USDA Natural Resources Conservation Service

Ecological site F043CY519WA
Warm-Cryic, Udic, Loamy, Mountains, Mixed Ash (subalpine fir/cool moist shrub)

Last updated: 9/08/2023
Accessed: 05/20/2024

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): 043C–Blue and Seven Devils Mountains

Description of MLRAs can be found in: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Available electronically at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053624#handbook

LRU notes

Major land resource area (MLRA): 043C-Blue and Seven Devils Mountains
Modal LRU – 43C01 Cold, Moist Volcanic Highlands
This LRU is composed predominantly of high-elevation mountain slopes, ridges, basins, and mid-elevation mountain slopes and valley walls. Climates are frigid to cryic and xeric to udic. Soils are dominantly loamy Argixerolls, Vitricryands and Vitrixerands. Parent materials are colluvium and residuum from basalt with a volcanic ash cap present on sheltered aspects and positions.

Classification relationships

This ecological site is aligned to the following classification systems:

• U.S. National Vegetation/NatureServe and Washington NHP Classification Matrix:

Plant Association Group* Alliance** Association***
ABLA/VASC G-219 A-3643 CEGL 000344
* G-218 is the U.S. National Vegetation Classification (NVC) Standard “Rocky Mountain Subalpine Moist Spruce-Fir Forest and Woodland..
** Alliance-3614 is the “Rocky Mountain Dry-Mesic Subalpine Fir-Engelmann Spruce Forest”.
*** CEGL 000344 is the “Subalpine Fir-Engelmann Spruce/Grouse Whortleberry Forest” (note that the local name for this plant association is /Grouse Huckleberry (ABLA/VAME) Forest

• USDA Forest Service Ecological Sub-region M332 “Blue Mountains”.
• LANDFIRE BpS model 0910550: Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland (primary model).
• Ecoclass Code: ABLA/VASC: CES 411 (the plant association code is identified in the Blue-Ochoco Plant Association publication (1991), as well as in the base source).

Ecological site concept

This Ecological Site occurs mainly on forested backslopes of higher elevation mountain slopes, ridges and cirques. They have a cryic temperature regime and udic moisture regime. Parent materials are derived from granite, andesite or metamorphic rock mantled by highly mixed volcanic ash and loess. They are well drained with adequate available water capacity.

Associated sites

F043CY517WA	**Warm-Cryic, Udic, Loamy, Mountains, and Uplands, Basalt, Mixed Ash (subalpine fir/cool moist shrub)** warm-cryic, udic, mixed ash surface, basalt geology.
F043CY518WA	**Warm-Cryic, Udic, Loamy, Mountains, Ashy surface (subalpine fir/cool moist shrub)** warm-cryic, udic, ashy surface, granitic geology.

Similar sites

F043CY514WA	**Cryic, Dry-Udic Mountains and Ridges (Subalpine Fir cold dry shrub)** Dry-udic soil moisture regime, cryic soil temperature regime
F043CY518WA	**Warm-Cryic, Udic, Loamy, Mountains, Ashy surface (subalpine fir/cool moist shrub)** Ashy surface
F043CY516WA	**Warm-Cryic, Udic, Loamy, Mountains, and Plateaus, Basalt, Ashy Surface (subalpine fir/cool moist shrub)** Basalt geology, ashy surface
F043CY517WA	**Warm-Cryic, Udic, Loamy, Mountains, and Uplands, Basalt, Mixed Ash (subalpine fir/cool moist shrub)** Basalt geology

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa* (2) *Picea engelmannii*
Shrub	(1) *Vaccinium membranaceum* (2) *Chimaphila umbellata*
Herbaceous	(1) *Anemone piperi* (2) *Arnica cordifolia*

Physiographic features

Landscapes: Mountains
Landform: mountain slopes, ridges, cirques

Elevation (m): Total range = 1970 to 2534 m
(6,463 to 8,314 feet)
Central tendency = 2199 to 2386 m
(7,215 to 7,828 feet)

Slope (percent): Total range = 0 to 143 percent
Central tendency = 44 to 84 percent

