

Ecological site R102AY021SD Clayey Overflow

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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.

MLRA notes

Major Land Resource Area (MLRA): 102A–Rolling Till Prairie

For further information on this Ecological Site Description (ESD), view on South Dakota Electronic Field Office Technical Guide (EFOTG), contact the NRCS State Office in Huron, SD, or MLRA Soil Survey Office in Redfield, SD.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 46e – Tewaukon Dead Ice Moraine, 46k – Prairie Coteau, 46l – Prairie Coteau Escarpment, 46m – Big Sioux Basin, 46o – Minnesota River Prairie, 47b – Des Moines Lobe, 48d – Lake Agassiz Plain, 51j – Alexandria Moraines and Detroit Lakes Outwash Plain.

Associated sites

R102AY001SD	Shallow Marsh
R102AY004SD	Wet Meadow
R102AY020SD	Loamy Overflow

Similar sites

R102AY011SD	Clayey (R102AY011SD) – Clayey [more big bluestem, less needlegrass; lower production]
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Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Nassella viridula</i>

Physiographic features

This site occurs in and adjacent to potholes.

Table 2. Representative physiographic features

Landforms	(1) Pothole
Flooding duration	Long (7 to 30 days)
Flooding frequency	Occasional
Elevation	305–610 m
Slope	0–1%
Water table depth	30–152 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 102A is considered to have a continental climate – cold winters and relatively hot summers, low to moderate 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 21 to 27 inches per year. The average annual temperature is about 43°F. January is the coldest month with average temperatures ranging from about 5°F (Mahnomen 1 W, Minnesota (MN)), to about 14°F (Tracy, MN). July is the warmest month with temperatures averaging from about 69°F (Mahnomen 1 W, MN), to about 73°F (Tracy, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 62°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 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)	152 days
Freeze-free period (average)	174 days
Precipitation total (average)	686 mm

Influencing water features

Soil features

The soils in this site are poorly drained and formed in clayey alluvium. The silty clay loam surface layer is typically about nine inches thick but can be deeper on some soils. These soils have a very slow infiltration rate. When dry these soils crack. When the soils are wet, surface compaction can occur with heavy traffic. This site often occurs as slightly elevated, relatively flat areas within potholes. This site typically should show 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 are no root restrictive layers in these soils; however, the high shrink-swell potential can cause damage and/or inhibit root growth.

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

Table 4. Representative soil features

Surface texture	(1) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Poorly drained
Permeability class	Very slow
Soil depth	203 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–2%
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.

