USDA Natural Resources
Conservation Service

Ecological site R108XA018IL
Ponded Floodplain Marsh

Last updated: 11/05/2024
Accessed: 05/13/2025

General information

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

MLRA notes

Major Land Resource Area (MLRA): 108X–Illinois and Iowa Deep Loess and Drift

The Illinois and Iowa Deep Loess and Drift, Eastern Part (MLRA 108A) encompasses the Grand Prairie physiographic division (Schewman et al. 1973). It spans two states – Illinois (97 percent) and Indiana (3 percent) – comprising about 11,145 square miles (Figure 1). The elevation ranges from 985 feet above sea level (ASL) in the northern part to 660 feet above sea level in the southern part. Local relief varies from 3 to 10 feet on most of the area which is on broad flat uplands. The maximum relief is about 160 feet along major streams. The northern part of this area is underlain by Ordovician and Silurian limestone and the southern part is underlain by Pennsylvanian shale, siltstone, and limestone. Except for some areas along streams where bedrock is exposed, glacial drift covers all the MLRA. The glacial drift consists of till and stratified outwash and is of Wisconsinan age. A moderately thin to thick layer of loess covers the entire area (USDA-NRCS 2006).

The vegetation in the MLRA has undergone drastic changes over time. At the end of the last glacial episode – the Wisconsinan glaciation – the evolution of vegetation began with the development of tundra habitats, followed by a phase of spruce and fir forests, and eventually spruce-pine forests. Not until approximately 9,000 years ago did the climate undergo a warming trend which prompted the development of deciduous forests dominated by oak and hickory. As the climate continued to warm and dry, prairies began to develop approximately 8,300 years ago. Another shift in climate that resulted in an increase in moisture prompted the emergence of savanna-like habitats from 8,000 to 5,000 years before present. Moisture continued to increase in the southernmost region 5,000 years ago, resulting in an increase of forested systems (Taft et al. 2009). Fire, droughts, and grazing by native mammals helped to maintain the prairies and savannas until the arrival of European settlers, and the forests were maintained by droughts, wind, lightning, and occasional fire (Taft et al. 2009; NatureServe 2018).

Classification relationships

USFS Subregions: Central Till Plains and Grand Prairies (251D) and Central Till Plains-Beech-Maple Sections; Northern Grand Prairie (251Dc), Eastern Grand Prairie (251Dd), Southern Grand Prairie (251De), and Entrenched Valleys (222Hf) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Illinois/Indiana Prairies (54a) and Glaciated Wabash Lowlands (72b) (USEPA 2013)

National Vegetation Classification – Ecological Systems: North-Central Interior Floodplain (CES202.694) , Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687) (NatureServe 2018)

National Vegetation Classification – Plant Associations: Schoenoplectus fluviatilis – Schoenoplectus spp. Marsh (CEGL002221), Carex lacustris Wet Meadow (CEGL002256) (Nature Serve 2018)

Biophysical Settings: Central Interior and Appalachian Floodplain Systems (BpS 4214710), Eastern Great Plains Wet Meadow-Marsh-Prairie System (BpS 4214880) (LANDFIRE 2009)

Illinois Natural Areas Inventory: Marsh, Sedge Meadow (White and Madany 1978)

Ecological site concept

Ponded Floodplain Marshes are located within the blue areas on the map (Figure 1). They occur on floodplains in river valleys. The soils are Mollisols and Entisols that are very poorly to poorly-drained and deep, formed in alluvium. The site experiences seasonal flooding and ponding for a significant portion of the growing season.

The historic pre-European settlement vegetation on this ecological site was dominated by emergent herbaceous vegetation adapted to flooded and saturated conditions. Hairy sedge (Carex lacustris L.) and broadleaf arrowhead (Sagittaria latifolia Willd.) are the dominant and characteristic species for the site, respectively. River bulrush (Bolboschoenus fluviatilis (Torr.) Soják), softstem bulrush (Schoenoplectus tabernaemontani (C.C. Gmel.) Palla), and broadleaf cattail (Typha latifolia L.) are other common emergent associates. An herbaceous species typical of an undisturbed plant community associated with this ecological site is swamp loosestrife (Decodon verticillatus (L.) Elliott) (White and Madany 1978; Taft et al. 1997). Depth and duration of flooding are the primary disturbance factors that maintain this ecological site, while native mammal herbivory is a secondary factor (LANDFIRE 2009).

Associated sites

F108XA019IL	**Silty Floodplain Forest** Silty alluvial parent material that experiences only flooding including Aetna, Armiesburg, Dozaville, Lawson, Radford, and Tice soils
F108XA020IL	**Loamy Floodplain Forest** Loamy alluvial parent material that experiences only flooding including Brouillet, DuPage, Landes, Medway, Ross, Rossburg, and Shaffton

Similar sites

R108XA008IL	**Ponded Loess Sedge Meadow** Ponded Loess Sedge Meadows occur on uplands and are a DEPRESSIONAL wetland

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex lacustris* (2) *Sagittaria latifolia*

Physiographic features

Ponded Floodplain Marshes occur on floodplains in river valleys (Figure 2). They are situated on elevations ranging from approximately 341 to 1499 feet ASL. The site experiences occasional to frequent flooding and ponding that can last up to 30 days at a time (Table 1).

