

Ecological site R048AY311CO

Mountain Outwash

Last updated: 4/02/2025
Accessed: 09/25/2026

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.

Classification relationships

NRCS: Major Land Resource Area 48A, Southern Rocky Mountains (United States Department of Agriculture, Natural Resources Conservation Service, 2006). USFS: M331F- Southern Parks and Rocky Mountain Range Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow M331G – South Central Highlands Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow M331H – North Central Highlands and Rocky Mountains Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow M331I – North Parks and Ranges Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow M341B – Tavaputs Plateau Section M341 Nevada-Utah Mountains Semi-Desert - Coniferous Forest - Alpine Meadow (Cleland, et al., 2007). EPA: 21a – Alpine Zone, 21b – Crystalline Subalpine Forests, 21c – Crystalline Mid-Elevations Forests, 21d -Foothill Shrublands, 21e – Sedimentary Subalpine Forests, 21f – Sedimentary Mid-Elevation Forests, 21g – Volcanic Subalpine Forests, and 21h – Volcanic Mid-Elevation Forests 21 Southern Rockies 6.2 Western Cordillera 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006). 20c – Semiarid Benchlands and Canyonlands and 20e - Escarpments 20 Colorado Plateau 10.1 Cold Deserts 10 North American Deserts (Griffith, 2006). USGS: Southern Rocky Mountain Province

Ecological site concept

R048AY311CO Mountain Outwash occurs on fan terraces, alluvial fans, and glacial moraines. Slopes are between 3 to 45 percent. Soils are deep (60+ inches). Soils are derived from alluvium that is coarse-textured and stony or cobbly. Soil surface texture is gravelly sandy loam or cobbly sandy loam with sandy-skeletal textured subsurface. It is an Arizona Fescue – mountain muhly community. It has a typical ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 16 to 20 inches.

Associated sites

R048AY228CO	Mountain Loam R048AY228CO Mountain Loam occurs mainly alluvial fans, mountain slopes, benches, terraces, or hills. Slopes average between 5 and 10% but can range from 0 to 30%. Soils are moderately deep to deep (20-60 inches) loamy soils derived from residuum from igneous and metamorphic rocks or sandstone and shale; slope alluvium from sandstone and shale, or igneous and metamorphic rocks; colluvium from igneous and metamorphic rocks or sandstone and shale, and/or alluvium from igneous and metamorphic rocks. Soil surface texture are loam, sandy loam or silt loam with loamy subsurface. It is a Mountain Big Sagebrush -Arizona Fescue community. It has a typical ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.
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Similar sites

R048AY287CO	Stony Foothills R048AY287CO Stony Foothills occurs on mountains, escarpments and hills. Slopes is between 3 to 30%. Soils are moderately deep to deep (20 to 60+ inches). Soils are derived from alluvium, residuum or colluvium from sandstone and shale or alluvium from basalt. Soil surface texture is gravelly, stony, or very stony sandy loam or very cobbly loam with loamy-skeletal textured subsurface. It is a Wyoming Big Sagebrush – western wheatgrass community. It has an aridic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 12 to 16 inches.
R048AY316CO	Dry Mountain Outwash R048AY316CO Dry Mountain Outwash occurs on fan terraces and alluvial fans. Slopes is between 1 to 45%. Soils are deep (60+ inches). Soils are derived from alluvium or outwash. Soil surface texture is gravelly sandy loam with sandy-skeletal textured subsurface. It is a prairie junegrass – pine needlegrass community. It has an aridic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 12 to 16 inches.
R048AY237CO	Stony Loam R048AY237CO Stony Loam occurs mainly alluvial fans, mountain slopes mountains and valley sides. Slopes is between 0 to 30%. Soils are deep (60 inches or more) loamy soils derived from outwash; till; colluvium from basalt, sandstone or granite and gneiss; and/or alluvium from igneous and metamorphic rocks; or basalt. Soil surface texture are stony to extremely stony loam, cobbly loam; or cobbly to very cobbly sandy loam with loamy-skeletal subsurface. It is a Mountain Big Sagebrush - Bluebunch wheatgrass community. It has a typical ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

