Ecological site R006XA202OR
North Slopes 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 foothills on the eastside of the Oregon cascades and the Columbia plateau. The reference plant community is that of an Oregon white oak (Quercus garryana) savannah with an understory of perennial native grasses such as Idaho fescue (Festuca idahoensis) and bluebunch wheatgrass (Pseudoroegneria spicata) and shrubs such as antelope bitterbrush

(Purshia tridentata) and deerbrush (Ceanothus integerrimus). East Cascade foothill plant communities are often moisture limited and therefore highly influenced by aspect. This site occupies north slopes at the lower end of the precipitation range for Oregon white oak (14-20 in) a condition which decreases evapotranspiration and increases soil moisture, allowing for a highly productive herbaceous understory. Conversely, sites on south aspects have much lower productivity and lower cover of Idaho fescue due to increased evapotranspiration.

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

R006XA300OR	**Loamy 14-20 PZ** non-aspect positions, higher effective precipitation

Similar sites

R006XA300OR	**Loamy 14-20 PZ** Non aspect, ponderosa pine common

Table 1. Dominant plant species

Tree	(1) *Quercus garryana*
Shrub	(1) *Purshia tridentata*
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata*

Physiographic features

This site typically occurs on ridgetops and north facing exposures of hills. Slopes range from 30 to 70 percent. Elevations typically range from 1,000 to 1,750 feet (350 to 550 meters) but may extend up to 3,000 feet (900 meters). This site is not subject to ponding or flooding and no water table is present within 100 inches of the soil surface.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Ridge (2) Mountains > Hillslope
Flooding frequency	None
Ponding frequency	None
Elevation	1,000–1,750 ft
Slope	30–70%
Ponding depth	0 in
Water table depth	100 in
Aspect	NW, N, NE, E

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,000–3,000 ft
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

This site has a xeric soil moisture regime with mean annual precipitation ranging from 14 to 20 inches (350 to 500 mm), most of which occurs during the months of October through May in the form of rain and snow. The soil temperature regime is mesic with a mean annual air temperature of about 47 degrees F (8.5 degrees C). Historical temperature extremes range from -15 to 100 degrees F (-26 to 38 degrees C). The frost-free period ranges from about 120 to 160 days. The optimum period for plant growth is April through July. 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 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)	120-160 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	14-20 in
Frost-free period (average)	140 days
Freeze-free period (average)	
Precipitation total (average)	17 in

