Ecological site F002XB005OR
Loess Hill Group

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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): 002X–Willamette and Puget Sound Valleys

The Willamette and Puget Sound Valleys Major Land Resource Area (MLRA 2) is located in western Washington and Oregon. It occupies a forearc basin between coast ranges and the Cascade Mountain volcanic arc. The northern part contains Pleistocene drift, outwash, lacustrine and glaciomarine deposits associated with continental glaciers. The southern part contains Late Pleistocene deposits from glacial outburst floods (Missoula Floods). Climate is mild and moist, with a long growing season. Mean annual precipitation ranges from 20 to 60 inches, falling mostly in fall, winter, and spring. Summers are dry. Soil temperature regime is mesic and soil moisture regimes are xeric and aquic.
Most sites in this MLRA can support forested vegetation, but some were maintained as prairie, savanna, or woodland through cultural burning prior to Euro-American settlement. Puget Sound has a moderating effect on temperatures and humidity can be higher in the northern part of the MLRA. Douglas-fir (*Pseudotsuga menziesii*) is widespread throughout. Oregon white oak (*Quercus garryana*) is common on uplands in the south and on warm, exposed or droughty sites in the north. Pacific madrone (*Arbutus menziesii*) occurs in areas close to salt water. Western hemlock (Tsuga heterophylla) is codominant with Douglas-fir in the north. Floodplains usually contain black cottonwood (Populus balsamifera ssp. trichocarpa) and red alder (*Alnus rubra*). Oregon ash (Fraxinus latifolia) is typical of forested wetlands in the south. Forestry, urban development, and cultivated agriculture are currently the most extensive land uses (Soil Survey Staff, 2006).

LRU notes

The Portland Basin and Hills Land Resource Unit (LRU B) is located in northwest Oregon and southwest Washington. It includes the Portland Basin and surrounding hills. Isolated areas of LRU C (Willamette Valley) occur below 400 feet in the Tualitan Valley on loamy or silty Missoula Flood deposits. The Columbia River Gorge borders this LRU on the east. Brackish tidewater beginning near the town of Cathlamet marks the northwestern limit of this LRU along the Columbia River floodplain. Elevation ranges from sea level to about 1200 feet. Topography is flat to steep. Major landforms include the Columbia River floodplain, glaciofluvial terraces, hills, and foothills. The valley floor is underlain by Pleistocene fluvial deposits (Rowland Formation). Hills and foothills are underlain by Eocene to Pliocene sedimentary rocks (Yamhill, Nestucca, Scotts Mills, Molalla, and Troutdale Formations), Miocene Columbia River Basalt, or Plio-Pleistocene Boring Lavas (Orr et al., 1992). Gravelly or sandy Late Pleistocene Missoula Flood deposits can occur below 400 feet elevation. Hills are covered in loess, and fragipans (brittle subsoil layers) are common.

Mean annual precipitation ranges from 35 to 60 inches. Most falls as rain between October and May. The frost-free period ranges from 160 to 210 days. Ice storms occur each winter. Locations near the Columbia River Gorge experience strong winds. Most locations experience less summer moisture stress compared with the main Willamette Valley; summertime average daily maximum temperatures at Vancouver, WA are 1 to 3 degrees F cooler compared with Corvallis, OR (Agricultural Climate Information System, 2007a, 2007b).

Cultural fire use prior to Euro-American settlement was apparently less than in the main Willamette Valley, though it was used in some areas. General Land Office (GLO) land surveys conducted between 1851 and 1910 indicate that forest and woodland communities were more prevalent than prairies and savannas (Hulse et al., 2002). Forested reference community phases have been chosen for these upland ecological sites.

Presence of Oregon white oak (*Quercus garryana*), and absence of western hemlock (Tsuga heterophylla) distinguish this area from coast range (MLRA 1) and Cascade mountain (MLRA 3) ecological types in Oregon. Relative abundance of western redcedar (*Thuja plicata*) helps distinguish this are from the Willamette Valley (LRU C).

