Ecological site R072XY101KS
Limy Slopes

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General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

MLRA notes

Major Land Resource Area (MLRA): 072X–Central High Tableland

Major Land Resource Area (MLRA) 72--Central High Tableland. This area is in Kansas (54 percent), Nebraska (25 percent), and Colorado (21 percent). A very small part of the area is in Wyoming. The area makes up about 34,550 square miles (89,535 square kilometers). It includes the towns of Garden City, Goodland, and Colby, Kansas; Imperial, North Platte, Ogallala, and Sidney, Nebraska; and Holyoke and Wray, Colorado. Interstate 70 bisects the area, and Interstates 76 and 80 follow the south side of the South and North Platte Rivers, respectively. The Cimarron National Grasslands occur in the southwest corner of the MLRA.

Classification relationships

MLRA 72 is in the Central Great Plains Winter Wheat and Range Land Resource Region. It is in the High Plains Section, of the Great Plains Province, of the Interior Plains (USDA, 2006). MLRAs can be defined by climate, landscapes, geology, and annual precipitation zones (PZ). Other features such as landforms, soil properties, and key vegetation further refine these concepts, and are described at the Ecological Site Description (ESD) level. Relationship to Other Classifications: Natural Resource Conservation Service (NRCS) Classification Hierarchy: Physiographic Division Physiographic Province Physiographic Section Land Resource Region Major Land Resource Area Land Resource Unit (Fenneman, 1946) United States Forest Service (USFS) Classification Hierarchy: Domain Division Province Section Subsection Landtype Association Landtype Landtype Phase (Cleland et al, 1997) Revision Notes: The Limy Slopes site was developed by an earlier version of the Limy Upland (2001). The earlier version of the Limy Upland ESD was based upon input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Limy Upland Range Site Description (1967, updated1983).

Ecological site concept

The Limy Slopes ecological site is located on shoulders and backslopes on hillslopes on tableland landscapes. Soils correlated with this site are moderately deep to very deep and have a surface that is 8 inches (20cm). The soil surface texture ranges from silt loam to loam, with most of the site surface textures being silt loam. Soils that are correlated to Limy Slopes have free carbonates occurring within 4 inches (10cm) of the surface. This site is dominated by loess parent material.

Associated sites

R072XY100KS	**Loamy Tableland** This site is located adjacent and usually upslope of Limy Slopes The Loamy Tableland ecological site is located on plains, rises and hillslopes on tablelands. Soils correlated with this site are moderately deep to very deep and have a surface that is >7 (18cm)inches mollic color. The majority of the site silt loam, loam, and very fine sandy loam. Soils that are correlated to Loamy Tableland have free carbonates below 4 inches (10cm). This site is dominated by loess parent material.

Similar sites

R072XY100KS	**Loamy Tableland** The Loamy Tableland ecological site is located on plains, rises and hillslopes on tablelands. Soils correlated with this site are moderately deep to very deep and have a surface that is >7 (18cm)inches mollic color. The majority of the site silt loam, loam, and very fine sandy loam. Soils that are correlated to Loamy Tableland have free carbonates below 4 inches (10cm). This site is dominated by loess parent material.
R072XY112KS	**Shallow Limy** This site occurs on the breaks landscape and characterized by soils that are less than 20 inches to bedrock. The breaks landscape is the area between the tableland and river valleys highlighted by cliff faces. The Shallow Limy ecological site occurs on nearly level to steeply sloping uplands. Much of the site is steep and characterized by rock ledges forming vertical drops.
R072XY113KS	**Gravelly Hills** It can occur in stream terraces, alluvial fans, foot slopes, and uplands. It is generally made up of complex slopes commonly greater than 10 percent. The site is characterized by 15-35 percent rock fragments in the surface horizon. The soils characteristic of this site formed in loamy, sandy, and gravelly soil material deposited over gravelly material on stream terraces, alluvial fans, foot slopes, and uplands.
R072XY114KS	**Loess Breaks** The loess breaks occur on steep to very steep hillslopes and canyon walls that have been dissected by geologic erosion creating narrow ridges or divides that break off steeply to narrow drainageways below. The slopes range from approximately 30 percent to near vertical. The hillslopes of this site are characteristically broken with a series of slope slips, often referred to as "catsteps."

