Ecological site F089XY003WI
Sandy Floodplains

Last updated: 9/27/2023
Accessed: 05/15/2024

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): 089X–Wisconsin Central Sands

The Wisconsin Central Sands (MLRA 89) corresponds closely to Central Sand Plains Ecological Landscape published by the Wisconsin Department of Natural Resources (WDNR, 2015). Much of the following brief overview of this MLRA is borrowed from that publication.

The Wisconsin Central Sands MLRA is entirely in Wisconsin. The total land area is 2,187,100 acres (3,420 square miles, 8858 square kilometers). It is bordered to the east by Johnstown-Hancock end moraines, which were pushed to their extent by the west side of the Green Bay Lobe (Clayton & Attig, 1999). It is bordered to the southwest by highly eroded, unglaciated valleys and ridges. The dominant feature of this MLRA is the remarkably flat, sandy plain, composed of lacustrine deposits and outwash sand, that was once the main basin of Glacial Lake Wisconsin. It also features extensive pine and oak barrens and wetland complexes.

Glacial Lake Wisconsin was fed primarily by glacial meltwater from the north and east. The lake deposited silt overlain by tens of meters of sand (Clayton & Attig, 1989). The silty layers are closer to the surface in some areas, where they impede drainage and contribute to the formation of extensive wetland complexes. It is believed that Glacial Lake Wisconsin drained within several days after a breach in the ice dam that supported it. The catastrophic flood that followed flowed to the south and carved the scattered buttes and mesas protruding from the sandy plain in the southern portion of this MLRA. Before vegetation established after glacial recession, strong winds formed aeolian sand dunes that now support xeric pine and oak stands within the Wisconsin Central Sands.

The surface of the northwestern portion is mostly undulating. The sandy surface sediment was mostly deposited by meltwater during the Wisconsin glaciation. Gentle hills are a result of underlying bedrock topography. Valleys and floodplains are formed by stream action. The underlying bedrock controls the water table elevation and contributes to the formation of numerous wetlands.

Historically, the Wisconsin Central Sands were dominated by large wetland complexes, sand prairies, and oak forests, savannas, and barrens. Some pine and hemlock forests were found in the northwest portion. The Wisconsin Central Sands was subject to frequent fires, leading to today’s need for prescribed burns to maintain the area.

Classification relationships

Major Land Resource Area (MLRA): Wisconsin Central Sands (89)
USFS Subregions: Central Wisconsin Sand Plain (222Ra) and Neillsville Sandstone Plateau (222Rb)

Ecological site concept

The Sandy Floodplains ecological sites occurs on floodplains along the rivers and streams that dissect expansive sandy outwash plains and lake plains in MLRA 89. They’re primarily (but not exclusively) found along the Yellow,

Baraboo, and Wisconsin Rivers and their tributaries. These sites are characterized by very deep, poorly to moderately well drained soils formed in sandy alluvium. They're subject to frequent periods of flooding, primarily in the spring and fall. Some sites are subject to frequent ponding. Water source is primarily stream overflow, but precipitation, runoff from adjacent uplands, and groundwater discharge are also significant waters sources. These sites range from very strongly acid to neutral. Some sites are wetlands.

This ecological site differs from Loamy Floodplains based on sandy parent materials and family particle size class. The sandy materials yield a lower pH and decreased available water capacity, which may limit vegetative growth on the sites.

