

## Ecological site R115XC012IL Wet Sand Prairie

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### General information

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

### MLRA notes

Major Land Resource Area (MLRA): 115X–Central Mississippi Valley Wooded Slopes

This MLRA is characterized by deeply dissected, loess-covered hills bordering well defined valleys of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers and their tributaries. It is used to produce cash crops and livestock. About one-third of the area is forested, mostly on the steeper slopes. This area is in Illinois (50 percent), Missouri (36 percent), Indiana (13 percent), and Iowa (1 percent) in two separate areas. It makes up about 25,084 square miles (64,967 square kilometers).

Most of this area is in the Till Plains section and the Dissected Till Plains section of the Central Lowland province of the Interior Plains. The Springfield-Salem plateaus section of the Ozarks Plateaus province of the Interior Highlands occurs along the Missouri River and the Mississippi River south of the confluence with the Missouri River. The nearly level to very steep uplands are dissected by both large and small tributaries of the Illinois, Mississippi, Missouri, Ohio, and Wabash Rivers. The Ohio River flows along the southernmost boundary of this area in Indiana. Well defined valleys with broad flood plains and numerous stream terraces are along the major streams and rivers. The flood plains along the smaller streams are narrow. Broad summits are nearly level to undulating. Karst topography is common in some parts along the Missouri and Mississippi Rivers and their tributaries. Well-developed karst areas have hundreds of sinkholes, caves, springs, and losing streams. In the St. Louis area, many of the karst features have been obliterated by urban development.

Elevation ranges from 90 feet (20 meters) on the southernmost flood plains to 1,030 feet (320 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters) but can be 50 to 150 feet (15 to 45 meters) in the steep, deeply dissected hills bordering rivers and streams. The bluffs along the major rivers are generally 200 to 350 feet (60 to 105 meters) above the valley floor.

The uplands in this MLRA are covered almost entirely with Peoria Loess. The loess can be more than 7 feet (2 meters) thick on stable summits. On the steeper slopes, it is thin or does not occur. In Illinois, the loess is underlain mostly by Illinoian-age till that commonly contains a paleosol. Pre-Illinoian-age till is in parts of this MLRA in Iowa and Missouri and to a minor extent in the western part of Illinois. Wisconsin-age outwash, alluvial deposits, and sandy eolian material are on some of the stream terraces and on dunes along the major tributaries. The loess and glacial deposits are underlain by several bedrock systems. Pennsylvanian and Mississippian bedrock are the most extensive. To a lesser extent are Silurian, Devonian, Cretaceous, and Ordovician bedrock. Karst areas have formed where limestone is near the surface, mostly in the southern part of the MLRA along the Mississippi River and some of its major tributaries. Bedrock outcrops are common on the bluffs along the Mississippi, Ohio, and Wabash Rivers and their major tributaries and at the base of some steep slopes along minor streams and drainageways.

The annual precipitation ranges from 35 to 49 inches (880 to 1,250 millimeters) with a mean of 41 inches (1,050 millimeters). The annual temperature ranges from 48 to 58 degrees F (8.6 to 14.3 degrees C) with a mean of 54 degrees F (12.3 degrees C). The freeze-free period ranges from 150 to 220 days with a mean of 195 days.

Soils The dominant soil orders are Alfisols and, to a lesser extent, Entisols and Mollisols. The soils in the area have

a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy. They are shallow to very deep, excessively drained to poorly drained, and loamy, silty, or clayey.

The soils on uplands in this area support natural hardwoods. Oak, hickory, and sugar maple are the dominant species. Big bluestem, little bluestem, and scattered oak and eastern redcedar grow on some sites. The soils on flood plains support mixed forest vegetation, mainly American elm, eastern cottonwood, river birch, green ash, silver maple, sweetgum, American sycamore, pin oak, pecan, and willow. Sedge and grass meadows and scattered trees are on some low-lying sites. (United States Department of Agriculture, Natural Resources Conservation Service, 2022).

## **LRU notes**

The Central Mississippi Valley Wooded Slopes, Northern part (Land Resource Unit (LRU) 115XC) encompasses the Wyaconda River Dissected Till Plains, Mississippi River Hills, and Mississippi River Alluvial Plain (Schwegman et al. 1973; Nelson 2010). It spans three states – Illinois (73 percent), Iowa (6 percent), and Missouri (21 percent) – comprising about 13,650 square miles (Figure 1). The elevation ranges from 420 feet above sea level (ASL) along the Mississippi River floodplains to 885 feet on the upland ridges. Local relief varies from 10 to 20 feet but can be as high as 50 to 100 feet along drainageways and streams and the bluffs on the major rivers reaching 250 feet above valley floors. Wisconsin-aged loess covers the uplands, while Illinoian glacial drift lies directly below. The loess and drift deposits are underlain by several bedrock systems, including the Cretaceous, Pennsylvania, Mississippian, Silurian, Devonian, and Ordovician Systems. Wisconsin outwash deposits and sandy eolian material occur along stream terraces of major tributaries (USDA-NRCS 2006).

The vegetation across the region has undergone drastic changes over time. At the end of the last glacial episode – the Wisconsin glacial episode – 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 (Taft et al. 2009). During the most recent climatic shifts, forested ecosystems maintained footholds on steep valley sides and wet floodplains. Due to the physiography of the MLRA, forests were the dominant ecosystems and were affected by such natural disturbances as droughts, wind, lightning, and occasional fire (Taft et al. 2009).

