USDA Natural Resources Conservation Service

Ecological site R060AY021SD
Clayey Overflow

Accessed: 05/16/2024

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.

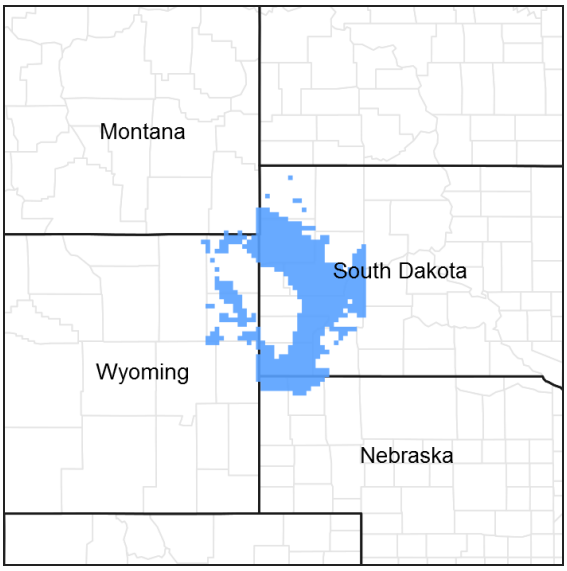

Figure 1. Mapped extent

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): 060A–Pierre Shale Plains

MLRA Notes:
The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is located in South Dakota (70 percent) and small portions are in Montana (2 percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

MLRA 60A is in the unglaciated section of the Missouri Plateau, of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been deeply eroded. Cretaceous Pierre Shale underlies almost all of this MLRA. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clay. These clays shrink as they dry and swell as they receive moisture. Soils are shallow to very deep and generally are well drained and clayey.
Elevations generally range from 2,620 to 3,610 feet throughout the MLRA, but can range up to 4,260 feet. The average annual precipitation for the western side of the MLRA is 13 to 16 inches, whereas the eastern side receives 16 to 18 inches. A suite of ecological sites have been written specifically for these two precipitation zones. The Locator Map shows the break between the two precipitation zones.

This area supports a mixed natural prairie vegetation consisting of both cool- and warm-season grasses and forbs. Wyoming big sagebrush occurs primarily in the drier western portion of the MLRA; however, small remnant stands can be found in the eastern portion. Dominant land uses of the area primarily are ranching and, to a lesser extent, farming. Major resource concerns to this MLRA are wind erosion and surface water quality.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 63B – Southern Rolling Pierre Shale Plains.

EPA - Level IV Ecoregions of the Continental United States: 43e – Sagebrush Steppe, 43g Semiarid Pierre Shale Plains, and 43k – Dense Clay Prairie.

Ecological site concept

The Clayey Overflow Ecological Site occurs throughout the MLRA. It is typically located on Stream Orders 2 and 3 however it can be found on lower stream reaches. This site is a run-in site and receives additional moisture through runoff from adjacent uplands and overflow during occasional flooding. Typical slope range is from 0 to 3 percent. The soil surface layer is 3 to 11 inches in depth with a texture range of silty clay loam to clay. When degraded, this site is susceptible to down cutting. The natural vegetation will gradually shift from almost exclusively herbaceous species in the upper reaches of a drainage to a mix of species including grasses, forbs, shrubs, and trees, in the lower reaches. Vegetation in Reference consists of a mix of cool- and warm-season tall- and mid-grasses. Western wheatgrass and green needlegrass are dominant, and prairie cordgrass, switchgrass, and big bluestem are sub-dominant. Forbs are common and very diverse. Patches of western snowberry, American plum, chokecherry, and willow are commonly present. In the western portion of the MLRA, Wyoming big sagebrush will likely be present. When trees are present, they will include plains cottonwood, willow, green ash, boxelder, and hackberry. When disturbed, this site is very susceptible to invasion of non-native cool-season grasses, Canada thistle, hound’s tongue, and other weedy forbs. It is also susceptible to invasion of Russian olive and saltcedar.

Associated sites

R060AY007SD	**Saline Lowland** The Saline Lowland can occur adjacent to the overflow site, either upstream or on a low terrace between the overflow and the Loamy Terrace.
R060AY011SD	**Clayey 13-16" P.Z.** The Clayey 13-16 PZ site will be located an upland landscape position above the overflow site.
R060AY015SD	**Thin Claypan** The Thin Claypan can occur adjacent to the overflow site, either upstream or on a low terrace above the overflow site.
R060AY018SD	**Dense Clay** The Dense Clay site will be located an upland landscape position above the overflow site.
R060AY022SD	**Loamy Terrace** The Loamy Terrace site will be located on the stream or river terrace above the overflow site.
R060AY040SD	**Clayey 16-18" P.Z.** The Clayey 16-18 PZ site will be located an upland landscape position above the overflow site.

