Ecological site R063AY017SD
Shallow Clay

Accessed: 04/26/2024

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.

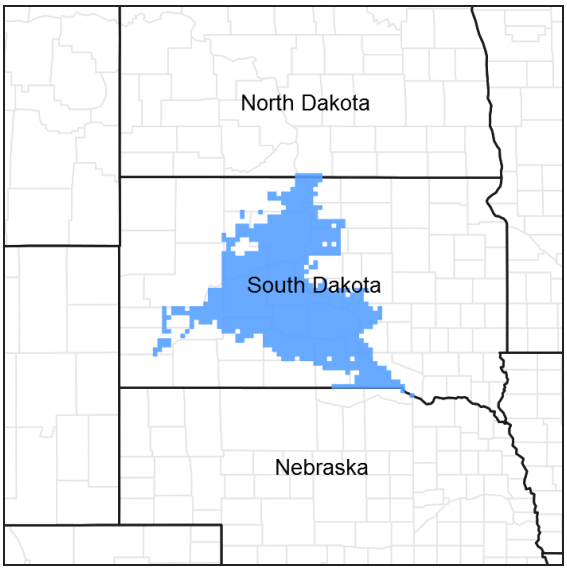

Figure 1. Mapped extent

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 15 to 20 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 Clay Ecological Site occurs throughout the MLRA. It is located on upland landscapes and does not receive additional moisture from run off or overflow. Typical slopes range from 6 to 60 percent. Soils are shallow, between 10 and 20 inches deep with clay, silty clay, or silty clay loam surface textures 3 to 8 inches thick. Soils are typically calcareous above the bedrock. Fine to very fine soft weathered shale fragment are common (up to 50 percent by volume), below 4 inches. The shale bedrock is often fractured in the upper part, and some fine roots can be found extending up to 30 inches below the surface. The vegetation in reference consists of a mix of cool- and warm-season grasses. Western wheatgrass and needlegrass are dominant, however warm-season grasses, including little bluestem, sideoats grama, big bluestem and prairie sandreed make up a significant portion of the composition. Forbs are common and diverse, shrubs are present but are in minor amounts. Yucca can be common on this site, especially on ridges.

Associated sites

R063AY010SD	**Loamy**
R063AY011SD	**Clayey**
R063AY012SD	**Thin Upland**
R063AY018SD	**Dense Clay**

Similar sites

R063AY024SD	**Shallow** Shallow [more green needlegrass; higher production]
R063AY011SD	**Clayey** Clayey [more sideoats; higher production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Schizachyrium scoparium*

Physiographic features

This site typically occurs on gently to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Hill (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,600–2,700 ft
Slope	6–60%
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) KENNEBEC [USC00394516], Kennebec, SD
- (2) POLLOCK [USC00396712], Pollock, SD
- (3) CEDAR BUTTE 1NE [USC00391539], White River, SD
- (4) COTTONWOOD 2 E [USC00391972], Kadoka, SD

Influencing water features

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

Soil features

The soils in this site are well drained and formed in residuum weathered from shale. The clay to silty clay loam surface layer is 3 to 8 inches thick and ranges from slightly to moderately alkaline. Fine to very fine, soft weathered shale fragments (up to 50 percent) are common below 4 inches. Fractured shale bedrock occurs between 10 and 20 inches but fine roots can be found extending up to 30 inches. The soils have a slow to very slow infiltration rate. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers.

Soils correlated the Shallow Clayey Ecological Site include: Conata, Midway, Okaton, Samsil, Sansarc, and Wayden

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 10 percent. Low available water capacity and very slow permeability strongly influences the soil-water-plant relationship.

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

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous shale
Surface texture	(1) Clay (2) Silty clay loam (3) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to moderate
Soil depth	10–20 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1–2 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–15
Soil reaction (1:1 water) (0-40in)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	5–15%
Subsurface fragment volume >3" (Depth not specified)	0%

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.

Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence, causes this site to depart from the Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community. Species such as blue grama will increase. Grasses such as green needlegrass, little bluestem, and western wheatgrass will decrease in frequency and production.

Interpretations are primarily based on the Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community. They have 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.

