USDA Natural Resources Conservation Service

Ecological site R061XY017SD
Shallow Clayey

Accessed: 05/19/2024

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.

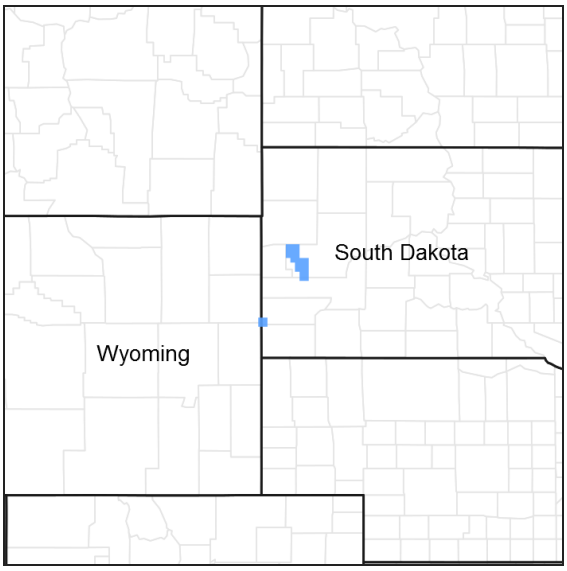


Figure 1. Mapped extent

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

R061XS010SD	**Loamy-South (16-18" PZ)**
R061XS011SD	**Clayey-South (16-18" PZ)**
R061XS012SD	**Thin Upland-South (16-18" PZ)**

Similar sites

R061XS012SD	**Thin Upland-South (16-18" PZ)** (R061XS012SD) – Thin Upland [more little bluestem and big bluestem; higher production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on moderately to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	884–1,219 m
Slope	15–30%
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 common features of soils in this site are the silty clay loam to clay textured sub-surface soils, with slopes ranging from about 15 to 30 percent. The soils in this site are well drained and formed in residuum. The silty clay loam surface layer is 3 to 5 inches thick. The soils have a slow to very slow infiltration rate. This site typically should

show slight to no evidence of rills, wind scoured areas or pedestalled plants. If present, water flow paths are broken, irregular in appearance or discontinuous. The soil surface is stable and intact. There is a restrictive layer (weathered shale bedrock) at about 16 inches in depth which impedes water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 20 percent. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production.

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

Table 4. Representative soil features

Surface texture	(1) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to slow
Soil depth	25–51 cm
Surface fragment cover <=3"	0–14%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	2–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–9
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0%

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.

