USDA Natural Resources Conservation Service

Ecological site R010XA024OR
Pumice North 8-10 PZ

Last updated: 12/13/2023
Accessed: 04/24/2024

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): 010X–Central Rocky and Blue Mountain Foothills

This MLRA is characterized by gently rolling to steep hills, plateaus, and low mountains at the foothills of the Blue Mountains in Oregon and the Central Rocky Mountains in Idaho. The geology of this area is highly varied and ranges from Holocene volcanics to Cretaceous sedimentary rocks. Mollisols are the dominant soil order and the soil climate is typified by mesic or frigid soil temperature regimes, and xeric or aridic soil moisture regimes. Elevation ranges from 1,300 to 6,600 feet (395 to 2,010 meters), increasing from west to east. The climate is characterized by dry summers and snow dominated winters with precipitation averaging 8 to 16 inches (205 to 405 millimeters) and increasing from west to east. These factors support plant communities with shrub-grass associations with considerable acreage of sagebrush grassland. Big sagebrush, bluebunch wheatgrass, and Idaho fescue are the dominant species. Stiff sagebrush, low sagebrush, and Sandberg bluegrass are often dominant on sites with shallow restrictive layers. Western juniper is one of the few common tree species and since European settlement has greatly expanded its extent in Oregon. Nearly half of the MLRA is federally owned and managed by the Bureau of Land Management. Most of the area is used for livestock grazing with areas accessible by irrigation often used for irrigated agriculture.

Ecological site concept

In reference condition, this site supports a plant community dominated by Idaho fescue (Festuca idahoensis), bluebunch wheatgrass (Pseudoroegneria spicata) with an overstory of mountain big sagebrush (Artimesia tridentata ssp. vaseyana) and sparse old growth western juniper (Juniperus occidentalis). Abiotically, this site is characterized by moderately deep, pumice and ash influenced soils occurring primarily on north aspects. The high ash content of these soils increases available water content and effective precipitation thereby facilitating the presence of species such as Idaho fescue and mountain big sagebrush. The soil climate is Mesic/Aridic. Historically, plant community dynamics were driven by disturbances such as fire, drought and insect/disease. Presently, reference conditions are less common and current dynamics are influenced by the spread of invasive species, infill of western juniper, livestock grazing pressures and fire suppression.

Associated sites

R010XA007OR	**Juniper Pumice South 9-12 PZ** South aspects receiving higher precipitation
R010XA022OR	**Juniper Lava Blisters 8-10 PZ** Occupying adjacent lava blisters
R010XA027OR	**Juniper Pumice Flat 8-10 PZ** Occupying adjacent low slope, non-aspect positions

Similar sites

R010XA026OR	**Juniper Pumice North 10-12 PZ** Higher precipitation

Table 1. Dominant plant species

Tree	(1) *Juniperus occidentalis*
Shrub	(1) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata ssp. spicata*

Physiographic features

This site occurs on moderate to steep, northerly slopes (ranging to east and west in some areas) of low hills, buttes and plateau rims. Examples of the site are often interspersed with rubble on the slopes below rims. No water table is present within the upper 100 inches of soil and the site is not subject to ponding or flooding.

Table 2. Representative physiographic features

Landforms	(1) Plateaus or tablelands > Rim (2) Plateaus or tablelands > Hill (3) Plateaus or tablelands > Butte (4) Plateaus or tablelands > Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–4,000 ft
Slope	20–65%
Water table depth	100 in
Aspect	W, NW, N, NE, E

Climatic features

This site has an aridic soil moisture regime and a mesic soil temperature regime. Mean annual precipitation ranges from 8 to 10 inches (200 to 250 mm) and falls primarily as rain and snow from November through April. The frost-free period ranges from 50 to 90 days. Localized convection storms occasionally occur during the summer. The optimum period for plant growth is April through June. Climate graphs are based on the nearest available climate stations to modal site locations and are provided to indicate general climate patterns.

