

# Ecological site R061XY029SD

## Stony Hills

Accessed: 05/03/2024

### 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: 17a – Black Hills Foothills.

### Associated sites

R061XN012SD	<b>Thin Upland-North (18-22" PZ)</b>
R061XN024SD	<b>Shallow Loamy-North (18-22" PZ)</b>

### Similar sites

R061XN012SD	<b>Thin Upland-North (18-22" PZ)</b> (R061XN012SD) – Thin Upland [less big bluestem and ponderosa pine; lower production]
R061XN024SD	<b>Shallow Loamy-North (18-22" PZ)</b> (R061XN024SD) – Shallow Loamy [less big bluestem; lower production]

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Schizachyrium scoparium</i>

### Physiographic features

This site occurs on steeply sloping uplands.

**Table 2. Representative physiographic features**

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	884–1,219 m
Slope	20–40%
Aspect	Aspect is not a significant factor

## Climatic features

The climate in this MLRA is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation ranges from 18 to 21 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

The average annual temperature is about 46° F. January is the coldest month with average temperatures ranging from about 20° F (Sundance, Wyoming (WY)) to about 26° F (Fort Meade, South Dakota (SD)). July is the warmest month with temperatures averaging from about 69° F (Sundance, WY) to about 72° F (Fort Meade, SD). The range of average monthly temperatures between the coldest and warmest months is about 48° 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 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 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)	140 days
Freeze-free period (average)	167 days
Precipitation total (average)	533 mm

## Influencing water features

No riparian areas or wetland features are directly associated with this site.

## Soil features

The soils in this site are well drained and formed in colluvium. The surface layer is about 2 inches thick. The surface layer texture is extremely stony, very fine sandy loam, while the subsurface layers range from very fine sandy loam to sandy clay loam and are very channery to extremely channery. The soils have a moderate to moderately slow infiltration rate. The soils on this site are modified by stones that occur in the profile and at the surface. This site should show slight to no evidence of rills or wind scoured areas. Plant pedestalling occurs occasionally, but no exposed roots should occur. 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 25 percent where vegetation is lacking or disturbed.

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

**Table 4. Representative soil features**

Surface texture	(1) Extremely stony very fine sandy loam
Family particle size	(1) Loamy

Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	15–20%
Surface fragment cover >3"	40–45%
Available water capacity (0-101.6cm)	15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	8–20%
Subsurface fragment volume >3" (Depth not specified)	30–40%

## Ecological dynamics

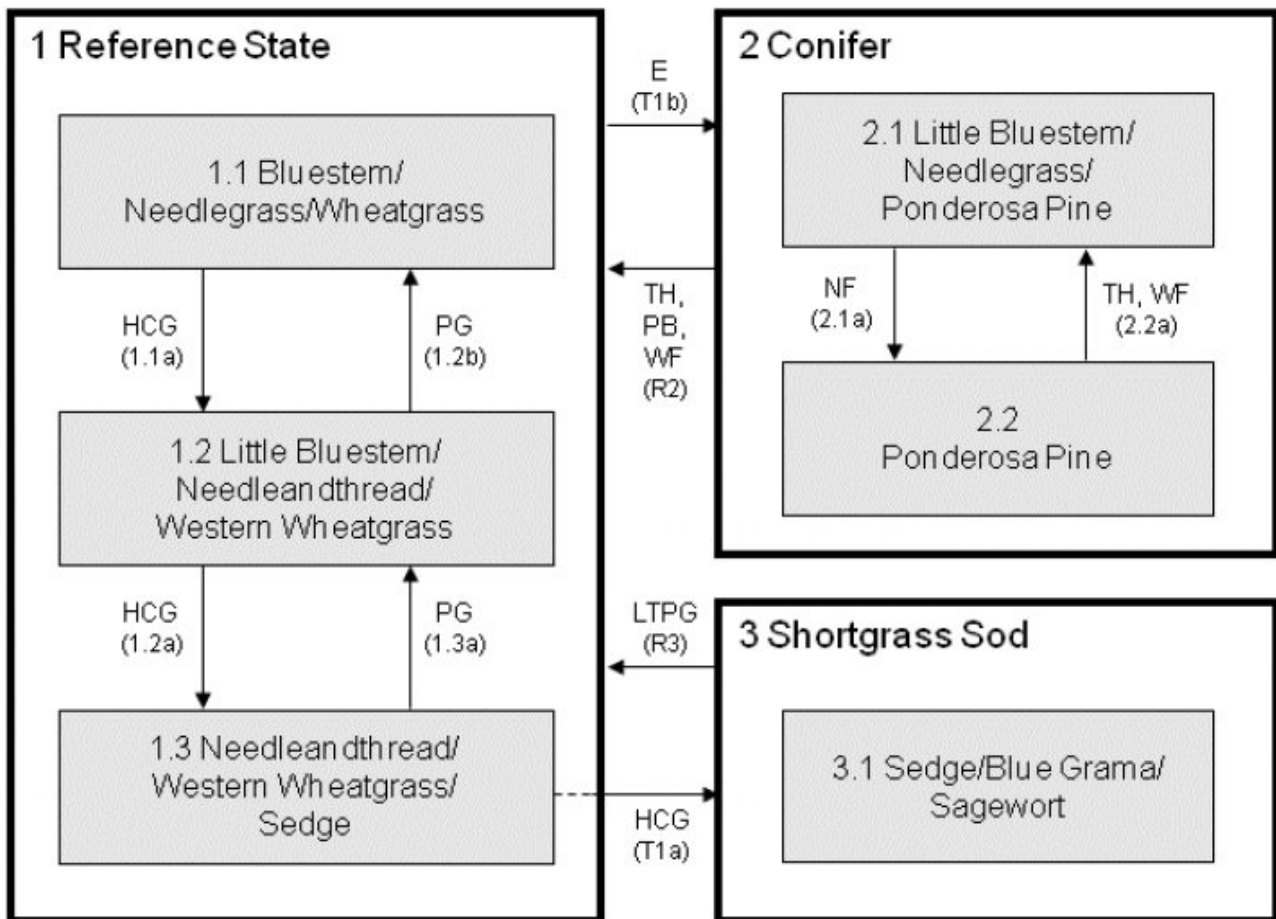
This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. Changes will occur 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 that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

