USDA Natural Resources Conservation Service

Ecological site R043CY501OR
Cold Wet Mountain Meadow (CAREX)

Last updated: 9/08/2023
Accessed: 04/25/2024

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 Wallowa-Snake Province (1987):
MM1922 - Tufted hairgrass wet meadow sedges

Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests (1997):
MM2918 - Cusick's sedge
MW2912 - Clustered field sedge

Riparian and Wetland Vegetation of Central and Eastern Oregon (2004):
CEGL000230 - *Carex cusickii* Association - Cusick's sedge Association

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

U.S. National Vegetation Classification Standard (NVCS)
Macrogroup:
Vancouverian-Rocky Mountain Montane Wet Meadow & Marsh
Group:
Carex spp. - Calamagrostis spp. Montane Wet Meadow & Marsh Group

Ecological site concept

This ecological site represents a broad group of plant communities existing in cold wet meadow environments of the Blue and Wallowa mountains of Oregon and Washington. These communities are dominated by obligate wetland sedge species (Carex spp.) yet often include a range of other graminoids, forbs and shrub pockets as well. This site is found among forested communities at moderate to high elevations, often occupying low gradient floodplains, wet basins and drainageways. Deep, fine textured mineral and organic soils promote high water holding capacity and persistently high water tables (0 - 30cm throughout the year) favor plant species that can tolerate saturated soils. Historically, climatic cycles acting on watershed hydrology would have controlled ecological dynamics and geomorphic processes.

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

R043CY502OR	**Cool Moist Mountain Meadow (DECE/CAREX)** Occupying adjacent landforms with meadow communities at somewhat higher positions relative to stream channels or more ephemeral sources of subsurface moisture

Similar sites

R043CY502OR	**Cool Moist Mountain Meadow (DECE/CAREX)** Water table drops to below 30 cm by mid to late summer. DECE dominated.
F043CY503OR	**Mountain Riparian Forest (PIEN/ALIN)** Moderate to high stream gradients. High energy soils.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Carex*

Physiographic features

This meadow site occurs on depositional floodplains in moderate to very broad mountain valleys. In addition to floodplains, the site also occurs on headwater basins, swales, drainageways, and is often adjacent to stream channels. It also occurs near marsh areas, on upland areas adjacent to springs and seeps and in pockets where snowpack persists into the late spring and early summer. When located near active stream channels it is subject to occasional flooding (5 to 50 times in 100 years) and sediment deposition, typically lasting from a few hours to a week. In reference condition, the floodplain is well connected to the primary channel. Water is typically above or near the surface throughout the spring and summer, and often remains within 30 cm of the soil surface through late summer. Valley gradients are typically very low to low and range from 0 to 5 percent. Elevations typically range from 4,500 to 5,500 feet (1,375 to 1,675 meters) but may occur between 3,800 to 7,000 ft (1,150 to 2,150 meters).

Table 2. Representative physiographic features

Landforms	(1) Mountains > Flood plain (2) Mountains > Drainageway (3) Mountains > Swale
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	Occasional
Ponding frequency	None
Elevation	4,500–5,500 ft
Slope	0–5%

Ponding depth	Not specified
Water table depth	0–12 in
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	3,800–7,000 ft
Slope	Not specified
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The annual precipitation averages 25-40 inches (640 – 1010 mm), most of which occurs in the form of snow during the months of November through March. The soil moisture regime is typically Aquic but may be Udic. The soil temperature regime is Cryic with a mean air temperature between 37 to 43 degrees F (3 to 6 degrees C). The frost-free period ranges from less than 30 to more than 70 days. Where this site occurs toward its lower elevations, cold air drainage and cold subsurface flows often decrease air and soil temperatures relative to nearby sites. 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)	30-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	25-40 in
Frost-free period (average)	40 days
Freeze-free period (average)	
Precipitation total (average)	28 in

