USDA Natural Resources
Conservation Service

Ecological site R048AA247CO
Deep Clay Loam Shale Highlands 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) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin and, west of the Great Plains and, 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:

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

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).

USGS:

Southern Rocky Mountain Province

Ecological site concept

The 48AA Deep Clay Loam Mountain Valley was drafted from the existing Deep Clay Loam Range Site (R048XY247CO, December, 1976). The original 1976 concept was expanded upon based on soil temperature and moisture regimes, and climate to cover the entire western slope. This site is located on hills and mountainslopes around the Gunnison Basin and Cerro Summit Area. This site occurs on hills and ridges on deep fine textured soils derived from alluvium and slope alluvium. It is a western wheatgrass, mountain big sagebrush community. It has a typic ustic moisture regime and cool, frigid to cryic temperature regime. The effective precipitation ranges from 16 to 20 inches.

Associated sites

R048AY239CO	**Brushy Mountain Loam** This site has slopes from 25-40%. Soils textures are gravelly-skeletal soils. This site has clumps of shrubs and open areas with grass. Dominant Shrubs is alderleaf mountain mahogany with snowberry, serviceberry and some Gambel's oak.
R048AY241CO	**Mountain Meadow** The mountain meadow ecological site often occurs in small pockets within the mountain swale ecological site. This is characterized by sedges, rushes and willows. Changes in the depth to bedrock and valley/channel topography alter the hydrology of the site and contribute to a water table higher than 60 inches. These results in soils and vegetation more closely associated with the mountain swale ecological site.
R048AA245CO	**Mountain Swale Gunnison Basin LRU** Mountain Swale is a run-in position which receives the extra moisture from the upland deep clay loam site. This site is characterized by basin wildrye, wood's rose and big sagebrush.
R048AY238CO	**Brushy Loam** This is a loamy texture site with textures from sandy loams to clay loams with Gambel's oak and serviceberry being the dominant shrubs.

Similar sites

R048AY252CO	**Subalpine Clay** Soils are heavy in clay like Deep Clay Loam but it is one precipitation range higher and start at 20" of precipitation. Dominant plants are silver sagebrush, mules-ear, oniongrass, and slender wheatgrass.
R048AA228CO	**Mountain Loam Gunnison Basin LRU** This site is has moderately deep to deep soils with a skeletal layer possible at about 26-30" sometimes. This site is fine-loamy texture with Deep Clay loam being fine textured. Dominant plants are Arizona fescue, muttongrass, flowery phlox and mountain big sagebrush.
R048AY247CO	**Deep Clay Loam** This site was originally written for the entire western slope of Colorado. This site is similar effective precipitation and does not recognize the difference in understory that can occur North to South in MLRA 48A. The resulting difference is the northern similar site has bluebunch wheatgrass and western wheatgrass, mules-ear as dominant plants with a winter dominated precipitation are and in South-Central area it has winter precipitation with the summer monsoonal rains resulting in the dominant grasses being western wheatgrass, milkvetch and pine needlegrass.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. vaseyana*
Herbaceous	(1) *Pascopyrum smithii*

Physiographic features

The landscape of this site varies from gently sloping to steep hilly lands. Most often the site occurs on mountain sides, valley sides and complex landslides. Occasionally it can be found on fill valleys, alluvial fans and slumps. The general range in elevation is between 7500 and 8800 feet. This site occurs in between oak motts (Brushy Loam ecological site) on hills and mountain sides between Montrose and Blue Mesa Lake.

Table 2. Representative physiographic features

Landforms	(1) Valley side (2) Hill (3) Landslide
Flooding frequency	None
Ponding frequency	None

Elevation	2,286–2,682 m
Slope	0–25%
Aspect	Aspect is not a significant factor

Climatic features

This plant community is usually found in the 16-20 inch precipitation zone, of which about 60% falls as snow. The average annual total snowfall is 83.5 inches. The highest snowfall record for the year in this area is 141.5 inches which occurred in 1957. This site normally has snow cover through the winter (November to March). This area is located in an area transitioning from Northern Colorado where the precipitation is winter dominated to southwestern Colorado where the climate is summer monsoonal dominant. The frost-free period typically ranges from 45 to 85 days. The shortest frost-free period on record is 30 days and the longest is 109 days. The last spring frost is the middle of June to the first week of July and the first fall frost is middle of August to the first week of September. Mean annual temperature ranges from 76.8 to -1.4ºF. The coldest winter temperature record was -38ºF in on January 4, 1974 and the coldest summer temperature recorded was 16ºF on June 15, 1976. The hottest day on record is 98 ºF on July 11, 1979. There is need for better climate data where is ecological site occurs. Ridgeway is the best representative climate station in the area for this climate zone. Better climate data is needed in this zone. Data is from Western Regional Climate Center (2012).

Table 3. Representative climatic features

Frost-free period (characteristic range)	42 days
Freeze-free period (characteristic range)	95 days
Precipitation total (characteristic range)	432 mm
Frost-free period (actual range)	42 days
Freeze-free period (actual range)	95 days
Precipitation total (actual range)	432 mm
Frost-free period (average)	42 days
Freeze-free period (average)	95 days
Precipitation total (average)	432 mm

