Ecological site F107XA213IA
Loamy Floodplain Forest

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General information

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

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, 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: North-Central Interior Floodplain (CES202.694) (NatureServe 2015)

National Vegetation Classification - Plant Associations: Populus deltoids – *Salix nigra* – Acer saccharinum

Floodplain Forest (CEGL002018) (NatureServe 2015)

Biophysical Settings: Eastern Great Plains Floodplain Systems (BpS 3914690) (LANDFIRE 2009)

Natural Resources Conservation Service – Iowa Plant Community Species List: Forest, Midwestern Cottonwood – Black Willow (USDA-NRCS 2007)

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

Minnesota Department of Natural Resources: FFs68a Silver Maple – (Virginia Creeper) Floodplain Forest (MDNR 2005)

U.S. Army Corps of Engineers: Floodplain Forests (Eggers and Reed 2015)

Ecological site concept

Loamy Floodplain Forests are located within the green areas on the map (Figure 1). They occur on floodplains of the Little Sioux River, and the soils are Mollisols that are moderately well-drained and deep formed in alluvium. The site experiences seasonal flooding that can last for up to seven days at a time. The plant community is comprised of hydrophytic woody and herbaceous vegetation.

The historic, pre-European settlement vegetation on this site was dominated by a dense, closed canopy of deciduous trees and a sparse to variable understory of shade- and flood-tolerant herbs. The tree canopy is comprised of silver maple (Acer saccharinum L.) and eastern cottonwood (Populus deltoides W. Bartram ex Marshall). Other tree species that may occur can include green ash (Fraxinus pennsylvanica Marshall), American elm (Ulmus americana L.), and common hackberry (Celtis occidentalis L.). Vines are a common component and often include riverbank grape (Vitis riparia Michx.). The understory is populated with species tolerant of repeated flood disturbances with whitegrass (Leersia virginica Willd.) and Canadian woodnettle (Laportea canadensis (L.) Weddell) the most commonly encountered. Seasonal flooding is the primary disturbance factor that maintains this ecological site, while windthrow events, beaver predation, and insect and disease outbreaks are secondary factors (MDNR 2005; LANDFIRE 2009).

Associated sites

R107XA214IA	**Loamy Floodplain Prairie** Somewhat poorly to moderately well-drained alluvium that experiences rare flooding.
R107XA215IA	**Wet Floodplain Sedge Meadow** Poorly-drained alluvium that experiences occasional flooding

Table 1. Dominant plant species

Tree	(1) *Acer saccharinum* (2) *Populus deltoides*
Shrub	Not specified
Herbaceous	(1) *Leersia virginica* (2) *Laportea canadensis*

Physiographic features

Loamy Floodplain Forests occur on floodplains adjacent to the stream channel (Figure 2). They are situated on elevations ranging from approximately 877 to 2001 feet ASL. This site experiences occasional to frequent flooding that can last up to seven days.

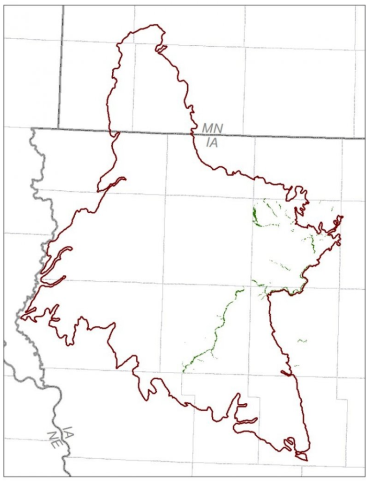


Figure 2. Figure 1. Location of Loamy Floodplain Forest ecological site within MLRA 107A.

