USDA Natural Resources Conservation Service

Ecological site R048AA231CO
Dry Mountain Loam Gunnison Basin LRU

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 048A–Southern Rocky Mountains

MLRA 48A makes up about 45,920 square miles (119 000 square kilometers). It is in the Southern Rocky Mountains province, which is east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande rift. MLRA 48A is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers, including the Colorado, Yampa, Arkansas, Rio Grande, North Platte, and South Platte Rivers are in this MLRA. It has numerous national forests, including the Medicine Bow National Forest in Wyoming; the Routt, Arapaho, Roosevelt, Pike, San Isabel, White River, Gunnison, Grand Mesa, Uncompahgre, Rio Grande, and San Juan National Forests in Colorado; and the Carson National Forest and part of the Santa Fe National Forest in New Mexico. Rocky Mountain National Park also is in this MLRA.

MLRA 48A is in the southern Rocky Mountains physiographic region. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Some high mesas and plateaus are included. The mountains were uplifted during the Laramide orogeny and then were subject to periods of glaciation. The ranges include the Sangre de Cristo Mountains, Laramie Mountains, and Front Range in the east and the San Juan Mountains and Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys that have steep gradients. In some areas, the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation of the MLRA typically is 6,500 to 14,400 feet (1980 to 4390 meters). The part of the MLRA in central Colorado includes the highest point in the Rocky Mountains, Mount Elbert, which reaches an elevation of 14,433 feet (4400 meters). More than 50 peaks in this part of the MLRA are at an elevation of more than 14,000 feet (4270 meters). Many small glacial lakes are in the high mountains.

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

The average annual precipitation is dominantly 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About one-half of the annual precipitation is received as snow in winter; the proportion increases as elevation increases. In the mountains, deep snowpack accumulates in winter and generally persists

until spring or early in summer, depending on elevation. Some permanent snowfields and small glaciers are on the highest mountain peaks. In the valleys at the lower elevations, snowfall is lighter and snowpack may be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days, but it ranges from 45 to 230 days, decreasing in length as elevation increases. The climate of this MLRA varies according to the elevation. Precipitation is higher and temperatures are cooler at the higher elevations. The plant communities vary according to elevation, aspect, and latitude due to variations in the kind and timing of the precipitation and the temperature.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy typically is mixed, smectitic, or paramicaceous. In areas of granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on the mountain slopes and Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on the mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on the mountain slopes at low elevations that receive a low amount of precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on the mountain slopes at high elevations.

LRU notes

This site occurs only in the Gunnison Basin Land Resource Unit. The Gunnison Basin is a valley with hills that occurs along the frigid/cryic temperature break and the aridic bordering on ustic/typic ustic climate break. Gunnison Basin has 5 dominant ecological sites.

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

Classification relationships

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

USFS:
M331G – South-Central Highlands Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

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

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

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 description of the Dry Mountain Loam Gunnison Basin LRU ecological site was drafted from the description of the Dry Mountain Loam range site (R048XY231CO, August 1975). The original concept was expanded based on the soil temperature and moisture regimes and the climate to cover the entire western slope of Colorado. The concept for this site was derived from data collected in the Gunnison Basin land resource unit of Colorado.

Dry Mountain Loam occurs mainly hillsides. Slopes average between 5 and 25% but can range up to 45% in some areas. Soils are moderately deep (20-40 inches); fine-loamy soils derived from slope alluvium derived from rhyolite and/or sedimentary rock or residuum from granite and rhyolite. Surface textures are fine sandy loam or gravelly sandy loam with loamy subsurface with an average of 20-30% clay. It is a Wyoming Big Sagebrush - Indian Ricegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.

Associated sites

R048AA235CO	**Dry Exposure Gunnison Basin LRU** Dry Exposure occurs mainly ridgetops, hills, and hillsides. Slopes average between 5 and 45%. Soils are shallow (10-20 inches); loamy soils derived from slope alluvium derived from rhyolite and/or or residuum from granite, gneiss, or rhyolite. Surface textures are gravelly loam with loamy subsurface with an average of 20-30% clay. It is a Black Sagebrush – Muttongrass - Squirreltail community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.
R048AA245CO	**Mountain Swale Gunnison Basin LRU** Mountain Swale occurs mainly swales, flood plains or drainageways. Slopes average between 1 and 15%. This is a run-in site which after large precipitation events or during spring snowmelt, water may flow in channels for short periods. Normally, water spreads out across the site rather than flowing in channels. If a water table is present is it greater than 60 inches during the growing season. Soils are deep to very deep (40-60+ inches); fine-loamy soils derived from alluvium derived from igneous, metamorphic, and sedimentary rock. Surface textures are loam, sandy loam, or silt loam with a loamy subsurface. It is a basin wildrye-slender wheatgrass-Wood's Rose community. It has an aridic ustic or typic ustic moisture regime. The effective precipitation ranges from 12 to 20 inches.
R048AA228CO	**Mountain Loam Gunnison Basin LRU** Mountain Loam occurs mainly hills, hillsides, mountainside, or mountain slopes. Slopes average between 3 and 25% but can range up to 45% in some areas. Soils are moderately deep to deep (20-60+ inches); fine-loamy soils derived from colluvium derived from rhyolite; slopes alluvium derived from rhyolite; colluvium derived from volcanic and sedimentary rock or igneous and metamorphic rock; residuum weathered from schist; or old alluvium derived from basalt and/or glacial till from basalt. Surface textures are loam, sandy loam, gravelly sandy loam, or sandy clay loam with subsurface clay content ranging from 25 to 45% clay. It is a Mountain Big Sagebrush -Arizona Fescue-needlegrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Similar sites

R048AY231CO	**Dry Mountain Loam** The concept for site R048AA231CO originally was for the entire western slope of Colorado. This entire area has similar effective precipitation, but the understory may differ from north to south in MLRA 48A. In the northern area, bluebunch wheatgrass is the dominant grass species and most of the precipitation is received in winter. In the south-central area, Indian ricegrass and pine needlegrass are the dominant grasses and precipitation is received in winter and as monsoonal rain in summer.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

The topography of this site is gently sloping to hilly. Slope commonly is 5 to 25 percent, but it can range to 45

percent in some locations. Elevation typically is 7,400 to 8,200 feet; aspect does not influence the site at this elevation. At elevations as high as 8,700 feet, the site is on south and southwest slopes and the effective precipitation is lower than at the lower elevations. The shape of the slopes is linear or convex. The prevailing winds blow snow from this site and deposits it in the concave position where R048AA228CO Mountain Loam can be found in small pockets on the landscape.

Table 2. Representative physiographic features

Landforms	(1) Hillslope (2) Hill
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,256–2,499 m
Slope	5–25%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 12 to 16 inches, of which 50 percent or more is received as snow. The average total snowfall is 49.7 inches at the Gunnison 1 N climate station. The highest annual snowfall, 104.9 inches, was recorded at the Gunnison 1 N climate station in 2008. This site is on south and west aspects, which are drier because of solar radiation and the prevailing winds.

The optimum growing season for native plants is late in spring through midsummer. The frost-free period is 55 to 75 days. The last frost in spring occurs sometime in the middle of June to the first week of July, and the first frost in fall is as early as the middle of August to the first week of September. The mean annual air temperature is 80.7 to -7.4 degrees F. The coldest temperature in winter, -47 degrees F, was recorded on December 10, 1939, and the coldest temperature in summer, 15 degrees F, was recorded on June 1, 1919. The mean annual air temperature is 37.7 degrees F. Associated with this site are areas in which wind exposure limits the height and growth of plants. Climate data are from the Western Regional Climate Center, Cochetopa and Gunnison 1 N climate stations (2012).