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Bouteloua curtipendula*

Physiographic features

This site occurs on backslopes and shoulders of side slopes, nose slopes, and interfluves on hillslopes, rises, and alluvial fans of Tablelands and Breaks landscapes. This site is dominated by Quaternary Period loess deposits and eolian deposits of Tertiary Period material from the local rivers and streams. The Limy Slopes ecological site consists of very deep upland soils with silty or loamy surface layers and subsoil. This site receives runoff water from adjacent sites on plains and rises. This site is subject to erosion by wind and water if the vegetative cover is reduced or absent by such things as overgrazing and fire events. Elevation for this site ranges from 2200 to 5400 feet.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up MLRA 72 is as follows: Republican (1025), 38 percent; Middle Arkansas (1103), 20 percent; Smoky Hill (1026), 15 percent; South Platte (1019), 13 percent; Upper Cimarron (1104), 11 percent; North Platte (1018), 2 percent; and Upper Arkansas (1102), 1 percent. The North Platte River forms the northern boundary of this MLRA. The South Platte River joins the North Platte River at the town of North Platte, Nebraska. The Arkansas River bisects the southern part of the MLRA. Other large rivers between the North Platte and Arkansas Rivers in the area include the Republican, Sappa, Prairie Dog, Solomon, Saline, and Smoky Hill Rivers. The Cimarron River is the southern boundary of MLRA 72.

Figure 1. MLRA72 ESD block diagram

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Rise
Flooding frequency	None
Ponding frequency	None
Elevation	670 – 1,650 m
Slope	0 – 20 %
Water table depth	200 cm
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in this area is 14 to 25 inches (355 to 635 millimeters). It fluctuates widely from year to year. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from late spring through early autumn. Precipitation in winter occurs as snow. The annual snowfall ranges from about 16 inches (40 centimeters) in the southern part of the area, to 35 inches (90 centimeters) in the northern part. The average annual temperature is 46 to 57 degrees F (8 to 14 degrees C). The freeze-free period averages 159 days and ranges from 135 to 210 days, increasing in length from northwest to southeast. Climate data comes from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The data set is from 1981-2010.

Table 3 Representative climatic features

Frost-free period (characteristic range)	120-130 days
Freeze-free period (characteristic range)	140-160 days
Precipitation total (characteristic range)	460-530 mm
Frost-free period (actual range)	110-140 days
Freeze-free period (actual range)	140-170 days
Precipitation total (actual range)	430-530 mm
Frost-free period (average)	130 days

Freeze-free period (average)	150 days
Precipitation total (average)	480 mm

- (1) SCOTT CITY [USC00147271], Scott City, KS
- (2) WALLACE 2W [USC00258920], Wallace, NE
- (3) BREWSTER 4W [USC00141029], Brewster, KS
- (4) JULESBURG [USC00054413], Julesburg, CO
- (5) YUMA [USC00059295], Yuma, CO
- (6) TRIBUNE 1W [USC00148235], Tribune, KS
- (7) ULYSSES 3NE [USC00148287], Ulysses, KS
- (8) KIMBALL 2NE [USC00254440], Kimball, NE
- (9) TRENTON DAM [USC00258628], Trenton, NE

Influencing water features

There are no water features of the Limy Slopes ecological site or adjacent wetland/riparian regimes that influence the vegetation and/or management of the site that make it distinctive from other ecological sites.

