

Ecological site R051XY277CO Basalt Hill 7-12 PZ

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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): 051X–High Intermountain Valleys

This MLRA encompasses the San Luis Valley in south central Colorado and the Taos Plateau and Taos alluvial fans of north central New Mexico. As part of the northern portion of the Rio Grande Rift, the MLRA consists of large, alluvium filled basins washed down from adjacent mountain ranges. The Rio Grande River flows through this MLRA, continuing its long function of carrying mountain sediment down to the basin. Cenozoic volcanism is an extensive characteristic of the MLRA where large basalt flows with volcanic hills and domes are abundant. Ancient Lake Alamosa is a large feature within the MLRA.

Classification relationships

NRCS:

Major Land Resource Area 51, High Intermountain Valleys (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:

331J – Northern Rio Grande Basin M331lc > 331Ja - San Luis Valley, 331Jb - San Luis Hills and 331C - Mogotes

EPA:

22 - Arizona/New Mexico Plateau > 22a - San Luis Shrublands and Hills ; 22b -San Luis Alluvial Flats and Wetlands ; 22c - Salt Flats; 22e - Sand Dunes and Sand Sheets and 22f -Taos Plateau (Griffith, 2006).

USGS:

Southern Rocky Mountain Province

Ecological site concept

Elevation ranges from 7500 to 8600 feet. The site encompasses all aspects, and therefore has a range of plants from the warmer and drier south aspects to the cooler and wetter north aspects. Slope is variable from toe slopes to back slopes. Soil depth is primarily very shallow to shallow over lithic bedrock, but there may be pockets of moderately deep to deep soil along head slopes of escarpments. The soils are loamy-skeletal with the presence of rocks, cobbles, and boulders throughout. Plant species diversity is high with a large gradient of slope and aspect.

Associated sites

R051XY283CO	Foothills 12-16 PZ The Foothills site was created for the Wild Horse/San Pedro Mesa area in Costilla County. The Foothills site is on basalt landforms but on deep soils vs the shallow soils of basalt hills.
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A significant portion of the San Luis basin is covered with extrusive igneous & volcanic features such as basalt flows and andesitic, and rhyolitic vents and plugs. During various ages throughout the Cenozoic era, much volcanic activity had occurred in the basin due to rifting and mountain building. This site occupies hills, mesas, ridges, escarpments and broken land formed by lava flows. Topography is mostly rough, but varies from gentle slopes to steep cliffs. Rock outcrops are common. Slopes are quite variable, most are between 1-35%, but it can range up to 65%. The Basalt Hills site describes the plant communities of these volcanic structures.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Hill (3) Escarpment (4) Scarp (5) Ridge
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	2,286–2,621 m
Slope	1–35%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The climate that typifies the High Intermountain Valley, ranges from arid to semi-arid, and is characterized by cold winters, moderate summers, and much sunshine. Average annual precipitation ranges from 7 to 10 inches along the valley floor and throughout most of the resource area. Upper elevations and southern reaches range from 10 to 12 inches. Precipitation extremes vary from 3 to 20 inches per year depending on location. The San Juan mountain range to the west and the Sangre de Cristo Mountains to the east intercept much of the precipitation causing a two-way rain shadow effect. Approximately 60 to 65 percent of the annual precipitation falls between May 1 and October 1, mostly from short duration high intensity thundershowers in July and August. Snowfall averages 34 inches annually; snow cover is light or patchy throughout much of the winter. Wind speeds average 7 miles per hour annually. High wind velocities are common in the spring.

Cold air from the encompassing mountain ranges drain into the valley and settle. This phenomena results in long cold winters and moderate summer temperatures. July is the hottest month and January is the coldest. Summer temperatures range from highs in the upper 70's and low 80's and occasionally reach to the mid 90s F. Summer nights are cool, with lows averaging in the mid 40's. Temperatures of -20oF to -40oF can be expected each year and are common during some winters. Higher elevations can receive a dusting of snow as early as September 1. There is a 50% probability that the first frost in the fall will occur near September 16, and the last frost in the spring on about June 9. The average length of the growing season is 119 days and varies from 94 to 143 days. Summer humidity is low. Evaporation rates average lower than those of dry regions because of the cool climate.