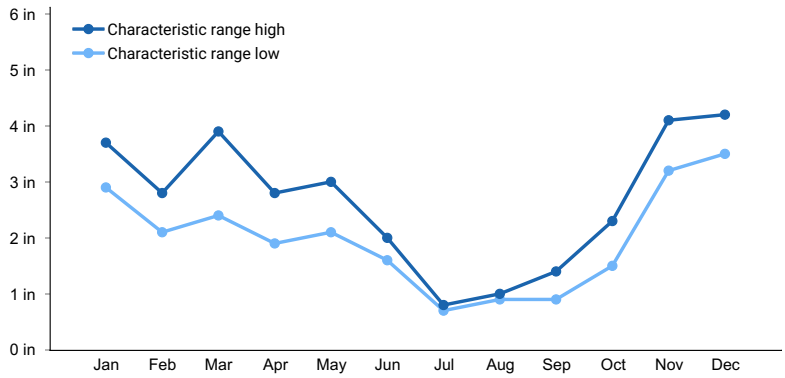


Figure 1. Monthly precipitation range

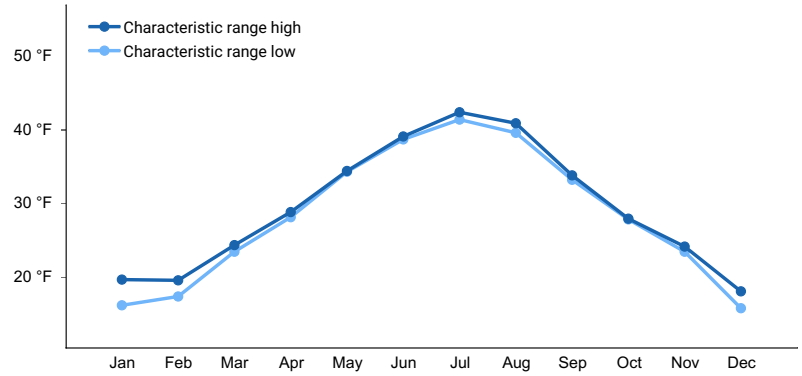


Figure 2. Monthly minimum temperature range

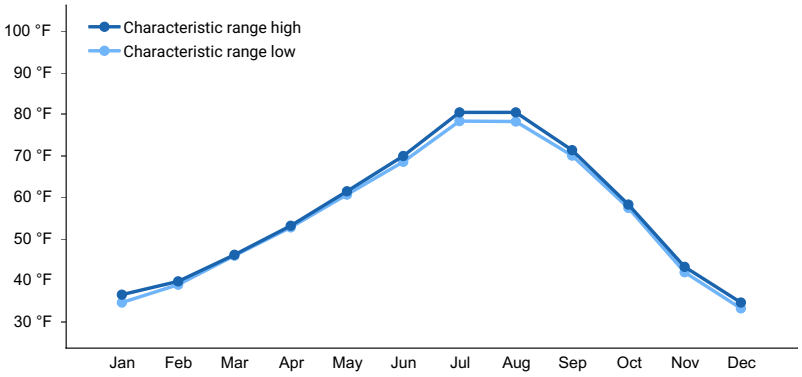


Figure 3. Monthly maximum temperature range

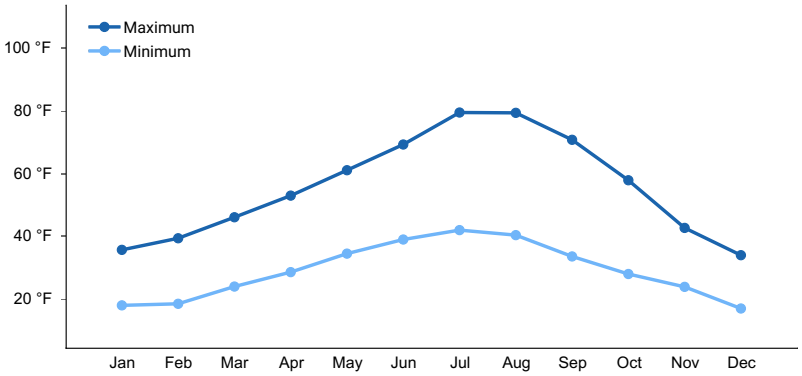


Figure 4. Monthly average minimum and maximum temperature

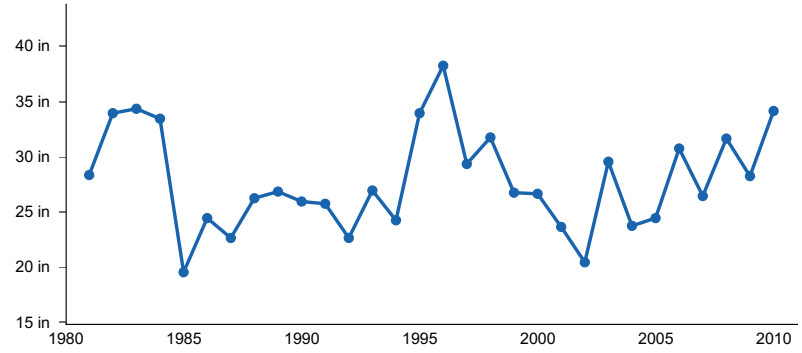


Figure 5. Annual precipitation pattern

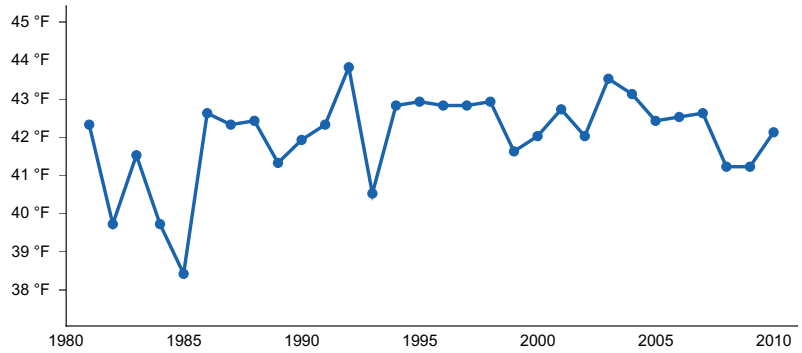


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MEACHAM [USW00024152], Pendleton, OR
- (2) AUSTIN 3 S [USC00350356], Prairie City, OR

Influencing water features

Frequent surface flows and long duration seasonal sub-surface flows from adjacent perennial and seasonal streams and associated uplands augment the precipitation. Duration and volume of flows during spring and summer will be dependent on snowpack within contributing watersheds, as well as vegetation type and cover, geology and geomorphology. These processes will in part be controlled by the interactions of spring and summer air temperature and spring precipitation on melting and runoff.

Soil features

The soils of this site are typically recent, deep to very deep and poorly drained. Surface layers may be formed in alluvium from mixed sources, peat or volcanic ash. Subsurface layers are formed in mixed alluvium, glacial till or lacustrine deposits. The surface texture is variable but typically a loam, silt loam or peat. The subsoil texture is variable, ranging from clay loam, silt loam, loam or loamy sand and may exhibit a cobbly or gravelly coarse fragment modifier. The family particle size is typically coarse-loamy but may vary considerably. See Bandarrow and Bycracky for soils commonly associated with this site concept.

Table 5. Representative soil features

