USDA Natural Resources Conservation Service

# Ecological site R049XE223CO
# Shrubby Foothill

Last updated: 9/07/2023
Accessed: 04/30/2024

## 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): 049X–Southern Rocky Mountain Foothills

MLRA 49 is in Colorado (58 percent), Wyoming (27 percent), and New Mexico (15 percent). It makes up about 11,130 square miles (28,845 square kilometers). The major cities in or adjacent to this MLRA are Laramie, Wyoming; Fort Collins, Boulder, Denver, Colorado Springs, and Pueblo, Colorado; and Santa Fe and Las Vegas, New Mexico. Interstates 25, 70, and 80 cross the MLRA. Part of the Medicine Bow National Forest is in the northern tip of this area, in Wyoming; parts of the Roosevelt, Pike, and San Isabel National Forests are in this area in Colorado; and part of the Santa Fe National Forest is in the southern end of this area, in New Mexico. The Rocky Flats Nuclear Arsenal, Peterson Air Force Base, most of the Air Force Academy grounds, and part of the Fort Carson Military Reservation are in the part of this area in Colorado.

Almost half of this area is in the Southern Rocky Mountains and Wyoming Basin Provinces in the Rocky Mountain System. The rest is in the Colorado Pediment, Raton, and High Plains Sections of the Great Plains Province of the Interior Plains. The northern part of the MLRA consists of the Laramie Mountains. The central and southern parts generally are bounded on the east by the Great Plains and on the west by the Southern Rocky Mountains. Elevation ranges from 5,000 feet (1,525 meters) to 8,000 feet (2,440 meters) in most of the MLRA, but small mountains in the area are as high as 10,000 feet (3,050 meters). The Laramie and North Platte Rivers and their associated tributaries are the principal streams in the Wyoming portion of the MLRA. The Cache La Poudre, Big Thompson, Saint Vrain, South Platte, Arkansas, Saint Charles, Huerfano, Cucharas, and Purgatoire Rivers, Clear Creek, Fountain Creek, and their associated tributaries are the principal streams in the Colorado portion. The Vermejo, Cimarron, Pecos, and Mora Rivers and their associated tributaries are the principal streams in the New Mexico portion.

This area has been impacted by the geologic processes of uplift, folding, and faulting and by subsequent erosion and deposition. The Southern Rocky Mountains were uplifted 50 to 70 million years ago during the Laramide uplift. Most of this MLRA is adjacent to this uplift and was also affected. The uplift induced erosion of the relatively soft Late Pennsylvanian to Cretaceous sedimentary rocks from the uplands and dissected the underlying crystalline Precambrian rocks. The relief of the area was reduced by a combination of erosion of uplands and alluvial filling. Approximately 7 million years ago, a large portion of the area was uplifted again to elevations of 14,000 feet (4,270 meters) or more at the core of the Laramide uplift. Since then, precipitation occurring as both rain and snow led to the renewal of erosion and subsequent alluvial fills. The Wyoming portion of the MLRA, the Laramie Mountains, consists primarily of Precambrian plutonic rocks with Pennsylvanian and Permian sedimentary rocks folded and faulted at the margin of the range. The Colorado and New Mexico portions of the area consist primarily of remnants of the uplifted and folded Pennsylvanian through Cretaceous sedimentary rocks forming hogbacks, ridges, and hills, the ranges of which trend in a general north-south direction, parallel to the uplifted Southern Rocky Mountains. Tertiary volcanic flows filled valleys in some areas. After extensive erosion, these more resistant volcanic rocks now form prominent mesas, such as North and South Table Mountains near Golden, Colorado, and Fishers Peak Mesa near the Colorado-New Mexico border. Stream erosion from the eastern front of the Southern Rocky Mountains fostered the creation of a sequence of large alluvial fan remnants, pediments, and terrace deposits in this MLRA.

The average annual precipitation is 12 to 25 inches (305 to 635 millimeters) in most of this area, but it ranges from 10 to 35 inches (255 to 890 millimeters), generally increasing with elevation. The highest precipitation occurs in the Laramie Mountains, in Wyoming, and the lowest precipitation occurs in the Arkansas River Valley, above Salida, Colorado. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. Winter precipitation occurs as snow. The average annual temperature is 36 to 54 degrees F (2 to 12 degrees C). The freeze-free period averages 140 days and ranges from 90 to 195 days, decreasing in length with elevation and from south to north.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the Colorado and New Mexico portions of the MLRA dominantly have a frigid or mesic soil temperature regime. Those in the Wyoming portion have a frigid or cryic soil temperature regime. A few of the higher peaks and some north aspects have a cryic soil temperature regime. Most of the soils in the area have an ustic soil moisture regime, but those on the higher peaks and on some north aspects have a udic soil moisture regime. The soils in the area dominantly have smectitic or mixed mineralogy. They are very shallow to very deep and are dominantly well drained. The texture is dominantly loamy in soils that formed in material weathered from igneous and metamorphic rocks and is dominantly loamy or clayey in soils that formed in material weathered from sedimentary rocks. Some of the most extensive and representative great groups are Haplustolls (Baller series), Argiustolls (Nederland, Nunn, Santa Fe, and Enmedio series), Haplustalfs (Fort Collins, Stoneham, and Dargol series), Haplustepts (Stout series), Ustorthents (Lorencito and Saruche series), and Paleustolls (Flatirons series). (USDA-NRCS, 2006)