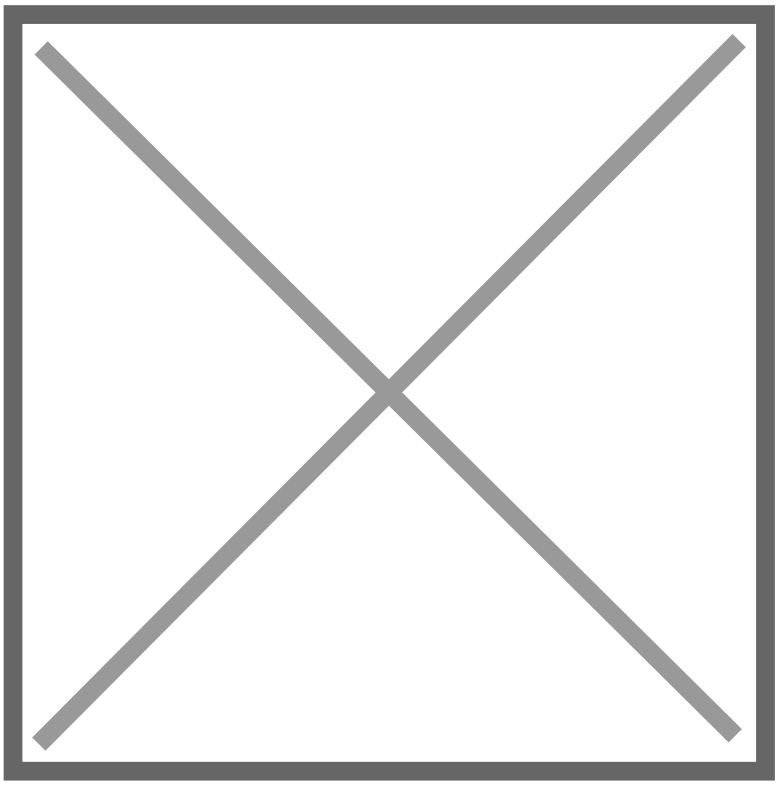

Figure 8. Fig.7-1 from National Range & Pasture Handbook

Soil features

The soils on this site are well drained and are moderately deep to very deep on slopes ranging from nearly level to 20 percent. Most of the soils associated with this site have loess as parent material and are dominated by silt loam and loam textures. The vast majority of parent material is Peoria Loess, which was deposited during the glacial retreat to the north during the Quaternary period. The other parent material for this site is eolian deposits from local river valley with Tertiary material.

The surface layer ranges from a depth of 4 to 8 inches thick and permeability is moderate to moderately slow. The subsoil and underlying material have a similar range in texture as the surface layer. Soils in this site are generally high in fertility, and most have strong effervescence within 6 inches of the surface. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Surface soil structure is granular to subangular blocky, and structure below the surface is prismatic or subangular blocky. Soil structure describes how soil particles are aggregated and defines the nature of the system of pores and channels in a soil. Together, soil texture and structure help to determine the ability of the soil to hold and conduct the water and air necessary for sustaining life.

Available water holding capacity (AWC) ranges from 0.77 to 2.93 inches of water per foot of soil depth in the upper 40 inches of the profile. Available water is the portion of water in a soil that can be readily absorbed by plant roots. This is the amount of water released between the field capacity and the permanent wilting point. As fineness of texture increases, there is a general increase in available moisture storage from sands to loams and silt loams.

Major soil series correlated to this ecological site and their relative percent acres include Colby (54%), Sulco (22%), Kimst, Atchison, Wagonbed, Campus, and Penden.

These attributes represent 0-40 inches in depth or to the first restrictive layer.

Figure 9. Colby silt loam, 7-15% slopes. Thomas co. KS

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	100 – 200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	6.5 – 24.87 cm
Calcium carbonate equivalent (0-101.6cm)	10 – 20 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The plant communities for the Limy Slopes ecological site are dynamic due to the complex interaction of many ecological processes. The interpretive plant community for this site is the Reference Plant Community. The Reference Community has been determined by the study of rangeland relic areas, areas protected from excessive disturbance, areas under long term rotational grazing strategies, literature of plant communities from the early 1900s and local expertise. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

This ecological site is made up of a Grassland State, a Sod-bound State, and a Tillage State. The Grassland State is characterized by non-broken land (no tillage), both warm and cool- season bunchgrasses, sod-forming grasses, forbs, and shrubs. The Sod-bound State is characterized by a warm-season, shortgrass plant community made up of primarily blue grama and buffalograss, with few remnant sideoats grama and western wheatgrass motts, and very few forbs. The tillage state has been mechanically disturbed (broken) by equipment and includes either a variety of reseeded warm-season bunch and sod-forming grasses or early successional plants to include the latter as well as annual grasses and forbs.

Vegetation changes are expected within this ecological site and will be dependent on the site's geographical location inside Major Land Resource Area (MLRA) 72. The northern part of MLRA 72 is characterized by cooler temperatures and shorter growing season in respect to the southern end. As a result, cool-season bunchgrasses and sod-formers proliferate. Growth of native cool-season plants begins about April 15, and continues to about June 15. Native warm-season plants begin growth about May 15, and continue to about August 15. Green up of cool-season plants may occur in September and October if adequate moisture is available (weather data from National Climate Data Center 1980-2010).

