Ecological site F004AA001WA
Udic Flood Plain Forest

Last updated: 1/24/2025
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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): 004A–Sitka Spruce Belt

This resource area is along the coast of the Pacific Ocean. It is characterized by a marine climate and coastal fog belt. The parent material is primarily glacial, marine, or alluvial sediment and some scattered areas of Tertiary sedimentary rock and organic deposits. Glacial deposits are dominant in the northern part of the MLRA in Washington; marine and alluvial deposits and eolian sand are dominant along the southern part of the Washington coast and extending into Oregon. The mean annual precipitation ranges from 52 to 60 inches near the beaches to more than 190 inches in the inland areas of the MLRA.
Andisols and Inceptisols are the dominant soil orders in the MLRA, but Spodosols, Entisols, and Histosols are also present. The soils are shallow to very deep and very poorly drained to somewhat excessively drained. They are on hilly marine terraces and drift plains; coastal uplands, hills, and foothills; flood plains; and coastal dunes, marshes, and estuaries.
The soil temperature regimes of MLRA 4A are moderated by the proximity to the Pacific Ocean, which eases the differences between the mean summer and winter temperatures. The seasonal differences in temperature are more pronounced in adjacent MLRAs further inland. Included in MLRA 4A are soils in cooler areas at higher elevations or on northerly aspects that have an isofrigid temperature regime.
The soil moisture regimes of MLRA 4A are typified by soils that do not have an extended dry period during normal years. Many of the soils further inland in MLRA 2 have a dry period in summer. Soils in low-lying areas and depressions of MLRA 4A are saturated in the rooting zone for extended periods due to a high water table or long or very long periods of flooding or ponding.

LRU notes

The Northern Sitka Spruce Belt land resource unit (LRU A) of MLRA 4A is along the northwest coast of the Olympic Peninsula to the Chehalis River in Washington State. The parent material is dominantly glacial deposits derived from continental or alpine sources. This LRU extends from the northwesternmost corner of the Olympic Peninsula south to the northern edge of Grays Harbor. It is bounded on the west by the Pacific Ocean and on the east by the Olympic Mountains. Several major rivers carved valleys through the glacially derived landscape and deposited more recent alluvium. These include the Sol Duc, Bogachiel, Hoh, Queets, Quinault, and Humptulips Rivers.

Ecological site concept

This ecological site is at low elevations (less than 1,500 feet) on the western coastline of the Olympic Peninsula. The site receives abundant precipitation and has persistent fog in summer. It is in riparian corridors and on coastal flood plains, levees, and terraces that are subject to stream overflow. Riparian ecological sites typically differ in topography, vegetation, geomorphology, and microclimate from the surrounding uplands of the forest ecosystem (Dwire, 2003).
The most common overstory species are Sitka spruce (Picea sitchensis), black cottonwood (Populus balsamifera ssp. trichocarpa), and western hemlock (Tsuga heterophylla). Bigleaf maple (Acer macrophyllum) may be present. Red alder (Alnus rubra) may be common where there are openings in the forest or pockets of disturbance.

Regeneration is limited by the canopy cover, and it commonly is only in gaps where sunlight is most available. Common understory species include vine maple (Acer circinatum), salmonberry (Rubus spectabilis), red elderberry (Sambucus racemosa), western swordfern (Polystichum munitum), ladyfern (Athyrium filix-femina), and Oregon oxalis (Oxalis oregana).
The most common natural disturbance is flooding. The volume and longevity of the flooding determine the effect on the dynamics of the forest. Wildfires are uncommon in this ecological site (greater than 450-year return interval), but they may be stand replacing (Balian, 2005). The longer the interval between major floods, the more diverse the overstory becomes as conifers establish. In the absence of disturbance, it is expected that forest maturation and succession will result in an old-growth conifer forest (Van Pelt, 2006).

Figure 1. The area identified as ‘A’ is the Udic Flood Plain Forest (F04AA001WA) ecological site, the area identified as ‘B’ is the Aquic Flood Plain Forest (F04AA002WA) site, and the area identified as ‘C’ is the Aquic Flood Plain (R04AA003WA) site.