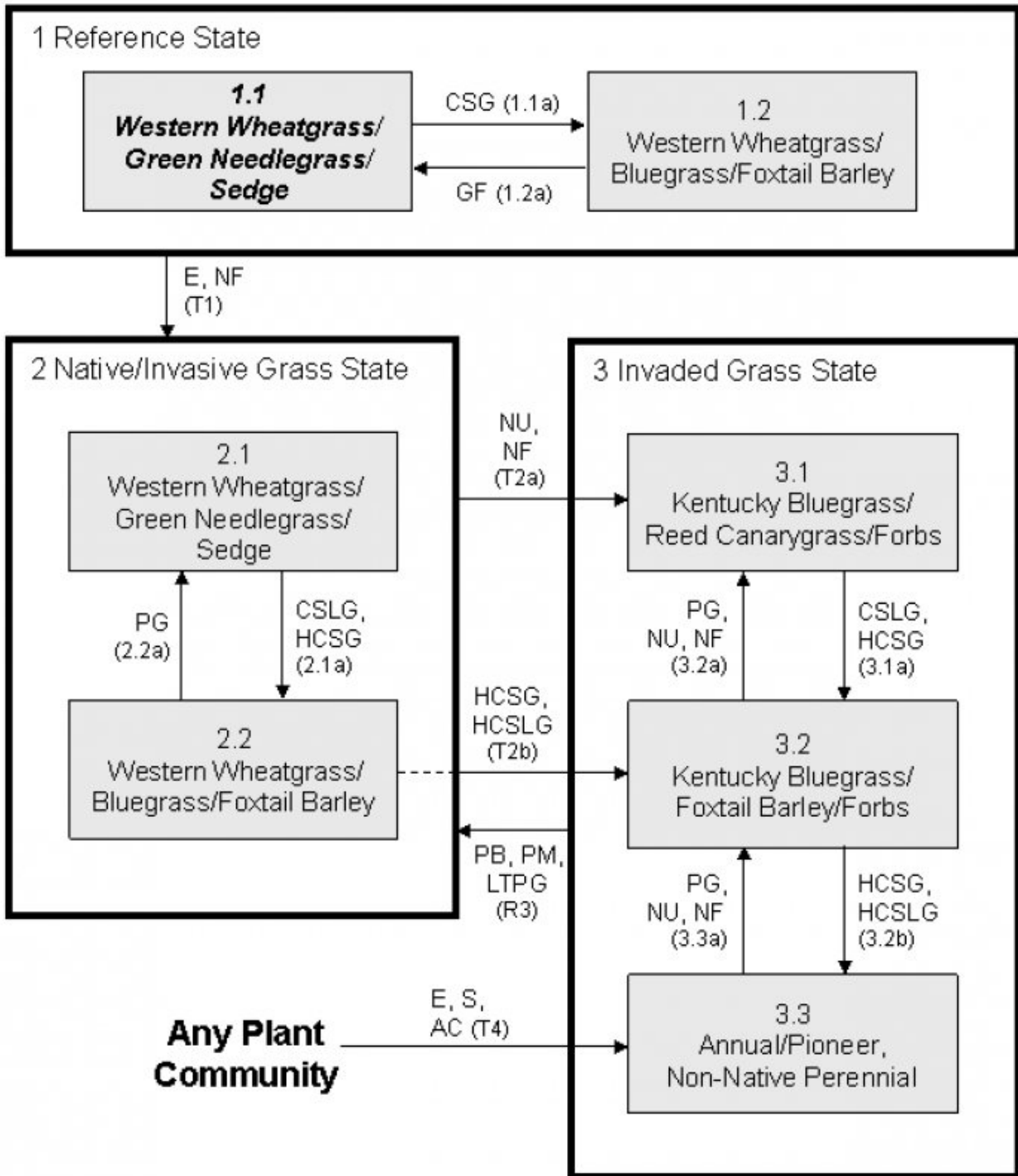
Fluctuations in the duration of ponding can temporarily shift this site to higher composition of grass-like species such as sedge, rush, and spikerush. Continuous season-long grazing (during the typical growing season of May through October) and/or heavy continuous seasonal grazing (i.e., grazing at the same time of year every year) without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass/Green Needlegrass/Sedge Plant Community. Western wheatgrass increases initially and will eventually decrease with continuous grazing. Grass and grass-like species such as green needlegrass and the more palatable sedges will decrease in frequency and production. With continued disturbance, this site is susceptible to invasion of

nonnative species such as Kentucky bluegrass. This species can become dominant and alter the ecological processes drastically.

Interpretations are primarily based on the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community. 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 plant community phase narratives for details on pathways: **AC** – Abandonment of cropping; **CSG** – Continuous seasonal grazing; **CSLG** – Continuous season-long grazing; **E** – Encroachment of non-native species; **GF** – Grazing and fire returned to normal disturbance regimes; **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; **PM** – Pest management (herbicide); **S** – Seeding.

State 1 Reference

This state represents the natural range of variability that dominated the dynamics of this ecological site (ES). This

state was dominated by cool-season grass and grass-like species. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included somewhat 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. A combination of disturbances such as fire followed by grazing during below average precipitation periods, or a severe single disturbance such as extended periods of below average precipitation, would have caused a decline in sedges and green needlegrass. This would have resulted in a simplification of the plant community with dominance by western wheatgrass.

Community 1.1

Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase

Interpretations are based primarily on the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase (this is also considered to be climax). The potential vegetation was about 85 percent grasses or grass-like plants and 15 percent forbs. The community was dominated by cool-season grasses. The major grass and grass-like species included western wheatgrass, green needlegrass, and clustered field sedge. Other grasses included switchgrass, plains bluegrass, prairie cordgrass, fowl bluegrass, and slender wheatgrass. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was 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	3604	4237	4758
Forb	207	471	846
Total	3811	4708	5604

Figure 5. Plant community growth curve (percent production by month). SD0207, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	13	20	25	18	11	5	3	0	0

Community 1.2

Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase

This plant community evolved under continuous seasonal grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 90 percent grasses and grass-like species and 10 percent forbs. The dominant grass was western wheatgrass. Grass and grass-like species of secondary importance included plains bluegrass, fowl bluegrass, foxtail barley, and sedge. Forbs commonly found in this plant community included cudweed sagewort, western yarrow, American licorice, goldenrod, and scurfpea. This plant community will have similar plant composition to the 2.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase (refer to the plant composition tables). The main difference is that nonnative species such as Kentucky bluegrass would not have been present in this plant community phase. When compared to the Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase (1.1), green needlegrass and sedge decreased significantly. Production and litter cover would have decreased as well and bare ground would have increased. The site would have been the most susceptible to erosion and gully formation during this phase. However, once conditions became more favorable, this plant community phase would have readily shifted back to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase.