## Classification relationships

NRCS:
Major Land Resource Area 49, Southern Rocky Mountain Foothills (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
M331Ib – North Front Range; M331Ic – North Laramie Mountains; M331Id – South Laramie Mountains; and M331Ii – Northern Arkansas Granitics – 39 mile Mountain M331I – Northern Parks and Ranges M331 - Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331Fb – Wet Mountains; M331Fc – Wet Mountain Valley; M331Ff – Raton Basin; M331Fg – Sangre de Cristo Mountains Woodland; and M331Fh – Sangre de Cristo Mountains Coniferous Forest M331F – Southern Parks and Rocky Mountain Range M331 - Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

331If – Arkansas Valley Tablelands; 331Ig- Arkansas Valley High Tablelands; 331Ih – Black Forest; and 331Ii – Southern Front Range Foothills < 331I – Arkansas Tablelands < 331 Great Plains – Palouse Dry Steppe

331Ha – Southern Denver-Julesburg Basin; 331Hc – Eastern Central High Plains; 331He – Northern Front Range Foothills and 331Hf – Denver-Julesburg Basin < 331H – Central High Plains < 331 Great Plains – Palouse Dry Steppe

EPA:
21b – Crystalline Subalpine Forests, 21c – Crystalline Mid-Elevations Forests, 21d -Foothill Shrublands, 21e – Sedimentary Subalpine Forests, and 21f – Sedimentary Mid-Elevation Forests, 21j – Grassland Parks < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006).

25c – Moderate Relief Plains, 25d – Flat to Rolling Plains, and 25l – Front Range Fans < 25 High Plains < 9.4 South Central Semi-Arid Prairies < 9 Great Plains (Griffith, 2006).

26e – Piedmont Plains and Tablelands, 26f- Mesa de Maya/Black Mesa, 26h- Pinyon-Juniper Woodlands and Savannas, 26i – Pine-Oak Woodlands, 26j – Foothills Grasslands, 26k – Sandsheets, and 26l – Upper Canadian Plateau < 26 Southwestern Tablelands < 9.4 South Central Semi-arid Prairies < 9 Great Plains (Griffith, 2006).

USGS:
Southern Rocky Mountain Province, Colorado Piedmont and Raton

## Ecological site concept

R049XE223CO Shrubby Foothill occurs on hillsides and steep hills. Slopes is between 25 to 50%. Soils are shallow to moderately deep with depth of 8 to 40 inches. Soils are derived from slopes alluvium, and/or residuum primarily from shale and siltstone. Soil surface texture is channery silty clay loam or clay loam. Family particle size is clayey or fine. It is an Oak – Mountain Mahogany – Mountain Muhly – Western Wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 22 inches.

## Associated sites

| | |
|---|---|
| R049XB208CO | **Clayey Foothill**<br>This site occurs on undulating hills to gently sloping uplands. Slopes is between 0 to 15%. Soils are moderately deep to deep (20 to 60 inches). Soils are derived from alluvium from basalt, and/or calcareous shale; or residuum from clayey shale, sandstone, calcareous shale and/or shale. Soil surface texture is clay loam or silty clay loam and it may or may not have cobbles, stone, or gravels (up to 15%). Family particle size is fine. It is a Western Wheatgrass – Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 17 inches. |

## Similar sites

| | |
|---|---|
| R049XB204CO | **Shallow Foothill**<br>This site occurs on ridges, hog-backs, and steep slopes. Slopes is between 0 to 35%. Soils are shallow (< 20 inches). Soils are derived from residuum from basalt, sandstone, shale, granite, gneiss and/or limestone; slope alluvium from basalt, sandstone and/or limestone. Soil surface texture is loam or sandy loam and it may have cobbles, stone, gravels or channers in it. It is a Mountain Mahogany – Big Bluestem – Little Bluestem community. It has an aridic ustic moisture regime. The effective precipitation ranges from 13 to 17 inches. |
| R049XB208CO | **Clayey Foothill**<br>This site occurs on undulating hills to gently sloping uplands. Slopes is between 0 to 15%. Soils are moderately deep to deep (20 to 60 inches). Soils are derived from alluvium from basalt, and/or calcareous shale; or residuum from clayey shale, sandstone, calcareous shale and/or shale. Soil surface texture is clay loam or silty clay loam and it may or may not have cobbles, stone, or gravels (up to 15%). Family particle size is fine. It is a Western Wheatgrass – Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 17 inches. |
| R049XB212CO | **Shaly Foothill**<br>This site occurs on break areas with short steep slopes that expose the raw shale parent material. Slopes is between 3 to 35%. Soils are shallow with depths of 6 to 20 inches. Soils are derived from slopes alluvium, and/or residuum primarily from shale or clayey shale. Soil surface texture is clay, clay loam, silt loam or gravelly clay loam. Family particle size is clayey or loamy. It is a Western Wheatgrass– Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 13 to 18 inches. |
| R049XY206CO | **Stony Foothill**<br>This site occurs on hillslopes, ridges, hills and mountainsides. Slopes is between 5 to 60%. Soils range from shallow to deep (10 to 100 inches) in depth. Soils are derived from residuum and/or colluvium from sedimentary rock or alluvium, residuum or colluvium in general. Soil surface texture range from extremely stony loam, very cobbly loam, stony loam, bouldery clay loam or stony sandy loam. Family particle size is clayey, fine, and loamy-skeletal. It is a Big Bluestem – Little Bluestem- Rocky Mountain Juniper community. It has a typic ustic moisture regime and mesic temperature regime. The effective precipitation ranges from 17 to 20 inches. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus ponderosa* |
| Shrub | (1) *Quercus*<br>(2) *Cercocarpus montanus* |
| Herbaceous | (1) *Muhlenbergia montana*<br>(2) *Pascopyrum smithii* |

## Physiographic features

This site has slopes of 25-50%. Elevation ranges from 7,000 to 8,500 ft. It is found on steep hills and hillsides.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Hill |
| Runoff class | Very high |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 7,000–8,500 ft |
| Slope | 25–50% |

## Climatic features

The mean average annual precipitation varies from 16 to 22 inches per year depending on location and ranges from 5 inches to over 27 inches per year. Approximately 60 to 75 percent of the annual precipitation occurs during the growing season from mid-April to late-September. The Rocky Mountains to the west intercept much of the precipitation from Pacific storms during the winter. Snowfall averages 40 inches annually. Wind speeds average 10 miles per hour annually. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 60 miles per hour.