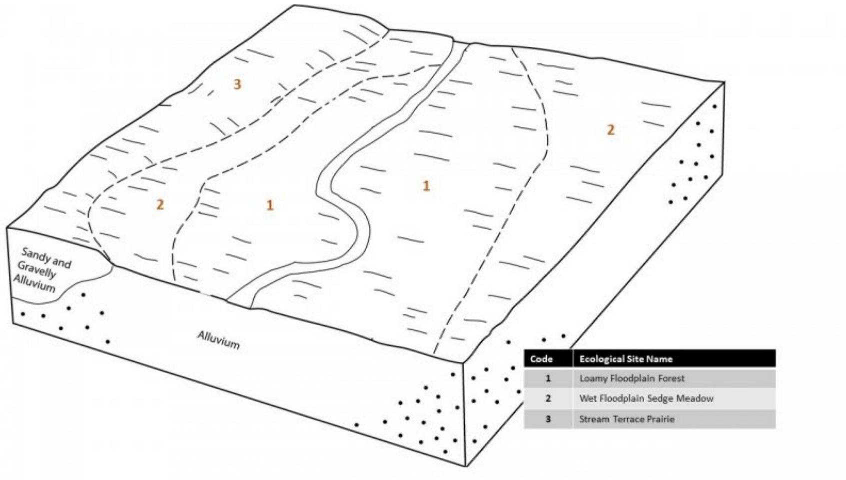


Figure 3. Figure 2. Representative block diagram of Loamy Floodplain Forest and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) River valley > Flood plain
Runoff class	Low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Elevation	267–610 m
Slope	0–2%
Water table depth	36–122 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 160 days, while the frost-free period is about 136 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 32 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 36 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)	126-127 days
Freeze-free period (characteristic range)	147-149 days
Precipitation total (characteristic range)	762-787 mm
Frost-free period (actual range)	126-127 days
Freeze-free period (actual range)	147-149 days
Precipitation total (actual range)	762-787 mm
Frost-free period (average)	126 days
Freeze-free period (average)	148 days
Precipitation total (average)	787 mm

Climate stations used

- (1) SIOUX RAPIDS 4 E [USC00137726], Sioux Rapids, IA
- (2) CHEROKEE [USC00131442], Cherokee, IA
- (3) SPENCER 1 N [USC00137844], Spencer, IA

Influencing water features

Loamy Floodplain Forests are classified as a RIVERINE: Frequently Flooded; forested wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Forested, Broad-leaved Deciduous, Temporarily Flooded wetland under the National Wetlands Inventory (FGDC 2013). Overbank flow from the channel and subsurface hydraulic connections are the main sources of water for this ecological site (Smith et al. 1995). Infiltration is slow (Hydrologic Group C) for undrained soils, and surface runoff is low (Figure 5).

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

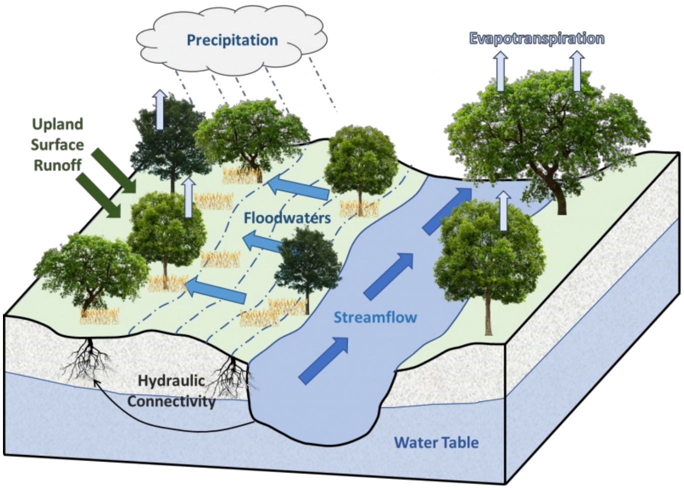


Figure 8. Figure 5. Hydrologic cycling in Loamy Floodplain Forest ecological site.

Soil features

Soils of Loamy Floodplain Forests are in the Mollisols orders, further classified as Cumulic Endoaquolls, Cumulic Hapludolls, and Fluventic Hapludolls with slow infiltration and low runoff potential. While these soils are classified as Mollisols, their dark surfaces and increased thickness of the epipedon are not the result of prairie vegetation but rather alluvial deposition and slope wash. The soil series associated with this site includes Colo, Omadi, and Spillville (Figure 6). The parent material is alluvium, and the soils are moderately well-drained and deep. Soil pH classes are moderately acid 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 of the hydric soils list (77 FR 12234).

