Ecological site HX074XY130
Shallow Sandstone

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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): 074X–Central Kansas Sandstone Hills

Major Land Resource Area (MLRA) 74, Central Kansas Sandstone Hills, is entirely located in Kansas. It makes up about 8,365 square miles (21,675 square kilometers). The city of Salina and the towns of Concordia, Junction City, McPherson, and Newton are in this MLRA. Interstate Highways 70 and 135 meet in Salina, and Interstate 35 crosses the southern part of this area. Wilson and Kanopolis State Parks are in this area. McConnell Air Force Base is in the southern part of the area. Following are the various kinds of land use in this MLRA: Cropland--private, 52 percent; Grassland--private, 38 percent, Federal 2 percent; Forest--private, 3 percent; Urban development--private, 3 percent; Water--private, 1 percent; Other--private, 1 percent. Most of MLRA 74 is in farms. More than one-half of the area is cropland. Winter wheat is the principal crop. Other small grains, grain sorghum, hay, and corn also are important crops. Some areas along the large rivers are irrigated. The crops grown in nonirrigated areas also are grown in irrigated areas, but more corn and less wheat are grown in the irrigated areas. More than one-third of the area supports native grasses grazed by cattle. The major soil resource concerns are the hazard of water erosion, maintenance of the content of organic matter and tilth of the soils, and soil moisture management. The resource concerns on pasture and rangeland are the productivity, health, and vigor of plants and the spread of noxious and invasive species. Conservation practices on cropland generally include high-residue crops in the cropping system; systems of crop residue management, such as no-till and mulch-till; a combination of terraces and grassed waterways; contour farming; contour stripcropping; conservation crop rotations; and nutrient management. Conservation practices on rangeland generally include prescribed grazing, brush management, management of upland wildlife habitat, proper distribution of watering facilities, and control of noxious and invasive plant species.

Classification relationships

Major Land Resource Area (MLRA): 074X--Central Kansas Sandstone Hills

Ecological site concept

The Shallow Sandstone ecological site is characterized by the Hedville soil which is shallow to very shallow. Many areas of exposed sandstone rock are evident on the higher elevations. This soil formed in residuum weathered from noncalcareous sandstone. This site is found on uplands that are moderately to strongly sloping with a loamy surface layer that may be cobbly.

Associated sites

HX074XY107	**Clay Hills** The Clay Hills ecological site sits adjacent to and in conjunction with the Shallow Sandstone ecological site. This site is made up of very deep to moderately deep, moderately well to well drained upland soils. This site has a loamy to silty surface (7 to 14 inches) over clayey subsoils and is non-calcareous to the surface. The clay content in the soil is approximately greater than 45 percent at depths less than 14 inches. Generally, the Clay Hills ecological site is located on uplands with a slope range of 0 to 40 percent.

HX074XY115	**Loamy Hills** The Loamy Hills ecological site sits adjacent to and in conjunction with the Shallow Sandstone ecological site. This site is made up of moderately deep to deep, moderately well to well drained upland soils. This site has a fine-silty and loamy surface texture and is non-calcareous to the surface. Generally, the Loamy Hills ecological site is located on uplands with a slope range of 0 to 16 percent.

Figure 1. MLRA 74 ESD block diagram.

Table 2. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon gerardii*

Legacy ID

R074XY130KS

Physiographic features

The northwest half of MLRA 74 is in the Plains Border Section of the Great Plains Province of the Interior Plains. The northeast corner is in the Dissected Till Plains Section of the Central Lowland Province of the Interior Plains, and the rest of the area is in the Osage Plains Section of the same province and division. This area is an undulating to hilly, dissected plain. Wide flood plains and terraces are along the larger rivers, and narrow bottom land is along the small streams. Elevation is generally 1,310 to 1,640 feet (400 to 500 meters), increasing from east to west. Local relief is typically 65 to 130 feet (20 to 40 meters).

