USDA Natural Resources Conservation Service

Ecological site R048AY515UT
High Mountain Loam (Thurber Fescue)

Last updated: 3/01/2024
Accessed: 05/10/2025

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.

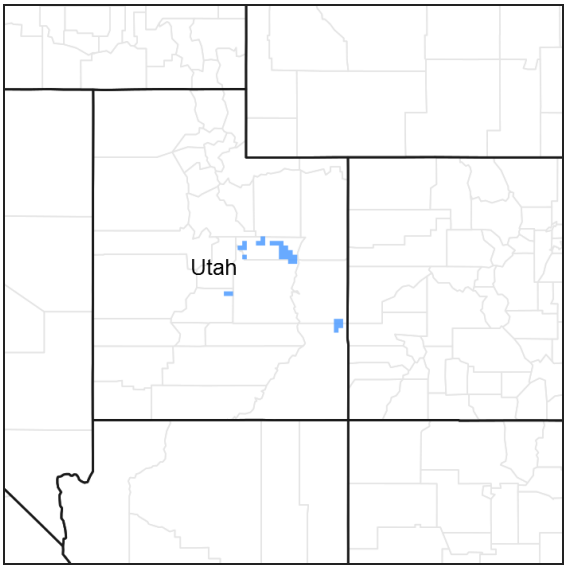


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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 colluvium and/or slope alluvium over residuum weathered from sandstone and shale. . Surface soils are very fine sandy loam, very stony loam to 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 moderately deep, well-drained, and have moderately slow to moderate permeability. pH is neutral and available water-holding capacity ranges from 2 to 7 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 20 to 30 inches annually.

Associated sites

F048AY506UT	**High Mountain Loam (Aspen)**

Similar sites

F048AY506UT	**High Mountain Loam (Aspen)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Festuca thurberi* (2) *Bromus marginatus*

Physiographic features

This ecological site typically is on mountain slopes, ridges, and plateaus. Sites are located between 8,000 to 11,500 feet in elevation. Slopes normally range from 3 to 70 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Plateau
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	8,000–11,500 ft
Slope	3–70%
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

Average annual precipitation is 22 to 35 inches. Approximately 55 percent occurs as rain from May through October. On the average, November through June are the driest months and July through October are the wettest months. Cool temperatures and length of growing season are important environmental factors in this site. In average years, plants begin growth around April 20 and end growth around September 30.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	40-60 days
Precipitation total (characteristic range)	20-30 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 colluvium and/or slope alluvium over residuum weathered from sandstone and shale. . Surface soils are very fine sandy loam, very stony loam to 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 moderately deep, well-drained, and have moderately slow to moderate permeability. pH is neutral and available water-holding capacity ranges from 2 to 7 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 20-30 inches annually.

Modal Soil: Senchert Family L – fine-loamy, mixed, argic Pachic Cryoborolls

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Slope alluvium–sandstone and shale (3) Residuum–sandstone and shale
Surface texture	(1) Very fine sandy loam (2) Very stony loam (3) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	0–18%
Surface fragment cover >3"	0–36%
Available water capacity (Depth not specified)	2–7 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)	6.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–11%
Subsurface fragment volume >3" (Depth not specified)	0–46%

Ecological dynamics

It is impossible to determine in any quantitative detail the historic climax plant community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area. However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs. In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long. Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

When available, monitoring data (of various types) were employed to validate more subjective inferences made in

this diagram. See the complete files in the office of the State Range Conservationist for more details.

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range & Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State 1 Reference State
The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The least modified plant community would have been co-dominated by a mixture of grass and forb species (1.1). A more complete list of species by lifeform for the Reference State is available in accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this ESD document.

Community Phase 1.1: co-dominant grass-forb mixture/ scattered snowberry & other low shrubs
This plant community would have been characterized by a co-dominance of grass and forb species. Grasses would have included Thurbers fescue (Festuca therberi), mountain brome (*Bromus marginatus*), Muttongrass (*Poa fendleriana*), Columbia needlegrass (*Achnatherum nelsonii*), and Letterman's needlegrass (*Achnatherum lettermanii*). Forb species would have included Nevada pea (*Lathyrus lanszwertii*) tailcup lupine(*Lupinus caudatus* ssp. caudatus), and yarrow (*Achillea millefolium*) among others. Mountain snowberry (*Symphoricarpos oreophilus*) and mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) would also have been scattered throughout the site.

