Ecological site R073XY111KS
Sandy Plains

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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): 073X–Rolling Plains and Breaks

This ESD is located in the Rolling Plains and Breaks Major Land Resource Area (MLRA) 73 of the Central Great Plains Winter Wheat and Range Region of the United States. MLRA 73 is in Kansas (78 percent) and Nebraska (22 percent). It makes up about 21,485 square miles (13,750,400 acres). The towns of Hays, Great Bend, and Dodge City, Kansas, and Alma, Curtis, Holdrege, and McCook, Nebraska are in this MLRA. The MLRA is bisected by Interstate 70. The Platte River is at the northern edge of the area, and the Arkansas River is at the southern edge.

Classification relationships

Major land resource area (MLRA): 073-Rolling Plains and Breaks

Ecological site concept

The Sandy Plains ecological site is characterized by sandy soils, generally with greater than 52 percent sand. Sandy eolian sediments make up the parent material of this ecological site. This site occurs on plains. The textures for the surface of the components of this group are loamy sand and fine sandy loam.

Associated sites

R073XY107KS	**Sandy Floodplain** This site occurs on nearly level to moderately sloping floodplains and low terraces. The Sandy Floodplain site is characterized by soils with greater than 55 percent sand in the surface. The soils characteristic of this site formed in sandy alluvium from mixed sources.
R073XY119KS	**Loamy Terrace** The Loamy Terrace ecological site is on nearly level to gently sloping alluvial benches, terraces, or fans. This site receives some additional water in the form of run-in from nearby uplands. The flooding frequency is none to rare on this site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	Not specified

Physiographic features

The western half of MLRA 73 and areas along the Arkansas River have remnants of the Tertiary river-laid sediments washed out onto the plains from erosion of the prehistoric Rocky Mountains in Colorado. In the valley of the Arkansas River, the wind reworked these sediments, forming a hummocky dune surface of eolian sand. A loess mantle occurs on the higher ground in the western half of the area. The Tertiary-age Ogallala and White River Formations cover Cretaceous Pierre Shale in the northern part of the area. The Ogallala Formation consists of loose to well cemented sand and gravel, and the White River Formation consists of ashy claystone and sandstone. Pierre Shale and Niobrara Chalk are at the surface in the valleys of the Republican, Smoky Hill, and Saline Rivers. Fort Hays limestone of the Niobrara Formation and Blue Hill shale of the Carlile Formation are at the surface in the valleys of the Saline and Smoky Hill Rivers. Shale can be seen exposed in the eastern half of this MLRA, in Kansas. Quaternary and more recent sand and gravel partially cover the shale in the river valleys.

The Sandy Plains site occurs on relatively smooth loess-mantled plains dissected by several river valleys with associated gently sloping to steep breaks. The elevation varies from 2,500 to 4,025 feet above mean sea level. This site occurs on nearly level to rolling topography with associated low sand dunes. The surface layer textures are loamy sand and fine sandy loam.

Figure 1. MLRA 73 ecological site block diagram.

Table 2. Representative physiographic features

Landforms	(1) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	760 – 1,230 m
Slope	0 – 20 %
Ponding depth	0 cm
Water table depth	150 cm

Climatic features

For MLRA 73 the average annual precipitation is 19 to 30 inches (48 to 76 centimeters). Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from the middle of spring to the early autumn months. Precipitation in winter occurs as snow. The annual snowfall ranges from about 17 inches (45 centimeters) in the southern part of the area to 24 inches (60 centimeters) in the northern part. The average annual temperature is 48 to 56 degrees F (9 to 14 degrees C). The freeze-free period averages 180 days and ranges from 145 to 210 days, increasing in length from northwest to southeast. The following weather data originated from weather stations chosen across the geographical extent of the ecological site, and will likely vary from the data for the entire MLRA. The climate data derives 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 (average)	150 days

Freeze-free period (average)	170 days
Precipitation total (average)	660 mm

- (1) ALTON 1 W [USC00140201], Alton, KS
- (2) HILL CITY 1E [USC00143665], Hill City, KS
- (3) NORTON DAM [USC00145852], Norton, KS
- (4) SMITH CTR [USC00147542], Smith Center, KS
- (5) PLAINVILLE 4WNW [USC00146435], Plainville, KS
- (6) WEBSTER DAM [USC00148648], Stockton, KS

Influencing water features

This ecological site is characterized by very deep sandy soils that are excessively drained.

