USDA Natural Resources Conservation Service

Ecological site R063AY013SD
Claypan

Last updated: 6/26/2024
Accessed: 05/10/2025

General information

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

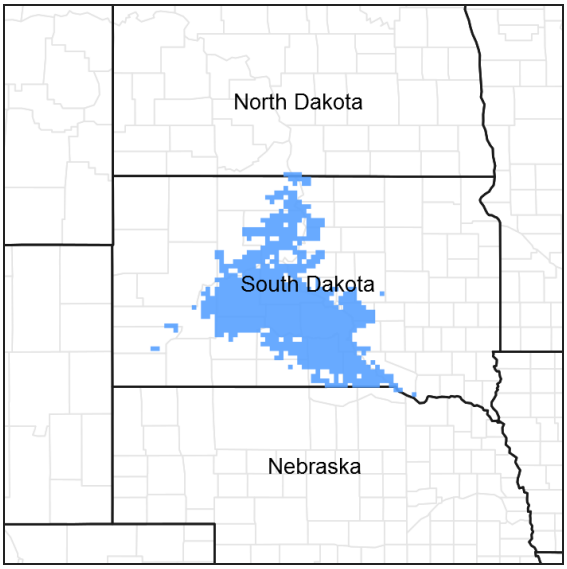

Figure 1. Mapped extent

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

MLRA notes

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

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

Elevation range from 1,300 to 1,640 feet on the bottom land along the Missouri River to 1,640 to 2,950 feet on the shale plain uplands. Cretaceous Pierre Shale underlies almost all of this area. This is a marine sediment having layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they get wet. Tertiary and Quaternary river deposits, remnants of erosion from the Black Hills uplift, cap isolated highlands in this area. Deposits of alluvial sand and gravel occur on the valley floors adjacent to the major streams in the area. The average annual precipitation in this area is 15 to 20 inches.
The vegetation in this area is a transition from tall grass prairie to a 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 Claypan sites occurs throughout the MLRA. It is located on gently undulating to rolling sedimentary uplands with slopes ranging from 0 to 6 percent. Soil are formed from soft siltstone, shales and alluvium. The soil surface texture is loam to silt loam, 4 to 10 inches thick, subsurface textures are silt loam to clay. The Btn horizon creates a claypan, of extremely hard sodium effected clay (natric) which occurs between 5 and 16 inches of the surface. This root restricting layer has round-topped or “biscuit-shaped” columnar structure. Vegetation in the Reference State consists primarily of cool-season rhizomatous wheatgrasses and needlegrasses and short warm-season grasses. Prickly pear cactus is typically present in the plant community but in minor amounts.

Associated sites

R063AY007SD	**Saline Lowland**
R063AY011SD	**Clayey**
R063AY015SD	**Thin Claypan**
R063AY018SD	**Dense Clay**

Similar sites

R063AY011SD	**Clayey** Clayey [more green needlegrass; higher production]
R063AY015SD	**Thin Claypan** Thin Claypan [lower production; greater dominance of short grass and salt tolerant species]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on gently undulating to rolling sedimentary uplands, terraces, fan remnants, flood plains and alluvium.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Alluvial fan (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	1,600–2,700 ft
Slope	0–6%
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 (characteristic range)	108-117 days
Freeze-free period (characteristic range)	129-131 days
Precipitation total (characteristic range)	17-20 in
Frost-free period (actual range)	104-120 days
Freeze-free period (actual range)	127-132 days
Precipitation total (actual range)	17-20 in
Frost-free period (average)	113 days
Freeze-free period (average)	130 days
Precipitation total (average)	19 in

Climate stations used

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

Influencing water features

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

Soil features

The common features of soils in this site are silt loam to clayey textured subsoils and slopes of zero to six percent. The soils in this site are moderately well to well drained and formed in soft siltstone, shales, and alluvium. The loam to silt loam surface layer is 4 to 10 inches thick. The extremely hard clayey Btn horizon has round-topped or "biscuit shaped" columnar structure. These Btn horizons are high in sodium. 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. The soil surface is stable and intact.

