USDA Natural Resources Conservation Service

Ecological site R053CY015SD
Thin Claypan

Last updated: 1/22/2024
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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.

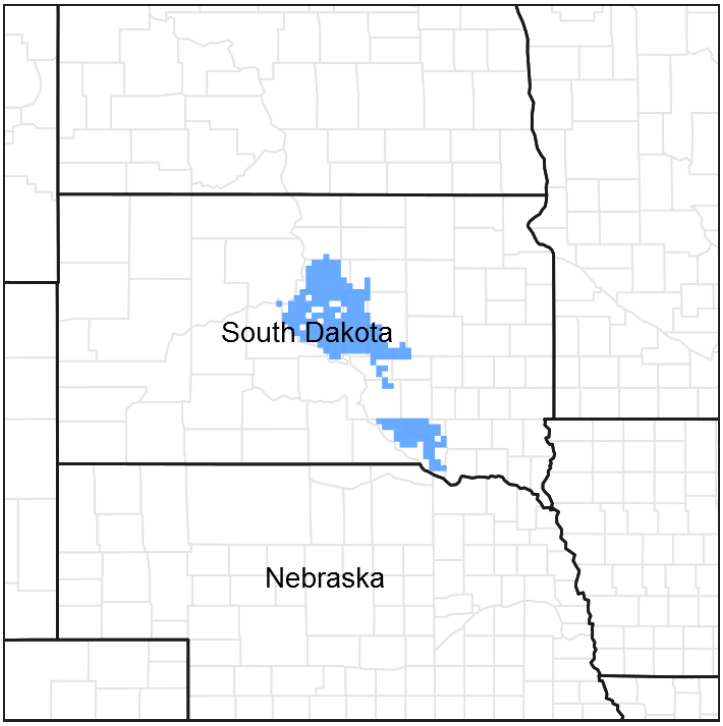


Figure 1. Mapped extent

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): 053C–Southern Dark Brown Glaciated Plains

The Southern Dark Brown Glaciated Plains (53C) is located within the Northern Great Plains Region. It is entirely in South Dakota encompassing about 3,990 square miles

(Figure 1). The elevation ranges from 1,300 to 2,300 feet. The MLRA is level to gently rolling till plains including many areas of potholes. A terminal moraine occurs in the southern end of the MLRA. Moderately steep and steep slopes are adjacent to the major valleys. The headwaters of many creeks in central South Dakota occur in the high-lying MLRA. (USDA-NRCS 2006).

The dominant soil orders in this MLRA are Mollisols and Inceptisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained, or moderately well drained, and are loamy or clayey. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), big bluestem (Andropogon gerardii), needleandthread (Hesperostipa comata), and green needlegrass (Nassella viridula), Little bluestem (Schizachyrium scoparium), sideoats grama (Bouteloua curtipendula), and prairie sandreed (Calamovilfa longifolia) are important species on steeper sites. Western snowberry (Symphoricarpos occidentalis) and prairie rose (Rosa arkansana) are commonly dispersed throughout the area. (USDA-NRCS 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Dark Brown Glaciated Plains (53C) (USDA-NRCS 2006)

USFS Subregions: Northeastern Glaciated Plains Section (331E); Missouri Coteau Subsection (331Ea); Western Great Plains Section (331F); Missouri Breaks Subsection (331Fe); Western Glaciated Plains Section (332B); Southern Missouri Coteau Slope Subsection (332Bd, 332Be); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al. 2007).

US EPA Level IV Ecoregion: Missouri Coteau (42a); Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f) - (USEPA 2013)

Ecological site concept

The Thin Claypan ecological site occurs in micro-lows on a nearly level landscape. Soils are moderately well drained which have a claypan (columnar structure) within 6 inches of the soil surface. The natric horizon in the subsoil typically has a Sodium Absorption Ratio (SAR) greater than 13 and an Exchangeable Sodium Percentage (ESP) greater than 15. The root restriction of the Natric horizon limits plant growth, production is lower, and species composition will tend towards shallow rooted and more tolerant of the higher sodium levels. Slopes can range from 0 to 2 percent.

