USDA Natural Resources
Conservation Service

Ecological site R063BY007SD
Saline Lowland

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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): 063B–Southern Rolling Pierre Shale Plains

MLRA Notes:
The Southern Rolling Pierre Shale Plains (MLRA 63B) is approximately 4,460 square miles in size. The majority of the MLRA is located in South Dakota (82 percent), and the remaining 18 percent is located in Nebraska. Interstate 90 crosses the northern portion through Chamberlin, SD. There are several Indian Reservations, including the Lower Brule, Crow Creek, Santee, and Yankton Reservations.
This MLRA is an area of old plateaus and terraces that have been deeply eroded, with nearly level to rolling long slopes and well-defined dendritic drainage systems. The rivers and creek valleys have smooth floors and steep walls. The majority of the MLRA is located in the unglaciated section of the Missouri Plateau, Great Plains Province. The northeast corner of the MLRA, east of the Missouri River, is located in the glaciated section where higher areas have deposits of glacial drift. The southwestern tip is located in the High Plains Section.
The elevations range from 1,310 feet to 1,640 feet on the bottom lands along the Missouri River, and from 1,310 feet to 1,970 feet on the shale plains uplands.
The Missouri and Niobrara Rivers, and the confluence of the White and Missouri Rivers, occur within this MLRA. Lake Francis Case, Fort Randall Dam, and Lewis and Clark Lake are also within the borders of MLRA 63B.
Cretaceous Pierre Shale underlies most of the area. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they become wet, causing significant problems for road and structural foundations.

Younger Niobrara chalk occurs in the southern part of the MLRA. Alluvial sand and gravel underlie the valley floors along major streams.

Soils are shallow to very deep, generally well drained, and with loamy or clayey textures. Annual precipitation is 19 to 26 inches, mostly falling during the growing season as frontal storms during the spring and convective thunderstorms in summer. The average annual temperature is 45°-50°F. The freeze-free period averages 165 days, and ranges from 145 to 185 days.

Vegetation is a transition between tall prairie grasses and mixed prairie grasses. Green needlegrass, porcupinegrass, western wheatgrass, and big bluestem are the major species. Little bluestem, buffalograss, sideoats grama, and sedges are dominant on the shallow soils. Buffaloberry, skunkbush sumac, and prairie rose are common on steep slopes along the major streams. Prairie cottonwood and a variety of willow species are common on flood plains along the major streams. Green ash, boxelder, chokecherry, bur oak, and buffaloberry occur in draws and narrow valleys. Encroachment of Rocky Mountain juniper and eastern redcedar on to the river breaks is becoming a concern.
The majority of the land is utilized for ranching (60 percent) and farming (27 percent). Major resource concerns for the area are wind and water erosion, maintenance of the content of organic matter and soil productivity, and management of soil moisture.

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 (USDA-NRCS, Ag Handbook 296).

EPA - Level IV Ecoregions of the Continental United States:

Northwestern Glaciated Plains - 42f – Southern Missouri Coteau Slopes, 42g – Ponca Plains, 42h – Southern River Breaks, 42p – Holt Tablelands

North Western Great Plains - 43C – River Breaks, 43f – Subhumid Pierre Shale Plains, 43r – Niobrara River Breaks.

Ecological site concept

The Saline Lowland ecological site occurs throughout MLRA 63B but is of minor extent. It is a run-in site located on nearly level flood plains along larger drainageways. Slopes range from 0 to 1 percent. The soils are deep, formed in clayey alluvium, are poorly drained, and have salt accumulation at 4 to 15 inches below the surface. The site has a seasonal water table between 1 and 4 feet in depth and permanently moist soil at 4 to 5 feet deep. Vegetation in the Reference State consists of salt-tolerant, cool- and warm-season grasses.

Associated sites

R063BY013SD	**Claypan** The Claypan site can be found adjacent to or intermixed with the Saline Lowland site.
R063BY015SD	**Thin Claypan** The Thin Claypan site can be found adjacent to or intermixed with the Saline Lowland site.

Similar sites

R063BY019SD	**Closed Depression** Closed Depression site will have more western wheatgrass, more dock and smartweed, and higher forage production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Spartina pectinata* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on nearly level lowlands and adjacent to small drainageways.

