USDA Natural Resources Conservation Service

Ecological site R049XB208CO
Clayey Foothill

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General information

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

MLRA notes

Major Land Resource Area (MLRA): 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

R049XB208CO Clayey Foothill 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, or calcareous shale; or residuum from clayey shale, sandstone, calcareous shale 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.

Associated sites

R049XB210CO	**Sandy Foothill** This site occurs on gently sloping to rolling hills and uplands. Slopes is between 0 to 10%. Soils are greater than 40 inches. Soils are derived from alluvium, eolian deposits, eolian sands, and residuum primarily from arkosic sedimentary rock and sandstone. Soil surface texture is loamy sand, sandy loam or fine sandy loam. Family particle size is coarse-loamy or sandy. It is a Big Bluestem– Prairie Sandreed community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches.
R049XB212CO	**Shaly Foothill** 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.
R049XB204CO	**Shallow Foothill** 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.
R049XY036CO	**Overflow** This site occurs on flood plains, terraces, valley floor and stream terraces. Slopes is between 0 to 9%. Soils are greater than 60 inches in depth. Soils are derived from slopes alluvium from sandstone and shale. Soil surface texture is loam or fine sandy loam. Family particle size is fine-loamy. It is a Western Wheatgrass– Green Needlegrass community. It has an aridic ustic moisture regime. The effective precipitation ranges from 11 to 18 inches.

Similar sites

R049XY214CO	**Gravelly Foothill** This site occurs on gently rolling and sloping uplands. Slopes is between 0 to 35%. Soils are deep and greater than 60 inches in depth. Soils are derived from slopes alluvium, alluvium and colluvium from arkose or igneous and metamorphic rocks. Soil surface texture is gravelly, sandy loam, cobbly sandy loam, gravelly loam or very gravelly loam. Family particle size is sandy-skeletal, loamy-skeletal or fine-loamy over sandy-skeletal. It is a Little Bluestem – Needle-and-Thread community. It has an aridic ustic moisture regime. The effective precipitation ranges from 12 to 16 inches
R049XY213CO	**Cobbly Foothill** This site occurs on fans, terraces, stream terraces, fan terraces, mesas and cuestas. Slopes is between 5 to 25%. Soils are moderately deep to very deep with depths of greater than 20 inches. Soils are derived from alluvium, colluvium and/or residuum primarily from sandstone and//or sedimentary rock. Soil surface texture is extremely cobbly sandy loam, stony sandy loam, cobbly sandy loam or extremely cobbly loam. Family particle size is loamy-skeletal or clayey skeletal. It is a Mountain Muhly – Big Bluestem community. It has a typic ustic moisture regime. The effective precipitation ranges from 15 to 18 inches.

R049XB212CO	**Shaly Foothill** 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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

Topography varies from undulating hills to gently sloping uplands. They occur on fans, terraces and upland ridges. Generally slopes range from nearly level to 15%. This site occurs on the Benton and Pierre geological formations. The early spring moisture pattern has a definite influence toward a cooler season vegetation. Elevation ranges from 5,500 to 7,500 ft.

Table 2. Representative physiographic features

Landforms	(1) Hillslope (2) Fan (3) Terrace (4) Alluvial fan (5) Hill (6) Plateau (7) Mesa (8) Fan remnant
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,286 m
Slope	0–30%
Aspect	Aspect is not a significant factor

Climatic features

Precipitation averages 12 to 17 inches annually with 60 to 70% falling during the growing season. Amount of snowfall averages 50 inches annually. Snowfall during March and April can amount to significant moisture in some years. High intensity summer thunderstorms followed by hot, dry periods are a common occurrence. The moisture pattern has a definite influence on cool season vegetation dominance.

The cool season plants generally begin growth from April 1 to April 15. Warm season plants usually start growing from April 20 to May 15. The length of the growing season is 120-150 days with average frost dates occurring on May 15 and October 1. The average annual temperature is about 49 degrees F with the hottest temperatures occurring during the months of July and August.