Vegetation in the Reference State is co-dominated by cool and warm season grasses including western wheatgrass and blue grama. Common forbs include scarlet globemallow, cudweed sagewort, and woolly Indianwheat. Non-native grasses such as

Kentucky bluegrass may invade due to shifts in disturbance regime.

Associated sites

R053CY011SD	**Clayey** These sites occur on upland areas. The soils are well drained and have greater than 40 percent clay in the surface and subsoil. The central concept soil series are Demky, Oko, and Raber, but other series are included.
R053CY013SD	**Claypan** These sites occur on upland areas. The soils are moderately well drained and have a claypan (columnar structure) within 16 inches, but greater than 6 inches of the soil surface. The central concept soil series are Cavo and DeGrey, but other series are included.
R053CY010SD	**Loamy** These sites occur on upland areas. The soils are well drained and have less than 40 percent clay in the surface and subsoil. The central concept soil series are Agar, Eakin, Glenham, and Highmore, but other series are included.

Similar sites

R053CY013SD	**Claypan** The Claypan site occurs in a similar landscape position but does not have a claypan (columnar structure) within 6 inches of the soil surface. The vegetative community has more green needlegrass, less blue grama, and higher production)

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Bouteloua gracilis*

Physiographic features

This site occurs on nearly level to gently undulating or rolling sedimentary uplands

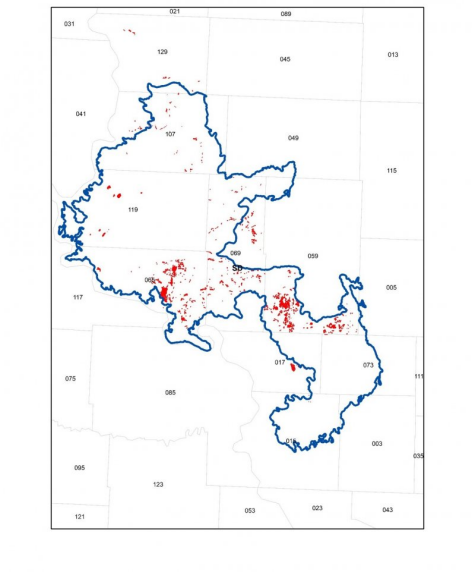


Figure 2. Distribution map

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Till plain
Flooding frequency	None
Ponding frequency	None
Elevation	1,300–2,300 ft
Slope	1–4%
Water table depth	30–60 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 53C is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much 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 15 to 25 inches per year. The average annual temperature is about 45°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, South Dakota (SD)), to about 16°F (Onida 4 NW, SD). July is the warmest month with temperatures averaging from about 72°F (Stephan, SD), to about 74°F (Onida 4 NW, 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 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about

11 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. Greenup 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)	107-127 days
Freeze-free period (characteristic range)	128-150 days
Precipitation total (characteristic range)	20-21 in
Frost-free period (actual range)	104-129 days
Freeze-free period (actual range)	127-159 days
Precipitation total (actual range)	19-24 in
Frost-free period (average)	117 days
Freeze-free period (average)	139 days
Precipitation total (average)	21 in

Climate stations used

- (1) GETTYSBURG 13W [USC00393302], Gettysburg, SD
- (2) GETTYSBURG [USC00393294], Gettysburg, SD
- (3) HIGHMORE 23 N [USC00393838], Highmore, SD
- (4) ONIDA 4 NW [USC00396292], Onida, SD
- (5) PIERRE RGNL AP [USW00024025], Pierre, SD
- (6) HARROLD 12 SSW [USC00393608], Pierre, SD
- (7) STEPHAN 2 NW [USC00397992], Highmore, SD
- (8) WESSINGTON SPRINGS [USC00399070], Wessington Springs, SD

Influencing water features

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

Soil features

The Thin Claypan site occurs in micro-lows on a nearly level landscape. The common features of soils in this site are the clay loam to clay textured subsoils and slopes of one to four percent. Soils are moderately well drained which have a claypan (columnar structure)

within 6 inches of the soil surface. The central concept soil series is Jerauld. The extremely hard clayey Btn horizon has round-topped or “bun shaped” columnar or prismatic structured subsoil. These Btn horizons are high in sodium. The soils have a very slow infiltration rate. Wet surface compaction can occur with heavy traffic. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. The soil surface is stable and intact.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetation is removed or severely disturbed. Loss of 30 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production.

