Ecological site R048AY234CO
Mountain Clay

Last updated: 3/05/2024
Accessed: 05/20/2024

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 - Escarpements < 20 Colorado Plateau < 10.1 Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS: Southern Rocky Mountain Province and the southern part of Unita Basin Section Colorado Plateaus Province

Ecological site concept

Mountain Clay occurs on hills, mesas, and alluvial fans. Slopes is between 0 to 25%. Soils are moderately deep to deep (20 to 60+ inches). Soils are derived from colluvium, slope alluvium, residuum and/or eolian deposits from sandstone and shale. Soil surface texture is loam, clay loam or very cobbly loam with a fine textured subsurface. It

is a black sagebrush – western wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Associated sites

R048AY228CO	**Mountain Loam** 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 typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Similar sites

R048AY257CO	**Clayey Valley** Clayey Valley occurs on hillslopes, and old high terraces. Slopes is between 1 to 12%. Soils are moderately deep to very deep (20 to 60+ inches). Soils are derived from slope alluvium from shale or mixed alluvium from sandstone and shale. Soil surface texture is loam or clay loam with fine textured subsurface. It is Western wheatgrass – Arizona Fescue. It has a Typic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 18 to 22 inches.
R048AY252CO	**Subalpine Clay** Subalpine Clay occurs on complex landslides, mountain slopes, dip slopes, and mesas. Slopes is between 0 to 35%. Soils are moderately deep to very deep (20 to 60+ inches). Soils are derived from complex landslide deposits from igneous, metamorphic and sedimentary rock; colluvium from shale; colluvium and/or slide deposits over residuum weathered from igneous and sedimentary rock. Soil surface texture is loam, clay loam or silt loam with fine-textured subsurface. It is Thurber's Fescue – western wheatgrass – mountain snowberry. It has an ustic udic/typic udic moisture regime and cryic temperature regime. The effective precipitation ranges from 20 to 30 inches.
R048AY248CO	**Mountain Clay Loam** Mountain Clay Loam occurs on alluvial fans, mesas, hills and mountain slopes. Slopes is between 0 to 35%. Soils are deep to very deep (40 to 60+ inches). Soils are derived from alluvium and slope alluvium from shale; or alluvium, slope alluvium, colluvium and/or residuum from sandstone and shale. Soil surface texture is loam or a clay loam with fine-textured subsurface. It is Arizona Fescue – western wheatgrass – Gambel's Oak community. It has a typic ustic moisture regime and frigid temperature regime. The effective precipitation ranges from 16 to 20 inches.
R048AY247CO	**Deep Clay Loam** Deep Clay Loam occurs on hills, hillsides, mountain-slope, complex landslides, alluvial fans, and structural benches. Slopes is between 0 to 35%. Soils are deep (60+ inches). Soils are derived from colluvium and slide deposits from igneous, metamorphic and sedimentary rocks, and/or alluvium, residuum or complex landslide deposits from shale. Soil surface texture is loam, clay loam or silty clay loam with fine-textured subsurface. 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.
R048AY238CO	**Brushy Loam** Brushy Loam occurs on hills, mountains, complex landslides, and benches. Slopes is between 3 to 35%. Soils are moderately deep to deep (20 to 60+ inches), soils derived from colluvium, residuum, slope alluvium and alluvium from sandstone and shale. Soil surface texture is loam or clay loam with fine-textured subsurface. It is a Gambel's oak – slender wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia nova*
Herbaceous	(1) *Pascopyrum smithii* (2) *Festuca arizonica*

Physiographic features

This range site normally occurs on slightly higher ground associated with the Clayey Valley range site. The slopes are mostly gentle to moderate (0-15%) , although it can range up to 25% slope. Elevation ranges from about 7100 to 8500 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mesa (3) Alluvial fan
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,164–2,591 m
Slope	0–15%
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 25.5ºF to 60.3ºF, averaging about 24ºF for the winter and 61.8ºF in the summer. Summer high temperatures of mid-70ºF to low 80ºF are not unusual. The coldest winter temperature recorded was -36ºF on February 2, 1985 and the warmest winter temperature recorded was 65ºF on December 5, 1995. The coldest summer temperature recorded was 19ºF on June 2, 1990 and the warmest was 98ºF 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.