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Smoky Hill (1026), 47 percent; Middle Arkansas (1103), 22 percent; Kansas (1027), 11 percent; Republican (1025), 10 percent; and Neosho-Verdigris (1107), 10 percent. The Little Arkansas River forms the southwestern border of this area. From north to south, other rivers that cross the area include the Little Blue, Big Blue, Republican, Solomon, Salt, Saline, Cottonwood, Walnut, and Arkansas Rivers. The Solomon and Saline Rivers join the Smoky Hill River just south of Salina.

The Shallow Sandstone ecological site is situated on uplands that are moderately to strongly sloping and somewhat excessively drained. The major soil series that represents this site is Hedville. It is often found as a complex in association with loamy upland soils such as Lancaster. Runoff is medium to very high with moderate permeability.

Figure 1. MLRA 74 ESD block diagram.

Figure 2. Landscape block diagram in MLRA 74.

Table 3. Representative physiographic features

Hillslope profile	(1) Shoulder (2) Backslope
Landforms	(1) Upland > Hillslope

Runoff class	Medium to very high
Elevation	400 – 500 m
Slope	0 – 30 %
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in MLRA 74 is 27 to 34 inches (680 to 860 millimeters). Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from the middle of spring to early in autumn. The annual snowfall averages 20 inches (50 centimeters). The average annual temperature is 54 to 57 degrees F (12 to 14 degrees C). The freeze-free period averages 200 days. Precipitation is usually evenly distributed throughout the year with the exception of November through February as the driest months and May and June as the wettest months. Summer precipitation occurs during intense summer thunderstorms. 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 from this narrative and from the tables below derives from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The dataset is from 1981-2010. The climate data from the geographical extent of the ecological site could be different from the MLRA 74 data. Climate stations that were used for this ecological site are listed.

Table 4 Representative climatic features

Frost-free period (characteristic range)	150-150 days
Freeze-free period (characteristic range)	180-190 days
Precipitation total (characteristic range)	740-790 mm
Frost-free period (actual range)	140-160 days
Freeze-free period (actual range)	170-190 days
Precipitation total (actual range)	710-810 mm
Frost-free period (average)	150 days
Freeze-free period (average)	180 days
Precipitation total (average)	760 mm

- (1) CONCORDIA 1 W [USC00141761], Concordia, KS
- (2) CONCORDIA MUNI AP [USW00013984], Concordia, KS
- (3) CLAY CTR [USC00141559], Clay Center, KS

- (4) MINNEAPOLIS [USC00145363], Minneapolis, KS
- (5) ELLSWORTH [USC00142459], Ellsworth, KS
- (6) SALINA MUNI AP [USW00003919], Salina, KS
- (7) SMOLAN 1NE [USC00147551], Lindsborg, KS
- (8) KANOPOLIS LAKE [USC00144178], Ellsworth, KS
- (9) MCPHERSON [USC00145152], McPherson, KS

Influencing water features

The Shallow Sandstone ecological site is somewhat excessively drained, has medium to rapid runoff, and has moderate permeability. The hazard of water erosion, gully erosion in particular, is a major concern when vegetation is overgrazed or otherwise mismanaged.