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

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained
Permeability class	Very slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–25
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The site which is located in the Southern Dark Brown Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

Continuous season-long grazing (during the typical growing season of May through October) and repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following grazing events causes departure from the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase. Blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needleandthread, and sideoats grama, will decrease in frequency and production. Extended periods of nonuse and lack of fire will result in excessive litter and a plant community strongly influenced by cool-season grasses such as Kentucky bluegrass (*Poa pratensis*), green needlegrass, and cheatgrass (*Bromus tectorum*).

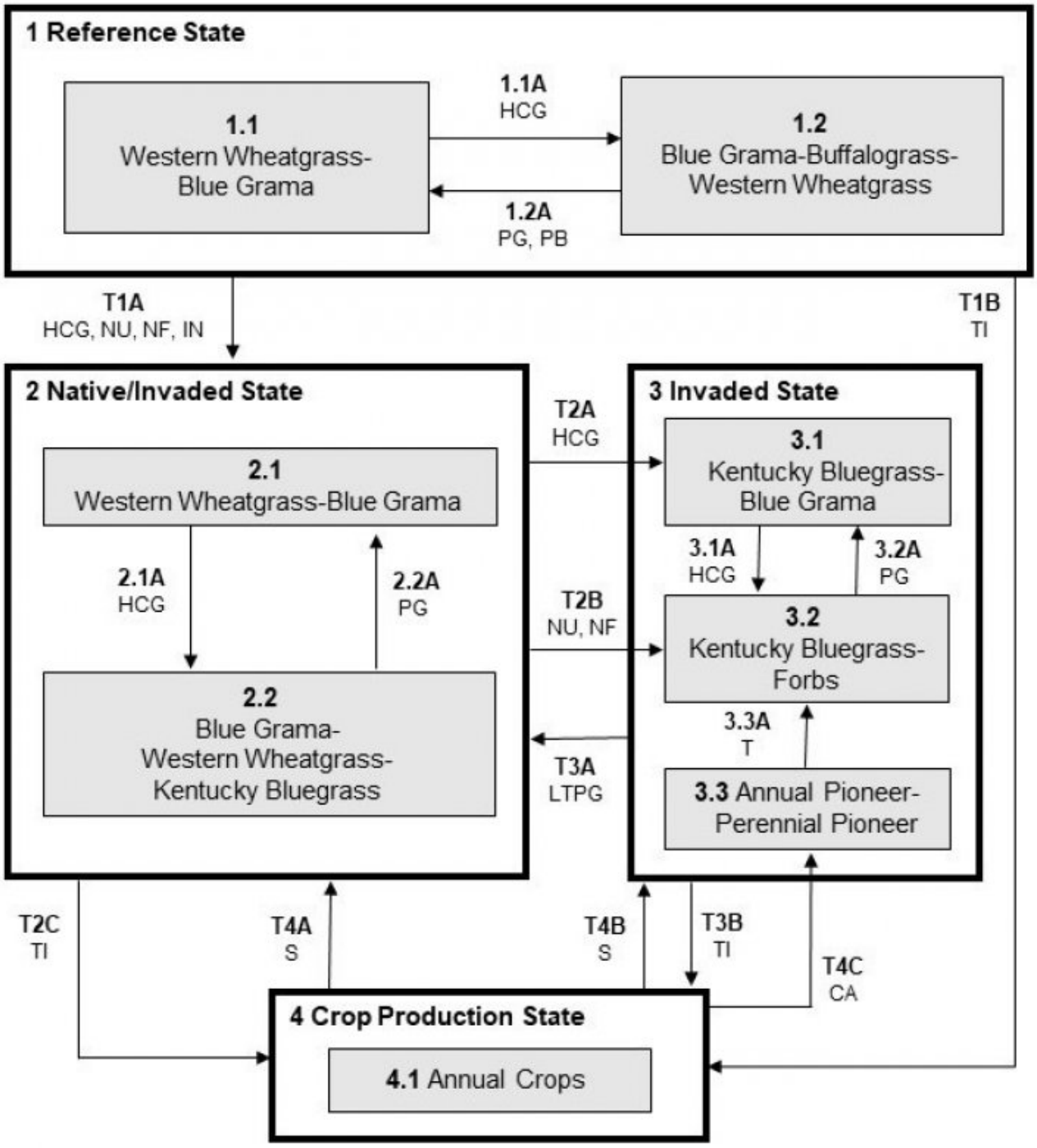
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states and community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

The vegetative pie charts may not add up to 100 percent due to internal rounding errors.

