USDA Natural Resources
Conservation Service

Ecological site F107XB016MO
Loamy Floodplain Forest

Last updated: 5/21/2020
Accessed: 04/30/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 107X–Iowa and Missouri Deep Loess Hills

The Iowa and Missouri Deep Loess Hills (MLRA 107B) includes the Missouri Alluvial Plain, Loess Hills, Southern Iowa Drift Plain, and Central Dissected Till Plains landform regions (Prior 1991; Nigh and Schroeder 2002). It spans four states (Iowa, 53 percent; Missouri, 32 percent; Nebraska, 12 percent; and Kansas 3 percent), encompassing over 14,000 square miles (Figure 1). The elevation ranges from approximately 1,565 feet above sea level (ASL) on the highest ridges to about 600 feet ASL along the Missouri River near Glasgow in central Missouri. Local relief varies from 10 to 20 feet in the major river floodplains, to 50 to 100 feet in the dissected uplands, and loess bluffs of 200 to 300 feet along the Missouri River. Loess deposits cover most of the area, with deposits reaching a thickness of 65 to 200 feet in the Loess Hills and grading to about 20 feet in the eastern extent of the region. Pre-Illinoian till, deposited more than 500,000 years ago, lies beneath the loess and has experienced extensive erosion and dissection. Pennsylvanian and Cretaceous bedrock, comprised of shale, mudstones, and sandstones, lie beneath the glacial material (USDA-NRCS 2006).

The vegetation in the MLRA has undergone drastic changes over time. Spruce forests dominated the landscape 30,000 to 21,500 years ago. As the last glacial maximum peaked 21,500 to 16,000 years ago, they were replaced with open tundras and parklands. The end of the Pleistocene Epoch saw a warming climate that initially prompted the return of spruce forests, but as the warming continued, spruce trees were replaced by deciduous trees (Baker et al. 1990). Not until approximately 9,000 years ago did the vegetation transition to prairies as climatic conditions continued to warm and subsequently dry. Between 4,000 and 3,000 years ago, oak savannas began intermingling within the prairie landscape, while the more wooded and forested areas maintained a foothold in sheltered areas. This prairie-forest transition ecosystem formed the dominant landscapes until the arrival of European settlers (Baker et al. 1992).

Classification relationships

Major Land Resource Area (MLRA): Iowa and Missouri Deep Loess Hills (107B)

USFS Subregions: Central Dissected Till Plains Section (251C), Loess Hills (251Cb) and Missouri River Alluvial Plain (251Cg) (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Missouri Alluvial Plain (47d), Steeply Rolling Loess Prairies (47e), Rolling Loess Prairies (47f), Western Loess Hills (47m)

Biophysical Setting (LANDFIRE 2009): Eastern Great Plains Floodplain System (4214690)

Ecological Systems (National Vegetation Classification System, Nature Serve 2015): North-Central Interior Floodplain (CES202.694)

Eilers and Roosa (1994): Missouri River Alluvium Region: Riverine Systems

Iowa Department of Natural Resources (INAI nd): Cottonwood Floodplain Woodland

Lauver et al. (1999): *Populus deltoides* – (*Salix nigra*)/Spartina pectinata – Carex spp. Woodland

Missouri Natural Heritage Program (Nelson 2010): Wet-Mesic Bottomland Forest

Nebraska Game and Parks Commission (Steinauer and Rolfsmeier 2010): Cottonwood – Dogwood Riparian Woodland

Plant Associations (National Vegetation Classification System, Nature Serve 2015): *Populus deltoides* – (*Salix nigra*)/Spartina pectinata – Carex spp. Floodplain Woodland (CEGL002014)

Ecological site concept

Loamy Floodplain Forests are located within the green areas on the map (Figure 1). They occur on floodplains adjacent to the channel. Soils are Entisols and Mollisols that are poorly to well-drained and very deep, formed from silty alluvium. The site experiences seasonal, shallow (less than three feet) flooding every two to five years that can last over a month (Nelson 2010). As a result, the plant community is comprised of both upland and hydrophytic woody and herbaceous vegetation. These sites occur adjacent to other floodplain forest ecological sites.

