USDA Natural Resources Conservation Service

Ecological site R010XB083OR
JD Shrubby Shallow 12-16 PZ

Last updated: 12/13/2023
Accessed: 05/11/2024

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 ecological site supports a plant community dominated by antelope bitterbrush (Purshia tridentata), Idaho fescue (Festuca idahoensis) and bluebunch wheatgrass (Pseudoroegneria spicata). Abiotically, this site is characterized by shallow soils and gentle slopes. The soil climate is frigid and mesic near frigid/xeric. Historically, plant community dynamics were driven primarily by disturbances such as periodic fire and drought. Presently, reference conditions are less common and current dynamics are influenced by the spread of invasive species, proliferation of western juniper (Juniperus occidentalis), livestock grazing pressures and fire suppression.

Associated sites

R010XB070OR	**JD North 12-16 PZ** North aspect site in complex with this site
R010XB047OR	**JD Shallow South 12-16 PZ** South aspect site in complex with this site

Similar sites

R010XB023OR	**JD Shallow 9-12 PZ** Shallow mesic/aridic site, lower precipitation
R010XB031OR	**JD Shallow 12-16 PZ** Shallow mesic / xeric site

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Purshia tridentata*
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata ssp. spicata*

Physiographic features

This site occurs on mountain plateaus and ridgetops. Slopes range from 2 to 15 percent. Elevation ranges from 3,000 to 5,700 feet (900 to 1,750 meters). This site occurs on all aspects. This site is not subject to ponding or flooding and no water table is present within the soil profile.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Plateau (2) Mountains > Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	914–1,737 m
Slope	2–15%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Precipitation ranges from 12 to 16 inches (300 to 400 mm) per year, mainly falling as snow from November through March. The soil temperature regime is frigid; and may go mesic near frigid; frost free period of 30 to 90 days. The graphs below are populated from the closest available weather station to representative site locations and are provided to indicate general climate patterns.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	305-406 mm
Frost-free period (average)	60 days
Freeze-free period (average)	
Precipitation total (average)	381 mm

