USDA Natural Resources
Conservation Service

Ecological site R063AY014SD
Shallow To Gravel

Last updated: 6/26/2024
Accessed: 05/11/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

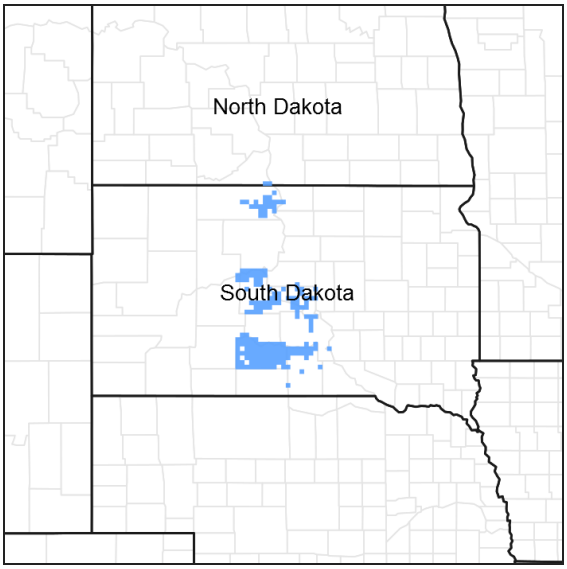

Figure 1. Mapped extent

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.

MLRA notes

Major Land Resource Area (MLRA): 063A–Northern Rolling Pierre Shale Plains

MLRA 63A is approximately 10,160 square miles in size, the majority of which is in South Dakota and a very small portion in North Dakota. The MLRA extends west of the northern half of the South Dakota reach of the Missouri River. All five of the major rivers draining western South Dakota cross this area. From north to south, these are the Grand, Moreau, Cheyenne, Bad, and White Rivers.

Elevation range from 1,300 to 1,640 feet on the bottom land along the Missouri River to 1,640 to 2,950 feet on the shale plain uplands. Cretaceous Pierre Shale underlies almost all of this area. This is a marine sediment having layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they get wet. Tertiary and Quaternary river deposits, remnants of erosion from the Black Hills uplift, cap isolated highlands in this area. Deposits of alluvial sand and gravel occur on the valley floors adjacent to the major streams in the area. The average annual precipitation in this area is 14 to 19 inches.
The vegetation in this area is a transition from eastern tall grass prairie to a western mixed grass prairie, (USDA-NRCS, Ag Handbook 296).

Classification relationships

Land Resource Region (LRR): G - Western Great Plains Range and Irrigated Region, Major Land Resource Area

(MLRA): 63A Northern Rolling Pierre Shale Plains, (USDA-NRCS, Ag Handbook 296).
Level IV Ecoregions of the Conterminous United States, 2013: 43c – River Breaks and 43f – Subhumid Pierre Shale Plains.

Ecological site concept

The Shallow to Gravel site occurs throughout the MLRA. It is located on ridges or broad outwash plains and high terraces. Slopes range from 2 to 25 percent. The soil is formed in 10 to 20 inches of loamy alluvium that is underlain by sand and gravel. The gravel deposits are remnants of old stream terraces that have been dissected and truncated. The site is considered a run-off site and does not receive additional moistures from run-in or overflow. Vegetation in the Reference State consists primarily of cool-season needlegrasses, short warm-season grasses, upland sedges, a wide variety of perennial forbs and several shrub species.

Associated sites

R063AY009SD	**Sandy**
R063AY010SD	**Loamy**
R063AY016SD	**Very Shallow**

Similar sites

R063AY016SD	**Very Shallow** Very Shallow [more needleandthread, but less blue grama, plains muhly, green needlegrass, and western wheatgrass]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata* (2) *Bouteloua gracilis*

Physiographic features

This site typically occurs on gently to steeply sloping uplands and high terraces.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Knoll (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,600–2,700 ft
Slope	2–25%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 63A is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and abundant sunshine. Extreme temperature fluctuations are also common. 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 air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 16 to 20 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 11°F (Pollock, South Dakota (SD)), to about 22°F (Cedar Butte, SD). July is the warmest month with temperatures averaging from about 72°F (Pollock, SD), to about 76° F (Cedar Butte, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 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 cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. 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)	130 days
Freeze-free period (average)	151 days
Precipitation total (average)	19 in