Cryic 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)	23-78 days
Freeze-free period (characteristic range)	75-111 days
Precipitation total (characteristic range)	432-457 mm
Frost-free period (actual range)	5-101 days
Freeze-free period (actual range)	43-134 days
Precipitation total (actual range)	432-483 mm
Frost-free period (average)	54 days
Freeze-free period (average)	92 days
Precipitation total (average)	457 mm

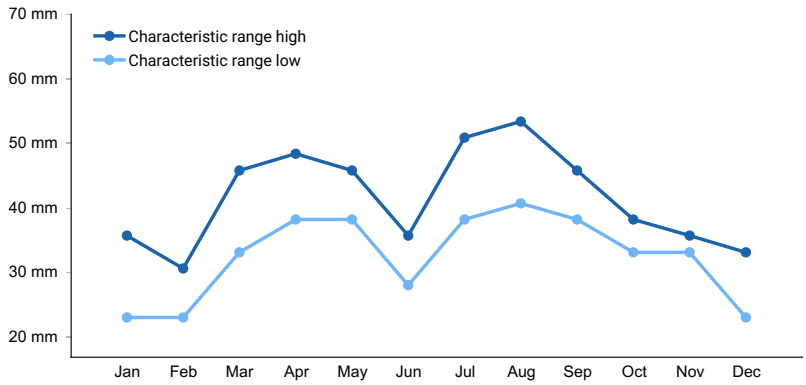


Figure 1. Monthly precipitation range

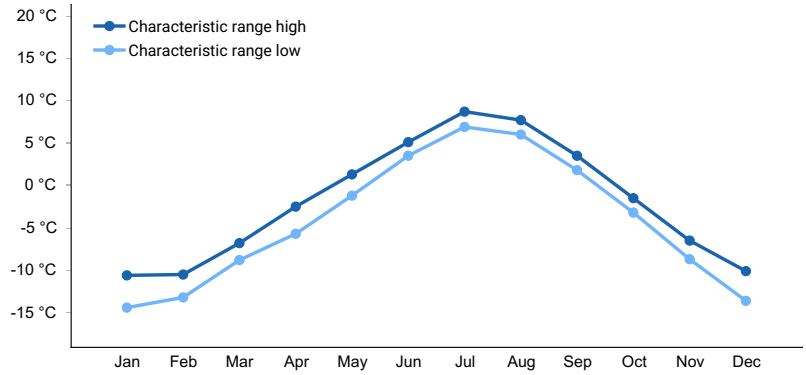


Figure 2. Monthly minimum temperature range

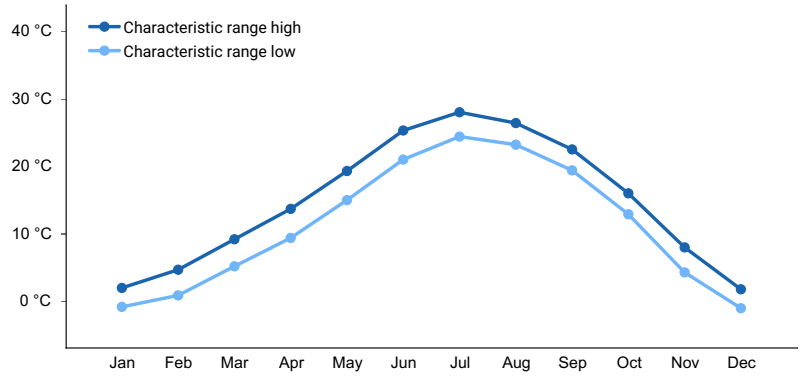


Figure 3. Monthly maximum temperature range

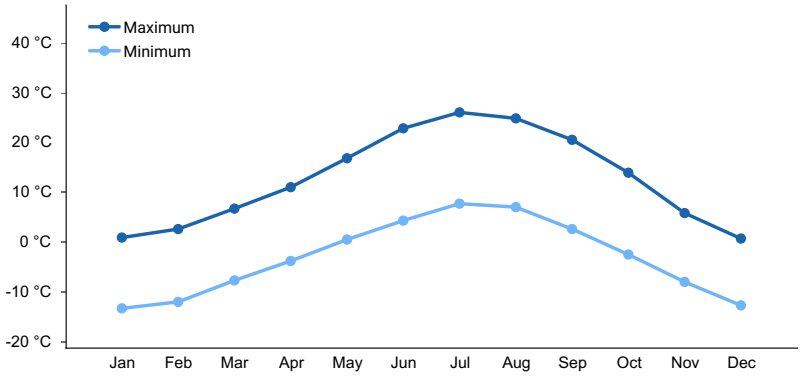


Figure 4. Monthly average minimum and maximum temperature

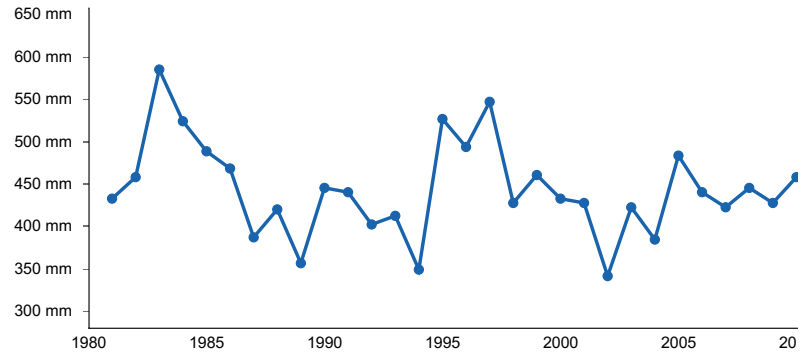


Figure 5. Annual precipitation pattern

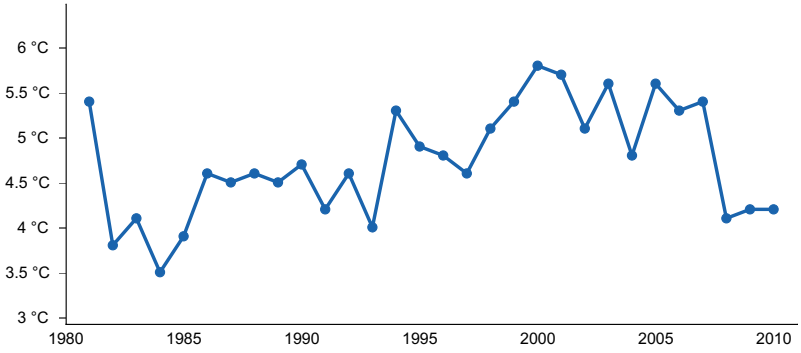


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GEORGETOWN [USC00053261], Idaho Springs, CO
- (2) FRASER [USC00053116], Fraser, CO
- (3) GLENWOOD SPGS #2 [USC00053359], Glenwood Springs, CO

- (4) HOURGLASS RSVR [USC00054135], Bellvue, CO
- (5) RIDGWAY [USC00057020], Ridgway, CO
- (6) YAMPA [USC00059265], Toponas, CO
- (7) ASPEN PITKIN CO AP [USW00093073], Aspen, CO

Influencing water features

None

Soil features

