USDA Natural Resources Conservation Service

Ecological site F046XP910MT
Upland Cool Woodland Group

Last updated: 9/07/2023
Accessed: 05/21/2025

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): 046X–Northern and Central Rocky Mountain Foothills

The Provisional ESD Initiative was established to expedite the development of ecological site descriptions through the development of provisional ESDs. While Provisional ESDs are not complete, the intent is to produce an ESD complete enough for land managers to use while approved ESDs are being developed. This project area has mixed ownership falling primarily under private ownership or lands managed by the Blackfeet Nation. This PES project is contained within MLRA 46.
Major Land Resource Area (MLRA) 46, Rocky Mountain Foothills, is approximately 11.6 million acres. MLRA 46's extent has changed over recent years and is now primarily located in Montana and Wyoming with limited acres in Utah and Colorado. It spans from the Canadian border south to the Uinta Mountains of Northwest Colorado. MLRA 46 is a transitional MLRA between the plains and mountains of primarily non-forested rangeland. In Montana, three LRUs exist based on differences in geology, landscape, soils, water resources, and plant communities. Elevations for this MLRA in Montana vary from a low of 3200 to 6500 feet (975 to 1981 m) however the elevations on the fringes of this MLRA may fall outside of that range in extremely small isolated areas where the boundaries between LRU C and MLRA 43B LRU G are not easily defined. Annual precipitation ranges from 8 inches (254 mm) to, in very isolated areas, 42 inches (1083 mm). In general precipitation rarely exceeds 24 inches (610 mm). Frost-free days are variable from 50 days near the Crazy and Beartooth Mountains to 130 days in the foothills south of the Bear's Paw Mountains of Central Montana. The geology of MLRA 46 is generally Cretaceous and Jurassic marine sediments

MLRA 46's plant communities are dominated by cool season bunchgrasses with mixed shrubs. This MLRA is rarely forested however Ponderosa and Limber pine do occupy

areas. Portions of this MRLA may have a sub dominance of warm season mid-statured bunchgrasses like Little bluestem, however the general concept of the MLRA does not have a large component of warm season species. Wyoming big sagebrush, Mountain big sagebrush, Silver sagebrush, and Shrubby cinquefoil tend to be the dominant shrub component. The kind and presences of shrubs tends to be driven by a combination of soils and climate. Due to the variable nature of the Land Resources Units, Climatic subsets will be necessary to describe the ecological sites and the variation of plant communities for this MLRA.

Ecological site concept

• Site does not receive any additional water
• Dominant Cover: Coniferous Forest
• Soils are
o Generally not saline or saline-sodic (limited extent)
o Moderately deep, deep, or very deep
o Typically less than 5% stone and boulder cover (<15% max)
• Soil surface texture ranges from sandy loam to clay loam in surface mineral 4”
• Transitional area of foothills separating plains and mountains
• Site landform: Hillslope, escarpments, fan remnants
• Moisture Regime: ustic
• Temperature Regime: frigid, cool
• Elevation Range: 3800-4800
• Slope: 0-60% (Typically less than 25%)

Associated sites

F046XP903MT	**Shallow Cool Woodland Group** The Shallow Cool Woodland is typically located nearby and often slightly higher on the landscape on the shoulder of the landform.

Similar sites

F046XP903MT	**Shallow Cool Woodland Group** The Shallow Cool Woodland is typically located nearby and often slightly higher on the landscape on the shoulder of the landform. The Shallow Cool site expresses a similar plant community with a similar STM

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii* (2) *Pinus ponderosa*
Shrub	(1) *Symphoricarpos albus* (2) *Juniperus scopulorum*

Herbaceous	(1) *Pseudoroegneria spicata* (2) *Calamagrostis rubescens*

Physiographic features

The Upland Cool Woodland is an upland site that occupies steeper buttes and escarpments on igneous or sedimentary parent materials. Slopes are variable from nearly level to over 45 percent. The site is less than 20 inches deep to lithic or paralithic root restriction. Sites are generally located on buttes, escarpments, and hills.

