Ecological site F105XY006WI
Moist Sandy Lowland

Last updated: 2/23/2024
Accessed: 05/04/2024

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): 105X–Upper Mississippi River Bedrock Controlled Uplands and Valleys

The Northern Mississippi Valley Loess Hills area corresponds closely to the Western Coulees and Ridges and Southwest Savanna Ecological Landscapes. Some of the following brief overview is borrowed from the Wisconsin Department of Natural Resources Ecological Landscape publication (2015).

Fifty-two percent of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is in Wisconsin; Iowa, Minnesota, and Illinois contain the rest. This region is the only area in Wisconsin that has not been covered by glaciers within the past 2.4 million years. The Wisconsin portion of this MLRA is approximately 7.4 million acres (11,600 square miles). The landscape is characterized by dissected topography with deeply-incised, steep-walled valleys between bedrock controlled ridges.

Though it's called the "Driftless Region", some glacial drift is found in the major river valleys of this region in the form of outwash, deposited by proglacial streams of glacial meltwater. Wisconsin's most recent glaciations also impacted the sediment of the area through the deposition of loess. After the glacier receded and before vegetation established, the bare surfaces of the glaciated areas were highly susceptible to wind erosion. As a result, a veneer of loess (wind-blown silt) was deposited over the entire region. The thickest deposits—nearly five meters—are on ridges near the Mississippi River and gradually thin moving eastward. The loess caps in Dane and Green counties are generally 0.5-1.5 meters deep. Much of the loess has eroded downslope and collected in floodplains.

Bedrock is shallow throughout this MLRA and is a major influence on topography and hydrology. Most of the MLRA has bedrock within two meters, except in the deep river valleys that are filled with outwash and alluvium materials. Sandstone is the dominant bedrock type in MLRA 105, but the southernmost portion is dominated by dolomite. Military Ridge is an escarpment that straddles the boundary between sandstone and dolomite bedrock. The sandstone north of the ridge is weaker than the erosion-resistant dolomite south of the ridge. The sandstone is deeply cut and dissected into steep slopes and valleys. The dolomite-controlled ridges tend to be less dissected and broader with more gentle, south sloping topography. Geomorphic and fluvial processes formed these landscapes by way of sheet wash, soil creep, and flowage. These processes eroded the hillslopes, cut into bedrock, and transported the debris to streams, forming floodplains and terraces.

Underfit streams are common in MLRA 105, especially in the southern portion. These streams currently occupy large river valleys—especially those of the Black, Chippewa, Mississippi, and Wisconsin Rivers—that were carved by proglacial meltwater streams carrying much larger quantities of water than what's present today. As the climate dried, waterflow decreased and the valleys filled with alluvial sediment. Narrow meanders were formed by the shrinking streams and are often dissimilar to the meanders of the larger valleys they occupy. Fluvial landforms – including terraces, oxbow lakes, sandbars, eroding bluffs, and large floodplain complexes – are found within these large valleys and are subject to varying flooding frequencies, intensities, and durations.
Karst topography formed in this region from dissolution of carbonate bedrock by surface and groundwater. Dolomite and limestone are more easily affected by dissolution, but karst topography also formed in sandstone. Erosion by water (stream meanders, rain/runoff, and groundwater), wind, and frost weaken joints and bedding planes that can

cause collapse. In addition, sandstone materials collapse into cavities in underlying dolomite or limestone.

Historically, MLRA 105 was dominated by oak forests and oak openings making up more than 50% of the area. Prairies were significant and covered 32% of the area south of Military Ridge. Maple-basswood forests covered 19% of the are north of Military Ridge. Dominant tree species were white oak (Quercus alba), bur oak (Quercus macrocarpa), black oak (Quercus velutina), and sugar maple (Acer saccharum).

Classification relationships

Relationship to Established Framework and Classification Systems:

Habitat Types of S. Wisconsin (Kotar, 1996): This ES correlates to the habitat type *Pinus strobus*/Vaccinium-Rubus hispidus [PVRh].

