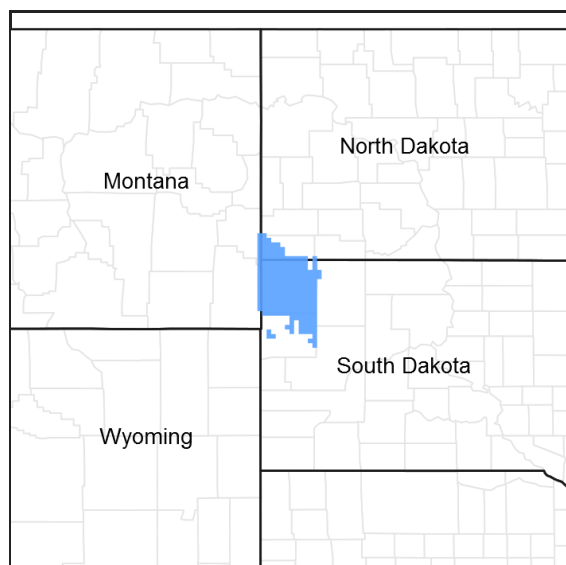


# **Ecological site R058DY010SD** **Loamy**

Accessed: 05/17/2024

## **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.

## **Classification relationships**

Level IV Ecoregions of the Conterminous United States: 43e – Sagebrush Steppe.

## **Associated sites**

R058DY009SD	<b>Sandy</b>
R058DY011SD	<b>Clayey</b>
R058DY012SD	<b>Thin Loamy</b>
R058DY013SD	<b>Claypan</b>
R058DY020SD	<b>Loamy Overflow</b>
R058DY024SD	<b>Shallow Loamy</b>

## **Similar sites**

R058DY020SD	<b>Loamy Overflow</b> [less needleandthread; more big bluestem; more productive]
R058DY011SD	<b>Clayey</b> [more green needlegrass; needleandthread minor component]

R058DY013SD	<b>Claypan</b> [more blue grama; more cactus; less productive]
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**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Nassella viridula</i>

## Physiographic features

This site occurs on nearly level to moderately steep uplands.

**Table 2. Representative physiographic features**

Landforms	(1) Hill (2) Fan (3) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	701–1,219 m
Slope	1–12%
Water table depth	203 cm
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 to the east. Annual precipitation ranges from 14 to 16 inches. Most of the rainfall occurs as frontal storms early in the growing season. Some high-intensity, convective thunderstorms occur the summer. Precipitation in winter occurs as snow. 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. Outbreaks of cold air from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. The normal average annual temperature is about 44° F. January is the coldest month with average temperatures ranging from about 12° F (Marmarth, ND) to about 20° F (Baker, MT). July is the warmest month with temperatures averaging from about 70° F (Marmarth, ND) to about 76° F (Baker, MT). The range of normal average monthly temperatures between the coldest and warmest months is about 55° 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 are generally 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 (average)	123 days
Freeze-free period (average)	140 days
Precipitation total (average)	406 mm

## Influencing water features

No significant water features influence this site.

## Soil features

The soils in this site are well drained and formed in alluvium or residuum from various sedimentary materials. The surface layer is 10 to 20 inches thick. The texture of the surface soils are loam or fine sandy loam, while the subsoil ranges from fine sandy loam to clay loam. The soils have a moderate infiltration rate. Occasionally carbonates will occur at or near the surface on this site. This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths are typically not present, but when visible they are broken and irregular in appearance or discontinuous. The soil surface is stable and intact. Sub-surface soil layers are non-restrictive to water movement and root penetration. These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 10 percent.

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

**Table 4. Representative soil features**

Surface texture	(1) Loam (2) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	51–203 cm
Surface fragment cover ≤3"	0–20%
Surface fragment cover >3"	0–25%
Available water capacity (0–101.6cm)	12.7–17.78 cm
Calcium carbonate equivalent (0–101.6cm)	0–20%
Electrical conductivity (0–101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0–101.6cm)	0–5
Soil reaction (1:1 water) (0–101.6cm)	6.1–9
Subsurface fragment volume ≤3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–20%

