Ecological site R069XY019CO
Deep Sand

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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): 069X–Upper Arkansas Valley Rolling Plains

MLRA 69 is located in the Arkansas Watershed of southeastern (SE) Colorado. It consists of rolling plains, river valleys, and canyonlands. The Arkansas River flows from the Rocky Mountains to Kansas. Tributaries include the Huerfano, and Purgatoire Rivers. The MLRA is traversed by Interstate 25 and U.S. Highway 50, and includes the cities of Pueblo, La Junta, and Lamar. Other cities include Cañon City, and Walsenburg. Bent's Fort was once a major trading post along the Santa Fe Trail. The majority of land use is rangeland (greater than 75 percent), and 6 percent cropland. The remainder is urban, recreation, etc. Land ownership is mostly private. Federal lands include U.S. Forest Service Comanche National Grassland, Department of Defense Piñon Canyon Maneuver Site and Fort Carson. There is a minor amount of Bureau of Land Management and other federal land. State areas include Pueblo and John Martin reservoirs. Elevations MLRA-wide are 3,700 to 6,400 feet. The "Dust Bowl" region (1930s) included SE Colorado, which is periodically affected by severe drought. Dust storms may form during drought years, in windy periods. Annual precipitation is 10 to 16 inches. Precipitation occurs mostly during the growing season, often during rapidly developing thunderstorms. Mean annual air temperature (MAAT) is 48 to 52 degrees Fahrenheit. Summer temperatures may exceed 100 degrees Fahrenheit. Evapotranspiration rates are high. Winter temperatures may be subzero. Snowfall varies from 20 to 40 inches per year. Blizzards can form quickly.

Classification relationships

MLRA 69 is in the Piedmont and Raton Sections of the Great Plains Province. The MLRA is further defined by Land Resource Units (LRUs) A, B, and C. The modal concepts of each LRU can be defined by soil properties and annual precipitation zones (PZ). Other features, such as climate, geology, landforms, and key vegetation, further refine these concepts and are described in the Ecological Site Description (ESD). LRU A (10 to 12 inches PZ) is 2.4 million acres in the central portion of MLRA 69. There is irrigated cropland in the Arkansas Valley. Precipitation is too limited for dryland crops. Most of LRU A is rangeland, and includes the Comanche National Grassland (FS). This LRU is in portions of Bent, Crowley, Otero, and Pueblo counties. Soil Moisture Regime is Ustic Aridic. The Mean Annual Air Temperature (MAAT) is 51 to 54 degrees Fahrenheit. LRU B (12 to 14 inches PZ) is 4.7 million acres and includes portions of Baca, Bent, Crowley, El Paso, Fremont, Kiowa, Las Animas, Lincoln, Prowers, and Pueblo counties. Most of the LRU is in rangeland. Land uses include irrigated and dry cropland, small acreage and urban ownership. Land east of Interstate 25 remains largely agricultural. Canyonlands are in the southern half and include Piñon Canyon Maneuver Site and the Picket Wire Canyon of the Comanche National Grasslands. Soil moisture regime is Ustic Aridic. The mean annual air temperature is 50 to 54 degrees Fahrenheit. The Deep Sand Ecological Site, LRUs A and B, was developed from an earlier version of the Sands Ecological Site (2004, renamed Deep Sand Ecological Site in 2007). This earlier version of the Sands Ecological Site (2004) was based on input from Natural Resources Conservation Service (formerly Soil Conservation Service) and historical information obtained from the Deep Sand Range Site descriptions (1975, revised 1983). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Deep Sand Ecological Site is in an upland position on plains with slopes of more than 10 percent. This site is on stabilized dunes and normally doesn't contain blowouts.

Associated sites

R069XY021CO	**Choppy Sands** Choppy Sands Ecological Site is commonly adjacent to Deep Sands Ecological Site.
R069XY026CO	**Sandy Plains** Sandy Plains Ecological Site is commonly adjacent to Deep Sands Ecological Site.