Table 3. Representative climatic features

Frost-free period (characteristic range)	50-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	8-10 in
Frost-free period (average)	70 days
Freeze-free period (average)	
Precipitation total (average)	9 in

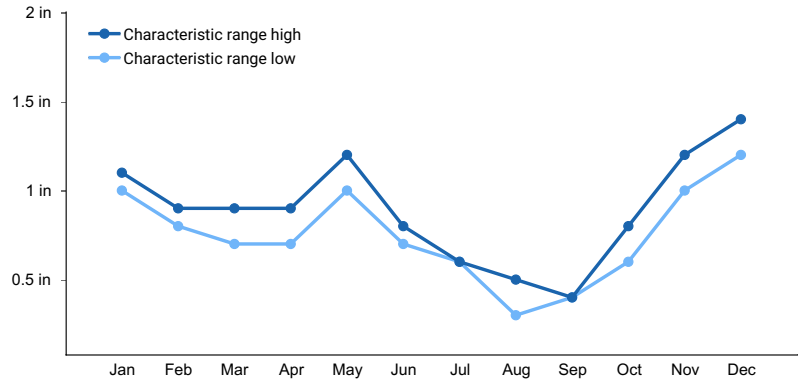


Figure 1. Monthly precipitation range

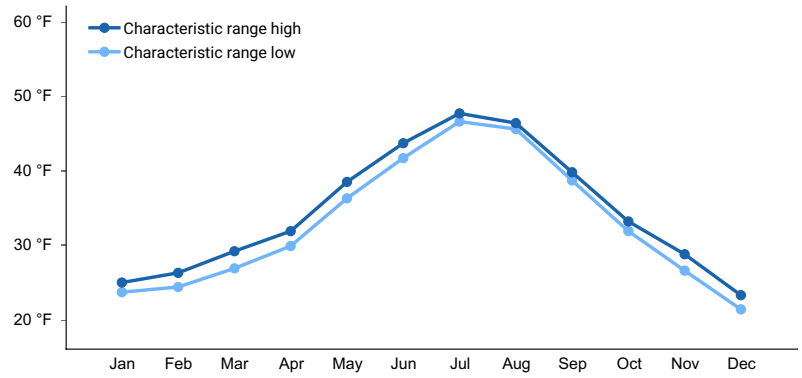


Figure 2. Monthly minimum temperature range

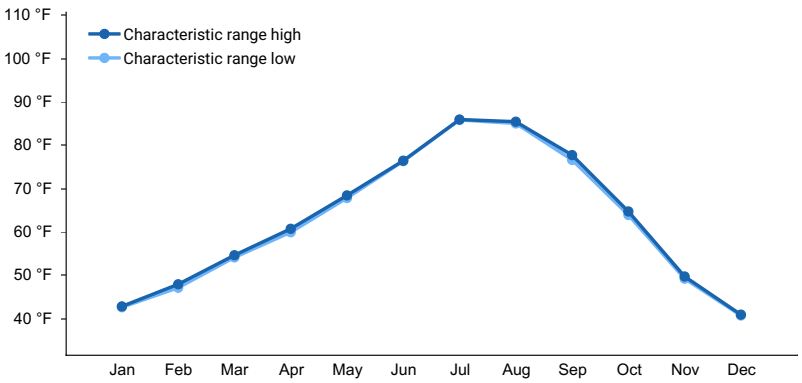


Figure 3. Monthly maximum temperature range

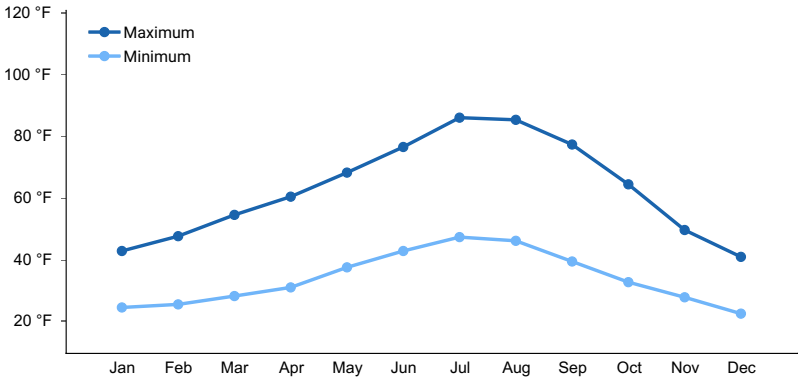


Figure 4. Monthly average minimum and maximum temperature

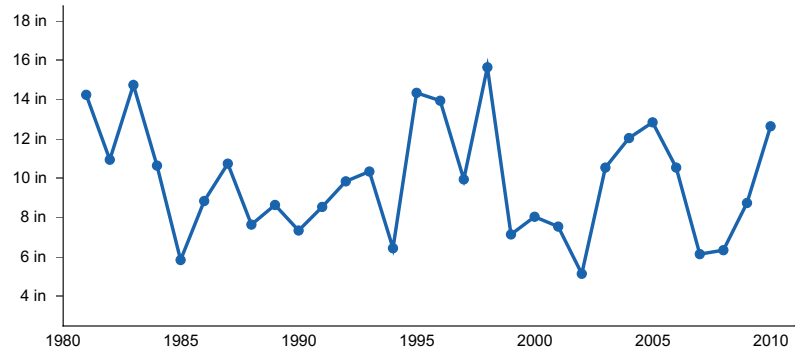


Figure 5. Annual precipitation pattern

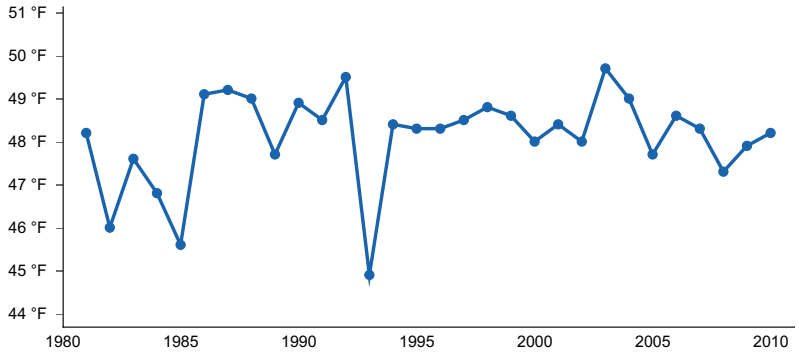


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PRINEVILLE [USC00356883], Prineville, OR
- (2) REDMOND ROBERTS FLD [USW00024230], Redmond, OR

Influencing water features

This site is not influenced by or associated with water features.

Wetland description

N/A

Soil features

The soils of this site are influenced by pumice/ash fallout from Mt. Mazama. They are usually moderately deep, loamy or sandy loam, gravelly or cobbly, and well drained. Some areas are greater in pumice/ash content and deeper than typical for the soil described here.

Table 4. Representative soil features

Parent material	(1) Eolian deposits–volcanic rock (2) Colluvium–volcanic rock (3) Residuum–volcanic rock
Surface texture	(1) Very cobbly loam (2) Ashy sandy loam
Family particle size	(1) Loamy (2) Loamy-skeletal (3) Coarse-loamy
Drainage class	Well drained

Permeability class	Moderately slow
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	5–15%
Surface fragment cover >3"	15–45%
Available water capacity (0-40in)	2–4 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–7.3
Subsurface fragment volume <=3" (4-40in)	0–25%
Subsurface fragment volume >3" (4-40in)	10–60%

