USDA Natural Resources Conservation Service

Ecological site R043CY802OR
Cool foothills and Mountains (FEID-KOMA-PSSPS)

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)
Idaho fescue-bluebunch wheatgrass - GB59

Plant Assoc. of Wallowa-Snake Province (R6 E 255-86)
Idaho fescue-prairie junegrass (ridge) - GB5911
Idaho fescue-prairie junegrass (mound) - GB5912
Idaho fescue-prairie junegrass (high elevation) - GB5913
Idaho fescue-bluebunch wheatgrass (ridge) - GB5915
Idaho fescue-bluebunch wheatgrass-arrowleaf balsamroot - GB5917

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

U.S. National Vegetation Classification Standard (NVCS)
Group: G273. Central Rocky Mountain Lower Montane, Foothill & Valley Grassland
Alliance: A3988. Festuca idahoensis - Pseudoroegneria spicata - Pascopyrum smithii Mesic Grassland Alliance
Association: CEGL001620. Festuca idahoensis - Koeleria macrantha Grassland

Ecological site concept

This site occurs on upland plateaus, mountainslopes and ridges with shallow to moderately deep soils over hard

igneous extrusive geologies (basalt, andesite, rhyolite, tuff, etc.). In the reference state, the site is characterized by dominance of Idaho fescue (Festuca idahoensis). Bluebunch wheatgrass (Pseudoroegneria spicata), prairie junegrass (Koeleria macrantha) and Sandberg bluegrass (*Poa secunda*) may also be found in significant amounts depending on soil depth, rock fragment content and overall available water capacity. Precipitation comes in the form of snow and rain primarily in the winter and early spring. Historically, plant community dynamics were driven primarily by disturbances such as localized fire and drought. Soil temperature regimes are typically frigid (although some mesic correlations currently exist). Soil moisture regimes are xeric.

This ecological site and its associated plant communities cover a broad range of elevations, soil climate regimes and soil depth classes. Further investigation will be needed to separate differences between these groups.

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

R043CY807OR	**Scabland (PSSPS-POSE-DAUN)** Occupying adjacent scabland areas with very shallow soil

Similar sites

R043CY806OR	**Very Shallow Scabland (ARRI2/PSSPS-POSE)** Dominantly very shallow soils with lower overall production. PSSPS/POSE dominant rather than FEID.
R043CY804OR	**Cool Mountain Bunchgrass (ARTRV/FEID)** Influenced by continental climate patterns, ARTRV common

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata*

Physiographic features

This site occurs on upland plateaus, mountainslopes and ridges with shallow to moderately deep soils over hard igneous extrusive geologies (basalt, andesite, rhyolite, tuff, etc.). Occasionally, this site may occur with metamorphic, metavolcanic or sedimentary geologies. Slopes are generally 10 to 30% however the total range is broad from 0 to 110%. The elevation is typically 3,950 to 4,950 (1,200 to 1,500 m) but ranges from 3,175 to over 7,000 feet (975 – 2,100 meters). With increased elevation, this site is more likely to occur on south slopes and conversely on north slopes with decreasing elevation. 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 (2) Mountains > Mountain slope (3) Mountains > Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,204–1,509 m
Slope	10–30%
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	968–2,134 m
Slope	0–100%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation typically ranges from 20 - 30 inches (510 – 755 mm). The precipitation occurs as rain and snow during the months of November through April. Localized, occasionally severe, convection storms may occur during the summer. The mean annual air temperature is approximately 43 degrees F (6 degrees C). Soil temperature regimes are frigid but may include mesic near frigid. Soil moisture regimes are xeric. The frost-free period ranges from 50 to 130 days. The period of optimum plant growth is from April through mid-July. 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)	50-130 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	508-762 mm
Frost-free period (average)	80 days
Freeze-free period (average)	
Precipitation total (average)	660 mm

