USDA Natural Resources Conservation Service

Ecological site F090AY003WI
Sandy Floodplain

Last updated: 10/02/2023
Accessed: 04/27/2024

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): 090A–Wisconsin and Minnesota Thin Loess and Till

MLRA 90A is part of the recently glaciated till and outwash plains of central Minnesota and northern Wisconsin. The area was covered with loamy alluvium or loess after glaciation. It is in Wisconsin (56 percent), Minnesota (40 percent), and Michigan (4 percent). It makes up about 21,967 square miles (56,901 square kilometers).

This MLRA has distinct boundaries to the north where it borders tills of a dissimilar origin on the less morainic landscapes of MLRAs 88, 92, and 93A. The boundary to the west is where the MLRA transitions to the calcareous tills of the Des Moines Lobe, in MLRA 57. To the south, MLRA 90A borders MLRA 90B, which has older soils and better-defined drainage patterns, and MLRA 91, which has the distinct lower landscape relief of an outwash channel.

The part of this area in Minnesota is mostly in the Western Lake section of the Central Lowland province of the Interior Plains. Nearly all the parts in Wisconsin and Michigan are in the Superior Upland province of the Laurentian Upland. Four distinct lobes of the Laurentide Ice Sheet (Rainy, Superior, Chippewa, and Green Bay) played major roles in shaping the landscape in this area. The landscape is characterized by gently undulating to rolling, loess-mantled till plains, drumlin fields, and end moraines mixed with outwash plains associated with major glacial drainageways, swamps, bogs, and fens. In some areas lake plains and ice-walled lakes are significant. Steeper areas occur mostly as valley side slopes along flood plains and as escarpments along the margins of lakes.

Lakes, ponds, and marshes are common throughout the area, and streams generally have a dendritic pattern. The major rivers in this area are the Chippewa, St. Croix, Mississippi, and Wisconsin Rivers. Elevation ranges from 1,100 to 1,950 feet (335 to 595 meters). Local relief is mainly less than 10 feet to 20 feet (3 to 6 meters), but some major valleys and hills are 200 feet (60 meters) above the adjacent lowland.

Precambrian-age bedrock underlies most of the glacial deposits in this MLRA. The bedrock is a complex of folded and faulted igneous and metamorphic rocks. The bedrock terrain has been modified by glaciation and is covered in most areas by Pleistocene deposits and windblown silts. The glacial deposits form an almost continuous cover in most areas. The drift is several hundred feet thick in many areas. Loess covered the area shortly after the glacial ice melted.

Ground water is abundant in deep glacial deposits in most of this area. It also occurs in sedimentary and volcanic rock in the western part of the area. It is scarce where the layer of drift is thin. The water meets the domestic, agricultural, municipal, industrial, rural, and irrigation needs of the area. The content of dissolved solids in the ground water from all the various aquifers in this area is low, and the water generally is moderately hard or hard. The level of total dissolved solids in some of the water can be much higher because of a high content of limestone in some of the glacial deposits. Most of this area obtains ground water from unconsolidated glacial sand and gravel deposits on or very near the surface. Some wells tap the Cambrian sandstone in the southwestern part of the area, in Wisconsin.

In northwest Wisconsin (Ashland and Bayfield Counties) where there are no glacial deposits and in much of the part of this area in Minnesota, ground water from sedimentary and volcanic rock aquifers is used. This water is of very good quality; however, many soils have very porous layers that are poor filters of domestic waste and agricultural chemicals, so there is a risk of contamination from development and agriculture. Minor water concerns are hardness and, in some areas, high concentrations of iron. Yields of water from the glacial deposits vary.

The dominant soil orders are Alfisols, Entisols, Histosols, and Spodosols. The soils in the area have a frigid temperature regime, a udic or aquic moisture regime, and mixed mineralogy.