Similar sites

R060AY020SD	**Loamy Overflow** The Loamy Overflow will have more bluestems, less western wheatgrass and more potential for tree and shrub establishment.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site is nearly level to gently sloping and occurs on uplands and river valleys.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain (3) Stream terrace
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	762–1,311 m
Slope	0–3%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains, where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation for the entire MLRA ranges from 13 to 18 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air masses from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but the more severe occur during late fall, late winter, and spring. The normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, WY) to about 22°F (Belle Fourche, SD). July is the warmest month with temperatures averaging from about 70°F (Moorcroft CAA, WY) to about 72°F (Belle Fourche, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 51°F. 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 generally are 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 can 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)	115 days
Freeze-free period (average)	133 days
Precipitation total (average)	432 mm

Climate stations used

- (1) UPTON [USC00489205], Upton, WY
- (2) REDBIRD [USC00487555], Lance Creek, WY
- (3) ARDMORE 1 NW [USC00390236], Edgemont, SD
- (4) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (5) WASTA [USC00398911], Owanka, SD

- (6) MOORCROFT 3S [USW00024088], Moorcroft, WY

Influencing water features

Stream Type: B6, C6 (Rosgen System)

Soil features

The soils in this site are moderately well to well drained and formed in alluvium. The silty clay loam to clay surface layer is 3 to 11 inches thick. The soils have a very slow to moderately slow infiltration rate. This site should show 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. The soil surface is stable and intact.
These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production.

Major soils correlated to the Clayey Overflow site include: Harlaker, Lodgepole, Lohmiller, and Setter.

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) Sandy clay loam (2) Clay (3) Sandy clay
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.7–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, 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 specify more typical transitions between communities that will occur, severe disturbances, such as periods of well-below average precipitation, can

cause significant shifts in plant communities and/or species composition.

As this site deteriorates, introduced species such as Kentucky bluegrass annual brome and Canada thistle will invade the site. Grasses such as slender wheatgrass, green needlegrass, prairie cordgrass, rhizomatous wheatgrasses, big bluestem, and switchgrass will decrease in frequency and production. Russian olive and/or saltcedar can become established on this site regardless of disturbance.

Clayey Overflow sites that are in association with Dense Clay and Thin Claypan sites with slick spots tend to create inclusions of a transitional plant community. The higher salt levels in the soils create a plant community that combines characteristics of both the Saline Lowland and Clayey Overflow sites. Due to the amount and pattern of the precipitation, the big sagebrush component typically is not resilient once it has been removed if a vigorous stand of grass exists and is maintained. Big sagebrush occurs mainly in the western portions of this MLRA, while silver sagebrush is found throughout the MLRA.

The plant community upon which interpretations are primarily based is the Reference Plant Community (1.1). The Reference Plant Community has been determined by studying 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 is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