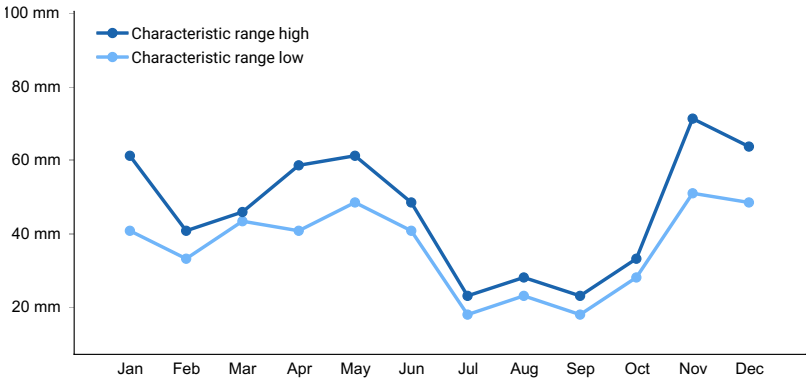


Figure 1. Monthly precipitation range

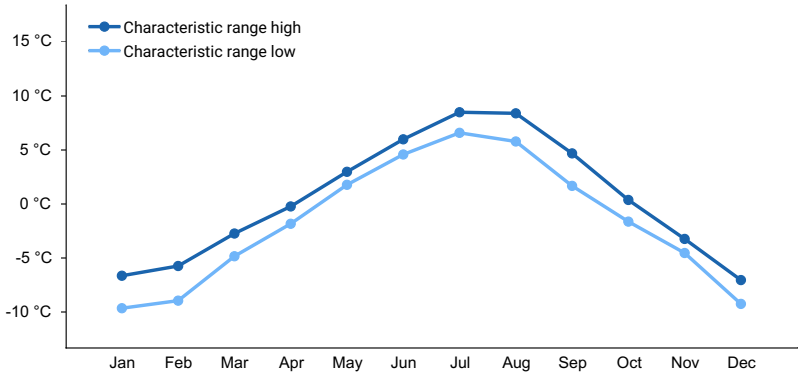


Figure 2. Monthly minimum temperature range

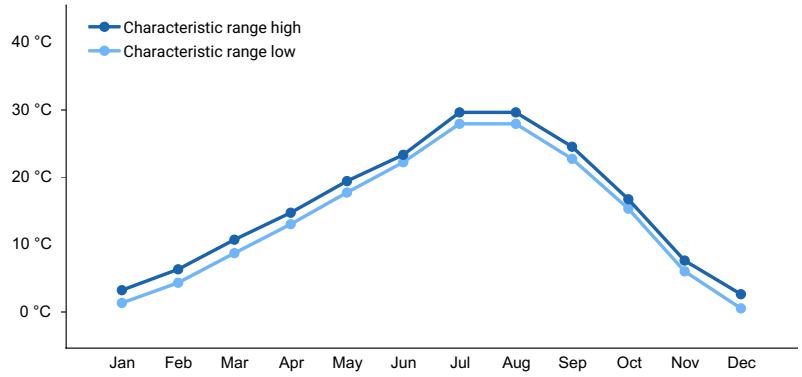


Figure 3. Monthly maximum temperature range

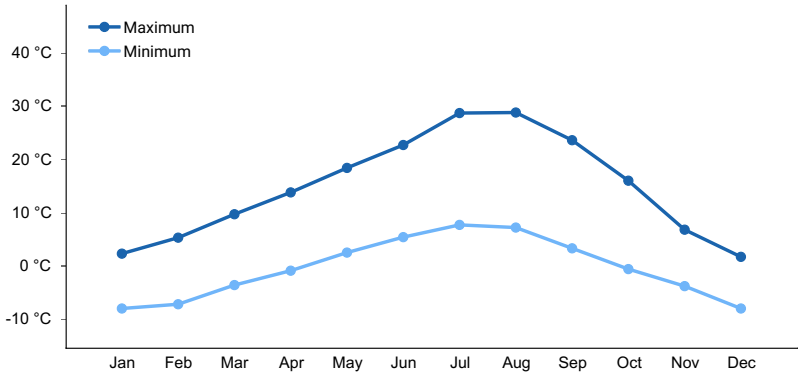


Figure 4. Monthly average minimum and maximum temperature

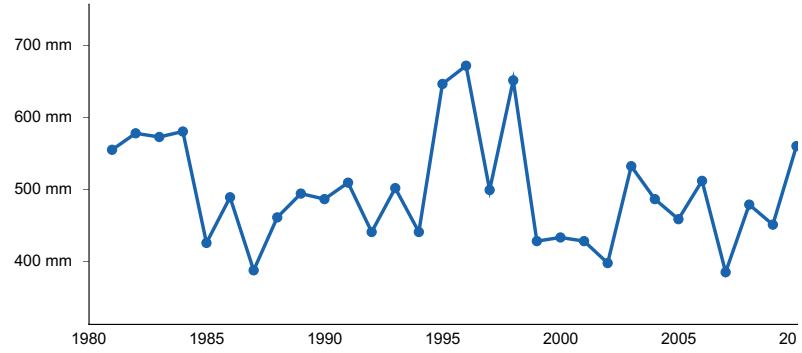


Figure 5. Annual precipitation pattern

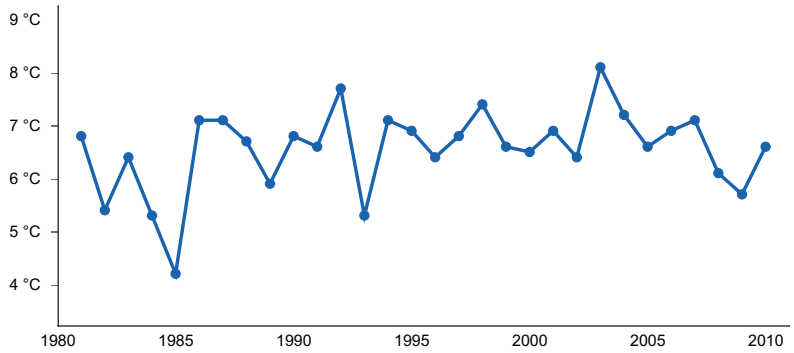


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MASON DAM [USC00355258], Baker City, OR
- (2) AUSTIN 3 S [USC00350356], Prairie City, OR
- (3) COVE 1 E [USC00351926], Cove, OR
- (4) ENTERPRISE 20 NNE [USC00352678], Enterprise, OR

Influencing water features

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

Soil features

The soils of this site are shallow to moderately deep over basalt bedrock and typically formed in colluvium and/or residuum derived from volcanic or metavolcanic rocks, primarily basalt. Surface textures are typically very stony silt loam (yet can vary considerably) while subsurface textures range from loam to silty clay loam. The family particle size is typically loamy-skeletal but may vary. Some soils may have a minor influence of volcanic ash in the surface. Total coarse fragments throughout the profile range from 15 to 60 percent by volume, typically averaging over 35%. See McCartycreek and Imnaha for modal series concepts