The historic pre-European settlement vegetation on this site was dominated by a massive, dense closed-canopy of deciduous trees with a well-developed understory of shade-tolerant shrubs and herbs (Nelson 2010). The tree canopy is dominated by bur oak (*Quercus macrocarpa* Michx.), pin oak (Quercus palustris Münchh.), green ash (Fraxinus pennsylvanica Marshall), and slippery elm (Ulmus rubra Muhl.), but eastern cottonwood (*Populus deltoides* W. Bartram ex Marshall) and swamp white oak (Quercus bicolor Willd.) are characteristic trees for this ecological site. Vines are a common component and typically consist of an assemblage of grapes (Vitis cinerea (Engelm.) Engelm. ex Millard, Vitis riparia Michx.,), eastern poison ivy (Toxicodendron radicans (L.) Kuntze), and trumpet creeper (Campsis radicans (L.) Seem. ex Bureau). The understory is populated with species tolerant of extended flooding to include fowl mannagrass (Glyceria striata (Lam.) Hitchc.), bristly buttercup (*Ranunculus hispidus* Michx.), and sedges (Carex crus-corvi Shuttlw. ex Kunze, Carex frankii Kunth, Carex lupulina Muhl. ex Willd.) (Nelson 2010). Herbaceous species typical of an undisturbed plant community associated with this ecological site include false hop sedge (Carex lupuliformis Sartwell ex Dewey), sweet woodreed (Cinna arundinacea L.), and veiny skullcap (Scutellaria nervosa Pursh) (Drobney et al. 2001; Nelson 2010; Ladd and Thomas 2015). Historically, seasonal flooding was the primary disturbance factor, while windthrow events, beaver predation, and insect and disease outbreaks were secondary factors (LANDFIRE 2009; Nelson 2010).

Associated sites

F107XB017MO	**Clayey Floodplain Forest** Clayey alluvium soils on floodplains near stream channel including Albaton, Blencoe, Blend, Leta, Myrick, Onawa, Onawet, Owego, Parkville, Percival, and SansDessein
R107XB018MO	**Ponded Floodplain Marsh** Ponded soils on floodplains including Aquolls, Darwin, Fluvaquents, Forney, and Levasy
F107XB015MO	**Sandy/Loamy Floodplain Forest** Silty alluvium soils on floodplains adjacent to stream channel including Alluvial land, Buckney, Carr, Grable, Haynie, Hodge, Kenmoor, Psammaquents, Riverwash, Sarpy, Treloar, and Waubonsie

Similar sites

F107XB016MO	**Loamy Floodplain Forest** Loamy Floodplain Forests are similar in landscape position but parent material is silty alluvium

F107XB017MO	**Clayey Floodplain Forest** Clayey Floodplain Forests are similar in landscape position but parent material is clayey alluvium
F107XB026MO	**Wet Floodplain Woodland** Wet Floodplain Woodlands are not adjacent to the channel

Table 1. Dominant plant species

Tree	(1) *Quercus bicolor* (2) *Populus deltoides*
Shrub	Not specified
Herbaceous	(1) *Glyceria striata* (2) *Ranunculus hispidus*

Physiographic features

Loamy Floodplain Forests occur on floodplains near the stream channel within the Missouri River alluvial valley (Figure 2). This ecological site is situated on elevations ranging from approximately 600 to 2,800 feet ASL. This site experiences rare to frequent flooding, inundating the site with less than 30 inches of water at a time.

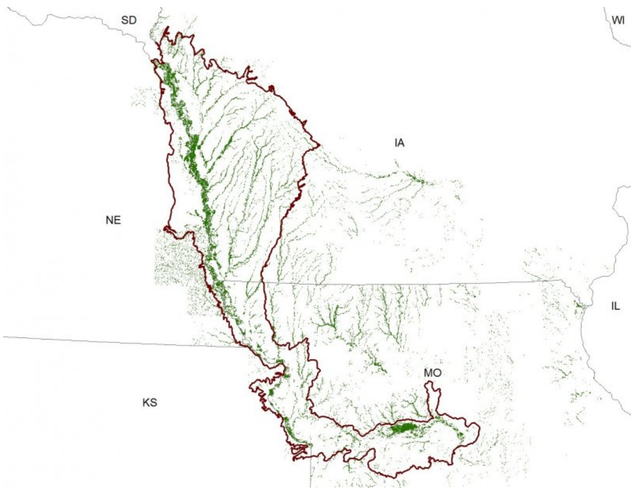


Figure 2. Figure 1. Location of Loamy Floodplain Forest ecological site within MLRA 107B.

