USDA Natural Resources Conservation Service

Ecological site R010XY033OR
Cold Moist Meadow

Last updated: 12/13/2023
Accessed: 05/20/2024

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 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 Engelmann spruce at upper elevations. Historical fire regimes also correlated with these forest types and ranged 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

Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests:
SW6111- *Artemisia cana*/*Deschampsia cespitosa*
SW6112- *Artemisia cana*/*Poa pratensis* (Degraded state)

Riparian and Wetland Vegetation of Central Oregon:
CEGL001074 - *Artemisia cana* ssp. viscidula / Deschampsia caespitosa

US National Vegetation Classification System:
Group: G526 - Rocky Mountain-Great Basin Lowland-Foothill Riparian Shrubland
Alliance: A2557 - *Artemisia cana* Wet Shrubland Alliance
Association: CEGL001074 - *Artemisia cana* ssp. viscidula / *Deschampsia cespitosa* Wet Shrubland

Ecological site concept

This site occurs on cold meadow habitats with intermediate moisture availability. On these sites, adjacent springs, streams and rivers provide subsurface soil moisture and sustain water tables within 30 to 100 cm of the soil surface. Moist soils (Aquic soil moisture regimes) and cool temperatures (Cryic soil temperature regimes) support highly productive plant communities dominated by silver sagebrush (*Artemisia cana*), tufted hairgrass (*Deschampsia cespitosa*), Cusick's bluegrass (Poa Cusickii) and a host of sedges (Carex spp.) and rushes (Juncus spp.) in reference condition. In comparison to sometimes adjacent wet meadow communities, these sites have lower water tables during summer and host lower proportions of obligate wetland and facultative wetland vegetation. Historical

ecological dynamics would have been highly influenced by climate cycles and their interactions with adjacent streamflow as well as wildfires on site and within the contributing watershed.

Associated sites

R010XY001OR	**Cold Wet Meadow** Water table remains within 30 cm of the soil surface throughout the summer. Higher proportion of sedges, silver sagebrush not present.

Similar sites

R010XY001OR	**Cold Wet Meadow** Water table remains within 30 cm of the soil surface throughout the summer. Higher proportion of sedges, silver sagebrush not present.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia cana ssp. viscidula*
Herbaceous	(1) *Deschampsia cespitosa*

Physiographic features

This site occurs on low floodplains of perennial streams and rivers and along the fringe of reservoirs and water impoundments in mountain valleys. Slopes typically range from 0 to 2 percent, but may be occasionally as steep as 5 percent. Elevation typically varies from 4,900 to 5,500 feet (1,500 to 1,675 meters) but may range from 4,000 to 6,000 feet (1,200 to 1,850 meters). Flooding is brief and rare or occasional. A seasonal water table will fluctuate between 12 and 72 inches (30 and 100 cm) throughout the year but may maintain a depth of between 12 to 24 inches (30 to 60 cm) below the surface from May to July.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Stream terrace (2) Mountains > Flood-plain step
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	1,494–1,676 m
Slope	0–2%
Water table depth	30–61 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding duration	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	1,219–1,829 m
Slope	0–5%
Water table depth	30–183 cm

Climatic features

The annual precipitation typically ranges from 20 to 30 inches (510 to 760 mm), yet may range from 15 to 36 inches (380 to 910 mm) primarily as rain and snow from September through July. The mean annual temperature is typically 36 to 41° F (2 to 5° C). The frost-free period is typically 0 to 20 days. A seasonal supply of subsurface moisture augments the precipitation. The soil temperature regime is cryic due to high moisture conditions and cold air entrapment in the valleys. High soil moisture conditions and low evapotranspiration facilitate an aquic soil moisture regime or aquic soil moisture conditions. Climate graphs are based on the nearest available climate stations to representative site locations and are provided to indicate general climate patterns.