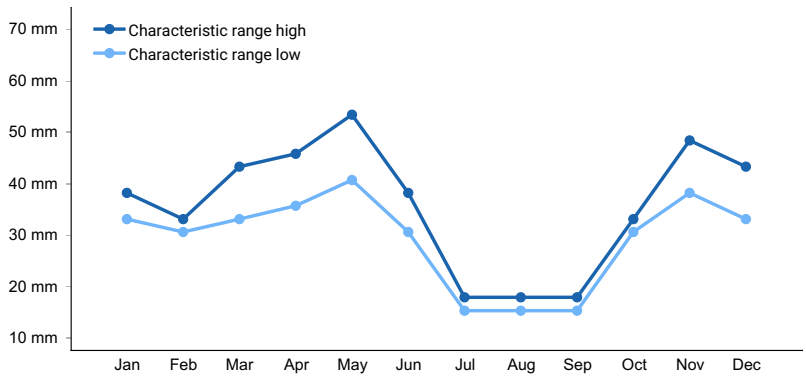


Figure 1. Monthly precipitation range

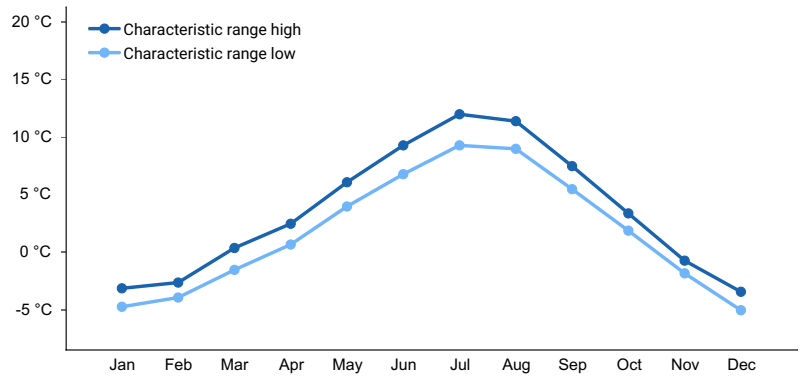


Figure 2. Monthly minimum temperature range

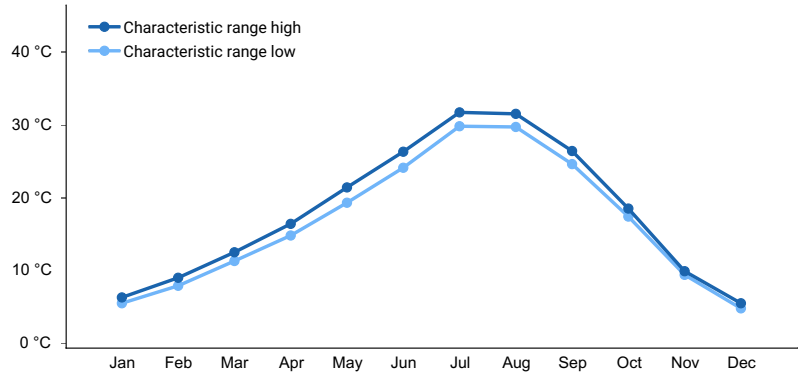


Figure 3. Monthly maximum temperature range

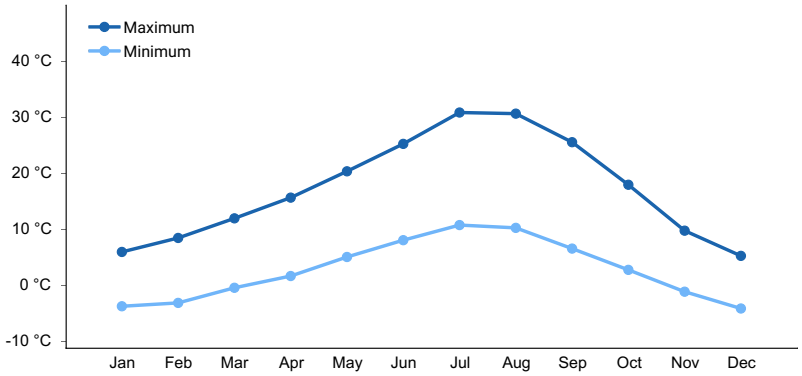


Figure 4. Monthly average minimum and maximum temperature

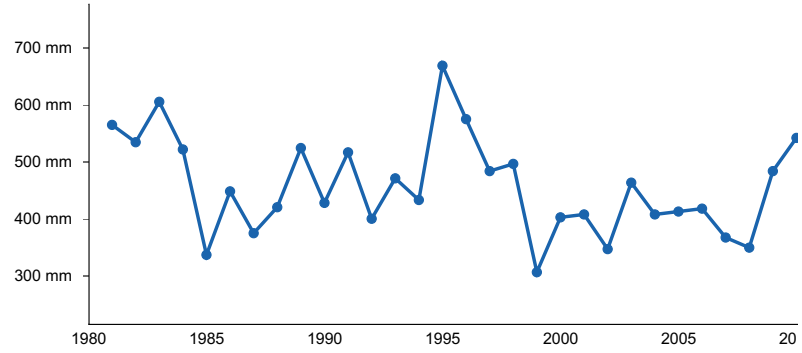


Figure 5. Annual precipitation pattern

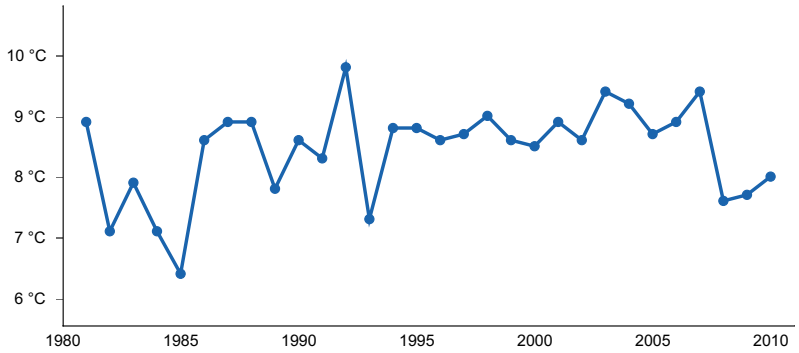


Figure 6. Annual average temperature pattern

Climate stations used

- (1) JOHN DAY 35 WNW [USW00004125], Mitchell, OR
- (2) LONG CREEK [USC00355020], Long Creek, OR

Influencing water features

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

Wetland description

Not applicable

Soil features

Soils are typically loam over clay loam and may be cobbly to extremely cobbly. These soils are typically less than 20 inches deep to fractured bedrock. The soil profile is primarily formed over sedimentary deposits. See Hutchley for a representative soil series.