Table 2. Representative physiographic features

Landforms	(1) Drainageway
Runoff class	Low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Elevation	396–610 m
Slope	0–1%
Water table depth	30–127 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 63B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 18 to 25 inches per year. The average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, SD), to about 22°F (Winner, SD). July is the warmest month with temperatures averaging from about 73°F (Stephan, SD), to about 76°F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56°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 (mph) annually, ranging from about 13 mph during the spring to about 10 mph 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 mph.

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)	113-122 days
Freeze-free period (characteristic range)	130-154 days
Precipitation total (characteristic range)	533-610 mm
Frost-free period (actual range)	110-126 days
Freeze-free period (actual range)	127-155 days
Precipitation total (actual range)	508-635 mm
Frost-free period (average)	118 days
Freeze-free period (average)	141 days
Precipitation total (average)	584 mm

Climate stations used

- (1) LYNCH [USC00255040], Lynch, NE
- (2) NIOBRARA [USC00255960], Niobrara, NE
- (3) GANN VALLEY 4NW [USC00393217], Gann Valley, SD
- (4) WOOD [USC00399442], Wood, SD
- (5) PICKSTOWN [USC00396574], Lake Andes, SD
- (6) STEPHAN 2 NW [USC00397992], Highmore, SD
- (7) WINNER [USC00399367], Winner, SD

Influencing water features

Palustrine wetlands can be associated with the Saline Lowland ecological site.
Cowardin, et. al., 1979

Wetland description

Palustrine System, Emergent Wetland Class
Cowardin System

Soil features

The common features of soils in this site are the silt loam to sandy loam-textured surface soils with slopes of 0 to 1 percent. The soils in this site are very deep, poorly drained, and formed in local alluvium. The surface layer is 1 to 3 inches thick and has moderate permeability and moderately high saturated hydraulic conductivity. Below the surface layer, these soils exhibit an extremely hard and clayey Btn (natric) horizon that has round-topped or “bun shaped” columnar structure. These Btn horizons are high in sodium and are restrictive to water movement and root penetration. The high sodium content decreases plant growth and productivity. This layer has a very slow permeability rate and accumulations of carbonates, gypsum, and other salts is common. Below the Btn horizons, the subsoil texture can be clay, clay loam, silty clay loam, or silty clay. Carbonates, gypsum, and other salts can also be present. Permeability is slow or very slow, and saturated hydraulic conductivity is moderately low or low in this layer. This site does not flood, but ponding occurs most years in the spring during snowmelt or after heavy rains. Ponding may last up to 30 days. These soils have a zone of water saturation that fluctuates between 1 and 4 feet below the surface during the growing season. Available water capacity ranges from moderate in the surface to low in the subsoil.

Areas within this site can become nearly barren due to the accumulation of sodium at the surface. Where vegetation is present, this site should show no evidence of rills, wind-scoured areas, or pedestalled plants. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration.

Major soils correlated to the Saline Lowland ecological site include: Durrstein and Lute.

These soils are somewhat susceptible to water erosion. Slow permeability strongly influences the soil-water-plant relationship. Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Alluvium–clayey shale
Surface texture	(1) Silt loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Clayey
Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	203 cm

Available water capacity (0-203.2cm)	5.08–12.7 cm
Calcium carbonate equivalent (0-203.2cm)	0–10%
Electrical conductivity (0-203.2cm)	4–16 mmhos/cm
Sodium adsorption ratio (0-203.2cm)	0–25
Soil reaction (1:1 water) (0-203.2cm)	6.1–9.6
Subsurface fragment volume <=3" (Depth not specified)	0–4%

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, species such as inland saltgrass and foxtail barley increase and annual species may invade the site. Grasses such as alkali sacaton, western wheatgrass, slender wheatgrasses, and Nuttall's alkaligrass will decrease in frequency and production. The high sodium content of the soils greatly influences the plant species present. Plant vigor can vary on a year-to-year basis in relation to current precipitation amounts, which influences the translocation of salts in the soil profile. Typically, only salt-tolerant plants are found on this site.

