upper Mississippi River Alluvial Plain (72d), River Hills (72f), and Western Dissected Illinoian Till Plain (72i) (USEPA 2013)

National Vegetation Classification – Ecological Systems: North-Central Interior Floodplain (CES202.694) (NatureServe 2015)

National Vegetation Classification - Plant Associations: Quercus macrocarpa – Quercus bicolor – Carya laciniosa/Leersia spp. – Cinna spp. Floodplain Forest (CEGL002098) (Nature Serve 2015)

Biophysical Settings: Central Interior and Appalachian Floodplain Systems (BpS 4214710) (LANDFIRE 2009)

Natural Resources Conservation Service – Iowa Plant Community Species List: Forest, Bur Oak – Swamp White Oak Mixed Bottomland (USDA-NRCS 2007)

Illinois Natural Areas Inventory: Wet-mesic floodplain forest (White and Madany 1978)

Iowa Department of Natural Resources: Floodplain Forest (INAI 1984)

Missouri Terrestrial Natural Communities: Wet-mesic bottomland forest (Nelson 2010)

Ecological site concept

Loamy Floodplain Forests are located within the green areas on the map. They occur on floodplains in river valleys. The soils are Mollisols, Entisols, and Inceptisols that are somewhat poorly to well drained and very deep, formed in alluvium.

The historic pre-European settlement vegetation on this ecological site was dominated by a dense, closed canopy of deciduous trees and an understory of flood-tolerant, hydrophytic herbaceous plants. Swamp white oak (Quercus bicolor Willd.) and bur oak (Quercus macrocarpa Michx.) are the main canopy species. Other tree species that may occur can include green ash (Fraxinus pennsylvanica Marshall), American elm (Ulmus americana L.), silver maple (Acer saccharinum L.), and slippery elm (Ulmus rubra Muhl.). Common hackberry (Celtis occidentalis L.) is a common subcanopy component. The understory is comprised of species tolerant of occasional flood disturbances such as sweet woodreed (Cinna arundinacea L.) and cutleaf coneflower (Rudbeckia laciniata L.). Seasonal flooding is the primary disturbance factor that maintains this site, while damage from storms and periodic pest outbreaks are secondary disturbances (LANDFIRE 2009).

Associated sites

F115XC019IL	**Clayey Floodplain Forest** Clayey alluvial parent material including Carlow, Chequest, McFain, Moline, and Titus soils
F115XC021IL	**Sandy Floodplain Forest** Sandy and gravelly alluvial parent material including Caneek variant, Elsah, Fruitfield, Klum, Landes, Psamments, Sarpy, and Zumbro soils

Similar sites

F115XC019IL	**Clayey Floodplain Forest** Clayey Floodplain Forests are in a similar landscape position, but the parent material is clayey alluvium
F115XC021IL	**Sandy Floodplain Forest** Sandy Floodplain Forests are in a similar landscape position, but the parent material is coarse alluvium

Table 1. Dominant plant species

Tree	(1) *Quercus bicolor* (2) *Quercus macrocarpa*
Shrub	(1) *Celtis occidentalis*
Herbaceous	(1) *Cinna arundinacea* (2) *Rudbeckia laciniata*

Physiographic features

Loamy Floodplain Forests occur on floodplains in river valleys. They are situated on elevations ranging from approximately 341 to 1528 feet ASL. The site experiences occasional to frequent flooding that can last up to 30 days.

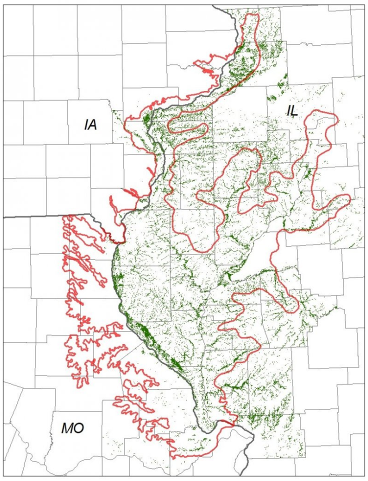


Figure 1. Location of Loamy Floodplain Forest ecological site within LRU 115XC.

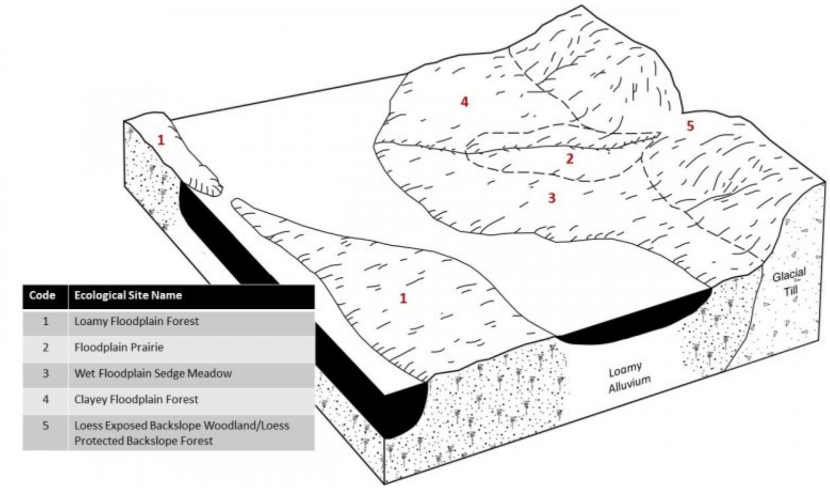


Figure 2. Representative block diagram of Loamy Floodplain Forest and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) River valley > Flood plain
Runoff class	Very low to very high
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Elevation	341–1,528 ft
Slope	0–2%
Water table depth	15–80 in
Aspect	Aspect is not a significant factor