Table 5. Representative soil features

Parent material	(1) Colluvium–volcanic and metamorphic rock (2) Residuum–volcanic and metamorphic rock
Surface texture	(1) Gravelly loam (2) Very stony silt loam (3) Extremely cobbly silt loam (4) Cobbly silt loam (5) Ashy silt loam
Family particle size	(1) Loamy-skeletal (2) Coarse-loamy (3) Clayey-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	25–102 cm
Soil depth	25–102 cm
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0–45%
Available water capacity (0-101.6cm)	3.05–10.92 cm
Soil reaction (1:1 water) (0-101.6cm)	6–7.3

Subsurface fragment volume <=3" (10.2-101.6cm)	5–45%
Subsurface fragment volume >3" (10.2-101.6cm)	5–45%

Ecological dynamics

Range in Characteristics:

Variability in plant composition and yield is dependent on aspect and soil depth rather than on precipitation and elevation ranges that occur within the site. Total annual production tends to increase on north slopes. There tends to be an increase of bluebunch wheatgrass and lower total production on south and southwesterly slopes, particularly at shallower depths.

Response to disturbance:

Following disturbance, Idaho fescue and other deep-rooted perennial bunchgrasses decrease, favoring shallow rooted species like Sandberg bluegrass and Kentucky bluegrass (*Poa pratensis*). With further deterioration, increaser forbs and non-native annual grasses invade. Under deteriorated conditions annuals and unpalatable forbs dominate the site.

