USDA Natural Resources Conservation Service

Ecological site R060AY019SD
Closed Depression

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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.

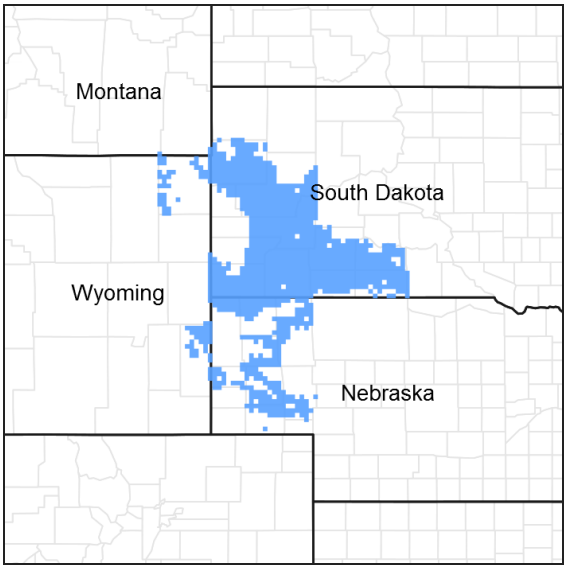

Figure 1. Mapped extent

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): 060A–Pierre Shale Plains

The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is located in South Dakota (70 percent) and small portions are in Montana (2 percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA 62) and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

MLRA 60A is in the unglaciated section of the Missouri Plateau, of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been deeply eroded. Cretaceous Pierre Shale underlies almost all of this MLRA. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clay. These clays shrink as they dry and swell as they receive moisture. Soils are shallow to very deep and generally are well drained and clayey.

Elevations generally range from 2,620 to 3,610 feet throughout the MLRA, but can range up to 4,260 feet. The average annual precipitation for the western side of the MLRA is 13 to 16 inches, whereas the eastern side receives 16 to 18 inches. A suite of ecological sites has been written specifically for these two precipitation zones. The Locator Map shows the break between the two precipitation zones.

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

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 60A – Pierre Shale Plains.

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

Ecological site concept

The Closed Depression ecological site occurs throughout MLRA 60A. It is located on level or nearly level upland landscapes with slopes ranging from 0 to 2 percent. The site is poorly to very poorly drained and will pond water from 15 to 60 days in the spring and after heavy rain events. Soils are formed from clayey alluvium. The texture of the surface layer is silty clay to clay. The high clay content of the subsurface soil layers are restrictive to water movement and root penetration. Depending on climatic cycles, the vegetation can range from nearly pure stands of rhizomatous wheatgrass in dry years to rushes, sedges, and smartweed during wet years.

Associated sites

R060AY011SD	**Clayey 13-16" P.Z.** The Clayey 13 to 16 inch PZ site is located adjacent to the Closed Depression site.
R060AY040SD	**Clayey 16-18" P.Z.** The Clayey 16 to 18 inch PZ site is located adjacent to the Closed Depression site.

Similar sites

R060AY007SD	**Saline Lowland** The Saline Lowland site will have less western wheatgrass, dock, and smartweed, and slightly higher production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii*

Physiographic features

This site occurs on level uplands.

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Basin floor
Flooding frequency	None
Ponding duration	Long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	2,500–4,300 ft
Slope	0–2%

Ponding depth	0–12 in
Water table depth	0–80 in
Aspect	Aspect is not a significant factor

Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains, where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation for the entire MLRA ranges from 13 to 18 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air masses from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but the more severe occur during late fall, late winter, and spring.

The normal average annual temperature is about 46°F. January is the coldest month with average temperatures ranging from about 19°F (Moorcroft CAA, WY) to about 22°F (Belle Fourche, SD). July is the warmest month with temperatures averaging from about 70°F (Moorcroft CAA, WY) to about 72°F (Belle Fourche, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 51°F. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds generally are stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and can continue to early or mid-September. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	98-105 days
Freeze-free period (characteristic range)	123-129 days
Precipitation total (characteristic range)	15-18 in
Frost-free period (actual range)	76-108 days
Freeze-free period (actual range)	113-133 days
Precipitation total (actual range)	14-18 in
Frost-free period (average)	97 days
Freeze-free period (average)	124 days
Precipitation total (average)	16 in

Climate stations used

- (1) UPTON [USC00489205], Upton, WY
- (2) ARDMORE 1 NW [USC00390236], Edgemont, SD
- (3) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (4) WASTA [USC00398911], Owanka, SD
- (5) MOORCROFT 3S [USW00024088], Moorcroft, WY
- (6) REDBIRD [USC00487555], Lance Creek, WY

Influencing water features

At times this site exhibits wet land characteristics.

Wetland description

Not Applicable.

Soil features

Soils in this site are very deep and poorly to very-poorly drained. They form in local clayey alluvium in closed upland basins on level to nearly level slopes (0 to 2 percent). Microrelief is pronounced in some of the more depressed areas. Permeability is slow to very slow except after dry periods when initial intake may be rapid due to cracks. These soils are ponded from surface runoff after heavy rains and snowmelt and no surface runoff occurs unless artificially drained. The surface layer is 3 to 6 inches thick and can have a silt loam to clay texture. The subsoils are typically clay, however silty clay, silty clay loam, and clay loam can occur. Natric horizons, (Btn) with columnar structure and high sodium can occur in some soils, restricting water movement and root penetration. Heavy traffic can cause surface compaction when wet.

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 correlated to the Close Depression ecological site: Hoven, McKenzie, and Macken.

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

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay (3) Clay
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)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	2–13
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–1%

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.

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 (Rhizomatous Wheatgrass and Grass-likes/Forbs) make up the natural fluctuation of what could be considered the Reference Plant Community (1.1).

The plant community upon which interpretations are primarily based is the Reference Plant Community (1.1). It has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

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

State and transition model

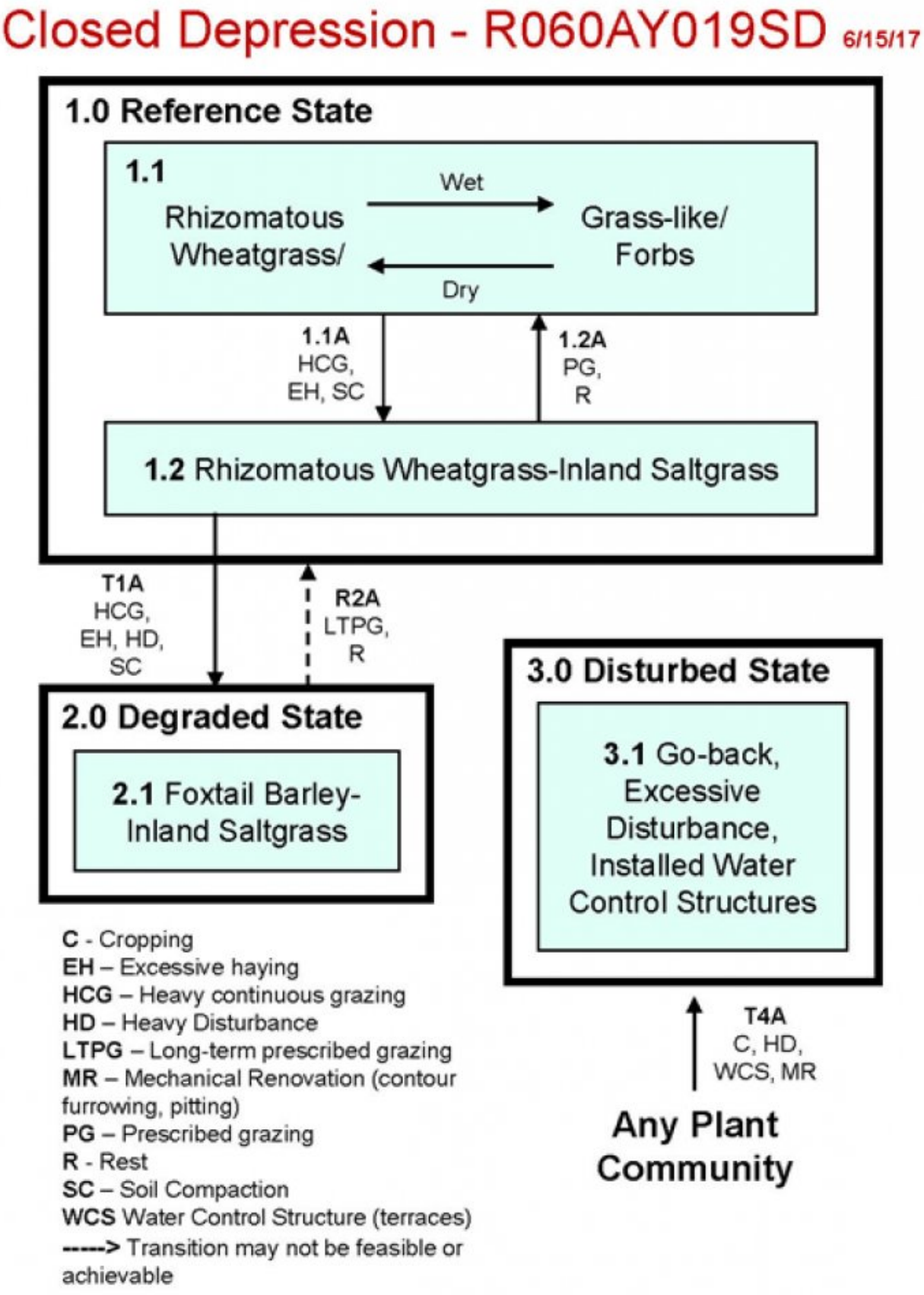

Figure 8. Closed Depression - R060AY019SD

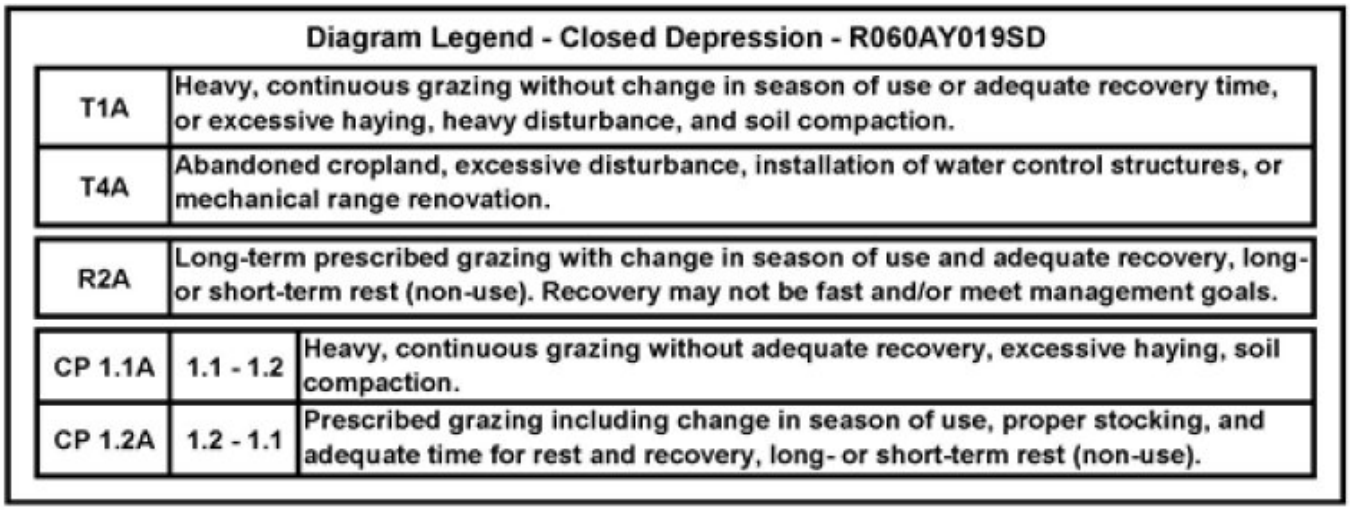

Figure 9. Closed Depression - R060AY019SD.

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. This site, in Reference, is dominated by a mix of cool-season wheatgrasses and grass-like species. Variations in annual precipitation and length of time the site is ponded greatly influence the species composition from year to year. During wet years the plant community will be dominated by grass-like species and forbs. During drier years the plant community will be dominated by cool-season wheatgrasses. This variability is independent of grazing pressure and is considered a distinct plant community. Grazing pressure on this site and surrounding sites also influence the plant community dynamics. Hoof action during wet periods can cause soil compaction and salts to accumulate on the surface, causing an increase in salt-tolerant species. The degree of grazing on uplands, adjacent to the Closed Depression site, can increase or decrease runoff into the site, creating a drier or wetter site. Adjacent areas that are grazed close will have more runoff compared to areas with proper grazing use.

Community 1.1
Rhizomatous Wheatgrass/Grass-Likes/Forbs

Interpretations are based primarily on the Rhizomatous Wheatgrass/Grass-likes/Forb Plant Community (1.1), which is also considered to be the Reference Plant Community. The Rhizomatous Wheatgrass and Grass-likes/Forb Plant Community can appear as separate communities because the two are influenced strongly by annual precipitation, runoff, and ponding. This plant community evolved with grazing by large herbivores and occasional fire, and can be maintained with prescribed grazing, prescribed burning, or