Soils are derived from shale and sandstone. They are moderately deep to very deep over shale and sandstone. The soils are high in clay and are slowly permeable. Water storage capacity is good. Much of the moisture is held by the soil particles and is not always readily available to the plants. The soils are subject to high runoff and damage from water erosion,. Water erosion increase as the slope increases.

Soils of this site are:

Ilex, Morapos, Pramiss and Herm variant

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and shale (2) Eolian deposits–sandstone and shale (3) Colluvium–sandstone and shale (4) Slope alluvium–sandstone and shale
Surface texture	(1) Loam (2) Clay loam (3) Very cobbly loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	51–152 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–25%
Available water capacity (Depth not specified)	8.13–19.56 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Soil reaction (1:1 water) (Depth not specified)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

The potential plant community is a mixture of grasses and black sagebrush. Western and slender wheatgrass, needlegrasses, and Arizona fescue are the dominant grasses, with lesser amounts of mountain muhly, mountain brome, Junegrass, muttongrass, and spike muhly scattered throughout. Scattered clumps of oakbrush and other large shrubs such as mountain snowberry and Saskatoon serviceberry will occur. Forbs such as fringed sage, yarrow, astragalus, penstemon, lupine, buckwheat, and cushion plants are also found in trace amounts.

The site is essentially treeless; however a few small and isolated clumps of ponderosa pine or pinyon pine and