Climatic features

The Central Mississippi Valley Wooded Slopes, Northern Part falls into the humid subtropical (Cfa) and hot-summer humid continental climate (Dfa) Köppen-Geiger climate classifications (Peel et al. 2007). The two main factors that drive the climate of the MLRA are latitude and weather systems. Latitude, and the subsequent reflection of solar input, determines air temperatures and seasonal variations. Solar energy varies across the seasons, with summer receiving three to four times as much energy as opposed to winter. Weather systems (air masses and cyclonic storms) are responsible for daily fluctuations of weather conditions. High-pressure systems are responsible for settled weather patterns where sun and clear skies dominate. In fall, winter, and spring, the polar jet stream is responsible for the creation and movement of low-pressure systems. The clouds, winds, and precipitation associated with a low-pressure system regularly follow high-pressure systems every few days (Angel n.d.).

The soil temperature regime of LRU 115XC is classified as mesic, where the mean annual soil temperature is between 46 and 59°F (USDA-NRCS 2006). Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south one travels. The average freeze-free period of this ecological site is about 184 days, while the frost-free period is about 152 days. The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is 38 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 42 and 62°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	141-168 days
Freeze-free period (characteristic range)	170-196 days
Precipitation total (characteristic range)	35-40 in
Frost-free period (actual range)	140-170 days
Freeze-free period (actual range)	169-203 days
Precipitation total (actual range)	35-40 in
Frost-free period (average)	152 days
Freeze-free period (average)	184 days
Precipitation total (average)	38 in