Climate stations used

- (1) CEDAR BUTTE 1NE [USC00391539], White River, SD
- (2) COTTONWOOD 2 E [USC00391972], Kadoka, SD
- (3) KENNEBEC [USC00394516], Kennebec, SD
- (4) POLLOCK [USC00396712], Pollock, SD

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

These soils are very deep and well drained. Soil textures include loam and gravelly loam soils over sand or sand and gravel between the depths of 15 to 25 inches. Permeability is moderately rapid to moderate in the upper part and very rapid in the lower part. Available water capacity is moderate in the upper part and low to very low in the lower part. Salinity and sodicity are minimal. This site occurs on flats, rises, and side slopes on outwash plains and terraces. Slope ranges from 2 to 25 percent. Runoff as evidenced by patterns of rill, gully, or other water flow is negligible to low, in spite of the slopes, due to the very high intake rate of these soils. Some pedestalling of plants occurs, but it is not very evident on casual observation and occurs on less than five percent of the plants.
These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship. Loss of the soil surface layer can result in a shift in species composition and/or production.

Murdo is correlated to the Shallow to Gravel Ecological Site.

Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid

Soil depth	80 in
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	3 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	15–90%
Subsurface fragment volume >3" (Depth not specified)	1–5%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions describe more typical transitions that will occur, severe disturbances, such as periods of well below average precipitation, can cause significant shifts in plant communities and/or species composition. Interpretations are primarily based on the Needleandthread-Blue Grama/Sedge Plant Community, which is considered to be the reference 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. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This site can be relatively productive but can deteriorate rapidly if not managed properly. The native grasses are typically under stress due to the low available water holding capacity. Further stress from overgrazing can result in a plant community dominated by short grasses and grass-likes, and the site also can have a high cover of club moss when the native grasses are of low vigor.

The following diagram illustrates the common plant communities and vegetation states commonly occurring on the site and the transition pathways between communities and states. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