Ecological Dynamics:

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. Introduction of exotic annual grasses and other non-native species compromises the resistance and resiliency of the site, putting it at higher risk of crossing a threshold into another state.

Periodic drought regularly influences these 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 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 (Chambers et al. 2007). With disturbance outside the normal range of variability, deep rooted perennial grasses are often outcompeted by native and non-native shallow rooted perennial grasses or non-native invasive annual grasses.

With repeated severe disturbance deep rooted perennial grasses are commonly replaced by shallow rooted, sod forming grasses. Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass and/or Kentucky bluegrass to expand into the interspaces.

The annual grass species most likely to invade these sites are cheatgrass (*Bromus tectorum*), 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, often resulting in increased fire frequency and more uniform burn patterns (less mosaic).

Fire Ecology:

Idaho fescue response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Mature Idaho fescue plants are commonly reported to be severely damaged by fire in all seasons (Wright et al. 1979). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50% (Barrington et al. 1989). Rapid burns have been found to leave little damage to root crowns, and new tillers are

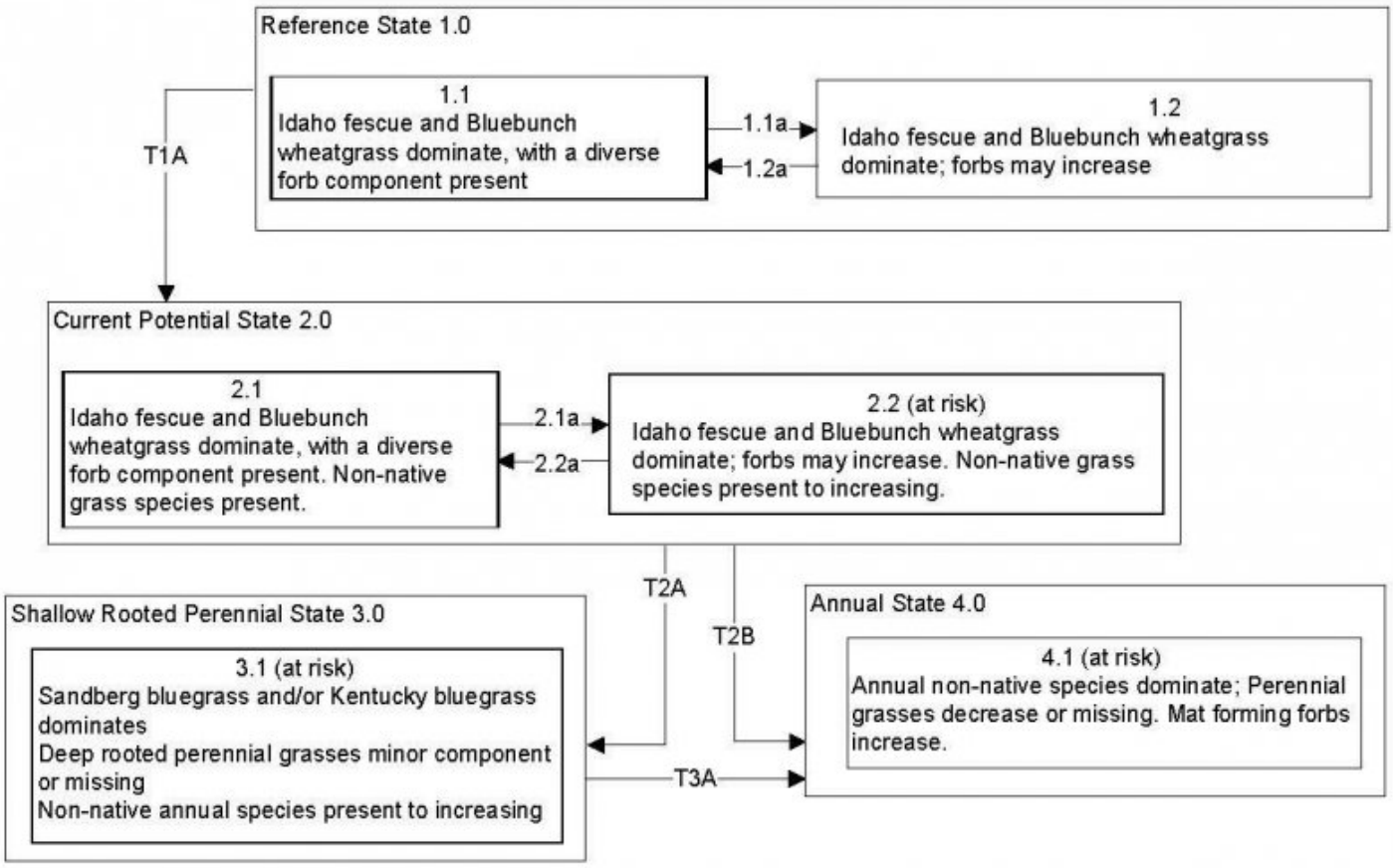
produced with onset of fall moisture (Johnson et al. 1994).

