USDA Natural Resources
Conservation Service

Ecological site R048AA241CO
Mountain Meadow Gunnison Basin LRU

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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). It is in the Southern Rocky Mountains province, which is east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande rift. MLRA 48A is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers, including the Colorado, Yampa, Arkansas, Rio Grande, North Platte, and South Platte Rivers are in this MLRA. It 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; and 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 in 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. The mountains were uplifted during the Laramide orogeny and then were subject to periods of glaciation. The ranges include the Sangre de Cristo Mountains, Laramie Mountains, and Front Range in the east and the San Juan Mountains and Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys that have steep gradients. In some areas, the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation of the MLRA typically is 6,500 to 14,400 feet (1980 to 4390 meters). The part of the MLRA in central Colorado includes the highest point in the Rocky Mountains, Mount Elbert, which reaches an elevation of 14,433 feet (4400 meters). More than 50 peaks in this part of the MLRA are at

an elevation of more than 14,000 feet (4270 meters). Many small glacial lakes are in the high mountains.

The mountains in this MLRA were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. This large MLRA can be subdivided into at least four general divisions. The first division includes the Rocky Mountains in the eastern part of this area, called the Front Range. This range is a fault block that has been tilted on edge and uplifted and is dominantly igneous and metamorphic rock. It was tilted on the east edge, so a steep front is on the east side and more gentle slopes are on the west side. In the southeast part, the exposed rock is mostly Precambrian igneous and metamorphic. The second division is the tertiary rock, primarily basalt and andesitic lava flows, tuff, breccia, and conglomerate, throughout the San Juan Mountains area. The third division is the northwest part of the MLRA, which is dominantly sedimentary rock from the Cretaceous and Tertiary periods and the Permian and Pennsylvanian periods. The fourth division is the long, narrow Sangre de Cristo Mountains uplifted during the Cenozoic era 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 and are an important source of sand and gravel.

The average annual precipitation is dominantly 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About one-half of the annual precipitation is received as snow in winter; the proportion increases as elevation increases. In the mountains, deep snowpack accumulates in winter and generally persists until spring or early in 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 snowpack may be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days, but it ranges from 45 to 230 days, decreasing in length as elevation increases. The climate of this MLRA varies according to the elevation. Precipitation is higher and temperatures are cooler at the higher elevations. The plant communities vary according to elevation, aspect, and latitude due to variations in the kind and timing of the precipitation and the 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 typically is mixed, smectitic, or paramicaceous. In areas of granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on the mountain slopes and 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 the mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on the mountain slopes at low elevations that receive a low amount of precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in

colluvium on the mountain slopes at high elevations.

LRU notes

This site occurs only in the Gunnison Basin Land Resource Unit. The Gunnison Basin is a valley with hills that occurs along the frigid/cryic temperature break and the aridic bordering on ustic/typic ustic climate break. Gunnison Basin has 5 dominant ecological sites.
The lower elevations are in the dry mountain ecological site climate zone and the upper elevations are in the mountain ecological site climate zone. Aspect and wind directions further complicates where plant communities occur in the basin. Southern aspects tend to be dry and warmer and Dry Mountain Loam (R048AA231CO) usually can be found on these aspects at middle elevations in the basin. Mountain Loam (R048AA228CO) occurs on the Northern and eastern aspects and depression areas were the wind blows the snow too. Thus, creating a higher effective precipitation at lower and middle elevations in the Basin. Dry exposure (R048AA235CO) is found on the southern most aspects and landscape positions where it is windswept from moisture that is received. Mountain Swale and Mountain Meadows occur in the draws where the snow is deposited during the winter. Mountain Swale (R048AY245CO) received extra water only during snow melt and large precipitation events. Mountain Meadows (R048AA241CO) has a water table year-round.

Classification relationships

Natural Resources Conservation Service (NRCS):
Major Land Resource Area 48A, Southern Rocky Mountains (USDA-NRCS, 2006).

U.S. Forest Service (USFS):
M331G – South-Central Highlands Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331H – North-Central Highlands and Rocky Mountain Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331I – Northern Parks and Ranges Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

Environmental Protection Agency (EPA):
21b–Crystalline Subalpine Forests, 21c–Crystalline Mid-Elevations Forests, 21d–Foothill Shrublands, 21f–Sedimentary Mid-Elevation Forests, and 21h–Volcanic Mid-Elevation Forests < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006).

U.S. Geological Survey (USGS):
Southern Rocky Mountain Province

Ecological site concept

This site is in flood plains on drainageways, floodplains, depressions, stream terraces, and the bottom of narrow, winding valleys along intermittent streams. Site has a water table year round. Soils are deep to very deep, very dark colored, highly organic, poorly to very poorly drained, and typically acid in reaction.

Associated sites

R048AA231CO	**Dry Mountain Loam Gunnison Basin LRU** Dry Mountain Loam occurs mainly hillsides. Slopes average between 5 and 25% but can range up to 45% in some areas. Soils are moderately deep (20-40 inches); fine-loamy soils derived from slope alluvium derived from rhyolite and/or sedimentary rock or residuum from granite and rhyolite. Surface textures are fine sandy loam or gravelly sandy loam with loamy subsurface with an average of 20-30% clay. It is a Wyoming Big Sagebrush - Indian Ricegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.
R048AA245CO	**Mountain Swale Gunnison Basin LRU** Mountain Swale occurs mainly swales, flood plains or drainageways. Slopes average between 1 and 15%. This is a run-in site which after large precipitation events or during spring snowmelt, water may flow in channels for short periods. Normally, water spreads out across the site rather than flowing in channels. If a water table is present is it greater than 60 inches during the growing season. Soils are deep to very deep (40-60+ inches); fine-loamy soils derived from alluvium derived from igneous, metamorphic, and sedimentary rock. Surface textures are loam, sandy loam, or silt loam with a loamy subsurface. It is a basin wildrye-slender wheatgrass-Wood’s Rose community. It has an aridic ustic or typic ustic moisture regime. The effective precipitation ranges from 12 to 20 inches.
R048AA228CO	**Mountain Loam Gunnison Basin LRU** Mountain Loam occurs mainly hills, hillsides, mountainside, or mountain slopes. Slopes average between 3 and 25% but can range up to 45% in some areas. Soils are moderately deep to deep (20-60+ inches); fine-loamy soils derived from colluvium derived from rhyolite; slopes alluvium derived from rhyolite; colluvium derived from volcanic and sedimentary rock or igneous and metamorphic rock; residuum weathered from schist; or old alluvium derived from basalt and/or glacial till from basalt. Surface textures are loam, sandy loam, gravelly sandy loam, or sandy clay loam with subsurface clay content ranging from 25 to 45% clay. It is a Mountain Big Sagebrush - Arizona Fescue-needlegrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

R048AA235CO	**Dry Exposure Gunnison Basin LRU** Dry Exposure Loam occurs mainly ridgetops, hills, and hillsides. Slopes average between 5 and 45%. Soils are shallow (10-20 inches); loamy soils derived from slope alluvium derived from rhyolite and/or or residuum from granite, gneiss, or rhyolite. Surface textures are gravelly loam with loamy subsurface with an average of 20-30% clay. It is a Black Sagebrush – Muttongrass - Squirreltail community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.