Most major plant species initiate growth between mid May and late July, but growth may extend into September. Some cool season plants begin growth earlier and complete growth by mid June.

Table 3. Representative climatic features

Frost-free period (characteristic range)	71-83 days
Freeze-free period (characteristic range)	97-106 days
Precipitation total (characteristic range)	178-305 mm
Frost-free period (actual range)	69-84 days
Freeze-free period (actual range)	94-108 days
Precipitation total (actual range)	178-305 mm

Frost-free period (average)	77 days
Freeze-free period (average)	101 days
Precipitation total (average)	229 mm

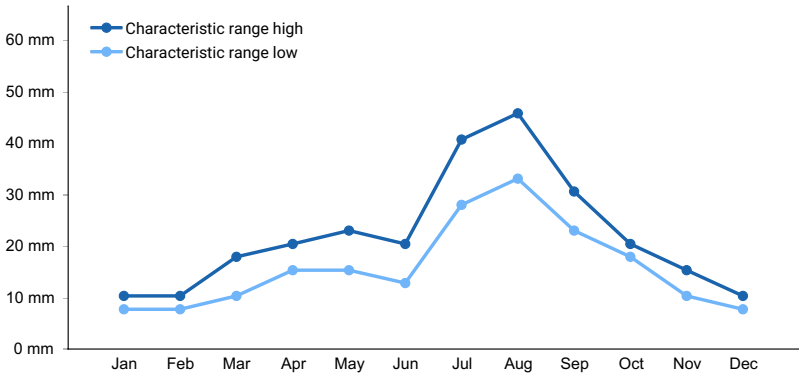


Figure 3. Monthly precipitation range

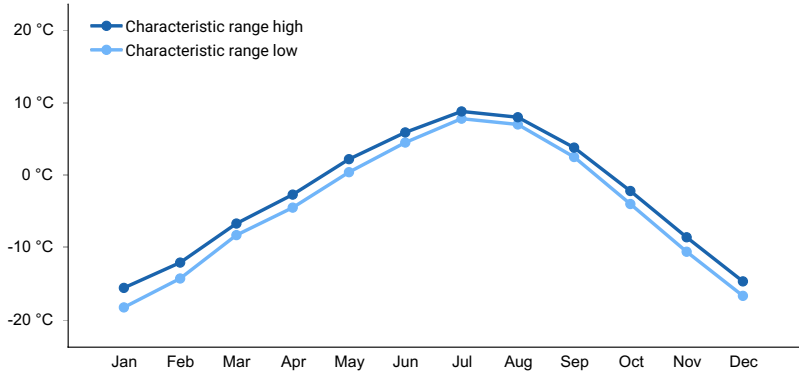


Figure 4. Monthly minimum temperature range

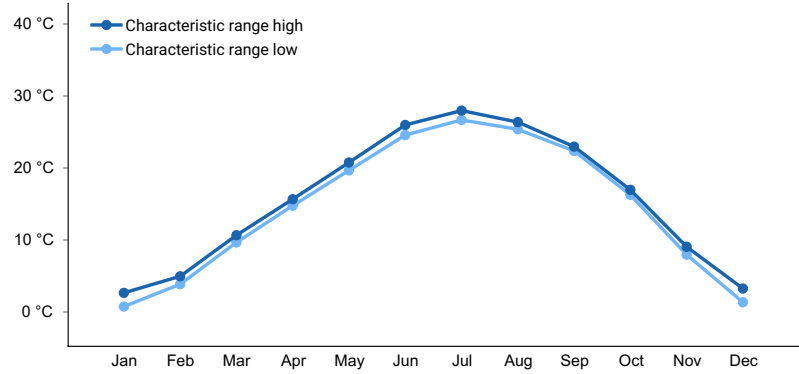


Figure 5. Monthly maximum temperature range

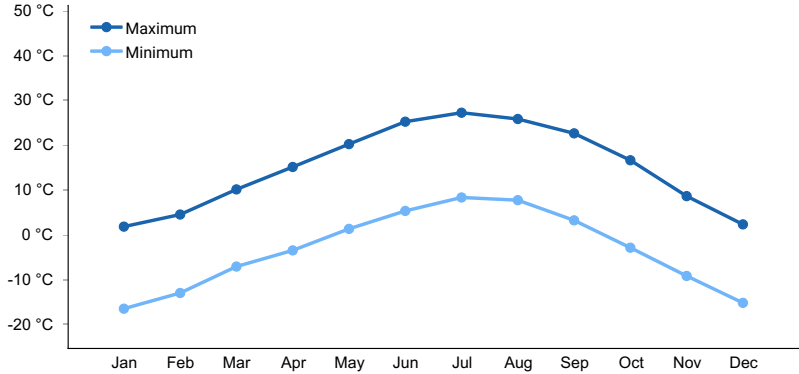


Figure 6. Monthly average minimum and maximum temperature

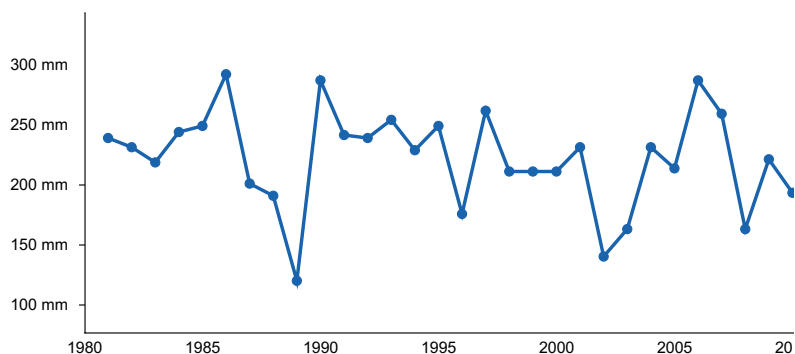


Figure 7. Annual precipitation pattern

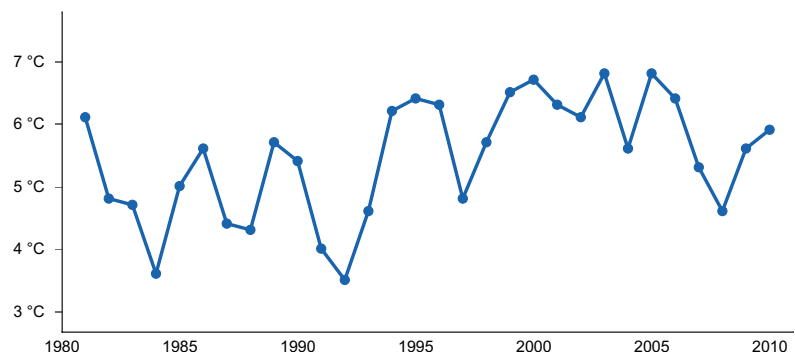


Figure 8. Annual average temperature pattern

Climate stations used

- (1) MANASSA [USC00055322], La Jara, CO
- (2) SAN LUIS 1 S [USC00057430], San Luis, CO
- (3) CENTER 4 SSW [USC00051458], Center, CO
- (4) DEL NORTE 2E [USC00052184], Del Norte, CO
- (5) MONTE VISTA 2W [USC00055706], Monte Vista, CO
- (6) ALAMOSA SAN LUIS AP [USW00023061], Alamosa, CO
- (7) BLANCA 4 NW [USC00050776], Blanca, CO

Influencing water features

This site does not have a water table.

Soil features

The soils are generally medium to light in texture, very stony, calcareous, and shallow over basalt or other volcanic rock. Water storage is limited due to stoniness and lack of depth. However, water collects around the rocks, in pockets of soil and fissures within the bedrock. This gives the a higher potential for plant growth than might be expected. The soil surface A horizon ranges from 2 to 4 inches in depth.

This site is most commonly correlated with the Travelers series which is classified as a Loamy-skeletal, mixed, superactive frigid Lithic Ustic Haplocalcid.