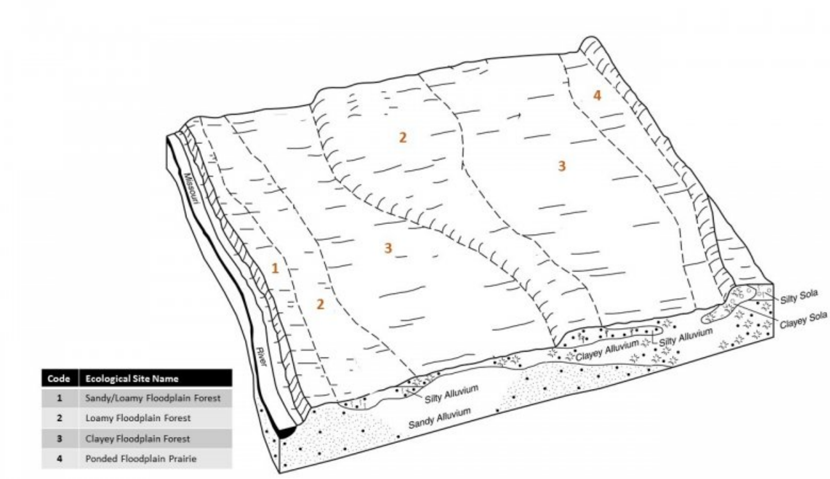


Figure 3. Figure 2. Representative block diagram of Loamy Floodplain Forest and associated ecological sites.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Linear
Slope shape up-down	(1) Linear

Landforms	(1) Flood plain
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	180–844 m
Slope	0–2%
Water table depth	30–183 cm
Aspect	Aspect is not a significant factor

Climatic features

The Iowa and Missouri Deep Loess Hills falls into two Köppen-Geiger climate classifications (Peel et al. 2007): hot humid continental climate (Dfa) dominates the majority of the MLRA with small portions in the south falling into the humid subtropical climate (Cfa). In winter, dry, cold air masses periodically shift south from Canada. As these air masses collide with humid air, snowfall and rainfall result. In summer, moist, warm air masses from the Gulf of Mexico migrate north, producing significant frontal or convective rains (Decker 2017). Occasionally, high pressure will stagnate over the region, creating extended droughty periods. These periods of drought have historically occurred on 22-year cycles (Stockton and Meko 1983).

The soil temperature regime of MLRA 107B 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 163 days (Table 2). The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is 37 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 41 and 63°F, respectively.

Climate data and analyses are derived from 30-year average gathered from eleven National Oceanic and Atmospheric Administration (NOAA) weather stations contained within the range of this ecological site (Table 4).

Table 3. Representative climatic features

Frost-free period (characteristic range)	133-153 days
Freeze-free period (characteristic range)	164-185 days
Precipitation total (characteristic range)	813-1,016 mm
Frost-free period (actual range)	131-160 days
Freeze-free period (actual range)	157-186 days
Precipitation total (actual range)	737-1,092 mm
Frost-free period (average)	145 days
Freeze-free period (average)	175 days
Precipitation total (average)	889 mm

Climate stations used

- (1) BRUNSWICK [USC00231037], De Witt, MO
- (2) LEXINGTON 3E [USC00234904], Lexington, MO
- (3) ST JOSEPH ROSECRANS AP [USW00013993], Wathena, MO
- (4) OMAHA EPPLEY AIRFIELD [USW00014942], Omaha, NE
- (5) SIOUX CITY GATEWAY AP [USW00014943], Sioux City, IA

- (6) LEAVENWORTH [USC00144588], Fort Leavenworth, KS
- (7) RULO 2W [USC00257401], Falls City, NE
- (8) BLAIR [USC00250930], Blair, NE
- (9) NEBRASKA CITY 2NW [USC00255810], Nebraska City, NE
- (10) GLENWOOD 3SW [USC00133290], Glenwood, IA
- (11) ATCHISON [USC00140405], Atchison, KS

