

Ecological site R048AY430UT Mountain Shallow Loam (Oak)

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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): 048A–Southern Rocky Mountains

MLRA 48A makes up about 45,920 square miles (119,000 square kilometers) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande Rift. It is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers such as the Colorado, Yampa, Arkansas, Rio Grande, North Platte and South Plate rivers are located here. This MLRA has numerous national forests, including the Medicine Bow National Forest in Wyoming; the Routt, Arapaho, Roosevelt, Pike, San Isabel, White River, Gunnison, Grand Mesa, Uncompahgre, Rio Grande, and San Juan National Forests in Colorado; the Carson National Forest and part of the Santa Fe National Forest in New Mexico. Rocky Mountain National Park also is in this MLRA.

MLRA 48A is the southern Rocky Mountains physiographic region. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Some high mesas and plateaus are included. It is characterized by mountain ranges that were uplifted during the Laramide Orogeny and then had periods of glaciation. The ranges include the Sangre de Cristo Mountains, the Laramie Mountains, and the Front Range in the east and the San Juan Mountains and the Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys having steep gradients. In some areas the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation typically ranges from 6,500 to 14,400 feet (1,980 to 4,390 meters) in this area. The part of this MLRA in central Colorado includes the highest point in the Rockies, Mount Elbert, which reaches an elevation of 14,433 feet (4,400 meters). More than 50 peaks in the part of the MLRA in Colorado are at an elevation of more than 14,000 feet (4,270 meters). Many small glacial lakes are in the high mountains.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. This large MLRA can be subdivided into at least 4 large general divisions. First is the Rockies on the east side of this area are called the "Front Range," which is a fault block that has been tilted up on edge and uplifted and is largely igneous and metamorphic geology. It was tilted up on the east edge, so there is a steep front on the east and the west side is more gently sloping and in the south east there are rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks. Second is the tertiary rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area (San Juan Mountains Area). The third division is Northwest part of the MLRA is dominantly sedimentary rock from the cretaceous/tertiary and Permian/Pennsylvanian periods. The fourth subset is the long and narrow Sangre de Cristos mountains uplifted in the Cenozoic are between the Rio Grande rift and the great plains. Many of the highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The average annual precipitation ranges predominantly from 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About half of the annual precipitation occurs as snow in winter; this proportion increases with elevation. In the mountains, deep snowpacks accumulate throughout the winter and

generally persist into spring or early summer, depending on elevation. Some permanent snowfields and small glaciers are on the highest mountain peaks. In the valleys at the lower elevations, snowfall is lighter and snowpacks can be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days and ranges from 45 to 230 days, decreasing in length with elevation. The climate of this area is strongly dependent upon elevation; precipitation is greater, and temperatures are cooler at the higher elevations. The plant communities vary with elevation, aspect and change in latitudes due to changing in precipitation kind and timing and temperature.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

Ecological site concept

The soils of this site formed mostly in alluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale. Surface soils are loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderate permeability. pH is slightly acid to neutral. Available water-holding capacity ranges from 2 to 3 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is frigid. Precipitation ranges from 16 to 22 inches annually.

Associated sites

R048AY436UT	Mountain Shallow Loam (Mountain Big Sagebrush) Often occur adjacent to each other.
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Similar sites

R048AY415UT	Mountain Loam (Oak) Similar plant communities but this site occurs on deeper soils.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Quercus gambelii</i>
Herbaceous	(1) <i>Elymus trachycaulus</i> (2) <i>Pseudoroegneria spicata</i>

Physiographic features

This site occurs at elevations between 6,000 and 9,000 feet. It is found on structural benches and mountain slopes with slopes ranging from 2 to15 percent. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Structural bench
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None

Elevation	6,000–9,000 ft
Slope	2–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is dry subhumid and semiarid. It is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 16 to 22 inches. July, August, and October are typically the wettest months with June being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are not reliable sources of moisture to support vegetative growth on this site. The soil moisture regime is mostly ustic and the soil temperature regime is frigid.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-100 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	16-22 in

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands.

Soil features

The soils of this site formed mostly in alluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale. Surface soils are loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderate permeability. pH is slightly acid to neutral. Available water-holding capacity ranges from 2 to 3 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is frigid. Precipitation ranges from 16-22 inches annually.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Residuum–sandstone and shale
Surface texture	(1) Loam
Family particle size	(1) Loamy (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	9–20 in
Soil depth	9–20 in
Surface fragment cover ≤3"	8–11%
Surface fragment cover >3"	0–3%
Available water capacity (Depth not specified)	2–3 in
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0 mmhos/cm

Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	16–21%
Subsurface fragment volume >3" (Depth not specified)	0–16%

Ecological dynamics

Reference State (State 1)

The reference state for the mountain loam (oak) site was determined by study of relic areas that have been protected from altered disturbance regimes and are considered to be representative of the historic climax plant community. Literature reviews, trends in plant community dynamics, and historical accounts are also considered.

State 1, the reference state, represents the historic plant communities of the mountain loam (oak) site and the naturally occurring dynamics associated with those communities. This state includes all known biotic communities that would exist under natural disturbance regimes and current climatic conditions. The dominant overstory species is Gambel oak (*Quercus gambelii*) with the understory dominated by the perennial bunchgrasses Slender wheatgrass (*Elymus trachycaulus*) and/or Bluebunch wheatgrass (*Elymus spicata*). The plant communities in state 1 are naturally resistant to disturbance and resilient following disturbance due to favorable amounts of precipitation and the ability of Gambel oak to resprout following disturbance. Wildfire is the predominant disturbance affecting ecological processes and is the primary factor driving plant community change in this state. The common fire return interval is 35-100 years and plant recovery following a wildfire is rapid, often with Gambel oak resprouting within the same growing season.

Community Phase 1.1 Gambel oak / Perennial Bunchgrasses

This plant community consists of mature Gambel oak trees that dominate the overstory and Slender wheatgrass and/or Bluebunch wheatgrass that dominate the understory. Mountain brome, Geyer sedge, as well as other cool season grasses may be present. Common shrubs and forbs are Mountain snowberry, Utah serviceberry, yarrow, and a suite of other species adapted to grow either in the interspaces or under the canopy of Gambel oak stands. Bare ground is not common and no non-native plants are present.

Community Pathway 1.1a Wildfire --This pathway often occurs late in the growing season when precipitation is low and fuel load is at its peak. Gambel oak is at peak underground carbohydrate storage around this time of year, which provides the energy needed for resprouting.

Community Pathway 1.1b No Fire --This pathway is a subsequent step in natural succession that occurs when fire free periods approach their upper limits and allow fire sensitive species to encroach into Gambel oak sites.

Community Phase 1.2 Post-fire Community / Resprouting Gambel oak Thicket

This plant community consists of young Gambel oak shoots that are beginning to reestablish following a wildfire. Burned trunks will usually be visible above the new growth. The Gambel oak suckers often form dense thickets of foliage up to several feet in height which effectively intercept sunlight and crowd out potential invaders. Given adequate recovery time of a few months to a year, the interspaces will exhibit native bunchgrasses and forbs, but few shrubs.

Community Pathway 1.2a Natural Succession—As the post-fire community ages, Gambel oak becomes less dominant near the soil surface, but maintains its dominance in the canopy. Perennial grasses become more robust and the plant community becomes more diverse with the establishment of shrubs and shade sensitive species.

Community Phase 1.3 Encroachment by Other Tree Species

This plant community is comparable in composition to community 1.1 with the addition of fire sensitive tree species such as Rocky mountain Douglas fir, Canyon maple, and/or white fir. The percent composition of these tree species is relatively low (3-5%).

Community Pathway 1.3a Wildfire-- This pathway often occurs late in the growing season when precipitation is low and fuel load is at its peak. Gambel oak also is at peak carbohydrate storage around this time of year, an adaptation which provides the energy needed to resprout and maintain its niche.

Transition 1-- Invasive Plants Transition from Reference State (State 1) to current Potential State (State 2)

This transition occurs when non-native or invasive species become established in the plant community. Common invasive species include Dalmatian toadflax, Annual forbs, Dandelion, Houndstongue, Rubber rabbitbrush, Broom snakeweed, and Cheatgrass. Intermediate wheatgrass, Smooth brome, and Kentucky bluegrass may also spread into the site. Events that may facilitate the establishment of non-native plants are wildfire, introduction of livestock, seeding, and recreation.

Current Potential State (State 2)

State 2 is very similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement.

