USDA Natural Resources
Conservation Service

Ecological site R060AY042SD
Lowland

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.

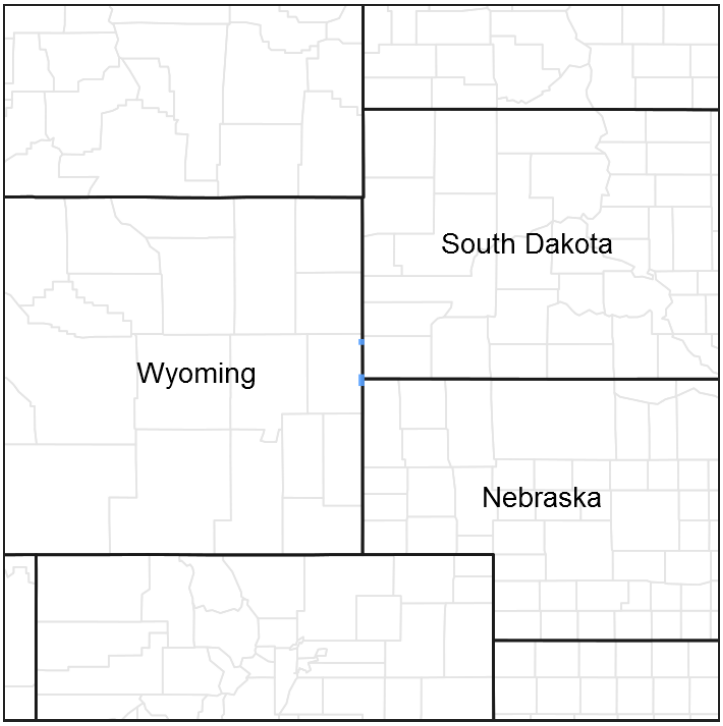

Figure 1. Mapped extent

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 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) 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 have 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 primarily are 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

U.S. Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Northwestern Great Plains — 43:
Semiarid Pierre Shale Plains — 43g
Dense Clay Prairie — 43k

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains and Palouse Dry Steppe Province — 331:
Western Great Plains Section — 331F:
Subsections:
Shale Scablands — 331Fb
Dense Clay Prairie — 331Ff
Northern Rolling Pierre Shale Plains — 331Fs

Ecological site concept

The Lowland ecological site is located on flood plains and low stream terraces. It can receive additional moisture from runoff or occasional overflow. Typically, slopes range from 0 to 4 percent. Soils are deep (greater than 20 inches). The surface soil will be highly variable and vary from 2 to 8 inches in thickness. Surface layer textures ranges from fine sandy loam to silty clay.

The vegetation in the Reference State (1.0) consists of warm- and cool-season grasses and grass-like species. Switchgrass and big bluestem, and occasionally prairie cordgrass are the dominant warm-season grasses. Cool-season grasses and grass-like species include green needlegrass, slender wheatgrass, bearded wheatgrass, and various sedges. Forbs are common and diverse. Shrubs will include silver sagebrush, western snowberry, and rose. Trees are primarily scattered stands of plains cottonwood.

Associated sites

R060AY003SD	**Subirrigated** The Subirrigated site can be located adjacent to the Lowland site.
R060AY020SD	**Loamy Overflow** The Loamy Overflow site can be found adjacent to or intermingled with the Lowland site.
R060AY022SD	**Loamy Terrace** The Loamy Terrace site will be located on the stream terrace above the Lowland site.

Similar sites

R060AY022SD	**Loamy Terrace** The Loamy Terrace site will rarely be flooded, will have fewer tree species and little, if any, tree regeneration.

Table 1. Dominant plant species

Tree	(1) *Populus deltoides ssp. monilifera*
Shrub	(1) *Artemisia cana*
Herbaceous	(1) *Panicum virgatum* (2) *Nassella viridula*

Physiographic features

The Lowland ecological site is located on nearly level flood plains and stream terraces adjacent to streams.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace (3) Flood plain
Runoff class	Negligible to very low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	2,500–4,300 ft
Slope	0–4%
Ponding depth	0 in
Water table depth	60–80 in
Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 60A 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) WASTA [USC00398911], Owanka, SD
- (2) UPTON [USC00489205], Upton, WY
- (3) REDBIRD [USC00487555], Lance Creek, WY
- (4) ARDMORE 1 NW [USC00390236], Edgemont, SD
- (5) BELLE FOURCHE [USC00390559], Belle Fourche, SD
- (6) MOORCROFT 3S [USW00024088], Moorcroft, WY

Influencing water features

The Lowland ecological site is located adjacent to terrace and overflow sites along stream corridors and drainageways.