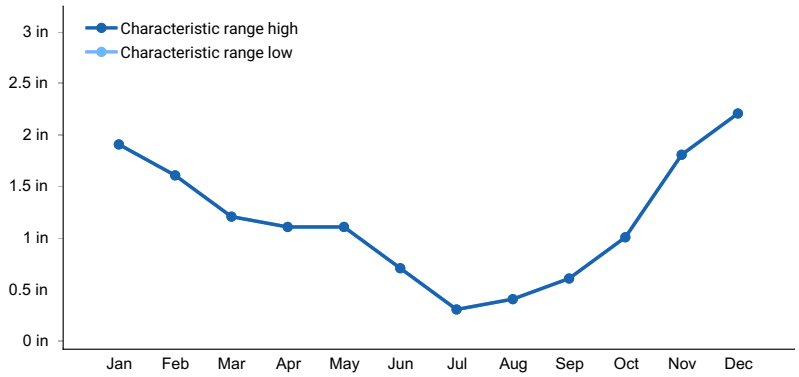


Figure 1. Monthly precipitation range

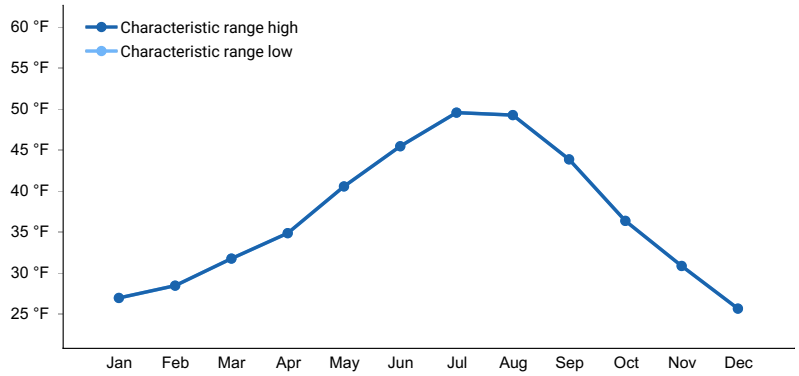


Figure 2. Monthly minimum temperature range

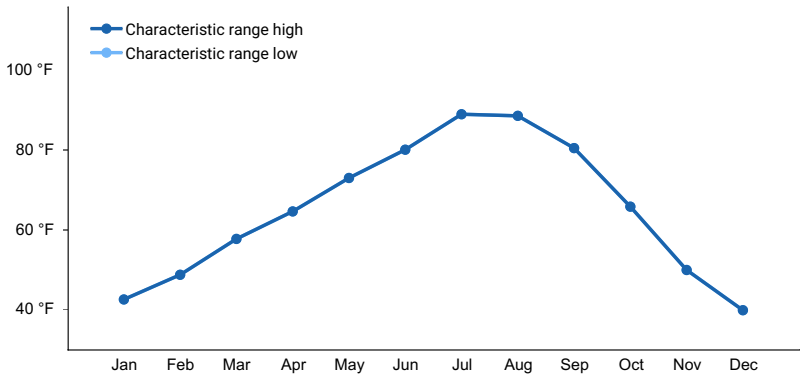


Figure 3. Monthly maximum temperature range

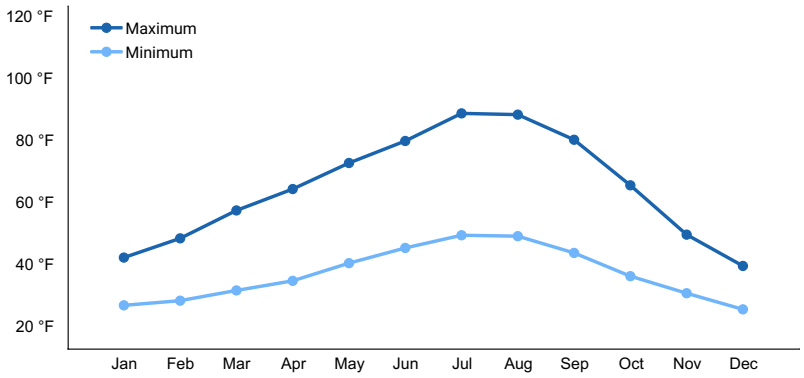


Figure 4. Monthly average minimum and maximum temperature

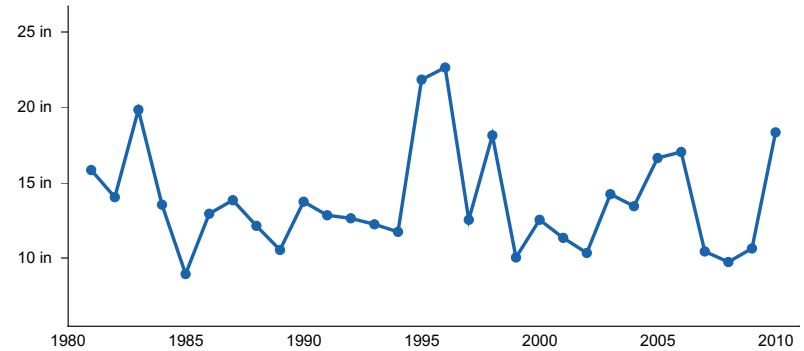


Figure 5. Annual precipitation pattern

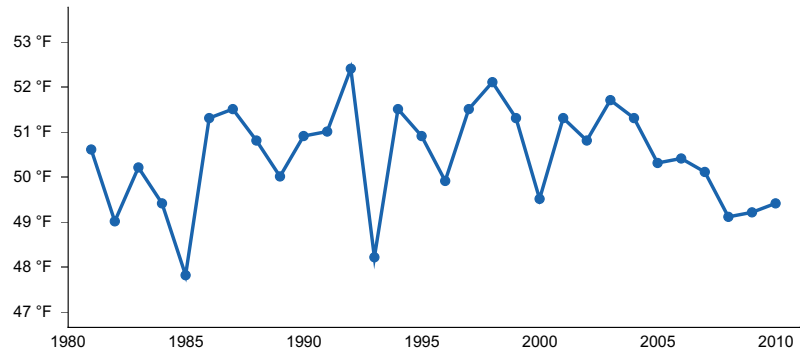


Figure 6. Annual average temperature pattern

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 of this site are typically moderately deep and well drained. Surface textures are often stony loam and subsoil textures are commonly loam or cobbly loam. Depth to bedrock or an indurated pan ranges from 20 to 40 inches. Permeability is moderate. The available water holding capacity is about 3 to 8 inches for the profile. The potential for erosion is severe.