Table 4. Representative climatic features

Frost-free period (characteristic range)	0-20 days
Freeze-free period (characteristic range)	20-50 days
Precipitation total (characteristic range)	508-762 mm
Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	381-914 mm
Frost-free period (average)	10 days
Freeze-free period (average)	35 days
Precipitation total (average)	635 mm

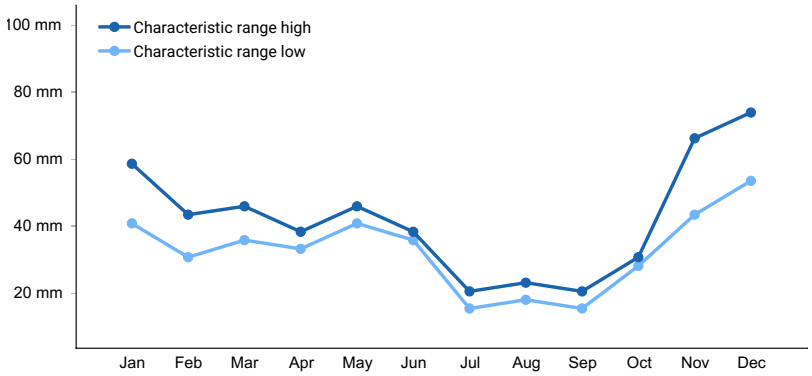


Figure 1. Monthly precipitation range

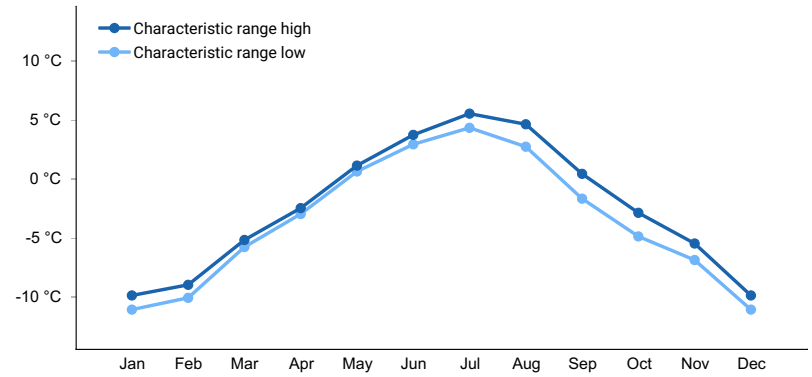


Figure 2. Monthly minimum temperature range

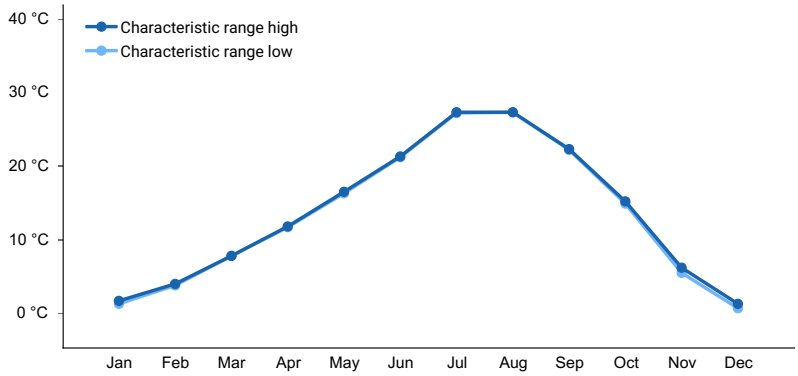


Figure 3. Monthly maximum temperature range

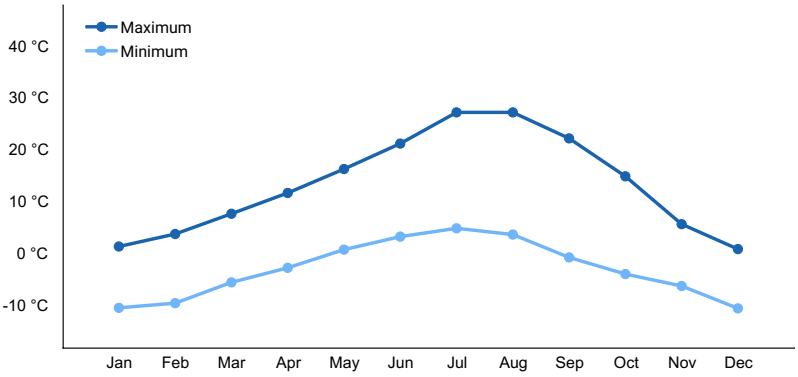


Figure 4. Monthly average minimum and maximum temperature

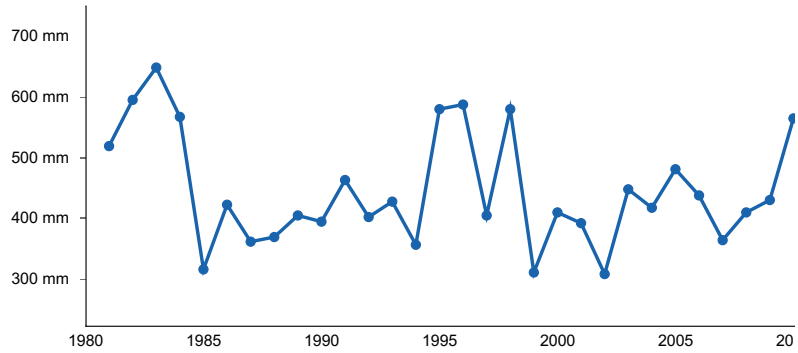


Figure 5. Annual precipitation pattern

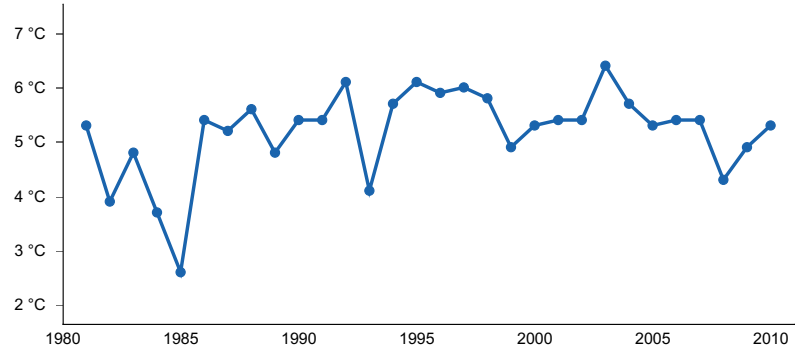


Figure 6. Annual average temperature pattern

Climate stations used

- (1) SENECA [USC00357675], Seneca, OR
- (2) AUSTIN 3 S [USC00350356], Prairie City, OR

Influencing water features

This site is classified as palustrine, emergent and seasonally flooded (PRMC) under the Cowardian System. Perennial streams that occur adjacent to this site are typically Rosgen stream types C and E, but may also occur along type F streams in degraded condition.

Wetland description

Not defined.

Soil features

The soils of this site are typically very deep and somewhat poorly drained to poorly drained. The surface layer is an ashy loam to silt loam. The family particle size is typically fine silty over sandy or sandy skeletal. These soils are typically formed in glaciofluvial deposits or alluvium with influences of volcanic ash. Permeability is typically moderately slow in the upper part and then rapid in the lower part. A representative soil series for this site is Frenchcabin fine silty over sandy or sandy skeletal, mixed superactive Aquandic Cryaquoll.