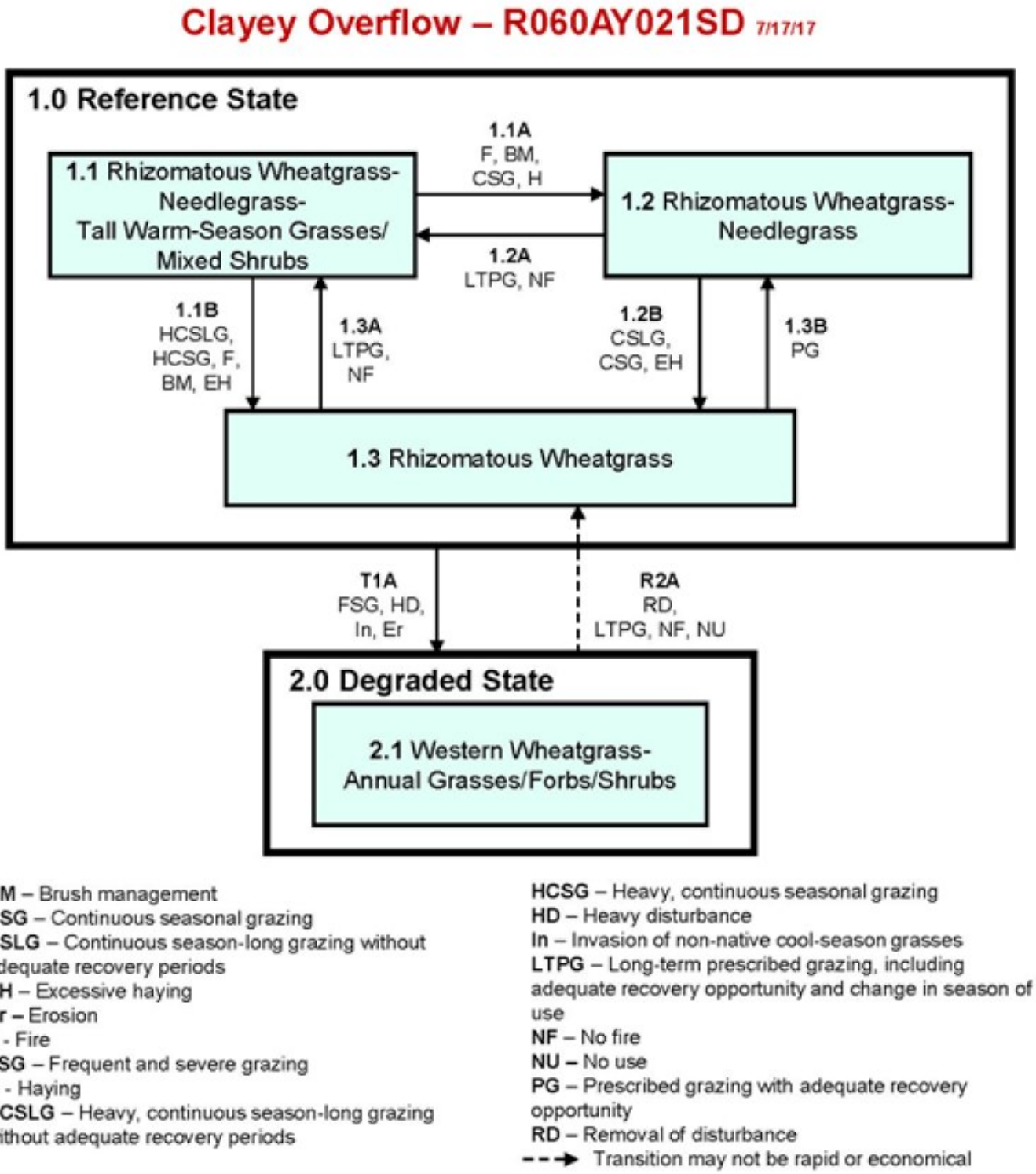

Figure 6. Clayey Overflow - R060AY021SD.

