Ecological site R107XB025IA
Loamy Floodplain Prairie

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Accessed: 05/15/2024

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), Deep Loess Hills (251 Ca), Loess Hills (251Cb), Missouri River Alluvial Plain (251Cg); Nebraska Rolling Hills Section (251H), Yankton Hills and Valleys (251Ha), Pawnee City-Seneca Rolling Hills (251Hd) (Cleland et al. 2007)

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

Biophysical Setting (LANDFIRE 2009): Eastern Great Plains Wet Meadow-Prairie-Marsh (4214880)

Ecological Systems (National Vegetation Classification System, Nature Serve 2015): Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687)

Eilers and Roosa (1994): Missouri River Alluvium Region - Oxbows

Iowa Department of Natural Resources (INAI nd): Eastern Wet Prairie

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

Nebraska Game and Parks Commission (Steinauer and Rolfsmeier 2010): Eastern Cordgrass Wet Prairie

Plant Associations (National Vegetation Classification System, Nature Serve 2015): Spartina pectinata – Carex spp. – Calamagrostis canadensis – Lythrum alatum – (Oxypolis rigidior) Wet Meadow (CEGL002224)

Ecological site concept

Loamy Floodplain Prairies are located within the green areas on the map (Figure 1). They occur on floodplains, and the soils are Entisols and Mollisols that are moderately well-drained and very deep, formed from alluvium. The site experiences seasonal flooding, resulting in a plant community dominated by hydrophytic and mesophytic herbaceous vegetation.

The historic pre-European settlement vegetation on this site was dominated by a high diversity of grasses, sedges, and forbs. Prairie cordgrass (Spartina pectinata Bosc ex Link) is the dominant species for the site, while eastern gamagrass (Tripsacum dactyloides (L.) L.) is a diagnostic component. Bluejoint (Calamagrostis canadensis (Michx) P. Beauv.), switchgrass (*Panicum virgatum* L.), smoothcone sedge (*Carex laeviconica* Dewey), and woolly sedge (*Carex pellita* Muhl. ex Willd.) are other common grass and grass-like associates. Herbaceous species typical of an undisturbed plant community associated with this ecological site include prairie milkweed (*Asclepias sullivantii* Engelm. ex A. Gray), stiff cowbane (Oxypolis rigidior (L.) Raf.), and Canadian lousewort (Pedicularis canadensis L.) (Drobney et al. 2001; Ladd and Thomas 2015). Historically, seasonal flooding and fire were the primary disturbance factors, while animal predation was a secondary factor (LANDFIRE 2009; Nelson 2010).

Relative to other floodplain prairie ecological sites in the MLRA, the Loamy Floodplain Prairies occur higher on the landscape, away from the stream channel. The loamy soils allow more drainage than other floodplain prairies, and the resulting vegetation is a highly diverse mix of upland and lowland species adapted to seasonal high water tables.

Associated sites

F107XB016MO	**Loamy Floodplain Forest** Silty alluvium soils on floodplains near stream channel including 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
R107XB019MO	**Wet Floodplain Prairie** Clayey alluvium soils on floodplains including Ackmore, Aquents, Bremer, Calco, Colo, Cooper, Fluvaquents, Fluvaquents-sandy, Fluvaquents-silty, Forney, Grantcenter, Holly Springs, Kezan, Lakeport, Larpenteur, Lawson, Mt. Sterling, Nishna, Orthents, Solomon, Tieville, Uturin, Vesser, Wabash, Woodbury, and Zook

Similar sites

R107XB019MO	**Wet Floodplain Prairie** Wet Floodplain Prairies have somewhat poorly to poorly-drained soils
R107XB023IA	**Natric Floodplain Prairie** Natric Floodplain Prairies have a significant component of salt/gypsum in the soils

R107XB018MO	**Ponded Floodplain Marsh** Ponded Floodplain Marshes can experience flooding and ponding

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Spartina pectinata* (2) *Tripsacum dactyloides*

Physiographic features

Loamy Floodplain Prairies occur on floodplains associated with large riverine systems (Figure 2). They are situated on elevations ranging from approximately 600 to 2,700 feet ASL on slopes that are generally less than six percent. These sites are subject to seasonal flooding where surface water may persist following high stream flows or heavy rain events.