The Limy Slopes ecological site developed with occasional fires as part of the ecological processes. Historically, it is believed that the fires were infrequent, randomly distributed, and started by lightning at various times throughout the season when thunderstorms were likely to occur. It is also believed that pre-European inhabitants may have used fire as a management tool for attracting herds of large migratory herbivores (bison, elk, deer, and pronghorn). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool in the semi-arid, High Plains area.

The degree of herbivory (feeding on herbaceous plants) has a significant impact on the dynamics of the site. Historically, periodic grazing by herds of large migratory herbivores was a primary influence. Secondary influences of herbivory by species such as prairie dogs, grasshoppers, gophers, and root-feeding organisms impacted the vegetation historically, and continue to this day.

The management of herbivory by humans through grazing of domestic livestock and/or manipulation of wildlife populations has been a major influence on the ecological dynamics of the site. This management, coupled with the High Plains climate, largely dictates the plant communities for the site.

Drought cycles were part of the natural range of variability within the site and have historically had a major impact upon the vegetation. The species composition changes according to the duration and severity of the drought cycle (Albertson and Weaver 1942).

The vegetation on this site is impacted by topography. The percent (steepness) and aspect of the slope interact with the other ecological processes to further influence the vegetative dynamics of the site.

The Limy Slopes site generally occurs on the more sloping parts of the landscape. The flatter slopes of this site and adjacent, more level sites are preferred by livestock, which can lead to grazing distribution problems. Water locations, salt placement, and other aids help to distribute grazing. Other management techniques such as concentrated grazing and/or grazing systems also help to distribute grazing more evenly.

The general response of the Limy Slopes ecological site to long-term continuous grazing pressure is to gradually lose the vigor and reproductive potential of the tall and midgrass species and shift the plant community toward shortgrass species.

The tall and midgrass species generally escape excessive grazing pressure on the steeper, less accessible areas. The tall and mid grasses maintained on the steep area help to provide a source for these species to repopulate the site after long periods of drought and/or overgrazing. The use of grazing management that includes needed distribution tools, proper stocking, and adequate recovery periods during the growing season, helps to restore this site to its productive potential.

Historically, mechanical treatment of this site was practiced. The theory of mechanical treatment was that it improves production and plant composition on rangeland. These mechanical treatments include such things as contour furrowing, contour pitting, terracing, chiseling, disking, and inter-seeding. Many of these treatments were implemented during the 1930s through the 1960s and have shown to have no significant long-term benefits for improving production. Many of these practices result in a permanently rough ground surface. Inter-seeding may be beneficial depending upon stand achieved and management used after seeding.

The following diagram illustrates pathways that the vegetation on this site may take from the Reference Plant Community as influencing ecological factors change. There may be other states or plant communities not shown in the diagram, as well as noticeable variations within those illustrated and described in the following sections.

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	**Midgrass warm-season, Dominant 40%**			252-701	
3	**Warm-season Shortgrass, Subdominant 16%**			93-296	
2	**Cool-season bunchgrass, Sub-dominant 19%**			56-353	
	western wheatgrass	PASM	*Pascopyrum smithii*	39-135	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	17-123	–
	green needlegrass	NAVI4	*Nassella viridula*	0-56	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0-34	–
	squirreltail	ELEL5	*Elymus elymoides*	0-11	–
4	**Tallgrass warm-season, Subdominant 10%**			0-185	
	big bluestem	ANGE	*Andropogon gerardii*	11-106	–
	switchgrass	PAVI2	*Panicum virgatum*	11-106	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0-22	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0-17	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0-11	–
5	**Sedges, Minor 2%**			11-34	
	threadleaf sedge	CAFI	*Carex filifolia*	6-17	–
	sedge	CAREX	*Carex*	6-17	–
Forb					
6	**Forbs, Minor 10%**			34-185	
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	6-22	–
	dotted blazing star	LIPU	*Liatris punctata*	6-22	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6-17	–
	purple locoweed	OXLAL2	*Oxytropis lambertii var. lambertii*	6-17	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	6-17	–