Influencing water features

Loamy Floodplain Forests are classified as a RIVERINE wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as Palustrine, Forested, Broad-Leaved Deciduous, Temporarily Flooded under the National Wetlands Inventory (FGDC 2013). The site is subject to seasonal flooding from the adjacent stream to depths of less than 30 inches. Infiltration is very slow (Hydrologic Group D) for undrained soils, and surface runoff is high. Flooding occurs every two to five years, and surface water or soil saturation can persist for approximately twelve to twenty percent of the growing season (Nelson 2010).

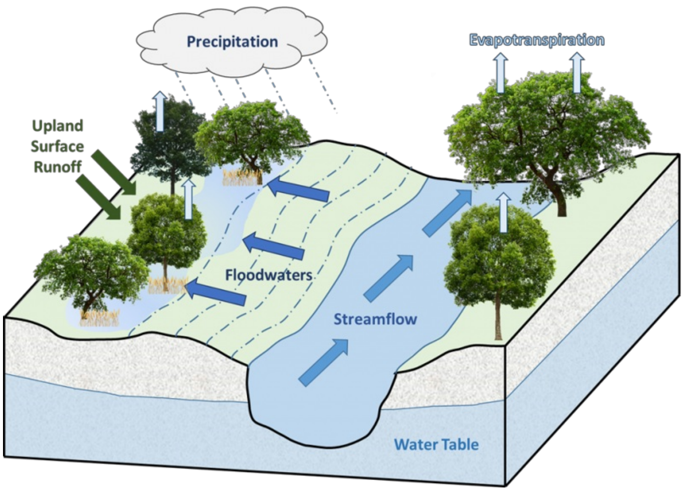


Figure 10. Figure 5. Hydrologic cycling in Loamy Floodplain Forest ecological site.

Soil features

Soils of Loamy Floodplain Forests are in the Entisol and Mollisol orders, further classified as Aquic Udifluvents, Cumulic Hapludolls, Fluventic Hapludolls, Mollic Fluvaquents, and Mollic Udifluvents with very-slow to moderate infiltration and very low to high runoff potential. The soil series associated with this site includes Blake, Danbury, Floris, Gilliam, Grable, Grable variant, Haynie, Haynie variant, Kenridge, Landes, Lossing, McPaul, Modale, Modale variant, Moniteau, Morconick, Motark, Moville, Nodaway, Omadi, Paxico, Ray, Rodney, Scroll, Ticonic, Udifluvents, Udorthents, and Waubonsie. The parent material is silty alluvium, and the soils are poorly to well-drained and very deep with seasonal high water tables. Soil pH classes are moderately acid to slightly alkaline. No rooting restrictions are noted for the soils of this ecological site.

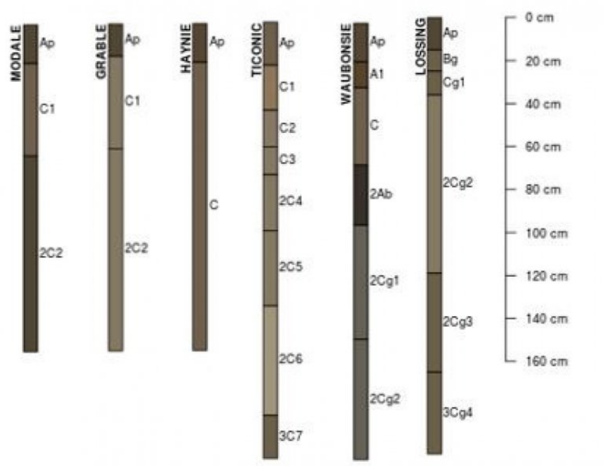


Figure 11. Figure 6. Profile sketches of soil series associated with Loamy Floodplain Forest.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Fine-silty (2) Coarse-silty
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderately slow
Soil depth	203 cm
Available water capacity (0-101.6cm)	15.24–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.8

Ecological dynamics

The Loess Hills region lies within the transition zone between the eastern deciduous forests and the Great Plains, with the Missouri River flowing through the middle. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies, savannas, woodlands, and forests (Nelson 2010). Loamy Floodplain Forests form an aspect of this vegetative continuum. This ecological site occurs on floodplains near the stream channel on silty alluvial soils. Species characteristic of this ecological site consist of hydrophytic woody and herbaceous species.