Ecological dynamics

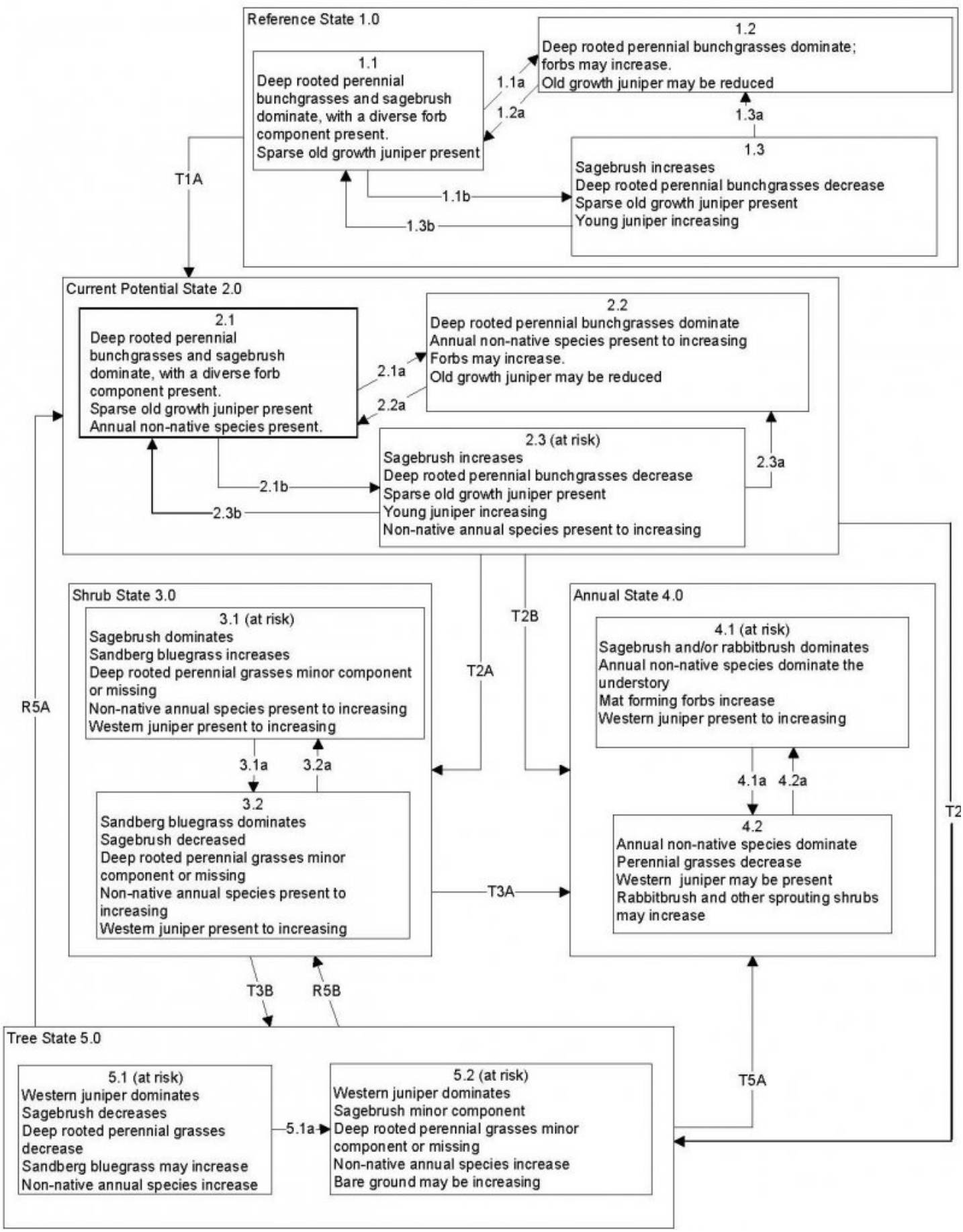
The reference plant community of this site is dominated by Idaho fescue mixed with bluebunch wheatgrass and a variety of other grasses and forbs. The site supports an open stand of mountain big sagebrush and occasional old growth western juniper.

Wildfires which remove more than single trees are uncommon but can occur and severely damage sensitive species like Idaho fescue and remove big sagebrush. Western juniper is intolerant of fire and historically was located in areas with minimal understory due primarily to soil characteristics; therefore, fire was very infrequent, and when it did occur it was low intensity. With the increased suppression of wildfire and introduction of livestock grazing which reduces ground fuels and understory competition, regeneration and establishment of western juniper has expanded into sites previously dominated by big sagebrush and herbaceous vegetation (Burns and Honkala 1990). The expansion of western juniper has been well documented. Probable causes include climate, altered fire frequencies and grazing of flammable ground fuels (Miller and Rose 1995). Fire resistance depends on age of the tree: seedlings, saplings and poles are highly vulnerable to fire. Mature trees have some resistance to fire due to lack of fuels near the trunk, relatively thick bark, and foliage which is fairly high above the ground (Burns and Honkala 1990).

Disturbance outside the normal range of variability converts the understory to primarily bluebunch wheatgrass, squirreltail, and forbs. Weeds like cheatgrass and willow weed begin to invade the site. Cheatgrass is the most common invasive annual grass to invade this site. Invasive grasses displace desirable perennial grasses, reduce livestock forage, and accumulate large fuel loads that foster frequent fires (Davies and Svejcar 2008). Invasion by annual grasses can alter the fire cycle by increasing fire size, fire season length, rate of spread, numbers of individual fires, and likelihood of fires spreading into native or managed ecosystems (D’Antonio and Vitousek 1992, Brooks et al. 2004). While historical fire return intervals are estimated at up to 100 years, areas dominated with cheatgrass are estimated to have a fire return interval of 3 to 5 years (Whisenant 1990). The mechanisms by which invasive annual grasses alter fire regimes likely interact with climate. For example, cheatgrass cover and biomass vary with climate (Chambers et al., 2007) and are promoted by wet and warm conditions during the fall and spring. Invasive annual species have been shown able to take advantage of high N availability following fire through higher growth rates and increased seedling established relative to native perennial grasses (Monaco et al. 2003).