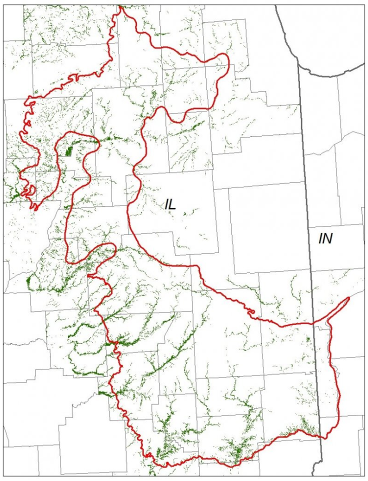


Figure 1. Figure 1. Location of Ponded Floodplain Marsh ecological site within MLRA 108A.

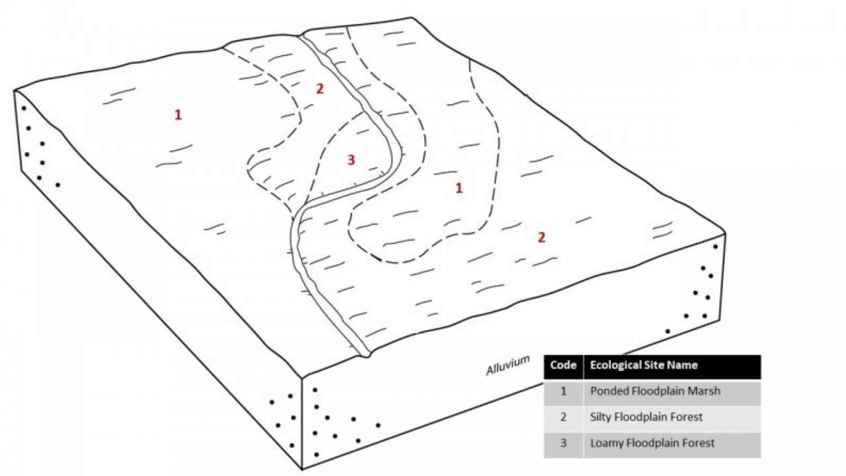


Figure 2. Figure 2. Representative block diagram of Ponded Floodplain Marsh and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Concave (2) Linear
Slope shape up-down	(1) Concave (2) Linear
Landforms	(1) River valley > Flood plain
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	104–457 m
Slope	0–2%
Ponding depth	0–15 cm
Water table depth	8–15 cm
Aspect	Aspect is not a significant factor

Climatic features

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

The soil temperature regime of MLRA 108A 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 169 days, while the frost-free period is about 141 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 39 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 41 and 61°F, respectively.

Climate data and analyses are derived from 30-year averages gathered from four 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)	135-149 days
Freeze-free period (characteristic range)	154-187 days
Precipitation total (characteristic range)	914-1,041 mm
Frost-free period (actual range)	129-151 days
Freeze-free period (actual range)	139-189 days
Precipitation total (actual range)	914-1,067 mm
Frost-free period (average)	141 days
Freeze-free period (average)	169 days
Precipitation total (average)	991 mm