Table 4. Representative soil features

Parent material	(1) Colluvium–basalt (2) Residuum–basalt (3) Alluvium–basalt
Surface texture	(1) Very stony loam (2) Very stony, gravelly sandy loam

Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Depth to restrictive layer	25–51 cm
Soil depth	25–51 cm
Surface fragment cover <=3"	5–45%
Surface fragment cover >3"	0–10%
Available water capacity (Depth not specified)	2.03–4.32 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–25%
Subsurface fragment volume >3" (Depth not specified)	20–40%

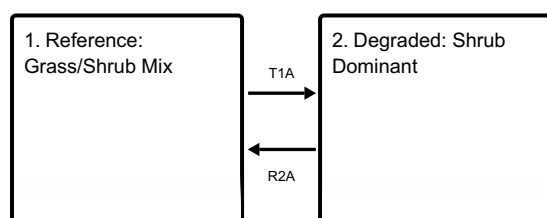
Ecological dynamics

Abiotic factors such as slope, aspect, and accumulated CaCo3 play an important role in species composition. There is a gradient between grass dominant cover on warmer, drier slopes and shrub dominant on cooler, wetter slopes. Percent slope also plays a factor as it affects runoff, infiltration, and land use. The gradient of CaCo3 affects the ability for plants to absorb nutrients and water. Higher CaCo3 will favor some species such as winterfat.

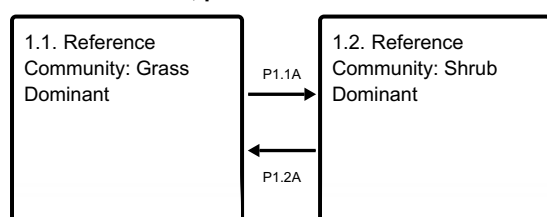
Indian ricegrass is the major grass. Others are blue grama, squirreltail, sand dropseed, threeawn, needleandthread and western wheatgrass. Greene's rabbitbrush is generally the most prominent shrub in the warmer, drier areas while big sagebrush is the prominent shrub in the cooler, wetter areas. Fourwing saltbush, winterfat, prickly pear, and yucca are common.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1

Reference: Grass/Shrub Mix



Figure 9. A productive plant community

The reference state will have a gradient of plant communities based on abiotic factors. North facing slopes will have shrubs such as big sagebrush and stunted pinon and juniper. South facing slopes will favor grasses. Those areas high in CaCo3 will favor winterfat. Indian ricegrass may be the most abundant plant species spanning all gradients. Blue grama, squirreltail, and western wheatgrass will be spread across the site as well.

Resilience management. The reference state is the most resilient to management. It provides the most cover which protects the soil surface from erosion, captures additional moisture, aids in infiltration, and helps decrease moisture loss. There are a variety of plants and root systems which can take advantage of high intensity precipitation events as well as moisture deep in the cracks and fissures of the bedrock.

Community 1.1
Reference Community: Grass Dominant



Figure 10. Grass Dominant

Aspect plays a role in species composition. Most southerly aspects are grass dominant. Areas where percent slope is low may also have more production from grasses. Indian ricegrass is the dominant species. Blue grama, squirreltail, and western wheatgrass will also be present.

Resilience management. This community phase is the most rich in fibrous root systems and organic matter. It is resilient to drought by maximizing plant cover and soil aggregate stability and thereby maximizing infiltration and water retention.

Dominant plant species

- Indian ricegrass (*Achnatherum hymenoides*), grass

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	163	280	398
Shrub/Vine	45	78	112
Forb	17	34	50
Total	225	392	560

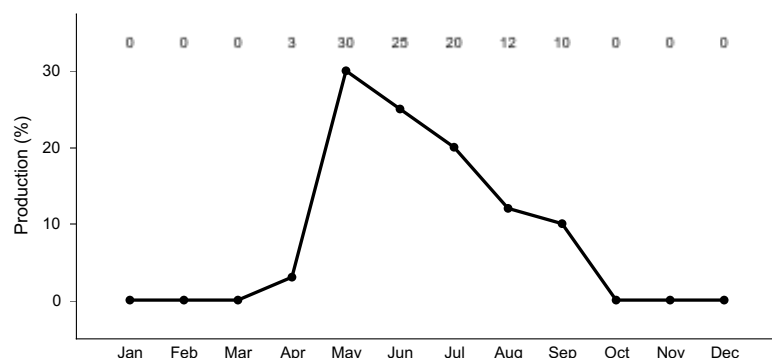


Figure 12. Plant community growth curve (percent production by month). CO5108, Cool-season Dominant Warm-season Subdominant, MLRA 51 Alluvial Fans & fan Remnants. Reference Plant Community for Chico Fan located in LRU 51-5 on fans and fan remnants above valley floor, pre-dominantly in areas surrounding Villa Grove and Saguache, Saguache County..