## 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 describe 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.

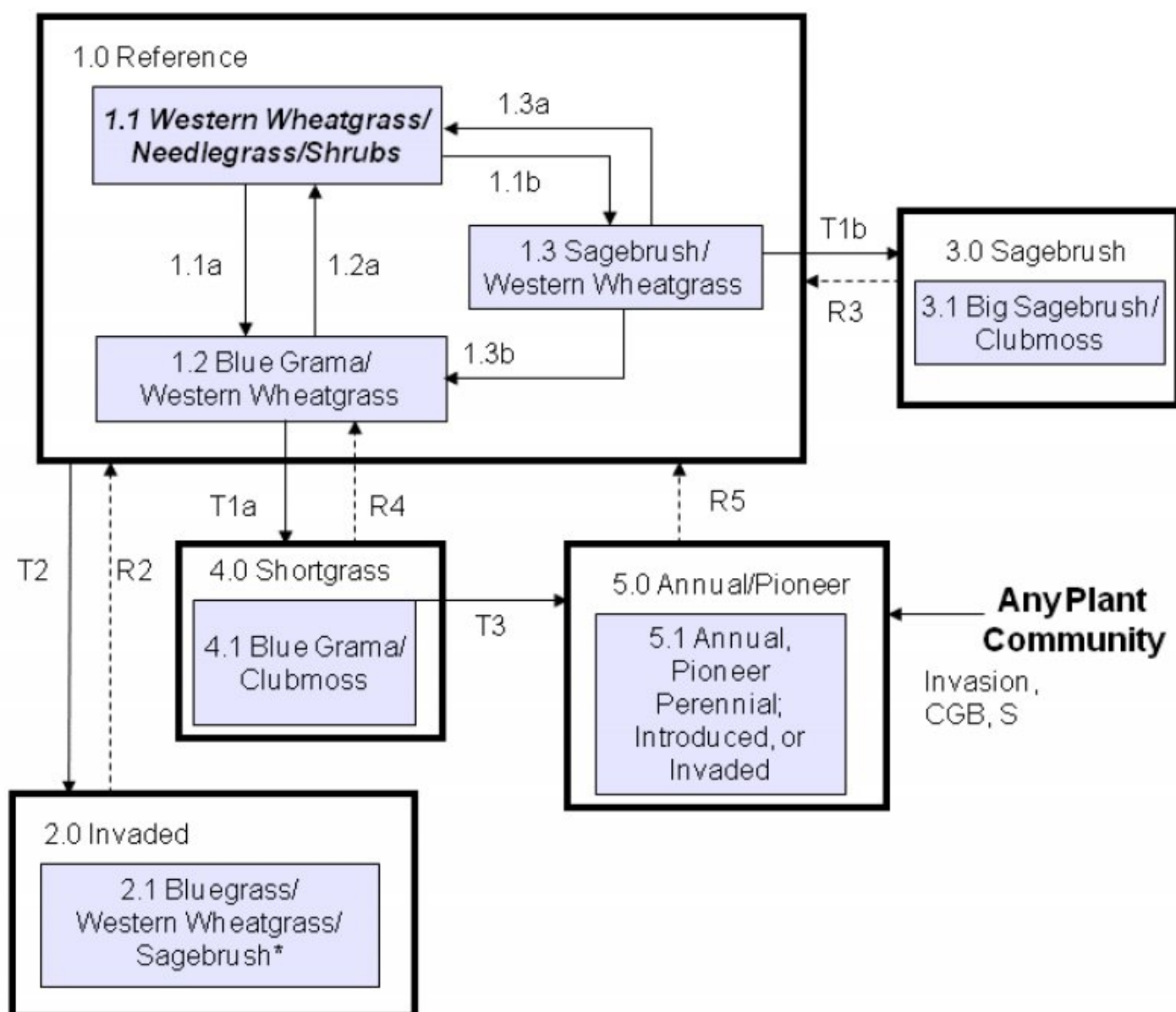
The plant community upon which interpretations are primarily based is the Western Wheatgrass/Needlegrass/Shrubs Plant Community. This plant community has been determined by studying rangeland relic

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.

Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass/Needlegrass/Shrubs Plant Community. Blue grama will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama to dominate and club moss to increase. This resulting plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive than the Western Wheatgrass/Needlegrass/Shrubs Plant Community. Runoff increases and infiltration will decrease. Soil erosion will be minimal. Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass. Shrubs such as western snowberry and chokecherry will also typically increase.

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



## State 1 Reference

The State narrative is under development.

### Community 1.1 Western Wheatgrass/Needlegrass/Shrubs

The interpretive plant community for this site is the Western Wheatgrass/Needlegrass/Shrubs Plant Community. This is also considered to be climax. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of deferment. The potential vegetation is about 80-90% grasses or grass-like plants, 5-10% forbs, and 5-10% shrubs. Cool season grasses dominate this plant community. The major grasses include western wheatgrass, green needlegrass and needleandthread. Other grasses or grass-likes occurring on the site include blue grama, big bluestem, sideoats grama, prairie junegrass, buffalograss and sedge. Significant forbs include scarlet globemallow, prairie coneflower, purple prairie clover, penstemon, American vetch, and green sagewort. The significant shrubs that occur include big sagebrush, leadplant, snowberry, winterfat and rose. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). The diversity in plant species allows for high drought tolerance. This is a healthy and sustainable plant community. Moderate or high available water capacity provides a favorable soil-water-plant relationship. Overall the interpretive plant community has the appearance of being stable, diverse and productive. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2000	2656
Shrub/Vine	112	177	241
Forb	112	177	241
<b>Total</b>	<b>1681</b>	<b>2354</b>	<b>3138</b>

Figure 5. Plant community growth curve (percent production by month).  
SD5801, Northern Rolling High Plains, cool-season dominant.. Cool-season dominant, uplands..