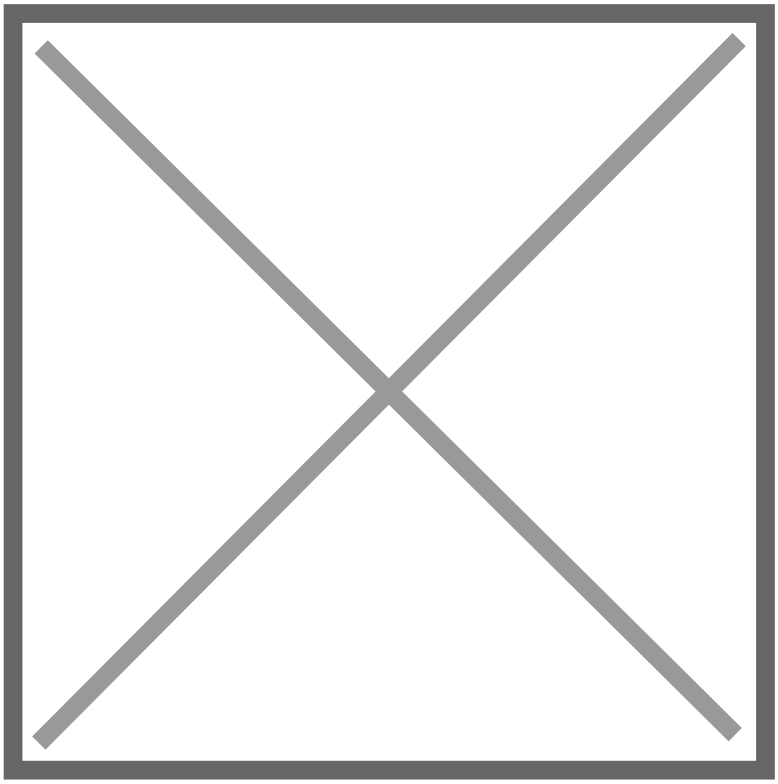

Figure 6. Fig.7-1 from National Range and Pasture Handbook.

Soil features

The soil series making up this ecological site consists of very deep, well drained soils that have a parent material of eolian deposits. These soils are on sand sheets, interdunes, plains, and hillslopes, and have slopes of 0 to 24 percent.

The surface texture is represented by loamy sand and fine sandy loam. The subsoil and underlying layers may become heavier-textured. The content of organic matter generally is moderately low or moderate. These soils are highly susceptible to wind erosion when vegetative cover is opened. Roads, trails, pipeline, overgrazing, fire, and other disturbances can be the cause of severe wind erosion on this site.

The Reference Plant Community should portray slight to no evidence of rills. Water flow paths, if present, are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. Wind- scoured areas and pedestaled plants may exist in areas but should be minor. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration.

Major soil series correlated to this ecological site include: Anselmo, Attica, Hersh, Sarben, and Carwile.

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

Figure 7. Anselmo soil series. Logan County, NE, 1974.

Table 4. Representative soil features

Surface texture	(1) Loamy sand (2) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderate to rapid
Soil depth	150 – 200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	18.52 – 25.78 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.5 – 7.2
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %

Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The grasslands of Major Land Resource Area (MLRA) 73, the Rolling Plains and Breaks, is located in south-central Nebraska and central Kansas. It evolved under sub-humid (20-40 inch precipitation range) climates, characterized by much the same weather extremes of temperatures, rainfall, and snowfall we are familiar with today. As a result of glacial activity and other natural forces, then and later, plants have migrated from their places of origin, so that today MLRA 73 grasslands are simple-to-complex mixtures of perennial grasses and forbs, plus a few native annuals and biennials. Species composition has been modified by the introduction of Kentucky bluegrass and cool-season annual and perennial grasses, particularly Japanese brome (Launchbaugh and Owensby, 1978).

Through the ages to modern times, wildfires – many started by lightning, but most by primitive people – influenced development of fire-tolerant grasses and suppressed woody vegetation (Sauer, 1950). Certain woody plants, however, always were present as natural components of some grasslands. Browsing by animals and frequent prairie fires were largely responsible for maintaining “normal” amounts of woody species (Dyksterhuis, 1958). In primitive time, numerous large herbivores subjected herbaceous vegetation to grazing stress. After the last glacial retreat, bison emerged as the major dominant large grazer, although the prairies and plains simultaneously supported many pronghorn antelope, elk, deer, prairie dogs, rabbits, rodents, and insects. Each exerted grazing pressures on the vegetation (Launchbaugh and Owensby, 1978). There is little doubt that during and long before Spanish explorations into this area, most of the grassland was used almost continuously throughout the year by one roving herd of buffalo after another, and by other grazing animals (early exploration accounts reviewed by Dary in 1974; diaries of early Kansas residents cited by Choate and Fleharty in 1975). Grazing and trampling by bison and their associates were often intensive, as was uncontrolled grazing by livestock in the late 1800s after most of the wild grazers had been eliminated.

