Ecological site R006XA300OR
Loamy 14-20 PZ

Last updated: 9/11/2023
Accessed: 10/12/2024

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): 006X–Cascade Mountains, Eastern Slope

Stretching from northern Washington to southern Oregon, MLRA6 encompasses the mountain slopes, foothills, elevated plateaus and valleys on the eastern slopes of the Cascade mountains. This MLRA is a transitional area between the Cascade Mountains to the west and the lower lying Columbia Basalt Plateau to the east. Situated in the rain shadow of the Cascade Crest, this MLRA receives less precipitation than portions of the cascades further west and greater precipitation than the basalt plateaus to the east. Geologically, the majority of the MLRA is dominated by Miocene volcanic rocks, while the northern portion is dominated by Pre-Cretaceous metamorphic rocks and the southern portion is blanketed with a thick mantle of ash and pumice from Mount Mazama. The soils in the MLRA dominantly have a mesic, frigid, or cryic soil temperature regime, a xeric soil moisture regime, and mixed or glassy mineralogy. They generally are moderately deep to very deep, well drained, and loamy or ashy. Biologically, the MLRA is dominated by coniferous forest, large expanses of which are dominated by ponderosa pine, Douglas-fir or lodgepole pine. Areas experiencing cooler and moister conditions include grand fir, white fir, and western larch while the highest elevations include pacific silver fir, subalpine fir and whitebark pine. Economically, timber harvest and recreation are important land uses in these forests. Historically, many of these forests would have experienced relatively frequent, low and mixed severity fire favoring the development of mature forests dominated by ponderosa pine or Douglas-fir. In the southern pumice plateau forests, less frequent, higher severity fire was common and promoted the growth of large expanses of lodgepole pine forests.

LRU notes

Located at the eastern edge of the Columbia river gorge, this unit is restricted to areas influenced by the modified maritime climate of this unique passageway through the Cascades. This setting allows for the persistence of Oregon White Oak woodlands east of the Cascade crest. These woodlands often include ponderosa pine, and on sites with greater soil moisture, Douglas-fir. Botanical diversity is high, with a mixture of West Cascade and East Cascade plant species commonly co-occurring. Physiographically, this unit is characterized by dissected foothills, valleys and ridges draining Mount Hood in Oregon and Mount Adams in Washington. Geologically, the unit is characterized by late tertiary pyroclastic and volcanoclastic deposits and basalt flows. The climate of this unit is generally warm and dry with a predominately xeric soil moisture regime and mesic soil temperature regime. Historically, the drier extent of these forests have been influenced by a fire regime whereby frequent low and mixed severity fires would have favored the development of open canopied forests. Higher elevations and more westerly locations receiving more moisture within this unit would have been influenced by moderately frequent, low and mixed severity fires favoring a mosaic of forest stages with closed canopy conditions common.

Ecological site concept

This site represents a dry woodland community at the transition zone between the eastside foothills of the Oregon Cascades and the Columbia plateau. The Reference Plant Community is that of a mixed Oregon white oak (Quercus garryana) – ponderosa pine (Pinus ponderosa) woodland with an understory dominated by Idaho fescue (Festuca idahoensis) and scattered antelope bitterbrush (Purshia tridentata). Compared to ponderosa communities

within the same precipitation band further south, this site is warmer and experiences a greater number of frost-free days, facilitating the persistence of white oak. Deep, loamy soils and gentle slopes increase soil water holding capacity and decrease soil drainage, thereby creating the conditions for a productive understory and the codominance of ponderosa pine. In comparison, adjacent sites on moisture limited south slopes with well drained soils containing substantial coarse fragments, favor the dominance of white oak with less canopy cover of ponderosa pine. Compared to adjacent sites on north slopes with lower evapotranspiration rates, this site has considerably lower herbaceous productivity.

This is a provisional ecological site and is subject to extensive review and revision before final approval. All data herein should be considered provisional and contingent upon field validation prior to use in conservation planning.