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

Soils correlated to the Claypan ecological site include: Absted, Beckton, Mosher and Wortman.

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

Table 4. Representative soil features

Parent material	(1) Alluvium–shale and siltstone (2) Alluvium–shale and siltstone
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to slow
Soil depth	20–60 in
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–5 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–50
Soil reaction (1:1 water) (0-40in)	6.1–9.6
Subsurface fragment volume <=3" (Depth not specified)	5–25%
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 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.

The plant community upon which interpretations are primarily based is the Western Wheatgrass-Green Needlegrass-Blue Grama plant community. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used.

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-Green Needlegrass-Blue grama plant community. Blue grama and buffalograss will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production.

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

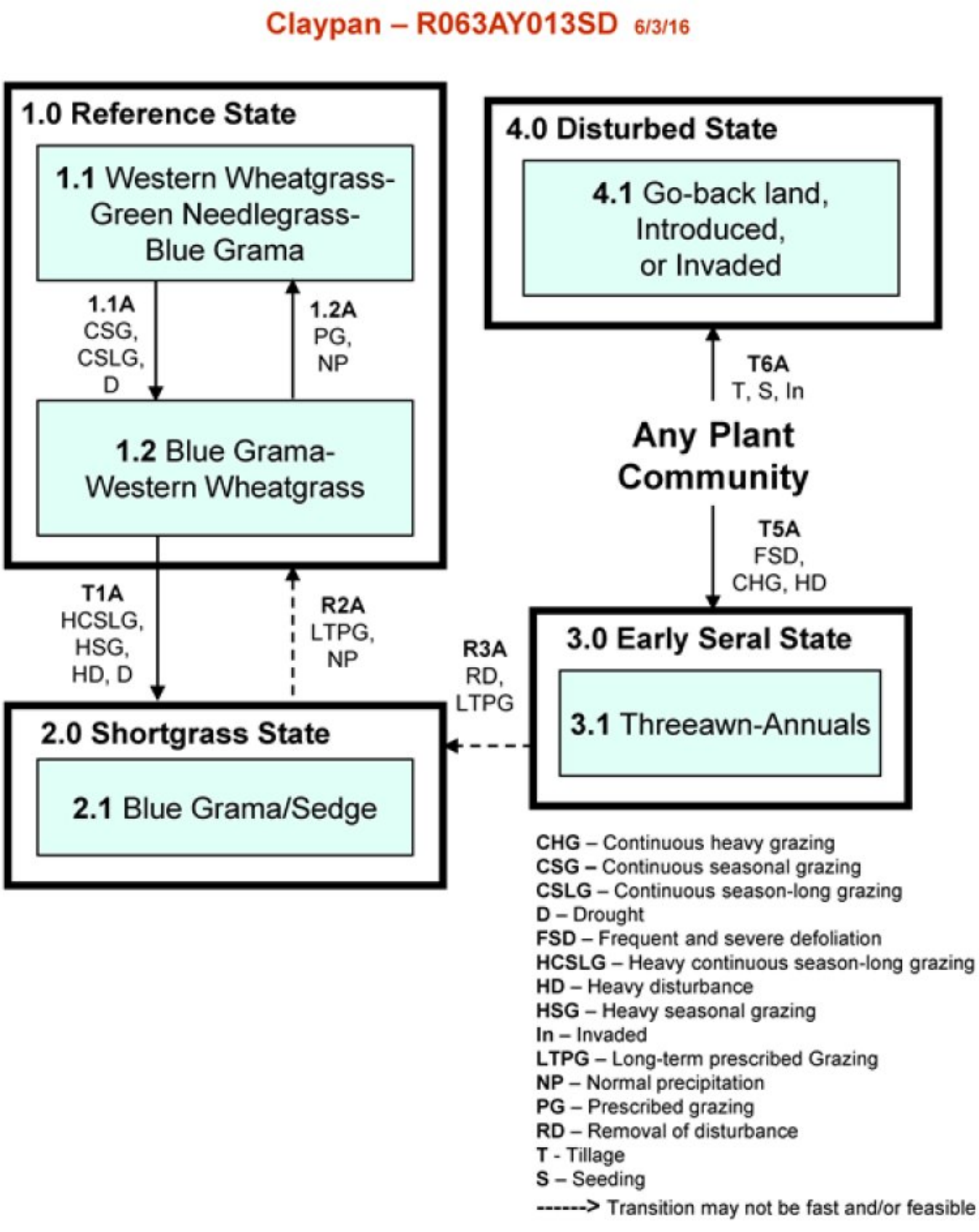

Figure 8. Claypan - R063AY013SD

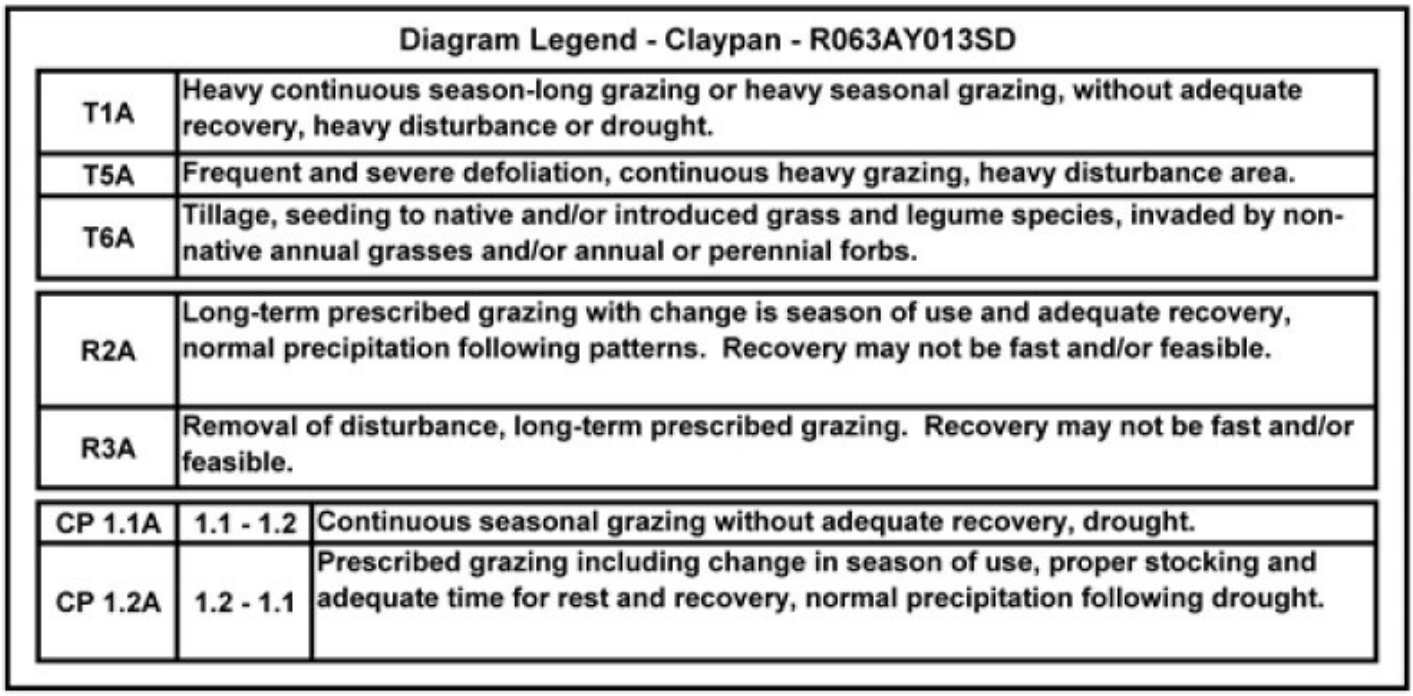

Figure 9. Claypan - R063AY013SD

State 1
Reference State

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

Community 1.1
Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community

The plant community upon which interpretations are primarily based is the Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community (this is also considered the reference plant community). Potential vegetation is about 80-85 percent grasses or grass-like plants, and 5-10 percent forbs, and 5-15 percent woody plants. Cool-season grasses dominate. Major grasses include western wheatgrass, green needlegrass, needleandthread, blue grama, buffalograss, and sedges. Forbs occurring in this plant community are cudweed sagewort, scurfpeas, and white prairie aster. Cactus, fringed sagewort, and silver sagebrush are most likely to occur in this plant community. This plant community is stable and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought resistance. This is a sustainable plant community (site/soil stability, watershed function, and biologic integrity). Occasionally, this plant community will have areas influenced by natural geologic erosion and will exhibit considerable bare ground.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	950	1320	1745
