Ecological site R107XA214IA
Loamy Floodplain Prairie

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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.

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 Minnesota Loess Hills (MLRA 107A) includes the Northwest Iowa Plains, Inner Coteau, and Coteau Moraines landforms (Prior 1991; MDNR 2005). It spans two states (Iowa, 89 percent; Minnesota, 11 percent), encompassing approximately 4,470 square miles (Figure 1). The elevation ranges from approximately 1,700 feet above sea level (ASL) on the highest ridges to about 1,115 feet ASL in the lowest valleys. Local relief is mainly 10 to 100 feet. However, some valley floors can range from 80 to 200 feet, while some upland flats only range between 3 and 6 feet. The eastern half of the MLRA is underlain by Wisconsin-age till, deposited between 20,000 and 30,000 years ago and is known as the Sheldon Creek Formation. The western half is underlain by Pre-Illinoian glacial till, deposited more than 500,000 years ago and has since undergone extensive erosion and dissection. Both surfaces are covered by approximately 4 to 20 feet of loess on the hillslopes, and Holocene alluvium covers the till in the drainageways. Cretaceous bedrock, comprised of sandstone and shale, lies 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

U.S. Forest Service Ecological Subregions: North Central Glaciated Plains (251B) Section, Outer Coteau des Prairies (251Bb), Northwest Iowa Plains (251Bd) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Loess Prairies (47a) (USEPA 2013)

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

National Vegetation Classification - Plant Associations: Spartina pectinata – Calamagrostis stricta – Carex spp. Wet

Meadow (CEGL002027) (NatureServe 2015)

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

Natural Resources Conservation Service – Iowa Plant Community Species List: Wet Prairie, Northern Cordgrass (USDA-NRCS 2007)

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

Minnesota Department of Natural Resources: WMp73 Prairie Wet Meadow/Carr; WPs54b Wet Prairie (Southern) (MDNR 2005)

U.S. Army Corps of Engineers: Wet to Wet-Mesic Prairies (Eggers and Reed 2015)

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 Mollisols that are somewhat poorly to moderately well-drained and deep, formed in alluvium. Flooding typically occurs in the spring from runoff but can also occur following a precipitation event. This occasional flooding can last up to 7 days at a time.

The historic pre-European settlement vegetation on this site was dominated by species adapted to periodic flooding. Prairie cordgrass (Spartina pectinata Bosc ex Link) and northern reedgrass (Calamagrostis stricta (Timm) Koeler spp. inexpansa (A. Gray) C.W. Greene) are the dominant grasses of Loamy Floodplain Prairies. Other grasses and grass-likes that may be present include bluejoint (Calamagrostis canadensis (Michx.) P. Beauv.), woolly sedge (Carex pellita Muhl. ex Willd.), and Sartwell's sedge (Carex sartwellii Dewey) (MDNR 2005; NatureServe 2015). Forbs typical of an undisturbed plant community associated with this ecological site include fourflower yellow loosestrife (Lysimachia quadriflora Sims), tufted loosestrife (Lysimachia thyrsiflora L.), hemlock waterparsnip (Sium suave Walter), and marsh bellflower (Campanula aparinoides Pursh) (Drobney et al. 2001; MDNR 2005). Shrubs are typically sparse and can include pussy willow (Salix discolor Muhl.) (MDNR 2005). Flooding and fire are the primary disturbance factors that maintain this site, while periodic drought is a secondary factor (MDNR 2005; LANDFIRE 2009).

Associated sites

R107XA215IA	**Wet Floodplain Sedge Meadow** Poorly drained alluvium in river valleys that experience flooding including Calco, Coland, Colo, Comfrey, Fluvaquents, and Havelock
R107XA212IA	**Stream Terrace Prairie** Silty or loamy sediments over outwash including Allendorf, Estherville, Fairhaven, Hawick, Salida, and Wadena
F107XA213IA	**Loamy Floodplain Forest** Moderately well drained alluvium in the Little Sioux River floodplain that experiences occasional to frequent flooding including Colo, Omadi, and Spillville

Similar sites

R107XA210IA	**Wet Upland Drainageway Prairie** Wet Upland Drainageway Prairies are similar in plant community composition, but site is a SLOPE wetland

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Spartina pectinata* (2) *Calamagrostis stricta ssp. inexpansa*

Physiographic features

Loamy Floodplain Prairies occur on floodplains (Figure 2). They are situated on elevations ranging from approximately 499 to 1801 feet ASL. The site experiences occasional flooding from spring runoff and precipitation events that can last up to 7 days.