Similar sites

R048AY241CO	**Mountain Meadow** Mountain Meadow occurs on floodplains, flood-plain steps, valley floors, drainageways and low terraces. This site has natural sub-irrigation. Slopes is between 0 to 15%. Soils are moderately deep to very deep (20 to 60+ inches). Soils are derived from alluvium from sandstone and shale, sedimentary rock, igneous, metamorphic and sedimentary rock, or shale. Soil surface texture is loam, sandy loam, sandy clay loam or clay loam with fine-loamy textured subsurface. It has a typic aquic or oxyaquic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches. This site is the generic site written before Land Resource Unit (LRU) level ecological sites.
R048AA245CO	**Mountain Swale Gunnison Basin LRU** Mountain Swale occurs mainly swales, flood plains or drainageways. Slopes average between 1 and 15%. This is a run-in site which after large precipitation events or during spring snowmelt, water may flow in channels for short periods. Normally, water spreads out across the site rather than flowing in channels. If a water table is present is it greater than 60 inches during the growing season. Soils are deep to very deep (40-60+ inches); fine-loamy soils derived from alluvium derived from igneous, metamorphic, and sedimentary rock. Surface textures are loam, sandy loam, or silt loam with a loamy subsurface. It is a basin wildrye-slender wheatgrass-Wood's Rose community. It has an aridic ustic or typic ustic moisture regime. The effective precipitation ranges from 12 to 20 inches.
R048AY245CO	**Mountain Swale** Mountain Swale occurs flood plains, alluvial fans, swales, stream terraces, and valley floors. Slopes is between 0 to 12%. Soils are deep (60+ inches) in depth. Soils are derived from alluvium. Soil surface texture is loam, with a fine-loamy subsurface. It is a basin wildrye-western wheatgrass community. It has a typic ustic moisture. The effective precipitation ranges from 16 to 20 inches. It receives extra moisture from surrounding uplands that drain into the area. These areas are sloped themselves and drain into perennially wet areas. They have well drained soils and ephemeral streams. This site is the generic site written before Land Resource Unit (LRU) level ecological sites.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Salix*
Herbaceous	(1) *Deschampsia cespitosa* (2) *Carex nebrascensis*

Physiographic features

This site is in flood plains on drainageways, floodplains, depressions, stream terraces, and the bottom of narrow, winding valleys along intermittent streams, Elevation is about 7,500 to 9,000 feet. Generally, the slopes are 0 to 5 percent. Slopes may be steeper in some areas, which will impact water movement and plant growth. Landscape position is an important factor for this site.

Due to differences in the depth to bedrock and water table, width of the valley, and slope, this site commonly has small inclusions of the Mountain Swale ecological site (R048AA245CO). The Mountain Meadow site has a high-water table year round, and the Mountain Swale site receives intermittent run-in from adjacent sites. The surrounding uplands commonly support the Mountain Loam (R048AA228CO) and Dry Mountain Loam (R048AA231CO) sites.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Depression (3) Stream terrace (4) Drainageway
Runoff class	Low to high
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	2,286–2,743 m
Slope	0–5%
Water table depth	0–102 cm

Climatic features

The annual precipitation ranges from 16 to 20 inches. The average annual precipitation is 17 inches, of which about 60 percent falls as snow. The average annual total snowfall is 83.5 inches at Lake City. The highest annual snowfall on record was 141.5 inches, which occurred in 1957 at Lake City. This site normally has a deep cover of snow in winter, some of which is windblown. The site is in a transition zone between winter dominant and summer monsoonal dominant.

The optimum growing season for native plants is late in spring through summer. The frost-free period is 50 to 70 days. The last frost in spring occurs sometime in the middle of June to the first week in July, and the first frost in fall occurs sometime in the middle of August to the first week in September. The annual air temperature ranges from 77 to -1 degree F. The lowest recorded temperature in winter was -38 degrees F on January 4, 1974, and the lowest recorded temperature in summer was 16 degrees F on June 15, 1976. The highest temperature on record was 98 degrees F on July 11, 1979.

Better climate data is needed for this ecological site. The Lake City climate station is the closest, but it is in an area at the low end of the precipitation range (16 inches). The data do not represent the average conditions for this site. Although the Ridgeway climate station is just outside the land resource unit, data from this station better represent the site. The site is dominantly on north- and east-facing slopes at the lower elevations, which impacts the effective precipitation. This site has a cryic temperature regime. Climate data are from the Western Regional Climate Center, Lake City climate station (2012).

Table 3. Representative climatic features

Frost-free period (characteristic range)	42-66 days
Freeze-free period (characteristic range)	81-89 days
Precipitation total (characteristic range)	406-508 mm
Frost-free period (actual range)	36-72 days
Freeze-free period (actual range)	79-91 days
Precipitation total (actual range)	406-508 mm
Frost-free period (average)	54 days
Freeze-free period (average)	85 days
Precipitation total (average)	457 mm