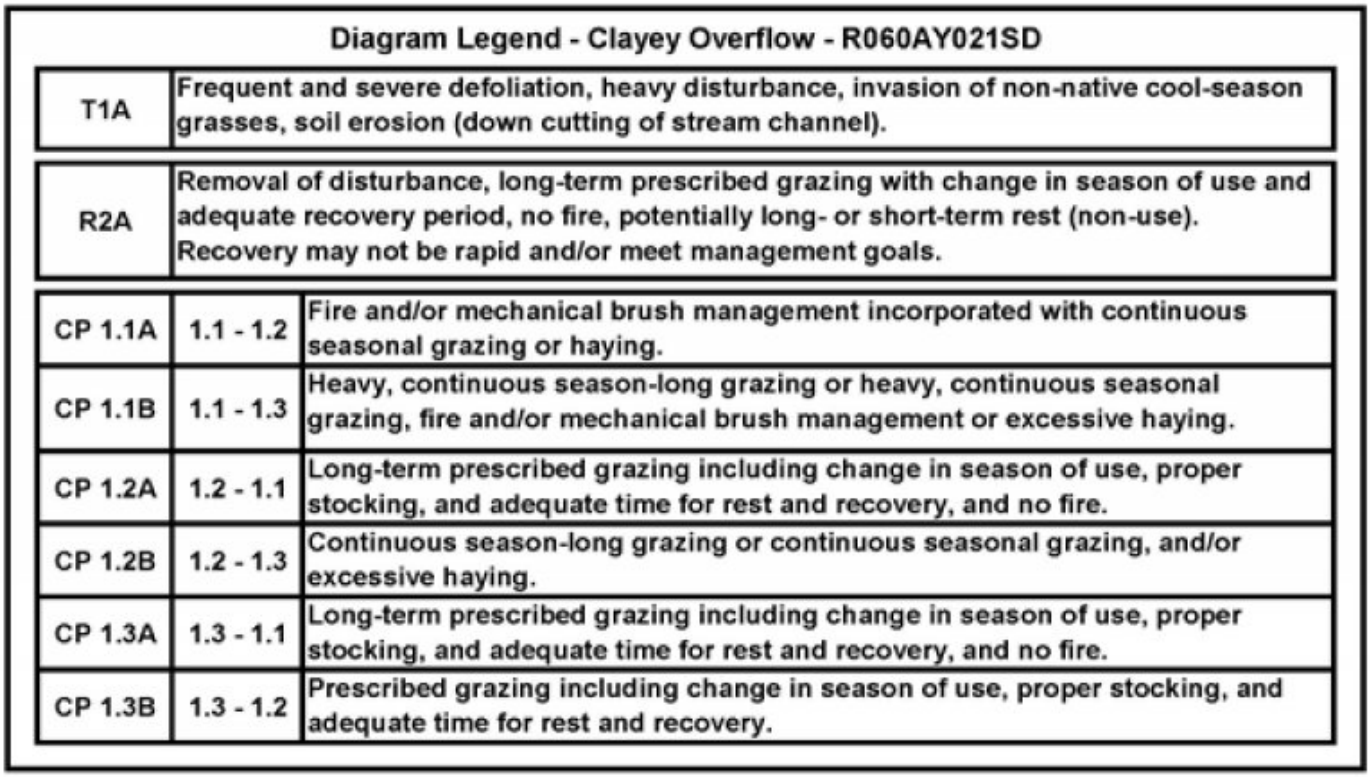

Figure 7. Clayey Overflow - R060AY021SD.

State 1
Reference State

This State represents what is believed to exist prior to European settlement In Reference, this site is dominated by cool- and warm-season season grasses, and various shrub species. Grazing or the lack of grazing, fire, excessive haying, erosion, and invasion of non-native cool-season grasses are major drivers in this State.

Community 1.1
Rhizomatous Wheatgrass-Needlegrass-Tall Warm-Season Grasses/Mixed Shrubs

The plant community upon which interpretations are primarily based is the Rhizomatous Wheatgrass- Needlegrass-Tall Warm-Season Grasses/Mixed Shrubs Plant Community (1.1). This is also considered the Reference Plant Community. Potential vegetation is about 65 to 85 percent grasses or grass-like plants, 5 to 10 percent forbs, 5 to 15 percent shrubs, and 0 to 3 percent trees. A mix of cool- and warm-season grasses dominates the plant community. The major grasses and grass-likes include rhizomatous wheatgrasses, prairie cordgrass, green needlegrass, big bluestem, switchgrass, sedges, and rushes. Other grasses in the plant community include mat muhly, Sandberg bluegrass, Canada wildrye, needleleaf sedge, blue grama, and prairie Junegrass. Shrubs include silver sagebrush, leadplant, chokecherry, big sagebrush, rose, and snowberry. Forbs such as aster, American vetch, prairie coneflower, prairie clover, American licorice, cudweed sagewort, and goldenrod are common. Trees occurring on the site include scattered green ash, cottonwood, boxelder, and elm. 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 off-site and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Run-off 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1009	1905	2544
Forb	112	235	392
Shrub/Vine	112	177	241
Tree	–	36	73
Total	**1233**	**2353**	**3250**

Figure 9. Plant community growth curve (percent production by month). SD6008, Pierre Shale Plains, lowland cool season/warm season co-dominant. Cool season, warm season co-dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	11	19	23	20	12	6	5	0	0

Community 1.2
Rhizomatous Wheatgrass-Needlegrass

This plant community is the result of fire or brush management followed by continuous seasonal grazing or haying. Western wheatgrass and green needlegrass dominate; however, many of the species found in the Reference Plant Community (1.1) continue to persist. These grasses form a sod which is very productive and is often used for dryland hay. This plant community is productive but lacks the diversity of the Reference Plant Community. The soil of this plant community is protected. The watershed is functioning but may produce slightly increased runoff.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1973	2394	2768
Shrub/Vine	22	155	308
Forb	135	211	308
Tree	–	43	90
Total	**2130**	**2803**	**3474**

Figure 11. Plant community growth curve (percent production by month). SD6008, Pierre Shale Plains, lowland cool season/warm season co-dominant. Cool season, warm season co-dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	11	19	23	20	12	6	5	0	0

Community 1.3
Rhizomatous Wheatgrass

This plant community results from heavy continuous season-long or seasonal grazing without adequate recovery periods between each grazing event during the growing season. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Western wheatgrass is the dominant species. Big bluestem, green needlegrass, switchgrass, and prairie cordgrass are greatly reduced. Forb species include western yarrow, asters, prairie coneflower, and western ragweed. Shrubs will be greatly reduced. This plant community is relatively stable and less productive than the Reference Plant Community (1.1). Reduction of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and increased runoff. This plant community can occur throughout the site, on spot-grazed areas, and around water sources where season-long grazing patterns occur. Soil erosion may increase as runoff increases.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	919	1480	2034
Forb	78	126	174
Shrub/Vine	11	50	90
Tree	–	26	56
Total	**1008**	**1682**	**2354**

Figure 13. Plant community growth curve (percent production by month). SD6007, Pierre Shale Plains, cool season dominant, warm season subdominant. Cool season dominant, warm season subdominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	13	20	25	18	11	5	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous seasonal grazing, haying, and/or brush management or fire will convert this plant community to the Rhizomatous Wheatgrass-Needlegrass Plant Community (1.2).