Table 5. Representative soil features

Parent material	(1) Glaciofluvial deposits (2) Alluvium (3) Volcanic ash
Surface texture	(1) Ashy silt loam (2) Ashy loam
Family particle size	(1) Fine-silty over sandy or sandy-skeletal
Drainage class	Somewhat poorly drained to poorly drained
Permeability class	Moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	5–20%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	16.51–18.29 cm
Soil reaction (1:1 water) (0-101.6cm)	6.6–7.8
Subsurface fragment volume <=3" (10.2-152.4cm)	10–30%
Subsurface fragment volume >3" (10.2-152.4cm)	5–15%

Ecological dynamics

The Reference plant community of the Cold Wet Meadow ecological site is distinguished by the presence of silver sagebrush (*Artemisia cana*) along with a productive mixture of largely facultative and facultative wetland graminoids and forbs.

Silver sagebrush occurs in mountain meadows of the Blue and Ochoco mountains of Oregon (Howard 2002). Compared to other common sagebrush species in the region, silver sagebrush requires greater soil moisture, (i.e. greater than 10 inches of precipitation or a water table within 1 m of the soil surface). Indeed, it is the only sagebrush species in North America that can tolerate soil saturation and flooding. Silver sagebrush reproduces primarily by cloning from roots and rhizomes. This resprouting ability increases the resilience of silver sagebrush to flood, drought, fire, ice scour and browsing. Two subspecies of silver sagebrush are found in Oregon (ssp. viscidula and ssp. bolanderi) and both may be represented by this concept (Crowe et al. 2004).

Tufted hairgrass (*Deschampsia cespitosa*) is a common bunchgrass in meadows of the Western US. Considered good to excellent forage for all classes of livestock, tufted hairgrass is moderately grazing tolerant yet decreases with long-term intensive defoliation, which depletes carbohydrate reserves (Walsh 1995). Excessive grazing may have removed or significantly reduced cover of this grass in many meadow of the blue mountains (Crowe and Clausnitzer 1997). Tufted hairgrass is resilient to all but the most severe fire, responding by resprouting from root crowns and returning to pre fire cover within a few years. A shade intolerant species, tufted hairgrass will likely decrease with conifer encroachment into meadows.

Historically, the ecological dynamics of the site would have been influenced largely by climate cycles affecting seasonal snowpack, runoff, drought and floods. These processes would have been partly controlled by the type and cover of upland and forest vegetation throughout the watershed which would have modified water capture, storage and sediment supply. These upland dynamics would have been altered by historical fire regimes and subsequently vegetation succession, erosion and runoff. Beaver also had widespread impacts on water table depth and seasonality, frequency and duration of ponding and flooding, and stream channel structure.

Variability in site productivity and composition is largely driven by subsurface moisture availability. As the subsurface moisture gradient decreases (lower water table), Silver sage, Tufted hairgrass (*Deschampsia cespitosa*) and Baltic rush (*Juncus arcticus* spp. littoralis) will decrease and this site will transition into upland mountain big sage (*Artemisia tridentata* ssp. vaseyana) plant communities; as the subsurface moisture gradient increases (higher water table), this site transitions into cold meadows and cold wet meadows and/or willow-riparian plant communities.

If the condition of the site deteriorates as a result of improperly managed grazing or heavy recreational disturbance, tufted hairgrass decreases while silver sage, Cusick's bluegrass (*Poa cusickii*), Nebraska sedge (*Carex nebrascensis*), Baltic rush, northwest cinquefoil (*Potentilla gracilis*), yarrow (Achillea spp.) and rosy pussytoes (*Antennaria rosea*) increase and native annuals increase. With further deterioration, Kentucky bluegrass (*Poa pratensis*) replaces Tufted hairgrass, silver sage becomes dominant, Cusick's bluegrass decreases and perennial and annual forbs dominate the herbaceous layer.