Adapted from: Stringham et al., 2017

State and transition model



Reference State 1.0 Community Pathways
1.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to a community dominated by grasses and forbs.
1.1b: Time and lack of disturbance such as fire facilitates an increase in the shrub overstory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: High severity fire significantly reduces sagebrush and juniper cover and leads to a community dominated by grasses and forbs.
1.3b: Low severity fire reduces sagebrush and juniper cover and creates sagebrush/grass mosaic.

Transition T1A: Introduction of non-native species

Current Potential State 2.0 Community Pathways
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to a community dominated by grasses and forbs. Brush treatments/tree thinning would also reduce the overstory allowing the perennial understory to increase.
2.1b: Time and lack of disturbance such as fire facilitates an increase in the shrub overstory; may be coupled with drought
2.2a: Time and lack of disturbance allows for shrub regeneration.
2.3a: Moderate to high severity fire reduces sagebrush and juniper cover and leads a community dominated by grasses and forbs. Brush treatments/tree thinning would also reduce the overstory allowing the perennial understory to increase.
2.3b: Low severity fire creates sagebrush/grass mosaic. Brush treatments/tree thinning would also reduce the overstory allowing the perennial understory to increase.

Transition T2A: Less frequent fire and/or extended drought reduces perennial bunchgrasses and allows for an increase in shrub/tree species (3.1).
Transition T2B: Catastrophic fire; often coupled with soil disturbing activities and/or extended drought.
Transition T2C: Time and lack of disturbance allows for maturation of the tree community (to 5.1).

Shrub State 3.0 Community Pathways
3.1a: Fire or brush treatments with minimal soil disturbance.
3.2a: Time and lack of disturbance allows for sagebrush to recover. Western juniper may increase.

Transition T3A: Catastrophic fire, multiple fires, and/or soil disturbing treatments/activities.
Transition T3B: Time and lack of disturbance allows for maturation of the tree community.

Annual State 4.0 Community Pathways
4.1a: Fire
4.2a: Time and lack of disturbance allows for sagebrush and sprouting shrubs to increase. Western juniper may be present.

Restoration R4A: Herbicide treatment may be coupled with seeding of desired species.

Tree State 5.0 Community Pathways
5.1a: Time and lack of disturbance allows for maturation of the tree community

Transition T5A: Catastrophic fire (4.2)
Restoration R5A: Mechanical treatment of trees coupled with seeding of desired species. (likely from 5.1)
Restoration R5B: Mechanical treatment of trees (likely from 5.1)

(Adapted from Stringham et al., 2017)

State 1
Historical Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The Reference State has 3 general community phases; a shrub-grass dominant with scattered old growth western juniper phase, a perennial grass dominant phase and a shrub-western juniper dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

Community 1.1
Reference Plant Community

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	530	685	840
Shrub/Vine	110	140	170
Tree	30	35	45
Forb	30	40	45
Total	**700**	**900**	**1100**

State 2
Current Potential

This state is similar to the Reference State 1.0 with three similar community phases. Ecological function has not changed; however, the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, residual dry matter accumulation, and adaptations for seed dispersal.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

State 3
Shrub State

This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses, changes in the historic fire regime or long-term drought favoring shrub establishment. Grazing tolerant Sandberg bluegrass will increase with a reduction in deep rooted perennial bunchgrass competition and become the dominant grass. Sagebrush dominates the overstory and rabbitbrush may be a significant component. Sagebrush cover exceeds site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory and Sandberg bluegrass understory dominate site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed (3.1). In both community phases, bare ground may be significant with soil redistribution occurring between interspace and shrub locations. Western juniper increases and may begin to influence the understory vegetation.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub

- rabbitbrush (*Chrysothamnus*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

State 4
Annual State

This state is characterized by the dominance of annual non-native species such as cheatgrass and tansy mustard (*Descurainia pinnata*) in the understory. Old growth juniper is present but scattered. Depending on transition, young juniper may be increasing. Sagebrush and/or rabbitbrush may dominate the overstory.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass

State 5
Tree State

This state is characterized by a dominance of young juniper (less than 100 years old) in the overstory. Sagebrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soi nutrients and soil organic matter distribution and cycling have been spatially and temporally altered.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

Transition T1A
State 1 to 2

Introduction of non-native species

Transition T2A
State 2 to 3

Less frequent fire and/or extended drought reduces perennial bunch grasses and allows for an increase in shrub/tree species.