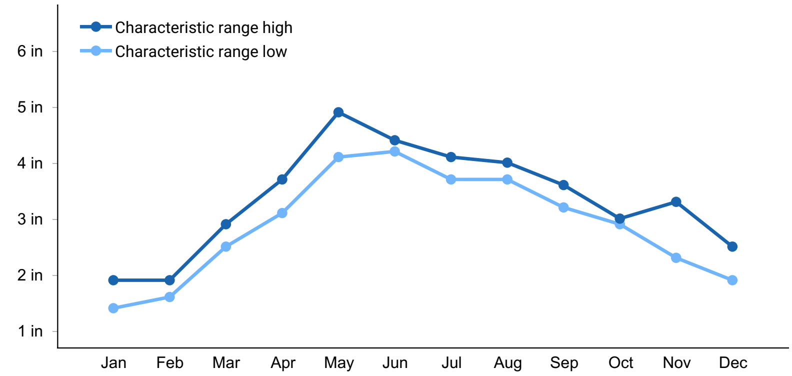


Figure 3. Monthly precipitation range

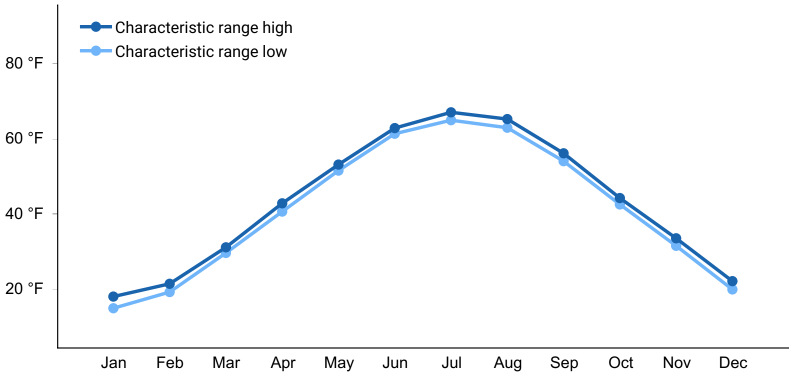


Figure 4. Monthly minimum temperature range

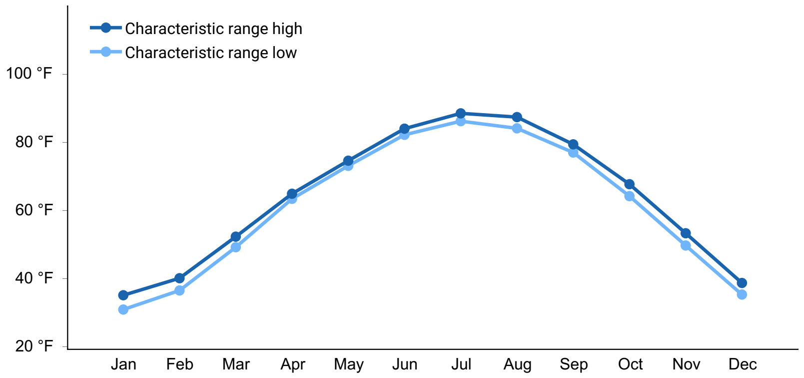


Figure 5. Monthly maximum temperature range

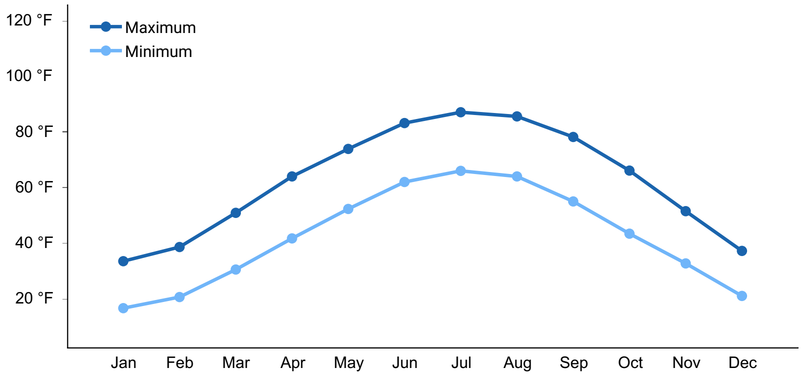


Figure 6. Monthly average minimum and maximum temperature

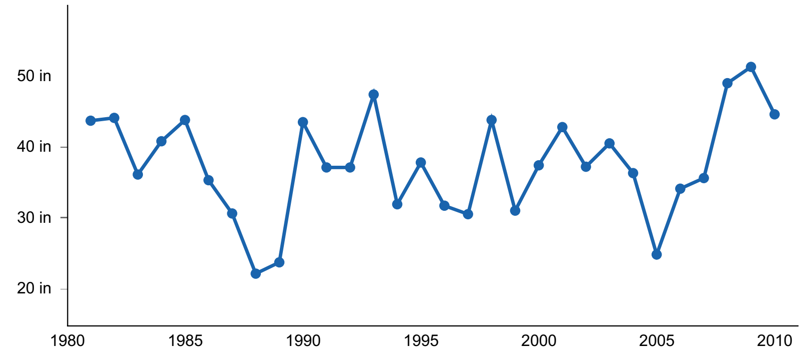


Figure 7. Annual precipitation pattern

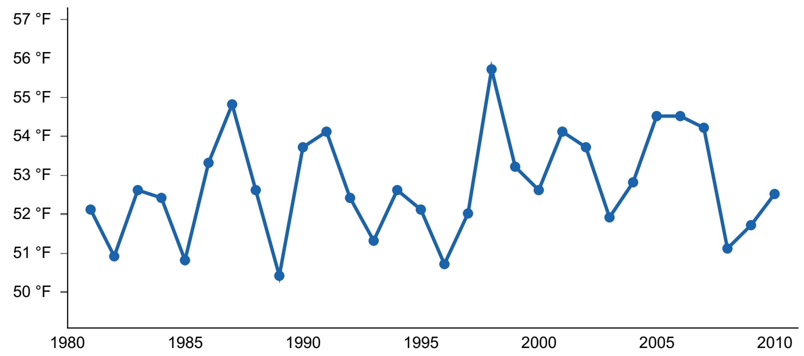


Figure 8. Annual average temperature pattern

Climate stations used

- (1) CLINTON #1 [USC00131635], Camanche, IA
- (2) NEW BOSTON DAM 17 [USC00116080], Wapello, IL
- (3) CANTON L&D 20 [USC00231275], Canton, MO

- (4) CLARKSVILLE L&D 24 [USC00231640], Clarksville, MO
- (5) HAVANA [USC00113940], Lewistown, IL

Influencing water features

Loamy Floodplain Forests are classified as a RIVERINE: Occasionally Flooded; forested wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Forested, Broad-leaved Deciduous, Temporarily Flooded wetland under the National Wetlands Inventory (FGDC 2013). Overbank flow from the channel and subsurface hydraulic connections are the main sources of water for this ecological site (Smith et al. 1995). Infiltration is very slow to moderate (Hydrologic Groups B, C, and D) for undrained soils, and surface runoff is very low to very high.

Wetland description

Primary wetland hydrology indicators for an intact Loamy Floodplain Forest may include: A1 Surface water, B1 Water marks, B2 Sediment deposits, B3 Drift deposits, and B9 Water-stained leaves. Secondary wetland hydrology indicators may include: D5 FAC-neutral test (USACE 2010).

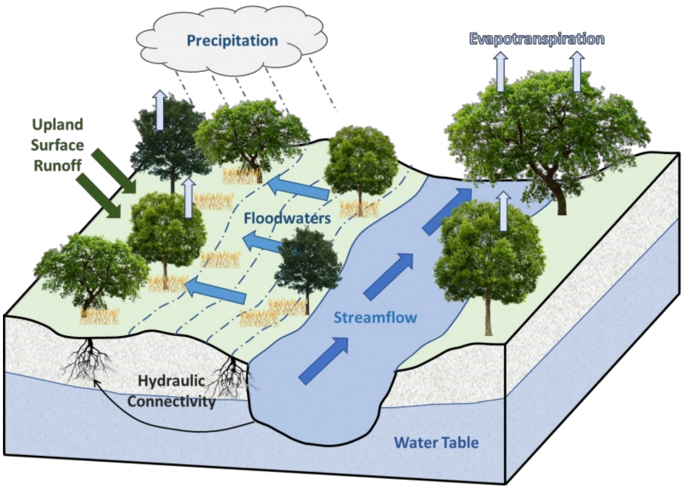


Figure 9. Hydrologic cycling in Loamy Floodplain Forest ecological site.

Soil features

Soils of Loamy Floodplain Forests are in the Mollisols, Entisols, and Inceptisols orders, further classified as Aquic Cumulic Hapludolls, Cumulic Hapludolls, Fluvaquentic Endoaquolls, Fluvaquentic Hapludolls, Fluventic Hapludolls, Typic Hapludolls, Mollic Fluvaquents, Aeric Fluvaquents, Aquic Udifluvents, Oxyaquic Udifluvents, Typic Udifluvents, Dystric Fluventic Eutrudepts, Fluvaquentic Endoaquepts with very slow to moderate infiltration and very low to very high runoff potential. The soil series associated with this site includes Ackmore, Ambraw, Arenzville, Belknap, Blake, Blyton, Ceresco, Coffeen, Dockery, Dorchester, Dozaville, Elrick, Haymond, Huntsville, Jules, Lawson, Medway, Orion, Paxico, Radford, Riley, Ross, Shaffton, Tice, Volney, Wakeland, and Wirt. The parent material is silty and loamy alluvium, and the soils are somewhat poorly to well drained and very deep. Soil pH classes are very strongly acid to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site.

