

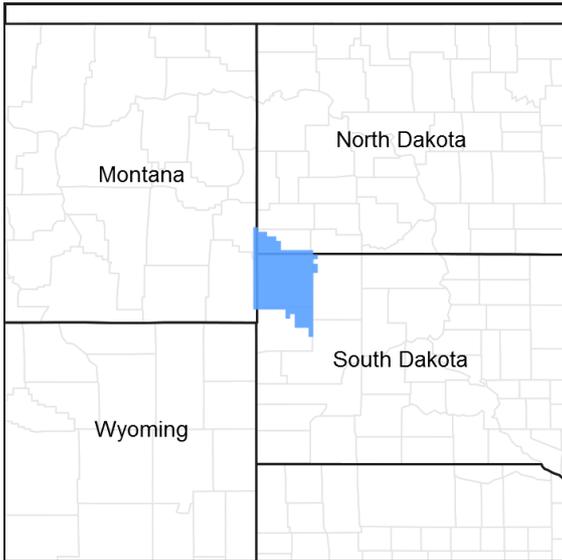
# Ecological site R058DY013SD

## Claypan

Accessed: 04/25/2024

### 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>
R058DY010SD	<b>Loamy</b>
R058DY011SD	<b>Clayey</b>
R058DY015SD	<b>Thin Claypan</b>
R058DY020SD	<b>Loamy Overflow</b>

### Similar sites

R058DY010SD	<b>Loamy</b> Loamy [more green needlegrass; more western wheatgrass; more productive]
R058DY020SD	<b>Loamy Overflow</b> Loamy Overflow [more big bluestem; more western wheatgrass; more productive]

R058DY011SD	<b>Clayey</b> Clayey [more green needlegrass; more western wheatgrass; more productive]
-------------	--

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Pascopyrum smithii</i> (2) <i>Bouteloua gracilis</i>

## Physiographic features

This site occurs on nearly level to moderately steep uplands.

**Table 2. Representative physiographic features**

Landforms	(1) Terrace (2) Plain (3) Flat
Flooding frequency	None
Ponding frequency	None
Elevation	2,300–4,000 ft
Slope	0–9%
Water table depth	80 in
Aspect	Aspect is not a significant factor

## Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland 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)	16 in

## Influencing water features

No significant water features influence this site.

## Soil features

The silt loam to fine sandy loam surface textures of this site change abruptly at about 5 to 15 inches below the surface, to a hard clayey or clay loam Btn horizon having round-topped or “bun shaped” columnar or prismatic structure. These subsoils are high in sodium. Permeability is very slow. Slopes range from 0 to 9 percent. The soils on this site are moderately deep to deep, well drained and were formed in alluvium or residuum from sandstone. The surface layer is 2 to 6 inches thick. The texture of the subsoil ranges from loam to clay. The soils have a very slow infiltration rate. This site should show slight to no evidence of rills or wind scoured areas. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers.

These soils are mainly susceptible to water erosion. Access Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/>) for specific local soils information.

**Table 4. Representative soil features**

Surface texture	(1) Fine sandy loam (2) Silt loam (3) Loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow
Soil depth	20–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–5 in
Calcium carbonate equivalent (0-40in)	0–20%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–20
Soil reaction (1:1 water) (0-40in)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0%

## Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions 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.

