USDA Natural Resources Conservation Service

Ecological site F091XY003WI
Floodplain

Last updated: 9/27/2023
Accessed: 04/23/2024

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): 091X–Wisconsin and Minnesota Sandy Outwash

The Wisconsin and Minnesota Sandy Outwash MLRA is the most extensive glacial outwash system in the northern half of Wisconsin. The total land area of the Wisconsin portion is just under 1.4 million acres (2,170 sq miles). The northern half is a former spillway for Glacial Lake Duluth. The flowing meltwater from the draining lake has left behind thick deposits of drift and carved a terraced river valley now occupied by the St. Croix and Bois Brule Rivers.

The northeastern section – the Bayfield hills – is a collapsed outwash plain where drift deposits are thick. Lacustrine materials from Glacial Lake Duluth line the northeastern tip. Moving southwest, the landscape transitions into a large pitted outwash plain. This is an area of extensive kettle holes, and, where the underlying till is less permeable, kettle lakes with some interspersed morainic hills and ridges. The glacial drift deposits are thinner in the southwestern section, although there is still no documented surface bedrock within this MLRA.

The St. Croix and Bois Brule rivers share a channel that lines much of the northwestern border of this MLRA. In some places, the underlying reddish-brown sandy loam till of the Copper Falls Formation is exposed along cut riverbanks, though most of it is covered by a mantle of outwash. Glacial lakes deposited pockets of fine-textured lacustrine materials, most of which were washed away or buried by glacial outwash and meltwater flowing through the channel. East of the channel, some of the silty and clayey lakebed deposits are found near the surface, where they impede drainage and contribute to the formation of extensive wetlands.

Historically, the area supported extensive jack pine (Pinus banksiana), scrub, and oak forests and barrens. The northern portion also supported stands of red pine (Pinus resinosa) and eastern white pine (Pinus strobus) as well. Marsh and sedge meadow, wet prairies, and lowland shrubs dominated the extensive wetland complexes in the southern tip of this MLRA (Finley, R., 1976).

Classification relationships

Relationship to Established Framework and Classification Systems:
Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest, Laurentian-Acadian Northern Pine Forest, Laurentian Pine Barrens, Boreal Aspen-Birch Forest, Eastern Boreal Floodplain Shrubland, and Laurentian Oak Barrens

Wetland Forest Habitat Type Classification System for N. Wisconsin (Kotar and Burger, 2017) and Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to three habitat types: *Fraxinus nigra*-Onoclea (FnOn); *Fraxinus nigra*-Abies balsamea-Impatiens (FnAbI); *Acer rubrum*/Vaccinium-*Rubus pubescens* (ArVRp)

WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Floodplain Forest community.

Hierarchical Framework Relationships:
Major Land Resource Area (MLRA): Wisconsin and Minnesota Sandy Outwash (91X)

USFS Subregions: Bayfield Sand Plains (212Ka)
Small sections occur in the Mille Lacs Uplands (212Kb) subregion

Wisconsin DNR Ecological Landscapes: Northwest Lowlands, Northwest Sands

Ecological site concept

The Floodplains ecological site is located throughout MLRA 91X in depressions and flats on floodplains along rivers and streams. These sites are characterized by deep to very deep, poorly to very poorly drained soils that formed in sandy or silty alluvium, primarily along the Saint Croix, Namekagon, Clam, Wood, Trade, Totagatic, and Eau Claire rivers. Some sites are underlain by dense till, clayey lacustrine, or bedrock. Most sites are subject to frequent flooding, and others are subject to ponding during the spring and fall. Stream inflow is the primary source of water but precipitation, runoff from adjacent uplands, and groundwater discharge may also contribute significantly. Some soils remain saturated for long periods in the growing season and meet hydric soil requirements. Soils range from strongly acid to neutral.

Vegetation largely reflects the history of flooding and ponding. Silver maple (Acer sacharinum) and black ash (*Fraxinus nigra*), with understory presence of speckled or tag - alder (Alnus incana or A. rugosa) represent communities that developed following relatively recent ponding periods. Ground-vegetation includes sedges and grasses (Graminae) as well as other high moisture requiring herbs such as sensitive fern (*Onoclea sensibilis*) and jewel weed, or touch-me-not (Impatiens capensis). Communities that have not been impacted by prolonged ponding for a long time, often include the more typically upland species such as basswood (Tilia americana), yellow birch (*Betula alleghaniensis*), ironwood (Ostrya virginiana) and some times even sugar maple (*Acer saccharum*). Understory vegetation is characterized by various species of currants (Ribes spp.), wood nettle (Laportea Canadensis), stinging nettle (Urtica dioica) and large-leaved aster (Eurybia macrophylla), as well as many other, sporadically-occurring upland species.

