Ecological site R055CY017SD
Shallow Clay

Accessed: 04/19/2024

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: 42e – Southern Missouri Coteau, 42f – Southern Missouri Coteau Slope, 46n – James River Lowland.

Associated sites

R055CY010SD	**Loamy**
R055CY011SD	**Clayey**
R055CY012SD	**Thin Upland**

Similar sites

R055CY011SD	**Clayey** (R055CY011SD) – Clayey [less big bluestem; higher production]
R055CY012SD	**Thin Upland** (R055CY012SD) – Thin Upland [more little bluestem, more needleandthread, and porcupine grass]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Nassella viridula* (2) *Andropogon gerardii*

Physiographic features

This site occurs on moderately to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	1,300–2,000 ft
Slope	9–35%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55C is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota (SD)), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 mph during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

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. Greenup 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)	159 days
Freeze-free period (average)	180 days
Precipitation total (average)	25 in

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 clayey residuum weathered from shale. The clay to surface

layer is about four inches thick. The bedrock which occurs at 13 to 16 inches is impervious shale which is virtually impenetrable to plant roots. The soils have a very slow infiltration rate. This site may show slight evidence of rills, wind scoured areas, and/or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. Some amount of erosion is occasionally present on this site even in the Reference State.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Wind erosion can also be a hazard when vigor of plants is reduced due to stress from grazing or prolonged periods of below average precipitation. Low available water capacity and very slow permeability strongly influences the soil-water-plant relationship.

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

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous shale
Surface texture	(1) Clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to very rapid
Soil depth	10–20 in
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1–2 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	6.6–8.4
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.

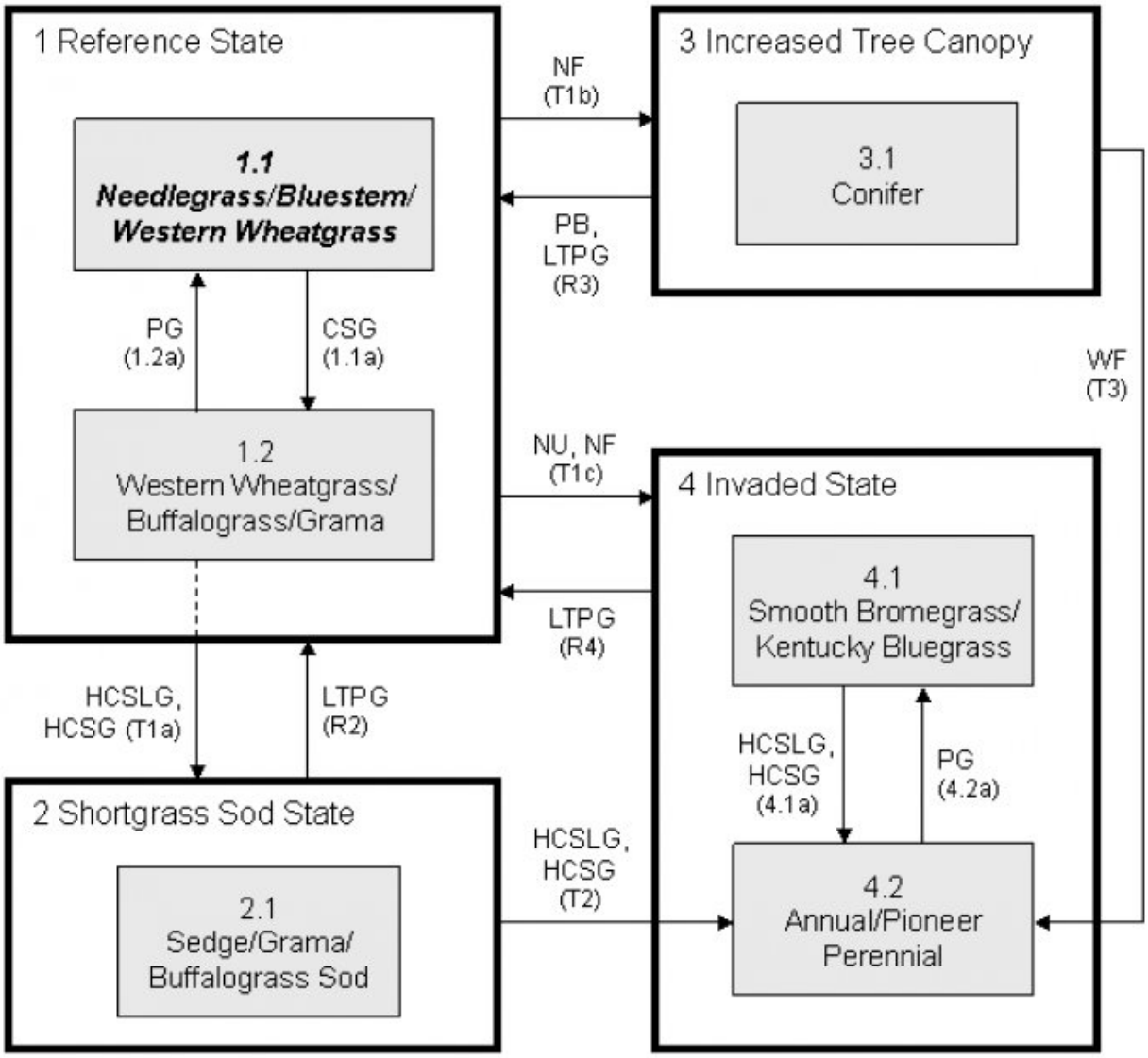
Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Needlegrass/Bluestem/Western Wheatgrass Plant Community. Sedge and other short grasses will increase and eventually develop into a sod. Little bluestem will increase initially and then begin to decrease. Green needlegrass, needleandthread, porcupine grass, sideoats grama, big bluestem,