## **Classification relationships**

USFS Subregions: Central Dissected Till Plains (251C)Section; Western Mississippi River Hills (251Ce), Mississippi River and Illinois Alluvial Plains (251Cf), Eastern Mississippi River Hills (251Ci), Galesburg Dissected Till Plain (251Cj), and Wyaconda River Dissected Till Plain (251Cm) Subsections (Cleland et al. 2007)

U.S. EPA Level IV Ecoregion: Upper Mississippi River Alluvial Plain (72d), River Hills (72f), and Western Dissected Illinoian Till Plain (72i) (USEPA 2013)

National Vegetation Classification – Ecological Systems: Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687) (NatureServe 2018)

National Vegetation Classification – Plant Associations: *Spartina pectinata* – *Carex* spp. – *Calamagrostis canadensis* Sand Wet Meadow (CEGL005178) (Nature Serve 2018)

Biophysical Settings: Eastern Great Plains Wet Meadow-Prairie-Marsh System (BpS 4914880) (LANDFIRE 2009)

Illinois Natural Areas Inventory: Wet sand prairie (White and Madany 1978)

Missouri Terrestrial Natural Communities: N/A (Nelson 2010)

## **Ecological site concept**

Wet Sand Prairies are located within the green areas on the map (Figure 1). They occur on uplands. The soils are

Mollisols and Alfisols that are very poorly to poorly drained and very deep, formed in sandy outwash, loamy sediments over outwash, or organic material over outwash.

The historic pre-European settlement vegetation on this ecological site was dominated by herbaceous vegetation adapted to temporary ponding and saturated soil conditions. Prairie cordgrass (*Spartina pectinata* Bosc ex Link) and bluejoint (*Calamagrostis canadensis* L.) are the dominant species on the site, but various sedges are present as well. A species characteristic of an undisturbed plant community associated with this ecological site includes eastern marsh fern (*Thelypteris palustris* Schott) (White and Madany 1978; Taft et al. 1997). Fire is the primary disturbance regime that maintains the structure of this ecological site, while saturated soil conditions and herbivory are secondary factors (LANDFIRE 2009).

### Associated sites

R115XC011IL	<b>Sand Prairie</b> Eolian sands, eolian deposits, or outwash not shallow to a high-water table including Ade, Chute, Crescent, Dakota, Dickinson, Disco, Hoopeston, Jasper, Onarga, Plainfield, Psammets, Ridgeville, Sparta, Watseka, and Wea soils
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### Similar sites

R115XC015IL	<b>Wet Terrace Sedge Meadow</b> Wet Terrace Sedge Meadows occur on low stream terraces and may be subject to rare flooding and ponding
R115XC018IL	<b>Wet Floodplain Sedge Meadow</b> Wet Floodplain Sedge Meadows occur on floodplains and are subject to flooding

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Spartina pectinata</i> (2) <i>Calamagrostis canadensis</i>

### Physiographic features

Wet Sand Prairies occur on uplands. They are situated on elevations ranging from approximately 459 to 1066 feet above sea level (ASL). The site does not experience flooding but rather generates runoff to adjacent, downslope ecological sites.

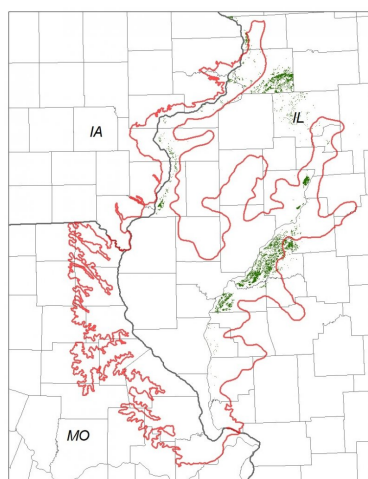
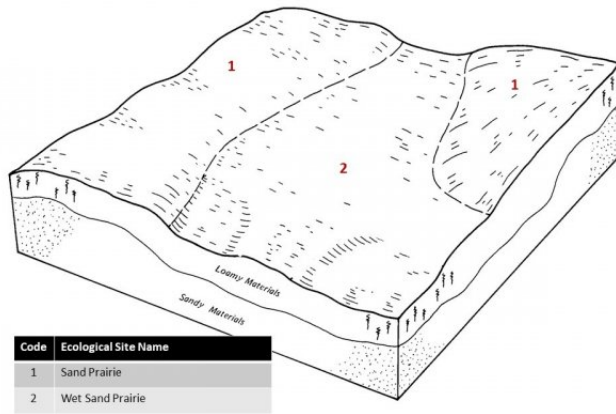


Figure 1. Location of Wet Sand Prairie ecological site within LRU 115XC.



**Figure 2. Representative block diagram of Wet Sand Prairie and associated ecological sites.**

**Table 2. Representative physiographic features**

Slope shape across	(1) Linear (2) Concave
Slope shape up-down	(1) Linear (2) Concave
Landforms	(1) Upland > Outwash plain (2) Upland > Lake plain
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	140–325 m
Slope	0–2%
Water table depth	0–30 cm
Aspect	Aspect is not a significant factor

### Climatic features

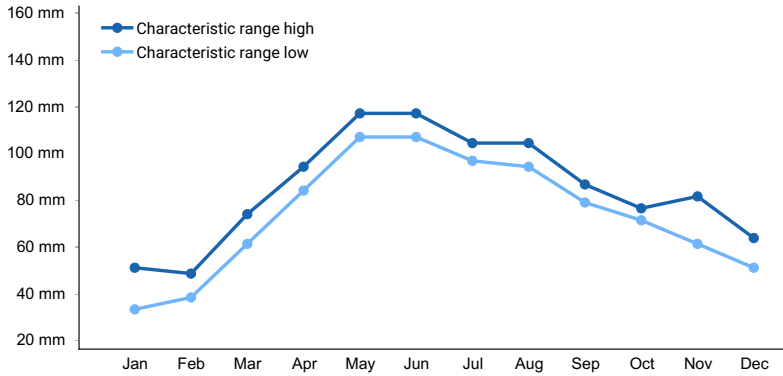
The Central Mississippi Valley Wooded Slopes, Northern Part falls into the humid subtropical (Cfa) and hot-summer humid continental climate (Dfa) Köppen-Geiger climate classifications (Peel et al. 2007). The two main factors that drive the climate of the MLRA are latitude and weather systems. Latitude, 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 LRU 115XC 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 179 days, while the frost-free period is about 146 days. The majority of the precipitation occurs as rainfall in the form of convective thunderstorms during the growing season. Average annual precipitation is 37 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 42 and 62°F, respectively.