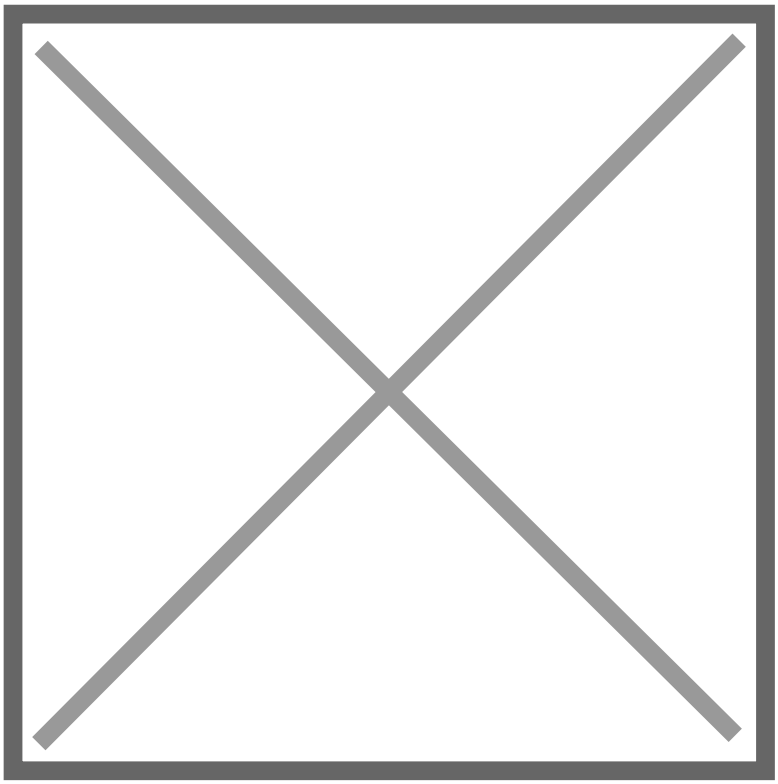

Figure 9.

Soil features

The Hedville soil series representing the Shallow Sandstone ecological site consists of shallow and very shallow, somewhat excessively drained, and moderately permeable soils on uplands. These soils formed in residuum weathered from noncalcareous sandstone. The Hedville soil has a loamy surface layer that may be cobbly or stony. The underlying substrata is a reddish brown sandstone, somewhat excessively drained, and medium to rapid runoff.

Figure 10. Hedville soil series (tape in photo is in cm).

Figure 11. Roadside profile of Hedville soil in Saline County, Kansas.

Table 5. Representative soil features

Parent material	(1) Residuum − sandstone
Surface texture	(1) Loam (2) Fine sandy loam

Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate
Depth to restrictive layer	10 – 50 cm
Soil depth	10 – 50 cm
Surface fragment cover >3"	0 – 30 %
Available water capacity (0-50.8cm)	4.06 – 5.08 cm
Electrical conductivity (0-50.8cm)	Not specified
Sodium adsorption ratio (0-50.8cm)	Not specified
Soil reaction (1:1 water) (0-50.8cm)	5.6 – 7.3

Ecological dynamics

The Shallow Sandstone ecological site in MLRA 74 consists of dynamic plant communities resulting from the complex interaction of many ecological factors and processes. The vegetation evolved on shallow to very deep, moderately well drained to somewhat excessively drained, and loamy or clayey soils under a diverse, fluctuating climate. Plants were historically grazed by herds of large herbivores and periodically subjected to intense wildfires.

The original plant community developed with fires of various intensities and frequencies during different seasons of the year playing an important part in ecological processes. Historically, wildfires started by lightning often occurred in the spring and early summer months when thunderstorms were prevalent, but also in late summer and fall during dry weather periods. It is also recognized that early Native Americans often used fire to attract herds of migratory herbivores, especially bison.

The dominant tall grasses were rhizomatous, enabling them to survive the ravages of even intense wildfires and thus gain a competitive advantage in the plant community. In contrast, most trees and shrubs were suppressed by fire and occurred only sparsely on protected areas. Growth of perennial forbs, and especially legumes, were usually enhanced following a fire event. After an intense fire there was usually a substantial, but short-term, increase in the abundance of annual forbs as well.

Grazing history has had a major impact on the dynamics of the site. The vegetative community developed under a grazing regime that consisted primarily of periodic grazing by large herds of bison. As the herds moved through an area, grazing was probably intense. When herds moved to adjacent areas, grazed vegetation was afforded an extended period of rest and recovery during the growing season. Other grazing and feeding animals such as elk, pronghorns, deer, rabbits, insects, and numerous burrowing rodents had secondary influences on plant community development.

Variations in climate, especially a pattern of annual late summer drought and long-term drought cycles spanning several years, also had a major impact upon plant community development. Species composition fluctuated according to the duration and severity of long-term droughts. During prolonged dry cycles, many of the weaker, shallow-rooted plants died and production of deeper-rooted plants significantly decreased. When sufficient rainfall occurred following an extended dry period, annual forbs and annual grasses would temporarily occur in abundance. When precipitation returned to normal or above-normal, the deeper-rooted grasses and forbs responded and returned to their production potentials.