Community 1.2

Reference Community: Shrub Dominant



Figure 13. Shrub Dominant

As the site grades toward cooler and wetter conditions it increases its shrub cover, with big sagebrush as the dominant shrub. This site will also have an assortment of grasses such as Indian ricegrass, squirreltail, and western wheatgrass.

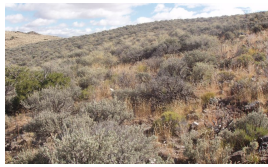
Resilience management. This community is resilient to disturbance as a mix of shrubs and grasses help protect the soil and increases moisture capture and retention.

Pathway P1.1A

Community 1.1 to 1.2



Reference Community: Grass Dominant



Reference Community: Shrub Dominant

As the site becomes wetter and cooler due to aspect and elevation, it shows an increase in shrub cover, especially big sagebrush. It will also have a scattering of pinyon and juniper. Shrubs have a competitive advantage to take advantage of snow drift, lesser rates of evapotranspiration, and cooler growing conditions. The north aspect also does not deal with freeze/thaw events as much as the south aspect which benefits shrubs in the long-term.

Pathway P1.2A Community 1.2 to 1.1



Reference Community: Shrub Dominant



Reference Community: Grass Dominant

As the site grades to warmer, drier conditions shrubs decrease and grass cover increases. Grasses have the ability to gain a competitive advantage due to fibrous root systems taking advantage of flash precipitation events during the growing season.

State 2 Degraded: Shrub Dominant

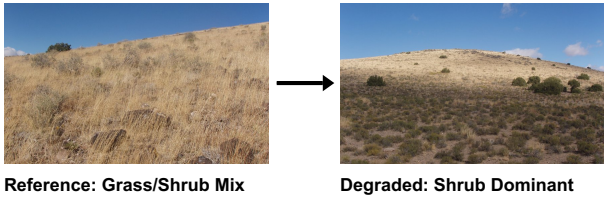


Figure 14. A dominance of rabbitbrush and bare ground.

This site has mostly lost its grass component. It becomes shrub dominant, either by Greene's rabbitbrush or fourwing saltbush where the site is warmer and drier or big sagebrush where the site grades toward cooler and wetter. Some blue grama, threeawn, and ring muhly will persist.

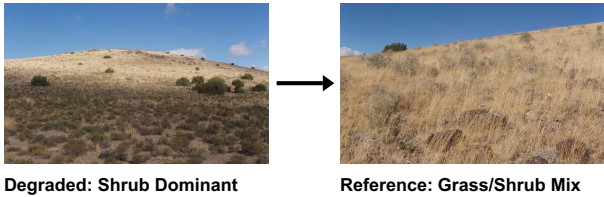
Resilience management. The degraded state is the least resilient to disturbance. Range health has suffered as plants, roots, litter, organic matter, and aggregate stability have been lowered. This degradation has increased soil erosion and has lowered water capture and retention.

Transition T1A State 1 to 2



The principal driver is a long-term grazing strategy where palatable plants are repetitively grazed and browsed at high utilization limiting growing opportunities. As plant mortality increases, feedbacks related to increased bare ground and soil loss eventually cause this site to cross a threshold. Drought exacerbates the situation and can quickly trigger a state shift, especially if coupled with high utilization and repetitive defoliation.

Restoration pathway R2A
State 2 to 1



The soil must slowly be restored and this requires stabilizing agents such as cover, root systems, organic matter, and aggregate stability. Grazing management with monitoring and adaptive management can be part of the process. A set-back to the shrubs, such as fire on big sagebrush may also be part of the process.