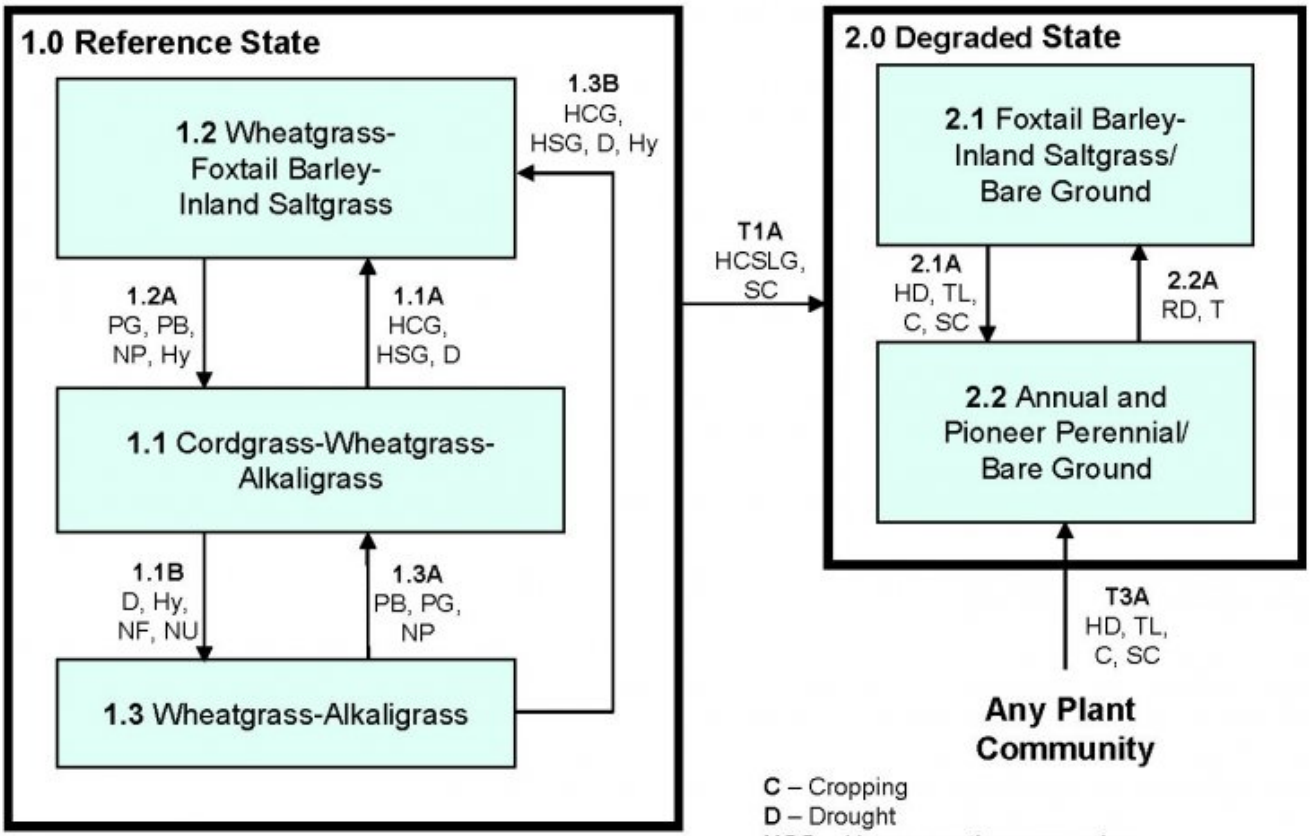
A loss of hydrologic function, or extended periods of drought, will resulting in a drier site resulting in a reduction in prairie cordgrass and a shift in the plant community dynamics. If the hydrologic function is restored, cordgrass will reestablish on the site.

The Cordgrass-Wheatgrass-Alkaligrass Plant Community (1.1) is the plant community upon which interpretations are primarily based. This 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 community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

Saline Lowland – R063BY007SD 6/18/18



C – Cropping
D – Drought
HCG – Heavy, continuous grazing
HCSLG – Heavy, continuous season-long grazing
HD – Heavy disturbance
HSG – Heavy, seasonal grazing
Hy – Hydrologic function
NF – No fire
NP – Return to normal precipitation patterns
NU – Non-use
PB – Prescribed burning
PG – Prescribed grazing
RD – Removal of disturbance
SC – Soil compaction
T – Time
TL – Tillage

Diagram Legend - Saline Lowland - R063BY007SD

T1A	Heavy, continuous, season-long grazing, without adequate recovery. Possible soil compaction.
T3A	Heavy disturbance, tillage, abandoned cropland, and/or soil compaction.