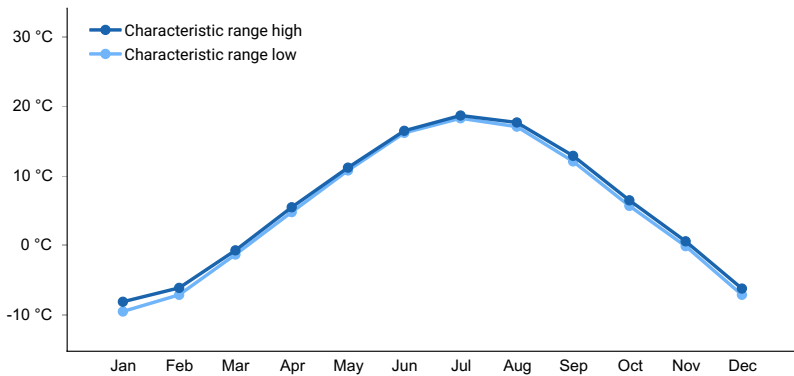
**Table 3. Representative climatic features**

Frost-free period (characteristic range)	138-153 days
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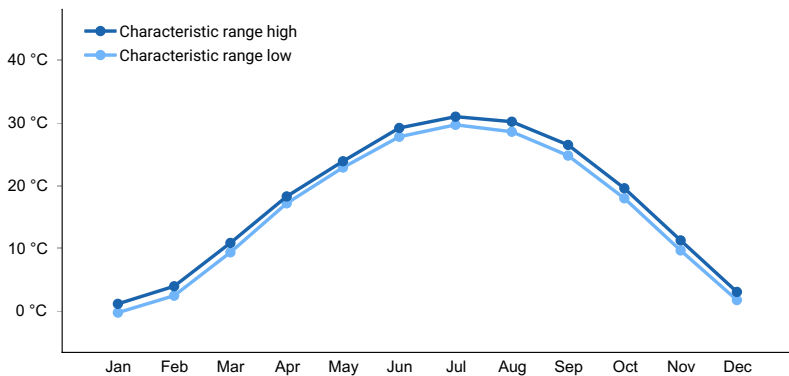
Freeze-free period (characteristic range)	170-185 days
Precipitation total (characteristic range)	914-991 mm
Frost-free period (actual range)	135-166 days
Freeze-free period (actual range)	169-198 days
Precipitation total (actual range)	889-1,016 mm
Frost-free period (average)	146 days
Freeze-free period (average)	179 days
Precipitation total (average)	940 mm



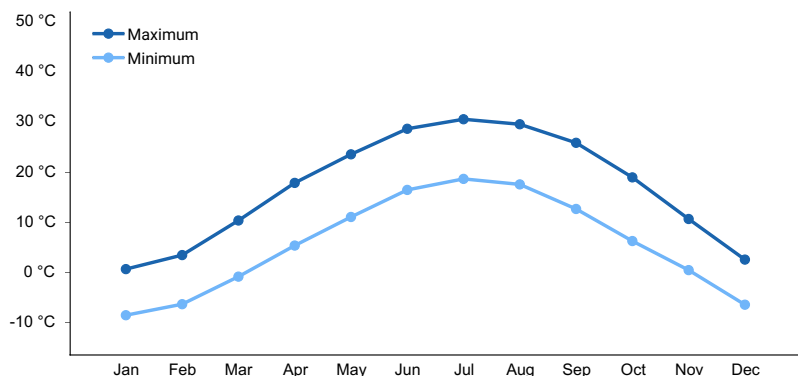
**Figure 3. Monthly precipitation range**



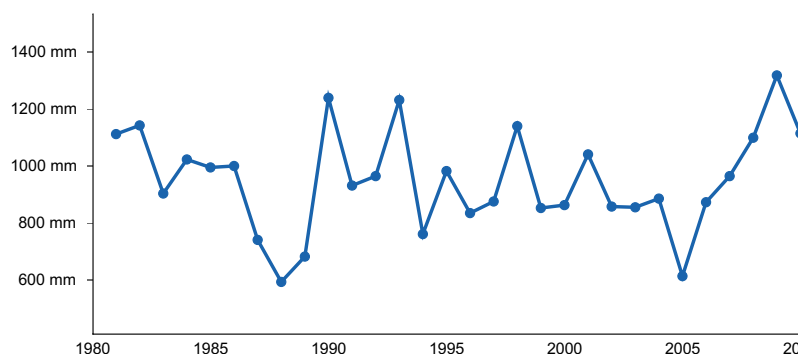
**Figure 4. Monthly minimum temperature range**



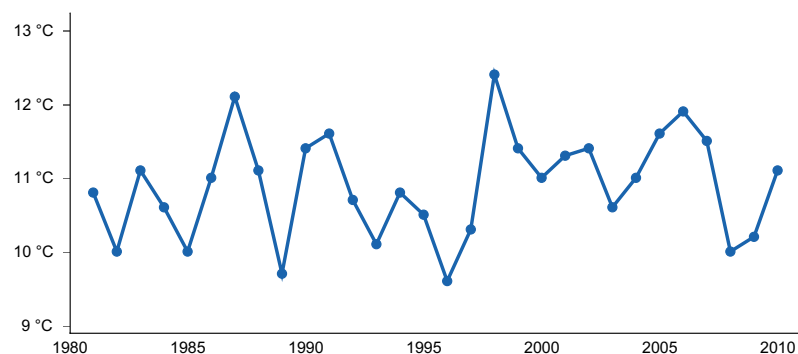
**Figure 5. Monthly maximum temperature range**