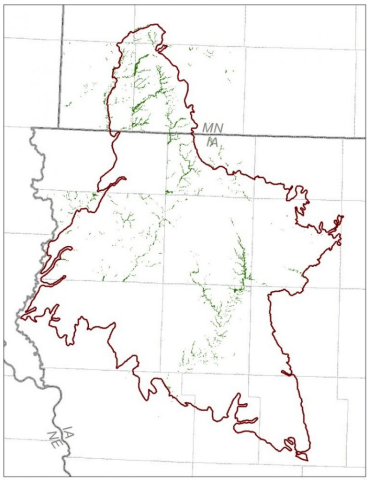


Figure 2. Figure 1. Location of Loamy Floodplain Prairie ecological site within MLRA 107A.

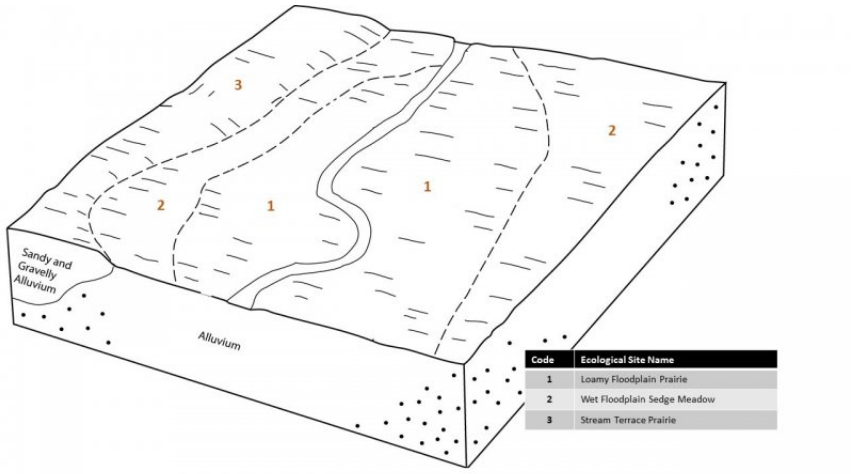


Figure 3. Figure 2. Representative block diagram of Loamy Floodplain Prairie and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) River valley > Flood plain
Runoff class	Low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Elevation	152–549 m
Slope	0–2%
Water table depth	30–122 cm
Aspect	Aspect is not a significant factor

Climatic features

The Iowa and Minnesota Loess Hills falls into the hot humid continental climate (Dfa) Köppen-Geiger climate

classification (Peel et al. 2007). 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. Occasionally, hot, dry winds originating from the Desert Southwest will stagnate over the region, creating extended droughty periods in the summer from unusually high temperatures. Air masses from the Pacific Ocean can also spread into the region and dominate producing mild, dry weather in the autumn known as Indian Summers (NCDC 2006).

The soil temperature regime of MLRA 107A 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 156 days, while the frost-free period is about 138 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 approximately 31 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 34 and 57°F, respectively (Table 3).

Climate data and analyses are derived from 30-year averages gathered from three 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)	121-124 days
Freeze-free period (characteristic range)	140-147 days
Precipitation total (characteristic range)	762-787 mm
Frost-free period (actual range)	120-126 days
Freeze-free period (actual range)	138-149 days
Precipitation total (actual range)	762-787 mm
Frost-free period (average)	123 days
Freeze-free period (average)	144 days
Precipitation total (average)	762 mm

Climate stations used

- (1) LUVERNE [USC00214937], Luverne, MN
- (2) CHEROKEE [USC00131442], Cherokee, IA
- (3) SHELDON [USC00137594], Sheldon, IA

Influencing water features

Loamy Floodplain Prairies are classified as a RIVERINE: Floodplain, Occasionally Flooded, herbaceous wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Emergent, Persistent, Temporarily Flooded wetland under the National Wetlands Inventory (FGDC 2013). Overbank flow and subsurface hydraulic connections are the main sources of water for this ecological site, but additional sources can include upland surface runoff, tributary inflow, and precipitation (Smith et al. 1995). Infiltration is slow to moderate (Hydrologic Group B and C) for undrained soils, and surface runoff is low (Figure 5).