State and transition model

Thin Claypan – R053CY015SD



LEGEND

Thin Claypan – R053CY015SD

CA – Cropped and abandoned
HCG – Heavy continuous grazing
IN – Invasion
LTPG – Long-term prescribed grazing
NU – Non-use
NF – No fire
PB – Prescribed burning
PG – Prescribed grazing
S – Seeding
T – Time w/wo disturbances
TI – Tillage

Figure 9. State-And-Transition model

Code	Process
T1A	Heavy continuous grazing, no use, no fire, invasion
T1B	Tillage
T2A	Heavy continuous grazing
T2B	Non-use, no fire
T2C	Tillage
T3A	Long term prescribed grazing
T3B	Tillage
T4A	Seeding
T4B	Seeding
T4C	Abandonment of cropping
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing with recovery periods, prescribed burning
2.1A	Heavy continuous grazing
2.2A	Prescribed grazing with recovery periods
3.1A	Heavy continuous grazing
3.2A	Prescribed grazing with recovery periods
3.3A	Time w/wo disturbances

Figure 10. Matrix

State 1
Reference State

This state represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is dominated by cool-season grasses with warm-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included precipitation cycles and grazing by large herding ungulates. Timing of grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this state can be found on areas that are properly managed with grazing and sometimes on areas receiving occasional short periods of rest. Cool-season species can decline and a corresponding increase in short, warm-season grasses will occur.

Community 1.1
Western Wheatgrass-Blue Grama

Interpretations are based primarily on the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase. This plant community evolved with grazing by large herbivores and variations in precipitation cycles and can be maintained with prescribed grazing or by occasional short periods of rest or deferment. The potential vegetation is about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. Cool-season grasses and warm-season grasses co-dominate the site. The major grasses include western wheatgrass and blue grama. Other grasses and grass-likes occurring on this site include buffalograss (*Bouteloua dactyloides*), inland saltgrass (*Distichlis spicata*), needleandthread, and sedge (Carex). The dominant forbs include scarlet globemallow (*Sphaeralcea coccinea*), white sagebrush (*Artemisia ludoviciana*), heath aster

(symphyotrichum ericoides), and woolly Indianwheat (*Plantago patagonica*). Shrubs that can occur in this plant community are brittle cactus (*Opuntia fragilis*), saltbush (Atriplex), and plains pricklypear (*Opuntia polyacantha*). 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 at the sites potential. Plant litter is properly distributed with some movement offsite and natural plant mortality is low. Low to moderate available water capacity coupled with high accumulations of sodium and slow permeability strongly influences the soil-water-plant relationships.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	680	1105	1510
Shrub/Vine	60	97	145
Forb	60	98	145
Total	**800**	**1300**	**1800**

Figure 12. Plant community growth curve (percent production by month). SD5303, Southern Dark Brown Glaciated Plains, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 1.2
Blue Grama-Buffalograss-Western Wheatgrass

This plant community can develop from the adverse effects of heavy continuous seasonal grazing. Short grasses tend to increase to dominate the site and annual production decreases dramatically. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and high evaporation, 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, buffalograss, and western wheatgrass are the dominant species. Other grasses and grass-likes occurring include Sandberg bluegrass (*Poa secunda*), sedge, and sometimes annual grasses. Forbs such as white sagebrush, scarlet globemallow, and woolly Indianwheat may also be present. Some nonnative species will begin to invade this plant community including western salsify (*Tragopogon dubius*), sweet clover (*Melilotus officinalis*), and cheatgrass (*Bromus tectorum*). This plant community is quite resilient. The thick sod and competitive advantage prevent other species from establishing. This plant community is less productive than the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase. Runoff increases and infiltration will

decrease. Soil erosion will be minimal due to the sod forming habit of blue grama.