This area has a significant acreage of public and private forestland used to support the paper and lumber industry Sap collection from sugar maple and syrup production are important forestry enterprises. Agricultural enterprises include row crops, dairy farms, and beef operations. Crops include corn, soybeans, oats, wheat, and alfalfa. Tourism, recreation, and wildlife management are important. Hunting, fishing, snowmobiling, hiking, and skiing are popular activities because of the area's abundance of water, the many acres of national and county forests, and public hunting grounds. (United States Department of Agriculture, Natural Resources Conservation Service, 2022)

Classification relationships

Major Land Resource Area (MLRA 90A): Wisconsin and Minnesota Thin Loess and Till

USFS Subregions: Rib Mountain Rolling Ridges (212Qd), Lincoln Formation Till Plain - Hemlock Hardwoods (212Qc)

Wisconsin DNR Ecological Landscapes: Forest Transition

Ecological site concept

The Sandy Floodplain ecological site is an uncommon site in MLRA 90A, located on floodplains primarily along the Wisconsin and Big Rib, Big Eau Pleine rivers which occupy valleys filled with sandy outwash deposits. These sites are characterized by very deep, poorly to somewhat poorly drained soils that formed primarily in sandy alluvium. Sites are subject to frequent flooding in spring and fall, some sites are subject to ponding. Soils remain saturated for long duration during growing season and some sites meet hydric soil requirements. Stream inflow, precipitation, runoff from adjacent uplands, and groundwater discharge are the primary sources of water. Soils range from strongly acid to neutral.

The characteristic traits of Sandy Floodplains site are their sandy textures and their location on a floodplain. Vegetation must be tolerant of frequent floods. Sandy Floodplains lack carbonates and have a lower pH and available water capacity than their loamy counterparts.

Similar sites

F090AY005WI	**Wet Sandy Lowland** Wet Sandy Lowland consist of deep sandy deposits derived from a mixture of outwash, alluvium, and lacustrine sources. They form in seasonally ponded depressions and are saturated long enough for hydric conditions to occur. Some sites are wetlands. They support similar vegetative communities as Sandy Floodplains.
F090AY004WI	**Loamy Floodplain** Loamy Floodplain are found exclusively on floodplains in loamy alluvium, sometimes underlain by sandy alluvium. Soils are very poorly to moderately well drained and are subject to flooding. Some sites may be saturated for long enough for hydric conditions to occur. They are found in similar landscape positions as Sandy Floodplains but have finer textures.
F090AY002WI	**Mucky Swamp** Mucky Swamp sites consist of deep, highly decomposed herbaceous organic materials. Some sites have mineral soil contact. They are very poorly drained and are neutral to slightly acid. These sites are permanently saturated wetlands. Some of the vegetative communities supported by Organic Nonacid sites may also be found on Sandy Floodplains.

Table 1. Dominant plant species

Tree	(1) *Acer rubrum* (2) *Fraxinus americana*
Shrub	Not specified
Herbaceous	(1) *Parthenocissus quinquefolia* (2) *Thalictrum*

Physiographic features

This site occurs in floodplains. These sites are subject to rare to frequent flooding. Runoff is negligible to high.

Table 2. Representative physiographic features

Slope shape across	(1) Linear
Slope shape up-down	(1) Linear
Landforms	(1) Flood plain
Runoff class	Negligible to high
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	555–905 ft
Slope	0–2%
Ponding depth	0–6 in
Water table depth	0–20 in
Aspect	Aspect is not a significant factor

Climatic features

The climate of the expansive Wisconsin and Minnesota Thin Loess and Till Plain is highly variable. The eco-climatic zone (the “Tension Zone”) that runs southeast-northwest across the state splits the MLRA. In general, the MLRA has cold winters and warm summers with an adequate amount of precipitation. Near Lake Superior, precipitation and temperature tend to increase. The far western section of the MLRA, known as the western prairie ecological landscape by the Wisconsin DNR, has warmer temperatures compared to the rest of the MLRA because it falls below the eco-climatic zone. The soil moisture regime of MLRA is udic (humid climate). The soil temperature regime is frigid and cryic.