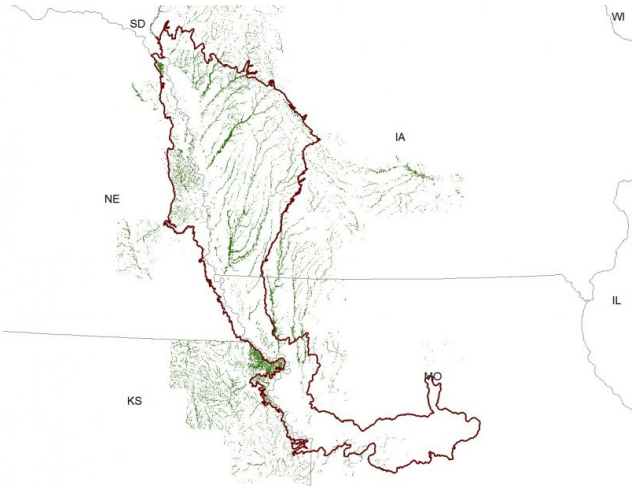


Figure 2. Figure 1. Location of Loamy Floodplain Prairie ecological site within MLRA 107B.

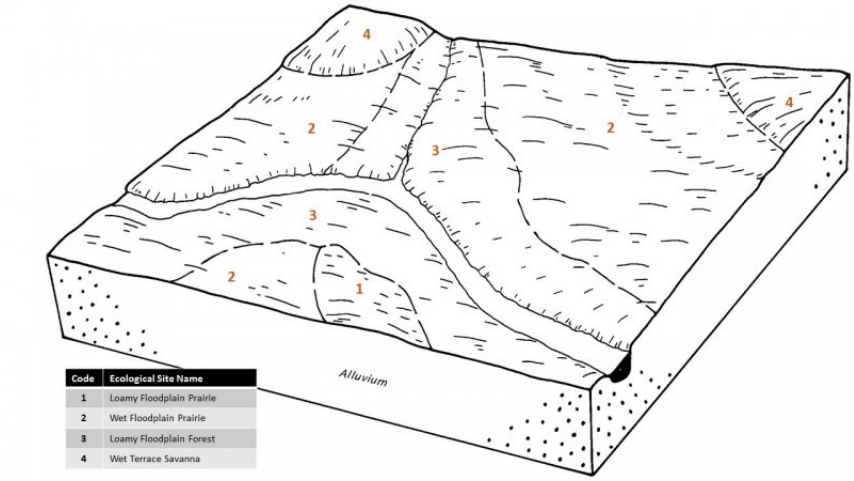


Figure 3. Figure 2. Representative block diagram of Loamy Floodplain Prairie and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Flood plain
Flooding duration	Brief (2 to 7 days)

Flooding frequency	Rare to frequent
Elevation	180–844 m
Slope	0–6%
Water table depth	15–203 cm

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 188 days, while the frost-free period is about 165 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 36 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 five 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)	132-158 days
Freeze-free period (characteristic range)	164-188 days
Precipitation total (characteristic range)	787-965 mm
Frost-free period (actual range)	131-164 days
Freeze-free period (actual range)	159-192 days
Precipitation total (actual range)	787-1,041 mm
Frost-free period (average)	148 days
Freeze-free period (average)	178 days
Precipitation total (average)	889 mm

Climate stations used

- (1) LEXINGTON 3E [USC00234904], Lexington, MO
- (2) BLAIR [USC00250930], Blair, NE
- (3) ONAWA 3NW [USC00136243], Onawa, IA
- (4) ATCHISON [USC00140405], Atchison, KS
- (5) OREGON [USC00236357], Oregon, MO

Influencing water features

Loamy Floodplain Prairies are classified as a RIVERINE wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as an Emergent Palustrine temporarily-to-seasonally flooded wetland under the National Wetlands Inventory (FGDC 2013). Overbank flow or subsurface hydraulic connections with the adjacent stream channel are the main sources of water for this ecological site, while precipitation replenishes and/or maintains levels (Smith et al. 1995; Nelson 2010). Infiltration is slow to moderate (Hydrologic

Groups B, C) for undrained soils, and surface runoff is low. Flooding generally occurs in winter and spring as well as during heavy rains.