The average length of the growing season is 162 days but varies from 149 to 176 days. The average date of first frost in the fall is October 7, and the last frost in the spring is about May 8. July is the hottest month and January is the coldest. Summer temperatures are moderate, with average highs in the low 80′s and occasionally reaching 90 degrees. Summer nights are comfortably cool, with lows averaging in the 40′s and 50′s. Higher elevations can receive a dusting of snow as early as mid-September. Severe cold is normally of short duration. Summer humidity is low and evaporation is high.

Cool season plants generally begin growth from April 1 to April 15. Southern areas can exhibit cool season growth as early as March 15. Native warm season plants typically begin growth about May 1 to May 15. Regrowth of cool season plants occurs in September and October of most years, depending on moisture availability.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 119-124 days |
| Freeze-free period (characteristic range) | 150-154 days |
| Precipitation total (characteristic range) | 17-19 in |
| Frost-free period (actual range) | 118-125 days |
| Freeze-free period (actual range) | 149-176 days |
| Precipitation total (actual range) | 16-22 in |
| Frost-free period (average) | 121 days |
| Freeze-free period (average) | 162 days |
| Precipitation total (average) | 18 in |

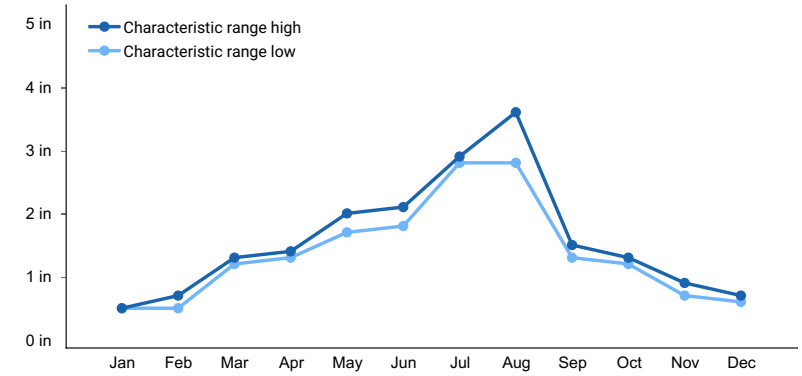



**Figure 1. Monthly precipitation range**

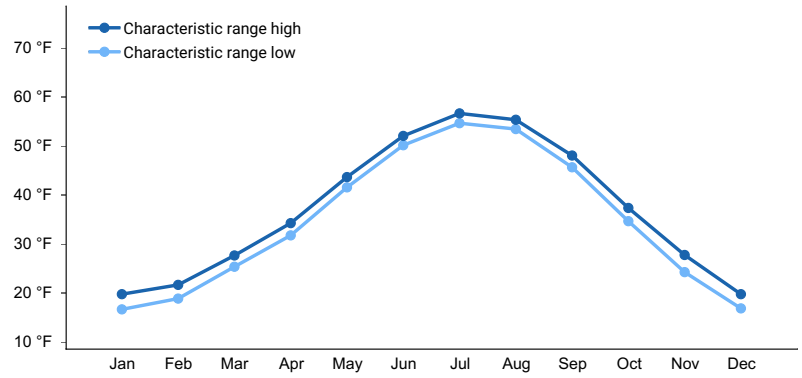



**Figure 2. Monthly minimum temperature range**

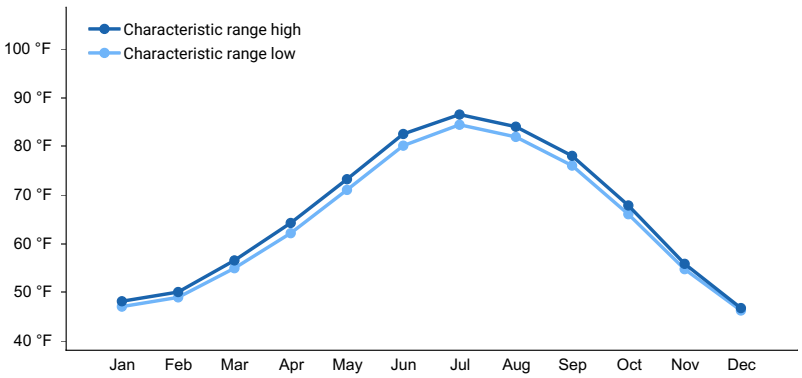



**Figure 3. Monthly maximum temperature range**

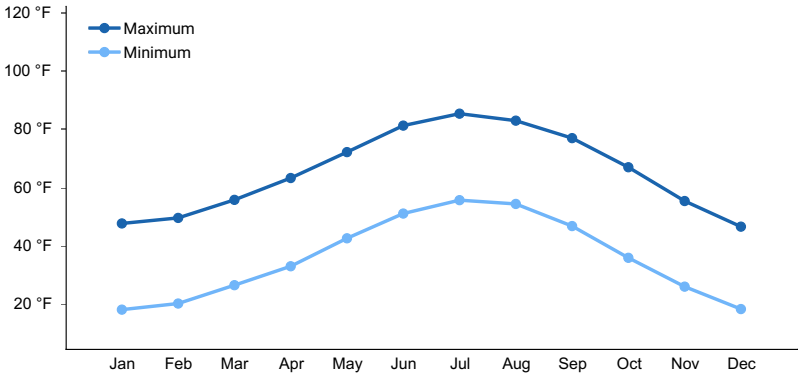



**Figure 4. Monthly average minimum and maximum temperature**

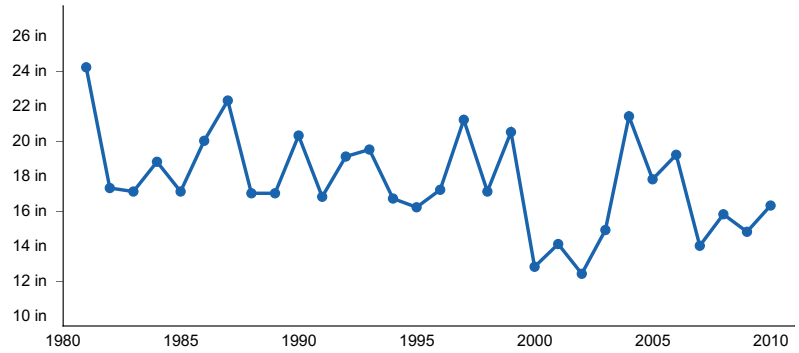



**Figure 5. Annual precipitation pattern**

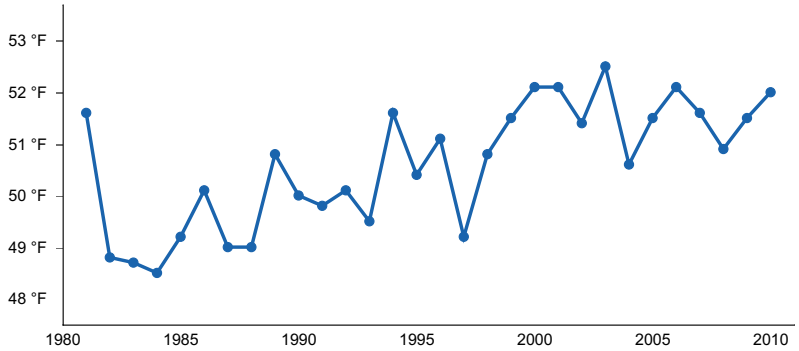



**Figure 6. Annual average temperature pattern**

## Climate stations used

- (1) TRINIDAD [USC00058429], Trinidad, CO
- (2) TRINIDAD LAKE [USC00058436], Trinidad, CO
- (3) RATON FLTR PLT [USC00297279], Raton, NM

## Influencing water features

None

## Soil features

The Rombo component is on hills on foothills. The parent material consists of slope alluvium and residuum weathered from shale and siltstone. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 4 percent.