Transition T1a: (State 1 to State 2)
The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, climate change, the advent of heavy continuous season long livestock grazing, and fire prevention has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

State 2 Shrub Steppe State
State 2 is a description of the ecological site shortly following Euro-American settlement, which has been influenced by the introduction of several non-native plants and animals, possible extinctions of native species, and a different climate. Historic heavy continuous season long grazing by livestock and the prevention of wildfire also had a major impact on these sites creating a shrub steppe which should now be considered the present potential. Unpalatable species such as shaggy fleabane and native woody species such as mountain snowberry, silver sagebrush (*Artemisia cana*), and mountain big sagebrush increased while the palatable herbaceous species diminished.

Community Phase 2.1: snowberry & sagebrush increased/ palatable grasses & forbs depleted
This plant community is characterized by a relative increase in native woody species such as snowberry, mountain big sagebrush, and silver sagebrush and unpalatable forbs.

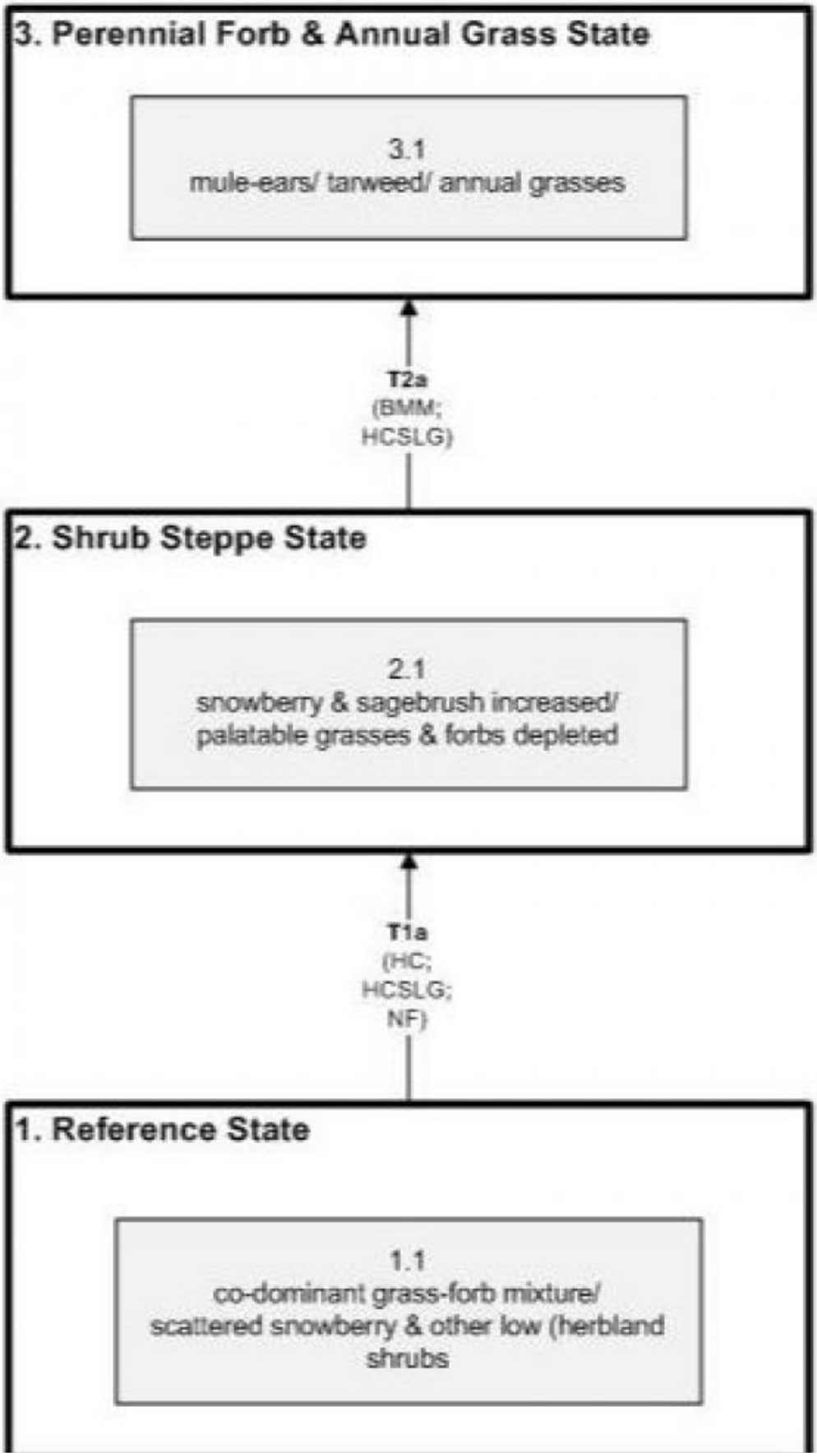
Transition T2a: (State 2 to State 3)
Mechanical disturbance of woody species and continued heavy livestock grazing during the growing season of grasses will cause a transition from State 2 to a perennial forb and annual grass-dominated state (State 3). The churning clay soils naturally favor herbs over woody species, thus shrubs are a temporary occupier of such sites. However both the mechanical and herbivory of interzonal grazing can trigger the shrubs which are moderately palatable, especially to sheep. Reducing livestock grazing has little effect on reducing its competitive hold. The only potential restoration pathway requires massive tillage with subsequent herbicide and reseeding efforts to convert these sites to perennial grasslands.