Similar sites

F089XY005WI	**Wet Sandy Bedrock Lowlands** Like Sandy Floodplains, Wet Sandy Bedrock Lowlands consist of sandy alluvium. These sites are underlain by loamy residuum. Bedrock occurs within 100 cm and perches the water table. Soils are poorly drained and subject to ponding. These sites are found in the northwestern portion of the Wisconsin Central Sands MLRA where the depth to bedrock is shallow. The vegetative communities found on these sites are very similar to those found on Sandy Floodplains.
F089XY006WI	**Wet Sandy Outwash Lowlands** Wet Sandy Outwash Lowlands consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They are very poorly to poorly drained, remain saturated for much of the growing season, and are subject to frequent ponding. These sites are primarily found in the eastern half of the Wisconsin Central Sands MLRA. The vegetative communities found on these sites are very similar to those found on Sandy Floodplains.
F089XY007WI	**Wet Siliceous Sand Lowlands** Wet Siliceous Sand Lowlands consist of deep sandy deposits sourced primarily from the weathering of sandstone high in silica. The weathered sand was deposited by rivers or glacial lakes. They are very poorly to poorly drained and remain saturated from much of the growing season. Some are subject to ponding. These sites are primarily found in the western half of the Wisconsin Central Sands MLRA. The vegetative communities found on these sites are very similar to those found on Sandy Floodplains.
F089XY004WI	**Loamy Floodplains** Loamy Floodplains are found exclusively on floodplains in loamy alluvium underlain by sandy alluvium. Soils are somewhat poorly to poorly drained and are subject to flooding. These sites occur primarily along tributaries to the Yellow River in central Wood County and along the Lemonweir River. The vegetative communities associated with Loamy Floodplains prefer a similar soil moisture regime as those of Sandy Floodplains but have higher nutrient requirements.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Quercus macrocarpa*
Shrub	(1) *Pinus strobus* (2) *Acer rubrum*
Herbaceous	(1) *Rubus hispidus*

Physiographic features

These sites occur in depressions and flats on floodplains. Slopes range from 0 to 3 percent. Sites are in toeslope or no hillslope position. Elevation ranges from 590 to 1411 feet (180 to 430 meters) above sea level.

Some sites are subject to ponding and the frequency ranges from rare to frequent. Ponding duration is brief (2 to 7 days) to long (7 to 30 days), at depths of 0 to 11.8 inches (0 to 30 cm) above the soil surface. All sites are subject to very rare to frequent flooding. The duration of flooding ranges from brief to long. Some sites have a perched seasonally high water table (episaturation) at depths of 0 to 11.8 inches (0 to 30 cm). Other sites have an apparent seasonally high water table (endosaturation) at depths of 0 to 48 inches (0 to 122 cm). The water table can drop to greater than 59 inches (150 cm) during dry conditions. Surface runoff is negligible to very low.

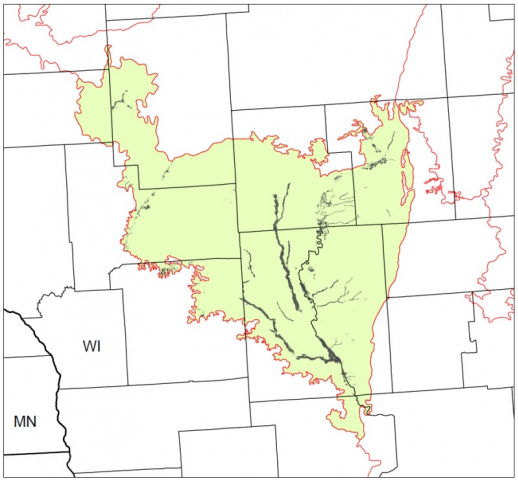


Figure 1. Distribution of Sandy Floodplains in the Wisconsin Central Sands MLRA (89).

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Toe
Runoff class	Negligible to very low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	180–430 m
Slope	0–3%
Ponding depth	0–30 cm
Water table depth	0–310 cm
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Wisconsin Central Sands is typical of the southern half of the state – cold winters and warm summers. Precipitation is well-distributed throughout the year with a slight peak in the summer months. Snowfall covers the ground from late fall to early spring. The soil moisture regime of MLRA 89 is udic (humid climate). The soil temperature regime is mostly frigid, with a small portion of mesic in the southern tip. Neither precipitation nor temperature vary greatly across this MLRA. More so than latitude, local topography seems to be an important predictor of growing season length, with fewer growing degree days in lower-lying areas.

This site occurs on landscape depressions and its local topography is expected to influence its growing season length. The freeze-free and frost-free periods may be shorter than what is represented here. The average annual precipitation for this ecological site is 33 inches. The average annual snowfall is 43 inches.