The Saruche component is on hills on foothills. The parent material consists of slope alluvium and residuum weathered from shale. Depth to a root restrictive layer, bedrock, paralithic, is 8 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Water flow paths should be broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers and exhibit slight to no evidence of rills, wind scoured areas or pedestal plants. As slopes become steeper, expect to find evidence water flow patterns and pedestal plants. Sub-surface soil layers, where not affected by bedrock, are non-restrictive to water movement and root penetration.

Major soil series correlated to this ecological site include: Rombo, and Saruche.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Slope alluvium–shale and siltstone<br>(2) Residuum–shale and siltstone |
| Surface texture | (1) Channery silty clay loam<br>(2) Clay loam |
| Family particle size | (1) Clayey<br>(2) Fine |
| Drainage class | Well drained |
| Permeability class | Slow |
| Depth to restrictive layer | 8–40 in |
| Soil depth | 8–40 in |
| Surface fragment cover <=3" | 15–25% |
| Surface fragment cover >3" | 1–5% |
| Available water capacity (Depth not specified) | 2.4–6.3 in |
| Calcium carbonate equivalent (Depth not specified) | 0% |
| Electrical conductivity (Depth not specified) | 0–2 mmhos/cm |
| Sodium adsorption ratio (Depth not specified) | 0 |
| Soil reaction (1:1 water) (Depth not specified) | 6.1–7.8 |
| Subsurface fragment volume <=3" (Depth not specified) | 20–30% |
| Subsurface fragment volume >3" (Depth not specified) | 0% |

## Ecological dynamics

Continuous grazing without adequate recovery periods following each grazing occurrence, will cause grasses such as western wheatgrass, green needlegrass, big bluestem, sideoats grama, and mountain muhly to decrease in frequency and production. American vetch, purple prairie clover, dotted blazing star, alderleaf mountain mahogany, fourwing saltbush, winterfat, currant and western snowberry to decrease. Grasses and grass-like plants such as blue grama, bottlebrush squirreltail, sand dropseed, threeawn, and sun sedge will increase. Oak will increase and show signs of low vigor if continuous grazing (browsers) persists in the absence of fire. Fire (prescribed fire or wildfire) causes oak to increase and dominate the plant community. Plant communities subjected to non-use (less than 20 years), in the absence of fire, causes increased plant litter and decadence.