Primary wetland hydrology indicators for an intact Loamy Floodplain Prairie may include: A1 Surface water, A2 High water table, and A3 Saturation. Secondary wetland hydrology indicators may include: B10 Drainage patterns, C2 Dry-season water table, and D5 FAC-neutral test (USACE 2010).

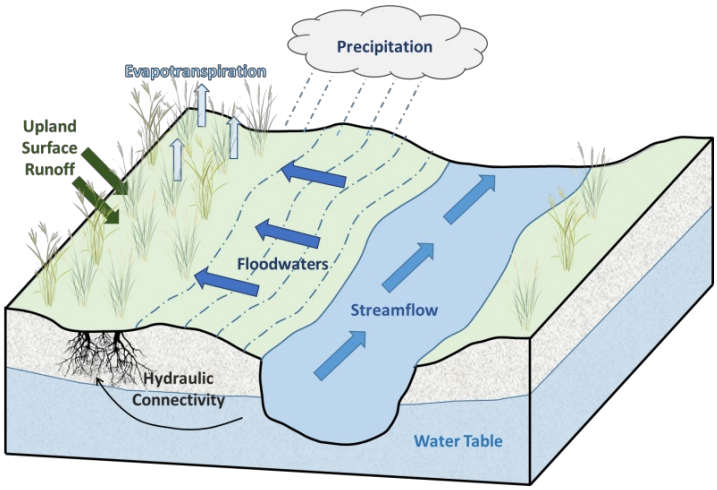


Figure 8. Figure 5. Hydrologic cycling in Loamy Floodplain Prairie ecological site.

Soil features

Soils of Loamy Floodplain Prairies are in the Mollisols order, further classified as Cumulic Endoaquolls and Cumulic Hapludolls with slow to moderate infiltration and low runoff potential. The soil series associated with this site includes Spillco, Spillville, and Turlin variant (Figure 6). The parent material is alluvium, and the soils are somewhat poorly to moderately well-drained and deep. Soil pH classes are neutral to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site (Table 5).

Some soil map units in this ecological site may meet the definition of hydric soils and are listed as meeting criteria 2 and 4 of the hydric soils list (77 FR 12234).

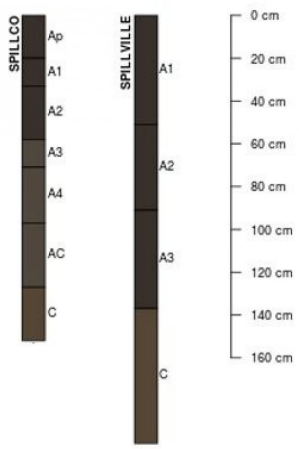


Figure 9. Figure 6. Profile sketches of soil series associated with Loamy Floodplain Prairie.

Table 4. Representative soil features

Parent material	(1) Alluvium
Family particle size	(1) Fine-loamy
Drainage class	Somewhat poorly drained to well drained
Permeability class	Slow to moderately slow
Soil depth	203 cm

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.

MLRA 107A is defined by a relatively low relief landscape that experiences lower rainfall amounts and available moisture compared to other MLRAs occurring to the south and east. As a result, prairie vegetation communities dominate the uplands, while forested communities are restricted to medium and large streams (Prior 1991; Eilers and Roosa 1994; MDNR 2017a, b). Loamy Floodplain Prairies form an aspect of this vegetative continuum. This ecological site occurs on floodplains on somewhat poorly to moderately well-drained soils. Species characteristic of this ecological site consist of hydrophytic herbaceous vegetation.

