USDA Natural Resources Conservation Service

Ecological site R048AA250CO
Subalpine Loam Gunnison Basin LRU

Last updated: 3/05/2024
Accessed: 05/03/2024

General information

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

MLRA notes

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

MLRA 48A makes up about 45,920 square miles (119,000 square kilometers) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin 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.

LRU notes

The site concept was established within the MLRA regions in the Central with the data being collected in the Gunnison Basin and Cerro Summit area of Colorado. West Central Area is the name of the proposed LRU (Land Resource Unit) where this site occurs in MLRA 48A. Verification of this ecological site concept in other areas of the MLRA is needed before it is correlated to those areas.

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 Subalpine Loam Central Area was drafted from the existing Subalpine Loam range site (R048AY250CO, August, 1975). The original 1975 concept was expanded and updated in October 1987. The 1975 concept was

written based on soil temperature and moisture regimes, and climate to cover the entire western. This site occurs on hills and ridges on deep loamy textured soils derived from alluvium and slope alluvium. It is a Thurber's fescue - mountain big sagebrush community. It has an ustic udic and typic udic moisture regime and cryic temperature regime. The effective precipitation ranges from 20 to 30 inches. Temperatures are cold and restrict the growing season length.

Associated sites

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, Woods' rose and big sagebrush.
F048AY449CO	**Aspen Woodland** This is a permanent aspen woodland site. Dominant plants are aspen, snowberry, mountain brome, Columbia needlegrass and slender wheatgrass. Soils are deep, high in organic matter and loamy in texture.
R048AY251CO	**Shallow Subalpine** On very steep slopes (>35 percent), slopes with southern exposures, shallow to moderately shallow soils, and/or soils with high amounts of rock (>20 percent), the site is more representative of the shallow subalpine loam ecological site. Shallow subalpine loam sites have lower effective precipitation, lower water holding capacities, and thinner Mollic epipedons.

Similar sites

R048AY253CO	**Wet Subalpine** This site is the meadow site of the subalpine zone. This site is a grassland site that may support shrubby cinquefoil.
R048AA228CO	**Mountain Loam Gunnison Basin LRU** Mountain Loam is lower in elevations and precipitation (15-30
R048AY252CO	**Subalpine Clay** If there is a restrictive clay layer above 20 inches or enough clay in the soil to affect plant growth and water availability the site is a Subalpine Clay in the same precipitation zone and similar elevations.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. vaseyana*
Herbaceous	(1) *Festuca thurberi* (2) *Festuca arizonica*

Physiographic features

Subalpine loam sites are often positioned on mountain side slopes, hills and alluvial fans. This site is found near aspen woodlands or the spruce-fir zone. Often, aspen may be present and/or surround the upslope boundary of the site. Generally slopes are between 5 and 25 percent, but can go as high as 35 percent.

The lower elevation at which this site occurs varies according to latitude as well as the amount of precipitation in the area. In central Colorado the site occurs above 9000 feet and as it progresses south in latitude it moves up in elevations to above 10,000 feet. The upper elevation is usually dictated by where true fir-spruce-aspen forests begin.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope (3) Alluvial fan
Flooding frequency	None

Ponding frequency	None
Elevation	9,000–11,500 ft
Slope	2–25%
Ponding depth	0 in
Aspect	Aspect is not a significant factor

Climatic features

Average annual mean precipitation is 26 inches of which about 70-80% falls as snow. This plant community is usually found in the 20-30 inch precipitation zone. The average annual total snowfall ranges from 197 inches. The highest snowfall record for the year in this area is 359 inches which occurred in 1957 at Crested Butte. This site normally has deep snow cover through the winter. Snow can fall in any month of the year with the least likely months to have snowfall being July and August. June is the direst month throughout the growing season. The freeze-free period ranges from 85 to 105 days and the frost –free ranges from 55 to 75. On average, the last spring freeze is the first week of July and the first fall freeze is middle of August.

Average annual temperature is between 30 and 40°F. Summer temperatures are generally below 76°F during the day. Night time temperatures can be close to freezing even during the summer. Winter temperatures can reach well below 0°F even during the day. Mean annual temperature ranges from high day time temperature of 76.0ºF in July to a low night time temperature of -4.4ºF in January. The coldest winter temperature recorded was -47ºF on February 6, 1982 and the coldest summer temperature recorded was 15ºF on June 20, 1920. The hottest day on record was 95 ºF on July 17, 1949. Data is from Western Regional Climate Center (2014).

This site is impacted by the short growing season. Some plants actually start growth while still covered by snow but the major site green-up often occurs in late June and early July with the first snow often falling in late September to mid-October. Soil moisture from snowmelt carries over until summer rains begin allowing for virtually unrestricted plant growth by water availability, especially for the shrubs which can take advantage of the water held deeper in the soil profile. The forbs on the sites take advantage of the early precipitation mostly flowering in late June and early July. Most grasses will continue growth throughout the season. The subalpine loam site is best classified under the cryic temperature regime and typic ustic and ustic udic moisture regimes.

Table 3. Representative climatic features

Frost-free period (characteristic range)	22-69 days
Freeze-free period (characteristic range)	69-113 days
Precipitation total (characteristic range)	24-25 in
Frost-free period (actual range)	11-80 days
Freeze-free period (actual range)	59-123 days
Precipitation total (actual range)	24-25 in
Frost-free period (average)	46 days
Freeze-free period (average)	91 days
Precipitation total (average)	24 in