Table 2. Representative physiographic features

Landforms	(1) Foothills > Butte (2) Foothills > Hillslope (3) Foothills > Escarpment
Elevation	1,158–1,463 m
Slope	0–60%
Aspect	Aspect is not a significant factor

Climatic features

The climate in the cool woodland designation averages 16 inches of precipitation with approximately 80 frost-free days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	69-90 days
Freeze-free period (characteristic range)	111-124 days
Precipitation total (characteristic range)	381-432 mm
Frost-free period (actual range)	54-98 days
Freeze-free period (actual range)	104-126 days
Precipitation total (actual range)	356-483 mm
Frost-free period (average)	80 days
Freeze-free period (average)	116 days
Precipitation total (average)	406 mm

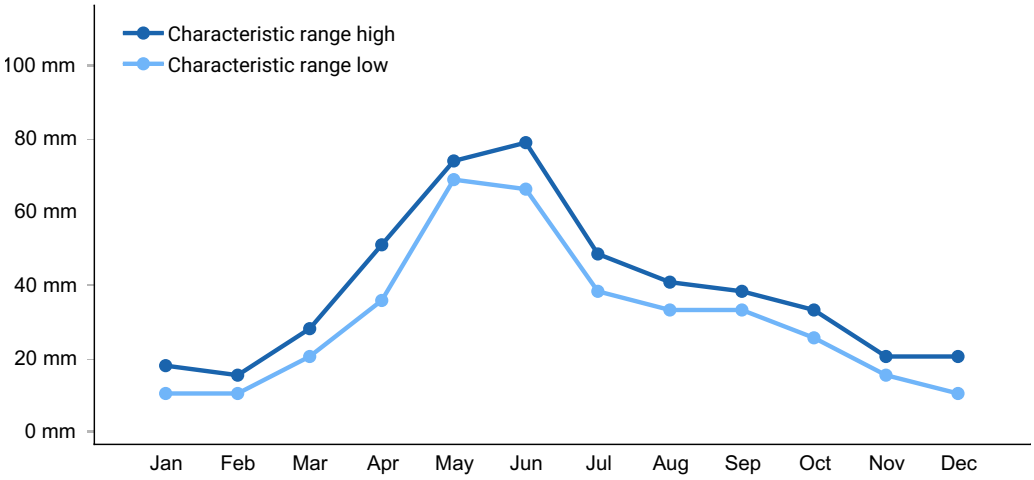


Figure 1. Monthly precipitation range