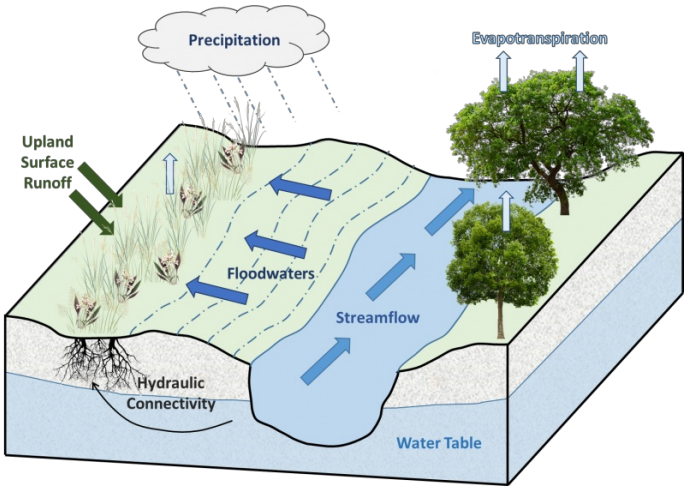


Figure 10. Figure 5. Hydrologic cycling in Loamy Floodplain Prairie ecological site.

Soil features

Soils of Loamy Floodplain Prairies 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 negligible to low runoff potential. The soil series associated with this site includes Blyburg, Kennebec, Kezan, Vore, and Wilsey. The soils were formed under herbaceous vegetation and have a dark, organic-rich surface horizon. The parent material is alluvium, and the soils are poor to well-drained and very deep with seasonal high water tables. Soil pH classes are slightly acid to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site.

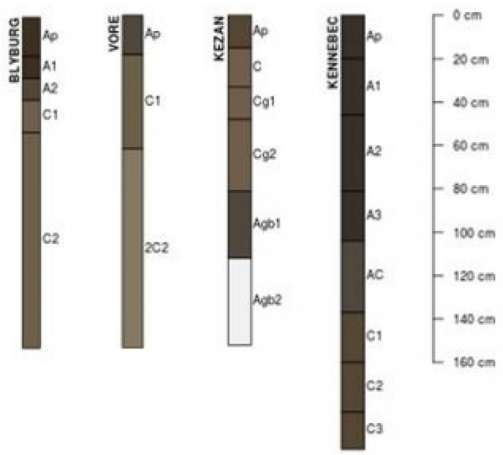


Figure 11. Figure 6. Profile sketches of soil series associated with Loamy Floodplain Prairie.

Table 4. Representative soil features

Parent material	(1) Alluvium
Family particle size	(1) Fine-silty (2) Coarse-silty
Drainage class	Poorly drained to well drained
Permeability class	Very slow to moderate
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)	6.1–8.4