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian Oak Barrens, Laurentian-Acadian Northern Hardwoods Forest, North-Central Interior Oak Savanna, North-Central Interior Maple-Basswood Forest, North-Central Oak Barrens Woodland, and Eastern Cool Temperate Row Crop

Hierarchical Framework Relationships:

Major Land Resource Area (MLRA): Upper Mississippi River Bedrock Controlled Uplands and Valleys (105)

USFS Subregions: Menominee Eroded Pre-Wisconsin Till (222La), Melrose Oak Forest and Savannah (222Lb)

Wisconsin DNR Ecological Landscapes: Western Coulee and Ridges

Ecological site concept

The Moist Sandy Lowland ecological site accounts for approximately 18,000 acres on MLRA 105, or about 0.26% of total land area. It is one of the least extensive sites in the MLRA. It can be found on sandy valley trains and sandstone hills in lower landscape positions. About 70% of the acreage of this site is found north of the Black River.

This site is characterized by very deep, somewhat poorly drained soils formed in sandy materials. Most sites in the east-central portion of this MLRA (mainly Monroe and Jackson counties) formed in siliceous sandy alluvium deposits weathered and reworked from silica-cemented sandstone. Other sites formed in sandy outwash deposits. Sites are generally not inundated by water during the growing season.

Associated sites

F105XY001WI	**Mucky Swamp** These sites are permanently saturated wetlands that consist of deep, herbaceous organic materials. They are very poorly drained. They may sometimes be found adjacent to Moist Sandy Lowlands on lower landscape positions.
F105XY004WI	**Wet Sandy Lowland** These sites form in depressions and drainageway in deep, sandy outwash deposits. They are very poorly or poorly drained and are saturated long enough for hydric conditions to occur. They may sometimes be found adjacent to Moist Sandy Lowlands on lower landscape positions.
F105XY009WI	**Sandy Upland** These sites form in deep sandy materials deposits by water and wind. They are moderately well to somewhat excessively drained. They may sometimes be found adjacent to Moist Sandy Lowlands on higher landscape positions.
F105XY019WI	**Dry Upland** These sites form in sandy materials deposited by wind, water, gravity, or weathered from sandstone bedrock. They are well drained to excessively drained. They may sometimes be found adjacent to Moist Sandy Lowlands on higher landscape positions.

Similar sites

F105XY008WI	**Moist Loamy-Clayey Lowland** These sites form in loamy and clayey materials. They are somewhat poorly drained. They are found in similar landscape positions as Moist Sandy Lowlands but have finer textures and a higher nutrient status.

Table 1. Dominant plant species

Tree	(1) *Pinus strobus* (2) *Acer rubrum*
Shrub	(1) *Vaccinium*
Herbaceous	(1) *Maianthemum canadense*

Physiographic features

These sites are found on outwash plains, stream terraces, valley trains, and pediments. Slopes range from 0 to 3 percent. Slope shape is linear and sites are in the toeslope position. Elevation of the landform ranges from 705 to 1001 feet (215 to 305 meters) above sea level.

These sites are generally subject to neither flooding nor ponding. The apparent seasonally high water table is generally found between 6 to 24 inches (15 and 61 cm) from the soil surface. Runoff potential is negligible to low.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Outwash plain (2) Stream terrace (3) Valley train (4) Pediment
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	705–1,001 ft
Slope	0–3%
Water table depth	6–24 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Upper Mississippi River Bedrock Controlled Uplands and Valleys MLRA is typical of southern Wisconsin, with warmer winters, warmer summers, and higher precipitation rates than MLRA in northern Wisconsin. The MLRA stretches over about 2.9 degrees of latitude, or nearly 200 miles, from its northern tip in Barron county to its southern Wisconsin extent on the border of Illinois. This results in considerable variation in climate throughout the MLRA. The growing season ranges from 117 to 181 growing degree days, with longer growing seasons in the southern portion.