Table 3. Representative climatic features

Frost-free period (characteristic range)	84-112 days
Freeze-free period (characteristic range)	114-136 days

Precipitation total (characteristic range)	356-432 mm
Frost-free period (actual range)	70-123 days
Freeze-free period (actual range)	105-142 days
Precipitation total (actual range)	330-432 mm
Frost-free period (average)	99 days
Freeze-free period (average)	125 days
Precipitation total (average)	381 mm

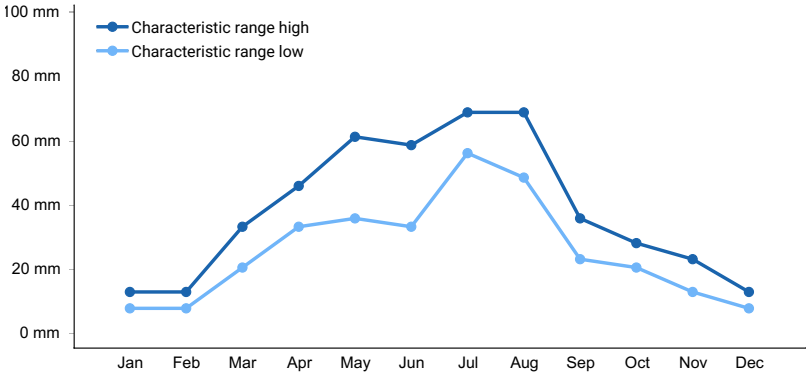


Figure 1. Monthly precipitation range

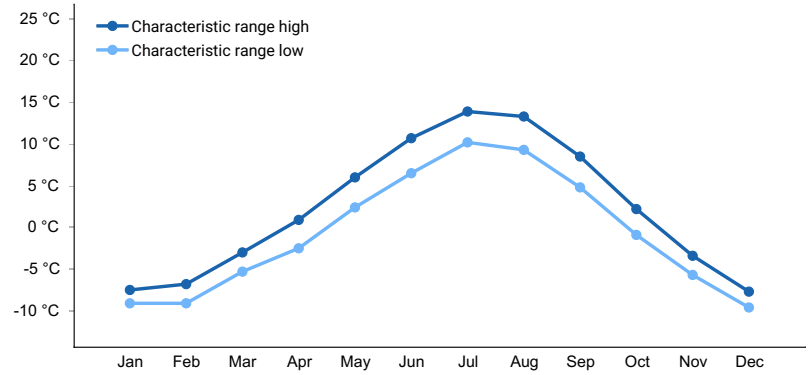


Figure 2. Monthly minimum temperature range

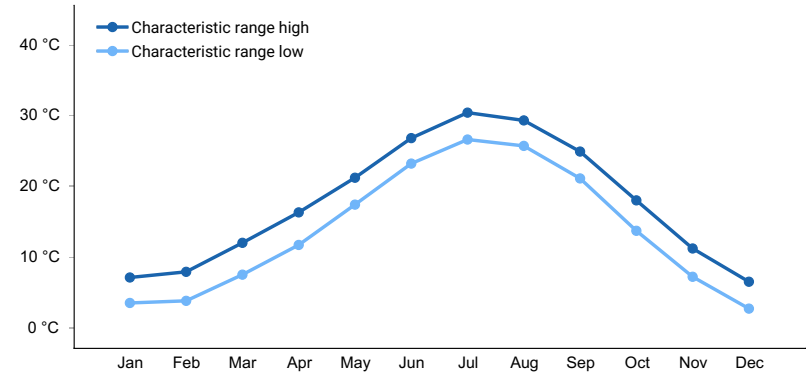


Figure 3. Monthly maximum temperature range

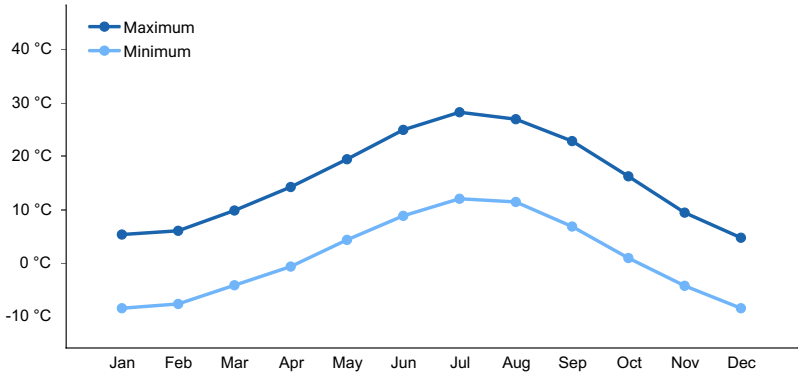


Figure 4. Monthly average minimum and maximum temperature

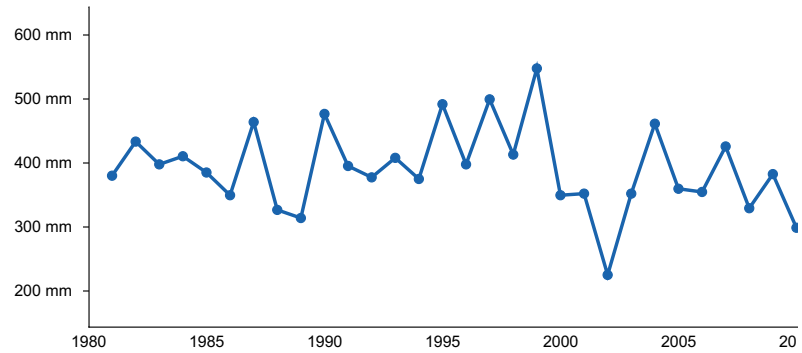


Figure 5. Annual precipitation pattern

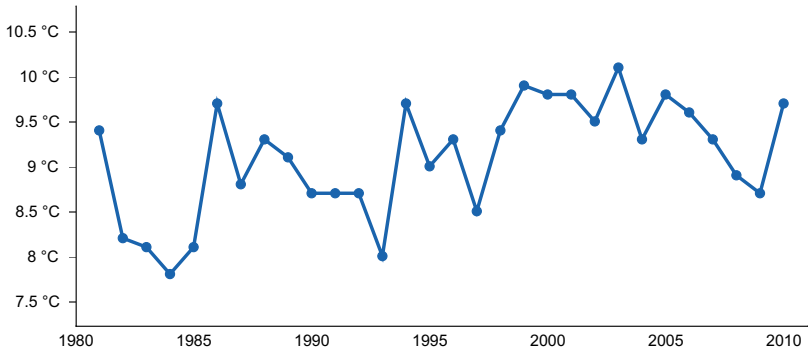


Figure 6. Annual average temperature pattern

Climate stations used

- (1) VIRGINIA DALE 7 ENE [USC00058690], Livermore, CO
- (2) WATERDALE [USC00058839], Loveland, CO
- (3) PARKER 6 E [USC00056326], Parker, CO
- (4) RUSH 1N [USC00057287], Rush, CO
- (5) COLORADO SPRINGS MUNI AP [USW00093037], Colorado Springs, CO
- (6) SHEEP MTN [USC00057572], Gardner, CO
- (7) RED WING 1 WSW [USC00056977], Gardner, CO

Influencing water features

None

Soil features

Soils are moderately deep to deep and are well drained. The surface textures are mostly clay loam but also include clay and silty clay loam. The surface layers vary in reaction from a pH of 6.1 to 8.4. These soils are formed in alluvium and residual parent material derived from calcareous shale and calcareous mixed lithology. The subsoils

are slowly permeable. Soils crack during dry periods.

Permeability varies from slow to moderately slow. The surface runoff is medium and the erosion hazard is moderate for most of the soils associated with this ecological site. However, on steeper slopes the surface runoff is rapid and the erosion hazard is high if not protected with vigorous vegetation.

