USDA Natural Resources Conservation Service

Ecological site R006XA200OR
South Slopes 14-20 PZ

Last updated: 9/11/2023
Accessed: 05/19/2024

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) woodland with an understory of perennial native grasses such as Sandberg bluegrass (Poa secunda) and bluebunch wheatgrass (*Pseudoroegneria spicata*) and shrubs such as antelope bitterbrush (Purshia

tridentata) and green rabbitbrush (Chrysothamnus viscidiflorus). East cascade foothill plant communities are moisture limited and therefore highly influenced by aspect. This site occupies south slopes at the lower end of the precipitation range for Oregon white oak (14 to 20 in). Increased evapotranspiration as a result of south aspects create conditions favorable for white oak dominance on this site. This is in contrast to adjacent sites with more gentle slopes and higher precipitation (20 to 40 in) which favor competition by conifers and therefore support higher density of ponderosa pine (Pinus ponderosa) and Douglas-fir (Pseudotsuga menziesii) in the stand. Sites on north aspects often retain higher soil moisture and therefore exhibit higher productivity and higher cover of Idaho fescue (Festuca idahoensis).

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
R006XA302OR	**Steep South Slopes 20-40 PZ** higher effective precipitation

Table 1. Dominant plant species

Tree	(1) *Quercus garryana*
Shrub	Not specified
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Poa secunda*

Physiographic features

This site occurs on south, southeasterly, and west facing exposures of hill and mountain side slopes. Slopes range from 2 to 65 percent. Elevations typically range from 1,000 to 2,500 (350 to 750 meters) but may extend from 500 to 3,500 feet (150 to 1,050 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) Foothills > Hillside or mountainside
Flooding frequency	None
Ponding frequency	None
Elevation	305–762 m
Slope	2–65%
Ponding depth	0 cm
Water table depth	254 cm
Aspect	W, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified

Elevation	152–1,067 m
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 500mm), most of which occurs during the months of November through March in the form of rain and snow. The soil temperature regime is mesic with a mean annual air temperature of approximately 48 degrees Fahrenheit (9 degrees C). Historical temperature extremes range from 105 to -15 degrees F (40 to -26 degrees C). The frost-free period ranges from about 120 to 180 days. The optimum period for plant growth is mid-March through mid-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)	120-180 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	356-508 mm
Frost-free period (average)	150 days
Freeze-free period (average)	
Precipitation total (average)	432 mm