occasional periods of rest. The following describes the transitional plant communities that occur within the Reference Plant Community: The Western Wheatgrass Phase is expressed following several years of average to slightly below average precipitation and shorter ponding periods. The plant community is dominated by western wheatgrass. Other grasses and grass-likes present include Nuttall's alkaligrass, sedge, rush, slender wheatgrass and inland saltgrass. The occurrence of forbs will be considerably lower, including some species such as American licorice, Pursh seepweed, western dock, lambsquarters, evening-primrose, and New England aster. The plant community is made up of about 80 to 90 percent grasses and grass-likes and about 10 to 20 percent forbs. The total annual production (air-dry weight) of this plant community is typically about 3,500 lbs./acre The Grass-likes/Forbs Phase occurs after a period of higher precipitation and longer periods of ponding. Grasses and grass-likes that commonly occur include sedge, spikerush, rush, foxtail barley, and western wheatgrass. Forbs commonly found include western dock, mint, Pursh seepweed, knotweed, buttercup, curlycup knotweed, New England aster, and Pennsylvania smartweed. 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. The total annual production (air-dry weight) is about 2,500 lbs./acre. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning at this site's potential. When present, plant litter is properly distributed with very little movement off-site. Natural plant mortality can be significant following periods of below average precipitation. The diversity in plant species allows for both the fluctuation of ponding as well as the occurrence of randomly occurring drought.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1295	1485	2200
Forb	105	715	1800
Total	**1400**	**2200**	**4000**

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

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

Community 1.2
Western Wheatgrass-Inland Saltgrass

This plant community is the result of heavy continuous grazing or excessive haying. Soil compaction, lack of litter, and reduced plant vigor result in higher soil temperatures, poor water infiltration rates, and high evapotranspiration which increases salt concentrations on the surface. This gives inland saltgrass and other salt-tolerant species a competitive advantage over less tolerant species. Inland saltgrass increases and competes with western wheatgrass as the dominant species. Other grasses and grass-likes will include Nuttall’s alkaligrass, plains bluegrass, ticklegrass, common spikerush, needle spikerush, and other sedges and rushes. Early cool-season grasses including foxtail barley and fowl bluegrass begin to increase and/or to invade. Forbs that will invade are curly dock, sweetclover, curlycup gumweed, and lambsquarters, pepperweed, povertyweed, purslane and western dock will increase. 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 Rhizomatous Wheatgrass/Grass-likes/Forbs Plant Community (1.1) and is considered at risk.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1115	1575	2025
Forb	85	225	375
Total	**1200**	**1800**	**2400**

Figure 13. Plant community growth curve (percent production by month). SD6008, Pierre Shale Plains, lowland cool season/warm season co-dominant. Cool season, warm season co-dominant, lowland..

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

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing or excessive haying can shift this plant community to the Western Wheatgrass-Inland Saltgrass plant community. Soil compaction caused by hoof action or mechanical harvesting activities can increase bulk density, reduce water-holding capacity, increase salinity on the surface, and increase salt-tolerant plant species.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that includes changes in season of use and timing of use to reduce potential for soil compaction and possible extended periods of rest or non-use will move this plant community back to the plant community phase (PCP) 1.1. Adapting haying practices that leave adequate residual cover and avoid potential for soil compaction will also move this plant community phase towards PCP 1.1.

State 2
Degraded State

This State is dominated by salt-tolerant plant species and is the result of soil compaction and salt accumulations at the surface. This state is very resilient and resistant to change.

Community 2.1
Foxtail Barley-Inland Saltgrass

This plant community developed with heavy continuous grazing or excessive haying where adequate recovery periods 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, and may only 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 Reference State. Loss of key cool-season grasses and increased bare ground has 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.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	465	700	935
Forb	35	100	165
Total	**500**	**800**	**1100**

Figure 15. Plant community growth curve (percent production by month). SD6007, Pierre Shale Plains, cool season dominant, warm season subdominant. Cool season dominant, warm season subdominant, lowland..

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

State 3
Disturbed State

This State developed through mechanical manipulation of the watershed causing the loss of hydrologic function, biotic integrity, and soil site stability. On existing rangeland, hydrologic function is disrupted through terracing, contour furrowing, or pitting the area surrounding the closed depression. Other causes include severe mechanical disturbance through tillage and conversion to cropland or pastureland.

Community 3.1
Go-back, Excessive Disturbance, Installed Water Control Structures

During the early successional stages, on go-back lands (abandoned cropland), the species that dominate are annual grasses and forbs, later replaced by both native and introduced perennials. The vegetation on this site varies greatly, sometimes dominated by threeawn, bluegrass, smooth bromegrass, annual brome, crested wheatgrass, buffalograss, broom snakeweed, sweetclover, and nonnative thistles. Other plants that commonly occur on the site include western wheatgrass, deathcamas, prickly lettuce, marestail, kochia, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health. Excessive disturbance can be reached when long duration flooding events and/or excessive defoliation occurs. This can result from heavy livestock or wildlife concentration, enduring wet cycles, 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 may become dominant along with fowl bluegrass, Nuttall's alkaligrass, and western wheatgrass. The dominant forbs include curly dock, curlycup gumweed, kochia, and other early successional salt-tolerant species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to nonnative 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. 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. When runoff reaching this site is eliminated though construction of water control structures such as terraces, or mechanical range renovation practices such as contour furrowing or pitting. This is likely to resemble, and have similar ecological dynamics, as the Claypan or Thin Claypan ecological site.

Transition T1A
State 1 to 2

Heavy continuous grazing, excessive haying, heavy disturbance, and soil compaction will shift the Western Wheatgrass-Inland Saltgrass Plant Community (1.2) to the Degraded State (2.0).

Transition T4A
State 1 to 3

Heavy disturbance, installation of water control structures, mechanical renovation practices, or land use conversion to crop or pasture will transition any plant community to the Degraded State (3.0).

Transition T4A
State 1 to 3

Heavy disturbance, installation of water control structures, mechanical renovation practices, or land use conversion to crop or pasture will transition any plant community to the Degraded State (3.0).

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing that includes changing season of use, and allowing for adequate recovery periods between grazing events, or extended periods of rest (non-use) and above average precipitation may lead this plant community back to the Reference State. This restoration may take a long period of time with management alone and may not meet management goals. Renovation (mechanical and/or chemical inputs) is not recommended due to the high salt content of the soil and the persistence of inland saltgrass.

Transition T4A
State 2 to 3

Heavy disturbance, installation of water control structures, mechanical renovation practices, or land use conversion to crop or pasture will transition any plant community to the Degraded State (3.0).

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	**Rhizomatous Wheatgrasses**			330–1320	
	western wheatgrass	PASM	*Pascopyrum smithii*	110–1320	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–660	–
2	**Other Native Grasses**			110–550	

	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	22–440	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–330	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	22–220	–
	bluegrass	POA	*Poa*	22–220	–
	saltgrass	DISP	*Distichlis spicata*	22–220	–
	Grass, perennial	2GP	*Grass, perennial*	0–220	–
	rough bentgrass	AGSC5	*Agrostis scabra*	0–110	–
	American sloughgrass	BESY	*Beckmannia syzigachne*	0–110	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–110	–
3	**Grass-likes**			110–660	
	needle spikerush	ELAC	*Eleocharis acicularis*	110–550	–
	common spikerush	ELPA3	*Eleocharis palustris*	110–550	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–330	–
	sedge	CAREX	*Carex*	110–330	–
	cosmopolitan bulrush	BOMA7	*Bolboschoenus maritimus*	22–220	–
	rush	JUNCU	*Juncus*	22–220	–
Forb					
5	**Forbs**			110–1320	
	Forb, perennial	2FP	*Forb, perennial*	0–440	–
	lambsquarters	CHAL7	*Chenopodium album*	0–440	–
	knotweed	POLYG4	*Polygonum*	0–440	–
	wild mint	MEAR4	*Mentha arvensis*	0–330	–
	buttercup	RANUN	*Ranunculus*	0–330	–
	western dock	RUAQ	*Rumex aquaticus*	0–330	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–330	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–330	–
	evening primrose	OENOT	*Oenothera*	0–330	–
	redwool plantain	PLER	*Plantago eriopoda*	0–220	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–220	–
	povertyweed	IVAX	*Iva axillaris*	0–220	–
	prairie ironweed	VEFA2	*Vernonia fasciculata*	0–220	–
	little hogweed	POOL	*Portulaca oleracea*	0–220	–
	bluebells	MERTE	*Mertensia*	0–110	–
	mountain deathcamas	ZIEL2	*Zigadenus elegans*	0–110	–
	pepperweed	LEPID	*Lepidium*	0–110	–
	slender cinquefoil	POGRF2	*Potentilla gracilis var. fastigiata*	0–110	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			720–1080	
	western wheatgrass	PASM	*Pascopyrum smithii*	720–1080	–

	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	180–540	–
2	**Other Native Grasses**			360–900	
	saltgrass	DISP	*Distichlis spicata*	360–720	–
	bluegrass	POA	*Poa*	18–180	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	90–180	–
	foxtail barley	HOJU	*Hordeum jubatum*	54–180	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	0–90	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–90	–
	Grass, perennial	2GP	*Grass, perennial*	0–90	–
	rough bentgrass	AGSC5	*Agrostis scabra*	0–90	–
	American sloughgrass	BESY	*Beckmannia syzigachne*	0–90	–
3	**Grass-likes**			90–360	
	sedge	CAREX	*Carex*	90–270	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–180	–
	common spikerush	ELPA3	*Eleocharis palustris*	36–180	–
	rush	JUNCU	*Juncus*	36–180	–
	cosmopolitan bulrush	BOMA7	*Bolboschoenus maritimus*	0–90	–
	needle spikerush	ELAC	*Eleocharis acicularis*	0–90	–
4	**Non-native Grasses**			0–90	
	cheatgrass	BRTE	*Bromus tectorum*	0–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–90	–
Forb					
5	**Forbs**			90–360	
	sweetclover	MELIL	*Melilotus*	0–360	–
	western dock	RUAQ	*Rumex aquaticus*	0–270	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–180	–
	little hogweed	POOL	*Portulaca oleracea*	0–180	–
	povertyweed	IVAX	*Iva axillaris*	0–180	–
	Forb, perennial	2FP	*Forb, perennial*	0–180	–
	lambsquarters	CHAL7	*Chenopodium album*	0–180	–
	cocklebur	XANTH2	*Xanthium*	0–180	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–90	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–90	–
	pepperweed	LEPID	*Lepidium*	0–90	–
	wild mint	MEAR4	*Mentha arvensis*	0–90	–
	buttercup	RANUN	*Ranunculus*	0–90	–
	prairie ironweed	VEFA2	*Vernonia fasciculata*	0–90	–
	redwool plantain	PLER	*Plantago eriopoda*	0–90	–
	knotweed	POLYG4	*Polygonum*	0–90	–
	evening primrose	OENOT	*Oenothera*	0–54	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–54	–
	slender cinquefoil	POGRF2	*Potentilla gracilis var. fastigiata*	0–54	–

	bluebells	MERTE	*Mertensia*	0–36	–
	mountain deathcamas	ZIEL2	*Zigadenus elegans*	0–36	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			40–120	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–120	–
	western wheatgrass	PASM	*Pascopyrum smithii*	40–120	–
2	**Other Native Grasses**			320–640	
	foxtail barley	HOJU	*Hordeum jubatum*	240–480	–
	saltgrass	DISP	*Distichlis spicata*	80–240	–
	scratchgrass	MUAS	*Muhlenbergia asperifolia*	8–80	–
	bluegrass	POA	*Poa*	16–80	–
	Nuttall's alkaligrass	PUNU2	*Puccinellia nuttalliana*	40–80	–
	Grass, perennial	2GP	*Grass, perennial*	0–40	–
	rough bentgrass	AGSC5	*Agrostis scabra*	0–40	–
	American sloughgrass	BESY	*Beckmannia syzigachne*	0–40	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–40	–
3	**Grass-likes**			16–160	
	sedge	CAREX	*Carex*	40–120	–
	needle spikerush	ELAC	*Eleocharis acicularis*	0–80	–
	common spikerush	ELPA3	*Eleocharis palustris*	16–80	–
	rush	JUNCU	*Juncus*	16–80	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–80	–
	cosmopolitan bulrush	BOMA7	*Bolboschoenus maritimus*	0–40	–
4	**Needlegrasses**			40–120	
	cheatgrass	BRTE	*Bromus tectorum*	0–80	–
	Kentucky bluegrass	POPR	*Poa pratensis*	16–80	–
Forb					
5	**Forbs**			40–160	
	western dock	RUAQ	*Rumex aquaticus*	0–120	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–80	–
	cocklebur	XANTH2	*Xanthium*	0–80	–
	povertyweed	IVAX	*Iva axillaris*	8–80	–
	knotweed	POLYG4	*Polygonum*	0–80	–
	little hogweed	POOL	*Portulaca oleracea*	0–80	–
	Forb, perennial	2FP	*Forb, perennial*	0–80	–
	lambsquarters	CHAL7	*Chenopodium album*	0–80	–
	sweetclover	MELIL	*Melilotus*	0–80	–
	evening primrose	OENOT	*Oenothera*	0–40	–
	redwool plantain	PLER	*Plantago eriopoda*	0–40	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–40	

