Ecological site F092XY002WI
Mucky Swamps

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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): 092X–Superior Lake Plain

The Wisconsin portion of the Superior Lake Plain (MLRA 92) corresponds very closely to the Superior Coastal Plain Ecological Landscape published by Wisconsin Department of Natural Resources (WDNR 2015). The following brief overview of this MLRA is borrowed from that publication.

The Superior Coastal Plain is bordered on the north by Lake Superior and on the south by the Northwest Sands, Northwest Lowlands, and North Central Forest Ecological Landscapes. The total land area is approximately 1.2 million acres, which mostly consists of privately-owned forestland. The climate is strongly influenced by Lake Superior, resulting in cooler summers, warmer winters, and greater precipitation compared to more inland locations. The most extensive landform in this ecological landscape is a nearly level plain of lacustrine clays that slopes gently northward toward Lake Superior. The coastal plain is cut by deeply incised stream drainages and interrupted by the comparatively rugged Bayfield Peninsula.

During the Late Wisconsin glacial period, this area was covered with the advancing and retreating lobes of Superior and Chippewa. The landscape was rippled with moraines, but they were subdued by deposition of lacustrine materials. As the glaciers receded, glacial lakes riddled the landscape—most notably, Glacial Lake Duluth. The glacier receded eastward, exposing the western Lake Superior Basin. The ice covered the eastern basin, blocking the outlet of the lake, and continued to recede and contribute meltwaters that filled the glacial lake. The deep, red clays were deposited during this period of glacial lakes. The meltwaters from the glacier also contained sands which were deposited along the edge of the glacial lakes as beach deposits. Deep, narrow valleys have since been carved by rivers and streams flowing north into Lake Superior.

Historically, the Superior Coastal Plain was almost entirely forested. Various mixtures of eastern white pine (Pinus strobus), white spruce (Picea glauca), balsam fir (Abies balsamea), white birch (Betula papyrifera), balsam poplar (Populus balsamifera), quaking aspen (Populus tremuloides), and northern white-cedar (Thuja occidentalis) occurred on the fine-textured glacio-lacustrine deposits bordering much of the Lake Superior coast. Sandy soils, sometimes interlayered with clays, occur in some places. Such areas supported forests dominated by eastern white pine and red pine (Pinus resinosa). Eastern white pine was strongly dominant in some areas, according to mid-19th century notes left by surveyors of the federal General Land Office (Finley, R. 1976). Dry-mesic to wet-mesic northern hardwoods or hemlock-hardwood forests were prevalent on the glacial tills of the Bayfield Peninsula. Large peatlands occurred along the Lake Superior shoreline, associated with drowned river mouths.

Classification relationships

Habitat Types of N. Wisconsin (Kotar, 2002): This ES keys out to Fraxinus nigra – Abies balsamea / Impatiens capensis, [FnAbI] but some sites are not well represented by this Habitat Type as they are more open sedge-meadow than forested wetland.

Biophysical Setting (Landfire, 2014): This ES is mapped as Eastern Boreal Floodplain, Boreal Acidic Peatland

System, and Laurentian – Acadian Alkaline Conifer – Hardwood Swamp.

Biophysical Setting (Landfire, 2014): Laurentian – Acadian Shrub-Herbaceous Wetland Systems.

WDNR Natural Communities (WDNR, 2015): This ES is most similar to Northern Sedge Meadow.

USFS Subregions: Superior-Ashland Clay Plain Subsection (212Ya); May contain small areas of Ewen Dissected Lake Plain Subsection (212Jo), Winegar Moraines Subsection (212Jc), Gogebic-Penokee Iron Range Subsection (212Jb), and NorthShore Highlands Subsection (212Lb)*

Major Land Resource Area (MLRA): Superior Lake Plain (92)