Table 3. Representative climatic features

Frost-free period (characteristic range)	35-47 days
Freeze-free period (characteristic range)	82 days
Precipitation total (characteristic range)	305-406 mm
Frost-free period (actual range)	32-50 days
Freeze-free period (actual range)	82 days
Precipitation total (actual range)	305-406 mm
Frost-free period (average)	41 days
Freeze-free period (average)	82 days
Precipitation total (average)	356 mm

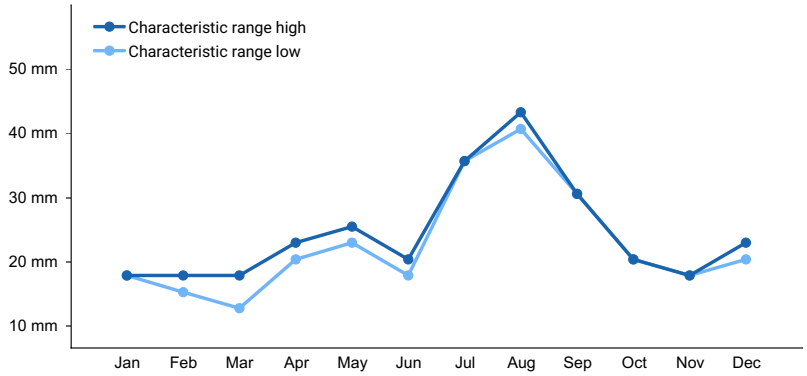


Figure 1. Monthly precipitation range

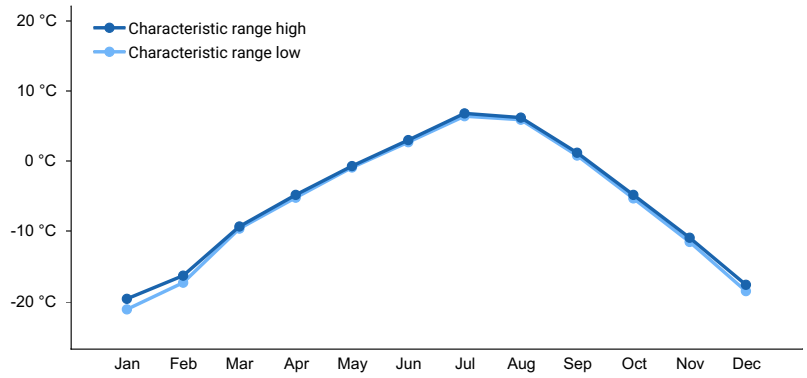


Figure 2. Monthly minimum temperature range

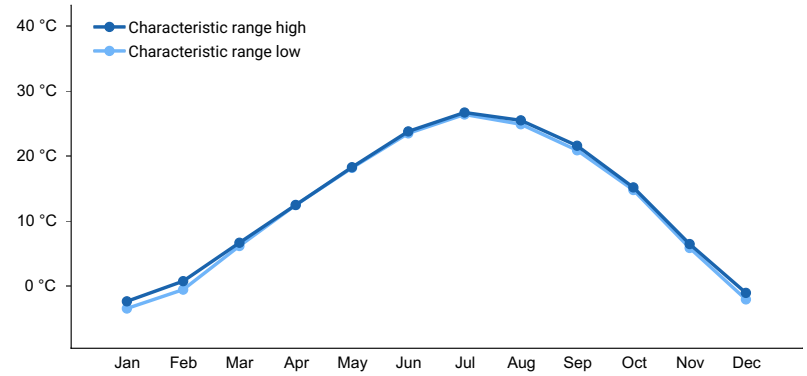


Figure 3. Monthly maximum temperature range

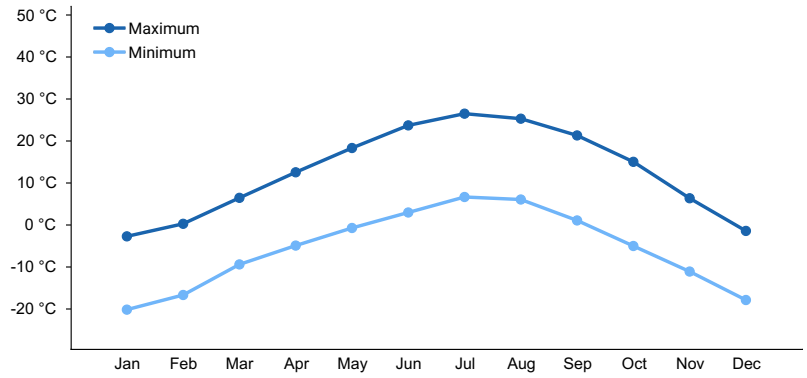


Figure 4. Monthly average minimum and maximum temperature

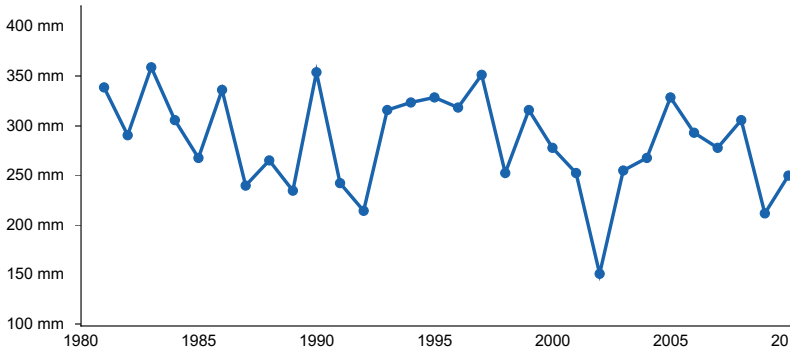


Figure 5. Annual precipitation pattern

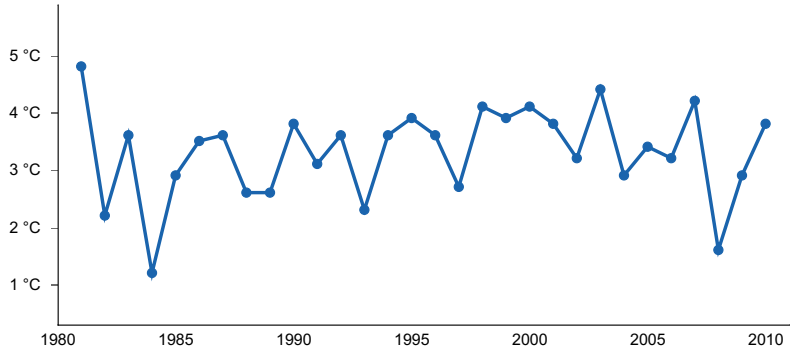


Figure 6. Annual average temperature pattern

Climate stations used

- (1) GUNNISON 3SW [USC00053662], Gunnison, CO
- (2) COCHETOPA CREEK [USC00051713], Gunnison, CO

Influencing water features

None

Soil features

The soils are dominantly gravelly sandy loam, gravelly loam, loam or fine sandy loam on the surface. The soil surface layer is usually 3 to 9 inches thick. The surface texture is typically between 15-20% clay content. The subsurface ranges from a heavy loam, clay loam or sandy clay loam which is heavier than the soil surface. The clay content of the subsurface is generally between 20-30% clay content. The soils typically are 20 to 40 inches deep (moderately deep). The rock fragments are typically under 3 inches in size and less than 30% rock fragments. The soil moisture regime is aridic bordering on ustic and the soil temperature regime is frigid.