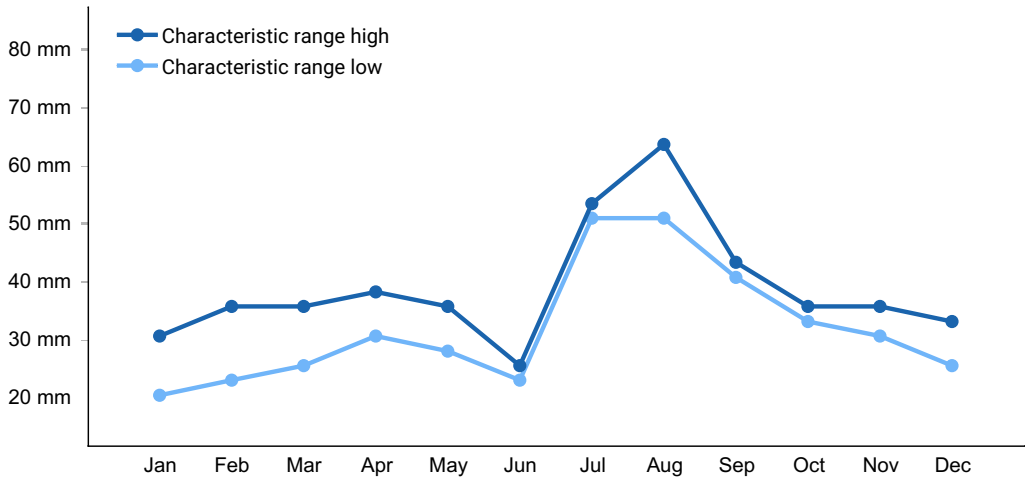


Figure 1. Monthly precipitation range

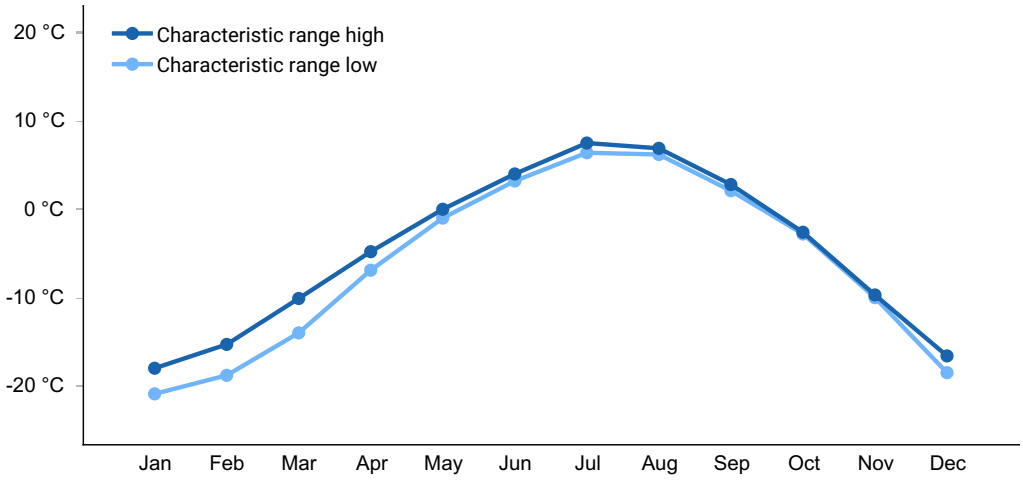


Figure 2. Monthly minimum temperature range

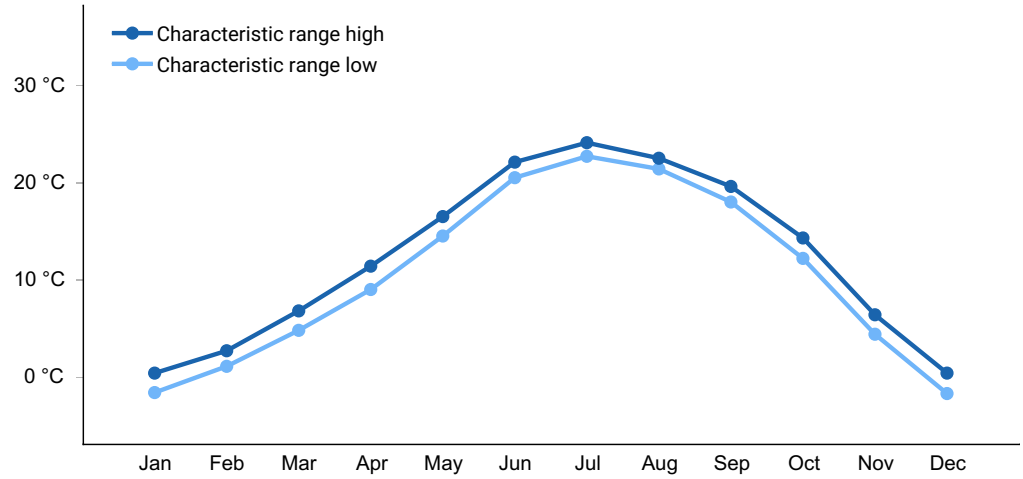


Figure 3. Monthly maximum temperature range

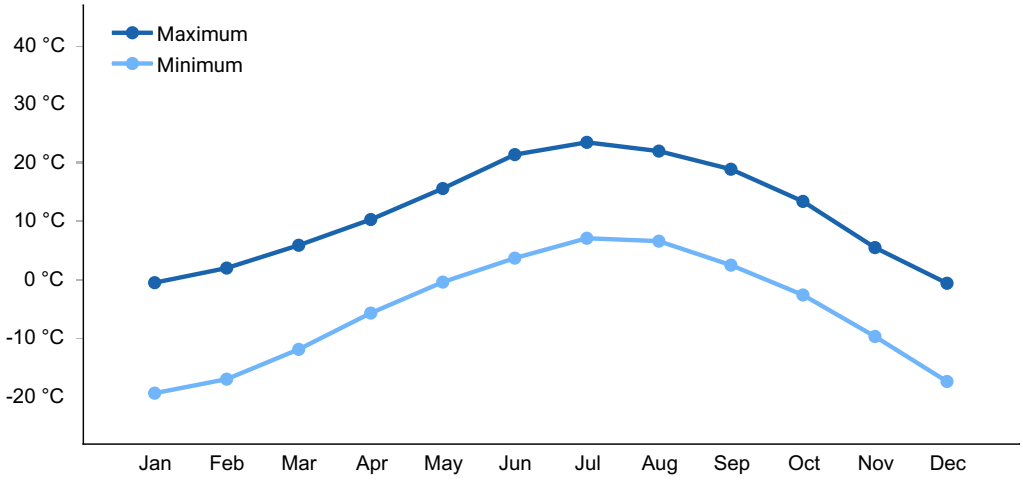


Figure 4. Monthly average minimum and maximum temperature

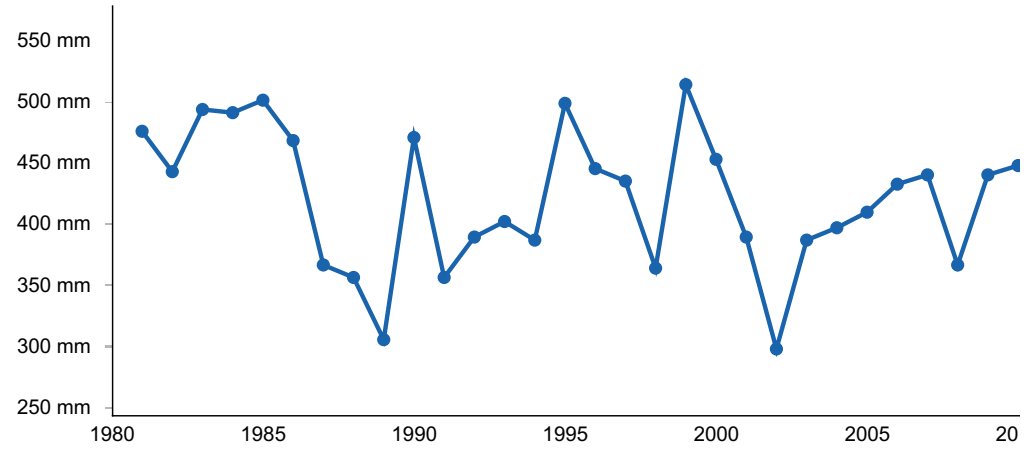


Figure 5. Annual precipitation pattern

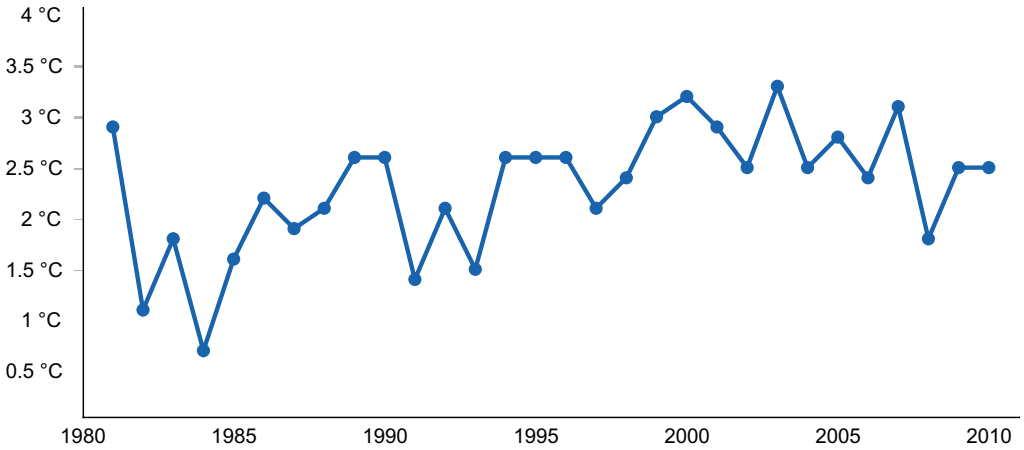


Figure 6. Annual average temperature pattern

Climate stations used

- (1) LAKE CITY [USC00054734], Lake City, CO
- (2) TAYLOR PARK [USC00058184], Almont, CO

Influencing water features

This site is associated with a perennial water source with running water that is often sinuous and highly mobile. Mountain meadows act to store and move large quantities of water to streams or rivers. If functioning properly, they decrease they can easily dissipate stored energy in the water to reduce erosion and act as a sponge to reduce flooding, especially lower in the watershed. The hydrologic function mountain meadows are imperative to ensuring the health of both the upland landscape and ecosystems lower in the watershed. Water table is 0 to 40 inches in depth during the months of April, May, June, July, August, and September.

Soil features

This site is in the typic ustic moisture regime and cryic temperature regime. Soils are deep