Heavy continuous grazing (e.g., every spring and/or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes departure from the Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1). Sedge and other short grasses will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needleandthread, green needlegrass, big bluestem, sideoats grama, Indiagrass and little bluestem will decrease in frequency and production. Excessive defoliation can cause annuals to increase and dominate the site. Extended periods of non-use and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as green needlegrass, western wheatgrass, bluegrass, smooth brome grass and cheatgrass.

Interpretations are primarily based on the Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1). It has been determined by study of 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 community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

## State and transition model



Refer to narrative for details on pathways: **E** – Encroachment; **HCG** – Heavy continuous grazing; **LTPG** – Long-term prescribed grazing; **NF** – No fire; **PB** – Prescribed burning; **PG** – Prescribed grazing; **TH** – Timber harvest; **WF** – Wildfire.

## State 1 Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by warm-season grasses, with cool-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included occasional fire and grazing by large ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller cool- and warm-season grasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest.

## Community 1.1 Bluestem/Needlegrass/Wheatgrass



Interpretations are based primarily on the Bluestem/Needlegrass/Wheatgrass Plant Community Phase (this is also considered to be climax). The potential vegetation is about 75 percent grasses or grass-like plants, 10 percent forbs, 10 percent shrubs, and 5 percent trees. The community is dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses include big bluestem, little bluestem, green needlegrass, needleandthread, western wheatgrass, and sideoats grama. Other grasses include porcupine grass, plains muhly, slender wheatgrass, prairie dropseed, Indiangrass, switchgrass, prairie sandreed, and a variety of other grass and grass-like species. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1732	2390	2987
Shrub/Vine	129	219	331
Forb	129	219	331
Tree	28	87	163
<b>Total</b>	<b>2018</b>	<b>2915</b>	<b>3812</b>

**Figure 5. Plant community growth curve (percent production by month). SD6104, Black Hills Foot Slopes, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	7	17	25	25	15	7	1		

## **Community 1.2 Little Bluestem/Needleandthread/Western Wheatgrass**

This plant community developed under heavy continuous grazing or from over utilization during extended drought periods. This community can also develop where this site occurs near water sources. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 5 percent trees. Dominant grasses include little bluestem, needleandthread, and western wheatgrass. Grasses and grass-likes species of secondary importance include sideoats grama, porcupine grass, big bluestem, threadleaf sedge, blue grama, and a variety of other grasses. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, white prairie aster, and scurfpea. When compared to the Bluestem/Needlegrass/Wheatgrass Plant Community Phase (1.1), blue grama, sedge, and western wheatgrass have increased. Tall warm-season grasses have decreased, and production has also been reduced. Needleandthread will persist in this phase. This plant community is moderately resistant to change. This is due in part to the shallow rooted nature of the shortgrass species which decreases infiltration especially to the deeper rooted tall and mid grass species. The herbaceous species present are well adapted to grazing; however, species

composition can be altered through continued overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1547	2022	2443
Shrub/Vine	112	185	280
Forb	112	185	280
Tree	22	74	135
<b>Total</b>	<b>1793</b>	<b>2466</b>	<b>3138</b>

**Figure 7. Plant community growth curve (percent production by month).**  
SD6103, Black Hills Foot Slopes, cool-season/warm-season co-dominant.  
Cool-season, warm-season co-dominant.

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

### **Community 1.3 Needleandthread/Western Wheatgrass/Sedge**

This plant community developed under heavy continuous grazing or from over utilization during extended drought periods. This community can also develop where this site occurs near water sources. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 5 percent trees. Dominant grass and grass-like species include needleandthread, western wheatgrass, threadleaf sedge, and blue grama. Grasses of secondary importance include little bluestem, hairy grama, sideoats grama, big bluestem, green needlegrass, Kentucky and/or Canada bluegrass, and a variety of other grasses. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, white prairie aster, scurfpea, and green sagewort. When compared to the Bluestem/Needlegrass/Western Wheatgrass Plant Community Phase (1.1), blue grama, sedge, and western wheatgrass have increased. Tall and mid warm-season grasses have decreased, and production has also been reduced. This plant community is moderately resistant to change. This is due in part to the shallow rooted nature of the shortgrass species which decreases infiltration especially to the deeper rooted tall and mid grass species. The herbaceous species present are well adapted to grazing; however, species composition can be altered through continued overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community phase is reaching a critical point where continued overgrazing will likely shift this community over a threshold leading to a short grass and grass-like dominated state. The shorter, more grazing tolerant species tend to self-perpetuate as the shallow, dense rooting structure takes advantage of rainfall and reduces deeper infiltration to the taller species.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1261	1562	1827
Shrub/Vine	90	143	213
Forb	90	143	213
Tree	17	56	101
<b>Total</b>	<b>1458</b>	<b>1904</b>	<b>2354</b>

**Figure 9. Plant community growth curve (percent production by month).**  
SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant.  
Cool-season dominant, warm-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

### **Pathway 1.1a**

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

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season) or a combination of disturbances for extended periods of time will lead to the 1.2 Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase.

### **Pathway 1.2b**

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

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 1.1 Bluestem/Needlegrass/Western Wheatgrass Plant Community Phase.

#### **Conservation practices**

Prescribed Grazing

### **Pathway 1.2a**

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

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season) or a combination of disturbances for extended periods of time will lead to the 1.3 Needleandthread/Western Wheatgrass/Sedge Plant Community Phase.

### **Pathway 1.3a**

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

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 1.2 Little Bluestem/Needleandthread/Western Wheatgrass Plant Community Phase.

#### **Conservation practices**

Prescribed Grazing

## **State 2**

### **Conifer**

This state consists of areas where tree canopy increases to a level that impedes the reproductive capability of the major native perennial grass species. The increase in tree canopy is a result of a disruption of the natural historic fire regime that kept the trees at an immature stage. This State is reached when mature tree canopy reaches about 25% or more. Tree canopy typically is dominated by ponderosa pine, but bur oak, eastern redcedar, and Rocky Mountain juniper may also be present in varying amounts.

### **Community 2.1**

#### **Little Bluestem/Needlegrass/Ponderosa Pine**

This plant community develops where trees from adjacent sites encroach and begin to shade out the herbaceous component. Ponderosa pine is the most common species to occupy the site, but encroachment also occurs by eastern redcedar, Rocky Mountain juniper, and/or occasionally deciduous trees such as bur oak. These species expand on this site due to suppression of fire. The tree canopy is 25 percent or greater. The potential plant community is made up of approximately 45 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 35 percent trees. Dominant grass and grass-like species include little bluestem, needleandthread, green needlegrass, sideoats grama, western wheatgrass, and threadleaf sedge. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses initially increase. Forbs commonly found in this

community include cudweed sagewort, goldenrod, and green sagewort. Non-native species such as cheatgrass and bluegrass will tend to invade. Compared to the Bluestem/Needlegrass/Western Wheatgrass Plant Community Phase (1.1), trees encroach and increase significantly. The grass component decreases dramatically with increased shading and the buildup of duff. Annual herbaceous production also decreases significantly. While the tree canopy provides excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased production. A significant reduction of tree canopy can be accomplished through timber harvest or crown fire. The vegetation in the understory is capable of enduring fire; however, very hot crown fires will have a detrimental effect to the plant community. The total annual production of the understory can range from nearly non-existent under a closed canopy to about 500 pounds per acre (air-dry weight) under a medium canopy.

**Figure 10. Plant community growth curve (percent production by month). SD6111, Black Hills Foot Slopes, heavy conifer canopy. Mature ponderosa pine/juniper overstory.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	11	24	27	12	5	4	3	2	1

## **Community 2.2 Ponderosa Pine**

This plant community is a result of continued suppression of fire, and a lack of tree harvest. The tree canopy eventually becomes closed, and most of the herbaceous understory is lost. Tree canopy approaches 45 percent or higher and competition slows the growth rate of the trees. A few cool-season species may survive, as well as shrubs and possibly vines. This plant community may only be altered through harvest, or possibly a wildfire that has enough energy to cause crowning of the trees. This plant community phase will also be accompanied by a relatively thick layer of acidic duff from the needles of the trees which will further reduce the establishment of herbaceous species.

### **Pathway 2.1a Community 2.1 to 2.2**

No fire or harvest for extended periods of time will cause tree canopy to continue to increase and shift this plant community to the 2.2 Ponderosa Pine Plant Community Phase.

### **Pathway 2.2a Community 2.2 to 2.1**

Timber harvest or wildfire (i.e., crown fire) will be required to shift this plant community away from this phase. Reproductive propagules of the herbaceous species will need to be present to result in a shift to the 2.1 Little Bluestem/Needlegrass/Ponderosa Pine Plant Community Phase.

## **State 3 Shortgrass Sod**

This state is a result of overgrazing (individual plants of selected species being repeatedly grazed due to continuous grazing systems which allow for long paddock occupation periods). This type of grazing causes reduced vigor of the selected species (i.e., typically the most desired by grazing ungulates). As the photosynthetic area of these species is repeatedly removed, carbohydrate production needed for root respiration is inadequate, and the root systems of these species begin to falter. The shorter, more grazing tolerant species are given the advantage, and will dominate the site. In the early stages of this State, mid and tall grass remnants may be present in sufficient quantities to allow for recovery to the Reference State. Over time, this recovery will become less likely due to higher runoff and reduced infiltration.

### **Community 3.1 Sedge/Blue Grama/Sagewort**

This plant community evolved under heavy continuous grazing, heavy continuous season-long grazing or from over



utilization during extended drought periods. The potential plant community is made up of approximately 65 percent grasses and grass-like species, 15 percent forbs, 15 percent shrubs, and 5 percent trees. Dominant grass and grass-like species include threadleaf sedge, blue grama, and sun sedge. Grasses of secondary importance include western wheatgrass, needleandthread, little bluestem, sideoats grama, hairy grama, and prairie junegrass. Cheatgrass may also invade and become quite prevalent. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, spiny phlox, and green sagewort. When compared to the Bluestem/Needlegrass/Western Wheatgrass Plant Community Phase (1.1), short statured species are dominant on this plant community. Tall and mid grasses have decreased significantly. This vegetation state is very resistant to change due to the increase in the root mat near the surface of the soil which further reduces infiltration. The herbaceous species present are well adapted to grazing. This plant community is less productive than other plant community phases. The thick sod prevents other species from getting established. Lack of litter and reduced plant vigor causes higher soil temperatures, poor water infiltration rates, and high evapotranspiration which give the short statured species a competitive advantage. Soil erosion will be minimal due to the sod forming habit of dominant species in this phase.

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

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	762	1036	1272
Shrub/Vine	62	135	224
Forb	62	135	224
Tree	11	40	73
<b>Total</b>	<b>897</b>	<b>1346</b>	<b>1793</b>

**Figure 12. Plant community growth curve (percent production by month). SD6102, Black Hills Foot Slopes, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	10	23	34	15	6	5	4		

### **Transition T1a State 1 to 3**

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season) or a combination of disturbances for extended periods of time will lead this plant community over a threshold and result in the 3.1 Sedge/Blue Grama/Sagewort Plant Community Phase within the Shortgrass Sod State (State 3).