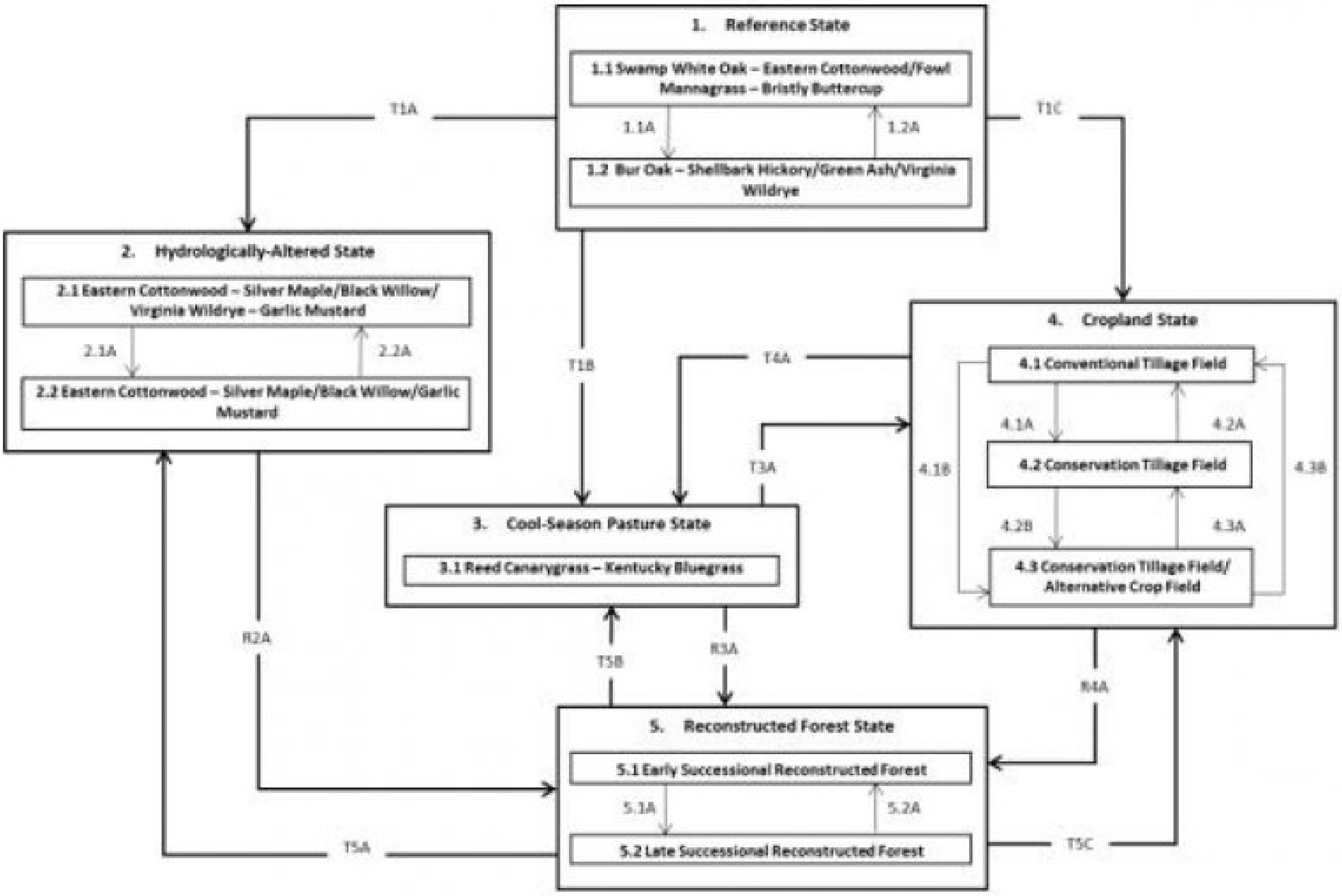
Flooding is the dominant disturbance factor in Loamy Floodplain Forests. Within MLRA 107B, seasonal flooding and/or saturation occurs in the fall, winter, and spring on average every two to five years. The water table is high, and shallow flooding can persist for over a month, particularly in the early growing season. Flooding lasts approximately twelve to twenty percent of the season (Nelson 2010).