Pathway 1.1B
Community 1.1 to 1.3

Heavy, continuous season-long grazing, heavy continuous seasonal grazing, or excessive haying in combination with brush management or fire will convert this plant community to the Rhizomatous Wheatgrass Plant Community (1.3)

Pathway 1.2A
Community 1.2 to 1.1

Long-term prescribed grazing that incorporates proper stocking rates, change in season of use, and adequate time for recovery following grazing, and protecting shrubs from fire will aid in returning this plant community phase to the Reference Plant Community (1.1).

Pathway 1.2B
Community 1.2 to 1.3

Heavy, continuous season-long grazing, or continuous seasonal grazing, or excessive haying will push this plant community to the Rhizomatous Wheatgrass Plan Community (1.3).

Pathway 1.3A
Community 1.3 to 1.1

Long-term prescribed grazing including change in season of use, proper stocking, and adequate time for rest and recovery, and no fire over time will shift this plant community back to the Reference Plant Community (1.1).

Pathway 1.3B
Community 1.3 to 1.2

Prescribed grazing that incorporates proper stocking rates, change in season of use, and adequate time for recovery following grazing will shift this plant community back to the Rhizomatous Wheatgrass- Needlegrass Plant Community (1.2).

State 2

Degraded State

Heavy, long-term animal or machinery impacts have altered soil site stability, hydrologic function, and the biotic integrity of the site. Erosion can down-cut the channel to the point that the site no longer receives additional moisture from overflow. This State is resistant to change and a restoration pathway may not be feasible.

Community 2.1
Western Wheatgrass-Annual Grasses/Forbs/Shrubs

This plant community developed with heavy continuous season-long grazing. Western wheatgrass and Kentucky bluegrass dominate the community. Green needlegrass has been greatly reduced. Big bluestem has been removed. Western yarrow, scurfpea, ragweed, and goldenrod have increased. Non- native grasses and forbs such as annual bromes, curlycup gumweed, thistle, and cocklebur will invade this plant community. This plant community is resistant to change to a higher successional plant community due to low plant diversity and competition of the invaded species. A significant amount of production and diversity has been lost when compared to the Reference Plant Community (1.1). The loss of desirable species has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly. Soil loss may be accelerated where concentrated flows occur. It will take a very long time to restore this plant community back to the Reference State with improved management alone. Renovation would be very costly.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	420	776	1244
Forb	95	151	207
Shrub/Vine	45	76	106
Tree	–	6	11
Total	**560**	**1009**	**1568**

Figure 15. Plant community growth curve (percent production by month). SD6006, Pierre Shale Plains, lowland cool season dominant. Cool season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Transition T1A
State 1 to 2

Frequent and severe defoliation, heavy disturbance such as livestock feed, excessive haying, invasion of non-native cool-season grasses, and erosion will transition the Reference State (1.0) to the Degraded State (2.0).

Restoration pathway R2A
State 2 to 1

Removal of disturbance that caused transition, in combination with long-term prescribed grazing, no fire, and potentially periods of non-use to allow for recovery. This transition may not be rapid or economical and may not meet management goals.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Western Wheatgrass**			824–1295	

	western wheatgrass	PASM	*Pascopyrum smithii*	824–1295	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	47–188	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	24–165	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	24–118	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–47	–
2	**Tall Warm-Season Grasses**			24–118	
	big bluestem	ANGE	*Andropogon gerardii*	0–235	–
	prairie cordgrass	SPPE	*Spartina pectinata*	22–112	–
	switchgrass	PAVI2	*Panicum virgatum*	24–71	–
3	**Needlegrass**			47–118	
	green needlegrass	NAVI4	*Nassella viridula*	47–118	–
4	**Native Grasses and Grass-likes**			118–235	
	buffalograss	BODA2	*Bouteloua dactyloides*	24–118	–
	blue grama	BOGR2	*Bouteloua gracilis*	24–118	–
	squirreltail	ELEL5	*Elymus elymoides*	0–118	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–118	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	24–118	–
	spikerush	ELEOC	*Eleocharis*	0–71	–
	rush	JUNCU	*Juncus*	0–71	–
	sedge	CAREX	*Carex*	24–71	–
	saltgrass	DISP	*Distichlis spicata*	24–71	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–71	–
	Grass, perennial	2GP	*Grass, perennial*	0–71	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–47	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–47	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–47	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–47	–
Forb					
6	**Forbs**			118–353	
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–118	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	0–118	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–118	–
	American vetch	VIAM	*Vicia americana*	0–71	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–71	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–71	–
	mint	MENTH	*Mentha*	24–71	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–71	–
	scurfpea	PSORA2	*Psoralidium*	24–71	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–71	–
	goldenrod	SOLID	*Solidago*	0–71	–
	false boneset	BREU	*Brickellia eupatorioides*	0–71	