CP 1.1A	1.1 - 1.2	Heavy continuous grazing, or heavy seasonal grazing without change in season of use, adequate recovery time, and drought.
CP 1.1B	1.1 - 1.3	Drought, loss of hydrologic function, no fire, and possibly from non-use.
CP 1.2A	1.2 - 1.1	Prescribed grazing following prescribed burning and a return to normal precipitation patterns following drought, and a return of hydrologic function.
CP 1.3A	1.3 - 1.1	Prescribed burning followed by prescribed grazing including change in season of use, proper stocking, and adequate time for rest and recovery, and a return to normal precipitation following drought.
CP 1.3B	1.3 - 1.2	Heavy continuous grazing, or heavy seasonal grazing without change in season of use, adequate recovery time, drought, and a loss of hydrologic function.
CP 2.1A	2.1 - 2.2	Heavy disturbance, tillage, abandoned cropland, and/or soil compaction.
CP 2.2A	2.2 - 2.1	Removal of management induced disturbance followed by time to allow for plant community succession.

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominates the dynamics of this ecological site prior to European settlement. The Reference State is dominated by cool-season grasses, while warm-season grasses are subdominant. The primary disturbance mechanisms for this site in the Reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing, coupled with weather events, dictated the dynamics that occurred within the natural range of variability. Today the primary disturbance is from a lack of fire and concentrated livestock grazing. Grasses that are desirable for livestock and wildlife can decline and a corresponding increase in less desirable grasses will occur.

Community 1.1
Cordgrass-Wheatgrass-Alkaligrass

This community evolved with grazing by large herbivores, occasional prairie fires, and periodic flooding events. It can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The potential vegetation is about 85 percent grasses and grass-like plants, 10 percent forbs, and 5 percent shrubs. The major grasses include western wheatgrass, Nuttall’s alkaligrass, and alkali and prairie cordgrass. Other grasses present include slender wheatgrass, inland saltgrass, and foxtail barley. Salt-tolerant forbs such as alkali plantain, western dock, and seepweed are common. Interpretations are based primarily on this plant community phase. This community phase is diverse, stable, productive, and well adapted to both saline soils and the Northern Great Plains climatic conditions. Community dynamics, nutrient and water cycles, and energy flow are functioning properly. Litter is properly distributed with very little movement offsite and natural plant mortality is very low. This community is resistant to many disturbances except continuous grazing, tillage, and/or development into urban or other uses. The diversity in plant species allows for both the fluctuation of flooding as well as large variations in climate.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2819	3510	4142
Forb	174	295	460
Shrub/Vine	34	118	219
Total	**3027**	**3923**	**4821**

Figure 9. Plant community growth curve (percent production by month). SD6307, 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

Community 1.2
Wheatgrass-Foxtail Barley-Inland Saltgrass

This community develops with heavy, continuous grazing with lack of adequate recovery periods during the growing season, and/or annual, early spring seasonal grazing. Lack of litter and reduced plant heights result in higher soil temperatures, poor water infiltration rates, high evapotranspiration, and increased percolation of the high water table, which increases salt concentrations on the surface. This gives inland saltgrass and other salt-tolerant species a competitive advantage over species that are less tolerant to salt. Nuttall's alkaligrass, slender wheatgrass, prairie cordgrass, and alkali cordgrass have decreased, while western wheatgrass and inland saltgrass will initially increase in composition. Mat muhly, foxtail barley, silverleaf cinquefoil, dock, and plantain will also increase in composition. As long as the herbaceous component remains intact, the plant community tends to be resilient. However, species composition can be further altered through long-term heavy, continuous grazing. With loss of Nuttall alkaligrass, cordgrasses, slender wheatgrass, and much of the western wheatgrass, inland saltgrass will eventually become the dominant species. This plant community is relatively stable and well adapted to increased salinity. Plant vigor, litter, plant density, and production have decreased. The biological integrity and water and nutrient cycles of this plant community are becoming impaired.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1894	2451	2707
Forb	123	280	499
Shrub/Vine	–	71	157
Total	**2017**	**2802**	**3363**

Figure 11. Plant community growth curve (percent production by month). SD6307, 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

Community 1.3
Wheatgrass-Alkaligrass

This plant community occurs in the absence of fire, and non-use, or extended periods of drought, or a loss in hydrologic function, resulting in a drier site. Plant composition is similar to Community Phase 1.1; however, individual species production and frequency will be lower. Much of the nutrients are tied up in excessive litter. The nutrient cycle is slowed due to standing dead plant residues not in contact with a moist soil surface. Above-ground litter also limits sunlight from reaching plant crowns. Tall warm-season grasses (cordgrasses) die off or are reduced in density and vigor, and typically develop into small but dense colonies. Thick litter and absence of grazing animals