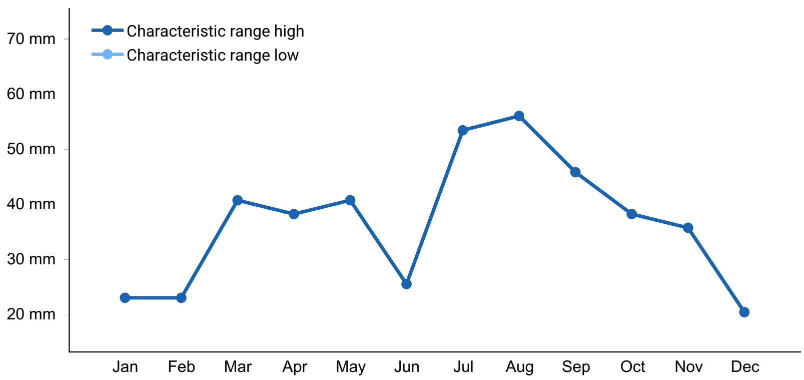


Figure 1. Monthly precipitation range

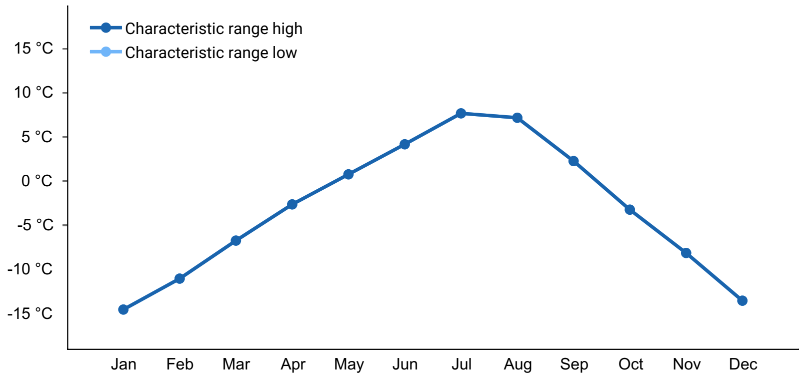


Figure 2. Monthly minimum temperature range

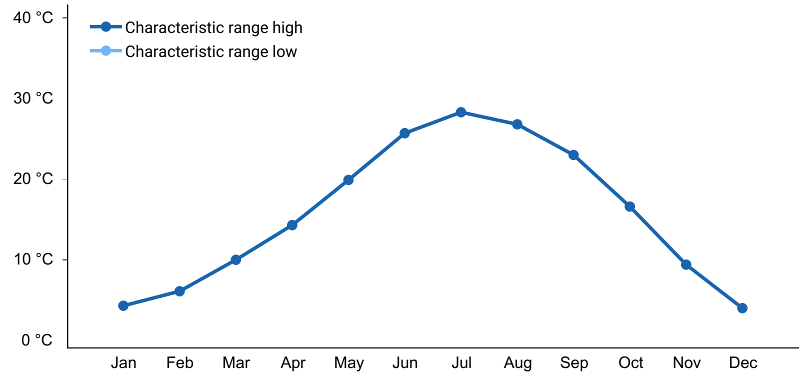


Figure 3. Monthly maximum temperature range

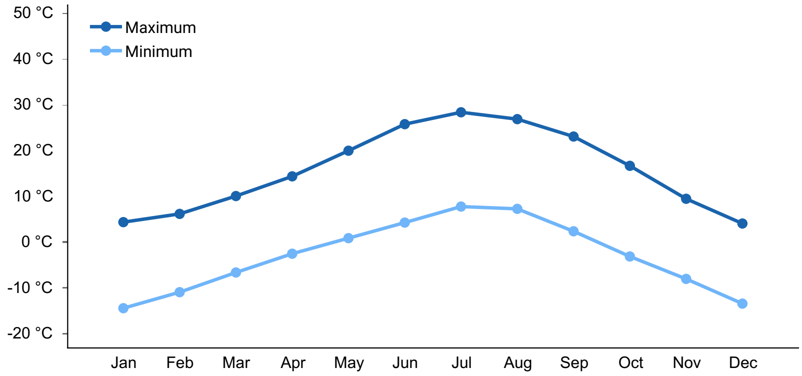


Figure 4. Monthly average minimum and maximum temperature

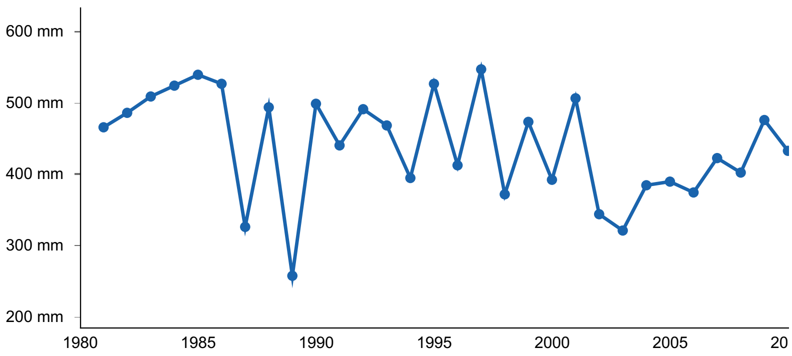


Figure 5. Annual precipitation pattern

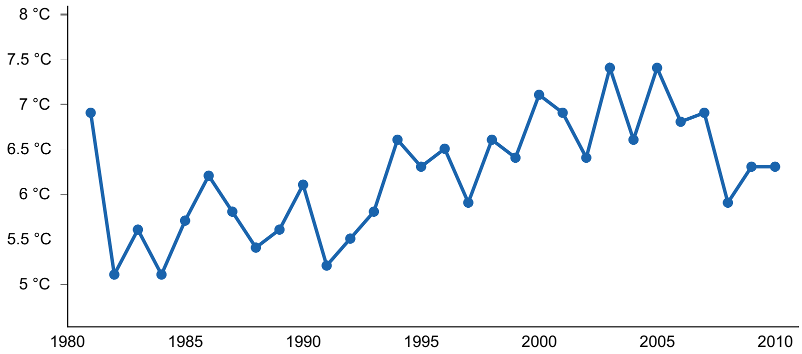


Figure 6. Annual average temperature pattern

Climate stations used

- (1) RIDGWAY [USC00057020], Ridgway, CO

Influencing water features

None

Soil features

Soils are deep with loam, silty clay loam or clay loam surface layers (25-38% clay). The A horizon is usually 2-6" in depth. The soil generally has mollic and argillic epipedons. The subsurface is silty clay or clay (35-55%+ clay). Soils are slowly to moderately slow permeable. When dry, the soil surface can have cracks an inch or more wide indicating high shrink swell (vertic) properties. Mollic epipedon ranging from 4 to 15 inches in depth slickensides are often present. Sometimes there are carbonates leached to 24" or deeper in the soil profile. The soil is in the fine particle control section. Parent materials are landslide deposits from shale, fine textured alluvium from shale, and clayey colluvium from silty shale and siltstone and sandstone mixed. Mancos shale is the most common shale parent material.

Cerro and Fughes are examples of the modal concept of this site.

Atypical soils included in this ecological site are deep clayey-skeletal soils. These soils are not included in the modal concept of this soil section. Atypical soils in the Gunnison and Ridgeway area are Karing and Thelma, very stony. These soils need to be investigated to see if they warrant their own ESD.

Older generation soil survey map unit cross the precipitation boundaries of this site and cross into subalpine clay. Subalpine clay occurs from 20-25” of precipitation and has mules-ear and silver sagebrush growing on in the central region on Colorado. The older mapunits run from 15/16 inches of precipitation to 24 inches of ppt. Soils data is based on field work and from the Soil Surveys of Gunnison Area (1975), Paonia and Ridgeway, Colorado. This section will be updated after soils/ESD update project is completed on these 3 surveys.

Figure 7. Soil Pit

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Colluvium–calcareous shale (3) Residuum–shale and siltstone
Surface texture	(1) Clay loam (2) Silty clay loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	76–152 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0–2%
Available water capacity (Depth not specified)	10.16–15.24 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–1
Subsurface fragment volume <=3" (Depth not specified)	0–2%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

This site is based on the range site Deep Clay Loam - R048XY247CO (SCS, 1976). This original site concept was written for the entire 48A MLRA, which covers the mountainous areas of Colorado. This ecological site is described and data collected primarily in the shale hills around the Montrose-Ridgeway area and a small area in the Gunnison Basin with a typic ustic soil moisture phase and cryic temperature regime. This site is treeless; however, trees are often in the general vicinity. This site is located below the spruce-fir tree line. The reference state is a cool season bunchgrass/shrub community. The appearance of this site is grassland in association with woody shrubs such as mountain big sagebrush, and several forbs. The dominant grass species are western wheatgrass, pine needlegrass, prairie Junegrass, bottlebrush squirreltail, Sandberg bluegrass, muttongrass, and upland sedges. The dominant shrub species is mountain big sagebrush. Yellow rabbitbrush and rubber rabbitbrush may be present in small amounts and will increase with some disturbances. Milkvetch, wild onion and yarrow are common on this site. These species account for most of the vegetative cover. There is a minor component of low-growing shrubs. Fluctuations in species composition and relative production may change from year to year depending upon precipitation and other climatic factors.

