USDA Natural Resources Conservation Service

Ecological site R060AY003SD
Subirrigated

Last updated: 6/25/2024
Accessed: 03/13/2026

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.

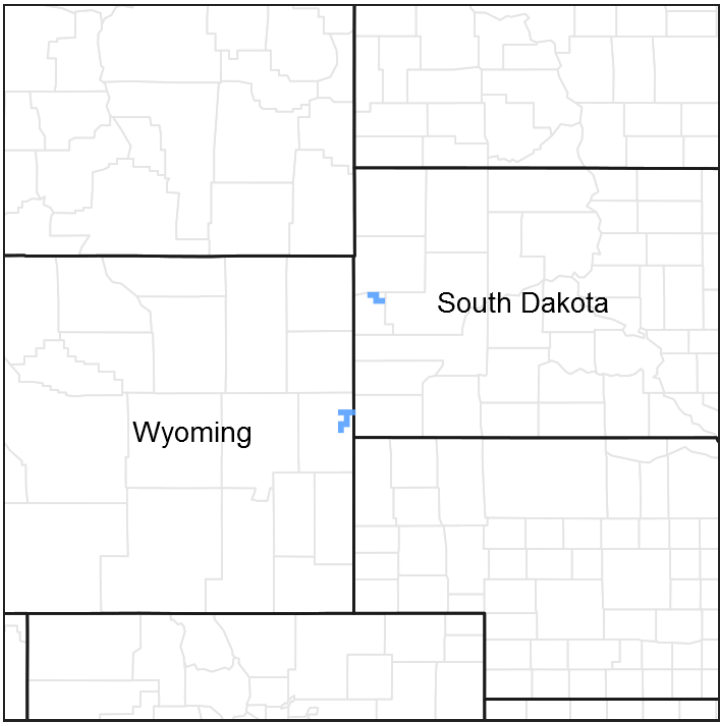


Figure 1. Mapped extent

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 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 Subirrigated ecological site occurs throughout MLRA 60A. It is a run-in site located on floodplains and low stream terraces. Slopes range from 0 to 3 percent. The soils are formed in loamy alluvium, are poor to moderately well drained, and have a water table that fluctuates between 2 and 5 feet below the surface. Vegetation in the Reference Plant Community consists of warm- and cool-season grasses, sedges, and a few shrubs and trees.

Associated sites

R060AY002SD	**Wet Land**

R060AY007SD	**Saline Lowland**
R060AY020SD	**Loamy Overflow**
R060AY021SD	**Clayey Overflow**
R060AY042SD	**Lowland**

Similar sites

R060AY002SD	**Wet Land** Higher production; more frequent ponding and higher water table

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Salix*
Herbaceous	(1) *Andropogon gerardii* (2) *Spartina pectinata*

Physiographic features

This site occurs on level to nearly level river valleys.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	2,500–4,300 ft
Slope	0–3%
Ponding depth	0 in
Water table depth	12–36 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)	13-18 in
Frost-free period (average)	97 days
Freeze-free period (average)	124 days
Precipitation total (average)	16 in

Climate stations used

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

Influencing water features

This site is influenced by a permanent water table within 2 to 5 feet of the surface.

Soil features

The soils in this site are somewhat poorly to moderately well drained and formed in loamy alluvium. The surface layer is 4 to 15 inches thick. The texture of the subsurface ranges from loamy fine sand to silty clay loam. Slopes range from 0 to 3 percent. This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

Table 4. Representative soil features

Surface texture	(1) Loamy fine sand (2) Silt loam (3) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Moderately slow to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–8 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

As this site deteriorates from a combination of heavy, continuous seasonal grazing and invasion of non-native cool-season grasses, and grass-likes species, the plant community will transition to a cool-season invaded state. Kentucky bluegrass will eventually become sod- bound. Grasses such as big bluestem, prairie cordgrass, and switchgrass will decrease in frequency, and production, and can eventually be removed from the site. As the site continues to deteriorate, bare ground may increase depending on water table depth. Kentucky bluegrass will persist in a broken sod appearance. Species such as Dalmatian toadflax, kochia, and leafy spurge can invade the site. Excessive litter, decadence, and plant mortality can result from the lack of fire or non-use.