Shrub/Vine	75	160	275
Forb	75	120	180
Total	**1100**	**1600**	**2200**

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

Community 1.2
Blue Grama-Western Wheatgrass Plant Community

This plant community develops under continuous seasonal grazing (i.e., grazing an area during the same season every year) or from heavy grazing during extended drought periods. The potential vegetation is about 75-90 percent grasses or grass-like plants, 5-10 percent forbs, and 5-15 percent shrubs. A fairly even mix of cool-season grasses and short warm-season grasses dominates this plant community. Blue grama and western wheatgrass are the dominant grasses. Other grasses and grass-like plants occurring include needleandthread, buffalograss, prairie Junegrass, threadleaf sedge, dropseed, Sandberg bluegrass, and inland saltgrass. Significant forbs and shrubs include silverleaf scurfpea, cudweed sagewort, western yarrow, fringed sagewort, rubber rabbitbrush, broom snakeweed, and cactus. This plant community is somewhat resistant to change. 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 seasonal grazing. If the herbaceous component is intact, it tends to be resilient, if disturbance is not long-term. Because of the sod forming habit of the shortgrass species, water infiltration decreases and runoff increases.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	690	990	1270
Shrub/Vine	55	120	200
Forb	55	90	130
Total	**800**	**1200**	**1600**

Figure 13. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

Pathway 1.1A
Community 1.1 to 1.2

Continuous seasonal grazing (extended grazing at the same time of year every year), continuous season-long grazing, including chronic over stocking and drought will move this plant community to the Blue Grama-Western Wheatgrass Plant Community.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, including proper stocking, change in season of use and adequate rest periods, will move this community through the successional stages leading to the Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community. Normal precipitation patterns following drought will hasten the recovery.