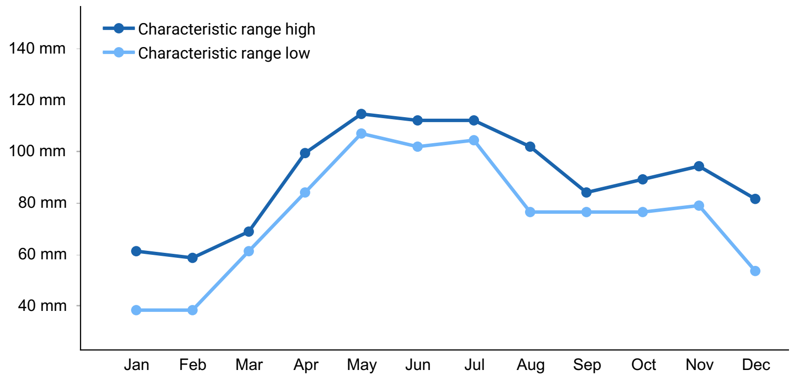


Figure 3. Monthly precipitation range

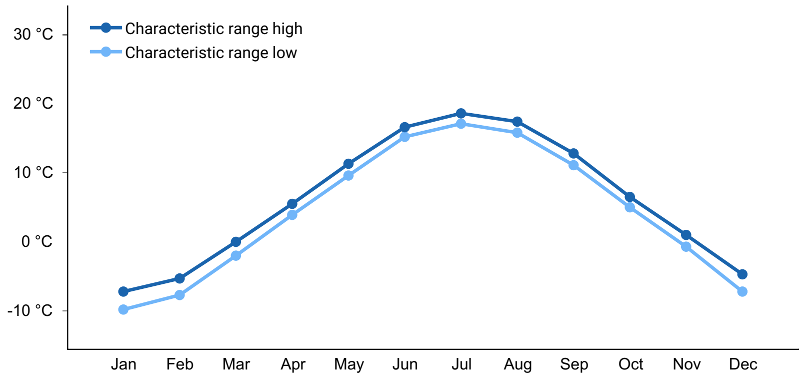


Figure 4. Monthly minimum temperature range

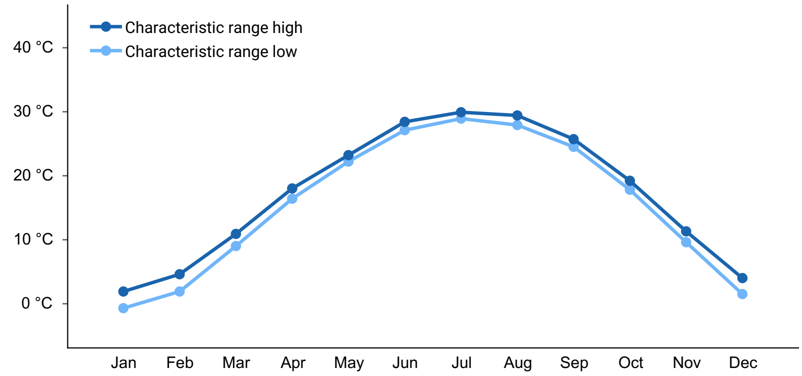


Figure 5. Monthly maximum temperature range

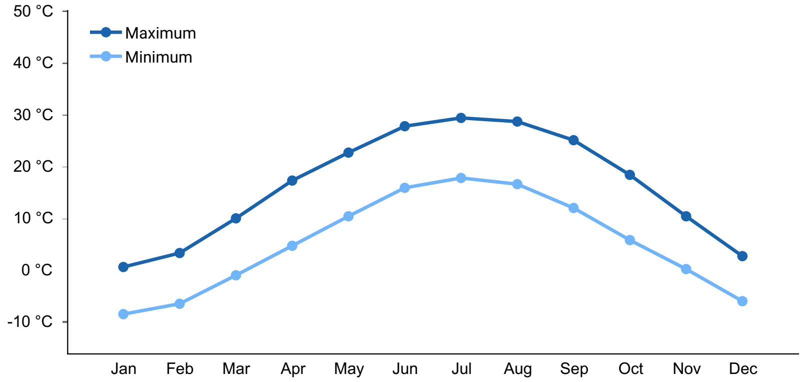


Figure 6. Monthly average minimum and maximum temperature

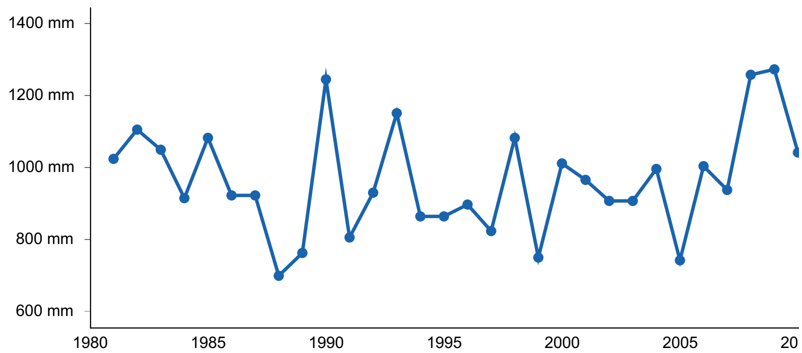


Figure 7. Annual precipitation pattern

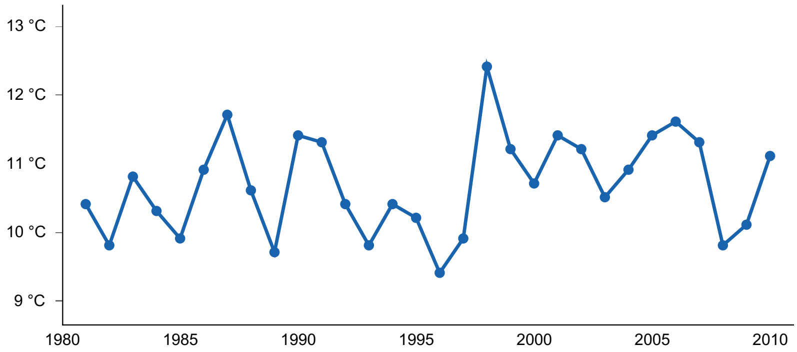


Figure 8. Annual average temperature pattern

Climate stations used

- (1) CHARLESTON [USC00111436], Charleston, IL
- (2) OTTAWA 5SW [USC00116526], Ottawa, IL
- (3) SULLIVAN 3S [USC00118389], Sullivan, IL
- (4) CHICAGO AURORA MUNI AP [USW00004808], Sugar Grove, IL

Influencing water features

Ponded Floodplain Marshes are classified as a RIVERINE: flooded, ponded, herbaceous wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Persistent, Emergent, Seasonally Flooded-Saturated 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 other sources may be from surface runoff from adjacent uplands and precipitation (Smith et al. 1995). Infiltration is very slow (Hydrologic Group D) for undrained soils, and surface runoff is negligible to low (Figure 5).