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

The following is a diagram that illustrates the common plant 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

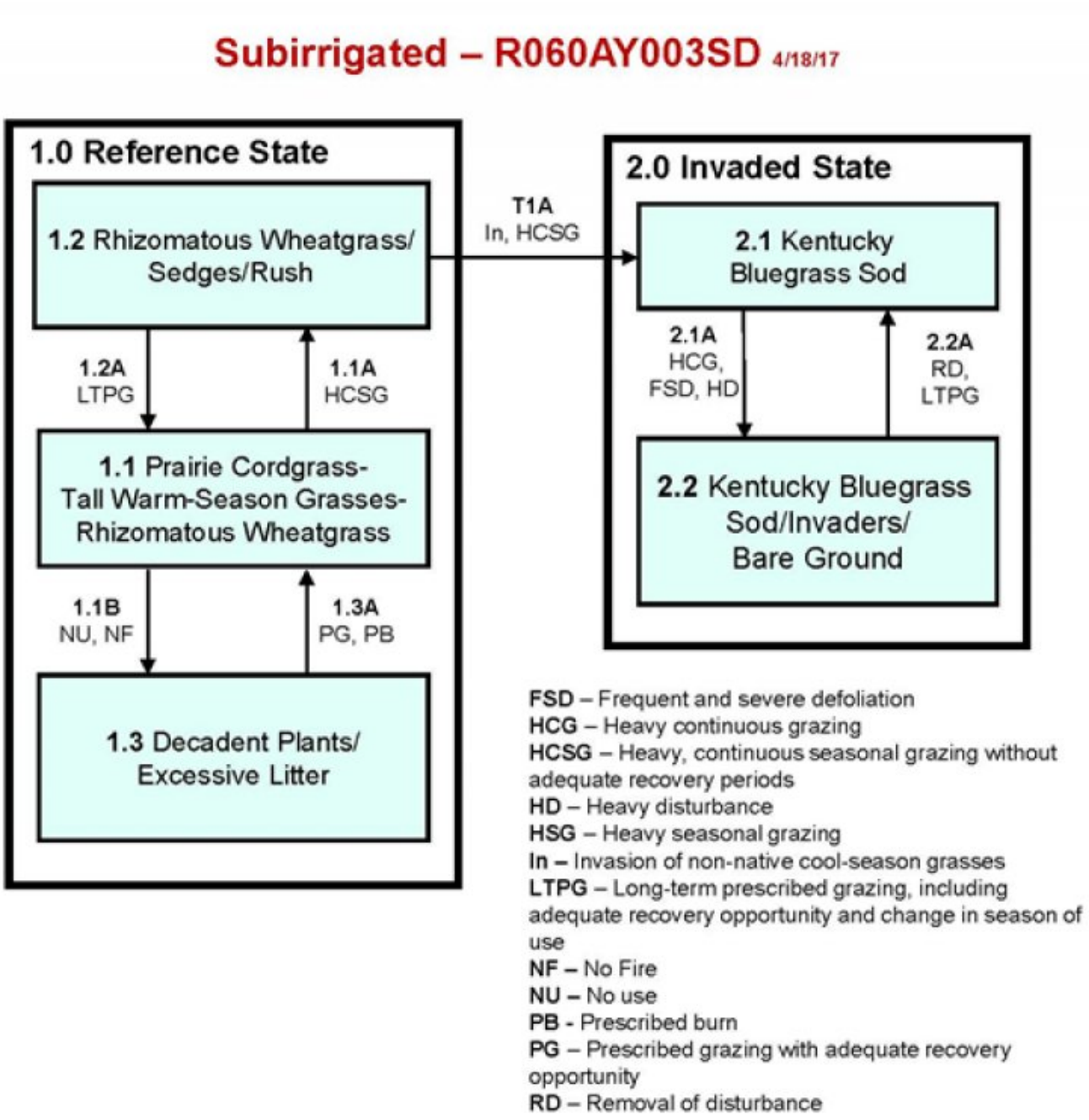


Figure 8. Subirrigated - R060AY003SD

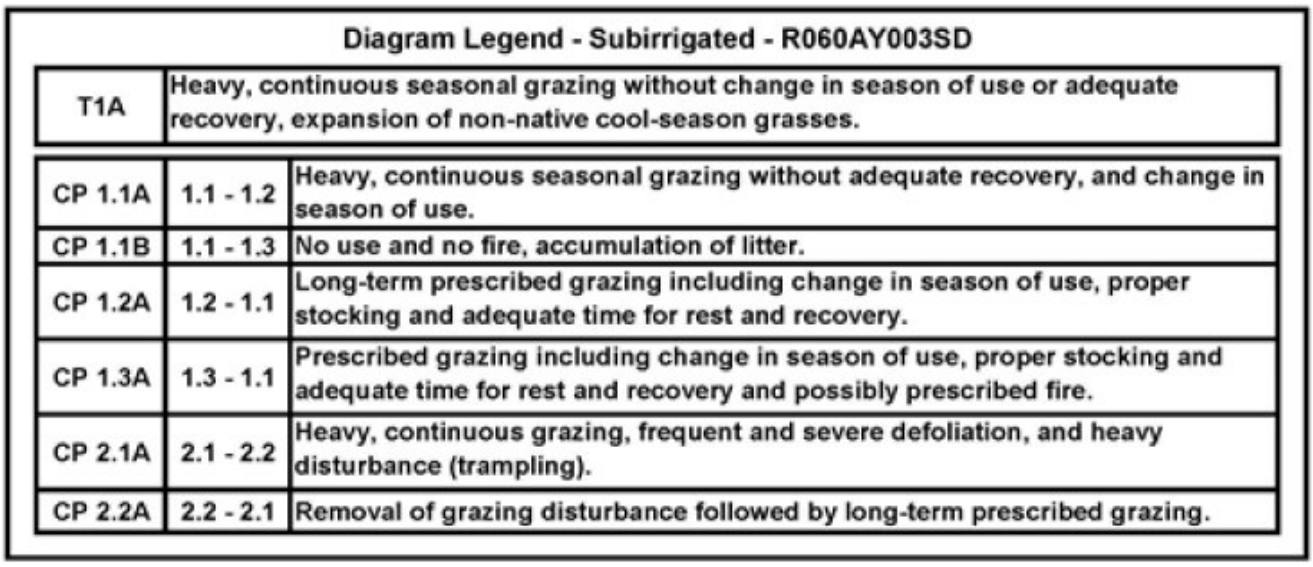


Figure 9. Subirrigated - R060AY003SD

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 the Reference State, is dominated by native warm- and cool-season grasses, forbs, and shrubs. Trace amounts of non-native species, including Kentucky bluegrass and smooth brome, may be present but are not prevalent. During wet years the plant community will respond to a higher water table and grass-like species will increase. During drier years the plant community will be dominated by grasses. Grazing pressure on this site and surrounding sites also influence the plant community dynamics. Heavy grazing will reduce the amount of tall warm-season grasses and increase non-native cool-season grasses. Conversely no use and no fire will cause an increase in litter and potentially an increase in non-native cool-season grasses.