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

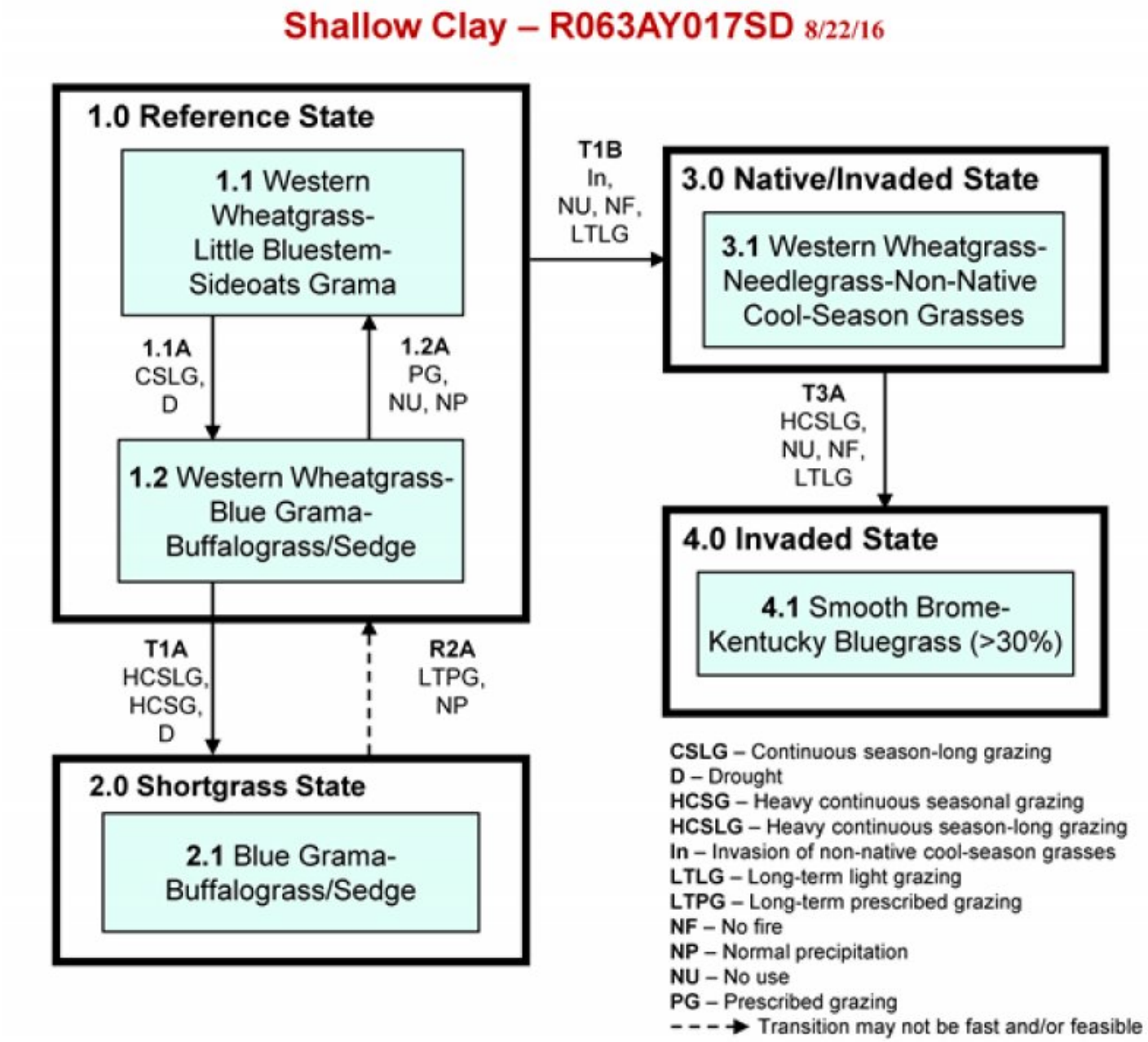

Figure 6. Shallow Clay - R063AY017SD

Diagram Legend - Shallow Clayey - R063AY017SD		
T1A	Heavy continuous season-long grazing or heavy continuous seasonal grazing, without adequate recovery, or heavy grazing in combination with drought.	
T1B	Invasion of non-native cool-season grasses, no use, no fire, or long-term light grazing.	
T3A	Heavy continuous season-long grazing, no use and no fire or long-term light grazing.	
R2A	Long-term prescribed grazing with change is season of use and time for adequate recovery, normal precipitation patterns.	
CP 1.1A	1.1 - 1.2	Continuous season-long grazing in combination with drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change is season of use and adequate time for recovery, normal precipitation following drought, possibly extended deferment or no use.