Water Table Depth: >80 inches

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Aspect: Total range 295-110-155
Central tendency: 10-110-120

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Mountains > Ridge (3) Mountains > Cirque
Flooding frequency	None
Ponding frequency	None
Elevation	2,199–2,387 m
Slope	45–85%
Water table depth	0 cm
Aspect	N, NE, E, SE

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,971–2,534 m
Slope	0–100%
Water table depth	0 cm

Climatic features

Frost-free period (days): Total range = 49 to 57 days
Central tendency = 51 to 53 days

Mean annual precipitation (cm): Total range = 756 to 1141 mm
(30 to 45 inches)
Central tendency = 867 to 985 mm
(34 to 39 inches)

MAAT (C): Total range = 1.3 to 5.5
(34 to 42 F)
Central tendency = 2.2 to 3.6
(36 to 38 F)

Climate Stations: none

Table 4. Representative climatic features

Frost-free period (characteristic range)	51-53 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	864-991 mm
Frost-free period (actual range)	49-57 days
Freeze-free period (actual range)	
Precipitation total (actual range)	762-1,143 mm

Frost-free period (average)	52 days
Freeze-free period (average)	
Precipitation total (average)	914 mm

Influencing water features

Water Table Depth: >80 inches

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Soil features

This ecological subsite is associated with several soil components (e.g. Jughandle, Cryochrepts). The soil components can be grouped into Vitrandic Haplocryepts, and Cryochrepts. These soils have developed in Mazama tephra deposits over residuum from andesite, granite, or metamorphic. The tephra layers are important for forest productivity in that they retain large amounts of water compared to other parent materials, have high cation exchange capacity and high availability of organically bound plant nutrients. The soils range from deep to very deep and have adequate available water capacity to a depth of 40 inches. The soils are well-drained.

Parent Materials:
Kind: Tephra (volcanic ash)
Origin: mixed
Kind: loess
Origin: mixed
Kind: residuum
Origin: Andesite, Granite, or Metamorphic

Surface Texture: (<2mm fraction)
(1) Ashy Loam
(2) Gravelly Loam

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Loess (3) Residuum–igneous and metamorphic rock
Surface texture	(1) Ashy loam (2) Gravelly loam
Drainage class	Well drained
Depth to restrictive layer	107 cm
Soil depth	102–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.67 cm
Calcium carbonate equivalent (0-152.4cm)	0%

Electrical conductivity (0-152.4cm)	0 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0
Soil reaction (1:1 water) (0-152.4cm)	5.8
Subsurface fragment volume <=3" (25.4-152.4cm)	16%
Subsurface fragment volume >3" (25.4-152.4cm)	17%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Depth to restrictive layer	51–152 cm
Soil depth	102–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.84–15.24 cm
Calcium carbonate equivalent (0-152.4cm)	0%
Electrical conductivity (0-152.4cm)	0 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0
Soil reaction (1:1 water) (0-152.4cm)	5.1–6.5
Subsurface fragment volume <=3" (25.4-152.4cm)	8–24%
Subsurface fragment volume >3" (25.4-152.4cm)	0–35%