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

### Community 1.2 Blue Grama/Western Wheatgrass

This plant community develops under continuous seasonal grazing (i.e., grazing an area during the same season every year) or from over utilization during extended drought periods. The potential vegetation is made up of approximately 75-85% grasses and grass-like species, 5-15% forbs and 1-10% shrubs. The dominant grasses include blue grama and western wheatgrass. Other grasses or grass-likes may include sedge, buffalograss, needleandthread and prairie junegrass. Significant forbs include cudweed sagewort, curlycup gumweed, green sagewort, scarlet globemallow, scurfpea and western yarrow. The dominant shrubs that occur include western snowberry, cactus, rose and fringed sagewort. Compared to the Western Wheatgrass/Needlegrass/Shrubs Plant Community, the shortgrass species including blue grama and threadleaf sedge have increased. The cool season species including western wheatgrass and green needlegrass have decreased in composition. Annual bromes, curlycup gumweed, sweetclover and other annual grasses and forbs can invade the site. This plant community can occur in a mosaic with patchy, slightly used areas occurring adjacent to and intermingled with this plant community. This plant community is resistant to change. The dominant herbaceous species are very adapted to grazing; however, the mid-grass species and the more palatable forbs will decrease. If the herbaceous component is intact, it tends to be resilient if disturbance is not long-term. Because of the sod forming habit of the shortgrass species,

water infiltration is low, and runoff is moderate to high. Typically the runoff is very clean because of the low potential for on-site soil erosion. However, off-site areas may be affected by increased runoff.

**Table 6. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	712	1103	1597
Forb	62	135	207
Shrub/Vine	11	74	140
Moss	—	34	73
<b>Total</b>	<b>785</b>	<b>1346</b>	<b>2017</b>

**Figure 7. Plant community growth curve (percent production by month).**  
SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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

### Community 1.3 Sagebrush/Western Wheatgrass

This plant community develops from continuous season-long grazing and the absence of fire. It is made up of 60-75% mid cool-season and short warm-season grasses, 5-10% forbs, 10-25% shrubs and 0-5% cryptogams. The dominant grasses and grass-likes include western wheatgrass, needleandthread, green needlegrass, blue grama and threadleaf sedge. Forbs commonly found on this plant community include cudweed sagewort, green sagewort, scarlet globemallow and heath aster. Sagebrush canopy typically ranges from 20-30%. Fringed sagewort is also common. As conditions deteriorate, desirable species are replaced by big sagebrush. Blue grama increases in the plant community. Cheatgrass, other annuals, and bluegrass can invade the plant community. When compared to the Western Wheatgrass/Needlegrass/Shrubs, sagebrush has increased while most of the grass species have either remained the same or declined in production. The sagebrush canopy provides some protection to the cool-season mid grasses, by making them unavailable for grazing. Under proper management, this plant community is stable. The soil erosion is low to moderate. Infiltration and runoff are moderate. Subsoil moisture conditions are typically drier due to the high water demand of the big sagebrush. This makes big sagebrush highly competitive with other species.

**Table 7. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	958	1380	1777
Shrub/Vine	185	334	504
Forb	90	143	196
Moss	—	48	101
<b>Total</b>	<b>1233</b>	<b>1905</b>	<b>2578</b>

**Figure 9. Plant community growth curve (percent production by month).**  
SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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

### Pathway 1.1a Community 1.1 to 1.2

Continuous seasonal grazing during the active growing period of cool season plants will lead to the Blue Grama/Western Wheatgrass Plant Community.

### **Pathway 1.1b**

#### **Community 1.1 to 1.3**

Continuous season-long grazing and no fire will lead to the Sagebrush/Western Wheatgrass Plant Community. This occurs with exposure to herbivory during the entire growing season at moderate stocking rates.

### **Pathway 1.2a**

#### **Community 1.2 to 1.1**

Prescribed grazing, which allows for adequate plant recovery periods will move this plant community to the Western Wheatgrass/Needlegrass/Shrubs Plant Community.

#### **Conservation practices**

Prescribed Grazing
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### **Pathway 1.3a**

#### **Community 1.3 to 1.1**

With brush management and prescribed grazing, this plant community will move towards the Western Wheatgrass/Needlegrass/Shrubs Plant Community.

#### **Conservation practices**

Brush Management
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Prescribed Grazing
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### **Pathway 1.3b**

#### **Community 1.3 to 1.2**

With brush management alone or with continuous seasonal grazing and browsing or mechanical disturbance of the brush, this plant community will move towards the Blue Grama/Western Wheatgrass Plant Community.

#### **Conservation practices**

Brush Management
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## **State 2**

### **Invaded**

The State narrative is under development.

### **Community 2.1**

#### **Bluegrass/Western Wheatgrass/Sagebrush**

This plant community develops after an extended period of 10 or more years of non-use by herbivores and exclusion of fire. Non-native grasses, such as Kentucky bluegrass and Canada bluegrass, tend to invade and may dominate this plant community. Other grasses present include western wheatgrass, green needlegrass, cheatgrass and slender wheatgrass. The common forbs include sweetclover, green sagewort, cudweed sagewort, and heath aster. Western snowberry is the principal shrub and tends to increase in density and cover. Sagebrush will typically be present, but may be absent if sufficient fuels from non-use build up and a wildfire occurs. Litter buildup reduces plant vigor and density, and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. This plant community is dispersed throughout the pasture, encircling spot grazed areas, and areas distant from

water sources. This plant community may be found intermingled in a mosaic with the Blue Grama/Western Wheatgrass Plant Community in properly stocked pastures grazed season-long. This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the Western Wheatgrass/Needlegrass/Shrubs Plant Community. Soil erosion is low. Runoff is similar to the interpretive plant community. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in diversity.

