USDA Natural Resources Conservation Service

Ecological site R048AY610UT
Alpine Slope

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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 colluvium derived from diorite. Surface soils are fine stony loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and generally make up more than 35 percent of the soil volume. These soils are moderately deep, well-drained, and have moderately rapid permeability. pH is moderately acidic. Available water-holding capacity ranges from 2 to 3 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 30 to 40 inches annually.

Associated sites

F048AY532UT	**High Mountain Very Steep Stony Loam (Engelmann Spruce)** Often occur adjacent to each other.

Similar sites

R048AY515UT	**High Mountain Loam (Thurber Fescue)** Similar in that it is a high elevation site that has a reference state that is dominated by grasses and forbs.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Salix*
Herbaceous	(1) *Kobresia myosuroides*

Physiographic features

This site occurs at elevations between 10,500 and 12,700 feet. It is found on cirques and peaks with slopes ranging from 20 to 70 percent. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Cirque (2) Peak
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None

Elevation	3,200–3,871 m
Slope	20–70%
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 30 to 40 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 udic and the soil temperature regime is cryic.

Table 3. Representative climatic features

Frost-free period (characteristic range)	5-20 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	762-1,016 mm

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 derived from diorite. Surface soils are fine stony loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and generally make up more than 35 percent of the soil volume. These soils are moderately deep, well-drained, and have moderately rapid permeability. pH is moderately acidic. Available water-holding capacity ranges from 2 to 3 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 30-40 inches annually.

Table 4. Representative soil features

Parent material	(1) Colluvium–diorite
Surface texture	(1) Stony loam
Family particle size	(1) Loamy-skeletal over fragmental
Drainage class	Well drained
Permeability class	Moderately rapid
Depth to restrictive layer	51–102 cm
Soil depth	51–102 cm
Surface fragment cover <=3"	10–14%
Surface fragment cover >3"	10–14%
Available water capacity (Depth not specified)	5.08–7.62 cm
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)	5.6–6
Subsurface fragment volume <=3" (Depth not specified)	8–12%
Subsurface fragment volume >3" (Depth not specified)	78–82%

Ecological dynamics

Kobresia, along with other sedge species and tufted hairgrass, arctic bluegrass, letterman bluegrass, and alpine bluegrass produce most of the vegetation on this site. A variety of forbs such as whiproot clover, cinquefoil, willowweed, and bistort are present. Also a variety of willows provide excellent forage and cover for wildlife species.

The state and transition model was added to fill the provisional ecological site instruction. It is a very general model. More field work and research is needed to make this model specific

State 1
Reference State
In sheltered cirques (rincons) and at lower elevations, this site merges into the subalpine transition and loses its alpine aspect. In this zone, tufted hairgrass predominates with sheep fescue and Thurber fescue from the subalpine zone to become part of the vegetation in these areas.

If retrogression is caused by sheep, the desirable grasses, forbs, and shrubs will be reduced. Deterioration of the site will be evident as dead branches on willow clumps, extensive trailing into the patches, completely dead standing willows, or merely a few dead stems lying on the site of former willow fields. Most frequently hummock areas indicate the former presence of willows. With the disappearance of the shrubs, the site dries out and compaction is hastened by the entrance of grazing animals. Thus the former ground level persists only around the old willow stumps. The light succulent forbs disappear and tufted hairgrass, sedges, or alpine bluegrass occupy the site. Gullies, following overgrazing, will hasten the drying out process.

The earliest evidence of willow damage is excessive browsing. Later the edges of clumps are killed, giving them a raw appearance. Healing is usually evidenced by new willow sprouts and new plants not currently grazed. New growth takes place along the raw edges where the patches have been killed back, thus gradually returning them to the rounded windbreak forms which keep the force of alpine winds and driven snow out of the patches. Elk and deer, as well as sheep and cattle, cause willow damage; and the cause must be properly assigned in order to correct excessive use.

Sedges, bluegrasses, western yarrow, sibbaldia (false strawberry), and cushion plants are co-dominant on this site when it is in a deteriorated condition.