Associated sites

R006XA200OR	**South Slopes 14-20 PZ** occupying adjacent south slopes
F006XA804OR	**Mesic Xeric Maritime Foothills 30-50 PZ** forested components within shared map units

Similar sites

R006XA310OR	**Juniper-Oak Clayey** Shallower soils, western juniper common
R006XA200OR	**South Slopes 14-20 PZ** south slope aspects, pine uncommon
R006XA202OR	**North Slopes 14-20 PZ** north slope aspects, pine uncommon

Table 1. Dominant plant species

Tree	(1) *Pinus ponderosa* (2) *Quercus garryana*
Shrub	Not specified
Herbaceous	(1) *Festuca idahoensis*

Physiographic features

This site occurs on summits, shoulders, and side slopes of foothills. Slopes range from 2 to 20 percent. Elevations typically range from 1,000 to 2,500 feet (300 to 750 meters) but may occur as low as 250 feet (75 meters). This site occurs on all aspects. This site is not subject to ponding or flooding and no water table is present within the upper 100 inches of soil.

Table 2. Representative physiographic features

Hillslope profile	(1) Summit (2) Shoulder (3) Backslope (4) Footslope
Landforms	(1) Foothills > Hillside or mountainside
Flooding frequency	None
Ponding frequency	None
Elevation	1,000–2,500 ft
Slope	2–20%
Ponding depth	0 in
Water table depth	100 in

Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	250–2,500 ft
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation ranges from 14 to 20 inches (350 to 500mm), most of which occurs during the months of October through May. Most of the precipitation occurs in the form of rain. The soil temperature regime is mesic with a mean annual air temperature of approximately 48 degrees F (9 degrees C). Historical temperature extremes range from 110 to -15 degrees Fahrenheit (43 to -26 degrees C). The frost-free period ranges from 120 to 200 days. This climate is modified by the influence of the Columbia River Gorge which acts as a conduit for maritime air masses to move past the Cascade mountains. The optimum period for plant growth is from mid-March through mid-July. The graphs below are populated from the closest available weather station to representative site locations and are provided to indicate general climate patterns.

Table 4. Representative climatic features

Frost-free period (characteristic range)	120-200 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	14-20 in
Frost-free period (average)	160 days
Freeze-free period (average)	
Precipitation total (average)	10 in