Ecological site concept

Mucky Swamps ES occur mostly in the eastern half of MLRA 92, with some sites located up in the Apostle Islands. This ES consists of saprist soils that have formed in deep organic materials in depressions in outwash plains, lake plains, and moraines. The organic materials range in their depth to mineral soil from 40 - >200cm and were formed from both herbaceous and woody origin. They are underlain by sandy to loamy glacial deposits. All the sites are poorly to very poorly drained and remain saturated throughout the year. These are classified as hydric soils. These sites receive water primarily through precipitation, runoff from adjacent uplands, and groundwater discharge. The groundwater flowing through the adjacent upland soils may be high in minerals and influence the organic deposit. The source of groundwater causes the soils to range from slightly acidic to slightly alkaline; those sites with a stronger influence of mineral-filled groundwater are likely to be more alkaline. This ES differs from Peaty Shore Fens in that these sites are underlain by loamy or sandy materials and were formed with some woody origin. Peaty Shore Fens is often surrounded by upland soils that are coarse and sandy, causing the groundwater to be slightly acidic; therefore, Peaty Shore Fens is often more acidic than Mucky Swamps. Peaty Shore Fens was formed primarily from herbaceous origin and is partially decomposed; whereas, Mucky Swamps is highly decomposed. Typical vegetation includes black ash, red maple, and balsam fir. Other vegetation includes tag alder and sedges when flooding or ponding is more frequent or prolonged.

Associated sites

F092XY012WI	**Moist Clayey Lowlands** These sites are somewhat poorly drained soils with fine textures that formed in clayey deposits. Some sites have a sandy or loamy mantle. The fine materials cause episaturation in spring and fall and remain saturated for extended period, but the water table can reach depths of 152cm during dry periods. Soils range from strongly acid to strongly alkaline. Carbonates present in some soils beginning at 30cm. These sites are higher up in the drainage sequence than Mucky Swamps.
F092XY015WI	**Clayey Uplands** These sites are deep, moderately well to well drained soils that formed in clayey till or glaciolacustrine deposits. Some sites have a sandy or loamy mantle. Sites have a seasonally high water table, but does not remain saturated for extended periods. Sites range from strongly acid to moderately alkaline, with carbonates present in many sites. These sites are at the top of the drainage sequence of Mucky Swamps.
F092XY007WI	**Wet Loamy or Clayey Lowlands** These sites are poorly to very poorly drained soils that formed in mainly clayey deposits. Some sites may have a sandy or loamy mantle overlying a clayey deposit. Soils remain saturated throughout the year and frequently experience ponding and flooding in the spring and fall. Water table rarely drops below 30cm in drought conditions. HGM criteria: recharge, Depressional. Most sites have apparent carbonates, and pH ranges from strongly acid to moderately alkaline. This site is often directly adjacent to Mucky Swamps, and is the next step up in the drainage sequence.

Similar sites

F092XY003WI	**Peaty Shore Fens** These sites are composed of deep, permanently saturated, partially decomposed herbaceous organic material. They are fens on active shore complexes of Lake Superior and are influenced by water levels and wave action. The depth of organic materials is greater than 200cm, and lack lithic contact. Sites are slightly acidic. These sites are similar to Mucky Swamps in that they are permanently saturated wetlands. They differ quite greatly in that these sites are more acidic, are influenced directly by lake water levels and wave action, and lack a mineral substratum within 200cm.

Table 1. Dominant plant species

Tree	(1) *Fraxinus nigra* (2) *Abies balsamea*
Shrub	Not specified
Herbaceous	(1) *Impatiens capensis* (2) *Carex*

Physiographic features

This site occurs in open depressions, floodplain oxbows and depressions, and drainageways located on till plains, lake plains, and outwash plains. Landform shape is concave to linear. Elevation of the landforms range from 185 to 330 meters above sea level. Slopes are 0 to 1 percent.