**Table 8. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1222	1601	1973
Forb	34	114	196
Shrub/Vine	90	143	196
Moss	—	47	101
<b>Total</b>	<b>1346</b>	<b>1905</b>	<b>2466</b>

**Figure 11. Plant community growth curve (percent production by month).**  
SD5801, Northern Rolling High Plains, cool-season dominant.. Cool-season dominant, uplands..

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

### State 3 Sagebrush

The State narrative is under development.

#### Community 3.1 Big Sagebrush/Clubmoss

This plant community is the result of continuous season-long grazing and no fire. Sagebrush dominates with canopy cover often exceeding 60%. The understory of grass includes western wheatgrass, needleandthread, blue grama, Sandberg bluegrass, and prairie junegrass. The sagebrush canopy protects the cool season grasses, but this protection makes them unavailable for grazing. Big sagebrush is long-lived and will persist for a long period with a lack of fire. This plant community differs from the Western Wheatgrass/Needlegrass/Shrubs Plant Community by an increase in big sagebrush and a decrease in grasses. Runoff will be higher due to a deterioration of the surface structure of the soil and the increase of clubmoss. The soils will tend to dry out much more quickly due to the high water use by sagebrush, making it less available for herbaceous species.

**Table 9. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	454	558	897
Shrub/Vine	247	605	729
Forb	62	101	140
Moss	22	81	140
<b>Total</b>	<b>785</b>	<b>1345</b>	<b>1906</b>

**Figure 13. Plant community growth curve (percent production by month).**  
SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

## State 4 Shortgrass

The State narrative is under development.

### Community 4.1 Blue Grama/Clubmoss

This plant community develops under heavy continuous season-long grazing, or with continuous seasonal grazing with concentrated use in the early part of the growing season (as in calving/lambing pastures). It is made up of approximately 70-80% grasses (primarily short, warm season grasses), 5-20% forbs, 1-10% shrubs and 5-15% cryptogams (clubmoss). The dominant grasses/grass-likes include blue grama and threadleaf sedge. Other grasses may include western wheatgrass, prairie junegrass, buffalograss and cheatgrass. The dominant forbs include common pepperweed, curlycup gumweed, cudweed sagewort, green sagewort, sweetclover and western yarrow. The dominant shrubs include fringed sagewort and cactus. Compared to the Western Wheatgrass/Needlegrass/Shrubs Plant Community, blue grama and sedge have increased, and the cool-season mid-grasses have diminished greatly. Non-palatable forbs and cactus have increased, and non-native species have invaded the site. Plant diversity is low. This plant community is very stable. Generally, this plant community will require significant management inputs (i.e., high animal impact, long-term prescribed grazing, favorable climatic conditions, etc.) and time to move it towards the Blue Grama/Western Wheatgrass Plant Community. On-site soil erosion is low. Infiltration is low, and runoff is high. Typically the runoff is very clean because of the low potential for on-site soil erosion. However, off-site areas can be significantly impacted due to the increased runoff.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	364	646	925
Forb	39	112	185
Moss	39	90	140
Shrub/Vine	6	49	95
<b>Total</b>	<b>448</b>	<b>897</b>	<b>1345</b>

Figure 15. Plant community growth curve (percent production by month).  
SD5805, Northern Rolling High Plains, warm-season dominant.. Warm-season dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	5	15	25	30	15	7	1	0	0

## State 5 Annual/Pioneer

The State narrative is under development.

### Community 5.1 Annual, Pioneer Perennial; Introduced, or Invaded

This group includes three separate vegetation states that are highly variable in nature. They are derived through distinct management scenarios, and are not related successional. Infiltration, runoff and soil erosion varies depending on the vegetation present on the site. The "Annual, Pioneer Perennial" state can be reached whenever severe disturbance (i.e., abandoned farmland, severe continuous season-long grazing, frequent and severe defoliation by rodents, etc.) occurs. During the early successional stages, the species that mainly dominate are

annual grasses and forbs, later being replaced by both native and introduced perennials. The vegetation on this site varies greatly, sometimes being dominated by threeawn, cheatgrass, crested wheatgrass, buffalograss, broom snakeweed, sweetclover and non-native thistles. Other plants that commonly occur on the site include wheatgrass, deathcamas, prickly lettuce, maretail, kochia, squirreltail, foxtail and sunflowers. The "Introduced" state is normally those areas seeded to crested wheatgrass, pubescent or intermediate wheatgrass and alfalfa. It requires considerable investment to establish and has a variable life expectancy. The "Invaded" state includes areas that have been invaded, and are dominated by species such as smooth brome, Kentucky bluegrass, crested wheatgrass, non-native thistles, field bindweed, knapweeds, leafy spurge, hoary cress and other introduced species.

### **Transition T2**

#### **State 1 to 2**

Non-use and no fire for extended periods of time will convert this plant community to the Bluegrass/Western Wheatgrass/Sagebrush

### **Transition T1b**

#### **State 1 to 3**

With heavy, continuous season-long grazing and no fire, this plant community will move to the Big Sagebrush/Clubmoss Plant Community

### **Transition T1a**

#### **State 1 to 4**

With heavy continuous seasonal grazing this plant community will move towards the Blue Grama/Clubmoss Plant Community.