MLRA 4A Soil Temperature Regimes[1]		
Isomesic	The mean annual soil temperature (measured at a depth of 20 inches) is 46 to 59 degrees F, and the difference between the mean winter and summer temperatures is less than 11 degrees.	The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer.
Isofrigid	The mean annual soil temperature (measured at a depth of 20 inches) is 32 degrees F to less than 46 degrees, and the difference between the mean winter and mean summer temperatures is less than 11 degrees.	The seasonal soil temperatures and difference between the mean winter and summer temperatures are moderated by the proximity to the ocean and the effects of fog in summer. The temperatures are cooler than in surrounding lowlands because of the higher elevation and differences in slope and aspect.
MLRA 4A Soil Moisture Regimes[1]		
Udic	The soil rooting zone is not dry in any part for more than 90 cumulative days in normal years.	Soil moisture does not limit plant growth because of the fog in summer.
Aquic	The soil is virtually free of dissolved oxygen due to saturation of the rooting zone.	The soils are saturated for extended periods during the growing season and may be subject to long or very long periods of ponding and flooding.
[1] Refer to Keys to Soil Taxonomy for complete definitions of the soil temperature and moisture regimes.		

Figure 2.

Table 1. Dominant plant species

Tree	(1) *Picea sitchensis* (2) *Populus balsamifera ssp. trichocarpa*
Shrub	(1) *Acer circinatum* (2) *Rubus spectabilis*
Herbaceous	(1) *Polystichum munitum* (2) *Oxalis oregana*

Physiographic features

Table 2. Representative physiographic features

Landforms	(1) River valley > Coastal plain (2) River valley > Levee (3) River valley > Terrace

Climatic features

The maritime climate is characterized by cool, moist summers and cool, wet winters. The mean annual precipitation is 73 to 165 inches. Coastal fog provides supplemental moisture in summer. Snowfall is rare, and it is not persistent when it occurs. The mean annual air temperature is 47 to 51 degrees F. The mild temperatures and long growing season result in highly productive forestland.