Similar sites

R069XY021CO	**Choppy Sands** Choppy Sands Ecological Site has blowouts present.
R069XY031CO	**Sandy Bottomland** Sandy Bottomlands Ecological Site is a run-on site with slopes of less than 10 percent.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens* (2) *Prunus pumila var. besseyi*
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site occurs on plains.

Table 2. Representative physiographic features

Landforms	(1) Dune (2) Hill (3) Ridge
Runoff class	Very low to low
Flooding frequency	None
Ponding frequency	None
Elevation	1,130 – 1,550 m

Slope	0 – 30 %
Ponding depth	0 cm
Water table depth	150 cm
Aspect	Aspect is not a significant factor

Climatic features

Approximately 75 percent of the annual precipitation occurs during the growing season from mid-April to late September. Snowfall can vary greatly from year to year and can range from 20 to 40 inches per year. Winds are estimated to average 6 to 7 miles per hour annually. Daytime winds are generally stronger than nighttime winds. Occasional strong storms may bring brief periods of high winds with gusts to more than 60 miles per hour. The average length of the freeze-free period (28 °F) is 168 days. The average last freeze in the spring is April 22nd, and the average date of first freeze in fall is October 7th. The average length of the frost-free period (32 °F) is 149 days. The last frost in the spring is May 5th, and the average date for first frost in the fall (32 °F), is October 1. July is the hottest month, and January is the coldest. It is not uncommon for temperature to exceed 100 degrees Fahrenheit during the summer. Summer humidity is low and evaporation is high. The winters are characterized with frequent northerly winds, producing severe cold and temperatures dropping to -30 degrees Fahrenheit.

LRU A, in the Arkansas River Valley, is the hottest and driest portion of the MLRA. Mean Annual Precipitation (MAP) is 10 to 12 inches, and Mean Annual Air Temperature (MAAT) is 51 to 54 degrees Fahrenheit. LRU B is the largest extent. MAP is 12 to 14 inches, and MAAT is 50 to 54 degrees Fahrenheit.

Table 3 Representative climatic features

Frost-free period (characteristic range)	130-130 days
Freeze-free period (characteristic range)	150-160 days
Precipitation total (characteristic range)	310-360 mm
Frost-free period (actual range)	120-140 days
Freeze-free period (actual range)	140-160 days
Precipitation total (actual range)	280-410 mm
Frost-free period (average)	130 days
Freeze-free period (average)	150 days
Precipitation total (average)	330 mm

- (1) CHERAW 1 N [USC00051539], La Junta, CO
- (2) LA JUNTA 20 S [USC00054726], La Junta, CO
- (3) ROCKY FORD 2 SE [USC00057167], Rocky Ford, CO
- (4) ORDWAY 21 N [USC00056136], Ordway, CO
- (5) PUEBLO MEM AP [USW00093058], Pueblo, CO
- (6) EADS [USC00052446], Eads, CO
- (7) ORDWAY 2 ENE [USC00056131], Ordway, CO
- (8) PUEBLO RSVR [USC00056765], Pueblo, CO
- (9) TACONY 13 SE [USC00058157], Boone, CO

Influencing water features

There are no water features associated with this site.

Wetland description

N/A

Soil features

The soils of this site are very deep. They are excessively drained with rapid or very rapid permeability. The surface layer thickness ranges from 2 to 8 inches thick. The soil moisture regime is ustic aridic. The soil temperature regime is mesic. Parent material kind is eolian sands. Major soil series correlated to this ecological site include Valent and Wigton.

Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for latest soils information: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Loamy sand (2) Sand
Drainage class	Excessively drained
Permeability class	Very rapid to rapid
Soil depth	150 – 200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	4.06 – 12.19 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %

Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 7.8
Subsurface fragment volume <=3" (0cm)	0 – 10 %
Subsurface fragment volume >3" (0cm)	Not specified

Ecological dynamics

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

Not all scenarios or plants are included. Key indicator plants, animals, and ecological processes are described to inform land management decisions.