### **Transition T4**

#### **State 1 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

### **Transition T4**

#### **State 1 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

### **Transition T4**

#### **State 1 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

### **Restoration pathway R2**

#### **State 2 to 1**

Under long-term prescribed grazing and prescribed burning, including adequate recovery periods, this plant community may eventually move towards a plant community resembling the Western Wheatgrass/Needlegrass/Shrubs Plant Community. This will take a long period of time and intensive management.

### **Conservation practices**

Prescribed Burning
Prescribed Grazing

## **Transition T4**

### **State 2 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

## **Restoration pathway R3**

### **State 3 to 1**

With prescribed burning (or a combination of brush management and some other control of clubmoss) and long-term prescribed grazing, this plant community may eventually return to the Sagebrush/Western Wheatgrass Plant Community.

#### **Conservation practices**

Prescribed Burning
Prescribed Grazing

## **Transition T4**

### **State 3 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

## **Restoration pathway R4**

### **State 4 to 1**

Long-term prescribed grazing, possibly including prescribed burning, and favorable climatic conditions, which allow for adequate plant recovery periods, may cause a shift to the Blue Grama/Western Wheatgrass Plant Community.

#### **Conservation practices**

Prescribed Burning
Prescribed Grazing

## **Transition T3**

### **State 4 to 5**

Heavy, continuous season-long grazing, or frequent and severe defoliation (e.g., rodents) will move this plant community to the Annual, Pioneer Perennial Plant Community.

## **Transition T4**

### **State 4 to 5**

Severe disturbance such as heavy, continuous grazing and/or excessive defoliation may shift this plant community to the Annual/Pioneer Perennial; Introduced, or Invaded Plant Community.

## **Restoration pathway R5**

### **State 5 to 1**

Range seeding and long term prescribed grazing will be required to move this community in a direction towards the Reference State.

## **Additional community tables**

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			471–824	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	471–824	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–118	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–118	–
2	<b>Needlegrass</b>			471–706	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	235–588	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	118–353	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–118	–
3	<b>Cool-season Grasses</b>			47–188	
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–118	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	24–93	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–47	–
4	<b>Warm-season Grasses</b>			118–353	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–235	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	24–118	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–118	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–118	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–71	–
5	<b>Short Warm-season</b>			118–235	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	71–235	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–118	–
6	<b>Grass-likes</b>			47–188	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	24–118	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	24–118	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–71	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	24–71	–
<b>Forb</b>					
8	<b>Forbs</b>			118–235	
	Forb, native	2FN	<i>Forb, native</i>	0–118	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	24–71	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–71	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	24–71	–
	American vetch	VIAM	<i>Vicia americana</i>	24–71	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–47	–
	silverleaf Indian breadroot	PEAR6	<i>Pedimelum argophyllum</i>	0–47	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	24–47	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	24–47	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	24–47	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	24–47	–

	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–24	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–24	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–24	–
	beardtongue	PENST	<i>Penstemon</i>	0–24	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	0–24	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–24	–
	old man's whiskers	GETR	<i>Geum triflorum</i>	0–24	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–24	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	0–24	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–24	–
	bastard toadflax	COMAN	<i>Comandra</i>	0–24	–
	groundplum milkvetch	ASCR2	<i>Astragalus crassicaupus</i>	0–24	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	0–24	–
	textile onion	ALTE	<i>Allium textile</i>	0–24	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–24	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			118–235	
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–118	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–118	–
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0–118	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–71	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–71	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	0–71	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0–47	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	24–47	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–24	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–24	–

Table 12. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			135–336	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	67–269	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–27	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–27	–
2	<b>Needlegrass</b>			27–135	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	13–108	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	13–67	–
3	<b>Cool-season Grasses</b>			13–67	
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–27	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	13–27	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–27	–

4	<b>Warm-season Grasses</b>			0–40	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–40	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–13	–
5	<b>Short Warm-season</b>			269–471	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	202–404	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	67–202	–
6	<b>Grass-likes</b>			67–202	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	27–161	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	13–94	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	13–67	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–67	–
7	<b>Non-native Grasses</b>			13–67	
	bluegrass	POA	<i>Poa</i>	13–67	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	13–40	–
<b>Forb</b>					
8	<b>Forbs</b>			67–202	
	sweetclover	MELIL	<i>Melilotus</i>	13–135	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–67	–
	Forb, native	2FN	<i>Forb, native</i>	0–67	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	13–54	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	13–54	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	13–40	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	13–40	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	13–40	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	13–40	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	13–40	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	13–27	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	13–27	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	0–27	–
	common pepperweed	LEDE	<i>Lepidium densiflorum</i>	0–27	–
	bastard toadflax	COMAN	<i>Comandra</i>	13–27	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	0–27	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–13	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–13	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–13	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–13	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–13	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–13	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–13	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–13	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–13	–
	American vetch	VIAM	<i>Vicia americana</i>	0–13	–

Shrub/Vine				
9	<b>Shrubs</b>			13–135
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	13–67
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	13–54
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0–40
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	13–40
	prairie rose	ROAR3	<i>Rosa arkansana</i>	13–40
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–27
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–13
<b>Moss</b>				
10	<b>Cryptogams</b>			0–67
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–67