The Gunnison basin lies in the climatic zone where pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) normally occurs in other areas. But, due to the Gunnison Basin's unique ecological characteristics, the pinyon-juniper ecotone does not exist in the basin. But the intergradations zone with Wyoming big sagebrush and mountain big sagebrush do exist in the Gunnison Basin where you would normally find pinyon-juniper. Emslie, et al. (2005), state that the Gunnison Basin is recognized for its unusual ecological characteristics, including absence of certain plant taxa and vertebrates, The examples given is that pinyon pine is rare in the basin and absent is the western rattlesnake. The unique topography and climate of the Upper Gunnison Basin is what is thought to be the cause. Winters are extremely cold and cold air settles into the basin. Also, this area is drier than other regions at this elevation. It is thought that these factors of temperature, moisture and topography are responsible for the sagebrush dominated plant communities in the Upper Gunnison Basin (Emslie et al., 2005).

This ecological site is located in the Gunnison Basin which is in the transition zone from Wyoming big sagebrush to mountain big sagebrush; subsequently Bonneville hybrid will occur on this site between the other two subspecies. Mountain big sagebrush is found at elevations of 6800-8500 feet (Winward, 2004). Bonneville big sagebrush (Wyoming and mountain big sagebrush hybrid) has been found at the head of Long Gulch near Gunnison Colorado at about 8000 feet in elevation between the boundaries of Wyoming big sagebrush and mountain big sagebrush (Winward, 2004). UV fluorescent tests showed intergradations between the two subspecies and they occurred between 8-15 inches of precipitation with 12 inches being the average precipitation was where it was found (Goodrich et al., 1999). This ecological site is found at 14-19 inches of precipitation. Thus, Mountain big sagebrush and the hybrid will be on this site depending upon the position in regards to elevation and aspect in the basin. Johnson (2000) stated that mountain big sagebrush can be found growing with Wyoming big sagebrush.

Soils, topographic location, climate, periodic droughts and fire influenced the stabilization of the Reference State on this site as was the case on most high mountain valley ecological sites. The Reference State is presumed to be as found by European settlers in the early 1800's developed under the prevailing climate over time along with the soils in their topographic location. Grazing and/or browsing by wildlife influenced the plant community as well. The resulting plant community was a cool season bunchgrass/shrub community. Sagebrush taxa in Colorado above 8500 feet in elevation are in relatively good condition and appear to be recovering slowly from the impacts during the settlement period of the west (Winward, 2004). Sagebrush below 8500 feet has been slower to recover from settlement of the west (Winward, 2004). The high elevation valley of the Gunnison Basin sits in a transitional area where the climate and topographic location helped recovery of the sagebrush communities after European settlement of the west.

Natural fire played an important role in the function of most high mountain valley sites, especially the sagebrush communities. Grasses such as needlegrasses and bluegrasses were dependent upon fire to stimulate them. Fire also kept sagebrush stands from getting too dense, while invigorating other sprouting shrubs such as serviceberry and snowberry. Fire helped to keep a balance between the grasses, forbs and shrubs. Plant community dynamics was improved by opening up canopies and stimulating forb growth creating a mosaic of different age classes and species composition. Other than sagebrush, the deep rooted shrub species that grow on the site are not easily damaged by fire. Shrubs which re-sprout (yellow rabbitbrush, and snowberry), are suppressed for a time allowing grasses to dominate. If periodic fire does not occur, then sagebrush will slowly increase and can begin to dominate the site. Mountain big sagebrush communities are more prone to fire than Wyoming big sagebrush with fire return intervals (FRI) ranging from 10-115 years for Wyoming big sagebrush year (West and Hassan 1985, Evers, et al, 2011, Johnson, 2000). Mountain big sagebrush becomes dominant on this site if periodic burning or some other method of brush control is not used (10 to 50 year FRI) (Goodrich et al., 1999, Arno and Gruell, 1983, Evers, et al, 2011, Johnson, 2000). Fire size prior to 1850 were most likely a large number of small to medium size mosaic burns and since 1980 can be typified by a few very large fires due to human caused changes (Evers, et al, 2011). This change in fire return intervals and intensities was cause by fire suppression and reduced fine-fuels from livestock grazing practices around the late 1800’s and early 1900’s. Treatment response will vary among sites due to differences in vegetation composition and abundance, soils, elevation, aspect, slope and climate (McIver, et al, 2010). Since fire is not always available to be applied, then other practices may necessary from time to time to help keep the community in balance.

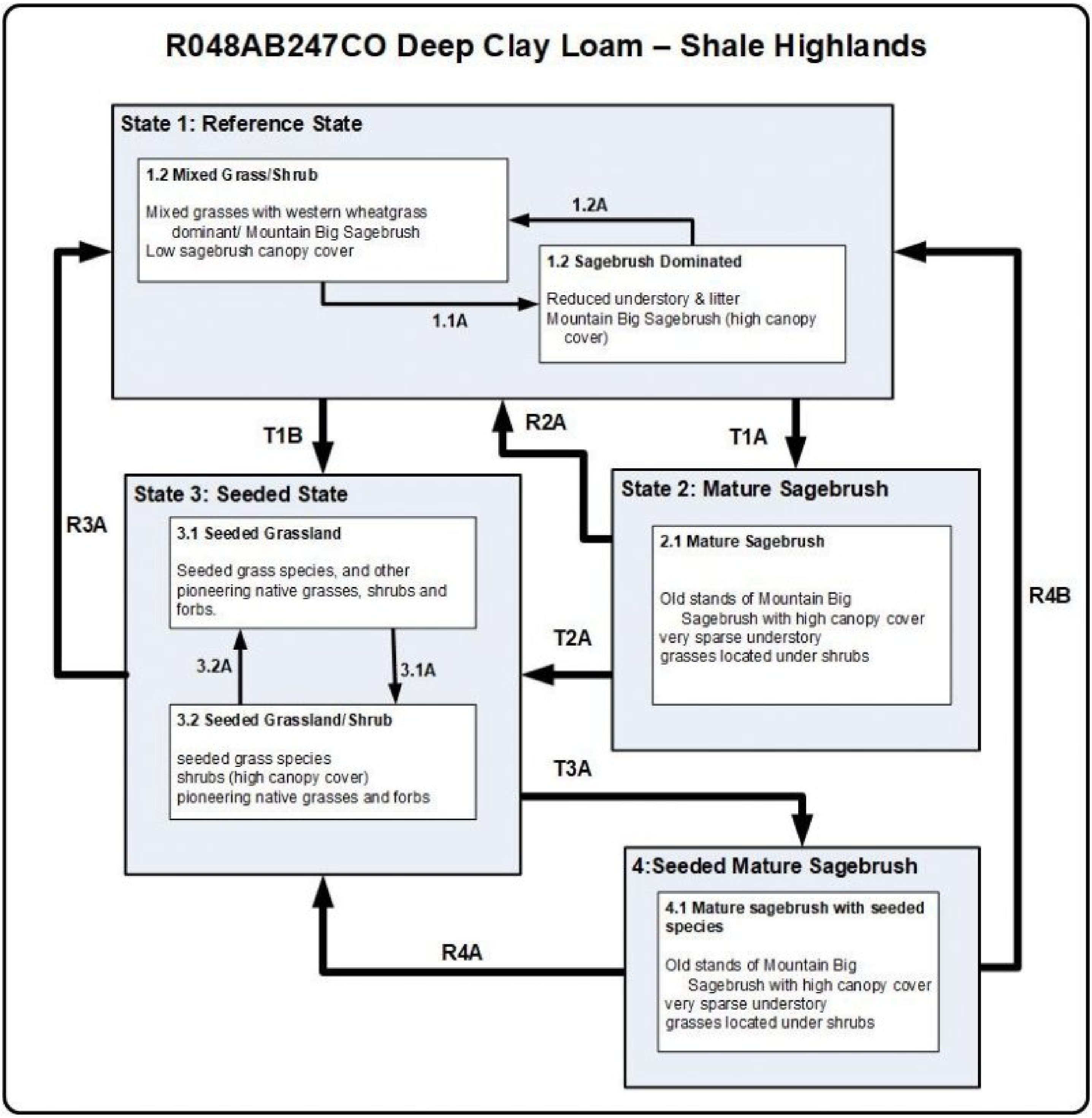
There has been shrub die-off in several sagebrush taxa in the past 10-15 years due to several factors. The two dominant factors are disease/pathogens and drought. Disease/pathogens to cause die-off are believed to be tied to disease or stem/root pathogens occurring in dense over-mature sagebrush stands throughout the west. It appears to be in older age sagebrush stands that most cases of disease/pathogen die-off are thinning sage densities. While in other cases, the factors of drought and heavy browsing occurring in conjunction with disease/pathogens complete areas are dying.