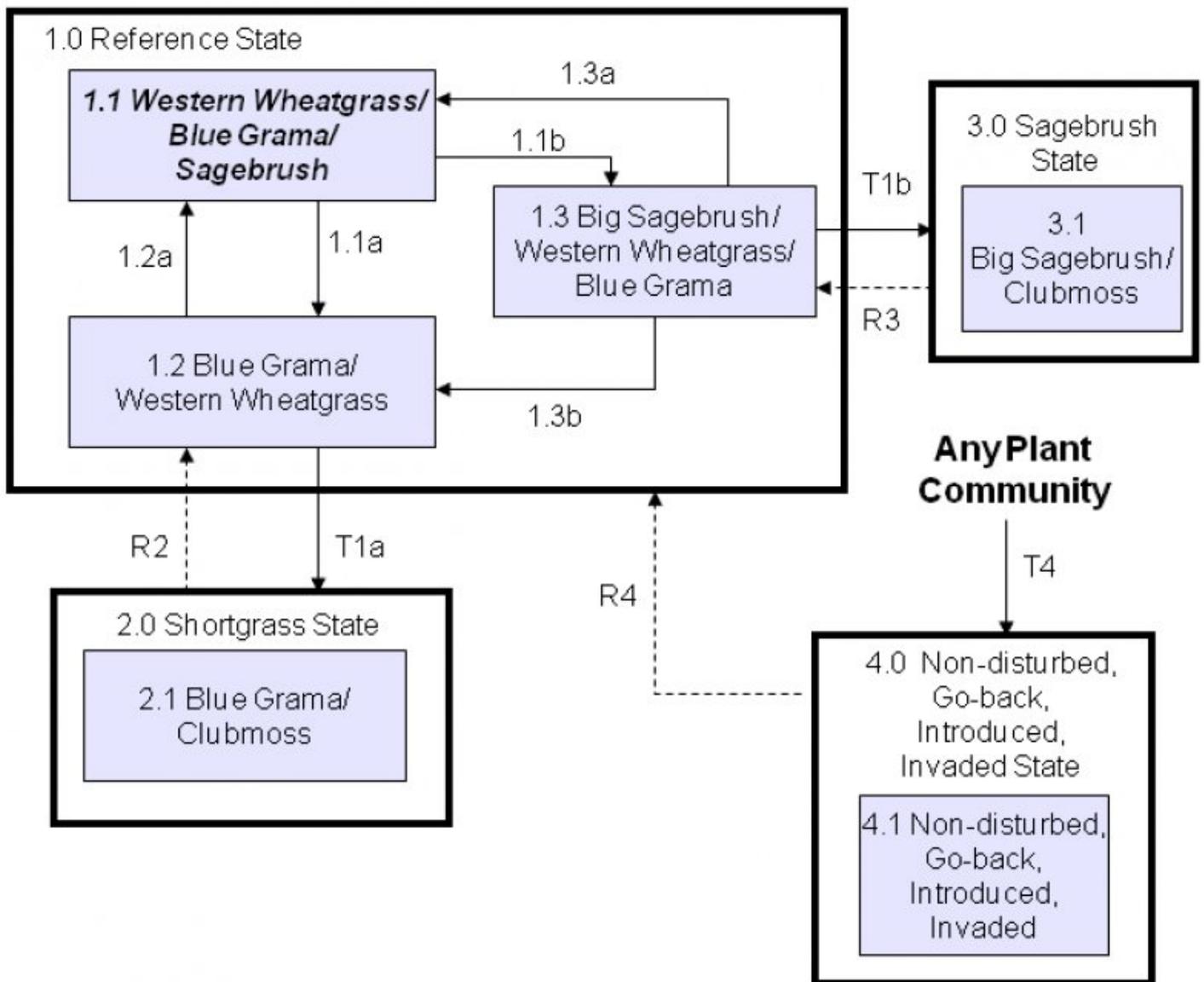
The plant community upon which interpretations are primarily based is the Western Wheatgrass/Blue Grama/Sagebrush Plant Community. This plant community has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. 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/Blue Grama/Sagebrush 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/Blue Grama/Sagebrush Plant Community. Runoff increases and infiltration will decrease. Soil erosion will be minimal.

Extended periods of nonuse 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 big sagebrush and western snowberry 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/Blue Grama/Sagebrush

The interpretive plant community for this site is the Western Wheatgrass/Blue Grama/Sagebrush 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 75-90 percent grasses or grass-like plants, 5-10 percent forbs, 5-15 percent shrubs, and 0-1 percent cryptogams. Cool-season grasses dominate this plant community. The major grasses include western wheatgrass and blue grama. Other grasses or grass-likes occurring on the site include needleandthread, prairie Junegrass, buffalograss, and sedge. Significant forbs include scarlet globemallow, prairie coneflower, prairie clover, and American vetch. The significant shrubs that occur include big sagebrush, winterfat, saltbush, and silver sagebrush. 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 offsite and natural plant mortality is very low.