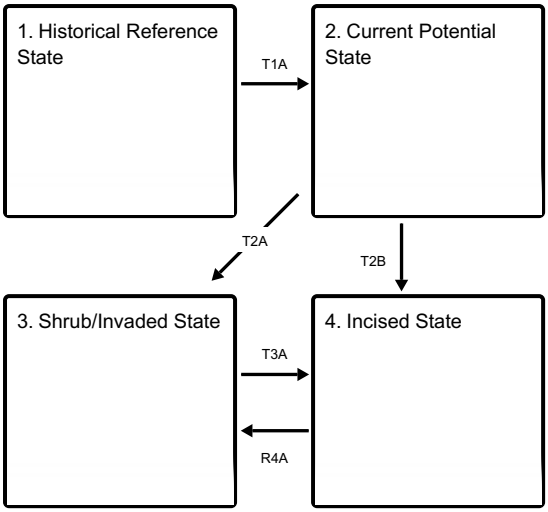
Where sites are connected to stream networks, sustained disturbance may lead to accelerated erosion, decreased streambank stability and eventually degradation of stream channels. Overtime, with increased depth and incision of channels, water tables may drop and floodplains may become disconnected from stream courses. If these effects are not mitigated, floodplains may convert to abandoned terraces and vegetation may shift to drought adapted shrub such as big sagebrush. High energy runoff events will accelerate this transition if banks have been destabilized by loss of vegetation. Site hydrology may also be altered by modifications to the stream channel by disturbances such as impoundment, removal of beaver, flow alteration for irrigation, channel realignment or terrace modifications for agricultural use. Channel straightening, deepening and drainage practices may be implemented to convert the site to agricultural use or facilitate transportation corridors. These impacts may be less common in these higher elevation meadows compared to low elevation bottomlands. When implemented, these land uses often increase stream gradients, decrease sinuosity and increase channel depths, leading to disconnected floodplains overtime. The effects of climate change on the long-term dynamics has not been evaluated, although research suggests that expected shifts in precipitation timing and type will have far reaching effects on blue mountain riparian and wetland ecosystems (Dwire et al 2018).

Emerging evidence suggests that montane meadows are experiencing conifer encroachment within the last century. Hypotheses for processes driving these vegetation changes range from climate cycles, alterations in fire regime and reductions in sheep grazing. While much of this site has excessively high soil moisture to accommodate significant conifer encroachment, populations of lodgepole pine (*Pinus contorta*) may become established in cold meadows due to altered disturbance regimes.

The state and transition model below represents an approximation of ecological states resulting from the disturbance dynamics described above. Data is lacking to discretely define thresholds between states and phases, and further work is needed to better understand the persistence of these plant communities.

State and transition model

Ecosystem states



T1A - Invasion of non-native meadow grasses

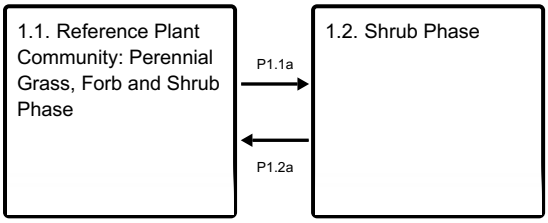
T2A - Sustained improperly managed grazing during sensitive times of year

T2B - Hydrologic and water table alteration

T3A - Hydrologic and water table alteration

R4A - Restoration of hydrologic and biotic processes

State 1 submodel, plant communities



P1.1a - Water tables are lowered for a prolonged period

P1.2a - Water tables are raised for a prolonged period

State 1
Historical Reference State

This represents the historical reference state in pristine conditions with no exotic species present. Variability in depth to water table and seasonal fluctuations support native facultative wetland vegetation and vegetated communities include all historical functional and structural groups. The historical disturbance regime is intact and driven primarily by climate which influences drought and flood cycles. The resilience and resistance of the site is bolstered by negative feedbacks between vegetation establishment and hydrologic processes that maintains a dynamic equilibrium with geomorphological processes.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- tufted hairgrass (*Deschampsia cespitosa*), grass