Ecological dynamics

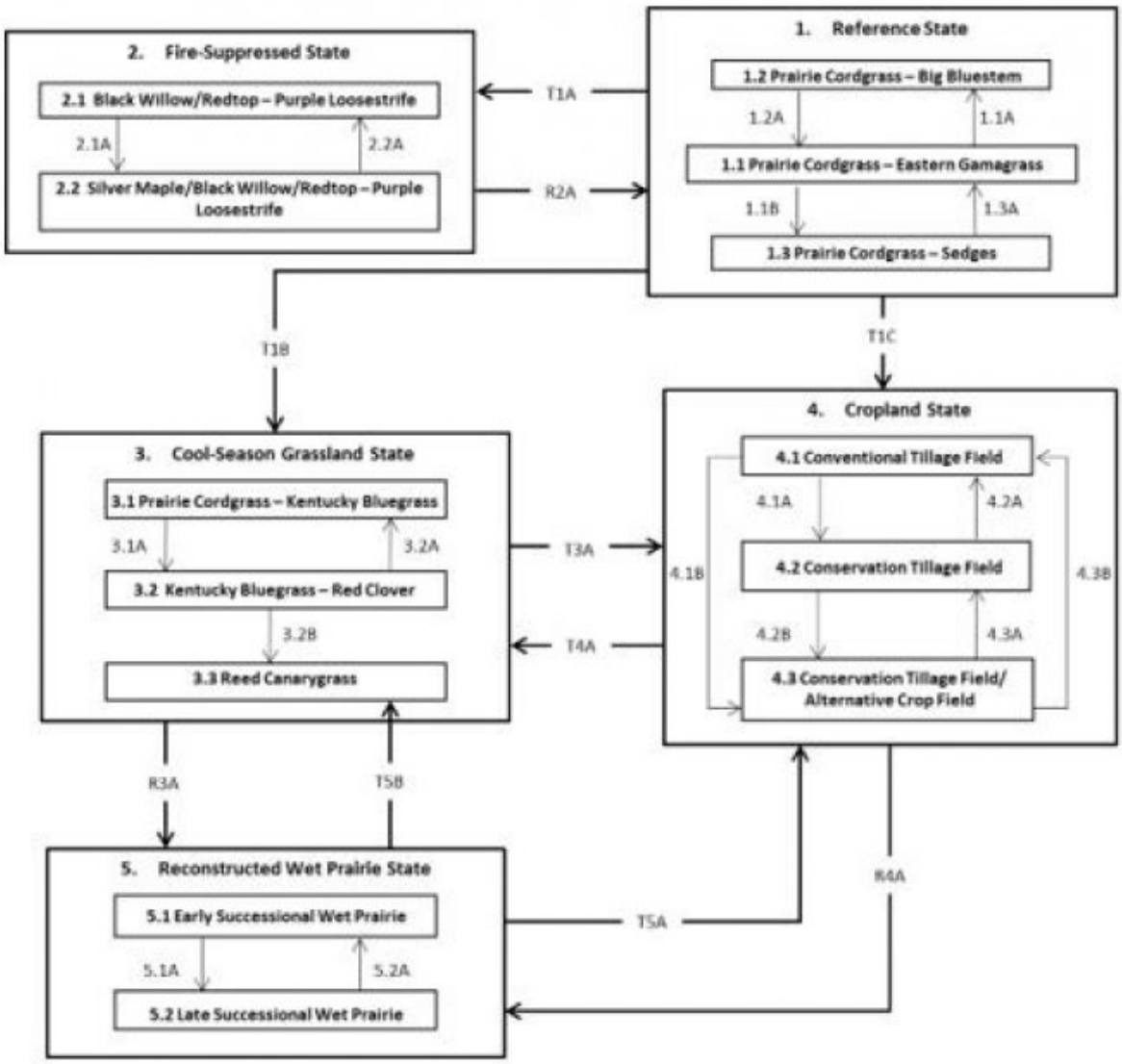
The Loess Hills region lies within the transition zone between the eastern deciduous forests and the Great Plains, with the Missouri River flowing through the middle. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn are able to support prairies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

Flooding is the dominant disturbance factor in Loamy Floodplain Prairies. Seasonal flooding occurs in winter and spring, but can also follow heavy rains (Nelson 2010). Periodic, hot replacement fires every two to five years helped to reduce the build-up of heavy thatch as well as keep the site free of encroaching woody vegetation (LANDFIRE 2009). Animal herbivory is a secondary disturbance factor that can impact plant composition, diversity, and cover. Historically, occasional browsing by large ungulates, such as bison, prairie elk, and white-tailed deer, might have prevented the invasion of woody species into this bottomland prairie (Nelson 2010).

Today, many original Loamy Floodplain Prairies have been reduced as a result of drainage and clearing for agriculture. Sites have also been degraded by stream channelization, wetland drainage, and excessive siltation, which have altered hydrologic flood cycles. Fire suppression has allowed woody vegetation to invade and overtake the native prairie. Invasive species, such as purple loosestrife (*Lythrum salicaria* L.), reed canarygrass (*Phalaris arundinacea* L.), redtop (*Agrostis gigantea* Roth), and Kentucky bluegrass (*Poa pratensis* L.) have also been invading this site and reducing native species diversity (Nelson 2010; Steinauer and Rolfsmeier 2010).