Figure 7. Shallow Clay - R063AY017SD

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. This site in Reference, is dominated by cool-season grasses and sub-dominant warm-season grass. Grazing, the lack of grazing, and drought are the major drivers between plant communities. Continuous season-long grazing can push this plant community to a point where short grasses become the dominant functional group.

Community 1.1
Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community

Interpretations are primarily based on the Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community (this is also considered to be reference plant community). Potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The major grasses include western wheatgrass, green needlegrass, little bluestem and sideoats grama. Other grasses and grass-likes occurring on this plant community include needleandthread, prairie sandreed, big bluestem, blue grama and sedge. Forbs commonly occurring include goldenrod, purple coneflower, cudweed sagewort, and scurfpea. Shrubs commonly occurring include yucca, fringed sagewort, rose and leadplant. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Runoff from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1075	1625	2070
Shrub/Vine	35	114	195
Forb	90	143	195
Tree	0	18	40
Total	**1200**	**1900**	**2500**

Figure 9. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 1.2
Western Wheatgrass-Blue Grama-Buffalograss/Sedge Plant Community

This plant community develops under continuous season-long grazing and/or drought. The potential vegetation is about 75 percent grasses and grass-likes, 15 percent forbs, and 10 percent shrubs. The major grasses and grass-likes include western wheatgrass, blue grama, buffalograss and sedge. Other grasses occurring on this plant community include little bluestem, threeawn, and needleandthread. Forbs commonly occurring on this site include goldenrod, cudweed sagewort, prairie coneflower, white prairie aster, and scurfpea. Shrubs commonly found include fringed sagewort, rose, yucca, and broom snakeweed. When compared to the Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community (1.1), blue grama and sedges have increased. Green needlegrass, little bluestem, and sideoats grama have decreased. Production of cool-season grasses has also been reduced. Non-native species such as cheatgrass, salsify, thistle, and sweetclover will likely invade this plant community. This plant community is stable and protected from excessive erosion. The dominant herbaceous species are very adapted to grazing; however, the mid-grass species and the more palatable forbs will decrease in the community through continuous season-long grazing. This plant community tends to be resilient if disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	815	1079	1435
Forb	60	130	200
Shrub/Vine	25	78	135
Tree	0	13	30
Total	**900**	**1300**	**1800**

Figure 11. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing and/or drought will convert the plant community to the Western Wheatgrass-Blue Grama-Buffalograss/Sedge Plant Community (1.2). Cool-season western wheatgrass and green needlegrass will decrease in frequency and production, while species such as blue grama, buffalograss, and sedges increase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing which included proper stocking, change in season of use and adequate time for recovery. A return to normal precipitation patterns and possibly extended periods of deferment or non-use will return this plant community back to the Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community (1.1).

State 2
Shortgrass State

The Shortgrass State is dominated by warm-season shortgrass species and upland sedges. This state is the result of grazing patterns that did not provide adequate recover time for the mid and tall statured warm- and cool-season grasses. The hydrologic function of this site is dramatically altered. Runoff is high and infiltration is low. This State

is very resistant to change through grazing management alone.

Community 2.1
Blue Grama-Buffalograss/Sedge Plant Community

This plant community develops under heavy continuous season-long grazing or heavy continuous seasonal grazing or drought. It is made up of approximately 65 to 80 percent grasses (primarily shortgrasses and grass-likes), 5 to 15 percent forbs, and 5 to 15 percent shrubs. The dominant grasses or grass-likes include blue grama, buffalograss, and sedge. Other grasses may include western wheatgrass, needlegrasses, little bluestem, sideoats grama, and threeawn. The dominant forbs include scurfpea, goldenrod, cudweed sagewort, and yarrow. The dominant shrubs are fringed sagewort, broom snakeweed, and yucca. Compared to the Western Wheatgrass-Little Blustem-Sideoats Grama Plant Community (1.1), shortgrasses have increased and the cool-season mid-grasses have diminished greatly. Some forbs and cactus have either increased and/or invaded the site. Plant diversity is low. This plant community is very stable. Generally, this plant community will require significant management inputs and time to move it away from this plant community. Onsite soil erosion is low. Infiltration is low and runoff is high. Typically, the runoff is very clean, but offsite areas can be significantly impacted due to the increased runoff.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	520	711	900
Shrub/Vine	40	90	140
Forb	40	90	140
Tree	0	9	20
Total	**600**	**900**	**1200**