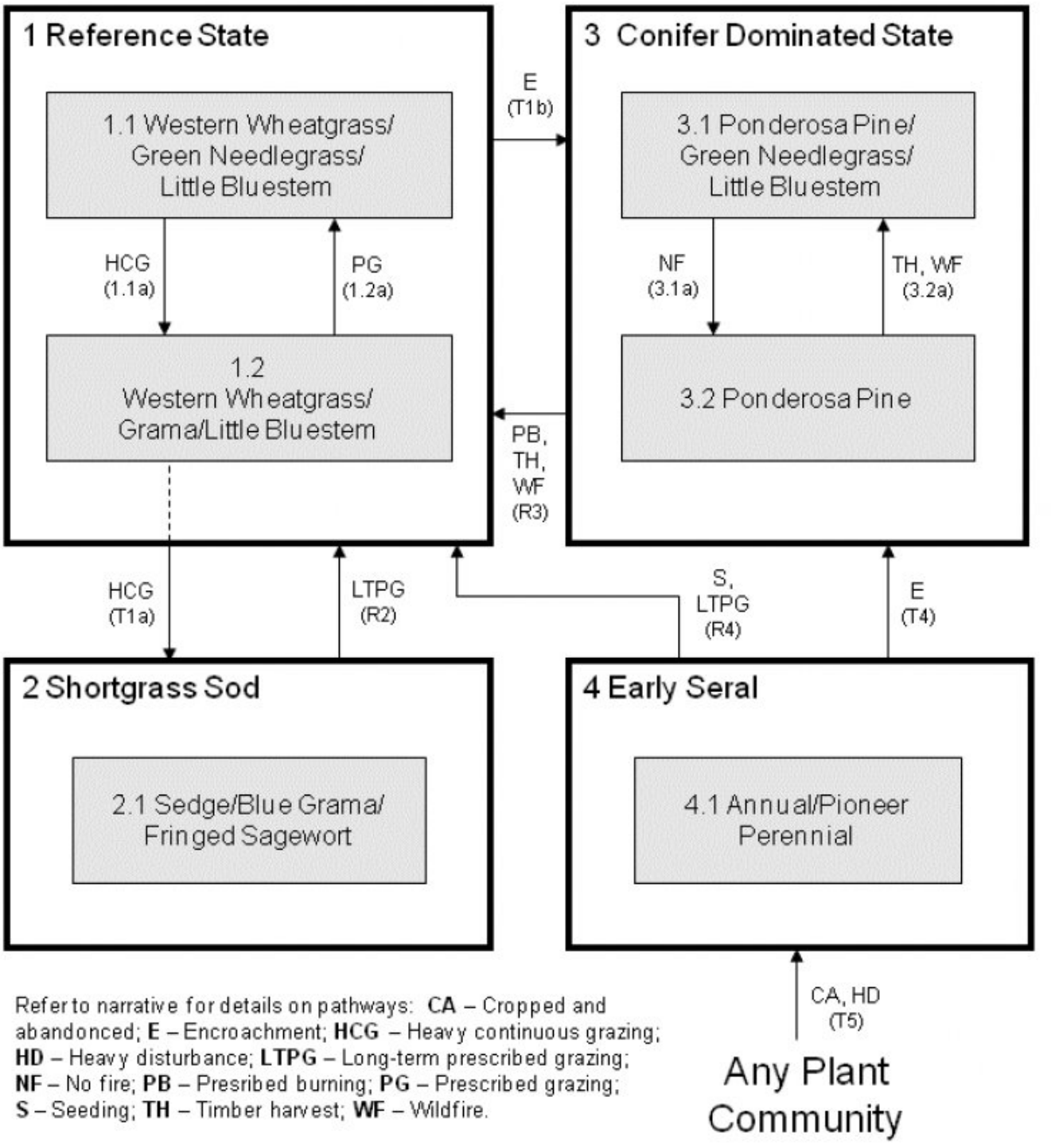
Heavy continuous grazing (e.g., every spring and/or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes departure from the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1). Blue grama and sedge can increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Needleandthread, green needlegrass, big bluestem, sideoats grama, and little bluestem will decrease in frequency and production. Excessive defoliation can cause threeawn and annuals to increase and dominate the site. A few mature trees comprised of ponderosa pine and Rocky Mountain juniper occupy this site. With extended periods of a lack of fire, trees will begin to encroach into the herbaceous community and may eventually dominate the site.

Interpretations are primarily based on the Western Wheatgrass/Green Needlegrass/Little Bluestem 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



State 1

Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool-season grasses, with warm-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
Western Wheatgrass/Green Needlegrass/Little Bluestem

Interpretations are based primarily on the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (this is also considered to be climax). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, 10 percent shrubs, and scattered mature trees. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass, green needlegrass, sideoats grama, and little bluestem. Other grass and grass-like species include plains muhly, big bluestem, needleandthread, bluebunch wheatgrass, blue grama, and needleleaf sedge. 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	1166	1601	2001
Shrub/Vine	90	143	213
Forb	90	143	213
Tree	–	18	39
Total	**1346**	**1905**	**2466**