Stream Type: B6, C6
(Rosgen System).

Wetland description

Not Applicable.

Soil features

The soils of this site are deep and very deep well-drained soils formed in mixed alluvium. These soils have moderate permeability. The surface soil will be highly variable and range from 2 to 8 inches in thickness. The surface soil will be one or more of the following textures: very fine sandy loam, fine sandy loam, sandy loam, loam, silt loam, clay loam,

clay, or silty clay. A fluctuating water table occurs in these areas and ranges from 1 to 5 feet, but is usually deeper than 3 feet. 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.

The only soil currently correlated to the Lowland ecological site is Draknab.

Bankard and Draknab are very similar soils that are found on the same landscape positions but Bankard is currently correlated to the (Sands R060AY008SD) ecological site. Bankard is planned to be recorrelated to the Lowland ecological site.

The Glenberg series, which is currently correlated to the Loamy Terrace and Loamy Overflow ecological sites, will also be recorrelated to the Lowland ecological site.

More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your location.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Clay loam (3) Fine sandy loam (4) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to rapid
Soil depth	20–80 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-40in)	3–6 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.1–8.4

Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

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

As this site deteriorates, species such as blue grama, snowberry, and silver sagebrush will increase. Cool-season grasses such as green needlegrass and rhizomatous wheatgrasses will decrease in frequency and production. Cottonwoods will not regenerate. This site is also susceptible to invasion of non-native cool-season grasses.

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

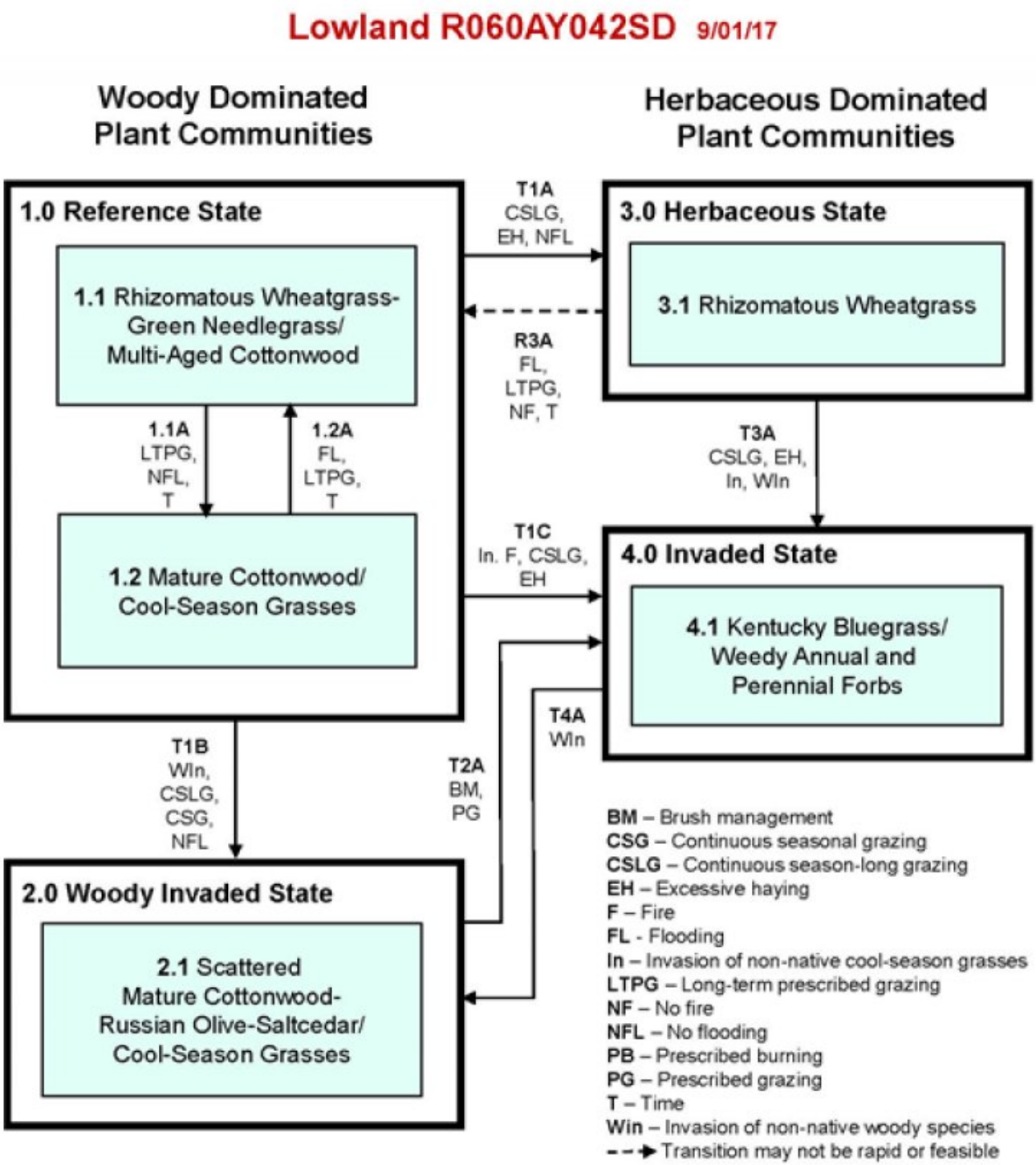

Figure 8. Lowland-R060AY042SD.