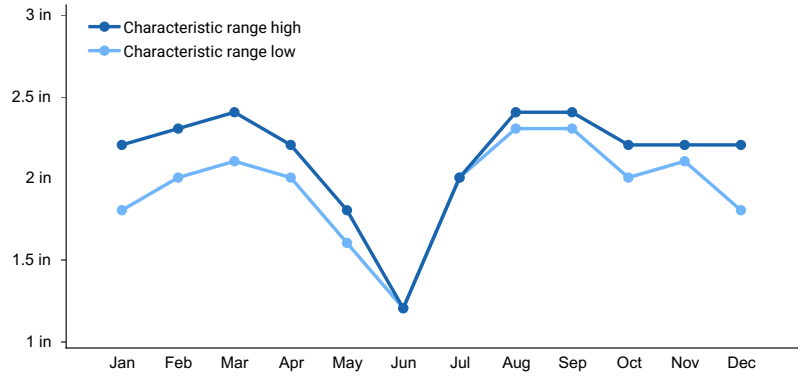


Figure 1. Monthly precipitation range

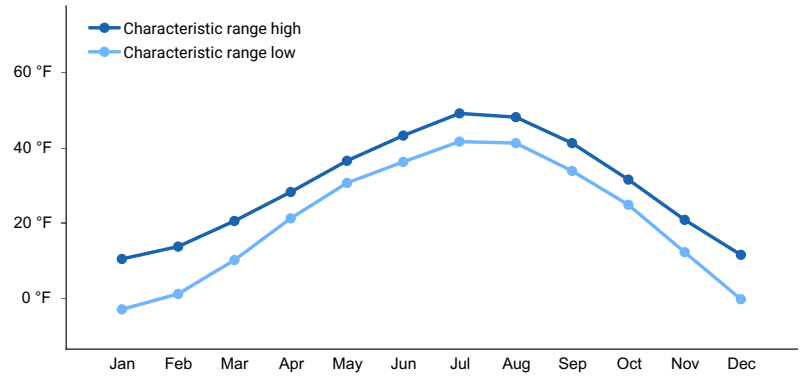


Figure 2. Monthly minimum temperature range

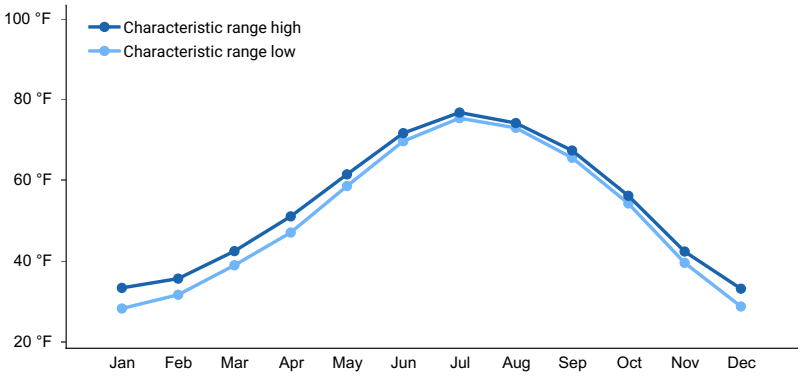


Figure 3. Monthly maximum temperature range

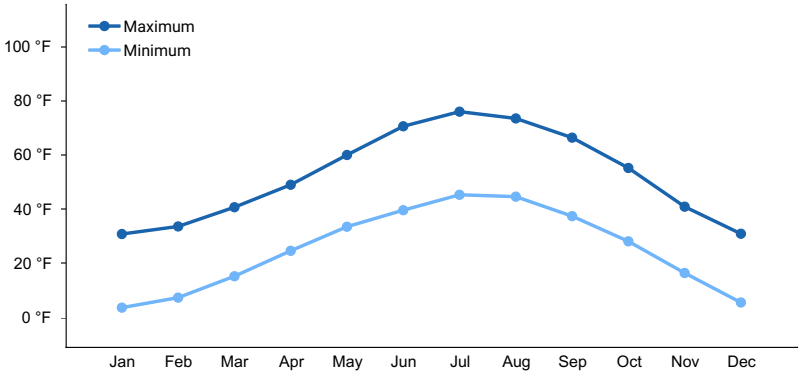


Figure 4. Monthly average minimum and maximum temperature

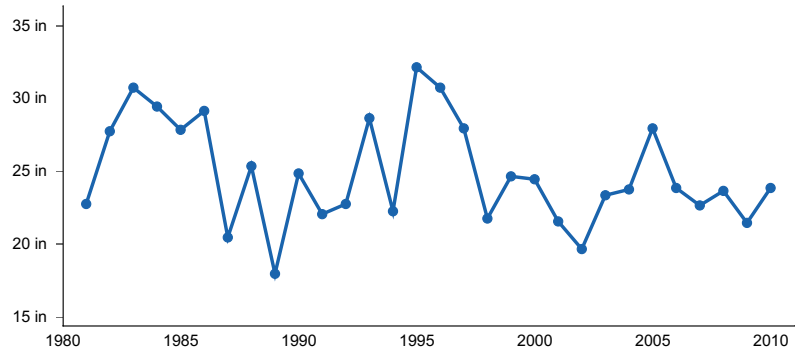


Figure 5. Annual precipitation pattern

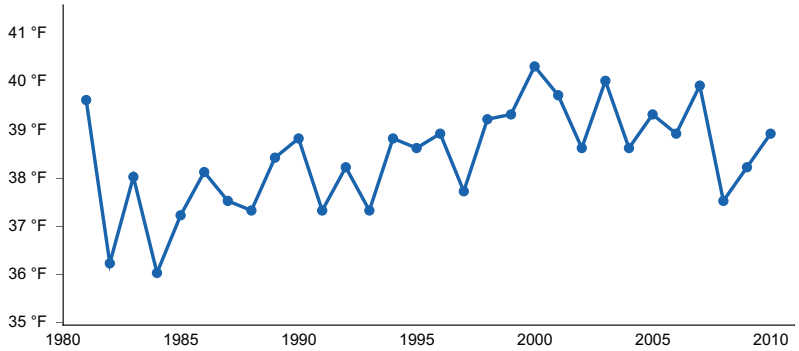


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CRESTED BUTTE [USC00051959], Crested Butte, CO
- (2) OURAY [USC00056203], Ouray, CO

Influencing water features

None.

Soil features

Soils are deep or very deep to unconsolidated, highly fracture bedrock. They have very good water holding capacity. The soil surface texture is a loam. Subsurface textures range from loam, silt loams to light clay loam. Clay percentage usually ranges from 14 to 24% on the surface and from approximately 19 to 32% in the subsurface. There is a restriction in the soil profile at 25 to 40 inches which can be an increase in rock fragments to skeletal (35% or greater rock fragment content) or a heavier clay horizon (40+% clay). These soils have a thick dark surface layer greater than 16 inches (pachic - high organic matter) and are well developed, with clay accumulation (argillic) increasing with depth in the profile. Water infiltration is high. If carbonates are present in the profile, it is deep. Water storage is moderate to high, even if the soil profile contains significant rock fragments. Soil moisture almost never limits plant growth and these soils are very conducive to plant growth. The pH normally ranges from 6.1 to 7.8 but when carbonates are present in subsurface horizon the pH in those horizons can be higher. The parent material can be from interbedded sandstone and shale, andesite and rhyolite.

Representative soils

Fine- Loamy Soils examples: Adel, Bachus, Clayburn, Hourglass, Leavittville, and Youga

Clayey restriction Soils examples: Powderhorn, Cebolia, Jerry, Mord and Youman

Fine-silty soil: Bogan.

Atypical soils assigned to this ecological site and need to be reevaluated are:

Loamy skeletal soils assigned to this ecological site include: Booneville, Bowen, Broad Canyon-warm, Gateview, Namela, Northwater, Papaspila–warm, Quander and Quazar.