(animal impact) or fire reduces seed germination and establishment. This plant community is resistant to change without prescribed grazing, fire, or a return of the hydrologic function. Soil erosion is low and runoff is virtually unchanged.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2287	3009	3463
Forb	151	252	387
Shrub/Vine	28	101	185
Total	**2466**	**3362**	**4035**

Figure 13. Plant community growth curve (percent production by month). SD6306, 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

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing (stocking rates well above capacity for extended portions of the growing season without adequate recovery) or heavy seasonal grazing (stocking rates well above capacity for a portion of the growing season, but at the same time of year every year and without adequate recovery) will shift the plant community phase to the Wheatgrass-Foxtail Barley-Inland Saltgrass Plant Community (1.2). In pre-European settlement times, this transition would have occurred following multiple disturbances such as extended periods of below-average precipitation followed by heavy concentrations of large ungulate herbivory.

Pathway 1.1B
Community 1.1 to 1.3

No fire and non-use for extended periods of time resulting in a buildup of litter, or extended periods of drought, and/or a loss in hydrologic function will result in a decline in cordgrass and shift to the Wheatgrass-Alkaligrass Plant Community (1.3).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing (moderate stocking levels with adequate recovery between grazing events) and possibly prescribed burning, and/or a return of hydrologic function and normal precipitation patterns, will allow prairie cordgrasses and Nuttall’s alkaligrass to increase in vigor and production, and will cause a shift back to the Cordgrass-Wheatgrass-Alkaligrass Plat Community (1.1). In pre-European settlement times, this would have occurred where light to moderate disturbances from large ungulates occurred sporadically.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A 1.3B
Community 1.3 to 1.1

1.3A) Prescribed grazing (stocking levels which match the animals to the forage resource and allow adequate recovery periods between grazing events) coupled with prescribed burning (typically spring burning, but fall burning may also be effective) is the most effective method of prompting this shift to the Cordgrass-Wheatgrass-Alkaligrass

Plant Community (1.1). A return to normal precipitation patterns will also expedite this shift in plant communities. 1.3B) Heavy, continuous grazing (stocking rates well above capacity for extended portions of the growing season without adequate recovery) or heavy seasonal grazing (stocking rates well above capacity for a portion of the growing season, but at the same time of year every year and without adequate recovery) will shift the plant community phase to the Wheatgrass-Foxtail Barley-Inland Saltgrass Plant Community (1.2). Extended periods of drought and/or the loss of hydrologic function, making this site much drier, will also shift this plant community to the Wheatgrass-Foxtail Barley-Inland Saltgrass Plant Community (1.2).

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Degraded State

This State is characterized by the dominance of the shorter-statured, more saline-tolerant species such as foxtail barley and inland saltgrass, the increase in bare ground, and the increased presence of salt accumulations on the soil surface. Infiltration is reduced, which allows the moisture and the salts carried by the moisture to be wicked up to the soil surface. The short-statured and shallow-rooted species are more capable of withstanding the higher concentrations of salts in the soil surface. As the disturbance level increases, plant density decreases even more, giving way to annual species and invasive perennial species, as well as a further increase in bare ground.

Community 2.1
Foxtail Barley-Inland Saltgrass/Bare Ground

This plant community developed with heavy, continuous season-long grazing where adequate recovery periods between grazing events were not allowed. Patches of inland saltgrass sod are typical and foxtail barley is well distributed throughout the community. Nuttall’s alkaligrass and western wheatgrass have been greatly reduced and may persist in remnant amounts and reduced in vigor. Bare ground may develop in microlows where salt concentrations are highest. A white salt crust is common on the surface. Only a few very salt-tolerant annuals, such as silverscale saltbush and seepweed, can survive. This plant community is resistant to change due to the grazing tolerance of inland saltgrass and increased surface salts. A significant amount of production and diversity has been lost when compared to Community Phase 1.1. Loss of key cool-season grasses and increased bare ground have negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the shallow rooting depth of inland saltgrass and the increased bare ground.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	958	1417	1564
Forb	163	359	639
Shrub/Vine	–	18	39
Total	**1121**	**1794**	**2242**

Figure 15. Plant community growth curve (percent production by month). SD6308, Pierre Shale Plains, lowland cool-season/warm-season codominant. Cool-season, warm-season codominant, 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 2.2
Annual and Pioneer Perennial/Bare Ground

This plant community develops under severe disturbance and/or excessive defoliation. This can result from heavy

livestock or wildlife concentration and cropping abandonment (“go-back land”). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include foxtail barley, which will dominate along with plains bluegrass, Nuttall’s alkaligrass, annual brome, and western wheatgrass. The dominant forbs include kochia, curly dock, and other early successional salt-tolerant species. Plant species from adjacent sites may become minor components of this plant community. The community is susceptible to invasion of non-native species due to severe soil disturbances and relatively high percentage of bare ground. This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persists, thus holding back secondary plant succession. The hazard of soil erosion is potentially high in this plant community. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates. Significant economic inputs, management, and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the production capability, but management changes would be needed to maintain the new plant community. Due to the highly variable nature of the plant community that may exist, no growth curve has been assigned.