The soil typically correlated to this site is Duffson. This section reflects information from an update of the soil map units and ecological sites conducted in 2011-2019 rather than that in the 1975 soil survey of Gunnison County Area.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–rhyolite (2) Slope alluvium–sedimentary rock (3) Residuum–granite (4) Residuum–rhyolite
Surface texture	(1) Gravelly sandy loam (2) Fine sandy loam (3) Loam (4) Gravelly loam

Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	51–102 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	7.62–10.67 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Soil reaction (1:1 water) (Depth not specified)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–30%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The description of this site is based on the existing description of the Dry Mountain Loam range site (R48XY231CO) (USDA-SCS, 1975). The original site concept covered the entire MLRA 48A, which consists of the mountainous areas in Colorado. The concept for this ecological site covers primarily the high mountain areas in the Gunnison Basin area. The site has an aridic bordering on ustic soil moisture regime and a frigid temperature regime. This site is treeless; however, trees commonly are in the general vicinity. The reference state is a cool-season bunchgrass/shrub community. The appearance of the site is grassland with woody shrubs such as Wyoming big sagebrush and several forbs. Indian ricegrass, blue grama, pine needlegrass, needle and thread, prairie Junegrass, bottlebrush squirreltail, Sandberg bluegrass, muttongrass, and upland sedges provide the sparse grassland appearance. Wyoming big sagebrush is the dominant shrub. Yellow rabbitbrush may be present in small amounts, but the abundance will increase under some disturbances. Hood's phlox, winterfat, buckwheat, and fringed sage are common. Black sagebrush, snowberry, serviceberry, and antelope bitterbrush may be present in small amounts, especially at the edges of the modal concept of this site. The species composition and relative productivity may fluctuate from year to year depending on precipitation and other climatic factors.

The Gunnison Basin is in a climatic zone where pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*) normally occur; however, the basin generally does not support these species because of its unique ecological characteristics. The basin does support intergradations of Wyoming big sagebrush and mountain big sagebrush. The Gunnison Basin is recognized for its unusual ecological characteristics, including absence of certain plants and vertebrates. Pinyon pine is rare in the basin, and western rattlesnake is absent. Winters are extremely cold, and the cold air settles into the basin. Also, this area is drier than other regions at similar elevations. It is thought that the temperature, moisture, and topography are responsible for the sagebrush-dominant plant communities in the Upper Gunnison Basin (Emslie et al., 2005).

The Gunnison Basin is in the transition zone from Wyoming big sagebrush to mountain big sagebrush. Wyoming big sagebrush generally is in areas that receive 7 to 11 inches of precipitation and are at an elevation of 4,500 to 6,000 feet, but in Colorado it may be in areas of well drained soils at an elevation of as high as 8,000 feet. Mountain big sagebrush is at an elevation of 6,800 to 8,500 feet. Bonneville big sagebrush, a hybrid of Wyoming big sagebrush and mountain big sagebrush, has been observed at the head of Long Gulch near Gunnison, Colorado, at an elevation of about 8,000 feet (between the boundaries of Wyoming big sagebrush and mountain big sagebrush (Winward, 2004). Ultraviolet fluorescent tests showed intergradations between the two subspecies in areas that receive 8 to 15 inches of precipitation (Goodrich et al., 1999). This ecological site is in areas that receive 10 to 14 inches of precipitation and are at an elevation of 7,200 to 8,200 feet; thus, both the subspecies and the hybrid may be in this site, depending on elevation and aspect. Mountain big sagebrush may grow in areas with Wyoming big sagebrush (Johnson, 2000); however, Wyoming big sagebrush tends to be associated with the Dry Mountain Loam ecological site (R048AA231CO) and mountain big sagebrush with the Mountain Loam site. The Dry Mountain Loam

site is on the warmer, drier south and southwest aspects at the higher elevations, and the Mountain Loam site is on the cooler, wetter north and northeast aspects at the lower elevations.

The soils, topographic location, climate, and periodic drought and fire influence the stability of the reference state. The reference state is presumed to be the community encountered by European settlers in the early 1800's that developed under the prevailing climate over time. Grazing and browsing by wildlife also influenced the plant community. The resulting plant community is a cool-season bunchgrass/shrub community. Sagebrush communities in Colorado above an elevation of 8,500 feet are in relatively good condition and appear to be recovering slowly from the impacts of settlement in the west. Sagebrush communities below an elevation of 8,500 feet have been slower to recover (Winward, 2004).

Natural fire plays an important role in the function of most sites in high mountain valleys, especially the sagebrush communities. Fire stimulates growth of grasses such as needlegrasses and bluegrasses. It also helps to keep sagebrush stands from becoming too dense and invigorate other sprouting shrubs such as serviceberry and snowberry. Fire helps to maintain a balance among grasses, forbs, and shrubs. The dynamics of a plant community are improved by opening the canopy and stimulating growth of forbs, creating a mosaic of different age classes of species and a diverse composition of species in the communities. Other than Wyoming big sagebrush, the deep-rooted shrub species in the site are not easily damaged by fire (USDI-BLM, 2002). Shrubs that re-sprout, such as yellow rabbitbrush and snowberry, are suppressed for a period. This allows grasses to become dominant. If periodic fires or other brush control does not occur, sagebrush slowly increases in abundance and can become dominant.

Wyoming big sagebrush plant communities have lower productivity (less fuel loads), less ground cover, less crown cover of shrubs, and less diversity in species and structure than do mountain big sagebrush plant communities (Goodrich et al., 1999; West and Hassan, 1985; Evers et al., 2011; Johnson, 2000). Wyoming big sagebrush communities are less susceptible to fire than are mountain big sagebrush communities. Wyoming big sagebrush communities in the western United States have a fire return interval of 10 to 115 years (West and Hassan, 1985; Evers et al., 2011; Johnson, 2000). The fire return interval for Wyoming big sagebrush communities varies greatly depending precipitation and temperature; it is about 10 to 70 years in the Gunnison Basin.

Prior to 1850, the fires most likely consisted of many small- to medium-sized mosaic burns. Since 1980, the fires typically are a few very large fires (Evers et al., 2011). The change in the return interval and intensity of fires was cause by fire suppression and reduced fine fuel as a result of livestock grazing practices in the late 1800’s and early 1900’s. Proper treatment varies among sites due to differences in the composition and abundance of vegetation, soils, elevation, aspect, slope, and climate (McIver et al., 2010). Shrub management treatments other than fire may be needed periodically to maintain the balance of the community.

Several sagebrush taxa have been subject to die-off of shrubs in the past 10 to 15 years. The dominant factors are disease and pathogens. Disease and stem and root pathogens have caused die-off in dense, over-mature sagebrush stands throughout the west. Drought and heavy browsing in conjunction with disease and pathogens have caused complete die-off in other areas.