Figure 14. Plant community growth curve (percent production by month). SD5304, Southern Dark Brown Glaciated Plains, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

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

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Blue Grama-Buffalograss-Western Wheatgrass Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, and prescribed burning occurring at relatively frequent intervals (3 to 5 years) and a return to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest converts this plant community to the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase.

Conservation practices

Prescribed Grazing

State 2
Native/Invaded State

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by cool-season and warm-season grasses. It can be found on areas that are properly managed with grazing and prescribed burning, and sometimes on areas receiving occasional short periods of rest. Taller warm-season species can decline and a corresponding increase in short statured grass will occur.

Community 2.1
Annual/Pioneer Perennial Plant

This plant community developed under prolonged heavy continuous grazing, prolonged

inundation, or abandonment after cropping. The potential plant community is highly variable often made up of annual introduced forbs and sometimes being almost devoid of vegetation. Plant diversity is low. The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank) within the existing plant community and the plant communities on adjacent sites.

Community 2.2
Blue Grama-Western Wheatgrass-Kentucky Bluegrass

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. Dominant grass and grass-like species include western wheatgrass, blue grama, and inland saltgrass with minor amounts of Kentucky bluegrass. Grass and grass-like species of secondary importance include needleandthread, buffalograss, tumblegrass (*Schedonnardus paniculatus*), and sedge. Forbs commonly found in this plant community included white sagebrush, prairie coneflower (*Ratibida columnifera*), and western yarrow. When compared to the 1.1 Western Wheatgrass-Blue Grama Plant Community Phase, blue grama and inland saltgrass have increased and Kentucky bluegrass has invaded. Needleandthread and prairie junegrass production has been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. The increase of shorter-statured, more compact rooted species will result in somewhat higher runoff and decreased infiltration. This will cause the site to become drier. These species will also be more competitive.

Pathway 2.1A
Community 2.1 to 2.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 2.2 Blue Grama-Western Wheatgrass-Kentucky Bluegrass Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 2.1 Western Wheatgrass-Blue Grama Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

State 3
Invaded State

This state is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early greenup and increased moisture and humidity at the soil surface, and grazing pressure cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases and energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominant species.

Community 3.1
Kentucky Bluegrass-Blue Grama

This plant community phase is a result of heavy continuous grazing. It is characterized by a dominance of very grazing tolerant species such as Kentucky bluegrass, inland saltgrass, blue grama, sedges, and forbs. The dominance is at times so complete that other species are difficult to find on the site. Nutrient cycling is greatly reduced, and mid-statured native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in the phase.

Community 3.2
Kentucky Bluegrass-Forbs

This plant community phase is a result of heavy continuous grazing or extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and forbs. Smooth bromegrass may also be present on the site. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface and eventually a thatch-mat layer may develop. Nutrient cycling is greatly reduced and native plants have a difficulty becoming established. When dominated by Kentucky bluegrass, infiltration is greatly reduced and

runoff is high. Production in this case will be significantly less than the interpretive plant community. The period that forage palatability is high is relatively short. Energy capture is also reduced due to the shorter active growth period and lack of warm season plant diversity.

Community 3.3
Annual Pioneer-Perennial Pioneer

This plant community developed under continuous heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include nonnative invasive and early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

Pathway 3.1A
Community 3.1 to 3.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites and no surface fire for extended periods of time (typically for 10 years or more) causing litter levels to become high enough to reduce native grass vigor, diversity, and density will shift this community to the 3.2 Kentucky Bluegrass-Forbs Plant Community Phase.

Pathway 3.2A
Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the 3.1 Kentucky Bluegrass-Blue Grama Plant Community Phase.

Pathway 3.3A
Community 3.3 to 3.2

This community pathway occurs with the passage of time as successional processes take

place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 3.2 Kentucky Bluegrass-Forbs Plant Community Phase.

State 4
Crop Production State

This state is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices.

Community 4.1
Annual Crops

This plant community developed with the use of a variety of tillage systems and cropping systems for the production of annual crops including corn, soybeans, wheat, and a variety of other crops.