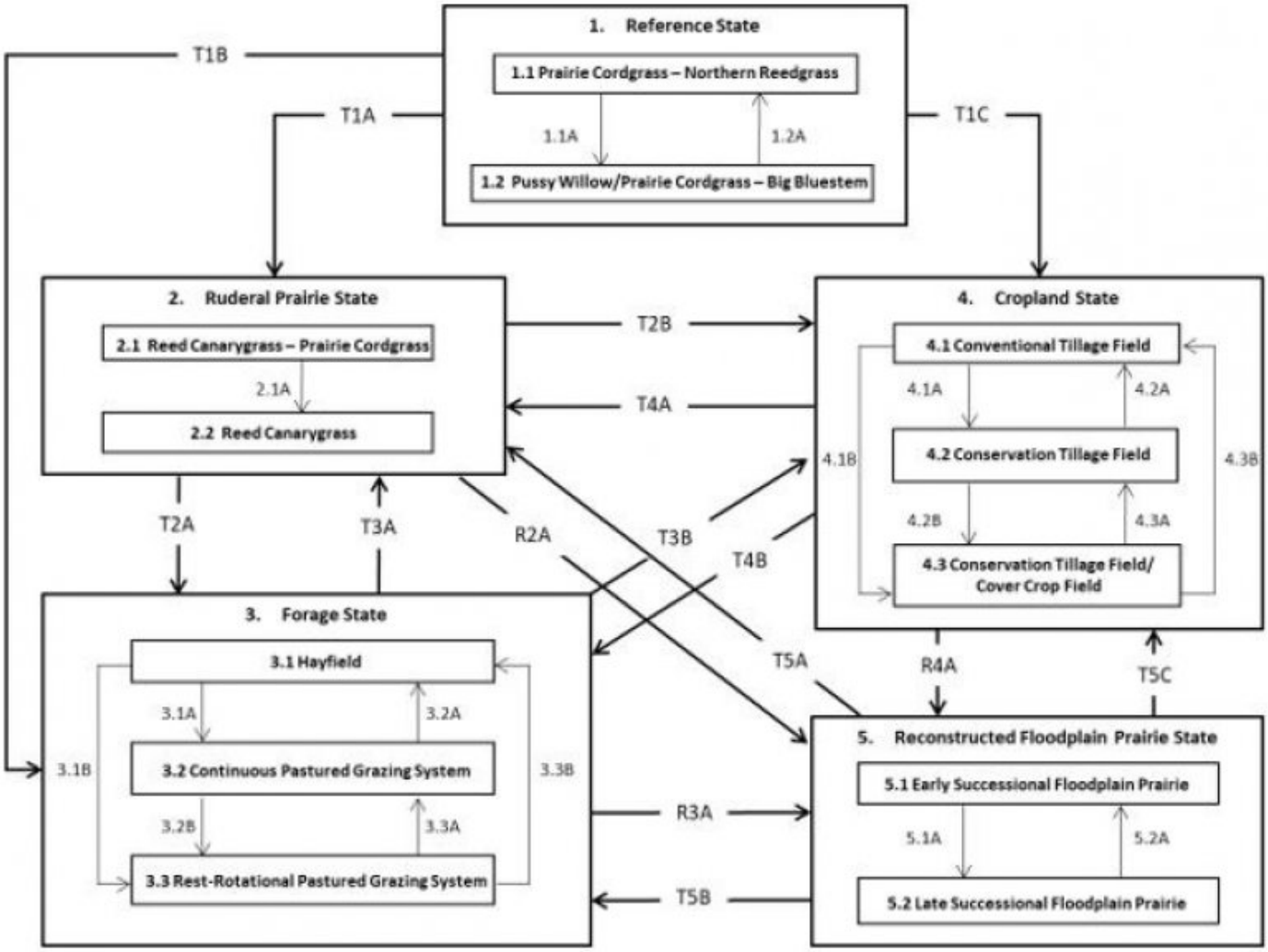
Flooding and fire are the primary disturbance factors of this ecological site. Seasonal flooding generally occurs following spring runoff and heavy rains causing alternating episodes of accretion and deposition. These fluctuations result in cyclic anaerobic and aerobic conditions (MDNR 2005). Fires were typically stand replacing, occurring approximately every 3 years (LANDFIRE 2009). The combination of periodic flooding and fire prevented the buildup of organic materials and significant shrub establishment.

Drought has also played a role in shaping this ecological site. The periodic episodes of reduced soil moisture in conjunction with the somewhat poorly to moderately well-drained soils have favored the proliferation of plant species tolerant of such conditions. Drought can also slow the growth of plants and result in dieback of certain species. When coupled with fire and flooding, periods of drought can greatly delay the establishment of woody vegetation (Pyne et al. 1996).