Some soil map units in this ecological site, if not drained, may meet the definition of hydric soils and are listed as meeting criteria 2 or 4 of the hydric soils list (77 FR 12234).

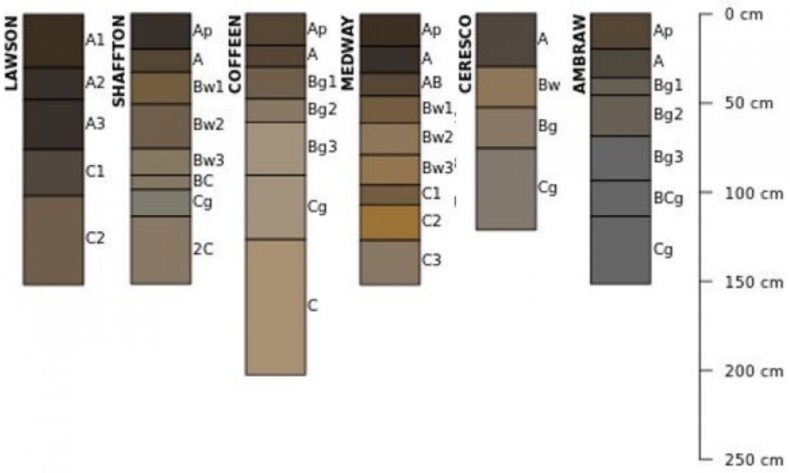


Figure 10. Profile sketches of soil series associated with Loamy Floodplain Forest.

Table 4. Representative soil features

Parent material	(1) Alluvium
Family particle size	(1) Fine-silty (2) Coarse-silty (3) Fine-loamy
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderate
Depth to restrictive layer	80 in
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	4–9 in
Calcium carbonate equivalent (Depth not specified)	0–40%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Soil reaction (1:1 water) (Depth not specified)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–23%

Ecological dynamics

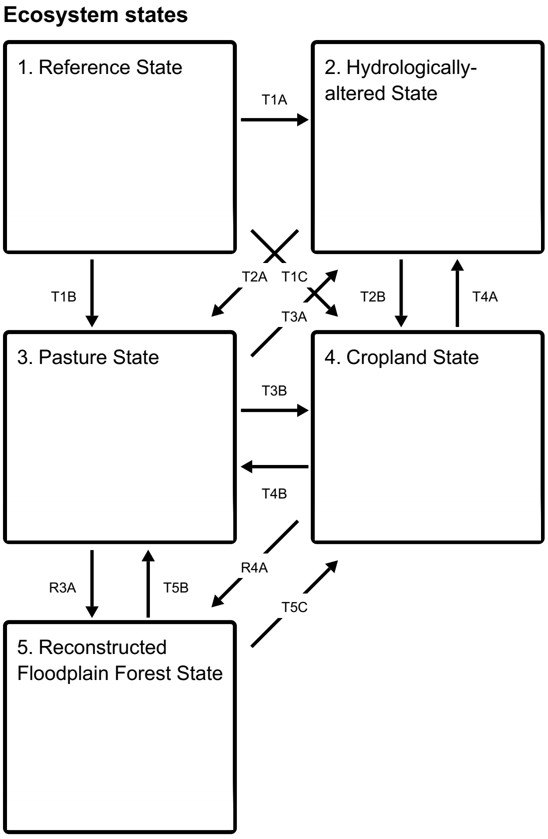
The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

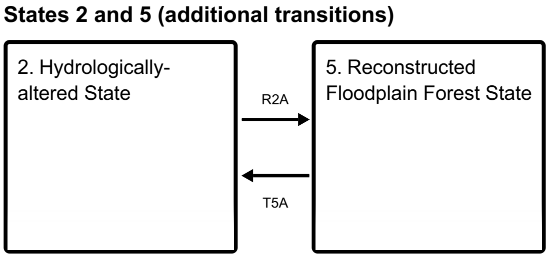
The MLRA lies within the tallgrass prairie ecosystem of the Midwest, but a variety of environmental and edaphic factors resulted in a landscape that historically supported upland hardwood forests, lowland mixed forests, and scattered grass and sedge meadows. Loamy Floodplain Forests form an aspect of this vegetative continuum. This ecological site occurs on floodplains on somewhat poorly to well drained alluvial soils. Species characteristic of this ecological site consist of hydrophytic woody and herbaceous vegetation.

Occasional flooding is the dominant disturbance factor in Loamy Floodplain Forests, and storm damage and pests are secondary disturbances. Seasonal flooding occurs every two to twenty years, and flooding can persist for up to 30 days at a time. Damage to trees from wind storms can vary from minor, patchy effects of individual trees to stand effects that temporarily affect community structure and species richness and diversity (Irland 2000; Peterson 2000). Oaks are susceptible to a variety of pests (e.g., insects, fungi, cankers, wilts), therefore periodic insect and disease outbreaks play an important role in local canopy structure (Snyder 1992).

Today, many Loamy Floodplain Forests have been reduced as a result of conversion to pasture. A few sites have been cleared and drained for agricultural production. Remnant sites have been degraded due to significant changes to the natural hydrologic regime and diminished water quality in the watershed. The state-and-transition model that follows provides a detailed description of each state, community phase, pathway, and transition. This model is based on available experimental research, field observations, literature reviews, professional consensus, and interpretations.