The plant communities for the Sandy Plains 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 Woody State, and a Tillage State. The Grassland State is characterized by non-broken land (no tillage), warm-season bunchgrasses, sod-forming grasses, forbs, and shrubs. The Woody State is characterized by a community made up of sand sagebrush, Chickasaw plum, and/or eastern redcedar with few remnant native grasses and forbs making up the understory. 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) 73. Variation in precipitation east and west is not as affected as is temperature north and south. The northern part of MLRA 73 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 Sandy Plains 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 sub-humid, High Plains and Smoky Hills 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 and Smoky Hills climate, largely dictates the plant communities for the site.

Drought cycles were part of the natural range of variability within the site and historically have had a major impact upon the vegetation. The species composition changes according to the duration and severity of the drought cycle (Albertson and Weaver, 1940).

This site appears on nearly level to moderately steep uplands and stream terraces. This site is made up of well drained deep soils.

The general response of this site to long-term continuous grazing pressure is to gradually lose the vigor and reproductive potential of the tallgrass species, and shift the plant community toward mid- and shortgrasses.

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	**Tallgrasses dominant component 40%**			673-947	
	sand bluestem	ANHA	*Andropogon hallii*	224-359	–
	switchgrass	PAVI2	*Panicum virgatum*	84-235	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	56-118	–
	Indiangrass	SONU2	*Sorghastrum nutans*	17-118	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	56-112	–
2	**Midgrasses subdominant component 25%**			224-583	
	sideoats grama	BOCU	*Bouteloua curtipendula*	118-241	–
	little bluestem	SCSC	*Schizachyrium scoparium*	118-235	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	56-118	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0-45	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0-45	–
3	**Shortgrasses subdominant 15%**			168-359	
	blue grama	BOGR2	*Bouteloua gracilis*	235-471	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0-118	–
4	**Cool-season grasses minor 5%**			0-112	
	threadleaf sedge	CAFI	*Carex filifolia*	0-118	–
	sedge	CAREX	*Carex*	0-118	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	0-45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0-45	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0-22	–
Forb					
5	**Forb minor component 10%**			112-235	
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	17-45	–
	dotted blazing star	LIPU	*Liatris punctata*	17-45	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	6-39	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11-39	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	6-39	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	6-28	–
	common yarrow	ACMI2	*Achillea millefolium*	6-28	–
	evening primrose	OENOT	*Oenothera*	6-17	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	6-17	–
	false boneset	BREU	*Brickellia eupatorioides*	6-17	–
	silky prairie clover	DAVI	*Dalea villosa*	6-17	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	6-17	–

	annual buckwheat	ERAN4	*Eriogonum annuum*	6-17	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	6-17	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	6-17	–
	white heath aster	SYER	*Symphyotrichum ericoides*	6-17	–
Shrub/Vine					
6	**Shrubs and Cacti minor component 5%**			34-118	
	sand sagebrush	ARFI2	*Artemisia filifolia*	11-22	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0-22	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	11-22	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	0-22	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0-22	–
	prairie rose	ROAR3	*Rosa arkansana*	0-22	–
	soapweed yucca	YUGL	*Yucca glauca*	11-22	–
	leadplant	AMCA6	*Amorpha canescens*	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 3.2 plant community composition

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

Animal community

Wildlife Interpretations This ecological site is characterized by nearly level to undulating topography with associated low sand dunes. Much of this site has been converted to cropland, especially where irrigation is feasible resulting in fragmentation and loss of habitat. Historically, the predominance of grasses and forbs on this site supported grazers and mixed feeders such as bison, elk, mule deer, pronghorn, and a variety of grassland-associated birds and small mammals. Due to the inherent heterogeneity of all landscapes, some areas were not grazed uniformly by these historic large herds of grazing animals. This type of grazing enhanced habitat for wildlife by creating a mosaic pattern, or patchiness of vegetative structural diversity throughout the landscape. Wildlife native to the site depend on a plant community diverse in species and structure. This need is evident in the variability of known habitat requirements of grassland-associated wildlife. Sand sagebrush may be present and locally abundant on this site. Sagebrush offers escape and thermal cover for several species of wildlife and a source of winter browse for other species. This site, as it occurs in the southern part of MLRA 73, is within the traditional range of the lesser prairie chicken and can offer exceptional habitat for this species. Tree encroachment can make this site generally unsuitable for prairie chickens and other ground-nesting birds that require large expanses of non-woody habitat. Woody species, such as those commonly established in tree plantings, provides habitat for mid-sized mammals such as raccoons, opossums, and striped skunks which can be detrimental to ground-nesting birds native to grassland habitats. The presence of trees can also increase the potential for nest parasitism by brown-headed cowbirds when adjacent to grasslands. Periodic events such as prolonged drought, wildfire, disease, or high insect numbers will alter plant community diversity and structure and associated wildlife species. Reference Plant Community The high diversity of grasses and forbs in this community provides habitat for a diverse group of insects. Areas with high forb diversity will generally support more insects such as the leaf-hoppers, important to young grassland nesting birds. Grasshoppers, associated with grasses, are a critical food source for birds in later stages of development. Plains garter snakes, western hognose snakes, and six-lined racerunners are common reptiles on the site. Reference Plant Community sites in good condition with tall native warm-season bunchgrasses and openings at ground level offer suitable northern bobwhite quail nesting habitat. Burrowing mammals such as thirteen-lined ground squirrels and kangaroo rats are common. Several species of pocket mice are common and provide prey for raptors such as red-tailed hawks and great-horned owls throughout the year, and prey for northern harriers and rough-legged hawks during the winter. Small mammals also provide prey for coyotes and other predators. Grazing Interpretations 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. During the dormant period, livestock may need supplementation based on reliable forage analysis. 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 on preference of plant species, and/or grazing system, and site grazeability factors (such as steep slopes, site inaccessibility, or distance to drinking water). Often the current plant community does not entirely match any particular 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 exactly 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 through the use of 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