Figure 13. Plant community growth curve (percent production by month). SD6304, Pierre Shale Plains, warm-season dominant, cool-season subdominant. Warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

State 3
Native/Invaded State

This State has been invaded by Kentucky bluegrass and/or smooth brome but not at the levels where the plant community is dominated by these species. This State is ‘At Risk’ of transitioning to the Invaded State (4.0) which is dominated by smooth brome and/or Kentucky bluegrass. Prescribed burning and/or chemical herbicides, and targeted grazing can be used to reduce the amount of smooth brome and Kentucky bluegrass in the plant community but it will not be completely removed. At this point a restoration pathway to the Reference State does not exist.

Community 3.1
Western Wheatgrass-Needlegrass-Non-Native Cool-Season Grasses Plant Community

This plant community develops when Kentucky bluegrass or smooth brome become established on the site. This may occur due to close proximity to seed sources or expansion from road ditches, improved pastures or other invaded sites. No use and no fire or very light stock stocking rates for long periods of time will allow these non-native cool-season grasses to increase in the plant community. Plant litter accumulates in large amounts when this community first develops. Litter buildup reduces mature native plant vigor and density, and seedling recruitment declines. Eventually litter levels become high enough that plant density decreases. Typically, rhizomatous grasses form small colonies because of a lack of tiller stimulation. The potential vegetation is made up of 80 to 85 percent grass or grass-like plants, 5 to 10 percent forbs, and 5 percent shrubs. The dominant grasses will be western wheatgrass, needlegrasses and non-native cool-season grasses, primarily, smooth brome and/or Kentucky bluegrass. Warm-season grasses will include patches of little bluestem and sideoats grama. Forbs will be diverse

but not dominate and some shrubs will persist. Forage production can be variable.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	870	1141	1410
Forb	65	140	215
Shrub/Vine	65	105	145
Tree	0	14	30
Total	**1000**	**1400**	**1800**

Figure 15. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

State 4
Invaded State

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant, introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant, introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014).

Community 4.1
Smooth Brome-Kentucky Bluegrass (>30%) Plant Community

This plant community is dominated by Kentucky bluegrass or smooth brome and/or other non-native cool season grasses (30 percent or more of the PC). This plant community evolved under no use and no fire or heavy continuous season-long grazing with no change in season of use or long-term light grazing. This plant community is made up of approximately 80 to 85 percent grasses and grass-like species, 5 to 10 percent forbs, and 5 percent shrubs. Dominant grasses include Kentucky bluegrass, and smooth brome. Western wheatgrass and some needlegrass may still be found in the plant community. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, scurfpea, and western ragweed. Production will be significantly reduced when compared to the interpretive plant community. The period when palatability is high is relatively short, as Kentucky bluegrass and smooth brome matures rapidly. Energy capture is also reduced. Runoff is high and biological activity in the soil is likely reduced significantly in this phase.

Transition 1A
State 1 to 2

Heavy continuous season-long grazing, heavy continuous seasonal grazing, and/or drought will shift this plant community to the Shortgrass State (2.0).

Transition 1B

State 1 to 3

Invasion of non-native, cool-season grasses, no use, no fire or long-term light grazing will convert this plant community to the Native/Invaded State (3.0).

Restoration pathway 2A
State 2 to 1

Long-term prescribed grazing that provides for proper stocking, change in season of use and adequate time for recovery, will move this plant community back to the Reference State (1.0), assuming an adequate seed/vegetative source is present. This could require significant time and input to achieve and a return to normal precipitation patterns, and in the end may not meet management objectives.

