USDA Natural Resources Conservation Service

Ecological site R102AY006SD
Limy Subirrigated

Accessed: 05/06/2024

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.

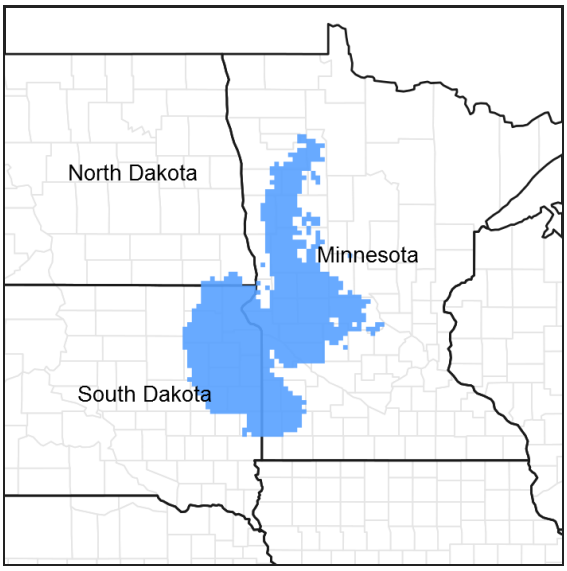


Figure 1. Mapped extent

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.

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

R102AY003SD	**Subirrigated**
R102AY004SD	**Wet Meadow**
R102AY020SD	**Loamy Overflow**

Similar sites

R102AY003SD	**Subirrigated** (R102AY003SD) – Subirrigated [more big bluestem, less little bluestem; higher production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Sorghastrum nutans* (2) *Andropogon gerardii*

Physiographic features

This site occurs on nearly level flood plains or swales.

Table 2. Representative physiographic features

Landforms	(1) Swale (2) Flood plain (3) Pothole
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional
Elevation	305–610 m
Slope	1–2%
Water table depth	76–203 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

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

Soil features

The soils in this site are somewhat poorly drained and formed in alluvium, loamy till, or silty drift. The loam to silty clay loam surface layer is 7 to 13 inches thick and typically has a granular structure. Dark colors are deep in these soils. The soils have a moderately slow infiltration rate. This site 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. These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production.

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) Loam (2) Silty clay loam (3) Silt loam
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	12.7–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	10–45%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–40%
Subsurface fragment volume >3" (Depth not specified)	0–2%

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 that may not be described within this document.