The average annual precipitation for this site is 32 inches. The average annual snowfall is 52 inches. The annual average maximum and minimum temperatures are 54°F and 34°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	78-97 days
Freeze-free period (characteristic range)	117-134 days
Precipitation total (characteristic range)	30-33 in
Frost-free period (actual range)	60-110 days
Freeze-free period (actual range)	102-137 days
Precipitation total (actual range)	27-33 in
Frost-free period (average)	89 days
Freeze-free period (average)	124 days

Precipitation total (average)	31 in

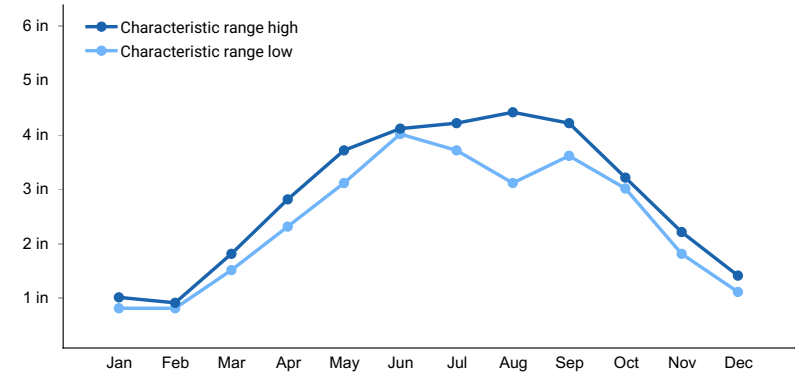


Figure 1. Monthly precipitation range

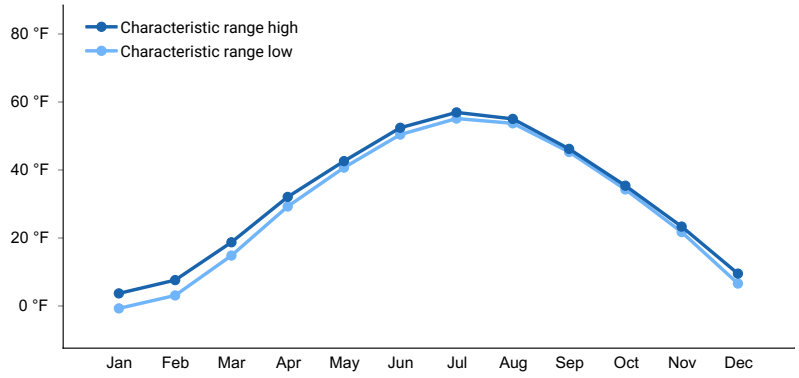


Figure 2. Monthly minimum temperature range

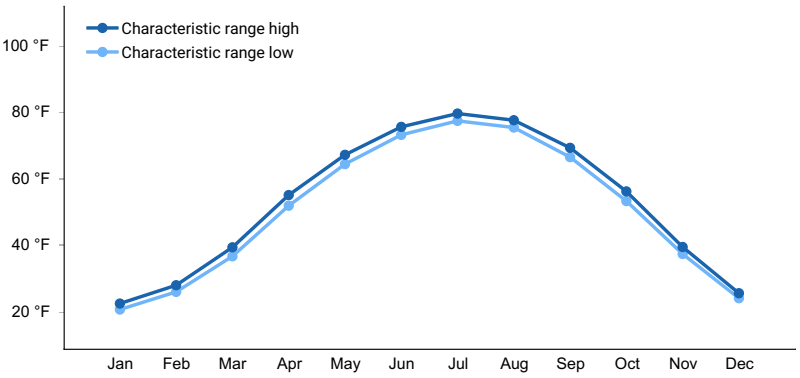


Figure 3. Monthly maximum temperature range

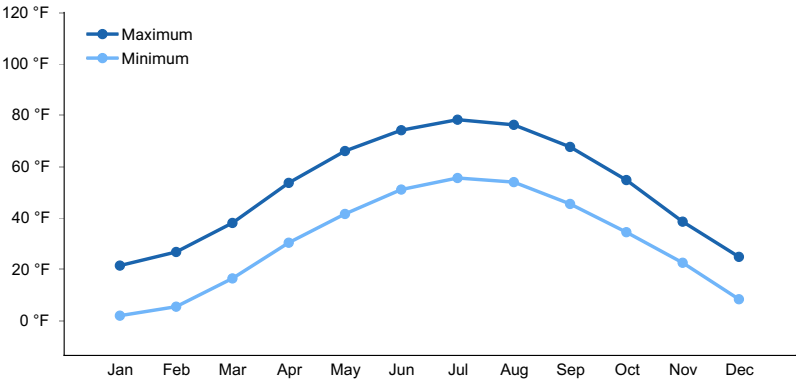


Figure 4. Monthly average minimum and maximum temperature

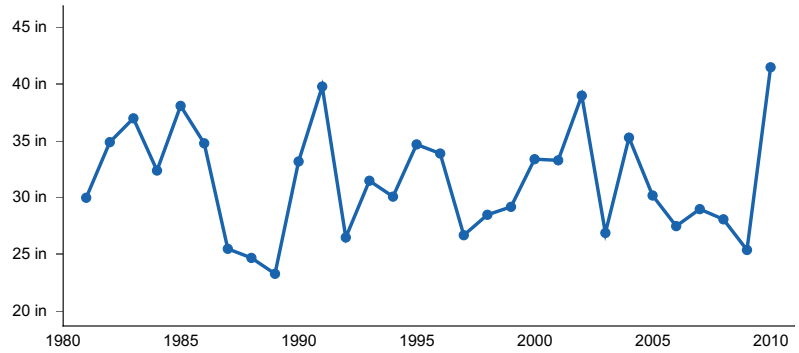


Figure 5. Annual precipitation pattern

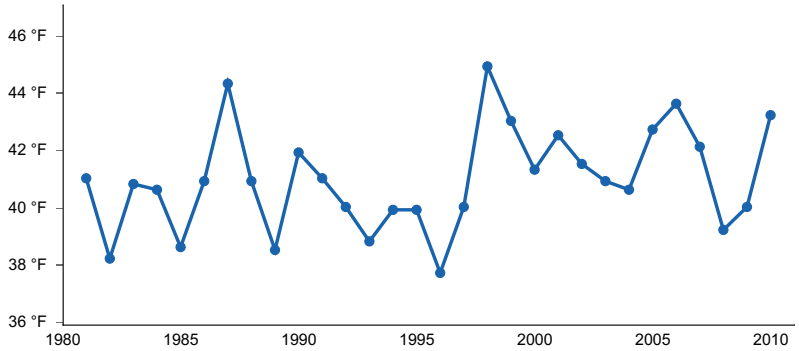


Figure 6. Annual average temperature pattern

Climate stations used

- (1) LAONA 6 SW [USC00474582], Laona, WI
- (2) ROSHOLT 9 NNE [USC00477349], Wittenberg, WI
- (3) STAMBAUGH 2SSE [USC00207812], Iron River, MI
- (4) WINTER [USC00479304], Ojibwa, WI
- (5) LUCK [USC00474894], Luck, WI
- (6) JUMP RIVER 3E [USC00474080], Sheldon, WI