Table 13. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			286–476	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	286–476	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–95	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–95	–
2	<b>Needlegrass</b>			95–381	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	38–191	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	38–191	–
3	<b>Cool-season Grasses</b>			19–95	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	19–57	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–38	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–38	–
4	<b>Warm-season Grasses</b>			0–95	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–57	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–57	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–38	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–19	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–19	–
5	<b>Short Warm-season</b>			95–286	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	95–286	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–95	–
6	<b>Grass-likes</b>			57–286	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	19–191	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	19–152	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	19–95	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–38	–
7	<b>Non-native Grasses</b>			38–191	

	cheatgrass	BRTE	<i>Bromus tectorum</i>	38–191	–
	bluegrass	POA	<i>Poa</i>	0–95	–
<b>Forb</b>					
8	<b>Forbs</b>			95–191	
	sweetclover	MELIL	<i>Melilotus</i>	0–95	–
	Forb, native	2FN	<i>Forb, native</i>	0–95	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	19–76	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–57	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	19–57	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	19–57	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	0–38	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	19–38	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	19–38	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	19–38	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	0–38	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	19–38	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	19–38	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	0–38	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	19–38	–
	common pepperweed	LEDE	<i>Lepidium densiflorum</i>	0–19	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–19	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–19	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–19	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–19	–
	textile onion	ALTE	<i>Allium textile</i>	0–19	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–19	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–19	–
	bastard toadflax	COMAN	<i>Comandra</i>	0–19	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–19	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–19	–
	American vetch	VIAM	<i>Vicia americana</i>	0–19	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			191–476	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	95–381	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	19–191	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	19–95	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	19–57	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–57	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–38	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–19	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	0–19	–
<b>Moss</b>					
10	<b>Cryptogams</b>			0–95	



	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–95	–
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Table 14. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			95–476	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	95–381	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–95	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–38	–
2	<b>Needlegrass</b>			95–381	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	38–286	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	38–286	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–57	–
3	<b>Cool-season Grasses</b>			0–57	
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–57	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–19	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–19	–
4	<b>Warm-season Grasses</b>			0–95	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–57	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–38	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–38	–
5	<b>Short Warm-season</b>			19–191	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	19–191	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–57	–
6	<b>Grass-likes</b>			191–286	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	38–191	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	38–191	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	38–191	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–95	–
7	<b>Non-native Grasses</b>			476–762	
	bluegrass	POA	<i>Poa</i>	381–667	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	95–191	–
<b>Forb</b>					
8	<b>Forbs</b>			38–191	
	sweetclover	MELIL	<i>Melilotus</i>	19–152	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	19–95	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	19–95	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	19–95	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	19–95	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	19–57	–
	Forb, native	2FN	<i>Forb, native</i>	0–57	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	19–57	–

	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	19–38	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	19–38	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	0–38	–
	common pepperweed	LEDE	<i>Lepidium densiflorum</i>	0–38	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–19	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–19	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–19	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–19	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			95–191	
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	19–152	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–57	–
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0–57	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–38	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–38	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0–19	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	0–19	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–19	–
<b>Moss</b>					
10	<b>Cryptogams</b>			0–95	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–95	–

Table 15. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			27–135	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	27–135	–
2	<b>Needlegrass</b>			0–67	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–67	–
3	<b>Cool-season Grasses</b>			0–40	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–27	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–13	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–13	–
5	<b>Short Warm-season</b>			67–202	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	67–202	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–40	–
6	<b>Grass-likes</b>			40–202	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	13–135	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	13–67	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	13–67	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–13	–
7	<b>Non-native Grasses</b>			67–202	

	cheatgrass	BRTE	<i>Bromus tectorum</i>	27–135	–
	bluegrass	POA	<i>Poa</i>	27–135	–
<b>Forb</b>					
8	<b>Forbs</b>			67–135	
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–108	–
	sweetclover	MELIL	<i>Melilotus</i>	13–108	–
	Forb, native	2FN	<i>Forb, native</i>	0–67	–
	tarragon	ARDR4	<i>Artemisia dracunculus</i>	13–54	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	13–40	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	13–40	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	13–40	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	13–40	–
	common pepperweed	LEDE	<i>Lepidium densiflorum</i>	0–40	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	13–40	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	13–27	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	13–27	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	13–27	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	13–27	–
	bastard toadflax	COMAN	<i>Comandra</i>	0–13	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–13	–
	textile onion	ALTE	<i>Allium textile</i>	0–13	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–13	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–13	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			471–740	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	404–673	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	27–161	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	27–108	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–54	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–40	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	0–27	–
<b>Moss</b>					
10	<b>Cryptogams</b>			27–135	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	27–135	–

Table 16. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			9–90	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	9–90	–
2	<b>Needlegrass</b>			0–45	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–45	–

3	<b>Cool-season Grasses</b>			9–27	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	9–18	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–18	–
5	<b>Short Warm-season</b>			224–493	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	179–404	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	45–179	–
6	<b>Grass-likes</b>			90–179	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	45–135	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	18–90	–
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	18–90	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–45	–
7	<b>Non-native Grasses</b>			0–45	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–45	–
	bluegrass	POA	<i>Poa</i>	0–45	–
<b>Forb</b>					
8	<b>Forbs</b>			45–179	
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–135	–
	sweetclover	MELIL	<i>Melilotus</i>	9–135	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	9–45	–
	Forb, native	2FN	<i>Forb, native</i>	0–45	–
	fetid marigold	DYPA	<i>Dyssodia papposa</i>	9–45	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	9–36	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	9–27	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	0–27	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	9–27	–
	common pepperweed	LEDE	<i>Lepidium densiflorum</i>	9–27	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	9–18	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	9–18	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	9–18	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	9–18	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	0–18	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–9	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–9	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–9	–
	bastard toadflax	COMAN	<i>Comandra</i>	0–9	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			9–90	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	9–45	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	9–45	–
	prairie rose	ROAR3	<i>Rosa arkansana</i>	9–27	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	9–27	–
<b>Moss</b>					