	false boneset	BRLE	*Brickellia eupatorioides*	0–71	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–71	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–71	–
	Forb, annual	2FA	*Forb, annual*	24–71	–
	Forb, perennial	2FP	*Forb, perennial*	24–71	–
	common yarrow	ACMI2	*Achillea millefolium*	0–71	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–47	–
	thistle	CIRSI	*Cirsium*	24–47	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–24	–
	cocklebur	XANTH2	*Xanthium*	0–24	–
Shrub/Vine					
7	**Shrubs**			118–235	
	silver sagebrush	ARCA13	*Artemisia cana*	47–353	–
	big sagebrush	ARTR2	*Artemisia tridentata*	47–353	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	47–353	–
	chokecherry	PRVI	*Prunus virginiana*	24–118	–
	rose	ROSA5	*Rosa*	24–118	–
	willow	SALIX	*Salix*	24–118	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–71	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–71	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–71	–
	leadplant	AMCA6	*Amorpha canescens*	0–71	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–56	–
Tree					
8	**Trees**			0–71	
	green ash	FRPE	*Fraxinus pennsylvanica*	0–71	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–71	–
	American elm	ULAM	*Ulmus americana*	0–71	–
	boxelder	ACNE2	*Acer negundo*	0–47	–
	common hackberry	CEOC	*Celtis occidentalis*	0–47	–
	hawthorn	CRATA	*Crataegus*	0–24	–
	Tree	2TREE	*Tree*	0–24	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			841–1121	
	western wheatgrass	PASM	*Pascopyrum smithii*	841–1121	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	280–560	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	280–560	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	140–420	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–140	–
2	**Tall Warm-Season Grasses**			280–841	

2	**Tall Warm Season Grasses**			280–841	
	big bluestem	ANGE	*Andropogon gerardii*	280–560	–
	switchgrass	PAVI2	*Panicum virgatum*	140–420	–
	prairie cordgrass	SPPE	*Spartina pectinata*	84–280	–
3	**Needlegrass**			420–841	
	green needlegrass	NAVI4	*Nassella viridula*	420–841	–
4	**Native Grasses and Grass-likes**			140–280	
	Canada wildrye	ELCA4	*Elymus canadensis*	140–280	–
	sedge	CAREX	*Carex*	140–280	–
	blue grama	BOGR2	*Bouteloua gracilis*	28–140	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	28–140	–
	squirreltail	ELEL5	*Elymus elymoides*	0–140	–
	spikerush	ELEOC	*Eleocharis*	0–140	–
	rush	JUNCU	*Juncus*	0–140	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	28–140	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–140	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–112	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–84	–
	Grass, perennial	2GP	*Grass, perennial*	0–84	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–56	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–56	–
	saltgrass	DISP	*Distichlis spicata*	0–28	–
Forb					
6	**Forbs**			140–280	
	Forb, annual	2FA	*Forb, annual*	0–84	–
	Forb, perennial	2FP	*Forb, perennial*	0–84	–
	common yarrow	ACMI2	*Achillea millefolium*	0–84	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–84	–
	false boneset	BREU	*Brickellia eupatorioides*	0–84	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–84	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–84	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–84	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	0–84	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–84	–
	scurfpea	PSORA2	*Psoralidium*	0–84	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–84	–
	goldenrod	SOLID	*Solidago*	0–84	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–84	–
	American vetch	VIAM	*Vicia americana*	0–84	–
	mint	MENTH	*Mentha*	0–56	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–56	–
	thistle	CIRSI	*Cirsium*	0–28	–
Shrub/Vine					