- (7) ISLE 12N [USC00214103], Isle, MN

Influencing water features

Water is received through stream inflow, precipitation, runoff from adjacent uplands, and groundwater discharge. Water levels are greatly influenced stream inflow, 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.

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 soil is moderately slow or rapid.
Hydrologic Group: A/D, B/D
Hydrogeomorphic Wetland Classification: Depressional, forested/organic; Depressional, scrub-shrub/organic
Cowardin Wetland Classification: PFO1B, PSS1B, PEM1B

Soil features

These sites are represented by the Sturgeon, Totagatic, and Winterfield soil series. Sturgeon is classified as an Aquic Udifluvent, Totagatic is a Typic Fluvaquent, and Winterfield is an Aquic Udipsamment.

These soils formed in sandy and silty alluvium. These soils are very deep and are poorly to somewhat poorly drained. Sites represented by the Totagatic series remain saturated for long periods of time and meet hydric soil requirements.

The surface of these soils is muck, sandy loam, or silt loam. Subsurface horizons include loamy sand, sand, and silt loam textures. Soil pH ranges from strongly acid to neutral with values of 5.5 to 7.0. Carbonates are absent in soils to 80 inches (200 cm).

Figure 7. Moquah soil series photograph courtesy of UWSP taken on 9/10/2019 in Marathon County, WI.