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				196–336	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	112–280	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	11–28	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	11–28	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	11–28	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	11–28	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	11–28	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	11–28	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	6–22	–
	ring muhly	MUTO2	<i>Muhlenbergia torreyi</i>	6–17	–
Forb					
2				17–45	
	Colorado four o'clock	MIMU	<i>Mirabilis multiflora</i>	11–28	–
	snowball sand verbena	ABFR2	<i>Abronia fragrans</i>	0–11	–
	bastard toadflax	COUM	<i>Comandra umbellata</i>	0–11	–
	sulphur-flower buckwheat	ERUM	<i>Eriogonum umbellatum</i>	0–11	–
	western wallflower	ERAS2	<i>Erysimum asperum</i>	0–11	–
	scarlet gilia	IPAG	<i>Ipomopsis aggregata</i>	0–11	–
	narrowleaf stoneseed	LIIN2	<i>Lithospermum incisum</i>	0–11	–
	tanseyleaf tansyaster	MATA2	<i>Machaeranthera tanacetifolia</i>	0–11	–
	crownleaf evening primrose	OECO2	<i>Oenothera coronopifolia</i>	0–11	–
	locoweed	OXYTR	<i>Oxytropis</i>	0–11	–
	sidebells penstemon	PESE11	<i>Penstemon secundiflorus</i>	0–11	–
	broom-like ragwort	SESP3	<i>Senecio spartioides</i>	0–11	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–11	–
Shrub/Vine					
3				22–101	
	Greene's rabbitbrush	CHGR6	<i>Chrysothamnus greenei</i>	11–84	–
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	11–84	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–56	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–56	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–28	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–28	–
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0–28	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–11	–
	soapweed yucca	YUGL	<i>Yucca glauca</i>	0–11	–
	kingcup cactus	ECTR	<i>Echinocereus triglochidiatus</i>	0–11	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–11	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–11	–

Inventory data references

Location of Typical Example of Site:

Colorado Division of Wildlife land along Hot Creek, about 15 miles northwest of La Jara in Conejos County; north of the road about 1/4 mile inside the east entrance.

Field Offices in Colorado where the site occurs:

Alamosa, Center, and San Luis

Other references

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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

Contributors

Cindy Villa

Scott Woodall

Approval

Curtis Talbot, 7/19/2021

Acknowledgments

Project Staff:

Suzanne Mayne-Kinney, Ecological Site Specialist, NRCS MLRA, Grand Junction SSO

Alan Stuebe, MLRA Soil Survey Leader, NRCS MLRA Alamosa SSO

Program Support:

Rachel Murph, NRCS CO State Rangeland Management Specialist, Denver

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

--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 51 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)	C. Villa, H. Garcia, T. Lucero
Contact for lead author	
Date	02/06/2005
Approved by	Curtis Talbot
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None
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2. **Presence of water flow patterns:** None to slight. Flow paths are short and disconnected. Broken by basalt surface rock.
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3. **Number and height of erosional pedestals or terracettes:** None to slight. Pedestals are minimal and associated with flow paths.
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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect 5% or less bare ground. Surface and sub-surface rock are inherent to this site.
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5. **Number of gullies and erosion associated with gullies:** None
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6. **Extent of wind scoured, blowouts and/or depositional areas:** None
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7. **Amount of litter movement (describe size and distance expected to travel):** Some movement is expected due to steepness of slope. Distance varies from 1-2 feet following intense rainfall events. Litter will tend to hang up on surface rock.
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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating anticipated to be 4-5 in the interspaces at soil surface.
-

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soils are very stony loam, calcareous, shallow and excessively drained. The A-horizon ranges from 2-4 inches in depth and color ranges from brown to dark brown. Surface structure is moderate fine granular. Rock fragments can makeup 35-85% of the volume.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The distribution and composition of grass, shrub, tree/forb canopy and root structure reduces raindrop impact and slows overland flow providing increased time for infiltration to occur. Also, the abundance of rock on the surface, slows velocity of runoff and acts to increase infiltration.
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None
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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant: cool season bunchgrass > >
- Sub-dominant: shrubs > warm season bunchgrass >
- Other: forbs > cool season rhizomatous grass > trees
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Perennial vegetation should show minimal mortality/decadence except during extreme drought when some decadence or mortality is expected.
-
14. **Average percent litter cover (%) and depth (in):** 5-10% litter cover at 0.25 inch depth or less.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 200 lbs./ac. low precip years; 350 lbs./ac. average precip years; 500 lbs./ac. above average precip years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 50 – 100 lbs./ac. or more.
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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Pricklypear cactus.
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17. **Perennial plant reproductive capability:** The only limitations are weather-related, wildfire, natural disease, inter-species competition, wildlife, and insects that may temporarily reduce reproductive capability.
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