Windthrow events, beaver activity, and periodic insect and disease outbreaks influence this site to a lesser, more localized extent (LANDFIRE 2009; Nelson 2010). Windthrow events are mostly caused from tornadoes and associated winds and generally occur in the early summer months. Immediate responses to high wind events can alter forest structure and species richness or evenness, thereby impacting species diversity. Composition can also shift to one containing more early-successional species (Peterson 2000). Beaver disturbances can be highly variable across the MLRA and likely had little impact on stands less than ten years old (LANDFIRE 2009).

Today, many original Loamy Floodplain Forests have been reduced as a result of upland soil erosion and drainage and clearing for agriculture and urban development. Sites have also been degraded by stream channelization, levee construction, and overgrazing which alters the hydrologic flood cycles and, ultimately, the reference plant community. Invasive species, such as garlic mustard (*Alliaria petiolata* L.), multiflora rose (*Rosa multiflora* Thunb.), dames rocket (*Hesperis matronalis* L.), Siberian elm (*Ulmus pumila* L.) and Oriental bittersweet (Celastrus orbiculata Thunb.) have been invading this site and reducing native species diversity (Nelson 2010; Steinauer and Rolfsmeier 2010).

State and transition model

F107BY016MO Loamy Floodplain Forest



Code	Process
T1A, T5A	Hydrology altered from stream channelization and levee construction
T1B, T4A, T5B	Woody removal, interseeding cool-season grasses, and continuous grazing
T1C, T3A, T5C	Agricultural conversion via drain tile installation, tillage, seeding, and non-selective herbicide
1.1A	Long-term sediment accretion and natural succession
1.2A	Catastrophic flood event
2.1A	Continuing hydrologic alterations within the watershed
2.2A	Non-native, invasive species control
R2A, R3A, R4A	Tree planting, timber stand improvement, invasive species control, and water control structures installed to improve and regulate hydrology
4.1A	Less tillage, residue management
4.1B	Less tillage, residue management, and implementation of cover cropping
4.2B	Implementation of cover cropping
4.2A, 4.3B	Intensive tillage, remove residue, and reinitiate monoculture row cropping
4.3A	Remove cover cropping
T5A	All management practices abandoned
5.1A	Application of stand improvement practices
5.2B	Reconstruction experiences a setback from extreme weather event or improper timing of management action

State 1
Reference State

The reference plant community is categorized as a closed canopy oak-cottonwood forest. The two community phases within the reference state are dependent on seasonal flood events. Long-term sediment accumulation can elevate the forest floor resulting in less flooding and a more stable plant community with an increasing number of upland species inhabiting the site. A catastrophic flood event removes younger, flood-intolerant species, resetting the site to an earlier stage of succession. Windthrow, beaver predation, and periodic insect and disease outbreak have less impact in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- eastern cottonwood (*Populus deltoides*), tree
- fowl mannagrass (*Glyceria striata*), grass
- Virginia wildrye (*Elymus submuticus*), grass
- bristly buttercup (*Ranunculus hispidus*), other herbaceous

Community 1.1
Swamp White Oak – Eastern Cottonwood/Fowl Mannagrass – Bristly Buttercup

Swamp white oak and eastern cottonwood are the characteristic tree species for this reference community phase, with sub-dominants including bur oak, green ash, and slippery elm (Nelson 2010). Tree heights range between 90-140 feet tall, tree size class is very large (>33-inches DBH), and the canopy is closed (100 percent) (LANDFIRE 2009; Nelson 2010). Grape, eastern poison ivy, and numerous shade- and flood-tolerant sedges and forbs form a well-developed understory and often include fowl mannagrass, various sedges, bristly buttercup (*Ranunculus hispidus* Michx.), wingstem (*Verbesina alternifolia* (L.) Britton ex Kearney), and smallspike false nettle (*Boehmeria cylindrica* (L.) Sw.) (Nelson 2010).

