

Ecological site R107XA208IA

Ponded Upland Depression Sedge Meadow

Last updated: 5/21/2020
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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): 107X—Iowa and Missouri Deep Loess Hills

The Iowa and Minnesota Loess Hills (MLRA 107A) includes the Northwest Iowa Plains, Inner Coteau, and Coteau Moraines landforms (Prior 1991; MDNR 2005). It spans two states (Iowa, 89 percent; Minnesota, 11 percent), encompassing approximately 4,470 square miles (Figure 1). The elevation ranges from approximately 1,700 feet above sea level (ASL) on the highest ridges to about 1,115 feet ASL in the lowest valleys. Local relief is mainly 10 to 100 feet. However, some valley floors can range from 80 to 200 feet, while some upland flats only range between 3 and 6 feet. The eastern half of the MLRA is underlain by Wisconsin-age till, deposited between 20,000 and 30,000 years ago and is known as the Sheldon Creek Formation. The western half is underlain by Pre-Illinoian glacial till, deposited more than 500,000 years ago and has since undergone extensive erosion and dissection. Both surfaces are covered by approximately 4 to 20 feet of loess on the hillslopes, and Holocene alluvium covers the till in the drainageways. Cretaceous bedrock, comprised of sandstone and shale, lies beneath the glacial material (USDA-NRCS 2006). The vegetation in the MLRA has undergone drastic changes over time. Spruce forests dominated the landscape 30,000 to 21,500 years ago. As the last glacial maximum peaked 21,500 to 16,000 years ago, they were replaced with open tundras and parklands. The end of the Pleistocene Epoch saw a warming climate that initially prompted the return of spruce forests, but as the warming continued, spruce trees were replaced by deciduous trees (Baker et al. 1990). Not until approximately 9,000 years ago did the vegetation transition to prairies as climatic conditions continued to warm and subsequently dry. Between 4,000 and 3,000 years ago, oak savannas began intermingling within the prairie landscape, while the more wooded and forested areas maintained a foothold in sheltered areas. This prairie-forest transition ecosystem formed the dominant landscapes until the arrival of European settlers (Baker et al. 1992).

Classification relationships

U.S. Forest Service Ecological Subregions: North Central Glaciated Plains (251B) Section, Outer Coteau des Prairies (251Bb), Northwest Iowa Plains (251Bd) Subsections (Cleland et al. 2007) U.S. EPA Level IV Ecoregion: Loess Prairies (47a) (USEPA 2013) National Vegetation Classification – Ecological System: Eastern Great Plains Wet Meadow, Prairie and Marsh (CES205.687) (NatureServe 2015) National Vegetation Classification – Plant Associations: *Carex atherodes* Wet Meadow (CEGL002220) (NatureServe 2015) Biophysical Settings: Eastern Great Plains Wet Meadow-Prairie-Marsh (4214880) (LANDFIRE 2009) Natural Resources Conservation Service – Iowa Plant Community Species List: Wet Meadow, Awned Sedge (USDA-NRCS 2007) Iowa Department of Natural Resources: Prairie Marsh (INAI 1984) Minnesota Department of Natural Resources: WMs92a Basin Meadow/Carr (MDNR 2005) U.S. Army Corps of Engineers: Sedge Meadows (Eggers and Reed 2015)

Ecological site concept

Ponded Upland Depression Sedge Meadows are located within the green areas on the map (Figure 1). They occur in upland depressions on slopes generally less than one percent. The soils are Mollisols that are very poorly-drained and deep, formed in loess. The site experiences occasional to frequent, brief to long ponding from precipitation, overland flow, and groundwater flow. The historic pre-European settlement vegetation on this site was dominated by herbaceous species adapted to temporarily ponded conditions. Wheat sedge (*Carex atherodes* Spreng.) , common rivergrass (*Scholochloa festuacea* (Willd.) Link), and water knotweed (*Polygonum amphibium* L.) are the dominant species of Ponded Upland Depression Sedge Meadows. Other grasses and grass-like that may occur include bluejoint (*Calamagrostis canadensis* (Michx.) P. Beauv), prairie cordgrass (*Spartina pectinata* Bosc ex Link), river bulrush (*Bolboschoenus fluvialis* (Torr.) Soják), and common spikerush (*Eleocharis palustris* (L.) Roem & Schult.) (MDNR 2005; NatureServe 2015). Species typical of an undisturbed plant community associated with this ecological site include hemlock waterparsnip (*Sium suave* Walter), woollyfruit sedge (*Carex lasiocarpa* Ehrh.), and water sedge (*Carex aquatilis* Wahlenb.) (Drobney et al. 2001; MDNR 2005; NatureServe 2015). Depth and duration of ponding as well as periodic fire are the primary disturbance factors that maintain this site, while native large mammal grazing and drought are secondary factors (MDNR 2005; LANDFIRE 2009; NatureServe 2015).