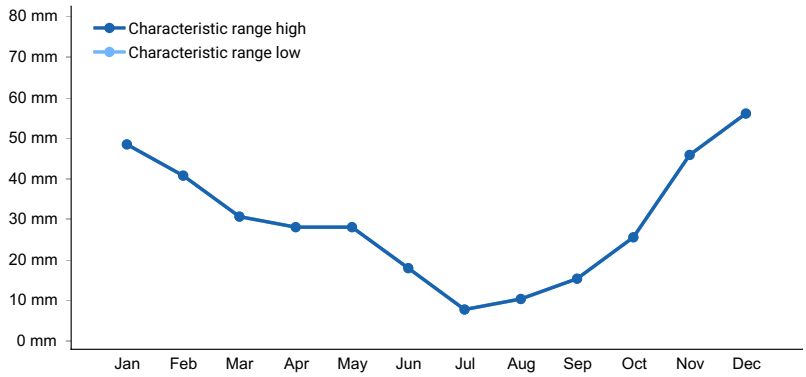


Figure 1. Monthly precipitation range

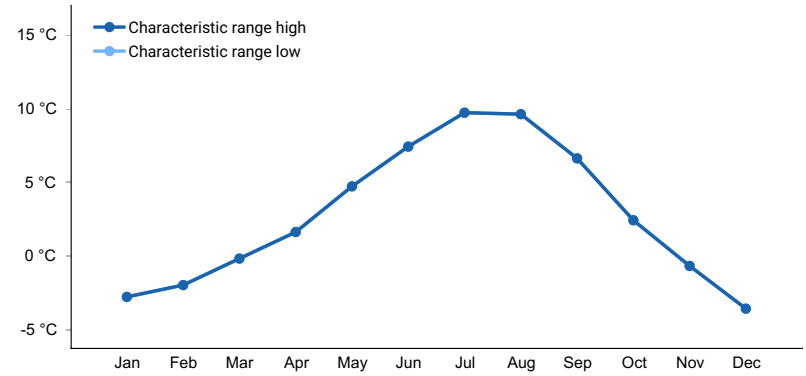


Figure 2. Monthly minimum temperature range

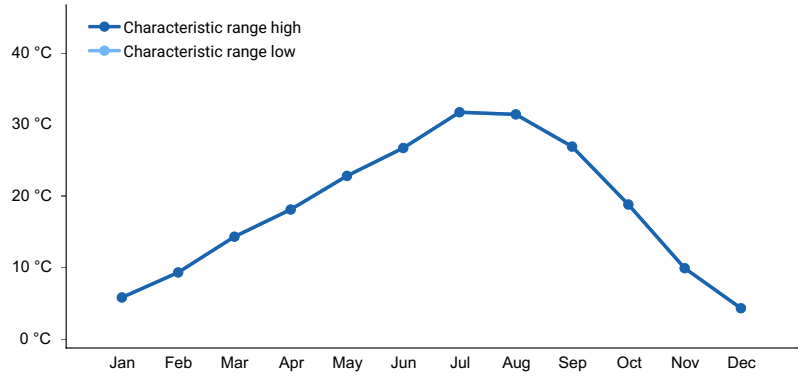


Figure 3. Monthly maximum temperature range

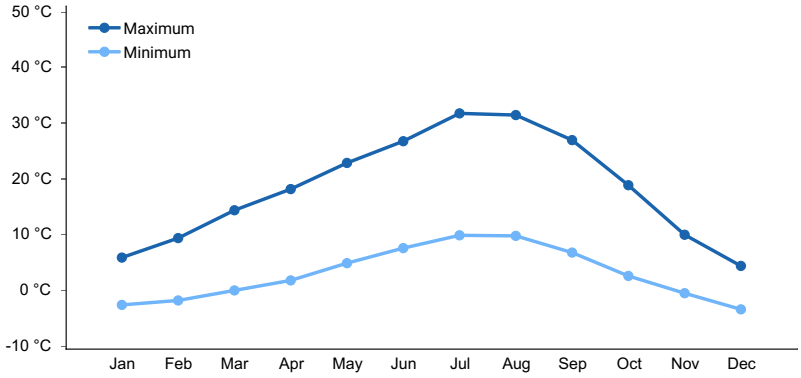


Figure 4. Monthly average minimum and maximum temperature

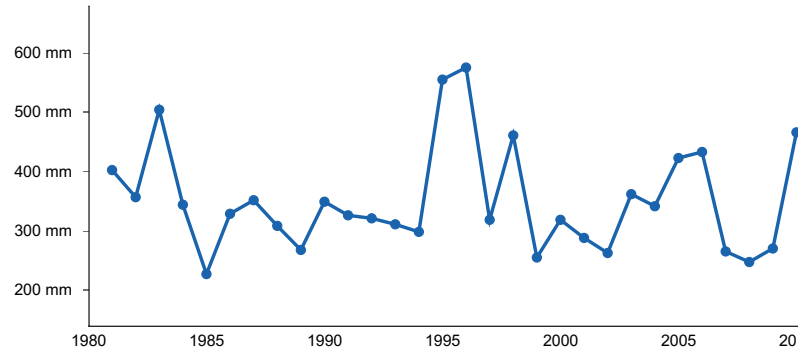


Figure 5. Annual precipitation pattern

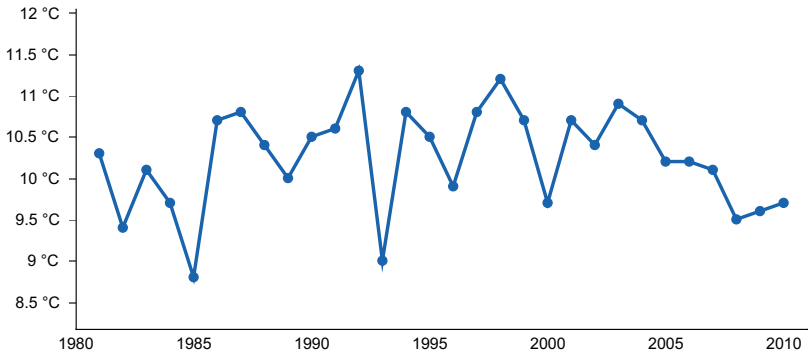


Figure 6. Annual average temperature pattern

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 shallow to deep to bedrock and well drained. Surface textures often range from silt loam to cobbly or stony loam. Subsoil textures often range from loam, cobbly loam or gravelly loam. The typical surface horizon is a cobbly loam about 5 inches thick. The subsoil is often a very cobbly loam or very cobbly clay loam about 13 inches thick. Depth to bedrock or an indurated pan ranges from 12 to 60 inches. Permeability is moderate to moderately slow. The available water holding capacity is about 5 to 12 inches for the profile.

Table 5. Representative soil features

Parent material	(1) Loess (2) Colluvium–volcanic rock (3) Colluvium–sedimentary rock