**Table 5. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	770	1148	1625
Shrub/Vine	65	140	215
Forb	65	105	145
Moss	0	7	15
<b>Total</b>	<b>900</b>	<b>1400</b>	<b>2000</b>

**Figure 5. Plant community growth curve (percent production by month). SD5802, Northern Rolling High Plains, cool-season dominant, warm-season subdominant. Cool-season dominant, warm-season subdominant..**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	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 percent grasses and grass-like species, 5-10 percent forbs, 5-15 percent shrubs, and 0-3 percent cryptogams. The dominant grasses include blue grama and western wheatgrass. Other grasses or grasslikes may include sedge, buffalograss, needleandthread, and prairie Junegrass. Significant forbs include cudweed sagewort, scarlet globemallow, scurfpea, and western yarrow. The dominant shrubs that occur include silver sagebrush, cactus, rose, and fringed sagewort. Compared to the Western Wheatgrass/Blue Grama/Sagebrush Plant Community, the shortgrass species including blue grama and 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 somewhat resistant to change. The dominant herbaceous species are very adapted to grazing; however, the midgrass 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 lower and runoff is moderate to high. Typically, the runoff is very clean because of the low potential for onsite soil erosion. However, offsite areas may be affected by increased runoff.

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

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	510	810	1305
Shrub/Vine	45	100	155
Forb	45	75	105
Moss	0	15	35
<b>Total</b>	<b>600</b>	<b>1000</b>	<b>1600</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 Big Sagebrush/Western Wheatgrass/Blue Grama

This plant community develops after an extended period of 10 or more years of nonuse by herbivores and exclusion of fire. Nonnative grasses, such as Kentucky bluegrass and Canada bluegrass, tend to invade. Grasses and grass-like species present include western wheatgrass, blue grama, green needlegrass, cheatgrass, and sedge. The common forbs include cudweed sagewort, western yarrow, and scurfpea. Big sagebrush and silver sagebrush are the principal shrubs and tend to increase in density and cover. 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/Blue Grama/Sagebrush Plant Community. Soil erosion is low. Runoff is similar to the interpretive plant community.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	630	876	1285
Shrub/Vine	105	210	345
Forb	55	90	130
Moss	10	24	40
<b>Total</b>	<b>800</b>	<b>1200</b>	<b>1800</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 or continuous seasonal grazing with fire will shift this plant community to the Blue Grama/Western Wheatgrass Plant Community. This occurs with grazing for extended periods during the same part of the growing season each year at moderate stocking rates.

### Pathway 1.1b Community 1.1 to 1.3

No fire for extended periods of time typically accompanied by grazing with inadequate recovery periods will shift this plant community to the Big Sagebrush/Western Wheatgrass/Blue Grama Plant Community.

### 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/Blue Grama/Sagebrush Plant Community.

### Conservation practices

Prescribed Grazing
--------------------

### Pathway 1.3a Community 1.3 to 1.1

Under prescribed grazing and brush management, including adequate recovery periods, this plant community may eventually move towards a plant community resembling the Western Wheatgrass/Blue Grama/Sagebrush Plant Community.

#### Conservation practices

Brush Management
Prescribed Grazing

### Pathway 1.3b Community 1.3 to 1.2

With brush management or fire, or with continuous seasonal grazing and heavy browsing, this plant community will shift to the Blue Grama/Western Wheatgrass Plant Community. Silver sagebrush will often still be a significant component of the resulting plant community.

#### Conservation practices

Brush Management
------------------

## State 2 Shortgrass

The State narrative is under development.

### Community 2.1 Blue Grama/Clubmoss

This plant community develops under heavy seasonal grazing. It is made up of approximately 70-90 percent grasses, 2-7 percent forbs, 5-15 percent shrubs, and 0-8 percent cryptogams. The dominant grasses/grass-likes include blue grama and sedge. Other grasses may include western wheatgrass, prairie Junegrass, buffalograss, and cheatgrass. The dominant forbs include common pepperweed, curlycup gumweed, cudweed sagewort, sweetclover, and western yarrow. The dominant shrubs include silver sagebrush, fringed sagewort, and cactus. Compared to the Western Wheatgrass/Blue Grama/Sagebrush Plant Community, blue grama and sedge have increased, and the cool-season mid-grasses have diminished greatly. Nonpalatable forbs and cactus have increased and nonnative 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. Onsite soil erosion is low. Infiltration is low and runoff is high. Typically, the runoff is very clean because of the low potential for onsite soil erosion. However, offsite areas can be significantly impacted due to the increased runoff.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	360	570	780
Shrub/Vine	30	70	110
Moss	0	28	60
Forb	10	32	50
<b>Total</b>	<b>400</b>	<b>700</b>	<b>1000</b>

Figure 11. 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 3 Sagebrush

The State narrative is under development.