Clayey- skeletal soils assigned to this site include: Doughspon–well drained, Sunshine, Tellura and Winnemucca.

Fine soils assigned to this site are: Cochetopa, Gothic, Guero, Iyers, Owen Creek Family and Ryman–dry.

Soil data in this section is from the Soil Survey in Western Colorado and updated from more recent field work collected between the years of 2009 to 2013.

Figure 7. Soil Pit - Subalpine Loam

Table 4. Representative soil features

Parent material	(1) Residuum–andesite (2) Colluvium–rhyolite (3) Alluvium–sandstone and shale
Surface texture	(1) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderate
Soil depth	30–60 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	5–6.9 in
Soil reaction (1:1 water) (Depth not specified)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

This site is based on the Subalpine Loam range site - R048XY250CO (SCS, 1975 & SCS, 1987). 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 mountains around the Gunnison Basin with a typic ustic or ustic udic soil moisture phase and cryic temperature regime. This site is treeless; however, trees are often in the general

vicinity. This site is located at and above 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 and forbs. The dominant grass and grass-like species are Thurber’s fescue, Arizona fescue, mountain brome, slender wheatgrass, and elk sedge. The dominant shrub species is mountain big sagebrush. Yarrow, peavine, lupine and American vetch are common forbs on this site. These species account for most of the vegetative cover. Fluctuations in species composition and relative production may change from year to year depending upon precipitation and other climatic factors.

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).

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 the FRI ranges from 10 to 50 years (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.

Currently, cheatgrass (*Bromus tectorum*) is present in the Gunnison Basin, but has not developed into a problem yet. Cheatgrass is limited in area in the Basin; it is 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).

Transitions between phases of the subalpine loam ecological site are heavily influenced by soil nutrient availability and water holding capacity. Thurber’s fescue/mountain big sagebrush phase (1.1) has a moderate to low nutrient availability and high water hold capacities. Sites with low nutrient cycling and low to very low nutrient availability

(due to diminished inputs from fine organics) in combination with diminished water hold capacity (due to erosion and soil loss) are often overgrown sagebrush communities (3.0). Sites with high nutrient availability are often either a Thurber's fescue and forb dominated community (1.3), or a non-native rhizomatous species dominated community (2.0). What differentiate between these two communities are the disturbance occurrence levels and recovery opportunities allotted to the site. Thurber's fescue and forb dominated sites (1.3) can take moderate levels of disturbance if there is an adequate period of recovery after disturbance. Non-native rhizomatous species begin to dominate the site at high disturbance levels or when there is no given recovery period (2.0).

The subalpine loam communities and community phases can also be roughly distinguished by the majority of forbs that are present. Take, for example, the Thurber's fescue and forb dominated phase (1.3). After fire or large scale disturbance often the dominant forb is silver lupine which can produce up to 30% of a site's production (particularly after fire). In the Reference Plant Community phase (1.1), in general there is a high diversity of forbs, particularly aspen peavine, American vetch, Richardson's geranium, and alumroot. As the Thurber's fescue community begins become more decadent (1.2), production from cinquefoil species (slender cinquefoil and woolly cinquefoil) drastically increase. A Rhizomatous Species State (2.0) tends to be dominated by forbs that can often reproduce in large quantities very quickly which are often weeds like dandelions. Sites dominated by big sagebrush (3.0) often have forbs that indicate a drier site like pussytoes, buckwheat and yarrow as well as forbs from both the Reference Plant Community (1.1) and the Decadent Thurber's Community (1.2) often giving the decadent sagebrush site the greatest diversity of forbs. These are rough community relationships that cannot be used to determine what community is being managed but it can help to interpret subtle shifts and trends that maybe occurring within the community.

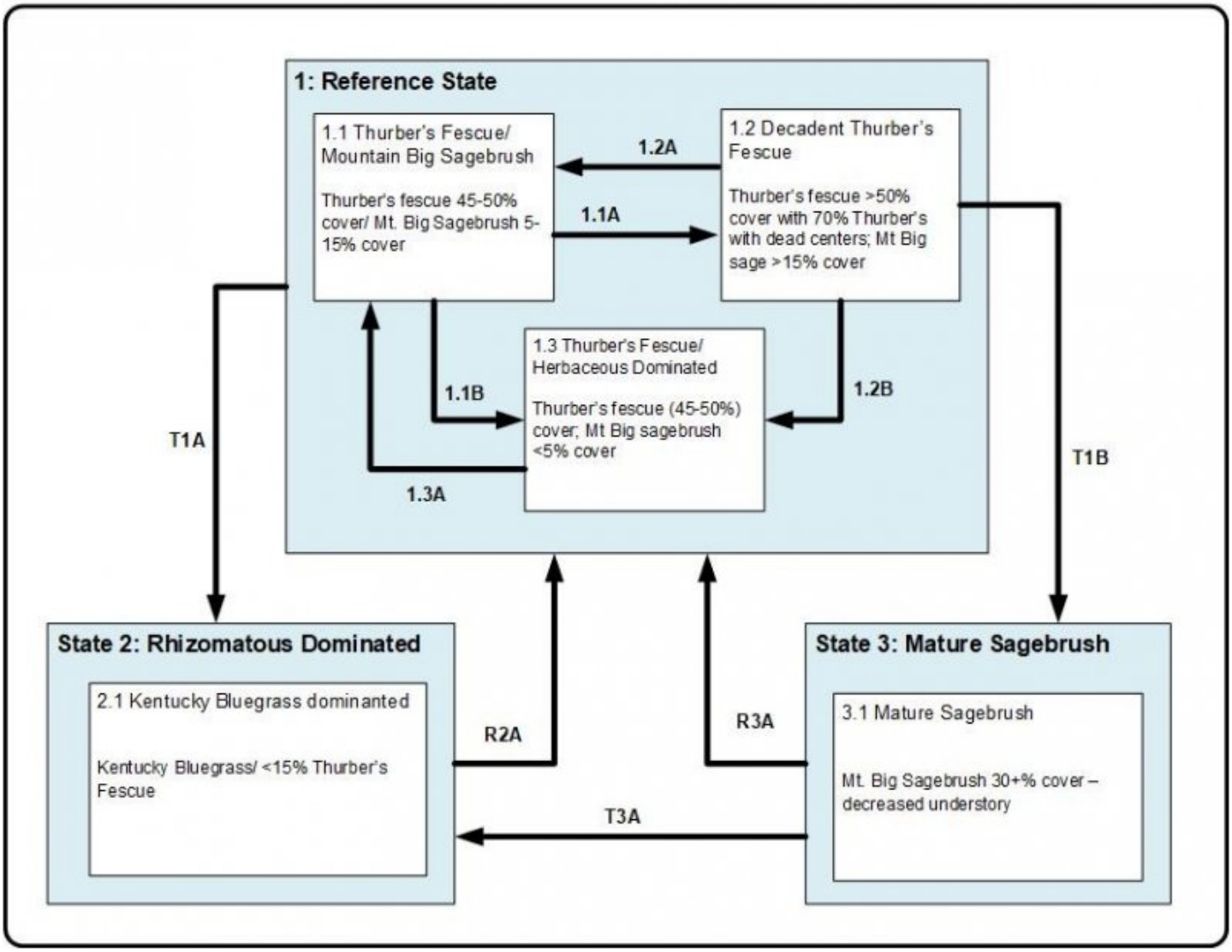
Proper grazing by both wild and domestic animals on subalpine loam sites is imperative to promote needed nutrient cycling in a nutrient limited environment. Without proper grazing in these systems, nutrients remain stored in above ground biomass and thus are unavailable to plants and microorganisms. Removal or drastic reduction of grazing from these systems reduces the stored organic matter in the soil that is ever so important in creating the high water storage capacity necessary for these systems to function properly. Often wild grazers are the most responsible for site degradation.