Major soil associated with this site:
(Soil Series - Surface Texture)

Denver clay loam, Englewood clay loam, Kutch clay loam, Litle silty clay loam, Manzanola Clay Loam. Nunn clay loam, Renohill clay loam, Ulm Clay Loam, Torreon clay loam or stony clay, Stanley gravelly clay loam, and Heldt clay loam

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Residuum–clayey shale (3) Alluvium–basalt (4) Residuum–sandstone and shale (5) Residuum–calcareous shale (6) Alluvium–calcareous shale
Surface texture	(1) Clay loam (2) Cobbly, gravelly, stony clay loam (3) Silty clay loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Slow
Soil depth	51–254 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	12.95–18.54 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

The information in this ESD, including the state-and-transition model diagram (STM), was developed using historical data, and professional experience. The information is representative of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration/time-controlled grazing strategies, and historical accounts.

The Clayey Foothill ecological site is characterized by four states: Reference, Warm-Season Shortgrass

Dominated, Increased *Bare Ground*, and Invaded States. The Reference State is characterized by dominant cool-season rhizomatous midgrass (western wheatgrass), and secondary cool-season mid-height bunchgrass (green needlegrass). The Warm-Season Shortgrass State is characterized by a warm-season short bunchgrass (blue grama), and secondary warm-season short stoloniferous grass (buffalograss). The Increased *Bare Ground* State is characterized by early successional warm-season bunchgrass (Fendler threeawn), cool-season short bunchgrass (squirreltail), annual grasses, annual forbs, and soapweed yucca. The Invaded State has been disturbed by equipment, and includes early successional annual plants as well as invasive species (knapweeds, yellow toadflax).