Dominant plant species

- swamp white oak (*Quercus bicolor*), tree
- eastern cottonwood (*Populus deltoides*), tree
- fowl mannagrass (*Glyceria striata*), grass
- bristly buttercup (*Ranunculus hispidus*), other herbaceous

Community 1.2
Bur Oak – Shellbark Hickory / Green Ash / Virginia Wild Rye

This reference community phase can occur over time when the floodplain becomes higher from sediment accumulation, isolating it from the channel and the seasonal flood events. Bur oak (*Quercus macrocarpa* Michx.) and shellbark hickory (*Carya laciniosa* (Michx. f.) G. Don) become the characteristic canopy species of this reduced flooding regime, with green ash an important sub-canopy species. The understory composition begins to shift from mostly wetland species to both wetland and upland species.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- shellbark hickory (*Carya laciniosa*), tree
- green ash (*Fraxinus pennsylvanica*), shrub
- Virginia wildrye (*Elymus submuticus*), grass

Pathway P1.1A
Community 1.1 to 1.2

Natural succession as a result of sediment accumulation and isolation from continuous flooding.

Pathway P1.2A
Community 1.2 to 1.1

Natural succession as a result of catastrophic flooding.

State 2
Hydrologically Altered State

Agricultural drainage, stream channelization, and levee construction in hydrologically-connected waters has drastically changed the natural hydrologic cycle of Loamy Floodplain Forests. These alterations have resulted in higher than normal flood events. Excessive siltation from upland soil erosion and streambank erosion is deposited across this site and has caused the historic tree canopy to be killed off. This has resulted in a type conversion from the species-rich oak-cottonwood forest to a simplified cottonwood-dominated state, similar to the Sandy/Loamy Floodplain Forest ecological site (Nelson 2010; Steinauer and Rolfsmeier 2010). In addition, exotic species are able to inhabit and continuously spread, reducing native diversity and ecosystem stability (Rodgers et al. 2008; Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- American sycamore (*Platanus occidentalis*), tree
- black willow (*Salix nigra*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass

Community 2.1
Eastern Cottonwood – Silver Maple/Black Willow/Virginia Wildrye – Garlic Mustard

This community phase represents a shift in plant community composition as a result of soil dehydration and excessive siltation. Eastern cottonwood (*Populus deltoides* W. Bartram ex Marshall) becomes co-dominant with silver maple, while black willow (*Salix nigra* Marshall) forms the dominant shrub component. The understory maintains some native species such as Virginia wildrye, but conditions also become suitable for the initial invasion of garlic mustard.

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- silver maple (*Acer saccharinum*), tree
- black willow (*Salix nigra*), shrub
- Virginia wildrye (*Elymus submuticus*), grass
- garlic mustard (*Alliaria petiolata*), other herbaceous

Community 2.2
Eastern Cottonwood – Silver Maple/Black Willow/Garlic Mustard

This community phase represents persisting changes to the natural hydrology of the watershed. Eastern cottonwood and silver maple canopies mature and increase cover, and black willow maintains the shrub component. Garlic mustard dominates the understory to the near exclusion of all other species (Munger 2001).

Dominant plant species

- eastern cottonwood (*Populus deltoides*), tree
- American sycamore (*Platanus occidentalis*), tree
- black willow (*Salix nigra*), shrub
- garlic mustard (*Alliaria petiolata*), other herbaceous

Pathway P2.1A
Community 2.1 to 2.2

Continuing hydrologic alterations within the watershed

Pathway P2.1A
Community 2.2 to 2.1

Non-native invasive species control

State 3

Cool Season Pasture State

The cool-season pasture state occurs when the reference state has been anthropogenically-altered for livestock production. Early settlers harvested the trees for timber and fuel and seeded such non-native cool-season species as Kentucky bluegrass (*Poa pratensis* L.), converting the woodland to pasture (Smith 1998). Over time, as lands were continually grazed by large herds of cattle, the non-native species were able to spread and expand across the site, reducing the native species diversity.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Community 3.1
Reed Canarygrass – Kentucky Bluegrass

Sites in this community phase arise from tree removal and seeding of non-native cool-season grasses (Steinauer and Rolfsmeier 2010). Oaks, hickories, and ash all have some timber value and were harvested to supply the timber market for early settlers. Limited flood events allowed the regeneration of some eastern cottonwoods, but heavy grazing adversely affects the maturation of seedlings (Taylor 2001). Reed canarygrass (*Phalaris arundinacea* L.) and Kentucky bluegrass were common species used for pasture planting. Grazing by livestock maintain this simplified grassland state.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

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.) have 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 impact 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).