Associated sites

R107XA208IA	Ponded Upland Depression Sedge Meadow Loess or loamy sediments on broad upland flats that do not experience ponding, including Gillet Grove, Letri, Marcus, Rushmore, Spicer
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Similar sites

R107XA209IA	Wet Upland Sedge Meadow Wet Upland Sedge Meadows are similar in landscape position, but site is a MINERAL SOIL FLATS wetland
R107XA210IA	Wet Upland Drainageway Prairie Wet Upland Drainageway Prairies are similar in landscape position, but site is a SLOPE wetland

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Carex atherodes</i> (2) <i>Scolochloa festucea</i>

Physiographic features

Ponded Upland Depression Sedge Meadows occur on upland depressions (Figure 2). They are situated on elevations ranging from approximately 1000 to 1401 feet ASL. Ponding is occasional to frequent and lasts from two to less than 30 days. Ponded water depths can be as high as twelve inches.

Figure 1. Figure 1. Location of Ponded Upland Depression Sedge Meadow ecological site within MLRA 107A.

Figure 2. Figure 2. Representative block diagram of Ponded Upland Depression Sedge Meadow and associated ecological sites.

Table 2. Representative physiographic features

Slope shape across	(1) Concave
Slope shape up-down	(1) Concave
Landforms	(1) Upland > Depression
Runoff class	Negligible
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)

Ponding frequency	Occasional to frequent
Elevation	310 – 430 m
Slope	0 %
Ponding depth	0 – 30 cm
Water table depth	0 – 180 cm

Climatic features

The Iowa and Minnesota Loess Hills falls into the hot humid continental climate (Dfa) Köppen-Geiger climate classification (Peel et al. 2007). In winter, dry, cold air masses periodically shift south from Canada. As these air masses collide with humid air, snowfall and rainfall result. In summer, moist, warm air masses from the Gulf of Mexico migrate north, producing significant frontal or convective rains. Occasionally, hot, dry winds originating from the Desert Southwest will stagnate over the region, creating extended droughty periods in the summer from unusually high temperatures. Air masses from the Pacific Ocean can also spread into the region and dominate producing mild, dry weather in the autumn known as Indian Summers (NCDC 2006).

The soil temperature regime of MLRA 107A is classified as mesic, where the mean annual soil temperature is between 46 and 59°F (USDA-NRCS 2006). Temperature and precipitation occur along a north-south gradient, where temperature and precipitation increase the further south one travels. The average freeze-free period of this ecological site is about 159 days, while the frost-free period is about 144 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 about 32 inches, which includes rainfall plus the water equivalent from snowfall. The average annual low and high temperatures are 36 and 58°F, respectively (Table 3).

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)	130-130 days
Freeze-free period (characteristic range)	150-150 days
Precipitation total (characteristic range)	760-810 mm
Frost-free period (actual range)	130-140 days
Freeze-free period (actual range)	150-150 days
Precipitation total (actual range)	740-840 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days

Precipitation total (average)	790 mm
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- (1) PRIMGHAR [USC00136800], Primghar, IA
- (2) ROCK RAPIDS [USC00137147], Rock Rapids, IA
- (3) CHEROKEE [USC00131442], Cherokee, IA
- (4) HOLSTEIN [USC00133909], Holstein, IA

Influencing water features

Ponded Upland Depression Sedge Meadows are classified as a DEPRESSIONAL: Recharge, Ponded, Closed Depression, herbaceous wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as a Palustrine, Persistent, Emergent Wetland under the National Wetlands Inventory (FGDC 2013). Precipitation, overland flow from adjacent uplands, and groundwater discharge are the main sources 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 (Figure 5).

Primary wetland hydrology indicators for an intact Ponded Upland Depression Sedge Meadow may include: A1 Surface water, A2 High water table, A3 Saturation, and B7 Inundation visible on aerial photography. Secondary wetland hydrology indicators may include: C2 Dry-season water table, D2 Geomorphic position, and D5 FAC-neutral test (USACE 2010).