This site developed with occasional fires being part of the ecological processes. Historically, it is believed that the fires were infrequent, randomly distributed, and started by lightning at various times throughout the season when thunderstorms were likely to occur. The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

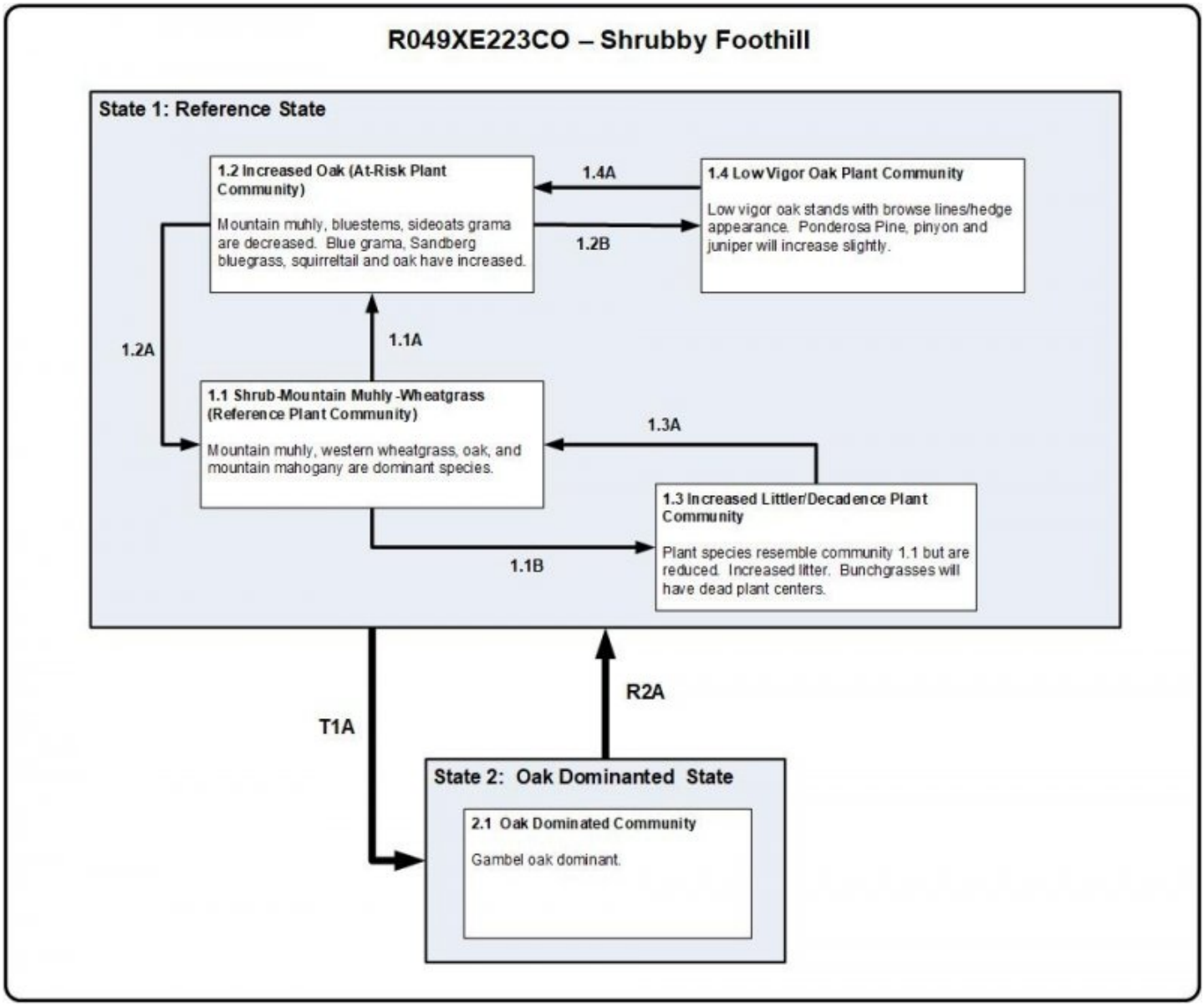
Drought cycles have historically had a major impact upon the vegetation. The species composition changes according to the duration and severity of the drought cycle.