Figure 6. Plant community growth curve (percent production by month). SD0206, Rolling Till Prairie, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	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 would have shifted this community to the 1.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase.

Pathway 1.2a

Community 1.2 to 1.1

Grazing and fire returned to normal disturbance regime levels and frequencies or periodic light to moderate grazing possibly including periodic rest would have converted this plant community to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase.

State 2

Native/Invaded Grass

This state is similar to the reference state in terms dominant plant composition and production. However, the invasion of introduced cool-season sod grasses alters the natural range of variability for this ES. This state is still dominated by mid- and tall native cool-season grasses, but invasive introduced cool-season sod grasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing and intensity of grazing events coupled with weather dictate the dynamics that occur within this state. The cool-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing. This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire followed by short-term intensive grazing. This state is dominated by cool-season grasses, with warm-season grasses being subdominant. It 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 2.1

Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase

This plant community phase is similar to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase, but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 85 percent grasses or grass-like plants and 15 percent forbs. The community is dominated by cool-season grasses. The major grass and grass-like species include western wheatgrass, green needlegrass, and clustered field sedge. Other grasses include switchgrass, plains bluegrass, prairie cordgrass, fowl bluegrass, and slender wheatgrass. 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. Refer to the 1.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase for details of the plant composition for this community phase.

Figure 7. Plant community growth curve (percent production by month). SD0207, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	13	20	25	18	11	5	3	0	0

Community 2.2

Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase

This phase is characterized by a shift to mid-cool-season rhizomatous grasses with lesser amounts of tall cool-season bunchgrasses and sedges. The vegetation is about 90 percent grasses and grass-like plants and 10 percent

forbs. The dominant grass is western wheatgrass. Grass and grass-like species of secondary importance include plains bluegrass, fowl bluegrass, foxtail barley, Kentucky bluegrass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, western yarrow, American licorice, goldenrod, and scurfpea. Energy capture by this plant community phase has shifted somewhat from late spring and summer to early spring through early summer. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2640	3421	4164
Forb	163	278	432
Total	2803	3699	4596

Figure 9. Plant community growth curve (percent production by month). SD0206, Rolling Till Prairie, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Pathway 2.1a Community 2.1 to 2.2

Continuous season-long grazing (grazing at light to moderate stocking levels for a majority of or the entire growing season), heavy continuous seasonal grazing (grazing at moderate to heavy stocking levels for extended portions of the growing season at the same time 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 2.2 Western Wheatgrass/Bluegrass/Foxtail Barley Plant Community Phase.

Pathway 2.2a Community 2.2 to 2.1

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 2.1 Western Wheatgrass/Green Needlegrass/Sedge Plant Community Phase.

Conservation practices

Prescribed Grazing

State 3 Invaded

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass 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. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short term reduction of Kentucky bluegrass. These events

may reduce the dominance of Kentucky bluegrass but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before Kentucky bluegrass rebounds and again dominates the system.

Community 3.1

Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase

This plant community phase is a result of extended periods of nonuse and no fire. It is characterized by a dominance of Kentucky bluegrass. At times, reed canarygrass can increase significantly and may potentially become codominant with Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates 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.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2791	3620	4136
Forb	347	639	1020
Total	3138	4259	5156

Figure 11. Plant community growth curve (percent production by month). SD0206, Rolling Till Prairie, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 3.2

Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase

This plant community phase is a result of continuous season-long grazing or heavy, continuous seasonal grazing. It is characterized by a dominance of Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. Infiltration is greatly reduced and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1777	2382	2914
Forb	241	420	673
Total	2018	2802	3587

Figure 13. Plant community growth curve (percent production by month). SD0206, Rolling Till Prairie, lowland cool-season dominant.. Cool-season dominant, lowland..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	6	15	20	26	17	9	4	3	0	0

Community 3.3

Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community evolved under heavy continuous season-long grazing, heavy continuous seasonal 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 and 20 to 50 percent forbs. The dominant species are highly variable in this phase, often consisting of invasive species such as Kentucky bluegrass and invasive forbs. This plant community is susceptible to invasion of Canada thistle and other nonnative species because of the relatively high percent of bare ground. This plant community phase may also be made up of seeded species such as legumes and intermediate wheatgrass. Refer to the corresponding Forage Suitability Group (FSG) for production and species adaptation. 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 invasive or early seral species.