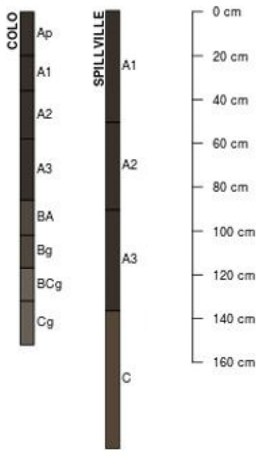


Figure 9. Figure 6. Profile sketches of soil series associated with Loamy Floodplain Forest.

Table 4. Representative soil features

Parent material	(1) Alluvium
Family particle size	(1) Fine-silty (2) Fine-loamy
Drainage class	Moderately well drained to well drained
Permeability class	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.

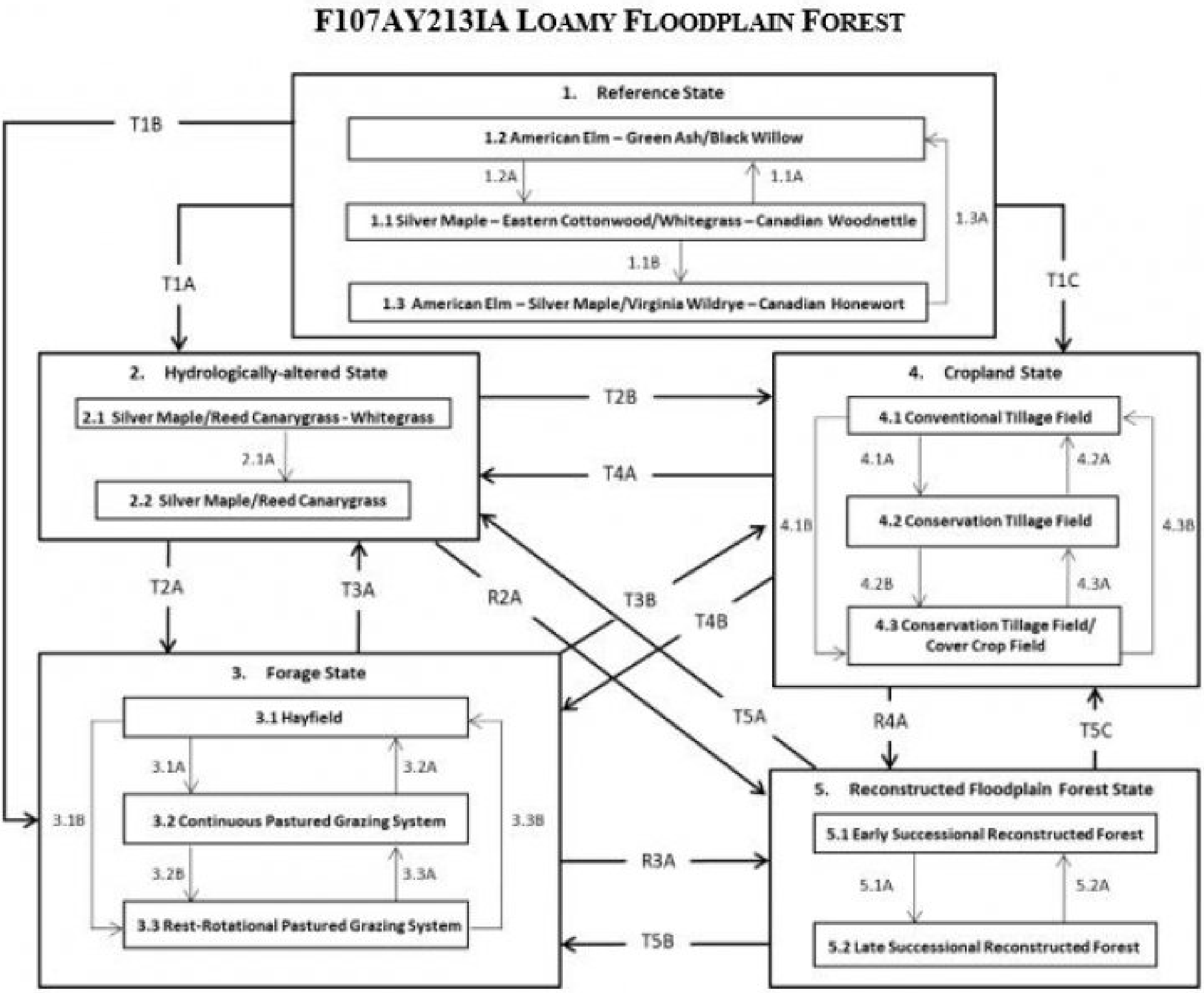
MLRA 107A is defined by a relatively low relief landscape that experiences lower rainfall amounts and available moisture compared to other MLRAs occurring to the south and east. As a result, prairie vegetation communities dominate the uplands, while forested communities are restricted to medium and large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