and western wheatgrass will decrease in frequency and production. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as western wheatgrass, bluegrass, smooth bromegrass, and cheatgrass.

Interpretations are primarily based on the Needlegrass/Bluestem/Western Wheatgrass Plant Community (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: **CSG** – Continuous seasonal grazing; **HCSG** – Heavy continuous seasonal grazing; **HCSLG** – Heavy continuous season-long grazing; **LTPG** – Long-term prescribed grazing; **NF** – No fire; **NU** – Non-use; **PB** – Prescribed burning; **PG** – Prescribed grazing; **WF** - Wildfire.

State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is codominated by cool- and warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this 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. The dominant cool- and warm-season species can decline and a corresponding increase in short-statured species will occur.

Community 1.1

Needlegrass/Bluestem/Western Wheatgrass

Interpretations are based primarily on the Needlegrass/Bluestem/Western Wheatgrass 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, 8 percent shrubs, and 2 percent trees. The community is codominated by cool- and warm-season grasses. The major grasses include western wheatgrass, big bluestem, green needlegrass, sideoats grama, and little bluestem. Other grass and grass-like species include needleandthread, porcupine grass, blue grama, buffalograss, and sedges. 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1260	1903	2505
Forb	100	165	250
Shrub/Vine	40	110	200
Tree	0	22	45
Total	**1400**	**2200**	**3000**

Figure 5. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 1.2
Western Wheatgrass/Buffalograss/Grama

This plant community developed under continuous seasonal grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 83 percent grasses and grass-like species, 10 percent forbs, 5 percent shrubs, and 2 percent trees. Dominant grasses include western wheatgrass, buffalograss, blue grama, and sideoats grama. Grasses of secondary importance include sedge, green needlegrass, Kentucky bluegrass, and tall dropseed. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, and western ragweed. When compared to the Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase (1.1), blue grama and buffalograss have increased. Needlegrasses and tall warm-season grasses have decreased and production has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	705	1320	1820
Forb	70	113	165
Shrub/Vine	25	52	80
Tree	0	15	35
Total	**800**	**1500**	**2100**

Figure 7. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

Pathway 1.1a
Community 1.1 to 1.2

Continuous seasonal grazing which includes grazing at moderate to heavy stocking levels at the same time of year each year or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will shift this community to the 1.2 Western Wheatgrass/Buffalograss/Grama 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 Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

