USDA Natural Resources
Conservation Service

Ecological site R043CY806OR
Very Shallow Scabland (ARRI2/PSSPS-POSE)

Last updated: 9/08/2023
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): 043C–Blue and Seven Devils Mountains

This MLRA covers the Blue and Seven Devils Mountains of Oregon, Washington and Idaho. The area is characterized by thrust and block-faulted mountains and deep canyons composed of sedimentary, metasedimentary, and volcanic rocks. Elevations range from 1,300 to 9,800 feet (395 to 2,990 meters). The climate is characterized by cold, wet winters and cool, dry summers. Annual precipitation, mostly in the form of snow, averages 12 to 43 inches (305 to 1,090 millimeters) yet ranges as high as 82 inches (2,085 millimeters) at upper elevations. Soil temperature regimes are predominately Frigid to Cryic and soil moisture regimes are predominately Xeric to Udic. Mollisols and Andisols are the dominant soil orders. Ecologically, forests dominate but shrub and grass communities may occur on south aspects and lower elevations as well as in alpine meadow environments. Forest composition follows moisture, temperature and elevational gradients and typically ranges from ponderosa pine and Douglas-fir plant associations at lower elevations, grand fir at middle elevations and subalpine fir and Engelman spruce at upper elevations. Historical fire regimes associated with these forest types range from frequent surface fires in ponderosa pine - Douglas Fir forest types to mixed and stand replacing fire regimes in grand fir and subalpine fir types. A large percentage of the MLRA is federally owned and managed by the U.S. Forest Service for multiple uses.

Classification relationships

Plant Assoc. of Blue and Ochoco Mountains (R6 E TP-036-92)
Stiff sagebrush/Sandberg bluegrass - SD9111

USDA Forest Service Ecological Sub-region
M332 “Blue Mountains”

U.S. National Vegetation Classification Standard (NVCS)
Group: G307. Columbia Plateau Scabland Dwarf-shrubland
Alliance: A1574. Artemisia rigida Steppe & Shrubland Alliance

Ecological site concept

This site occurs on upland plateaus with very shallow soils over hard igneous extrusive geologies (basalt, andesite, rhyolite, tuff, etc.). In the reference state, the site is characterized by stiff sagebrush (Artemisia rigida), bluebunch wheatgrass (Pseudoroegneria spicata) and Sandberg bluegrass (*Poa secunda*). This is a low production site. Production is limited by the low water holding capacity of the soil. Precipitation comes in the form of snow and rain primarily in the winter and early spring. The soil profile is not able to store all the moisture that the site receives, and excess moves to adjacent sites. In areas where the entire soil profile stays wet into the late spring, one-spike oatgrass (Danthonia unispicata) is common. Historically, plant community dynamics were driven primarily by disturbances such as localized fire and drought.

This is a provisional ecological site that groups characteristics at a broad scale with little to no field verification and is subject to extensive review and revision before final approval. All data herein was developed using existing information and literature and should be considered provisional and contingent upon field validation prior to use in conservation planning.

Associated sites

F043CY608OR	**Cool Dry Conifer Foothills and Mountains (PIPO/FEID-PSSPS)** Deeper soils, forested with ponderosa pine

Similar sites

R043CY807OR	**Scabland (PSSPS-POSE-DAUN)** Influenced by maritime climate thus does not have as much of a shrub (ARRI2) component

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia rigida*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Poa secunda*

Physiographic features

This site typically occurs on upland plateaus typically over indurated basalt but may also occur over other hard igneous extrusive geologies (andesite, rhyolite, tuff, etc.). Slopes range from 0 to 20 %. Elevation typically ranges from 4,000 to 5,750 (1,225 to 1,750 m) but ranges as high as 6,600 (2,000 m). This site occurs on all aspects. This site does not experience ponding or flooding and no water table is present within the upper two meters of soil.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Plateau
Flooding frequency	None
Ponding frequency	None
Elevation	1,219–1,753 m
Slope	0–20%
Ponding depth	0 cm
Water table depth	254 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,219–2,012 m
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation is typically 12 - 17 inches (305 - 355 mm), most of which occurs in the form of snow and rain during the months of November through March. Localized convection storms occasionally occur during the

summer but resulting precipitation does not generally have a significant effect on soil moisture. The soil temperature regime is frigid. Temperature extremes range from 90 to -20 degrees F (-34 to 32 degrees C). The frost-free period ranges from less than 30 up to 90 days. The optimum growth period for plant growth is late April through June. Climate graphs are populated from the closest available weather stations and are included to represent general trends rather than representative values.