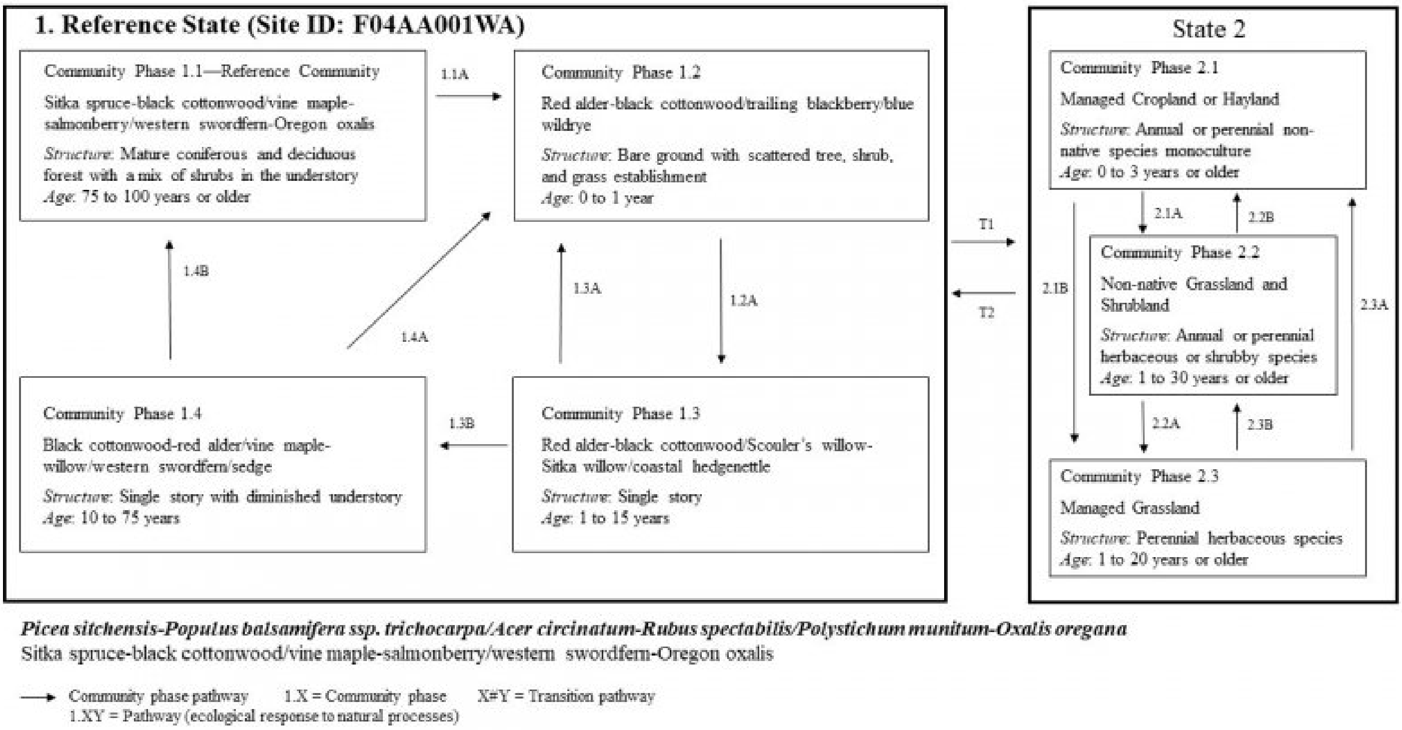
Influencing water features

Soil features

The soils that support this ecological site are in the isomesic soil temperature regime and udic soil moisture regime. They formed dominantly in alluvium on river flood plains, levees, and terraces. Soil moisture is not a limiting factor to forest growth due to the abundance of precipitation and fog in summer. These soils typically are subject to flooding in November through April. They are Inceptisols that are poorly developed or weakly developed because of their young age and association with active flood plains.

Ecological dynamics

State and transition model



State 1
Reference

Community 1.1
Sitka Spruce, Black Cottonwood, Vine Maple, Salmonberry, Western Swordfern, and Oregon Oxalis

Structure: Mature coniferous and deciduous forest with a mix of shrubs in the understory Sitka spruce is the dominant overstory species in the reference community. Black cottonwood is long-living (up to 200 years) and remains a dominant deciduous species in the overstory along the riparian edge; however, regeneration is limited as the forest matures and the canopy cover increases. Red alder remains a major component in most mature stands, but it will start to actively decline after 40 to 70 years. Alder regeneration typically is limited to pockets of disturbance where sunlight is abundant (Balian, 2005). Western hemlock (typically in stands older than 100 years), bigleaf maple, and western redcedar (*Thuja plicata*) may be present in the stand. Herbivory on western hemlock and western redcedar by elk (Cervus elaphus) and black-tailed deer (Odocoeleus hemionus columbianus) may greatly impact the prominence of these species (Stolnack, 2010). The reference community represents a lack of major flooding for at least 75 years, which allows the pioneering species to form a mature canopy. It also allows for growth of a vigorous understory of shrubs and forbs, including vine maple, salmonberry, western swordfern, and Oregon oxalis. Common disturbances include small gap dynamics (1/2-acre openings or smaller) following the decline of the red alder canopy and minor scouring from flooding. Soil deposition following minor scouring from flooding temporarily affects the understory community, but it does not alter the composition of the overstory. Beaver (Castor canadensis) activity can by a significant driver in small-scale disturbances, affect hydrologic morphology, and contribute to large woody debris in riparian edges and corridors.

Dominant plant species

- Sitka spruce (*Picea sitchensis*), tree
- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- red alder (*Alnus rubra*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- bigleaf maple (*Acer macrophyllum*), tree
- vine maple (*Acer circinatum*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous
- redwood-sorrel (*Oxalis oregana*), other herbaceous

Community 1.2
Red Alder, Black Cottonwood, Trailing Blackberry, and Blue Wildrye

Structure: Bare ground with scattered tree, shrub, and grass establishment Community phase 1.2 represents a riparian forest that is undergoing regeneration or stand initiation immediately following flooding. The soil surface is gravelly and highly variable depending on the intensity and frequency of flooding and aggradation from flooding (Fonda, 1974). Scattered remnant mature trees may be in some areas, and woody debris is abundant. Successful regeneration is dependent on the local seed source, an adequate seedbed, and sufficient light and water (Nierenberg, 2000). Red alder can establish quickly as compared to conifers. It can sprout and establish in full sunlight and fixes nitrogen in shallow flood plain soils, which provide an early competitive advantage (Villarin, 2009). Seeds of deciduous species are light and can be transported long distances by wind and water, allowing for rapid recolonization. Black cottonwood will establish quickly on gravel bars, and it commonly develops into a thick, even-aged stand. California blackberry (*Rubus ursinus*) and blue wildrye (*Elymus glaucus*) commonly are established in this community phase. Plant cover is relatively sparse; it ranges from 5 to 20 percent during this stage (Fonda, 1974). Introduced grass species such as creeping bentgrass (*Agrostis stolonifera*) may be present. Infestation by invasive species such as Japanese knotweed (*Polygonum cuspidatum*) and giant knotweed (*Polygonum sachalinense*) is a concern during this community phase.