Figure 5. 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		

Community 1.2
Western Wheatgrass/Grama/Little Bluestem

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 80 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and a minor amount of mature trees scattered randomly across the site. Dominant grass and grass-like species include western wheatgrass, green needlegrass, sideoats grama, blue grama, needleleaf sedge, and little bluestem. Grasses of secondary importance include needleandthread, buffalograss, prairie junegrass, and bottlebrush squirreltail. Forbs commonly found in this plant community include cudweed sagewort, desert biscuitroot, goldenpea, milkvetch, scarlet globemallow, silverleaf scurfpea, and white prairie aster. Dominant shrubs include fringed sagewort and yucca. When compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1), blue grama and needleleaf sedge have increased. Tall and mid cool- and 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 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	975	1318	1636
Shrub/Vine	73	118	174
Forb	73	118	174
Tree	–	16	34
Total	**1121**	**1570**	**2018**

Figure 7. 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 Western Wheatgrass/Grama/Little Bluestem Plant Community Phase.

Pathway 1.2a
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 Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase.

Conservation practices

Prescribed Grazing

State 2
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 2.1
Sedge/Blue Grama/Fringed Sagewort

This plant community evolved under heavy continuous grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 10

percent forbs, 15 percent shrubs, and scattered mature trees. Dominant grass and grass-like species include needleleaf sedge and blue grama. Other grasses include western wheatgrass, sideoats grama, buffalograss, and a variety of other grasses. Cheatgrass may also invade and become quite prevalent. Forbs commonly found in this plant community include cudweed sagewort, silverleaf scurfpea, and white prairie aster. When compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem 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 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	673	1005	1311
Shrub/Vine	56	123	207
Forb	56	93	135
Tree	–	11	28
Total	**785**	**1232**	**1681**

Figure 9. 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		

State 3
Conifer Dominated

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 eastern redcedar, Rocky Mountain juniper, and other trees may also be present in varying amounts.

Community 3.1
Ponderosa Pine/Green Needlegrass/Little Bluestem

This plant community develops where trees from adjacent sites encroach, or trees naturally occurring on the site increase 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 and Rocky Mountain juniper. 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 35 percent grasses and grass-like species, 5 percent forbs, 10 percent shrubs, and 50 percent trees. Dominant grass and grass-like species include little bluestem, green needlegrass, needleandthread, blue grama, threeawn, and needleleaf 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, white prairie aster, silverleaf scurfpea, and pussytoes. Non-native species such as cheatgrass and bluegrass will tend to invade. Compared to the Western Wheatgrass/Green Needlegrass/Little Bluestem Plant Community Phase (1.1), tree canopy increases 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.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	359	582	874
Grass/Grasslike	544	693	762
Shrub/Vine	67	110	163
Forb	39	73	106
Total	**1009**	**1458**	**1905**

Figure 11. 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 3.2
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 3.1a
Community 3.1 to 3.2

No fire or harvest for extended periods of time will cause tree canopy to continue to increase and shift this plant community to the 3.2 Ponderosa Pine Plant Community Phase.

Pathway 3.2a
Community 3.2 to 3.1

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 3.1 Ponderosa Pine/Green Needlegrass/Little Bluestem Plant Community Phase.

State 4
Early Seral

Community 4.1
Annual/Pioneer Perennial

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include non-native invasive and/or early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and

vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

Transition T1a
State 1 to 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 this plant community over a threshold and result in the 2.1 Sedge/Blue Grama/Fringed Sagewort Plant Community Phase within the Shortgrass Sod State (State 2).

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 Dominated State (State 3). This threshold will be crossed when tree canopy reaches about 25% or more of mature trees.

Transition T5
State 1 to 4

Cropping followed by abandonment or heavy disturbance (e.g., feeding areas, areas adjacent to water sources, or occupation of the area by rodents) may lead this plant community phase over a threshold to the Early Seral State (State 4) and more specifically to the 4.1 Annual/Pioneer Perennial Plant Community Phase.

Restoration pathway R2
State 2 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

Transition T5
State 2 to 4

Cropping followed by abandonment or heavy disturbance (e.g., feeding areas, areas adjacent to water sources, or occupation of the area by rodents) may lead this plant community phase over a threshold to the Early Seral State (State 4) and more specifically to the 4.1 Annual/Pioneer Perennial Plant Community Phase.

