Ecological site R104XY006IA Wet Loamy Upland 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): 104X–Eastern Iowa and Minnesota Till Prairies

The Eastern Iowa and Minnesota Till Prairies (MLRA 104) includes the Iowan Surface, Oak Savanna, and Western Coulee and Ridges landforms (Prior 1991; MDNR 2005; WDNR 2015). It spans three states (Iowa, 74 percent; Minnesota, 22 percent; Wisconsin, 4 percent), encompassing approximately 9,660 square miles (Figure 1). The elevation ranges from approximately 1,310 feet above sea level (ASL) on the highest ridges to about 985 feet ASL in the lowest valleys. Local relief is mainly 10 to 20 feet. Glacial till and outwash deposits cover the uplands of the MLRA with recent alluvium located in the major river valleys. Paleozoic bedrock sediments, comprised primarily of shale and limestone, lies beneath the glacial material. The depth to limestone is shallow, resulting in karst topography across much of the area (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

USFS Subregions: North Central U.S. Driftless and Escarpment (222L), Minnesota and Northeast Iowa Morainal-Oak Savannah (222M), Central Dissected Till Plains (251C) Sections; Menominee Eroded Pre-Wisconsin Till (222La), Oak Savannah Till and Loess Plains (222Me), Southeast Iowa Rolling Loess Hills (251Ch) Subsections (Cleland et al. 2007) U.S. EPA Level IV Ecoregion: Eastern Iowa and Minnesota Drift Plains (47c), Rolling Loess Prairies (47f), Lower St. Croix and Vermillion Valleys (47g), Rochester/Paleozoic Plateau Upland (52c) (USEPA 2013) National Vegetation Classification – Ecological Systems: Central Tallgrass Prairie (CES205.683) (NatureServe 2015) National Vegetation Classification - Plant Associations: Andropogon gerardii – Panicum virgatum – Helianthus grosseserratus Wet Meadow (CEGL002024) (Nature Serve 2015) Biophysical Settings: Central Tallgrass Prairie (BpS 4314210) (LANDFIRE 2009) Natural Resources Conservation Service – Iowa Plant Community Species List: Prairie, Central Wet-Mesic Tallgrass (USDA-NRCS 2007) Minnesota Department of Natural Resources: Ups23 Southern Mesic Prairie [From MDNR Veg Classification] (MDNR 2005) U.S. Army Corps of Engineers: Wet to Wet-Mesic Prairies (Eggers and Reed 2015)

Ecological site concept

Wet Loamy Upland Prairies are located within the green areas on the map (Figure 1). They occur on level or slightly concave positions on broad uplands. The soils are Mollisols that are poorly-drained and deep, formed in loamy sediments. Low hydraulic gradients create a shallow depth to an apparent and/or perched water table during the growing season. The historic pre-European settlement vegetation on this ecological site was dominated by both upland and hydrophytic tallgrass vegetation. Bluejoint (Calamagrostis canadensis (Michx.) P. Beauv) and Virginia mountainmint (Pycnanthemum virginianum (L.) T. Dur & B.D. Jacks. ex B.L. Rob. & Fernald) are the dominant and characteristic grass and forb species, respectively. Other grasses present can include prairie cordgrass (Spartina pectinata Bosc ex Link), big bluestem (Andropogon gerardii Vitman), and various sedges. Forbs typical of an undisturbed plant community associated with this ecological site include fourflower yellow loosestrife (Lysimachia quadriflora Sims), pride of Ohio (Dodecatheon meadia L.), and marsh bellflower (Campanula aparinoides Marsh) (Drobney et al. 2001). Shrubs, when present, are widely scattered and may include white meadowsweet (Spiraea alba Du Roi) and pussy willow (Salix discolor Muhl.). Fire is the primary disturbance factor that maintains this site, while herbivory and drought are secondary factors (LANDFIRE 2009).

Associated sites

R104XY012IA	**Wet Upland Drainageway Sedge Meadow** Alluvium and erosional sediment parent material that is rarely to occasionally flooded including Ackmore, Arenzville, Clyde, Coland, Colo, Ely, Marshan, Nerwoods, Orion, Sawmill and Terril soils
R104XY005IA	**Loamy Upland Prairie** Loamy sediment parent material that is not shallow to a water table including Aredale, Ashdale, Atkinson, Bolan, Carmi, Cerlin, Cresco, Cresken, Dinsdale, Dinsmore, Floyd, Fort Dodge, Kenyon, Klinger, Klingmore, Marquis, Merton, Moland, Norville, Ostrander, Plano, Port Byron, Protivin, Readlyn, Tallula, Tama, Warsaw, Winnebago

Similar sites

R104XY013IA	**Ponded Upland Depression Sedge Meadow** Ponded Upland Depression Sedge Meadows are similar in landscape position but can experience ponding and are DEPRESSIONAL wetlands
R104XY012IA	**Wet Upland Drainageway Sedge Meadow** Wet Upland Drainageway Sedge Meadows occur on upland drainageways and are SLOPE wetlands

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Calamagrostis canadensis* (2) *Pycnanthemum virginianum*

Physiographic features

Wet Loamy Upland Prairies occur on level or slightly concave positions on broad uplands (Figure 2). They are situated on elevations ranging from approximately 558 to 1738 feet ASL. The site does not experience flooding, but rather allows for groundwater recharge due to low hydraulic gradients (Table 1).

Figure 1. Figure 1. Location of Wet Loamy Upland Prairie ecological site within MLRA 104.