State 2
Shortgrass Sod

Community 2.1
Sedge/Grama/Buffalograss Sod

This plant community evolved under heavy continuous season-long grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 82 percent grasses and grass-like species, 10 percent forbs, 6 percent shrubs, and 2 percent trees. Dominant grass and grass-like species include sedge, buffalograss, blue grama, and sideoats grama. Grasses of secondary importance include needleandthread, bluegrass, annual bromegrass, and smooth bromegrass. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, and sweet clover. When compared to the Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase (1.1), short-statured species are dominant on this plant community. Tall/mid cool- and warm-season grasses have decreased significantly. This vegetation state is very resistant to change. The herbaceous species present are well adapted to grazing; however, composition can be altered through long-term prescribed grazing. This plant community is less productive than most other 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	445	788	1230
Forb	40	68	95
Shrub/Vine	15	35	55
Tree	0	9	20
Total	**500**	**900**	**1400**

Figure 9. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

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

State 3
Increased Tree Canopy

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.

Community 3.1
Conifer

This plant community develops under non-use, no fire, and encroachment 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 15 percent or greater. The potential plant community is made up of approximately 48 percent grasses and grass-like species, 10 percent forbs, 7 percent shrubs, and 35 percent trees. Dominant grasses and grass-likes include western wheatgrass, green needlegrass, Canada wildrye, sideoats grama, little bluestem, and sedges. 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 sweetclover. Nonnative species such as annual bromegrasses and bluegrass will tend to invade. Compared to the Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase (1.1), juniper increases significantly. The grass component decreases dramatically as the buildup of juniper needles increases. Annual herbaceous production also decreases significantly. While the juniper 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 juniper 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	525	882	955
Tree	185	350	585
Forb	65	105	155
Shrub/Vine	25	63	105
Total	**800**	**1400**	**1800**

Figure 11. Plant community growth curve (percent production by month). SD6311, Pierre Shale Plains, heavy conifer canopy.. Mature eastern redcedar 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

State 4
Invaded

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth bromegrass and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the

introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition.

Community 4.1
Smooth Bromegrass/Kentucky Bluegrass

This plant community phase is a result of extended periods of nonuse and no fire. It is characterized by a dominance of smooth bromegrass and Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer may also accumulate at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

Figure 12. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

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

Community 4.2
Annual/Pioneer Perennial

This plant community evolved under heavy continuous season-long grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 50 to 80 percent grasses and grass-like species, 10 to 25 percent forbs, and 5 to 25 percent shrubs and trees. The dominant species are highly variable in this phase, often consisting of invasive species such as annual bromegrass, Kentucky bluegrass, and invasive forbs. Other plant species, from adjacent ecological sites, can become minor components of this plant community. This plant community is susceptible to invasion of Canada thistle and other nonnative species because of the relatively high percent of bare ground. Compared to the Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase (1.1), annual bromegrass, invasive forbs, and percent of bare ground have increased. Western wheatgrass, needlegrasses and other cool-season grasses and grass-like species have decreased as have the warm-season species including big bluestem, sideoats grama, little bluestem, plains muhly, and prairie dropseed. 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. This community can be renovated to improve the production capability, however if management changes are not made the vegetation could revert back to a threeawn/annual community.

Figure 13. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

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

Pathway 4.1a
Community 4.1 to 4.2

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) or heavy continuous season-long grazing will convert this

plant community to the 4.2 Annual/Pioneer Perennial Plant Community Phase.

Pathway 4.2a
Community 4.2 to 4.1

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 4.1 Smooth Bromegrass/Kentucky Bluegrass Plant Community Phase.

Conservation practices

Prescribed Grazing

Transition T1b
State 1 to 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 1.1 Needlegrass/Bluestem/Western Wheatgrass Plant Community Phase.

Transition T1b
State 1 to 3

No fire for extended periods of time will lead the Reference State (State 1) across a threshold resulting in the Increased Tree Canopy State (State 3). This transition also requires the presence of eastern redcedar and/or Rocky Mountain juniper, or other trees that can increase on this site. It is a result of a disruption of the natural historic fire regime that occurred in the past.