Pathway 2.1A
Community 2.1 to 2.2

Heavy disturbance such as concentrated livestock areas (e.g., watering sources, calving or feeding areas) or tillage and cropping abandonment will cause any plant community of this MLRA to shift to the Annual and Pioneer Perennial/*Bare Ground* Plant Community (2.2). Attempts to crop these areas often fail, resulting in bare ground and weedy species such as kochia.

Pathway 2.2A
Community 2.2 to 2.1

This pathway occurs with the passage of time following the removal of the management-induced disturbance. Successional processes will take place and native plant species will gradually begin to establish on the site again.

Transition T1A
State 1 to 2

T1A) Heavy, continuous season-long grazing (stocking levels well above recommended rates, for the entire growing season or for extended portions of the growing season without adequate recovery periods) will cause this site to cross a threshold leading to the Degraded State (2.0). Grazing pressure and physical impacts of livestock on the soil surface, including soil compaction, will alter the Reference Plant Communities. The less grazing-tolerant/more palatable plant species are reduced, while the grazing-tolerant species increase. Physical impacts result in increased bare ground which increases surface salinity and further enhances the salt-tolerant species. The physical impacts (i.e., compaction) are greater when the soil surface is wet from short-term flooding events.

Transition T3A
State 1 to 2

Heavy disturbance such as concentrated livestock areas (e.g., watering sources, calving or feeding areas) or tillage and cropping abandonment will cause any plant community to shift to the Annual and Pioneer Perennial/*Bare Ground* Plant Community (2.2). Attempts to crop these areas often fail, resulting in bare ground and weedy species such as kochia.

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	**Warm-Season Grasses**			588–1373	
	alkali cordgrass	SPGR	*Spartina gracilis*	196–1177	

	alkali cordgrass	SPGR	*Spartina gracilis*	196–1177	–
	prairie cordgrass	SPPE	*Spartina pectinata*	196–1177	–
	alkali sacaton	SPAI	*Sporobolus airoides*	78–392	–
	switchgrass	PAVI2	*Panicum virgatum*	0–196	–
2	**Wheatgrass**			392–981	
	western wheatgrass	PASM	*Pascopyrum smithii*	196–785	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	196–588	–
3	**Cool-Season Grasses**			392–785	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	392–785	–
	foxtail barley	HOJU	*Hordeum jubatum*	39–196	–
	plains bluegrass	POAR3	*Poa arida*	39–196	–
4	**Short-Warm Season Grasses**			118–392	
	saltgrass	DISP	*Distichlis spicata*	78–392	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	39–118	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–118	–
5	**Grass-Likes**			196–588	
	sedge	CAREX	*Carex*	78–392	–
	spikerush	ELEOC	*Eleocharis*	39–196	–
	rush	JUNCU	*Juncus*	39–196	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–118	–
Forb					
6	**Forbs**			0–39	
	Forb, native	2FN	*Forb, native*	39–157	–
	aster	ASTER	*Aster*	39–118	–
	annual marsh elder	IVAN2	*Iva annua*	0–118	–
	redwool plantain	PLER	*Plantago eriopoda*	39–78	–
	silver cinquefoil	POAR8	*Potentilla argentea*	39–78	–
	western dock	RUAQ	*Rumex aquaticus*	39–78	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	39–78	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	39–78	–
	lambsquarters	CHAL7	*Chenopodium album*	39–78	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	39–78	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–78	–
	Carelessweed	CYXA2	*Cyclachaena xanthiifolia*	0–78	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–39	–
	silverscale saltbush	ATAR2	*Atriplex argentea*	0–39	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–39	–
Shrub/Vine					
7	**Shrubs**			39–196	
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–157	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–157	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–118	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Grasses**			0–280	
	alkali cordgrass	SPGR	*Spartina gracilis*	0–280	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–280	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–140	–
2	**Wheatgrass**			420–841	
	western wheatgrass	PASM	*Pascopyrum smithii*	420–841	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–280	–
3	**Cool-Season Grasses**			140–701	
	foxtail barley	HOJU	*Hordeum jubatum*	140–420	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–280	–
	plains bluegrass	POAR3	*Poa arida*	28–224	–
4	**Short Warm-Season Grasses**			140–560	
	saltgrass	DISP	*Distichlis spicata*	140–560	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	28–168	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–140	–
5	**Grass-Likes**			140–420	
	spikerush	ELEOC	*Eleocharis*	28–224	–
	sedge	CAREX	*Carex*	28–196	–
	rush	JUNCU	*Juncus*	28–140	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–84	–
Forb					
6	**Forbs**			140–420	
	Forb, introduced	2FI	*Forb, introduced*	0–140	–
	Forb, native	2FN	*Forb, native*	28–140	–
	lambsquarters	CHAL7	*Chenopodium album*	28–84	–
	aster	ASTER	*Aster*	28–84	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	28–84	–
	cocklebur	XANTH2	*Xanthium*	0–56	–
	curly dock	RUCR	*Rumex crispus*	0–56	–
	burningbush	BASC5	*Bassia scoparia*	0–56	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–56	–
	povertyweed	IVAX	*Iva axillaris*	0–56	–
	prickly lettuce	LASE	*Lactuca serriola*	0–56	–
	redwool plantain	PLER	*Plantago eriopoda*	28–56	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	28–56	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	28–56	–
	redroot amaranth	AMRE	*Amaranthus retroflexus*	0–56	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–28	–
	Carelessweed	CYXA2	*Cyclachaena xanthiifolia*	0–28	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–28	–
	western dock	RUAQ	*Rumex aquaticus*	0–28	–
	annual marsh elder	IVAN2	*Iva annua*	0–28	–