Parent material	(1) Alluvium–volcanic and metamorphic rock (2) Herbaceous organic material (3) Till–volcanic and metamorphic rock (4) Lacustrine deposits (5) Volcanic ash–volcanic rock
Surface texture	(1) Peat (2) Silt loam (3) Loam (4) Very gravelly loamy sand (5) Very fine sandy loam
Family particle size	(1) Coarse-loamy (2) Sandy-skeletal (3) Loamy-skeletal (4) Fine
Drainage class	Poorly drained
Permeability class	Moderately slow to rapid
Depth to restrictive layer	40–80 in
Soil depth	40–80 in
Surface fragment cover <=3"	0–45%

Surface fragment cover >3"	0–45%
Available water capacity (0-40in)	0.6–8.5 in
Soil reaction (1:1 water) (0-40in)	5.6–8
Subsurface fragment volume <=3" (4-60in)	20–80%
Subsurface fragment volume >3" (4-60in)	0–30%

Ecological dynamics

In its reference state, this site is dominated by wetland obligate graminoids such as Cusick's sedge (*Carex cusickii*), bladder sedge (*Carex utriculata*), densely-tufted sedge (*Carex lenticularis*), few-flowered spikerush (*Eleocharis quinqueflora*), and clustered field sedge (*Carex praegracilis*). Common forbs (and fern allies in the case of horsetail) found on this site may include largeleaf avens (*Geum macrophyllum*), slender cinquefoil (*Potentilla gracilis*), western polemonium (*Polemonium occidentale*), american bistort (*Polygonum bistortoides*), common camas (*Camassia quamash* ssp. Breviflora), and common horsetail (*Equisetum arvense*). Common grass species may include slender muhly (*Muhlenbergia filiformis*), tufted hairgrass (Deschampsia caespitosa), tall mannagrass (*Glyceria striata*). Bareground is low and litter cover is high. In aerated soils with cobbly or stony subsurface horizons, or slight raises in wetland areas, complexes of gray alder (*Alnus incana*) are commonly found. Willow species (Salix spp.) may also be found in aerated soils and along streambanks.