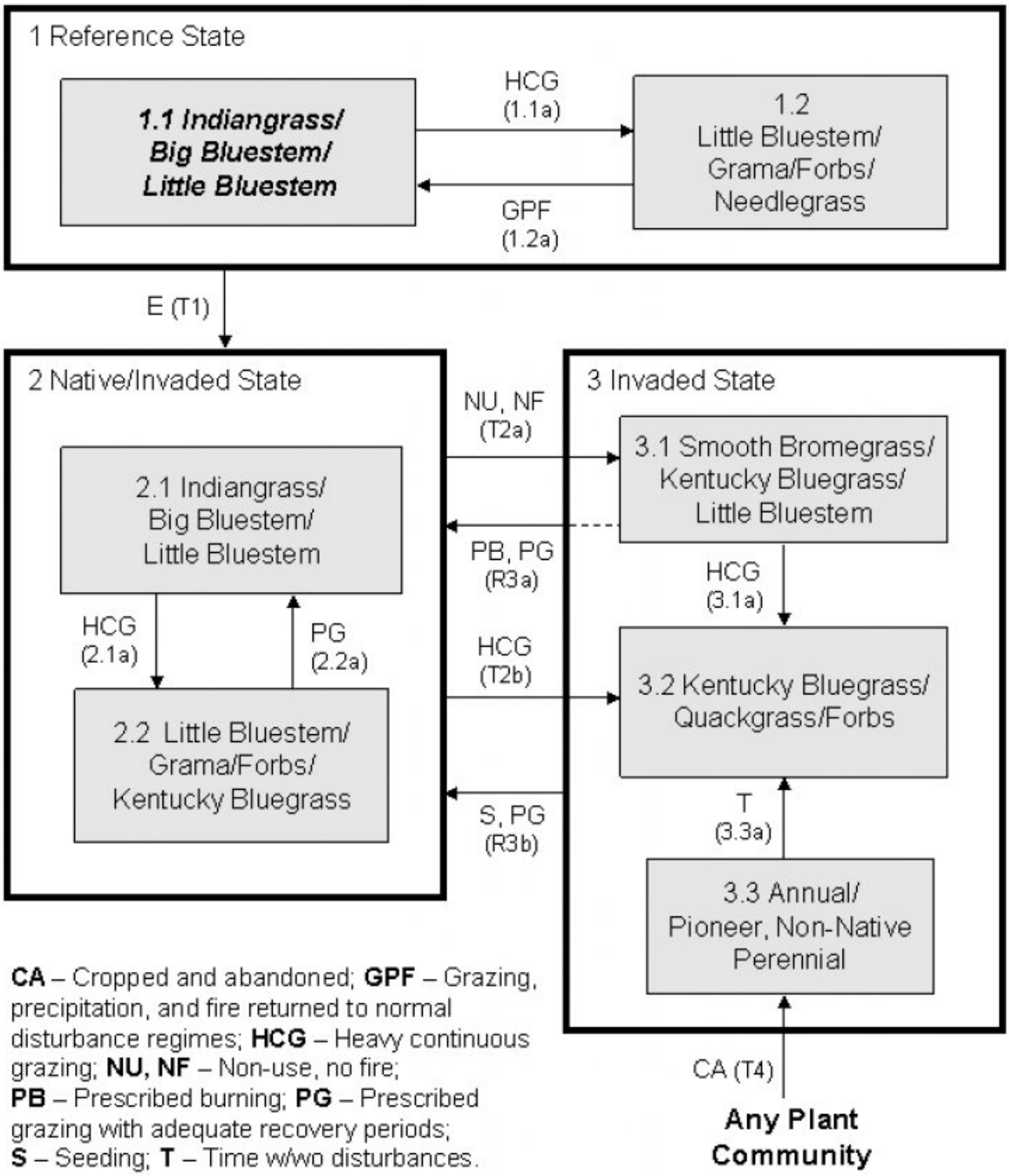
Heavy continuous grazing without adequate recovery periods following each grazing occurrence over several years

causes this site to depart from the interpretive plant community. Species such as little bluestem, sideoats grama, and blue grama will initially increase. Big bluestem, Indiangrass, and switchgrass will decrease in frequency and production. Heavy continuous grazing causes Kentucky bluegrass to increase and eventually develop into a sod condition. Extended periods of nonuse and no fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and smooth bromegrass. In time, shrubs such as western snowberry will also increase.

Interpretations are primarily based on the 1.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

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

State and transition model



State 1
Reference

This state represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by warm-season grasses. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined and shorter warm-season grasses would have increased. Today, a similar state (State 2) can be found on areas that are properly managed with grazing

and/or prescribed burning and sometimes on areas receiving occasional short periods of rest.

Community 1.1
Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase

Interpretations are based primarily on the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included Indiangrass, big bluestem, and little bluestem. Other grass or grass-like species included sideoats grama, porcupine grass, green needlegrass, slender wheatgrass, and sedge. 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	3447	4096	4601
Forb	207	471	846
Shrub/Vine	45	141	269
Total	**3699**	**4708**	**5716**

Figure 5. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	5	15	25	30	15	7	1	0	0

Community 1.2
Little Bluestem/Grama/Forbs/Needlegrass Plant Community Phase

This plant community evolved under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses included little bluestem, sideoats grama, and green needlegrass. Grasses of secondary importance included Indiangrass, big bluestem, blue grama, porcupine grass, and slender wheatgrass. Forbs commonly found in this plant community included Canada goldenrod, cudweed sagewort, heath aster, scurfpea, stiff goldenrod, and western yarrow. This plant community had similar plant composition to the 2.2 Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase (refer to the plant composition tables). The main difference is that this plant community phase did not have the presence of nonnative invasive species such as Kentucky bluegrass and smooth bromegrass. When compared to the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (1.1), sideoats grama and little bluestem increased. Production of tall warm-season grasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. Most of the components of the ecological processes would have been functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