	silverscale saltbush	ATAR2	*Atriplex argentea*	0–28	–
	red swampfire	SARU	*Salicornia rubra*	0–28	–
Shrub/Vine					
7	**Shrubs**			0–140	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–140	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–112	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–28	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Grasses**			168–504	
	alkali cordgrass	SPGR	*Spartina gracilis*	67–504	–
	prairie cordgrass	SPPE	*Spartina pectinata*	67–504	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–101	–
	switchgrass	PAVI2	*Panicum virgatum*	0–67	–
2	**Wheatgrass**			673–1177	
	western wheatgrass	PASM	*Pascopyrum smithii*	504–1009	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	168–673	–
3	**Cool-Season Grasses**			336–841	
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	336–841	–
	plains bluegrass	POAR3	*Poa arida*	34–168	–
	foxtail barley	HOJU	*Hordeum jubatum*	34–101	–
4	**Short Warm-Season Grasses**			34–168	
	saltgrass	DISP	*Distichlis spicata*	34–168	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	34–67	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–67	–
5	**Grass-Likes**			336–673	
	spikerush	ELEOC	*Eleocharis*	67–404	–
	sedge	CAREX	*Carex*	67–336	–
	rush	JUNCU	*Juncus*	34–168	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–101	–
Forb					
6	**Forbs**			168–336	
	Forb, introduced	2FI	*Forb, introduced*	0–135	–
	aster	ASTER	*Aster*	34–135	–
	Forb, native	2FN	*Forb, native*	34–101	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	34–101	–
	lambsquarters	CHAL7	*Chenopodium album*	34–67	–
	Flodman's thistle	CIFL	*Cirsium flodmanii*	0–67	–
	Carelessweed	CYXA2	*Cyclachaena xanthiifolia*	0–67	–
	annual marsh elder	IVAN2	*Iva annua*	0–67	–
	western dock	RUAQ	*Rumex aquaticus*	0–67	–
	curly dock	RUCR	*Rumex crispus*	0–67	–