**Figure 6. Monthly average minimum and maximum temperature**



**Figure 7. Annual precipitation pattern**



**Figure 8. Annual average temperature pattern**

## Climate stations used

- (1) CLINTON #1 [USC00131635], Camanche, IA
- (2) GLADSTONE DAM 18 [USC00113455], Burlington, IL
- (3) HAVANA [USC00113940], Lewistown, IL
- (4) LACON 1N [USC00114805], Lacon, IL

## Influencing water features

Wet Sand Prairies are classified as mineral soil flats: saturated, recharge, herbaceous wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Persistent Emergent, Seasonally Saturated wetland under the National Wetlands Inventory (FGDC 2013). Precipitation is the main source of water for this ecological site (Smith et al. 1995). Infiltration is very slow (Hydrologic Group D) for undrained soils, and surface runoff is negligible to low.

## Wetland description

Primary wetland hydrology indicators for an intact Wet Sand Prairie may include: A2 High water table and A3 Saturation. Secondary wetland hydrology indicators may include: C2 Dry-season water table and D5 FAC-neutral

test (USACE 2010).

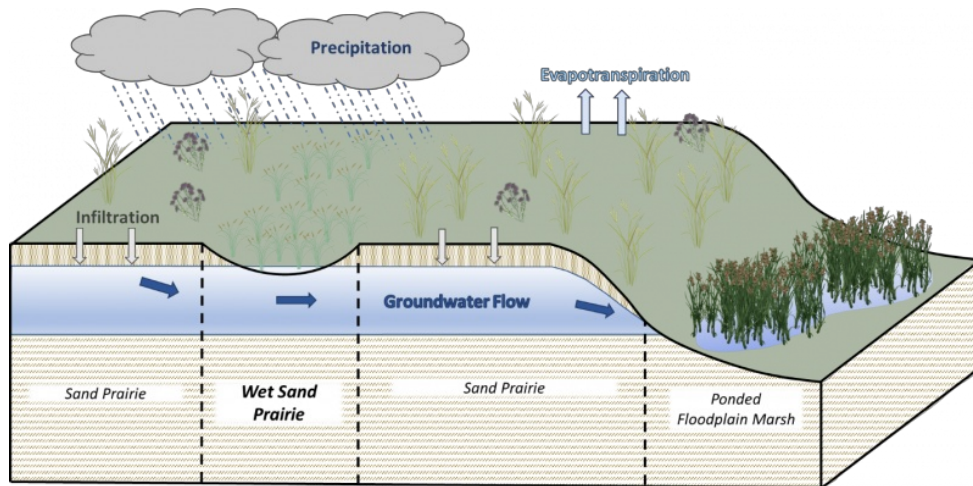


Figure 9. Hydrologic cycling in Wet Sand Prairie ecological site.

### Soil features

Soils of Wet Sand Prairies are in the Mollisols and Alfisols orders, further classified as Typic Endoaquolls and Mollic Endoaqualfs with very slow infiltration and negligible to low runoff potential. The soil series associated with this site includes Maumee, Selma, Selmass, Udolpho, and Will. The parent material is sandy outwash, loamy sediments over outwash, or organic material over outwash, and the soils are very poorly to poorly drained and very deep with seasonal high-water tables. Soil pH classes are very strongly 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, if not drained, may meet the definition of hydric soils (77 FR 12234).

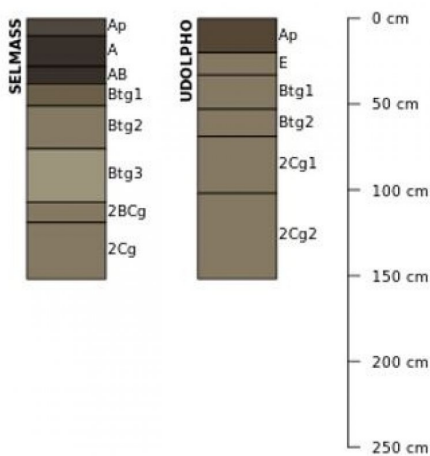


Figure 10. Profile sketches of soil series associated with Wet Sand Prairie.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Herbaceous organic material
Surface texture	(1) Loam (2) Loamy sand (3) Sandy loam
Family particle size	(1) Fine-loamy (2) Sandy
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow

Depth to restrictive layer	203 cm
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	7.62–20.32 cm
Calcium carbonate equivalent (Depth not specified)	0–30%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	2–7%
Subsurface fragment volume >3" (Depth not specified)	1–3%

## 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, but a variety of environmental and edaphic factors resulted in a landscape that historically supported upland hardwood forests, lowland mixed forests, and scattered grass and sedge meadows. Wet Sand Prairies form an aspect of this vegetative continuum. This ecological site occurs on uplands on very poorly to poorly drained soils. Species characteristic of this ecological site consist of hydrophytic herbaceous vegetation.

Fire is a critical disturbance factor that maintains Wet Sand Prairies. Fire intensity typically consisted of periodic, low-intensity surface fires occurring every 2 to 5 years (LANDFIRE 2009). Ignition sources included summertime lightning strikes from convective storms and bimodal, human ignitions during the spring and fall seasons. Native Americans regularly set fires to improve sight lines for hunting, driving large game, improving grazing and browsing habitat, agricultural clearing, and enhancing vital ethnobotanical plants (Barrett 1980).