Typically, growth of warm-season grasses in MLRA 74 begins during the period of May 1 to May 15 and continues until mid-September. Generally, 70 percent of total production is completed by mid-July. This varies only slightly from year to year depending on temperature and precipitation patterns. Cool-season grasses generally have two short growing periods, one in the fall (September and October) and again in the spring (April, May, and June).

As European settlers began utilizing the area for production of domestic livestock within fenced pastures in place of roaming bison herds, the ecological dynamics and physical aspects were altered, and the plant community shifted from its original composition. These changes were usually in proportion to the season and intensity of the use by livestock and were accelerated by a combination of drought and overgrazing. Taller grasses and forbs more palatable to bison were similarly selected and consumed by cattle and horses. Those palatable species were repeatedly grazed throughout the growing season, thus weakening them. Over time, they were gradually replaced by the increase and spread of less palatable species. Where the history of overuse by domestic livestock was more intense, even the plants which initially increased were often replaced by less desirable and lower-producing plants. In some instances, production and plant diversity was reduced to a mixture of mid- and shortgrasses, annual grasses, and unpalatable forbs.

The frequency and role that fires played in maintaining the plant community was reduced with the advent of roads, cultivated fields, and fire suppression techniques developed by European settlers. Use of prescribed fire as a management tool has also diminished in some localities, especially surrounding population centers. In the absence of periodic, intense fire, there has often been a gradual increase in woody species. In some areas, shrubs and trees have encroached to the point of being the dominant influence in the plant community.

The gently rolling topography of this ecological site was attractive to European settlers who sought to create agrarian lifestyles. Some areas of this site were brought under cultivation and used to grow wheat, corn, sorghum, and other crops. Tillage and crop production caused the destruction of the original native plant community and often major degradation of the inherent structure and fertility of the surface soil layer. Many acres that were formerly used for cultivated crops have been reseeded or allowed to revegetate through natural succession.

The following diagram illustrates some of the 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 on the diagram, as well as noticeable variations within those illustrated.

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass Dominant 45%**			807-1261	
	big bluestem	ANGE	*Andropogon gerardii*	560-981	–
	Indiangrass	SONU2	*Sorghastrum nutans*	140-280	–
	switchgrass	PAVI2	*Panicum virgatum*	78-140	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	22-45	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	6-17	–
2	**Midgrass Subdominant 36%**			689-1009	
	little bluestem	SCSC	*Schizachyrium scoparium*	560-897	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	78-140	–
	thin paspalum	PASE5	*Paspalum setaceum*	6-17	–
3	**Shortgrass Minor 4%**			50-106	
	buffalograss	BODA2	*Bouteloua dactyloides*	22-45	–
	blue grama	BOGR2	*Bouteloua gracilis*	22-45	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	6-17	–
4	**Cool-season grass Minor 3%**			45-90	

	Canada wildrye	ELCA4	*Elymus canadensis*	22-45	–
	western wheatgrass	PASM	*Pascopyrum smithii*	22-45	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	22-45	–
	sedge	CAREX	*Carex*	22-45	–
Forb					
5	**Forbs Minor 10%**			84-280	
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0-28	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	11-28	–
	common yarrow	ACMI2	*Achillea millefolium*	0-28	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0-28	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0-28	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0-28	–
	dotted blazing star	LIPU	*Liatris punctata*	0-28	–
	woolly plantain	PLPA2	*Plantago patagonica*	0-28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0-28	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0-28	–
	Baldwin's ironweed	VEBA	*Vernonia baldwinii*	0-28	–
Shrub/Vine					
6	**Shrubs Trace 2%**			0-56	
	fragrant sumac	RHARS	*Rhus aromatica var. serotina*	0-17	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0-17	–
	twistspine pricklypear	OPMA2	*Opuntia macrorhiza*	0-17	–
	smooth sumac	RHGL	*Rhus glabra*	0-17	–