10	Cryptogams			45–135	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	45–135	–

## Animal community

### ANIMAL COMMUNITY - WILDLIFE INTERPRETATIONS

Major Land Resource Area (MLRA) 58D lies within the drier portion of Northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass/shrub land habitats interspersed with varying densities of depressional, in-stream wetlands, and woody riparian corridors. These habitats provided critical life cycle components for many of its users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the wolf, mountain lion, and grizzly bear as well as smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the Northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. Bison were historically a keystone species but have been extirpated as a free-ranging herbivore. The loss of the bison and prairie dog, and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 58D, the Loamy ecological site provides upland grassland cover with an associated forb and shrub component. It was typically part of an expansive grassland landscape that included combinations of Shallow Loamy, Shallow Clayey, Thin Loamy, Claypan, Sandy, Sandy Claypan, Clayey, and Thin Claypan ecological sites. This site provided habitat for species requiring un-fragmented grassland. Important habitat features and components found commonly or exclusively on this site may include greater sage grouse and sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black footed ferret, mountain plover, Rocky Mountain locust and swift fox.

The majority of Loam ecological site remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species such as annual brome grasses and crested wheat have impacted the biological integrity of the site for some grassland birds such as greater sage-grouse. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/grass percentages. Greater sage-grouse and Brewer's sparrow benefit when big sagebrush increases.

"Western Wheatgrass/Needlegrass/Shrubs": The predominance of grasses plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as deer, and pronghorn. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds. Brewer's and grasshopper sparrow, lark bunting, western meadowlark, greater sage grouse, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides.

This site provides important breeding habitat for the loggerhead shrike. This site provides excellent nesting and brood rearing habitat for greater sage and sharp-tailed grouse. Diverse prey populations are available for grassland raptors such as ferruginous hawk, Swainson's hawk, golden eagle, and prairie falcon.

The diversity of grasses, forbs and shrubs provide high nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrel, white-tailed jackrabbit, and deer. This ecological site provides excellent wintering habitat for pronghorn. The moderate stature of this plant community provides suitable thermal, protective

and escape cover for small herbivores and grassland birds. Predators utilizing this plant community include the coyote, American badger, red fox and long-tailed weasel. This plant community provides habitat for spade foot toad, Great Plains toad, bull snake, and western rattlesnake.

"Blue Grama/Western Wheatgrass": Resulting from continued heavy continuous season-long grazing without adequate recovery periods between grazing events or increased fire frequency, blue grama and western wheatgrass will dominate. The forb diversity has decreased. A shift to shorter plant structure will favor prairie dog expansion and associate species such as ferruginous hawk, burrowing owl, tiger salamander, and swift fox. Species such as the horned lark, long-billed curlew, upland sandpiper and white-tailed jackrabbit will increase due to the loss of big sagebrush. The density of species such as Brewer's sparrow, greater sage-grouse, and desert cottontail will greatly decline. However, this plant community may provide areas suitable for lek site development.

The short stature of this plant community limits thermal, protective and escape cover. Predators utilizing this plant community include the coyote, American badger, red fox and long-tailed weasel.

"Blue Grama/Clubmoss": This plant community develops under continuous seasonal grazing or from over utilization during extended drought periods. The forb diversity has decreased. A shift to short plant structure will favor prairie dog expansion with prairie dog town sites and associate species such as ferruginous hawk and burrowing owl. Species such as horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of big sagebrush. Species such as Brewer's sparrow, greater sage-grouse, and desert cotton tail will rarely use this site.

The short stature of this plant community limits thermal, protective and escape cover. Prey populations are reduced but are more vulnerable to predation by raptors and mammalian predators. Predators utilizing this plant community include coyote, American badger, red fox and long-tailed weasel.

Extreme impairment of the ecological processes impacts off-site aquatic habitats through excessive runoff, nutrient and sediment loads. Elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds and mammals.

"Bluegrass/Western Wheatgrass/Sagebrush":

This plant community develops after an extended period of ten or more years of non-use by herbivores and exclusion of fire. Habitat diversity declines due to encroachment of non-native bluegrasses. As big sagebrush becomes scarce species such as greater sage-grouse, Brewer's sparrow, and desert cottontail will decline. Chestnut-collared longspur may increase with the decrease of big sagebrush while species such as vesper sparrow and western meadowlark are still common. Prey populations are available for grassland raptors such as golden eagle, ferruginous hawk, Swainson's hawk, and northern harrier. Predators utilizing this plant community include coyote, American badger, red fox and long-tailed weasel.