Today, Loamy Floodplain Prairies have experienced numerous disturbances that reduced their historic range. Many areas have been converted to agricultural production land – either cropland dominated by corn (*Zea mays* L.) and soybeans (*Glycine max* (L.) Merr.) or as forage land for livestock. Other areas have been invaded by non-native species. A return to the historic plant community may not be possible following extensive land modification and significant hydrologic and water quality changes in the watershed, but long-term conservation agriculture or prairie reconstruction efforts can help to restore some biotic diversity and ecological function. 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

R107AY214IA Loamy Floodplain Prairie



Code	Process
T1A, T3A, T4A, T5A	Changes to natural hydroperiod and/or land abandonment
T1B, T2A, T4B, T5B	Cultural treatments are implemented to increase forage quality and yield
T1C, T2B, T3B, T5C	Agricultural conversion via tillage, seeding, and non-selective herbicide
1.1A	Natural succession following prolonged absence of fire and flooding
1.2A	Natural succession following short fire return interval and flooding frequency
2.1A	Increasing changes to hydrology and increasing sedimentation
R2A, R3A, R4A	Site preparation, non-native species control, and native seeding
3.1A	Mechanical harvesting is replaced with domestic livestock and continuous grazing
3.1B	Mechanical harvesting is replaced with domestic livestock and rest-rotational grazing
3.2A, 3.3B	Tillage, forage crop planting, and mechanical harvesting replace grazing
3.2B	Implementation of rest-rotational grazing
3.3A	Implementation of continuous grazing
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
5.1A	Maintenance of proper hydrology, fire, and nutrient balances
5.2A	Drought or improper timing/use of management actions

State 1
Reference State

The reference plant community is categorized as a wet-mesic community, dominated by herbaceous vegetation. The two community phases within the reference state are dependent on fire and flooding. Periodic flooding alters species composition, cover, and extent, while regular fire intervals keep woody species from encroaching. Drought has more localized impacts in the reference phases, but does contribute to overall species composition, diversity, cover, and productivity.

Dominant plant species

- pussy willow (*Salix discolor*), shrub
- prairie cordgrass (*Spartina pectinata*), grass
- northern reedgrass (*Calamagrostis stricta ssp. inexpansa*), grass

Community 1.1
Prairie Cordgrass – Northern Reedgrass

Prairie Cordgrass – Northern Reedgrass – Sites in this reference community phase are dominated by herbaceous tallgrass species. Vegetative cover is interrupted to continuous (50 to 100 percent) and the tallest plants reach heights greater than 3 feet tall (MDNR 2005; LANDFIRE 2009). Prairie cordgrass and northern reedgrass are the dominant monocot species, but other species present include bluejoint, woolly sedge, and Sartwell's sedge. Characteristic forbs include white panicle aster (*Symphyotrichum lanceolatum* (Willd.) G.L. Nesom ssp. lanceolatum var. lanceolatum), rough bugleweed (*Lycopus asper* Greene), swamp milkweed (*Asclepias incarnata* L.), sawtooth sunflower (*Helianthus grosseserratus* M. Martens), and wild mint (*Mentha arvensis* L.) (MDNR 2005; NatureServe 2015).

Dominant plant species

- prairie cordgrass (*Spartina pectinata*), other herbaceous
- northern reedgrass (*Calamagrostis stricta ssp. inexpansa*), other herbaceous

Community 1.2
Pussy Willow/Prairie Cordgrass – Big Bluestem

Pussy Willow/Prairie Cordgrass – Big Bluestem – This reference community phase represents the site following a prolonged absence of fire or flooding (greater than 3 years). Shrubs become sparsely established, comprising less than 5 percent cover, and include pussy willow and redosier dogwood (*Cornus sericea* L.) (MDNR 2005). Grasses are still abundant and continuous, but more mesic species – such as big bluestem (*Andropogon gerardii* Vitman) and switchgrass (*Panicum virgatum* L.) – begin to add to the plant community diversity.

Dominant plant species

- pussy willow (*Salix discolor*), shrub
- prairie cordgrass (*Spartina pectinata*), other herbaceous
- big bluestem (*Andropogon gerardii*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Natural succession following prolonged absence of fire and flooding

Pathway 1.2A
Community 1.2 to 1.1

Natural succession following short fire return interval and flooding frequency

State 2
Ruderal Prairie State

The ruderal prairie state arises when the reference state has experienced hydrologic and nutrient alterations as a

result of ditching, drain tiling, impoundments, heavy grazing, and agricultural runoff (MDNR 2005). Sites impacted by these activities can become heavily invaded by non-native species that significantly reduce the native biodiversity and natural physiochemical cycling.