to very deep, very dark colored, highly organic, poorly to very poorly drained, and typically acid in reaction. They range from sandy loam, loam, to silty clay loam in texture and include peats and mucks. Peat sometimes can form layers up to 6 inches thick at certain locations. Loam surface textures are the most common. Clay content in the surface layer ranges from 15 to 25 percent; and from 25 to 45 percent in the subsurface layers. Gravels and cobbles may be present in the subsurface layers. Soil moisture is plentiful throughout the growing season in most years. Soils may become dry on the surface in some spots in late summer and fall or during unusually dry spells; other spots are nearly always wet.

Table 4. Representative soil features

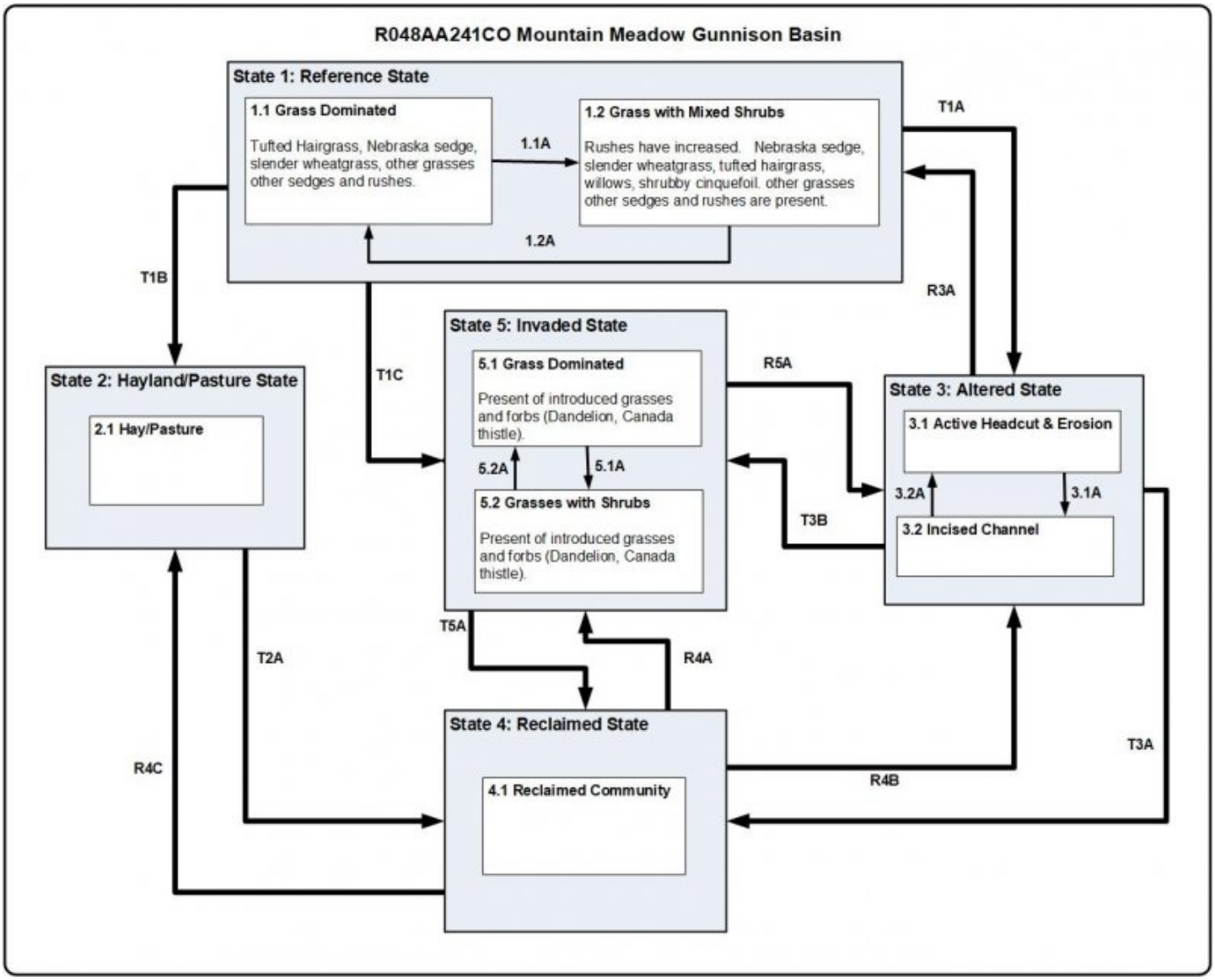
Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock (2) Alluvium–shale
Surface texture	(1) Loam (2) Silty clay loam (3) Sandy loam
Family particle size	(1) Fine-loamy (2) Fine (3) Loamy-skeletal
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately slow to moderate
Soil depth	152–305 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	14.48–23.88 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Clay content (Depth not specified)	15–25%
Electrical conductivity (Depth not specified)	0–1 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.6–7.4
Subsurface fragment volume <=3" (Depth not specified)	1–30%
Subsurface fragment volume >3" (Depth not specified)	5–10%