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 system, conservation tillage methods can reduce soil erosion, increase organic matter and water availability, improve water quality, and reduce soil compaction.

Community 4.3
Conservation Tillage Field/Alternative 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.

Pathway P4.1A
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 P4.1B
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 P4.2A
Community 4.2 to 4.1

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

Pathway P4.2B
Community 4.2 to 4.3

Cover crops are implemented to prevent soil erosion.

Pathway P4.3B
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 P4.3A
Community 4.3 to 4.2

Cover crop practices are abandoned.

State 5
Reconstructed Forest State

The combination of natural and anthropogenic disturbances occurring today has resulted in a number of ecosystem health issues, and restoration back to the historic reference condition is likely not 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; Nelson 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 bottomland 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.

Community 5.1
Early Successional Reconstructed 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 stewardship management plans.

Community 5.2
Late Successional Reconstructed Forest

Appropriately timed management practices (e.g., prescribed fire, hazardous fuels management, 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.

Pathway P5.1A
Community 5.1 to 5.2

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

Pathway P5.2A
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 from stream channelization and levee construction transition this site to the hydrologically-altered state (2).

Transition T1B
State 1 to 3

Woody species reduction, interseeding of non-native, cool-season grasses, and continuous grazing transition this site to the cool-season pasture state (3).

Transition T1C
State 1 to 4

Tillage, seeding of agricultural crops, and non-selective herbicide transition this 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 4

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

Restoration pathway R3A
State 3 to 5

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

Restoration pathway T4A
State 4 to 3

Non-selective herbicide, seeding of non-native cool-season grasses, and continuous grazing transitions the site to the cool-season pasture state (3).

Restoration pathway R4A
State 4 to 5

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

Transition T5A
State 5 to 2

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

Restoration pathway T5B
State 5 to 3

Tree removal and interseeding non-native cool-season grasses transition this site to the cool-season pasture state (3).

Transition T5C
State 5 to 4

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

Additional community tables

Animal community

Wildlife (MDC 2006)

This ecological site is a dense, muti-layered forest, with snags and cavities and down dead wood that provides habitat for many species requiring cool, rich, moist conditions.

Bird species associated with these mature forests include Great Blue Heron (colonies especially in large sycamores and cottonwoods), Bald Eagle, Belted Kingfisher, Red-shouldered Hawk, Northern Parula, Louisiana Waterthrush, Wood Duck, Hooded Merganser, Kentucky Warbler, Hooded Warbler, Acadian Flycatcher, Barred Owl, Pileated Woodpecker, Cerulean Warbler, and Yellow-throated Warbler.

Reptiles and amphibians associated with this ecological site include small-mouthed salamander, central newt, midland brown snake, and gray treefrog.

Other information

Forestry

Management: Estimated site index values range from 70 to 110. Timber management opportunities are good to excellent. Create group openings of at least 2 acres. Large clearcuts should be minimized if possible to reduce impacts on wildlife and aesthetics. Uneven-aged management using single tree selection or group selection cuttings of ½ to 1 acre are other options that can be used if clear cutting is not desired or warranted. Harvest methods that leave some mature trees to provide shade and soil protection may be desirable. Where possible, favor bur oak, black walnut, pecan, sycamore, and cottonwood. Maintain adequate riparian buffer areas.

Limitations: Wetness from flooding – short duration and/or high water table; Use of equipment may be restricted in spring and other excessively wet periods. Equipment use when wet may compact soil and damage tree roots. Tree planting is difficult during spring flooding periods. Seedling mortality may be high due to excess wetness. Ridging the soil and planting on the ridges may increase survival.

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 ecological site description.

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Approval

Chris Tecklenburg, 5/21/2020

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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	05/21/2020
Approved by	Chris Tecklenburg
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):**

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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:

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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:**