Table 4. Representative soil features

Parent material	(1) Colluvium–volcanic and sedimentary rock (2) Residuum–tuff (3) Residuum–volcanic and sedimentary rock (4) Volcanic ash
Surface texture	(1) Cobbly loam (2) Extremely cobbly silt loam (3) Silt loam (4) Loam
Family particle size	(1) Clayey-skeletal (2) Loamy-skeletal (3) Fine
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	25–51 cm
Soil depth	25–51 cm
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-50.8cm)	5.08–16.51 cm
Soil reaction (1:1 water) (0-50.8cm)	6.1–8.4

Subsurface fragment volume <=3" (10.2-50.8cm)	15–45%
Subsurface fragment volume >3" (10.2-50.8cm)	10–50%

Ecological dynamics

The reference plant community is dominated by Idaho fescue, bluebunch wheatgrass, and antelope bitterbrush. Sandberg bluegrass is common along with a variety of forbs. Western juniper may be present in trace amounts, but under a normal disturbance regime is controlled by periodic fire.

Response to Disturbance
Disturbance outside the natural range of variability may cause a decrease in deep-rooted perennial bunchgrass, primarily Idaho fescue and bluebunch wheatgrass. Woody species such as bitterbrush and juniper increase and the percentage of squirreltail may also increase. As grass cover declines the potential for weed invasion and expansion of juniper increases.

Ecological dynamics of this site are primarily driven by interactions between climatic patterns and disturbance regimes. Frequent low intensity fires were the historical disturbance that maintained the reference state and drove plant community shifts within the state. Intensity and frequency of these fires is strongly influence by drought cycles and/or insect or disease attacks on the plant community. Introduction of exotic annual grasses compromises the resistance and resiliency of the site, putting it at higher risk of crossing a threshold into another state.

Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability with the soil profile (Bates et al. 2006).

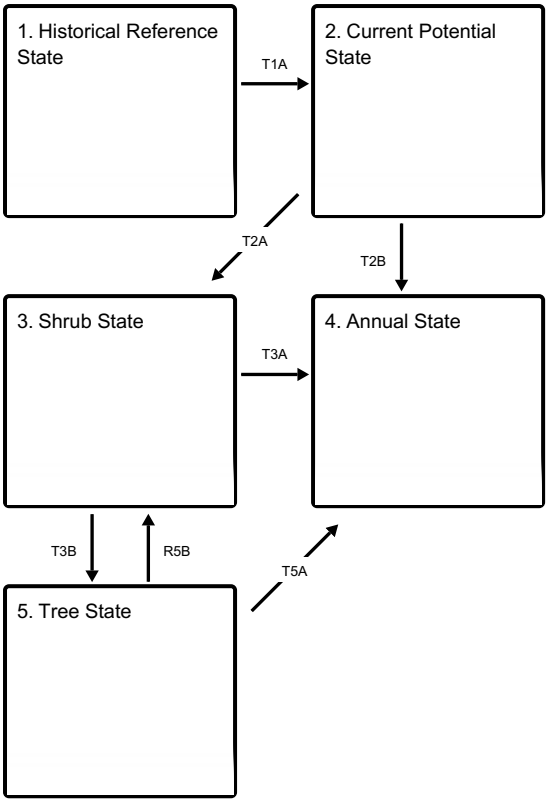
The Great Basin plant communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of plant communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al. 2007).

The range and density of western juniper has increased since the middle of the nineteenth century (Tausch 1999, Miller and Tausch 2000). Causes for expansion of western juniper into sagebrush ecosystems include wildfire suppression, historic livestock grazing, and climate change (Bunting 1994). Mean fire return intervals prior to European settlement in these ecosystems were 15 to 25 years (Burkhardt and Tisdale 1976, Young and Evans 1981), frequent enough to inhibit the encroachment of western juniper into these cover types (Miller and Tausch 2000). With the increased suppression of wildfire and livestock grazing, which reduces ground fuels and understory competition, regeneration and establishment of western juniper have expanded into suitable sites previously dominated by shrubs (Burns and Honkala 1990). An increase in crown density causes a decrease in understory perennial vegetation and an increase in bare ground. This allows for the invasion of non-native annual species such as cheatgrass (*Bromus tectorum*) and medusahead (*Taeniatherum caput-medusae*). With annual species in the understory wildfire can become more frequent and increase in intensity. With frequent wildfires these plant communities can convert to annual species with a sprouting shrub and juvenile tree overstory.