State 2
Short Grass State

This state is dominated by shortgrass species and upland sedges and is the result of grazing practices that remove

the mid-stature, cool- and warm-season grasses and provide a competitive advantage to shortgrasses and grass-like species that are grazing resistant. This state is very resilient and resistant to change.

Community 2.1
Blue Grama/Sedge Plant Community

This plant community results from heavy seasonal grazing. Shortgrasses and forbs increase to dominate the plant community and annual production decreases dramatically. Lack of litter and short plant heights result in high soil temperatures, high soil water loss, and poor water infiltration rates; which gives blue grama a competitive advantage over cool-season mid-grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. Blue grama and sedge are the prominent species with the balance being lesser amounts of buffalograss, inland saltgrass, Sandberg bluegrass, threeawn, western wheatgrass, and needleandthread. Common forbs on the site include cudweed sagewort, curlycup gumweed, scurfpea, and western yarrow. This plant community is relatively stable. The thick sod and competitive advantage prevents other species from establishing. This plant community is less productive than the Western Wheatgrass-Green Needlegrass-Blue Grama Plant Community. Runoff increases and infiltration will decrease. Soil erosion will be minimal due to the sod forming habit of blue grama and buffalograss.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	475	697	905
Shrub/Vine	85	135	200
Forb	40	68	95
Total	**600**	**900**	**1200**

Figure 15. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

State 3
Early Seral State

This state is the result of very heavy, concentrated disturbance such as prairie dog activity, or concentrated livestock areas. Extended periods of drought accompanied by heavy grazing can also push an “At Risk” plant community phase to this state. In most cases, this phase is dominated by annual and/or pioneer perennial species. Bare ground is typically greater than on any other plant community phase.