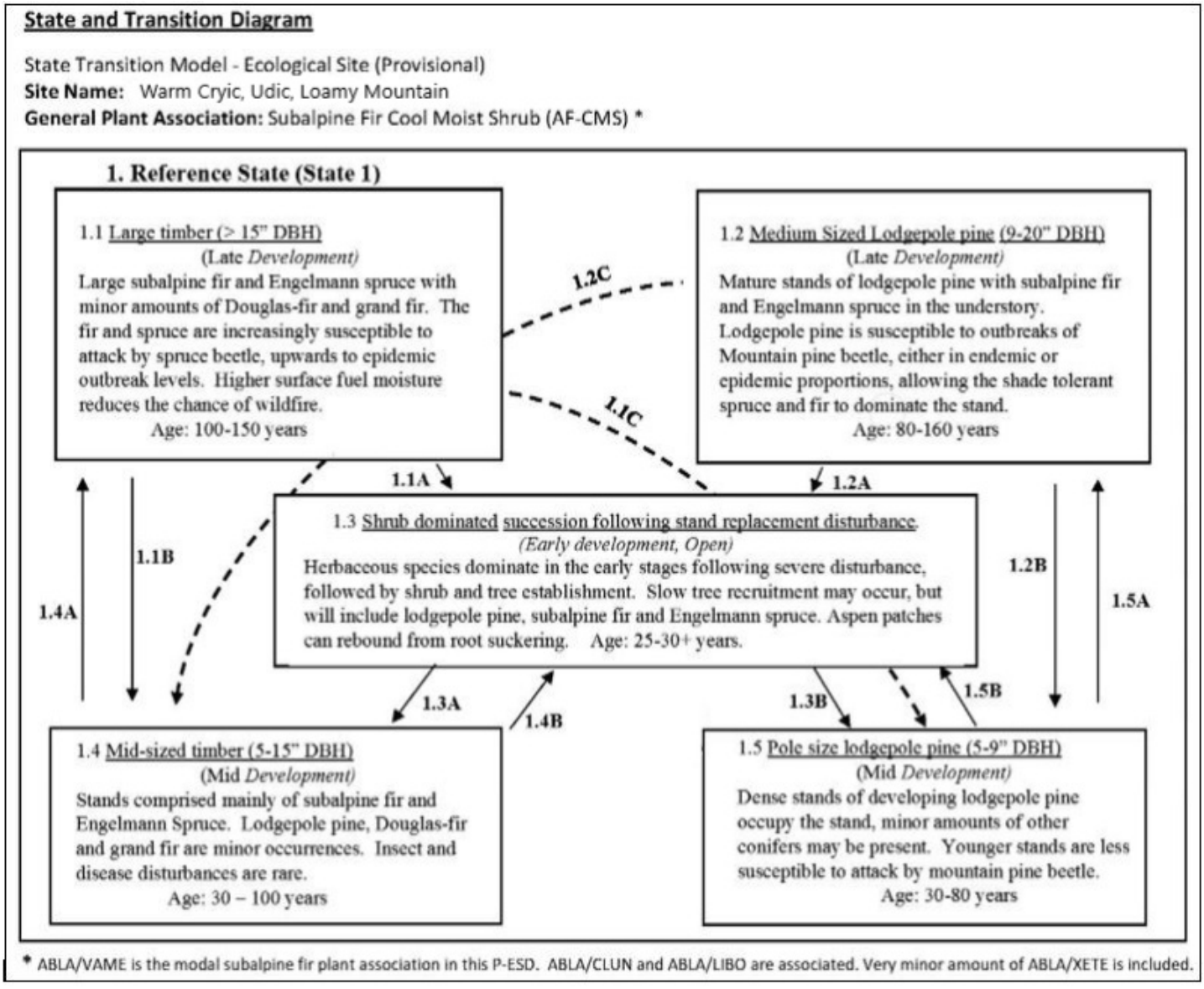
Ecological dynamics

The subalpine fir cool moist shrub (AF -CMS) ecological site (ES) is made up of the modal subalpine fir (*Abies lasiocarpa*)/big huckleberry (*Vaccinium membranaceum*) plant association (code named ABLA/VAME). The less extensive subalpine fir/Queen’scup beadlily (*Clintonia uniflora*) and subalpine fir/twinflower (Linnea borealis) are included in this ecological site group (respectively coded as ABLA/CLUN and ABLA/LIBO).
A very limited amount of Subalpine fir/common beargrass (*Xerophyllum tenax*), coded as ABLA/XETE, may be found in association with this ecological site. ABLA/XETE is not described in the Blue-Ochoco plant association reference, and no data is available for this plant association in the local references used for the other plant association(s). ABLA/XETE is most likely cooler than the other named associations.
These plant associations are identified in the plant association group as “cool moist”, and in the broader plant vegetative type group as “moist upland forest.” This ecological site is transitional to the grand fir cool moist forb ecological site (GF-CMF: BpS model 910470) at lower elevations, and to the subalpine fir cold dry shrub AF-CDS: BpS 910550) found at higher elevations on very cold, relatively dry sites. The ecological site on all aspects, over a wide variety of slope positions and gradients. Stand canopy coverage is broadly variable, even in the late development community plant phases.
The historic long term climatic expression of this ecologic site is characterized by cold winters and cool summers, where frost can occur in any month of the summer season. Snowfall amounts are high and the accumulated snowpack lingers long into the summer months. As the global climate continues to change, a shift towards a warmer and drier environment will occur, changing the nature and expression of the forests included in the current