Figure 6. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

Pathway 1.1a
Community 1.1 to 1.2

Heavy continuous grazing which included herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or a combination of disturbances such as extended periods of below average precipitation coupled with periodic or chronic heavy grazing would have shifted this community to the 1.2 Little Bluestem/Grama/Forbs/Needlegrass Plant Community Phase.

Pathway 1.2a
Community 1.2 to 1.1

Grazing, precipitation, and/or 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 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase.

State 2
Native/Invaded

This state represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire due to fire suppression. This state is dominated by warm-season grasses. 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. Taller warm-season species can decline and a corresponding increase in short statured grass will occur.

Community 2.1
Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase

This plant community phase is similar to the 1.1 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase but it also contains minor amounts of nonnative invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 10 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community is dominated by warm-season grasses. The major grasses include Indiangrass, big bluestem, and little bluestem. Other grass or grass-like species include sideoats grama, porcupine grass, green needlegrass, slender wheatgrass, and sedge. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Figure 7. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	5	15	25	30	15	7	1	0	0

Community 2.2
Little Bluestem/Grama/Forbs/Kentucky Bluegrass Plant Community Phase

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses include little bluestem, sideoats grama, and green needlegrass. Grasses of secondary importance included Indiangrass, big bluestem, blue grama, porcupine grass, and slender wheatgrass. Forbs commonly found in this plant community included Canada goldenrod, cudweed sagewort, heath aster, scurfpea, stiff goldenrod, and western yarrow. When compared to the Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase (1.1), sideoats grama and little bluestem increased. Production of tall warm-season grasses was 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. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive

capability of the tall warm-season grasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of nonnative invasive species such as Kentucky bluegrass and smooth bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers and the structure will begin to be modified. These changes favor the shallow-rooted species and hasten their eventual dominance if steps are not taken to reduce these species. Transitions or pathways leading to other plant communities are as follows: • T2b – Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) will cause a shift across a threshold leading to the 3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase within the Invaded State (State 3). • 2.2a – 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 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3032	3410	3626
Forb	179	504	970
Shrub/Vine	39	121	224
Total	**3250**	**4035**	**4820**

Figure 9. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous 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 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 Little Bluestem/Grama/Forbs/Kentucky Bluegrass 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 Indiangrass/Big Bluestem/Little Bluestem Plant Community Phase.

Conservation practices

Prescribed Grazing

State 3
Invaded

This state is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. 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. The opportunity for high intensity spring burns is severely reduced by early greenup and increased moisture and humidity at the soil surface and grazing pressure cannot

cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases and energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominant species.

Community 3.1
Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase

This plant community phase is a result of extended periods of nonuse and no fire or occasionally light levels of grazing over several years. It is characterized by 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 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. The dominance of these introduced species has been shown to alter the biotic component of the soil, as well as organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass and tend to make establishment of native species extremely difficult.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3239	3901	4321
Forb	196	448	807
Shrub/Vine	39	135	252
Total	**3474**	**4484**	**5380**

Figure 11. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

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 3.2
Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass and quackgrass. 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	1564	2219	2802
Forb	230	404	639
Shrub/Vine	–	67	146
Total	**1794**	**2690**	**3587**

Figure 13. Plant community growth curve (percent production by month).

SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

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 3.3
Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community developed under continuous heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include nonnative invasive and/or early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites. Transitions or pathways leading to other states are as follows: • 3.3a – This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase.

Pathway 3.1a
Community 3.1 to 3.2

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) will convert this plant community to the 3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase.

Pathway 3.2a
Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the 3.1 Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase.