Table 4. Representative soil features

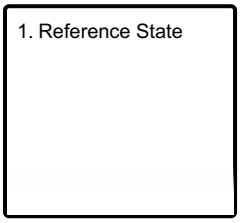
Parent material	(1) Alluvium
Surface texture	(1) Mucky sandy loam (2) Mucky silt loam
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Moderately slow to rapid
Soil depth	80–100 in
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	4.36–7.2 in
Soil reaction (1:1 water) (0-40in)	5.5–7
Subsurface fragment volume <=3" (Depth not specified)	5–14%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

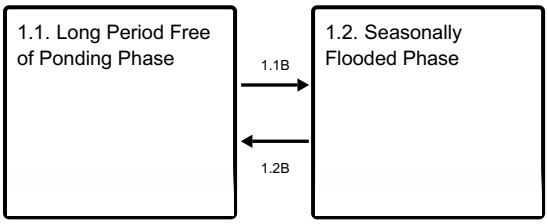
Because this Ecological Site is subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events 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 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*) is well adapted to growing in saturated conditions, allowing it to grow commonly in seasonally flooded habitats. Other species that may become established in periods without major flooding, or ponding are red maple (*Acer rubrum*) and white ash (*Fraxinus americana*).

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1B - Major flooding event depositing new sediment.

1.2B - Long period without major flooding.

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 ponded community phase.

Community 1.1
Long Period Free of Ponding Phase

Figure 8. Photo courtesy of UWSP taken on 9/10/2019 in Marathon County, WI.

Periods of several decades, or longer, without prolonged ponding allow for the development of forest communities closely resembling the upland mesic or wet-mesic communities. Such forests are characterized by strong presence, or dominance of any of the following species: red maple, white ash, and boxelder (*Acer negundo*). Characteristic understory plants Virginia creeper (*Parthenocissus quinquefolia*), meadow rue (*Thalictrum dioicum*), orange jewelweed (*Impatiens capensis*), sensitive fern (Onoclea sensibillis) and wood fern (*Dryopteris carthusiana*). Possible small scale canopy disturbances, e.g., snow/ice breakage and individual tree mortality, increase light on forest floor and stimulate regeneration of canopy species. Through this process the relative importance of different species varies, but the basic mesic community is perpetuated.

Dominant plant species

- red maple (*Acer rubrum*), tree
- white ash (*Fraxinus americana*), tree
- Virginia creeper (*Parthenocissus quinquefolia*), other herbaceous
- meadow-rue (*Thalictrum*), other herbaceous

Community 1.2
Seasonally Flooded Phase

Figure 9. Photo courtesy of UWSP taken on 9/10/2019 in Marathon County, WI.

Silver maple is a well-adapted species to frequently flooded conditions. On such sites it typically occurs in pure stands, or with only sporadic association of other species that become established on micro-sites with less frequent, or shorter duration ponding. Such associates are black ash, red maple, swamp white oak, elms (Ulmus spp.) and occasionally yellow birch. Understory vegetation is sparse, consisting mostly of goldenrod (Solidago, spp.), grasses (Poaceae.), and false-nettle (*Laportea canadensis*). Possible seasonal flooding with fresh sediment deposition.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- white ash (*Fraxinus americana*), tree
- Grass, native (*Grass, native*), grass
- goldenrod (*Oligoneuron*), other herbaceous
- false nettle (*Boehmeria*), other herbaceous

Pathway 1.1B
Community 1.1 to 1.2

Long Period Free of Ponding Phase

Seasonally Flooded Phase

Major flooding event deposits new sediment that causes mortality of some of the canopy trees and provides germination and seedling establishment conditions for some species, most frequently silver maple.

Pathway 1.2B
Community 1.2 to 1.1

Seasonally Flooded Phase

Long Period Free of Ponding Phase

Long period without major 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.

Habitat Types of N. Wisconsin (Kotar, 2002): The sites of this ES keyed out to two habitat types: Acer/Hydrophyllum-Impatiens (AHI); Acer-Tsuga/Athyrium-Onoclea (ATAtOn)

Biophysical Settings (Landfire, 2014): This ES is largely mapped as Laurentian-Acadian Northern Hardwoods Forest and Laurentian-Acadian Floodplain Forest
WDNR Natural Communities (WDNR, 2015): Floodplain Forest

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Approval

Suzanne Mayne-Kinney, 10/02/2023

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NRCS contracted UWSP to write ecological sites in MLRA 90A, 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	04/27/2024
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):**

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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):**

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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:**