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically occupied by large grazing animals such as bison and elk, along with pronghorn and mule deer. Grazing by these large herbivores, along with climatic and seasonal weather fluctuations, had a major influence on the ecological dynamics of the site.

Historically, it is believed, grazing patterns by herds of large ungulates was driven by water distribution, precipitation events, drought events, and fire. It is believed that grazing periods would have been shorter, followed by longer recovery periods. These large migrating herds impacted the ecological processes of nutrient and hydrologic cycles, by urination, trampling (incorporation of litter into the soil surface), and breaking of surface crust, to increase water infiltration.

This site developed with occasional fires being part of the ecological processes. Historic fire frequency (pre-industrial), is estimated at 10-12 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season.
Dendroecological reconstructions of fire history showed that fires burned during years of extreme drought (2011. Schoennagel, Sherriff, Veblen).

Early human inhabitants were also likely to start fires for various reasons (deliberately or accidentally). Both of these types of fire events likely impacted the site by leaving mosaic vegetation patterns. The impact of fire over the past 50 years has been relatively insignificant due to wildfire suppression and the lack of acceptance of prescribed fire as a management tool. However, prolonged drought, coupled with fire suppression has increased the frequency and intensity of periodic wildfires in the area.

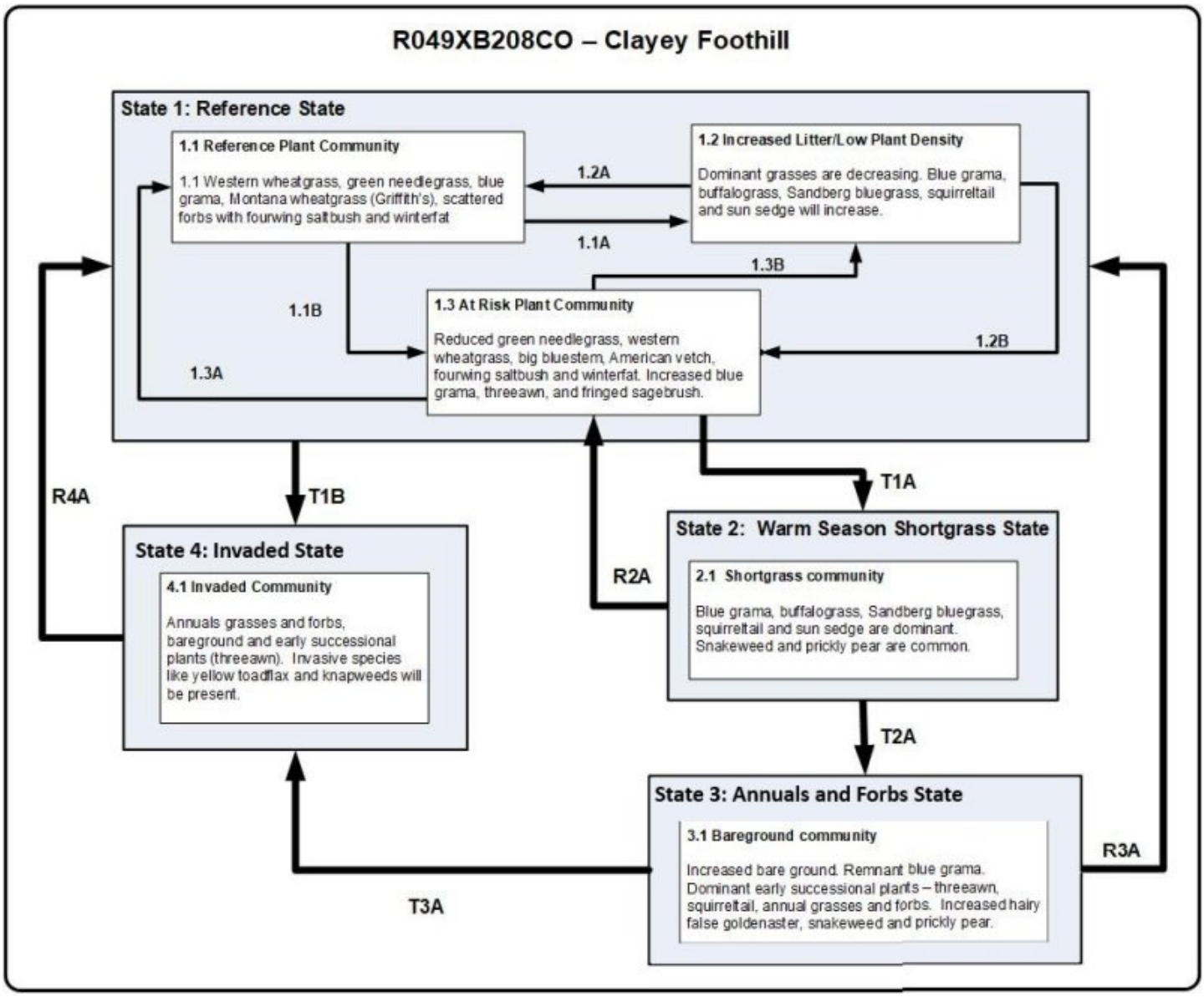
Deterioration of this site, due to continuous grazing without adequate recovery periods following each grazing occurrence and/or overstocking, will cause blue grama to increase. Cool-season grasses such as green needlegrass and western wheatgrass will decrease. Warm-season grasses such as big bluestem, and palatable forbs such as purple prairie clover will also decrease. Fendler threeawn, annuals and bare ground increase under heavy continuous grazing. Lack of grazing and lack of fire initially causes increased herbaceous litter. Decadence of bunchgrasses, such as green needlegrass and Indian ricegrass, and lower vigor vegetation is expected to occur with non-use and lack of fire. This also allows invasive species like diffuse knapweed, spotted knapweed, cheatgrass, toadflax and other similar vegetation to establish. Grazing which allows adequate recovery periods following each grazing event and proper stocking will maintain the palatable plants.