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 2.1
Reed Canarygrass - Prairie Cordgrass

Reed Canarygrass – Prairie Cordgrass – This community phase represents the early changes to the natural hydroperiod, increasing sedimentation, and unabated nutrient runoff. Native grasses, such as prairie cordgrass, continue to form a component of the herbaceous layer, but the highly invasive reed canarygrass (*Phalaris arundinacea* L.) co-dominates (Waggy 2010). As reed canarygrass invades, it can not only alter species composition, but vegetation structure as well (Annen et al. 2008).

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), other herbaceous
- prairie cordgrass (*Spartina pectinata*), other herbaceous

Community 2.2
Reed Canarygrass

Reed Canarygrass – Sites falling into this community phase have experienced significant sedimentation and nutrient enrichment and are dominated by a monoculture of reed canarygrass (MDNR 2005). Reed canarygrass stands can significantly alter the physiochemical environment as well as the biotic communities, making the site only suitable to reed canarygrass. These monotypic stands create a positive feedback loop that perpetuates increasing sedimentation, altered hydrology, and dominance by this non-native species, especially in sites affected by nutrient enrichment from agricultural runoff (Vitousek 1995; Bernard and Lauve 1995; Kercher et al. 2007; Waggy 2010; Eggers and Reed 2015).

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), other herbaceous

Pathway 2.3A
Community 2.1 to 2.2

Increasing changes to hydrology and increasing sedimentation

State 3
Forage State

The forage 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.) 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 prairie ecosystem, reducing the native species diversity and ecological function.

Community 3.1
Hayfield

Hayfield – Sites in this community phase consist of forage plants that are planted and mechanically harvested.

Mechanical harvesting removes much 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).

Community 3.2
Continuous Pastured Grazing System

Continuous Pastured Grazing System – This community phase is characterized by continuous grazing where domestic livestock graze a pasture for the entire season. Depending on stocking density, this can result in lower forage quality and productivity, weed invasions, and uneven pasture use. Continuous grazing can also increase the amount of bare ground and erosion and reduce soil organic matter, cation exchange capacity, water-holding capacity, and nutrient availability and retention (Bharati et al. 2002; Leake et al. 2004; Teague et al. 2011). Smooth brome, Kentucky bluegrass, and white clover (*Trifolium repens* L.) are common pasture species used in this phase. Their tolerance to continuous grazing has allowed these species to dominate, sometimes completely excluding the native vegetation.

Community 3.3
Rest-Rotation Pastured Grazing System

Rest-Rotation Pastured Grazing System – This community phase is characterized by rotational grazing where the pasture has been subdivided into several smaller paddocks. Through the development of a grazing plan, livestock utilize one or a few paddocks, while the remaining area is rested allowing plants to restore vigor and energy reserves, deepen root systems, develop seeds, as well as allow seedling establishment (Undersander et al. 2002; USDA-NRCS 2003). Rest-rotation pastured grazing systems include deferred rotation, rest rotation, high intensity – low frequency, and short duration methods. Vegetation is generally more diverse and can include orchardgrass (*Dactylis glomerata* L.), timothy (Phleum pretense L.), red clover (*Trifolium pratense* L.), and alfalfa (*Medicago sativa* L.). The addition of native prairie species can further bolster plant diversity and, in turn, soil function. This community phase promotes numerous ecosystem benefits including increasing biodiversity, preventing soil erosion, maintaining and enhancing soil quality, sequestering atmospheric carbon, and improving water yield and quality (USDA-NRCS 2003).

Pathway 3.1A
Community 3.1 to 3.2

Mechanical harvesting is replaced with domestic livestock and continuous grazing

Pathway 3.1B
Community 3.1 to 3.3

Mechanical harvesting is replaced with domestic livestock and rest-rotational grazing

Pathway 3.2A
Community 3.2 to 3.1

Tillage, forage crop planting, and mechanical harvesting replace grazing

Pathway 3.2B
Community 3.2 to 3.3

Implementation of rest-rotational grazing

Pathway 3.3B
Community 3.3 to 3.1

Tillage, forage crop planting, and mechanical harvesting replace grazing

Pathway 3.2A
Community 3.3 to 3.2

Tillage, forage crop planting and mechanical harvesting replace grazing

State 4
Cropland State

The low topographic relief across the MLRA has resulted in nearly the entire area being converted to agriculture (Eilers and Roosa 1994). Agricultural tile drains used to lower the water table and 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 and soybeans are the dominant crops for the site, and oats (Avena L.) and alfalfa (*Medicago sativa* L.) may be rotated periodically. These areas are likely to remain in crop production for the foreseeable future.