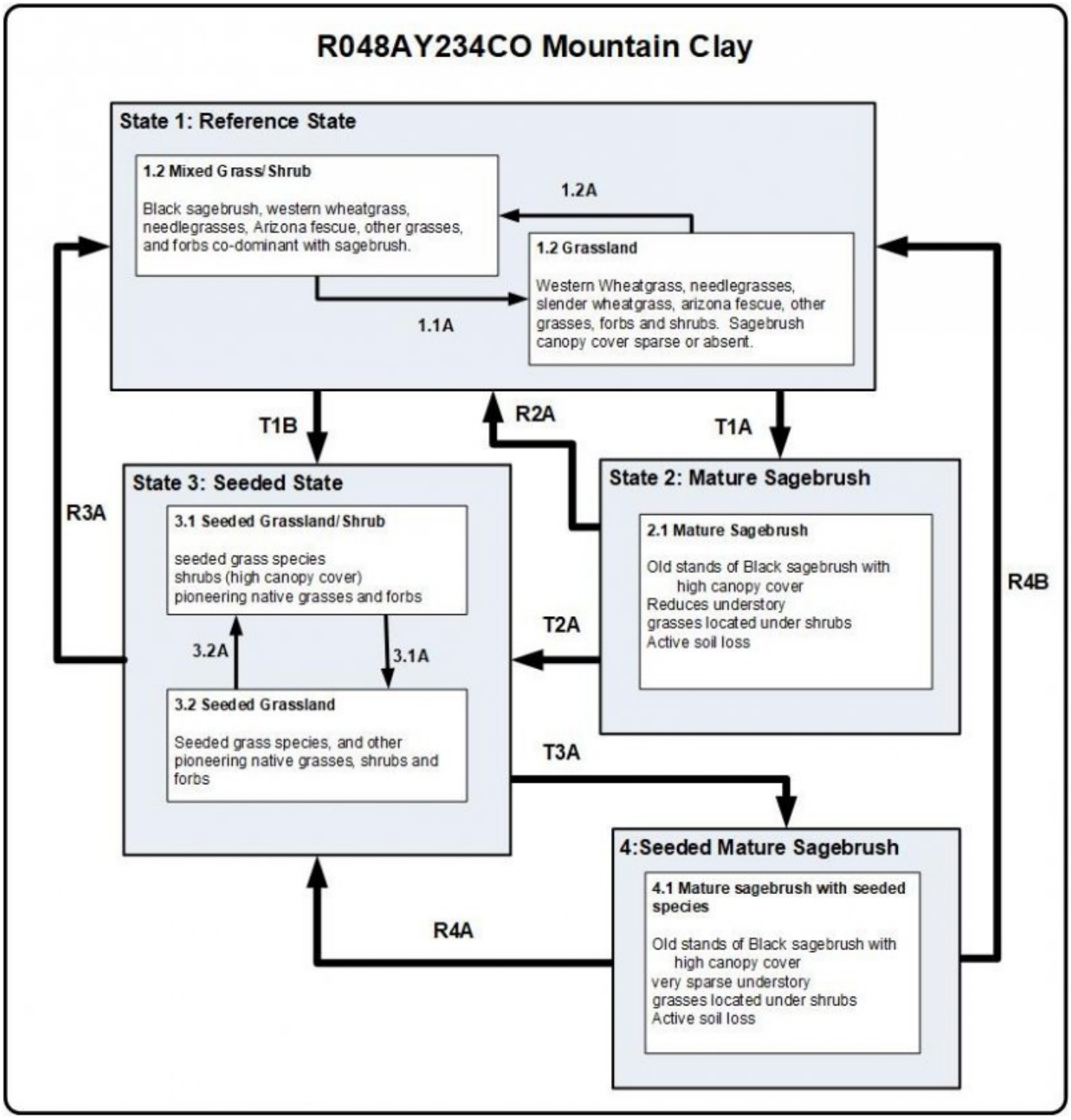
juniper may occur. Approximate ground cover is 30 to 35%.