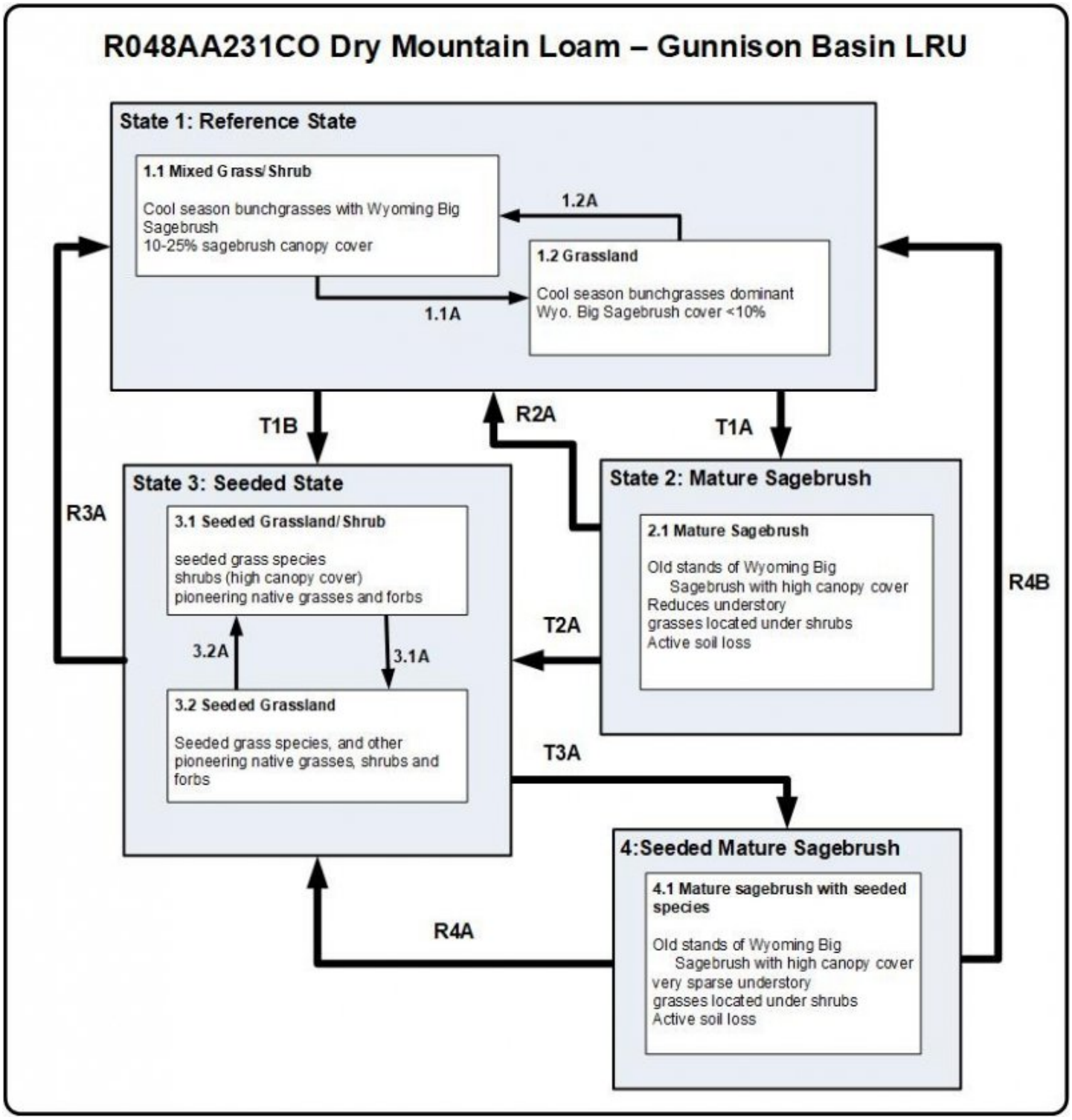
The major drivers of transitions from the reference plant community are continuous season-long grazing by ungulates and a decrease in the frequency of fires. As the population of ungulates increases and grazing exceeds the ability of plants to sustain under defoliation, the more palatable plants decline in stature, productivity, and density.

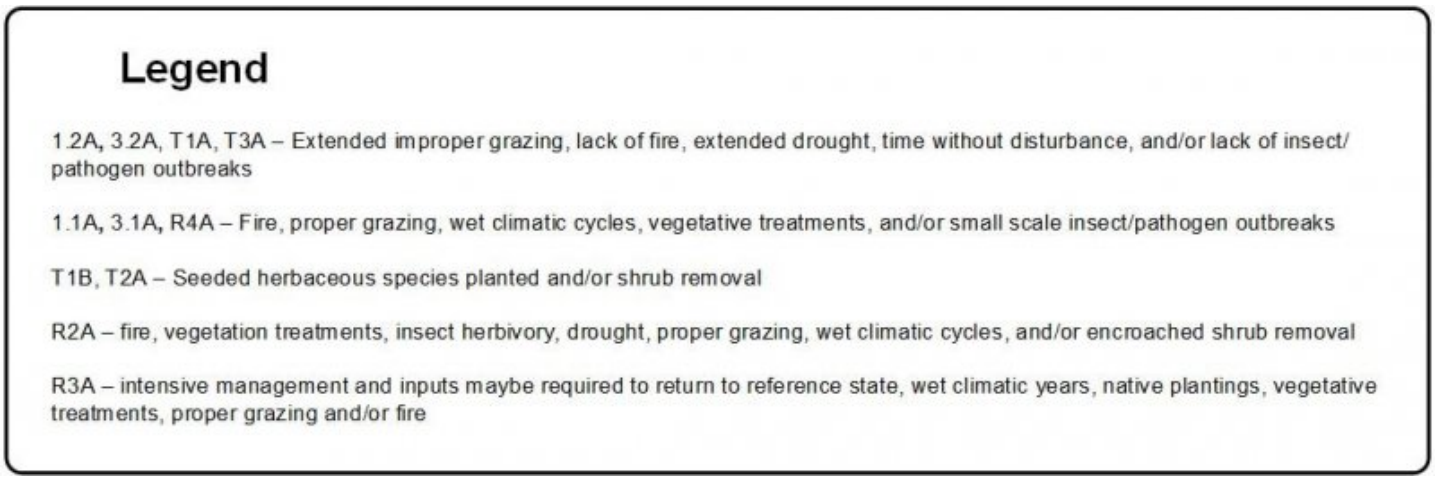
Limited cheatgrass (*Bromus tectorum*) currently is in the Gunnison Basin. It is primarily along roadsides and in campgrounds. A study of cheatgrass seeds collected in the Gunnison Basin showed significant differences in germination characteristics regarding storage duration and temperature. This may indicate that cheatgrass is adapting to the colder temperatures in the Gunnison Basin, but further study is needed (Gasch and Bingham, 2006).

Variability in climate, soils, aspect, and complex biological processes results in differing plant communities. The species listed in this description are representative; not all occurring or potentially occurring species are listed. The species listed do not cover the full range of conditions and responses of the site. The state-and-transition model is based on available research, field observations, and interpretations by experts; changes may be needed as knowledge increases. The reference plant community is the interpretive community. This plant community evolved as a result of grazing, fire, and other disturbances such as drought. This site is well suited to grazing by domestic

livestock and wildlife, and it is in areas that are properly managed by prescribed grazing.