This ecological site is differentiated from all others by its position on floodplain landforms along streams and rivers. The vegetative communities they support must be tolerant of frequent flooding that may persist for a month. The Terraces ecological site is similar, but it occurs on stream and strath terraces higher on the landscape and farther from the river, where flooding is less frequent.

Table 1. Dominant plant species

Tree	(1) *Acer saccharinum* (2) *Fraxinus nigra*
Shrub	(1) *Alnus incana ssp. rugosa*
Herbaceous	(1) *Ribes* (2) *Onoclea sensibilis*

Physiographic features

Floodplain ecological sites occur in depressions and flats on floodplains. Most sites have slopes ranging from 0 to 3 percent, but a few sites may reach 20 percent. Sites are in footslope or toeslope positions.

Some sites are subject to ponding and the frequency ranges from none to frequent. Ponding duration is long (7 to 30 days), at depths of 0 to 6 inches cm above the soil surface. Most sites are subject to flooding with frequency ranging from none to frequent. The duration of flooding is brief (2 to 7 days) to long (7 to 30 days). Most sites have an apparent seasonally high water table (endosaturation) with depths of 0 to 36 inches below the soil surface. Few sites have a perched seasonally high water table (episaturation) with depths of 6 to 30 inches below the soil surface. The water table can drop to greater than 60 inches during dry conditions.

Table 2. Representative physiographic features

Hillslope profile	(1) Footslope (2) Toeslope

Slope shape across	(1) Concave
Slope shape up-down	(1) Linear
Landforms	(1) Depression (2) Flat (3) Flood plain
Runoff class	Negligible to low
Flooding duration	Long (7 to 30 days)
Flooding frequency	None to frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	590–1,605 ft
Slope	0–20%
Ponding depth	0–6 in
Water table depth	0–36 in
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Wisconsin and Minnesota Sandy Outwash MLRA is typical of northern Wisconsin – colder winters and warmer summers. In general, the northern latitudes have cooler summers, colder winters, lower precipitation, and shorter growing seasons than the south; however, neither average annual precipitation nor average annual minimum and maximum temperatures vary greatly within this MLRA. The climate of the northernmost tip is somewhat affected by Lake Superior and receives higher annual precipitation in the form of lake effect snow.

The Floodplains ecological site sometimes 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	103-116 days
Freeze-free period (characteristic range)	131-140 days
Precipitation total (characteristic range)	29-33 in
Frost-free period (actual range)	99-118 days
Freeze-free period (actual range)	128-141 days
Precipitation total (actual range)	29-33 in
Frost-free period (average)	109 days
Freeze-free period (average)	135 days
Precipitation total (average)	31 in