Transition T1c
State 1 to 4

Non-use and no fire for extended periods of time (typically for 10 or more years) will likely lead this state over a threshold resulting in the 4.1 Smooth Bromegrass/Kentucky Bluegrass Plant Community Phase within the Invaded State (State 4).

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 and smooth bromegrass.

Conservation practices

Prescribed Grazing

Transition T2
State 2 to 4

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year, typically beginning early in the season) or heavy continuous season-long grazing will convert this plant community to the 4.2 Annual/Pioneer Perennial Sod Plant Community Phase and the Invaded State (State 4).

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.

Conservation practices

Prescribed Grazing

Transition T3
State 3 to 4

Wildfire that is intense enough to crown and kill mature trees will cause this plant community to cross a threshold and lead to the Invaded State (State 4) and specifically to the Annual/Pioneer Perennial Plant Community Phase (4.2).

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.

Conservation practices

Prescribed Grazing

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. Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly.

Conservation practices

Prescribed Grazing

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			330–550	
	green needlegrass	NAVI4	*Nassella viridula*	220–440	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	44–220	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	44–220	–

	Canada wildrye	ELCA4	*Elymus canadensis*	0–110	–
2	**Tall Warm-Season Grasses**			220–550	
	big bluestem	ANGE	*Andropogon gerardii*	220–550	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–176	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–110	–
3	**Wheatgrass**			220–550	
	western wheatgrass	PASM	*Pascopyrum smithii*	220–550	–
4	**Mid Warm-Season Grasses**			220–440	
	sideoats grama	BOCU	*Bouteloua curtipendula*	110–330	–
	little bluestem	SCSC	*Schizachyrium scoparium*	110–330	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–110	–
5	**Short Warm-Season Grasses**			22–110	
	buffalograss	BODA2	*Bouteloua dactyloides*	22–110	–
	blue grama	BOGR2	*Bouteloua gracilis*	22–110	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–66	–
6	**Other Native Grasses**			22–110	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–110	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	22–66	–
7	**Grass-likes**			22–110	
	sedge	CAREX	*Carex*	22–110	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–66	–
Forb					
8	**Forbs**			110–220	
	Forb, native	2FN	*Forb, native*	22–88	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	22–66	–
	false boneset	BREU	*Brickellia eupatorioides*	0–44	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	22–44	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–44	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	22–44	–
	dotted blazing star	LIPU	*Liatris punctata*	22–44	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–44	–
	beardtongue	PENST	*Penstemon*	0–44	–
	scurfpea	PSORA2	*Psoralidium*	22–44	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	22–44	–
	goldenrod	SOLID	*Solidago*	22–44	–
	white heath aster	SYER	*Symphyotrichum ericoides*	22–44	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–22	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–22	–
	milkweed	ASCLE	*Asclepias*	0–22	–
	textile onion	ALTE	*Allium textile*	0–22	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–22	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–22	–

Shrub/Vine					
9	**Shrubs**			44–176	
	leadplant	AMCA6	*Amorpha canescens*	22–88	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–66	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–44	–
	rose	ROSA5	*Rosa*	22–44	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	22–44	–
	soapweed yucca	YUGL	*Yucca glauca*	22–44	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–22	–
Tree					
10	**Trees**			0–44	
	Tree	2TREE	*Tree*	0–44	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–44	–
	eastern redcedar	JUVI	*Juniperus virginiana*	0–44	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–44	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			30–150	
	green needlegrass	NAVI4	*Nassella viridula*	0–150	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–45	–
2	**Tall Warm-Season Grasses**			0–150	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–150	–
	big bluestem	ANGE	*Andropogon gerardii*	0–75	–
3	**Wheatgrass**			225–450	
	western wheatgrass	PASM	*Pascopyrum smithii*	225–450	–
4	**Mid Warm-Season Grasses**			30–150	
	sideoats grama	BOCU	*Bouteloua curtipendula*	30–150	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–75	–
5	**Short Warm-Season Grasses**			75–300	
	buffalograss	BODA2	*Bouteloua dactyloides*	30–225	–
	blue grama	BOGR2	*Bouteloua gracilis*	15–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	15–120	–
6	**Other Native Grasses**			15–75	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–75	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	15–45	–
7	**Grass-likes**			30–150	
	sedge	CAREX	*Carex*	30–150	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–75	–
8	**Non-Native Grasses**			30–150	