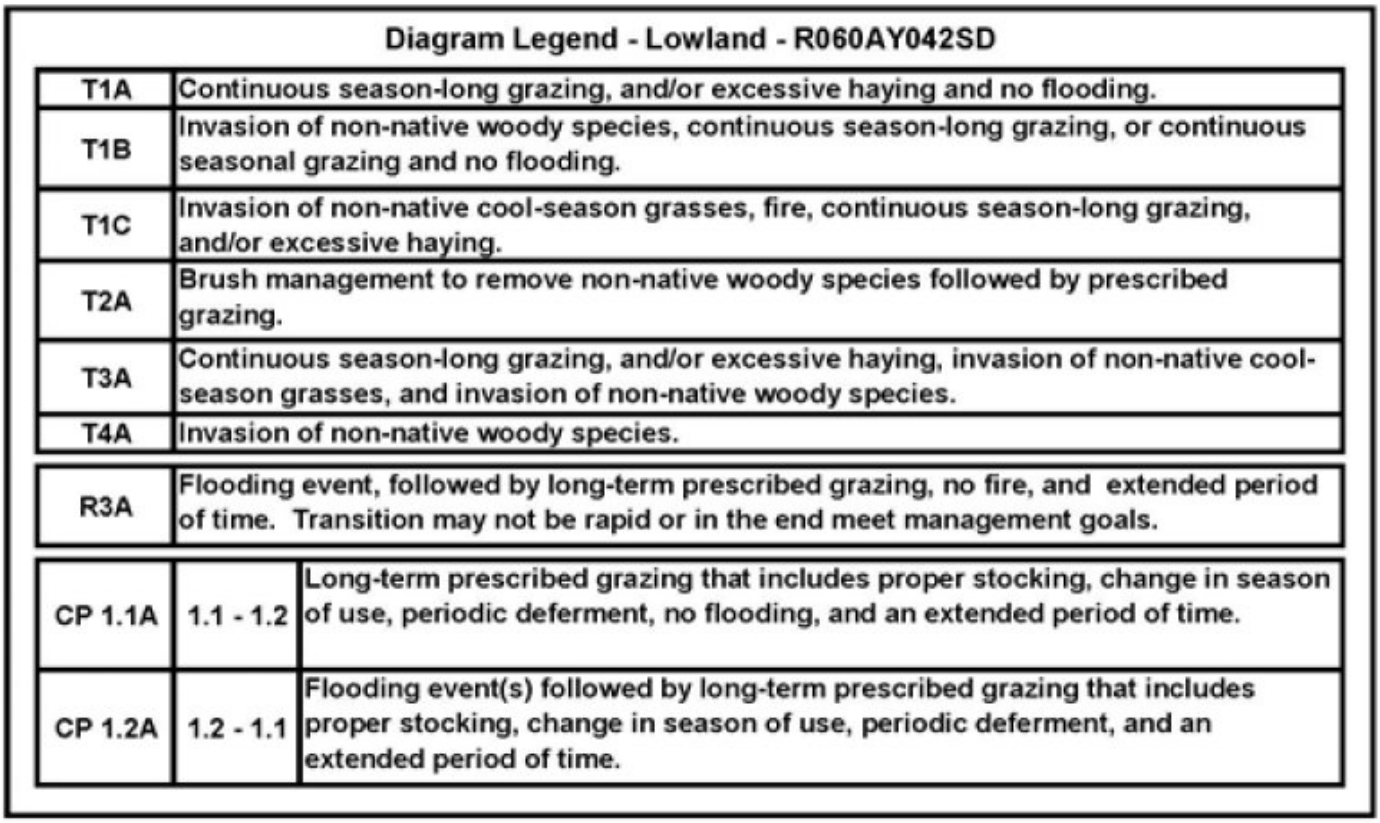

Figure 9. Lowland - R060AY042SD.

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 (1.0), is dominated by cool-season grasses and plains cottonwood. Grazing, fire, and flooding are the major drivers between plant communities. Cottonwood requires flooding to regenerate and, with long periods of no flooding, the plant communities will eventually transition into an Herbaceous State (3.0). The invasion of non-native cool-season grasses and heavy grazing result in a transition to an Invaded State (4.0). The invasion of non-native woody species will cause a transition to a Wooded Invaded State (2.0).

Community 1.1
Rhizomatous Wheatgrass-Green Needlegrass/Multi-Aged Cottonwood

Figure 10. Lowland - PCP 1.1.

The plant community upon which interpretations are primarily based is the Rhizomatous Wheatgrasses-Green Needlegrass/Cottonwood Plant Community. This is also considered the Reference Plant Community. Potential vegetation is about 55 to 75 percent grasses or grass- like plants, 5 to 15 percent forbs, and 5 to 30 percent woody plants. The understory is dominated by cool-season midgrasses. Major grasses include rhizomatous wheatgrasses, green needlegrass, needle and thread, and slender wheatgrass. Other grasses occurring include Sandberg bluegrass, Canada wildrye, and prairie Junegrass. Cottonwoods of various age classes are a conspicuous part of the overstory. This plant community is extremely stable and well adapted to the Northern Great Plains climatic conditions. Plant litter is properly distributed with very little movement off-site, and natural plant mortality is very low. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community (site/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	1910	2175	2325
Shrub/Vine	145	375	650
Forb	145	300	500
Tree	0	150	325
Total	**2200**	**3000**	**3800**

Figure 12. 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 1.2
Mature Cottonwoods/Cool-season Grasses

This plant community evolved under proper grazing use by domestic livestock and no flooding. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grasses, and miscellaneous forbs. Mature cottonwoods make up the overstory. Dominant grasses include rhizomatous wheatgrasses, Kentucky bluegrass, green needlegrass, and needle and thread. Other grasses include prairie Junegrass, Sandberg bluegrass, and slender wheatgrass. Forbs commonly occurring in this site phase include Louisiana sagewort (cudweed), plains wallflower, slimflower scurfpea, and scarlet globemallow. Silver sagebrush, wild rose, and snowberry canopy cover may be up to 20 to 40 percent. When compared to the Reference Plant Community (1.1), rhizomatous wheatgrass and green needlegrass have decreased. Needle and thread and Sandberg bluegrass have increased. Silver sagebrush also has increased. The site contains mature cottonwood trees, with little or no regeneration occurring. The overstory of cottonwoods and understory of grass and forbs provide a diverse plant community that will support domestic livestock and wildlife such as birds, mule deer, and antelope. The plant community is stable and protected from excessive erosion. The biotic integrity of this plant community is usually intact. However, the lack of cottonwood regeneration will reduce the quality of habitat for wildlife. The watershed is usually functioning.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1560	1812	1975
Shrub/Vine	120	313	550
Forb	120	250	400
Tree	0	125	275
Total	**1800**	**2500**	**3200**

Figure 14. 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

Long-term prescribed grazing without flooding will convert this plant community to the Mature Cottonwoods/Cool-Season Grasses Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Long-term prescribed grazing, flooding event(s), and time will result in a plant community very similar to the Reference Plant Community (1.1), with multiple age classes of cottonwood.

State 2
Woody Invaded State

This State developed as a result of the invasion of Russian olive and/or saltcedar, in combination with continuous season-long grazing or continuous seasonal grazing and no flooding. With time, the cottonwood will become mature with little or no regeneration occurring. Grazing that limits regeneration also results in a reduction of the desirable native herbaceous species, often resulting in a dominance of species such as Kentucky bluegrass and/or smooth brome, and forbs such as western ragweed, Canada thistle, burdock, and hound’s tongue.