#### Community 3.1 Big Sagebrush/Clubmoss

This plant community develops from heavy continuous season-long grazing and the absence of fire. It is made up of 50-80 percent grass and grass-likes species, 2-7 percent forbs, 15-35 percent shrubs, and 1-7 percent cryptogams. The dominant grasses and grass-likes include blue grama, sedge, and buffalograss. Forbs commonly found on this plant community include cudweed sagewort, scarlet globemallow, and scurfpea. Sagebrush canopy typically ranges from 20-40 percent. 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/Blue Grama/Sagebrush Plant Community, 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 midgrasses, by making them unavailable for grazing. Without fire, this plant community is stable. The soil erosion is low to moderate. Infiltration is low and runoff is high. 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 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	445	665	840
Shrub/Vine	135	250	410
Forb	15	45	75
Moss	5	40	75
<b>Total</b>	<b>600</b>	<b>1000</b>	<b>1400</b>

Figure 13. 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

### State 4 Non-disturbed, Go-Back, Introduced, or Invaded

The State narrative is under development.

#### Community 4.1 Non-disturbed, Go-Back, Introduced, or Invaded States

This group includes four 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 Go-back state can be reached whenever severe mechanical disturbance (i.e., abandoned farmland) occurs. During the early successional stages, the species that mainly dominant 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 three-awn, annual brome, 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 Non-Disturbed state develops from extended periods of exclusion by large herbivores, fire suppression and lack of other surface disturbance. Plant litter accumulates in large amounts when this community first develops. Litter buildup reduces mature plant vigor and density, and seedling recruitment declines. Eventually litter levels become high enough that plant density decreases. Interspaces are commonly filled by annual forbs, annual grasses, and cryptogams. Typically rhizomatous grasses form small colonies because of a lack of tiller stimulation. This state is typically dominated by introduced bluegrasses. 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 T1a**

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

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

### **Transition T1b**

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

Under heavy continuous season long grazing w/ no fire, this plant community will move towards the Big Sagebrush/Clubmoss Plant Community.

### **Transition T4**

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

Cropped go-back with continuous grazing; frequent and severe defoliation; no fire for extended periods, and Non-use for extended periods may lead this plant community over a threshold to the Non-disturbed,Go-back,Introduced,Invaded State.

### **Transition T4**

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

Cropped go-back with continuous grazing; frequent and severe defoliation; no fire for extended periods, and Non-use for extended periods may lead this plant community over a threshold to the Non-disturbed,Go-back,Introduced,Invaded State.

### **Transition T4**

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

Cropped go-back with continuous grazing; frequent and severe defoliation; no fire for extended periods, and Non-use for extended periods may lead this plant community over a threshold to the Non-disturbed,Go-back,Introduced,Invaded State.

### **Restoration pathway R2**

#### **State 2 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 T4 State 2 to 4

Cropped go-back with continuous grazing; frequent and severe defoliation; no fire for extended periods, and Non-use for extended periods may lead this plant community over a threshold to the Non-disturbed, Go-back, Introduced, Invaded State.

## Restoration pathway R3 State 3 to 1

With prescribed burning and long term prescribed grazing, this plant community will move towards the Big Sagebrush/Western Wheatgrass/Blue Grama Plant Community, or eventually will resemble the Western Wheatgrass/Blue Grama/Sagebrush Plant Community. This will take long periods with proper management and requires a remnant diverse native species population.

### Conservation practices

Prescribed Burning
Prescribed Grazing

## Transition T4 State 3 to 4

Cropped go-back with continuous grazing; frequent and severe defoliation; no fire for extended periods, and Non-use for extended periods may lead this plant community over a threshold to the Non-disturbed, Go-back, Introduced, Invaded State.