Ecological dynamics

The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. This site can range from a couple of acre to several thousand acres in size. Grasses and grass-likes gives this site its characteristic appearance. The native riparian areas are in the Mountain Meadow ecological site, usually are dominated by tufted hairgrass and Nebraska sedge, and often containing willows. (Barnes, Et. al, 2009). Nebraska sedge, water sedge and beaked sedge or other large sedges are dominant on the lowest, usually permanently wet, areas. Tufted hairgrass dominates slightly higher ground, which may be dry on the surface at times. The two types intergrade in many places. Other common grasses or grass-like plants are slender wheatgrass (drier portions), Baltic rush, and bluejoint. Some of the prominent forbs are also common to lower meadow sites, native clovers, Rocky Mountain iris, asters, herbaceous cinquefoils, mints, yarrow, golden pea, and vetch.

The state and transition model was added to fill the provisional ecological site instruction. It is a very general model. A 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 document.

State and transition model



Legend

1.1A – lack of disturbance, decreased water flow events and lower water table, and/or extended drought
1.2A – disturbance, increased water flow events and higher water table, and/or wetter climatic cycle
3.1A – Increased changes to hydrology (lower water table, decreased water flow events), extended drought, and/or large flow event
3.2A – changes to hydrology (increased sedimentation, increased water flow events, higher water table), and/or wetter climatic cycles
5.1A – lack of disturbance, extended improper grazing, extended drought
5.2A – wetter climatic cycles, proper grazing, disturbance

T1A, R4B– changes to hydrology, extended improper grazing, extensive drought, and/or large flow event
T1B – Land treatments implemented to increase forage quality and yield
T1C, T3B, R4A – introduction of invasive species to the site, extensive drought, and/or extended improper grazing
T2A – site treatment including non-native species control and native seeding
T3A – site treatment, native seeding
R3A – site treatment, proper grazing, and/or wetter climatic cycle
R4C – Land treatments implemented to increase forage quality and yield
T5A – invasive species control, native seeding, proper grazing, and/or wetter climatic cycles
R5A – treatment of invasive species, native seeding, changes to hydrology, extended improper grazing, extensive drought, and/or large flow even

State 1
Reference

This site occurs on gently sloping valley bottoms. An persistent channel or water source is typical. The vegetation would have been a grassland (meadow) dominated by a rich

mixture of native grasses and grass-likes such as Nebraska sedge and tufted hairgrass Minor amounts of forage production was due to native perennial forbs. The plant community is very productive because of the extended growing season as compared to the uplands. Early flooding at the time of peak snowmelt in the watersheds above (May-June) is the usual pattern. The reference state is stable and has properly functioning hydrology. Notable patch dynamics influence pockets of vegetation. For example, a greater dominance of grass-likes are near the water source and depression areas. Bunchgrasses, increase in prevalence further from the channel. Forbs and preferred shrubby species such as snowberry, Woods' rose, and willows also increase. The high diversity of species in this state allows plants to adapt to periods of additional moisture or drought.

Community 1.1
Grass/Grass-likes Dominated

This plant community would have been dominated by assorted grasses and grass-likes with a very minor component of mesic shrubs. Grasses and grass-likes would have included, tufted hairgrass, timothy, , Nebraska sedge, beaked sedge, water sedge, bluejoint, other sedges and bunchgrasses. The diverse community consists of 15 to 20 species or more, which help to stabilize it. A decrease in the diversity of species is one of the first indicators of site deterioration. Species that increase in abundance under disturbance and indicate deterioration of the site include rush, fleabane, herbaceous cinquefoil, horsetail, and Rocky Mountain iris.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1681	2466	3194
Forb	336	504	673
Shrub/Vine	224	392	616
Total	**2241**	**3362**	**4483**

Community 1.2
Grass/Grasslikes with Mixed Shrubs

The diversity of this community is similar to that of the reference plant community; it commonly supports 15 to 20 species. Unlike the reference plant community, however, a larger proportion of the plants are upland species that have invaded the meadows.

Species such as rushes, foxtail, Kentucky bluegrass, fleabane, herbaceous cinquefoil, horsetail, iris and upland sedges commonly indicate a transition to an altered hydrologic function. This community phase is moderately stable. It is somewhat vulnerable to erosion due to the bare ground between the plants. The hydrologic function and biotic integrity of this community is intact throughout the meadow; no benches or entrenched channels are present. The community can be at risk if the canopy cover of shrubs or the amount of bare ground increases. The water has access to the entire meadow, which helps to dissipate the energy and minimize the effects of flooding. Willows will be multiple-age cohorts. Removal of grasses and herbaceous litter from the soil surface increases the rate of the flow of water and decreases infiltration. Water that could have been transported, infiltrated, stored, and moved to the meadow at a later time is added to the already erosive overland flow; thus, larger amounts of water and sediment are flowing into the swale more rapidly and in a shorter period. Minor changes in the microclimate, especially at the periphery of meadow, allowing sagebrush and other obligate upland species to advance into the meadows, which further dries them out. If it is left untreated, it likely will transition to a degraded state and a high flow event could permanently alter the hydrologic function. Moderate and large flows can result in excessive erosion. The meadows are at risk for developing deeply eroded channels and contributing higher sediment loads in streams. .