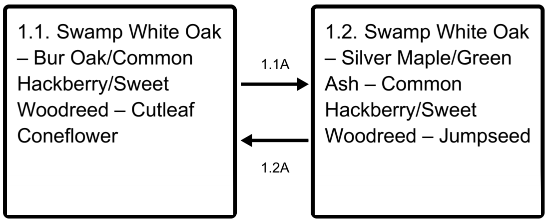
State and transition model





T1A - Hydrology altered
T1B - Management inputs to increase yields
T1C - Establish row-crop agriculture
T2A - Management inputs to produce forage
T2B - Establish row-crop agriculture
R2A - Restoration inputs
T3A - Abandonment; natural succession
T3B - Establish row-crop agriculture
R3A - Restoration inputs
T4A - Abandonment; site still hydrologically altered
T4B - Management inputs for pasture/forage production
R4A - Restoration inputs
T5A - No active management; altered hydrology
T5B - Establish forage production on site
T5C - Site cleared; management for agriculture

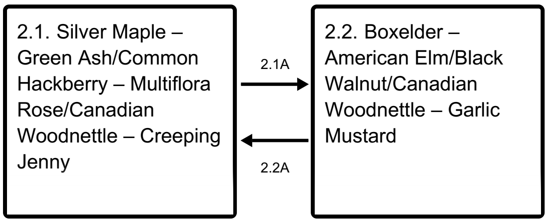
State 1 submodel, plant communities



1.1A - Major flood event

1.2A - Natural succession as a result of no disturbances

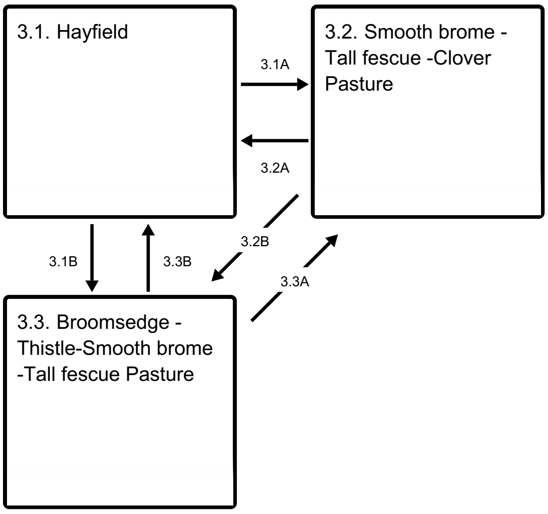
State 2 submodel, plant communities



2.1A - Increasing frequency of disturbances

2.2A - Decreasing frequency of disturbances

State 3 submodel, plant communities



3.1A - Grazing; .balance of animal to forage

3.1B - Grazing; overutilization of forage

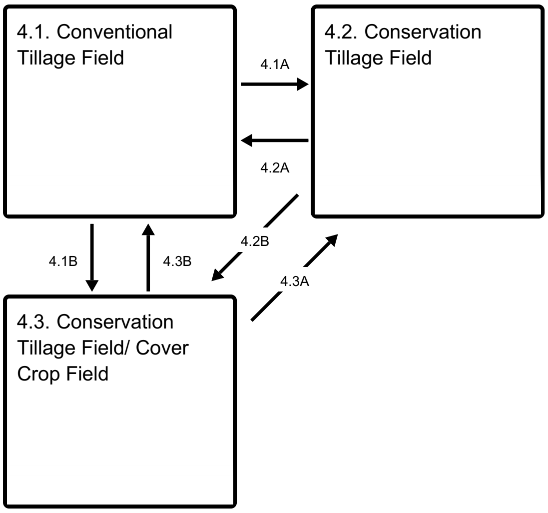
3.2A - Mechanical harvesting

3.2B - Grazing; overutilization of the forage plants

3.3B - Mechanical harvesting

3.3A - Grazing; no overutilization of forage plants

State 4 submodel, plant communities



4.1A - Less tillage, residue management

4.1B - Less tillage, residue management, and implementation of cover cropping

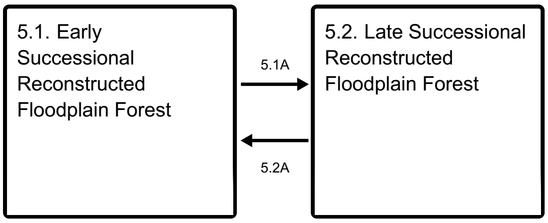
4.2A - Intensive tillage, remove residue, and reinitiate monoculture row cropping

4.2B - Implementation of cover cropping

4.3B - Intensive tillage, remove residue, and reinitiate monoculture row cropping

4.3A - Remove cover cropping

State 5 submodel, plant communities



5.1A - Timber stand improvement practices implemented

5.2A - Setback from extreme weather event or improper timing of management actions

State 1
Reference State

The reference plant community is categorized as an oak bottomland forest community, dominated by upland and hydrophytic oaks and herbaceous vegetation. The two community phases within the reference state are dependent on a regular flood regime. The amount and duration of flooding alters species composition, cover, and extent. Periodic pest outbreaks and wind storms have more localized impacts in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- silver maple (*Acer saccharinum*), tree
- bur oak (*Quercus macrocarpa*), tree
- common hackberry (*Celtis occidentalis*), tree
- sweet woodreed (*Cinna arundinacea*), grass
- jumpseed (*Polygonum virginianum*), other herbaceous

Community 1.1
Swamp White Oak – Bur Oak/Common Hackberry/Sweet Woodreed – Cutleaf Coneflower

Sites in this reference community phase are a closed canopy forest (80 to 100 percent cover) dominated by swamp white oak and bur oak, with subdominants including green ash, American and slippery elm, and silver maple. Common hackberry may be a frequent component of the subcanopy. Trees are large (21 to 33-inch DBH) and range in height from 30 to over 80 feet tall (LANDFIRE 2009). Sweet woodreed and cutleaf coneflower may be dominant and characteristic herbaceous species, respectively (Runkel and Roosa 2014). Other herbaceous species can include nodding fescue (*Festuca subverticillata* (Pers.) Alexeev), fowl mannagrass (*Glyceria striata* (Lam.) Hitchc.), Gray's sedge (*Carex grayi* Carey), and jumpseed (Polygonum virginanum L.) (NatureServe 2015). Occasional flooding every 2 to 20 years will maintain this phase, but a major flood event can shift the community to an earlier successional floodplain forest, phase 1.2 (Myers and Buchman 1984).