Restoration pathway R3
State 3 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

Transition T5
State 3 to 4

Cropping followed by abandonment or heavy disturbance (e.g., feeding areas, areas adjacent to water sources, or occupation of the area by rodents) may lead this plant community phase over a threshold to the Early Seral State (State 4) and more specifically to the 4.1 Annual/Pioneer Perennial Plant Community Phase.

Restoration pathway R4
State 4 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. Success depends on whether native reproductive propagules remain intact on the site. Seeding of native species may result in a plant community phase that resembles a phase within the Reference State (State 1).

Conservation practices

Prescribed Grazing

Transition T4
State 4 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 Dominated State (State 3). This threshold will be crossed when tree canopy reaches about 25% or more of mature trees.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			286–667	
	western wheatgrass	PASM	*Pascopyrum smithii*	286–667	–
2	**Cool-Season Bunchgrasses**			191–476	
	green needlegrass	NAVI4	*Nassella viridula*	191–476	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–95	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–95	–
3	**Mid Warm-Season Grasses**			286–476	
	little bluestem	SCSC	*Schizachyrium scoparium*	95–381	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	95–286	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–95	–
4	**Short Warm-Season Grasses**			95–191	
	blue grama	BOGR2	*Bouteloua gracilis*	38–133	–
	buffalograss	BODA2	*Bouteloua dactyloides*	19–76	–

	threeawn	ARIST	*Aristida*	0–38	–
5	**Other Native Grasses**			57–152	
	big bluestem	ANGE	*Andropogon gerardii*	0–95	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–76	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	19–38	–
	Sandberg bluegrass	POSE	*Poa secunda*	19–38	–
	squirreltail	ELEL5	*Elymus elymoides*	0–38	–
6	**Grass-likes**			38–133	
	needleleaf sedge	CADU6	*Carex duriuscula*	38–133	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–57	–
Forb					
7	**Forbs**			95–191	
	Forb, native	2FN	*Forb, native*	19–95	–
	textile onion	ALTE	*Allium textile*	19–38	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–38	–
	false boneset	BREU	*Brickellia eupatorioides*	0–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–38	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	19–38	–
	milkvetch	ASTRA	*Astragalus*	19–38	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	19–38	–
	desert biscuitroot	LOFO	*Lomatium foeniculaceum*	19–38	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	19–38	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	19–38	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	19–38	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–38	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–38	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–38	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–19	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–19	–
	Wyoming besseya	BEWY	*Besseya wyomingensis*	0–19	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–19	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–19	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
Shrub/Vine					
8	**Shrubs**			95–191	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–57	–
	leadplant	AMCA6	*Amorpha canescens*	19–57	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–57	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–57	–
	rose	ROSA5	*Rosa*	19–38	–

	soapweed yucca	YUGL	*Yucca glauca*	0–38	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	19–38	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–38	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–38	–
Tree					
9	**Trees**			0–38	
	Tree	2TREE	*Tree*	0–38	–
	juniper	JUNIP	*Juniperus*	0–38	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–38	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			314–628	
	western wheatgrass	PASM	*Pascopyrum smithii*	314–628	–
2	**Cool-Season Bunchgrass**			78–235	
	green needlegrass	NAVI4	*Nassella viridula*	78–235	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–78	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–31	–
3	**Mid Warm-Season Grasses**			78–235	
	sideoats grama	BOCU	*Bouteloua curtipendula*	78–235	–
	little bluestem	SCSC	*Schizachyrium scoparium*	16–110	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–31	–
4	**Short Warm-Season Grasses**			110–235	
	blue grama	BOGR2	*Bouteloua gracilis*	78–235	–
	buffalograss	BODA2	*Bouteloua dactyloides*	16–110	–
	threeawn	ARIST	*Aristida*	16–47	–
5	**Other Native Grasses**			16–78	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–47	–
	squirreltail	ELEL5	*Elymus elymoides*	0–47	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–47	–
	big bluestem	ANGE	*Andropogon gerardii*	0–31	–
	Sandberg bluegrass	POSE	*Poa secunda*	16–31	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–16	–
6	**Grass-likes**			78–204	
	needleleaf sedge	CADU6	*Carex duriuscula*	78–188	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–78	–
7	**Non-Native Grasses**			16–78	
	brome	BROMU	*Bromus*	16–63	–
	bluegrass	POA	*Poa*	0–63	–
Forb					
8	**Forbs**			78–157	
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–47	