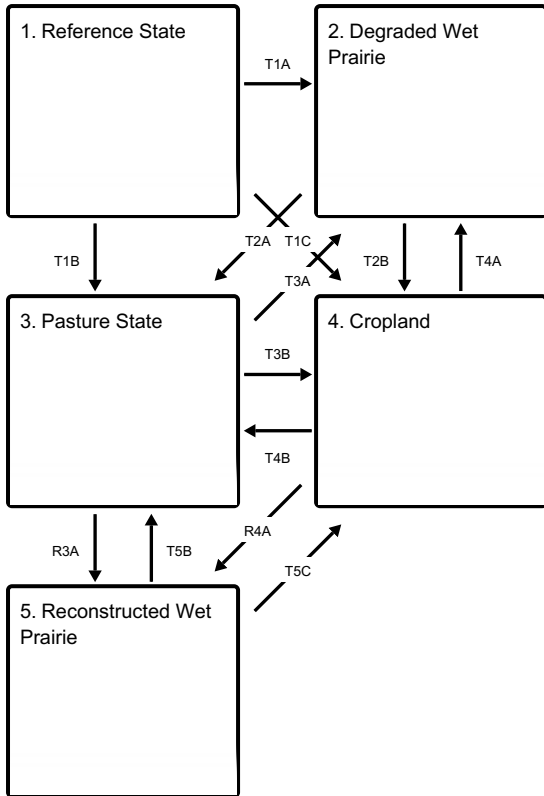
Saturated soil conditions and herbivory by native ungulates have also played a role in shaping this ecological site. The high soil moisture conditions in conjunction with occasional ponding have favored the proliferation of plant species tolerant of such conditions. The high-water tables prevent woody species from establishing, thus maintaining the prairie structure. Grazing also likely contributed to woody species reduction (LANDFIRE 2009). When coupled with fire, saturated soils and herbivory can further delay the establishment of woody vegetation (Pyne et al. 1996).

Today, Wet Sand Prairies have been greatly reduced as most areas have been converted to agricultural production. Corn (*Zea mays* L.) and soybeans (*Glycine max* (L.) Merr.) are the dominant crops grown, but small patches of forage land may be present. Remnants that do exist show evidence of indirect anthropogenic influences from fire suppression, subsurface drainage, and non-native species invasion. A return to the historic plant community may not be possible following extensive land modification, but long-term conservation agriculture or prairie reconstruction efforts can help to restore some biotic diversity and ecological function. The state-and-transition model that follows provides a detailed description of each state, community phase, pathway, and transition. This model is based on available experimental research, field observations, literature reviews, professional consensus, and interpretations.

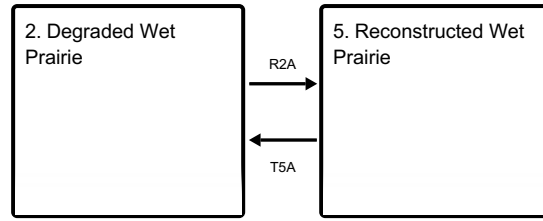


# State and transition model

## Ecosystem states

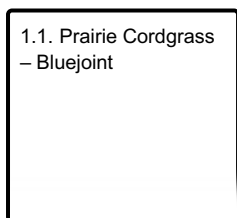


## States 2 and 5 (additional transitions)

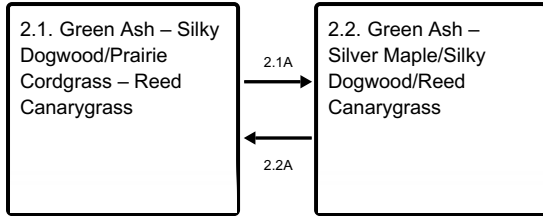


- T1A** - Fire suppression; altered hydrology
- T1B** - Practices to enhance forage quality and quantity
- T1C** - Conversion to agriculture
- T2A** - Practices to enhance forage quality and quantity
- T2B** - Conversion to agriculture
- R2A** - Site preparation; invasive species control; seeding native species
- T3A** - Land abandonment
- T3B** - Conversion to agriculture
- R3A** - Site preparation, invasive species control, and seeding native species
- T4A** - Land abandonment
- T4B** - Practices to enhance forage quantity and quality
- R4A** - Site preparation, invasive species control, and seeding native species
- T5A** - Land abandonment
- T5B** - Practices to enhance forage quality and quantity
- T5C** - Site preparation, invasive species control, and seeding native species