Community 2.1
Scattered Mature Cottonwoods-Russian Olive-Saltcedar/Cool-Season Grasses

This plant community is the result of long-term improper grazing use and the invasion of non-native woody species. Kentucky bluegrass, cheatgrass, and blue grama are dominant grasses. Mature cottonwoods, Russian olive, and/or saltcedar make up the overstory. Noxious weeds such as Canada thistle and leafy spurge may invade. When compared to the Reference Plant Community (1.1) rhizomatous wheatgrasses and green needlegrass have decreased, silver sagebrush, Russian olive, and/or saltcedar have increased, and cottonwoods have not reproduced. The soil of this state is protected from erosion. The watershed is functioning, but may produce excessive runoff. The biotic integrity is threatened by invasive species.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	660	1012	1120
Tree	100	375	455
Shrub/Vine	70	225	400
Forb	70	188	325
Total	**900**	**1800**	**2300**

Figure 16. 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

State 3
Herbaceous State

This State consists of primarily rhizomatous wheatgrass, needlegrass, and scattered mature cottonwood. It is the result of continuous season-long grazing and/or haying and no flooding. Grasses and grass-like species make up 90 to 95 percent of the plant community. This State is at risk of transitioning to a bluegrass-dominated Invaded State (3.0).

Community 3.1
Rhizomatous Wheatgrass

This plant community is the result of haying. The state is dominated by rhizomatous wheatgrass with some green needlegrass. The overstory is mature cottonwoods. When compared to the Reference Plant Community (1.1), this site has lost much of its diversity. Woody vegetation consists mainly of mature cottonwoods. There are few forbs. The soil is protected from erosion by a wheatgrass sod. The biotic community is restricted by the lack of diversity. Watershed values are protected due to the lack of steep slopes on this site.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1405	1750	2085
Forb	95	150	205
Tree	0	50	105
Shrub/Vine	0	50	105
Total	**1500**	**2000**	**2500**

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

State 4
Invaded State

This state is the result of invasion and dominance of introduced cool-season grass species. This state is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade-tolerant, introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen, which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns, thereby shifting competitive advantage to shade-tolerant, introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community, and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D. et al., 2014).

Community 4.1
Kentucky Bluegrass/Weedy Annual and Perennial Forbs

This plant community developed with continuous season-long grazing and/or excessive haying and the invasion of non-native cool-season grasses. Kentucky bluegrass dominates the community and can develop into a “sod-bound” appearance. Low-vigor western wheatgrass can be found scattered throughout the community. Green needlegrass has been greatly reduced. Western yarrow, scurfpea, and ragweed have

increased. Non-native grasses and forbs such as annual bromes, curlycup gumweed, thistle, and cocklebur will invade this plant community. Silver sagebrush, western snowberry, and rose may persist in the plant community if not removed during haying activities. Russian olive and saltcedar may be present, but in minor amounts. This plant community is resistant to change due to grazing tolerance of Kentucky bluegrass. A significant amount of production and diversity has been lost when compared to the Reference Plant Community (1.1). The dominance of non-native cool-season grasses and the loss of other desirable species has negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly and soil loss may be accelerated where concentrated flows occur.

Figure 19. Plant community growth curve (percent production by month). SD6001, Pierre Shale Plains, cool-season dominant. Cool-season dominant..

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

Transition T1B
State 1 to 2

Continuous season-long grazing or continuous seasonal grazing, and the invasion of Russian olive and/or saltcedar, and no flooding will transition the Reference Plant Communities to the Woody Invaded State (2.0).

Transition T1A
State 1 to 3

Continuous season-long grazing and/or excessive haying, and no flooding will convert this state to the Rhizomatous Wheatgrass State (3.0).

Transition T1C
State 1 to 4

Invasion on non-native cool-season grasses and/or fire that removes the majority of woody species, followed by continuous season-long grazing and/or excessive haying, will transition the Reference Plant Communities to the Invaded State (4.0).

Transition T2A
State 2 to 4

Brush management used to remove and treat the non-native trees, followed by prescribed grazing will transition this Plant Community to the Invaded State (4.0).