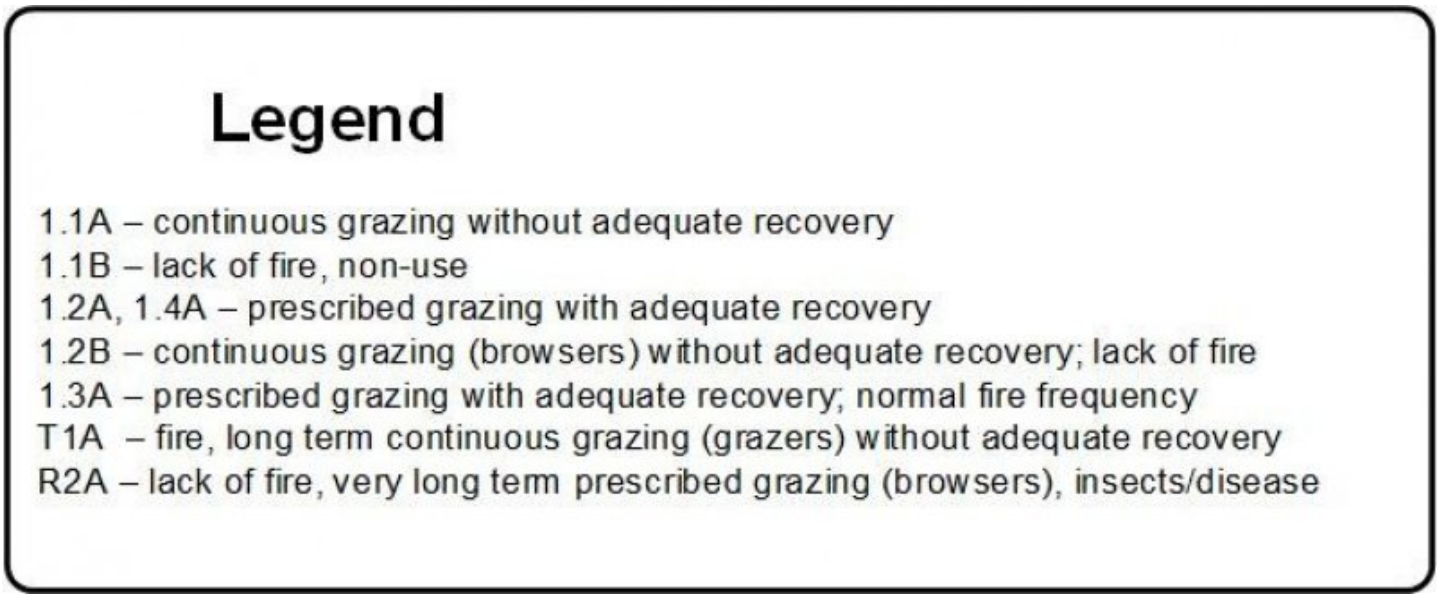
The reference plant community (description follows the plant community diagram) has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration/time-controlled grazing and historical accounts.

Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they probably are the most prevalent and repeatable plant communities. The plant composition table shown above has been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways (arrows) among communities. Bold lines surrounding each plant community or communities represent ecological thresholds. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

## State and transition model






## State 1
## Reference State

The reference state consists of four distinct plant community phases. The Reference Plant Community, At Risk Plant Community, Increase Litter/Decadence Plant Community and Low Vigor Oak represent the state. Shrubs and a mixture of warm and cool season mid grasses give the site a sloping shrubland appearance on the landscape. The plant communities, and the various successional states between them, represent the natural range of variability due to the disturbance regimes applicable to the site.

### Community 1.1
### Reference Plant Community- Shrub/Mountain Muhly/Wheatgrass

This plant community is the interpretive plant community for this site and is the Reference Plant Community. This community developed with grazing by large herbivores and is suited to grazing by domestic livestock. Historically, fires likely occurred infrequently. This plant community can be found on areas where grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 40-50% grasses and grass-likes, 10-15% forbs, 35-40% shrubs, and 1-5% trees. Shrubs and a mixture of warm and cool season mid grasses dominate this community. Principal grasses consist of mountain muhly, western wheatgrass, green needlegrass, big bluestem, little bluestem, and sideoats grama. Secondary grasses consist of blue grama, Scribner needlegrass, muttongrass, Sandberg bluegrass, and bottlebrush squirreltail. Threadleaf and sun sedge are common. Elk sedge occupies the higher elevation portions of the landscape. Dominant forbs are American vetch, purple prairie clover, Drummond's milkvetch, and scarlet globemallow. Key shrubs include Gambel or wavyleaf oak, alderleaf mountain mahogany, skunkbush sumac, fourwing saltbush, winterfat, and Wood's rose. Serviceberry and snowberry exist on higher elevations. Ponderosa pine, twoneedle pinyon , oneseed juniper, and Rocky Mountain juniper comprise the tree component. This is a sustainable plant community in terms of soil stability, watershed function and biological integrity. Litter is properly distributed. Decadence and natural plant mortality are low. The biotic community, nutrient cycle, water cycle and energy flow are functioning properly. Livestock and vehicle trails are subject to water erosion. Total annual production, during an average year, ranges from 900 to 2100 pounds of air-dry weight and will average 1600 pounds.

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---|---|---|
| Grass/Grasslike | 510 | 752 | 1115 |
| Shrub/Vine | 220 | 600 | 650 |
| Forb | 155 | 200 | 250 |
| Tree | 15 | 48 | 85 |
| **Total** | **900** | **1600** | **2100** |

### Community 1.2
### At Risk Plant Community - Increased Oak

This plant community developed with continuous grazing without providing adequate recovery periods during the growing season. Mountain muhly, big bluestem, little bluestem, sideoats grama, western wheatgrass, and green needlegrass have been reduced. Blue grama, prairie junegrass, Sandberg bluegrass, and bottlebrush squirreltail have increased. American vetch and purple prairie clover have also been reduced. Various forbs and shrubs such as American vetch, purple prairie clover, mountain mahogany, fourwing saltbush, winterfat, and currants are present but reduced in production. White sagebrush (Louisiana sagewort), western ragweed, yarrow, hairy false goldenaster, slimflower scurfpea, small soapweed and prairie sagewort (fringed sagebrush) have increased slightly. Oak production and canopy coverage have increased. Kentucky bluegrass is beginning to establish/invade under oak canopy. Ponderosa pine, twoneedle pinyon, and juniper species may increase or remain static. Increase in oak and reduction of warm/cool season grasses, nitrogen-fixing forbs, shrub component and increased Kentucky bluegrass, has begun to alter the biotic integrity of this community. Water and nutrient cycles are at risk of becoming impaired. Litter levels have increased due to increased oak production. Total annual production, during an average year, ranges from 500-1500 pounds of air-dry weight and will average 1000 pounds.