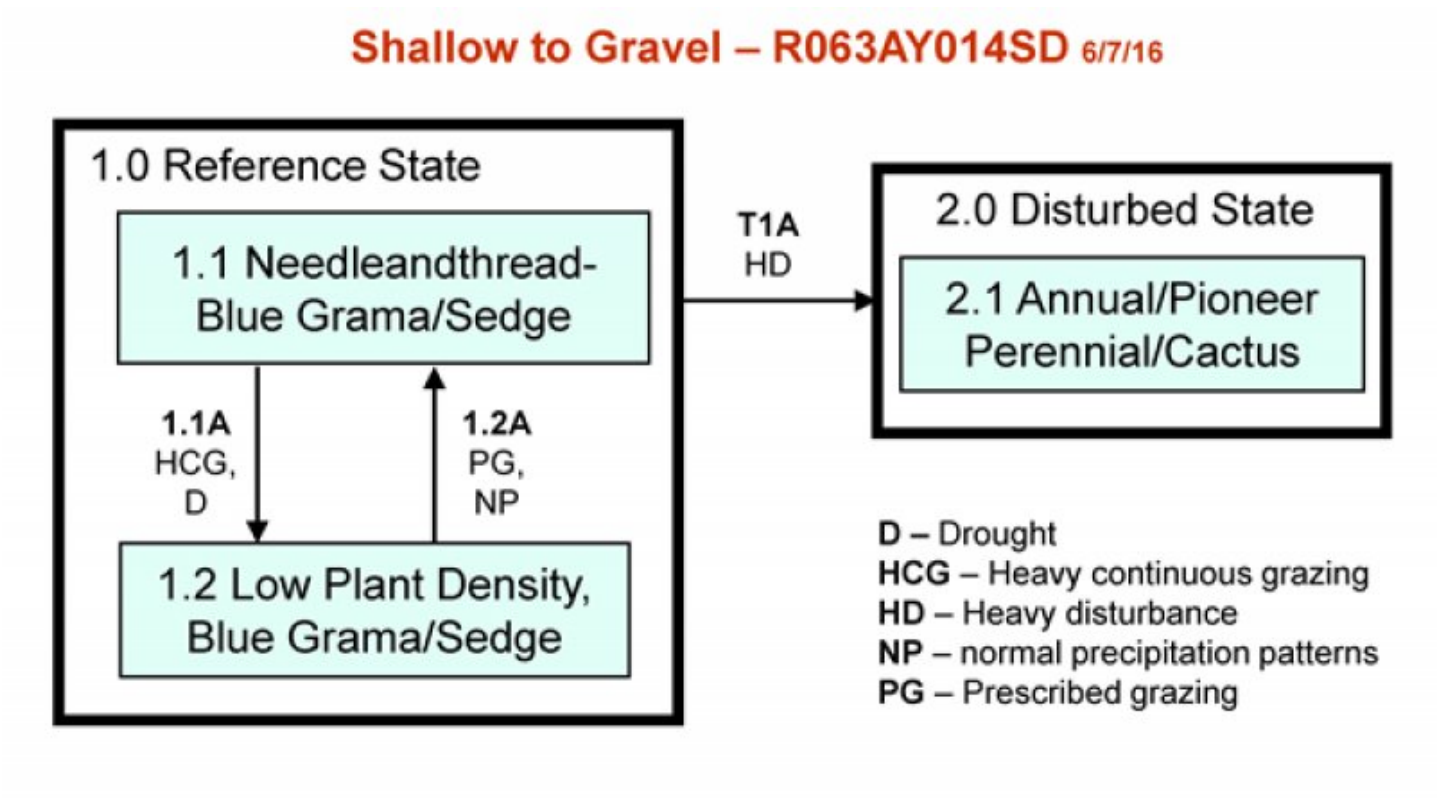

Figure 6. Shallow To Gravel - R063A014SD

Diagram Legend - Shallow to Gravel - R063AY014SD

T1A		Heavy disturbance such as gravel mining without reclamation.
CP 1.1A	1.1 - 1.2	Heavy continuous grazing without adequate rest and recovery and/or drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing including change in season of use, proper stocking and adequate time for rest and recovery, normal precipitation following drought.

Figure 7. Shallow to Gravel - R063A014SD

State 1
Reference State

This state represents what is believed to show the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. This site, in reference, is dominated by a mix of cool-season needlegrass and warm-season shortgrasses. Excessive grazing will cause the plant community to transition to a community dominated by the warm-season shortgrasses and upland sedges. Erosion of the surface horizon is also a likely outcome with heavy grazing. In pre-European times the primary disturbances included grazing by large ungulates and small mammals and drought. Favorable growing conditions occurred during the spring, and warm months of June through August. Today a similar state can be found in areas where proper livestock use has occurred.

Community 1.1
Needleandthread-Blue Grama/Sedge

This is the interpretive plant community and is considered to be the reference plant community. This community evolved with grazing by large herbivores and occasional prairie fire. It is well suited for grazing by domestic livestock and can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation is about 80 to 90 percent grasses or grass-like plants, 5 to 10 percent forbs, 5 to 10 percent shrubs. The

major grasses and grass-likes include needleandthread, blue grama, and little bluestem. Other grasses occurring on this plant community include hairy grama, sideoats grama, plains muhly, and sedges. Common forbs include cudweed sagewort, dotted gayfeather, green sagewort, hairy goldaster, Missouri goldenrod, purple coneflower, bush morning-glory, and scurfpea. Significant shrubs include fringed sagewort and leadplant. This plant community is well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a healthy and sustainable plant community (site/soil stability, watershed function, and biologic integrity).