Community 3.1
Threeawn-Annuals

This plant community is dominated by threeawn, perennial forbs (some of which are invasive), annual grasses and annual forbs. Total annual production has decreased significantly resulting in reduced litter, increased bare ground, poor water infiltration, higher soil temperature and higher evaporation rates. Soil loss through erosion may expose salts and increase inland saltgrass and other salt tolerant species.

State 4
Disturbed State

This state includes highly disturbed areas that have been allowed to grow back naturally, have been seeded to introduced forage species or have converted to weedy annuals. The plant communities on these site varies greatly. In most cases the hydrologic function, biotic integrity and soil site stability are dysfunctional.

Community 4.1
Go-back land, Introduced, or Invaded State

The Go-back Land state can be reached whenever severe mechanical disturbance occurs (e.g., tilled and abandoned land, either past or present). During the early successional stages, the species that mainly dominate are annual grasses and forbs, later being replaced by both native and introduced perennials. The vegetation on this site varies greatly, sometimes being dominated by threeawn, Kentucky bluegrass, smooth bromegrass, annual brome, crested wheatgrass, buffalograss, broom snakeweed, sweetclover, and nonnative thistles. Other plants that commonly occur on the site include western wheatgrass, deathcamas, prickly lettuce, marestail, kochia, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health. The Introduced state is normally those areas seeded to crested wheatgrass, pubescent wheatgrass, intermediate wheatgrass, alfalfa, or other introduced species. Refer to the associated Forage Suitability Group description for adapted species (South Dakota Field Office Tech Guide – FOTG). The Invaded state includes areas that have been invaded by species such as smooth bromegrass, Kentucky bluegrass, nonnative thistles, field bindweed, knapweeds, leafy spurge, hoary cress, and other introduced species.

Transition 1A
State 1 to 2

Heavy seasonal grazing, heavy continuous season-long grazing, heavy disturbance or drought will convert this plant community to the Blue Grama-Sedge Plant State. This transition is most likely to come from the Blue Grama-Western Wheatgrass PCP 1.2.

Transition 5A
State 1 to 3

This State can transition to State 3.0 as a result of frequent and severe defoliation due to such occurrences as prairie dog activity, confined feeding areas, and heavy use areas.

Transition 6A
State 1 to 4

This State can transition to State 4.0 as a result of tillage, seeding or invasion of non-native weedy species.

Restoration pathway 2A
State 2 to 1

Under long-term prescribed grazing, including adequate rest periods and normal precipitation patterns, this plant community will return to the Reference State. This may take a long period of time and may not meet management goals.

Transition 5A
State 2 to 3

This State can transition to State 3.0 as a result of frequent and severe defoliation due to such occurrences as prairie dog activity, confined feeding areas, and heavy use areas.

Transition 6A
State 2 to 4

This State can transition to State 4.0 as a result of tillage, seeding or invasion of non-native weedy species.

Restoration pathway 3A
State 3 to 2

This plant community can transition to the Shortgrass State (2.0) by removing the disturbance and applying long-term prescribed grazing. This may take an extended period of time and may not meet management objectives.