Flooding is the dominant disturbance factor in Loamy Floodplain Forests. Seasonal flooding occurs nearly every year, and flooding can persist up to seven days. Less frequent major and extreme floods result in shifts in the plant community, from early successional communities with small trees and saplings forming open canopies to late successional communities with large trees and closed canopies (LANDFIRE 2009).

Windthrow events, beaver activity, and periodic insect and disease outbreaks influence this site to a lesser, more localized extent (LANDFIRE 2009). Windthrow events are mostly caused from tornadoes and associated winds and generally occur in the 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 10 years old (LANDFIRE 2009).

Loamy Floodplain Forests have increased since pre-settlement times, occurring now in all three of the major rivers in the MLRA. However, the communities present on the landscape today have been greatly altered by significant changes in the hydrology and water quality of the watershed as well as from invasions by exotic species. Some historic forests have been converted to agricultural production land. 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



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	Major flood event
1.1B, 1.2A	Natural succession
1.3A	Extreme flood event
2.1A	Increasing changes to hydrology, increasing sedimentation, and non-native species invasion
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
R2A, R3A, R4A	Site preparation, tree planting, repair hydrology, non-native species control
5.1A	Timber stand improvement practices implemented
5.2A	Setback from extreme weather event or improper timing of management actions

State 1
Reference State

The reference plant community is categorized as a floodplain forest community, dominated by hydrophytic woody and herbaceous vegetation. The three community phases within the reference state are dependent on a periodic flood regime. The amount and duration of flooding alters species composition, cover, and extent. Windthrow, beaver activity, and periodic insect and disease outbreaks have more localized impacts on the reference phases, but do contribute to overall species composition, diversity, cover, and productivity. Community Phase 1.1 Silver Maple – Eastern Cottonwood/Whitegrass – Canadian Woodnettle – Sites in this reference community phase are a closed canopy forest (up to 70 percent cover) dominated by silver maple and eastern cottonwood, with sub-dominants including green ash, American elm, common hackberry, and boxelder (*Acer negundo* L.). Trees are medium in size (9-21 inches DBH) and range in height from 16 to 80 feet tall (LANDFIRE 2009). Climbing vines, especially riverbank grape and common moonseed (*Menispermum canadense* L.), can be common. Whitegrass and Canadian woodnettle are the dominant herbaceous species, but other species that can be encountered include cutleaf coneflower (*Rudbeckia laciniata* L.), sweet woodreed (*Cinna arundinacea* L.), and Canadian clearweed (*Pilea pumila* (L.) A. Gray). This community phase occurs from approximately 35 to 155 years (MDNR 2005).

Dominant plant species

- American elm (*Ulmus americana*), tree
- silver maple (*Acer saccharinum*), tree
- eastern cottonwood (*Populus deltoides*), tree
- black willow (*Salix nigra*), shrub
- whitegrass (*Leersia virginica*), other herbaceous
- Canadian woodnettle (*Laportea canadensis*), other herbaceous
- Virginia wildrye (*Elymus submuticus*), other herbaceous
- Canadian honewort (*Cryptotaenia canadensis*), other herbaceous

Community 1.1
Silver Maple - Eastern Cottonwood/Whitegrass - Canadian Woodnettle

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Community 1.2
American Elm - Green Ash/Black Willow

This reference community phase represents a young forest in recovery from a severe flood or wind event, reducing the overstory canopy to less than 50 percent cover (LANDFIRE 2009). American elm, green ash, and slippery elm (*Ulmus rubra* Muhl.) are the dominant trees, and black willow (*Salix nigra* L.) becomes an important component in the shrub canopy occupying recently cleared areas (Tesky 1992). Silver maple and eastern cottonwood may occur as saplings, and the ground layer is very sparse. This community phase occurs from 0 to approximately 35 years since the time of last significant disturbance (MDNR 2005).