	white sagebrush	ARLU	*Artemisia ludoviciana*	16–47	–
	Forb, introduced	2FI	*Forb, introduced*	0–47	–
	Forb, native	2FN	*Forb, native*	16–47	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	16–31	–
	milkvetch	ASTRA	*Astragalus*	16–31	–
	desert biscuitroot	LOFO	*Lomatium foeniculaceum*	0–31	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	16–31	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	16–31	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–31	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–16	–
	false boneset	BREU	*Brickellia eupatorioides*	0–16	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–16	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–16	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–16	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–16	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–16	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–16	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–16	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–16	–
	textile onion	ALTE	*Allium textile*	0–16	–
	pussytoes	ANTEN	*Antennaria*	0–16	–
Shrub/Vine					
9	**Shrubs**			78–157	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–63	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–63	–
	soapweed yucca	YUGL	*Yucca glauca*	16–63	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–31	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–31	–
	rose	ROSA5	*Rosa*	16–31	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–31	–
	leadplant	AMCA6	*Amorpha canescens*	0–16	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–16	–
Tree					
10	**Trees**			0–31	
	Tree	2TREE	*Tree*	0–31	–
	juniper	JUNIP	*Juniperus*	0–31	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–31	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			12–99	
	western wheatgrass	PASM	*Pascopyrum smithii*	12–99	–

2	**Cool-Season Bunchgrasses**			0–62	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–62	–
	green needlegrass	NAVI4	*Nassella viridula*	0–49	–
3	**Mid Warm-Season Grasses**			12–123	
	sideoats grama	BOCU	*Bouteloua curtipendula*	12–99	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–62	–
4	**Short Warm-Season Grasses**			123–370	
	blue grama	BOGR2	*Bouteloua gracilis*	99–308	–
	buffalograss	BODA2	*Bouteloua dactyloides*	12–99	–
	threeawn	ARIST	*Aristida*	0–62	–
5	**Other Native Grasses**			12–62	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–37	–
	squirreltail	ELEL5	*Elymus elymoides*	0–37	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–25	–
	Sandberg bluegrass	POSE	*Poa secunda*	12–25	–
6	**Grass-likes**			123–370	
	needleleaf sedge	CADU6	*Carex duriuscula*	123–308	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–99	–
7	**Non-Native Grasses**			25–123	
	brome	BROMU	*Bromus*	12–99	–
	bluegrass	POA	*Poa*	12–99	–
Forb					
8	**Forbs**			62–123	
	Forb, introduced	2FI	*Forb, introduced*	12–86	–
	Forb, native	2FN	*Forb, native*	12–49	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	12–37	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	12–37	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	12–25	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	12–25	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–25	–
	milkvetch	ASTRA	*Astragalus*	12–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	textile onion	ALTE	*Allium textile*	0–12	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–12	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–12	–
Shrub/Vine					
9	**Shrubs**			62–185	
	soapweed yucca	YUGL	*Yucca glauca*	12–99	–
	prairie sagewort	ARFR4	*Artemisia frigida*	37–99	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–62	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–25	–
	rose	ROSA5	*Rosa*	0–25	–