State and transition model

F107BY025IA Loamy Floodplain Prairie



Code	Process
T1A	Fire suppression
T1B, T4A	Interseeding cool-season grasses, haying, and/or grazing
T1C, T3A, T5A	Agricultural conversion via drain tile installation, tillage, seeding, and herbicide
1.1A, 1.3A	Decreased flooding disturbance regime or prolonged drought
1.1B, 1.2A	Increased flooding disturbance regime
R2A	Brush and exotic species control and reintroduction of historic natural disturbance regimes
2.1A	Extended fire-free period
2.2A	Reduced fire-free period
3.1A, 3.2B	Annual haying and/or heavy grazing
3.2A	Reducing haying/grazing frequency
4.1A	Less tillage, residue management
4.1B	Less tillage, residue management, cover cropping
4.2A, 4.3B	Intensive tillage, monoculture row crop production
4.2B	Add cover cropping
4.3A	Remove cover cropping
R3A, R4A	Site prep, exotic species control, native seedings, post-planting management
5.1A	Introduce native forbs (seeding or planting), invasive species control, natural disturbance regimes
5.2A	Restoration setbacks from improper timing of management actions or hydrologic functioning
T5B	Uncontrolled reed canarygrass invasion

Figure 12. STM

State 1
Reference State

The reference plant community is categorized as a wet meadow community, dominated by hydrophytic and mesophytic vegetation. The three community phases within the reference state are dependent on seasonal flooding and precipitation as well as an average fire return interval of three years (LANDFIRE 2009; Nelson 2010). The amount and duration of floodwater alters species composition, cover, and extent, while regular fire intervals keep woody species from encroaching. Animal herbivory from large ungulates have more localized impacts in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity (Nelson 2010).

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- big bluestem (*Andropogon gerardii*), grass

Community 1.1
Prairie Cordgrass – Eastern Gamagrass

Sites in this reference community phase are generally diverse and consist of a wide array of grasses and forbs. The dominant species for this reference community phase are prairie cordgrass and eastern gamagrass. Other species characteristic of this phase include switchgrass (*Panicum virgatum* L.), Michigan lily (*Lilium michiganense* Farw.), common boneset (*Eupatorium perfoliatum* L.), and groundnut (*Apios americana* Medik.) (Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass

Community 1.2
Prairie Cordgrass – Big Bluestem

This reference community phase occurs along the drier edges of Loamy Floodplain Prairies that grade into drier upland prairies. It can also occur as a result of prolonged drought. Prairie cordgrass and big bluestem (*Andropogon gerardii* Vitman) are the dominant and diagnostic species for this phase. Other species that can occur in this phase include prairie milkweed (*Asclepias sullivantii* Engelm. ex A. Gray), bluejacket (*Tradescantia ohiensis* Raf.), and lanceleaf loosestrife (*Lysimachia lanceolata* Walter) (Nelson 2010).

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- big bluestem (*Andropogon gerardii*), grass

Community 1.3
Prairie Cordgrass – Sedges

This reference community phase occurs along the moister edges of Loamy Floodplain Prairies that grade into other wet floodplain prairies. It can also occur from increased flooding. Prairie cordgrass and various sedges (*Carex laeviconica* Dewey, *Carex annectens* (E.P. Bicknell) E.P. Bicknell, *Carex pellita* Muhl. ex Willd.)) are the dominant and diagnostic species of the site. Other species characteristic of this phase include bluejoint, green bulrush (*Scirpus atrovirens* Willd.), prairie ironweed (*Vernonia fasciculata* Michx.), and northern bog violet (*Viola nephrophylla* Greene) (Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- sedge (*Carex*), grass

Pathway P1.1A
Community 1.1 to 1.2

Natural succession as a result of decreased flooding or prolonged drought.

Pathway P1.1B
Community 1.1 to 1.3

Natural succession as a result of increased flooding.

Pathway P1.2A
Community 1.2 to 1.1

Natural succession as a result of increased flooding.

Pathway P1.3A
Community 1.3 to 1.1

Natural succession as a result of decreased flooding or prolonged drought.