## State 1 submodel, plant communities



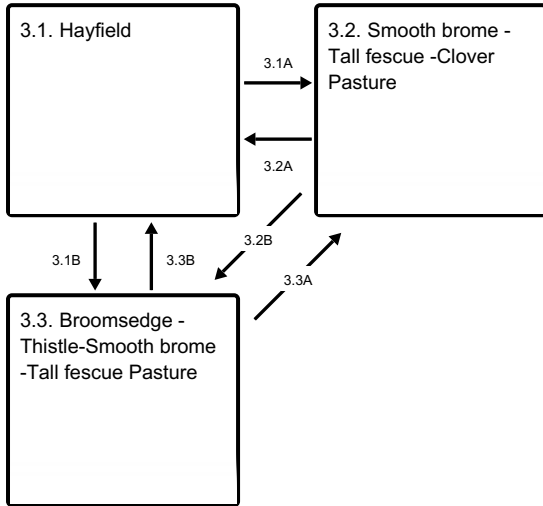
**State 2 submodel, plant communities**



**2.1A** - Fire suppression 20 yrs+

**2.2A** - Single large disturbance event

**State 3 submodel, plant communities**



**3.1A** - Grazing; proper animal to forage balance

**3.1B** - Grazing; forage plants overutilized

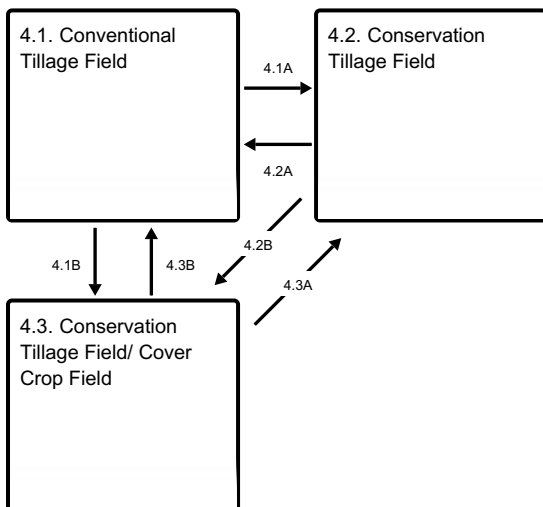
**3.2A** - Mechanical harvesting

**3.2B** - Grazing; overutilization of forage plants

**3.3B** - Mechanical harvesting

**3.3A** - Grazing; proper animal for forage balance

**State 4 submodel, plant communities**



**4.1A** - Less tillage, residue management

**4.1B** - Less tillage, residue management, and implementation of cover cropping

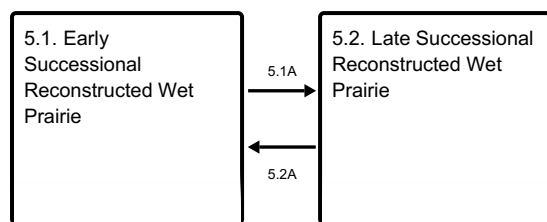
**4.2A** - Intensive tillage, remove residue, and reinitiate monoculture row cropping

**4.2B** - Implementation of cover cropping

**4.3B** - Intensive tillage, remove residue, and reinitiate monoculture row cropping

**4.3A** - Remove cover cropping

#### State 5 submodel, plant communities



**5.1A** - Management practices to increase native species

**5.2A** - Decrease in native species

## State 1 Reference State

The reference plant community is categorized as a wet tallgrass prairie community, dominated by hydrophytic herbaceous vegetation. The one community phase within the reference state is dependent on periodic fire. The intensity and frequency alter species composition, cover, and extent, while regular fire intervals keep woody species from dominating. Soil saturation and native mammal grazing have more localized impacts in the reference phases, but do contribute to overall species composition, diversity, cover, and productivity.

### Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- bluejoint (*Calamagrostis canadensis*), grass

## Community 1.1 Prairie Cordgrass – Bluejoint

Community Phase 1.1 Prairie Cordgrass – Bluejoint – Sites in this reference community phase are dominated by a mix of hydrophytic grasses, sedges, and forbs. Vegetative cover is continuous (95 to 100 percent) and plants can reach heights between 3 and 6 feet tall (NatureServe 2018). Prairie cordgrass, bluejoint, and various sedges are the dominant monocots on the site. Characteristic forbs can include common boneset (*Eupatorium perfoliatum* L.), Virginia iris (*Iris virginica* L.), and hemlock waterparsnip (*Sium suave* Walter) (NatureServe 2018). A fire return interval of 2 to 5 years characterizes the fire regime, maintaining this reference plant community (LANDFIRE 2009).

### Dominant plant species

- prairie cordgrass (*Spartina pectinata*), grass
- bluejoint (*Calamagrostis canadensis*), grass

## State 2 Degraded Wet Prairie

Long-term fire suppression and landscape hydrologic alterations can transition the reference wet tallgrass prairie community into a woody-invaded state. This state is evidenced by a well-developed shrub layer and sparse trees (LANDFIRE 2009). Proximity to lands that have been altered provide opportunities for non-native invasive species to readily colonize this state, thereby reducing the native biodiversity and changing the vegetative community.

### Dominant plant species

- green ash (*Fraxinus pennsylvanica*), tree
- silky dogwood (*Cornus amomum*), tree
- prairie cordgrass (*Spartina pectinata*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

## Community 2.1

### Green Ash – Silky Dogwood/Prairie Cordgrass – Reed Canarygrass

This community phase represents the early stages of long-term fire-suppression. In as little as six fire-free years, the prairie can be disrupted and succeeded by woody shrubs. Native trees – e.g., green ash (*Fraxinus pennsylvanica* Marshall), silver maple (*Acer saccharinum* L.), elm (*Ulmus* L.) – and shrubs – e.g. silky dogwood (*Cornus obliqua* Raf.) – can form dense thickets with cover reaching up to 30 percent and plant heights as tall as 9 feet (LANDFIRE 2009). Some native prairie plants will persist, but non-native herbaceous species, including reed canarygrass (*Phalaris arundinacea* L.), smooth brome (*Bromus inermis* Leyss.), Kentucky bluegrass (*Poa pratensis* L.), and redtop (*Agrostis gigantea* Roth) can begin to encroach from adjacent, disturbed sites.

#### Dominant plant species

- green ash (*Fraxinus pennsylvanica*), tree
- silky dogwood (*Cornus amomum*), tree
- prairie cordgrass (*Spartina pectinata*), grass
- reed canarygrass (*Phalaris arundinacea*), grass

## Community 2.2

### Green Ash – Silver Maple/Silky Dogwood/Reed Canarygrass

Sites falling into this community phase have a well-established shrub layer, and scattered trees begin to develop in the continued absence of fire and reduced water table.