Figure 2. Figure 2. Representative block diagram of Wet Loamy Upland 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
Runoff class	Negligible to low
Elevation	170 – 530 m
Slope	0 %
Water table depth	0 – 20 cm
Aspect	Aspect is not a significant factor

Climatic features

The Eastern Iowa and Minnesota Till Prairies falls into the hot-summer humid continental climate (Dfa) and warm-summer humid continental climate (Dfb) Köppen-Geiger climate classifications (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 104 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 154 days, while the frost-free period is about 130 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 34 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 36 and 56°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)	130-130 days
Freeze-free period (characteristic range)	140-160 days
Precipitation total (characteristic range)	840-910 mm
Frost-free period (actual range)	130-140 days
Freeze-free period (actual range)	140-170 days

Precipitation total (actual range)	790-910 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	860 mm

- (1) RED WING DAM 3 [USC00216822], Hager City, MN
- (2) AUSTIN WWT FAC [USC00210355], Austin, MN
- (3) CHARLES CITY [USC00131402], Charles City, IA
- (4) MANCHESTER #2 [USC00135086], Manchester, IA

Influencing water features

Wet Loamy Upland Prairies are classified as a MINERAL SOIL FLATS: saturated, recharge, herbaceous wetland under the Hydrogeomorphic (HGM) classification system (Smith et al. 1995; USDA-NRCS 2008) and as an 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 (Figure 5).

Primary wetland hydrology indicators for an intact Wet Loamy Upland Prairies 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).

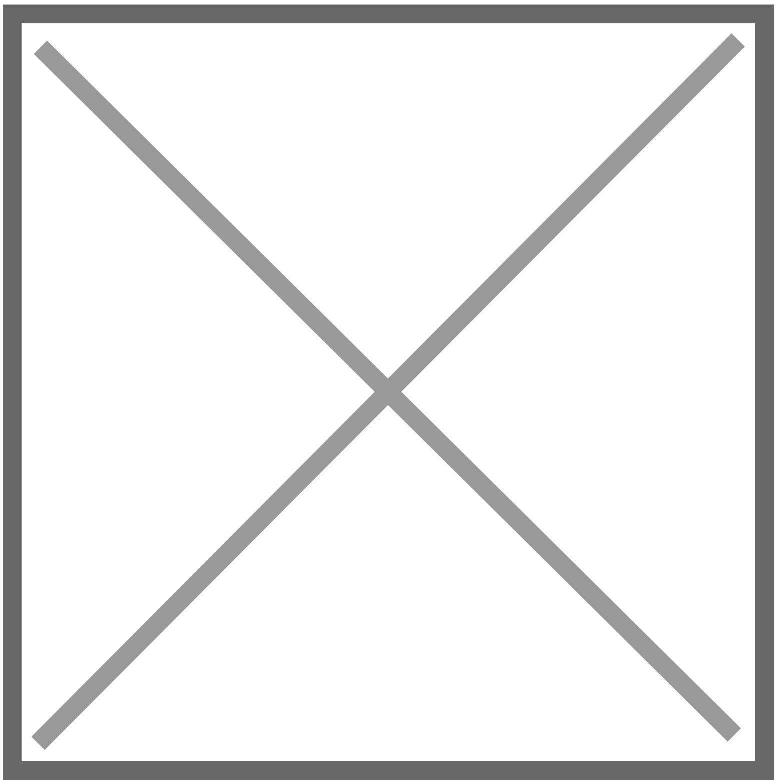

Figure 9. Figure 5. Hydrologic cycling in Wet Loamy Upland Prairie ecological site.

Soil features

Soils of Wet Loamy Upland Prairies are in the Mollisols order, further classified as Typic Argiaquolls and Typic Endoaquolls with very slow infiltration and negligible to low runoff potential. The soil series associated with this site includes Clyde, Garwin, Jameston, Marshan, Maxcreek, Maxfield, Maxmore, and Tripoli. The parent material is loamy sediments, and the soils are 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).

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

Figure 10. Figure 6. Profile sketches of soil series associated with Wet Loamy Upland Prairie.

Table 4. Representative soil features

Family particle size	(1) Fine-loamy
Drainage class	Poorly drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	200 cm
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.

The MLRA lies within the transition zone between the eastern deciduous forests and the tallgrass prairies. The heterogeneous topography of the area results in variable microclimates and fuel matrices that in turn support prairies, savannas, woodlands, and forests. Wet Loamy Upland Prairies form an aspect of this vegetative continuum. This ecological site occurs on broad uplands on poorly-drained soils. Species characteristic of this ecological site consist of both upland and hydrophytic herbaceous vegetation.

Fire is a critical disturbance factor that maintains Wet Loamy Upland Prairies. Fire intensity typically consisted of periodic, low-intensity surface fires occurring every 1 to 3 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).

Drought and herbivory by native ungulates have also played a role in shaping this ecological site. The periodic episodes of reduced soil moisture in conjunction with the 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. Bison (Bos bison) grazing, while present, served a more limited role in community composition and structure than lands further west. Prairie elk (Cervus elaphus) and white-tailed deer (Odocoileus virginianus) likely contributed to woody species reduction but are also considered to be of a lesser impact compared to the west (LANDFIRE 2009). When coupled with fire, periods of drought and herbivory can further delay the establishment of woody vegetation (Pyne et al. 1996).

Today, Wet Loamy Upland 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

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 12. Community 3.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 13. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 14. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Inventory data references

Tier 3 Sampling Plots used to develop the reference state, community phases 1.1: State County Ownership Easting Northing Iowa Howard Hayden Prairie State Preserve – Iowa Department of Natural Resources 550037 4809877 Iowa Clinton Duke Prairie – Clinton County Conservation Board 692977 4627883

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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	09/08/2026
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:**