Community 1.1
Reference Plant Community: Perennial Grass, Forb and Shrub Phase

The reference plant community of this site is identified by an open stand dominated by silver sage and tufted hairgrass with Cusick's bluegrass (*Poa cusickii*), various sedges and rushes along with a diverse forb community.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2466	3278	4119
Shrub/Vine	757	1009	1261
Forb	140	196	224
Total	**3363**	**4483**	**5604**

Community 1.2
Shrub Phase

Silver sagebrush cover is increased relative to the Reference Plant Community. Cover of Cusick's bluegrass may be increased relative to tufted hairgrass, rushes and sedges. Facultative wetland plants are less common than in the reference plant communities, replaced by facultative and facultative upland plants. A shrub dominated state may also follow heavy disturbance such as improperly managed grazing but will include non-native exotic species (see state 3).

Pathway P1.1a
Community 1.1 to 1.2

Water tables are lowered for a prolonged period as a consequence of sustained drought, decreased aquifer recharge, conifer encroachment, or lack of wildfire in the surrounding watershed.

Pathway P1.2a
Community 1.2 to 1.1

Water tables are raised for a prolonged period as a consequence of sustained above average snowpack, increased aquifer recharge, or wildfire in the surrounding watershed.

State 2
Current Potential State

This state is similar to the reference state yet includes a component of non-native species such as Kentucky bluegrass (*Poa pratensis*), common timothy (*Phleum pratense*), and meadow foxtail (*Alopecurus pratensis*). Ecological process and function have not been altered fundamentally by this low level of invasion, yet resistance and resilience are decreased. Erosion processes are still within a historical range of variation, yet with continued vegetation loss the site risks a transition to an alternative state. Variability in depth to water table and seasonal fluctuations support native vegetation and vegetated communities include all historical functional and structural groups, yet composition and richness may be reduced. This state is common due to widespread invasion of non-native meadow grasses in the Western US. Prolonged improperly managed grazing will promote the spread of Kentucky bluegrass, increase cover of silver sage and reduce tufted hairgrass risking a transition to a shrub state (State 3). Further improperly managed grazing will increase bareground, increase erosion and risk a transition to a drained state (State 4).

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- tufted hairgrass (*Deschampsia cespitosa*), grass

State 3
Shrub/Invaded State

Soil compaction, trampling and sustained overutilization has altered vegetated composition and increased bare ground. Relative to the current potential state, composition of wetland facultative species has been reduced, silver sage has increased and forbs have increased. Much of the tufted hairgrass cover has been replaced by Kentucky bluegrass. The state may also be invaded by exotic annual grasses and forbs and exotic tap rooted perennials. Soil erosion and vegetation pedestalling is often present. Banks are moderately stable, hydrology may be altered with

somewhat lowered water tables. A return to the current potential state may not be possible given the following considerations: burning or cutting of silver sage will likely be ineffective due to the ability to resprout; proximity to waterways makes herbicide application impractical or risky in most situations.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass
- timothy (*Phleum pratense*), grass
- meadow foxtail (*Alopecurus pratensis*), grass

State 4
Incised State

Sustained disturbance may lead to unstable stream banks, entrenched channels and headcuts. Active floodplains and primary terraces will become disconnected from the channel and evolve into high terraces with significantly lowered water tables. This will often lead to the replacement of facultative wetland communities with mountain big sagebrush communities. Plant community composition within this state will vary and may depend on adjacent vegetation types, water table levels, past disturbance history, drought and current management.

Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Kentucky bluegrass (*Poa pratensis*), grass

Transition T1A
State 1 to 2

Invasion of non-native meadow grasses into the site.

Transition T2A
State 2 to 3

Sustained improperly managed grazing during times of year when soils are most susceptible to compaction, and when graminoids are most prone to damage by trampling and over utilization.