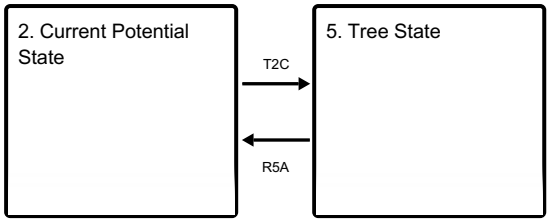
(Stringham, T.K. et al, 2017)

State and transition model

Ecosystem states



States 2 and 5 (additional transitions)



T1A - Introduction of non-native species

T2A - Less frequent fire and/or extended drought reduces perennial bunchgrasses and allows for an increase in shrub/tree species.

T2B - Catastrophic fire; often coupled with soil disturbing activities and/or extended drought.

T2C - Time and lack of disturbance allows for maturation of the tree community

T3A - Catastrophic fire, multiple fires, and soil disturbing treatments or activities.

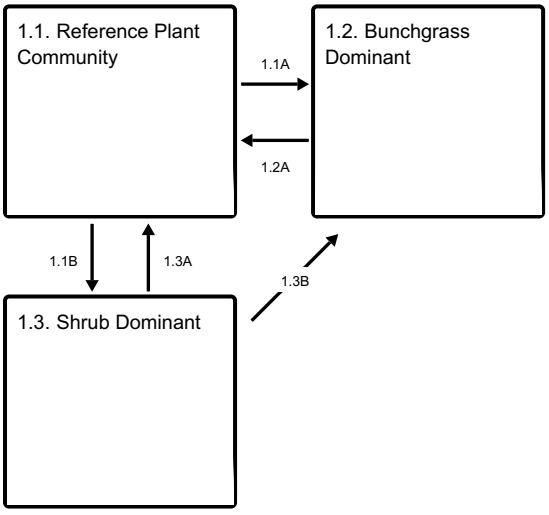
T3B - Time and lack of disturbance allows for maturation of the tree community.

R5A - Mechanical treatment of trees coupled with seeding of desired species.

R5B - Mechanical treatment of trees.

T5A - Catastrophic fire.

State 1 submodel, plant communities



1.1A - Low and high severity fire

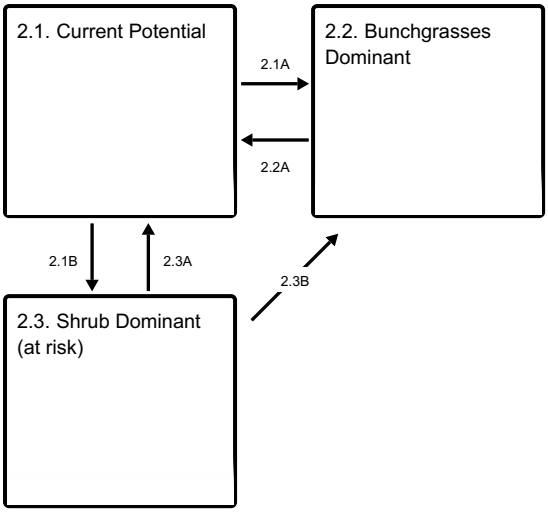
1.1B - Time and lack of disturbance, such as fire