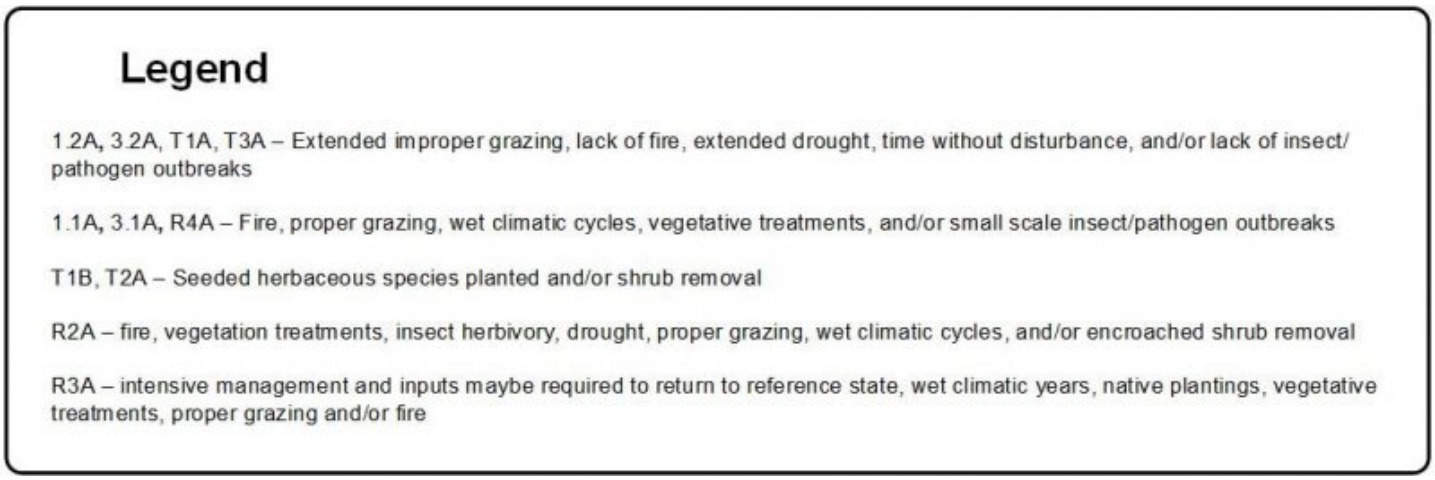
Species most likely to invade this site or increase drastically from the amounts shown above are needlegrasses, sedges, blue grama, threeawn, fringed sagebrush, black sagebrush, yarrow, lupine, snakeweed, pingue, and annual forbs. There may also be a sharp increase in oakbrush in some localized areas.

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

Production
Favorable years 1200 pounds per acre
Median years 900 pounds per acre
Unfavorable years 600 pounds per acre

State and transition model





State 1
Reference State

Community 1.1
Reference State

Approximate ground cover is 30 to 35%.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	532	684	818
Shrub/Vine	95	252	420
Forb	45	78	106
Total	**672**	**1014**	**1344**

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	**Grasses**			56–95	
	western wheatgrass	PASM	*Pascopyrum smithii*	252–404	–
	Arizona fescue	FEAR2	*Festuca arizonica*	78–202	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	101–202	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	50–101	–
	mountain brome	BRMA4	*Bromus marginatus*	22–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	22–50	–
	mountain muhly	MUMO	*Muhlenbergia montana*	22–50	–
	muttongrass	POFE	*Poa fendleriana*	22–50	–
Forb					
2	**Forbs**			50–101	
	yarrow	ACHIL	*Achillea*	22–50	–
	milkvetch	ASTRA	*Astragalus*	22–50	–
	buckwheat	ERIOG	*Eriogonum*	22–50	–
	lupine	LUPIN	*Lupinus*	22–50	–
	beardtongue	PENST	*Penstemon*	22–50	–
	yarrow	ACHIL	*Achillea*	22–50	–
	milkvetch	ASTRA	*Astragalus*	22–50	–
	buckwheat	ERIOG	*Eriogonum*	22–50	–
	lupine	LUPIN	*Lupinus*	22–50	–
	beardtongue	PENST	*Penstemon*	22–50	–
Shrub/Vine					
3	**Shrubs**			101–404	
	black sagebrush	ARNO4	*Artemisia nova*	151–252	–
	Gambel oak	QUGA	*Quercus gambelii*	50–101	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	34–50	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	34–50	–

Animal community

INTERPRETATIONS FOR GRAZING ANIMALS:
This site provides a high value rating for cattle and sheep and a medium value rating for horses.

INTERPRETATIONS FOR GRAZING WILDLIFE:
It provides a low value rating for antelope, bison, and it is not applicable for waterfowl. The site has a medium value rating for deer and cottontail and a high value for elk.

Hydrological functions

This site offers a high value rating for watershed.

Recreational uses

The value rating for recreation and natural beauty is high.

Wood products

No wood products are produced on this site.

Other information

RARE, THREATENED, or ENDANGERED PLANTS AND ANIMALS:
To be added when known

Field offices in Colorado where site occurs
Cortez

Type locality

Location 1: Montezuma County, CO	
General legal description	Along the road between beaver creek and glade in vicinity of Plateau and Calf Creeks northwest of Dolores.

Other references

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Contributors

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Approval

Kirt Walstad, 3/05/2024

Acknowledgments

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Those involved in developing earlier versions of this site description include: Bob Rayer, retired NRCS Soil Scientist; Herman Garcia, retired CO State RMS and NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ.

--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 48A must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

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	05/20/2024
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:**

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:**

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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):**

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

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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:

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17. **Perennial plant reproductive capability:**