Community Phase 2.1 Gambel oak / Slender wheatgrass

Phase 2.1 After a fire, Gambel oak sprouts vigorously and suppresses perennial grass and forb production. Non-native species are present, but not dominant.

Community Pathway 2.1a Wildfire -- This pathway often occurs late in the growing season when precipitation is low and fuel load is at its peak. Gambel oak is at peak underground carbohydrate storage around this time of year, which provides the energy needed for resprouting.

Community Pathway No Fire -- This pathway is a subsequent step in natural succession that occurs when fire free periods approach their upper limits and allow fire sensitive species to encroach into Gambel oak sites.

Community Pathway 2.1c Prescribed Fire and Re-seed – This pathway occurs when land owners and/or land managers are attempting to improve the vigor of the native plant community.

Community Pathway 2.1d Continuous Heavy Grazing – This pathway occurs when improper grazing continues for extended periods of time not allowing for native plants to recover, ultimately lowering the health and vigor of these plants to compete with available resources.

Community Phase 2.2 Resprouting Gambel oak thicket

Phase 2.2 Gambel oak stem density is less than phase 1.1, though oak production may be higher. Non-native species are present, but not dominant.

Community Pathway 2.2a Natural Succession on the site

Community Phase 2.3 Encroachment by other tree species

Phase 2.3 is characterized by encroachment of conifer species including Douglas fir, juniper and pinyon. Higher elevations of this ecological site are more susceptible to conifer encroachment. At lower elevations, this phase is characterized by decadent Gambel oak with patches of young sprouts. Gambel oak dies naturally around 80 years of age and promptly responds with vigorous young sprouts to replace the oak foliage. Native species are present, but not dominant

Community Pathway 2.3a Wildfire -- This pathway often occurs late in the growing season when precipitation is low and fuel load is at its peak. Gambel oak is at peak underground carbohydrate storage around this time of year, which provides the energy needed for resprouting.

Community Pathway 2.3b Brush Management (Fire) and re-seeding – Utilization of techniques such as prescribed fire and range seeding can reduce composition of invading conifers as well as temporarily reduce competition from oak to allow for the herbaceous component to become established.

Community Pathway 2.3c Continuous Heavy Grazing -- This pathway occurs when improper grazing continues for extended periods of time not allowing for native herbaceous plants and shrubs to recover, ultimately lowering the health and vigor of these plants to compete with available resources.

Community Phase 2.4 Seeded Gambel oak Woodland

Phase 2.4 is an aerial seeding following fire. Both native and non-native perennial grasses and forbs are included in most seed mixes. Under proper grazing, native grass and forb species can outcompete introduced species and dominate the understory within 5-10 years.

Community Pathway 2.4a Wildfire -- This pathway often occurs late in the growing season when precipitation is low and fuel load is at its peak. Gambel oak is at peak underground carbohydrate storage around this time of year, which provides the energy needed for resprouting.

Community Pathway 2.4b Natural Succession/prescribed grazing -- This pathway can occur through natural succession and prescribed grazing. Over time the oak will begin to be the dominant aspect on the site, and with proper grazing management the herbaceous understory and shrubs will maintain health and vigor on the site.

Community Pathway 2.4c Continuous Heavy Grazing -- This pathway occurs when improper grazing continues for extended periods of time not allowing for native herbaceous plants and shrubs to recover, ultimately lowering the health and vigor of these plants to compete with available resources.

Community Phase 2.5 Overgrazed Gambel oak

Phase 2.5 displays a reduction in the herbaceous understory and/or shrub component due to improper grazing/browsing from livestock and/or wildlife.

Community Pathway 2.5a No Fire -- lack of fire over time will allow other tree species to naturally encroach into the site.

Community Pathway 2.5b Brush Management (Mechanical) and re-seeding -- utilization of techniques such as mechanical brush management and range seeding can reduce composition of oak to allow for the herbaceous component to become established.

Community Pathway 2.5c Natural succession and prescribed grazing -- practicing prescribed grazing over time will allow the herbaceous and shrub components to become established on this site.

Transition 2 Noxious Weed Invasion / Repeated Wildfires

Transition from State 2 to State 3

Transition 3 Prescribed Grazing (Goats)

Transition from State 2 to State 4

State 3 Noxious Weed State

State 3 is characterized by a dominance of non-native noxious weeds. The threshold has been crossed into State 3 and the dynamics of this site will likely prohibit the return back into State 2 without an extraordinary amount of external inputs.

