Ecological site R051XY281CO
Mountain Outwash

Last updated: 12/11/2024
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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..

Ecological site concept

The soils are derived from alluvium from mostly metamorphic and igneous sources. The soils have a range from loam to sandy loam over skeletal layers of gravel and cobble. The soils may have accumulated carbonates in the B horizon but not to the extent that defines the limy bench site. Soils are are often skeletal throughout the profile, are rapidly drained and have low water-storage capacity. Blue grama is usually the most abundant grass, but taller grasses, mostly cool-season species make up a significant part of the annual production.

Associated sites

R051XY277CO	**Basalt Hill 7-12 PZ** Basalt hills are associated with basalt flows that are adjacent and surrounded by the fans of the mountain outwash.
R051XY276CO	**Limy Bench** The Mountain Outwash site occupies similar landforms as the limy bench but does not have as much accumulated CaCo3 in the B horizon. The limy bench will have masses and sometimes nodules of CaCo3 near the surface which promotes winterfat dominance.
R051XY273CO	**Sandy Bench** The Sandy Bench site has non-skeletal, courser soils. The particle size class is normally course-loamy. The sandy bench also has a calcic diagnostic horizon while the Mountain Outwash does not.
R051XY233CO	**Mountain Loam 10-18 PZ** The Mountain Loam site occurs in the mixed conifer zone of the bounding mountains. The site occurs at the lower slopes of the mountain base, consisting of the lower colluvial apron, mountain valley fans, and terraces of drainages. Elevation ranges from 8200 feet to 9500 feet. Soils are formed from colluvium and alluvium derived from igneous rock. Soils are very deep and surface textures range from loam to sandy loam.

R051XY286CO	**Rocky Foothills** Parent materials are mostly residuum with some colluvium and alluvium, derived from andesite and rhyolite. Soils are shallow. Areas of rock outcrop are scattered throughout. Elevation ranges from 8000 to 9500 feet. Slope position is variable from summit positions to back slopes. The soils are loamy-skeletal with the presence of rocks, cobbles, and stones throughout.

Similar sites

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Figure 1.

Table 2. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bouteloua gracilis* (2) *Achnatherum hymenoides*

Physiographic features

This site occupies broad alluvial fans formed by outwash from high mountain ranges. In many places, the fans have coalesced to form a smooth plain that feathers out to a flat valley floor. In some places, they form low benches or terraces above stream courses. There are some minor undulations caused by small drainageways, but most of the site has smooth topography.

Table 3. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan (3) Terrace
Runoff class	Very low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,290 − 2,530 m

Slope	0 – 10 %
Aspect	Aspect is not a significant factor

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. Approximately 55 percent of the annual precipitation falls between May 1 and September 1. May and June are normally dry. Precipitation comes mostly from short duration high intensity thundershowers in July and August. Wide seasonal and yearly variations are common. 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. 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. There may be late re-growth on some of the plants.

Cold air from the encompassing mountain ranges drain into the valley and settle. This phenomena results in long cold winters and moderate summer temperatures. Mean average annual temperature ranges between 42 to 44 degrees F. 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 90 degrees F. Summer nights are cool. Temperatures of -20 degrees F to -30 degrees F can be expected each year and are common during some winters. Average frost-free period is 90-115 days, from late May or early June to September.

Wind that often reaches high velocities are common, especially in the spring. Relative humidity is usually low. Even so, evaporation rates average lower than those of many dry regions because of the cooler climate. Snow cover is often light and is sometimes lacking through much of the winter. There is usually some snow, though, during the coldest weather.

Table 4 Representative climatic features

Frost-free period (characteristic range)	80-80 days
Freeze-free period (characteristic range)	100-100 days
Precipitation total (characteristic range)	180-230 mm
Frost-free period (actual range)	70-80 days
Freeze-free period (actual range)	90-110 days
Precipitation total (actual range)	180-230 mm
Frost-free period (average)	80 days
Freeze-free period (average)	100 days
Precipitation total (average)	200 mm

- (1) ALAMOSA SAN LUIS AP [USW00023061], Alamosa, CO
- (2) CENTER 4 SSW [USC00051458], Center, CO

- (3) MANASSA [USC00055322], La Jara, CO

Influencing water features

This site does not have a water table.

Soil features

Soil surface horizons range from 12 to 20% clay content with the most common surface textures being gravelly sandy loam, cobbly sandy loam, very gravelly sandy loam, very gravelly loam, and cobbly loam. Surface horizons are over skeletal horizons heavy in gravel and/or cobble. The subsurface clay content at 20 inches can range from 12 to 25% clay.
These soils are rapidly drained and have a low water-storage capacity. But moisture retention is low, allowing plants access to available moisture.

Typical soils correlated to this site are:
Derrick, Dunul, Quamon and Saguache.