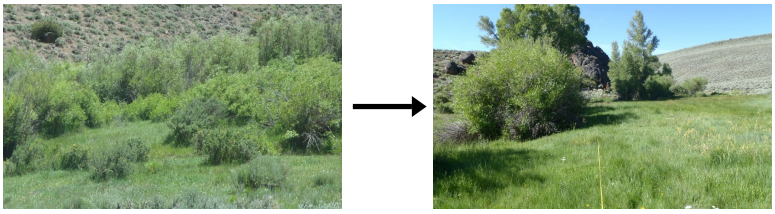
Pathway 1.1A
Community 1.1 to 1.2

Grass/Grass-likes Dominated

Grass/Grasslikes with Mixed Shrubs

Lack of natural disturbance, decreased water flow events and lower water table, improper grazing and/or extended drought

Pathway 1.2A
Community 1.2 to 1.1



Grass/Grasslikes with Mixed Shrubs

Grass/Grass-likes Dominated

natural disturbance, increased water flow events and higher water table, proper grazing and/or wetter climatic cycle

State 2
Hayland or Pasture

These meadows are a key part of the agricultural development of the basin. A very high percentage of these sites were homesteaded. The home base for many livestock ranches are along the rivers and streams where this ecological site occurs. This ecological site has been greatly expanded by flood irrigation and are now mostly anthropogenic grasslands of timothy (*Phleum pratense*), meadow foxtails (Alopecurus spp.), smooth and meadow bromes (Bromus inermus and B. riparius), Kentucky bluegrass (*Poa pratensis*), and in some places, orchardgrass (*Dactylis glomerata*). Barnes, Et. al (2009). Other common seeded species include: timothy, alsike clover, red clover, and alfalfa. These meadows have been improved by leveling, re-seeding, irrigation systems, and fertilizing. The most commonly, meadows are hayed during the summer and them pastured on the aftermath. Irrigation impacts the soil by building a organic matter and supports introduced grasses with some native sedges and rushes. Native species more tolerant of disturbance (e.g. curlycup gumweed, baltic rush, foxtail barley, and Rocky Mountain iris). Sedges, and timothy increased relative to the less grazing tolerant and palatable grasses and grass-likes such as beaked sedge and tufted hairgrass. Additionally, exotics such as common dandelion, Canada thistle, Kentucky bluegrass, and meadow fescue increased. In general, species richness declined and species equitability became more concentrated in fewer dominants. The single most important impact is whether enhanced irrigation took place to supplement the hydrologic input. In the cold temperatures of Gunnison County, haying and pasturing has been the more sustainable pattern.

Community 2.1
Hayfield/Pasture

Exotic grasses such as meadow foxtail, tall oatgrass, colonial bentgrass, or slimstem reedgrass are found at sites where plowing and re-seeding has taken place to improve forage for livestock. This plant community may have remnants of native grasses and grasses-likes. They may include sedges, tufted hairgrass, timothy, bluejoint, and slender wheatgrass.

State 3
Altered

This state is degraded, and the hydrology is altered. The plant community and surface debris are insufficient to slow runoff and dissipate the erosive energy of the water. During flow events, the amount of fine organic material on the surface is not sufficient to stabilize the soil, slow the flow of water, and allow for infiltration. Water from the uplands builds energy as it collects in the meadows and forms channels. The meadows cannot dissipate the energy; thus, channelization increases and head cuts form. The channel also begins to drain subterranean water, further dewatering the system in a self-perpetuating loop. This state has two fluctuating phases. Both phases have an entrenched channel, and water has no access to the flood plain of the meadows. The plant community in the

channel may be similar to that of the reference state, but the majority of the meadow supports a degraded community that produces a fraction of its original potential. The least stable fluctuating community phase is subject to excessive erosion during a flow event. No vegetation is on the sidewalls or bottom of the channel. It has a distinctly V-shaped channel that widens and deepens during each flow event. In the other fluctuating community phase, the bottom of the channel is revegetated. The vegetation is similar to that of the reference community. The water is consolidated in a smaller area. Common plants in the channel are those that are tolerant of flooding; thus, the abundance of obligate and facultative wetland species. The vegetation helps to stabilize the channel during periods of minor or moderate flooding and prevent further degradation. Commonly, the channel in this phase is U-shaped. Kentucky bluegrass dominates as the site dries out. Shrubby cinquefoil remnants provide little protection for the herbaceous understory. American licorice and herbaceous cinquefoils are dominant forbs. Willows and other woody species are rare to nonexistent. The state is unstable and vulnerable to excessive erosion. The biotic integrity of this plant community and watershed is nonfunctioning.

Community 3.1
Active Headcut & Erosion

This community is the least stable in this state. It has an actively eroding channel and active head cuts at the top of the channel. Excessive erosion occurs during flow events due to the lack of vegetation on the sidewalls and bottom of the channel. The channel commonly is V-shaped, and it widens and deepens during each flow event. The amount of bare ground is increased. The diversity of the community is very low, and few forbs are present. Kentucky bluegrass dominates as the site dries out. Shrubby cinquefoil remnants provide little protection for the herbaceous understory. American licorice and herbaceous cinquefoils are dominant forbs. Willows and other woody species are rare to nonexistent. The state is unstable and vulnerable to excessive erosion. The biotic integrity of this plant community and watershed is nonfunctioning.

Community 3.2
Incised Channel

In this community phase, the bottom of the channel is revegetated with plants similar to those in the reference community. The water is consolidated in a smaller area. T Common plants in the channel are those that are tolerant of prolonged periods of flooding; thus, the abundance of obligate and facultative wetland species is higher as compared to the reference plant community. The vegetation helps to stabilize the channel during periods of minor or moderate flooding. Commonly, the channel in this phase is U-shaped. The side slopes are denuded and subject to erosion. A “bench” (elevated top slopes that have relict reference state vegetation) may be along a narrow, entrenched channel. This plant community is the result of frequent and severe grazing. Kentucky bluegrass and Baltic rush are the dominant species with other grasses including rhizomatous wheatgrass and bearded wheatgrass. The site overall has dried due to downcutting associated with soil erosion from overgrazing. Common forbs include herbaceous cinquefoils, elephanthead, arrowgrass, and Rocky Mountain iris. Cinquefoil often dominates the landscape and produces more than 10-15% of the annual production on the site. Willow communities will lack a diversity of age classes. The state is moderately stable and protected from excessive erosion. The biotic integrity of this plant community is intact. The watershed is functioning.