Table 5. Representative soil features

Parent material	(1) Loess (2) Volcanic ash (3) Colluvium–sedimentary rock
Surface texture	(1) Stony loam
Family particle size	(1) Coarse-loamy (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-40in)	3–8 in
Soil reaction (1:1 water) (0-40in)	6.6–7.3
Subsurface fragment volume <=3" (4-60in)	5–20%
Subsurface fragment volume >3" (4-60in)	0–20%

Ecological dynamics

The reference plant community of this site is characterized by an open, savannah-like Oregon white oak woodland maintained by relatively frequent, low-intensity fires. The herbaceous component of the understory is primarily composed of Idaho fescue and bluebunch wheatgrass. Bitterbrush, deerbrush, Sandberg bluegrass (*Poa secunda*), Kentucky bluegrass (*Poa pratensis*), and big bluegrass (*Poa secunda*, formerly P. ampla) are also common in the stand. Vegetative composition of the community is approximately 70 percent grasses, 15 percent forbs and 15 percent shrubs/trees. Variability in plant composition and yield is dependent on aspect, soil depth, and coarse fragments, rather than on precipitation and elevation ranges that occur within the site. Bluebunch wheatgrass will increase in composition on more westerly aspects.

Disturbance:

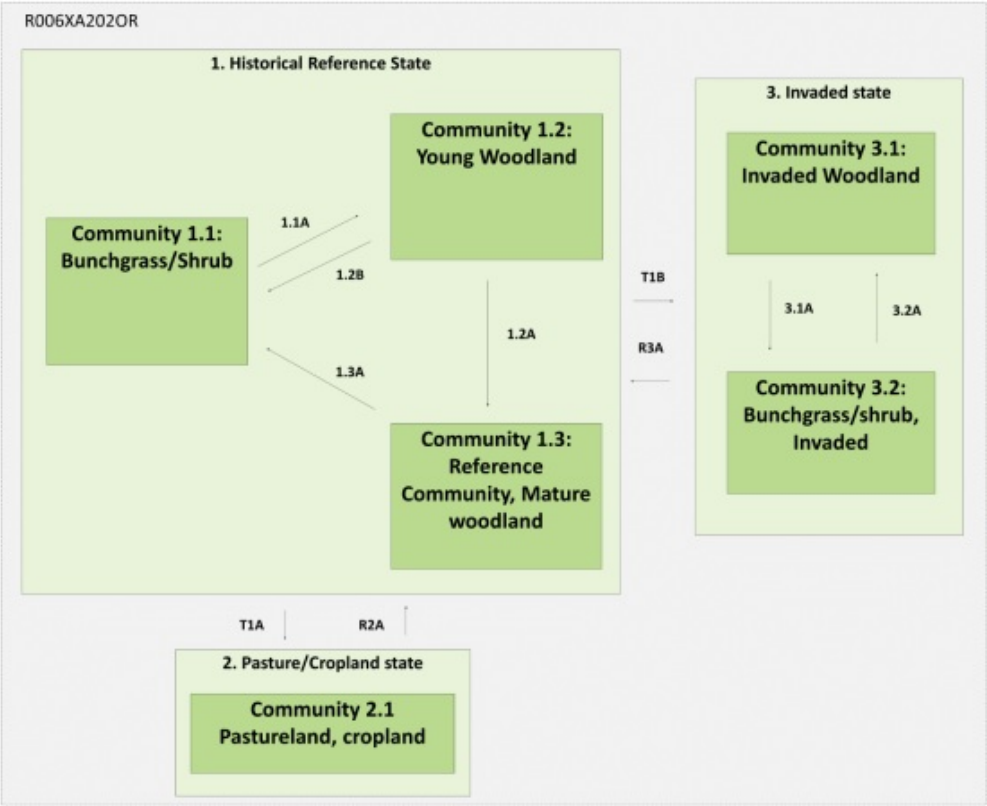
As one of the driest woodland types in Oregon, white oak - ponderosa pine communities on the eastside of the Cascades were historically subject to frequent, low severity fires that maintained the open, savannah-like appearance and higher cover of herbs in the understory, both due to natural and cultural 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 resprouting from bases following topkill as well as developing thick, fire-resistant bark with maturity (Devine et al 2013). White oak is susceptible to mortality by low intensity fires when young, yet gains resistance with age. If fires are frequent enough, they can remove many of the young trees, 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 resprout following fire, repeated fire may reduce its cover over time (Busse and Riegel 2009). As warm, dry, open, woodland communities, these white oak sites may be highly susceptible to invasive plant species introductions (Lillybridge et al 1995), yet productive north aspects such as this site may be less susceptible compared to other sites. 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 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 needlegrasses and bluegrasses invade. Under deteriorated conditions minor forbs, grasses and shrubs increase, and exotic annual grasses and gray rabbitbrush may invade. Severe annual grass invasion may alter the fire regime of this site (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	Restoration activities
T1B	Invasion of annual grasses
R3A	Restoration activities