Classification relationships

This ecological site group is similar to following USDA Forest Service Plant Associations (McCain and Diaz, 2001) which emphasize late-successional plant communities:
• grand fir / poison oak (CWS622)
• grand fir / California hazel / inside-out flower (CWS555)
• grand fir / dwarf Oregon grape - salal (CWS528)
• grand fir / oceanspray / sword fern (CWS529)
• grand fir / vine maple / sword fern (CWS527)
• Douglas-fir / poison oak (CDC124)
• Douglas-fir / dwarf Oregon grape - salal (CDS512)
• Douglas-fir / oceanspray - dwarf Oregon grape (CDS216)
• Douglas-fir / dwarf Oregon grape (CDC711)
• Douglas-fir / California hazel - snowberry / sword fern (CDS312)
• Douglas-fir / oceanspray - snowberry (CDS217)

This ecological site group also fits within the following LANDFIRE Biophysical Setting (BpS):
• LANDFIRE Biophysical Setting: North Pacific Dry Douglas-fir Forest and Woodland (0710350)

Ecological site concept

This site occurs on loess-covered hills. Soils are silty. A perched water table located below 20 inches may be present in early spring. The rooting zone is dry 45 to 60 consecutive days during the summer.

Table 1. Dominant plant species

Tree	(1) *Abies grandis* (2) *Pseudotsuga menziesii*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

Landform: hills
Parent material: loess
Elevation: 200 to 1200 feet
Slope: 0 to 60 percent
Flooding: none
Ponding: none

This site occurs on the Dolph and Eola geomorphic surfaces located around the edges of the Portland Basin (Balster and Parsons, 1968; Reckendorf, 1993).

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None

Ponding frequency	None
Elevation	200–1,200 ft
Slope	0–60%

Climatic features

Mean annual air temperature: 50 to 54 degrees F
Mean annual precipitation: 45 to 60 inches
Frost free period: 165 to 210 days

Influencing water features

A perched water table located below 20 inches may be present in early spring.

Wetland description

None.

Soil features

Drainage class: well drained or moderately well drained
Parent material: loess
Soil restrictive feature(s): fragipan (brittle subsoil layer) occurs below 20 inches is some soils
Soil moisture regime: xeric
Soil moisture subclass: typic or aquic
Soil temperature regime: mesic
Particle-size family(s): fine-silty
Soil mineralogy: mixed
Cation exchange capacity: superactive
Soil reaction: moderately or strongly acid

The rooting zone is usually dry 45 to 60 consecutive days during the summer which is typical of upland sites in this LRU. Soils with fragpians may have perched water tables which rise no higher than 20 inches below the soil surface Soils classify as Alfisols or Inceptisols. Additions of loess have rejuvenated and increased the fertility of these soils; cation-exchange activity class is higher compared with soils on the same geomorphic surfaces in the Willamette Valley (LRU C).

Soils correlated with this site include Cascade, Cornelius, Kinton, and Laurelwood.

Table 3. Representative soil features

Parent material	(1) Loess
Family particle size	(1) Fine-silty
Drainage class	Moderately well drained to well drained

Ecological dynamics

Central Concept

This site occurs on loess-covered hills. Soils are silty. A perched water table located below 20 inches may be present in early spring. The rooting zone is dry 45 to 60 consecutive days during the summer which is typical for upland sites in this LRU. Conifer forest tends to develop. The reference plant community is grand fir - Douglas-fir.

Range in Variability

Variation in soils and landscape position may define subtypes with distinct reference communities. Some southern exposures and convex hillslopes support drought-tolerant communities. Northern exposures and concave hillslopes may support plant communities where grand fir (*Abies grandis*) regenerates in the understory (McCain and Diaz, 2001). A water table present in soils with fragipans may give hardwood trees competitive advantage by restricting rooting depth for some conifer species.