The major forces that influence the transition from the reference plant community are continuous season long grazing by ungulates and/or the decrease in the fire frequency. As ungulate numbers increase and grazing use exceeds a plant's ability to sustain defoliation, the more palatable and more productive species, and decline in stature, productivity and density.

Cheat grass is not typically found in this region due to the colder temperatures but it has been found primarily along roadsides, and campgrounds (Gasch and Bingham, 2006). A germination study of cheatgrass seeds collected in the Gunnison Basin showed significant differences in germination characteristics with regards to storage duration and germination temperature (Gasch and Bingham, 2006). This may indicate that cheatgrass is adapting to colder temperatures in the Gunnison Basin, but further study is needed (Gasch and Bingham, 2006). Based on evidence to date, cheatgrass is not found on this ecological site.

Variability in climate, soils, aspect and complex biological processes will cause the plant communities to differ. The species lists are representative and not complete list of all occurring or potentially occurring species on this site. The species lists are not intended to cover the full range of conditions, species and responses of the site. The State & Transition model depicted for this site is based on available research, field observations and interpretations by experts and could change as knowledge increases. This is the interpretive plant community and is considered to be the Reference Plant Community (RPC). This plant community evolved with grazing, fire, and other disturbances such as drought. This site is well suited for grazing by domestic livestock and wildlife and can be found on areas that are properly managed prescribed grazing.

State and transition model



Legend

1.1A, 3.1A, T1A, T3A – Extended improper grazing, lack of fire, extended drought, time without disturbance, and/or lack of insect/ pathogen outbreaks

1.2A, 3.2A – Fire, proper grazing, wet climatic cycles, vegetative treatments, and/or small scale insect/pathogen outbreaks

T1B, T2A – Seeded herbaceous species planted and/or shrub removal

R2A – fire, vegetation treatments, insect herbivory, drought, proper grazing, and/or encroached shrub removal

R3A, R4B – intensive management and inputs maybe required to return to reference state, wet climatic years, native plantings, vegetative treatments, proper grazing and/or fire

R4A – Fire, proper grazing, wet climatic cycles, small scale insect/pathogen outbreaks and/or seeding, vegetative treatments

State 1
Reference State

Dominant view of potential plant community of this ecological site is from grasses and forbs with mountain big sagebrush in the overstory. Western wheatgrass is the principal specie. Muttongrass, Columbia needlegrass, Letterman needlegrass, mountain brome and squirreltail are frequently occurring grasses. Major forbs are silver lupine, milkvetch, wild onion, Indian paintbrush, and yarrow. Mountain big sagebrush is the most conspicuous shrub. Serviceberry, yellow rabbitbrush and snowberry grow in scattered stands. Although this site is commonly bordered by spruce-fir or aspen woodlands, few of these or other trees actually grow on the site. This site favors rhizomatous species like western wheatgrass and yarrow because of the vertic soil properties that occur naturally on this site. This state represents the closest description and function of the site prior to European settlement. There are two dominant plant community phases in the reference state. Fire and drought are natural disturbances that change the pathways between community phases. Drought is frequent on this site and fires were of mixed intensity and frequency. Mountain big sagebrush sites it has on average 10-50 years FRI. Sagebrush species less than 50 years old are easily killed by fire (Miller and Eddleman, 2001). Most forb species which re-sprout from a caudex, corm, bulb, rhizome or rootstock exhibit rapid recovery following fire and suffrutescent low-growing or mat-forming forbs such as pussytoes or buckwheat can be severely damaged by fire (Miller and Eddleman, 2001).

Community 1.1
Mixed Grass/ Shrub

Figure 8. Landscape View

Figure 9. Landscape View

Figure 10. Close Up View

Dominant aspect of potential plant community of this ecological site is from grasses and forbs. Western wheatgrass, slender wheatgrass are the principal species. Subdominant grasses include muttongrass, Columbia needlegrass, Letterman's needlegrass, mountain brome, and squirreltail. Major forbs are silver lupine, milkvetch, Indian paintbrush, wild onion and yarrow. Mountain big sagebrush is the most conspicuous shrub. Serviceberry and snowberry grow in scattered stands. Although this site is commonly bordered by spruce-fir or aspen woodlands and oak motts, few of these or other trees actually grow on the site. The approximate canopy cover of mountain big sagebrush is 0-20%.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1009	1401	1709
Forb	448	560	729
Shrub/Vine	224	280	364
Total	**1681**	**2241**	**2802**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-35%
Grass/grasslike foliar cover	30-50%
Forb foliar cover	15-30%
Non-vascular plants	0-1%
Biological crusts	0-2%
Litter	10-30%
Surface fragments >0.25" and <=3"	0-2%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	15-30%	25-40%	5-15%
>0.15 <= 0.3	–	15-30%	25-40%	5-15%
>0.3 <= 0.6	–	10-20%	10-25%	2-8%
>0.6 <= 1.4	–	0-15%	0-5%	0-2%
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