Conservation practices

Prescribed Grazing

Pathway 3.3a
Community 3.3 to 3.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase.

Transition T1
State 1 to 2

Encroachment of non-native grasses such as Kentucky bluegrass and smooth bromegrass, and disruption of natural disturbance regimes (typically as a result of fire suppression following settlement led this state over a threshold to the Native/Invaded State (State 2).

Transition T4

State 1 to 3

Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 3) and more specifically to the 3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T4
State 1 to 3

Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 3) and more specifically to the 3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T4
State 2 to 3

Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 3) and more specifically to the 3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T4
State 2 to 3

Encroachment of non-native invasive/noxious species, abandonment of cropping, or seeding of introduced and/or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 3) and more specifically to the 3.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T2b
State 2 to 3

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) will cause a shift across a threshold leading to the 3.2 Kentucky Bluegrass/Quackgrass/Forbs Plant Community Phase within the Invaded 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 Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem Plant Community Phase within the Invaded State (State 3).

Restoration pathway R3a
State 3 to 2

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 may lead this plant community phase over a threshold to the Native/Invaded State (State 2). Pest management (i.e., herbicide) may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Conservation practices

Prescribed Burning
Prescribed Grazing

Restoration pathway R3b
State 3 to 2

Seeding followed by prescribed grazing may lead this plant community phase over a threshold to the Native/Invaded State (State 2).

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	**Tall Warm-season Grasses**			942–2118	
	Indiangrass	SONU2	*Sorghastrum nutans*	471–1883	–
	big bluestem	ANGE	*Andropogon gerardii*	235–1648	–
	switchgrass	PAVI2	*Panicum virgatum*	0–235	–
2	**Mid Warm-season Grasses**			706–1412	
	little bluestem	SCSC	*Schizachyrium scoparium*	471–1412	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	94–706	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–235	–
3	**Cool-season Grasses**			235–1177	
	porcupinegrass	HESP11	*Hesperostipa spartea*	94–942	–
	green needlegrass	NAVI4	*Nassella viridula*	47–471	–
	Canada wildrye	ELCA4	*Elymus canadensis*	47–235	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	47–235	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–141	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	0–141	–
4	**Other Native Grasses**			47–235	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	47–188	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–188	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–47	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–47	–
5	**Grass-likes**			47–235	
	sedge	CAREX	*Carex*	47–235	–
	spikerush	ELEOC	*Eleocharis*	0–141	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
Forb					

Forb					
6	**Forbs**			235–706	
	Forb, native	2FN	*Forb, native*	47–188	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	47–141	–
	goldenrod	SOLID	*Solidago*	47–141	–
	white heath aster	SYER	*Symphyotrichum ericoides*	47–94	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–94	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	47–94	–
	Norwegian cinquefoil	PONO3	*Potentilla norvegica*	47–94	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–94	–
	Indianhemp	APCA	*Apocynum cannabinum*	47–94	–
	meadow zizia	ZIAP	*Zizia aptera*	47–94	–
	tall blazing star	LIAS	*Liatris aspera*	47–94	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	47–94	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	47–94	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	47–94	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–94	–
	purple prairie clover	DAPU5	*Dalea purpurea*	47–94	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–47	–
	Virginia strawberry	FRVI	*Fragaria virginiana*	0–47	–
	closed bottle gentian	GEAN	*Gentiana andrewsii*	0–47	–
	downy gentian	GEPU5	*Gentiana puberulenta*	0–47	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–47	–
	Canadian anemone	ANCA8	*Anemone canadensis*	0–47	–
	common goldstar	HYHI2	*Hypoxis hirsuta*	0–47	–
	palespike lobelia	LOSP	*Lobelia spicata*	0–47	–
	rough bugleweed	LYAS	*Lycopus asper*	0–47	–
	bluebell bellflower	CARO2	*Campanula rotundifolia*	0–47	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–47	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–47	–
	prairie violet	VIPE2	*Viola pedatifida*	0–47	–
Shrub/Vine					
7	**Shrubs**			47–235	
	leadplant	AMCA6	*Amorpha canescens*	47–188	–
	rose	ROSA5	*Rosa*	0–94	–
	willow	SALIX	*Salix*	0–94	–
	snowberry	SYMPH	*Symphoricarpos*	0–94	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–94	–