The average annual precipitation for this ecological site is 33 inches. The average annual snowfall is 41 inches. The annual average maximum and minimum temperatures are 55°F and 34°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	111-124 days
Freeze-free period (characteristic range)	130-151 days

Precipitation total (characteristic range)	32-35 in
Frost-free period (actual range)	109-126 days
Freeze-free period (actual range)	130-151 days
Precipitation total (actual range)	31-35 in
Frost-free period (average)	118 days
Freeze-free period (average)	144 days
Precipitation total (average)	33 in

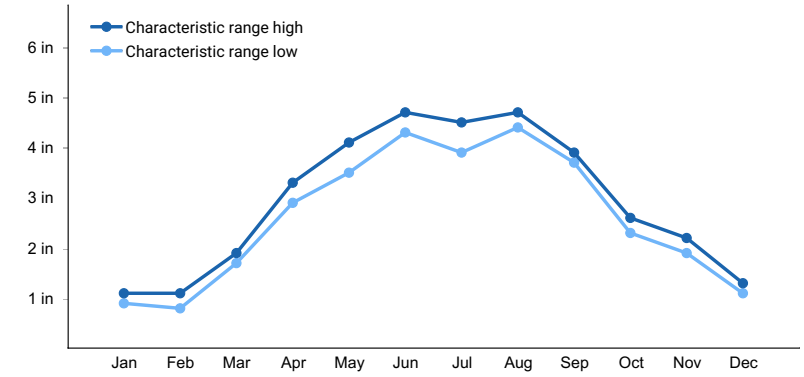


Figure 1. Monthly precipitation range

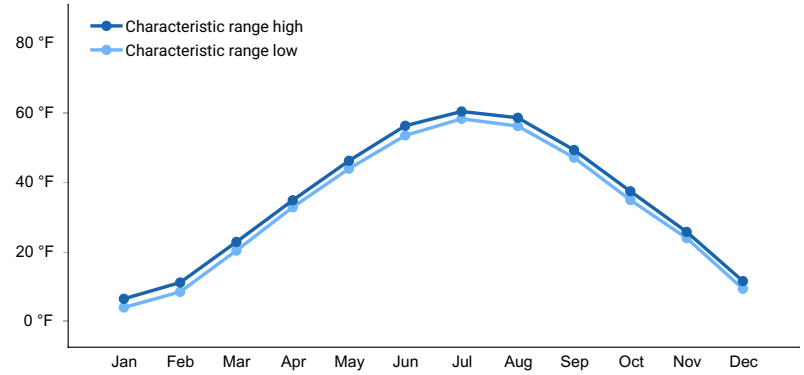


Figure 2. Monthly minimum temperature range

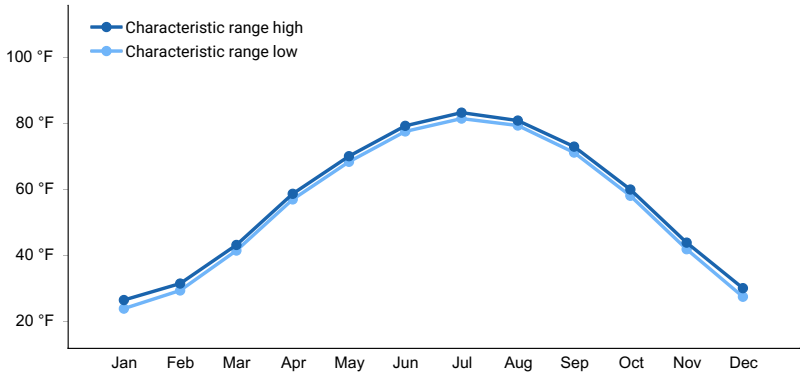


Figure 3. Monthly maximum temperature range

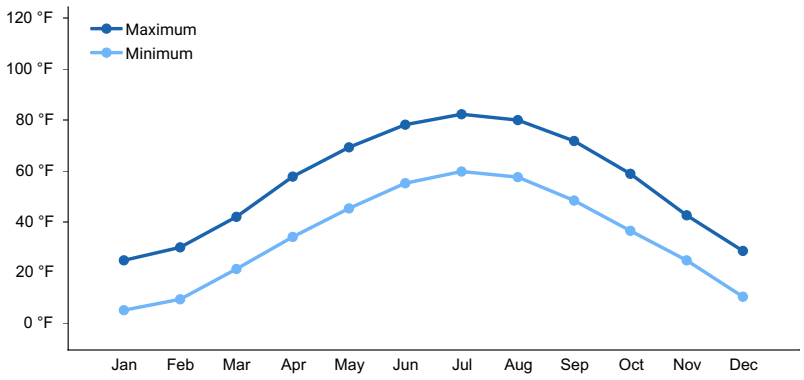


Figure 4. Monthly average minimum and maximum temperature

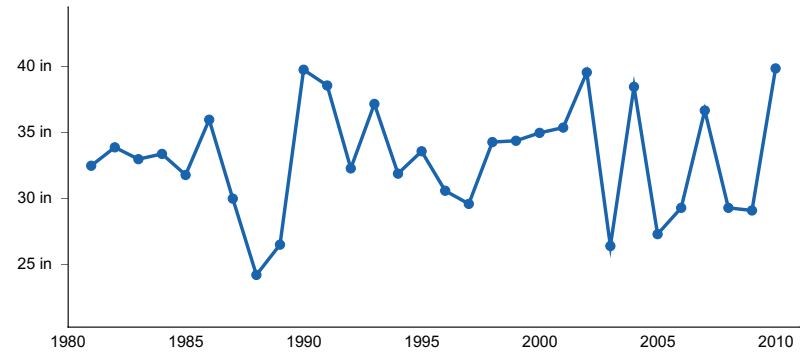