Community 1.3
American Elm - Silver Maple/Virginia Wildrye - Canadian Honewort

This reference community phase can occur over time when the floodplain becomes higher from sediment accumulation, isolating it from the channel and the frequent flood events. The overstory canopy is mature and continuous (100 percent cover). American elm and silver maple become the dominant canopy species, with green ash an important sub-canopy species. Trees are very large (>33 inches DBH) with heights reaching 115 feet tall (LANDFIRE 2009). The understory composition begins to shift from mostly wetland species to both wetland and upland species. Understory species may include Virginia wildrye (*Elymus virginicus* L.), Canadian honewort (*Cryptotaenia canadensis* (L.) DC.), and stinging nettle (*Urtica dioica* L.). This community phase occurs after approximately 155 years of development and persists until an extreme flood event resets the community (MDNR 2005; LANDFIRE 2009).

Pathway 1.1A
Community 1.1 to 1.2

Major flood event

Pathway 1.2A
Community 1.2 to 1.1

Natural succession

Pathway 1.1B
Community 1.2 to 1.3

Natural succession

State 2
Hydrologically-Altered State

Agricultural tile 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 forest to a simplified silver maple-dominated state. In addition, exotic species have encroached and continuously spread, reducing native diversity and ecosystem stability (Eggers and Reed 2015). Community Phase 2.1 Silver Maple/Reed Canarygrass – Whitegrass – This community phase represents a shift in plant community composition as a result of soil dehydration and excessive siltation. Silver maple is the dominant, sometimes only, tree species present. Willows may also occur on the site. The understory maintains some native species such as whitegrass, but conditions become suitable for the initial invasion of exotic species such as reed canarygrass (*Phalaris arundinacea* L.) and garlic mustard (*Alliaria petiolata* (M. Bieb.) Cavara & Grande) (MDNR 2005; Eggers and Reed 2015).

Community 2.1
Silver Maple/Reed Canrygrass - Whitegrass

Community Phase 2.1 Silver Maple/Reed Canarygrass – Whitegrass – This community phase represents a shift in plant community composition as a result of soil dehydration and excessive siltation. Silver maple is the dominant, sometimes only, tree species present. Willows may also occur on the site. The understory maintains some native species such as whitegrass, but conditions become suitable for the initial invasion of exotic species such as reed canarygrass (*Phalaris arundinacea* L.) and garlic mustard (*Alliaria petiolata* (M. Bieb.) Cavara & Grande) (MDNR 2005; Eggers and Reed 2015).

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- reed canarygrass (*Phalaris arundinacea*), other herbaceous
- whitegrass (*Leersia virginica*), other herbaceous

Community 2.2
Silver Maple/Reed Canarygrass

This community phase represents persisting changes to the natural hydrology of the watershed. The overstory canopy remains relatively unchanged, but reed canarygrass forms monotypic stands, excluding all other species (Eggers and Reed 2015).

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- reed canarygrass (*Phalaris arundinacea*), other herbaceous

Pathway 2.1A
Community 2.1 to 2.2

Increasing changes to hydrology, increasing sedimentation, and non-native species invasion

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 Phase 3.1 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 3.1
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

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

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 3.2A
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 3.3A
Community 3.3 to 3.2

Implementation of continuous grazing

State 4
Cropland State

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

Community 4.1
Conventional Tillage Field

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

Community 4.2
Conservation Tillage Field

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

Community 4.3
Conservation Tillage with Cover Crop Field

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

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 re-initiate 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 re-initiate monoculture row cropping