Surface texture	(1) Silt loam (2) Cobbly, stony loam
Family particle size	(1) Loamy (2) Coarse-loamy (3) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	30–152 cm
Soil depth	30–152 cm
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-152.4cm)	12.7–30.48 cm
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.3
Subsurface fragment volume <=3" (10.2-152.4cm)	0–25%
Subsurface fragment volume >3" (10.2-152.4cm)	0–20%

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 (0-152.4cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4

Subsurface fragment volume <=3" (10.2-152.4cm)	Not specified
Subsurface fragment volume >3" (10.2-152.4cm)	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 oak and some ponderosa pine in the overstory. The dominant grass species is bluebunch wheatgrass (*Pseudoroegneria spicata*) with Sandberg bluegrass, bitterbrush and a variety of forbs also common in the stand. Vegetative composition of the community is approximately 85 percent grasses, 5 percent forbs and 10 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. Idaho fescue will increase as aspect changes to more east facing.

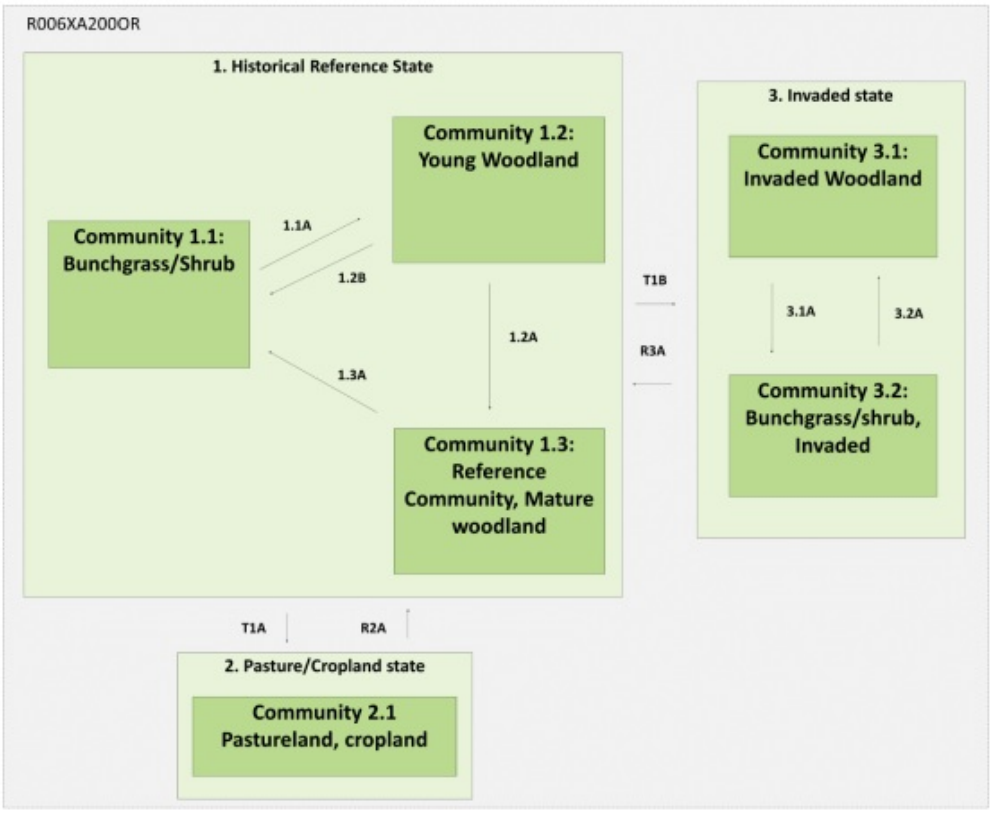
Disturbance:

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 bases following top kill 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). This white oak site may include some ponderosa pine which may compete effectively with oak for soil moisture and light on microsites yet the dry south slopes of this site will preclude conifer dominance overtime (Gucker 2007). 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 bluebunch wheatgrass as the preferred species during spring and summer. Overgrazing may result in a decrease in bluebunch wheatgrass and Idaho fescue, and an increase in Sandberg bluegrass. With further deterioration, annual forbs increase and annual grasses invade, possibly altering the fire regime (Gucker 2007). Under deteriorated conditions bare ground increases. Excessive erosion in the bare interspaces markedly reduces the site potential and contributes to downstream sedimentation. These effects may be intensified when soil moisture is high, a condition and increases the susceptibility of these soils to erosion and compaction by grazing animals.

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
T1B	Invasion of annual grasses
R3A	Restoration activities

State 1
Historical Reference State

The Reference Plant Community is 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 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. As a south aspect site, this site may have lower resistance and resilience to invasion by exotic plant species compared to adjacent sites.

Dominant plant species

- Oregon white oak (*Quercus garryana*), tree
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Sandberg bluegrass (*Poa secunda*), grass

Community 1.1
Bunchgrass/Shrub

Site characterized by bunchgrasses, shrubs 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 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 an 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 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	404	673	852
Tree	50	84	106
Forb	26	43	54
Shrub/Vine	26	43	54
Total	**506**	**843**	**1066**

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 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 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 (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass and Grasslike plants**			381–773	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	331–628	–
	Sandberg bluegrass	POSE	*Poa secunda*	56–146	–
	Idaho fescue	FEID	*Festuca idahoensis*	6–17	–
2	**Other perennial grasses**			6–45	
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	–	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	–	–
	squirreltail	ELEL5	*Elymus elymoides*	–	–
	Geyer's sedge	CAGE2	*Carex geyeri*	–	–
3	**Big Bluegrass**			6–17	
	Sandberg bluegrass	POSE	*Poa secunda*	6–17	–
Forb					
4	**Forbs**			11–34	
	arrowleaf balsamroot	basa3	*Balsamorhiza sagittata*	6–17	–
	common yarrow	acmi2	*Achillea millefolium*	6–17	–
5	**Other perennial forbs**			6–45	
	arrowleaf buckwheat	ERCO12	*Eriogonum compositum*	–	–
	desertparsley	lomat	*Lomatium*	–	–
	lupine	lupin	*Lupinus*	–	–
	pussytoes	anten	*Antennaria*	–	–
	Douglas' dustymaiden	chdo	*Chaenactis douglasii*	–	–
	onion	alliu	*Allium*	–	–
	Scouler's woollyweed	hisc2	*Hieracium scouleri*	–	–
Tree					
6	**Trees**			28–129	
	Oregon white oak	quga4	*Quercus garryana*	39–84	–
	ponderosa pine	pipo	*Pinus ponderosa*	6–39	–
Shrub/Vine					
7	**Shrubs**			17–84	
	antelope bitterbrush	putr2	*Purshia tridentata*	6–39	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–22	–
	deerbrush	CEIN3	*Ceanothus integerrimus*	6–17	–

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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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	05/19/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**