State and transition model





State 1
Reference State

Grass and minor amounts of woody plants such as sagebrush and several forbs make up most of the vegetative cover of this state. The site is treeless; however, trees commonly are in the general vicinity. The dominant grasses are native bluegrasses, Letterman's needlegrass, pine needlegrass, and Indian ricegrass. Germander beardtongue, spiny phlox, and hollyleaf clover are the principal forbs. Sagebrush may become dominant if the understory species are over-defoliated. The optimum amount of ground cover is 35 percent. The species most likely to increase or invade are cheatgrass, blue grama, and rabbitbrush. This state represents the community and function of the site prior to European settlement. Two dominant plant community phases are in the reference state. Fire and drought are natural disturbances that drive the pathways between the community phases. The site is subject to frequent periods of drought and fires of mixed intensity and frequency. The fire return interval (FRI) is 10 to 70 years in the more arid sagebrush areas (Wyoming big sagebrush) (Howard, 1999), and it is 15 to 40 years in the wetter mountain big sagebrush areas (Johnson, 2000). Sagebrush species less than 50 years old are easily killed by fire. Most forb species that re-sprout from a caudex, corm, bulb, rhizome, or rootstock recover rapidly following fire, and suffrutescent, low-growing or mat-forming forbs such as pussytoes and buckwheat may be severely damaged by fire (Miller and Eddleman, 2001). Needle and thread (Bunting, 1985), Indian ricegrass, and muttongrass are very palatable and can be over-defoliated. Wyoming big sagebrush, western wheatgrass, yellow rabbitbrush, Sandberg bluegrass (Bunting, 1985), prairie Junegrass (Bunting, 1985), blue grama, and needlegrasses are less palatable and can increase in abundance. Sagebrush has tap roots, lateral roots and tertiary roots which allows this advantage in competition. Thinning sagebrush crowns may be necessary for understory establishment. Treatments methods need to fit the site's specific needs. Sagebrush recruitment is episodic in 7-9 year cycles and sagebrush seeds have a limited viability after their second year. (Winward, 2004) Resting and/or deferring grazing after brush management promotes the establishment of grasses which in turn slows down sagebrush establishment. Grazing by species that prefer grasses and forbs will speed up the establishment of sagebrush. When the density and canopy cover of sagebrush are near maximum for several decades, sagebrush can become competitive with the understory forbs and grasses. Grazing by species that prefer grasses and forbs will speed up the establishment of sagebrush. Sagebrush has tap, lateral, and tertiary roots that give it a competitive advantage. Thinning of sagebrush crowns may be necessary for establishment of the understory. Treatment methods should be adapted to the specific needs of the site. Sagebrush recruitment is episodic in 7- to 9-year cycles, and sagebrush seeds have limited viability after the second year (Winward, 2004). Resting or deferring grazing after brush management promotes the establishment of grasses and slows the establishment of sagebrush.

Community 1.1
Mixed Grass/Shrub

Figure 7. Reference plant community.

This plant community is characterized by Wyoming big sagebrush and Indian ricegrass. Based on annual production, the potential vegetation is about 40 to 60 percent grasses and grasslike plants, 5 to 15 percent forbs, and 25 to 35 percent woody plants. Prolonged grazing during periods of drought can result in an increase in subdominant grass species and shift the plant community to mixed grasses rather than dominantly Indian ricegrass. Primary grasses include needle and thread, muttongrass, western wheatgrass, pine needlegrass, Indian ricegrass, and blue grama. Major forbs include redroot buckwheat, spiny phlox (Hood's phlox), and scarlet globemallow. The plant community is diverse, stable, and productive under normal precipitation. Litter is properly distributed and little is moved offsite. The natural plant mortality rate is low. Forbs are a dynamic component of this site; production can vary greatly depending on the annual precipitation. Community dynamics, the nutrient and water cycles, and energy flow function properly in this community. The community can be maintained by properly management of grazing, including adequate deferment during the growing season to allow for establishment of grasses and recovery of the vigor of stressed plants. This community is resistant to many disturbances, but it may be affected by continuous overgrazing, tillage, urban sprawl, and oil and gas infrastructures and other developments.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	319	471	616
Shrub/Vine	185	280	381
Forb	56	90	123
Total	**560**	**841**	**1120**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	15-25%
Forb foliar cover	3-10%
Non-vascular plants	0-2%
Biological crusts	0-2%
Litter	15-30%
Surface fragments >0.25" and <=3"	15-25%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	25-40%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	10-25%	10-25%	3-10%
>0.15 <= 0.3	–	10-25%	5-15%	1-5%
>0.3 <= 0.6	–	10-20%	0-5%	1-5%
>0.6 <= 1.4	–	0-10%	0-2%	0-1%
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

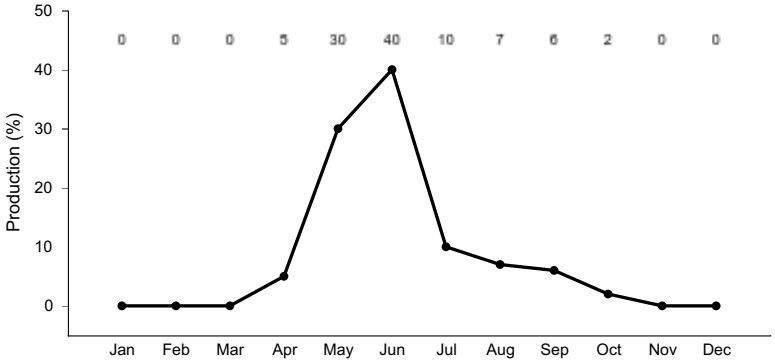


Figure 9. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

Community 1.2
Grassland

Figure 10. Area of community 1.2 ten years after a fire.

This community is characterized by an increase in the abundance of grasses and forbs following a disturbance such as fire. Recurring fires at an internal of less than 10 years maintain the grassland and prevent establishment of sagebrush. Five to ten years is needed for sagebrush to establish after a fire and 15 to 20 years for the density and cover to return to pre-burn levels (Nelle et al., 2000). Severe fires can slow the re-establishment and dominance of Wyoming big sagebrush. The maximum total production of grass herbage is reached 2 to 5 years after burning, but the increased grass cover is short lived. Production declines as the abundance of sagebrush and other shrub species increases. The forb cover has the highest biomass 5 to 15 years after burning (Nelle et al., 2000).

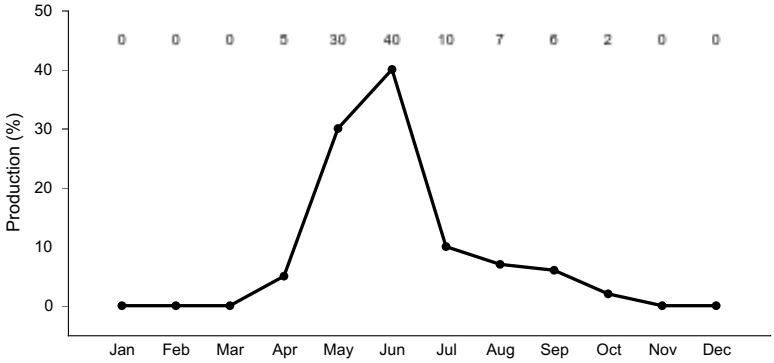


Figure 11. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

Pathway 1.1A
Community 1.1 to 1.2

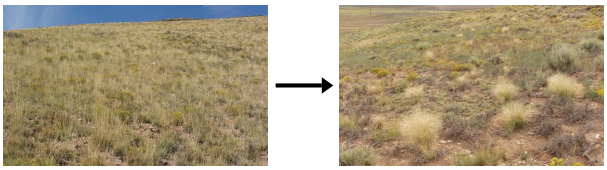
Mixed Grass/Shrub **Grassland**

The natural fire return interval and fire intensity characterize this pathway (McIver, et al., 2010). Shrub management including applying herbicides and mowing can be used to mimic this pathway. Drought and prescribed grazing or improper grazing can influence the time frame of the pathway. This pathway can be a result of high use by wildlife in winter and browsing by livestock. Short periods of drought in winter and early in spring facilitate an increase in the understory. Grasses respond quicker to moisture received in midsummer and late in summer than do shrubs.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Pathway 1.2A
Community 1.2 to 1.1



Grassland **Mixed Grass/Shrub**

This pathway is characterized by the natural fire return interval. Improper grazing can decrease the abundance of the understory and increase the sagebrush canopy, which shortens the time to transition back to reference community phase 1.1. Extended drought and improper grazing can change the time frame for this pathway. Improper browsing and suitable grazing of the understory species, frequent fires prior to seed set of the sagebrush but after seed set of the understory, and large-scale die-off of sagebrush from insects or pathogens can cause this pathway (Evers et al., 2011).