State 2
Fire Suppressed State

Fire suppression can transition the reference herbaceous wet meadow community into a shrub-dominated community. Historically, hot replacement fires occurred on a two to five year cycle and helped to reduce woody encroachment and thatch build-up (LANDFIRE 2009). Over the past 150 years, however, fire suppression policies have allowed shrubs and trees to succeed into areas they did not historically occur.

Dominant plant species

- black willow (*Salix nigra*), shrub
- redtop (*Agrostis gigantea*), grass
- purple loosestrife (*Lythrum salicaria*), other herbaceous

Community 2.1
Black Willow/Redtop – Purple Loosestrife

In this community phase, fire has been eliminated from the landscape in excess of five years. Woody species have begun to encroach on the herbaceous marsh. The dominant shrub overtaking the reference community is black willow (*Salix nigra* Marshall). While native species can persist, continued fire suppression can also lead to invasion of exotic species such as redtop and purple loosestrife (Nelson 2010).

Dominant plant species

- black willow (*Salix nigra*), shrub
- redtop (*Agrostis gigantea*), grass
- purple loosestrife (*Lythrum salicaria*), other herbaceous

Community 2.2
Silver Maple/Black Willow/Redtop – Purple Loosestrife

Sites in this community phase have continued to have fire suppressed from the landscape, allowing the woody canopies to mature. Silver maple (*Acer saccharinum* L.) becomes a dominant tree, and black willow continues to maintain the shrub canopy.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- black willow (*Salix nigra*), shrub

- redtop (*Agrostis gigantea*), grass
- purple loosestrife (*Lythrum salicaria*), other herbaceous

Pathway P2.1A
Community 2.1 to 2.2

Continued fire suppression

Pathway P2.2A
Community 2.2 to 2.1

Single fire event within 20 years.

State 3
Cool Season Pasture State

The cool-season grassland state occurs when the reference state has been anthropogenically-altered for livestock and/or hay production. Interseeding of non-native cool-season grasses, annual mowing, and grazing by domesticated livestock transition and maintain this simplified grassland state. Over time, as lands were continually grazed by large herds of cattle, native plant species diversity decreases and the non-native species were able to spread and expand across the prairie habitat (Nelson 2010; Steinauer and Rolfsmeier 2010).

Dominant plant species

- multiflora rose (*Rosa multiflora*), shrub
- common pricklyash (*Zanthoxylum americanum*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

Community 3.1
Prairie Cordgrass – Kentucky Bluegrass

Sites in this community phase arise from interseeding non-native forage species followed by grazing and/or haying. Prairie cordgrass can persist in the early phases due to its high grazing resistance and haying tolerance, but will decrease under intensive pressure (Walkup 1991). Kentucky bluegrass (*Poa pratensis* L.) is a commonly planted forage species and is well-adapted to moist conditions (Uchytil 1993).

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 3.2
Kentucky Bluegrass- Red Clover

This community phase represents increasing grazing and continuous haying. Kentucky bluegrass and red clover (*Trifolium pratense* L.) are characteristic species of frequently mowed sites. Other non-native species that can increase under these anthropogenically-induced conditions include alsike clover (*Trifolium hybridum* L.), timothy (*Phleum pratense* L.), and reed canarygrass (Steinauer and Rolfsmeier 2010).

Community 3.3
Reed Canarygrass

This community phase represents a near-to-complete exclusion of the native wet prairie species by reed canarygrass. This species regenerates aggressively by seed, seed banking, and vegetative regeneration. Disturbance may aid establishment, but it is not a requirement for colony spread. Monotypic stands are believed to influence and complicate successional pathways, especially in sites affected by nutrient enrichment from agricultural runoff (Green and Galatowitsch 2002; Kercher et al. 2007; Waggy 2010).

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), grass

Pathway P3.1A
Community 3.1 to 3.2

Annual haying and/or continuous grazing frequency increased.

Pathway P3.2A
Community 3.2 to 3.1

Haying and grazing frequency reduced.

Pathway P3.2B
Community 3.2 to 3.3

Annual haying and/or grazing frequency increased.