Variability in climate, soils and aspect and complex biological processes will cause the plant communities to differ. The species lists provided within this document are not a complete list of all occurring or potentially occurring species on this site. These 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 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

Subalpine Loam

R048AA250CO



Legend

1.1A, 1.3A, T1B – Extended improper grazing, lack of fire, extended drought, time without disturbance, and/or lack of insect/pathogen outbreaks

1.1B, 1.2B – Fire, proper grazing, wet climatic cycles, vegetative treatments, and/or small scale insect/pathogen outbreaks

1.2A – proper intensive grazing of Thurber's to remove decadence; vegetative treatments, and/or small scale fires

T1A, T3A = repeated disturbance which includes fire, continuous improper grazing, extended drought, and uncontrolled recreation

R2A – seeding of native bunchgrasses, vegetative treatments. Intensive management and inputs needed

R3A – 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. Thurber’s Fescue is the principal species. Arizona fescue, elk sedge, slender wheatgrass, mountain brome and Porter’s brome are frequently occurring grasses. Major forbs are silvery lupine, yarrow, Richardson’s geranium and American vetch. Mountain big sagebrush is the most conspicuous shrub. Snowberry, yellow rabbitbrush and Woods’ rose grow in scattered stands in the grass. Although this site is commonly bordered by spruce-fir or aspen woodlands, few of these or other trees actually grow on the 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 (Fire Return Interval). 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). The Reference State (1.0) is made up of three community phases- a Thurber’s Fescue/mountain big sagebrush phase (1.1), a Decadent Thurber’s Fescue phase (1.2), and a Thurber’s Fescue / Herbaceous Dominant phase (1.3). The transition between these phases is strongly linked to disturbance regimes and nutrient availability and cycling.

Community 1.1
Thurber's Fescue/ Mountain Big Sagebrush

Figure 8. Landscape View

Figure 9. Close Up View

This phase is dominated by Thurber’s fescue in both production and cover. Arizona fescue, elk sedge, slender wheatgrass, mountain brome and Porter’s brome are subdominant grasses. Mountain big sagebrush is a dominant shrub at 5-15% canopy cover, but produces less than 15% of the site’s total production. Forb diversity is high and can make up to 25-30% of the total production. Major forbs are silvery lupine, American vetch, peavine, geranium and yarrow. There is a healthy functioning balance in nutrient cycling and availability that allows for very favorable plant growth conditions. High cover and moderate amounts of litter protect the soils from loss and degradation and allow a continuous supply of fine organics for nutrient replenishment. Healthy deep soils allow for a high water

holding capacity and the ability for plants to grow throughout the growing season with little impact from lack of water. This site is at the spruce-fir and aspen tree-line, but, few of these or other trees actually grow on the site.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1400	1600	1900
Forb	300	500	600
Shrub/Vine	300	400	500
Total	**2000**	**2500**	**3000**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	40-70%
Forb foliar cover	15-30%
Non-vascular plants	0-1%
Biological crusts	0-2%
Litter	50-70%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-10%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-15%	40-65%	5-25%
>0.5 <= 1	–	1-15%	40-65%	5-20%
>1 <= 2	–	1-15%	30-55%	2-10%
>2 <= 4.5	–	0-5%	5-20%	0-2%
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

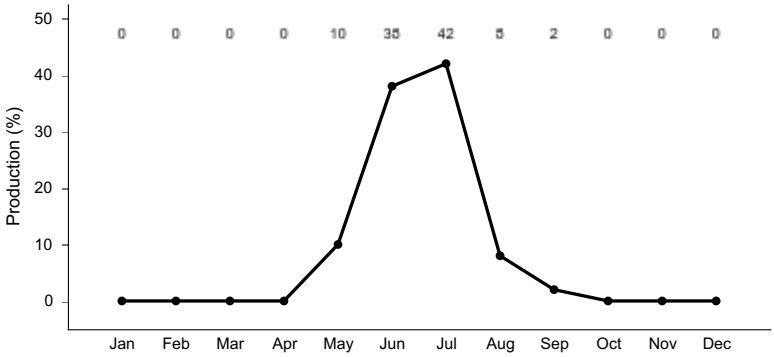


Figure 11. Plant community growth curve (percent production by month). CO0106, MLRA 48A - Subalpine Sites. MLRA 48A.

Community 1.2
Decedent Thurber's Fescue

Figure 12. Landscape View

This phase is dominated by Thurber’s fescue and mountain big sagebrush of greater than 15% canopy cover. There is an increase in shrub cover due to lack of disturbance and a decrease in the understory from the reference community. The sagebrush would be single age stand. The Decadent Thurber’s Fescue community (1.2) is often due to a lack of disturbance that would facilitate the removal and cycling of organic matter through the system. The removal of fire and/or grazing encourages litter buildup which reduces water infiltration and availability decrease both plant and microbial activity furthering site deterioration. Other cumulating effects of degrading sagebrush habitats could include: higher erosion and sedimentation, decreased water quality, decline in forage base for domestic livestock, and decreased habitat for wildlife species (McIver, et al, 2010). Improper grazing that damages dominant species like the Thurber’s fescue results in the reduction of litter input into the system and lessening nutrient availability as well as decreases in soil shading that leads to greater surface water loss thus drying the site and allowing for a slow transition to the Mature Sagebrush (3.0). This phase is losing species diversity compared with phase 1.1.