1.2A - Time and lack of disturbance

1.3A - High severity fire

1.3B - Low severity fire

State 2 submodel, plant communities



2.1A - Low and high severity fire

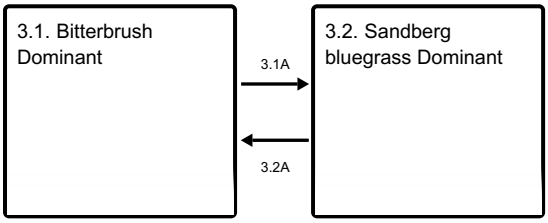
2.1B - Time and lack of disturbance

2.2A - Time and lack of disturbance

2.3A - Moderate to high severity fire

2.3B - Low severity fire

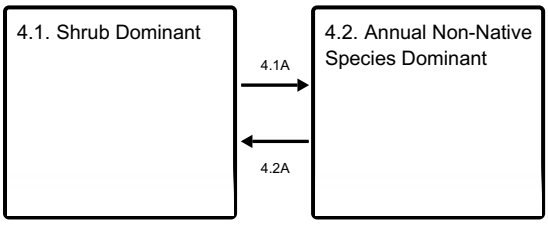
State 3 submodel, plant communities



3.1A - Fire or brush treatments

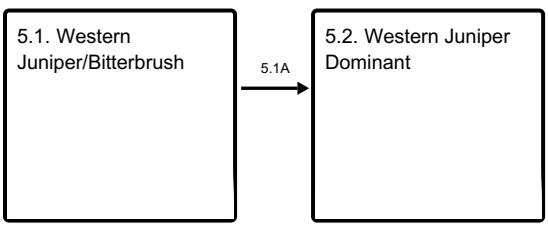
3.2A - Time and lack of disturbance

State 4 submodel, plant communities



4.1A - Fire

State 5 submodel, plant communities



5.1A - Time and lack of disturbance

State 1
Historical Reference State

The Reference State 1.0 is a representation of the natural range of variability under pristine conditions. The reference state has three general community phases; a shrub-grass dominant phase, a perennial grass dominant phase and a shrub 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

- antelope bitterbrush (*Purshia tridentata*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

Community 1.1
Reference Plant Community

Deep-rooted perennial bunchgrasses and bitterbrush are dominant, with a diverse forb component present.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	588	734	1031
Shrub/Vine	219	269	370
Forb	73	95	135
Tree	17	22	34
Total	**897**	**1120**	**1570**

Community 1.2
Bunchgrass Dominant

Deep-rooted perennial bunchgrasses are dominant; forbs may increase.

Community 1.3
Shrub Dominant

Bitterbrush increases, deep-rooted perennial bunchgrasses decrease, and young juniper are increasing in community.

Pathway 1.1A
Community 1.1 to 1.2

Low severity fire creates a grass and shrub mosaic; high severity fire significantly reduces shrub cover and leads to a community dominated by grasses and forbs.

Pathway 1.1B
Community 1.1 to 1.3

Time and lack of disturbance, such as fire, facilitates an increase in shrub overstory.

Pathway 1.2A
Community 1.2 to 1.1

Time and lack of disturbance, allows for shrub regeneration.

Pathway 1.3A
Community 1.3 to 1.1

High severity fire significantly reduces shrub and juniper cover and leads to a community dominated by grasses and forbs.

Pathway 1.3B
Community 1.3 to 1.2

Low severity fire reduces shrub and juniper cover and creates a shrub and grass mosaic.

State 2
Current Potential State

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

- antelope bitterbrush (*Purshia tridentata*), shrub
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

Community 2.1
Current Potential

Deep-rooted perennial bunchgrasses and bitterbrush are dominant, with a diverse forb component present. Annual non-native species are also present.

Community 2.2
Bunchgrasses Dominant

Deep-rooted perennial bunchgrasses are dominant, with annual non-native species present and increasing. Forb may increase as well.

Community 2.3
Shrub Dominant (at risk)

Bitterbrush increases, deep-rooted perennial bunchgrasses decrease, young juniper are increasing, and non-native annual species are present and increasing.

Pathway 2.1A
Community 2.1 to 2.2

Low severity fire creates a grass and shrub mosaic; high severity fire significantly reduces shrub cover and leads to a community dominated by grasses and forbs. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

Pathway 2.1B

Community 2.1 to 2.3

Time and lack of disturbance such as fire facilitates an increase in the shrub overstory; may be coupled with drought.

Pathway 2.2A
Community 2.2 to 2.1

Time and lack of disturbance allows for shrub regeneration.

Pathway 2.3A
Community 2.3 to 2.1

Moderate to high severity fire reduces shrub and juniper cover and leads a community dominated by grasses and forbs. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

Pathway 2.3B
Community 2.3 to 2.2

Low severity fire creates a shrub and grass mosaic. Brush treatments and tree thinning would also reduce the overstory allowing the perennial understory to increase.

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. Bitterbrush dominates the overstory and rabbitbrush may be a significant component. Bitterbrush 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

- antelope bitterbrush (*Purshia tridentata*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

Community 3.1
Bitterbrush Dominant

Bitterbrush dominates with Sandberg bluegrass increases. Deep rooted perennial grasses minor component is missing. Non-native annual species are present to increasing. Western juniper is also present to increasing.