Disturbance

Fire is the dominant natural landscape level driver. Mixed severity and low severity fires dominate in this vegetation type. This type is transitional from the high frequency/low severity of the valley floor (likely assisted by cultural burning) and the lower frequency mixed severity regime of the higher elevation western hemlock types. Frequency of cultural burning generally decreased with distance from human settlements (Christy and Alverson, 2011). Given the location of this type, fire frequency may be quite variable. Historical fire has varied from 20-100 years mean fire return intervals (MFRI) (Weisberg 1997, Robbins 2004, Spies et al. 2018). Fire has been suppressed since modern wildland fire suppression efforts began. Wind, insects and pathogens, and infrequent landslides may also shape forest composition and pattern at finer scales. Human management is prevalent in this type, with activities such as regeneration harvest and thinning occurring within its range and dominating phase trajectories over fire (Spies et al. 2013). Tree-throw occurs in forested communities. Pocket gophers (Thomomys spp.) make burrows and mounds in early-seral communities (Oregon Department of Fish and Wildlife).

Plant Composition

Conifer forest was typical prior to Euro-American settlement but fire suppression has generally led to denser forest stands. Savanna can be created and maintained on this site with difficulty due to competing woody vegetation and lack of frequent fire.

Grand fir - Douglas-fir forests have some of the highest levels of plant diversity compared with all western Oregon forests (McCain and Diaz 2001). Representative native plants are listed below. Not all species are present within the same community phase. Plant lists (especially for graminoids and herbs) are incomplete.

TREES:
Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco)
grand fir (*Abies grandis* (Douglas ex D. Don) Lindl)
bigleaf maple (*Acer macrophyllum* Pursh)
Oregon white oak (*Quercus garryana* Douglas ex Hook)
western redcedar (*Thuja plicata*)
Pacific dogwood (*Cornus nuttallii*)
ponderosa pine (*Pinus ponderosa* Lawson & C. Lawson)
Pacific madrone (*Arbutus menziesii* Pursh)
red alder (*Alnus rubra*)

SHRUBS:
vine maple (*Acer circinatum* Pursh)
Cascade barberry (*Mahonia nervosa* (Pursh) Nutt.)
cascara buckthorn (*Frangula purshiana* (DC.) A. Gray ssp. Purshiana)
salal (*Gaultheria shallon* Pursh)
common snowberry (*Symphoricarpos albus* (L.) S.F. Blake)
creeping snowberry (*Symphoricarpos mollis* Nutt.)
beaked hazelnut (*Corylus cornuta* Marshall)
dwarf rose (*Rosa gymnocarpa* Nutt.)
California blackberry (*Rubus ursinus* Cham. & Schltdl.)
Pacific poison oak (*Toxicodendron diversilobum* (Torr. & A. Gray) Greene)
oceanspray (*Holodiscus discolor* (Pursh) Maxim)
hollyleaved barberry (*Mahonia aquifolium* (Pursh) Nutt)
common whipplea (*Whipplea modesta* Torr.)

HERBS:
western swordfern (*Polystichum munitum* (Kaulf.) C. Presl)

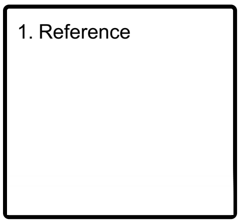
sweetcicely (*Osmorhiza berteroi* DC.)
white insideout flower (*Vancouveria hexandra* (Hook.) C. Morren & Decne.)
starflower (*Trientalis borealis* Raf.)
woodland strawberry (*Fragaria vesca* L)
American trailplant (*Adenocaulon bicolor* Hook.)
sweet after death (*Achlys triphylla* (Sm.) DC.)
Columbian windflower (*Anemone deltoidea* Hook)
pale bellflower (*Campanula scouleri* Hook. ex A. DC.)
largeleaf sandwort (*Moehringia macrophylla* (Hook.) Fenzl)
western brackenfern (*Pteridium aquilinum* (L.) Kuhn)
snowqueen (*Synthyris reniformis* (Douglas ex Benth.) Benth.)
sweetscented bedstraw (*Galium odoratum* (L.) Scop.)
houndstongue hawkweed (*Hieracium cynoglossoides* Arv. -Touv.)
evergreen violet (*Viola sempervirens* Greene)
twinflower (*Linnaea borealis* L)
yerba Buena (*Clinopodium douglasii* (Benth.) Kuntze)