Conservation practices

Prescribed Grazing

State 2

Mature Sagebrush

State 2 is a sagebrush-dominant plant community. This state has an increase in shrub cover and a decrease in understory cover as compared to state 1. This sagebrush community is a single-aged stand. The abundance of Sandberg bluegrass and western wheatgrass is increased and that of Indian ricegrass and prairie Junegrass is decreased. The abundance of low shrubs such as yellow rabbitbrush, spineless horsebrush, and broom snakeweed also is increased, replacing some of the herbaceous component in the understory. The diversity of species is lower in this state than in state 1. Improper grazing management practices that decrease the abundance of the deep-rooted understory species can lead to compaction of the soil, increased susceptibility to erosion, decreased organic matter in the soil, and increased exposure of the soil.

Community 2.1
Sagebrush Dominated

Figure 12. Area of sagebrush-dominant community 2.1.

This state has a very dense stand of Wyoming big sagebrush and little, if any, understory. A few remnant herbaceous plants are in the understory but not enough to re-seed the site if it is disturbed. This state is comprised dominantly of shrubs, including Wyoming big sagebrush, yellow rabbitbrush, and prickly pear cactus. The dominant forb is Hood's phlox. Trace amounts of Sandberg bluegrass, pine needlegrass, and Letterman's needlegrass may be present. The minimal understory helps to suppress low-intensity fires because of a lack of fine fuel; however, high-intensity crown fires may occur because of the high canopy cover. An increase in the sagebrush canopy may be due to lack of disturbance such as wildfire. Cumulating effects of degrading sagebrush habitats include higher susceptibility to erosion and sedimentation, decreased water quality, decreased forage for domestic livestock, and decreased habitat for wildlife species (McIver et al., 2010).

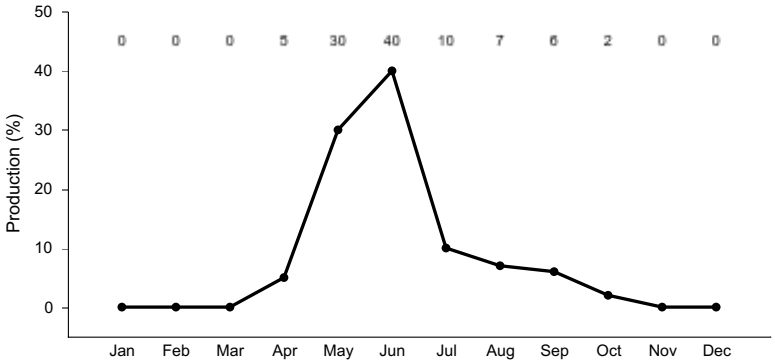


Figure 13. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

State 3
Seeded State

This state is characterized by sagebrush removal due to fire or shrub management treatments, which may include chaining, disking, and mowing. The community dynamics are similar those of the reference state. This state could persist for long periods. Sagebrush will start to re-establish when the conditions are favorable. This site is seeded to

perennial species such as crested wheatgrass and Russian wildrye.

Community 3.1
Seeded Grassland/Shrub

Figure 14. Area of crested wheatgrass.

This community consists dominantly of seeded perennial grasses such as Russian wildrye and crested wheatgrass and some Wyoming big sagebrush establishing as the overstory species. The sagebrush is seeded from adjacent areas or the seedbanks after the grasses are seeded. Small amounts of Sandberg bluegrass, western wheatgrass, pine needlegrass, and Letterman's needlegrass slowly become established in this community phase. The sagebrush canopy is 1 to 15 percent, and the herbaceous understory cover is 30 to 40 percent.

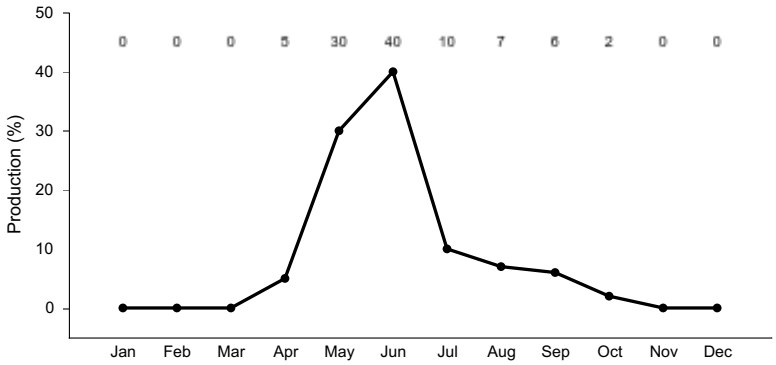


Figure 15. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

Community 3.2
Seeded Grassland

This community is characterized by introduced perennial grasses such as crested wheatgrass and Russian wildrye. Fire or other shrub management is needed to maintain this community phase.

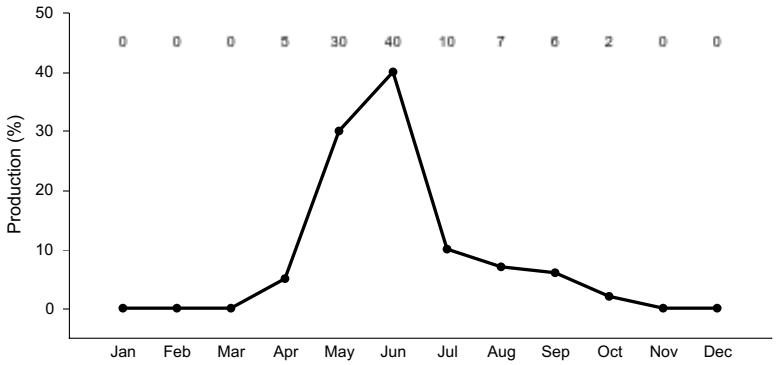


Figure 16. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

Pathway 3.1A
Community 3.1 to 3.2

Proper grazing and wet periods can move this community toward phase 3.1. Shrub management, including use of herbicides, can be used to mimic the pathway. Mortality of establishing sagebrush from pathogens and insects can influence this pathway. Short-term drought in winter and early in spring will facilitate an increase in the understory. Grasses respond quicker to moisture received in midsummer and late in summer than do shrubs.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Pathway 3.2A
Community 3.2 to 3.1

The natural pathway over time without fire. Improper grazing of the understory species and little, if any, seedling establishment or regeneration results in an increased canopy cover of sagebrush.

State 4
Seeded Mature Sagebrush

State 4 is a sagebrush-dominant community. The abundance of shrub cover is increased and that of the understory is decreased. The sagebrush consists of an even-structured, single-aged stand. The abundance of introduced species is decreased in this community. The abundance of low shrubs such as yellow rabbitbrush and spineless horsebrush also is increased, replacing some of the herbaceous component in the understory. The diversity of species is low. Improper grazing management leads to a decrease in deep-rooted species in the understory.

Community 4.1
Sagebrush Dominated with Introduced Species

This community has more than 45 percent live canopy cover of Wyoming big sagebrush. Little, if any, grasses and forbs are in the interspaces. The grasses and forbs that remain are directly under the canopy of the Wyoming big sagebrush. Soil erosion is active.