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- bur oak (*Quercus macrocarpa*), tree
- sweet woodreed (*Cinna arundinacea*), grass
- cutleaf coneflower (*Rudbeckia laciniata*), other herbaceous

Community 1.2
Swamp White Oak – Silver Maple/Green Ash – Common Hackberry/Sweet Woodreed – Jumpseed

This reference community phase represents a plant community in recovery from a major flood event. Mature swamp white oaks and bur oaks may still be present, but disturbance-tolerant species – such as silver maple, green ash, common hackberry, and eastern cottonwood (*Populus deltoides* L.) – become important co-dominant species in the tree canopy and subcanopy. Immediately following the flood event, the herbaceous layer is likely to be comprised mostly of annuals. Frequent flooding will maintain this community phase, but lack of disturbances will eventually allow this site to shift back to phase 1.1 (Myers and Buchman 1984).

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- silver maple (*Acer saccharinum*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- common hackberry (*Celtis occidentalis*), tree
- sweet woodreed (*Cinna arundinacea*), grass
- jumpseed (*Polygonum virginianum*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Major flood event.

Pathway 1.2A
Community 1.2 to 1.1

Natural succession as a result of no disturbances.

State 2
Hydrologically-altered State

Agricultural tile drainage, stream channelization, and levee construction in hydrologically-connected waters have drastically changed the natural hydrologic regime of Floodplain Forests. In addition, increased amounts of precipitation and intensity have amplified flooding events (Pryor et al. 2014). This has resulted in a type conversion from the species-rich forest to a ruderal floodplain forest state. In addition, exotic species have encroached and continuously spread, reducing native diversity and ecosystem stability (Eggers and Reed 2015).

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- green ash (*Fraxinus pennsylvanica*), tree

- boxelder (*Acer negundo*), tree
- American elm (*Ulmus americana*), tree
- Canadian woodnettle (*Laportea canadensis*), other herbaceous

Community 2.1
Silver Maple – Green Ash/Common Hackberry – Multiflora Rose/Canadian Woodnettle – Creeping Jenny

This community phase represents a transition in plant community composition as a result of an altered hydrologic regime. Silver maple, green ash, American elm, and slippery elm become the dominant tree canopy species. Common hackberry, honeylocust (*Gleditsia triacanthos* L.), and boxelder (*Acer negundo* L.) are dominant subcanopy species, while roughleaf dogwood (*Cornus drummondii* C.A. Mey) and multiflora rose (*Rosa multiflora* L.) are dominant shrubs. The herbaceous layer is nearly continuous but lacking in diversity. Canadian woodnettle (*Laportea canadensis* (L.) Weddell) and Canadian honewort (*Cryptotaenia canadensis* (L.) DC.) are common native species, and creeping jenny (*Lysimachia nummularia* L.) can be a frequently encountered non-native species.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- common hackberry (*Celtis occidentalis*), tree
- multiflora rose (*Rosa multiflora*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous
- creeping jenny (*Lysimachia nummularia*), other herbaceous

Community 2.2
Boxelder – American Elm/Black Walnut/Canadian Woodnettle – Garlic Mustard

This community phase represents persisting changes to the natural hydrology of the watershed. The overstory canopy continues to shift, becoming dominated by boxelder due to frequent disturbances (Rosario 1988). American elm can be a co-dominant canopy species, and black walnut (*Juglans nigra* L.) can be present in the subcanopy. The understory may continue to be invaded by more non-native species, such as garlic mustard (*Alliaria petiolata* (M. Bieb.) Cavara & Grande), as a result of the frequent disturbances.

Dominant plant species

- boxelder (*Acer negundo*), tree
- American elm (*Ulmus americana*), tree
- black walnut (*Juglans nigra*), tree
- Canadian woodnettle (*Laportea canadensis*), other herbaceous
- garlic mustard (*Alliaria petiolata*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.2

Increasing frequency of disturbances.

Pathway 2.2A
Community 2.2 to 2.1

Decreasing frequency of disturbances.

State 3
Pasture State

The pasture state arises when the site is converted to a farming system that emphasizes domestic livestock production, known as grassland agriculture. Fire suppression, periodic cultural treatments (e.g., clipping, drainage, soil amendment applications, planting new species and/or cultivars, mechanical harvesting) and grazing by domesticated livestock transition and maintain this state (USDA-NRCS 2003). Early settlers seeded non-native species, as smooth brome (*Bromus inermis* Leyss.), tall fescue (Festuca arundinacea), and Kentucky bluegrass (*Poa pratensis* L.), to help extend the grazing season (Smith 1998). Over time, as lands were continuously harvested or grazed by herds of cattle, these species were able to spread and expand across the landscape, reducing the native species diversity and ecological function.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Hayfield

Sites in this community phase consist of forage plants that are planted and mechanically harvested. Mechanical harvesting removes a significant portion of the aboveground biomass and nutrients that feed the soil microorganisms (Franzluebbers et al. 2000; USDA-NRCS 2003). As a result, soil biology is reduced leading to decreases in nutrient uptake by plants, soil organic matter, and soil aggregation. Frequent biomass removal can also reduce the site's carbon sequestration capacity (Skinner 2008). Many species may be seeded on these sites and the plants selected will depend upon the landowner's objectives.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- timothy (*Phleum pratense*), grass
- orchardgrass (*Dactylis glomerata*), grass
- alfalfa (*Medicago*), other herbaceous
- clover (*Trifolium*), other herbaceous

Community 3.2
Smooth brome -Tall fescue -Clover Pasture

This community is characterized by seeded cool-season grass and forbs. Species will depend upon landowner goals and objectives and may include many different grasses and forbs. Common species include smooth brome (*Bromus inermis*), tall fescue (Festuca arundinacea), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), red clover (*Trifolium pratense*) and white clover (*Trifolium repens* L.). Management inputs include control of weeds and brush. These sites are managed to ensure a proper forage/animal balance. Plants are not overutilized and have adequate rest and recovery.