	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–34	–
	cocklebur	XANTH2	*Xanthium*	0–34	–
	povertyweed	IVAX	*Iva axillaris*	0–34	–
	prickly lettuce	LASE	*Lactuca serriola*	0–34	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–34	–
	redwool plantain	PLER	*Plantago eriopoda*	0–34	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–34	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–34	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–34	–
	silverscale saltbush	ATAR2	*Atriplex argentea*	0–34	–
Shrub/Vine					
7	**Shrubs**			34–168	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–168	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–168	–
	Gardner's saltbush	ATGA	*Atriplex gardneri*	0–67	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
2	**Wheatgrass**			0–179	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–179	–
3	**Cool-Season Grasses**			269–807	
	foxtail barley	HOJU	*Hordeum jubatum*	269–807	–
	plains bluegrass	POAR3	*Poa arida*	0–90	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–90	–
4	**Short Warm-Season Grasses**			179–538	
	saltgrass	DISP	*Distichlis spicata*	179–538	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	18–90	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–90	–
5	**Grass-Likes**			18–90	
	spikerush	ELEOC	*Eleocharis*	18–90	–
	rush	JUNCU	*Juncus*	0–72	–
	sedge	CAREX	*Carex*	0–54	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–36	–
Forb					
6	**Forbs**			179–538	
	burningbush	BASC5	*Bassia scoparia*	36–448	–
	Forb, introduced	2FI	*Forb, introduced*	0–179	–
	curly dock	RUCR	*Rumex crispus*	18–179	–
	cocklebur	XANTH2	*Xanthium*	0–179	–
	redroot amaranth	AMRE	*Amaranthus retroflexus*	0–143	–
	prickly lettuce	LASE	*Lactuca serriola*	0–90	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	18–90	–
	povertyweed	IVAX	*Iva axillaris*	0–54	–
	lambsquarters	CHAL7	*Chenopodium album*	18–54	–
	Forb, native	2FN	*Forb, native*	0–54	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–36	–
	aster	ASTER	*Aster*	0–36	–
	silverscale saltbush	ATAR2	*Atriplex argentea*	0–36	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–36	–
	red swampfire	SARU	*Salicornia rubra*	0–36	–
Shrub/Vine					
7	**Shrubs**			0–36	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–36	–

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 ESD).

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.

The following stocking rates are based on 912 lbs./acre (air-dry weight) per Animal-Unit-Month (AUM), with a 25 percent harvest efficiency of preferred and desirable forage species. An AUM is defined as the equivalent amount of forage required by a 1,000 pound cow with calf up to 6 months of age for one month (refer to USDA NRCS, National Range and Pasture Handbook).

Plant Community: Cordgrass-Wheatgrass-Alkaligrass (1.1)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate (AUM/acre): 0.96

Plant Community: Wheatgrass-Foxtail Barley-Inland Saltgrass (1.2)
Average Annual Production (lbs./acre, air-dry): 2,500
Stocking Rate (AUM/acre): 0.69

Plant Community: Wheatgrass-Alkaligrass (1.3)
Average Annual Production (lbs./acre, air-dry): 3,000
Stocking Rate (AUM/acre): 0.82

Plant Community: Foxtail Barley-Inland Saltgrass/*Bare Ground* (2.1)
Average Annual Production (lbs./acre, air-dry): 1,600
Stocking Rate (AUM/acre): 0.44

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 forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is slow and runoff potential for this site is high. In many cases, areas with greater than 75 percent ground cover have the greatest potential for higher infiltration and lower runoff. An example of an exception would be an area where shortgrasses form a strong sod and dominate the site.
Dominance by inland saltgrass 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

No appreciable wood products are typically present on 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 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 toward an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is necessary 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 required 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 include: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Rick Peterson, RMS, NRCS; and Dana Larsen, RMS, NRCS.

Other references

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Editorial Review by Carla Green Adams.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	02/20/2009
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground normally less than 10 percent. Some slickspots may be associated with this site, and are not a part of this site. These slickspots will have higher amounts of bare ground and salt crusting.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Litter falls in place.

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 typically 3 or greater. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure at least for short periods when dipped in distilled water. Some fragments will dissolbe in less than 1 minute.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface horizon is a dark gray E-horizon (leached). Structure is platy parting to fine granular.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep rooted species (mid and tall rhizomatous cool- and warm-season grasses and grass-likes) 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 or pan-like, 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: Tall and mid, warm-season grasses >

    Sub-dominant: Mid, cool-season rhizomatous grasses > mid, cool-season bunchgrasses > grass-like species >

Other: Short, warm-season grasses > forbs > shrubs

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.

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14. **Average percent litter cover (%) and depth (in):** About 50 to 70 percent litter cover, litter in contact with soil surface. Depth of litter is about 0.25 to 0.5 inches.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 2,700 pounds/acre to 4,300 pounds/acre, with the reference value 3,500 pounds/acre (air-dry basis).

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

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17. **Perennial plant reproductive capability:** Perennial grasses and grass-likes should have vigorous rhizomes or tillers.