Community Phase 3.1 Broadleaf weed dominates interspaces

Native herbaceous and/or shrubs have largely been replaced by prolific noxious weeds establishment which generally flourish in sites where there is a short fire return interval. This process makes it incredibly hard for native herbaceous species to become reestablished on the site. Gambel oak is able to remain on this site by utilizing available resources due to its extensive root system and its sprouting abilities following wildfire.

Community Pathway 3.1a Wildfire -- The nature of this site with the abundance of noxious weeds/fine fuels shortens the fire return interval compared to the historic fire regime.

Community Phase 3.2 Weed co-dominant with resprouting Gambel oak

Following a wildfire, the herbaceous weed component and sprouting Gambel oak will dominate this site.

Community Pathway 3.2a Natural Succession -- Due to the nature of this site, there is often a frequent fire return interval which will return this site back to Community Phase 3.1.

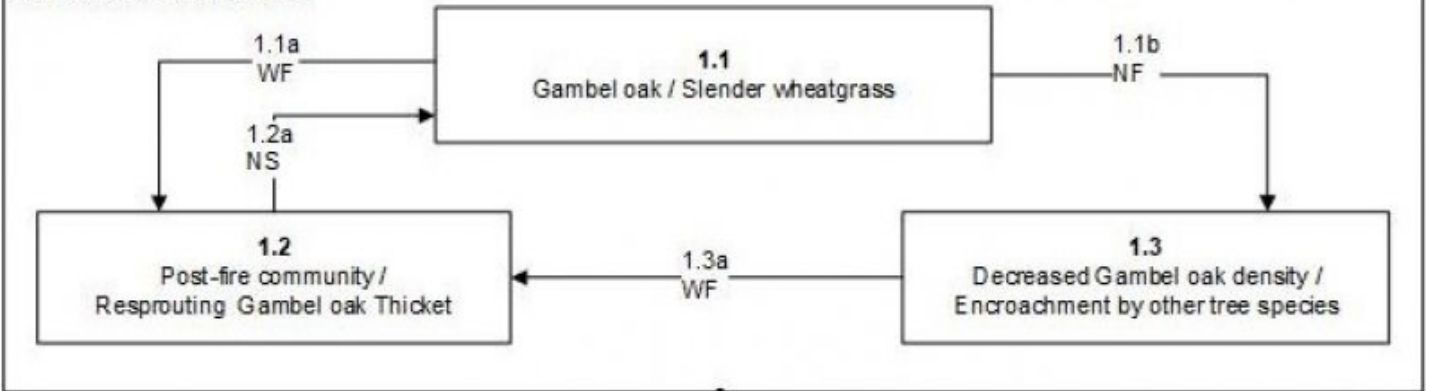
State 4: Herbaceous State:

Utilizing browsing animals such as goats, the threshold from State 2 is crossed in to this State. Browsing animals will shift the competitive advantage to the herbaceous component leaving the site devoid of Gambel oak and dominated by the herbaceous understory.