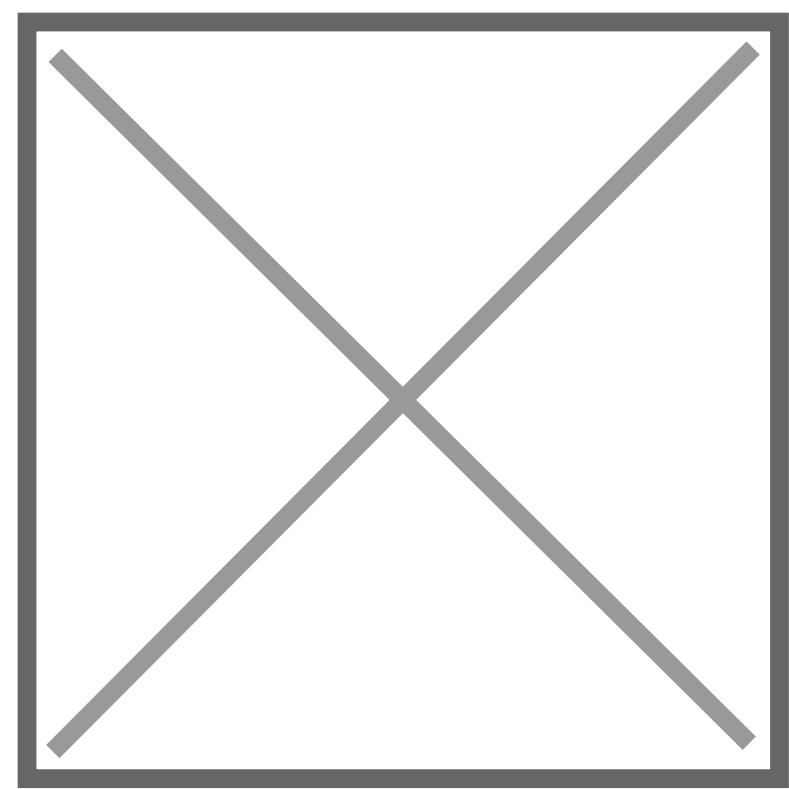


Figure 7. Figure 5. Hydrologic cycling in Ponded Upland Depression Sedge Meadow ecological site.

Soil features

Soils of Ponded Upland Depression Sedge Meadows are in the Mollisols order, further classified as Typic Argialbolls that are impermeable with a negligible runoff potential. The soil series associated with this site includes Sperry (Figure 6). The parent material is loess, and the soils are very poorly-drained and deep with seasonal high-water tables. Soil pH classes are strongly acid to neutral (Table 5).

Soil map units in this ecological site, if not drained, may meet the definition of hydric soils and are listed as meeting criteria 2 and 3 of the hydric soils list (77 FR 12234).

Figure 8. Figure 6. Profile sketches of soil series associated with Ponded Upland Depression Sedge Meadow.

Table 4. Representative soil features

Parent material	(1) Loess
Family particle size	(1) Fine
Drainage class	Very poorly drained
Soil depth	200 cm

Ecological dynamics

The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

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

Ponding and fire are the most important ecosystem drivers for maintaining Ponded Upland Depression Sedge Meadows. The depth and duration of ponding affect species composition, cover, and vegetative production due to alternating aerobic and anaerobic surface substrate conditions. Periodic fires likely occurred on a two to five-year rotation interval and helped to reduce the accumulation of peat. The combination of fire and high-water levels prevented the establishment of shrubs for any significant amount of time (MDNR 2005; LANDFIRE 2009).

Drought has also played a role in shaping this ecological site. The periodic episodes of reduced soil moisture in conjunction with the very poorly-drained soils have favored the proliferation of plant species tolerant of such conditions. Drought can also slow the growth of plants and result in dieback of certain species. When coupled with fire, periods of drought can also eliminate or greatly reduce the occurrence of woody vegetation, substantially altering the extent of shrubs and trees (Pyne et al. 1996; MDNR 2005).

Today, Ponded Upland Depression Sedge Meadows have been virtually eliminated as the land has mostly been converted to agricultural production (Eilers and Roosa 1994; LANDFIRE 2009). Corn (*Zea mays* L.) and soybeans (*Glycine max* (L.) Merr.) are the dominant crops grown, but small patches of forage land may be present. A return to the historic plant community is likely not 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 functioning. 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

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 10. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 11. Community 3.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 12. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 13. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 14. Community 4.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 15. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 16. Community 5.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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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 the sources identified in the ecological site description.

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Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	10/04/2026
Approved by	
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:
