USDA Natural Resources Conservation Service

Ecological site R055CY019SD
Closed Depression

Last updated: 1/31/2024
Accessed: 05/21/2025

General information

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

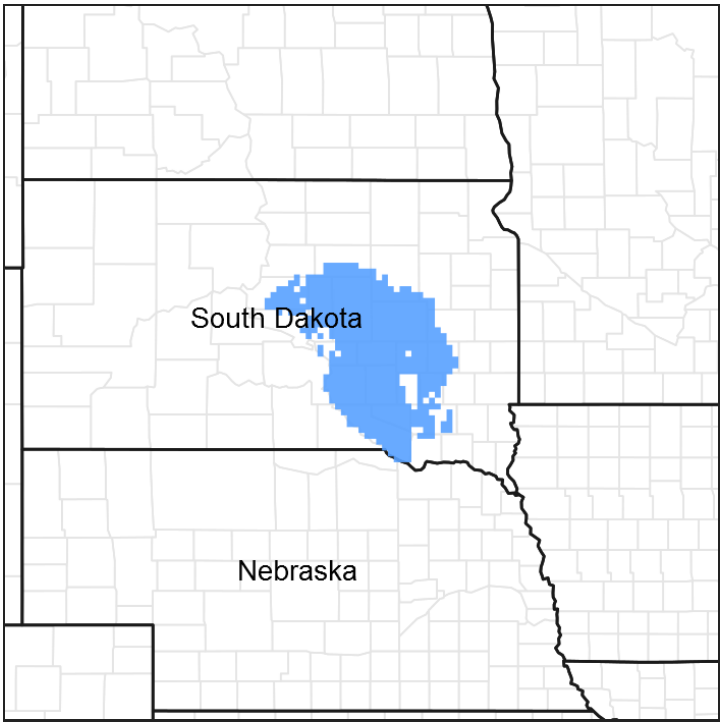


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles

(Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. 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 to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), green needlegrass (Nassella viridula), needle and thread (Hesperostipa comata), and porcupinegrass (Hesperostipa spartea) with Prairie cordgrass (Spartina pectinata), and reed canarygrass (Phalaris arundinacea) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Level IV Ecoregions of the Conterminous United States: 42e – Southern Missouri Coteau, 42f – Southern Missouri Coteau Slope, 46n – James River Lowland.

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); 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: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

Ecological site concept

The Closed Depression ecological site typically occurs in slight depressions on nearly level slopes in the upland areas. Soils are poorly drained and may have a claypan (columnar structure) within 6 inches of the soil surface or an abrupt texture change within 12 inches of the soil surface. Permeability is very slow due to the claypan (columnar structure) or the clayey subsoil and the site may pond water 4 to 8 weeks in the spring of the year. Ponded water conditions and very slow permeability and/or a natric horizon strongly influences the soil-water-plant relationship. The natric horizon in the subsoil typically has a Sodium Absorption Ratio (SAR) greater than 13 and/or an Exchangeable Sodium Percentage (ESP) greater than 15. Vegetation in the Reference State is co-dominated by cool-season grasses and grasslikes including western wheatgrass and spikerush. Common forbs include American vetch, knotweeds, smartweeds, and western

dock. Change in disturbance regime may lead to a Degraded State where foxtail barley and inland saltgrass are common.

Associated sites

R055CY010SD	**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 Clarno, Hand, and Houdek, but other series are included.
R055CY011SD	**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 Beadle and Stickney, but other series are included.
R055CY013SD	**Claypan** These sites occur on uplands. Soils are moderately well drained and have a claypan (columnar structure) between 6 and 16 inches from the soil surface. The central concept soil series is Dudley, but other series are included.

Similar sites

R055CY004SD	**Wet Meadow** The Wet Meadow site occurs in a similar landscape position and does not have a claypan (columnar structure) within 6 inches of the soil surface or an abrupt texture change within 12 inches of the soil surface. The Wet Meadow site will have more grass-likes and more tall warm-season grasses than a Closed Depression.
R055CY015SD	**Thin Claypan** The Thin Claypan site occurs in a similar landscape position is moderately well drained and has a claypan (columnar structure) within 6 inches of the soil surface. The Thin Claypan site will have less blue gram and lower production than a Closed Depression site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Hordeum jubatum*

Physiographic features

This site typically occurs on nearly level depressions on uplands.

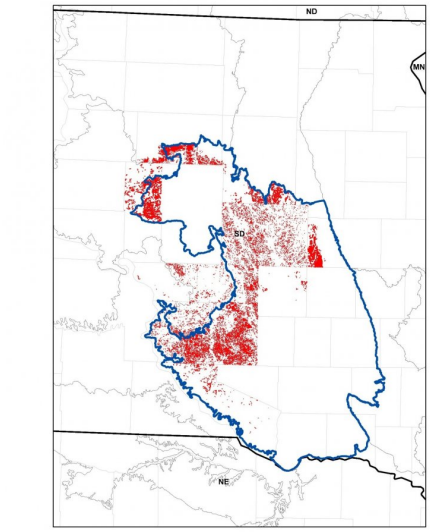


Figure 2. Distribution Map for the Closed Depression Site in MLRA 55C.

Table 2. Representative physiographic features

Landforms	(1) Pothole (2) Depression
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	1,300–2,000 ft
Slope	0–1%
Ponding depth	0–12 in
Water table depth	0–80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55C 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 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, 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. 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)	123-129 days
Freeze-free period (characteristic range)	138-151 days
Precipitation total (characteristic range)	22-26 in
Frost-free period (actual range)	114-131 days
Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	22-27 in
Frost-free period (average)	125 days
Freeze-free period (average)	144 days
Precipitation total (average)	24 in

Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) DE SMET [USC00392302], De Smet, SD
- (6) HOWARD [USC00394037], Howard, SD
- (7) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (8) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (9) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (10) ACADEMY 2NE [USC00390043], Platte, SD
- (11) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (12) MITCHELL 2 N [USC00395671], Mitchell, SD
- (13) MITCHELL [USC00395669], Mitchell, SD
- (14) ALEXANDRIA [USC00390128], Alexandria, SD
- (15) SALEM 5NE [USC00395360], Salem, SD

- (16) BRIDGEWATER [USC00391032], Bridgewater, SD
- (17) MARION [USC00395228], Marion, SD
- (18) MENNO [USC00395481], Menno, SD
- (19) TYNDALL [USC00398472], Tyndall, SD
- (20) WAGNER [USC00398767], Wagner, SD
- (21) ARMOUR [USC00390296], Armour, SD

Influencing water features

This section is under construction.

Soil features

The common features of soils in this site are the clay to clay loam textured subsoil and slopes of 0 to 1 percent. The soils in this site are poorly drained and formed in alluvium or alluvium over till. The silt loam surface layer is 3 to 9 inches thick. Some soils exhibit an extremely hard clayey Btn horizon that has round-topped or bun shaped columnar structure. These Btn horizons are high in sodium. The soils have a very slow infiltration rate. Available water capacity is 5 to 6 inches. The soils crack when dry and heavy traffic can cause surface compaction when wet. Subsurface soil layers are restrictive to water movement and root penetration. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact.

Soil series are Hoven and Plankinton.

High accumulations of sodium and slow permeability strongly influence the soil-water-plant relationship on this site. Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Silt loam
Family particle size	(1) Clayey
Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–6 in

Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	2–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–20
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The site which is located in the Southern Black 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 Reference 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. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This site is very sensitive to precipitation fluctuations from year to year. With above average precipitation the site becomes very wet, leading to a much different plant community than what would be present with average to below average precipitation. In dry years, plant density becomes very low. The two plant communities influenced strongly by precipitation alone, Western Wheatgrass-Common Spikerush Plant Community Subphase and Common Spikerush-Pale Dock Plant Community Subphase make up the natural fluctuation of what could be considered the 1.1 Reference Plant Community Phase.

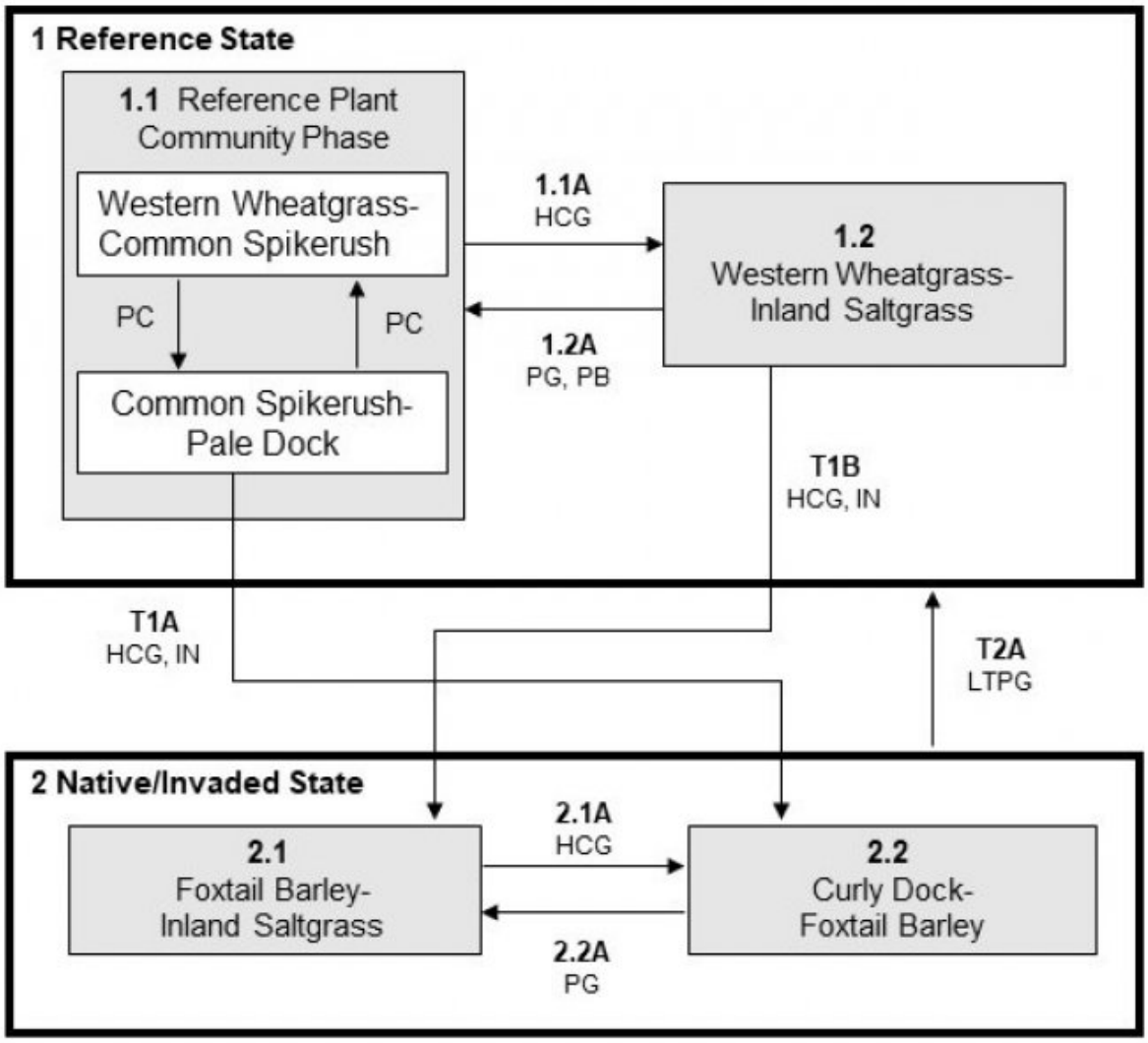
Following the state-and-transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states and community phases. The associated plant composition tables have been developed from the 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.

State and transition model

Closed Depression – R055CY019SD



LEGEND
Closed Depression – R055CY019SD

HCG – Heavy continuous grazing
IN – Invasion
LTPG – Long-term prescribed grazing
PB – Prescribed burning
PC – Precipitation cycles
PG – Prescribed grazing

Figure 9. State-And-Transition Model and Legend for the Closed Depression Site in MLRA 55C.

Code	Process
T1A	Heavy continuous grazing, invasion
T1B	Heavy continuous grazing, invasion
1.1A	Heavy continuous grazing
1.2A	Prescribed grazing, prescribed burning
2.1A	Heavy continuous grazing
2.2A	Prescribed grazing
T2A	Long-term prescribed grazing

Figure 10. Matrix for the Closed Depression Site in MLRA 55C.

State 1

Reference State

The Reference State represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state is co-dominated by cool-season grasses and grasslikes. Prior to Europeansettlement of North America, the primary disturbance mechanisms for this site in the Reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. Wheatgrass species can decline and a corresponding increase in foxtail barley (*Hordeum jubatum*), short, warm-season grasses and forbs will occur. Under extended periods of disturbance, the main change is a reduction in vigor and production and an increase in bare ground and forb composition. Interpretations are based primarily on the 1.1 Reference Plant Community Phase. This plant community evolved with grazing by large herbivores and occasional fire, as well as periodic flooding and drying, and can be maintained with prescribed grazing, prescribed burning, or areas receiving occasional short periods of rest or deferment. This plant community phase has two sub-phases, just referred to as plant communities here. These sub-phases are mainly driven by precipitation and flooding and drying sequences.

Community 1.1
Reference Community: Community Subphase 1.1 Western Wheatgrass-Common Spikerush: Community Subphase 1.1 Common Spikerush-Pale Dock

Western Wheatgrass-Common Spikerush – Interpretations are based primarily on the 1.1 Western Wheatgrass-Common Spikerush Plant Community Subphase . Following several years of above average precipitation, the plant community stabilizes and becomes dominated with perennial grasses such as western wheatgrass and common spikerush. Other grasses and grass-likes present include Nuttall’s alkaligrass (*Puccinellia nuttalliana*), sedge (Cyperacea), rush (Juncus), slender wheatgrass (Elymus trachcaulus). The occurrence of forbs will be considerably lower, including some species such as American licorice (*Glycyrrhiza lepidota*), curlytop knotweed (*Polygonum lapathifolium*), Pennsylvania smartweed (*Polygonum pensylvanicum*), Pursh seepweed (*Suaeda calceoliformis*), and western dock (*Rumex aquaticus*). The plant community is made up of about 80 to 90 percent grasses and grass-likes, and about 10 to 20 percent forbs.
Common Spikerush-Pale Dock – Interpretations are based primarily on the 1.1 Common Spikerush-Pale Dock Plant Community Subphase. This plant community often occurs after a period of higher precipitation that follows an extended dry cycle. Grasses and grass-likes commonly occurring include common spikerush, sedge, rush, foxtail barley, western wheatgrass, and bluegrasses. The forbs commonly found include pale dock, western dock, mint (Mentha), Pursh seepweed, lambsquarters (*Chenopodium album*), knotweed (Polygonum), evening-primrose (Oenothera), buttercup (Ranunculus), and New England aster (*Symphyotrichum novae-angliae*). The plant community is made up of about 5 to 10 percent grasses, 30 to 40 percent grass-likes, and about 50 to 60 percent forbs. Precipitation cycles will shift this community between the 1.1 Western Wheatgrass-

Common Spikerush Plant Communtity Subphase and the 1.1 Common Spikerush-Pale Dock Plant Communtity Subphase. After several years of above average precipitation, the plant community stabilizes and perennial grasses and western wheatgrass will dominate the site with few grass-likes and forbs; and in the instance of higher precipitation received after extended years of drought, there will be an increase in the grass-likes and forbs components.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1845	2363	3050
Forb	155	1137	1450
Total	**2000**	**3500**	**4500**

Figure 12. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

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

Community 1.2
Western Wheatgrass-Inland Saltgrass

This plant community is the result of heavy, continuous grazing. Repeated defoliation depletes stored carbohydrates resulting in weakening and eventual death of the most palatable grasses. Lack of litter and reduced plant vigor 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 (*Distichlis spicata*) and other salt tolerant species a competitive advantage over less tolerant species. Inland saltgrass drastically increases and competes with western wheatgrass as the dominant species. Other grass and grass-like species present will include Nuttall’s alkaligrass, plains bluegrass (*Poa arida*), common spikerush, needle Spikerush (*Eleocharis acicularis*), and other sedges (Cyperaceae) and rushes (Juncaceae). Early cool-season grasses including foxtail barley, fowl bluegrass (*Poa palustris*), and Kentucky bluegrass (Poa Pratensis) begin to invade. Forbs that will invade are curly dock (*Rumex crispus*) and cocklebur (Xanthium). Common forbs to the site include lambsquarters, Pennsylvania smartweed, curlytop knotweed, plantain (Plantago), and povertyweed (*Iva axillaris*). This plant community is relatively stable and well adapted to increased salinity. Plant vigor, litter, frequency and production have decreased. The biological integrity, water, and nutrient cycles of this plant community are becoming impaired. This plant community is less productive than the 1.1 Reference Plant Community Phase.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1400	1760	1875
Forb	100	440	925
Total	**1500**	**2200**	**2800**

Figure 14. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing (grazing at full to heavy levels for extended portions of the growing season without adequate recovery periods) will shift this community to the 1.2 Western Wheatgrass-Inland Saltgrass Plant Community.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, prescribed burning every 3 to 5 years, a return to normal disturbance regime levels and frequencies, or periodic light to moderate grazing (possibly including periodic rest) will convert this plant community to the 1.1 Reference Plant Community Phase.

State 2
Native/Invaded State

The Native/Invaded State represents the range of variability that exists with reduced vigor and production of the dominant species as a result of grazing-induced disturbance and the introduction of non-native species. This state is dominated by cool-season grasses. It can be found on areas that are impacted by extended periods of heavy, continuous grazing. Grazing tolerant species become dominant, and non-native species are present.

Community 2.1
Foxtail Barley-Inland Saltgrass

This plant community developed with heavy, continuous grazing where adequate recovery periods between grazing events were not allowed. Patches of inland saltgrass sod are

typical and foxtail barley and fowl bluegrass are well distributed throughout the community. Nuttall's alkaligrass and western wheatgrass have been greatly reduced in production and vigor, but may persist in remnant amounts. 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 the 1.1 Reference Plant Community Phase. 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 massive shallow root system "root pan," characteristic of inland saltgrass and increased bare ground. It will take a long time to bring this plant community back to the Reference State (State 1) with management alone. Renovation (mechanical or chemical inputs) is typically not effective due to high salt content of the soil and saltgrass persistence.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	745	1020	1455
Forb	55	180	345
Total	**800**	**1200**	**1800**

Figure 16. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 2.2
Curly Dock-Foxtail Barley

This plant community can be reached with heavy, continuous grazing coupled with compaction due to grazing when the soil is saturated. This plant community can also result from long-term ponding and occasional subsequent drying as when this site is developed for a water source. The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include foxtail barley (which may become dominant), fowl bluegrass, Nuttall's alkaligrass, and western wheatgrass. The dominant forbs include curly dock, curlycup gumweed (*Grindelia squarrosa*), kochia (*Bassia scoparia*), cocklebur, and other early successional salt tolerant species. The community is susceptible to non-native species due to severe soil disturbances and relatively high percent 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. 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.

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 Curly Dock-Foxtail Barley Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

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 the Native/Invaded State (State 2) over a threshold to the Reference State (State 1).

Conservation practices

Prescribed Grazing

Transition T1A
State 1 to 2

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, typically beginning early in the season) or invasion of non-native plant species will convert the 1.1 Common Spikerush-Pale Dock Plant Communtity Subphase within the Reference State (State 1) to the 2.2 Curly Dock-Foxtail Barley Plant Community Phase within the Native/Invaded State (State 2).

Restoration pathway T2A
State 2 to 1

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 the Native/Invaded State (State 2) over a threshold to the Reference State (State 1).

Conservation practices

Prescribed Grazing

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			700–2975	
	western wheatgrass	PASM	*Pascopyrum smithii*	700–2975	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–175	–
2	**Cool-Season Bunchgrasses**			175–1400	
	foxtail barley	HOJU	*Hordeum jubatum*	70–1225	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	70–525	–
3	**Short Warm-Season Grasses**			35–350	
	saltgrass	DISP	*Distichlis spicata*	35–350	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–175	–
4	**Other Native Grasses**			70–350	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–350	–
	plains bluegrass	POAR3	*Poa arida*	35–175	–
	fowl bluegrass	POPA2	*Poa palustris*	35–175	–
5	**Grass-likes**			350–1575	
	common spikerush	ELPA3	*Eleocharis palustris*	175–1400	–
	needle spikerush	ELAC	*Eleocharis acicularis*	35–525	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–350	–
	sedge	CAREX	*Carex*	70–350	–
	rush	JUNCU	*Juncus*	0–175	–
Forb					
6	**Forbs**			175–2100	
	Forb, native	2FN	*Forb, native*	0–700	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–525	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–525	–
	pale dock	RUAL4	*Rumex altissimus*	0–525	–
	western dock	RUAQ	*Rumex aquaticus*	0–350	–

	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–350	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–350	–
	lambsquarters	CHAL7	*Chenopodium album*	0–350	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–175	–
	golden tickseed	COTI3	*Coreopsis tinctoria*	0–175	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–175	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–175	–
	povertyweed	IVAX	*Iva axillaris*	0–175	–
	bushy knotweed	PORA3	*Polygonum ramosissimum*	0–175	–
	cinquefoil	POTEN	*Potentilla*	0–175	–
	plantain	PLANT	*Plantago*	0–175	–
	mint	MENTH	*Mentha*	0–175	–
	evening primrose	OENOT	*Oenothera*	0–175	–
	creeping woodsorrel	OXCO	*Oxalis corniculata*	0–105	–
	tall fringed bluebells	MECI3	*Mertensia ciliata*	0–105	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–105	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			330–880	
	western wheatgrass	PASM	*Pascopyrum smithii*	330–880	–
2	**Cool-Season Bunchgrasses**			110–440	
	foxtail barley	HOJU	*Hordeum jubatum*	66–330	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	22–220	–
3	**Short Warm-Season Grasses**			220–880	
	saltgrass	DISP	*Distichlis spicata*	220–880	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–66	–
4	**Other Native Grasses**			0–110	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–110	–
	plains bluegrass	POAR3	*Poa arida*	0–66	–

	fowl bluegrass	POPA2	*Poa palustris*	0–66	–
5	**Grass-likes**			110–550	
	common spikerush	ELPA3	*Eleocharis palustris*	44–330	–
	sedge	CAREX	*Carex*	0–176	–
	needle spikerush	ELAC	*Eleocharis acicularis*	0–110	–
	rush	JUNCU	*Juncus*	0–110	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–110	–
6	**Non-Native Grasses**			22–220	
	bluegrass	POA	*Poa*	0–220	–
	cheatgrass	BRTE	*Bromus tectorum*	22–110	–
Forb					
7	**Forbs**			110–770	
	lambsquarters	CHAL7	*Chenopodium album*	0–220	–
	Forb, introduced	2FI	*Forb, introduced*	0–220	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–220	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–220	–
	bushy knotweed	PORA3	*Polygonum ramosissimum*	0–110	–
	creeping woodsorrel	OXCO	*Oxalis corniculata*	0–110	–
	plantain	PLANT	*Plantago*	0–110	–
	Forb, native	2FN	*Forb, native*	0–110	–
	povertyweed	IVAX	*Iva axillaris*	0–110	–
	cocklebur	XANTH2	*Xanthium*	0–110	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–110	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–66	–
	evening primrose	OENOT	*Oenothera*	0–66	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–66	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–66	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–66	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–66	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–66	–

	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–66	–
	pale dock	RUAL4	*Rumex altissimus*	0–66	–
	western dock	RUAQ	*Rumex aquaticus*	0–66	–
	curly dock	RUCR	*Rumex crispus*	0–66	–
	cinquefoil	POTEN	*Potentilla*	0–22	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrasses**			0–60	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–60	–
2	**Cool-Season Bunchgrasses**			240–600	
	foxtail barley	HOJU	*Hordeum jubatum*	240–600	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	0–36	–
3	**Short Warm-Season Grasses**			120–480	
	saltgrass	DISP	*Distichlis spicata*	120–480	–
4	**Other Native Grasses**			0–60	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–60	–
5	**Grass-likes**			60–240	
	common spikerush	ELPA3	*Eleocharis palustris*	24–180	–
	sedge	CAREX	*Carex*	0–60	–
	needle spikerush	ELAC	*Eleocharis acicularis*	0–60	–
	rush	JUNCU	*Juncus*	0–36	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–36	–
6	**Non-Native Grasses**			12–96	
	cheatgrass	BRTE	*Bromus tectorum*	12–60	–
	bluegrass	POA	*Poa*	0–60	–
Forb					
7	**Forbs**			60–300	
	lambsquarters	CHAL7	*Chenopodium album*	0–180	–
	Forb, introduced	2FI	*Forb, introduced*	0–120	–
	curly dock	RUCR	*Rumex crispus*	0–120	–
	cocklebur	XANTH2	*Xanthium*	0–60	–

	Forb, native	2FN	*Forb, native*	0–60	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–60	–
	povertyweed	IVAX	*Iva axillaris*	0–36	–
	creeping woodsorrel	OXCO	*Oxalis corniculata*	0–36	–
	plantain	PLANT	*Plantago*	0–36	–
	curlytop knotweed	POLA4	*Polygonum lapathifolium*	0–36	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–36	–
	bushy knotweed	PORA3	*Polygonum ramosissimum*	0–36	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–36	–
	mealy goosefoot	CHIN2	*Chenopodium incanum*	0–24	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–12	–

Animal community

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this 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. Following consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

Reference Plant Community Phase (1.1)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate* (AUM/acre): 0.96

Western Wheatgrass/Inland Saltgrass (1.2)
Average Annual Production (lbs./acre, air-dry): 2,200
Stocking Rate* (AUM/acre): 0.60

Foxtail Barley/Inland Saltgrass (2.1)

Average Annual Production (lbs./acre, air-dry): 1,200
Stocking Rate* (AUM/acre): 0.33

*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 an area where short-grasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, 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:

• SD059 Hand County, SD did not use the (SvA) Stickney-Java-Hoven complex, 0 to 4 percent slopes (national symbol cw6h) as used in the adjoining SD069 Hyde County, SD.
• SD059 Hand County, SD did not use the (Tn) Tonka-Nishon silt loams (national symbol cwly) as used in the adjoining SD049 Faulk County, SD.
• SD059 Hand County, SD did not use the (WoA) Williams-Bowbells-Nishon complex, 0 to 3 percent slopes (national symbol cxm5) as used in the adjoining SD049 Faulk County, SD.
• SD059 Hand County, SD did not use the (Te) Tetonka-Hoven silt loams (national symbol cwzt) as used in the adjoining SD005 Beadle County, SD.
• SD005 Beadle County, SD did not use the (Nv) Northville-Farmsworth-Hoven silt loams 0 to 2 percent slopes (national symbol cz59) as used in the adjoining SD115 Spink County, SD.
• SD005 Beadle County, SD did not use the (Su) Stickney-Dudley-Hoven silt loams 0 to 2 percent slopes (national symbol 2wkpf) as used in the adjoining SD115 Spink County, SD.
• SD097 Miner County, SD did not use the (Sv) Stickney-Dudley-Hoven silt loams 0 to 2 percent slopes (national symbol 2wkpf) as used in the adjoining SD077 Kingsbury County, SD.
• SD111 Sanborn County, SD did not use the (Te) Tetonka-Hoven silt loams (national symbol cwzt) as used in the adjoining SD005 Beadle County, SD.
• SD111 Sanborn County, SD did not use the (Pr) Plankinton-Crossplain complex (national symbol cyxl) as used in the adjoining SD073 Jerauld County, SD.
• SD111 Sanborn County, SD did not use the (Pt) Plankinton-Prosper complex (national symbol cx89) as used in the adjoining SD003 Aurora County, SD.
• SD043 Bon Homme County, SD did not use the (Pt) Plankinton-Prosper complex (national symbol cx89) as used in the adjoining SD003 Aurora County, SD.
• SD043 Bon Homme County, SD did not use the (Os) Onita-Hoven silt loams (national symbol cxgk) as used in the adjoining SD003 Aurora County, SD.
• NOTE: Hoven silt loam, 0 to 1 percent slopes (national symbol 2tlcc) is currently a MLRA 53C Map Unit in which is also located in the MLRA 55C. A future project will be needed to split correlate and designate to the correct ESD for those areas located in MLRA 55C.
• 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

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, NRCS, and Bruce Kunze, Soil Scientist, NRCS.

There are 3 SCS-RANGE-417's collected from 1986-2005 in Aurora and Faulk Counties, SD.
Data Source Sample Period State County
SCS-RANGE-417 (0508646049) 8/20/1986 SD Faulk

Other references

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Approval

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This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft 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)	David Schmidt, Tim Nordquist, Stan Boltz
Contact for lead author	Stan Boltz, stanley.boltz@sd.usda.gov, 605-352-1236
Date	12/07/2004
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 not present.

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Normally bare ground is less than 5 percent and patches less than two inches in diameter. Following well-above average or well-below average precipitation periods, bare ground can be very high for brief periods of time.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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 4 to 6 rating. Typically high root content and organic matter in the soil surface. Soil surface is very resistant to erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep-rooted native grass and grass-like species enhance infiltration and reduce runoff, but because of the nature of the site, infiltration is often poor due to soil characteristics.

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 present. Platy layers naturally occur near the surface of some soils and should not be confused with compaction.

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: Drier precipitation cycles: Wheatgrasses (mid, cool-season rhizomatous) >> mid, cool-season bunchgrasses >
    Wetter precipitation cycles: Grass-like species = forbs >

    Sub-dominant: Drier precipitation cycles: Short, warm-season grasses >

Wetter precipitation cycles: Wheatgrasses (mid, cool-season rhizomatous) > short, warm-season grasses >

Other: Drier precipitation cycles: Forbs > grass-like species
Wetter precipitation cycles: Mid, cool-season bunchgrasses

Additional: Other grasses in other functional groups occur 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):** 10-60 percent plant litter cover, roughly 0.5 inch 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):** 2,000-4,500 lbs./acre air-dry weight; average 3,500 lbs./acre air-dry weight.

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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 grass and grass-like species have vigorous rhizomes and/or tillers.