Table 2. Representative physiographic features

Landforms	(1) Till plain > Drainageway (2) Lake plain > Depression
Runoff class	Negligible
Flooding frequency	None to frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Elevation	607–1,083 ft
Slope	0–1%
Ponding depth	0–15 in
Aspect	Aspect is not a significant factor

Climatic features

The Mucky Swamps PESD has a wide geographic spread throughout the MLRA, so the climatic ranges can be large. The annual average precipitation is 29-31 inches, with an average snowfall of 56-167 inches (PRISM, 1981-2010). The annual average minimum temperatures range from 29-33oF, and the annual average maximum ranges from 46-52oF (PRISM, 1981-2010). The length of the freeze-free period ranges from 156 to 197, with an average of 171 days (Table 2). The length of the frost-free period ranges from 130 to 169, with an average of 144 days (Table 2). Since Mucky Swamps sites tend to occur in depressions and remain wet for most or all of the year, they likely remain cooler and wetter than adjacent upland PESDs. The data gathered from PRISM and NOAA weather stations may not fully represent the very local weather to this PESD, as it may have a shorter freeze-free period, and different annual average maximum and minimum temperatures than what is presented.

Table 3. Representative climatic features

Frost-free period (characteristic range)	80-108 days
Freeze-free period (characteristic range)	116-133 days
Precipitation total (characteristic range)	31 in
Frost-free period (actual range)	69-113 days
Freeze-free period (actual range)	107-137 days

Precipitation total (actual range)	30-33 in
Frost-free period (average)	94 days
Freeze-free period (average)	125 days
Precipitation total (average)	31 in