Transition T1A
State 1 to 2

Non-use and no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, or heavy continuous grazing or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

Transition T1B
State 1 to 4

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Transition T2A, T2B
State 2 to 3

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year), will likely lead this state over a threshold leading to the 3.1 Kentucky Bluegrass-Blue Grama Plant Community Phase within the Invaded State (State 3). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling. Non-use and no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will likely lead this state over a threshold leading to the 3.2 Kentucky Bluegrass-Forbs Plant Community Phase within the Invaded State (State 3).

Transition T2C

State 2 to 4

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Restoration pathway T3A
State 3 to 2

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this Invaded State (State 3) over a threshold to the Native/Invaded State (State 2).

Transition T3B
State 3 to 4

Tillage will cause a shift over a threshold leading to the 4.1 Annual Crops Plant Community Phase within the Crop Production State (State 4).

Restoration pathway T4A
State 4 to 2

T4A – Seeding may lead this Crop Production State (State 4) over a threshold to the Native/Invaded State (State 2).

Restoration pathway T4B, T4C
State 4 to 3

Seeding may lead this Crop Production State (State 4) over a threshold to the Invaded State Cropping followed by abandonment may lead this plant community phase over a threshold to the 3.3 Annual Pioneer- Perennial Pioneer Plant Community Phase within the Invaded State (State 3).

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			325–585	
	western wheatgrass	PASM	*Pascopyrum smithii*	325–585	–
2	**Short Warm-Season Grasses**			260–455	
	blue grama	BOGR2	*Bouteloua gracilis*	195–325	–

	saltgrass	DISP	*Distichlis spicata*	26–195	–
	buffalograss	BODA2	*Bouteloua dactyloides*	26–195	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–65	–
3	**Needlegrass**			26–130	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	26–130	–
	green needlegrass	NAVI4	*Nassella viridula*	0–91	–
4	**Mid Warm-Season Grasses**			0–65	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–65	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–65	–
5	**Other Native Grasses**			26–65	
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–65	–
	Sandberg bluegrass	POSE	*Poa secunda*	13–39	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–39	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–13	–
6	**Grass-likes**			26–130	
	needleleaf sedge	CADU6	*Carex duriuscula*	13–104	–
	threadleaf sedge	CAFI	*Carex filifolia*	13–65	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–39	–
Forb					
7	**Forbs**			65–130	
	Forb, native	2FN	*Forb, native*	13–39	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–39	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	13–26	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–26	–
	pussytoes	ANTEN	*Antennaria*	13–26	–
	field sagewort	ARCA12	*Artemisia campestris*	0–26	–
	desertparsley	LOMAT	*Lomatium*	0–26	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–26	–
	spiny phlox	PHHO	*Phlox hoodii*	13–26	–
	woolly plantain	PLPA2	*Plantago patagonica*	13–26	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	13–26	–

	slimflower scurfpea	PSTE5	*Pediomelum tenuiflorum*	13–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	13–26	–
	white heath aster	SYER	*Symphyotrichum ericoides*	13–26	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–13	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–13	–
	textile onion	ALTE	*Allium textile*	0–13	–
	povertyweed	IVAX	*Iva axillaris*	0–13	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–13	–
Shrub/Vine					
8	**Shrubs**			65–130	
	prairie sagewort	ARFR4	*Artemisia frigida*	13–52	–
	saltbush	ATRIP	*Atriplex*	0–39	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–26	–
	brittle pricklypear	OPFR	*Opuntia fragilis*	13–26	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	13–26	–
	rose	ROSA5	*Rosa*	13–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–13	–

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			90–180	
	western wheatgrass	PASM	*Pascopyrum smithii*	90–180	–
2	**Short Warm-Season Grasses**			270–450	
	blue grama	BOGR2	*Bouteloua gracilis*	180–360	–
	buffalograss	BODA2	*Bouteloua dactyloides*	45–225	–
	saltgrass	DISP	*Distichlis spicata*	18–180	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–72	–
3	**Needlegrass**			0–45	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	green needlegrass	NAVI4	*Nassella viridula*	0–18	–
4	**Other Native Grasses**			18–45	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–36	–
	Sandberg bluegrass	POSE	*Poa secunda*	9–36	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–27	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–18	–
5	**Grass-likes**			45–135	
	needleleaf sedge	CADU6	*Carex duriuscula*	18–90	–
	threadleaf sedge	CAFI	*Carex filifolia*	9–63	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–27	–
6	**Non-Native Grasses**			0–90	
	brome	BROMU	*Bromus*	0–90	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–72	–
	bluegrass	POA	*Poa*	0–45	–

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 ES 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.