Restoration pathway R3A

State 3 to 1

Flooding, followed by long-term prescribed grazing, no fire, and an extended period of time may transition this Plant Community to the Reference State (1.0).

Transition T3A
State 3 to 4

Continuous season-long grazing and/or excessive haying and the invasion of non-native cool-season grasses will transition this plant community to the Invaded State (4.0).

Transition T4A
State 4 to 2

Invasion of non-native woody species will transition this State to the Woody Invaded State (2.0).

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	**Rhizomatous Wheatgrasses**			150–300	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	150–300	–
	western wheatgrass	PASM	*Pascopyrum smithii*	150–300	–
2	**Slender Wheatgrass**			150–300	
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	150–300	–
3	**Green Needlegrass**			300–450	
	green needlegrass	NAVI4	*Nassella viridula*	300–450	–
4	**Bearded Wheatgrass**			120–300	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	120–300	–
5	**Other Native Grasses**			450–750	
	Grass, perennial	2GP	*Grass, perennial*	0–150	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–150	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–150	–
	squirreltail	ELEL5	*Elymus elymoides*	0–150	–

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–150	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–150	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–150	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–150	–
	threeawn	ARIST	*Aristida*	0	–
Forb					
7	**Forbs**			150–450	
	American vetch	VIAM	*Vicia americana*	0–150	–
	Forb, perennial	2FP	*Forb, perennial*	0–150	–
	common yarrow	ACMI2	*Achillea millefolium*	0–150	–
	onion	ALLIU	*Allium*	0–150	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–150	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–150	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–150	–
	aster	ASTER	*Aster*	0–150	–
	milkvetch	ASTRA	*Astragalus*	0–150	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–150	–
	white prairie clover	DACA7	*Dalea candida*	0–150	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–150	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–150	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–150	–
	desertparsley	LOMAT	*Lomatium*	0–150	–
	bluebells	MERTE	*Mertensia*	0–150	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–150	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–150	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–150	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–150	–
	goatsbeard	TRAGO	*Tragopogon*	0	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0	–

	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0	–
	thistle	CIRSI	*Cirsium*	0	–
	Forb, annual	2FA	*Forb, annual*	0	–
Shrub/Vine					
8	**Shrubs**			150–600	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–150	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–150	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–150	–
	silverberry	ELCO	*Elaeagnus commutata*	0–150	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–150	–
	Woods' rose	ROWO	*Rosa woodsii*	0–150	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–150	–
Tree					
9	**Trees**			0–300	
	cottonwood	POPUL	*Populus*	0–300	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			125–250	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	125–250	–
	western wheatgrass	PASM	*Pascopyrum smithii*	125–250	–
2	**Slender Wheatgrass**			125–250	
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	125–250	–
3	**Green Needlegrass**			125–250	
	green needlegrass	NAVI4	*Nassella viridula*	125–250	–
4	**Bearded Wheatgrass**			100–250	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	100–250	–
5	**Other Native Grasses**			250–875	
	blue grama	BOGR2	*Bouteloua gracilis*	125–250	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	125–250	–

			comata		
	Sandberg bluegrass	POSE	*Poa secunda*	50–200	–
	Canada wildrye	ELCA4	*Elymus canadensis*	50–200	–
	squirreltail	ELEL5	*Elymus elymoides*	50–200	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–125	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–125	–
	Grass, perennial	2GP	*Grass, perennial*	0–125	–
	threeawn	ARIST	*Aristida*	0–75	–
6	**Non-native Grasses**			50–250	
	Kentucky bluegrass	POPR	*Poa pratensis*	50–250	–
	cheatgrass	BRTE	*Bromus tectorum*	0–75	–
Forb					
7	**Forbs**			125–375	
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–150	–
	tarragon	ARDR4	*Artemisia dracunculus*	25–150	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–125	–
	Forb, annual	2FA	*Forb, annual*	0–125	–
	Forb, perennial	2FP	*Forb, perennial*	0–125	–
	common yarrow	ACMI2	*Achillea millefolium*	0–125	–
	aster	ASTER	*Aster*	0–125	–
	milkvetch	ASTRA	*Astragalus*	0–125	–
	thistle	CIRSI	*Cirsium*	0–125	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–125	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–125	–
	goatsbeard	TRAGO	*Tragopogon*	0–125	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–75	–
	desertparsley	LOMAT	*Lomatium*	0–75	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–75	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–75	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–75	–