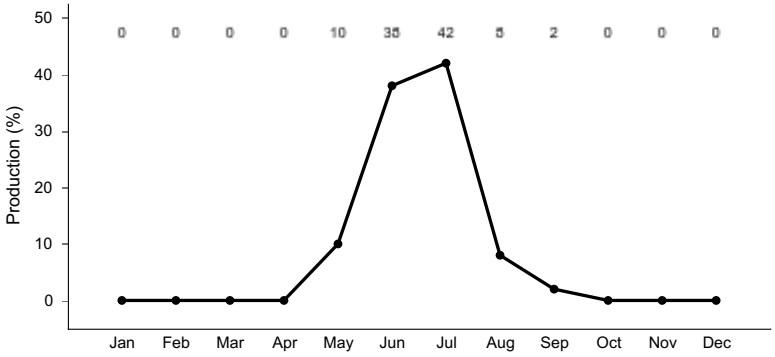


Figure 13. Plant community growth curve (percent production by month). CO0106, MLRA 48A - Subalpine Sites. MLRA 48A.

Community 1.3
Thurber's Fescue / Herbaceous Dominated

Figure 14. Landscape View

Figure 15. Soil Pit

Figure 16. Close Up View

This state would be characterized by an increase of grasses and forbs following a disturbance such as fire. Grasses would include Arizona fescue, Mountain brome, Porter’s brome, slender wheatgrass and Thurber’s fescue. Re-occurring fires of less than 10 years would keep this in grassland and prevent mountain big sagebrush establishment, as it takes 5-10 years for mountain big sagebrush to establish and 15-20 years to get back to pre-burn density and cover (Nelle, 2000). Severe fires can slow re-establishment and make longer time frames are needed for Mountain big sagebrush to become dominant (Nelle et al, 2000) 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 was short lived; forb cover has been found to have greater biomass 5-15 years after burning (Nelle et al, 2000).

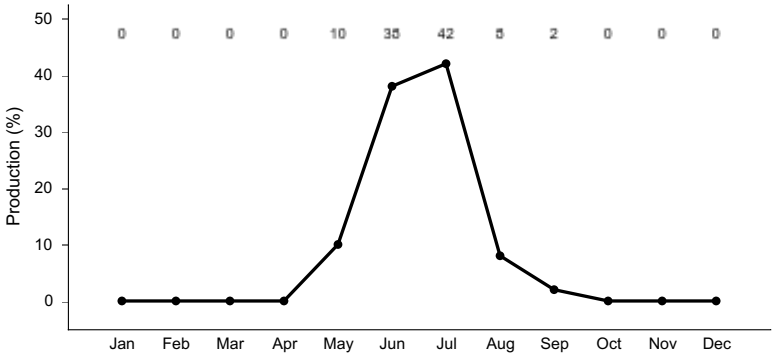
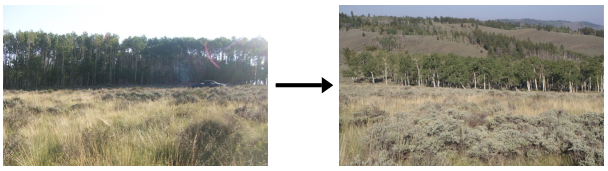


Figure 17. Plant community growth curve (percent production by month). CO0106, MLRA 48A - Subalpine Sites. MLRA 48A.

Pathway 1.1A
Community 1.1 to 1.2

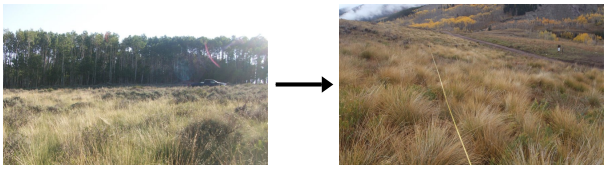


Thurber's Fescue/ Mountain Big Sagebrush

Decedent Thurber's Fescue

Thurber’s fescue/Mountain Big Sagebrush (1.1) can transition to the Decadent Thurber’s Fescue community (1.2) with the removal of regular, healthy disturbance. Regular health disturbances can be considered infrequent, low severity fire and proper grazing- things that encourage healthy nutrient cycling and continued soil development. This transition can also occur if there is a continuous detrimental impact to the Thurber’s fescue that reduces its vigor and health. This type of disturbance may be extended severe drought occurring over multiple years and improper grazing by wild or domestic animals which reduce the fine fuels in 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 (10-50 years mean FRI) to more frequent and high severity (>50 years mean FRI) (McIver, et al, 2010). 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.

Pathway 1.1B
Community 1.1 to 1.3

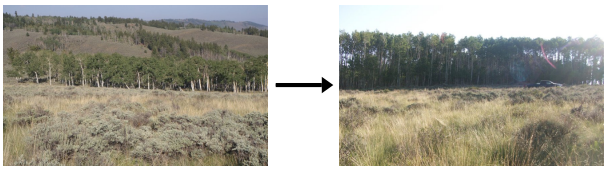


Thurber's Fescue/ Mountain Big Sagebrush

Thurber's Fescue / Herbaceous Dominated

Reference Plant Community (1.1) can transition to the Thurber’s Fescue and Forb Dominated community (1.3) under a short-term sever disturbance event, like fire, if the site is in good health prior to the event (often a result of proper grazing). Shrub management including herbicide application and mowing can be used to mimic this pathway. A community in good health prior to the disturbance will be highly resilient as long as large amounts of soil loss can be avoided. 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.

Pathway 1.2A
Community 1.2 to 1.1

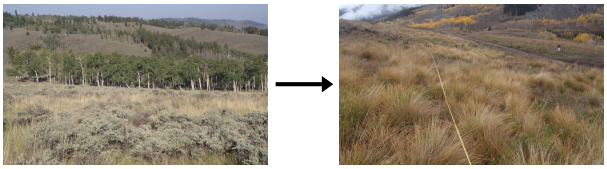


Decedent Thurber's Fescue

Thurber's Fescue/ Mountain Big Sagebrush

A Decadent Thurber’s Fescue community (1.2) can sometimes transition to the Reference Plant Community (1.1) if the Thurber’s plants aren’t that decadent to begin with. This transition would require proper, but very intensive grazing to reduce standing biomass and promote nutrient cycling. Shrub management including herbicides, prescribed burning can be used to mimic the pathways and seeding with natives after burning.