Transition 3A
State 3 to 4

Heavy continuous season-long grazing, or no use and no fire, or long-term light grazing will cause a transition from the Native/Invaded State (3.0) to the Invaded State (4.0). The ecological threshold can be identified by the percentage of non-native cool-season species in the Plant Community. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition (Toledo, D. et al., 2014). Smooth brome is assumed to follow a similar ecological threshold but is not documented scientifically.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			380–570	
	western wheatgrass	PASM	*Pascopyrum smithii*	380–665	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–190	–
2	**Needlegrass**			95–380	
	green needlegrass	NAVI4	*Nassella viridula*	95–380	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–190	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–95	–
3	**Tall/Mid Warm-Season**			285–475	
	little bluestem	SCSC	*Schizachyrium scoparium*	190–475	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	95–380	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	38–190	–
	big bluestem	ANGE	*Andropogon gerardii*	38–190	–
4	**Short Warm-Season**			38–190	
	buffalograss	BODA2	*Bouteloua dactyloides*	38–190	–
	blue grama	BOGR2	*Bouteloua gracilis*	38–190	–
	threeawn	ARIST	*Aristida*	0–57	–
5	**Other Native Grasses**			38–152	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–95	–
	dropseed	SPORO	*Sporobolus*	0–95	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–95	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–57	

	prairie sandreed	CALO	*Calamovilfa longifolia*	0–57	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
6	**Grass-likes**			19–95	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–95	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–95	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–95	–
Forb					
8	**Forbs**			95–190	
	goldenrod	SOLID	*Solidago*	0–57	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–57	–
	Forb, native	2FN	*Forb, native*	0–57	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–57	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–57	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–38	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–38	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–38	–
	desertparsley	LOMAT	*Lomatium*	0–38	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–38	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–38	–
	milkvetch	ASTRA	*Astragalus*	0–38	–
	false boneset	BREU	*Brickellia eupatorioides*	0–38	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–38	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–38	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–38	–
	American vetch	VIAM	*Vicia americana*	0–38	–
	scurfpea	PSORA2	*Psoralidium*	0–27	–
	dotted blazing star	LIPU	*Liatris punctata*	0–19	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–19	–
	textile onion	ALTE	*Allium textile*	0–19	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–19	–
Shrub/Vine					
9	**Shrubs**			38–190	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–57	–
	rose	ROSA5	*Rosa*	19–57	–
	soapweed yucca	YUGL	*Yucca glauca*	19–57	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–38	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–38	–
	leadplant	AMCA6	*Amorpha canescens*	19–38	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–19	–
Tree					
10	**Trees**			0–38	
	Tree	2TREE	*Tree*	0–38	–
	juniper	JUNIP	*Juniperus*	0–38	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			65–260	
	western wheatgrass	PASM	*Pascopyrum smithii*	65–260	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–65	–
2	**Needlegrass**			0–130	
	green needlegrass	NAVI4	*Nassella viridula*	0–130	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–65	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–65	–
3	**Tall/Mid Warm-Season**			65–130	
	little bluestem	SCSC	*Schizachyrium scoparium*	26–195	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	65–130	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–65	–
	big bluestem	ANGE	*Andropogon gerardii*	0–26	–
4	**Short Warm-Season**			130–455	
	blue grama	BOGR2	*Bouteloua gracilis*	130–390	–
	buffalograss	BODA2	*Bouteloua dactyloides*	65–130	–
	threeawn	ARIST	*Aristida*	0–104	–
5	**Other Native Grasses**			13–65	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–65	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–65	–
	dropseed	SPORO	*Sporobolus*	0–65	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–26	–
6	**Grass-Likes**			65–130	
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–140	–
	needleleaf sedge	CADU6	*Carex duriuscula*	26–130	–
	threadleaf sedge	CAFI	*Carex filifolia*	26–130	–
7	**Non-Native Grasses**			0–65	
	smooth brome	BRIN2	*Bromus inermis*	0–65	–
	cheatgrass	BRTE	*Bromus tectorum*	0–65	–
	bluegrass	POA	*Poa*	0–65	–
Forb					
8	**Forbs**			65–195	
	Forb, introduced	2FI	*Forb, introduced*	0–65	–
	Forb, native	2FN	*Forb, native*	0–65	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–65	–
	goldenrod	SOLID	*Solidago*	13–52	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–39	–
	scurfpea	PSORA2	*Psoralidium*	13–39	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–39	–
	desertparsley	LOMAT	*Lomatium*	0–39	–