R048AY229CO	Rocky Loam R048AY229CO – Rocky Loam occurs on ridges, mountainside, mountain slopes and mountains. Soils are very shallow to shallow (less than 20 inches) loamy-skeletal soils derived from residuum from granite, gneiss, phyllite, schist, sandstone and/or limestone. Soil surface texture are generally coarse sandy loams to light clay loams. It is a Mountain Big sagebrush – western wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Festuca arizonica</i> (2) <i>Muhlenbergia montana</i>

Physiographic features

This site occurs on gently rolling to moderately steep fan terraces, alluvial fans, and glacial moraines. Slopes usually ranges from 3 to 25 percent but can go as high as 45 percent. Elevation ranges from 8,200 to 9,600 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Alluvial fan (3) Moraine
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,500 – 2,930 m
Slope	0 – 50 %
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is about 16 to 20 inches. Of this, approximately 45-55% falls as snow, and 45-55% falls as rain between middle of May to and the end of September. Summer moisture is mostly from thundershowers in July, August and September. December to February is the driest period of the year with the driest month being January. July thru September is the wettest period and the wettest month is usually August. The average annual total snowfall is 84.9 inches. The snow depth usually ranges from 1 to 5 inches during

November thru March. The highest winter snowfall record in this area is 127 inches which occurred in 2007-2008. The lowest snowfall record is 46.5 inches during the 2017-2018 winter. The frost-free period typically ranges from 80 to 120 days. The last spring frost is typically the middle of June to the end of June. The first fall frost is usually the end of August to the middle of September. Mean daily annual air temperature ranges from about 25.5°F to 60.3°F, averaging about 24°F for the winter and 61.8°F in the summer. Summer high temperatures of mid-70°F to low 80°F are not unusual. The coldest winter temperature recorded was -36°F on February 2, 1985 and the warmest winter temperature recorded was 65°F on December 5, 1995. The coldest summer temperature recorded was 19°F on June 2, 1990 and the warmest was 98°F on July 31, 2002. Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2018) for Ridgway, Colorado Climate Station.

This zone in MLRA 48 will need to be broken up into at multiple land resources zones in future projects based on current knowledge of precipitation and temperature patterns.

West Central Zone Stations: Alterbern, Aspen, Avon, Glenwood Springs #2, Shoshone, Placerville and Ridgway. This LRU zone is use in write up above. Driest month is usually January, February and June and wettest months are July, August and September.

Northwest Zone Climate Stations: Meeker and Yampa are at the low end of this LRU zone. Driest months usually are January and February. Wettest months usually are April and August.

Southwest Zone Climate Stations (Precambrian sedimentary and igneous): There are no climate stations in this LRU zone.

Southwest Volcanics: There are no climate stations in this LRU zone.

Northeast (Front Range Igneous and Metamorphic): Cabin Creek, Caribou Ranch, Dillion 1 R, Fraser, Georgetown, Grand lake 1 NW, Hourglass Reservoir, Nederland 2 NNE, Red Feathers Lakes, Red Feather Lakes 2 SE and Victor. April, May, July and August are the wettest months. February, December, November and October are the driest. The climate stations is this zone are cryic. These areas have shorter growing seasons by 20 to 40 days over the frigid stations.

Southeast (Sangre de Cristo Mtns): There are no climate stations in this zone in MLRA 48A. Closest ones are in MLRA 49. The growing season appears to be longer on the Sangre de Cristos. Driest months are December to February and the wettest are July & August.

Crylic High elevation valleys: Pitkin, Taylor River and Meredith. These areas have shorter growing seasons by 20 to 40 days over the frigid stations.