This region was historically occupied by large grazing animals, such as bison, along with pronghorn and mule deer. Deer and pronghorn are widely distributed throughout the MLRA. This is an important site for livestock grazing, especially cattle.

This is a mixed tallgrass and midgrass prairie with a diverse forb and shrub component. Sand bluestem (warm-season, tall bunchgrass) and prairie sandreed (warm-season, tall rhizomatous grass) are primary. Secondary components include midgrasses, such as needle and thread and Indian ricegrass (cool-season bunchgrass) and little bluestem (warm-season bunch). Forbs, such as lemon scurfpea, are common. Shrubs include sand sagebrush and western sandcherry.

Drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Recent drought events have increased mortality of blue grama significantly in some locales, along with other bunchgrasses, such as sand bluestem, little bluestem, needle and thread, Fendler threeawn, and squirreltail. Historic fire frequency (pre-industrial) is estimated at 15 to 20 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants were also likely to start fires (deliberate or accidental).

Southeastern Colorado was strongly affected by extended drought conditions in the “Dust Bowl” period of the 1930s, with recurrent drought cycles in the 1950s and 1970s. Extreme to exceptional drought conditions have re-visited the area from 2002 to 2012, with brief interludes of near normal to normal precipitation years. “During periods of drought, high winds give rise to the dust storms which are especially characteristic of the southeastern plains (WRCC, 2022).” Recent drought events have increased mortality of blue grama upwards of 80 percent in some locales. The long-term effects of these latest drought years have yet to be determined.

Growth of native cool-season plants begins about April 15 and continues to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occurs in September and October in most years, depending on moisture. For detailed information, visit the Western Regional Climate Center website at https://wrcc.dri.edu/.

Continuous grazing without adequate recovery opportunities following each grazing event during the growing season initially causes blue grama and sand sagebrush to increase. Species such as sand bluestem, yellow Indiangrass, switchgrass, prairie sandreed, western sandcherry, leadplant, and palatable forbs decrease in frequency and production. Brush management (spraying) initially reduces sand

sagebrush and other forbs and shrubs. Brush management followed by continuous grazing can eliminate remaining grasses, favoring sagebrush. Prescribed grazing that allows adequate recovery periods following brush management results in a grass-dominated plant community. Long-term non-use, continuous grazing, fire, brush management, or any type of physical disturbance can lead to serious erosion problems on these fragile soils.

Drier and warmer climatic conditions exist in the central portion of MLRA 69. This area includes the eastern half of Pueblo county, northern Otero, extreme northwestern Bent, western edge of Kiowa, southern edge of Lincoln and all of Crowley County. These conditions are primarily caused by a rain shadow effect from the southern Rocky Mountains. Evapotranspiration rates (atmospheric demand) are higher in this area of MLRA 69. Total annual production is typically lower.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1				1177-1429	
	sand bluestem	ANHA	*Andropogon hallii*	336-504	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	252-336	–
	switchgrass	PAVI2	*Panicum virgatum*	168-336	–
	Indiangrass	SONU2	*Sorghastrum nutans*	84-168	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	84-118	–
	little bluestem	SCSC	*Schizachyrium scoparium*	50-118	–
	blue grama	BOGR2	*Bouteloua gracilis*	50-118	–
	Grass, perennial	2GP	*Grass, perennial*	17-84	–
	blowout grass	REFL	*Redfieldia flexuosa*	17-50	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	17-50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	17-50	–
	western wheatgrass	PASM	*Pascopyrum smithii*	17-34	–
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	17-34	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	17-34	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	17-34	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	17-34	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0-34	–
	squirreltail	ELEL5	*Elymus elymoides*	0-17	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0-17	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0-17	–
	thin paspalum	PASE5	*Paspalum setaceum*	0-17	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0-17	–
Forb					
2				168-252	
	Forb, perennial	2FP	*Forb, perennial*	17-50	–
	othake	PASP	*Palafoxia sphacelata*	0-34	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	17-34	–
	silky prairie clover	DAVI	*Dalea villosa*	17-34	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	17-34	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0-17	–
	phlox heliotrope	HECO5	*Heliotropium convolvulaceum*	0-17	–
	stiff sunflower	HEPAP2	*Helianthus pauciflorus ssp. pauciflorus*	0-17	–