Pathway 4.3A
Community 4.3 to 4.2

Remove cover cropping

State 5
Reconstructed Floodplain Forest State

The combination of natural and anthropogenic disturbances occurring today has resulted in numerous ecosystem health issues, and restoration back to the historic reference state may not be possible. Many natural forest communities are being stressed by non-native diseases and pests, habitat fragmentation, permanent changes in hydrologic regimes, and overabundant deer populations on top of naturally-occurring disturbances (severe weather and native pests) (Flickinger 2010). However, these habitats provide multiple ecosystem services including carbon sequestration; clean air and water; soil conservation; biodiversity support; wildlife habitat; as well as a variety of cultural activities (e.g., hiking, hunting) (Millennium Ecosystem Assessment 2005; Flickinger 2010). Therefore, conservation of floodplain forests should still be pursued. Habitat reconstructions are an important tool for repairing natural ecological functioning and providing habitat protection for numerous species of Loamy Floodplain Forests.

Therefore, ecological restoration should aim to aid the recovery of degraded, damaged, or destroyed ecosystems. A successful restoration will have the ability to structurally and functionally sustain itself, demonstrate resilience to the ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed forest state is the result of a long-term commitment involving a multi-step, adaptive management process.

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 conservation management plans.

Community 5.2
Late Successional Reconstructed Forest

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

Pathway 5.1A
Community 5.1 to 5.2

Timber stand improvement practices implemented

Pathway 5.2A
Community 5.2 to 5.1

Setback from extreme weather event or improper timing 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, tree planting, repair hydrology, non-native species control

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 herbicide

Transition R3A
State 3 to 5

Site preparation, tree planting, repair hydrology, non-native species control

Restoration pathway R4A
State 4 to 2

Site preparation, tree planting, repair hydrology, non-native species control

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, tree planting, repair hydrology, non-native species control

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

Tier 2 Sampling Points used to develop the reference state, community phase 1.1 and alternative state, community phase 2.2:

State County Ownership Legal Description Points
Iowa Clay Hawk Valley Wildlife Area – Iowa Department of Natural Resources T96N R36W S26 11, 14, 15

Other references

Baker, R.G., C.A. Chumbley, P.M. Witinok, and H.K. Kim. 1990. Holocene vegetational changes in eastern Iowa. Journal of the Iowa Academy of Science 97: 167-177.

Baker, R.G., L.J. Maher, C.A. Chumbley, and K.L. Van Zant. 1992. Patterns of Holocene environmental changes in the midwestern United States. Quaternary Research 37: 379-389.

Bharati, L., K.-H. Lee, T.M. Isenhart, and R.C. Schultz. 2002. Soil-water infiltration under crops, pasture, and established riparian buffer in Midwestern USA. Agroforestry Systems 56: 249-257.

Changes in Hydric Soils Database Selection Criteria. 77 Federal Register 12234 (29 February 2012), pp. 12234-12235.

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC. 92 pps.

Eggers, S.D. and D.M. Reed. 2015. Wetland Plants and Plant Communities of Minnesota and Wisconsin, Version 3.2. U.S. Army Corps of Engineers, Regulatory Branch, St. Paul District. St. Paul, MN. 478 pps.

Eilers, L. and D. Roosa. 1994. The Vascular Plants of Iowa: An Annotated Checklist and Natural History. University of Iowa Press, Iowa City, IA. 319 pps.

Federal Geographic Data Committee. 2013. Classification of Wetlands and Deepwater Habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C. 90 pps.

Flickinger, A. 2010. Iowa Forests Today: An Assessment of the Issues and Strategies for Conserving and Managing Iowa's Forests. Iowa Department of Natural Resources. 329 pps.

Franzluebbers, A.J., J.A. Stuedemann, H.H. Schomberg, and S.R. Wilkinson. 2000. Soil organic C and N pools under long-term pasture management in the Southern Piedmont USA. Soil Biology and Biochemistry 32:469-478.

Iowa Natural Areas Inventory [INAI]. 1984. An Inventory of Significant Natural Areas in Iowa: Two Year Progress Report of the Iowa natural Areas Inventory. Iowa Natural Areas Inventory, Iowa Department of Natural Resources, Des Moines, IA.