Drought and/or early killing frost cycles have historically impacted the vegetation. Changes in species composition will vary depending upon the duration and severity of the drought and/or frost cycle.

Some of this ecological site has been tilled and used for crop production. Today, much of this site is urban/suburban residence and small acreage development. Residential development leads to fire suppression. This is an important site for livestock grazing, especially beef cattle. Today the management of livestock grazing has been a major influence on the ecological dynamics of the site. This management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site.

The following diagram illustrates the common plant communities that can occur on the site and the pathways (arrows) among communities. Bold lines surrounding each plant community or communities represent ecological thresholds and a plant community state. Community phase pathways in the reference state represent shifts in the plant community within the natural range of variability. Transition and Restoration pathways represent the plant community crossing an ecological threshold between states. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model



Legend

1.1A. 1.3B – lack of grazing, lack of fire, time without disturbance
1.2A – fire, drought, proper grazing
1.3A – proper grazing, wetter climatic periods, normal fire frequency
1.1B – repeated herbivory without recovery time, drought, reduced fire frequency
T1A – continuous grazing and/or high stocking rates, extended drought
R2A, R3A – long-term prescribed grazing and proper stocking rates over lengthy time frame, wetter climatic cycles
T2A – long term heavy continuous grazing without adequate recovery time
T1B – heavy continuous grazing, lack of fire, time without disturbance, invasive species introduction
1.2B – proper grazing with recovery time, fire
T3A – long term heavy continuous grazing, mechanical disturbance
R4A – very long term prescribed grazing, insect/disease, vegetation manipulation (invasive species management)

State 1
Reference State

The Reference State is characterized by three distinct plant community phases; Reference Plant Community, At

Risk Plant Community, and Decadent Plant Community. These plant communities, and the various secessional stages between them, represent the natural range of variability due to the disturbance regimes applicable to this site. This site has a rolling grassland aspect with mid-grasses dominating. Western wheatgrass clearly dominates the plant community. Green needlegrass is also abundant. Western wheatgrass and green needlegrass produce about 60% of the total vegetation on this site. Plants such as blue grama, muttongrass, Sandberg bluegrass, sun sedge, purple prairie clover, fourwing saltbush and winterfat are secondary in the plant community. Indian ricegrass, buffalograss, bottlebrush squirreltail, Fendler threeawn, scarlet globemallow, slimflower scurfpea and prairie sagewort occur in small amounts in scattered distribution. Following is the narrative for the reference plant community. This plant community may not represent every possibility, but it probably is the most prevalent and repeatable plant community. As more data are 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.