	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0-17	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0-17	–
	common starlily	LEMO4	*Leucocrinum montanum*	0-17	–
	dotted blazing star	LIPU	*Liatris punctata*	0-17	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0-17	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	0-17	–
	Colorado four o'clock	MIMU	*Mirabilis multiflora*	0-17	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	0-17	–
	crownleaf evening primrose	OECO2	*Oenothera coronopifolia*	0-17	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0-17	–
	painted milkvetch	ASCEF	*Astragalus ceramicus var. filifolius*	0-17	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0-17	–
	Texas croton	CRTE4	*Croton texensis*	0-17	–
	white prairie clover	DACA7	*Dalea candida*	0-17	–
	nineanther prairie clover	DAEN	*Dalea enneandra*	0-17	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0-17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0-17	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0-17	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0-17	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0-17	–
	gilia beardtongue	PEAM	*Penstemon ambiguus*	0-17	–
	prostrate pigweed	AMAL	*Amaranthus albus*	0-17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0-17	–
	tarragon	ARDR4	*Artemisia dracunculus*	0-17	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0-17	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0-11	–
	snowball sand verbena	ABFR2	*Abronia fragrans*	0-11	–
	broadbeard beardtongue	PEAN4	*Penstemon angustifolius*	0-11	–
	sanddune cryptantha	CRFE3	*Cryptantha fendleri*	0-11	–
Shrub/Vine					
3				84-252	
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	34-84	–
	leadplant	AMCA6	*Amorpha canescens*	34-84	–
	sand sagebrush	ARFI2	*Artemisia filifolia*	17-84	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	17-50	–
	soapweed yucca	YUGL	*Yucca glauca*	0-34	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0-17	–
	prairie rose	ROAR3	*Rosa arkansana*	0-17	–
	spreading buckwheat	EREF	*Eriogonum effusum*	0-17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-17	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 1.3 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 3.1 plant community composition