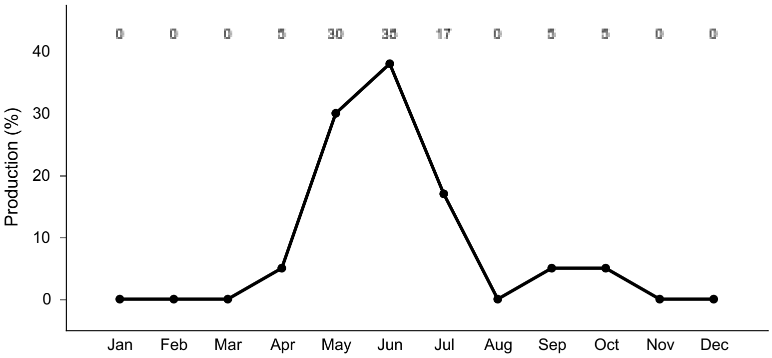


Figure 12. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

Community 1.2
Sagebrush Dominated

Figure 13. Landscape View

This community consists of a mountain big sagebrush dominated community with an increase in shrub cover and a decrease in the understory than the reference community. Grasses would include western wheatgrass, Sandberg bluegrass, prairie Junegrass and pine needlegrass. 20-40% mountain big sagebrush canopy cover would be present. The sagebrush would be moving towards a single age stand. Also, low shrubs such as yellow rabbitbrush and spineless horsebrush will increase and replace part of the herbaceous component in the understory. Lack of an understory helps to suppress low intensity fires as there is no fuel to carry the fire unless it is a high intensity fire. Increased sagebrush canopy can be due to lack of disturbance such as wildfire. Cumulating effects of degrading sagebrush habitats could include: higher erosion and sedimentation, decreased water quality, declines in forage base for domestic livestock, and decreased habitat for wildlife species (McIver, et al, 2010). This phase is losing species diversity compared with phase 1.1.

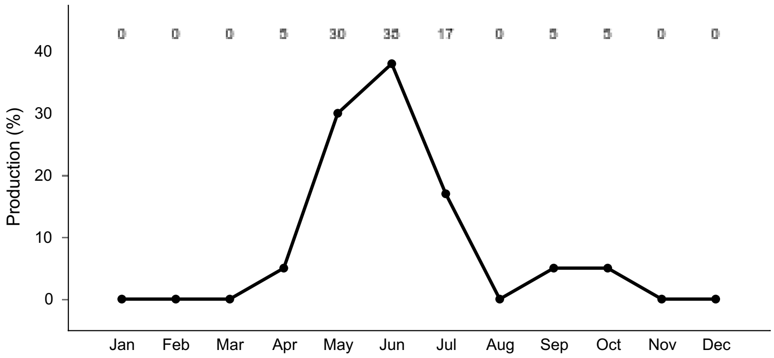


Figure 14. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

Pathway 1.1A
Community 1.1 to 1.2

Mixed Grass/ Shrub

Sagebrush Dominated

Natural occurring fire return intervals and intensities would characterize this pathway (McIver, et al, 2010). Brush management can be used to mimic this pathway. Drought and prescribed grazing or improper grazing can influence the timeframe of this community pathway. Short term drought during the winter and early spring will facilitate to increase the understory. Grasses respond quicker and take advantage of mid-summer and late summer moisture where the shrubs do not

Conservation practices

Brush Management
Fence
Prescribed Grazing

Pathway 1.2A
Community 1.2 to 1.1

Sagebrush Dominated

Mixed Grass/ Shrub

Fires occurring within the naturally occurring fire return intervals (10-50 years) would characterize this pathway. Total herbage production of grasses reach a maximum 2-5 years after burning after which it declines as sagebrush and other shrubs species increase; increased grass cover is short lived; forb cover has been found to have greater biomass 5-15 years after burning (Nelle et al, 2000). Improper grazing can decrease the understory; increase sagebrush canopy and shorten the time span it takes to transition back to reference community phase 1.1. Extended drought and improper grazing can change the time frame of this transition. Improper browsing and suitable grazing on the understory species can cause this shift, along with frequent fires prior to seed set for the sagebrush but after seed set for the understory, and large scale insect or pathogen die-off of the sagebrush could cause this pathway (Evers et al, 2011).

State 2
Mature Sagebrush

State 2 is a sagebrush dominated community. This state has an increase in shrub cover and a decrease in the understory cover from State 1. The sagebrush community is an even structured single age stand. Also, low shrubs such as yellow rabbitbrush will increase and replace part of the herbaceous component in the understory. This state has lower species diversity than State 1. Improper grazing management practices that lead to decreased deep rooted understory species can lead to compaction in the soil, erosion from lack of plant canopy, decreased organic matter in the soil, and increased soil exposure due to reduction in the litter cover. Sagebrush canopy cover would be >45%.

Community 2.1
Mature Mountain Big Sagebrush

Figure 15. Landscape View

This state has a very dense stand of Mountain big sagebrush with little to no understory. There may be a few remnant herbaceous plants under the sagebrush but the number of understory plants left would not be able to re-seed the site if there was a disturbance. This state is comprised predominantly of shrubs consisting of Mountain big sagebrush and yellow rabbitbrush. Trace amounts of Sandberg bluegrass, pine/Letterman's needlegrass may be present. Lack of an understory helps to suppress low intensity fires as there is a lack of fine fuels load to carry a low intensity fire; however, with high canopy cover, high intensity crown fires are a threat to this community. Increased sagebrush canopy can be due to lack of disturbance such as wildfire. Cumulating effects of degrading sagebrush habitats include higher erosion and sedimentation, decreased water quality, declines in forage base for domestic livestock, and decreased habitat for wildlife species (McIver, et al, 2010). This phase is losing species diversity compared with phase 1.1.

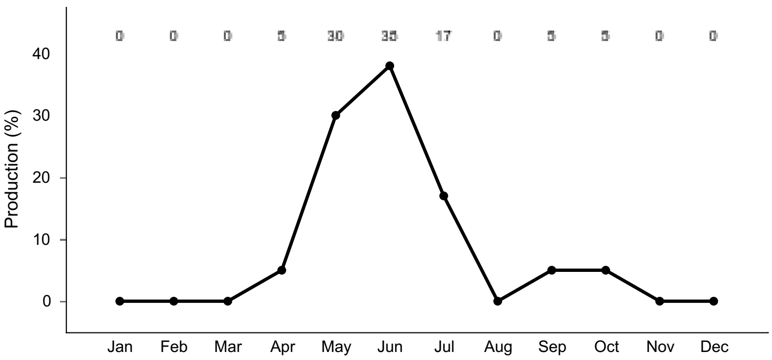


Figure 16. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

State 3
Seeded State

This state is characterized by the fact that sagebrush has been removed due to fire and/or shrub management treatments. Shrub management treatments may include techniques such as chaining, disking, or mowing. The community dynamics are similar to the reference state. This state could persist for long periods of time. Sagebrush will start to re-establish when the conditions are right for it to do so. This site has been historically seeded to perennial species such as smooth brome, intermediate wheatgrass, western wheatgrass, thickspike wheatgrass and Russian wildrye. Due to changes in the soil properties and seeded plants, this site is not likely to return to the Reference State without active restoration practices.