Community 1.1
Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass

Figure 10. Plant Community Phase 1.1

The plant community phase (PCP) upon which interpretations are primarily based is the Prairie Cordgrass-Tall Warm-Season Grasses- Rhizomatous Wheatgrass Plant Community. This is also considered to be the Reference Plant Community (1.1). This plant community can be found on areas where grazed plants receive adequate periods of deferment during the growing season in order to recover. Historically, fires occurred infrequently. The potential vegetation is about 80 to 90 percent grasses and grass-likes, 5 to 10 percent forbs, and 0 to 10 percent shrubs. Tall and mid- warm-season grasses dominate this community. Major grasses include prairie cordgrass, big bluestem, and switchgrass. Other grasses and grass-likes occurring on the community include western wheatgrass, Canada wildrye, Baltic rush, spikerush, and bulrush. Key forbs and shrubs include American licorice, Maximilian sunflower, milkvetch, and willow. This plant community is diverse, stable, productive, and well adapted to the Northern Great Plains. The high water table supplies much of the moisture for plant growth. Plant litter is properly distributed with little movement and natural plant mortality is very low. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3290	3762	4100
Forb	210	323	450
Shrub/Vine	0	215	450
Total	**3500**	**4300**	**5000**

Figure 12. Plant community growth curve (percent production by month). SD6010, Pierre Shale Plains, lowland warm season dominant. Warm season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	8	15	21	26	15	8	5	0	0

Community 1.2
Rhizomatous Wheatgrass/Sedges/Rush

Figure 13. Plant Community Phase 1.2

This plant community developed under heavy, continuous seasonal grazing without periodic deferment. Prairie cordgrass, tall warm-season grasses, and Canada wildrye have been significantly reduced. Western wheatgrass will increase, while Kentucky bluegrass will begin to invade. Non-palatable forbs such as heath aster and ironweed have increased. Palatable forbs and shrubs are still present in small amounts. This plant community is at risk of losing tall warm-season grasses, palatable forbs, and shrubs. This community indicates key management concerns. Prescribed grazing at this point will stabilize the community at or near the Reference Plant Community phase (1.1), while increased disturbance can easily move the community to a more degraded state. While plant diversity has been reduced, the soil is stable. The water cycle, nutrient cycle, and energy flow is slightly reduced but continues to adequately function.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2255	2550	2775
Forb	145	300	500
Shrub/Vine	0	150	325
Total	**2400**	**3000**	**3600**

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

Community 1.3
Decadent Plants/Excessive Litter

Figure 16. Plant Community Phase 1.3

This plant community occurs after an extended period of non-use, and where fire has been eliminated. The dominant plants tend to be similar to those found in the PCP 1.1, however in advanced stages, frequency and production can be lower. Litter amounts have increased causing plants to become decadent. Much of the plant nutrients are tied up in excessive litter. Organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact. Typically, bunchgrasses develop dead centers and rhizomatous grasses (prairie cordgrass) form small colonies because of a lack of tiller stimulation. This plant community is not resistant to change. Grazing or fire can easily move it toward the Reference State. Soil erosion is not a concern due to increased litter levels and landscape position. This PCP does have the potential for invasion of Kentucky bluegrass and could, under the right conditions, transition to the Invaded State (2.0).

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2740	2888	3300
Forb	160	248	350
Shrub/Vine	0	164	350
Total	**2900**	**3300**	**4000**

Figure 18. Plant community growth curve (percent production by month). SD6006, Pierre Shale Plains, lowland cool season dominant. Cool season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass

Rhizomatous Wheatgrass/Sedges/Rush

Heavy, continuous seasonal grazing without adequate recovery, and change in season of use, will move this PCP to 1.2.

Pathway 1.1B
Community 1.1 to 1.3

Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass

Decadent Plants/Excessive Litter

Extended periods of no use and/or no fire will initially result in excessive accumulation of litter. Eventually native plants can show signs of decadence and mortality.

Pathway 1.2A
Community 1.2 to 1.1

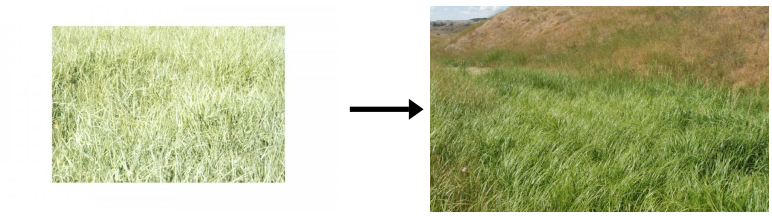
Rhizomatous Wheatgrass/Sedges/Rush

Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass

Long-term prescribed grazing with proper stocking, change in season of use, and

adequate deferment will move this PCP back to the Reference Plant Community (1.1).