Table 4. Representative climatic features

Frost-free period (characteristic range)	30-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	305-432 mm
Frost-free period (average)	50 days
Freeze-free period (average)	
Precipitation total (average)	356 mm

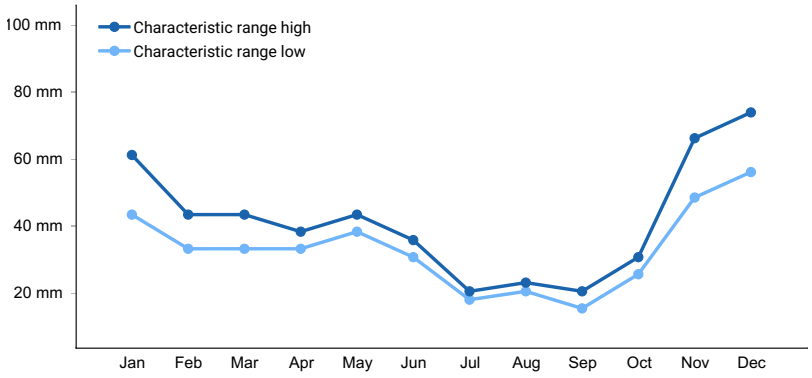


Figure 1. Monthly precipitation range

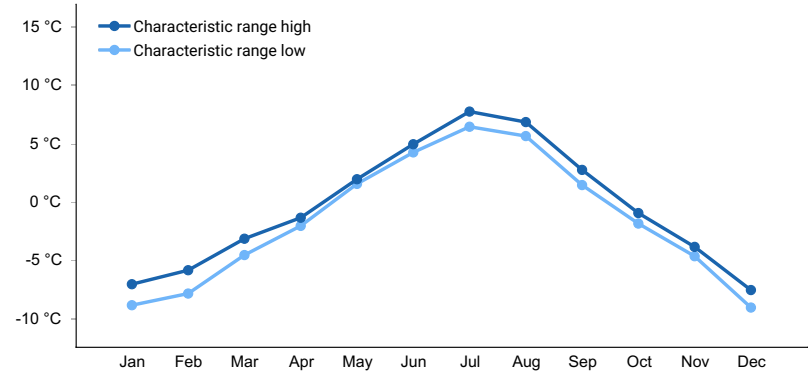


Figure 2. Monthly minimum temperature range

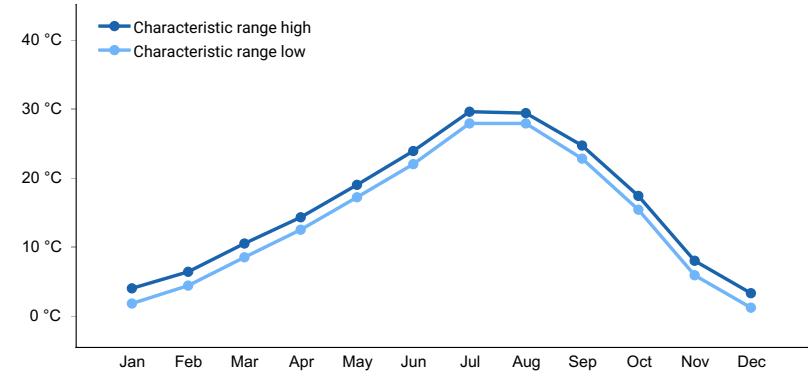


Figure 3. Monthly maximum temperature range

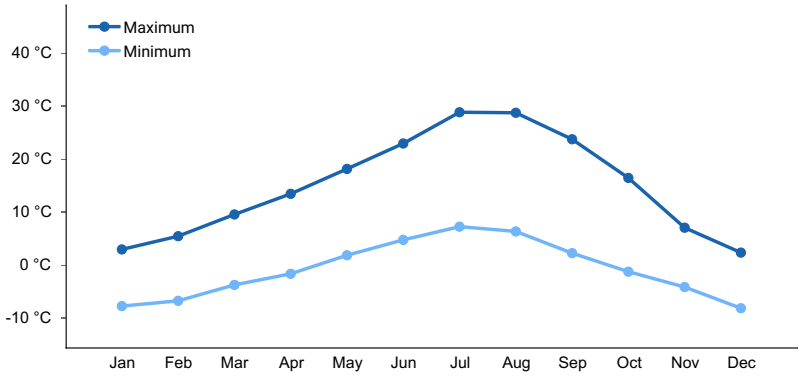


Figure 4. Monthly average minimum and maximum temperature

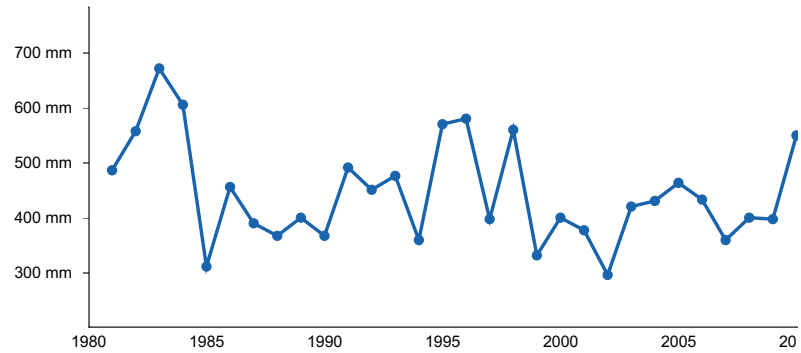


Figure 5. Annual precipitation pattern

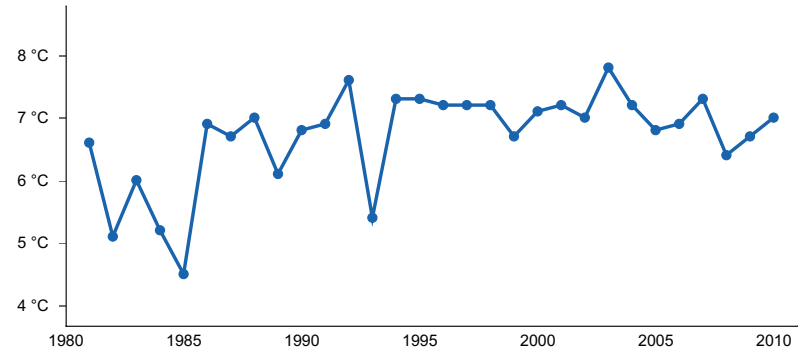


Figure 6. Annual average temperature pattern

Climate stations used

- (1) BARNES STN [USC00350501], Prineville, OR
- (2) AUSTIN 3 S [USC00350356], Prairie City, OR

Influencing water features

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

Soil features

The soils of this site are very shallow over indurated basalt. These soils formed in colluvium and residuum derived from volcanic rock, mainly basalt and andesite. The family particle size is typically clayey-skeletal but may also be loamy-skeletal. Surface textures typically range from very cobbly to very stony clay loam, while subsurface textures range from loam to clay. Total coarse fragments throughout the profile range typically from 15 to 60 percent by volume, typically averaging over 35%. See Canest and Bocker for modal series concepts.

Table 5. Representative soil features

Parent material	(1) Colluvium–volcanic rock (2) Residuum–volcanic rock