	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0–50	–
	white prairie clover	DACA7	*Dalea candida*	0–50	–
	onion	ALLIU	*Allium*	0–50	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–50	–
	American vetch	VIAM	*Vicia americana*	0–50	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–50	–
	bluebells	MERTE	*Mertensia*	0–25	–
Shrub/Vine					
8	**Shrubs**			125–500	
	silver sagebrush	ARCA13	*Artemisia cana*	0–200	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–200	–
	Woods' rose	ROWO	*Rosa woodsii*	0–125	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–125	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–125	–
	silverberry	ELCO	*Elaeagnus commutata*	0–125	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–125	–
Tree					
9	**Trees**			0–250	
	cottonwood	POPUL	*Populus*	0–250	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			0–150	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–150	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–150	–
2	**Slender Wheatgrass**			0–75	
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–75	–
3	**Green Needlegrass**			0–45	
	green needlegrass	NAVI4	*Nassella viridula*	0–45	–

4	**Bearded Wheatgrass**			0–75	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–75	–
5	**Other Native Grasses**			375–750	
	blue grama	BOGR2	*Bouteloua gracilis*	150–300	–
	squirreltail	ELEL5	*Elymus elymoides*	75–225	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	75–225	–
	Canada wildrye	ELCA4	*Elymus canadensis*	30–120	–
	Sandberg bluegrass	POSE	*Poa secunda*	30–120	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–75	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–75	–
	Grass, perennial	2GP	*Grass, perennial*	0–75	–
	threeawn	ARIST	*Aristida*	0–75	–
6	**Non-native Grasses**			150–300	
	Kentucky bluegrass	POPR	*Poa pratensis*	75–225	–
	cheatgrass	BRTE	*Bromus tectorum*	75–150	–
Forb					
7	**Forbs**			75–300	
	Forb, annual	2FA	*Forb, annual*	0–150	–
	tarragon	ARDR4	*Artemisia dracunculus*	30–150	–
	thistle	CIRSI	*Cirsium*	0–150	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–120	–
	common yarrow	ACMI2	*Achillea millefolium*	0–120	–
	goatsbeard	TRAGO	*Tragopogon*	30–120	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–75	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–75	–
	Forb, perennial	2FP	*Forb, perennial*	0–75	–
	aster	ASTER	*Aster*	0–75	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–75	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–75	–
	sulphur-flower	ERUM	*Eriogonum umbellatum*	0–45	–

	buckwheat				
	milkvetch	ASTRA	*Astragalus*	0–45	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0–45	–
	onion	ALLIU	*Allium*	0–30	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–30	–
	desertparsley	LOMAT	*Lomatium*	0–30	–
	bluebells	MERTE	*Mertensia*	0	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0	–
	white prairie clover	DACA7	*Dalea candida*	0	–
	American vetch	VIAM	*Vicia americana*	0	–
Shrub/Vine					
8	**Shrubs**			75–375	
	silver sagebrush	ARCA13	*Artemisia cana*	30–150	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	30–150	–
	Woods' rose	ROWO	*Rosa woodsii*	0–75	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–75	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–75	–
	silverberry	ELCO	*Elaeagnus commutata*	0–75	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–75	–
Tree					
9	**Trees**			150–400	
	Russian olive	ELAN	*Elaeagnus angustifolia*	100–300	–
	cottonwood	POPUL	*Populus*	50–150	–
	saltcedar	TARA	*Tamarix ramosissima*	0–100	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			200–500	
	thickspike	ELLAL	*Elymus lanceolatus ssp.*	200–500	

	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	200–500	–
	western wheatgrass	PASM	*Pascopyrum smithii*	200–500	–
2	**Slender Wheatgrass**			100–200	
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	100–200	–
3	**Green Needlegrass**			200–300	
	green needlegrass	NAVI4	*Nassella viridula*	200–300	–
4	**Bearded Wheatgrass**			100–200	
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	100–200	–
5	**Other Native Grasses and Grass-likes**			400–700	
	blue grama	BOGR2	*Bouteloua gracilis*	100–200	–
	squirreltail	ELEL5	*Elymus elymoides*	0–200	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	100–200	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–100	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–100	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–100	–
	Grass, perennial	2GP	*Grass, perennial*	0–100	–
	threeawn	ARIST	*Aristida*	0–60	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–60	–
6	**Non-native Grasses**			100–300	
	Kentucky bluegrass	POPR	*Poa pratensis*	100–200	–
	cheatgrass	BRTE	*Bromus tectorum*	0–100	–
Forb					
7	**Forbs**			100–200	
	Forb, annual	2FA	*Forb, annual*	0–100	–
	Forb, perennial	2FP	*Forb, perennial*	0–100	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–100	–
	thistle	CIRSI	*Cirsium*	0–80	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–80	–
	aster	ASTER	*Aster*	0–60	–
	milkvetch	ASTRA	*Astragalus*	0–60	–