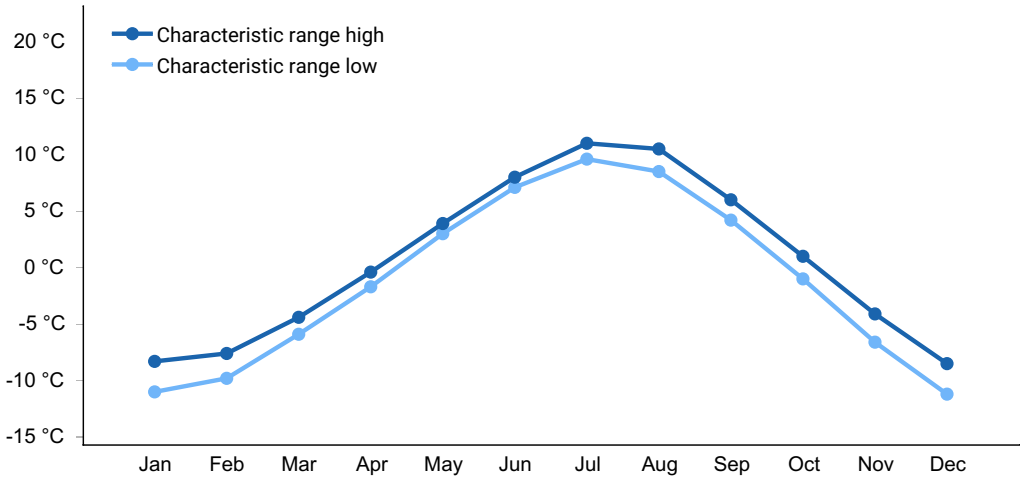


Figure 2. Monthly minimum temperature range

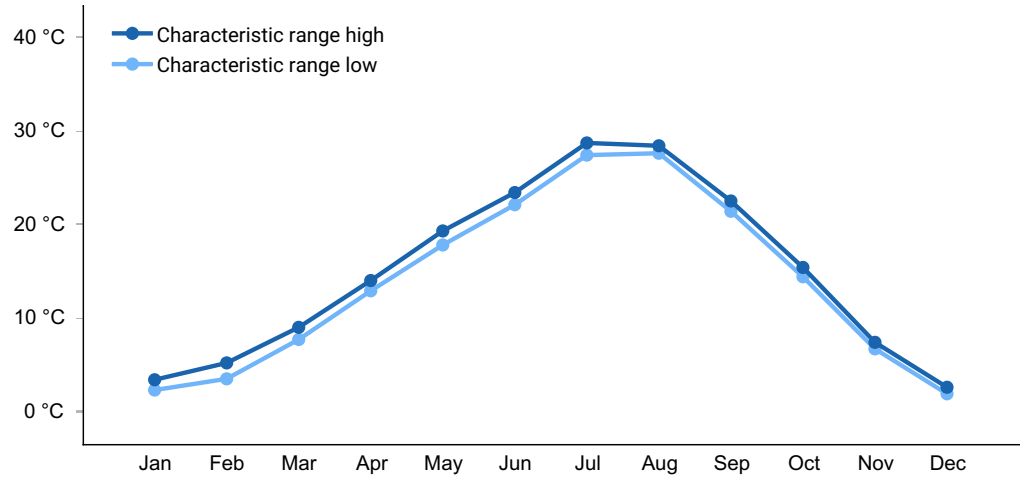


Figure 3. Monthly maximum temperature range

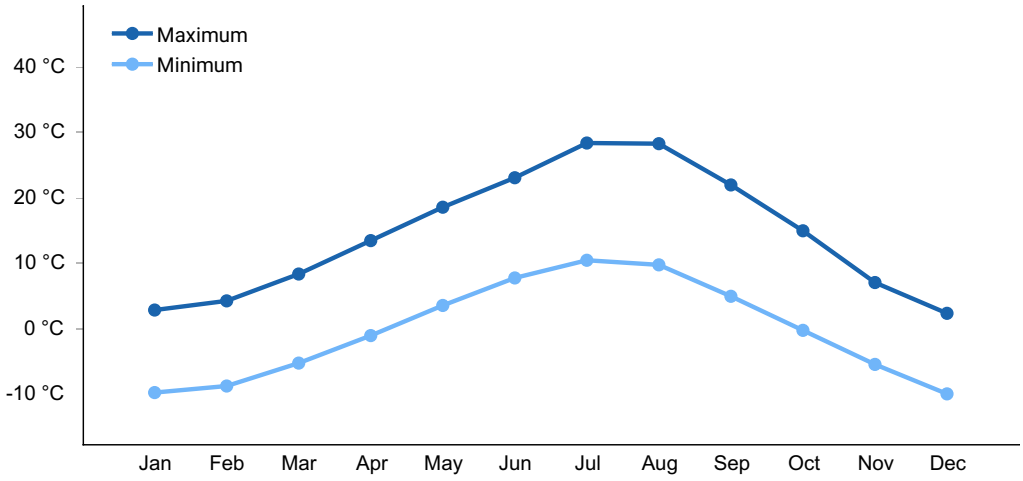


Figure 4. Monthly average minimum and maximum temperature

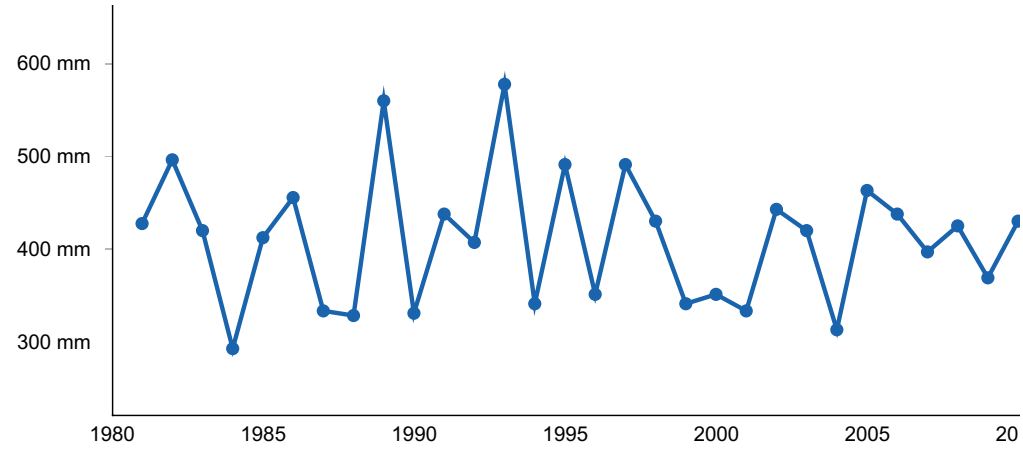


Figure 5. Annual precipitation pattern

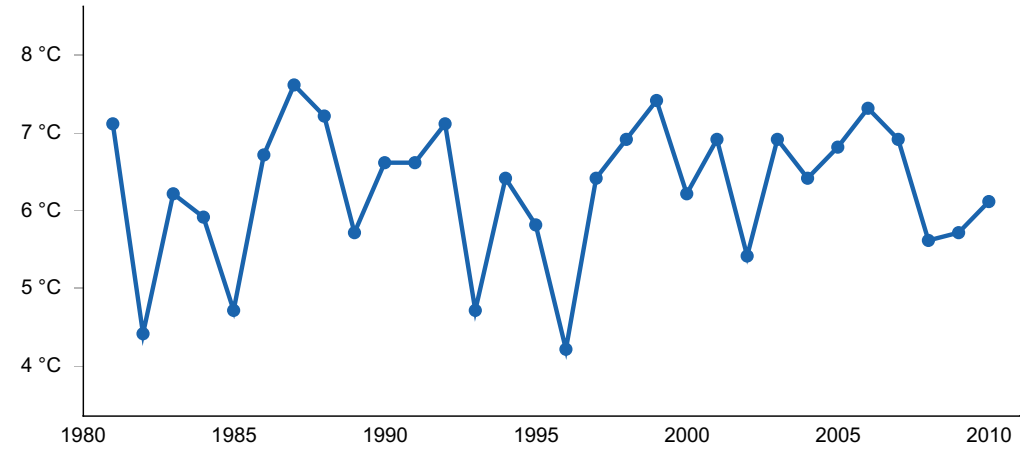


Figure 6. Annual average temperature pattern

Climate stations used

- (1) AUGUSTA [USC00240364], Augusta, MT
- (2) BIG TIMBER [USC00240780], Big Timber, MT
- (3) DENTON [USC00242347], Denton, MT
- (4) RAYNESFORD 2 NNW [USC00246902], Raynesford, MT

- (5) LEWISTOWN MUNI AP [USW00024036], Lewistown, MT

Influencing water features

n/a

Wetland description

n/a

Soil features

Soils of the Upland Cold Woodland are moderately deep to deep with a minimum of 20 inches deep to lithic or paralithic root restrictive layer. Soils will often have high amounts of rock fragments throughout the profile, generally increasing with depth. Soils are well drained with often less than 20 percent clay in the surface 4 inches.

Common soil series include Babb, Elve, and Whitore

Table 4. Representative soil features

Parent material	(1) Residuum–volcanic and sedimentary rock
Surface texture	(1) Cobbly loam (2) Gravelly loam (3) Stony loam
Drainage class	Well drained
Permeability class	Slow to moderately rapid
Depth to restrictive layer	51–254 cm
Soil depth	51–254 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	7.87–16.51 cm
Soil reaction (1:1 water) (0-25.4cm)	6.1–7.3
Subsurface fragment volume <=3" (0-50.8cm)	0–65%
Subsurface fragment volume >3" (0-50.8cm)	0–15%