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

Table 10. Community 4.1 plant community composition

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

Table 11. Community 4.2 plant community composition

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

Animal community

WILDLIFE INTERPRETATIONS: The variety of grasses, forbs, and shrubs on this ecological site in the various plant communities provides habitat for a wide range of wildlife species. Historic large grazers that influenced these plant communities were bison, elk, and pronghorn. Changes over time have resulted in the loss of bison, the reduction in elk numbers, and pronghorn population swings. Domestic grazers now share these habitats with wildlife. The grassland communities of eastern Colorado are home to many bird species. Changes in the composition of the plant community when moving from the reference plant community to other communities on this ecological site may result in dramatic species shifts in the bird community. Because of a lack of permanent water, fish and many amphibians are not expected on this ecological site. Mule and white-tailed deer may use this ecological site, however the shrub cover is too low to expect more than occasional use. The gray wolf and wild bison used this ecological site in historic times. The wolf is thought to be extirpated from Eastern Colorado. Bison in the area are domesticated. Reference Plant Community: The grasses, forbs, and shrubs in this plant community provide habitat for reptiles such as western rattlesnake and bullsnake. The structural diversity in the plant community on this site provides habitat for Cassin's and Brewer's sparrow, lark bunting, scaled quail, and ferruginous and Swainson's hawks. The combination of mid-tall grasses and shrubs provides habitat for lesser prairie chicken in the eastern part of this ecological site. Small mammals, such as white-tailed jackrabbit, badger, swift fox, and several species of mice, are common in this plant community. Pronghorn is a typical ungulate in this community. 1.2, 1.3 Plant Communities: As these communities develop into an open landscape, the wildlife species shift away from reference plant community species and toward the species that prefer unvegetated areas and short plants. Texas short-lizard, six-lined racerunner, and black-tailed jackrabbit would be expected more frequently here than in the reference community. In addition, mountain plover, black-tailed prairie dog, and burrowing owl might use these communities where slopes are less than five percent and vision is unobstructed. State 2 Plant Communities: Species typically associated with sand sagebrush communities are eastern fence lizard, scaled quail, lesser prairie chicken, pronghorn, and mule deer. These species would be expected in these plant communities in all or parts of MLRA 69. Grass Dominated State: This plant community can be quite variable. The wildlife species expected here would be those listed for the plant community most similar to this community. GRAZING INTERPRETATIONS: The following table lists suggested initial stocking rates for an animal unit (1000 pound beef cow) under continuous grazing (yearlong grazing or growing-season-long grazing) based on normal growing conditions. However, continuous grazing is not recommended. These estimates should only be used as preliminary guidelines in the initial stages of the conservation planning process. Often, the existing plant composition does not entirely match any particular plant community described in this ecological site description. Therefore, field inventories are always recommended to document plant composition, total production, and palatable forage production. Carrying capacity estimates that reflect on-site conditions should be calculated using field inventories. If the following production estimates are used, they should be adjusted based on animal kind or class and on the specific palatability of the forage plants in the various plant community descriptions. Under a properly stocked, properly applied, prescribed grazing management system that provides adequate recovery periods following each grazing event, improved harvest efficiencies eventually result in increased carrying capacity. See USDA-NRCS Colorado Prescribed Grazing Standard and Specification Guide (528). The stocking rate calculations are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency divided by 912.5 pounds of ingested air-dry vegetation for an animal unit per month. Plant Community Production (lbs./acre) and Stocking Rate (AUM/acre) Reference Plant Community - (1500) (0.41) Community 1.1 - (850) (0.23) The vegetative production for the remaining communities is highly variable. 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. All recommendations are guidelines. Actual stocking rates should be determined on-site.

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 high. Runoff potential for this site varies from moderate to low depending on ground cover. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan: General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):Updated. All “Required” items are complete to Provisional level. Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant Community, Species Composition List, Annual Production Table): Updated. All “Required” items are complete to Provisional level. NOTE: Annual Production Table and Species Composition List are from the “Previously Approved” ESD (2004). These need review for future updates at the next Approved level. Minor edit was made to Species Composition List. Each Alternative State/Community:Complete to Provisional level. Narrative for each state and community has been updated. Action Item: Need to find supporting data for The Sand Sagebrush and Grass Dominant Plant Communities. Further group discussion is needed. Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, References): Updated. All “Required” items are complete to Provisional level. Animal Community Wildlife Interpretations:First “overview” paragraph retained. Individual Plant Community phase interpretations are removed and need to be updated at next “Approved” level. Livestock Interpretations: Updated to reflect the plant community name revisions. The Stocking rate calculations remain the same because they are based on the “Legacy” Total Annual Production table. The stocking rate calculations need to be updated when Total Annual Production and Plant Community annual production is revised at the next “Approved” level. Hydrology: From “Previously Approved” ESD (2004). This needs to be updated at next “approved” level. Other Site Interpretation: Recreational Uses, Wood Products, Other Products, and Plant Preferences table, and Rangeland Health Reference Sheet carried over from “Previously Approved” ESD (2004). Rangeland Health Reference Sheet: From “Previously Approved” ESD (2004). This needs to be updated at the “Approved” level. Note: Deep Sand ESD is not in LRU C. “Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.” (NI 430_306 ESI and ESD, April, 2015)

Other information

Relationship to Other Classifications: NRCS Classification Hierarchy: Physiographic Divisions of the United States (Fenneman, 1946): Physiographic DivisionPhysiographic ProvincePhysiographic SectionLand Resource RegionMajor Land Resource Area (MLRA)Land Resource Unit (LRU). USFS Classification Hierarchy: National Hierarchical Framework of Ecological Units (Cleland et al, 181-200): DomainDivisionProvinceSectionSubsectionLandtype Association LandtypeLandtype Phase.