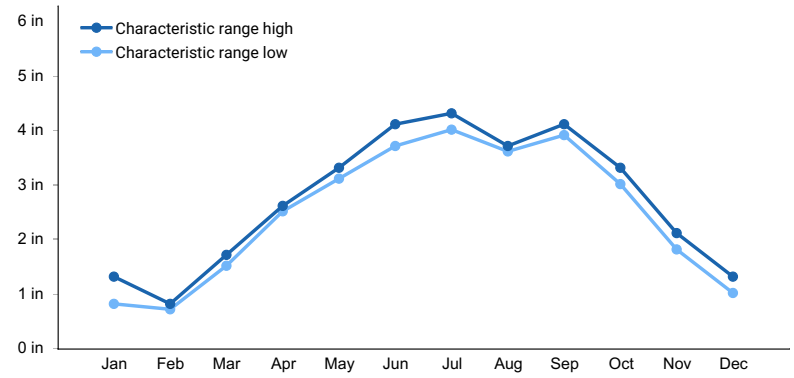


Figure 1. Monthly precipitation range

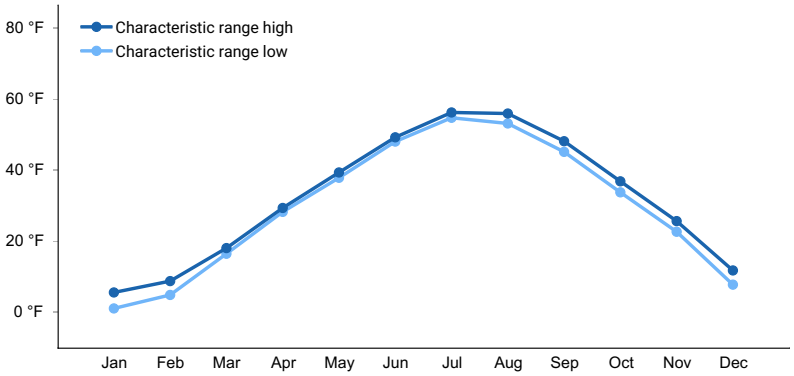


Figure 2. Monthly minimum temperature range

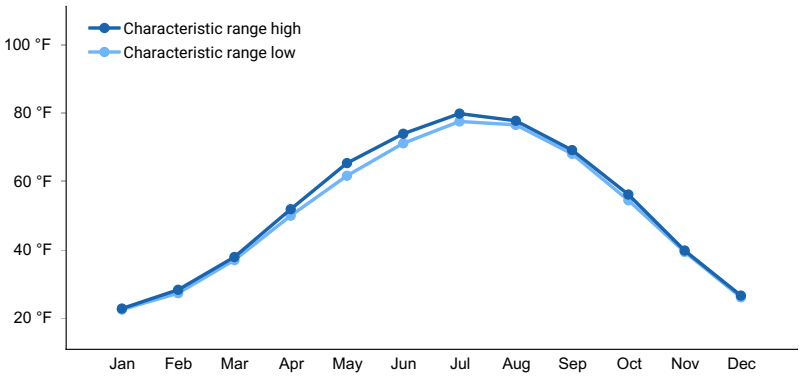


Figure 3. Monthly maximum temperature range

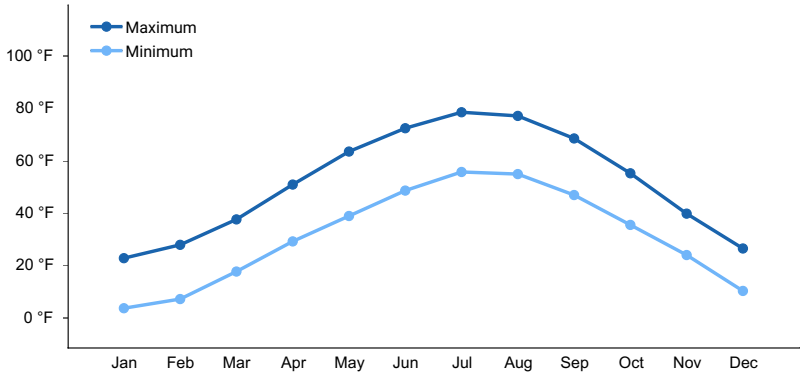


Figure 4. Monthly average minimum and maximum temperature

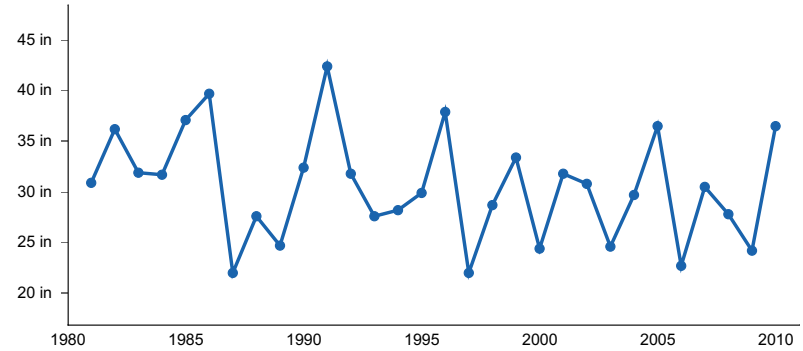


Figure 5. Annual precipitation pattern

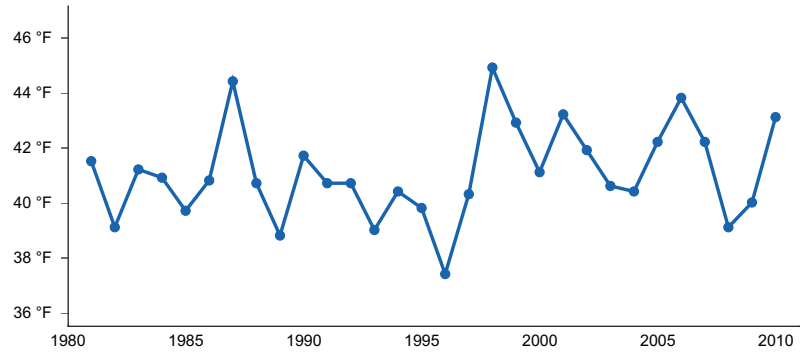


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SUPERIOR [USC00478349], Superior, WI
- (2) FOXBORO [USC00472889], Foxboro, WI
- (3) MADELINE ISLAND [USC00474953], La Pointe, WI
- (4) ASHLAND EXP FARM [USC00470349], Ashland, WI
- (5) ASHLAND KENNEDY MEM AP [USW00094929], Ashland, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, stream inflow (when site occurs on a floodplain), and ground water discharge. Water is lost from the site primarily through evapotranspiration, stream outflow, subsurface outflow, and ground water recharge. These sites are wetlands.