"Big Sagebrush/Western Wheatgrass": This plant community develops from continuous season-long grazing and the absence of fire. The increased occurrence of big sage favors species such as greater sage-grouse, Brewer's sparrow, and desert cottontail. This site provides excellent habitat for wintering pronghorn and greater sage-grouse. Chestnut-collared longspur may decrease with the increase of big sagebrush while vesper sparrow and western meadowlark are still common. Prey populations are still available for grassland raptors such as golden eagle, ferruginous hawk, Swainson's hawk, and northern harrier.

"Big Sagebrush/Clubmoss": In comparison to the big sagebrush/western wheatgrass/blue grama plant community this plant community develops after an extended fire free period and extended periods of heaving grazing favoring species such as big sage brush and clubmoss. The loss of understory grasses limits this vegetative community for big sagebrush-associated species such as greater sage-grouse, Brewer's sparrow, and desert cottontail. Prey populations are limited reducing availability for grassland raptors such as golden eagle, ferruginous hawk, and Swainson's hawk.

Extreme impairment of the ecological processes impacts off-site aquatic habitats through excessive runoff, nutrient and sediment loads. Increased amount of bare ground causes elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds and mammals.

"Annual/Pioneer Plant Community": This plant community develops under severe disturbance and/or excessive

defoliation. This can result from heavy livestock or prairie dog concentration or cropping abandonment (go-back land). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of annual brome grasses, crested wheatgrass, and other non-native species due to severe soil disturbances and relatively high percent of bare ground. Soil erosion is potentially high, impacting off-site aquatic habitats through increased runoff, nutrient and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased wildlife abundance and diversity. Since secondary succession is highly variable plant and wildlife species will vary. This plant community provides habitat for generalist or early successional species. In addition, these communities may contain prairie dog towns. Prairie dog towns are sites of high plant and wildlife diversity.

#### **Introduced, and/or Invaded States**

This group includes separate vegetation states that are highly variable in nature. They are derived through distinct management scenarios. These plant communities have been or are highly susceptible to invasion of annual brome grasses, bluegrasses, crested wheatgrass, and other non-native species. Since secondary succession is highly variable plant and wildlife species will vary. This plant community provides habitat for generalist or early successional species. In addition, these communities may contain prairie dog towns. Prairie dog towns are sites of high plant and wildlife diversity.

The "Introduced" state provides increased forage and therefore a potential for increased herbivore populations such as deer, pronghorn, and various small mammals. These sites provide diverse foraging, reproductive, and escape cover favoring multiple edge species.

The "Invaded" state includes areas that have been invaded, and are dominated by species such as smooth brome, Kentucky bluegrass, crested wheatgrass, non-native thistles, field bindweed, knapweeds, leafy spurge, hoary cress and other introduced species. These sites greatly reduce foraging, reproductive, and escape cover for grassland nesting bird species.

#### **ANIMAL COMMUNITY - GRAZING INTERPRETATIONS**

As this site improves in condition through proper management (from the more short grass dominated plant communities to the interpretive plant community), the advantage for livestock production includes: higher forage production from cool season grasses, improved early spring forage production and higher water infiltration. The disadvantage for livestock include: reduction in cool/warm season grass mix which would provides better management flexibility, less plant diversity, and a potential increase in soil erosion. The Annual, Pioneer Perennial Plant Community is of limited value for livestock production.

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

#### **Hydrological functions**

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where shortgrasses form a strong sod and dominate the site. Normally areas where ground cover is less than 50% 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 esthetic value that appeals to visitors.

## Wood products

No appreciable wood products are typically present on this site.

## Other products

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

## Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations and experience were also used. Those involved in developing this site description include: Ryan Beer, Range Management Specialist, NRCS; Chuck Berdan, Biologist, BLM; Stan Boltz, Range Management Specialist, NRCS; Dave Dewald, Wildlife Biologist, NRCS; Jody Forman, Range Management Specialist, NRCS; Dennis Froemke, Range Management Specialist, NRCS; Tom Juntti, Biologist, USFS; Cheryl Nielsen, Range Management Specialist, NRCS; Jeff Printz, Range Management Specialist, NRCS; Mike Stirling, Range Management Specialist, NRCS; Dan Svingen, Biologist, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, Biologist, NRCS; Tim Zachmeier, Biologist, BLM.

Two SCS-RANGE-417's collected from 1974 to 2004 in Harding County.

## Other references

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://www.hprcc.unl.edu>)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://www.wcc.nrcs.usda.gov>)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://nasis.nrcs.usda.gov>)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, NRCS, Various Published Soil Surveys.

## Contributors

Stan Boltz

Travis Patient

## Rangeland health reference sheet

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

Author(s)/participant(s)	Stan Boltz, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	05/06/2010
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production



## Indicators

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

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous.  

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 10 percent is typical.  

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.  

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability 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.  

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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 5 to 8 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular at least in the upper 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:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool-season grasses) 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: Rhizomatous wheatgrasses > mid/tall cool-season bunchgrasses >>

Sub-dominant: Mid/tall warm-season grasses > short warm-season grass >

Other: Forbs = Shrubs > Mid/short cool-season grasses = Grass-likes

Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth brome grass do not fit into reference plant community F/S groups.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.
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14. **Average percent litter cover (%) and depth ( in):**
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,500-2,800 lbs./acre (air-dry weight). Reference value production is 2,100 lbs./acre (air-dry weight).
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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds, annual bromes, Kentucky bluegrass, and smooth brome grass.
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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.
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