Historically, the ecological dynamics of the site would have been influenced largely by climate cycles affecting seasonal snowpack, runoff, droughts and flood. 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.

Much of this site is unsuitable to livestock use for much of the year due to saturated soils. However, grazing may be accessible especially during mid to late summer. When soils are moist they may be more prone to compaction. Vegetation may be susceptible to damage by tramping, especially during reproductive. Prolonged disturbance by grazing animals will favor an increase in forbs and an altered composition of graminoids, with facultative wetland species such as baltic rush (Juncus balticus), and grazing resistant species such as Nebraska sedge (*Carex nebrascensis*), often increasing relative to other sedges. With continued improperly managed grazing, non-native meadow grasses such as Kentucky bluegrass (*Poa pratensis*), common timothy (Phleum pretense), and meadow foxtail (*Alopecurus pratensis*) commonly increase. Prolonged improperly managed livestock grazing will increase bareground, erosion and pedestalling, and decrease litter cover.

Where sites are connected to stream networks, these impacts may lead to decreased streambank stability and eventually degradation of stream channels. Overtime, with increased depth and incision of channels, water tables may recede and floodplains may become disconnected from stream courses. If these effects are not mitigated, a decrease in water table depth will favor a shift toward communities without the potential to sustain obligate wetland sedges and are instead dominated facultative wetland grasses such as tufted hairgrass or Kentucky bluegrass. 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. Chanel 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 bottom lands. When implemented, these land uses often increase stream gradients, decrease sinuosity and increase channel depths, leading to disconnected floodplains overtime.

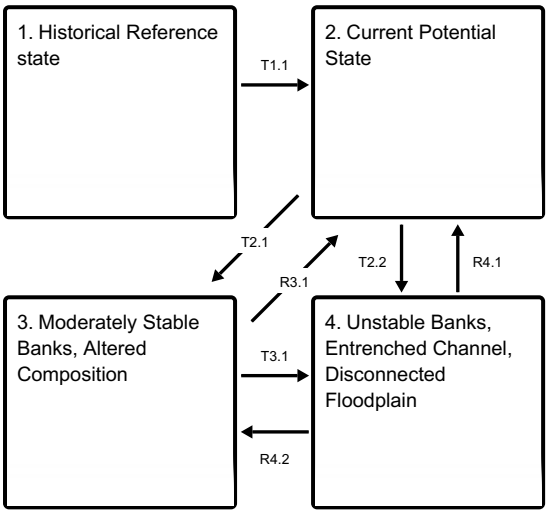
Emerging evidence suggests that montane meadows are experiencing conifer encroachment within the last century. Hypotheses for processes driving these vegetation changes range from climate cycles, alterations in fire regime and reductions in sheep grazing. While much of this site have soil moisture too high to accommodate

significant conifer encroachment, populations of conifers such as lodgepole pine (*Pinus contorta*) and Engelmann spruce (*Picea engelmannii*), species somewhat tolerant of saturated soils, may become established due to climate or altered disturbance regimes.

This site may be vulnerable to alterations in surface and ground water hydrology as a result of climate change. Snowpack is expected to decline across the mountains of Oregon with a warming climate (Mote et al. 2005) and shifts from snow to rain is expected to be most pronounced at middle elevations of the Cascade and Blue Mountains. Research suggests that expected shifts in precipitation timing and type will have far reaching effects on blue mountain riparian, wetland and ground-water-dependent ecosystems and that wet meadows may experience shifts in dominant vegetation as a result of altered water tables (Dwire et al 2018). The state and transition model below does not take into account the potential impacts of a changing climate and instead represents an approximation of ecological dynamics resulting from a simplified model of this meadow system. Further work is needed to better understand community response to climate shifts as well as the existence of alternative states and plant communities that may exist within these states.