Dominant plant species

- red alder (*Alnus rubra*), tree
- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- California blackberry (*Rubus ursinus*), shrub
- blue wildrye (*Elymus glaucus*), grass

Community 1.3
Red Alder, Black Cottonwood, Scouler’s Willow, Sitka Willow, and Coastal Hedgenettle

Structure: Single story Community phase 1.3 is an early seral forest in regeneration. Scattered remnant mature trees may be present. Competition among individual trees for available water, light, and nutrients is increased. Red alder, black cottonwood, Sitka willow (*Salix sitchensis*), and Scouler’s willow (*Salix scouleriana*) are dominant in the overstory. California blackberry is a major component of the understory along with coastal hedgenettle (*Stachys chamissonis*) and Mexican hedgenettle (*Stachys mexicana*). The understory is grassy and a mixture of introduced and native species.

Dominant plant species

- red alder (*Alnus rubra*), tree
- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- Sitka willow (*Salix sitchensis*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- California blackberry (*Rubus ursinus*), shrub
- Mexican hedgenettle (*Stachys mexicana*), other herbaceous
- coastal hedgenettle (*Stachys chamissonis*), other herbaceous

Community 1.4
Black Cottonwood, Red Alder, Vine Maple, Willow, Western Swordfern, and Sedge

Structure: Single story with diminished understory Community phase 1.4 is a forest in the competitive exclusion stage. Scattered remnant mature trees may be present. Black cottonwood and red alder are dominant in the overstory. Red alder will begin to die 40 to 70 years following disturbance and more light will penetrate the newly nitrogen-rich soil (Naiman, 2009). As a result, conifer regeneration is more prevalent in this community phase. Seedlings of Sitka spruce will begin to establish sporadically, especially in areas that have more shade. They may establish within 4 years of hardwood establishment (Stolnack, 2010). Downed logs, which are more prevalent in established stands, are an important component for conifer establishment (Villarin, 2009). About 60 to 90 years following disturbance, Sitka spruce begins to flourish and replace red alder (Van Pelt, 2006). Sitka spruce seedlings can survive small floods and inundation by producing adventitious roots from recently buried stems (Van Pelt, 2006). During this phase, the canopy closure will mature to 100 percent and the understory will diminish. Some understory species that are better adapted to at least partial shade, such as vine maple and western swordfern, will begin to flourish in the community. Farther from the flood plain, the shrub community decreases and a closed-canopy forest develops (Villarin, 2009). If red alder regeneration is in this community phase, it may be inferred that frequent minor flooding has been influencing the site dynamics (Nierenberg, 2000). Over time, the forest begins to self-thin as a result of competition and a decrease in species that are intolerant of shade.

Dominant plant species

- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- red alder (*Alnus rubra*), tree
- Sitka spruce (*Picea sitchensis*), tree
- vine maple (*Acer circinatum*), shrub
- western swordfern (*Polystichum munitum*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents a stand-replacing wildfire or major 100- or 500-year flood that scours the stream channel, removes understory and overstory vegetation, and may alter the streamflow. This type of disturbance may completely reconfigure sediment loads and dramatically reduce or eliminate the forest overstory.

Pathway 1.2A
Community 1.2 to 1.3

Red Alder, Black Cottonwood, Trailing Blackberry, and Blue Wildrye

Red Alder, Black Cottonwood, Scouler's Willow, Sitka Willow, and Coastal Hedgenettle

This pathway represents growth over time with no further major disturbance.

Pathway 1.3A
Community 1.3 to 1.2

Red Alder, Black Cottonwood, Scouler's Willow, Sitka Willow, and Coastal Hedgenettle

Red Alder, Black Cottonwood, Trailing Blackberry, and Blue Wildrye

This pathway represents a stand-replacing wildfire or a major 100- or 500-year flood that scours the stream channel, removes the understory and overstory vegetation, and may alter the streamflow. This type of disturbance may completely reconfigure sediment loads and dramatically reduce or eliminate the forest overstory.