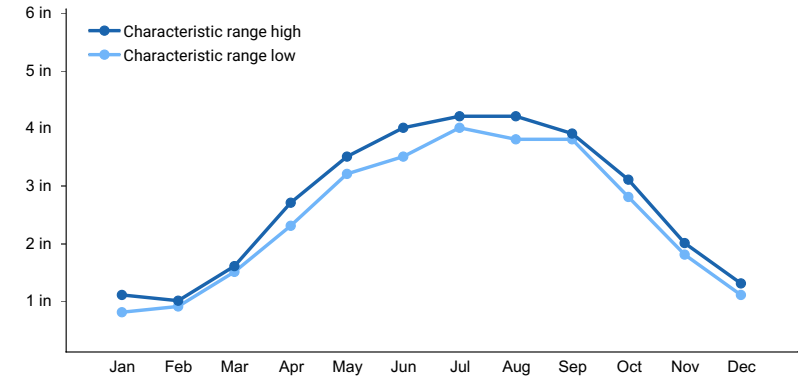


Figure 1. Monthly precipitation range

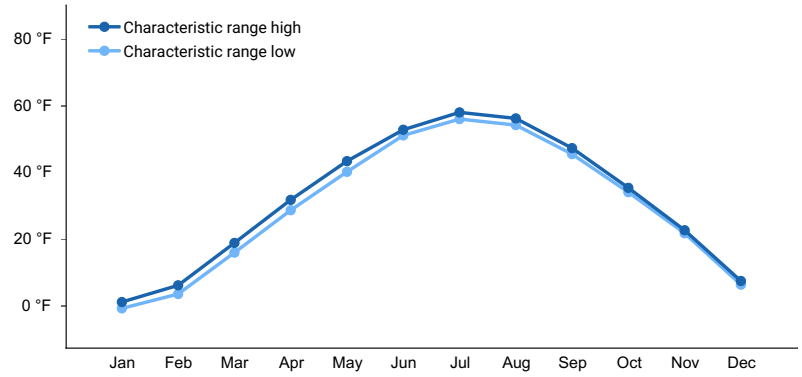


Figure 2. Monthly minimum temperature range

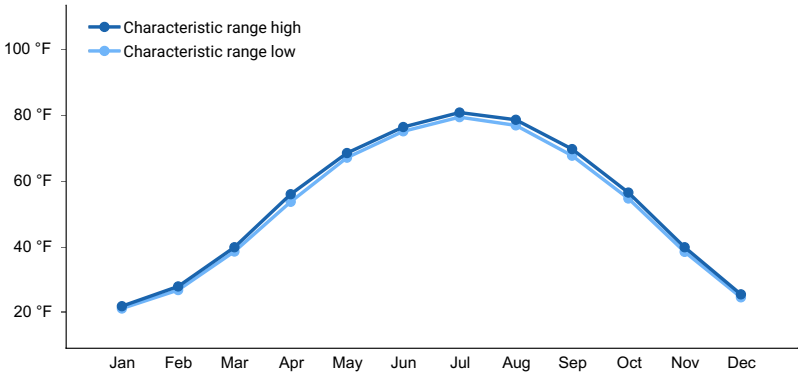


Figure 3. Monthly maximum temperature range

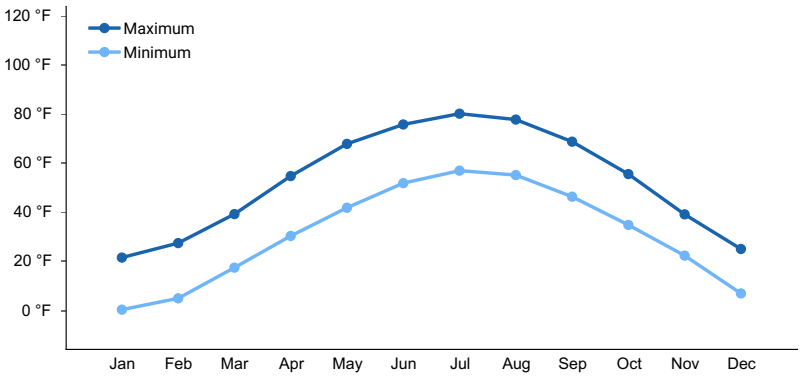


Figure 4. Monthly average minimum and maximum temperature

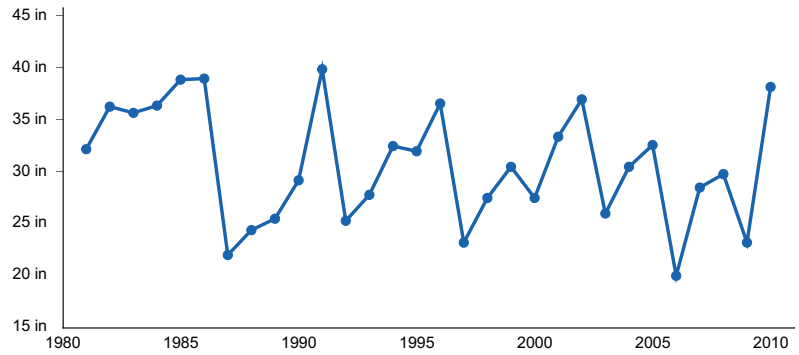


Figure 5. Annual precipitation pattern

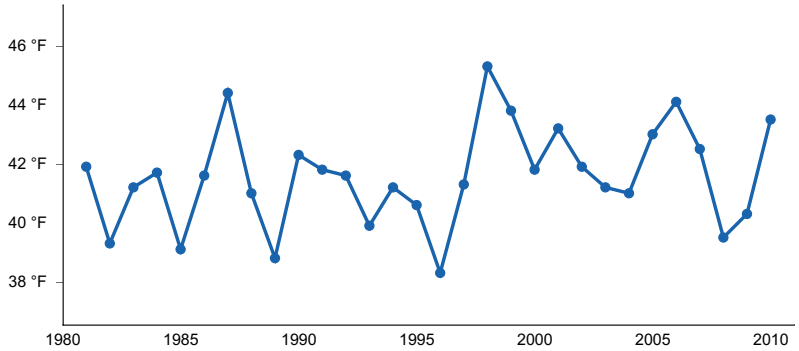


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DANBURY [USC00471978], Danbury, WI
- (2) GRANTSBURG [USW00014995], Grantsburg, WI
- (3) BRULE RS [USC00471131], Brule, WI
- (4) MINONG 5 WSW [USC00475525], Minong, WI