Shrub/Vine					
7	**Shrubs**			28–280	
	big sagebrush	ARTR2	*Artemisia tridentata*	0–140	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–140	–
	rose	ROSA5	*Rosa*	28–140	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–140	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–84	–
	leadplant	AMCA6	*Amorpha canescens*	0–84	–
	chokecherry	PRVI	*Prunus virginiana*	0–84	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–84	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–84	–
	willow	SALIX	*Salix*	0–56	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–56	–
Tree					
8	**Trees**			0–84	
	green ash	FRPE	*Fraxinus pennsylvanica*	0–84	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–84	–
	American elm	ULAM	*Ulmus americana*	0–84	–
	boxelder	ACNE2	*Acer negundo*	0–56	–
	common hackberry	CEOC	*Celtis occidentalis*	0–56	–
	hawthorn	CRATA	*Crataegus*	0–56	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			588–757	
	western wheatgrass	PASM	*Pascopyrum smithii*	588–757	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	17–84	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	34–84	–
	Montana wheatgrass	ELAL7	*Elymus albicans*	0–34	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–34	–
2	**Tall Warm-Season Grasses**			34–168	
	big bluestem	ANGE	*Andropogon gerardii*	0–84	–
	switchgrass	PAVI2	*Panicum virgatum*	34–84	–
	prairie cordgrass	SPPE	*Spartina pectinata*	34–84	–
3	**Needlegrass**			168–336	
	green needlegrass	NAVI4	*Nassella viridula*	168–336	–
4	**Native Grasses and Grass-likes**			84–168	
	buffalograss	BODA2	*Bouteloua dactyloides*	17–84	–
	blue grama	BOGR2	*Bouteloua gracilis*	17–84	–
	sedge	CAREX	*Carex*	34–84	–
	saltgrass	DISP	*Distichlis spicata*	17–84	–
	Canada wildrye	ELCA4	*Elymus canadensis*	17–84	

	Canada wildrye	ELCA4	*Elymus canadensis*	17–84	–
	squirreltail	ELEL5	*Elymus elymoides*	0–84	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	17–84	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–50	–
	spikerush	ELEOC	*Eleocharis*	0–50	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–50	–
	rush	JUNCU	*Juncus*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–34	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–34	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–34	–
5	**Non-native Grasses**			34–168	
	Kentucky bluegrass	POPR	*Poa pratensis*	34–168	–
	cheatgrass	BRTE	*Bromus tectorum*	17–84	–
Forb					
6	**Forbs**			84–168	
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–84	–
	white heath aster	SYER	*Symphyotrichum ericoides*	17–84	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–50	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–50	–
	scurfpea	PSORA2	*Psoralidium*	17–50	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–50	–
	goldenrod	SOLID	*Solidago*	0–50	–
	thistle	CIRSI	*Cirsium*	17–50	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–50	–
	Forb, annual	2FA	*Forb, annual*	17–50	–
	Forb, perennial	2FP	*Forb, perennial*	17–50	–
	common yarrow	ACMI2	*Achillea millefolium*	0–50	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–34	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–34	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–34	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	0–34	–
	cocklebur	XANTH2	*Xanthium*	0–34	–
	mint	MENTH	*Mentha*	0–17	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–17	–
Shrub/Vine					
7	**Shrubs**			17–84	
	silver sagebrush	ARCA13	*Artemisia cana*	0–84	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–84	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–84	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–50	–
	chokecherry	PRVI	*Prunus virginiana*	0–50	–

	rose	ROSA5	*Rosa*	17–50	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–50	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–50	–
	willow	SALIX	*Salix*	0–34	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–17	–
	leadplant	AMCA6	*Amorpha canescens*	0–17	–
Tree					
8	**Trees**			0–50	
	green ash	FRPE	*Fraxinus pennsylvanica*	0–50	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–34	–
	American elm	ULAM	*Ulmus americana*	0–34	–
	boxelder	ACNE2	*Acer negundo*	0–34	–
	common hackberry	CEOC	*Celtis occidentalis*	0–34	–
	hawthorn	CRATA	*Crataegus*	0–17	–
	Tree	2TREE	*Tree*	0–17	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			101–353	
	western wheatgrass	PASM	*Pascopyrum smithii*	101–353	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–50	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	10–50	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–20	–
2	**Tall Warm-Season Grasses**			28–112	
	prairie cordgrass	SPPE	*Spartina pectinata*	28–112	–
3	**Needlegrass**			0–50	
	green needlegrass	NAVI4	*Nassella viridula*	0–50	–
4	**Native Grasses and Grass-likes**			50–202	
	saltgrass	DISP	*Distichlis spicata*	10–101	–
	squirreltail	ELEL5	*Elymus elymoides*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–50	–
	buffalograss	BODA2	*Bouteloua dactyloides*	10–50	–
	blue grama	BOGR2	*Bouteloua gracilis*	10–50	–
	sedge	CAREX	*Carex*	10–50	–
	foxtail barley	HOJU	*Hordeum jubatum*	20–50	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	10–50	–
	rush	JUNCU	*Juncus*	0–30	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–30	–
	spikerush	ELEOC	*Eleocharis*	0–30	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–20	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–20	–