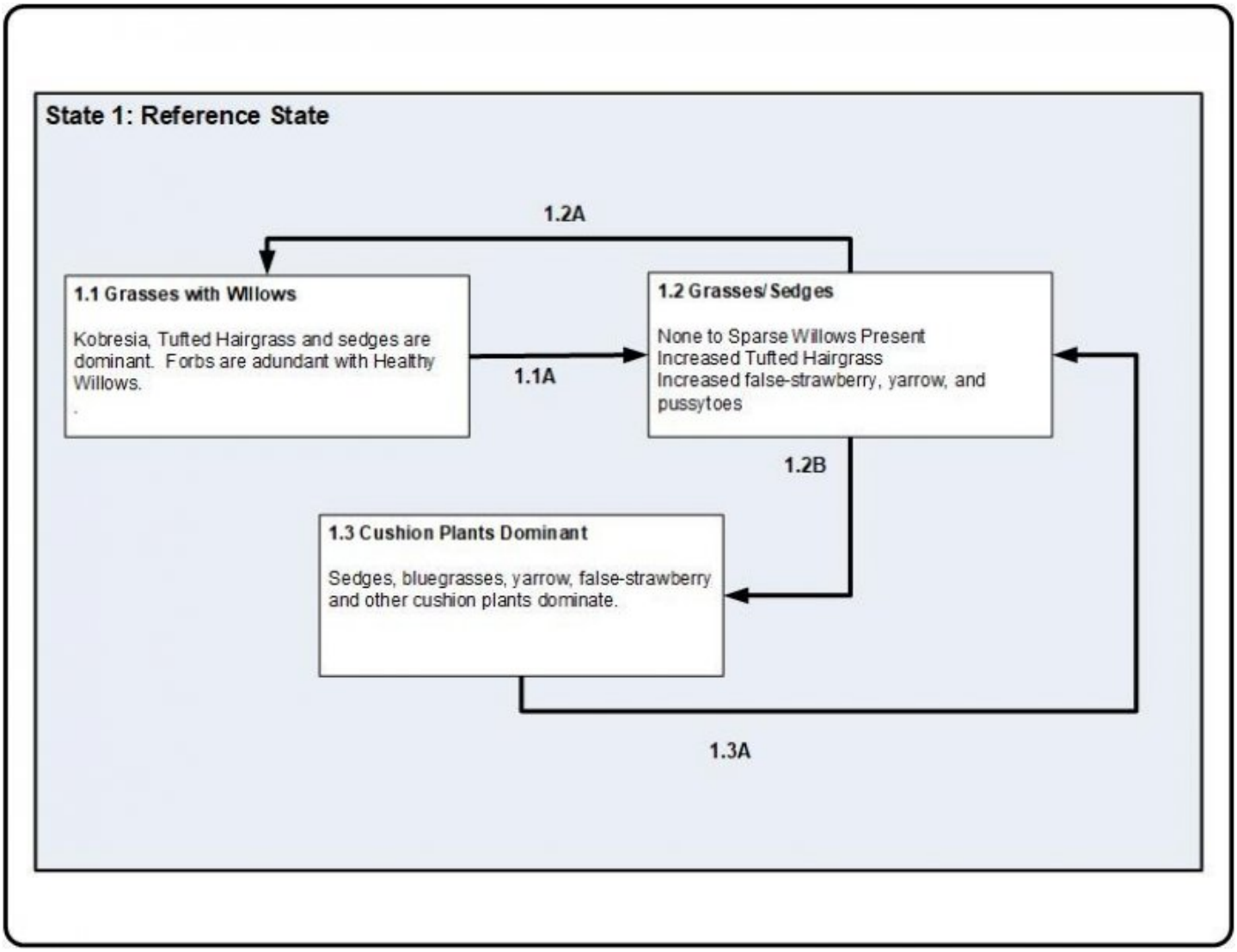
Community 1.1 Reference Plant Community
The plant community is about 15 to 25 percent sedges, 30 to 55 percent grasses, 15 to 30 percent forbs, and 15 to 30 percent shrubs, air-dry weight.

Basal area (the area of ground surface covered by the perennial vegetation measured one inch above the soil) is approximately 65-75 percent.

Annual production
If the range is in excellent condition, the approximate total annual production (air-dry) ranges are:
Favorable years 3000 pounds/Ac
Normal years 2800 pounds/Ac
Unfavorable years 2400 pounds/Ac

Of this production, 10-15 percent will likely be unpalatable or out of reach of grazing animals.

State and transition model



Legend

1.1A, 1.2B – improper grazing, prolonged drought, time without disturbance

1.2A, 1.3A – disturbance, insect herbivory of shrubs, proper grazing, wetter climate cycles

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	05/17/2024
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:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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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):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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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):**

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:**