Surface texture	(1) Very cobbly clay loam (2) Very stony clay loam
Family particle size	(1) Clayey-skeletal (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	0–25 cm
Soil depth	0–25 cm
Surface fragment cover <=3"	15–45%
Surface fragment cover >3"	45–70%
Available water capacity (0-25.4cm)	0.76–2.29 cm
Soil reaction (1:1 water) (0-25.4cm)	6.2–7.2
Subsurface fragment volume <=3" (10.2-25.4cm)	5–30%
Subsurface fragment volume >3" (10.2-25.4cm)	10–55%

Ecological dynamics

Range in Characteristics:

Plant composition and production is dependent on soil depth and bedrock fracture. Sandberg bluegrass increases over unfractured bedrock and soils that are less than 4 inches deep.

Ecological Dynamics:

Ecological dynamics of this site are primarily driven by interactions between climatic patterns and disturbance regimes. Infrequent and typically small area 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 as 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 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 sagebrush 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 species most likely to invade these sites are cheatgrass, medusahead (*Taeniatherum caput-medusae*), and North Africa grass (*Ventenata dubia*); cool-season annual grasses that germinate in the fall, overwinter as seedlings, and initiate growth in the spring (Miller et al. 1999a). Expansion of these grasses creates seed reserves that can infest adjoining areas and cause changes to the fire regime. These grasses create fuel continuity in the understory, often resulting in increased fire frequency and more uniform burn patterns (less mosaic).