Pathway 1.2B
Community 1.2 to 1.3

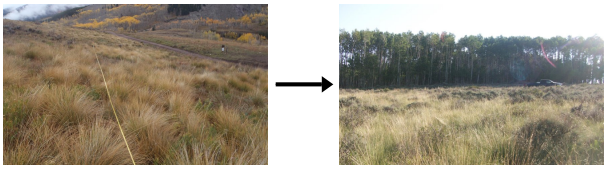


Decedent Thurber's Fescue

Thurber's Fescue / Herbaceous Dominated

Decadent Thurber’s Fescue community (1.2) can transition to the Thurber’s Fescue and Forb Dominated community (1.3) when tools are applied to reinvigorate unhealthy Thurber’s plants. This often requires freeing up nutrients that are otherwise locked away in standing biomass. Fire and proper grazing post-fire will result in this favorable transition.

Pathway 1.3A
Community 1.3 to 1.1



Thurber's Fescue / Herbaceous Dominated

Thurber's Fescue/ Mountain Big Sagebrush

The Thurber’s Fescue and Forb Dominated community (1.3) gradually transitions to the Reference Plant Community (1.1) if proper grazing by both/either wild and/or domestic grazers occurs. Proper grazing on these sites promotes nutrient cycling in a nutrient limited environment. Without proper grazing in these systems, nutrients remain stored in above ground biomass and thus are unavailable to plants and microorganisms. Removal of grazing from these systems also reduces the stored organic matter in the soil that is ever so important in creating the high water storage capacities necessary for these systems to function properly. Extended drought and improper grazing can change the time frame of this transition.

State 2
Rhizomatous Dominant

The Rhizomatous Species Dominant State (2.0) is characterized by high levels of nutrient cycling and high levels of frequent or sever disturbance. High levels of available nutrients in the soil favor early seral species that are able to take advantage of the free resources which are often weedy like dandelion, western salsify and knotweeds. Sever and frequent levels of defoliation favor plants with low growing points and the ability to re-sprout-- Kentucky bluegrass is a prime example. Large bunch grasses with elevated growing points and shrubs/forbs with little re-sprout ability suffer and are eventually removed from the community. These changes to the site’s processes lead to a dominance of Kentucky bluegrass and other rhizomatous grasses, and lesser forb diversity. Production is also decreased to 1500-2000 pounds per acre.

Community 2.1

Rhizomatous Dominant

Figure 18. Landscape View

Figure 19. Soil Pit

These sites tend to be in areas where wild and domestic animal congregate, or in areas with high amounts of recreational activity, or in topographical landscape positions that are continuously exposed to high winds and sever cold temperature like saddles. Repeated frequent fires can also cause sites to transition to this community. Forbs and shrubs most likely to increase and occur are yellow rabbitbrush, Douglas knotweed, tarweed, hounds tongue, Colorado (pingue) rubberweed an oxeye daisy

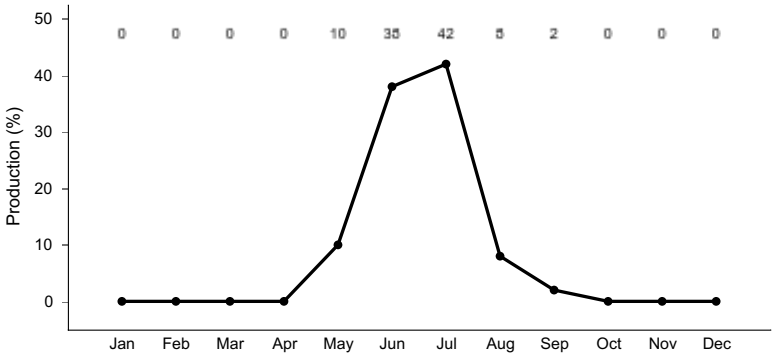


Figure 20. Plant community growth curve (percent production by month). CO0106, MLRA 48A - Subalpine Sites. MLRA 48A.

State 3
Mature Sagebrush

The Mature Sagebrush state (3.0) is a compilation of many factors including soils loss that results in a reduction of water storage capacity and changes in litter composition that reduces nutrient cycling in the soils. All other communities for the subalpine loam ecological site are mostly restricted by nutrient availability but such is not the same for this community. Such drastic alterations have occurred that water becomes the most limiting factor for the

site although nutrient cycling and availability can still be restrictive. With reduced storage capacity in the profile and restricted infiltration from surface rock fragments the site becomes drier and species that can take advantage of that, like mountain big sagebrush, proliferate. Increases in woody litter and more complex secondary compounds as well as the drier soil environment are what decreases the rate at which nutrients cycle. Restoring this site would require rebuilding the soil organic matter, reducing surface rock mantling, and changing the plant community in such a way to promote high cover and herbaceous litter input preferably from leguminous species. Fire is a good tool, if erosion can be controlled; otherwise, brush management (either chemical or mechanical) may be a viable tool.

Community 3.1
Mature Sagebrush

As the mountain big sagebrush on a site gradually increases to greater than 30% cover there is a substantial reduction in herbaceous production and although the site may still produce around 2000 pounds of vegetation per acre, palatable forage production drastically decreases. There is an increase in the diversity of forbs across a site but a decrease in their total cover and production. Sites dominated by big sagebrush (3.0) often have forbs that indicate a drier site like pussytoes, buckwheat and flowery phlox as well as forbs from both the Reference Plant Community (1.1) and the Decadent Thurber's Community (1.2) often giving the decadent sagebrush site the greatest diversity of forbs. As degradation and soil loss occurs, the mollic epipedon may erode to an ochric epipedon and the soil order classification would change from a mollisol to an alfisol. More typically on eroded sites, the mollic epipedon may thin to less than 16 inches in thickness. On these eroded sites, pedestalling is usually apparent under the stable plant canopies. As the soil continues to erode, course rock fragments may increase on the surface until there is so much rock that the surface becomes mantled. Typically this type of degradation will only be present on sites that are marginal subalpine loam sites. Sites with steep slopes, high rock fragments (>20%), low effective precipitation areas, and south/southwest exposures are more susceptible to this type of degradation. Eroded sites may now resemble shallow subalpine loam sites.

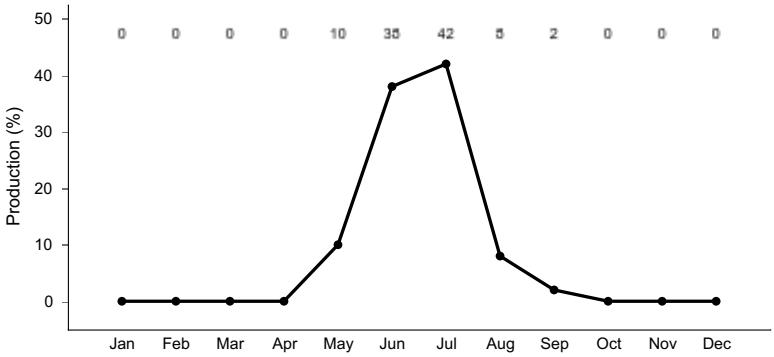


Figure 21. Plant community growth curve (percent production by month). CO0106, MLRA 48A - Subalpine Sites. MLRA 48A.