Community 4.1
Conventional Tillage Field

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).

Community 4.2
Conservation Tillage Field

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 improve soil ecosystem function by reducing soil erosion, increasing organic matter and water availability, improving water quality, and reducing soil compaction.

Community 4.3
Conservation Tillage with Cover Crop Field

Conservation Tillage with Cover Crop Field – This community phase 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 ecosystem. 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 4.1A
Community 4.1 to 4.2

Less tillage, residue management

Pathway 4.1B
Community 4.1 to 4.3

Less tillage, residue management and implementation of cover cropping

Pathway 4.2A
Community 4.2 to 4.1

Intensive tillage, remove residue, and reinitialize monoculture row cropping

Pathway 4.2B
Community 4.2 to 4.3

Implementation of cover cropping

Pathway 4.3B
Community 4.3 to 4.1

Intensive tillage, remove residue and reinitialize monoculture row cropping

Pathway 4.3A
Community 4.3 to 4.2

Remove cover cropping

State 5
Reconstructed Floodplain Prairie State

Floodplain prairie habitats provide multiple ecosystem services including flood abatement, water quality improvement, and biodiversity support (Mitsch and Gosselink 2007). However, many floodplain prairie communities have been eliminated as a result of type conversions to agricultural production, wildfire suppression, changes to the natural hydrologic regime, and invasion of non-native species, thereby significantly reducing these services (Annen et al. 2008). The extensive alterations of lands adjacent to Loamy Floodplain Prairies may not allow for restoration back to the historic reference condition. But ecological reconstruction can aim to aid the recovery of degraded, damaged, or destroyed functions. A successful reconstruction 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; Mitsch and Jørgensen 2004).

Community 5.1
Early Successional Floodplain Prairie

Early Successional Floodplain Prairie – This community phase represents the early community assembly from floodplain prairie reconstruction and is highly dependent on invasive species control, hydroperiod repair, planting, and properly timed prescribed fire activities (Adams and Galatowitsch 2006). In addition, adaptive restoration tactics that incorporate multiple restoration methods should be implemented in order to more clearly identify cause-effect relationships of vegetative development (Zedler 2005).

Community 5.2
Late Successional Floodplain Prairie

Late Successional Floodplain Prairie – Appropriately timed disturbance regimes (e.g. hydroperiod, prescribed fire, invasive species control) and nutrient management applied to the early successional community phase can help increase the species richness and improve ecosystem function, pushing the site into a late successional community phase over time (Mitsch and Gosselink 2007).

Pathway 5.1A
Community 5.1 to 5.2

Maintenance of proper hydrology, fire and nutrient balances

Pathway 5.2A
Community 5.2 to 5.1

Drought or improper timing/use of management actions

Transition T1A
State 1 to 2

Changes to natural hydroperiod and/or land abandonment

Transition T1B
State 1 to 3

Cultural treatments are implemented to increase forage quality and yield

Transition T1C
State 1 to 4

Agricultural conversion via tillage, seeding and non-selective herbicide

Transition T2A
State 2 to 3

Cultural treatments are implemented to increase forage quality and yield

Transition T2B
State 2 to 4

Agricultural conversion via tillage, seeding and non-selective herbicide

Transition R2A
State 2 to 5

Site preparation, non-native species control and native seeding

Restoration pathway T3A
State 3 to 2

Changes to natural hydroperiod and/or land abandonment

Transition T3B
State 3 to 4

Agricultural conversion via tillage, seeding and non-selective herbicides

Transition R3A
State 3 to 5

Site preparation, non-native species control and native seeding

Restoration pathway T4A

State 4 to 2

Changes to natural hydroperiod and/or land abandonment

Restoration pathway T4B
State 4 to 3

Cultural treatments are implemented to increase forage quality and yield

Transition R4A
State 4 to 5

Site preparation, non-native species control and native seeding

Restoration pathway T5A
State 5 to 2

Changes to natural hydroperiod and/or land abandonment

Restoration pathway T5B
State 5 to 3

Cultural treatments are implemented to increase forage quality and yield

Restoration pathway T5C
State 5 to 4

Agricultural conversion via tillage, seeding and non-selective herbicide

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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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/19/2024
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:**

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17. **Perennial plant reproductive capability:**