Table 3. Representative climatic features

Frost-free period (characteristic range)	91-125 days
Freeze-free period (characteristic range)	124-145 days
Precipitation total (characteristic range)	838-864 mm
Frost-free period (actual range)	77-125 days
Freeze-free period (actual range)	102-149 days
Precipitation total (actual range)	813-864 mm

Frost-free period (average)	107 days
Freeze-free period (average)	132 days
Precipitation total (average)	838 mm

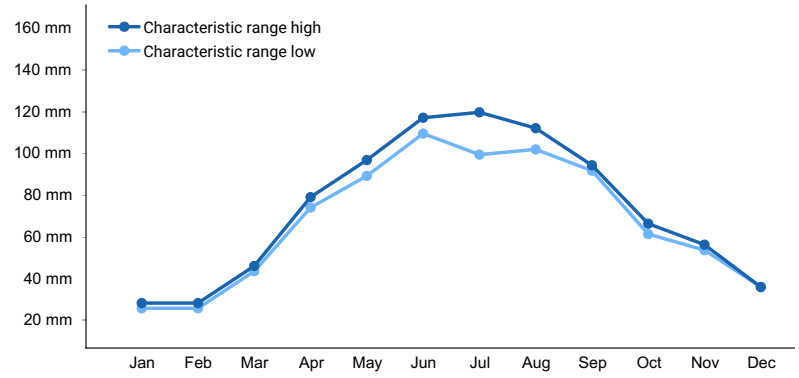


Figure 2. Monthly precipitation range

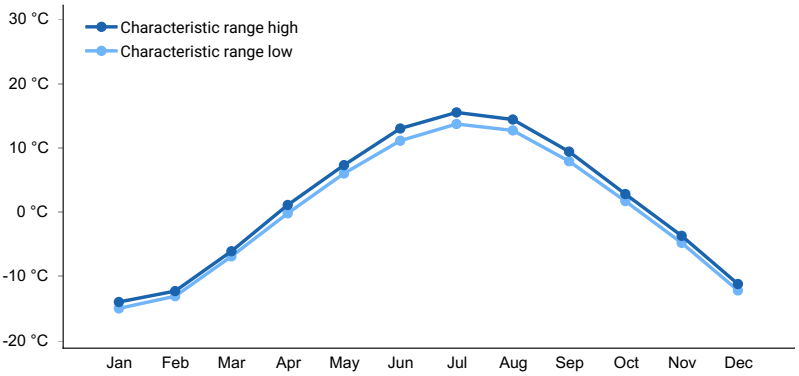


Figure 3. Monthly minimum temperature range

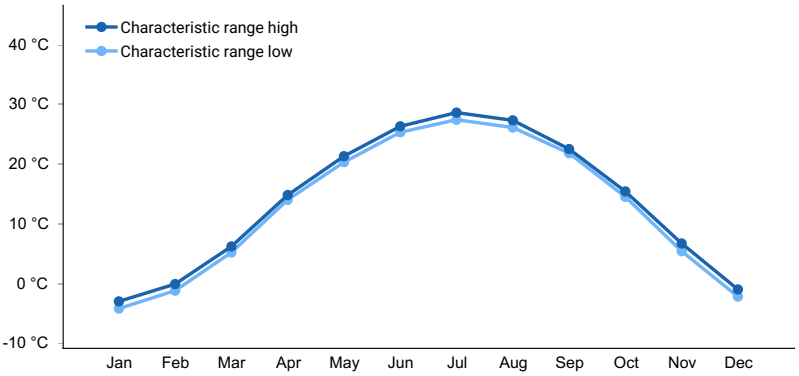


Figure 4. Monthly maximum temperature range

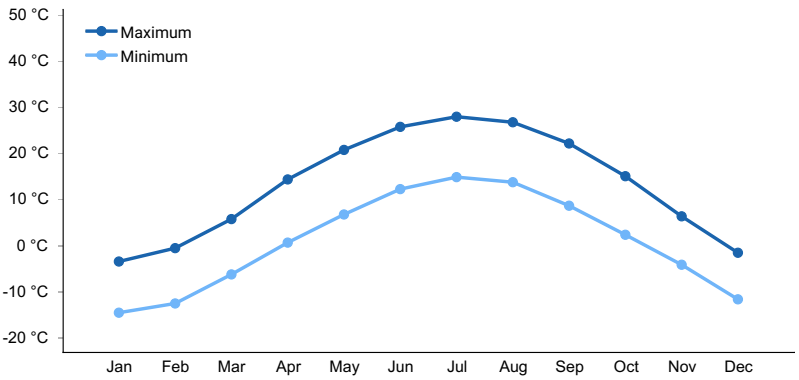


Figure 5. Monthly average minimum and maximum temperature

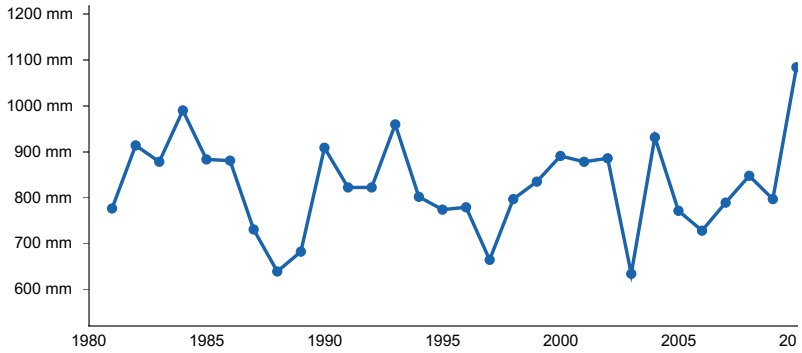


Figure 6. Annual precipitation pattern

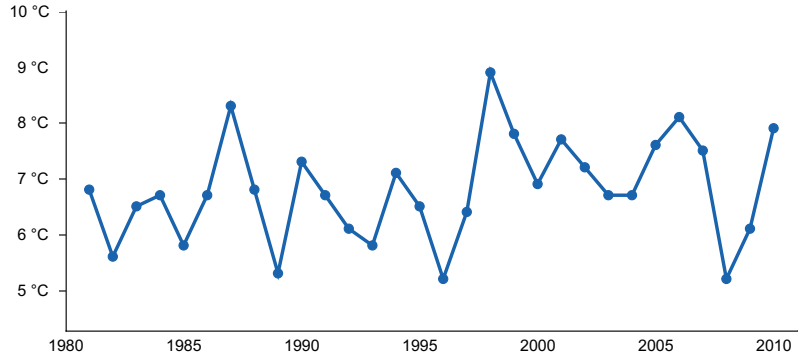


Figure 7. Annual average temperature pattern

Climate stations used

- (1) FRIENDSHIP [USC00472973], Adams, WI
- (2) MAUSTON 1 SE [USC00475178], Mauston, WI
- (3) HATFIELD [USC00473471], Merrillan, WI
- (4) NECEDAH [USC00475786], Necedah, WI
- (5) STEVENS POINT [USC00478171], Stevens Point, WI
- (6) WISCONSIN RAPIDS [USC00479335], Wisconsin Rapids, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, stream inflow, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water leaves from the site primarily through stream outflow, subsurface outflow, evapotranspiration, and groundwater recharge. Some of these sites are wetlands.
Frequent flooding from stream inflow is a significant factor in the ecological development of Sandy Floodplain sites. The vegetation must be tolerant of frequent flooding that may persist for a month.

Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:

1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
3) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:

1) Depressional, acid, forested/organic, or
2) Depressional, acid, scrub-shrub/organic

Permeability of the soils is moderate to slow. The hydrologic group of these sites is A or A/D.