Pathway 3.1a

Community 3.1 to 3.2

Continuous season-long grazing (grazing at light to moderate stocking levels for a majority of or the entire growing season), heavy continuous seasonal grazing (grazing at moderate to heavy stocking levels for extended portions of the growing season at the same time 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 3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase.

Pathway 3.2a

Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods), extended periods of nonuse and no fire or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the 3.1 Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase.

Conservation practices

Prescribed Grazing

Pathway 3.2b

Community 3.2 to 3.3

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase.

Pathway 3.3a

Community 3.3 to 3.2

Prescribed grazing (alternating season of use and providing adequate recovery periods), extended periods of nonuse and no fire, or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the 3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase.

Conservation practices

Prescribed Grazing

Transition T1

State 1 to 2

Encroachment of non-native grasses such as Kentucky bluegrass, and disruption of natural disturbance regimes such as periodic fire followed by short-term high intensity grazing would have led this plant community phase over a threshold to the Native/Invasive Grass State (State 2). This occurs as natural and/or management actions (altered grazing and/or fire regime) favored a decline in the composition of the native species and an increase in cool-season sod grasses. Chronic season-long or heavy continuous grazing facilitated this transition. Complete rest from grazing and no fire events could also have accelerated this transition.

Transition T4

State 1 to 3

Encroachment of highly competitive non-native species (e.g., Canada thistle, diffuse knapweed, leafy spurge, etc.), seeding with improved native or non-native forage species, or abandonment after cropping will shift any plant community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded Grass State (State 3).

Transition T5

State 1 to 3

Encroachment of highly competitive non-native species (e.g., Canada thistle, diffuse knapweed, leafy spurge, etc.), seeding with improved native or non-native forage species, or abandonment after cropping will shift any plant community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded Grass State (State 3).

Transition T5

State 2 to 3

Encroachment of highly competitive non-native species (e.g., Canada thistle, diffuse knapweed, leafy spurge, etc.), seeding with improved native or non-native forage species, or abandonment after cropping will shift any plant community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded Grass State (State 3).

Transition T5

State 2 to 3

Encroachment of highly competitive non-native species (e.g., Canada thistle, diffuse knapweed, leafy spurge, etc.), seeding with improved native or non-native forage species, or abandonment after cropping will shift any plant community to the 3.3 Annual/Pioneer, Non-Native Perennial Plant Community Phase within the Invaded Grass State (State 3).

Transition T2a

State 2 to 3

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 3.1 Kentucky Bluegrass/Reed Canarygrass/Forbs Plant Community Phase within the Invaded Grass State (State 3).

Transition T2b

State 2 to 3

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the 3.2 Kentucky Bluegrass/Foxtail Barley/Forbs Plant Community Phase in the Invaded Grass State (State 3).

Restoration pathway R3 State 3 to 2

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) coupled with prescribed burning and/or pest management (herbicide) may lead this plant community phase over a threshold to the Native/Invasive Grass State (State 2). 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 Burning
Prescribed Grazing
Integrated Pest Management (IPM)

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			706–2589	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	706–2589	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–942	–
2	Grass-likes			235–1412	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	47–942	–
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	47–706	–
	fox sedge	CAVU2	<i>Carex vulpinoidea</i>	0–706	–
	Sartwell's sedge	CASA8	<i>Carex sartwellii</i>	0–471	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–471	–
	rush	JUNCU	<i>Juncus</i>	0–471	–
	spikerush	ELEOC	<i>Eleocharis</i>	0–377	–
	woolly sedge	CAPE42	<i>Carex pellita</i>	0–188	–
3	Native Cool-season Grasses			706–1177	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	471–942	–
	plains bluegrass	POAR3	<i>Poa arida</i>	47–471	–
	fowl bluegrass	POPA2	<i>Poa palustris</i>	47–471	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–235	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0–141	–
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	0–141	–
4	Warm-season Grasses			0–235	
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–235	–
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	0–141	–
Forb					
5	Forbs			235–706	
	Forb, native	2FN	<i>Forb, native</i>	47–235	–