	common yarrow	ACMI2	*Achillea millefolium*	0–60	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–60	–
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–60	–
	goatsbeard	TRAGO	*Tragopogon*	0–60	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	0–60	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–40	–
	onion	ALLIU	*Allium*	0–40	–
	desertparsley	LOMAT	*Lomatium*	0–40	–
	bluebells	MERTE	*Mertensia*	0	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	0	–
	white prairie clover	DACA7	*Dalea candida*	0	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0	–
	twogrooved milkvetch	ASBI2	*Astragalus bisulcatus*	0	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0	–
	American vetch	VIAM	*Vicia americana*	0	–
Shrub/Vine					
8	**Shrubs**			0–100	
	prairie sagewort	ARFR4	*Artemisia frigida*	0–100	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–60	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–60	–
	Woods' rose	ROWO	*Rosa woodsii*	0–40	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–40	–
	silverberry	ELCO	*Elaeagnus commutata*	0	–
Tree					
9	**Trees**			0–100	
	cottonwood	POPUL	*Populus*	0–100	–

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-Green Needlegrass/Multi-Aged Cottonwood (1.1)
Average Annual Production (lbs./ac., air-dry) = 3000
Stocking Rate (AUM/ac) = 0.68*

Plant Community = Mature Cottonwoods/Cool-season Grasses (1.2)
Average Annual Production (lbs./ac., air-dry) = 2500
Stocking Rate (AUM/ac) = 0.57*

Plant Community = Scattered Mature Cottonwoods-Russian Olive-Saltcedar/Cool-Season Grasses (2.1)
Average Annual Production (lbs./ac., air-dry) = 1800
Stocking Rate (AUM/ac) = Variable

Plant Community = Rhizomatous Wheatgrass (3.1)
Average Annual Production (lbs./ac., air-dry) = 2000
Stocking Rate (AUM/ac) = 0.55

Plant Community = Kentucky Bluegrass/Weedy Annual and Perennial Forbs (4.1)
Average Annual Production (lbs./ac., air-dry) = Variable
Stocking Rate (AUM/ac) = Variable

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, desirable, or accessible 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.

Wildlife

Rhizomatous Wheatgrass-Green Needlegrass/Multi-Aged Cottonwood Plant Community (1.1): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood rearing/foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include Western meadowlarks, horned larks, and golden eagles. Many grassland obligate small mammals would occur here.

Mature Cottonwoods/Cool-season Grasses Plant Community (1.2): This plant community may be useful for the same large grazers that would use the Reference Plant Community (1,1). However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds. The overstory of large cottonwoods provides habitat for a variety of birds ranging from raptors to neo-tropical migrants.

Rhizomatous Wheatgrass Plant Community (3.1): This plant community may be useful for the same large grazers that would use the Reference Plant Community (1.1). However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B. Infiltration ranges from moderately slow to rapid. Runoff potential for this site varies from very low to medium depending on slope and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong 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 upland game species. The wide variety 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 toward an “Approved” status.

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

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Inventory data references

Information presented here was 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: Everet Bainter, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Glen Mitchell, RMS, NRCS; and Cheryl Nielsen, RMS, NRCS.

Other references

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Contributors

Stan C. Boltz
Rick L. Peterson

Acknowledgments

ESD updated by Rick L. Peterson on 8/22/17

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

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 3 to 19 inches thick with dark grayish brown colors when moist. Structure typically is coarse sub-angular blocky in the A-horizon.

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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.

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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):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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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: Mid cool-season rhizomatous grasses >

    Sub-dominant: Tall warm-season rhizomatous grasses > mid warm-season bunchgrasses > shrubs > mid cool-season bunchgrasses > short warm-season rhizomatous grasses >

    Other: Forbs = trees = grass-likes

    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 1,500-2,600 lbs./acre (air-dry weight). Reference value production is 2,000 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; 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.