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1050	1360	1640
Forb	75	120	180
Shrub/Vine	75	120	180
Total	**1200**	**1600**	**2000**

Figure 9. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Community 1.2
Low Plant Density, Blue Grama/Sedge Plant Community

This plant community develops after heavy continuous grazing or from extended periods of below average precipitation. Dominant grass and grass-like species include blue grama, hairy grama, threeawn, and sedge. Other grasses present include needleandthread, sideoats grama, and little bluestem. Eventually, species such as tumblegrass, sand dropseed, cheatgrass, and sweetclover will invade and may dominate this plant community. The common forbs include green sagewort, cudweed sagewort, western ragweed, scurfpea, and white prairie aster. Fringed sagewort and plains pricklypear are the principal shrubs. This plant community is resistant to change without prescribed grazing and/or the return of normal precipitation patterns. Soil erosion is low. Runoff is similar to the climax plant community.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	550	852	1130
Shrub/Vine	100	165	250
Forb	50	83	120
Total	**700**	**1100**	**1500**

Figure 11. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing and/or extended periods of drought will convert the plant community to the Low Plant Density, Blue Grama-Sedge Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with adequate precipitation and recovery time from grazing occurrences will move this plant community toward the Needleandthread-Blue Grama/Sedge Plant Community (1.1).

State 2
Disturbed State

This state is the result of gravel mining activates resulting in heavy disturbance and loss of topsoil and the existing seed bank. In most cases, this phase is dominated by annual and/or pioneer perennial species. Bare ground is typically greater than on any other plant community phase. This state can be restored through reclamation practices but it is unlikely to return to the reference state.

Community 2.1
Annual/Pioneer Perennial/Cactus State

This plant community is dominated by early successional species including: threeawn, sand dropseed, stinkgrass, witchgrass, tumblegrass, false buffalograss, annual brome grasses, perennial forbs (some of which are invasive), and many annual forbs. Prickly pear and fragile cactus can also become established on this site. The plants that establish are relatively sparse and produce very little forage. Bare ground is extensive and the he establishment of perennial grasses is unlikely because of the loss of top soil, and hydrological function. Soil temperature can be very high along with higher evaporation rates.

Transition 1A
State 1 to 2

Gravel mining activities or tillage will cause a transition to the Disturbed State. The loss of topsoil, hydrological function and biotic integrity will permanently alter this site unless reclamation practices and employed.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrasses**			240–480	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	240–480	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–80	–
2	**Short Warm-Season Grasses**			240–400	
	blue grama	BOGR2	*Bouteloua gracilis*	160–320	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	32–160	–
	threeawn	ARIST	*Aristida*	0–48	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–48	–
3	**Mid and Tall Warm-Season Grasses**			160–320	
	little bluestem	SCSC	*Schizachyrium scoparium*	80–240	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	32–160	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	16–128	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–64	–
4	**Wheatgrass**			32–160	
	western wheatgrass	PASM	*Pascopyrum smithii*	32–160	–

5	**Other Native Grasses**			16–80	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–48	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–48	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–16	–
6	**Grass-likes**			80–160	
	threadleaf sedge	CAFI	*Carex filifolia*	80–160	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–80	–
Forb					
8	**Forbs**			80–160	
	Forb, native	2FN	*Forb, native*	0–80	–
	field sagewort	ARCA12	*Artemisia campestris*	16–48	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–48	–
	false boneset	BREU	*Brickellia eupatorioides*	0–32	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–32	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	16–32	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	16–32	–
	dotted blazing star	LIPU	*Liatris punctata*	16–32	–
	scurfpea	PSORA2	*Psoralidium*	16–32	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	16–32	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	16–32	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–16	–
	hoary verbena	VEST	*Verbena stricta*	0–16	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–16	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–16	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–16	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–16	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–16	–
Shrub/Vine					
9	**Shrubs**			80–160	
	leadplant	AMCA6	*Amorpha canescens*	16–80	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–64	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–48	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	16–48	–
	rose	ROSA5	*Rosa*	16–48	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–16	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–16	–

Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrasses**			11–77	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	11–77	–