	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–40	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–40	–
	buttercup	RANUN	*Ranunculus*	0–40	–
	pepperweed	LEPID	*Lepidium*	0–40	–
	prairie ironweed	VEFA2	*Vernonia fasciculata*	0–40	–
	silver cinquefoil	POAR8	*Potentilla argentea*	0–24	–
	slender cinquefoil	POGRF2	*Potentilla gracilis var. fastigiata*	0–24	–
	mountain deathcamas	ZIEL2	*Zigadenus elegans*	0–16	–

Animal community

The following table lists annual suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this Ecological Site Description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community = Rhizomatous Wheatgrass/Grass-likes/Forb (1.1)
Average Annual Production (lbs./ac, air-dry) = 3500 to 2500
Stocking Rate (AUM/ac) = 0.96 to 0.68

Plant Community = Western Wheatgrass-Inland Saltgrass (1.2)
Average Annual Production (lbs./ac, air-dry) = 1800
Stocking Rate (AUM/ac) = 0.50

Plant Community = Foxtail Barley-Inland Saltgrass (2.1)
Average Annual Production (lbs./ac, air-dry) = 800
Stocking Rate (AUM/ac) = 0.22

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

Total annual production on-site may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic group D. Infiltration varies from moderate to very slow and the site is a depression without any runoff potential. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting opportunities for both waterfowl and upland game species. The wide varieties of plants

that bloom from spring until fall have an aesthetic value that appeals to visitors.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997, rev.1, 2003 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current “Approved” level of documentation but it is expected that the “Previously Approved” ESD will continue refinement towards an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is needed to validate the information in this Provisional Ecological Site Description. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

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Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site description include: Stan Boltz, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, Range Management Specialist, NRCS; and Mike Stirling, Range Management Specialist, NRCS.

Other references

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Contributors

Stan C. Boltz

Approval

Suzanne Mayne-Kinney, 6/25/2024

Acknowledgments

ESD updated by Rick L. Peterson on 6/15/17.

MLRA 60A Provisional Level Quality Control (QC) Process 9/28/17

Ecological Site from MLRA 60A were Previously Approved ESDs and meet the requirements as stated in the 2003 National Range and Pasture Handbook.

The Sites were updated to the Provisional Level by Rick L. Peterson, ESS, Rapid City, SSO in FY17.

The sites were reviewed by George Gamblin, RMS, Wheatland, WY and Mitch Faulkner, RMS, Belle Fourche, SD. Mitch Faulkner acted as the Provisional QC. The Sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS.
Worked closely with Kent Cooley, Area SS, with MLRA key development and soils narratives

Rangeland health reference sheet

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

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

Indicators

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

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 10 percent is typical during normal precipitation cycles. Considerably higher amounts can occasionally occur after flooding/drying cycles, up to 50%.

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. Little movement occurs.

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 can range widely. Readings of 2-3 are not uncommon, but can range up to 5-6. Surface organic matter adheres to the soil surface, but due to the inherent content of soluble salts in these soils, flocculation can readily occur. Soil surface fragments can dissolve quickly when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 6 inches thick with dark gray colors when moist. Structure typically is thin platy to subangular blocky in the A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration is greatly reduced on this site due to the nature of the soils. Plant

composition changes have little effect. Default rating of none to slight is acceptable.

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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):** A-horizon naturally has some platy structure. Compaction layers, if formed by management, do not typically persist. Compaction will be difficult to determine. Evidence of compaction can be confirmed by signs of recent concentration of livestock.

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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:

    Sub-dominant:

    Other:

    Additional: Functional/structural groups can be highly variable due to periodic flooding and drying cycles. Cool-season rhizomatous grasses can dominate during normal precipitation periods. Forbs may dominate following wet periods, and rushes, sedges, and spikerushes can be sub-dominant during and after wet periods.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,400-4,000 lbs./acre (air-dry weight). Reference value production is 2,200 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:** State and local noxious weeds

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