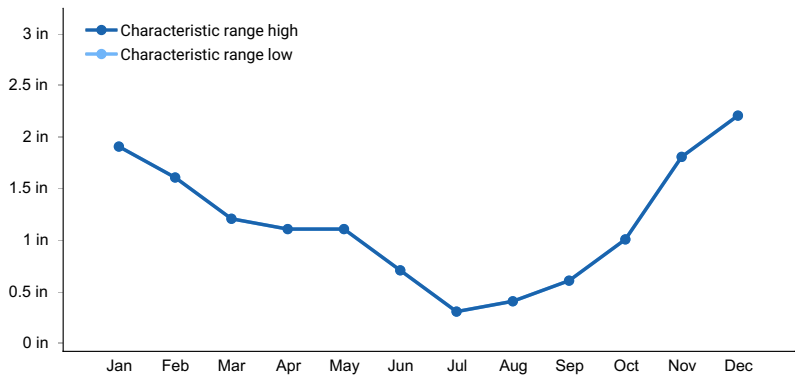


Figure 1. Monthly precipitation range

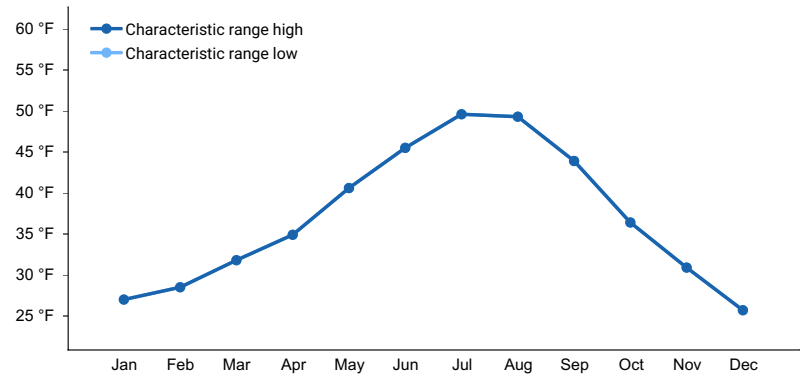


Figure 2. Monthly minimum temperature range

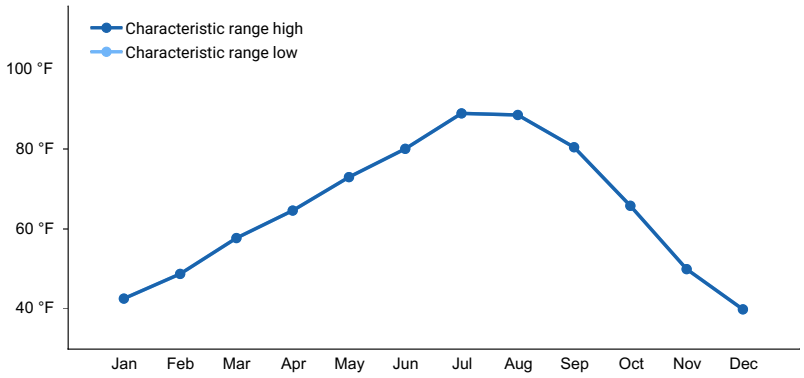


Figure 3. Monthly maximum temperature range

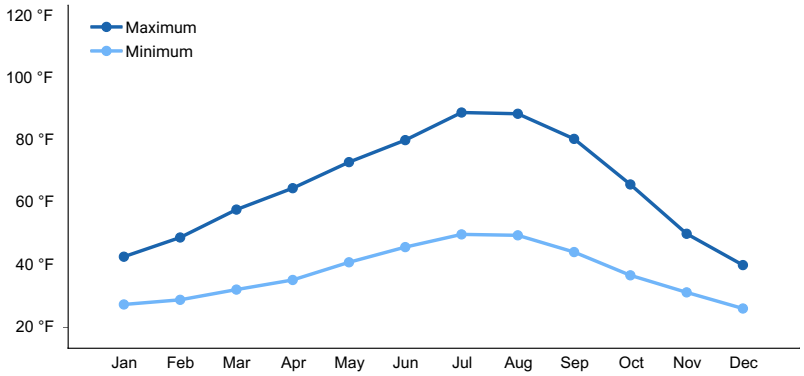


Figure 4. Monthly average minimum and maximum temperature

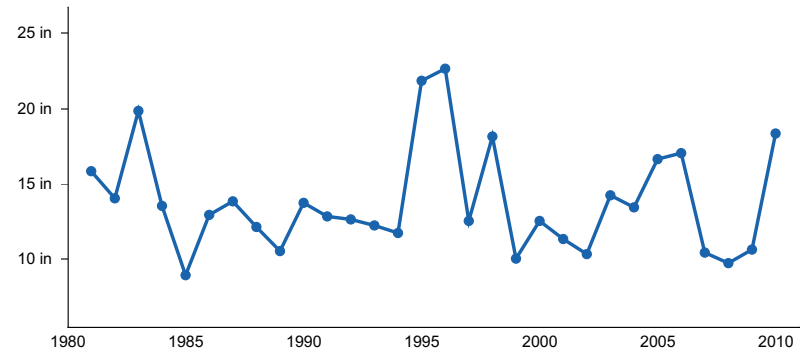


Figure 5. Annual precipitation pattern

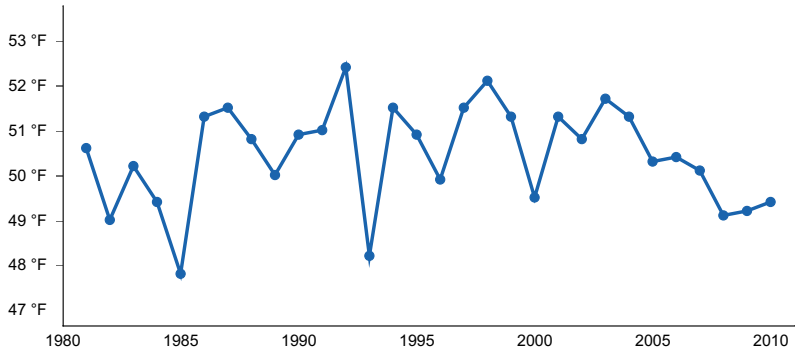


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DUFUR [USC00352440], Dufur, OR

Influencing water features

This site is not influenced by water from a wetland or stream.