ES.
Engelmann spruce (Picea engelmanii) often dominates post-disturbance stands in mid- to late community development stages, but subalpine fir easily establishes in the understory shade of the mature spruce forest. For these reasons, both subalpine fir and Engelmann spruce (which is a persistent, long lived conifer) are common overstory associates in mature, late seral forests. Although these two species are typically co-dominant in the stand, subalpine fir is considered the climax series. As a species, subalpine fir is well adapted to long fire free intervals, where fires that do occur are either stand replacement or mixed fire events. Conversely, individual subalpine fir trees rarely survive any type of fire because of the thin bark, shallow rooting structure, and dense branching characteristics which often continue down to the surface of the ground. Needle foliage and crowns are highly flammable and many older trees contain abundant lichen growth.
Although it is very shade tolerant, subalpine fir is often the pioneer conifer species on harsh sites, and it establishes well in the absence of plant competition under partial sunny conditions.
Engelmann spruce is well adapted to recover rapidly following mixed or stand replacement fire occurrences. It produces abundant seed crops which have good viability and are well dispersed by wind. Engelmann spruce requires mineral soils in order to achieve optimum levels of seedling germination and subsequent establishment, and it will germinate in all light conditions although it does best under shady conditions. Young spruce seedlings growing under full sun exposure will often succumb to the late summer impacts of solar radiation, which results in drought or heat girdling losses.
Engelmann spruce shares many of the same attributes as subalpine fir regarding individual tree susceptibility to wildfire.
Douglas-fir (*Pseudotsuga menziesii*) is a mid-seral component of this ecological site. The species is approaching the upper limits of its ecological tolerance (i.e. ecological “amplitude”) to colder temperature regimes, but Douglas-fir is often a viable component of mid and late seral stands on the more favorable sites.
Lodgepole pine (*Pinus contorta*), western larch (*Larix occidentalis*), and limited levels of quaking aspen (Populus trichocarpa) are all early seral tree species which can aggressively occupy severely disturbed sites when conditions are favorable. Disturbances (i.e. wildfire or endemic insect outbreaks) initiates the process of lodgepole pine regeneration. Lodgepole pine produces viable seed crops at a relatively early age, and both serotinous and non-serotinous cones are common, allowing regeneration to occur with and without fire. Pure stands of disturbance driven lodgepole (mainly following stand replacement fire) are generally restricted to slopes of 15% or less, where cold air pooling enhances lodgepole dominance.
Persistent, self-replacing lodgepole pine stands may develop in this ecologic site, often following replacement fire episodes coupled with the absence of subalpine fir and Engelmann spruce seed source(s). These stand(s) could persist for 100’s of years if they are not replaced by mid to late seral conifers, and if the cycle of stand replacement disturbance is relatively short. In this case lodgepole acts as a dominant seral species. Mixed fire maintains the stand in a dense population of pole sized lodgepole pine. However another very common route of succession introduces shade tolerant spruce and subalpine fir into the understory of mature lodgepole pine stands, eventually overtopping and dominating the older lodgepole stand in a longer term fire free environment.
Lodgepole pine and aspen can quickly establish following catastrophic wildfire events, and at times can be found together in mixed stands where lodgepole is the more dominant of the two species. In the very early post-disturbance phase, lodgepole pine regeneration will overtop and outcompete newly emerging Engelmann spruce or subalpine fir seedlings where seedlings of all three conifers have regenerated. Mountain pine beetle is the major biotic disturbance agent in lodgepole pine, especially when it reaches epidemic population levels.
Western larch is an extremely fast growing early seral conifer. It is the most fire adapted conifer in this ecologic site. Mature trees have thick bark, along with high open branches that are very resistant to torching. Western larch will persist into late seral community phases, and will typically survive even the most extreme level of fire, enabling it to seed the emerging post-fire forest communities. Larch establishes well under full sunlight.
In this ecologic site, small patches of aspen are scattered among the more extensive spruce-fir forests and within seral lodgepole pine stands. Quaking aspen stands are very resistant to fire because of the moist environment in which they occur. However individual aspen trees, smaller sized aspen patches, or stands in close proximity to flammable conifers are killed when wildfires sweep across the larger landscape. Aspen typically responds following fire to produce above ground stems that have sprouted (i.e. “sucker”) from underground roots.
Surface fires (or “underburns”) are essentially absent from this ecologic site. Mixed severity wildfire events are very rare, and replacement fire episodes will occur at three times the frequency of mixed severity fires. The average “mean fire return interval” (MFRI) of fires of all types is just under 100 years.
In addition to fire disturbance, the SF-CMS ecologic site is also impacted and changed by periodic windthrow, and by significant insect and disease disturbances (typically when these occur at an epidemic rather than an endemic level).
Other biotic and abiotic disturbance factors for the common conifers of the ecologic site:

• Engelmann Spruce is impacted by spruce beetle and by the western spruce budworm, wood rotting fungi, broom rusts and windthrow. Armillaria and laminated root disease susceptibility is moderate.
• Subalpine fir is impacted by western spruce budworm, as well as by bark beetles (such as the western balsam bark beetle and fir engraver), the non-native balsam aphid, and tussock moth. Anosus root disease, laminated root rot, Indian paintbrush and other fungi weaken subalpine fir. Subalpine fir is also prone to windthrow, especially at an advanced age or when weakened by root disease.
• Western larch is attacked by the dwarf mistletoe parasite. It is also impacted by needlecast and red ring rot, as well as by western spruce budworm and larch casebearer. Larch is not prone to windthrow except in rare instances, and is relatively free of most root disease.
• Douglas-fir suffers from tussock moth and other insect defoliators and dwarf mistletoe, and is susceptible to armillaria and laminated root disease.
• Lodgepole pine is attacked by mountain pine beetle, pine engraver, weevils, mistletoe and various fungi causing stem canker and gall rust. It is moderately susceptible to
armillaria root disease.
Understory species found in this ecologic include Grouse whortleberry, Big huckleberry (*Vaccinium membranaceum*), prince's pine (*Chimaphila umbellata*), and heartleaf arnica (Arnica cardifolia). Twinflower occurs primarily in the ABLA/LIBO plant association.

State and transition model



Plant Community, Transition(s) and Restoration Pathways

Reference State Community Pathways:

(see Appendix 1 for tree-size classes)

1.1A Wildfire transitions the stand to community phase 1.3.

1.1B Spruce beetle epidemic transition to community phase 1.4.

1.1C Widespread mortality from root disease transition to community phase 1.5.

1.2A Disturbance event (i.e. mixed severity wildfire) transitions the stand back to early succession.

1.2B Mountain pine beetle outbreak moves the stand back to phase 1.5.

1.2C Long term fire free episode combined with the natural thinning effect of mountain pine beetle (lodgepole pine) transition the stand to community phase.

1.3A Initial tree regeneration lacks significant lodgepole pine and matures to mid-development spruce-fir dominated stand.

1.3B Initial tree regeneration composed primarily of dominant early seral lodgepole.

1.4A Stand grows and develops to late development phase 1.1.

1.4B Replacement fire transitions the stand back to the early development phase.

1.5A Stand grows and develops to late development phase 1.2.

1.5B Replacement fire resets the stand in the early development phase (1.3)

Although climate change and the impacts of a warmer and dryer environment threaten this ecologic site, no transitions or alternative states are described in this ecologic site.

References

Powell, D.C., C.G. Johnson, E.A. Crowe, A. Wells, and D.K. Swanson. 2007. Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho. Gen. Tech. Rep. PNW-GTR-709.. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station., Portland, OR.

Other references

see Ecological Site Group EX043CESG4

Contributors

Frank Gariglio
Paul Gadecki

Approval

Kirt Walstad, 9/08/2023

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	05/20/2024
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):**

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**