Community 1.1
Reference Plant Community

This is the interpretive plant community. This plant community evolved with grazing by large herbivores, and is well suited for grazing by domestic livestock. It can be found on areas that are properly managed with prescribed grazing that allows for adequate recovery periods following each grazing event. The potential vegetation is about 80-90% grasses and grass-like plants, 5-10% forbs, and 5-10% shrubs (air-dry weight). The major grasses in the Reference Plant Community include western wheatgrass, green needlegrass, blue grama, big and little bluestem, and sideoats grama. These plants provide valuable forage throughout the growing season. Sub-dominant grasses include mountain muhly, Griffith's wheatgrass, native bluegrass, and prairie junegrass. Major forbs include purple prairieclover, American vetch, scarlet globemallow, upright prairie coneflower, and dotted gayfeather. Dominant shrubs include fourwing saltbush and winterfat. Overgrazing with cattle will cause western wheatgrass, green needlegrass, Indian ricegrass, muttongrass, winterfat and fourwing saltbush to decrease in the plant community. Blue grama, buffalograss, Sandberg bluegrass, bottlebrush squirreltail, and sun sedge will increase. Overgrazing with sheep will cause purple prairie clover, scarlet globemallow, slimflower scurfpea, winterfat, and fourwing saltbush to decrease. With further deterioration of this site blue grama, Sandberg bluegrass, bottlebrush squirreltail, and sun sedge will disappear and be replaced by Fendler threeawn. Continued heavy grazing will cause plants such as ring muhly, cheatgrass, texas tumblegrass, sleepygrass, plains pricklypear, broom snakeweed, and curlycup gumweed to dominate the site. This plant community is diverse, and productive. Litter is properly distributed with very little movement off-site, and natural plant mortality is very low. It is well-suited to carbon sequestration, effective water cycle, and wildlife use by many species, livestock use, and is aesthetically pleasing. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. This community is resistant to disturbances except continuous moderate to heavy grazing, tillage, and/or development into urban or other uses. Total annual production ranges from 680 to 1600 pounds of air-dry vegetation per acre and will average 1200 pounds during an average year. Of this production, 5 to 10% will likely be unpalatable out of reach of grazing animals. These production figures are the fluctuations expected during favorable, normal and unfavorable years due to the timing and amount of precipitation and temperature. Total annual production should not be confused with species productivity, which is annual production and variability by species throughout the extent of the community phase. Resilience management. Grazing management that provides for proper stocking and adequate recovery opportunity will maintain this community and provide sustainable ecosystem goods and services from the plant community

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	605	1076	1435
Forb	78	135	179
Shrub/Vine	78	135	179
Total	**761**	**1346**	**1793**

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses and Grass-likes**			785–1233	
	western wheatgrass	PASM	*Pascopyrum smithii*	471–673	–
	green needlegrass	NAVI4	*Nassella viridula*	202–336	–
	blue grama	BOGR2	*Bouteloua gracilis*	135–269	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	67–135	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	39–56	–
	Sandberg bluegrass	POSE	*Poa secunda*	39–56	–
	muttongrass	POFE	*Poa fendleriana*	39–56	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	28–56	–
	big bluestem	ANGE	*Andropogon gerardii*	1–56	–
	switchgrass	PAVI2	*Panicum virgatum*	1–56	–
	Canada wildrye	ELCA4	*Elymus canadensis*	1–56	–
	squirreltail	ELEL5	*Elymus elymoides*	1–39	–
	buffalograss	BODA2	*Bouteloua dactyloides*	1–39	–
	needle and thread	HECO26	*Hesperostipa comata*	1–39	–
	Grass, perennial	2GP	*Grass, perennial*	1–39	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	1–17	–
Forb					
2	**Forbs**			56–224	
	purple prairie clover	DAPU5	*Dalea purpurea*	28–56	–
	American vetch	VIAM	*Vicia americana*	11–39	–
	Drummond's milkvetch	ASDR3	*Astragalus drummondii*	11–39	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–39	–
	Forb, perennial	2FP	*Forb, perennial*	1–39	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	11–28	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	1–17	–
	foothill arnica	ARFU3	*Arnica fulgens*	1–17	–
	tarragon	ARDR4	*Artemisia dracunculus*	1–17	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	1–17	–
Shrub/Vine					
3	**Shrubs**			56–224	
	fourwing saltbush	ATCA2	*Atriplex canescens*	39–106	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	39–67	–
	prairie sagewort	ARFR4	*Artemisia frigida*	11–39	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	1–39	–

	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	11–28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	1–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	1–17	–

Animal community

Livestock Grazing:
This site provides excellent forage for cattle during the spring and fall season due to the dominance of cool season grasses. It provides good forage for sheep, pronghorn, and deer.