State 1
Historical Reference State

The reference plant community of this site is that of an open, mature, white oak savannah represented by community phase 1.3. This is the most advanced community within the historical disturbance regime for this site, yet this site 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 woodlands would have cycled from a stand initiation phase (1.1) to a young woodland stage (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. As north aspect site, this site may have higher resistance and resilience to invasion by exotic plant species than other nearby sites.

Dominant plant species

- Oregon white oak (*Quercus garryana*), tree
- antelope bitterbrush (*Purshia tridentata*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

Community 1.1
Bunchgrass/shrub

Site characterized by bunchgrasses, shrubs and white oak sprouting as coppice from bases. Herbivory or frequent fire will maintain the community in this phase.

Community 1.2
Young Woodland

Young stand characterized by an open overstory of intermediate aged oak and an 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 facilitate an understory dominated by herbaceous species and sprouting shrubs.

Community 1.3
Reference Community: Mature Woodland

This is the Reference Community. Mature stand characterized by an open overstory of mature, mostly multi-stemmed oaks with bunchgrasses, shrubs and perennial grasses in the understory. 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.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	460	660	925
Forb	95	130	185
Shrub/Vine	73	105	145
Tree	73	105	145
Total	**701**	**1000**	**1400**

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 the site is invaded 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
- medusahead (*Taeniatherum caput-medusae*), grass
- bulbous bluegrass (*Poa bulbosa*), grass

Community 3.1
Invaded Woodland

Site characterized by an oak woodland that includes a significant portion of invasive annual grasses with 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 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 7. 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**			410–600	
	Idaho fescue	FEID	*Festuca idahoensis*	210–400	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	70–150	–
	Sandberg bluegrass	POSE	*Poa secunda*	7–50	–
2	**Other perennial grasses**			20–50	
	western needlegrass	acoc3	*Achnatherum occidentale*	0	–
	blue wildrye	elgl	*Elymus glaucus*	0	–
	Geyer's sedge	CAGE2	*Carex geyeri*	0	–
	timothy	phpr3	*Phleum pratense*	0	–
	prairie Junegrass	Koma	*Koeleria macrantha*	0	–
3	**Big Bluegrass**			10–50	
Forb					
4	**Forbs**			40–80	
	common yarrow	acmi2	*Achillea millefolium*	7–20	–
	pea	lathy	*Lathyrus*	7–20	–
	lupine	lupin	*Lupinus*	7–20	–
	Scouler's woollyweed	hisc2	*Hieracium scouleri*	7–20	–
5	**Other perennial forbs**			10–100	
	buckwheat	Eriog	*Eriogonum*	0	–
	arrowleaf balsamroot	basa3	*Balsamorhiza sagittata*	0	–
	waterleaf	hydro4	*Hydrophyllum*	0	–
	milkvetch	astra	*Astragalus*	0	–
	pearly everlasting	anaph	*Anaphalis*	0	–
	desertparsley	lomat	*Lomatium*	0	–
	phlox	phlox	*Phlox*	0	–
	strawberry	Fraga	*Fragaria*	0	–
Tree					
6	**Trees**			30–150	
	Oregon white oak	quga4	*Quercus garryana*	15–100	–
	ponderosa pine	pipo	*Pinus ponderosa*	7–50	–
Shrub/Vine					
7	**Shrubs**			20–100	
	deerbrush	cein3	*Ceanothus integerrimus*	7–50	–
	antelope bitterbrush	putr2	*Purshia tridentata*	7–50	–

8	**Other Shrubs**			10–50	
	common snowberry	syal	*Symphoricarpos albus*	0	–
	rubber rabbitbrush	ernan5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0	–
	rose	ROSA5	*Rosa*	–	–

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.

References

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Other references

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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 1997. 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):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**