Wetland description

N/A

Soil features

The soils that typify this site concept are deep and well drained. They have medium textured surface layers and loamy subsoils. One to three foot high soil hummocks are often present. Depth to bedrock ranges from 40 inches to over 60 inches. Permeability is moderately slow to moderately rapid.

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Loess (3) Alluvium–volcanic rock (4) Colluvium–volcanic rock
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Coarse-loamy (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	40–60 in
Soil depth	40–60 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-40in)	5.5–7.3 in
Soil reaction (1:1 water) (0-40in)	6.1–7.3
Subsurface fragment volume <=3" (4-60in)	0–10%

Subsurface fragment volume >3" (4-60in)	0–5%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	4.5–7.4 in
Soil reaction (1:1 water) (0-40in)	5.6–8.4
Subsurface fragment volume <=3" (4-60in)	Not specified
Subsurface fragment volume >3" (4-60in)	Not specified

Ecological dynamics

Reference Plant Community:

The Reference Plant Community of this site is characterized by an open, savannah-like woodland maintained by relatively frequent, low-intensity fires dominated by Oregon white oaks and some ponderosa pine in the overstory. The understory is primarily composed of grasses and some forbs and scattered shrubs. The dominant understory species are Idaho fescue and antelope bitterbrush, with bluebunch wheatgrass (*Pseudoroegneria spicata*) also common. Vegetative composition of the community is approximately 70 percent grasses, 10 percent forbs and 20 percent shrubs and trees. This site is generally dominated by Idaho fescue in the understory, yet bluebunch wheatgrass may increase on more coarse textured soils. Oak and ponderosa pine regeneration may be either scattered or in concentrated patches.

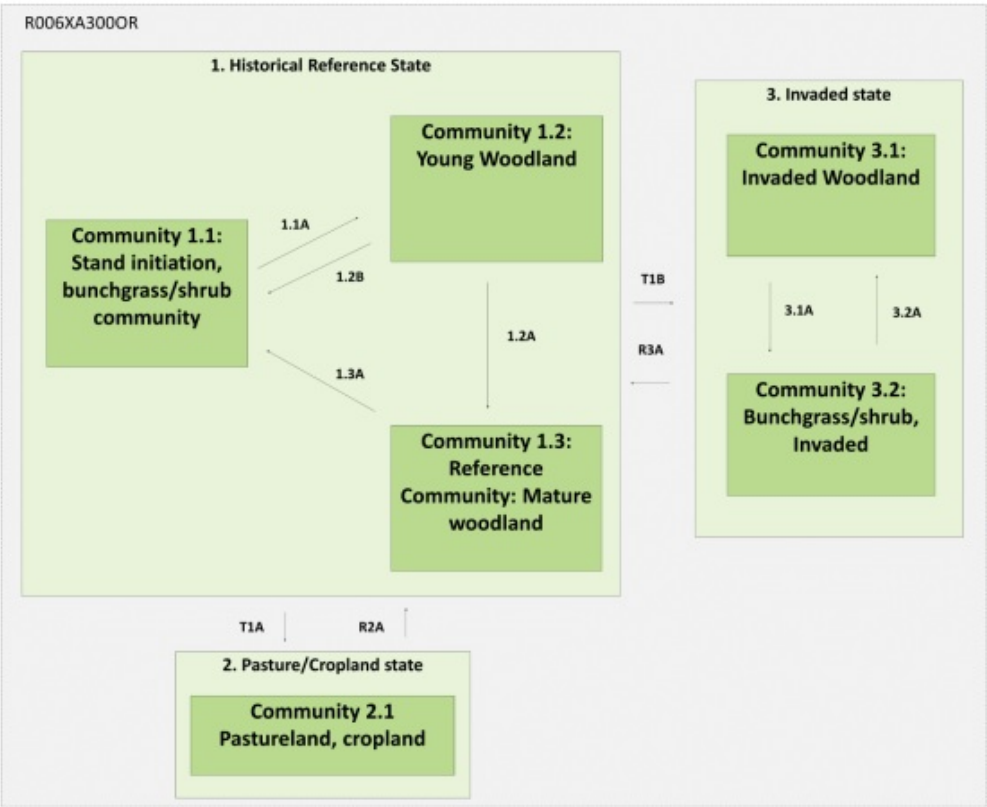
Disturbance:

As one of the driest woodland types in Oregon, white oak - ponderosa pine communities on the eastside of the Cascades were historically subject to frequent, low severity fires that maintained the open, savannah-like appearance and higher cover of herbs in the understory, both due to natural and cultural ignitions (Landfire 2007). Mixed and stand replacement fires also occurred occasionally in these stands but were rare due to limited fuels and fire tolerant canopies (Landfire 2007). Oregon white oak is adapted to these conditions by re-sprouting from the base, following top kill, and developing thick, fire-resistant bark with maturity (Devine et al 2013). Ponderosa pine is also well adapted to these conditions, developing increasing fire resistance with age by growing thick bark and self-thinning lower limbs (Fryer 2008). Both tree species are susceptible to mortality by low intensity fires when young, yet gain resistance with age. If fires are frequent enough, they can remove many of the pines and infill seedlings, leaving only those trees that managed to survive and continue growing (Landfire 2007). With a disruption of this fire regime, the canopy becomes more closed and the understory declines in cover and production (Devine et al. 2013). While bitterbrush may re-sprout following fire, repeated fire may reduce cover over time (Busse and Riegel 2009). As a shade tolerant species when young, white oak can be a pioneer species following fire, and will attain dominance on sites not suitable for ponderosa pine or Douglas-fir. White oak may be particularly competitive rocky, shallow soils and droughty aspects (Devine et al 2013). With age, white oak loses much of its shade tolerance and will often be outcompeted on favorable sites by conifers, especially if fire is suppressed (Gucker 2007). This site represents conditions where ponderosa pine and white oak may attain codominance, yet information about long-term stand dynamics is lacking. As warm, dry, open, woodland communities, these white oak sites may be highly susceptible to invasive plant species introductions (Lillybridge et al 1995). Common invasive plant species include cheatgrass (*Bromus tectorum*), diffuse knapweed (*Centaurea diffusa*), and bulbous bluegrass (*Poa bulbosa*).

This site may be used for livestock grazing, with Idaho fescue as the preferred species during spring and early summer. If the condition of the site deteriorates as a result of overgrazing, Idaho fescue decreases while bluebunch wheatgrass increases. With further deterioration, bluebunch wheatgrass decreases and rabbitbrush (Chrysothamnus and Ericameria spp.), cheatgrass and diffuse knapweed invade. Under deteriorated conditions annual grasses and shrubs dominate the site, possibly altering the fire regime (Gucker 2007). Restoration activities for East Cascades White Oak sites should be informed by the document “Oregon White Oak Restoration Strategy for National Forest System Lands East of the Cascade Range” by Devine et al 2013.

The state and transition model below represents a generalized and simplified version of plant community change in response to major disturbance types in this ecological site. It does not attempt to model all of the complex interacting effects of grazing, fire and invasive species on ecosystem change and the potential restoration pathways emerging from these dynamics. Emerging evidence is suggesting that climate change is leading to hotter and drier conditions in western forests that will increase fire frequency and extent and lengthen fire seasons (Halofsky et al. 2020). When combined with the interacting impacts of fire suppression, drought, and insect outbreaks, it is possible that this ecological system will experience unpredictable ecosystem shifts and additional alternative states. For warm and dry sites, these impacts may include the possibility of regeneration failure following wildfire disturbance (Halofsky et al. 2020). As this site is updated in future iterations, and further research informs our understanding of East Cascades oak woodlands, descriptions will include more thorough treatments of disturbance and ecological change. The Reference State is largely based on Landfire biophysical settings model 710600: East Cascades Oak-Ponderosa Pine Forest and Woodland (Landfire 2007).