Permeability of the soil is slow. Runoff is negligible. The hydrologic group of this site is A/D.

These sites are subject to occasional to frequent ponding for brief to long periods during the spring and fall with water depths up to 15 cm above the surface. Typically these sites do not flood. The soil has an apparent seasonally high water table (endosaturation) that is at a depth of 0 cm throughout the year. Water within the soil is generally

lost through subsurface outflow, along with plant uptake and evapotranspiration. There is a very high potential for significant ground water recharge.

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, forested, needle-leaved evergreen, saturated, or
3) Palustrine, scrub-shrub, broad-leaved deciduous, saturated.
Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:
1) Depressional, forested/organic, or
2) Depressional, scrub-shrub/organic.

Hydrologic Group: A/D
Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic
Cowardin Wetland Classification: PFO1B, PFO4B, PSS1B

Soil features

The soils of this site are represented by the Lupton, Cathro, and Tawas soil series. These soils are classified as Haplosaprists. Some sites the soils are simply referred to, and classified as, Saprists with no soil series attached.

This ecological site is characterized by very deep, very poorly drained soils formed in highly decomposed organic deposits. The muck is of both herbaceous and woody origin. The muck is very deep to any mineral deposits (Lupton and Saprists), or is moderately deep to either loamy deposits (Cathro and Saprists) or sandy deposits (Tawas and Saprists). These soils formed under saturated conditions throughout most of the year and meet the criteria for hydric soils.

Gravel, cobbles, and stones are typically absent. Soil reaction (pH) in the upper 100 cm is slightly acid to slightly alkaline. Carbonates are absent within 200 cm.

Table 4. Representative soil features

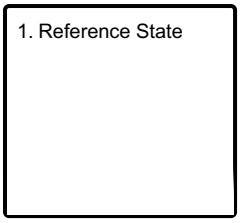
Parent material	(1) Organic material
Surface texture	(1) Mucky
Drainage class	Very poorly drained
Permeability class	Slow
Soil depth	80 in
Available water capacity (0-60in)	12.94–15.75 in
Soil reaction (1:1 water) (0-40in)	5.9–7.6

Ecological dynamics

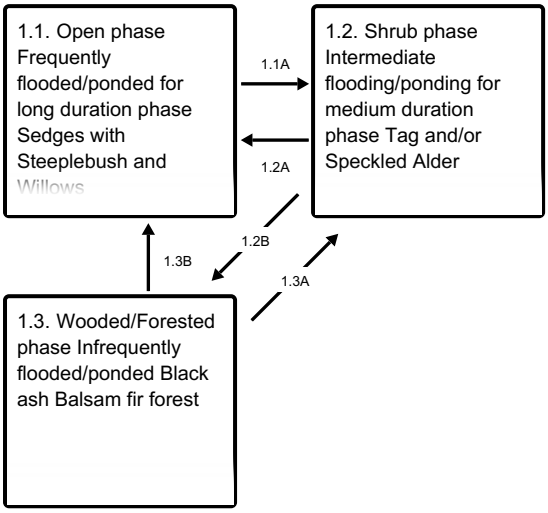
This ES can be characterized as a hydroperiod influenced ecosystem with vegetation ranging from northern wet meadow to northern shrub thicket to Black ash/Balsam fir forest. Frequency and duration of flooding/ponding is the main driver as to which of these states will be achieved and maintained.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1A - Flooding frequency and duration decreases

1.2A - Flooding frequency and duration increases

1.2B - Very infrequent flooding

1.3B - Flooding frequency and duration increases dramatically

1.3A - Flooding frequency and duration increases moderately

State 1
Reference State

Reference State is a continuum of hydroperiod influenced vegetation where flooding frequency and duration drive vegetation communities. There are three distinct phases, each being stable within a window of hydroperiod variation. Sites on or near floodplains are most likely to be in phases 1.1 and 1.2 while sites farther from streams are more likely to be in phase 1.3. The higher the frequency and more prolonged the wetness the more likely the site will be a northern wet meadow 1.1 (dominantly sedges with sporadic willows and steeplebush). As wetness frequency and duration decreases the site will become a northern shrub thicket 1.2 and speckled alder (and tag alder) will appear and begin to dominate the vegetation. If a site has very low frequency flooding/ponding that is of short duration a Black ash/Balsam fir forest will likely form 1.3. This forested state can be described by the Kotar Wetland Forest Habitat Type Black ash-Balsam fir/Spotted Touch-me-not [FnAbI]. In some cases this forest will also include White cedar an associate, but deer browsing has limited the regeneration of this species in this MLRA.