Figure 5. Annual precipitation pattern

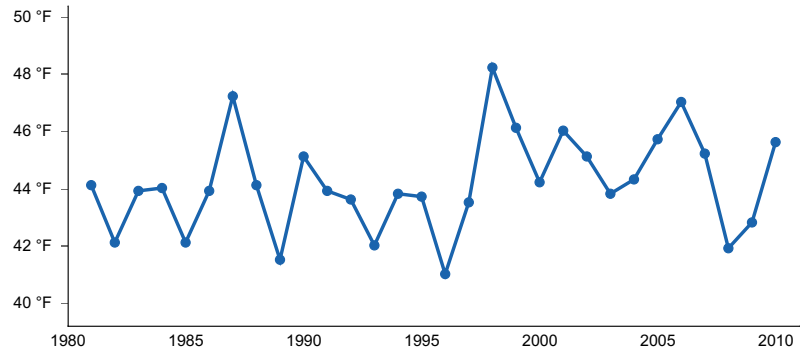


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIDGELAND 1 NNE [USC00477174], Dallas, WI
- (2) EAU CLAIRE RGNL AP [USW00014991], Eau Claire, WI
- (3) MENOMONIE [USC00475335], Menomonie, WI
- (4) SPARTA [USC00477997], Sparta, WI
- (5) DURAND [USC00472279], Durand, WI
- (6) LONE ROCK TRI CO AP [USW00014921], Spring Green, WI
- (7) BLAIR [USC00470882], Blair, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water is lost from the site primarily through runoff, evapotranspiration, and groundwater recharge.

Permeability of the soil is very slow to rapid. The hydrological groups for this site are A and A/D.

Wetland description

Not Applicable

Soil features

This site is represented by the Farrington, Majik, Meehan, Morocco, and Watseka soil series, and by a variant of the Warma soil series. Aquic Quartzipsamments make up 39% of the acreage of this site. Aquic Hapludolls make up 30%, Aquic Udipsamments make up 22%, and Ultic Epiaquods make up 9%.