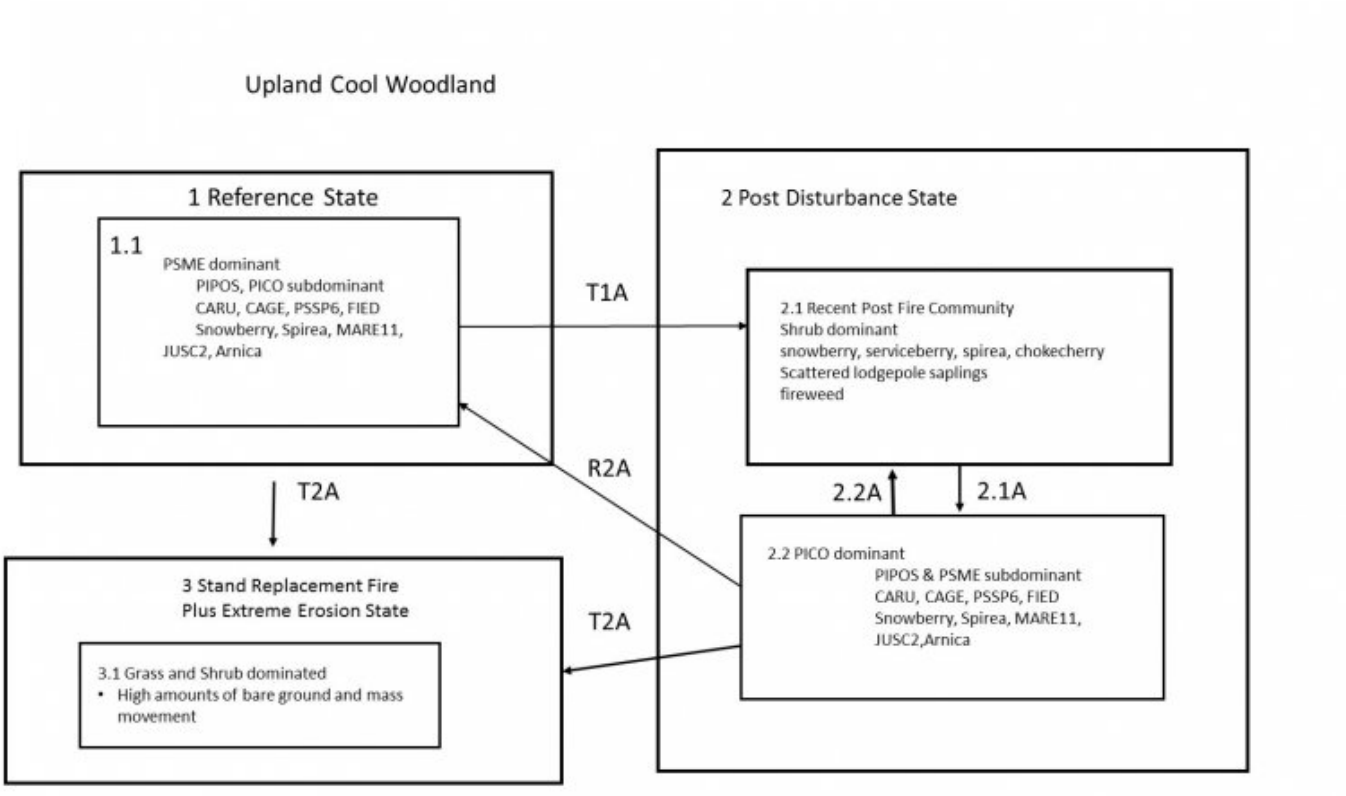
Ecological dynamics

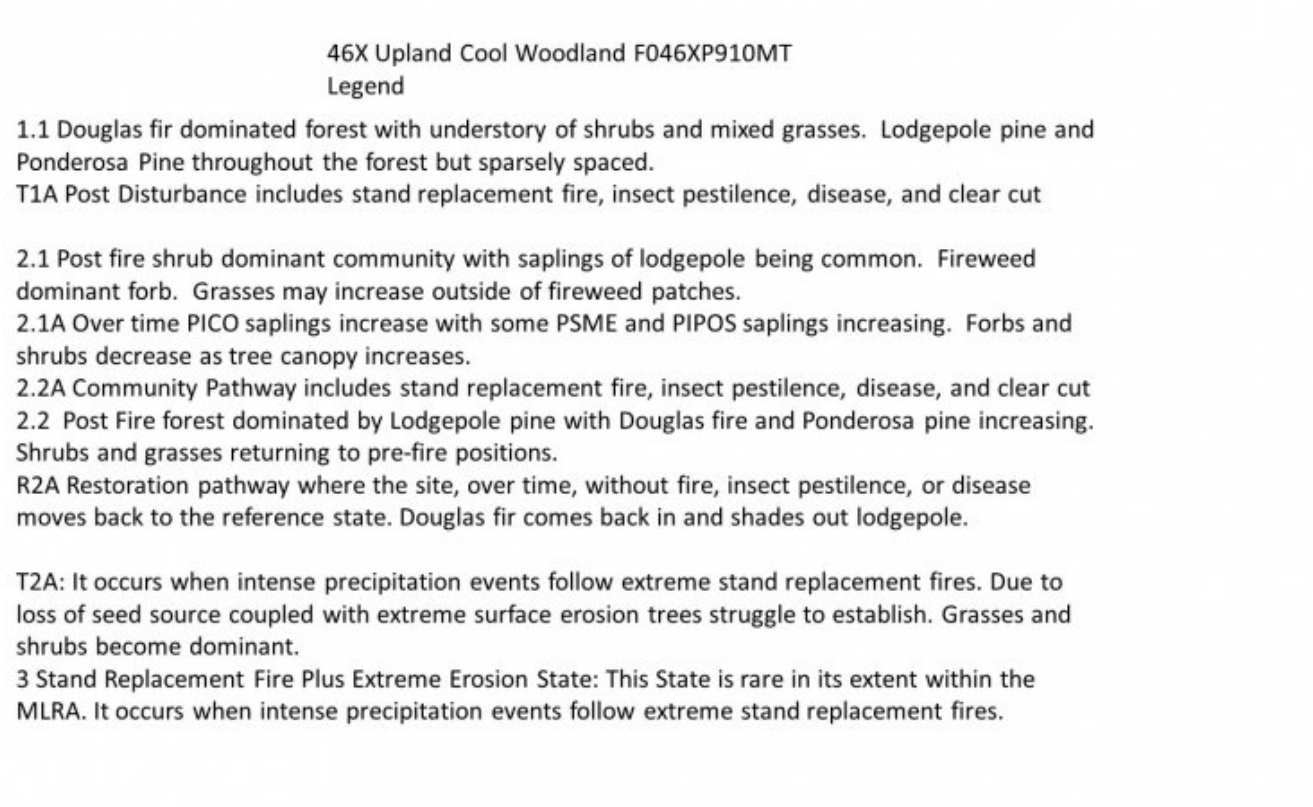
1.1 Douglas fir dominated forest with understory of shrubs and mixed grasses. Lodgepole pine and Ponderosa Pine throughout the forest but sparsely spaced.
T1A Post Disturbance includes stand replacement fire, insect pestilence, disease, and clear cut

2.1 Post fire shrub dominant community with saplings of lodgepole being common. Fireweed dominant forb. Grasses may increase outside of fireweed patches.
2.1A Over time PICO saplings increase with some PSME and PIPOS saplings increasing. Forbs and shrubs decrease as tree canopy increases.
2.2A Community Pathway includes stand replacement fire, insect pestilence, disease, and clear cut
2.2 Post Fire forest dominated by Lodgepole pine with Douglas fire and Ponderosa pine increasing. Shrubs and grasses returning to pre-fire positions.
R2A Restoration pathway where the site, over time, without fire, insect pestilence, or disease moves back to the reference state. Douglas fir comes back in and shades out lodgepole.

T2A: It occurs when intense precipitation events follow extreme stand replacement fires. Due to loss of seed source coupled with extreme surface erosion trees struggle to establish. Grasses and shrubs become dominant.
3 Stand Replacement Fire Plus Extreme Erosion State: This State is rare in its extent within the MLRA. It occurs when intense precipitation events follow extreme stand replacement fires.

State and transition model





Animal community

Site is good to excellent for grazing livestock and wildlife.