Soil features

These sites are represented by the Evart, Newlang, Pelkie, and Winterfield soil series. Evart is classified as a Fluvaquentic Endoaquoll; Newlang is a Humaqueptic Psammaquent; Pelkie is an Oxyaquic Udipsamment; and Winterfield is an Aquic Udipsamment. 75% of the acreage of this ecological site is mapped as Udipsamments.

These soils formed in sandy alluvium. Soils are very deep, and most sites are somewhat poorly or poorly drained. These sites are saturated for long periods of time and meet hydric soil requirements. Pelkie is moderately well drained and does not meet hydric soil requirements.

The surface texture of these sites is primarily loamy sand or loamy fine sand, but some sites have muck at the surface. Subsurface textures include loamy sand, loamy fine sand, and sand. Soil pH ranges from very strongly acid to neutral with values of 4.6 to 7.0. Surface fragments less than 3 inches can be present up to 5 percent, and fragments greater than 3 inches can be present up to 3 percent. Subsurface fragments less than 3 inches can be present up to 20 percent, and fragments greater than 3 inches can be present up to 3 percent. Carbonates are absent.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loamy sand
Drainage class	Poorly drained to moderately well drained
Permeability class	Slow to moderate
Soil depth	183 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–3%
Available water capacity (0-152.4cm)	10.8–25.96 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Soil reaction (1:1 water) (0-101.6cm)	5.1–6.7
Subsurface fragment volume <=3" (0-203.2cm)	0–5%
Subsurface fragment volume >3" (0-203.2cm)	0–3%

Ecological dynamics

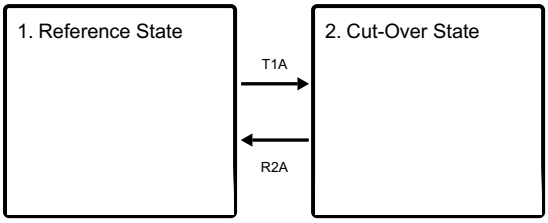
Because this Ecological Site is subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events create conditions temporarily favorable to a given species, or groups of species, and unfavorable to other species or groups. Species differ greatly in their ability to tolerate frequency of flooding and duration of ponding. Silver maple (*Acer saccharinum*) is best adapted tree species to colonize freshly deposited sediment. It is a prolific seed producer and germinates immediately upon maturing, without the need of undergoing a cold period. Once established, seedlings, as well as mature trees, tolerate repeated flooding and prolonged ponding. Established trees can withstand the entire season of ponding (USDA, 1990). However, silver maple's tolerance of shade varies greatly with site quality, from moderately tolerant on good sites and almost completely intolerant on nutrient-poor sites (USDA, 1990). ES 4 is a nutrient-poor site type, which is probably the reason silver maple was not observed in the mature forest communities sampled in this project.

Species that often become established on this Ecological Site during periods without major flooding, or ponding, are swamp white oak (*Quercus bicolor*), bur oak (*Q. macrocarpa*), white oak (*Q. alba*) and white pine (*Pinus strobus*). It

appears that very long period without ponding leads this site type to develop into relatively stable PVRh (Pinus/Vaccinium-*Rubus hispidus*) Forest Habitat Type (Kotar and Burger, 1996).

State and transition model

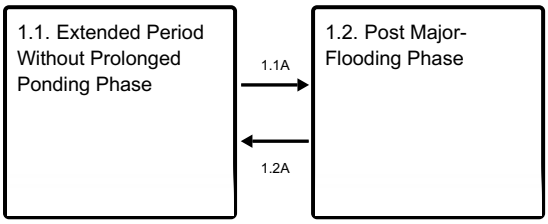
Ecosystem states



T1A - Clearcutting, or stand replacing natural disturbance.