#### Dominant plant species

- green ash (*Fraxinus pennsylvanica*), tree
- silver maple (*Acer saccharinum*), tree
- silky dogwood (*Cornus amomum*), shrub
- reed canarygrass (*Phalaris arundinacea*), grass

## Pathway 2.1A

### Community 2.1 to 2.2

Continued fire suppression in excess of 20 years.

## Pathway 2.2A

### Community 2.2 to 2.1

Large disturbance event such as a hot fire.

## State 3

### Pasture State

The pasture 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) 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.), tall fescue (*Festuca arundinacea*) 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.

#### Dominant plant species

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- red clover (*Trifolium pratense*), other herbaceous

- white clover (*Trifolium repens*), other herbaceous

### **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). Many species may be seeded depending on landowner objectives.

#### **Dominant plant species**

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- orchardgrass (*Dactylis*), grass
- timothy (*Phleum pratense*), grass
- alfalfa (*Medicago*), other herbaceous
- clover (*Trifolium*), other herbaceous

### **Community 3.2**

#### **Smooth brome -Tall fescue -Clover Pasture**

This community is characterized by seeded cool-season grass and forbs. Species will depend upon landowner goals and objectives and may include many different grasses and forbs. Common species include smooth brome (*Bromus inermis*), tall fescue (*Festuca arundinacea*), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), red clover (*Trifolium pratense*) and white clover (*Trifolium repens* L.). Management inputs include control of weeds and brush. These sites are managed to ensure a proper forage/animal balance. Plants are not overutilized and have adequate rest and recovery.

#### **Dominant plant species**

- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- timothy (*Phleum pratense*), grass
- white clover (*Trifolium repens*), other herbaceous
- red clover (*Trifolium pratense*), other herbaceous

### **Community 3.3**

#### **Broomsedge -Thistle-Smooth brome -Tall fescue Pasture**

Overutilization of the pasture will result in a shift to include more undesirable species such as thistle (*Cirsium* spp.), broomsedge (*Andropogon virginicus* L.), ironweed (*Vernonia gigantea*), buttercup (*Ranunculus* spp.), ragweed (*Ambrosia* spp.) and blackberries (*Rubus* spp.). Many woody and weed species may be present depending on seed sources and level of soil disturbance. This community reflects an improper forage-to-animal balance which will negatively impact forage productivity and reproduction, soil health, and water quality. Ecological resiliency is compromised under these conditions.

#### **Dominant plant species**

- broomsedge bluestem (*Andropogon virginicus*), grass
- smooth brome (*Bromus inermis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- thistle (*Cirsium*), other herbaceous
- buttercup (*Ranunculus*), other herbaceous
- ironweed (*Vernonia*), other herbaceous
- ragweed (*Ambrosia*), other herbaceous

### **Pathway 3.1A**

#### **Community 3.1 to 3.2**

Mechanical harvesting is replaced with domestic livestock grazing.

### **Pathway 3.1B**

#### **Community 3.1 to 3.3**

Mechanical harvesting is replaced with domestic livestock grazing. Forage plants are overutilized.

### **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**

Grazing of livestock with overutilization of the forage plants.

### **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**

Forage plants are not overutilized and the site has a proper forage-to-animal balance.

## **State 4**

### **Cropland**

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 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.

#### **Dominant plant species**

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

### **Community 4.1**

#### **Conventional Tillage Field**

Community Phase 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).

#### **Dominant plant species**

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

## **Community 4.2 Conservation Tillage Field**

Community Phase 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.

### **Dominant plant species**

- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

## **Community 4.3 Conservation Tillage Field/ Cover Crop Field**

Community Phase 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.

### **Dominant plant species**

- rye (*Secale*), grass
- wheat (*Triticum*), grass
- oat (*Avena*), grass
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous
- alfalfa (*Medicago*), other herbaceous
- clover (*Trifolium*), other herbaceous

## **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 crops 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 Wet Prairie**

Prairie reconstructions have become an important tool for repairing natural ecological functions and conserving biodiversity. Because the historic plant and soil biota communities of the tallgrass prairie were highly diverse with complex interrelationships, historic prairie replication cannot be guaranteed on landscapes that have been so extensively manipulated for extended timeframes (Kardol and Wardle 2010; Fierer et al. 2013). Therefore, ecological restoration should aim to aid the recovery of degraded, damaged, or destroyed ecosystems. A successful restoration will have the ability to structurally and functionally sustain itself, demonstrate resilience to the natural ranges of stress and disturbance, and create and maintain positive biotic and abiotic interactions (SER 2002). The reconstructed wet prairie state is the result of a long-term commitment involving a multi-step, adaptive management process that includes hydrologic restoration. Diverse, species-rich seed mixes are important to utilize as they allow the site to undergo successional stages that exhibit changing composition and dominance over time (Smith et al. 2010). On-going management via prescribed fire and/or light grazing can help the site progress from an early successional community dominated by annuals and some weeds to a later seral stage composed of native, perennial grasses, forbs, and a few shrubs. Establishing a prescribed fire regimen that mimics natural disturbance patterns can increase native species cover and diversity while reducing cover of non-native forbs and grasses. Light grazing alone can help promote species richness, while grazing accompanied with fire can control the encroachment of woody vegetation (Brudvig et al. 2007).

#### **Dominant plant species**

- prairie cordgrass (*Spartina pectinata*), grass
- bluejoint (*Calamagrostis canadensis*), grass

### **Community 5.1**

#### **Early Successional Reconstructed Wet Prairie**

This community phase represents the early community assembly from prairie reconstruction and is highly dependent on hydroperiod repair, a diverse seed mix, and the timing and priority of planting operations.