Community 3.1
Seeded Grassland

This state is characterized by introduced perennial grasses. This site is seeded to perennial species such as intermediate wheatgrass, orchard-grass, smooth brome and Russian wildrye. Sagebrush would reestablish from seed coming in from adjacent areas or in the seed bank after the land was seeded to the introduced grasses. Sandberg bluegrass and western wheatgrass would slowly establish in small amounts into this plant community phase. This community phase will need maintenance to remain in 3.1 by either fire or shrub management This pathway will cause short term topsoil loss and in turn reduction in water holding capacity of the soil at the surface as the understory is reduced and present to prevent runoff. The sagebrush canopy cover would be 0-20% and the herbaceous understory component has 30-40% canopy cover.

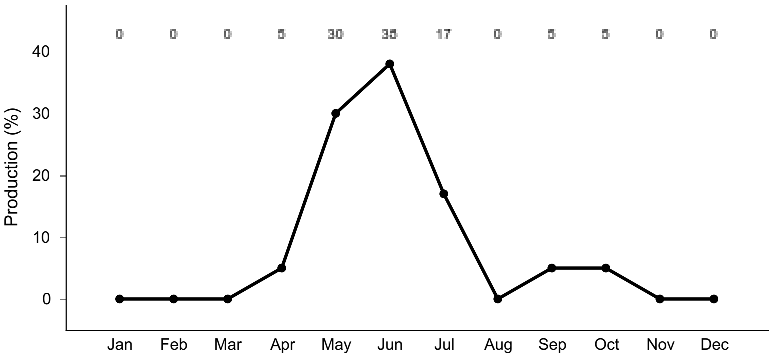


Figure 17. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

Community 3.2
Seeded Grassland/Shrub

This state is characterized by introduced perennial grasses which could include perennial species such as intermediate wheatgrass and Russian wildrye. This community phase will need maintenance to remain in this community phrase 3.2 by either fire or shrub management. This community would consist of seeded perennial grass such as Russian wildrye and intermediate wheatgrass with mountain big sagebrush established as the overstory species. This would result from sagebrush seed coming in from adjacent areas or in the seed bank after the land was seeded to the introduced grasses. Also, mountain big sagebrush could be in a species in the seed mix when the seeding occurred. The canopy of sagebrush cover would be approximately 20-40%.

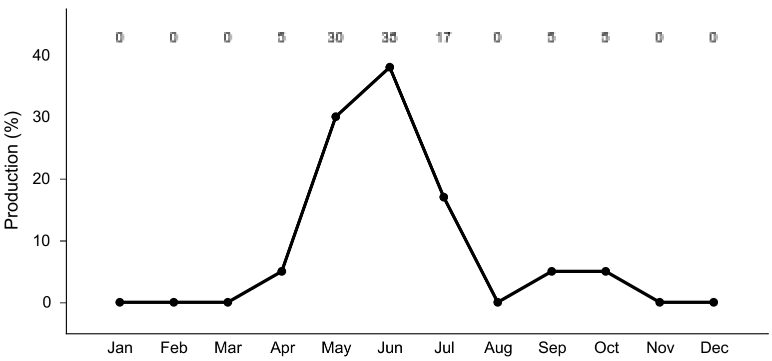


Figure 18. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

Pathway 3.1A
Community 3.1 to 3.2

The natural pathway is lack of fire over time. Improper grazing on the understory species and little to no seedling establishment or regeneration time with result in increased sagebrush canopy cover and establishment.

Pathway 3.2A
Community 3.2 to 3.1

Proper grazing and wet climatic periods can move this community towards community phase 3.1. Shrub management including herbicides can be used to mimic the pathways. Pathogens and insect mortality of establishing sagebrush can influence this pathway. Short term drought during the winter and early spring will facilitate to increase the understory. Grasses respond quicker and take advantage of mid-summer and late summer moisture where the shrubs do not.

State 4
Seeded Mature Sagebrush

State 4 would be a sagebrush dominated community; This state would have an increase in shrub cover and a decrease in the understory cover. The sagebrush community would be an even structured single age stand. Introduced species would have decreased in this state. Also, low shrubs such as yellow rabbitbrush and spineless horsebrush will increase and replace part of the herbaceous component in the understory. This state has low species diversity. Improper grazing management practices that lead to decreases deep rooted understory.

Community 4.1
Mature Mountain Big Sagebrush/ Introduced grasses

This state has greater than 45% live canopy cover of mountain big sagebrush. The understory is reduced so that there is little to no grass and forb cover in the interspaces. The grass and forb cover left will be found in directly under the canopy of the Wyoming big sagebrush plants. Also, there is active soil erosion.

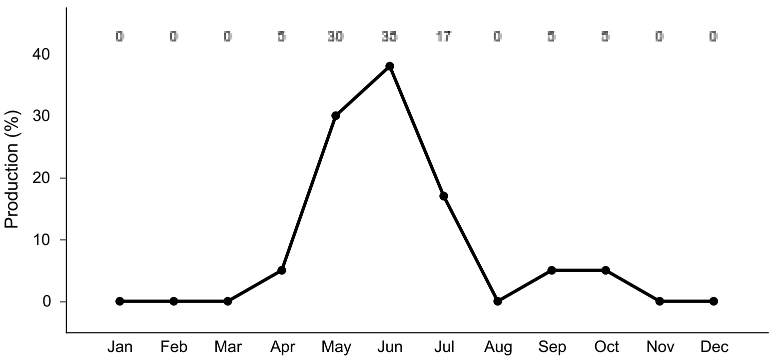


Figure 19. Plant community growth curve (percent production by month). CO0105, MLRA 48A - Mountain Sites. MLRA 48A.

Transition T1A
State 1 to 2

Improper grazing for extended periods during the growing season can reduce the fine fuels of the understory and thus, favor sagebrush encroachment. Lack of fire over time can cause this transition (McIver, et al, 2010). Extended periods of drought, lack of insect and pathogen activity can influence this pathway to create a more single age stand of sagebrush. This transition is characterized by loss of the understory and increased bare ground between the shrubs and/or other evidence of increased soil erosion. Fine fuels depletion due to inappropriate grazing has shifted fire regimes, from relatively frequent and low to mixed severity (10-70 years mean FRI) to more frequent and high severity (>70 years mean FRI).

Transition T1B
State 1 to 3

This transition is human induced through shrub management, prescribed burning and/or reseeding with introduced species after a catastrophic wildfire.

Restoration pathway R2A
State 2 to 1

Proper grazing, wet climatic periods, fire after seed set of the understory, and small scale insect and pathogen mortality of shrubs can move this community towards diverse understory and away from the dense single age stand of sagebrush (Evers et al, 2011). Shrub management including herbicides, prescribed burning can be used to mimic the pathways and seeding with natives after treatment.

Transition T2A
State 2 to 3

This transition is human induced through shrub management, prescribed burning and/or reseeding with introduced species after a catastrophic wildfire.