R2A - Absence of disturbance

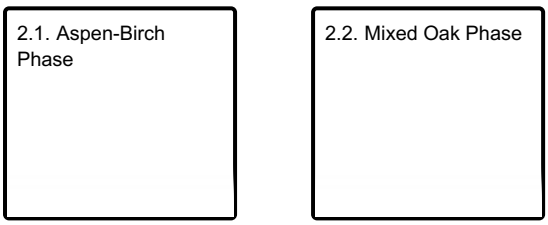
State 1 submodel, plant communities



1.1A - Major flooding event depositing new sediment

1.2A - Long period without major flooding

State 2 submodel, plant communities



State 1
Reference State

Because of the dynamic nature of hydrological events affecting this Ecological Site, many different plant communities can be found at any given time. We chose two distinct community phases to represent the Reference state: 1, a long-period free of extended ponding community phase and 2, frequently flooded and pounded community phase.

Dominant plant species

- oak (*Quercus*), tree
- eastern white pine (*Pinus strobus*), tree

Community 1.1
Extended Period Without Prolonged Ponding Phase

It appears that a multi-year dry period leads to a time gap in seasonal flooding, allowing seedlings and saplings of species such as white pine, bur oak and red oak to become adequately established to withstand the return to normal seasonal flooding. Red maple is another species that often colonizes the site during such conditions. Once a closed-canopy forest community has developed, small scale canopy disturbances, such as now/ice breakage and single tree mortality will increase light on the forest floor and stimulate regeneration of canopy species. This

perpetuates community composition and structure.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- bur oak (*Quercus macrocarpa*), tree
- northern red oak (*Quercus rubra*), tree

Community 1.2
Post Major-Flooding Phase

Major flooding events can deposit thick layers of sediment causing partial or complete mortality of the canopy trees. New sediment and increased light on the forest floor again create suitable conditions for colonization by pioneer species. Most common tree species colonizing new sandy deposits in floodplains is silver maple. It is typically followed by red maple and, depending on seed source availability, also white pine. The ground layer species composition is extremely varied, depending largely on presence or absence of propagules (seeds, spores, rhizomes, etc.) of legacy species. Initially, sites are dominated by sedges and grasses. Common associates include starflower (*Trientalis borealis*), wild lily-of-the-valley (*Maianthemum canadense*), swamp dewberry (*Rubus pubescens*), cinnamon fern (Osmunda cinamomea), Common shrubs include winterberry (*Ilex verticillata*), juneberry (Amelanchier spp.) and blueberries (Vaccinium spp.).

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- red maple (*Acer rubrum*), tree
- eastern white pine (*Pinus strobus*), tree
- sedge (*Abildgaardia*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Major flooding event may deposit thick layers of sediment causing partial or complete mortality of the canopy trees. New sediment and increased light on the forest floor again create condition suitable for colonization of the site by silver maple and many other pioneering species of trees, shrubs and herbs.

Pathway 1.2A
Community 1.2 to 1.1

Once a closed-canopy forest community develops, small scale canopy disturbances, such as snow/ice brakeage and single tree mortality, increase light on forest floor and stimulate regeneration of canopy species, thus perpetuating community composition and structure.

State 2
Cut-Over State

This state describes a site that was clear cut or has incurred a stand replacing natural disturbance.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree

Community 2.1
Aspen-Birch Phase

Clearcutting, especially if followed by fire, may lead to seeding in by quaking aspen and paper birch.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree

- paper birch (*Betula papyrifera*), tree

Community 2.2
Mixed Oak Phase

If cut-over stand contained oaks, a mixed oak community may develop by stump sprouting.

Dominant plant species

- oak (*Quercus*), tree
- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree

Transition T1A
State 1 to 2

Clearcutting, or stand replacing natural disturbance.

Restoration pathway R2A
State 2 to 1

A long time period without natural disturbances such as flooding.

Additional community tables

Inventory data references

Plot and other supporting inventory data for site identification and community phases is located on a NRCS North Central Region shared and one drive folder. University Wisconsin-Stevens Point described soils, took photographs, and inventoried vegetation data at community phases within the reference state. The data sources include WI ESD Plot Data Collection Form - Tier 2, Releve Method, NASIS pedon description, NRCS SOI 036, photographs, and Kotar Habitat Types.

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Approval

Suzanne Mayne-Kinney, 9/27/2023

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	09/27/2023
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

   _____

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

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

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

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

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