## Restoration pathway R4 State 4 to 1

Mechanical renovation, accompanied by range seeding and long-term prescribed grazing, may eventually lead these plant communities back to one resembling the Reference Plant Community.

### Conservation practices

Prescribed Grazing
--------------------

## Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			350–560	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	280–490	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	28–140	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	28–140	–
2	<b>Short-Warm Season Grasses</b>			70–280	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	70–210	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	28–140	–
	saltgrass	DISP	<i>Distichlis spicata</i>	0–70	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–70	–
3	<b>Cool-Season Bunch Grasses</b>			70–210	

	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	70–210	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	14–42	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	14–42	–
4	<b>Short Cool-Season Grasses</b>			14–112	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	14–70	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–42	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	14–28	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–28	–
5	<b>Warm-Season Grasses</b>			14–42	
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–28	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–28	–
6	<b>Annual Grasses</b>			14–28	
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	14–28	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–14	–
7	<b>Grass-Likes</b>			70–140	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	42–140	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	14–70	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–42	–
	rush	JUNCU	<i>Juncus</i>	0–28	–
<b>Forb</b>					
9	<b>Forbs</b>			70–140	
	Forb, native	2FN	<i>Forb, native</i>	14–56	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	14–42	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	14–42	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	14–42	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–28	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	14–28	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	14–28	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–28	–
	American vetch	VIAM	<i>Vicia americana</i>	0–28	–
	Nuttall's violet	VINU2	<i>Viola nuttallii</i>	14–28	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	14–28	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–28	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–28	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	14–28	–
	prairie clover	DALEA	<i>Dalea</i>	0–28	–
	bighead pygmyweed	EVPR	<i>Evax prolifera</i>	14–28	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	14–28	–
	desertparsley	LOMAT	<i>Lomatium</i>	14–28	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	14–28	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–28	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–14	–

	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–14	–
	onion	ALLIU	<i>Allium</i>	0–14	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–14	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–14	–
	tiny trumpet	COLI2	<i>Collomia linearis</i>	0–14	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			70–210	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	28–140	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	14–98	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	14–42	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–42	–
	saltbush	ATRIP	<i>Atriplex</i>	14–42	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–42	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	14–42	–
	rose	ROSA5	<i>Rosa</i>	0–28	–
	greasewood	SAVE4	<i>Sarcobatus vermiculatus</i>	0–28	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–28	–
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	14–28	–
	spiny star	ESVIV	<i>Escobaria vivipara var. vivipara</i>	0–14	–
<b>Moss</b>					
11	<b>Cryptogams</b>			0–14	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–14	–

Table 11. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			100–200	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	100–200	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–80	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0–80	–
2	<b>Short-Warm Season Grasses</b>			150–300	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	150–250	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	50–150	–
	saltgrass	DISP	<i>Distichlis spicata</i>	0–80	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–80	–
3	<b>Cool-Season Bunch Grasses</b>			50–100	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	50–100	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–10	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–10	–
4	<b>Short Cool-Season Grasses</b>			20–100	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	10–80	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	10–40	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–10	–

	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–10	–
5	<b>Warm-Season Grasses</b>			0–20	
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–10	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–10	–
6	<b>Annual Grasses</b>			10–30	
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	10–30	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–20	–
7	<b>Grass-Likes</b>			50–150	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	50–100	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	10–80	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–30	–
	rush	JUNCU	<i>Juncus</i>	0–20	–
8	<b>Non-Native Grasses</b>			0–50	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–50	–
	bluegrass	POA	<i>Poa</i>	0–50	–
<b>Forb</b>					
9	<b>Forbs</b>			50–100	
	scurfpea	PSORA2	<i>Psoralegium</i>	10–40	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	10–40	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	10–40	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	10–30	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	10–30	–
	Forb, native	2FN	<i>Forb, native</i>	10–30	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	10–30	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–20	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–20	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–20	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–20	–
	Nuttall's violet	VINU2	<i>Viola nuttallii</i>	0–20	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–20	–
	bighead pygmycudweed	EVPR	<i>Evax prolifera</i>	10–20	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	10–20	–
	desertparsley	LOMAT	<i>Lomatium</i>	10–20	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	10–20	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	10–20	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–10	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–10	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–10	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–10	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–10	–
	tiny trumpet	COLI2	<i>Collomia linearis</i>	0–10	–
	prairie clover	DALEA	<i>Dalea</i>	0–10	–

	onion	ALLIU	<i>Allium</i>	0–10	–
	American vetch	VIAM	<i>Vicia americana</i>	0–10	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			50–150	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0–100	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–80	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–30	–
	rose	ROSA5	<i>Rosa</i>	0–20	–
	greasewood	SAVE4	<i>Sarcobatus vermiculatus</i>	0–10	–
	saltbush	ATRIP	<i>Atriplex</i>	0–10	–
	spiny star	ESVIV	<i>Escobaria vivipara var. vivipara</i>	0–10	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–10	–
<b>Moss</b>					
11	<b>Cryptogams</b>			0–30	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–30	–

Table 12. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			60–300	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	60–240	–
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–96	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0–96	–
2	<b>Short-Warm Season Grasses</b>			120–300	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	60–240	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	24–144	–
	saltgrass	DISP	<i>Distichlis spicata</i>	12–96	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–84	–
3	<b>Cool-Season Bunch Grasses</b>			24–120	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	24–120	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–12	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–12	–
4	<b>Short Cool-Season Grasses</b>			24–60	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	12–60	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	12–24	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–12	–
	plains reedgrass	CAMO	<i>Calamagrostis montanensis</i>	0–12	–
5	<b>Warm-Season Grasses</b>			0–24	
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–12	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–12	–
6	<b>Annual Grasses</b>			12–36	
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	12–36	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–24	–

7	<b>Grass-Likes</b>			120–180	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	60–180	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	24–120	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–36	–
	rush	JUNCU	<i>Juncus</i>	0–24	–
8	<b>Non-Native Grasses</b>			12–60	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	12–60	–
	bluegrass	POA	<i>Poa</i>	12–60	–
<b>Forb</b>					
9	<b>Forbs</b>			60–120	
	scurfpea	PSORA2	<i>Psoralegium</i>	12–48	–
	Forb, native	2FN	<i>Forb, native</i>	12–48	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	12–48	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	12–36	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	12–36	–
	bighead pygmyweed	EVPR	<i>Evax prolifera</i>	12–36	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	12–36	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–24	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	12–24	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–24	–
	bigseed alfalfa dodder	CUIN	<i>Cuscuta indecora</i>	12–24	–
	desertparsley	LOMAT	<i>Lomatium</i>	12–24	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	12–24	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–24	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–24	–
	onion	ALLIU	<i>Allium</i>	0–12	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–12	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–12	–
	tiny trumpet	COLI2	<i>Collomia linearis</i>	0–12	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–12	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–12	–
	prairie clover	DALEA	<i>Dalea</i>	0–12	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–12	–
	American vetch	VIAM	<i>Vicia americana</i>	0–12	–
	Nuttall's violet	VINU2	<i>Viola nuttallii</i>	0–12	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–12	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–12	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			120–300	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	60–180	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	48–144	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	12–48	–
	prairie wintergreen	GRDO	<i>Quercus velutina</i>	12–48	–

	prains pricklypear	OPPO	<i>Opuntia polyacantha</i>	12-48	-
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0-36	-
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	12-36	-
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-36	-
	saltbush	ATRIP	<i>Atriplex</i>	0-24	-
	rose	ROSA5	<i>Rosa</i>	0-24	-
	greasewood	SAVE4	<i>Sarcobatus vermiculatus</i>	0-12	-
	spinystar	ESVIV	<i>Escobaria vivipara var. vivipara</i>	0-12	-
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0-12	-
<b>Moss</b>					
11	<b>Cryptogams</b>			12-36	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	12-36	-