These soils formed in sandy outwash or sandy alluvium. The sandy deposits are often derived of weathered sandstone and may contain over 95% silica (siliceous sand).
These soils sometimes have loamy or organic surfaces. They typically do not have bedrock contact within 6 feet (2 meters). They are somewhat poorly drained. They do not meet hydric soil requirements. Subsurface fragments smaller than 3inches in diameter (gravel) may occupy up to 21% volume in some sites, especially those sites in the sandy outwash plains along major rivers within this MLRA. Soils are very strongly acid to neutral. They typically lack secondary carbonates.

Figure 7. Meehan tax-adjunct Soil Series sampled on 07/16/2020

Table 4. Representative soil features

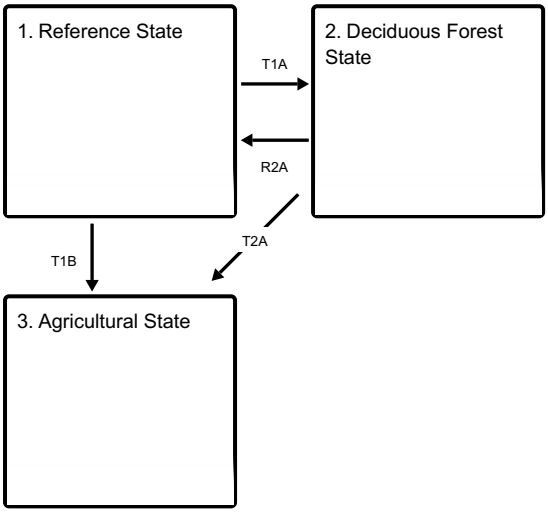
Parent material	(1) Outwash (2) Alluvium
Surface texture	(1) Moderately decomposed plant material (2) Loamy sand (3) Sandy loam
Drainage class	Somewhat poorly drained
Permeability class	Slow to rapid
Soil depth	80–100 in
Surface fragment cover <=3"	0–4%
Surface fragment cover >3"	0%
Available water capacity (0-59.1in)	1.48–2 in
Soil reaction (1:1 water) (0-39.4in)	4.7–7
Subsurface fragment volume <=3" (0-39.4in)	0–21%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

In pre-European settlement time wildfire was the main controlling factor of forest community dynamics. Following a severe, stand-replacing fire, any of the species present on the landscape could become established, depending on seed source availability and specific conditions of post-fire seedbed. The newly established young stands of any species were easily eliminated by recurring fires, but differences in fire-resisting properties among the species began to play a role in any species' survival success. Many pine and oak species were dominant in the region because of their fire-resistant properties and successful regeneration post-fire. With clear cutting and continued fire suppression, many of these species adapted to fire and intolerant of shade, are replaced by other species. Species such as white pine and red oak are still common on the landscape based on their tolerance to some shade; these species to establish under a canopy, and in time, may become a component of the canopy. Red maple is sensitive to fire, but in its absence, it has the ability to dominate sites based on its shade tolerance and prolific seed production. Many sites within this ES may lack White pine as the seed source is still only slowly returning after most of the White pine was logged. In situations where White pine seed source is lacking, Red maple and various oaks will dominate.

State and transition model

Ecosystem states



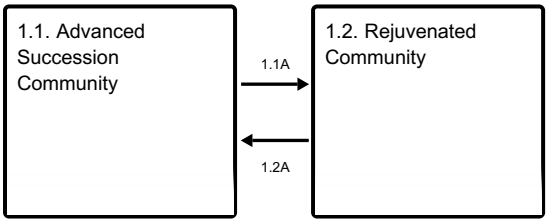
T1A - Stand replacing disturbance that includes fire.

T1B - Removal of forest cover and tilling for agricultural crop production.

R2A - Deciduous forest community is slowly invaded by conifers.