Dominant plant species

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- red clover (*Trifolium pratense*), other herbaceous
- white clover (*Trifolium repens*), other herbaceous

Community 3.3
Broomsedge -Thistle-Smooth brome -Tall fescue Pasture

Over utilization of the pasture will result in a shift to include more undesirable species such as thistle (Cirsium spp.), broomsedge (*Andropogon virginicus* L.), ironweed (*Vernonia gigantea*), buttercup (Ranunculus spp.), ragweed (Ambrosia spp.) and blackberries (Rubus spp.). Many woody and weed species may be present depending on seed sources and level of soil disturbance. This community reflects an improper forage-to-animal balance which will negatively impact forage productivity and reproduction, soil health, and water quality. Ecological resiliency is compromised under these conditions.

Dominant plant species

- broomsedge bluestem (*Andropogon virginicus*), grass
- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- crabgrass (*Digitaria*), grass
- thistle (*Cirsium*), other herbaceous
- ragweed (*Ambrosia*), other herbaceous
- buttercup (*Ranunculus*), other herbaceous
- ironweed (*Vernonia*), other herbaceous

Pathway 3.1A
Community 3.1 to 3.2

Mechanical harvesting is replaced with domestic livestock grazing. Animal to forage plant balance with no over grazing.

Pathway 3.1B
Community 3.1 to 3.3

Mechanical harvesting is replaced with domestic livestock grazing. Forage plants are overutilized.

Pathway 3.2A
Community 3.2 to 3.1

Domestic livestock are removed and mechanical harvesting is implemented.

Pathway 3.2B
Community 3.2 to 3.3

Grazing of livestock with overutilization of the forage plants.

Pathway 3.3B
Community 3.3 to 3.1

Domestic livestock are removed and mechanical harvesting is implemented.

Pathway 3.3A
Community 3.3 to 3.2

Forage plants are not overutilized and the site has a proper forage-to-animal balance.

State 4
Cropland State

The Midwest is well-known for its highly-productive agricultural soils, and as a result, much of the MLRA has been converted to cropland, including portions of this ecological site. The continuous use of tillage, row-crop planting, and chemicals (i.e., herbicides, fertilizers, etc.) has effectively eliminated the reference community and many of its natural ecological functions in favor of crop production. Corn (*Zea mays* L.) and soybeans (*Glycine max* (L.) Merr.) are the dominant crops for the site. These areas are likely to remain in crop production for the foreseeable future.

Community 4.1
Conventional Tillage Field

Sites in this community phase typically consist of monoculture row-cropping maintained by conventional tillage practices. They are cropped in either continuous corn or corn-soybean rotations. The frequent use of deep tillage, low crop diversity, and bare soil conditions during the non-growing season negatively impacts soil health. Under these practices, soil aggregation is reduced or destroyed, soil organic matter is reduced, erosion and runoff are increased, and infiltration is decreased, which can ultimately lead to undesirable changes in the hydrology of the watershed (Tomer et al. 2005).

Dominant plant species

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 4.2
Conservation Tillage Field

This community phase is characterized by rotational crop production that utilizes various conservation tillage methods to promote soil health and reduce erosion. Conservation tillage methods include strip-till, ridge-till, vertical-till, or no-till planting systems. Strip-till keeps seedbed preparation to narrow bands less than one-third the width of the row where crop residue and soil consolidation are left undisturbed in-between seedbed areas. Strip-till planting may be completed in the fall and nutrient application either occurs simultaneously or at the time of planting. Ridge-till uses specialized equipment to create ridges in the seedbed and vegetative residue is left on the surface in between the ridges. Weeds are controlled with herbicides and/or cultivation, seedbed ridges are rebuilt during cultivation, and soils are left undisturbed from harvest to planting. Vertical-till systems employ machinery that lightly tills the soil and cuts up crop residue, mixing some of the residue into the top few inches of the soil while leaving a large portion on the surface. No-till management is the most conservative, disturbing soils only at the time of planting and fertilizer application. Compared to conventional tillage systems, conservation tillage methods can reduce soil erosion, increase organic matter and water availability, improve water quality, and reduce soil compaction.

Dominant plant species

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 4.3
Conservation Tillage Field/ Cover Crop Field

This condition applies conservation tillage methods as described above as well as adds cover crop practices. Cover crops typically include nitrogen-fixing species (e.g., legumes), small grains (e.g., rye, wheat, oats), or forage covers (e.g., turnips, radishes, rapeseed). The addition of cover crops not only adds plant diversity but also promotes soil health by reducing soil erosion, limiting nitrogen leaching, suppressing weeds, increasing soil organic matter, and improving the overall soil. In the case of small grain cover crops, surface cover and water infiltration are increased, while forage covers can be used to graze livestock or support local wildlife. Of the three community phases for this state, this phase promotes the greatest soil sustainability and improves ecological functioning within a cropland system.