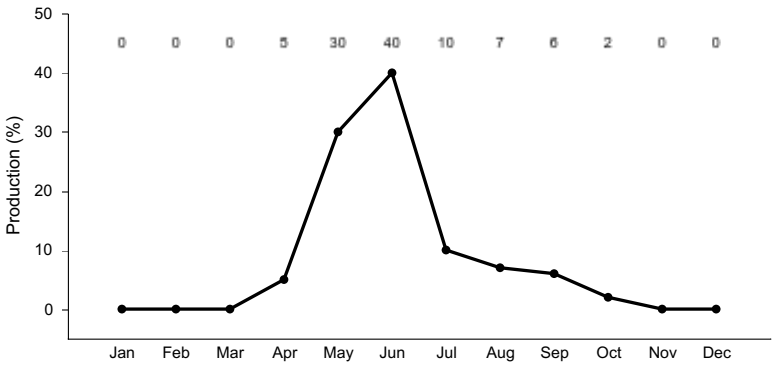


Figure 17. Plant community growth curve (percent production by month). CO0104, MLRA 48A & 34A - Foothill Frigid. MLRA 48A & 34A.

Transition T1A
State 1 to 2

Improper grazing for extended periods during the growing season can reduce the amount of fine fuel in the understory, which favors sagebrush encroachment. Lack of fire over time can cause this transition (McIver et al., 2010). Extended periods of drought and lack of insect and pathogen activity can result in a single-aged stand of

sagebrush. This transition is characterized by a decrease in the understory and an increase in the amount of bare ground between the shrubs and other evidence of soil erosion. The depletion of fine fuel due to improper grazing shifts the fire regime from relatively frequent fires of low to mixed severity (10- to 70-year mean fire return interval) to less frequent fires of high severity (more than 70-year mean fire return interval).

Transition T1B
State 1 to 3

Historically, this transition has resulted from a catastrophic wildfire but it can be induced by human activity (shrub management or prescribed burning). It is seeded with introduced species. Short-term loss of topsoil and a reduction in the water-holding capacity in the upper part of the soil occur, and the diversity of species is decreased.

Restoration pathway R2A
State 2 to 1

Proper grazing, wet periods, fire after seed set of the understory, and small-scale mortality of shrubs from insects and pathogens can move this community toward a more diverse understory and away from a dense, single-aged stand of sagebrush (Evers et al., 2011). Shrub management, including application of herbicides and prescribed burning, and seeding of native species after burning can be used to mimic this pathway.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Transition T2A
State 2 to 3

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

Restoration pathway R3A
State 3 to 2

The site may be restored to resemble the Indian ricegrass and Wyoming big sagebrush community in the reference state by seeding commercial mixtures of native grasses, forbs, and shrubs. Selective removal of introduced species also may be needed. If properly managed, a semblance of the diversity and complexity of the reference state can be restored. This restoration pathway is intensive if attempted on a large scale.

Transition T3A
State 3 to 4

Improper grazing for an extended period and lack of fire are the main drivers of this transition. Extended periods of drought also can affect the productivity of the understory. These factors can return the community to a mature, single-aged shrub community that has a few seeded introduced species in the understory, mostly under the canopy of the shrubs.

Restoration pathway R4A
State 4 to 3

Fire and wet periods can cause the mature, single-aged shrub community to return to a grassland state if proper grazing management is implemented and sufficient seed is in the seed bank to regenerate the understory species. If sufficient seed or mature plants are not available for this pathway, reseeding may be needed. Shrub management practices such as prescribed burning, prescribed grazing, and seeding could help to move the community from state

4 to state 3.

Conservation practices

Brush Management
Prescribed Burning
Fence
Range Planting
Watering Facility
Upland Wildlife Habitat Management
Prescribed Grazing

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 Perennial Cool Bunchgrasses**			213–448	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	67–168	2–8
	muttongrass	POFE	*Poa fendleriana*	28–112	1–5
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	17–84	1–4
	pine needlegrass	ACPI2	*Achnatherum pinetorum*	17–84	1–4
	Sandberg bluegrass	POSE	*Poa secunda*	22–67	1–3
	squirreltail	ELEL5	*Elymus elymoides*	11–56	1–3
	needle and thread	HECO26	*Hesperostipa comata*	11–28	1–3
	prairie Junegrass	KOMA	*Koeleria macrantha*	6–28	1–2
2	**Dominant Native Perennial Cool Rhizomatous**			39–112	
	western wheatgrass	PASM	*Pascopyrum smithii*	34–84	1–4
	threadleaf sedge	CAFI	*Carex filifolia*	6–28	0–2
3	**Occasional Native Warm Rhizomatous**			11–28	
	blue grama	BOGR2	*Bouteloua gracilis*	11–28	0–2
4	**Occasional Native Warm Bunchgrasses**			0–28	
	muhly	MUHLE	*Muhlenbergia*	0–28	0–2
Forb					
5	**Dominant Native Perennial Forbs**			50–196	
	spiny phlox	PHHO	*Phlox hoodii*	6–28	1–3
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	6–28	1–2
	Indian paintbrush	CASTI2	*Castilleja*	6–17	0–1
	buckwheat	ERIOG	*Eriogonum*	6–17	0–1
	pingue rubberweed	HYRI	*Hymenoxys richardsonii*	0–17	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	0–11	0–1
	lupine	LUPIN	*Lupinus*	0–11	0–1
	germander beardtongue	PETE9	*Penstemon teucrioides*	6–11	0–1
	longleaf phlox	PHLO2	*Phlox longifolia*	6–11	0–1

	Rollins' twinpod	PHRO4	*Physaria rollinsii*	0–11	0–1
	cinquefoil	POTEN	*Potentilla*	0–11	0–1
	spearleaf stonecrop	SELA	*Sedum lanceolatum*	6–11	0–1
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6–11	0–1
	bastard toadflax	COUM	*Comandra umbellata*	0–11	0–1
	cryptantha	CRYPT	*Cryptantha*	6–11	0–1
	fleabane	ERIGE2	*Erigeron*	0–11	0–1
	agoseris	AGOSE	*Agoseris*	0–11	0–1
	pussytoes	ANTEN	*Antennaria*	0–11	0–1
	Fendler's sandwort	ARFEF3	*Arenaria fendleri var. fendleri*	0–11	0–1
	Gunnison milkvetch	ASAN4	*Astragalus anisus*	0–11	0–1
	lesser rushy milkvetch	ASCO12	*Astragalus convallarius*	0–11	0–1
	aster	ASTER	*Aster*	0–11	0–1
	redroot buckwheat	ERRA3	*Eriogonum racemosum*	6–11	0–1
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–11	0–1
Shrub/Vine					
6	**Dominant Native Non-Sprouting Shrubs**			140–308	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	56–224	5–20
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	11–56	1–5
	spineless horsebrush	TECA2	*Tetradymia canescens*	6–28	1–3
7	**Occasional Native Non-Sprouting Shrubs**			22–112	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	6–28	1–3
	prairie sagewort	ARFR4	*Artemisia frigida*	6–28	1–3
	black sagebrush	ARNO4	*Artemisia nova*	0–28	0–2
	mountain ball cactus	PESI	*Pediocactus simpsonii*	0–28	0–2
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–28	0–2
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–28	0–2
	Parry's rabbitbrush	ERPAP10	*Ericameria parryi var. parryi*	6–22	0–2
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–17	0–2
	plains pricklypear	OPPO	*Opuntia polyacantha*	6–11	0–1
8	**Occasional Native Resprouting Shrubs**			17–73	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–28	0–2
	antelope bitterbrush	PUTR2	*Purshia tridentata*	6–28	0–2
	snowberry	SYMPH	*Symphoricarpos*	6–28	0–2

Animal community

Interpretations for Wildlife
By Christina Santana, NRCS Partner Wildlife Biologist.