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 (USGS 1999). Agricultural tile drains used to lower the water table and 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 Wet Prairie State

Prairie reconstructions have become an important tool for repairing natural ecological functioning and providing habitat protection for numerous grassland-dependent species. The historic plant community of wet prairie was extremely diverse and complex, and prairie replication is not considered to be possible once the native vegetation has been altered by post-European settlement land uses. 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 natural ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed wet prairie state is the result of a long-term commitment involving a multi-step, adaptive management process. Diverse, species-rich seed mixes are important to utilize as they allow the site to undergo successional stages that exhibit changing composition and dominance over time (Smith et al. 2010). On-going post-planting management will help the site

progress from an early successional community dominated by annuals and some weeds to a later seral stage composed of native perennial grasses, sedges, and forbs.

Community 5.1
Early Successional Reconstructed Wet Prairie

This community phase represents the early community assembly from prairie reconstruction and is highly dependent on the seed mix utilized and the timing and priority of planting operations. The seed mix should look to include a diverse mix of native cool-season and warm-season annual and perennial grasses and forbs typical of the reference state. Cool-season annuals can help to provide litter that promotes cool, moist soil conditions to the benefit of the other species in the seed mix. The first season following site preparation and seeding will typically result in annuals and other volunteer species forming the vegetative cover (Steinauer et al. 2003). Control of non-native species, particularly perennial species, is crucial at this point in order to ensure they do not establish before the native vegetation (Martin and Wilsey 2012). After the first season, native warm-season grasses should begin to become more prominent on the landscape and, over time, close the canopy.

Community 5.2
Late Successional Reconstructed Wet Prairie

Appropriately timed disturbance regimes (e.g., seasonal flooding, prescribed fire) applied to the early successional community phase can help increase the beta diversity, pushing the site into a late successional community phase over time. While prairie communities are dominated by grasses, these species can suppress forb establishment and reduce overall diversity and ecological functioning (Martin and Wilsey 2006; Williams et al. 2007). Reducing accumulated plant litter from such tallgrasses as prairie cordgrass and bluejoint allows more light and nutrients to become available for forb recruitment, allowing for greater ecosystem complexity (Wilsey 2008).

Pathway P5.1A
Community 5.1 to 5.2

Selective herbicides are used to control non-native species, and prescribed fire and/or light grazing help to increase the native species diversity and control woody vegetation.

Pathway P5.2A
Community 5.2 to 5.1

Reconstruction experiences a decrease in native species diversity from drought or improper timing of management actions (e.g., lack of flooding, reduced fire frequency, use of non-selective herbicides).

Transition T1A
State 1 to 2

Transition 1A – Long-term fire suppression transitions this site to the fire-suppressed state (2).

Transition T1B
State 1 to 3

Transition 1B – Interseeding of cool-season grasses and annual mowing and/or grazing transition this site to the cool-season grassland state (3).

Transition T1C
State 1 to 4

Transition 1C – Installation of drain tiles, tillage, seeding of agricultural crops, and non-selective herbicide transition this site to the cropland state (4).

Restoration pathway R2A

State 2 to 1

Restoration 2A – Re-establishment of a historic fire regime and non-native species control transitions this site to the reference state (1).

Transition T3A
State 3 to 4

Transition 3A – 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

Restoration 3A – Site preparation, exotic species control, native species seeding, and post-planting management transition this site to the reconstructed wet prairie state (5).

Restoration pathway T4A
State 4 to 3

Transition 4A – Interseeding of cool-season grasses and annual mowing and/or grazing transition this site to the cool-season grassland state (3).

Restoration pathway R4A
State 4 to 5

Restoration 4A – Removal of drain tiles, site preparation, native seeding, and invasive species control transition this site to the reconstructed wet prairie state (5).

Restoration pathway T5B
State 5 to 3

Transition 5B – Uncontrolled reed canarygrass invasions transition this site to the cool-season grassland state (3).

Transition T5A
State 5 to 4

Transition 5A – 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 ecological site description.

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Approval

Chris Tecklenburg, 5/21/2020

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development of state and community phases of the state-and-transition model, providing peer review and technical editing, and conducting quality control and quality assurance reviews.

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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	05/15/2024
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):**

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:**