Primary wetland hydrology indicators for an intact Ponded Floodplain Marshes may include: A1 Surface water, A2 High water table, A3 Saturation, and B14 True aquatic plants. Secondary wetland hydrology indicators may include: B10: Drainage patterns, C2 Dry-season water table, D2 Geomorphic position, and D5 FAC-neutral test (USACE 2010).

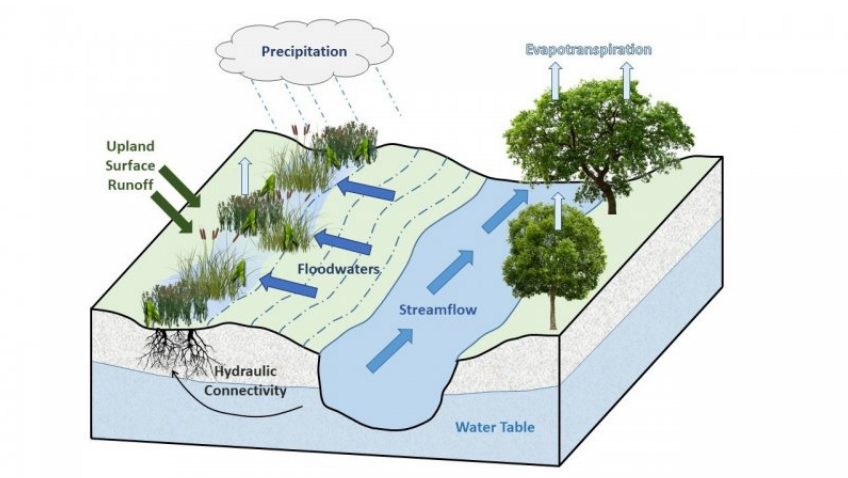


Figure 9. Figure 5. Hydrologic cycling in Ponded Floodplain Marsh ecological site.

Soil features

Soils of Ponded Floodplain Marshes are in the Mollisols and Entisols orders, further classified as Cumulic Endoaquolls, Cumulic Vertic Endoaquolls, Mollic Fluvaquents, and Vertic Endoaquolls with very slow infiltration and negligible to low runoff potential. The soil series associated with this site includes Colo, Comfrey, Millington, Moundprairie, Otter, Sawmill, Titus, and Wabash (Figure 6). The parent material is alluvium, and the soils are very poorly to poorly-drained and deep with seasonal high-water tables. Soil pH classes are moderately acid to moderately alkaline. No rooting restrictions are noted for the soils of this ecological site (Table 5).

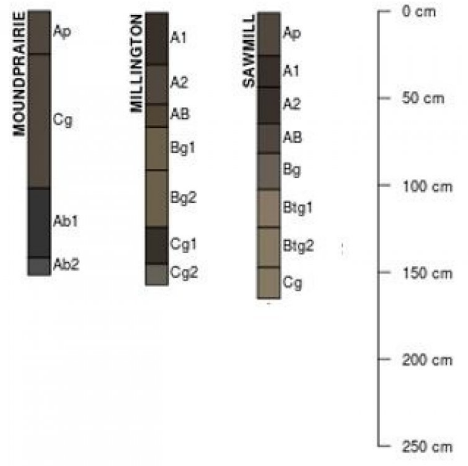


Figure 10. Figure 6. Profile sketches of soil series associated with Ponded Floodplain Marsh.

Table 4. Representative soil features

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

The MLRA lies within the tallgrass prairie ecosystem of the Midwest. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn support prairies, savannas, and forests. Ponded Floodplain Marshes form an aspect of this vegetative continuum. This ecological site occurs on floodplains on very poorly to poorly-drained soils. Species characteristic of this ecological site consist of hydrophytic vegetation.