Transition 6A
State 3 to 4

This State can transition to State 4.0 as a result of tillage, seeding or invasion of non-native weedy species.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			240–560	
	western wheatgrass	PASM	*Pascopyrum smithii*	240–560	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–80	–
2	**Cool-Season Bunchgrasses**			160–480	
	green needlegrass	NAVI4	*Nassella viridula*	160–400	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	32–160	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–80	–
3	**Mid and Tall Warm-Season Grasses**			32–160	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–160	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–160	–
4	**Short Warm-Season Grasses**			80–240	
	blue grama	BOGR2	*Bouteloua gracilis*	80–160	–
	buffalograss	BODA2	*Bouteloua dactyloides*	16–80	–
	saltgrass	DISP	*Distichlis spicata*	16–48	–
	threeawn	ARIST	*Aristida*	16–32	–
5	**Other Native Grasses**			16–80	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–48	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–48	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–32	–
6	**Grass-Likes**			80–160	
	needleleaf sedge	CADU6	*Carex duriuscula*	32–128	–
	threadleaf sedge	CAFI	*Carex filifolia*	16–80	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–48	–
Forb					
8	**Forbs**			80–160	
	Forb, native	2FN	*Forb, native*	16–64	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–48	–
	scurfpea	PSORA2	*Psoralidium*	16–48	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	16–48	–
	American vetch	VIAM	*Vicia americana*	16–32	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	16–32	–
	goldenrod	SOLID	*Solidago*	16–32	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	16–32	–

	desertparsley	LOMAT	*Lomatium*	16–32	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	16–32	–
	woolly plantain	PLPA2	*Plantago patagonica*	16–32	–
	milkvetch	ASTRA	*Astragalus*	16–32	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	16–32	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	16–32	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	16–32	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	16–32	–
	textile onion	ALTE	*Allium textile*	0–16	–
	pygmyflower rockjasmine	ANSE4	*Androsace septentrionalis*	0–16	–
	pussytoes	ANTEN	*Antennaria*	0–16	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–16	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–16	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–16	–
	deathcamas	ZIGAD	*Zigadenus*	0–16	–
	slimpod Venus' looking-glass	TRLE3	*Triodanis leptocarpa*	0–16	–
Shrub/Vine					
9	**Shrubs**			80–240	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–80	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–80	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–80	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	16–80	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	16–80	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–48	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–32	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			120–240	
	western wheatgrass	PASM	*Pascopyrum smithii*	120–240	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–24	–
2	**Cool-Season Bunchgrasses**			60–180	
	green needlegrass	NAVI4	*Nassella viridula*	12–120	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	24–96	–
3	**Mid and Tall Warm-Season Grasses**			0–60	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–60	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–36	–
4	**Short Warm-Season Grasses**			240–420	
	blue grama	BOGR2	*Bouteloua gracilis*	180–360	–
	buffalograss	BODA2	*Bouteloua dactyloides*	12–120	–

	saltgrass	DISP	*Distichlis spicata*	12–60	–
	threeawn	ARIST	*Aristida*	12–60	–
5	**Other Native Grasses**			12–60	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–60	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–48	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–24	–
6	**Grass-likes**			120–240	
	needleleaf sedge	CADU6	*Carex duriuscula*	60–180	–
	threadleaf sedge	CAFI	*Carex filifolia*	24–96	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–60	–
7	**Non-Native Grasses**			12–60	
	cheatgrass	BRTE	*Bromus tectorum*	0–60	–
	bluegrass	POA	*Poa*	12–60	–
Forb					
8	**Forbs**			60–120	
	Forb, introduced	2FI	*Forb, introduced*	0–60	–
	Forb, native	2FN	*Forb, native*	12–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	12–48	–
	scurfpea	PSORA2	*Psoralidium*	12–48	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	12–48	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	12–36	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	12–24	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	12–24	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	12–24	–
	goldenrod	SOLID	*Solidago*	12–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	12–24	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–24	–
	woolly plantain	PLPA2	*Plantago patagonica*	12–24	–
	American vetch	VIAM	*Vicia americana*	0–12	–
	deathcamas	ZIGAD	*Zigadenus*	0–12	–
	desertparsley	LOMAT	*Lomatium*	0–12	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–12	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–12	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–12	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–12	–
	milkvetch	ASTRA	*Astragalus*	0–12	–
	textile onion	ALTE	*Allium textile*	0–12	–
	pygmyflower rockjasmine	ANSE4	*Androsace septentrionalis*	0–12	–
	pussytoes	ANTEN	*Antennaria*	0–12	–
Shrub/Vine					
9	**Shrubs**			60–180	