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, bluebunch wheatgrass is considered to experience slight damage to fire but 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



Reference State 1.0 Community Pathways
1.1a: Low severity fire creates grass/forb mosaic
1.2a: Time since fire allows for perennial grasses to increase.

Transition T1A: Introduction of non-native species

Current Potential State 2.0 Community Pathways
2.1a: Low severity fire creates grass/forb mosaic
2.2a: Time since fire allows for perennial grasses to increase.

Transition T2A: Severe or continuous disturbance reduces deep rooted perennial bunchgrasses. This is accelerated when in combination with extended drought. These conditions favor shallow-rooted perennials. (Disturbances could inlcude: inappropriate grazing management resulting in utilization of deep rooted perennial grasses that impact the plant's ability to recover and/or soil compaction due to grazing while soils are wet and/or catastrophic fire and/or soil disturbing treatments)

Transition T2B: Severe or continuous disturbance in the presence of non-native annual species, may be combined with higher than normal spring precipitation. (e.g. Catastrophic fire and/or soil disturbing treatments and/or inappropriate grazing management resulting in soil compaction due to grazing while soils are wet and/or utilization of perennial grasses that impact the plant's ability to recover)

Transition T3A: Soil disturbing activity in the presence of non-native annual species. This activity breaks up the shallow rooted sod forming grasses creating open spaces for establishment non-native annual species.

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 is bunchgrass dominated with a diverse forb component. 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 including the presence of all structural and functional groups, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire and/or periodic drought.

Dominant plant species

- Idaho fescue (*Festuca idahoensis*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

State 2
Current Potential State

This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds and non-native species. Non-natives may increase in abundance but will not become dominant within this State. Non-native annuals can be highly flammable and can promote increased fire frequency, perennial introduced species tend to withstand disturbance pressure better than native species and outcompete natives when resources are scarce. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These are maintained by elements of ecosystem structure and function including the presence of all structural and functional plant groups 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' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Dominant plant species

- Idaho fescue (*Festuca idahoensis*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata ssp. spicata*), grass

State 3
Shallow Rooted Perennial State

This state is the product of repeated heavy disturbance during time periods harmful to deep rooted perennial bunchgrasses. Sandberg bluegrass and Kentucky bluegrass will increase with a reduction in deep rooted perennial bunchgrass competition and become the dominant grasses.

Dominant plant species

- Sandberg bluegrass (*Poa secunda*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

State 4
Annual State

This state is characterized by the dominance of annual non-native species such as cheatgrass, medusahead and ventenata.

Dominant plant species

- 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 plant species

Transition T2A
State 2 to 3

Severe or continuous disturbance, such as prolonged improperly managed grazing

Transition T2B
State 2 to 4

Severe or continuous disturbance, such as prolonged improperly managed grazing, catastrophic fire, or soil disturbing treatments, in the presence of invasive plant species

Transition T3A
State 3 to 4

Soil disturbing activities in the presence of invasive plant species

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Contributors

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

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):**

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:

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17. **Perennial plant reproductive capability:**