Pathway 1.3A
Community 1.3 to 1.1



Decadent Plants/Excessive Litter

Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass

Prescribed grazing that breaks up litter mat followed by proper stocking, change in season of use, and adequate recover will move this PCP back to 1.1. Prescribed burning will also move this PCP back to 1.1.

State 2
Invaded State

This state has been invaded and is dominated by non-native invasive cool-season species. Kentucky bluegrass occurs on this site and drives the successional process. Preliminary studies would indicate that a 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. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014). Hoof action during wet periods can potentially cause soil compaction and reduce rooting depth and soil saturation levels. Heavy animal concentrations or cropping on the surrounding landscapes can increase runoff and sedimentation. Once Kentucky bluegrass becomes established and dominates the ecological dynamics on this site it is unlikely that management alone will be able to provide a restoration pathway back to the Reference State (1.0).

Community 2.1
Kentucky Bluegrass Sod

This plant community developed with continuous heavy grazing. The plant community is predominantly cool-season grasses and grass-likes. Kentucky bluegrass has fully invaded the community and persists in a sod-bound condition. Baltic rush, various sedges, and foxtail barley have increased. Remnant amounts of western wheatgrass may still persist in localized colonies. Big bluestem, prairie cordgrass, and switchgrass have been removed. Forbs such as kochia and Russian thistle have also increased. This community remains stable but has lost much of its production and diversity. The nutrient cycle is impaired due to the loss of warm-season grass species, deep-rooted forbs (legumes and others) and shrubs. Soil compaction can be a concern if continuously grazed during wet cycles. It is

unlikely management alone will bring this plant community back to the Reference State. Renovation would be very costly.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1370	1530	1650
Forb	195	300	425
Shrub/Vine	35	170	325
Total	**1600**	**2000**	**2400**

Figure 20. Plant community growth curve (percent production by month). SD6006, Pierre Shale Plains, lowland cool season dominant. Cool season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 2.2
Kentucky Bluegrass Sod/Invaders/Bare Ground

This plant community develops with continues heavy grazing and trampling during the growing season. High stock densities have resulted in trampling of the vegetation and compaction of the soil surface. Kentucky bluegrass still dominates the community; however, areas of sod have been removed resulting in a broken sod-bound appearance. Bare ground may be a concern if water table levels are low. Dalmatian toadflax, cheatgrass, and leafy spurge tend to invade. Compared to the Reference Plant Community, all perennial plants have been greatly reduced with only remnants of the most grazing-tolerant species remaining. Plant diversity and production are very low. Planned deferment during the growing season will improve the vigor of any the plant species present. Wind and water erosion may occur if bare ground has increased. Litter amounts are greatly reduced. Mineral crusting caused by raindrop impact disrupts surface soil aggregates, increasing ponding and slowing infiltration. Continued heavy use will cause severe compaction problems. Animal wastes can contaminate ground water or runoff.

Figure 21. Plant community growth curve (percent production by month). SD6006, Pierre Shale Plains, lowland cool season dominant. Cool season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Pathway 2.1A
Community 2.1 to 2.2

Continued heavy, continuous grazing, frequent and severe defoliation, and heavy disturbance (trampling) will eventually shift this plant community to the Kentucky Bluegrass Sod/Invaders/*Bare Ground* Plant Community (2.2).

Pathway 2.2A
Community 2.2 to 2.1

Removal of grazing related disturbance followed by long-term prescribed grazing will move this PCP back to 2.1.