The animal forage preference changes as the growing season progresses. Western wheatgrass, green needlegrass, and needle-and-thread are very palatable during the spring. These three grasses alone comprise 65% by weight (air-dry) of the potential plant community. Therefore, it is necessary to periodically defer grazing in the spring so that these cool season plants are not grazed out and replaced by less desirable species. Deferment of grazing through the late spring and summer months will benefit the warm season plants.

It is important that proper grazing use and planned deferred rotation grazing be followed on this site. This level of grazing management will insure maximum utilization of the available forage while maintaining the desirable plants.

Vegetation palatability will influence proper use considerations. The season of use, kind of grazing animal, past grazing use, and the plant composition will directly influence the animal preference and performance.

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.

Plant Community (PC)/Production (lbs./acre)/ Stocking Rate (AUM/acre)
Reference PC/ 1200/ 0.33
Increased Litter/Decadence PC/ 560/ 0.15
At Risk PC/ 675 0.19
Shortgrass Dominated PC/ 485/ 0.13
Bare Ground PC/ 250/ 0.07
Invaded PC/ */ *
* Highly variable; stocking rate needs to be determined on site.

Adjustments to the initial stocking rates should be made as needed to obtain proper use. With specialized grazing systems, large livestock breeds, uncontrolled ungulates, inaccessibility, dormant season use, presence of introduced forage species, seeded rangeland etc., stocking rate adjustments will be required.

Wildlife Values:
This site provides habitat for pronghorn, deer, cottontail, jackrabbit, other small mammals, quail, doves and a variety of non-game birds.

This site has a medium to high value for wildlife. The high percentage of cool season grasses make the site attractive for grazing particularly in the spring and fall. If range condition declines due to overgrazing wildlife grazing values drop rapidly due to the reduction of the cool season grasses and lack of palatable forbs. Also, overgrazing will result in a reduction of nesting and cover values for all game birds and non-game birds. Open water livestock ponds can support fisheries resource and waterfowl habitat.

Hydrological functions

Soils in this site are grouped into "C" hydrologic group, as outlined in the "Soils of Colorado Loss Factors and Erodibility Hydrologic Groupings 1979 Handbook". Field investigations are needed to determine hydrologic cover conditions and hydrologic curve numbers. Refer to NRCS "National Engineering Handbook", Section 4, and "Peak Flows in Colorado Handbook" for more information.

Recreational uses

This site has a fair to good aesthetic appeal and natural beauty due to the rolling, mid-grass prairie aspect of the site in excellent condition. The recreation provided through hunting for pronghorn and mule deer is generally good on this site.

Wood products

No potential production on this site.

Other products

Endangered/Threatened Plants and Animals: Gaura neomexicana coloradensis or Colorado butterfly plant has been reported as threatened in Douglas County. However, its occurrence on this ecological site has not been proven. The plains sharp-tailed grouse (Tympanuchus phasianellus jamesii) is listed as state endangered by the Colorado Parks and Wildlife. This species is probably associated with this site when it is near its reference state.

Major Poisonous Plants to Livestock:

Plant common name - livestock affected - type of poisoning - season serious

broom snakeweed - cattle, sheep - may cause abortion when up to 10-12% body weight consumed in 1/2 to 7 weeks - spring, early summer other forage not available

drummond milkvetch - suspected in cattle, horses and sheep - cumulative, also selenium concentration suspected - all, but especially spring

Twogrooved milkvetch - all animals - cumulative, affects motor nerves and respiratory system, also accumulates selenium - all seasons by mainly when forage is scarce.Inventory data references

Inventory data references

This site occurs in the following counties Arapahoe, Boulder, Douglas, Elbert, El Paso, Fremont, Huerfano, Jefferson, Larimer, Las Animas.

Location of Typical Example of the site:
a. Green Mountain, Jefferson County
b. Harold Wolf Ranch, 10 miles southeast of Kiowa, Elbert County
c. SMS Ranch, 7 miles northwest of Simla, Elbert County

Other references

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Approval

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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.

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	

Date	05/21/2024
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:

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

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

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

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

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17. **Perennial plant reproductive capability:**