The soils of this site have sandy surface layers and sandy, loamy, or clayey subsoils. The intake rate is rapid with stored moisture varying from low to high, depending upon the texture of the subsoil.

Recreational uses

None noted.

Wood products

No appreciable wood products are present on the site.

Other products

The sandy nature of this site limits its use primarily to rangeland. Large areas, however, are cultivated successfully when high residue-producing crops are grown and the residues are managed to prevent wind erosion.

Other information

Site Development and Testing Plan This site 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 were used extensively to develop this ecological site description. NRCS individuals involved in developing the Sandy ESD in 2002 include Darrell Beougher, Jon Deege, Lorne Denetclaw, Sharla Schwien, Joel Willhoft, Dwayne Rice, and Bob Tricks from Kansas; and Nadine Bishop, Kristin Dickinson, Kim Stine, Dana Larson, and Chuck Markley from Nebraska. Range Condition Guides and Technical Range Site Descriptions for Kansas, Sandy, USDA, Soil Conservation Service, August, 1967. Range Site Description for Kansas, Sandy, USDA-Soil Conservation Service, September, 1983. Ecological Site Description for Kansas, Sandy (R073XY022KS) located in Ecological Site Information System (ESIS), 2007.

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Contributors

Chris Tecklenburg

Approval

Curtis Talbot, 4/12/2021

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 in regards to 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. Non-discrimination Statement In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident. Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA’s TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English. To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the

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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.

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Contact for lead author	Chris Tecklenburg (chris.tecklenburg@ks.usda.gov)
Date	10/01/2019
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 to slight. If present, are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers.**

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3. **Number and height of erosional pedestals or terracettes:** **Pedestalled plants caused by wind or water erosion would be minor.**

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

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5. **Number of gullies and erosion associated with gullies:** There are no gullies present on this site.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Minor wind scouring may occur on knolls. Wind erosion can occur with disturbances such as wildfire or extended drought.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter should be uniformly distributed with little movement.

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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 sufficient to intercept the majority of raindrops. Soil organic matter is incorporated into aggregates at the surface, and/or adhesion of decomposing organic matter is present, and/or biological crusts are present on the surface. Soil stability scores will range from 4-6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Anselmo soil series OSD: Ap--0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary. A--5 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; neutral; gradual smooth boundary. (Combined A horizons 7 to 20 inches thick)

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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. Extended drought and/or wildfire may reduce canopy cover and litter amounts, resulting in decreased infiltration and increased runoff on steeper slopes.

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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 animal impact or cultural practices.

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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: Group 1 Tallgrass dominant 40%; sand bluestem 200-320, prairie sandreed 50-100, switchgrass 75-210, sand dropseed 50-105, Indiangrass 15-105.

    Sub-dominant: Group 2 midgrasses subdominant 25%; sideoats grama 105-215, little bluestem 105-215, sand lovegrass 50-105, plains muhly 0-40, purple lovegrass 0-40.

    Other: Group 3 Shortgrasses subdominant 15%; blue grama 210-420, buffalograss 0-105 Group 4 Cool-season grasses minor component 5%

    Additional: Group 5 Forbs minor 10% Group 6 Shrubs and Cacti minor 5%

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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 subdominant groups.

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14. **Average percent litter cover (%) and depth (in):** 40-65% litter cover at 0.25-0.50 inch depth. Litter cover during and following drought can range from 20-30% and 5-15% following wildfire.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,500 lbs./ac. low precipitation years, 2,100 lbs./ac. average precipitation years, 3,000 lbs./ac. high precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 500 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:** Invasive plants should not occur in Reference Plant Community. Following wildfire or extended drought, cheatgrass, Russian thistle, and kochia will invade assuming a seed source is available.

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17. **Perennial plant reproductive capability:** The number and distribution of tillers or rhizomes is assessed on perennial plants occupying the evaluation area. No reduction in vigor or capability to produce seed or vegetative tillers given the constraints of climate and herbivory.