Table 7. Community 1.2 plant community composition

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

Table 8. Community 2.1 plant community composition

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

Table 9. Community 3.1 plant community composition

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

Animal community

Wildlife A variety of small native rodents find refuge in the nooks and crannies formed by rocks. Inclusions of deep soil pockets, as well as scattered small caves and rock outcrops, make this a preferred den site for prairie predators such as coyotes and foxes as well as the badger. Reptiles including lizards such as the collared lizard and others like the common bull snake make this site their home. The rough topography provided by this site offers protection for many wildlife species during severe weather periods. The native forb species found growing on this site provide a variety of desirable food for birds and small mammals. Some animals are important because of their threatened and endangered status and require special consideration. Please check the Kansas Department of Wildlife, Parks, and Tourism (KDWPT) website at http://ksoutdoors.com for the most current listing for your county. 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 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

Following are the estimated withdrawals of freshwater by use in MLRA 74: Public supply—surface water, 6.5%; ground water, 5.7% Livestock—surface water, 0.3%; ground water, 4.2% Irrigation—surface water, 70.8%; ground water, 0.5% Other—surface water, 12.0%; ground water, 0.0%. The total withdrawals average 210 million gallons per day (795 million liters per day). About 10 percent is from ground water sources, and 90 percent is from surface water sources. If moisture is carefully conserved, the moderate precipitation generally is adequate for crops and pasture. The surface water is generally suitable for most uses with appropriate treatment. Water is stored in reservoirs outside this area for public supply, industry, and irrigation within this area. Some in-stream diversions also are used. Hedville is a somewhat excessively drained soil with medium to rapid runoff and moderate permeability. It is classified as a hydrologic group D soil. However, Hedville is most often found in a complex with other soils such as Lancaster, a hydrologic group B soil, or Edalgo, a hydrologic group C soil. This makes hydrology determinations for the site somewhat complex. Please refer to the NRCS National Engineering Handbook Section 4 (NEH-4) for runoff quantities and hydrologic curves when making hydrology determinations.

Recreational uses

This site provides for a variety of outdoor activities including bird watching, hiking, and outdoor and wildlife photography. There are a variety of flowering plants in bloom throughout the growing season that provide much aesthetic appeal to the landscape. Recreation can be a valued use, but there are site considerations such as somewhat steep, rocky, rough terrain.

Wood products

Wood products are not a consideration on this site.

Other products

Woody shrubs such as plum and currant, which are protected from browsing and fire by the rough terrain, provide fruits for jams and jellies.

Other information

Of historical significance, large sandstone outcrops found on this site in Central Kansas were often used by Native Americans to carve pictures, called petroglyphs, in the soft sandstone. One can only guess as to their purpose and meaning, which have been lost with time. Many are recorded as historical sites. All should be protected and valued as a part of our heritage. The sandstone was gathered and used in prehistory by Native Americans in the Great Plains area as an abrasive to sharpen awls and smooth arrow shafts, and as manos and metates for grinding corn and other native plant foods such as amaranth, little barley, and marsh elder. In historic times, the legacy of the Sternberg family as fossil hunters started in 1866 when U.S. Army Dr. George M. Sternberg was stationed at Ft. Harker in Ellsworth County, site of present day Kanopolis, Kansas. The family, including his brother Charles, soon followed him from the east to settle on a ranch in Ellsworth County. Young Charles's interest in fossils was first sparked when he found ancient fossil leaves in sandstone concretions in the Ellsworth area. Thus began a much-storied career for Charles in paleontology and plains fossil hunting and later, for his son George as well, for whom the Sternberg Museum at Hays, Kansas is named.

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 contracted the development of MLRA 79 ESDs in 2005. Extensive review and improvements were made to those foundational ESDs in 2017-2018 which provided an approved product. Range Condition Guides and Technical Range Site Descriptions for Kansas, Shallow Sandstone, USDA, Soil Conservation Service, March, 1967. Range Site Description for Kansas, Shallow Sandstone, USDA-Soil Conservation Service, September, 1985. Ecological Site Description for Kansas, Shallow Sandstone (R074XY030KS) located in Ecological Site Information System (ESIS), 2007

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Contributors

Chris Tecklenburg

Approval

David Kraft, 10/04/2019

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 mid-2000s in regard 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.

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)	Chris Tecklenburg/Revision 10-10-2018 David Kraft, John Henry, Doug Spencer, and Dwayne Rice/original authors 1-15-2005.
Contact for lead author	State Rangeland Management Specialist for Kansas
Date	10/03/2019
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **No natural rill formation common or part of the Shallow Sandstone ecological site.**

2. **Presence of water flow patterns:** **There are no water flow patterns evidenced by litter, soil, or gravel redistribution, or pedestalling of vegetation or stones that break the flow of water as a result of overland flow.**

3. **Number and height of erosional pedestals or terracettes:** **There is no evidence of pedestals or terracettes that would indicate the movement of soil by water and/or by wind on this site.**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **Less than 10% bare ground is found on this site. It is the remaining ground cover after accounting for ground surface covered by vegetation (basal and canopy [foliar] cover), litter, standing dead vegetation, gravel/rock, and visible biological crust (e.g., lichen, mosses, algae).**

5. **Number of gullies and erosion associated with gullies:** **No evidence of accelerated water flow resulting in downcutting of the soil.**

6. **Extent of wind scoured, blowouts and/or depositional areas:** **No wind-scoured or blowout areas where the finer particles of the topsoil have blown away, sometimes leaving residual gravel, rock, or exposed roots on the soil surface. Also, there are no areas of redeposited soil onto this site from another site due to the wind, i.e., depositional areas.**

7. **Amount of litter movement (describe size and distance expected to travel):** No evidence of litter movement (i.e., dead plant material that is in contact with the soil surface).

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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):** Soil surfaces may be stabilized by soil organic matter which has been fully incorporated into aggregates at the soil surface, adhesion of decomposing organic matter to the soil surface, and biological crusts. A soil stability kit will score a 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):** Hedville OSD: A1--0 to 12 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) moist; moderate fine granular structure, upper 1 inch is very fine granular; slightly hard, very friable; many fine roots; many insect burrows and pores; 20 percent pebbles and angular cobbles of sandstone; slightly acid; gradual wavy boundary. A2--12 to 16 inches; brown (7.5YR 4/2) cobbly loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; many insect burrows; pebbles and angular cobblestones of weathered sandstone comprise 20 percent of soil mass; moderately acid; clear irregular boundary extending into cracks and pockets weathered into sandstone bedrock. (Combined thickness of the A horizon ranges from 4 to 19 inches.)

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Functional and structural groups have not changed that inhibits the capture and storage of precipitation.

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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 a compacted soil layer less than 6 inches from the soil surface. Soil structure is similar to that described in Indicator 9. Compacted physical features will include platy, blocky, dense soil structure over less dense soil layers, horizontal root growth, and increase bulk density (measured by weighing a known volume of oven-dry soil).

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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 Grasses Dominant 45% 1125 lbs. big bluestem 500-875, switchgrass 70-125, Indiangrass 125-250, composite dropseed 20-40, sand dropseed 5-15.

    Sub-dominant: Group 2 Grasses Subdominant 36% 900 lbs. little bluestem 500-800, sideoats grama 70-125, sand paspalum 5-15.

    Other: Group 3 Shortgrass Minor 4% 95 lbs. buffalograss 20-40, blue grama 20-40, hairy grama 5-15. Group 4 Cool-season grass Minor 3% 80 lbs. Canada wildrye 20-40, western wheatgrass 20-40, Scribner's rosette grass 20-40, sedge 20-40,

    Additional: Group 5 Forbs Minor 10% 250 lbs. Group 6 Shrubs Trace 2% 50 lbs.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Recruitment of plants is occurring and there is a mixture of many age classes of plants. The majority of the plants are alive and vigorous. Some mortality and decadence is expected for the site, 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):** Plant litter is distributed evenly throughout the site. There is no restriction to plant regeneration due to depth of litter. When prescribed burning is practiced, there will be little litter the first half of the growing season.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** All species (e.g., native, seeded, and weeds) alive in the year of the evaluation, are included in the determination of total above ground production. Site potential (total annual production) ranges from 1,500 lbs in a below-average rainfall year and 3,500 lbs in an above-average rainfall year. The representative value for this site is 2,500 lbs production per year.

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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:** There are no noxious weeds present. Invasive plants make up a small percentage of plant community, and invasive brush species are < 5% canopy.

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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.