Dominant plant species

- rye (*Secale*), grass
- wheat (*Triticum*), grass
- oat (*Avena*), grass
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous
- alfalfa (*Medicago*), other herbaceous
- clover (*Trifolium*), other herbaceous

Pathway 4.1A
Community 4.1 to 4.2

Tillage operations are greatly reduced, crop rotation occurs on a regular schedule, and crop residue is allowed to remain on the soil surface.

Pathway 4.1B
Community 4.1 to 4.3

Tillage operations are greatly reduced or eliminated, crop rotation is either reduced or eliminated, and crop residue is allowed to remain on the soil surface, and cover crops are implemented to prevent soil erosion.

Pathway 4.2A
Community 4.2 to 4.1

Intensive tillage is utilized and monoculture row-cropping is established.

Pathway 4.2B
Community 4.2 to 4.3

Cover crops are implemented to prevent soil erosion.

Pathway 4.3B
Community 4.3 to 4.1

Intensive tillage is utilized, cover crops practices are abandoned, monoculture row-cropping is established, and crop rotation is reduced or eliminated.

Pathway 4.3A
Community 4.3 to 4.2

Cover crop practices are abandoned.

State 5
Reconstructed Floodplain Forest State

The combination of natural and anthropogenic disturbances occurring today has resulted in numerous ecosystem health issues, and restoration back to the historic reference state may not be possible. Many natural forest communities are being stressed by non-native diseases and pests, habitat fragmentation, permanent changes in hydrologic regimes, and overabundant deer populations on top of naturally-occurring disturbances (severe weather and native pests) (Flickinger 2010). However, these habitats provide multiple ecosystem services including carbon sequestration; clean air and water; soil conservation; biodiversity support; wildlife habitat; as well as a variety of cultural activities (e.g., hiking, hunting) (Millennium Ecosystem Assessment 2005; Flickinger 2010). Therefore, conservation of floodplain forests should still be pursued. Habitat reconstructions are an important tool for repairing natural ecological functioning and providing habitat protection for numerous species of Loamy Floodplain Forests. Therefore, ecological restoration should aim to aid the recovery of degraded, damaged, or destroyed ecosystems. A successful restoration will have the ability to structurally and functionally sustain itself, demonstrate resilience to the ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed forest state is the result of a long-term commitment involving a multi-step, adaptive management process.

Dominant plant species

- oak (*Quercus*), tree

Community 5.1
Early Successional Reconstructed Floodplain Forest

This community phase represents the early community assembly from forest reconstruction. It is highly dependent on the current condition of the site based on past and current land management actions, invasive species, and proximity to land populated with non-native pests and diseases. Therefore, no two sites will have the same early successional composition. Technical forestry assistance should be sought to develop suitable conservation management plans.

Community 5.2
Late Successional Reconstructed Floodplain Forest

Appropriately timed management practices (e.g. forest stand improvement, continuing integrated pest management) applied to the early successional community phase can help increase the stand maturity, pushing the site into a late successional community phase over time. A late successional reconstructed forest will have an uneven-aged, closed canopy and a well-developed understory.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- bur oak (*Quercus macrocarpa*), tree

Pathway 5.1A
Community 5.1 to 5.2

Application of stand improvement practices in line with a developed management plan.

Pathway 5.2A
Community 5.2 to 5.1

Reconstruction experiences a setback from extreme weather event or improper timing of management actions.

Transition T1A
State 1 to 2

Altered hydrology throughout the watershed transitions the site to the hydrologically-altered state (2).

Transition T1B
State 1 to 3

Woody species removal and cultural treatments to enhance forage quality and yield transition the site to the pasture state (3).

Transition T1C
State 1 to 4

Woody species removal, tillage, seeding of agricultural crops, and non-selective herbicide transition the site to the cropland state (4).

Transition T2A
State 2 to 3

Woody species removal and cultural treatments to enhance forage quality and yield transition the site to the pasture state (3).

Transition T2B
State 2 to 4

Woody species removal, tillage, seeding of agricultural crops, and non-selective herbicide transition the site to the cropland state (4).

Restoration pathway R2A
State 2 to 5

Site preparation, tree planting, timber stand improvement, non-native species control, and water control structures installed to improve and regulate hydrology transition this site to the reconstructed forest state (5).

Transition T3A
State 3 to 2

Land is abandoned and left fallow; natural succession by opportunistic species transition this site the hydrologically-altered state (2).

Transition T3B
State 3 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition the site to the cropland state (4).

Restoration pathway R3A
State 3 to 5

Restoration 3A – Site preparation, tree planting, timber stand improvement, non-native species control, and water control structures installed to improve and regulate hydrology transition this site to the reconstructed forest state (5).

Transition T4A
State 4 to 2

Land abandonment transitions the site to the hydrologically-altered state (2).

Transition T4B
State 4 to 3

Cultural treatments to enhance forage quality and yield transition the site to the pasture state (3).

Restoration pathway R4A
State 4 to 5

Site preparation, tree planting, timber stand improvement, non-native species control, and water control structures installed to improve and regulate hydrology transition this site to the reconstructed forest state (5).

Restoration pathway T5A
State 5 to 2

Removal of water control structures and unmanaged invasive species populations transition this site to the hydrologically-altered state (2).

Transition T5B
State 5 to 3

Tree removal and cultural treatments to enhance forage quality and yield transition the site to the pasture state (3).

Transition T5C
State 5 to 4

Tree removal, tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Additional community tables

Inventory data references

No field plots were available for this site. A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in this ecological site description.

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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)	Lisa Kluesner
Contact for lead author	
Date	05/10/2025
Approved by	Suzanne Mayne-Kinney
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):**

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