### **Transition T1b State 1 to 3**

Encroachment and/or an increase in canopy cover of native coniferous tree species will lead this plant community phase over a threshold to the Conifer State (State 3). This threshold will be crossed when tree canopy reaches about 25% or more of mature trees.

### **Restoration pathway R2 State 2 to 1**

Prescribed burning in conjunction with long-term prescribed grazing may lead this plant community across a threshold back to the Reference State (State 1). This would have to take place before the trees reach maturity and are still susceptible to fire, and reproductive propagules of the perennial grasses are still present. After trees reach maturity, a crown fire or timber harvest would be needed to move this plant community over the threshold back to the Reference State (State 1).

### **Conservation practices**

Prescribed Burning
Prescribed Grazing

## Restoration pathway R3 State 3 to 1

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) may lead this plant community phase over a threshold to the Reference State (State 1). This will likely take a long period of time, possibly up to 10 years or more, and recovery may not be attainable. Under certain circumstances, the harsh conditions created by the shortgrass sod can lead to the elimination of invasive grass species such as Kentucky bluegrass.

### Conservation practices

Prescribed Grazing
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## Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tall Warm-Season Grasses</b>			437–874	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	291–729	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	58–233	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	29–204	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	29–117	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–87	–
2	<b>Mid Warm-Season Grasses</b>			437–874	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	146–583	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	146–437	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	29–291	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	29–146	–
3	<b>Needlegrass</b>			146–437	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	58–291	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	58–291	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–146	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	0–146	–
4	<b>Wheatgrass</b>			146–437	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	58–437	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	29–291	–
	slender wheatgrass	ELTRS	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	29–291	–
5	<b>Other Native Grasses</b>			29–146	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–117	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	29–87	–

	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–58	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–29	–
	Cusick's bluegrass	POCU3	<i>Poa cusickii</i>	0–29	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–29	–
6	<b>Grass-likes</b>			146–291	
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	29–146	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–87	–
<b>Forb</b>					
7	<b>Forbs</b>			146–291	
	Forb, native	2FN	<i>Forb, native</i>	29–146	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	29–58	–
	nineanther prairie clover	DAEN	<i>Dalea enneandra</i>	0–58	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	29–58	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	29–58	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	29–58	–
	stiff sunflower	HEPA19	<i>Helianthus pauciflorus</i>	0–58	–
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	29–58	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	29–58	–
	stiff goldenrod	OLRI	<i>Oligoneuron rigidum</i>	29–58	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	29–58	–
	large Indian breadroot	PEES	<i>Pediomelum esculentum</i>	29–58	–
	beardtongue	PENST	<i>Penstemon</i>	0–29	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–29	–
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	0–29	–
	white prairie aster	SYFA	<i>Symphotrichum falcatum</i>	0–29	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–29	–
	groundplum milkvetch	ASCR2	<i>Astragalus crassicaarpus</i>	0–29	–
	downy Indian paintbrush	CAPU11	<i>Castilleja purpurea</i>	0–29	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–29	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	0–29	–
<b>Shrub/Vine</b>					
8	<b>Shrubs</b>			146–291	
	leadplant	AMCA6	<i>Amorpha canescens</i>	58–233	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–87	–
	rose	ROSA5	<i>Rosa</i>	29–87	–
	snowberry	SYMPH	<i>Symphoricarpus</i>	0–58	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–58	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–29	–
<b>Tree</b>					
9	<b>Trees</b>			29–146	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	29–146	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–87	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tall Warm-Season Grasses</b>			49–247	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	25–197	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–74	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	0–74	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	0–74	–
	prairie sandreed	CALO	<i>Calamovilfa longifolia</i>	0–25	–
2	<b>Mid Warm-Season Grasses</b>			247–493	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	123–493	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	49–247	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	0–123	–
	plains muhly	MUCU3	<i>Muhlenbergia cuspidata</i>	0–74	–
3	<b>Needlegrass</b>			247–616	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	123–493	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	25–197	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–74	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	0–25	–
4	<b>Wheatgrass</b>			247–493	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	247–493	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–123	–
	slender wheatgrass	ELTRS	<i>Elymus trachycaulus</i> ssp. <i>subsecundus</i>	0–123	–
5	<b>Other Native Grasses</b>			123–247	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	49–197	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–99	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	25–74	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–49	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–49	–
6	<b>Grass-likes</b>			247–370	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	123–296	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	25–173	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–99	–
7	<b>Non-Native Grasses</b>			25–123	
	brome	BROMU	<i>Bromus</i>	25–99	–
	bluegrass	POA	<i>Poa</i>	0–99	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–74	–
<b>Forb</b>					
8	<b>Forbs</b>			123–247	
	Forb, native	2FN	<i>Forb, native</i>	25–99	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–74	–