Table 13. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			490-630	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-56	-
	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0-35	-
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus ssp. lanceolatus</i>	0-35	-
2	<b>Short-Warm Season Grasses</b>			175-315	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	140-280	-
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	35-140	-
	saltgrass	DISP	<i>Distichlis spicata</i>	7-70	-
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0-56	-
3	<b>Cool-Season Bunch Grasses</b>			0-35	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0-35	-
4	<b>Short Cool-Season Grasses</b>			14-70	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	7-70	-
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	7-35	-
6	<b>Annual Grasses</b>			7-35	
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	7-35	-
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0-21	-
7	<b>Grass-Likes</b>			70-140	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	35-105	-
	threadleaf sedge	CAFI	<i>Carex fillifolia</i>	14-70	-
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0-21	-
	rush	JUNCU	<i>Juncus</i>	0-14	-
8	<b>Non-Native Grasses</b>			7-35	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	7-35	-
	bluegrass	POA	<i>Poa</i>	7-35	-
<b>Forb</b>					
9	<b>Forbs</b>			14-40	

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	7–35	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	7–28	–
	scurfpea	PSORA2	<i>Psoralegium</i>	0–28	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	7–21	–
	bighead pygmyweed	EVPR	<i>Evax prolifera</i>	7–21	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	7–21	–
	Forb, native	2FN	<i>Forb, native</i>	0–14	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–14	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–14	–
	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–14	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–14	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–14	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	0–14	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–14	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–7	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–7	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–7	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–7	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–7	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	0–7	–
	tiny trumpet	COLI2	<i>Collomia linearis</i>	0–7	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–7	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			35–105	
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	0–70	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	14–56	–
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	0–56	–
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	7–56	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	35–56	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	7–35	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–21	–
	spinystar	ESVIV	<i>Escobaria vivipara</i> var. <i>vivipara</i>	0–7	–
	rose	ROSA5	<i>Rosa</i>	0–7	–
<b>Moss</b>					
11	<b>Cryptogams</b>			0–56	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	0–56	–

Table 14. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Rhizomatous Wheatgrass</b>			0–100	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–100	–

	Montana wheatgrass	ELAL7	<i>Elymus albicans</i>	0–30	–
	thickspike wheatgrass	ELLAL	<i>Elymus lanceolatus</i> ssp. <i>lanceolatus</i>	0–30	–
2	<b>Short-Warm Season Grasses</b>			150–300	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	100–250	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	30–150	–
	saltgrass	DISP	<i>Distichlis spicata</i>	10–100	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–70	–
3	<b>Cool-Season Bunch Grasses</b>			0–50	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–50	–
4	<b>Short Cool-Season Grasses</b>			10–50	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	10–50	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	10–20	–
6	<b>Annual Grasses</b>			10–50	
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	10–40	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	0–30	–
7	<b>Grass-Likes</b>			150–200	
	needleleaf sedge	CADU6	<i>Carex duriuscula</i>	80–200	–
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	50–150	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–30	–
	rush	JUNCU	<i>Juncus</i>	0–20	–
8	<b>Non-Native Grasses</b>			10–50	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	10–50	–
	bluegrass	POA	<i>Poa</i>	10–50	–
<b>Forb</b>					
9	<b>Forbs</b>			20–70	
	Forb, introduced	2FI	<i>Forb, introduced</i>	10–40	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	10–40	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	10–40	–
	bighead pygmyweed	EVPR	<i>Evax prolifera</i>	10–30	–
	Forb, native	2FN	<i>Forb, native</i>	10–30	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	10–30	–
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	10–30	–
	rosy pussytoes	ANRO2	<i>Antennaria rosea</i>	0–20	–
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	10–20	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	0–10	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–10	–
	desertparsley	LOMAT	<i>Lomatium</i>	0–10	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–10	–
	leafy wildparsley	MUDI	<i>Musineon divaricatum</i>	0–10	–
	purple locoweed	OXLA3	<i>Oxytropis lambertii</i>	0–10	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–10	–
	littlepod false flax	CAMI2	<i>Camelina microcarpa</i>	0–10	–

	wavyleaf thistle	CIUN	<i>Cirsium undulatum</i>	0–10	–
	tiny trumpet	COLI2	<i>Collomia linearis</i>	0–10	–
<b>Shrub/Vine</b>					
10	<b>Shrubs</b>			150–350	
	big sagebrush	ARTR2	<i>Artemisia tridentata</i>	50–250	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	50–200	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	10–50	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	10–50	–
	brittle pricklypear	OPFR	<i>Opuntia fragilis</i>	10–40	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–30	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–30	–
	spiny star	ESVIV	<i>Escobaria vivipara var. vivipara</i>	0–10	–
<b>Moss</b>					
11	<b>Cryptogams</b>			10–70	
	lesser spikemoss	SEDE2	<i>Selaginella densa</i>	10–70	–