Fire Ecology:

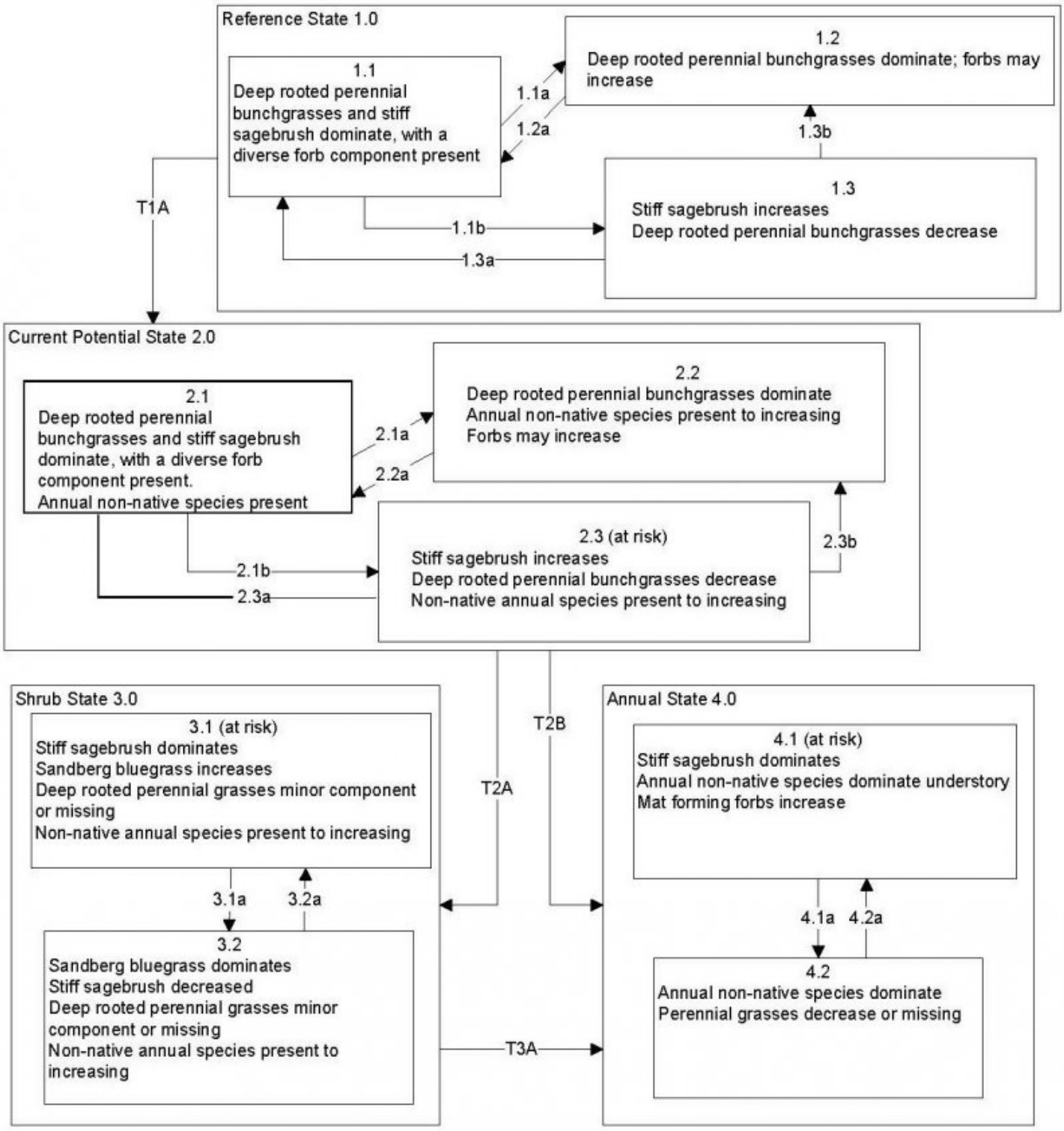
Stiff sagebrush is killed by fire and does not sprout (Young 1983). Establishment after fire is from seed, generally blown in and not from the seed bank (Bradley et al. 1992). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Historically fires were probably patchy due to the low productivity of these sites.