	upright prairie coneflower	RACO3	*Ratibida columnifera*	6-17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0-17	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0-11	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0-11	–
	white penstemon	PEAL2	*Penstemon albidus*	0-11	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0-11	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0-11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0-11	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0-11	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0-11	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0-11	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0-6	–
	yellowspine thistle	CIOC2	*Cirsium ochrocentrum*	0-6	–
	golden prairie clover	DAAU	*Dalea aurea*	0-6	–
	spiny phlox	PHHO	*Phlox hoodii*	0-6	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0-6	–
	stiff greenthread	THFIF	*Thelesperma filifolium var. filifolium*	0-6	–
Shrub/Vine					
7	**Shrubs, Minor 5%**			0-95	
	winterfat	KRLA2	*Krascheninnikovia lanata*	0-28	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0-28	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	6-22	–
	prairie rose	ROAR3	*Rosa arkansana*	0-17	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0-17	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0-11	–
	soapweed yucca	YUGL	*Yucca glauca*	0-11	–
	tarragon	ARDR4	*Artemisia dracunculus*	0-11	–
	leadplant	AMCA6	*Amorpha canescens*	0-6	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0-6	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0-6	–

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 3.2 plant community composition

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

Animal community

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis. Grazing Interpretations Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. In addition to usable forage, safe stocking rates should consider ecological condition, trend of the site, past grazing use history, season of use, stock density, kind and class of livestock, forage digestibility, forage nutritional value, variation of harvest efficiency based upon desirability preference of plant species and/or grazing system, and site graze ability factors (such as steep slopes, site inaccessibility, or distance to drinking water). Often the current plant community does not entirely match any given community phase as described in this Ecological Site Description. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate. No two years have the same weather conditions. For this reason, year-to-year and season-to season fluctuations in forage production are to be expected on grazing lands. Livestock producers must make timely adjustments in the numbers of animals or in the length of grazing periods to avoid overuse of forage plants when production is unfavorable, and to make advantageous adjustments when forage supplies are above average. Initial stocking rates should be improved using vegetation monitoring and actual use records that include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based on the variability factors. Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Hydrological functions

Water is the principal factor limiting forage production on this site. Infiltration and runoff potential for this site varies from low to high. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff.

Recreational uses

Because of the deep, fertile soils and gentle slopes of this site, it is exposed to development for cropland, home sites, roads, and urban uses. The site exhibits little visual contrast but does present a panoramic view of the wide-open spaces cherished by many in the Great Plains States. Hunting opportunities for upland game species abound.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Other information

Site Development and Testing Plan: This ESD went through the approval process.

Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates and other inventory data. Field observations from experienced range trained personnel was used extensively to develop this ecological site description. NRCS individuals involved in developing the Limy Upland (South) ESD in 2001 include: Tim Watson, Amanda Shaw, Susan Francis, Jon Deege, and Robert Schiffner from Kansas. Harvey Sprock, and Josh Saunders from Colorado. NRCS individuals involved in developing the Limy Upland (North) ESD in 2001 include: Harvey Sprock from Colorado. Carol Eakins, Chuck Markley, Jeff Nichols, and Mary Schrader from Nebraska. Joan Gienger, and Ted Houser from Kansas. Range Condition Guides and Technical Range Site Descriptions for Kansas, Limy Upland, USDA, Soil Conservation Service, August 1967 Range Site Description for Kansas, Limy Upland, USDA-Soil Conservation Service, September 1983 Range Site Description for Colorado, Loamy Slopes, USDA-Soil Conservation Service, December 1975 Range Site Description for Colorado, Loess Breaks 15-45% slope, USDA-Soil Conservation Service, January 1975 Guide for determining range condition and suggestive initial stocking rates for Nebraska, Limy Upland, Vegetative Zone 1 and II, USDA-Soil Conservation Service, April 1983 Range Site Description for Nebraska, Limy Upland, USDA-Soil Conservation Service, August 1981 Schacht, Walter H., Larsen, Dana. Section III Range Sites, Limy Upland Range Site, The Board of Regents of the University of Nebraska, publication Ecological Site Description for Kansas, Limy Upland North (R072XA012KS) and South (R072XB012KS), located in Ecological Site Information System (ESIS), 2007 Ecological Site Description for Colorado, Loamy slopes (R072XY007CO), located in Ecological Site Information System (ESIS)