Community 1.1
Open phase Frequently flooded/ponded for long duration phase Sedges with Steeplebush and Willows

With frequent flooding and long durations of inundation this ES will exhibit as a northern wet meadow. The vegetation will be dominated by sedges and grasses with sporadic willows and steeplebush present. Willows can be quite extensive in these sites at times. As long as the hydroperiod is consistent this is a stable state.

Community 1.2
Shrub phase Intermediate flooding/ponding for medium duration phase Tag and/or Speckled Alder

With moderate frequency of flooding with out very long durations of inundation a shrub thicket will form on these sites. The composition of the shrubs on these sites is often dominated by Tag and/or Speckled alder but willow may occur as well. As long as the hydroperiod is consistent this is a stable state.

Community 1.3
Wooded/Forested phase Infrequently flooded/ponded Black ash Balsam fir forest

In the absence of frequent long duration flooding a wet forest community composed of Black ash and Balsam fir will dominate these sites. Common associates may include Red maple, American elm, and White cedar. Reproduction of Black ash is often very successful in these stands. A shrub layer may be present in this community phase as well. The shrub layer is often composed of Tag alder and Winterberry. Understory plant communities may be composed of many different species including sedges, grasses, and ferns. Dwarf raspberry and Touch-me-not are commonly present and skunk cabbage may be present if there is moving water (small streams). As long as flooding frequency and duration remain low this is a stable state.

Pathway 1.1A
Community 1.1 to 1.2

This transition represents a decrease in hydroperiod where flooding frequency and duration decrease enough for Tag alder and Speckled alder to establish in what was previously open sedges with Steeplebush, and a few isolated Willows.

Pathway 1.2A
Community 1.2 to 1.1

This transition represents an increase in the hydroperiod where flooding frequency and duration increase enough for Sedges to out compete Tag alder and Speckled alder. This could be done as a restoration effort if hydroperiod is controllable or the stream channel is made narrower causing increased frequency of flooding.

Pathway 1.2B
Community 1.2 to 1.3

Shrub phase Intermediate flooding/ponding for medium duration phase Tag and/or Speckled Alder

Wooded/Forested phase Infrequently flooded/ponded Black ash Balsam fir forest

This transition represents a decrease in hydroperiod where flooding frequency and duration decrease enough for Black ash and Balsam fir to establish and out compete Tag alder and Speckled alder. This ecosystem is stable with very infrequent and/or short duration flooding. Understory species will shift to Impatiens spp., sedges, and sometimes skunk cabbage. Sites where there is little deer browse may include White cedar as an associate.

Pathway 1.3B
Community 1.3 to 1.1

This transition represents a dramatic increase in the hydroperiod where flooding frequency and duration increase enough for Sedges to out compete Black ash and Balsam fir. This could be done as a restoration effort if hydroperiod is controllable or the stream channel is made narrower causing increased frequency of flooding.

Pathway 1.3A
Community 1.3 to 1.2

Wooded/Forested phase Infrequently flooded/ponded Black ash Balsam fir forest

Shrub phase Intermediate flooding/ponding for medium duration phase Tag and/or Speckled Alder

This transition represents an increase in the hydroperiod where flooding frequency and duration increase enough for Tag alder and Speckled alder to outcompete Black ash and Balsam fir.

Additional community tables

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Approval

Chris Tecklenburg, 4/08/2020

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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	11/13/2024
Approved by	Chris Tecklenburg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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):**

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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:**