### Community 1.3
### Decadent Plant Community- Increased Litter/Decadence

This plant community develops under non-use (rest) and lack of fire. Plant species resemble the Reference PC however, frequency and production will be reduced. Eventually, litter levels can become high enough to cause stagnation and mortality of various species such as big and little bluestem, Indiangrass, and switchgrass. Bunchgrasses typically develop dead centers and rhizomatous grasses can form small decadent communities due to a lack of stimulation by grazing animals. Kentucky bluegrass has invaded. Management changes can easily shift this plant community toward the Reference PC. Non-disturbance will initially increase litter levels, minimizing soil erosion. In advanced stages of non-use (rest) or lack of fire, plants will begin to die off and bare areas will increase causing an erosion concern. Total annual production can vary from 400 to 1200 pounds of air-dry vegetation per acre and will average 800 pounds.

### Community 1.4
### Low Vigor Oak Plant Community

Continuous grazing by domestic livestock and wildlife can lead to suppressed and low vigor oak stands. Browse lines are evident and exhibit a hedged appearance. New growth oak is not likely under this grazing regime. Ponderosa pine, twoneedle pinyon , oneseed juniper and Rocky mountain juniper have increased slightly. Compared to the Reference PC, native herbaceous understory has been significantly reduced, however Kentucky bluegrass will continue to increase. Sideoats grama and little bluestem may still be present in small amounts on steeper slopes. White sagebrush (Louisiana sagewort), hairy false goldenaster, western ragweed, and western yarrow have replaced American vetch and purple prairie clover. Mountain mahogany and other shrubs remain scattered throughout. Species diversity and production have decreased due to the reduction and low vigor/decadence of native shrub and grass species. A shift to introduced grass (Kentucky bluegrass) is beginning to affect the biotic integrity of this community. The community remains fairly stable. Energy flow, water cycle and mineral cycle have been negatively affected. Litter levels are lower compared to the Reference PC. Production ranges from 300 to 700 pounds of air-dry vegetation per acre per year and will average 500 pounds.

### Pathway 1.1A
### Community 1.1 to 1.2

Continuous grazing without adequate recovery periods between grazing events will shift this plant community to the At Risk Plant Community.

### Pathway 1.1B
### Community 1.1 to 1.3

Non-use (rest) and no fire will move this plant community to the Decadent Plant Community.

### Pathway 1.2A
### Community 1.2 to 1.1

Prescribed grazing with adequate recovery opportunities between grazing events and proper stocking will move this plant community toward the Shrubs, Mountain Muhly, Western Wheatgrass Plant Community (Reference PC).

### Pathway 1.2B
### Community 1.2 to 1.4

Continuous grazing (browsers) without adequate recovery opportunities between grazing events and the lack of fire will shift this toward a Low Vigor Oak Plant Community.

### Pathway 1.3A
### Community 1.3 to 1.1

Prescribed grazing, which allows for adequate recovery opportunity between grazing events and proper stocking, and normal fire frequency, will shift this plant community toward the Shrub, Mountain Muhly, Western Wheatgrass (Reference PC).

### Pathway 1.4A
### Community 1.4 to 1.2

Prescribed grazing with adequate recovery opportunities between grazing events and proper stocking will move this plant community toward the Increased Oak Plant Community.

## State 2
## Oak Dominated State

The Oak Dominated state consists of one distinct plant community phase. The Oak Dominated Plant Community represents the state. Oak has become dominant with minor amounts of understory vegetation consisting of Kentucky bluegrass and upland sedge species. This state is very resistant to disturbances due to the dominance of oak. Species diversity and biologic integrity has been lost.

### Community 2.1
### Oak Dominated Plant Community

Herbaceous understory and production can vary depending on the diversity and production of the community from which it came. Mountain mahogany, pine and juniper are susceptible to fire and may be lost or substantially reduced. Erosion will be a concern shortly after the fire event. Eventually, this plant community will stabilize as the oak becomes dominant. Presently, it is not economically feasible to convert dense oak stands back to pre-fire levels. Production on this community is highly variable. Expect ranges from 200 to 600 pounds of air-dry vegetation per acre per year.

### Transition T1A
### State 1 to 2

Fire (prescribed or wild) reduces or eliminates tree competition and stimulates oak growth, and long-term continuous grazing (grazers) without adequate recovery opportunity, results in a shift across an ecological threshold toward an Oak Dominated Plant Community. This transition can pathway from the Reference PC or any associated successional plant communities.

### Restoration pathway R2A
### State 2 to 1

The lack of fire together with very long-term prescribed grazing (browsers) that allows adequate recovery opportunity following each grazing event, and insects/disease, will cause the Oak Dominated Plant Community to transition across and ecological threshold toward the Reference State. The time frame for this plant community shift

is dependent on the length of fire removal from the system and the level of grazing management applied. These factors will contribute to the uncertainty of the restoration.