Other references

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Quality control review: MLRA 72 Loamy Tableland Workshop, Goodland KS, September 21-22, 2015. David Kraft, Hutchinson, KS Area office 9-28-2015

Quality assurance review: David Kraft (acting QA for region 5 and 9)

Contributors

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Approval

Suzanne Mayne-Kinney, 6/06/2025

Acknowledgments

The ecological site development process is a collaborative effort, conceptual in nature, dynamic and is never considered complete. I thank all those who set the foundational work in the early 2000s regarding this ESD. I thank all those who contributed to the development of this site. In advance, I thank those who would provide insight, comments, and questions about this ESD in the future.

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.

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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 (steeper slopes following intense storms) short and not connected.**

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3. **Number and height of erosional pedestals or terracettes:** **None, due to the slope percentage and amount of cover. Pedestals and terracettes are indicators of soil being moved by water and/or wind.**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **Less than 5% bare ground is found on this site, with bare patches generally less than 2-3 inches in diameter. Extended drought can cause bare ground to increase. Bare ground is the remaining ground cover after accounting for ground surface covered by vegetation (basal and foliar canopy), litter, standing dead vegetation, gravel/rock, and visible biological crust (e.g., lichen, mosses, algae).**

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5. **Number of gullies and erosion associated with gullies:** **None. There are no channels that are being cut into the soil by moving water. Gullies are not a natural feature of this landscape and site.**

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6. **Extent of wind scoured, blowouts and/or depositional areas:** **None. The vegetative cover in the Reference State is sufficient to limit wind-scoured or blowout areas. This site is not a depositional area for offsite wind erosion.**

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7. **Amount of litter movement (describe size and distance expected to travel):** None. The inherent capacity for litter movement on a soil is a function of its slope and landscape position.

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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):** Plant canopy is large enough to intercept most raindrops. The soil characteristic of this site is resistant to erosion. No physical crusts apparent. Soil stability scores will range from 5-6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer thickness (A horizon) averages 4 to 8 inches. Surface texture is silt loam, loam, and clay loam. Soil Surface structure is weak to moderate granular, and structure below the surface layer (B horizon), is prismatic or subangular blocky. The surface (A) horizon is dark grayish brown 10YR 4/2 to 10YR 5/2 grayish brown (moist), and the subsurface (B) horizon color is brown 10 YR 4/3 to 10YR 5/3 (moist). SOM in the surface layer averages 1 to 2 percent. (Note: the surface layer is darker than the subsurface layer due to higher SOM content).

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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.

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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):** There is no evidence of compacted soil layers due to cultural practices. Soil structure is conducive to water movement and root penetration.

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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: little bluestem > sideoats grama >> plains muhly = Fendler threeawn

    Sub-dominant: cool season bunchgrasses/sod formers(western wheatgrass, needle and thread) > shortgrass warm season (blue grama, buffalograss) >> tallgrass warm season (big bluestem, switchgrass)

    Other: Minor: Forbs (western ragweed, dotted gayfeather, purple locoweed, slimflower scurfpea, upright prarieconeflower) = Sub/Shrubs (broom snakeweed, fourwing saltbush, winterfat, pricklypear, yucca) >> Sedges (threadleaf sedge)

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** The majority of plants are alive and vigorous. Some mortality and decadence is expected for the site. This in part is due to drought, unexpected wildfire, or a combination of the two events. This would be expected for both dominant and sub-dominant groups.

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14. **Average percent litter cover (%) and depth (in):** Plant litter is distributed evenly throughout the site.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **Annual production is 1,650 lbs./ac. in a normal precipitation year. Production may vary from 800 lbs./ac. in below-average years to 2,400 lbs/ac in above-average years. Annual production may be reduced to 20 to 40% the first year following wildfire or extended drought.**

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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 or noxious weeds should not occur in the Reference Community. However, cheatgrass, Russian thistle, kochia, and other non-native annuals can invade following extended drought assuming as seed source is available.**

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17. **Perennial plant reproductive capability:** **The number and distribution of tillers or rhizomes is assessed relative to the expected production of the perennial warm and cool season mid and shortgrasses.**