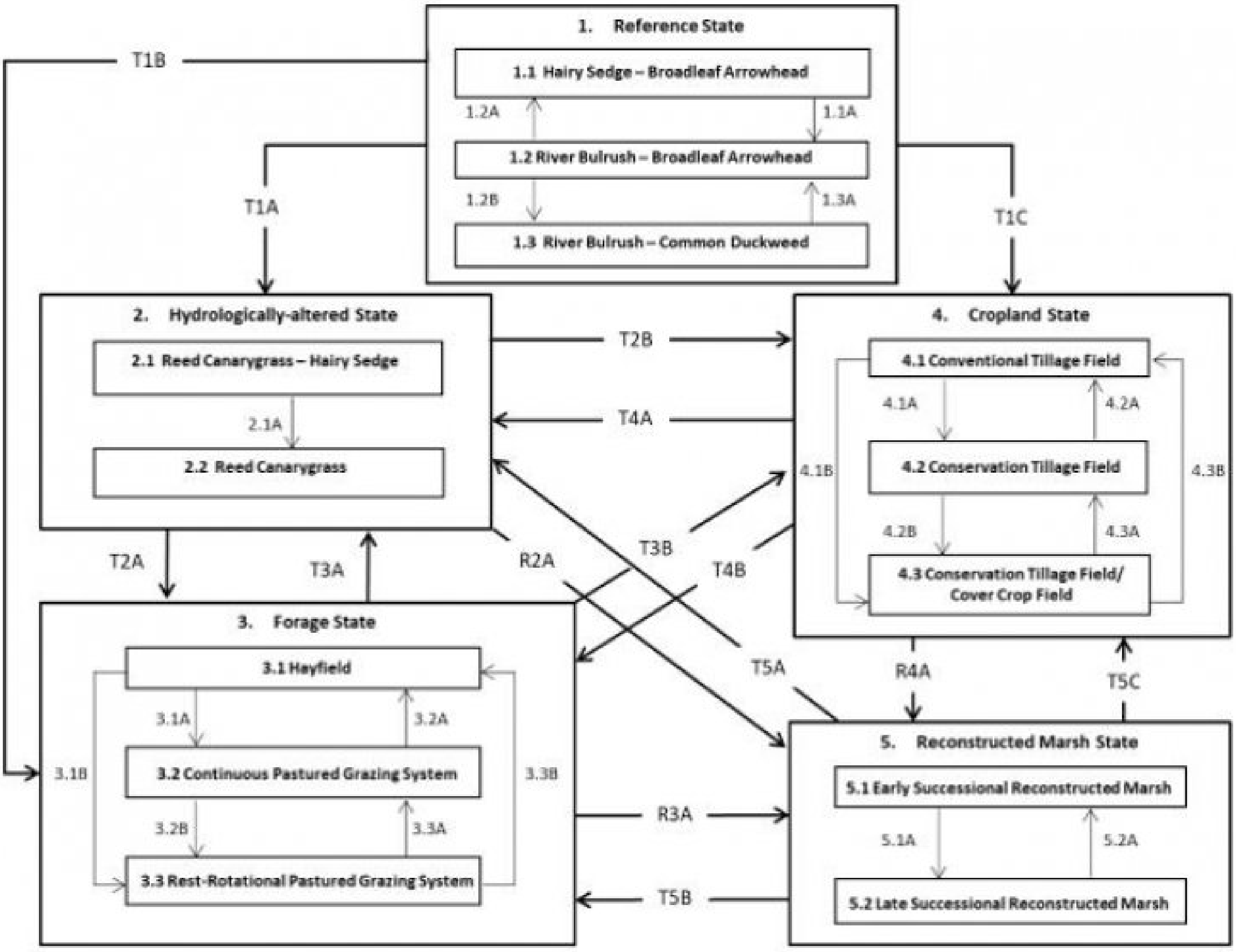
Flooding and ponding are the dominant disturbance factors in Ponded Floodplain Marshes (LANDFIRE 2009). Seasonal flooding likely occurred annually from spring snow melt and heavy rains. The depth and duration of ponded water affects species diversity, composition, and productivity. Little to no ponded water allows more of a sedge meadow community to dominate, while deep water depths create a shallow to deep marsh community populated with emergent and aquatic vegetation.

Animal herbivory also played a role in shaping this ecological site. Foraging muskrats can alter the extent of emergent vegetation, creating larger patches of open water. Left unchecked, muskrats can remove all the emergent vegetation, which won’t re-establish until the next drought or drawdown event (White and Madany 1978).

Today, Ponded Floodplain Marshes have been greatly reduced as the land has mostly been converted for agricultural production. Remnants that do exist show evidence of indirect anthropogenic influences from hydrological alterations as non-native species have replaced the natural vegetation. A return to the historic plant community may not be possible due to significant hydrologic and water quality changes in the watershed, but long-term conservation agriculture or habitat reconstruction efforts can help to restore some natural 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

R108AY018IL Ponded Floodplain Marsh



Code	Process
1.1A, 1.3A	Ponded water depths 12-24 inches
1.2A	Ponded water depths <12 inches
1.2B	Ponded water depths >24 inches
T1A, T3A, T4A, T5A	Changes to natural hydroperiod and/or land abandonment
2.1A	Increasing changes to hydrology and increasing sedimentation
T1B, T2A, T4B, T5B	Cultural treatments are implemented to increase forage quality and yield
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
T1C, T2B, T3B, T5C	Agricultural conversion via drainage, tillage, seeding, and non-selective herbicide
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, non-native species control, hydroperiod repair, and native seeding
5.1A	Invasive species control and implementation of disturbance regimes
5.2A	Drought or improper timing/use of management actions

State 1
Reference State

The reference plant community is categorized as a sedge meadow-marsh community, dominated by hydrophytic vegetation. The three community phases within the reference state are dependent on seasonal flooding and subsequent ponding. The depth and duration of ponding alters species composition, cover, and extent. Animal herbivory has more localized impacts in the reference phases, but does contribute to overall species composition, diversity, cover, and productivity.