#### **Dominant plant species**

- prairie cordgrass (*Spartina pectinata*), grass
- bluejoint (*Calamagrostis canadensis*), grass

### **Community 5.2**



## **Late Successional Reconstructed Wet Prairie**

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

### **Dominant plant species**

- prairie cordgrass (*Spartina pectinata*), grass
- bluejoint (*Calamagrostis canadensis*), grass
- big bluestem (*Andropogon gerardii*), grass
- switchgrass (*Panicum virgatum*), grass
- New England aster (*Symphyotrichum novae-angliae*), other herbaceous

### **Pathway 5.1A**

#### **Community 5.1 to 5.2**

The seed mix should look to include a diverse mix of cool-season and warm-season annual and perennial grasses and forbs typical of the reference state (e.g., big bluestem, switchgrass, prairie cordgrass, New England aster). Cool-season annuals can help provide litter that promotes cool, moist soil conditions to the benefit of the other species in the seed mix. The first season following site preparation and seeding will typically result in annuals and other volunteer species forming a majority of the vegetative cover. Control of non-native species, particularly perennial species, is crucial at this point to ensure they do not establish before the native vegetation (Martin and Wilsey 2012). After the first season, native warm-season grasses should begin to become more prominent on the landscape. Selective herbicides are used to control non-native species, and prescribed fire and/or light grazing helps to increase the native species diversity and control woody vegetation.

### **Pathway 5.2A**

#### **Community 5.2 to 5.1**

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

### **Transition T1A**

#### **State 1 to 2**

Long-term fire suppression and hydrologic alterations transition the site to the degraded wet prairie state (2).

### **Transition T1B**

#### **State 1 to 3**

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

### **Transition T1C**

#### **State 1 to 4**

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 transitions the site to the pasture state (3).

### **Restoration pathway T2B**

## **State 2 to 4**

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

## **Restoration pathway R2A**

### **State 2 to 5**

Site preparation, invasive species control, and seeding native species transition this site to the reconstructed wet prairie state (5).

## **Transition T3A**

### **State 3 to 2**

Land abandonment transitions the site to the degraded wet prairie state (2).

## **Restoration pathway T3B**

### **State 3 to 4**

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

## **Restoration pathway R3A**

### **State 3 to 5**

Site preparation, invasive species control, and seeding native species transition this site to the reconstructed wet prairie state (5).

## **Transition T4A**

### **State 4 to 2**

Land abandonment transitions the site to the degraded wet prairie state (2).

## **Transition T4B**

### **State 4 to 3**

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

## **Restoration pathway R4A**

### **State 4 to 5**

Site preparation, invasive species control, and seeding native species transition this site to the reconstructed wet prairie state (5).

## **Transition T5A**

### **State 5 to 2**

Land abandonment transitions the site to the degraded wet prairie state (2).

## **Transition T5B**

### **State 5 to 3**

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

## **Transition T5C**

### **State 5 to 4**

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

## **Additional community tables**

### **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**

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.

Barrett, S.W. 1980. Indians and fire. *Western Wildlands Spring*: 17-20.

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

Brudvig, L.A., C.M. Mabry, J.R. Miller, and T.A. Walker. 2007. Evaluation of central North American prairie management based on species diversity, life form, and individual species metrics. *Conservation Biology* 21:864-874.

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 Conterminous 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.

Kardol, P. and D.A. Wardle. 2010. How understanding aboveground-belowground linkages can assist restoration ecology. *Trends in Ecology and Evolution* 25: 670-679.

LANDFIRE. 2009. Biophysical Setting 4914880 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.

Martin, L.M. and B.J. Wilsey. 2006. Assessing grassland restoration success: relative roles of seed additions and native ungulate activities. *Journal of Applied Ecology* 43: 1098-1110.

Martin, L.M. and B.J. Wilsey. 2012. Assembly history alters alpha and beta diversity, exotic-native proportions and functioning of restored prairie plant communities. *Journal of Applied Ecology* 49: 1436-1445.

NatureServe. 2018. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1 NatureServe, Arlington, VA. Available at <http://explorer.natureserve.org>. (Accessed 4 December 2019).

Nelson, P. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Natural Resources,

Missouri Natural Areas Committee. 550 pps.

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.

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-and-iv-ecoregions-continental-united-states>. (Accessed 1 March 2017).

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.

Williams, D.A., L.L. Jackson, and D.D. Smith. 2007. Effects of frequent mowing on survival and persistence of forbs seeded into a species-poor grassland. *Restoration Ecology* 15: 24-33.

Wilsey, B.J. 2008. Productivity and subordinate species response to dominant grass species and seed source during restoration. *Restoration Ecology* 18: 628-637.

## Contributors

Lisa Kluesner  
Rick Francen

## Approval

Suzanne Mayne-Kinney, 12/30/2024

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List of primary contributors and reviewers.

Organization Name Title Location

Iowa Department of Natural Resources Kevin Andersen State Private Lands Biologist Fairfield, IA

Natural Resources Conservation Service Patrick Chase State Soil Scientist Des Moines, IA

Ron Collman State Soil Scientist Champaign, IL

Tonie Endres Senior Regional Soil Scientist Indianapolis, IN

Rick Francen Soil Scientist Springfield, IL

Lisa Kluesner Ecological Site Specialist Waverly, IA

Jorge, Lugo-Camacho State Soil Scientist Columbia, MO

Kevin Norwood Soil Survey Regional Director Indianapolis, IN

Stanley Sipp Resource Inventory Specialist Champaign, IL

Jason Steele Area Resource Soil Scientist Fairfield, IA

Chris Tecklenberg Acting Regional Ecological Site Specialist Hutchinson, KS

Doug Wallace ACES Ecologist Columbia, MO

## Rangeland health reference sheet

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

Author(s)/participant(s)	Lisa Kluesner
Contact for lead author	
Date	01/10/2025
Approved by	Suzanne Mayne-Kinney
Approval date	

## 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:**
-