	bluegrass	POA	*Poa*	30–150	–
	brome	BROMU	*Bromus*	0–75	–
	smooth brome	BRIN2	*Bromus inermis*	0–30	–
Forb					
9	**Forbs**			75–150	
	sweetclover	MELIL	*Melilotus*	0–150	–
	Forb, introduced	2FI	*Forb, introduced*	0–75	–
	Forb, native	2FN	*Forb, native*	0–45	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	15–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	15–45	–
	goldenrod	SOLID	*Solidago*	15–45	–
	white heath aster	SYER	*Symphyotrichum ericoides*	15–30	–
	field pennycress	THAR5	*Thlaspi arvense*	0–30	–
	scurfpea	PSORA2	*Psoralidium*	0–30	–
	common pepperweed	LEDE	*Lepidium densiflorum*	0–30	–
	dotted blazing star	LIPU	*Liatris punctata*	0–15	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–15	–
	milkweed	ASCLE	*Asclepias*	0–15	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
Shrub/Vine					
10	**Shrubs**			30–75	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–45	–
	soapweed yucca	YUGL	*Yucca glauca*	15–45	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	15–30	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–30	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–30	–
	rose	ROSA5	*Rosa*	0–15	–
	leadplant	AMCA6	*Amorpha canescens*	0–15	–
Tree					
11	**Trees**			0–30	
	Tree	2TREE	*Tree*	0–30	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–30	–
	eastern redcedar	JUVI	*Juniperus virginiana*	0–30	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–30	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			9–63	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–54	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–27	–
	green needlegrass	NAVI4	*Nassella viridula*	0–27	

	green needlegrass	NAVI4	*Nassella viridula*	0–27	–
2	**Wheatgrass**			0–45	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–45	–
3	**Mid Warm-Season Grasses**			0–45	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–45	–
4	**Short Warm-Season Grasses**			9–90	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–63	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–45	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–45	–
5	**Other Native Grasses**			9–45	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–27	–
6	**Grass-likes**			135–360	
	sedge	CAREX	*Carex*	135–360	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–72	–
7	**Non-Native Grasses**			90–270	
	bluegrass	POA	*Poa*	45–225	–
	smooth brome	BRIN2	*Bromus inermis*	0–90	–
	brome	BROMU	*Bromus*	9–90	–
Forb					
8	**Forbs**			45–90	
	sweetclover	MELIL	*Melilotus*	0–72	–
	Forb, introduced	2FI	*Forb, introduced*	0–45	–
	Forb, native	2FN	*Forb, native*	0–27	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–27	–
	common pepperweed	LEDE	*Lepidium densiflorum*	0–27	–
	field pennycress	THAR5	*Thlaspi arvense*	0–27	–
	white heath aster	SYER	*Symphyotrichum ericoides*	9–18	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	9–18	–
	goldenrod	SOLID	*Solidago*	9–18	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–9	–
	scurfpea	PSORA2	*Psoralidium*	0–9	–
Shrub/Vine					
9	**Shrubs**			18–54	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	9–36	–
	soapweed yucca	YUGL	*Yucca glauca*	9–36	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–27	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–27	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–9	–
	rose	ROSA5	*Rosa*	0–9	–
Tree					
10	**Trees**			0–18	
	Tree	2TREE	*Tree*	0–18	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–18	