Community 1.1
Hairy Sedge - Broadleaf Arrowhead

This reference community phase can occur when the frequency and depth of ponding are reduced to less than 1 foot. Hairy sedge is the dominant monocot, but bulrushes can also be present. Broadleaf arrowhead is still the dominant forb, but forb diversity is greatest in this phase with species such as marsh skullcap (*Scutellaria galericulata* L.), longroot smartweed (*Polygonum amphibium* L. var. emersum Michx.), spotted joe pye weed (*Eutrochium maculatum* (L.) E.E. Lamont), and jewelweed (*Impatiens capensis* Meerb.) (White and Madany 1978; NatureServe 2018). Shallow ponded water depths (less than 1 foot) will maintain this phase, but an increase in water depths can shift the community to phase 1.2.

Dominant plant species

- hairy sedge (*Carex lacustris*), other herbaceous
- broadleaf arrowhead (*Sagittaria latifolia*), other herbaceous

Community 1.2
River Bulrush - Broadleaf Arrowhead

Sites in this reference community phase are dominated by hydrophytic herbaceous vegetation. River bulrush and broadleaf arrowhead are the dominant species. Some sites may be dominated by other bulrushes, such as softstem bulrush. Characteristic forbs can include broadfruit bur-reed (*Sparganium eurycarpum* Engelm.) and American water plantain (*Alisma subcordatum* Raf.) (NatureServe 2018). Water depths between 1 and 2 feet will maintain this phase, but a reduced water level (below 1 foot) will shift the community to phase 1.1 while an increase in water level (above 2 feet) will shift the community to phase 1.3.

Dominant plant species

- river bulrush (*Bolboschoenus fluviatilis*), other herbaceous
- broadleaf arrowhead (*Sagittaria latifolia*), other herbaceous

Community 1.3
River Bulrush - Common Duckweed

This reference community phase can occur when the frequency and depth of ponding are greater than 2 feet. Bulrushes and cattails are the dominant monocots. Aquatic vegetation becomes important characteristic species during this phase and can include species such as common duckweed (*Lemna minor* L.), common duckmeat (*Spirodela polyrrhiza* (L.) Schleid), and American white waterlily (*Nymphaea odorata* Aiton ssp. tuberosa(Paine) Wiersma & Hellquist) (NatureServe 2018). Deep ponded water depths (greater than 2 feet) will maintain this phase, but a decrease in water depths can shift the community back to phase 1.1.

Dominant plant species

- river bulrush (*Bolboschoenus fluviatilis*), other herbaceous
- common duckweed (*Lemna minor*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Ponded water depths increase 12 - 24 inches.

Pathway 1.2A

Community 1.2 to 1.1

Ponded water depths decrease to < 12 inches.

Pathway 1.2B
Community 1.2 to 1.3

Ponded water depths increase to > 24 inches.

Pathway 1.3A
Community 1.3 to 1.2

Ponded water depths decrease to 12 - 24 inches.

State 2
Hydrologically-Altered State

Hydrology is the most important determinant of wetlands and wetland processes. Hydrology modifies and determines the physiochemical environment (i.e., sediments, soil chemistry, water chemistry) which in turn directly affects the vegetation, animals, and microbes (Mitsch and Gosselink 2007). Human activities on landscape hydrology have greatly altered Ponded Floodplain Marshes. Alterations such as agricultural tile draining and conversion to cropland on adjacent lands in addition to stream channelization and damming have changed the natural hydroperiod, increased the rate of sedimentation, and intensified nutrient pollution (Werner and Zedler 2003; Mitsch and Gosselink 2007).

Community 2.1
Reed Canarygrass - Hairy Sedge

This community phase represents the early changes to the natural wetland hydroperiod, increasing sedimentation, and unabated nutrient runoff. Native monocots, such as river bulrush, softstem bulrush, and cattails, 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). Common reed (*Phragmites australis* (Cav.) Trin. Ex Steud.) may be a non-native invader in conjunction with or in place of reed canarygrass.

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), grass
- hairy sedge (*Carex lacustris*), other herbaceous

Community 2.2
Reed Canarygrass

Sites falling into this community phase have experienced significant sedimentation and nutrient enrichment and are dominated by a monoculture of reed canarygrass. 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). As in community phase 2.1, common reed may be present, dominant, or monotypic on the site.

Dominant plant species

- reed canarygrass (*Phalaris arundinacea*), grass

Pathway 2.1A
Community 2.1 to 2.2

Continuing alterations to the natural hydrology and increasing sedimentation.

State 3
Forage State

The forage state occurs when the reference state 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), hydrologic alterations and grazing by domesticated livestock transition and maintain this state (USDA-NRCS 2003). Early settlers seeded non-native species, such as smooth brome (*Bromus inermis* Leyss.) and Kentucky bluegrass (*Poa pratensis* L.), to help extend the grazing season. Over time, as lands were continuously harvested or grazed by herds of cattle, the non-native species were able to spread and expand across the landscape, reducing the native species diversity and ecological function.