Influencing water features

Water on the Floodplain ecological site 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 is lost from the site primarily through stream outflow, subsurface outflow, evapotranspiration, and groundwater recharge.

Frequent flooding from stream inflow is a significant factor in the ecological development of Floodplain sites. The vegetation must be tolerant of frequent flooding that may persist for a month.

Wetland description

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

Permeability of the soils is very slow to rapid. The hydrologic group of these sites is A, B, A/D, or B/D.

Soil features

Floodplain ecological sites are represented by the Ausable, Clemens, Dairyland, Dechamps, Fordum, Makwa, Rockmarsh, Soderbeck, Skog, Totagatic, and Winterfield soil Series. The Ausable and Makwa series are classified as Histic Humaquepts; Clemens is an Aquic Dystric Eutrudept; Dairyland is a Mollic Oxyaquic Hapludalf; Dechamps is an Aquic Udifluvent; Fordum is a Mollic Fluvaquent; Rockmarsh is an Aquollic Hapludalf; Soderbeck is an Aquic Hapludalf; Skog is an Oxyaquic Udorthent; Totagatic is a Typic Fluvaquent; and Winterfiled is an Aquic Udipsamment.

These soils formed in sandy or silty alluvium. Some sites may have underlying bedrock, dense loamy till, or clayey lacustrine deposits. Most sites are very deep, but soil depth may be as shallow as 55 inches. Soils are primarily somewhat poorly to very poorly drained, but a few sites are moderately well drained. Soils are saturated for some of the year, but most sites do not meet hydric soil requirements. (Sites with Ausable, Fordum, and Totagatic soil series do meet hydric soil requirements.)

Surface textures are primarily loamy sand and sandy loams. Some sites have fragments at the surface. Other sites have muck (saturated) or moderately to highly decomposed plant material (unsaturated) at the surface. Subsurface textures are sand, loamy sand, sandy loam, and silt loam. Soil pH ranges from strongly acid to neutral with values of 5.3 to 7.0. Carbonates are absent on most sties, but may be present up to 3 percent beginning at 3 inches.

Figure 7. Fordum Soil Series sample taken in Burnett Count, WI on 07/23/2019. Courtesy of UWSP

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Till (3) Lacustrine deposits
Surface texture	(1) Mucky peat (2) Loam (3) Loamy sand (4) Silt loam (5) Highly decomposed plant material
Drainage class	Moderately well drained to very poorly drained
Permeability class	Very slow to rapid
Soil depth	55–80 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–22%
Available water capacity (0-60in)	2.67–7.48 in
Calcium carbonate equivalent (0-40in)	0–3%

Soil reaction (1:1 water) (0-40in)	5.3–7
Subsurface fragment volume <=3" (0-40in)	0–55%
Subsurface fragment volume >3" (0-40in)	0–27%

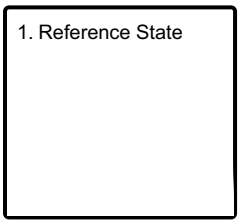
Ecological dynamics

Because the Floodplain 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 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. Black ash (*Fraxinus nigra*) has similar ecological properties. Species that become established in periods without major flooding, or ponding are swamp white oak (*Quercus bicolor*), white oak (*Q. alba*), yellow birch (*Betula alleghaniensis*) and even such typically upland species as basswood (Tilia Americana) and sugar maple (*Acer saccharum*). It appears that very long periods without ponding lead this site type to develop into a mesic, nutrient rich ASaI (*Acer saccharum*-Sanicua – Impatiens) Forest Habitat Type, (Kotar and Burger, 2002). However, presence of basswood and sugar maple also heavily depends on existence of local seed sources.