2	**Short Warm-Season Grasses**			275–495	
	blue grama	BOGR2	*Bouteloua gracilis*	220–440	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	55–275	–
	threeawn	ARIST	*Aristida*	11–110	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–55	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–25	–
3	**Mid and Tall Warm-Season Grasses**			11–88	
	sideoats grama	BOCU	*Bouteloua curtipendula*	11–55	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–55	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–20	–
4	**Wheatgrass**			0–55	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–55	–
5	**Other Native Grasses**			11–77	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–55	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–33	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–22	–
6	**Grass-likes**			110–275	
	threadleaf sedge	CAFI	*Carex filifolia*	110–275	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–110	–
7	**Non-Native Grasses**			11–88	
	bluegrass	POA	*Poa*	11–77	–
	cheatgrass	BRTE	*Bromus tectorum*	11–55	–
Forb					
8	**Forbs**			55–110	
	field sagewort	ARCA12	*Artemisia campestris*	11–55	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–55	–
	Forb, introduced	2FI	*Forb, introduced*	0–55	–
	Forb, native	2FN	*Forb, native*	0–55	–
	sweetclover	MELIL	*Melilotus*	0–55	–
	scurfpea	PSORA2	*Psoralidium*	11–33	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11–33	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	11–33	–
	hoary verbena	VEST	*Verbena stricta*	0–33	–
	common dandelion	TAOF	*Taraxacum officinale*	0–22	–
	yellow salsify	TRDU	*Tragopogon dubius*	11–22	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	11–22	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–11	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–11	–
	dotted blazing star	LIPU	*Liatris punctata*	0–11	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–11	–
Shrub/Vine					
9	**Shrubs**			110–220	

	plains pricklypear	OPPO	*Opuntia polyacantha*	22–110	–
	prairie sagewort	ARFR4	*Artemisia frigida*	22–110	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	11–44	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–44	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–33	–
	rose	ROSA5	*Rosa*	11–33	–
	leadplant	AMCA6	*Amorpha canescens*	0–22	–

Animal community

Animal Community – Grazing Interpretations
The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Grazing by domestic livestock is one of the major income producing industries in the area. Rangeland in this area may provide yearlong 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.

Needleandthread-Blue Grama-Sedge
Average Annual Production (lbs./acre, air-dry): 1600
Stocking Rate* (AUM/acre): 0.44

Low Plant Density, Blue Grama-Sedge
Average Annual Production (lbs./acre, air-dry): 1100
Stocking Rate* (AUM/acre): 0.30

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency (refer to USDA NRCS, National Range and Pasture Handbook).

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B. Infiltration varies from moderate to rapid and runoff potential varies from negligible to medium for this site depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where shortgrasses form a dense 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 (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

Timber harvest of eastern redcedar may occur on localized areas of this site.

Other products

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

Other information

Revision Notes: “Previously Approved Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first generation tier of documentation that prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirement as an Approved ESD as laid out in the 2003 National Range and Pasture Handbook (NRPH). The document fully describe the reference state and community phase in the state and transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current Approved level of documentation but it is expected that the “Previously Approved” ESD will continue refinement towards an Approved status.
Site Development and Testing Plan:
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used. Those involved in developing this site include: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Kent Cooley, Soil Scientist, NRCS; Rick Peterson, RMS, NRCS; and L. Michael Stirling, Range Management Specialist, NRCS. There are no SCS-RANGE-417 clipping records in the national database for this site.

Other references

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Contributors

Stan Boltz

Approval

Suzanne Mayne-Kinney, 6/26/2024

Acknowledgments

Peterson, Rick L., ESD update 6/8/16

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:** Typically none.

2. **Presence of water flow patterns:** None, or barely visible and discontinuous.

3. **Number and height of erosional pedestals or terracettes:** Typically none, and no exposed roots.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 15 percent is typical.

5. **Number of gullies and erosion associated with gullies:** None should be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

7. **Amount of litter movement (describe size and distance expected to travel):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 3 to 12 inches thick with dark brownish gray colors. Structure should typically be fine granular at least in the upper A-horizon.

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.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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: Mid/tall cool-season bunchgrasses > Short warm-season grasses >

    Sub-dominant: Mid/tall warm-season rhizomatous grasses and bunchgrasses >

    Other: Mid cool-season rhizomatous grasses = Grass-likes = Forbs = Shrubs > Short cool-season bunchgrasses

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,200-2,000 lbs./acre (air-dry weight). Reference value production is 1,600 lbs./acre (air-dry weight).

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:** State and local noxious weeds, Kentucky bluegrass, annual bromes

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.