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 utilizing continuous grazing.

Pathway 3.1B
Community 3.1 to 3.3

Mechanical harvesting is replaced with domestic livestock utilizing rotational grazing.

Pathway 3.2A
Community 3.2 to 3.1

Domestic livestock are removed, and mechanical harvesting is implemented.

Pathway 3.2B
Community 3.2 to 3.3

Rotational grazing replaces continuous grazing.

Pathway 3.3B
Community 3.3 to 3.1

Domestic livestock are removed, and mechanical harvesting is implemented.

Pathway 3.3A
Community 3.3 to 3.2

Continuous grazing replaces rotational grazing.

State 4
Cropland State

The continuous use of tillage, row-crop planting, and chemicals (i.e., herbicides, fertilizers, etc.) and hydrologic alterations 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

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 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 Field/Alternative 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

Tillage operations are greatly reduced, crop rotation occurs on a regular interval, and crop residue remains on the soil surface.

Pathway 4.1B
Community 4.1 to 4.3

Tillage operations are greatly reduced or eliminated, crop rotation occurs on a regular interval, crop residue remains on the soil surface, and cover crops are planted following crop harvest.

Pathway 4.2A
Community 4.2 to 4.1

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

Pathway 4.2B
Community 4.2 to 4.3

Cover crops are implemented to minimize soil erosion.

Pathway 4.3B
Community 4.3 to 4.1

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

Pathway 4.3A
Community 4.3 to 4.2

Cover crop practices are abandoned.

State 5
Reconstructed Marsh State

Marsh habitats provide multiple ecosystem services including flood abatement, water quality improvement, and biodiversity support (Mitsch and Gosselink 2007). However, many marsh communities have been eliminated as a result of type conversions to agricultural production, 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 Ponded Floodplain Marshes 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 Reconstructed Marsh

This community phase represents the early community assembly from marsh habitat reconstruction and is highly dependent on invasive species control, hydroperiod repair, and planting (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 Reconstructed Marsh

Appropriately timed disturbance regimes (e.g., hydroperiod, 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 and nutrient balances in line with a developed wetland management plan.

Pathway 5.2A
Community 5.2 to 5.1

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

Transition T1A
State 1 to 2

Direct and indirect alterations to the landscape hydrology from human-induced land development transition the site to the hydrologically-altered state (2).

Transition T1B
State 1 to 3

Cultural treatments to enhance forage quality and yield transitions this site to the forage state (3).

Transition T1C
State 1 to 4

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

Transition T2A
State 2 to 3

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

Transition T2B
State 2 to 4

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

Restoration pathway R2A
State 2 to 5

Hydroperiod restoration, site preparation, non-native species control, and seeding native species transition the site to the reconstructed marsh state (5).

Transition T3A
State 3 to 2

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

Transition T3B
State 3 to 4

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

Restoration pathway R3A
State 3 to 5

Hydroperiod restoration, site preparation, non-native species control, and seeding native species transition the site to the reconstructed marsh state (5).

Transition T4A
State 4 to 2

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

Transition T4B
State 4 to 3

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

Restoration pathway R4A
State 4 to 5

Hydroperiod restoration, site preparation, non-native species control and seeding native species transition this site to the reconstructed marsh state (5).

Transition T5A
State 5 to 2

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

Transition T5B
State 5 to 3

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

Transition T5C
State 5 to 4

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

Additional community tables

Inventory data references

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

Other references

Adams, C.R. and S.M. Galatowitsch. 2006. Increasing the effectiveness of reed canary grass (*Phalaris arundinacea* L.) control in wet meadow restorations. Restoration Ecology 14: 441-451.

Angel, J. No date. Climate of Illinois Narrative. Illinois State Water Survey, Prairie Research Institute, University of Illinois at Urbana-Champaign. Available at https://www.isws.illinois.edu/statecli/General/Illinois-climate-narrative.htm. Accessed 8 November 2018.

Annen, C.A., E.M. Kirsch, and R.W. Tyser. 2008. Reed canarygrass invasions alter succession patterns and may reduce habitat quality in wet meadows. Ecological Restoration 26: 190-193.

Bernard, J.B. and T.E. Lauve. 1995. A comparison of growth and nutrient uptake in *Phalaris arundinacea* L. growing in a wetland and a constructed bed receiving landfill leachate. Wetlands 15: 176-182.

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.

Budelsky, R.A. and S.M. Galatowitsch. 1999. Effects of moisture, temperature, and time on seed germination of five wetland Carices: implications for restoration. Restoration Ecology 7: 86-97.

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.

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.

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.

Green, E.K. and S.M. Galatowitsch. 2002. Effects of *Phalaris arundinacea* and nitrate-N addition on the establishment of wetland plant communities. Journal of Applied Ecology 39: 134-144.

Hall, S.J. and J.B. Zedler. 2010. Constraints on sedge meadow self-restoration in urban wetlands. Restoration Ecology 18: 671-680.