GRAMINOIDS:
Columbia brome (*Bromus vulgaris* (Hook.) Shear)
western fescue (*Festuca occidentalis* Hook.)
bearded fescue (*Festuca subulata* Trin.)
California fescue (*Festuca californica* Vasey)
sedge species (Carex L.)

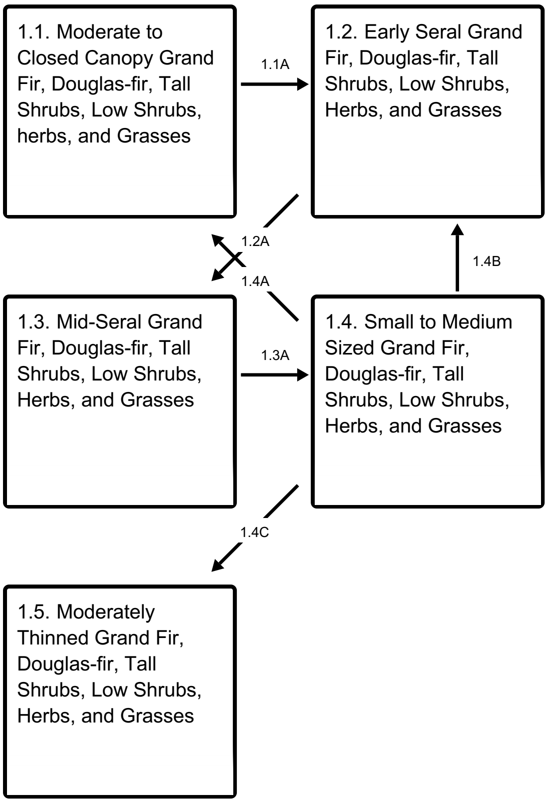
Structural Descriptions Used in State and Transition Model
Phases are described by size class, cover class and layering. Size class description refers to either the average diameter of the dominant and co-dominant trees (quadratic mean diameter or qmd) in the state and transition model or the general sizes by species in the following narrative.
Size Class
Grass Forb/Seedling Sapling Pole Small Medium Large/Giant
DBH (inches) NA 0.1-4.9 5-9.9 10-19.9 20-29.9 =30
Canopy Cover Class
Open Moderate Closed
Canopy cover (%) <10 10-60 >60

State and transition model

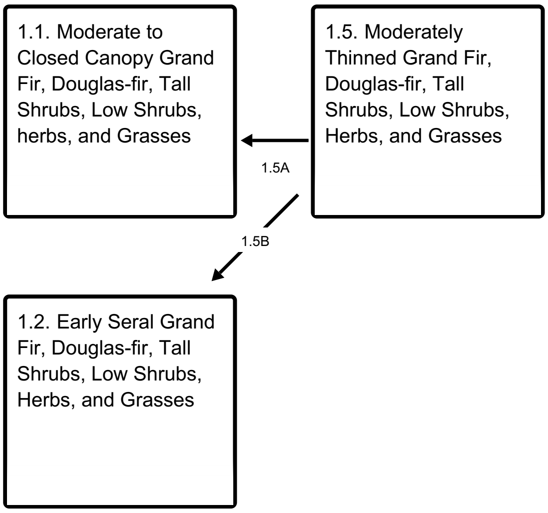
Ecosystem states



State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



State 1
Reference

Community 1.1
Moderate to Closed Canopy Grand Fir, Douglas-fir, Tall Shrubs, Low Shrubs, herbs, and Grasses