State and transition model



Community Pathways

1.1A	Time without fire
1.2A	Time without fire
1.2B	High severity, stand-replacing fire occurs
1.3A	High severity, stand-replacing fire occurs
3.1A	High severity, stand-replacing fire occurs
3.2A	Time without fire

Transitions / Restoration Pathways

T1A	Conversion of the site to agricultural use
R2A	Extensive restoration activities
T1B	Invasion of annual grasses
R3A	Extensive restoration activities

State 1
Historical Reference State

The Reference Plant Community is an open, mature, ponderosa pine - white oak stand represented by Community Phase 1.3. This is the most advanced community within the historical disturbance regime for this site, yet occurs across the landscape as a mosaic of plant community phases characterized by variation in community structural stage (tree age, density and cover) and species composition. Historically, Oregon white oak - ponderosa pine woodlands would have cycled from a shrub bunchgrass young tree stand initiation phase (1.1) to a young woodland phase (1.2) to a mature woodland phase (1.3) with a disturbance regime characterized by frequent, low intensity surface fires with occasional mixed or replacement severity fires (Landfire fire regime group 1). Fire suppression has likely diminished the presence of mature savannah across the landscape, instead favoring closed canopy conditions and higher densities of younger trees (Devine et al. 2013). Given the likelihood that this state, even in the best condition and highest potential, will almost always include at least some component of exotic species regardless of management inputs, this may also be referred to as the “current potential state”. In this document, the term “reference state” is used synonymously with “current potential state” for the sake of simplicity.

Dominant plant species

- ponderosa pine (*Pinus ponderosa*), tree
- Oregon white oak (*Quercus garryana*), tree
- Idaho fescue (*Festuca idahoensis*), grass

Community 1.1
Stand initiation, bunchgrass/shrub community

Site characterized by bunchgrasses, shrubs, seedling ponderosa pine initiating and white oak sprouting as coppice from bases. Heavy herbivory or frequent fire will maintain the community in this phase.

Community 1.2
Young woodland

Young stand characterized by an open overstory of mixed intermediate aged oak and ponderosa with and understory of bunchgrasses and shrubs. Regular surface fire will maintain the community in this phase. Frequent low severity fires in this stage will maintain the overstory of older pole sized oak trees, kill young trees and saplings and an facilitate an understory dominated by herbaceous species and sprouting shrubs.

Community 1.3
Reference Plant Community: Mature Woodland

This is the Reference Community. Mature stand characterized by an open overstory of mature, mostly multi-stemmed oaks, large ponderosa and an understory composed of bunchgrasses, shrubs and perennial grasses. Regular surface fire will maintain the community in this phase. Frequent low severity fires in this stage will maintain the overstory of older pole sized oak trees, kill young trees and saplings and facilitate an understory dominated by herbaceous species and sprouting shrubs.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	295	490	620
Tree	65	105	135
Forb	45	80	100
Shrub/Vine	45	75	95
Total	**450**	**750**	**950**

Pathway 1.1A
Community 1.1 to 1.2

Time without fire

Pathway 1.2B
Community 1.2 to 1.1

High severity, stand replacing fire occurs

Pathway 1.2A
Community 1.2 to 1.3

Time without fire

Pathway 1.3A
Community 1.3 to 1.1

High severity, stand replacing fire occurs

State 2
Pasture/Cropland State

In this state, the site is used for agricultural production. This may include perennial pasture or annual crops.