Kercher, S.M., A. Herr-Turnoff, J.B. Zedler. 2007. Understanding invasion as a process: the case of *Phalaris arundinacea* in wet prairies. Biological Invasions 9: 657-665.

LANDFIRE. 2009. Biophysical Setting 4214880 Eastern Great Plains Wet Meadow-Marsh-Prairie System. In: LANDFIRE National Vegetation Dynamics Models. USDA Forest Service and US Department of Interior. Washington, DC.

Leake, J., D. Johnson, D. Donnelly, G. Muckle, L. Boddy, and D. Read. 2004. Networks of power and influence: the role of mycorrhizal mycelium in controlling plant communities and agroecosystem functioning. Canadian Journal of Botany 82: 1016-1045.

Mitsch, W.J. and S.E. Jørgensen. 2004. Ecological Engineering and Ecosystem Restoration. John Wiley & Sons, Inc. Hoboken, NJ. 428 pps.

Mitsch, W.J. and J.G. Gosselink. 2007. Wetlands, Fourth Edition. John Wiley & Sons, Inc. Hoboken, NJ. 582 pps.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at http://explorer.natureserve.org. (Accessed 26 April 2019).

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.

Perry, L.G. and S.M. Galatowitsch. 2003. A test of two annual cover crops for controlling *Phalaris arundinacea* invasion in restored sedge meadow wetlands. Restoration Ecology 11: 297-307.

Schwegman, J.E., G.B. Fell, M. Hutchinson, G. Paulson, W.M. Shepherd, and J. White. 1973. Comprehensive Plan for the Illinois Nature Preserves System, Part 2 The Natural Divisions of Illinois. Illinois Nature Preserves Commission, Rockford, IL. 32 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).

Taft, J.B., G.S. Wilhelm, D.M. Ladd, and L.A. Masters. 1997. Floristic Quality Assessment for vegetation in Illinois, a method for assessing vegetation integrity. Erigenia 15: 3-95.

Taft, J.B., R.C. Anderson, L.R. Iverson, and W.C. Handel. 2009. Chapter 4: Vegetation ecology and change in terrestrial ecosystems. In: C.A. Taylor, J.B. Taft, and C.E. Warwick (eds.). Canaries in the Catbird Seat: The Past, Present, and Future of Biological Resources in a Changing Environment. Illinois Natural Heritage Survey Special Publication 30, Prairie Research Institute, University of Illinois at Urbana-Champaign. 306 pps.

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.

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.

U.S. Army Corps of Engineers [USACE]. 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region (Version 2.0). U.S. Army Corps of Engineers, Wetlands Regulatory Assistance Program, U.S. Army Engineer Research and Development Center, Vicksburg, MS. 141 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 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).

Van der Valk, A.G., T.L. Bremholm, and E. Gordon. 1999. The restoration of sedge meadows: seed viability, seed germination requirements, and seedling growth of Carex species. Wetlands 19: 756-764.

Vitousek, P.M. 1990. Biological invasions and ecosystem processes: towards an integration of population biology and ecosystem studies. Oikos 57: 7-13.

Waggy, M.A. 2010. *Phalaris arundinacea*. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at: https://www.feis-crs.org/feis/. (Accessed 1 February 2017).

Werner, K.J. and J.B. Zedler. 2002. How sedge meadow soils, microtopography, and vegetation respond to sedimentation. Wetlands 3: 451-466.

White, J. and M.H. Madany. 1978. Classification of natural communities in Illinois. In: J. White. Illinois Natural Areas Inventory Technical Report. Illinois Natural Areas Inventory, Department of Landscape Architecture, University of Illinois at Urbana/Champaign. 426 pps.

Zedler, J.B. 2003. Wetlands at your service: reducing impacts of agriculture at the watershed scale. Frontiers in Ecology and the Environment 1: 65-72.

Contributors

Lisa Kluesner
Kristine Ryan
Sarah Smith
Tiffany Justus

Approval

Suzanne Mayne-Kinney, 11/05/2024

Acknowledgments

This project could not have been completed without the dedication and commitment from a variety of staff members (Table 6). Team members supported the project by serving on the technical team, assisting with the 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.

Table 6. List of primary contributors and reviewers.

Organization Name Title Location
Natural Resources Conservation Service:
Scott Brady, Acting Regional Ecological Site Specialist, Havre, MT
Stacey Clark, Regional Ecological Site Specialist, St. Paul, MN
Tonie Endres, Senior Regional Soil Scientist, Indianapolis, IN
Tiffany Justus, Soil Scientist, Aurora, IL
Lisa Kluesner, Ecological Site Specialist, Waverly, IA
Kevin Norwood, Soil Survey Regional Director, Indianapolis, IN

Kristine Ryan, MLRA Soil Survey Leader, Aurora, IL
Sarah Smith, Soil Scientist, Aurora, IL

This site was originally approved by Chris Tecklenburg, 5/01/2020.

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	05/01/2020
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

---

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

---

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:**