State and transition model

Ecosystem states



T1.1 - Invasion of non-native meadow grasses

T2.1 - Sustained improperly managed grazing

T2.2 - Hydrologic alteration

R3.1 - Rehabilitation actions

T3.1 - Severe hydrologic alteration

R4.1 - Rehabilitation actions

R4.2 - Rehabilitation actions and significant passage of time

State 1
Historical Reference state

This represents the historical reference state in pristine conditions. Variability in depth to water table and seasonal fluctuations support native obligate 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

- gray alder (*Alnus incana*), shrub
- willow (*Salix*), shrub
- Cusick's sedge (*Carex cusickii*), grass
- Northwest Territory sedge (*Carex utriculata*), grass

- lakeshore sedge (*Carex lenticularis*), grass
- fewflower spikerush (*Eleocharis quinqueflora*), grass
- clustered field sedge (*Carex praegracilis*), grass
- tufted hairgrass (*Deschampsia cespitosa*), grass

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 pretense), 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. 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. This state is common due to widespread invasion of non-native meadow grasses in the Western US.

Dominant plant species

- sedge (*Carex*), grass
- tufted hairgrass (*Deschampsia cespitosa*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- timothy (*Phleum pratense*), grass
- meadow foxtail (*Alopecurus pratensis*), grass

State 3
Moderately Stable Banks, Altered Composition

Soil compaction, trampling and sustained overutilization has altered vegetated composition and increased bare ground. Relative to the current potential state, composition of wetland obligate sedges has been altered and may include a greater composition of grazing resistant Nebraska sedge or wetland facultative graminoids such as baltic rush. Non-native facultative wetland grasses such as Kentucky bluegrass, timothy and meadow foxtail are increasing. Soil erosion and vegetation pedestalling is often present. Banks are moderately stable and hydrology may be altered somewhat, with slightly lowered water tables. This state may also include scenarios where an entrenched, confined floodplain has developed following restoration of an incised reach (from state 4 via restoration pathway 4.2).

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- meadow foxtail (*Alopecurus pratensis*), grass
- timothy (*Phleum pratense*), grass
- tufted hairgrass (*Deschampsia cespitosa*), grass
- Nebraska sedge (*Carex nebrascensis*), grass
- arctic rush (*Juncus arcticus*), grass

State 4
Unstable Banks, Entrenched Channel, Disconnected Floodplain

Where this site is hydrologically dependent on a stream network, sustained disturbance may lead to unstable stream banks and entrenched channels. Primary floodplains will become disconnected from the channel and evolve into terraces with significantly lowered water tables. This will often lead to the replacement of obligate wetland sedges with facultative wetland grasses such as tufted hairgrass and Kentucky bluegrass. Plant communities within this state will vary and may depend on water table levels, past disturbance history, drought and current management.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- meadow foxtail (*Alopecurus pratensis*), grass
- timothy (*Phleum pratense*), grass
- tufted hairgrass (*Deschampsia cespitosa*), grass

Transition T1.1
State 1 to 2

Invasion of non-native meadow grasses into the site.

Transition T2.1
State 2 to 3

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

Transition T2.2
State 2 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support obligate 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 R3.1
State 3 to 2

Restoration of hydrologic and biotic process and function through rehabilitation of channel and vegetation structure may be possible but will require considerable inputs, time and cost. This may require the 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 among other intensive interventions. Restoration options will be highly site specific and may not be possible in many circumstances.

Transition T3.1
State 3 to 4

This transition may be the result of several disturbances that lower water tables beyond depths that support obligate 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 R4.1
State 4 to 2

Restoration of hydrologic and biotic process and function through rehabilitation of channel and vegetation structure may be possible but will require considerable inputs, time and cost. This may require the 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 among other intensive interventions. Restoration options will be highly site specific and may not be possible in many circumstances.

Restoration pathway R4.2
State 4 to 3

Given time, if channel disturbances are removed and natural channel evolution processes are allowed to take place, the stream will form an entrenched floodplain at a lower depth than the original. The original floodplain will remain a low terrace, perched above the newly forming floodplain and supporting a lowered water table and facultative wetland plant species. The resulting riparian area will be more confined and of significantly less extent than originally. The capacity of the basin to capture and regulate water will be reduced considerably.

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Contributors

Andrew Neary - Original concept 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	04/25/2024
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:**