Fire will remove aboveground biomass from bluebunch wheatgrass but plant mortality is generally low (Robberecht and Defossé 1995) because the buds are underground (Conrad and Poulton 1966) or protected by foliage. Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass. Thus, while bluebunch wheatgrass may experience slight damage to fire, it is more susceptible in drought years (Young 1983). Plant response will vary depending on season, fire severity, fire intensity and post-fire soil moisture availability.

Sandberg bluegrass (*Poa secunda*), has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975). Sandberg bluegrass may retard reestablishment of deeper rooted bunchgrass.

(Adapted from: Stringham, T.K. et al., 2016)

State and transition model



(Adapted from Stringham, T.K. et al., 2016)

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 early/mid seral community, dominated by grasses and forbs.
1.1b: Time and lack of disturbance. Excessive herbivory and/or long-term drought may also reduce perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: Low severity fire creates sagebrush/grass mosaic.
1.3b: Moderate severity fire significantly reduces sagebrush cover and leads to early/mid seral community, dominated by grasses and forbs.

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 early/mid seral community, dominated by grasses and forbs.
2.1b: Time and lack of disturbance. Inappropriate grazing management and/or long-term drought may also reduce perennial understory. 2.2a Time and lack of disturbance allows for shrub regeneration.
2.3a: Low severity fire creates sagebrush/grass mosaic.
2.3b:Moderate severity fire significantly reduces sagebrush cover and leads to early/mid seral community, dominated by grasses and forbs.

Transition T2A: Grazing management favoring shrubs and/or severe drought will reduce the perennial bunchgrasses in the understory (3.1)
Transition T2B: Catastrophic fire and/or soil disturbing treatments. Inappropriate grazing management in the presence of non-native annual species, may be combined with higher than normal spring precipitation (4.1).

Shrub State 3.0 Community Pathways
3.1a: Fire.
3.2a: Time without disturbance.

Transition T3A: Catastrophic fire, multiple fires, and/or soil disturbing treatments (4.2), Inappropriate grazing management in the presence of non-native species, may be combined with higher than normal spring precipitation (4.1). Bare ground levels depend on variations in annual precipitation

Annual State 4.0 Community Pathways
4.1: Fire
4.2: Time without disturbance

(Adapted from Stringham, T.K. et al., 2016)

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 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 are maintained by elements of ecosystem structure and function such as 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

- scabland sagebrush (*Artemisia rigida*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass
- Sandberg bluegrass (*Poa secunda*), grass

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. Processes and characteristics that contribute to positive feedbacks include the non-natives species' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Dominant plant species

- scabland sagebrush (*Artemisia rigida*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass
- Sandberg bluegrass (*Poa secunda*), grass

State 3
Shrub state

This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses and/or severe drought. Sagebrush dominates the overstory. 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 dominates site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed.

Dominant plant species

- scabland sagebrush (*Artemisia rigida*), shrub
- Sandberg bluegrass (*Poa secunda*), grass

State 4
Annual state

This community is characterized by the dominance of annual non-native species such as medusahead, cheatgrass, and ventenata in the understory. Stiff sagebrush may dominate the overstory.

Dominant plant species

- scabland sagebrush (*Artemisia rigida*), shrub
- cheatgrass (*Bromus tectorum*), grass
- medusahead (*Taeniatherum caput-medusae*), grass
- North Africa grass (*Ventenata dubia*), grass

Transition T1A
State 1 to 2

Introduction of non-native species

Transition T2A
State 2 to 3

Grazing management favoring shrubs and/or severe drought will reduce the perennial bunchgrasses in the understory

Transition T2B
State 2 to 4

Catastrophic fire, and/or soil disturbing treatments/activities. Inappropriate grazing management in the presence of non-native annual species, may be combined with higher than normal spring precipitation

Transition T3A
State 3 to 4

Catastrophic fire, and/or soil disturbing treatments/activities. Inappropriate grazing management in the presence of non-native annual species, may be combined with higher than normal spring precipitation

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Contributors

Jennifer Moffitt - Original concept developed for 2020 PES initiative
Andrew Neary - Further concept development for 2020 PES initiative

Approval

Kirt Walstad, 9/08/2023

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	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):**

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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:**