	FORD, introduced	ZFI	FORD, introduced	0-74	-
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	25-74	-
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	25-74	-
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	0-49	-
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0-49	-
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	25-49	-
	white prairie aster	SYFA	<i>Symphyotrichum falcatum</i>	25-49	-
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0-49	-
	field sagewort	ARCA12	<i>Artemisia campestris</i>	0-49	-
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	25-49	-
	stiff goldenrod	OLRI	<i>Oligoneuron rigidum</i>	25-49	-
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0-25	-
	pussytoes	ANTEN	<i>Antennaria</i>	0-25	-
	stiff sunflower	HEPA19	<i>Helianthus pauciflorus</i>	0-25	-
	groundplum milkvetch	ASCR2	<i>Astragalus crassicaarpus</i>	0-25	-
	nineanther prairie clover	DAEN	<i>Dalea enneandra</i>	0-25	-
	Indian breadroot	PEDIO2	<i>Pediomelum</i>	0-25	-
	beardtongue	PENST	<i>Penstemon</i>	0-25	-
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-25	-
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			123-247	
	Shrub (>.5m)	2SHRUB	Shrub (>.5m)	0-99	-
	leadplant	AMCA6	<i>Amorpha canescens</i>	0-74	-
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	25-74	-
	rose	ROSA5	<i>Rosa</i>	25-74	-
	snowberry	SYMPH	<i>Symphoricarpus</i>	0-74	-
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0-49	-
<b>Tree</b>					
10	<b>Trees</b>			25-123	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	25-123	-
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0-74	-

Table 11. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tall Warm-Season Grasses</b>			0-95	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0-76	-
	composite dropseed	SPCOC2	<i>Sporobolus compositus var. compositus</i>	0-57	-
2	<b>Mid Warm-Season Grasses</b>			38-191	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	19-191	-
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	19-152	-
3	<b>Needlegrass</b>			191-476	
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	191-476	-

	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–76	–
4	<b>Wheatgrass</b>			191–381	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	191–381	–
5	<b>Other Native Grasses</b>			95–286	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	38–229	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–76	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	19–57	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–38	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–38	–
6	<b>Grass-likes</b>			191–381	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	95–286	–
	sun sedge	CAINH2	<i>Carex inops ssp. heliophila</i>	19–152	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–76	–
7	<b>Non-Native Grasses</b>			38–191	
<b>Forb</b>					
8	<b>Forbs</b>			95–191	
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	19–76	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	19–76	–
	Forb, native	2FN	<i>Forb, native</i>	0–57	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	19–57	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	19–57	–
	white prairie aster	SYFA	<i>Symphotrichum falcatum</i>	19–38	–
	slimflower scurfpea	PSTE5	<i>Psoralidium tenuiflorum</i>	0–38	–
	stiff goldenrod	OLRI	<i>Oligoneuron rigidum</i>	19–38	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	19–38	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–19	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–19	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–19	–
	hairy false goldenaster	HEVI4	<i>Heterotheca villosa</i>	0–19	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–19	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–19	–
<b>Shrub/Vine</b>					
9	<b>Shrubs</b>			95–191	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	19–114	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–76	–
	snowberry	SYMPH	<i>Symphoricarpos</i>	0–57	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–38	–
	rose	ROSA5	<i>Rosa</i>	0–38	–
<b>Tree</b>					
10	<b>Trees</b>			19–95	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	19–95	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–57	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Mid Warm-Season Grasses</b>			0–67	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	0–67	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–40	–
2	<b>Needlegrass</b>			0–135	
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–135	–
3	<b>Wheatgrass</b>			0–135	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–135	–
4	<b>Other Native Grasses</b>			135–269	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	67–242	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–40	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–40	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–27	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	13–27	–
5	<b>Grass-likes</b>			202–404	
	threadleaf sedge	CAFI	<i>Carex filifolia</i>	135–336	–
	sun sedge	CAINH2	<i>Carex inops</i> ssp. <i>heliophila</i>	27–135	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–54	–
6	<b>Non-Native Grasses</b>			67–202	
	brome	BROMU	<i>Bromus</i>	27–161	–
	bluegrass	POA	<i>Poa</i>	0–108	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–27	–
<b>Forb</b>					
7	<b>Forbs</b>			67–202	
	Forb, introduced	2FI	<i>Forb, introduced</i>	13–81	–
	field sagewort	ARCA12	<i>Artemisia campestris</i>	13–67	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	13–67	–
	Missouri goldenrod	SOMI2	<i>Solidago missouriensis</i>	13–40	–
	Forb, native	2FN	<i>Forb, native</i>	0–27	–
	stiff goldenrod	OLRI	<i>Oligoneuron rigidum</i>	0–27	–
	silverleaf Indian breadroot	PEAR6	<i>Pediomelum argophyllum</i>	0–27	–
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–13	–
	slimflower scurfpea	PSTE5	<i>Psoraleidum tenuiflorum</i>	0–13	–
	pussytoes	ANTEN	<i>Antennaria</i>	0–13	–
	white prairie aster	SYFA	<i>Symphotrichum falcatum</i>	0–13	–
<b>Shrub/Vine</b>					
8	<b>Shrubs</b>			67–202	
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	27–161	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	0–40	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	0–27	–