Dominant plant species

- orchardgrass (*Dactylis glomerata*), grass

State 3
Invaded State

In this state much of the native herbaceous vegetation has been replaced by exotic annual grasses which at high levels may create positive feedbacks that alter fire regimes and promote prolonged invasion.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- bulbous bluegrass (*Poa bulbosa*), grass
- medusahead (*Taeniatherum caput-medusae*), grass

Community 3.1
Invaded woodland

Site characterized by an oak woodland that includes a significant portion of invasive annual grasses that have sufficient cover to alter the fire regime and reduce understory biodiversity. Fires become more frequent and may be shifted earlier into the season.

Community 3.2
Bunchgrass/Shrub, Invaded

Site characterized by invasive annual grasses within the understory composition, bunchgrasses are reduced, shrubs and young pine reestablishing and white oak sprouting as coppice from bases. Frequent fire will maintain the community in this phase.

Pathway 3.1A
Community 3.1 to 3.2

High severity, stand replacing fire occurs

Pathway 3.1B
Community 3.2 to 3.1

Time without fire

Transition T1A
State 1 to 2

Conversion of the site to agricultural use.

Transition T2A
State 1 to 3

Invasion of annual grasses, such as cheatgrass and bulbous bluegrass, occupying a significant amount of ground cover. Research has not identified a threshold for cover that will shift this community into an alternative state.

Restoration pathway R2A
State 2 to 1

Restoration of this site will likely be time and labor intensive and require significant inputs. Possible restoration activities will be site specific and may be informed by Devine et al. 2013.

Restoration pathway R3A
State 3 to 1

Reduction of invasive species may be possible yet will be time and labor intensive and require significant inputs. Possible restoration activities will be site specific and may be informed by Devine et al. 2013.

Additional community tables

Table 8. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass and Grasslike plants**			370–585	
	Idaho fescue	FEID	*Festuca idahoensis*	300–375	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	40–115	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–60	–
	prairie Junegrass	Koma	*Koeleria macrantha*	15–40	–
2	**Big Bluegrass**			0	
3	**Other perennial grasses**			15–75	
	squirreltail	ELELB2	*Elymus elymoides ssp. brevifolius*	0	–
	Geyer's sedge	CAGE2	*Carex geyeri*	0	–
	western needlegrass	acoc3	*Achnatherum occidentale*	0	–
Forb					
4	**Forbs**			45–75	
	arrowleaf balsamroot	basa3	*Balsamorhiza sagittata*	15–25	–
	common yarrow	acmi2	*Achillea millefolium*	15–25	–
	pea	Lathy	*Lathyrus*	10–15	–
	lupine	lupin	*Lupinus*	10–15	–
5	**Other perennial forbs**			10–40	
	desertparsley	lomat	*Lomatium*	0	–
	Scouler's woollyweed	hisc2	*Hieracium scouleri*	0	–
	buckwheat	eriog	*Eriogonum*	0	–
	fleabane	erige2	*Erigeron*	0	–
	largehead clover	trma3	*Trifolium macrocephalum*	0	–
	beardtongue	penst	*Penstemon*	0	–
	groundsel	rolda	*Roldana*	0	–
	agoseris	agose	*Agoseris*	0	–
Shrub/Vine					
6	**Shrubs**			40–75	
	antelope bitterbrush	putr2	*Purshia tridentata*	38–75	–
7	**Other shrubs**			10–40	
	deerbrush	cein3	*Ceanothus integerrimus*	0	–
	common snowberry	syal	*Symphoricarpos albus*	0	–
	greenleaf manzanita	arpa6	*Arctostaphylos patula*	0	–
	rose	rosa5	*Rosa*	0	–
	Saskatoon serviceberry	amal2	*Amelanchier alnifolia*	0	–
Tree					
8	**Trees**			75–150	
	Oregon white oak	quga4	*Quercus garryana*	40–75	–
	ponderosa pine	pipo	*Pinus ponderosa*	40–75	–

Inventory data references

Information presented here has been derived from NRCS data. Field observations from range trained personnel were also used. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

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Contributors

Andrew Neary - 2020/2021 update of original draft concept

Approval

Kirt Walstad, 9/11/2023

Acknowledgments

Development of this site as a range site was based on field data collection completed in 1989. It was revised and updated with information regarding ecological dynamics in 2020.

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	10/12/2024
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:**