State 3 Perennial Forb & Annual Grass State
With continued impacts from heavy livestock grazing and mechanical, herbicidal, or fire removal of native shrubs, the native grass component will markedly decrease or be absent, shrubs will also be reduced to absence, but perennial forbs and annual grasses such as tarweed , (*Madia glomerata*) and cheatgrass (*Bromus tectorum*) will

increase.

Community Phase 3.1: mule-ears/ tarweed/ annual grasses
This plant community is characterized by a suite of very grazing-tolerant herbaceous species.

State and transition model



BMM	Brush Management Mechanical
HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire

State 1
Reference State

Community 1.1
Reference Plant Community

The general view of this site is grassland. The composition by air-dry weight is approximately 60 percent perennial grasses, 25 percent forbs, and 15 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1170	1470	1770
Forb	487	612	737
Shrub/Vine	293	368	443
Total	**1950**	**2450**	**2950**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	9-11%
Grass/grasslike foliar cover	39-41%
Forb foliar cover	14-16%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	14-16%
>1 <= 2	–	–	39-41%	–
>2 <= 4.5	–	9-11%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			150–250	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	75–125	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	75–125	–
3	**Sub-Dominant Shrubs**			200–350	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	75–125	–
	silver sagebrush	ARCA13	*Artemisia cana*	25–75	–
	yellow rabbitbrush	CHVIV4	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus*	25–75	–
	creeping barberry	MARE11	*Mahonia repens*	25–75	–
Grass/Grasslike					
0	**Dominant Grasses**			825–1325	
	Thurber's fescue	FETH	*Festuca thurberi*	500–625	–
	mountain brome	BRMA4	*Bromus marginatus*	125–250	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	125–250	–
	muttongrass	POFE	*Poa fendleriana*	25–75	–
1	**Sub-Dominant Grasses**			425–1025	
	Grass, annual	2GA	*Grass, annual*	125–250	–
	Grass, perennial	2GP	*Grass, perennial*	125–250	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	25–75	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	25–75	–
	Douglas' sedge	CADO2	*Carex douglasii*	25–75	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–75	–
	western wheatgrass	PASM	*Pascopyrum smithii*	25–75	–
	Sandberg bluegrass	POSE	*Poa secunda*	25–75	–
Forb					
0	**Dominant Forbs**			150–250	

0	**Dominant Forbs**			150–250	
	Nevada pea	LALA3	*Lathyrus lanszwertii*	75–125	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	75–125	–
2	**Sub-Dominant Forbs**			400–800	
	Forb, annual	2FA	*Forb, annual*	250–375	–
	Forb, perennial	2FP	*Forb, perennial*	250–375	–
	common yarrow	ACMI2	*Achillea millefolium*	25–75	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	25–75	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	25–75	–
	western sweetroot	OSOC	*Osmorhiza occidentalis*	25–75	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	25–75	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	25–75	–
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	25–75	–
	tobacco root	VAED	*Valeriana edulis*	25–75	–

Animal community

This site provides proper grazing for cattle and sheep during summer and fall.