	snowberry	SYMPH	<i>Symphoricarpos</i>	0–27	–
	rose	ROSA5	<i>Rosa</i>	0–13	–
<b>Tree</b>					
9	<b>Trees</b>			13–67	
	ponderosa pine	PIPO	<i>Pinus ponderosa</i>	13–67	–
	Rocky Mountain juniper	JUSC2	<i>Juniperus scopulorum</i>	0–40	–

## Animal community

### Animal Community – Grazing Interpretations

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

#### Bluestem/Needlegrass/Western Wheatgrass (1.1)

Average Annual Production (lbs./acre, air-dry): 2,600

Stocking Rate\* (AUM/acre): 0.71

#### Little Bluestem/Needleandthread/Western Wheatgrass (1.2)

Average Annual Production (lbs./acre, air-dry): 2,200

Stocking Rate\* (AUM/acre): 0.60

#### Needleandthread/Western Wheatgrass/Sedge (1.3)

Average Annual Production (lbs./acre, air-dry): 1,700

Stocking Rate\* (AUM/acre): 0.47

#### Sedge/Blue Grama/Sagewort (3.1)

Average Annual Production (lbs./acre, air-dry): 1,200

Stocking Rate\* (AUM/acre): 0.33

#### Little Bluestem/Needlegrass/Ponderosa Pine (2.1)

Average Annual Production (lbs./acre, air-dry): 500

Stocking Rate\* (AUM/acre): 0.14

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

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. 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 example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama and/or sedge will result in reduced infiltration and increased runoff.



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, hiking, photography, bird watching and other opportunities. The wide variety of plants that 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 from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS.

## 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://wcc.nrcs.usda.gov>)

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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.

## Contributors

SCB

Stan Boltz

## 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.

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Date	09/30/2009
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Slight to none, typically on steeper slopes and discontinuous.  

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous with numerous debris dams when present.  

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3. **Number and height of erosional pedestals or terracettes:** Few pedestalled plants typically on steeper slopes. Terracettes not present.  

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is roughly 5 to 20 percent, and patches are less than 2 inches in diameter.  

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not 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):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.  

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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 typically 5 to 6, normally 6. Surface organic matter adheres to the soil surface.  

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically granular, and mollic (higher organic matter) colors of surface horizon about 2 to 4 inches deep. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.  

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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- and warm-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.  

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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: Tall, warm-season grasses = mid, warm-season grasses >>

Sub-dominant: Mid and tall cool-season bunchgrasses = wheatgrasses (mid, cool-season rhizomatous) >

Other: Grass-like species = forbs = shrubs > trees

Additional: Other grasses occur in other functional groups in minor amounts.

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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.
- 
14. **Average percent litter cover (%) and depth ( in):** 55 to 65 percent plant litter cover, roughly 0.25 to 0.5 inch depth. Litter cover is in contact with soil surface.
- 
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Ranges from 1,800 to 3,400 pounds/acre. Reference value is 2,600 pounds/acre (air-dry weight basis).
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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:** Refer to State and Local Noxious Weed List.
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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 typically have vigorous rhizomes or tillers.
-