	silver sagebrush	ARCA13	*Artemisia cana*	0–12	–
Tree					
10	**Trees**			0–25	
	Tree	2TREE	*Tree*	0–25	–
	juniper	JUNIP	*Juniperus*	0–25	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–25	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			0–44	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–44	–
2	**Cool-Season Bunchgrasses**			29–146	
	green needlegrass	NAVI4	*Nassella viridula*	15–117	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	15–102	–
3	**Mid Warm-Season Grasses**			15–146	
	little bluestem	SCSC	*Schizachyrium scoparium*	15–117	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–58	–
4	**Short Warm-Season Grasses**			29–146	
	threeawn	ARIST	*Aristida*	15–102	–
	blue grama	BOGR2	*Bouteloua gracilis*	15–87	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–58	–
5	**Other Native Grasses**			29–73	
	squirreltail	ELEL5	*Elymus elymoides*	0–44	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–44	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–29	–
6	**Grass-likes**			15–146	
	needleleaf sedge	CADU6	*Carex duriuscula*	15–146	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–73	–
7	**Non-Native Grasses**			15–146	
	brome	BROMU	*Bromus*	15–117	–
	bluegrass	POA	*Poa*	0–58	–
Forb					
8	**Forbs**			44–102	
	Forb, introduced	2FI	*Forb, introduced*	15–44	–
	Forb, native	2FN	*Forb, native*	0–44	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–29	–
	pussytoes	ANTEN	*Antennaria*	0–29	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	15–29	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	15–29	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	0–15	–
	milkvetch	ASTRA	*Astragalus*	0–15	–

	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	textile onion	ALTE	*Allium textile*	0–15	–
Shrub/Vine					
9	**Shrubs**			73–146	
	prairie sagewort	ARFR4	*Artemisia frigida*	15–87	–
	soapweed yucca	YUGL	*Yucca glauca*	15–73	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–58	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–44	–
	rose	ROSA5	*Rosa*	0–44	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–15	–
Tree					
10	**Trees**			437–729	
	ponderosa pine	PIPO	*Pinus ponderosa*	364–656	–
	juniper	JUNIP	*Juniperus*	29–219	–
	Tree	2TREE	*Tree*	0–73	–

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.

Western Wheatgrass/Green Needlegrass/Little Bluestem (1.1)
Average Annual Production (lbs./acre, air-dry): 1,700
Stocking Rate* (AUM/acre): 0.47

Western Wheatgrass/Grama/Little Bluestem (1.2)
Average Annual Production (lbs./acre, air-dry): 1,400
Stocking Rate* (AUM/acre): 0.38

Sedge/Blue Grama/Fringed Sagewort (2.1)
Average Annual Production (lbs./acre, air-dry): 1,100
Stocking Rate* (AUM/acre): 0.30

Ponderosa Pine/Green Needlegrass/Little Bluestem (3.1)
Average Annual Production (lbs./acre, air-dry): 1,300
Stocking Rate* (AUM/acre): 0.16

Annual/Pioneer Perennial (4.1)
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 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% 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, buffalograss, bluegrass, and/or smooth bromegrass 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; Cynthia Englebert, Range Management Specialist, Forest Service; George Gamblin, Range Management Specialist, NRCS; Tate Lantz, Range Management Specialist, NRCS; Ryan Murray, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; L. Michael Stirling, Range Management Specialist, NRCS; Jim Westerman, Soil Scientist, NRCS.

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Contributors

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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:** If present, rills are short (roughly 6 inches long or less), sporadic, and discontinuous. Typically on steeper slopes.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground normally less than 15 percent, and patches less than 2 inches in diameter.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not 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):** 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.

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 4 to 6. Surface organic matter adheres to the soil surface.

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 A-horizon about 3 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 – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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

    Dominant: Wheatgrasses (mid, cool-season rhizomatous grasses) >

    Sub-dominant: Mid and tall, cool-season bunchgrasses = mid, warm-season grasses >

    Other: Short, warm-season grasses = forbs = shrubs > grass-likes species > 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.

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14. **Average percent litter cover (%) and depth (in):** 60 to 70 percent plant litter cover, roughly 0.25 to 0.5 inch depth. Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Ranges from 1,300 to 2,200 pounds/acre. Reference value is 1,700 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.