Western Wheatgrass/Blue Grama (1.1)
Average Annual Production (lbs./acre, air-dry): 1,300
Stocking Rate* (AUM/acre): 0.36

Blue Grama/Western Wheatgrass (1.2)
Average Annual Production (lbs./acre, air-dry): 900
Stocking Rate* (AUM/acre): 0.25

Blue Grama/Cactus (1.3)
Average Annual Production (lbs./acre, air-dry): 700
Stocking Rate* (AUM/acre): 0.19

Annual/Pioneer Perennial (2.1)
Average Annual Production (lbs./acre, air-dry): 400
Stocking Rate* (AUM/acre): 0.11

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (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 varies from very slow to slow and runoff potential for this site varies from high to very 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. Dominance by blue grama, buffalograss, bluegrass, and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50

percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

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

Ecological Site Correlation Issues and Questions:

• SD069 Hyde County, SD did not use the (OdC) Oko-Jerauld complex, 2 to 9 percent slopes (national symbol cvn3) as used in the adjoining SD065 Hughes County, SD.
• SD059 Hand County, SD did not use the (CrA) Cavo-Jerauld loams, 0 to 4 percent slopes (national symbol cw4j) as used in the adjoining SD069 Hyde County, SD.
• SD059 Hand County, SD did not use the (BgB) Beadle-Jerauld-Dudley complex, 1 to 5 percent slopes (national symbol cyvy) (R55CY015SD ESD) as used in the adjoining SD073 Jerauld County. SD073 Jerauld County, SD (BgB) Beadle-Jerauld-Dudley complex, 1 to 5 percent slopes (national symbol cyvy) (R55CY015SD ESD) will need to be split correlated to match SD059 Hand County, SD ESD.
• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. 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: Stan Boltz, Range Management Specialist (RMS), NRCS, Shane Deranleau, RMS, NRCS, Bruce Kunze, Soil Scientist, NRCS, and Mitch Faulkner, RMS, NRCS.

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Approval

Suzanne Mayne-Kinney, 1/22/2024

Acknowledgments

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This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Quality Assurance was approved by David Kraft, NRCS Regional Ecologist as of 11/12/2020.

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, Mitch Faulkner, Shane Deranleau
Contact for lead author	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	03/15/2011
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Barely observable, or only in association with slickspots.

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3. **Number and height of erosional pedestals or terracettes:** Some pedastalling of bunchgrasses or coppice mounds occurs, but exposed roots are not present.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground typically 10 to 35 percent. Bare ground patches may be up to 4 to 6 inches in diameter. Slickspots occur in complex with this site and are largely devoid of vegetation, but are not part of this site.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Plant litter

may be moved during ponding events and small accumulations of litter may be visible. Small plant litter may move roughly 4 to 8 inches. Larger plant litter will typically remain in place.

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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 normally a 3 to 5 rating. Soil surface is somewhat resistant to erosion. Crusts may be present (e.g., biological and physical crusts).

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically platy parting to granular. Surface E-horizon is typically leached and does not have dark, mollic (higher organic matter) colors. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Rhizomatous grasses provide for moderate infiltration, but shallow pan reduces effective 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):** No compaction layer should be evident. At less than four inches, an extremely dense clay B horizon exists, which has a round-topped columnar structure. This pan layer should not be confused with compaction.

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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: Wheatgrasses (mid, cool-season rhizomatous) >

    Sub-dominant: Short, warm-season grasses >

    Other: Needlegrasses (mid/tall cool-season bunch) = grass-like species = forbs = shrubs > mid, warm-season grasses

Additional: Other native grasses occur in other functional groups in minor amounts.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** 35-65 percent plant litter cover, roughly 0.25 to 0.5 inches in depth. Litter cover is in contact with the soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,300 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:** Refer to State and local Noxious Weed List.

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17. **Perennial plant reproductive capability:** Perennial grasses have vigorous rhizomes and/or tillers.