Pathway 3.1A
Community 3.1 to 3.2

Increased changes to hydrology (lower water table, decreased water flow events), extended drought, improper grazing, and/or large flow event

Pathway 3.2A
Community 3.2 to 3.1

3.2A – changes to hydrology (increased sedimentation, increased water flow events, higher water table), and/or wetter climatic cycles

State 4
Reclaimed

The state has had man made reconstructive techniques applied to it. Some inputs may be non-intensive like building the rock walls at the start of headcuts. Other inputs may be intensive and involve time, energy, and resources to restore the level of the water table to meadow instead of the bottom of the channel. The amount of inputs needed depends on the degraded level of the specific site being restored.

Community 4.1
Reclaimed Community

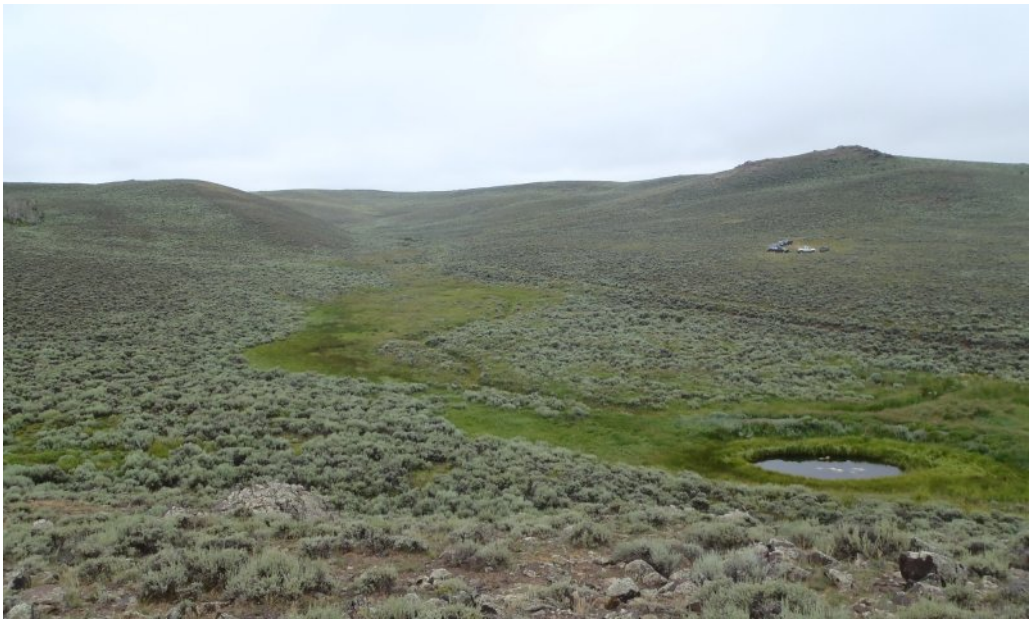


Figure 8. Pond in Reclaimed Meadow

Figure 9. Rock work with established grasses

Figure 10. New rock work at headcut

Figure 11. Reclaimed Meadow

This community phase is characterized by restoration of the level of the water table to the meadow. Commonly, a large amount of site work is needed. Site work may include soil movement, brush removal, and installation of check dams to reclaim the community, but it may never be restored to the reference plant community. Areas directly behind the check dams commonly have a higher water table, which promotes growth of facultative and obligate wetland species. Areas directly below the structures may be drier. This promotes invasion of upland species that typically are not in the reference plant community. Buildup of sediment in the check dams needs to be monitored. Seeding may be needed to help stabilize the community.

State 5
Invaded

This plant community is the result of long-term improper grazing use and subsequent downcutting of watercourses resulting in a lowered water table. Bare ground has allowed

the invasion of noxious weeds such as Canada thistle. The site has dried out, and most plants requiring additional moisture have disappeared. Rhizomatous wheatgrass and Kentucky bluegrass are dominant grasses. Woods rose are the dominant woody plants. Willows may have disappeared although remnants may still exist. Bare ground has increased. The soil of this state is not well protected. Degraded stream banks erode due to the lack of deep-rooted riparian plants. The watershed is nonfunctioning and usually produces excessive runoff. The biotic community is nonfunctioning due to invasive plants.

Community 5.1
Grass/Grasslike Dominated

Figure 12. Canada thistle in the foreground

Figure 13. Close-up of Canada thistle in meadow

This plant community is the result of long-term improper grazing use and subsequent downcutting of watercourses resulting in a lowered water table. Bare ground has allowed the invasion of noxious weeds such as Canada thistle. The site has dried out, and most plants requiring additional moisture have disappeared. Kentucky bluegrass are dominant

grasses. Willows may have disappeared although remnants may still exist. Bare ground has increased. The soil of this state is not well protected. Degraded stream banks erode due to the lack of deep-rooted riparian plants. The watershed is nonfunctioning and usually produces excessive runoff. The biotic community is nonfunctioning due to invasive plants.

Community 5.2
Grass/Grasslikes with Shrubs

This plant community is the result of noxious weed control and prescribed grazing. Grazing is used as a tool to control introduced and noxious weeds by selecting livestock type and timing use during the flowering of the identified weed such as Canada thistle. Other weed control efforts such as chemical, mechanical, or biological methods are employed in conjunction with a grazing management scheme. The native plant community responds to this management by increasing in production and vigor, however it is very sensitive to any management change that allows the seed production and increase of noxious weeds such as nonuse or overuse. Noxious weeds are still present, but in smaller amounts and may be isolated to exposed or bare ground areas such as sandbars. Bare ground has decreased. The soil of this state is moderately protected. Degraded stream banks may still erode, but increased amounts of deep-rooting sedges provide adequate stability to the system. The biotic community has been compromised, but is relatively stable and at risk due to invasive plants. The watershed is functioning, but is at risk of degrading rapidly with the introduction of improper management techniques.

Pathway 5.1A
Community 5.1 to 5.2

Lack of natural disturbance, extended improper grazing, extended drought

Pathway 5.2A
Community 5.2 to 5.1

Wetter climatic cycles, proper grazing, natural disturbance

Transition T1B
State 1 to 2

Land treatments are implemented to increase forage quality and yield.