	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	47–141	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	47–94	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	47–94	–
	swamp smartweed	POHY2	<i>Polygonum hydropiperoides</i>	0–94	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	0–94	–
	cinquefoil	POTEN	<i>Potentilla</i>	47–94	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	47–94	–
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	47–94	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	47–94	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	47–94	–
	swamp milkweed	ASIN	<i>Asclepias incarnata</i>	0–94	–
	Flodman's thistle	CIFL	<i>Cirsium flodmanii</i>	47–94	–
	meadow zizia	ZIAP	<i>Zizia aptera</i>	0–94	–
	white panicle aster	SYLA6	<i>Symphotrichum lanceolatum</i>	0–94	–
	rough bugleweed	LYAS	<i>Lycopus asper</i>	0–94	–
	western dock	RUAQ	<i>Rumex aquaticus</i>	0–94	–
	goldenrod	SOLID	<i>Solidago</i>	47–94	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–47	–
	mint	MENTH	<i>Mentha</i>	0–47	–
	wild bergamot	MOFI	<i>Monarda fistulosa</i>	0–47	–
	American vetch	VIAM	<i>Vicia americana</i>	0–47	–
	northern bedstraw	GABO2	<i>Galium boreale</i>	0–47	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–47	–
	Carolina geranium	GECAC4	<i>Geranium carolinianum</i> var. <i>carolinianum</i>	0–47	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–47	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–47	–
	Macoun's buttercup	RAMA2	<i>Ranunculus macounii</i>	0–47	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–47	–
	Rydberg's sunflower	HENUR	<i>Helianthus nuttallii</i> ssp. <i>rydbergii</i>	0–47	–

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Wheatgrass			925–2404	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	925–2219	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–370	–
2	Grass-likes			74–555	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	0–370	–
	rush	JUNCU	<i>Juncus</i>	0–296	–
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	0–185	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–185	–
	spikerush	ELEOC	<i>Eleocharis</i>	0–111	–

	fox sedge	CAVU2	<i>Carex vulpinoidea</i>	0–74	–
3	Native Cool-season Grasses			370–1110	
	plains bluegrass	POAR3	<i>Poa arida</i>	74–555	–
	fowl bluegrass	POPA2	<i>Poa palustris</i>	74–555	–
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	74–444	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–296	–
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	0–111	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–111	–
4	Warm-season Grasses			0–111	
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	0–111	–
5	Non-Native Grasses			37–370	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	37–370	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–148	–
Forb					
6	Forbs			185–370	
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–148	–
	Forb, native	2FN	<i>Forb, native</i>	37–111	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	37–111	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	37–111	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	37–74	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–74	–
	cinquefoil	POTEN	<i>Potentilla</i>	37–74	–
	scurfpea	PSORA2	<i>Psoralegium</i>	37–74	–
	goldenrod	SOLID	<i>Solidago</i>	37–74	–
	white panicle aster	SYLA6	<i>Symphotrichum lanceolatum</i>	0–37	–
	Canadian anemone	ANCA8	<i>Anemone canadensis</i>	0–37	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	0–37	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0–37	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	0–37	–
	Flodman's thistle	CIFL	<i>Cirsium flodmanii</i>	0–37	–

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Wheatgrass			85–639	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	85–639	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–213	–
2	Grass-likes			85–639	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	43–426	–
	spikerush	ELEOC	<i>Eleocharis</i>	0–341	–
	rush	JUNCU	<i>Juncus</i>	0–213	–
	Grass-like (not a true	2GL	<i>Grass-like (not a true grass)</i>	0–128	–