Transition 1A
State 1 to 2

Invasion of non-native cool-season grasses in combination with heavy, continuous seasonal grazing will transition the Reference State (1.0) to the Invaded State (2.0). This transition is most likely to occur from PCP 1.2, however the transition could also occur through PCP 1.3 if Kentucky bluegrass invades the plant community.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm Season Tall & Mid Grasses**			2150–2795	
	big bluestem	ANGE	*Andropogon gerardii*	860–1505	–
	prairie cordgrass	SPPE	*Spartina pectinata*	430–860	–
	switchgrass	PAVI2	*Panicum virgatum*	215–645	–
2	**Cool-Season Tall & Mid Grasses**			430–860	
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	215–430	–
	basin wildrye	LECI4	*Leymus cinereus*	0–430	–
	western wheatgrass	PASM	*Pascopyrum smithii*	215–430	–
3	**Other Native Grasses**			215–430	
	Grass, perennial	2GP	*Grass, perennial*	0–215	–
	saltgrass	DISP	*Distichlis spicata*	0–215	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–215	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–215	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–215	–

	bluegrass	POA	*Poa*	0–215	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–215	–
	prairie wedgescale	SPOB	*Sphenopholis obtusata*	0–86	–
4	**Grass-Likes**			215–430	
	sedge	CAREX	*Carex*	0–430	–
	spikerush	ELEOC	*Eleocharis*	0–86	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–86	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–86	–
	rush	JUNCU	*Juncus*	0–86	–
	bulrush	SCHOE6	*Schoenoplectus*	0–86	–
Forb					
6	**Forbs**			215–430	
	white heath aster	SYER	*Symphyotrichum ericoides*	0–129	–
	blazing star	LIATR	*Liatris*	0–129	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–129	–
	goldenrod	SOLID	*Solidago*	0–129	–
	Forb, perennial	2FP	*Forb, perennial*	0–129	–
	prairie clover	DALEA	*Dalea*	0–129	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–129	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–129	–
	Virginia strawberry	FRVI	*Fragaria virginiana*	0–86	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–86	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–86	–
	false boneset	BREU	*Brickellia eupatorioides*	0–86	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–43	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–43	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–43	–
	marsh arrowgrass	TRPA28	*Triglochin palustris*	0–43	–
Shrub/Vine					
7	**Shrubs**			0–430	

	willow	SALIX	*Salix*	0–430	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–215	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–215	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–215	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–215	–
	rose	ROSA5	*Rosa*	0–215	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm Season Tall & Mid Grasses**			150–450	
	big bluestem	ANGE	*Andropogon gerardii*	0–150	–
	switchgrass	PAVI2	*Panicum virgatum*	0–150	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–150	–
2	**Cool-Season Tall & Mid Grasses**			750–1050	
	western wheatgrass	PASM	*Pascopyrum smithii*	600–1050	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	150–300	–
3	**Other Native Grasses**			150–600	
	saltgrass	DISP	*Distichlis spicata*	60–300	–
	foxtail barley	HOJU	*Hordeum jubatum*	150–300	–
	bluegrass	POA	*Poa*	60–300	–
	Grass, perennial	2GP	*Grass, perennial*	0–150	–
	prairie wedgescale	SPOB	*Sphenopholis obtusata*	0–60	–
4	**Grass-Likes**			150–600	
	sedge	CAREX	*Carex*	150–450	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	60–300	–
	rush	JUNCU	*Juncus*	0–150	–
	spikerush	ELEOC	*Eleocharis*	0–150	–
	horsetail	EQUIS	*Equisetum*	0–150	–
	bulrush	SCHOE6	*Schoenoplectus*	0–90	–
5	**Non-Native Grasses**			150–450	

	Kentucky bluegrass	POPR	*Poa pratensis*	150–450	–
	cheatgrass	BRTE	*Bromus tectorum*	0–150	–
Forb					
6	**Forbs**			150–450	
	white heath aster	SYER	*Symphyotrichum ericoides*	60–240	–
	goldenrod	SOLID	*Solidago*	0–210	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–150	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–150	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–120	–
	Forb, annual	2FA	*Forb, annual*	0–90	–
	Forb, perennial	2FP	*Forb, perennial*	0–90	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–90	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–90	–
	prairie clover	DALEA	*Dalea*	0–90	–
	blazing star	LIATR	*Liatris*	0–90	–
	curly dock	RUCR	*Rumex crispus*	0–90	–
	marsh arrowgrass	TRPA28	*Triglochin palustris*	0–90	–
	cocklebur	XANTH2	*Xanthium*	0–60	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–60	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–60	–
Shrub/Vine					
7	**Shrubs**			0–300	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–150	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–150	–
	rose	ROSA5	*Rosa*	0–150	–
	willow	SALIX	*Salix*	0–150	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–150	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–150	–

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Grass/Grasslike					
1	**Warm Season Tall & Mid Grasses**			495–1485	
	big bluestem	ANGE	*Andropogon gerardii*	165–660	–
	prairie cordgrass	SPPE	*Spartina pectinata*	165–330	–
	switchgrass	PAVI2	*Panicum virgatum*	0–165	–
2	**Cool-Season Tall & Mid Grasses**			660–990	
	western wheatgrass	PASM	*Pascopyrum smithii*	495–825	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	165–330	–
	basin wildrye	LECI4	*Leymus cinereus*	0–330	–
3	**Other Native Grasses**			165–495	
	foxtail barley	HOJU	*Hordeum jubatum*	66–264	–
	bluegrass	POA	*Poa*	0–264	–
	Grass, perennial	2GP	*Grass, perennial*	0–165	–
	saltgrass	DISP	*Distichlis spicata*	0–165	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–165	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–99	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–99	–
	prairie wedgescale	SPOB	*Sphenopholis obtusata*	0–66	–
4	**Grass-Likes**			165–495	
	sedge	CAREX	*Carex*	165–330	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	66–165	–
	rush	JUNCU	*Juncus*	0–165	–
	bulrush	SCHOE6	*Schoenoplectus*	0–99	–
	spikerush	ELEOC	*Eleocharis*	0–99	–
	horsetail	EQUIS	*Equisetum*	0–99	–
5	**Non-Native Grasses**			165–495	
	Kentucky bluegrass	POPR	*Poa pratensis*	165–330	–
	cheatgrass	BRTE	*Bromus tectorum*	66–264	–
Forb					
6	**Forbs**			165–330	
	goldenrod	SOLID	*Solidago*	0–165	–

	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–132	–
	Forb, perennial	2FP	*Forb, perennial*	0–99	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–99	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	33–99	–
	blazing star	LIATR	*Liatris*	0–99	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–99	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–99	–
	prairie clover	DALEA	*Dalea*	0–99	–
	marsh arrowgrass	TRPA28	*Triglochin palustris*	0–66	–
	curly dock	RUCR	*Rumex crispus*	0–66	–
	Forb, annual	2FA	*Forb, annual*	0–66	–
	thistle	CIRSI	*Cirsium*	0–66	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–33	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–33	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–33	–
	false boneset	BREU	*Brickellia eupatorioides*	0–33	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–33	–
	cocklebur	XANTH2	*Xanthium*	0–33	–
Shrub/Vine					
7	**Shrubs**			0–330	
	willow	SALIX	*Salix*	0–330	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–165	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–165	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–165	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–165	–
	rose	ROSA5	*Rosa*	0–99	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
2	**Cool-Season Tall**			0–200	