## Animal community

### Animal Community – Wildlife Interpretations

Major Land Resource Area 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, instream 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 black-tailed 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, reduction of prairie dog colonies, and loss of 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 Claypan Ecological Site (ES) 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, Thin Claypan, Sandy, Sandy Claypan, Loamy, and Clayey ESs. This site provided habitat for species requiring unfragmented 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 bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Claypan ES remains intact and provides increasingly important habitat for grassland and shrub steppe nesting birds, small rodents, coyotes, and a variety of reptiles, amphibians, and insects. Invasive species such as annual brome grasses and crested wheatgrass 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/Blue Grama/Big Sagebrush:** The predominance of grasses plus the 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-grouse and sharp-tailed grouse. Diverse prey populations are available for grassland raptors such as northern harrier, 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 squirrels, white-tailed jackrabbit, and deer. This ES 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. Many wide ranging predators utilize this plant community including 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.

**Big Sagebrush/Western Wheatgrass/Blue Grama:** This plant community develops after an extended fire free period favoring species such as big sagebrush. This increases habitat diversity and quality for 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.

**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, and swift fox. Species such as horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase due to the loss of big sagebrush. Density of species such as Brewer's sparrow, greater sage-grouse, as well as, 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 suitable thermal, protective, and escape cover. Predators utilizing this plant community include the coyote, American badger, red fox, and long-tailed weasel.

**Blue Grama/Clubmoss:** Resulting from continued heavy continuous season-long grazing without adequate recovery periods between grazing events or increased fire frequency, blue grama and clubmoss will dominate. 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, as well as, desert cottontail will rarely use this site.

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

Extreme impairment of the ecological processes impacts offsite 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.

**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 heavy grazing favoring species such as big sagebrush and clubmoss. The loss of understory grasses limits this vegetative community for

big sage brush 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 offsite 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.

Non-disturbed, Go-back, Introduced, and/or Invaded States

This group includes four 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 nonnative 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 Non-Disturbed state is typically dominated by introduced bluegrasses. Bird species typically associated with bluegrasses include those species that prefer limited vegetative structure such as horned lark. Mammal species typically associated with increasing amounts of litter include voles, thirteen-lined ground squirrels, northern pocket gopher, and American badger. Increased prey populations are more vulnerable to predation by raptors and mammalian predators. Lack of forbs reduces insect populations including but not limited to pollinators.

The Go-back state can be reached whenever severe mechanical disturbance (i.e., abandoned farmland) is eliminated. Early successional plant communities include annual and perennial weedy type species first to occupy the site. These sites provide diverse foraging, reproductive, and escape cover favoring multiple edge species. This pioneer plant community provides abundant opportunity for insect, bird, and small mammal foraging due to abundant flowers and seed sources.

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, nonnative 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 Blue Grama/Clubmoss and Go-Back Plant Communities are 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 D. 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 percent 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 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 varieties 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 (RMS), NRCS; Chuck Berdan, Biologist (BIO), Bureau of Land Management (BLM); Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Jody Forman, RMS, NRCS; Dennis Froemke, RMS, NRCS; Tom Juntti, BIO, United States Forest Service (USFS); Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS; Dan Svingen, BIO, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, BIO, NRCS; and Tim Zachmeier, BIO, BLM.

There are 8 SCS-RANGE-417's compiled from 1985-2004 in Harding County, South Dakota.

### **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	07/23/2009
Approved by	Stan Boltz
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, or barely visible and discontinuous.  

---
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 15 percent is typical.  

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

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

---
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.  

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

---
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 6 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular at least in the upper A-horizon.  

---
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.  

---
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be**

**mistaken for compaction on this site):** None – natural pan appears at roughly 5 to 15 inches with “biscuit-top” appearance at top of pan.

---

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: Mid cool-season bunchgrasses = short warm-season grasses >

Other: Forbs > shrubs

Additional:

---

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

---

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 900-2,000 lbs./acre (air-dry weight). Reference value production is 1,400 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

---

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.

---