Inventory data references

NRI: references to Natural Resource Inventory data Information presented here has been derived from data collection on private and federal lands using: • Double Sampling (clipped 2 of 5 plots)* • Rangeland Health (Pellant et al., 2005) • Soil Stability (Pellant et al., 2005) • Line Point Intercept : Foliar canopy, basal cover (Forb, Graminoid, Shrub, subshrub, Lichen, Moss, Rock fragments, bare ground, % Litter) (Herrick et al., 2005) • Soil pedon descriptions collected on site (Schoeneberger et al., 2012) *NRCS double-sampling method, CO NRCS Similarity Index Worksheet 528(1). Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; Field observations from experienced range trained personnel. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

References

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Other references

Data collection for this ecological site was done in conjunction with the progressive soil surveys within the Upper Arkansas Valley (MLRA 69) of Colorado. The site has been mapped and correlated with soils in the following soil surveys: Baca County, Bent County, Crowley County, El Paso County Area, Fremont County Area, Huerfano County Area, Kiowa County, Las Animas County: Parts of Huerfano and Las Animas, Lincoln County, Otero County, Prowers County, and Pueblo Area: Parts of Pueblo and Custer Counties.

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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)	Ben Berlinger, Kimberly Diller, Daniel Nosal

Contact for lead author	Ben Berlinger, Area Rangeland Management Specialist, La Junta, CO,
Date	01/12/2005
Approved by	
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:** **Typically none. If present, water flow patterns are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers, usually following intense rainfall events.**

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3. **Number and height of erosional pedestals or terracettes:** **Pedestalled plants caused by wind erosion are minor. Terracettes are nonexistent.**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **The site has 3 percent or less bare ground, with bare patches ranging from 3-5 inches in diameter. Prolonged drought or wildfire events cause bare ground to increase upwards to 10-15 percent with bare patches ranging from 8-12 inches in diameter.**

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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:** **Minor wind scouring naturally occurs on knolls. An increase in wind erosion can result from disturbances, such as wildfire, extended drought, and rodent activity.**

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7. **Amount of litter movement (describe size and distance expected to travel):** **Litter should be uniformly distributed with little movement. On steep slopes or knolls, litter may move from a few inches to 1-2 feet depending on intensity of storm.**

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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 is anticipated to be 4-5 in the interspaces at soil surface. Soil surface is stabilized by decomposing organic matter. Biological crusts (lichens, algae, cyanobacteria, mosses) may be present on or just below soil surface.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Average SOM ranges from 1-3 percent. Soils are very deep, pale brown, weak coarse granular to crumbly structure, at a 0-5 inch depth.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Raindrop impact is reduced by the diverse grass, forb, shrub functional/structural groups and root structure. This slows overland flow and provides increased time for infiltration to occur. Extended drought, wildfire or both may reduce basal density, canopy cover, and litter amounts (primarily from tall, warm-season bunch and rhizomatous grasses), resulting in decreased infiltration and increased runoff on steep slopes following intense rainfall events.

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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: Warm-season, tall bunch grass >>

    Sub-dominant: Warm-season, tall rhizomatous > shrubs > warm-season, mid bunchgrass = cool-season, mid bunchgrass > warm season short bunchgrass >

    Other: Leguminous forbs > warm-season forbs > cool-season forbs > warm-season, mid rhizomatous > cool-season, mid rhizomatous

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typically minimal. Expect slight short- and mid bunchgrass and shrub mortality/decadence during and following drought.

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14. **Average percent litter cover (%) and depth (in):** Litter cover during and following drought can range from 20-30%, and 5-15 percent following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 900 lbs/ac low precipitation years; 1500 lbs/ac average precipitation years; 2000 lbs/ac high precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 300 – 600 lbs/ac).

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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: Invasive plants should not occur in reference plant community. Following fire or extended drought, Russian thistle, kochia, Rocky Mountain beeplant may invade assuming a seed source is available.**

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17. **Perennial plant reproductive capability: The only limitations are weather-related, wildfire, and natural disease that may temporarily reduce reproductive capability.**