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Gravelly, cobbly, very gravelly sandy loam (2) Very gravelly, cobbly loam
Family particle size	(1) Loamy-skeletal (2) Sandy-skeletal
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Moderately slow to rapid
Soil depth	150 cm
Surface fragment cover <=3"	20 – 40 %
Surface fragment cover >3"	10 – 30 %
Available water capacity (Depth not specified)	2.54 – 7.62 cm
Calcium carbonate equivalent (Depth not specified)	0 – 10 %

Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	0 – 10
Soil reaction (1:1 water) (Depth not specified)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	20 – 60 %
Subsurface fragment volume >3" (Depth not specified)	10 – 40 %

Ecological dynamics

This site exists on the same land forms as the limy bench. The difference is that the limy bench has a Bk horizon with masses or nodules of accumulated CaCo3. This calcareous layer favors winterfat. The mountain outwash site has the look of a fairly uniform stand of grass with a few low shrubs. Blue grama is usually the most abundant grass. But taller grasses, mostly cool-season species, make up a significant part of the annual production. Of these, squirreltail, western wheatgrass, and Indian ricegrass are most important. There are usually small amounts of needle-and-thread, sand dropseed, purple threeawn, and needleleaf sedge, along with a few forbs such as scarlet globemallow, eriogonum, senecio, locoweed, evening primrose, and paintbrush. Scattered shrubs include winterfat, Greene's rabbitbrush, pricklypear, fringed sage, smooth horsebrush, snakeweed, and yucca.

Site degradation due to excessive grazing pressure will cause the site to change in species composition. Initially, western wheatgrass, winterfat, and fourwing saltbush will decerase while species with more grazing defenses such as blue grama and Greene’s rabbitbrush will gain a competitive advantage. If the excessive grazing pressure continues long term and drives the site across a threshold, important cool season grasses such as Indian ricegrass and needleandthread will be lost. A site that has lost soil and has crossed a threshold will exhibit bare areas with a few hardy species such as Bottlebrush squirreltail, rabbitbrush, low vigor blue grama, ring muhly, and scattered annuals.

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			392-560	
	blue grama	BOGR2	*Bouteloua gracilis*	101-269	–
	squirreltail	ELEL5	*Elymus elymoides*	50-135	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	50-135	–
	western wheatgrass	PASM	*Pascopyrum smithii*	50-135	–
	needle and thread	HECO26	*Hesperostipa comata*	34-90	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	34-90	–
	purple threeawn	ARPU9	*Aristida purpurea*	17-45	–

	ring muhly	MUTO2	*Muhlenbergia torreyi*	3-9	–
Forb					
2	**Forbs**			39-84	
	snowball sand verbena	ABFR2	*Abronia fragrans*	0-9	–
	bastard toadflax	COUM	*Comandra umbellata*	0-9	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0-9	–
	western wallflower	ERAS2	*Erysimum asperum*	0-9	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	0-9	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0-9	–
	tanseyleaf tansyaster	MATA2	*Machaeranthera tanacetifolia*	0-9	–
	Colorado four o'clock	MIMU	*Mirabilis multiflora*	0-9	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0-9	–
	locoweed	OXYTR	*Oxytropis*	0-9	–
	sidebells penstemon	PESE11	*Penstemon secundiflorus*	0-9	–
	broom-like ragwort	SESP3	*Senecio spartioides*	0-9	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0-9	–
Shrub/Vine					
2	**Shrubs**			84-168	
	fourwing saltbush	ATCA2	*Atriplex canescens*	50-135	–
	Greene's rabbitbrush	CHGR6	*Chrysothamnus greenei*	50-135	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	50-135	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	50-135	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	3-9	–
	skunkbush sumac	RHTR	*Rhus trilobata*	3-9	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	3-9	–
	soapweed yucca	YUGL	*Yucca glauca*	3-9	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0-9	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0-9	–

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Wood products

NA

Inventory data references

Location of Typical Example of the Site: Along Gunbarrel Highway northwest of Capulin in Conejos County, between Alamosa Creek and the Rio Grande County line. Field Offices in Colorado where the site occurs: Alamosa, Center, and San Luis

References

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Other references

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Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections andSubsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington,DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored.

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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

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Approval

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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)	S. Woodall, C. Villa
Contact for lead author	
Date	12/14/2004
Approved by	
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to slight. If present, short and discontinuous and apparent following intense rainfall events.

2. **Presence of water flow patterns:** None, except following high intensity storms. Flow paths if present will be short (1-3 feet), with minimal evidence of past or current soil deposition.

3. **Number and height of erosional pedestals or terracettes:** Very minor, if present, terracettes may occur in flow paths following intense storms.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5% or less bare ground, with bare patches generally less than 3-5 inches in diameter. Extended drought can cause bare ground to increase upwards to 5-10% with bare patches reaching upwards to 6-10 inches in diameter.

5. **Number of gullies and erosion associated with gullies:** None

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is minimal and short (6-12 inches).

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 soil textures range from gravelly sandy loam, cobbly sandy loam, very gravelly sandy loam, very gravelly loam, and cobbly loam. The A-horizon is light brownish gray that can extend from 4 to 16 inches thick. Structure is typically weak medium granular, moderate fine granular structure or weak fine granular structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Diverse grass, forb, shrub canopy and root structure reduces raindrop impact and slows overland flow providing increased time for infiltration to occur. Extended drought reduces grass, forb, and shrub production causing decreased infiltration and increased runoff following intense storms.

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

    Sub-dominant: warm season bunchgrass > cool season bunchgrass = cool season rhizomatous >

    Other: forbs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimum. Expect some natural mortality and decadence on bunchgrasses and shrubs.

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14. **Average percent litter cover (%) and depth (in):** 10-20% litter cover at 0.25 inch depth. Litter cover during and following extended drought ranges from 5-10%.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250 lbs./ac. low precip years; 550 lbs./ac. average precip years; 850 lbs./ac. above average precip years. After extended drought, production will be significantly reduced to 200 – 400 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:** None

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17. **Perennial plant reproductive capability:** The only limitations are weather-related, natural disease, inter-species competition, wildlife, and insects that may temporarily reduce reproductive capability.