Restoration pathway R3A
State 3 to 1

This site could be restored to resemble the reference site of western wheatgrass and mountain big sagebrush community by seeding mixtures of commercially available native grasses, forbs, and shrubs. Selective remove of introduced species might be needed also, to restore this site. With proper management, over time this site can be come close to the diversity and complexity of the reference state. This can be an intensive option on a large scale.

Transition T3A
State 3 to 4

Improper grazing for extended time frames and lack of fire are the main pathways. Extended drought can influence the production of the understory and combine with improper grazing can reduced this state back to a mature/single age shrub community with a few introduced seeded understory species found mostly under the canopy of the shrubs.

Restoration pathway R4B
State 4 to 1

This site could be restored to resemble the reference site of Western Wheatgrass and Mountain big sagebrush community by seeding mixtures of commercially available native grasses, forbs, and shrubs. Selective remove of introduced species might be needed also, to restore this site. With proper management, over time this site can be come close to the diversity and complexity of the reference state. This can be an intensive option on a large scale.

Restoration pathway R4A
State 4 to 3

Fire and wetter climatic periods can cause the mature/single age shrub communities to go back to a grassland state if proper grazing strategies are implemented. This will only happen if enough seed is in the seed bank to regenerate the understory species. If the seed or mature plants are not available for this pathway then the site may need to be re-seeded. Shrub management practices such as prescribed burning, prescribed grazing and seeding could be used to assist in moving this state 4 to state 3.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Native Cool Season Rhizomatous**			448–1121	
	western wheatgrass	PASM	*Pascopyrum smithii*	448–1121	30–55
	Geyer's sedge	CAGE2	*Carex geyeri*	22–140	5–10

2	**Dominant Native Cool Season Bunchgrasses**			112–673	
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	22–168	3–10
	pine needlegrass	ACPI2	*Achnatherum pinetorum*	22–168	3–10
	muttongrass	POFE	*Poa fendleriana*	22–157	5–15
	mountain brome	BRMA4	*Bromus marginatus*	22–112	1–10
3	**Occasional Native Cool Season Bunchgrasses**			45–448	
	squirreltail	ELEL5	*Elymus elymoides*	11–112	1–5
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–112	1–3
	Sandberg bluegrass	POSE	*Poa secunda*	11–84	0–5
	western needlegrass	ACOC3	*Achnatherum occidentale*	11–56	1–3
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–34	0–1
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	0–1
	Arizona fescue	FEAR2	*Festuca arizonica*	0–22	0–1
Forb					
4	**Dominant Perennial Native Forbs**			84–336	
	milkvetch	ASTRA	*Astragalus*	28–140	5–20
	onion	ALLIU	*Allium*	28–112	5–15
	common yarrow	ACMI2	*Achillea millefolium*	28–112	1–10
5	**Subdominant Perennial Native Forbs**			168–504	
	fleabane	ERIGE2	*Erigeron*	11–168	1–10
	silvery lupine	LUAR3	*Lupinus argenteus*	28–168	1–10
	agoseris	AGOSE	*Agoseris*	28–140	1–5
	Indian paintbrush	CASTI2	*Castilleja*	28–84	1–5
	larkspur	DELPH	*Delphinium*	28–84	1–5
	beardtongue	PENST	*Penstemon*	28–84	1–5
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	11–84	1–3
	American vetch	VIAM	*Vicia americana*	28–56	1–3
6	**Occasional Perennial Native Forbs**			11–168	
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	0–56	0–5
	pussytoes	ANTEN	*Antennaria*	2–56	1–3
	alumroot	HEUCH	*Heuchera*	0–28	0–5
	longleaf phlox	PHLO2	*Phlox longifolia*	2–28	0–3
	cinquefoil	POTEN	*Potentilla*	0–28	0–3
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	6–28	1–3
	Gunnison's mariposa lily	CAGU	*Calochortus gunnisonii*	0–28	0–3
	leather flower	CLEMA	*Clematis*	0–28	0–3
	bastard toadflax	COUM	*Comandra umbellata*	0–28	0–3
	springparsley	CYMOP2	*Cymopterus*	2–28	0–3
Shrub/Vine					
7	**Dominant Native Non-sprouting Shrub**			112–336	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	112–336	–

8	**Occasional Native Non-Sprouting Shrubs**			11–56	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	11–84	1–5
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	6–28	1–5
	prairie sagewort	ARFR4	*Artemisia frigida*	0–6	0–1
	currant	RIBES	*Ribes*	0–6	0–1
	Woods' rose	ROWO	*Rosa woodsii*	0–6	0–1
9	**Occasional Native Sprouting Shrubs**			6–45	
	roundleaf snowberry	SYRO	*Symphoricarpos rotundifolius*	11–56	1–5
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–11	0–1

Animal community

INTERPRETATIONS FOR GRAZING ANIMALS:
This site provides a high value rating for cattle, sheep, and horses (SCS, 1976).

INTERPRETATIONS FOR WILDLIFE:
The site offers a high value rating for elk and upland game birds. It offers a medium value rating for antelope and deer. It is not used by cottontails, jackrabbits, or waterfowl (SCS, 1976).

Hydrological functions

Soils were originally assigned to hydrologic soil groups based on measured rainfall, runoff, and infiltrometer data (Musgrave 1955). Since the initial work was done to establish these groupings, assignment of soils to hydrologic soil groups has been based on the judgment of soil scientists. Assignments are made based on comparison of the characteristics of unclassified soil profiles with profiles of soils already placed into hydrologic soil groups. Most of the groupings are based on the premise that soils found within a climatic region that are similar in depth to a restrictive layer or water table, transmission rate of water, texture, structure, and degree of swelling when saturated, will have similar runoff responses. Four (4) Hydrologic Soil Groups are recognized (A-D). For specific definitions of each hydrologic soil group see the National Engineering Handbook, Chapter 7, Part 630 Hydrology, or visit: http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=22526.wba The hydrologic soil groups are based on the following factors:

-intake and transmission of water under the conditions of maximum yearly wetness (thoroughly wet)
- soil not frozen
- bare soil surface
- maximum swelling of expansive clays

The slope of the soil surface is not considered when assigning hydrologic soil groups. In its simplest form, hydrologic soil group is determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less water impermeable (such as a fragipan or duripan) or depth to a water table (if present). (Caudle, et. al, 2013)

The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Soil Hydrologic Group

Typical Soils -
Cerro - C
Fughes - C

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission (Soil Survey Staff, 2014).

Recreational uses

This site offers a high value rating for recreation and natural beauty.

Wood products

No wood products are produced on this site.

Other information

FIELD OFFICES

This site is in the Gunnison, Montrose, and Grand Junction field offices.

Other references

Arno, Stephen F. and Gruell, George E. 1983. Fire history at the forest-grassland ecotone in southwestern Montana. Journal of Range Management. 36(3): 332-336.

Chapman, S.S., G.E. Griffith, J.M. Omernik, A.B. Price, J. Freeouf, and D.L. Schrupp. 2006. Ecoregions of Colorado. (2 sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:1,200,000.