	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	215–430	–
	basin wildrye	LECI4	*Leymus cinereus*	0–430	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–200	–
3	**Other Native Grasses**			100–600	
	saltgrass	DISP	*Distichlis spicata*	40–200	–
	foxtail barley	HOJU	*Hordeum jubatum*	100–200	–
	bluegrass	POA	*Poa*	0–200	–
	Grass, perennial	2GP	*Grass, perennial*	0–60	–
4	**Grass-Likes**			200–500	
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	100–300	–
	sedge	CAREX	*Carex*	100–200	–
	horsetail	EQUIS	*Equisetum*	0–100	–
	rush	JUNCU	*Juncus*	0–100	–
	bulrush	SCHOE6	*Schoenoplectus*	0–100	–
	spikerush	ELEOC	*Eleocharis*	0–60	–
5	**Non-Native Grasses**			300–800	
	Kentucky bluegrass	POPR	*Poa pratensis*	165–330	–
	cheatgrass	BRTE	*Bromus tectorum*	40–200	–
Forb					
6	**Forbs**			200–400	
	white heath aster	SYER	*Symphyotrichum ericoides*	40–160	–
	goldenrod	SOLID	*Solidago*	40–160	–
	Forb, annual	2FA	*Forb, annual*	0–160	–
	thistle	CIRSI	*Cirsium*	0–160	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–100	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–100	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–100	–
	curly dock	RUCR	*Rumex crispus*	0–100	–
	Russian thistle	SALSO	*Salsola*	0–100	–
	cocklebur	XANTH2	*Xanthium*	0–100	–
	marsh arrowgrass	TRPA28	*Triglochin palustris*	0–60	–

	marsh arrowgrass	TRPA20	*Triglochin palustris*	0–60	
	Forb, perennial	2FP	*Forb, perennial*	0–60	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–60	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–60	–
	blazing star	LIATR	*Liatris*	0–40	–
	Pursh seepweed	SUCA2	*Suaeda calceoliformis*	0–40	–
Shrub/Vine					
7	**Shrubs**			40–300	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–200	–
	rose	ROSA5	*Rosa*	0–100	–
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–60	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–60	–
	willow	SALIX	*Salix*	0–20	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–20	–

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. In consultation with consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community = Prairie Cordgrass-Tall Warm-Season Grasses-Rhizomatous Wheatgrass (1.1)
Average Annual Production (lbs./ac, air-dry) = 4300
Stocking Rate (AUM/ac) = 1.18*

Plant Community = Rhizomatous Wheatgrass/Sedges/Rush (1.2)
Average Annual Production (lbs./ac, air-dry) = 3000
Stocking Rate (AUM/ac) = 0.82*

Plant Community = Decadent Plants, Excessive Litter (1.3)
Average Annual Production (lbs./ac, air-dry) = 3300

Stocking Rate (AUM/ac) = 0.90**

Plant Community = Kentucky Bluegrass Sod
Average Annual Production (lbs./ac, air-dry) = 2000
Stocking Rate (AUM/ac) = 0.55*

Plant Community = Kentucky Bluegrass Sod, Invaders, *Bare Ground*
Average Annual Production (lbs./ac, air-dry) = 1600
Stocking Rate (AUM/ac) = 0.44**

*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).
**Highly variable; stocking rate needs to be determined onsite.

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

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils from hydrologic groups A to D. Infiltration and runoff potential for this site varies from very low to high depending on soil hydrologic group, slope, and water table. Runoff may be high on this site if the soil becomes saturated (refer to Section 4, NRCS National Engineering Handbook, for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting opportunities for upland game species. The wide varieties of plants, which 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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Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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; Jill Epley, 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 Boltz

Acknowledgments

Rick L. Peterson, ESD update 4/19/17
MLRA 60A Provisional Level Quality Control (QC) Process9/28/17

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, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	07/14/2008
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 5 percent is typical.

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 10 to 30 inches thick with black to very dark gray colors when moist. Structure typically is medium to fine granular in the upper A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep rooted species (mid and tall rhizomatous cool- and warm-season grasses and grass-likes) with fine and coarse roots positively influences infiltration.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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

    Dominant: Tall/mid warm-season rhizomatous grasses >>

    Sub-dominant: Mid/tall cool-season grasses >

    Other: Grass-likes = forbs = shrubs

    Additional:

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.

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 3,500-5,000 lbs./acre (air-dry weight). Reference value production is 4,300 lbs./acre (air-dry weight).

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

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