The shrubs, grasses, and forbs of the sagebrush steppe communities associated with this ecological site provide habitat for a variety of wildlife species. Large grazers in these communities include elk, mule deer, pronghorn, and bighorn sheep. Small mammals include jackrabbit, cottontail rabbit, coyote, and fox. Migratory and resident bird species that are sagebrush obligate include sage thrasher, sage sparrow, vesper sparrow, Brewer’s sparrow, and

Gunnison sage-grouse. Domestic grazers also use this habitat. Changes in the composition of the plant community from the reference state to other states may also result in changes in the carrying capacity for the wildlife species.

Reference State (State 1)
The reference state provides food and cover for a variety of wildlife species. Elk use this state in winter, and mule deer, pronghorn, and bighorn sheep use it year round. The big sagebrush in plant community 1.1 meets many of the habitat requirements for sagebrush-obligate birds and small mammals. The shrub and herbaceous cover is ideal for nesting hens and young broods of Gunnison sage-grouse. The available forage and browse in plant community 1.2 may be used by mule deer, elk, pronghorn, and bighorn sheep. Some sagebrush-obligate avian species may be less abundant in community 1.2 due to insufficient sagebrush for nesting cover.

Sagebrush Dominated Community (State 2)
Because of the minimal grasses and forbs in the understory in this state, many wildlife species may travel through areas of this state to areas that have more abundant forage and an increased diversity of plants. Sagebrush-obligate bird species may remain even though the understory is insufficient for food and cover. Some small mammals likely remain in this state.

Seeded State (State 3)
This state is similar to the reference state; it provides habitat for a variety of wildlife species. Elk use the habitat in winter, and mule deer, pronghorn, and bighorn sheep use it year round. The big sagebrush plant community 3.1 meets many of the habitat requirements for sagebrush-obligate birds and small mammals. The shrub and herbaceous cover provides ideal cover for nesting hens and young broods of Gunnison sage-grouse. The available forage and browse in plant community 3.2 is used by mule deer, elk, pronghorn, and bighorn sheep. Some sagebrush-obligate avian species may be less abundant in community 3.2 due to insufficient sagebrush for nesting cover.

Sagebrush Dominated with Introduced Species (State 4)
Because of the limited understory and dense sagebrush in state 4, large wild ungulates may pass through areas of state 4 to areas where the herbaceous understory is more abundant and diverse. The sagebrush canopy may provide hiding and nesting cover for sagebrush-obligate avian species and small mammals. Although some ungulates, mammals, and birds may use the habitat in this state, the lack of understory and active erosion limit the quality of the habitat.

Hydrological functions

Soils originally were 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 in a specific climatic region will have a similar runoff response if the depth to a restrictive layer or water table, the transmission rate of water, texture, structure, and the degree of swelling when saturated are similar. Four hydrologic soil groups are recognized (A, B, C, and D). For specific definitions of each group, see the National Engineering Handbook, Chapter 7, Part 630, Hydrology (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 maximum yearly wetness (thoroughly wet),
—unfrozen soil,
—bare soil surface, and
—maximum swelling of expansive clays.

The slope of the soil surface is not considered when assigning hydrologic soil groups. In its simplest form, the hydrologic soil group is determined by the water-transmitting soil layer that has 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 the hydrologic cover conditions and hydrologic soil groups.

Hydrologic soil groups of typical soils:

Mergel series—Group C
Kezar series—Group C

Hydrologic soil groups of atypical soils:
Corpening series—Group D
Cheadle series—Group C
Hopkins series—Group C
Spring Creek series—Group C

Recreational uses

This site is cool in summer, which makes it very desirable for a wide range of outdoor activities such as picnicking, sightseeing, photography, wildlife watching, hiking, and camping.

Wood products

No trees are in this ecological site.

Other products

None.

Other information

The Gunnison and Montrose field offices are responsible for this ecological site.

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Those involved in developing earlier versions of this site description include Bob Rayer, retired NRCS soil scientist, and Herman Garcia, retired State rangeland management specialist and MLRA ecological site specialist (quality assurance).

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

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

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

Rangeland health reference sheet

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

Author(s)/participant(s)	Original by John Murray, Charlie Holcomb, Lars Santana, Fred Cummings, Alvin Jones, Paul Billig, and Steven Jaouen; 12/08/2004. Update by Suzanne Mayne-Kinney; 7/27/2015.
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Approved by	Kirt Walstad
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Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** A few rills on slopes less than 10 percent. Rills may be more defined on slopes of 15 to 25 percent, especially following intense storms and fire. More rills will be present after extended periods of drought.

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2. **Presence of water flow patterns:** Slight. Few water patterns; short, unconnected flow patterns. Flow patterns present only after an intense weather event. The length and number of flow patterns increase after wildfires and extended periods of drought. Flow patterns are more apparent on slopes of more than 15 percent.

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3. **Number and height of erosional pedestals or terracettes:** Slight. No pedestals or terracettes caused by water are in the reference community phase. Wind-caused pedestals are rare and commonly only present after wildfires and extended periods of drought. The additional water from intense storms may result in pedestals on the steeper slopes.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Commonly, 25 to 35 percent of the ground is bare. Extended drought and other disturbances may increase the percentage of bare ground.

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. On steeper slopes there may be an occasional gully, depending on soil texture, slope steepness and length.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Some wind scouring may occur in areas where the surface is not rough from rock or other fragments. Significant wind erosion may occur after a wildfire or extended periods of drought.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter commonly is evenly disturbed across the site, but it is slightly 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-lived and minimal. Most movement occurs after wildfires, extended periods of drought, and other disturbances. High-intensity thunderstorms may increase the amount of movement and the size of material moved.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The average stability class rating is is 2 to 3 in areas with no plant cover on the soil surface and 3 to 5 in areas with plant cover.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The A horizon is pale brown loam to very gravelly loam and granular. It typically is 0 to 4 inches deep and well drained.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The canopy of grasses, forbs, and shrubs, basal cover, and inherent interspaces between plants allow for some overland flow and loss of infiltration. Extended periods of drought in spring reduce the abundance of cool-season bunchgrasses, resulting in 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):** None.

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 Perennial Cool Bunchgrasses >>> Dominant Native Non-Sprouting Shrubs >= Dominant Native Perennial Forbs

Sub-dominant: > Occasional Native Non-Sprouting Shrubs >> Dominant Native Perennial Cool Rhizomatous > Occasional Native Resprouting Shrubs >

Other: Occasional Native Warm Rhizomatous >= Occasional Native Warm Bunchgrasses

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Slight mortality or decadence of shrubs and grasses during and after periods of drought. Extended periods of drought typically result in a relatively high mortality rate in short-lived species. The mortality of shrubs is limited to periods of severe drought. Sagebrush species are affected by a lack of snow in winter. A combination of wildfire and extended periods of drought would cause more mortality for several years than would either disturbance by itself.

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14. **Average percent litter cover (%) and depth (in):** The litter cover is 15 to 30 percent at a depth of 0.25 inch. No litter remains after a wildfire or extended periods of drought. Depending on climate and plant production, post-disturbance levels of litter will be in the site within one to five growing seasons.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 pounds per acre in low precipitation years, 650 pounds in average precipitation years, and 800 pounds in above-average precipitation years. After extended periods of drought or during the first growing season following wildfire, production may be significantly reduced by 250 to 500 pounds per acre 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:** Cheatgrass.

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17. **Perennial plant reproductive capability:** All plant species should be able to reproduce if water is available. All plants should be vigorous and healthy. Plants should produce seed heads and vegetative tillers, etc. Weather, wildfire, natural disease, interspecies competition, wildlife, and insects may temporarily limit reproduction.