T2A - Removal of forest vegetation and tilling.

State 1 submodel, plant communities



1.1A - Light to moderate intensity fires, blow-downs, snow-ice breakage.

1.2A - Disturbance-free period 30+ years

State 2 submodel, plant communities

2.1. Deciduous Forest Phase

State 3 submodel, plant communities

3.1. Planted Crops

State 1
Reference State

Reference state is a forest community dominated by White pine (*Pinus strobus*) and red maple (*Acer rubrum*), and various oaks (Quercus spp.). Depending on history of disturbance, two community phases can be distinguished largely by differences in dominance of tree species, shrub layer presence and coverage, and community age structure.

Community 1.1
Advanced Succession Community

In the absence of major disturbance—particularly fire—these sites are dominated by a canopy of White pine and Red maple. Red oak (*Quercus rubra*) may be present, but has low coverage and is only able to regenerate in gaps Pin oak (*Quercus ellipsoidalis*) is also likely. The shrub layer is not well developed but likely contains blueberries (Vaccinium, spp.) and Rubus spp. The ground layer is dominated by Canada mayflower (*Maianthemum canadense*).

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red maple (*Acer rubrum*), tree
- oak (*Quercus*), tree
- blueberry (*Vaccinium*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous

Community 1.2
Rejuvenated Community

The canopy of the rejuvenated community is still dominated by original species, but the understory now also includes a well-established younger cohort and perhaps a few additional seedlings and saplings of less shade tolerant species. The shrub layer is more developed in this phase and likely contains Black cherry and chokecherry.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red maple (*Acer rubrum*), tree
- oak (*Quercus*), tree
- black cherry (*Prunus serotina*), shrub
- chokecherry (*Prunus virginiana*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous

Pathway 1.1A

Community 1.1 to 1.2

Light intensity fires, crown breakage from ice and snow and small scale blow-downs create canopy openings, releasing advance regeneration and stimulating new seedling establishment. Some additional less shade tolerant species such as red oak may be able to enter the community.

Pathway 1.2A
Community 1.2 to 1.1

A long period without major canopy disturbance allows gradual replacement of oldest canopy trees by younger cohorts. Small scale disturbances may still occur periodically, but once second or third canopies are established there is minimal new regeneration taking place and the forest gradually returns to mature state.

State 2
Deciduous Forest State

Post disturbance pioneer community of aspen and paper birch with mixtures of other species from available seed sources.

Community 2.1
Deciduous Forest Phase

Pure, or mixed, aspen – paper birch community replaces the reference state community. If seed source is present, red maple and young cohorts of oaks readily become members of this community.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- European white birch (*Betula pendula*), tree
- red maple (*Acer rubrum*), tree
- oak (*Quercus*), tree

- beaked hazelnut (*Corylus cornuta*), shrub
- black cherry (*Prunus serotina*), shrub
- Canada mayflower (*Maianthemum canadense*), other herbaceous

State 3
Agricultural State

Indefinite period of applying agricultural practices. Crops likely include alfalfa, corn, soybeans, and hay or pasture. It is possible that some areas are or have been in ginseng production as well.

Community 3.1
Planted Crops

Indefinite period of applying agricultural practices. Crops likely include alfalfa, corn, soybeans, and hay or pasture.

Transition T1A
State 1 to 2

Stand replacing disturbance that must include fire to create conditions for aspen and paper birch to colonize the site.

Transition T1B
State 1 to 3

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

Restoration pathway R2A
State 2 to 1

Deciduous forest community is slowly invaded by conifers.

Transition T2A
State 2 to 3

Removal of forest cover, tilling and application of other agricultural techniques to grow agricultural crops.

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 of 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, 2/23/2024

Acknowledgments

NRCS contracted UWSP to write ecological sites in MLRA 105. Completed in 2021.

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	05/04/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

   _____

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

   _____

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

   _____

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

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

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