## Additional community tables

**Table 6. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Lb/Acre) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Grasses/Grasslikes** | | | 640–800 | |
| | mountain muhly | MUMO | *Muhlenbergia montana* | 160–240 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 80–160 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–112 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 48–80 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 48–80 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 48–80 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 32–80 | – |
| | Arizona fescue | FEAR2 | *Festuca arizonica* | 16–80 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 16–80 | – |
| | slender wheatgrass | ELTRS | *Elymus trachycaulus ssp. subsecundus* | 16–48 | – |
| | muttongrass | POFE | *Poa fendleriana* | 16–48 | – |
| | nodding brome | BRAN | *Bromus anomalus* | 16–48 | – |
| | Montana wheatgrass | ELAL7 | *Elymus albicans* | 0–48 | – |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–48 | – |
| | Scribner needlegrass | ACSC11 | *Achnatherum scribneri* | 0–48 | – |
| | sedge | CAREX | *Carex* | 16–46 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 16–32 | – |
| | squirreltail | ELELE | *Elymus elymoides ssp. elymoides* | 0–16 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–16 | – |
| **Forb** | | | | | |
| 2 | **Forbs** | | | 160–240 | |
| | Forb, perennial | 2FP | *Forb, perennial* | 16–80 | – |
| | American vetch | VIAM | *Vicia americana* | 16–32 | – |
| | purple prairie clover | DAPUP | *Dalea purpurea var. purpurea* | 16–32 | – |
| | leafy false goldenweed | OOFOF | *Oonopsis foliosa var. foliosa* | 0–32 | – |
| | scarlet globemallow | SPCO | *Sphaeralcea coccinea* | 0–32 | – |
| | Drummond's milkvetch | ASDR3 | *Astragalus drummondii* | 0–16 | – |
| | foothill arnica | ARFU3 | *Arnica fulgens* | 0–16 | – |
| | hairy false goldenaster | HEVI4 | *Heterotheca villosa* | 0–16 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 0–16 | – |
| | Indian paintbrush | CASTI2 | *Castilleja* | 0–16 | – |
| | beardtongue | PENST | *Penstemon* | 0–16 | – |
| | slimflower scurfpea | PSTE5 | *Psoralidium tenuiflorum* | 0–16 | – |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 0–16 | – |
| | twogrooved milkvetch | ASBI2 | *Astragalus bisulcatus* | 0–16 | – |

| | | | | | |
|---|---|---|---|---|---|
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–16 | – |
| **Shrub/Vine** | | | | | |
| 3 | **Shrubs** | | | 560–640 | |
| | oak | QUERC | *Quercus* | 160–240 | – |
| | alderleaf mountain mahogany | CEMO2 | *Cercocarpus montanus* | 160–240 | – |
| | fourwing saltbush | ATCA2 | *Atriplex canescens* | 16–80 | – |
| | skunkbush sumac | RHTR | *Rhus trilobata* | 16–80 | – |
| | winterfat | KRLA2 | *Krascheninnikovia lanata* | 16–80 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 16–48 | – |
| | Woods' rose | ROWO | *Rosa woodsii* | 16–32 | – |
| | wax currant | RICE | *Ribes cereum* | 16–32 | – |
| | rabbitbrush | CHRYS9 | *Chrysothamnus* | 0–32 | – |
| | Saskatoon serviceberry | AMAL2 | *Amelanchier alnifolia* | 0–32 | – |
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 0–32 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 0–16 | – |
| | prairie sagewort | ARFR4 | *Artemisia frigida* | 0–16 | – |
| | plains pricklypear | OPPO | *Opuntia polyacantha* | 0–16 | – |
| | soapweed yucca | YUGL | *Yucca glauca* | 0–16 | – |
| **Tree** | | | | | |
| 4 | **Trees** | | | 16–80 | |
| | ponderosa pine | PIPO | *Pinus ponderosa* | 16–80 | – |
| | juniper | JUNIP | *Juniperus* | 16–48 | – |
| | twoneedle pinyon | PIED | *Pinus edulis* | 0–32 | – |

## Animal community

The following table lists suggested initial stocking rates for cattle under continuous grazing (year-long grazing or growing season long grazing) under normal growing conditions, however, continuous grazing is not recommended. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process. Often, the current plant composition does not entirely match any particular plant community (described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data, particularly when grazers other than cattle are involved. Under more intensive grazing management, improved harvest efficiencies can result in an increased carrying capacity.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide yearlong forage under prescribed grazing for cattle, sheep, horses and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

Plant Community (PC)/ Production (lbs./acre)/ Stocking Rate**(AUM/acre)

1.1 Shrub, Mountain Muhly, Western Wheatgrass (Reference PC)/ 1600/ 0.44
1.2 Increased Oak (At Risk PC)/ 1000/ 0.27
1.3 Increased Litter/Decadence (Decadent PC)/ 800/ 0.22
1.4 Low Vigor Oak (Low Vigor Oak PC)/ 500/ 0.14
2.1 Oak Dominated PC/ */ *

* Highly variable; stocking rate needs to be determined on site.

**The stocking rate calculations are based on the total annual forage production in a normal year multiplied by 25% harvest efficiency divided by 912.5 pounds of ingested air-dry vegetation for an animal unit per month. (refer to USDA NRCS, National Range and Pasture Handbook).

## Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group A. Infiltration is moderate to high and runoff potential for this site is moderate depending on ground cover. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (NEH-4) for runoff quantities and hydrologic curves).

## Recreational uses

This site provides hunting, horseback riding, hiking, photography, bird watching and other opportunities. The wide varieties of plants that bloom from spring until fall have an esthetic value that appeals to visitors.

## Wood products

Fence posts and firewood are potential wood products.

## Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates and other inventory data. Field observations from experienced range trained personnel were used extensively to develop this ecological site description. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

Counties in which this ecological site is expected to occur include Huerfano and Las Animas in Colorado, and Colfax, Mora and San Miguel in New Mexico.

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Kirt Walstad, 9/07/2023

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--Site Development and Testing Plan--:

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

Additional information and data are required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 49 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.

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## Rangeland health reference sheet

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

| | |
|---|---|
| Author(s)/participant(s) | |
| Contact for lead author | |
| Date | 04/30/2024 |
| Approved by | Kirt Walstad |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

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

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

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

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

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

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**