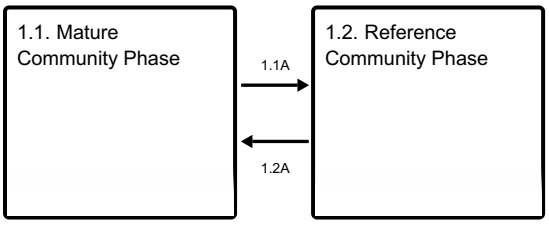
On sandier inclusions within this site type, community characteristics approach those of ArVRp (*Acer rubrum*/Vaccinium spp. – *Rubus pubescens*) Habitat Type. In addition to red maple, commonly present are swamp white oak (*Q. bicolor*), bur oak (*Q. macrocarpa*) or red oak (*Q. rubra*). Prolonged ponding may eliminate, or reduce the presence of these species and trigger another developmental cycle, beginning with colonization of the site by silver maple.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1A - Prolonged ponding, or fresh sediment deposition.

1.2A - Very long period without prolonged ponding.

State 1
Reference State

Because of significant variation in frequency and duration of flooding, this Ecological Site is characterized by two well defined community phases and many transitional phases between the two.

Community 1.1
Mature Community Phase

Figure 8. Photo courtesy of UWSP taken on 07/23/2019 in Burnett County, WI.

This community develops on higher topographic positions within the floodplain, where prolonged ponding is not common and many upland forest species can become established. In addition to commonly present black ash and red maple, these communities may include yellow birch, ironwood, swamp-white oak, bur oak, basswood and, under most favorable conditions, also sugar maple. The shrub layer may be well developed or sparse, but species diversity can be high. Most commonly present species include speckled alder (alnus incana), winterberry (Ilex verticilata), currants (Ribes spp.), prickly ash (*Zanthoxylum americanum*), choke cherry (*Prunus virginiana*), musclewod (Carpinus carliniana) and mountain ash (*Sorbus americana*). Best represented herbs are sedges and grasses (Gramineae), sensitive fern (*Onoclea sensibilis*) and several species of true and false nettles (Laportea spp,. Boehmeria spp., Urtica spp.).

Dominant plant species

- black ash (*Fraxinus nigra*), tree
- red maple (*Acer rubrum*), tree
- speckled alder (*Alnus incana ssp. rugosa*), shrub
- common winterberry (*Ilex verticillata*), shrub
- currant (*Ribes*), shrub
- common pricklyash (*Zanthoxylum americanum*), shrub
- western chokecherry (*Prunus virginiana var. demissa*), shrub
- American mountain ash (*Sorbus americana*), shrub
- sensitive fern (*Onoclea sensibilis*), other herbaceous

Community 1.2
Reference Community Phase

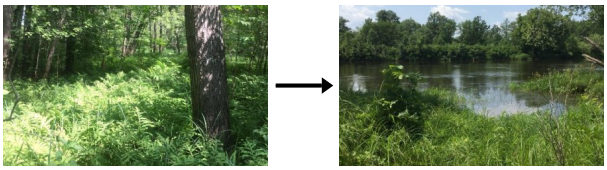
Figure 9. Community 1.2 image taken on 07/13/2019. Courtesy of UWSP

This Community Phase is dominated by species that became established immediately following major flooding and ponding periods. It was chosen as the Reference Community Phase because it is more widely distributed across the Ecological Site than is the Mature Phase and is consistently dominated by the two most characteristic tree species, silver maple and black ash. The shrub layer is more strongly dominated by speckled alder than it is on the Mature Community Phase, while prickly ash is more common on the latter. The herb layer is dominated by grasses and sedges, often with abundant coverage of many fern species, most notably the sensitive fern and false nettle (Laportea Canadensis).

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- black ash (*Fraxinus nigra*), tree
- speckled alder (*Alnus incana ssp. rugosa*), shrub
- Canadian woodnettle (*Laportea canadensis*), other herbaceous
- sensitive fern (*Onoclea sensibilis*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2



Mature Community Phase **Reference Community Phase**

Prolonged ponding and deposition of fresh sediment often results in mortality in the tree layer, particularly among the upland species that might have become established during long ponding-free periods. This event again creates conditions best suited to silver maple, black ash and other woody species with ecological adaptations to ponding.

Pathway 1.2A
Community 1.2 to 1.1

Reference Community Phase | Mature Community Phase

A drop in water table and long periods without flooding and ponding create conditions favorable to many upland species, both woody and herbaceous. Availability of seed sources becomes a major factor in the development of species composition and structure of maturing plant communities.

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

Acknowledgments

NRCS contracted UWSP to write ecological sites in MLRA 91, 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	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:**

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

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

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

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

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

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

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

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

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

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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:

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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:**