Transition T1A
State 1 to 2

The Reference State (all phases) transition into the Rhizomatous Species Dominant State (2.0) through repeated and heavy disturbance. Disturbance in this instance means anything that would cause the plant community to shift from a site dominated by non-sprouting plants with elevated growing points, to a site with plants with the capabilities to re-sprout after a defoliating event or those who can avoid sever defoliation by keeping growing points low to the ground. Disturbances that can facilitate this transition include fire in combination with continuous improper grazing (wild and domestic), multi-year improper grazing, uncontrolled recreation, and repeated exposure to extreme cold temperatures with little snow cover to insulate elevated growing points.

Transition T1B
State 1 to 3

A Decadent Thurber's Fescue community (1.2) can transition to the Mature Sagebrush State (3.0) if cover and production are so reduced as to allow for soil loss and degradation. Removal of fire from the system to help cycle nutrients and reinvigorate decadent plants in combination with repeated yearly improper grazing (wild and domestic)

that removes soil cover is one way to force the site to transition. Extended periods of drought, lack of insect and pathogen activity can influence this pathway to create a more single age stand of sagebrush. Once the sagebrush becomes dominant numerous changes occur that allow a site to be more susceptible to erosion and continued degradation. 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 (10-50 years mean FRI) to more frequent and high severity (>50 years mean FRI) (McIver, et al, 2010). 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. This transition will have topsoil loss and in turn reduced water holding capacity of the soil at the surface as the understory is reduced and not present to prevent runoff.

Restoration pathway R2A
State 2 to 1

This site could be restored to resemble the reference site of Thurber's fescue, Arizona fescue and mountain big sagebrush community by seeding mixtures of commercially available native grasses, forbs, and shrubs. Selective remove of rhizomatous 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. There would be an intensive management and inputs to change this state 2 back to state 1.

Restoration pathway R3A
State 3 to 1

A Mature Sagebrush State (3.0) may be restored if soil functionality and nutrient cycling can be restored to the Thurber's Fescue /Herbaceous Dominated phase (1.3). If too much soil loss has occurred, extreme measures will probably have to be taken. This is because the soil is imperative in storing water throughout the growing season so that plants seldom experience droughty conditions- if the soil's ability to store water is decreased (either though decreased depth, increase course material, or reduced infiltration) the site no longer functions like a subalpine loam site should. Fire can be used to reduce woody matter and may temporarily increase soil nutrients thus promoting herbaceous plant production in a normally nutrient restricted site. If fire is to be used, caution should be taken to avoid any further soil loss through erosion. If erosion cannot be controlled, fire may not be the best tool to use to transition this to a preferred condition. Mechanical and chemical brush control treatments can be used to reduce sagebrush cover and release the herbaceous understory by freeing up water and nutrient resources. However, if a soil is severely eroded and water is still restrictive during the growing season other means, like soil amendment; in conjunction with brush management may need to be attempted. Severely eroded Subalpine loam sites are very difficult to reclaim and without significant and costly inputs and may not achieve the productive potential and community stability of a representative subalpine loam site for many years.

Transition T3A
State 3 to 2

If a Mature Sagebrush State (3.0) does not suffer from soil loss, but is continuously impacted by disturbance it will transition to a Rhizomatous Species Dominated State (2.0). Disturbances can include fire in conjunction with repeated improper grazing (wild and domestic), or long-term repeated improper grazing.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Native Perennial Cool Bunchgrasses**			1200–1650	
	Thurber's fescue	FETH	*Festuca thurberi*	600–1300	60–75
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	140–360	1–15
	Arizona fescue	FEAR2	*Festuca arizonica*	125–250	5–15
	mountain brome	BRMA4	*Bromus marginatus*	70–210	5–10

	Porter brome	BRPO2	*Bromus porteri*	70–210	5–10
	muttongrass	POFE	*Poa fendleriana*	55–150	5–10
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	50–125	3–10
	pine needlegrass	ACPI2	*Achnatherum pinetorum*	50–125	3–10
	Sandberg bluegrass	POSE	*Poa secunda*	25–75	1–5
2	**Subdominant Native Perennial Cool Rhizomatous**			80–200	
	Geyer's sedge	CAGE2	*Carex geyeri*	70–180	5–10
	western wheatgrass	PASM	*Pascopyrum smithii*	20–70	1–5
3	**Occasional Native Perennial Cool Bunchgrasses**			20–250	
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–125	1–10
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	5–100	0–5
	squirreltail	ELEL5	*Elymus elymoides*	5–90	0–5
	Rocky Mountain fescue	FESA	*Festuca saximontana*	0–50	0–3
	western needlegrass	ACOC3	*Achnatherum occidentale*	0–50	0–3
	spike trisetum	TRSP2	*Trisetum spicatum*	0–45	0–3
	Parry's oatgrass	DAPA2	*Danthonia parryi*	0–25	0–1
4	**Occasional Native Perennial Warm Bunchgrasses**			0–25	
	mountain muhly	MUMO	*Muhlenbergia montana*	0–25	0–1
Forb					
5	**Dominant Native Perennial Forbs**			300–700	
	Richardson's geranium	GERI	*Geranium richardsonii*	100–300	5–10
	silvery lupine	LUAR3	*Lupinus argenteus*	50–200	5–15
	American vetch	VIAM	*Vicia americana*	50–200	1–10
	aspen pea	LALA6	*Lathyrus laetivirens*	50–200	1–10
	common yarrow	ACMI2	*Achillea millefolium*	50–150	1–5
6	**Occasional Native Perennial Forbs**			25–400	
	western Indian paintbrush	CAOC4	*Castilleja occidentalis*	5–75	0–5
	aspen fleabane	ERSP4	*Erigeron speciosus*	0–75	0–5
	hairy clematis	CLHI	*Clematis hirsutissima*	0–75	0–3
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–50	0–5
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–50	0–5
	flowery phlox	PHMU3	*Phlox multiflora*	5–50	0–5
	cinquefoil	POTEN	*Potentilla*	5–50	0–5
	alpine false springparsley	PSMO	*Pseudocymopterus montanus*	5–50	0–3
	ragwort	SENEC	*Senecio*	0–50	0–3
	Fendler's meadow-rue	THFE	*Thalictrum fendleri*	0–50	0–3
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	0–50	0–3
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–35	0–4
	lanceleaf springbeauty	CLLA2	*Claytonia lanceolata*	0–35	0–3
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	5–35	0–3
	littleflower alumroot	HEPA10	*Heuchera parviflora*	0–25	0–3
	owl's-claws	HYHO	*Hymenoxys hoopesii*	0–25	0–3
	Rocky Mountain penstemon	PEST2	*Penstemon strictus*	0–25	0–3