Transition T2B
State 2 to 4

Catastrophic fire; often coupled with soil disturbing activities and/or extended drought.

Transition T2C
State 2 to 5

Time and lack of disturbance allows for maturation of the tree community.

Transition T3A
State 3 to 4

Catastrophic fire, multiple fires, and/or soil disturbing treatments/activities.

Transition T3B
State 3 to 5

Time and lack of disturbance allows for maturation of the tree community.

Restoration pathway R5A

State 5 to 2

Mechanical treatment of trees coupled with seeding of desired species.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Grasses**			475–750	
	Idaho fescue	FEID	*Festuca idahoensis*	325–500	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	150–250	–
2	**Other Perennial Grasses**			71–120	
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	20–30	–
	Sandberg bluegrass	POSE	*Poa secunda*	20–30	–
	bluegrass	POA	*Poa*	20–30	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–25	–
	needle and thread	HECO26	*Hesperostipa comata*	1–5	–
Forb					
4	**Forbs**			15–30	
	fleabane	ERIGE2	*Erigeron*	5–10	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	5–10	–
	milkvetch	ASTRA	*Astragalus*	5–10	–
5	**Other Forbs**			9–25	
	lupine	LUPIN	*Lupinus*	1–5	–
	common yarrow	ACMI2	*Achillea millefolium*	2–5	–
	agoseris	AGOSE	*Agoseris*	1–5	–
	spreading phlox	PHDI3	*Phlox diffusa*	2–5	–
	Indian paintbrush	CASTI2	*Castilleja*	1–2	–
	nineleaf biscuitroot	LOTR2	*Lomatium triternatum*	1–2	–
	prairie flax	LILEL2	*Linum lewisii var. lewisii*	1	–
Shrub/Vine					
7	**Shrubs**			100–150	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	100–150	–
8	**Other Shrubs**			14–26	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	10–15	–
	snow buckwheat	ERNI2	*Eriogonum niveum*	1–5	–
	desert gooseberry	RIVE	*Ribes velutinum*	1–2	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	1–2	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	1–2	–
Tree					
6	**Trees**			25–50	
	western juniper	JUOC	*Juniperus occidentalis*	25–50	–

Animal community

Livestock grazing has been a historic use for this site. Plant community structure (Reference) consists of an open juniper canopy (less than 35 ft) with low shrubs (3 to 5 ft) and upland bunchgrass/forbs for wildlife species. These species include mule deer during fall-spring, coyotes, a variety of birds and small mammals. Natural water sources for livestock and wildlife are usually absent from this site.

Hydrological functions

Runoff may occur due to the steepness of slope. Hydrologic Group for soils of this site is group C. Significant amounts of precipitation are intercepted by juniper trees and lost by evaporation to the atmosphere, especially after light storms. However, natural stands (Reference) and understories are in balance with these environmental factors.

Recreational uses

hunting, hiking

Wood products

only juniper wood products

Other products

watershed values

Inventory data references

Vegetation-Soil Units in the Central Oregon Juniper Zone, by Richard S. Driscoll. PNW Forest & Range Experiment Station, Research Paper, PNW-19, 1964.

Type locality

Location 1: Crook County, OR	
Township/Range/Section	T16S R15E S26-NW
General legal description	upper Swartz Canyon
Location 2: Crook County, OR	
Township/Range/Section	T14s R15E S27-SE
General legal description	NW of Prineville- along River Rd. below rim of plateau

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Contributors

Jenni Moffitt, general edits and updates 8/2020
Tamzen Stringham et al. (2017), Ecological Dynamics and S&T Model
Gene Hickman, original author
Andrew Neary - additional minor PES updates 2021

Approval

Kirt Walstad, 12/13/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/24/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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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:

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:**