Table 3 Representative climatic features

Frost-free period (characteristic range)	40-80 days
Freeze-free period (characteristic range)	90-110 days
Precipitation total (characteristic range)	430-460 mm
Frost-free period (actual range)	10-100 days
Freeze-free period (actual range)	50-140 days
Precipitation total (actual range)	430-480 mm
Frost-free period (average)	60 days
Freeze-free period (average)	100 days
Precipitation total (average)	460 mm

- (1) FRASER [USC00053116], Fraser, CO
- (2) GLENWOOD SPGS #2 [USC00053359], Glenwood Springs, CO
- (3) GEORGETOWN [USC00053261], Idaho Springs, CO
- (4) RIDGWAY [USC00057020], Ridgway, CO
- (5) YAMPA [USC00059265], Toponas, CO
- (6) ASPEN PITKIN CO AP [USW00093073], Aspen, CO

Influencing water features

None

Soil features

Soils are deep to very deep from gravelly, cobbly and stony soils developing in and from calcareous, moderately coarse-textured gravelly alluvium; stony & cobbly, coarse-textured alluvium and/or stony & cobbly, coarse-textured outwash. Water holding capacity is low due to the skeletal nature of the soil. Plant growth is low for the climatic zone because a large part of the moisture percolates below the root zone and also because of the low natural soil fertility.

Sandy-Skeletal family particle size:

Pieran and Poncha

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Gravelly sandy loam (2) Stony sandy loam
Family particle size	(1) Sandy-skeletal
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to very rapid
Soil depth	150 – 200 cm
Surface fragment cover <=3"	20 – 30 %
Surface fragment cover >3"	10 – 20 %
Available water capacity (Depth not specified)	3.81 – 7.11 cm

Calcium carbonate equivalent (Depth not specified)	0 – 10 %
Soil reaction (1:1 water) (Depth not specified)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	10 – 40 %
Subsurface fragment volume >3" (Depth not specified)	10 – 30 %

Ecological dynamics

Aspect of this site is a grassland, however, this becomes a shrub annual grass aspect with a decline in range condition. Arizona fescue, western wheatgrass, sedges, rushes, and squirreltail are dominant on the site. Other grasses include muttongrass and other native bluegrasses, needleandthread, Indian ricegrass, mountain muhly, Junegrass, blue grama, slimstem muhly, and threeawn. Forbs include phlox, mat penstemon, buckwheat, pussytoes, yarrow, aster, daisy, and geranium. Shrubs include fringed sage, winterfat, low rabbitbrush, mountain big sagebrush, tall rabbitbrush, spineless horsebrush, yucca, currant, shrubby potentilla.

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

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Grasses			538-628	
	Arizona fescue	FEAR2	<i>Festuca arizonica</i>	0-179	–
	muttongrass	POFE	<i>Poa fendleriana</i>	73-106	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	73-106	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	73-106	–
	mountain muhly	MUMO	<i>Muhlenbergia montana</i>	73-106	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	34-56	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	34-56	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	36-54	–
Forb					
2	Forbs			90-135	
	Forb, perennial	2FP	<i>Forb, perennial</i>	90-135	–
Shrub/Vine					
3	Shrubs			179-224	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	45-90	–

	mountain big sagebrush	ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	17-45	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	17-45	–

Animal community

INTERPRETATIONS FOR GRAZING ANIMALS: This site offers a medium value for cattle and horses and a low value for sheep. INTERPRETATIONS FOR WILDLIFE: The site has a medium value rating for elk, cottontail, jackrabbit, and upland game birds. It offers a low value rating for antelope and deer. It is not used by waterfowl.

Hydrological functions

The site provides a medium value rating for watershed.

Recreational uses

RECREATION AND NATURAL BEAUTY: The site provides a medium value rating for recreation and natural beauty.

Wood products

No trees grow on this site naturally.

Other information

Rare, Threatened, or Endangered Plants and Animals: To be added when known. Field offices where this site occurs: Cripple Creek Gunnison Salida

Type locality

Location 1: Gunnison County, CO	
General legal description	Cochetopa Park about 1.5 miles south of the Flying M Ranch, near the highway.
Location 2: Park County, CO	
General legal description	Benchland south of Fairplay and between Fairplay and Alma, Colorado.

Other references

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Contributors

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Approval

Kirt Walstad, 4/02/2025

Acknowledgments

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/02/2025
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

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

5. Number of gullies and erosion associated with gullies:

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

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

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):

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

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):

12. Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):

Dominant:

Sub-dominant:

Other:

Additional:

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):

14. Average percent litter cover (%) and depth (in):

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):

16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

17. Perennial plant reproductive capability:
