USDA Natural Resources Conservation Service

Ecological site R066XY033NE
Sands 18-22 P.Z.

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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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 43i - Keya Paha Tablelands.

Associated sites

R066XY032NE	**Sandy 18-22" P.Z.** Sandy 18-22" P.Z.
R066XY046NE	**Subirrigated** Subirrigated
R066XY056NE	**Choppy Sands** Choppy Sands
R066XY062NE	**Shallow To Gravel** Shallow to Gravel

Similar sites

R066XY056NE	**Choppy Sands** Choppy Sands (steeper slope; lower production; blowout grass present; shrubs more evident)

R066XY032NE	**Sandy 18-22" P.Z.** Sandy 18-22" P.Z. (slope not as steep; higher productions; prairie sandreed dominant)

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on dunes of uplands where eolian sands have been deposited.

Table 2. Representative physiographic features

Landforms	(1) Dune
Elevation	579–914 m
Slope	3–60%
Aspect	Aspect is not a significant factor

Climatic features

MLRA 66 is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA’s location near the geographic center of North America. There are few natural barriers on the northern Great Plains and the winds move freely across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 18 to 22 inches per year. The normal average annual temperature is about 47° F. January is the coldest month with average temperatures ranging from about 20° F (Valentine, NE) to about 23° F (Ainsworth, NE). July is the warmest month with temperatures averaging from about 73° F (Harrington, SD) to about 75° F (Ainsworth, NE). The range of normal average monthly temperatures between the coldest and warmest months is about 53° F. This large annual range attests to the continental nature of this area's climate. Hourly winds average about 10 miles per hour annually, ranging from about 11 miles per hour during the spring to about 9 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool season plants begins mid to late March and continues to late June. Native warm season plants begin growth in early May and continue to late August. Green up of cool season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	154 days
Freeze-free period (average)	172 days
Precipitation total (average)	559 mm

Influencing water features

No significant water features influence this site.

Soil features

The features common to all soils in this site are the sandy textured surface layer and control section, low available water capacity, and slopes of 3 to 60 percent. The soils in this site are excessively drained and formed in eolian

sands on dunes. The surface layer is 2 to 9 inches thick. The control section textures are fine sand, sand, or loamy fine sand. Runoff as evidenced by patterns of rill, gully or other water flow is negligible to low depending on the percent of slope. Water infiltration is high because of the sandy surface layer. Cryptobiotic crusts are present, but their function is not well understood. Some pedestalling of plants occurs, but it is not very evident on casual observation and occurs on less than 5% of the plants.

More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location.

Table 4. Representative soil features

Surface texture	(1) Fine sand (2) Loamy fine sand (3) Sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Historically, large areas of blowing sand resulted in the active movement of the sand dunes. Evaporation from the soil surface was extremely high due to the large areas of bare ground, lack of litter, and sparse plant populations. The transpiration rate of these sparse plant populations was also high due to the harsh soil environment. Occasional wild fires, severe grazing by transient bison herds, and drought contributed to the lack of stability of the sand dunes. This lack of stability caused the dunes to go back and forth through multiple stages of plant succession over the course of time. Early perennial plants such as sandhill muhly, blowout grass, and blowout penstemon were common due to their ability to tolerate the movement of the sand and droughty conditions. As these plants began to colonize and stabilize the sand movement, other perennials such as prairie sandreed, sand bluestem, hairy grama, lemon scurfpea, and rose slowly became evident on the site. Annual native plants such as sandbur, woolly Indianwheat, annual eriogonum, and annual sunflower eventually colonized the areas between the perennials.

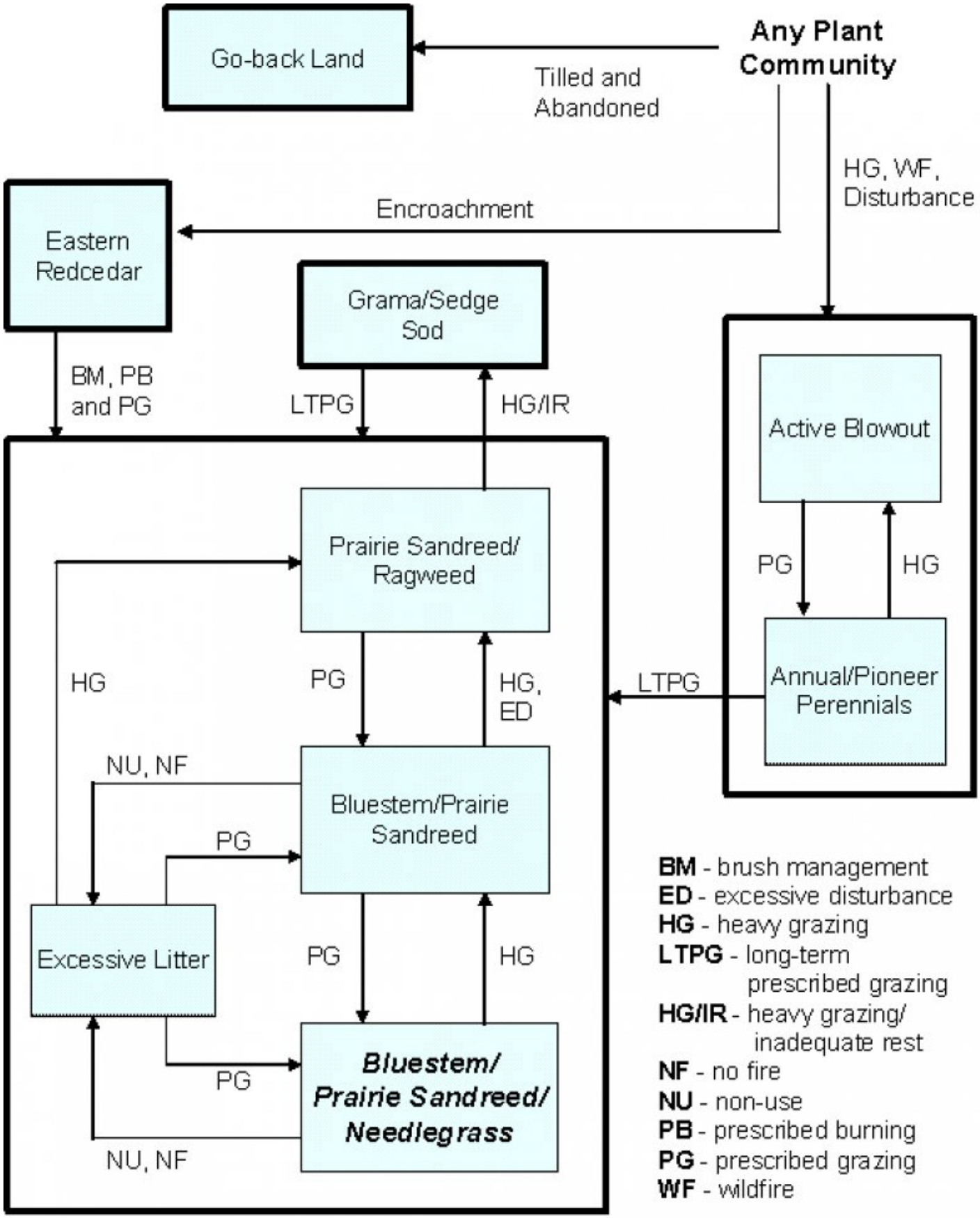
As this site deteriorates, prairie sandreed, sand dropseed, and blue grama will increase. Species such as sand bluestem and switchgrass will decrease in frequency and production. The site is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought resistance.

Interpretations are primarily based on the Bluestem/Prairie Sandreed/Needlegrass Plant Community. It has been

determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Subclimax plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model



State 1
Bluestem/Prairie Sandreed/Needlegrass

Community 1.1
Bluestem/Prairie Sandreed/Needlegrass

Interpretations are primarily based on the Bluestem/Prairie Sandreed/Needlegrass Plant Community. This site

evolved with grazing by large herbivores and is well suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional periods of rest. This plant community consists chiefly of tall and mid warm season grasses. Principle dominants are sand bluestem, prairie sandreed, and little bluestem. Grasses of secondary importance are needleandthread, switchgrass, sand dropseed, and hairy or blue grama. Sedges occur in the understory. Forbs and shrubs such as gayfeather, stiff sunflower, leadplant, rose, and sandcherry are significant. This plant community is about 80% grasses, 10% forbs, and 10% shrubs by weight. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. This is a healthy and sustainable plant community (site/soil stability, watershed function, and biologic integrity). Plant litter is properly distributed with some movement off-site and natural plant mortality is low. The diversity in plant species allows for high drought tolerance. Moderate or high available water capacity provides a favorable soil-water-plant relationship. The following growth curve shows the estimated monthly percentages of total annual growth of the dominant species expected during a normal year: Growth curve number: NE6637 Growth curve name: Eroded Tableland, warm-season dominant, cool-season sub-dominant. Growth curve description: Warm-season dominant, cool-season sub-dominant. Transitional pathways and/or community pathways leading to other plant communities are as follows: Heavy grazing and/or improper rest periods will convert this plant community to the Bluestem/Prairie Sandreed Plant Community. Continuous heavy grazing tends to accelerate this movement. Non-use and no fire will convert this plant community to the Excessive Litter Plant Community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1821	2217	2802
Shrub/Vine	73	168	280
Forb	123	194	280
Total	**2017**	**2579**	**3362**

Figure 5. Plant community growth curve (percent production by month). NE6637, Eroded Tableland, warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