Transition T1A
State 1 to 3

Changes to hydrology, extended improper grazing, extensive drought, and/or large flow event

Transition T1C
State 1 to 5

Introduction of invasive species to the site, extensive drought, and/or extended improper grazing

Transition T2A
State 2 to 4

Site treatments including treatment of introduced pasture grasses and native seeding. May include dirt work as water may have been spread out in the past to make the pastures larger.

Restoration pathway R3A
State 3 to 1

Site treatment, native species seeding, proper grazing, and/or wetter climatic cycle. Return to the reference state can happen, if the head-cutting is caught early before it cuts a incised channel.

Transition T3A
State 3 to 4

Site treatment - this may include dirt work, native seeding, rock work, proper grazing, wetter climate cycles. This transition will include intensive inputs.

Transition T3B
State 3 to 5

Introduction of invasive species to the site, change in hydrology, extensive drought, and/or extended improper grazing

Restoration pathway R4C
State 4 to 2

Land treatments implemented to increase forage quality and yield. May include dirt work/making ditches to spread out water, seeding introduced pasture grasses

Restoration pathway R4B
State 4 to 3

Changes to hydrology, extended improper grazing, extensive drought, and/or large flow event; starting of headcuts.

Transition T5A
State 4 to 5

Invasive species control, native seeding, proper grazing, and/or wetter climatic cycles, rock work or dirt work may be needed.

Restoration pathway R5A
State 5 to 3

Treatment of invasive species, native seeding, changes to hydrology, extended improper grazing, extensive drought, and/or large flow event

Restoration pathway R4A
State 5 to 4

T1C, T3B, R4A – introduction of invasive species to the site, extensive drought, and/or extended improper grazing

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				2802–3923	
	beaked sedge	CARO6	*Carex rostrata*	673–1345	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	673–1121	–
	water sedge	CAAQ	*Carex aquatilis*	224–673	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	224–673	–
	timothy	PHPR3	*Phleum pratense*	112–448	–
	sedge	CAREX	*Carex*	224–448	–
	tufted hairgrass	DECE	*Deschampsia cespitosa*	168–336	–
	creeping bentgrass	AGST2	*Agrostis stolonifera*	56–168	–
	bluejoint	CACA4	*Calamagrostis canadensis*	0–112	–
	arctic rush	JUAR2	*Juncus arcticus*	28–112	–
Forb					
2				448–841	
	Forb (herbaceous, not	2FORB	*Forb (herbaceous, not*	56–112	–

	grass nor grass-like)		*grass nor grass-like)*		
	white checkerbloom	SICA3	*Sidalcea candida*	22–112	–
	American vetch	VIAM	*Vicia americana*	17–84	–
	common yarrow	ACMI2	*Achillea millefolium*	17–84	–
	fleabane	ERIGE2	*Erigeron*	17–56	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–56	–
	cinquefoil	POTEN	*Potentilla*	17–56	–
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	17–56	–
	white clover	TRRE3	*Trifolium repens*	17–56	–
	geranium	GERAN	*Geranium*	0–56	–
	mountain nettle	URGR	*Urtica gracilenta*	0–28	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	0–28	–
Shrub/Vine					
3				224–785	
	narrowleaf willow	SAEX	*Salix exigua*	112–448	–
	Geyer willow	SAGE2	*Salix geyeriana*	112–448	–
	Bebb willow	SABE2	*Salix bebbiana*	112–448	–
	yellow willow	SALU2	*Salix lutea*	112–448	–
	currant	RIBES	*Ribes*	0–112	–
	shrubby cinquefoil	DAFR6	*Dasiphora fruticosa*	0–112	–

Recreational uses

The site provides a high value rating for recreation and natural beauty.

Wood products

Wood products are not produced on this site.

Inventory data references

This ecological site occurs in the Gunnison, and Montrose field offices in the Gunnison Basin.

Other references

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Approval

Kirt Walstad, 3/11/2025

Acknowledgments

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Site Development and Testing:
Future work is needed to validate and further refine the information in this provisional ecological site description (pESD). This will include field activities to collect low-, medium-, and high-intensity samples, soil correlation, and analysis of data.

Additional information and data are required to refine the plant production and annual production data in the tables for this ecological site. The extent of MLRA 48A requires further investigation.

Field testing of the information in this pESD is required. As this pESD progresses to the approved level, reviews will be conducted by the technical team, quality control and quality assurance staff, and peers.

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)	Original MLRA wide Reference sheet written by J. Murray, C. Holcomb, L. Santana, F. Cummings, A. Jones, P. Billig, S. Jaouen. Updated for Gunnison Basin by Suzanne Mayne-Kinney
Contact for lead author	
Date	12/16/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None

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2. **Presence of water flow patterns:** None

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3. **Number and height of erosional pedestals or terracettes:** None

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect < 5% bare ground. Extended drought can cause bare ground to increase.

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5. **Number of gullies and erosion associated with gullies:** Rare, and when they due appear they are caused by offsite influences.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Typically slight, however during major flooding events this site slows water flow and captures litter and sediment.

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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):** Stability class rating anticipated to be 5-6 at the soil surface. This site has a lot of organic matter that occurs at the soil surface and is usually hydrophobic and floats.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soils are typically deep, poorly drained with a dark brown/black A-horizon with is ranges from 2 to 21 inches in depth. A litter (Oi soil horizon) may be 0 to 1 inches in depth on top of the soil surface.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Diverse grass, sedge/rushes, forb functional/structural groups and diverse root structure/patterns reduces raindrop impact slows overland flow providing increased time for infiltration to occur.

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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):** None

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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: cool season bunchgrass = sedges/rushes >

    Sub-dominant: forbs >

    Other: shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typically minimal, however lack of disturbance results in litter buildup and increased decadence.

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14. **Average percent litter cover (%) and depth (in):** Litter cover is typically 80-95% under the plant cover and 5-15% between the plant cover. Litter cover depth ranges from 1.0 to 2.0 inches. Litter cover declines during and following extended drought.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2000 lbs./ac. low precip years; 3000 lbs./ac. average precip years; 4000 lbs./ac. above average precip years. After extended drought, production may be reduced by 500 – 1000 lbs./ac. or more.

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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:** Kentucky bluegrass, Canada thistle, Dandelion and other noxious weeds.

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17. **Perennial plant reproductive capability:** The only limitations are weather-related, wildfire, natural disease, inter-species competition, wildlife, excessive litter, and insects that may temporarily reduce reproductive capability.