	prairie sagewort	ARFR4	*Artemisia frigida*	24–96	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	12–96	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	12–96	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	12–60	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–36	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–12	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			0–72	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–72	–
2	**Cool-Season Bunchgrasses**			0–45	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
4	**Short Warm-Season Grasses**			225–450	
	blue grama	BOGR2	*Bouteloua gracilis*	180–360	–
	buffalograss	BODA2	*Bouteloua dactyloides*	18–135	–
	saltgrass	DISP	*Distichlis spicata*	9–90	–
	threeawn	ARIST	*Aristida*	9–90	–
5	**Other Native Grasses**			0–63	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–45	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–9	–
6	**Grass-likes**			90–225	
	needleleaf sedge	CADU6	*Carex duriuscula*	45–180	–
	threadleaf sedge	CAFI	*Carex filifolia*	18–90	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–45	–
7	**Non-Native Grasses**			18–45	
	cheatgrass	BRTE	*Bromus tectorum*	9–45	–
	bluegrass	POA	*Poa*	9–45	–
Forb					
8	**Forbs**			45–90	
	scurfpea	PSORA2	*Psoralidium*	9–45	–
	Forb, introduced	2FI	*Forb, introduced*	0–45	–
	Forb, native	2FN	*Forb, native*	9–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–45	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	9–45	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	9–36	–
	woolly plantain	PLPA2	*Plantago patagonica*	9–27	–
	goldenrod	SOLID	*Solidago*	9–27	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	9–27	–

	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–27	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	9–18	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	9–18	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–9	–
	deathcamas	ZIGAD	*Zigadenus*	0–9	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–9	–
	pussytoes	ANTEN	*Antennaria*	0–9	–
Shrub/Vine					
9	**Shrubs**			90–180	
	brittle pricklypear	OPFR	*Opuntia fragilis*	18–108	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	9–90	–
	prairie sagewort	ARFR4	*Artemisia frigida*	18–90	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	9–72	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–27	–

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

Blue Grama/Western Wheatgrass
Average Annual Production (lbs./acre, air-dry): 1200
Stocking Rate* (AUM/acre) 0.33

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

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

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 forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration and runoff potential for this site varies from moderate to high 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. 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 esthetic 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.

Other references

High Plains Regional Climate Center, University of Nebraska. (http://www.hprcc.unl.edu/)
USDA, NRCS. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296, 2006
USDA, NRCS. National Ecological Site Handbook, 1st Ed. January, 2014
USDA, NRCS. National Water and Climate Center. (http://www.wcc.nrcs.usda.gov/)
USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center. (http://nasis.nrcs.usda.gov)
USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center.
USDA, NRCS, Various Published Soil Surveys

Contributors

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Approval

Suzanne Mayne-Kinney, 6/26/2024

Acknowledgments

Peterson, Rick L. ESD Update 6/16

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
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	05/08/2010
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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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 4 to 10 inches thick with mollic (dark) colors when moist. Structure typically is medium to 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-season grasses) with fine and coarse roots positively influences infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – natural pan appears at roughly 4 to 16 inches with “biscuit-top” appearance at top of pan.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid cool-season rhizomatous grasses > Mid/tall cool-season bunchgrasses >

    Sub-dominant: Shrubs = Short warm-season grasses > Mid/tall warm-season grasses = Grass-likes = Forbs >

    Other: Short cool-season bunchgrasses

    Additional:

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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.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,100-2,200 lbs./acre (air-dry weight). Reference value production is 1,600 lbs./acre (air-dry weight).

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds

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.