Caudle, D., H. Sanchez, J. DiBenedetto, C. Talbot, and M. Karl. 2013. Draft Interagency Ecological Site Handbook for Rangelands. US Dept. of Agriculture. Washington D.C

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored.

Emslie, S. D., M. Stiger, and E. Wambach. 2005. Packrat Middens and late Holocene environmental change in southwestern Colorado. The Southwestern Naturalist 50(2): 209-15.

Evers, L., R. F. Miller, M. Hemstrom, J. Merzenich, and R. Neilson. 2011. Estimating historical sage-grouse habitat abundance using state-and-transition model. Natural Resources and Environmental Issues Vol. 17 Article 16. 1-13 pp.

Gasch, C. and R. Bingham. 2006. A Study of Bromus tectorum L. seed germination in the Gunnison Basin, Colorado. BIOS 77(1): 7-12.

Goodrich, S., E. D. McArthur, and A. H. Winward. 1999. Sagebrush Ecotones and Average Annual Precipitation. In: McArthur, E. D.; K. W. Ostler, C. L. Wambolt, comps 1999. Proceedings: shrubland ecotones; 1998 August 12-14: Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: USDA, Forest Service, Rocky Mountain Research Station.

Johnson, Kathleen A. 2000. Artemisia tridentata subsp. vaseyana. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 28].

McIver, J. D., Brunson, M., Bunting, S. C., and others. 2010. The sagebrush steppe treatment evaluation project (SageSTEP): a test of state-and-transition theory. Gen. Tech. Rep. RMRS-GTR-237. Fort Collins, CO. USDA, Forest Service, Rocky Mountain Research Station. 16 p.

Musgrave, G.W. 1955. How much of the rain enters the soil? In Water: U.S. Department of Agriculture Yearbook. Washington, D.C. pp. 151â€“159.

Nelle, P. J., K. P. Reese, and J. W. Connelly. 2000. Long-term effects of fire on sage grouse habitat. Journal of Range Management 53: 586-591.

Soil Conservation Service (SCS). December 1976. Range Site Description for Deep Clay Loam #247: USDA, Denver Colorado

Soil Survey Staff, Natural Resources Conservation Service, US Dept. of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed [08/25/2014].

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA- SCS. 1975. Soil Survey of Gunnison Area, Colorado. Gunnison: parts of Gunnison, Hinsdale, and Saguache Counties. US Dept. of Agriculture. Washington D.C.

West, N.E. and M.A. Hassan. 1985. Recovery of sagebrush-grass vegetation following wildfire. Journal of Range Management 38(2):131-134.

Western Regional Climate Center. Retrieved from http://www.wrcc.dri.edu/summary/Climsmco.html on May 10, 2012

Winward, A. H. 2004. Sagebrush of Colorado: taxonomy, distribution, ecology and management. Colorado Division of Wildlife, Department of Natural Resources, Denver, Colorado 46pp.

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Approval

Kirt Walstad, 3/05/2024

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--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)	Original participants: J. Murray, C. Holcomb, L. Santana, F. Cummings, S. Jaouen on 01/18/2005 Updated 8/27/2014 by Suzanne Mayne-Kinney
Contact for lead author	Colorado State Rangeland Management Specialist, Rachel Murph 720-544-2866
Date	08/27/2014
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Slight. A few short rills slight on slopes less than 15%. Rills can be more defined on slopes greater than 15%. After intense storms, after wildfires, extended droughts or a combination of these disturbances rill will increase in number.

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2. **Presence of water flow patterns:** Slight. Flow paths should be short and mostly disconnected with debris dams obvious. Flow patterns should only be present following an intense weather event. Flow length and numbers will

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3. **Number and height of erosional pedestals or terracettes:** Some pedestals can be expected near or in flow paths from water. Wind cause pattern are rare and usually only on this site after wildfires, and/or extended drought. On steeper slopes, with the additional water from intense storms, slightly more pedestals would be expected.

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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 10-20% 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 drainages are present they are stabilized with native vegetation and should show no active signs of erosion. Some gullies may be present on steeper slopes where flows have concentrated from high intensity, low frequency rainfall events.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind erosion is minimal to non-existent. Significant wind erosion would only be present following wildlife, and/or extended drought. Wind scour, blowouts and/or depositional areas should be rare and only associated with disturbances (examples: bedding areas and small mammal burrows).

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should be evenly disturbed across the site with it being a little thicker under the shrub canopy. Litter movement consists primarily of redistribution of fine litter (herbaceous plant material) associated with flow paths. Movement is expected to be short and minimal. Litter movement will be greater after wildfires, extended drought and other disturbances. High intensity thunderstorms may increase the amount and size of materials moved.

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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 are expected to 5-6 under the plant canopy and protected and 3-4 in the interspaces with no protection at soil surface.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM is 1-5%. Surface soils range from silty clay loam to clay loam. Soils are typically deep and well drained with a high water holding capacity. The A-horizon ranges from a 0-10 inch depth with a grayish brown color The surface structure can be weak fine granular, weak medium granular, weak fine sub-angular blocky and weak medium sub-angular blocky structures.

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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, forb, shrub canopy and root structure reduces raindrop impact and slows overland flow providing increased time for infiltration to occur. The heavy clay soils on this site are naturally subject to slow infiltration but the perennial vegetation provides adequate cover to intercept most rain drops and reduce raindrop splash erosion. Extended drought reduces perennial plant cover which in turn causes decreased infiltration and increased runoff following intense storms.

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be present. . Naturally occurring soil horizons may be harder than the surface and should not be considered as compaction layers.

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

    Dominant: Dominant Native Cool Season Rhizomatous >> Subdominant Perennial Native Forbs > Dominant Native Cool Season Bunchgrass>

    Sub-dominant: Occasional Native Cool Season Bunchgrasses = Dominant Native Non-Sprouting Shrub > Dominant Perennial Native Forbs = Subdominant Perennial Native Forbs>>

    Other: Occasional Native non-sprouting Shrubs > Occasional Sprouting Native 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. Expect slight shrub and grass mortality/decadence during and following drought. Extended drought would tend to cause relatively high mortality in short lived species. Shrub mortality would be limited to

severe droughts. Sagebrush species are most affected by lack of snow during the winter. The combination of wildfire and extended droughts would cause even more mortality for several years after the fire than either disturbance functioning by itself would cause.

---

14. **Average percent litter cover (%) and depth (in):** The reference community average 50-60% litter under the shrub canopy and 10 to 30% in the interspaces where no plant cover is litter cover declines during and following a drought. After wildfires, and/or extended droughts, litter cover and depth decreases to none immediately after the disturbance and dependent on climate and plant production increase to post-disturbance levels in 1 to 5 growing seasons.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1500 lbs. /ac. low precipitation years; 2000 lbs. /ac. average precipitation years; 2500 lbs./ac. above average precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 500 – 600 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

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17. **Perennial plant reproductive capability:** All plant species should be capable of reproduction depending on availability of water. All plants should be vigorous, and healthy. Plant should produce seed heads and, vegetative tillers, etc. The only limitations are weather-related, wildfire, natural disease, inter-species competition, wildlife, and insects that may temporarily reduce reproductive capability.