Pathway 1.3B
Community 1.3 to 1.4

Red Alder, Black Cottonwood, Scouler's Willow, Sitka Willow, and Coastal Hedgenettle

Black Cottonwood, Red Alder, Vine Maple, Willow, Western Swordfern, and Sedge

This pathway represents growth over time with no further major disturbance.

Pathway 1.4B
Community 1.4 to 1.1

This pathway represents an area with no further major disturbance. Continued growth over time and ongoing mortality lead to increased vertical diversification. The community begins to resemble the structure of the reference community, including small pockets of regeneration (both deciduous and coniferous species) and a more diversified understory.

Pathway 1.4A
Community 1.4 to 1.2

Black Cottonwood, Red Alder, Vine Maple, Willow, Western Swordfern, and Sedge

Red Alder, Black Cottonwood, Trailing Blackberry, and Blue Wildrye

This pathway represents a stand-replacing wildfire or a major 100- or 500-year flood that scours the stream channel, removes the understory and overstory vegetation, and may alter the streamflow. This type of disturbance may completely reconfigure sediment loads and dramatically reduce or eliminate the forest overstory.

State 2
Converted

Community 2.1
Managed Cropland or Hayland

Community Phase 2.1 may consist of a range of crops, including annually planted species, short-lived perennial species, and more permanent shrubby species. Hay and grasses and legumes for silage are included in this community phase. Structure: Annual or perennial non-native species monoculture

Community 2.2
Non-Native Grassland and Shrubland

Community phase 2.2 is characterized by low-level agronomic or management activity such as adding fertility, intensive grazing management, regular mowing, or weed control. This plant community commonly consists dominantly of introduced weedy species. Areas that have extremely low fertility or are subject to heavy grazing pressure have a higher proportion of annual, stoloniferous, or rhizomatous species. Wetland areas commonly support dominantly non-native rhizomatous grasses. The plant community may include remnants of introduced pasture species that commonly are seeded. Structure: Annual or perennial herbaceous or shrubby species

Community 2.3
Managed Grassland

Community phase 2.3 receives regular agronomic inputs, including adding soil nutrients and other soil amendments such as lime, implementing grazing management plans or regular mowing, controlling weeds, and reseeding as needed. This plant community typically includes introduced perennial pasture and hay species that commonly are seeded. In areas of historic native grassland, mixtures of perennial and annual native species may be seeded and managed by appropriate agronomic and livestock management activities. Minor amounts of introduced species that commonly are in non-native grassland and shrub communities (community phase 2.2) are in this phase. Structure: Perennial herbaceous species

Pathway 2.1A
Community 2.1 to 2.2

In the absence of agronomic and livestock management activities, seeds from surrounding weedy plant communities will be transported to the site by wind, flood water, animals, or vehicle traffic. Adapted species will become established. Management activities include tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Pathway 2.1B
Community 2.1 to 2.3

This pathway represents agronomic and livestock management activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Pathway 2.2B
Community 2.2 to 2.1

This pathway represents agronomic activities such as tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, and planting to desirable crop species.

Pathway 2.2A
Community 2.2 to 2.3

This pathway represents agronomic and livestock management activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Pathway 2.3A
Community 2.3 to 2.1

This pathway represents agronomic activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, and planting to desirable crop species.

Pathway 2.3B
Community 2.3 to 2.2

In the absence of agronomic and livestock management activities, seeds from surrounding weedy plant communities will be transported to the area by wind, floodwater, animals, or vehicle traffic. Adapted species will become established. Management activities include tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Transition T1A
State 1 to 2

This pathway represents a change in land use, including modifications to the hydrologic function to develop pasture and agriculture. Non-native seed disbursement is introduced (intentionally or unintentionally), which alters the reference community.

Restoration pathway T2A
State 2 to 1

This pathway represents restoration of the natural hydrologic function and native plant habitat. Native seed sources and extensive management and mitigation of brush and invasive species are needed to restore the community.

Additional community tables

Inventory data references

Other Established Classifications for Ecological Site
National vegetation classification: G254 North Pacific Lowland Riparian Forest and Woodland Group
Forest association: CEGL003418 Redwood Sorrel Riparian Forest
Ecological Systems of Washington State community type: North Pacific Lowland Riparian Forest and Shrubland

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Approval

Kirt Walstad, 1/24/2025

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	05/07/2024
Approved by	Kirt Walstad
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):

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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:**