Growth from community phase 1.4 and 1.5 are the dominant pathways producing this condition. Moderate to low severity fire and background mortality (insects, pathogens, wind, etc.) processes also serve to maintain a single- to multi- layered, moderate to closed canopy forest with heterogeneous composition of medium to large trees. Small to large snags are present, as well as down wood (Mellen-McLean et al. 2017). Dominant medium to large Douglas-fir and grand fir, with medium bigleaf maple are indicators of the reference community. Other trees, such as large ponderosa pine may be found as well. Hardwoods including Oregon white oak and Pacific madrone may occur on drier, warmer sites. These forests produce the highest plant diversity in western Oregon forested systems. Many of the shrubs listed above co-occur within the zone, averaging 30% to >60% cover. Many of the forbs listed above are found within the zone range. Graminoids such as brome and fescue species are found in low to moderate cover. Slender false brome (*Brachypodium sylvaticum* (Huds.) P. Beauv.), a shade-tolerant, non-native species, has invaded many sites that otherwise resemble the reference community.

Community 1.2
Early Seral Grand Fir, Douglas-fir, Tall Shrubs, Low Shrubs, Herbs, and Grasses

This community is a post-disturbance, early seral condition resulting from high severity fire or regeneration harvest, or other disturbance. Open canopy conditions, with or without legacy structure, and tree regeneration characterize this phase. Douglas-fir, grand fir, and ponderosa pine may exist as scattered live legacy overstory. Post-fire conditions may consist of moderate to high densities of small to large snags, resulting in diverse cover of down wood (Mellen-McLean et al. 2017). Seedlings of various coniferous species may be present, with Douglas-fir and grand fir likely dominating. Bigleaf maple, Pacific madrone, and Oregon white oak may persist through basal sprouting. Early seral trees, such as bitter cherry (*Prunus emarginata* (Douglas ex Hook.) D. Dietr.) and ponderosa pine, may be present (Oakley and Franklin 1998.). Many shrubs in this type are adapted to disturbance and will persist through post-disturbance sprouting (e.g. vine maple, Cascade barberry, California hazelnut, snowberry). California blackberry may greatly increase in cover to dominate the ground layer. Red elderberry, (*Sambucus racemosa* L), willow species (Salix L.), snowbrush ceanothus (*Ceanothus velutinus* Douglas ex Hook), and thimbleberry (*Rubus parviflorus* Nutt.) are native early seral shrubs that may be present (Halpern 1988, Brown et al. 2013). Snowbrush ceanothus can dominate on drier sites after burning. Non-native shrubs such as Scotch broom (*Cytisus scoparius* (L.) Link) may be present in low to moderate cover. Many late seral herbs and graminoid species recover and persist. Early seral native species such as fireweed (*Chamerion angustifolium* (L.) Holub), and Canadian horseweed (*Conyza canadensis* (L.) Cronquist) may be ephemeral dominants (Halpern 1989). Bull thistle (*Cirsium vulgare* (Savi) Ten), woodland ragwort (*Senecio sylvaticus* L.) and slender false brome (*Brachypodium sylvaticum* (Huds.) P. Beauv.), non-native herbs, may dominate the understory if seed source is present (Halpern 1988, Halpern 1989, McCain and Diaz 2001).

Community 1.3
Mid-Seral Grand Fir, Douglas-fir, Tall Shrubs, Low Shrubs, Herbs, and Grasses

This mid-seral phase is the result of growth from community 1.2. Medium to large decayed snags from previous disturbances may persist in this phase, although low levels of small snags may be more common. Down wood is variable, with high levels possible in post-fire generated conditions (Mellen-McLean et al. 2017). The live canopy has simple structure, dominated by sapling to pole sized trees, with some stands displaying some medium to large pre-disturbance legacy trees. Douglas-fir and grand fir likely dominate, with scattered ponderosa pine, Oregon white oak, Pacific madrone, and bigleaf maple present to varying degrees depending on site conditions. Canopy cover is moderate due to site conditions and shrub, forb, and graminoid cover. There is minimal to no tree regeneration and low to moderate cover of shrub and herbs. On heavily burned sites snowbrush ceanothus may continue to dominate the shrub layer, resulting in lower tree density (Brown et al. 2013). Sprouting shrubs (e.g. vine maple, Cascade barberry, California hazelnut, snowberry) are present in low to moderate cover. Native red elderberry, willow species, snowbrush ceanothus, and non-native scotch broom may be present in stands with lower tree canopy cover. Native herbs will persist, and non-native bull thistle and slender false brome may continue to inhabit and dominate this phase.