LANDFIRE. 2009. Biophysical Setting 3914690 Eastern Great Plains Floodplain Systems. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-Being: Current States and Trends. World Resources Institute. Island Press, Washington, D.C. 948 pages.

Minnesota Department of Natural Resources [MDNR]. 2005. Field Guide to the Native Plant Communities of Minnesota: The Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Minnesota Department of Natural Resources [MDNR]. 2017a. Coteau Moraines Subsection. Minnesota Department of Natural Resources: Ecological Classification System. Available at: http://www.dnr.state.mn.us/ecs/251Bb/index.html. (Accessed 10 October 2017).

Minnesota Department of Natural Resources [MDNR]. 2017b. Inner Coteau Subsection. Minnesota Department of Natural Resources: Ecological Classification System. Available at:

http://www.dnr.state.mn.us/ecs/251Bc/index.html. (Accessed 10 October 2017).

National Climate Data Center [NCDC]. 2006. Climate of Iowa. Central Region Headquarters, Climate Services Branch, National Climatic Data Center, Asheville, NC.

NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at: http://explorer.natureserve.org. (Accessed 13 February 2017).

Peel, M.C., B.L. Finlayson, and T.A. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. Hydrology and Earth System Sciences 11: 1633-1644.

Peterson, C.J. 2000. Catastrophic wind damage to North American forests and the potential impact of climate change. The Science of the Total Environment 262: 287-311.

Prior, J.C. 1991. Landforms of Iowa. University of Iowa Press for the Iowa Department of Natural Resources, Iowa City, IA. 153 pps.

Skinner, R.H. 2008. High biomass removal limits carbon sequestration potential of mature temperate pastures. Journal for Environmental Quality 37: 1319-1326.

Smith, R.D., A. Ammann, C. Bartoldus, and M.M. Brinson. 1995. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices. U.S. Army Corps of Engineers, Waterways Experiment Station, Wetlands Research Program Technical Report WRP-DE-9. 78 pps.

Society for Ecological Restoration [SER] Science & Policy Working Group. 2002. The SER Primer on Ecological Restoration. Available at: http://www.ser.org/. (Accessed 28 February 2017).

Teague, W.R., S.L. Dowhower, S.A. Baker, N. Haile, P.B. DeLaune, and D.M. Conover. 2011. Grazing management impacts on vegetation, soil biota and soil chemical, physical and hydrological properties in tall grass prairie. Agriculture, Ecosystems and Environment 141: 310-322.

Tesky, J.L. 1992. *Salix nigra*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at: https://www.crs-feis.org/feis. (Accessed 6 March 2018).

Tomer, M.D., D.W. Meek, and L.A. Kramer. 2005. Agricultural practices influence flow regimes of headwater streams in western Iowa. Journal of Environmental Quality 34:1547-1558.

Undersander, D., B. Albert, D. Cosgrove, D. Johnson, and P. Peterson. 2002. Pastures for Profit: A Guide to Rotational Grazing (A3529). University of Wisconsin-Extension and University of Minnesota Extension Service. 43 pps.

United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS). 2003. National Range and Pasture Handbook, Revision 1. Grazing Lands Technology Institute. 214 pps.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. 682 pps.

United States Department of Agriculture – Natural Resources Conservation Service (USDA-NRCS). 2007. Iowa NRCS Plant Community Species Lists. Des Moines, IA. Available at: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ia/technical/ecoscience/bio/?cid=nrcs142p2_008160. (Accessed 1 February 2018).

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2008. Hydrogeomorphic Wetland Classification: An Overview and Modification to Better Meet the Needs of the Natural Resources Conservation Service. Technical Note No. 190-8-76. Washington, D.C. 8 pps.

U.S. Environmental Protection Agency [EPA]. 2013. Level III and Level IV Ecoregions of the Continental United

States. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1: 3,000,000. Available at: http://www.epa.gov/eco-research/level-iii-andiv-ecoregions-continental-united-states. (Accessed 1 March 2017).

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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:**

17. **Perennial plant reproductive capability:**