Recreational uses

Site suitable for multiple outdoor recreational uses such as hunting, hiking, landscape/viewshed, and photography

Wood products

Limited wood products available. Smaller post-and-pole and firewood product operations may be best suited to this site.

Inventory data references

Information presented was derived from NRCS inventory data, National Resources Inventory (NRI) Data, literature, field observations, and personal contacts with range-trained personnel (i.e., used professional opinion of agency specialists, observations of land managers, and outside scientists).

Other references

Barrett, H. 2007. Western Juniper Management: A Field Guide.
Bestelmeyer, B., J.R. Brown, J.E. Herrick, D.A. Trujillo, and K.M. Havstad. 2004. Land Management in the American Southwest: a state-and-transition approach to ecosystem

complexity. Environmental Management 34:38–51.
Bestelmeyer, B. and J. Brown. 2005. State-and-Transition Models 101: A Fresh look at vegetation change.
Blaisdell, J.P. 1958. Seasonal development and yield of native plants on the Upper Snake River Plains and their relation to certain climate factors.
Colberg, T.J. and J.T. Romo. 2003. Clubmoss effects on plant water status and standing crop. Journal of Range Management 56:489–495.
DiTomaso, J.M. 2000. Invasive weeds in Rangelands: Species, Impacts, and Management. Weed Science 48:255–265.
Dormaar, J.F., B.W. Adams, and W.D. Willms. 1997. Impacts of rotational grazing on mixed prairie soils and vegetation. Journal of Range Management 50:647–651.
Hobbs, J.R. and S.E. Humphries. 1995. An integrated approach to the ecology and management of plant invasions. Conservation Biology 9:761–770.
Humphrey, L. David. 1984. Patterns and mechanisms of plant succession after fire on Artemisia-grass sites in southeastern Idaho Vegetation. 57: 91-101.
Masters, R. and R. Sheley. 2001. Principles and practices for managing rangeland invasive plants. Journal of Range Management 38:21–26.
McLean, A. and S. Wikeem. 1985. Influence of season and intensity of defoliation on bluebunch wheatgrass survival and vigor in southern British Columbia. Journal of Range Management 38:21–26.
Miller, R.F., T.J. Svejcar, and J.A. Rose. 2000. Impacts of western juniper on plant community composition and structure. Journal of Range Management 53:574–585.
Ross, R.L., E.P. Murray, and J.G. Haigh. July 1973. Soil and Vegetation of Near-pristine sites in Montana.
Smoliak, S., R.L. Ditterlin, J.D. Scheetz, L.K. Holzworth, J.R. Sims, L.E. Wiesner, D.E. Baldridge, and G.L. Tibke. 2006. Montana Interagency Plant Materials Handbook.
Stavi, I. 2012. The potential use of biochar in reclaiming degraded rangelands. Journal of Environmental Planning and Management 55:1–9.
Stringham, T.K., W.C. Kreuger, and P.L. Shaver. 2003. State and Transition Modeling: an ecological process approach. Journal of Range Management 56:106–113.
Stringham, T.K. and W.C. Krueger. 2001. States, Transitions, and Thresholds: Further refinement for rangeland applications.
Tirmenstein, D. 1999. Gutierrezia sarothrae. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
https://www.fs.fed.us/database/feis/plants/shrub/gutsar/all.html [2022, March 30].
Walker, L.R. and S.D. Smith. 1997. Impacts of invasive plants on community and ecosystem properties. Pages 69–86 in Assessment and management of plant invasions. Springer, New York, NY.
Whitford, W.G., E.F. Aldon, D.W. Freckman, Y. Steinberger, and L.W. Parker. 1989. Effects of Organic Amendments on Soil Biota on a Degraded Rangeland. Journal of Range Management 41:56–60.
Wilson, A.M., G.A. Harris, and D.H. Gates. 1966. Cumulative Effects of Clipping on Yield of Bluebunch wheatgrass. Journal of Range Management 19:90–91.

Contributors

Petersen, Grant

Approval

Kirt Walstad, 9/07/2023

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	05/21/2025
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:**

---

17. **Perennial plant reproductive capability:**