Community Phase 4.1 Devoid of Gambel oak

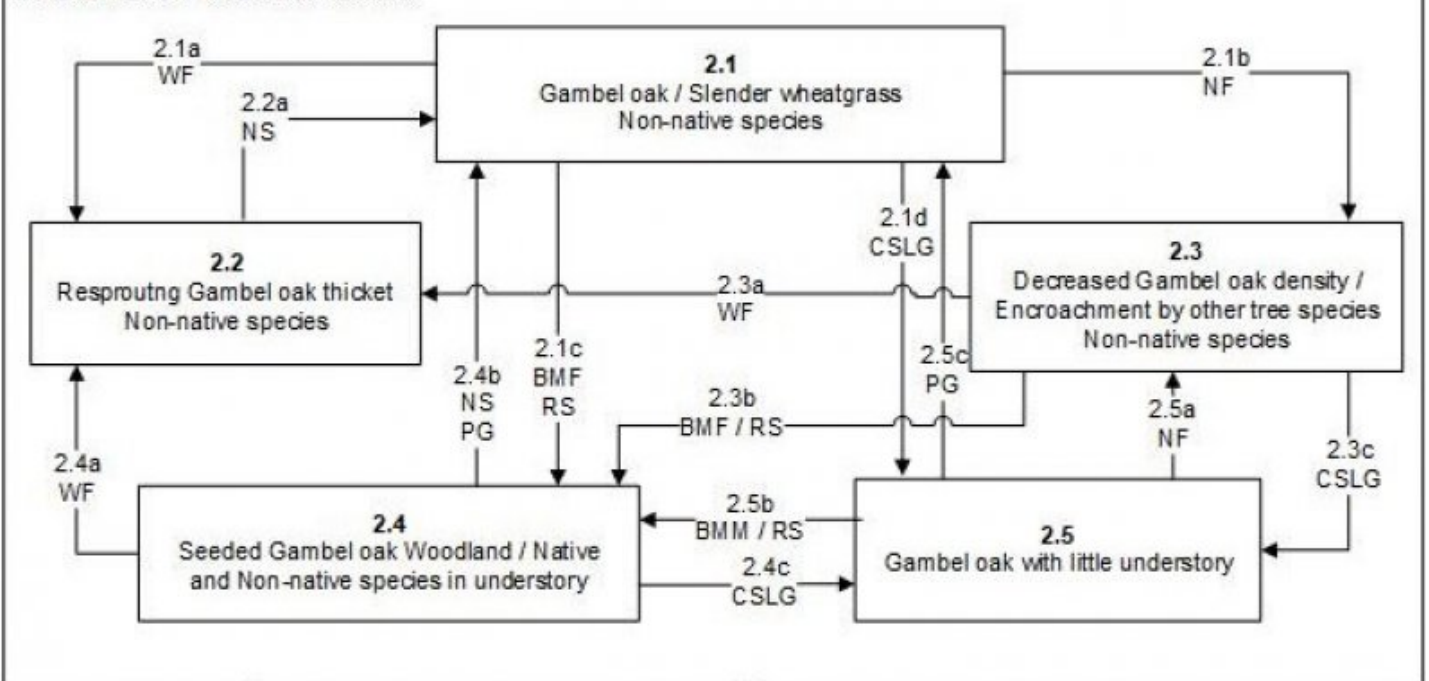
State and transition model

1. Reference State



T1
IP

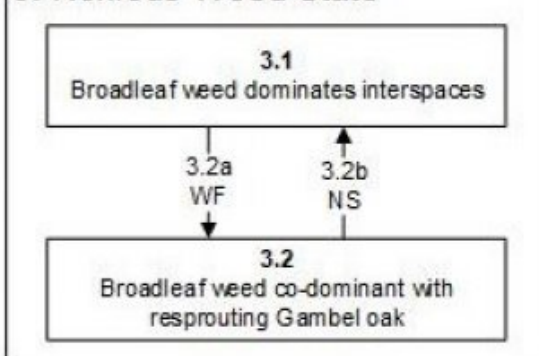
2. Current Potential State



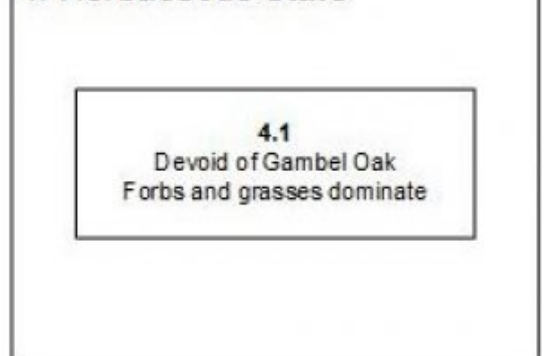
T2
NWI / RWF

T3
PG (Goats)

3. Noxious Weed State



4. Herbaceous State



Legend: WF = Wildfire NF = No Fire BMM = Brush Management (Mechanical)
 RS = Re-seeding NS = Natural Succession BMF = Brush Management (Fire)
 PG = Prescribed Grazing RWF = Recurring Wildfire CSLG = Continuous Season-long Grazing
 RPT = Replant Trees IP = Introduced Species NWI = Noxious Weed Invasion

Inventory data references

Data to support ecological site gathered from historic surveys by USDA range professionals.

Other references

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Contributors

M. Dean Stacy

Approval

Kirt Walstad, 3/05/2024

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	05/10/2025
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:**