	grass)				
	manyhead sedge	CASY	<i>Carex sychnocephala</i>	0–128	–
3	Native Cool-season Grasses			213–1491	
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	85–1278	–
	plains bluegrass	POAR3	<i>Poa arida</i>	0–128	–
	fowl bluegrass	POPA2	<i>Poa palustris</i>	0–128	–
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	0–128	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–128	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–85	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0–43	–
4	Non-Native Grasses			639–1917	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	639–1917	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–213	–
Forb					
5	Forbs			426–852	
	Forb, introduced	2FI	<i>Forb, introduced</i>	43–298	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	43–170	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	43–170	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	43–170	–
	goldenrod	SOLID	<i>Solidago</i>	43–128	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	0–128	–
	Flodman's thistle	CIFL	<i>Cirsium flodmanii</i>	43–128	–
	Forb, native	2FN	<i>Forb, native</i>	43–128	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	43–128	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–128	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	43–128	–
	Carolina geranium	GECAC4	<i>Geranium carolinianum var. carolinianum</i>	0–85	–
	cinquefoil	POTEN	<i>Potentilla</i>	43–85	–
	mint	MENTH	<i>Mentha</i>	0–85	–
	white panicle aster	SYLA6	<i>Symphotrichum lanceolatum</i>	0–85	–
	meadow zizia	ZIAP	<i>Zizia aptera</i>	0–43	–
	wild bergamot	MOFI	<i>Monarda fistulosa</i>	0–43	–
	swamp smartweed	POHY2	<i>Polygonum hydropiperoides</i>	0–43	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0–43	–
	rough bugleweed	LYAS	<i>Lycopus asper</i>	0–43	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–43	–
	swamp milkweed	ASIN	<i>Asclepias incarnata</i>	0–43	–

Table 12. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Wheatgrass			0–140	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–140	–
2	Grass-likes			0–280	
	clustered field sedge	CAPR5	<i>Carex praegracilis</i>	0–196	–
	rush	JUNCU	<i>Juncus</i>	0–196	–
	spikerush	ELEOC	<i>Eleocharis</i>	0–140	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–84	–
3	Native Cool-season Grasses			280–701	
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	280–701	–
	reed canarygrass	PHAR3	<i>Phalaris arundinacea</i>	0–140	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–84	–
4	Non-Native Grasses			701–1961	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	701–1961	–
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–140	–
Forb					
5	Forbs			280–560	
	Forb, introduced	2FI	<i>Forb, introduced</i>	56–280	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	28–224	–
	goldenrod	SOLID	<i>Solidago</i>	28–224	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	28–196	–
	Forb, native	2FN	<i>Forb, native</i>	0–140	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	28–140	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	28–112	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–84	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–56	–
	swamp smartweed	POHY2	<i>Polygonum hydropiperoides</i>	0–28	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pennsylvanicum</i>	0–28	–
	cinquefoil	POTEN	<i>Potentilla</i>	0–28	–
	Indianhemp	APCA	<i>Apocynum cannabinum</i>	0–28	–

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 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.

Western Wheatgrass/Green Needlegrass/Sedge (1.1 & 2.1)

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

4200

Stocking Rate* (AUM/acre): 1.15

Western Wheatgrass/Bluegrass/Foxtail Barley (2.2)

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

3300

Stocking Rate* (AUM/acre): 0.90

Kentucky Bluegrass/Reed Canarygrass/Forbs (3.1)

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

3800

Stocking Rate* (AUM/acre): 1.04

Kentucky Bluegrass/Foxtail Barley/Forbs (3.2)

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

2500

Stocking Rate* (AUM/acre): 0.69

Annual/Pioneer, Non-Native Perennial (3.3)

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

1200

Stocking Rate* (AUM/acre): 0.33

*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 dominated by soils in hydrologic groups C and D. Infiltration is typically very slow and runoff potential for this site is normally negligible due to the concave feature of the landform.

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

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

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range

Management Specialist, NRCS.

Other references

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

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

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

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.

Author(s)/participant(s)	David Schmidt, Tim Nordquist, Stan Boltz
Contact for lead author	
Date	12/04/2007
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.
-

2. **Presence of water flow patterns:** Barely observable.
-

3. **Number and height of erosional pedestals or terracettes:** Essentially, non-existent.
-

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 5% and 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):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 6. Typically high root content, organic matter, and granular structure. Soil surface is very resistant to erosion.
-
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.
-
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.
-
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.
-
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant: Tall warm-season rhizomatous grass >> tall cool-season bunch grass
- Sub-dominant: > mid cool-season rhizomatous grass > mid warm-season bunch grass > short cool-season grass = forb > shrub > tree
- Other:
- Additional:
-
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.
-
14. **Average percent litter cover (%) and depth (in):** 85-90%, roughly 0.5 inch thick or less. Litter cover is in contact with soil surface.
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 4000 – 5200 lbs./acre air-dry weight, average 4,600 lbs./acre air-dry weight
-

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

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