Community 3.2
Sandberg bluegrass Dominant

Sandberg bluegrass is dominant where bitterbrush decreased. Deep-rooted perennial grasses are a minor component is missing. Non-native annual species are present to increasing. Western juniper is also present to increasing.

Pathway 3.1A
Community 3.1 to 3.2

Fire or brush treatments with minimal soil disturbance.

Pathway 3.2A
Community 3.2 to 3.1

Time and lack of disturbance allows for shrub to recover. Western juniper may increase.

State 4
Annual State

This State is characterized by the dominance of annual non-native species such as cheatgrass, medusahead, and tansy mustard in the understory. Bitterbrush and rabbitbrush may dominate the overstory.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- medusahead (*Taeniatherum caput-medusae*), grass
- North Africa grass (*Ventenata dubia*), grass

Community 4.1
Shrub Dominant

Bitterbrush and rabbitbrush is dominant, with annual non-native species dominant in the understory. Mat forming forbs increase and western juniper is present and increasing.

Community 4.2
Annual Non-Native Species Dominant

Annual non-native species are dominant, while perennial grasses decrease. Western juniper may be present, and rabbitbrush and other sprouting shrubs may increase.

Pathway 4.1A
Community 4.1 to 4.2

Fire

Pathway 4.2A
Community 4.2 to 4.1

Time and lack of disturbance allows for bitterbrush and sprouting shrubs to increase. Western juniper may be present.

State 5
Tree State

This state is characterized by a dominance of western juniper in the overstory. Bitterbrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soil nutrients and soil organic matter distribution and cycling have been spatially and temporally altered.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

Community 5.1
Western Juniper/Bitterbrush

Western juniper dominates, bitterbrush decreases, deep-rooted perennial grasses decrease, Sandberg bluegrass may increase, and non-native annual species increase.

Community 5.2
Western Juniper Dominant

Western juniper dominates and bitterbrush is a minor component. Deep-rooted perennial grasses are also a minor component or are missing. The non-native annual species increase. Bare ground may also be increasing.

Pathway 5.1A
Community 5.1 to 5.2

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

Transition T1A
State 1 to 2

Introduction of non-native species

Transition T2A
State 2 to 3

Less frequent fire and extended drought reduces perennial bunchgrasses and allows for an increase in shrub and tree species.

Transition T2B
State 2 to 4

Catastrophic fire; often coupled with soil disturbing activities 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 soil disturbing treatments or 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.

Restoration pathway R5B
State 5 to 3

Mechanical treatment of trees.

Transition T5A
State 5 to 4

Catastrophic fire.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Perennial Grasses**			426–863	
	Idaho fescue	FEID	*Festuca idahoensis*	224–448	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	168–336	–
	Sandberg bluegrass	POSE	*Poa secunda*	34–78	–
2	**Other Perennial Grasses**			56	
	blue wildrye	ELGL	*Elymus glaucus*	0–22	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	0–22	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–22	–
	squirreltail	ELEL5	*Elymus elymoides*	0–22	–
Forb					
4	**Forbs**			90	
	common yarrow	ACMI2	*Achillea millefolium*	0–22	–
	phlox	PHLOX	*Phlox*	0–22	–
	buckwheat	ERIOG	*Eriogonum*	0–22	–
	fleabane	ERIGE2	*Erigeron*	0–22	–
	lupine	LUPIN	*Lupinus*	0–22	–
	pussytoes	ANTEN	*Antennaria*	0–22	–
	milkvetch	ASTRA	*Astragalus*	0–22	–
	desertparsley	LOMAT	*Lomatium*	0–22	–
Tree					
6	**Trees**			22	
	western juniper	JUOC	*Juniperus occidentalis*	0–22	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–22	–
Shrub/Vine					
7	**Shrubs**			112–336	
	antelope bitterbrush	PUTR2	*Purshia tridentata*	112–336	–
8	**Other Shrubs**			34	
	common snowberry	SYAL	*Symphoricarpos albus*	0–22	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–22	–

Type locality

Location 1: Grant County, OR	
Township/Range/Section	T12S R28E S19
General legal description	T12S R28E sec 19 near Marks Creek on Aldrich Mt. North Quad
Location 2: Grant County, OR	

General legal description	T8S R27E on Top Bench on Johnny Cake Quad

References

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Contributors

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Approval

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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)	
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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:

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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:**