	desertparsley	LOMAT	*Lomatium*	0–39	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–39	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	13–39	–
	American vetch	VIAM	*Vicia americana*	0–26	–
	dotted blazing star	LIPU	*Liatris punctata*	0–26	–
	milkvetch	ASTRA	*Astragalus*	0–26	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–26	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–26	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–13	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–13	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–13	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–13	–
	false boneset	BREU	*Brickellia eupatorioides*	0–13	–
	textile onion	ALTE	*Allium textile*	0–13	–
Shrub/Vine					
9	**Shrubs**			26–130	
	prairie sagewort	ARFR4	*Artemisia frigida*	13–65	–
	soapweed yucca	YUGL	*Yucca glauca*	13–65	–
	rose	ROSA5	*Rosa*	13–39	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	13–39	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–39	–
	leadplant	AMCA6	*Amorpha canescens*	0–13	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–13	–
Tree					
10	**Trees**			0–26	
	Tree	2TREE	*Tree*	0–26	–
	juniper	JUNIP	*Juniperus*	0–26	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			9–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	9–90	–
2	**Needlegrass**			0–45	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	green needlegrass	NAVI4	*Nassella viridula*	0–27	–
3	**Tall/Mid Warm-Season**			0–45	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–45	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–27	–
4	**Short Warm-Season**			225–450	
	blue grama	BOGR2	*Bouteloua gracilis*	180–360	–
	buffalograss	BODA2	*Bouteloua dactyloides*	45–135	–

	threeawn	ARIST	*Aristida*	9–90	–
5	**Other Native Grasses**			9–27	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–27	–
	dropseed	SPORO	*Sporobolus*	0–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–18	–
6	**Grass-Likes**			90–180	
	needleleaf sedge	CADU6	*Carex duriuscula*	45–135	–
	threadleaf sedge	CAFI	*Carex filifolia*	45–135	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–27	–
7	**Non-Native Grasses**			9–45	
	smooth brome	BRIN2	*Bromus inermis*	0–45	–
	cheatgrass	BRTE	*Bromus tectorum*	9–45	–
	bluegrass	POA	*Poa*	9–45	–
Forb					
8	**Forbs**			45–135	
	Forb, introduced	2FI	*Forb, introduced*	0–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–45	–
	goldenrod	SOLID	*Solidago*	9–45	–
	Forb, native	2FN	*Forb, native*	0–36	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	9–27	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–27	–
	scurfpea	PSORA2	*Psoralidium*	9–27	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–18	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	9–18	–
	milkvetch	ASTRA	*Astragalus*	0–18	–
	dotted blazing star	LIPU	*Liatris punctata*	0–18	–
	desertparsley	LOMAT	*Lomatium*	0–9	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–9	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–9	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–9	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–9	–
	textile onion	ALTE	*Allium textile*	0–9	–
Shrub/Vine					
9	**Shrubs**			45–135	
	prairie sagewort	ARFR4	*Artemisia frigida*	18–90	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	9–63	–
	soapweed yucca	YUGL	*Yucca glauca*	9–45	–
	rose	ROSA5	*Rosa*	9–27	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–18	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–9	–
Tree					