	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–18	–
	eastern redcedar	JUVI	*Juniperus virginiana*	0–18	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–18	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			28–210	
	green needlegrass	NAVI4	*Nassella viridula*	14–210	–
	Canada wildrye	ELCA4	*Elymus canadensis*	14–140	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–70	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–70	–
2	**Wheatgrass**			28–280	
	western wheatgrass	PASM	*Pascopyrum smithii*	28–280	–
3	**Mid Warm-Season Grasses**			28–140	
	sideoats grama	BOCU	*Bouteloua curtipendula*	14–112	–
	little bluestem	SCSC	*Schizachyrium scoparium*	14–112	–
4	**Short Warm-Season Grasses**			0–70	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–70	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–56	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–42	–
5	**Other Native Grasses**			14–70	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–70	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–42	–
6	**Grass-likes**			14–70	
	sedge	CAREX	*Carex*	14–70	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–42	–
7	**Non-Native Grasses**			0–70	
	brome	BROMU	*Bromus*	0–70	–
	bluegrass	POA	*Poa*	0–70	–
	smooth brome	BRIN2	*Bromus inermis*	0–42	–
Forb					
8	**Forbs**			70–140	
	sweetclover	MELIL	*Melilotus*	0–70	–
	white heath aster	SYER	*Symphyotrichum ericoides*	14–42	–
	Forb, introduced	2FI	*Forb, introduced*	0–42	–
	Forb, native	2FN	*Forb, native*	0–42	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	14–42	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	14–28	–
	common pepperweed	LEDE	*Lepidium densiflorum*	0–28	–
	field pennycress	THAR5	*Thlaspi arvense*	0–28	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–28	–
	scurfpea	PSORA2	*Psoralidium*	14–28	–

	scurfpea	PSORA2	*Psoralidium*	14–28	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–28	–
	goldenrod	SOLID	*Solidago*	0–28	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–14	–
	alpine golden buckwheat	ERFLF	*Eriogonum flavum var. flavum*	0–14	–
	dotted blazing star	LIPU	*Liatris punctata*	0–14	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–14	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–14	–
	milkweed	ASCLE	*Asclepias*	0–14	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–14	–
Shrub/Vine					
9	**Shrubs**			28–98	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–42	–
	rose	ROSA5	*Rosa*	14–42	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	14–42	–
	soapweed yucca	YUGL	*Yucca glauca*	0–28	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–28	–
	leadplant	AMCA6	*Amorpha canescens*	0–14	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–14	–
Tree					
10	**Trees**			210–490	
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–490	–
	eastern redcedar	JUVI	*Juniperus virginiana*	0–490	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–280	–
	Tree	2TREE	*Tree*	0–140	–

Animal community

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ES 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.

Needlegrass/Bluestem/Western Wheatgrass (1.1)
Average Annual Production (lbs./acre, air-dry): 2,200
Stocking Rate* (AUM/acre): 0.60

Western Wheatgrass/Buffalograss/Grama (1.2)
Average Annual Production (lbs./acre, air-dry): 1,500
Stocking Rate* (AUM/acre): 0.41

Smooth Bromegrass/Kentucky Bluegrass (4.1)
Average Annual Production (lbs./acre, air-dry): 2,000
Stocking Rate* (AUM/acre): 0.55

Sedge/Grama/Buffalograss Sod (2.1)
Average Annual Production (lbs./acre, air-dry): 900
Stocking Rate* (AUM/acre): 0.25

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM) and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (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 typically dominated by soils in hydrologic group D. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An 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 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties 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

No appreciable wood products are typically present 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

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	12/07/2004
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Typically not observable, but sometimes present after heavy storms.

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3. **Number and height of erosional pedestals or terracettes:** Some slight pedestalling of bunch grasses.

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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 less than 10 percent and 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):** Little to no plant litter movement. Some accumulations (small litter dams) may be present after storm events.

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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):** Stability class usually 5-6. Typically high root content, organic matter, and granular structure. Soil surface is resistant to erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil

series description for depth and color of A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.

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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):** No compaction layer should be evident.

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

    Dominant: Mid and tall cool-season bunchgrasses = tall warm-season grasses = mid cool-season rhizomatous grass >

    Sub-dominant: Mid warm-season grasses >

    Other: Forbs > shrubs > short warm-season grasses = short grass-likes > short cool-season grasses > trees.

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

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,400–3,000 lbs./acre air-dry weight, average 2,200 lbs./acre air-dry weight.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Refer to State and Local Noxious Weed List, also Kentucky bluegrass, smooth bromegrass.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.