	Gunnison's mariposa lily	CAGU	*Calochortus gunnisonii*	0–25	0–3
	bluebell bellflower	CARO2	*Campanula rotundifolia*	0–25	0–3
Shrub/Vine					
7	**Dominant Non-Sprouting Shrubs**			175–450	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	100–300	5–15
	Woods' rose	ROWO	*Rosa woodsii*	5–75	1–5
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–50	0–5
	shrubby cinquefoil	DAFRF	*Dasiphora fruticosa ssp. floribunda*	0–25	0–2
8	**Dominant Sprouting Shrubs**			60–250	
	snowberry	SYMPH	*Symphoricarpos*	50–150	3–10
	creeping barberry	MARE11	*Mahonia repens*	10–100	1–5

Animal community

Proper grazing by both wild and domestic animals on subalpine loam sites is imperative to promote needed nutrient cycling in a nutrient limited environment. Without proper grazing in these systems, nutrients remain stored in above ground biomass and thus are unavailable to plants and microorganisms. Removal or drastic reduction of grazing from these systems reduces the stored organic matter in the soil that is ever so important in creating the high water storage capacity necessary for these systems to function properly. Often wild grazers are the most responsible for site degradation. Improper grazing can be defined as continuous summer-long grazing, even with low animal densities.

This ecological site is extremely valuable for mule deer and elk during fawning and calving as well as throughout the rest of the year. This it provides habitat for a variety of other wildlife including sage-grouse, rabbits, chipmunks, badgers and occasionally black bear, porcupine, blue grouse, and gray jay. Since this ecological site is in close proximity to aspen, spruce, and/or fir trees, it may provide some habitat requirements for warbling vireo, gray-headed junco, Coopers hawk, sharp-shinned hawk, and tree swallow.

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 Series Hydrologic Group

Fine- Loamy Soils examples:
Adel - B
Bachus - B
Clayburn - B
Hourglass - C
Leavittville - C
Youga – B

Clayey restriction Soils examples:
Powderhorn
Cebolia - C
Jerry – B & C
Mord - C
Youman - C

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission. (Soil Survey Staff, 2014)

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 is a high quality area for recreation and natural beauty. Cool temperatures during the summer make the site attractive for summer picnics, fishing trips, and camping trips. Wild flowers are prolific and add to the landscape beauty. Hunting is another extensive use of the site.

Wood products

None.

Other information

Counties where this ecological site occurs are: Gunnison, Hinsdale, Mesa, Montrose, and Saguache. Other counties need to be verified.

MAJOR POISONOUS PLANTS TO LIVESTOCK
Silvery lupine is considered poisonous to all livestock, especially sheep. The toxin is concentrated in the seed; the poisoning is acute, not cumulative. Lupines are a valuable forage if grazing is properly managed and plenty of other forage is available (SCS, 1987)

Type locality

Location 1: Mesa County, CO	
Township/Range/Section	TT10S RR93W S36
General legal description	Sec 36, T10S, R93W, Mesa County, CO.

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.

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

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.

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.

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). August 1975. Range Site Description for Subalpine Loam #250: USDA, Denver Colorado

Soil Conservation Service (SCS). October, 1987. Range Site Description for Subalpine Loam #250: 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 [09/09/2014].

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 September

9, 2014

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

Contributors

Liz With
Suzanne Mayne-Kinney

Approval

Kirt Walstad, 3/05/2024

Acknowledgments

Project Staff:
Suzanne Mayne-Kinney, Ecological Site Specialist, NRCS MLRA, Grand Junction SSO
Chuck Peacock, MLRA Soil Survey Leader, NRCS MLRA Grand Junction SSO

Program Support:
Rachel Murph, NRCS CO State Rangeland Management Specialist, Denver
Scott Woodhall, NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ
Eva Muller, Regional Director, Rocky Mountain Regional Soil Survey Office, Bozeman, MT
B.J. Shoup, CO State Soil Scientist, Denver
Eugene Backhaus, CO State Resource Conservationist, Denver

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

--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include more 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)	Participants were John Murray and Lars Santana - written originally on 12-13-2004. Updated 7/27/2015 by Suzanne Mayne-Kinney
Contact for lead author	
Date	07/27/2015
Approved by	Kirt Walstad

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None on slopes less than 15%. A few 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.

---

2. **Presence of water flow patterns:** None. On slopes greater than 15%, water pattern may be few, but those present flow patterns are short and not connected. Flow patterns should only be present following an intense weather event. Flow length and numbers will increase after wildfires, and/or extended drought.

---

3. **Number and height of erosional pedestals or terracettes:** Pedestals and/or terracettes do not occur on this site at the reference community phase. When runoff is increased from intense storms, it may expect to find some pedestalling and terracettes. On steeper slopes, with intense storms, there will be pedestalling and terracettes that form.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect 2-10% bare ground. Extended drought can cause bare ground to increase.

---

5. **Number of gullies and erosion associated with gullies:** Very rare and when drainages are present they are stabilized with native vegetation and should show no active signs of erosion.

---

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):** None to Slight; litter should be evenly disturbed across the site a thicker layer 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.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating at 3 to 4 in unprotected areas in the interspaces. Under plant shrub or grass plant canopy values will be 5 to 6.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM is 2-6%. Surface soils layer (A-horizon) is typically dark brown loam, usually greater than 16” in depth and typically granular structure. Soil surface is stable and evidence of movement is minimal. Soils are typically deep and well drained.

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. Infiltration is high and runoff is low with extensive plant ground cover and fibrous root systems. Extended spring drought reduces cool season bunchgrasses causing 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. Care should be taken as to not misinterpret clay layers in the soil for compaction.

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 Perennial Forbs Occasional Native Perennial Forbs

    Sub-dominant: Dominant Non-Sprouting Shrubs = Occasional Native Perennial Cool Bunchgrasses Subdominant Native Perennial Cool Rhizomatous = Dominant Sprouting Shrubs

    Other: Occasional Native Perennial Warm Bunchgrasses

    Additional:

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

14. **Average percent litter cover (%) and depth (in):** 50-70% litter cover and ranges from 1.0 to 2.0 inches in depth. Litter cover declines during and following extended 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):** 2000 lbs. /ac. low precipitation years; 2500 lbs. /ac. average precipitation years; 3000 lbs./ac. above average precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 600 – 800 lbs. /ac. or more.

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that**

become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Kentucky bluegrass, Canada thistle

---

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.