This site provides food and cover for wildlife. Wildlife using this site include mule deer, elk, rabbit, coyote, squirrel, hawk, owl, and sparrow.

Hydrological functions

This soil series is in hydrologic group C. The hydrologic curve number is 74 when the vegetation is in good condition.

Recreational uses

Hiking and hunting

Wood products

None

Inventory data references

Type Location: Consult the soil survey report

Contributors

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Approval

Kirt Walstad, 3/01/2024

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.

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Date	12/12/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No rills present. Very minor rill development may occur in sparsely vegetated areas. If rills are present, they should be widely spaced and not connected. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run inflow enters site from adjacent sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop). Site is essentially level and rills do not form.

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2. **Presence of water flow patterns:** Water flow patterns will be very short (1-3'), narrow (<1'), and meandering; interrupted by plants and exposed rocks. Slight to no evidence of erosion or deposition associated with flow patterns. Where slopes exceed 5%, water flow patterns may be of medium length (5 –10 feet).

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3. **Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (1-3") where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (1-3") and show little sign of active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, they are the result of litter and soil accumulating at plant bases, forming the appearance of a pedestal.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10-20% bare ground (soil with no protection from raindrop impact). Very few if any bare spaces of greater than 1 square foot. In general, bare ground increases as production decreases. As species composition of shrubs relative to grasses increases, bare ground is likely to increase. Poorly developed biological soil crust that is susceptible to erosion from raindrop impact should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** No gullies present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water and wind movement. Very minor litter removal may occur in water flow paths with deposition occurring at points of obstruction. Where litter movement does occur, litter accumulates at plant bases. Some

leaves, stems, and small twigs may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have an average erosion rating of 6 using the soil stability kit test.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A--3 to 7 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; soft, very friable; few fine and very fine roots; neutral (pH 7.2); abrupt smooth boundary. (2 to 12 inches thick)

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Bunchgrasses and shrubs are equally important for increasing infiltration and reducing runoff. Plant litter and canopy cover from all functional groups intercept rainfall and prevent splash erosion. Bunchgrasses contribute organic matter directly to soil through root decay, and organic matter helps stabilize soil aggregates and maintain soil porosity. Shrubs hold snow and slow wind evaporation. Bunchgrass bases intercept litter and soil in water flow paths, reducing runoff. Biological soil crusts (where present) are resistant to raindrop impact and splash erosion. Spatial distribution of vascular plants and well-developed biological soil crusts (where present) provides detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and any well-developed biological soil crusts (where present) may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms.

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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):** A compaction layer is not expected.

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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: Dominant: Perennial cool-season bunchgrass (Thurber’s fescue, California brome, slender wheatgrass)

    Sub-dominant: Sub-dominant: Non-sprouting shrubs (mountain big sagebrush) = sprouting shrubs (mountain snowberry) = perennial forbs (Nevada pea, tailcup lupine)

    Other: Other: Other perennial forbs > other perennial grasses > other shrubs

    Additional: Natural disturbance regimes include fire, drought, and insects. Assumed fire cycle of 30 to 40+ years. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference. Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect different functional community phases within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. Some mortality of bunchgrass and other shrubs may occur during very severe (long-term) droughts. There may be partial mortality of individual bunchgrasses and shrubs during less

severe drought and toward the end of the fire cycle. Long-lived species dominate the site. Open spaces from disturbance are quickly filled by new plants through seedlings and asexual reproduction (tillering).

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14. **Average percent litter cover (%) and depth (in):** Litter cover includes litter under plants. Most litter will be fine (herbaceous) litter. Litter will be concentrated under plant canopies and sparser between plant canopies, with an average cover of 20-40% and an average depth of 0.75-1.5 inches. Litter cover may increase following years with favorable growing conditions. Excess litter may accumulate in absence of disturbance. Vegetative production may be reduced if litter cover exceeds 40%.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2400-2500 lbs/acre.
    Even the most stable communities exhibit a range of production values. Production will vary between communities and across the MRLA. Refer to the community descriptions in the ESD. Production will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context.

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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:** Invasive species unlikely because of high elevation

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually, except in drought years. Density of plants indicates that plants reproduce at level sufficient to fill available resource. Within capability of site there are no restrictions on seed or vegetative reproductive capacity.