State 2
Bluestem/Prairie Sandreed

State 3
Prairie Sandreed/Ragweed

State 4
Excessive Litter

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Sand Bluestem**			516–1031	
	sand bluestem	ANHA	*Andropogon hallii*	516–1031	–
2	**Prairie Sandreed**			387–902	
	prairie sandreed	CALO	*Calamovilfa longifolia*	387–902	–
3	**Little Bluestem**			387–644	

	little bluestem	SCSC	*Schizachyrium scoparium*	387–644	–
4	**Needlegrass**			129–387	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	129–387	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–129	–
5	**Grama**			129–258	
	blue grama	BOGR2	*Bouteloua gracilis*	129–258	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	129–258	–
6	**Other Warm-Season Grasses**			129–387	
	switchgrass	PAVI2	*Panicum virgatum*	129–258	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–129	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–129	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	26–129	–
	thin paspalum	PASE5	*Paspalum setaceum*	0–52	–
7	**Native Grass/Grass-Likes**			52–206	
	sedge	CAREX	*Carex*	26–129	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	26–129	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–52	–
	Grass, perennial	2GP	*Grass, perennial*	0–52	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–52	–
Forb					
9	**Forbs**			129–258	
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–52	–
	Forb, perennial	2FP	*Forb, perennial*	0–52	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–52	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–52	–
	blazing star	LIATR	*Liatris*	0–52	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–26	–
	spiny phlox	PHHO	*Phlox hoodii*	0–26	–
	scurfpea	PSORA2	*Psoralidium*	0–26	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–26	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–26	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–26	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–26	–
	spiderwort	TRADE	*Tradescantia*	0–26	–
Shrub/Vine					
10	**Shrubs**			26–129	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–77	–
	leadplant	AMCA6	*Amorpha canescens*	26–77	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	26–77	–
	rose	ROSA5	*Rosa*	26–77	–
	soapweed yucca	YUGL	*Yucca glauca*	0–26	–
	pricklypear	OPUNT	*Opuntia*	0–26	–

Animal community

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide year-long forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. Normal rainfall is 17-22 inches per year. Valentine soils on this site are in Hydrologic Soil Group A (low runoff and high infiltration even when thoroughly wetted). Water transmission through Group A soils is normally greater than 0.30 inches per hour. Runoff is expected to occur only during the most intense storms (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

For the interpretive plant community, rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses such as little bluestem. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present but only cover 1-2% of the soil surface. Overall this site has the appearance of being very stable and productive.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Other products

Seed harvest of native plant species can provide additional income on this site.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel was also used. Those involved in developing this site include: Wayne Bachman, Soil Scientist, NRCS; Stan Boltz, Range Management Specialist, NRCS; Anna Ferguson, Soil Conservationist, NRCS; Roger Hammer, Soil Scientist, NRCS; Dana Larsen, Range Management Specialist, NRCS; Dave Schmidt, Rangeland Management Specialist, NRCS; Kim Stine, Rangeland Management Specialist, NRCS.

Other references

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpccsun.unl.edu)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)

USDA, NRCS, 2002. National Soil Survey Handbook, title 430-VI. (http://soils.usda.gov/procedures/handbook/main.htm)

Contributors

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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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Date	08/01/2006
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None.

3. **Number and height of erosional pedestals or terracettes:** Bunchgrasses may be pedestalled, but no exposed roots should be present.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground typically less than 15 percent. Occasional small blowouts may occur immediately adjacent to areas receiving repeated disturbance, but areas should be few and typically not greater than a few feet in diameter.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Occasional areas associated with increased animal activity (e.g., rodent burrows, animal trailing) may exhibit small wind scoured areas, typically less than 5 feet in diameter.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Some series on this site typically have little organic matter in the surface horizon, and the structure is single grain sand. Soil aggregate stability will be difficult to measure on these soils. Surface organic matter should still adhere

to the soil surface. Surface erosion by water rarely occurs due to rapid infiltration, but surface is susceptible to wind erosion if vegetative cover is reduced due to drought or heavy grazing. Biological crusts are often present (up to 10% of the surface) and serve to provide resistance to erosion. The dominant rhizomatous warm-season species are adapted to these coarse soils and when vigorous are vital in preventing erosion by wind.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 10 inches thick. Some soils have little organic matter in the A-horizon and dark grayish brown colors when moist, but possibly not mollic. Structure can be single grain to fine granular parting to single grain in the A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration. Infiltration is typically high due to the coarse nature of these soils.

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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):** No compaction layer should be present.

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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: Tall, warm-season grasses >>

    Sub-dominant: Mid, warm-season grasses > needlegrasses (mid, cool-season bunch) >

    Other: Short, warm-season grasses = forbs = shrubs > grass-like species

    Additional: Other native grasses occur in other functional groups in minor amounts.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** 50-70 percent plant litter cover, roughly 0.25 to 0.5 inches in depth. Litter cover is in contact with the soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 1,800 to 3,000 pounds/acre, with the reference value being 2,300 pounds/acre (air-dry basis).

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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: Refer to State and local Noxious Weed List.

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