	prairie sandreed	CALO	*Calamovilfa longifolia*	0–20	–
5	**Non-native Grasses**			50–151	
	Kentucky bluegrass	POPR	*Poa pratensis*	20–151	–
	cheatgrass	BRTE	*Bromus tectorum*	20–101	–
Forb					
6	**Forbs**			101–202	
	cocklebur	XANTH2	*Xanthium*	20–101	–
	thistle	CIRSI	*Cirsium*	20–101	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–50	–
	Forb, annual	2FA	*Forb, annual*	20–50	–
	common yarrow	ACMI2	*Achillea millefolium*	20–50	–
	goldenrod	SOLID	*Solidago*	20–50	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–50	–
	scurfpea	PSORA2	*Psoralidium*	20–50	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	10–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	10–30	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–30	–
	Forb, perennial	2FP	*Forb, perennial*	10–30	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–20	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–20	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–20	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–10	–
Shrub/Vine					
7	**Shrubs**			50–101	
	silver sagebrush	ARCA13	*Artemisia cana*	0–50	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	10–50	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–30	–
	rose	ROSA5	*Rosa*	10–30	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–30	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–20	–
	chokecherry	PRVI	*Prunus virginiana*	0–10	–
	willow	SALIX	*Salix*	0–10	–
Tree					
8	**Trees**			0–10	
	boxelder	ACNE2	*Acer negundo*	0–10	–
	common hackberry	CEOC	*Celtis occidentalis*	0–10	–
	hawthorn	CRATA	*Crataegus*	0–10	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–10	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–10	–
	American elm	ULAM	*Ulmus americana*	0–10	–

Animal community

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). Therefore, 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.

Plant Community = Rhizomatous Wheatgrass-Needlegrass-Tall Warm-Season Grasses/Mixed Shrubs (1.1)
Average Annual Production (lbs./ac, air-dry) = 2100
Stocking Rate (AUM/ac) = 0.58

Plant Community = Western Wheatgrass-Needlegrass (1.2)
Average Annual Production (lbs./ac, air-dry) = 2200
Stocking Rate (AUM/ac) = 0.60

Plant Community = Rhizomatous Western Wheatgrass (1.3)
Average Annual Production (lbs./ac, air-dry) = 1500
Stocking Rate (AUM/ac) = 0.41

Plant Community = Western Wheatgrass-Annual Grasses/Forbs/Shrubs (2.1)
Average Annual Production (lbs./ac, air-dry) = 900
Stocking Rate (AUM/ac) = 0.25

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 deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

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.

Hydrological functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic groups C and D. Infiltration ranges from very slow to moderately slow, and runoff potential for this site varies from low to medium 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 short grasses form a dense sod. Normally 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 opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

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 requirements as an “Approved” ESD as laid out in the 1997, rev.1, 2003 National Range and Pasture Handbook (NRPH). The document fully described 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, is needed to validate the information in this Provisional Ecological Site Description. 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. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

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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 description include: Stan Boltz, Range Management Specialist, NRCS; Darrel DuVall, Range Management Specialist, NRCS; Jill Epley, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, Range Management Specialist, NRCS; and Mike Stirling, Range Management Specialist, NRCS.

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Contributors

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Acknowledgments

ESD updated by Rick L. Peterson on 7/20/17

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, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	06/04/2008
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** Typically none or barely visible. Evidence of water flow may be present after high overland flow events or flooding from adjacent streams, but vegetation normally remains intact.

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3. **Number and height of erosional pedestals or terracettes:** None.

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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 5 percent is typical.

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5. **Number of gullies and erosion associated with gullies:** None typical, however limited headcutting may form after high runoff or flooding events. Existing gullies should be stabilized with good vegetative cover.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None typical, but limited deposition may occur after major runoff or flooding events.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter of small and medium size classes will move after average to high rainfall events. Litter does not travel far, typically being trapped in small bunches by the extensive vegetative cover. Litter movement may be fairly extensive after major runoff or flooding events.

---

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 4 to 10 inches thick with mollic (dark) colors when moist. Structure typically is medium subangular blocky 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 – 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: Mid cool-season rhizomatous grasses >>

    Sub-dominant: Mid/tall cool-season bunchgrasses > tall warm-season rhizomatous grasses > short cool-season grasses/grass-likes >

    Other: Shrubs = forbs

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 1,900-3,100 lbs./acre (air-dry weight). Reference value production is 2,500 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.