Transition T2B
State 2 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support facultative wetland vegetation, alter sediment supply and transport leading to scouring and channel incision, or directly increase flow velocities or flashiness. These may include: alteration of streamflow by irrigation or impoundment leading to a lowering of the water table during times of year when riparian woody vegetation is dependent; prolonged improperly managed livestock grazing; removal of beaver; direct manipulation of channel morphology (namely straightening for agricultural or development purposes); removal of large woody debris or large woody debris sources from channels or adjacent forests; and significant alterations of upland watershed vegetation altering peak discharge or sediment loads.

Transition T3A
State 3 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support facultative wetland vegetation, alter sediment supply and transport leading to scouring and channel incision, or directly increase flow velocities or flashiness. These may include: alteration of streamflow by irrigation or impoundment leading to a lowering of the water table during times of year when riparian woody vegetation is dependent; prolonged improperly managed livestock grazing; removal of beaver; direct manipulation of channel morphology (namely straightening for agricultural or development purposes); removal of large woody debris or large woody debris sources from channels or adjacent forests; and significant alterations of upland watershed vegetation

altering peak discharge or sediment loads.

Restoration pathway R4A
State 4 to 3

Restoration of hydrologic and biotic process and function through rehabilitation of channel and vegetation structure may be possible in some cases but will require considerable inputs, time and cost. Restoration actions should be designed to promote sediment capture and increase channel aggradation. These may include a combination of treatments including placement of large woody debris; creation or removal of impoundments; alteration of water withdrawals; management changes to adjacent agricultural or grazing practices; or mechanical manipulation of stream channel courses, often in combination with intensive planting of locally adapted, native species.

Context dependence. Restoration options will be highly site specific and may not be possible in many circumstances.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Deep-rooted, perennial grasses**			2690–3587	
	tufted hairgrass	DECE	*Deschampsia cespitosa*	2690–3587	–
2	**Sedges**			448–897	
	sedge	CAREX	*Carex*	448–897	–
3	**Rushes**			224–448	
	rush	JUNCU	*Juncus*	224–448	–
4	**Shallow-rooted, perennial bluegrasses**			135–359	
	bluegrass	POA	*Poa*	135–359	–
Forb					
5	**Forbs**			0–493	
	cinquefoil	poten	*Potentilla*	0–45	–
	yarrow	ACHIL	*Achillea*	0–45	–
	American bistort	POBI6	*Polygonum bistortoides*	0–45	–
	buttercup	RANUN	*Ranunculus*	0–45	–
	ragwort	SENEC	*Senecio*	0–45	–
	beardtongue	PENST	*Penstemon*	0–45	–
	checkerbloom	SIDAL	*Sidalcea*	0–45	–
	horkelia	HORKE	*Horkelia*	0–45	–
	elk thistle	CIFO	*Cirsium foliosum*	0–45	–
	blue eyed Mary	COLLI	*Collinsia*	0–45	–
	owl's-clover	ORTHO	*Orthocarpus*	0–45	–
Shrub/Vine					
6	**Shrubs**			897–1793	
	silver sagebrush	ARCA13	*Artemisia cana*	897–1793	–

Animal community

Wildlife
The main wildlife species of concern on this site are large herbivores including mule deer, elk and antelope. This

site may also be home to a variety of small herbivores, birds and their associated predators. Beaver may influence sites where woody riparian species are present and where adjacent riparian areas facilitate their presence.

Livestock
While this site produces considerable forage, much of this site is unsuitable to livestock use for much of the year due to saturated soils. However, the site may be accessible to grazing during late summer or early fall if water tables have lowered. When soils are moist they may be more prone to compaction. Vegetation may be susceptible to damage by tramping, especially during reproductive periods. Prolonged improperly managed livestock grazing will increase bareground, alter plant community composition, increase erosion and pedestalling, and decrease litter cover. Evidence suggests that silver sagebrush has expanded into moist meadow systems, while tufted hairgrass has declined, as a result of improperly managed livestock grazing.

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Contributors

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2020/2021 Update: Andrew Neary

Approval

Kirt Walstad, 12/13/2023

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	05/20/2024
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:**

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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:**