Community 1.4
Small to Medium Sized Grand Fir, Douglas-fir, Tall Shrubs, Low Shrubs, Herbs, and Grasses

Growth from CP1.3 produces this community phase. Medium to large snags and down wood from previous disturbances are likely present but declining in abundance due to decay and fragmentation. Smaller snags are being created from background mortality due to competition, insects, and pathogens (Mellen-McLean et al. 2017). Forest structure is still simple and largely single layered. Canopy cover is moderate to high and dominated by small to medium sized Douglas-fir and grand fir. Some legacy medium and large trees may be present in some cases. Bigleaf maple can be co-dominant in some stands. Scattered ponderosa pine, Pacific madrone, and Oregon white oak may be present to varying degrees. Regeneration varies depending on light levels. Sprouting shrubs (e.g. vine maple, Cascade barberry, California hazelnut, snowberry) are present in low to moderate cover. Herb and graminoid presence and cover vary depending on light levels.

Community 1.5
Moderately Thinned Grand Fir, Douglas-fir, Tall Shrubs, Low Shrubs, Herbs, and Grasses

This phase is the result of moderate severity fire or moderate thinning of community 1.4. Small to medium sized Douglas-fir, grand fir, and bigleaf maple may dominate the overstory canopy layer. Medium to large snags and down wood from previous disturbances are likely present but declining in abundance due to decay and fragmentation. Small and medium snags in varying densities may result from fire and may lead to later recruitment of down wood (Mellen-McLean et al. 2017). A range of shade tolerant (grand fir, bigleaf maple) and shade intolerant (Douglas-fir, ponderosa pine, Pacific madrone) trees may be present, depending on the severity and size of the disturbance. Regeneration may also include shade tolerant and intolerant species. Shrub species are varied, including sprouting shrubs (e.g. vine maple, Cascade barberry, California hazelnut, snowberry). Scotch broom may invade post-disturbance. Native and non-native herbs and graminoids are present, dependent on seed source and disturbance severity. Slender false brome may be maintained and increase in cover. Stands that reach this community phase may progress to a multi-layered community 1.1 more quickly than undisturbed stands maturing along community phase pathway 1.4A. Disturbances such as moderately severity fire or thinning alter structure instantaneously compared with slower causes of tree mortality considered part of growth pathway 1.4A.

Pathway 1.1A

Community 1.1 to 1.2

Stand replacing fire, regeneration harvest, large scale wind event, insects, and pathogens are the dominant processes returning this phase to an early seral condition.

Pathway 1.2A
Community 1.2 to 1.3

Growth is the major process transitioning out of this early seral condition.

Pathway 1.3A
Community 1.3 to 1.4

Growth is the major process transitioning out of this phase. Pre-commercial thinning may also facilitate this phase change.

Pathway 1.4A
Community 1.4 to 1.1

Growth will serve to transition this phase into the reference community.

Pathway 1.4B
Community 1.4 to 1.2

Regeneration harvest or stand replacing fire can return this phase back to early seral conditions.

Pathway 1.4C
Community 1.4 to 1.5

Management actions such as thinning can trigger a shift in phases. Mixed severity fire can also result in a transition to more diverse stand conditions.

Pathway 1.5A
Community 1.5 to 1.1

Growth will serve to transition this phase into the reference community.

Pathway 1.5B
Community 1.5 to 1.2

Regeneration harvest or stand replacing fire can return this phase to early seral conditions.

Additional community tables

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Approval

Kirt Walstad, 12/03/2024

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	10/03/2023
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:**