10	**Trees**			0–18	
	Tree	2TREE	*Tree*	0–18	–
	juniper	JUNIP	*Juniperus*	0–18	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			210–420	
	western wheatgrass	PASM	*Pascopyrum smithii*	210–420	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–70	–
2	**Needlegrass**			70–280	
	green needlegrass	NAVI4	*Nassella viridula*	70–210	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–140	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–70	–
3	**Tall/Mid Warm-Season**			5–10	
	sideoats grama	BOCU	*Bouteloua curtipendula*	28–140	–
	little bluestem	SCSC	*Schizachyrium scoparium*	28–112	–
	big bluestem	ANGE	*Andropogon gerardii*	0–42	–
4	**Short Warm-Season**			28–210	
	blue grama	BOGR2	*Bouteloua gracilis*	14–140	–
	threeawn	ARIST	*Aristida*	14–100	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–42	–
5	**Other Native Grasses**			14–70	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–70	–
	dropseed	SPORO	*Sporobolus*	0–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–42	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–14	–
6	**Grass-Likes**			2–8	
	needleleaf sedge	CADU6	*Carex duriuscula*	14–112	–
	threadleaf sedge	CAFI	*Carex filifolia*	14–112	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–70	–
7	**Non-Native Grasses**			70–210	
	smooth brome	BRIN2	*Bromus inermis*	28–210	–
	bluegrass	POA	*Poa*	28–210	–
	cheatgrass	BRTE	*Bromus tectorum*	14–70	–
Forb					
8	**Forbs**			70–210	
	Forb, introduced	2FI	*Forb, introduced*	0–112	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	14–112	–
	Forb, native	2FN	*Forb, native*	0–70	–
	goldenrod	SOLID	*Solidago*	14–70	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	14–56	–

	scurfpea	PSORA2	*Psoralidium*	14–56	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	14–42	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–28	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–28	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–28	–
	dotted blazing star	LIPU	*Liatris punctata*	0–28	–
	desertparsley	LOMAT	*Lomatium*	0–28	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–28	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–14	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–14	–
	milkvetch	ASTRA	*Astragalus*	0–14	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–14	–
	American vetch	VIAM	*Vicia americana*	0–14	–
	textile onion	ALTE	*Allium textile*	0–14	–
Shrub/Vine					
9	**Shrubs**			70–140	
	prairie sagewort	ARFR4	*Artemisia frigida*	14–98	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–42	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–42	–
	rose	ROSA5	*Rosa*	14–42	–
	soapweed yucca	YUGL	*Yucca glauca*	14–42	–
	leadplant	AMCA6	*Amorpha canescens*	0–28	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–28	–
Tree					
10	**Trees**			0–28	
	Tree	2TREE	*Tree*	0–28	–
	juniper	JUNIP	*Juniperus*	0–28	–

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.

Western Wheatgrass-Little Bluestem-Sideoats Grama Plant Community (1.1)

Average Annual Production (lbs./acre, air-dry): 1900
Stocking Rate* (AUM/acre): 0.52

Western Wheatgrass-Blue Grama-Buffalograss/Sedge Plant Community (1.2)
Average Annual Production (lbs./acre, air-dry): 1300
Stocking Rate* (AUM/acre): 0.36

Blue Grama-Buffalograss/Sedge Plant Community (2.1)
Average Annual Production (lbs./acre, air-dry): 900
Stocking Rate* (AUM/acre): 0.25

Western Wheatgrass-Needlegrasses-Non-Native Cool-Season Grasses Plant Community (3.1)
Average Annual Production (lbs./acre, air-dry): 1400
Stocking Rate* (AUM/acre): 0.38

Other Plant Community Phases have highly variable forage production levels. Actual on-site forage inventories will need to be conducted to determine average annual production and stocking rates.

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

Total annual production on site may contain vegetation which is deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration and runoff potential for this site varies from very slow to moderate 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 example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, and/or smooth bromegrass will result in reduced infiltration and increased runoff. 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, RMS, NRCS.

There are 5 SCS-Range-417's collected from 1969-1986 in Dewey, Haakon, Lyman, and Mellette County, SD.

Other references

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Acknowledgments

Rick L. Peterson, Update of ESD - 8/24/16

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.

Author(s)/participant(s)	Stan Boltz
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Date	05/09/2010
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Slight to none, typically on steeper slopes and discontinuous.

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous with numerous debris dams when present.

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3. **Number and height of erosional pedestals or terracettes:** Few pedastalled plants typically on steeper slopes.

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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.

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

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

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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.

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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 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.

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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 8 inches thick with light to dark brownish gray colors. Structure should typically be fine granular at least in the upper 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.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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: Rhizomatous wheatgrass >

    Sub-dominant: Mid/tall cool-season bunchgrasses = Mid/tall warm-season grasses >

    Other: Short warm-season grasses = Forbs = Shrubs > Grass-likes > Trees > 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 1,200-2,500 lbs./acre (air-dry weight). Reference value production is 1,900 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

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.