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			81–605	

	big bluestem	ANGE	*Andropogon gerardii*	0–404	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–404	–
	switchgrass	PAVI2	*Panicum virgatum*	0–121	–
2	**Mid Warm-season Grasses**			605–1614	
	little bluestem	SCSC	*Schizachyrium scoparium*	404–1412	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	202–726	–
3	**Cool-season Grasses**			40–404	
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–202	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–161	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–121	–
	green needlegrass	NAVI4	*Nassella viridula*	0–121	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–81	–
4	**Other Native Grasses**			81–404	
	blue grama	BOGR2	*Bouteloua gracilis*	40–282	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	40–161	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–81	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–40	–
5	**Grass-likes**			40–202	
	sedge	CAREX	*Carex*	40–202	–
	spikerush	ELEOC	*Eleocharis*	0–161	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–81	–
6	**Non-Native Grasses**			202–605	
	Kentucky bluegrass	POPR	*Poa pratensis*	202–605	–
	smooth brome	BRIN2	*Bromus inermis*	0–282	–
	quackgrass	ELRE4	*Elymus repens*	0–202	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–202	–
Forb					
7	**Forbs**			202–807	
	goldenrod	SOLID	*Solidago*	40–242	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	40–202	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	40–161	–
	Indianhemp	APCA	*Apocynum cannabinum*	40–121	–
	Forb, introduced	2FI	*Forb, introduced*	40–121	–
	Forb, native	2FN	*Forb, native*	0–121	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	40–121	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	40–121	–
	white heath aster	SYER	*Symphyotrichum ericoides*	40–121	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–121	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–121	–
	tall blazing star	LIAS	*Liatris aspera*	0–81	–
	rough bugleweed	LYAS	*Lycopus asper*	0–40	–

	Norwegian cinquefoil	PONO3	*Potentilla norvegica*	0–40	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–40	–
	meadow zizia	ZIAP	*Zizia aptera*	0–40	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–40	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–40	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–40	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–40	–
Shrub/Vine					
8	**Shrubs**			40–202	
	snowberry	SYMPH	*Symphoricarpos*	40–161	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–81	–
	leadplant	AMCA6	*Amorpha canescens*	0–81	–
	rose	ROSA5	*Rosa*	0–81	–
	willow	SALIX	*Salix*	0–40	–

Table 11. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			0–224	
	big bluestem	ANGE	*Andropogon gerardii*	0–135	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–135	–
	switchgrass	PAVI2	*Panicum virgatum*	0–90	–
2	**Mid Warm-season Grasses**			0–897	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–897	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–269	–
3	**Cool-season Grasses**			0–448	
	green needlegrass	NAVI4	*Nassella viridula*	0–359	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–224	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–135	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–45	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–45	–
4	**Other Native Grasses**			0–224	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–179	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–135	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–45	–
5	**Grass-likes**			45–224	
	sedge	CAREX	*Carex*	45–224	–
	spikerush	ELEOC	*Eleocharis*	0–179	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–90	–
6	**Non-Native Grasses**			1121–2690	
	smooth brome	BRIN2	*Bromus inermis*	673–2466	–

	Kentucky bluegrass	POPR	*Poa pratensis*	448–1569	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–673	–
	quackgrass	ELRE4	*Elymus repens*	0–135	–
Forb					
7	**Forbs**			224–673	
	white sagebrush	ARLU	*Artemisia ludoviciana*	45–224	–
	goldenrod	SOLID	*Solidago*	45–224	–
	Forb, introduced	2FI	*Forb, introduced*	45–179	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–179	–
	Forb, native	2FN	*Forb, native*	0–135	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	45–135	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	45–135	–
	white heath aster	SYER	*Symphyotrichum ericoides*	45–135	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–90	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–90	–
	tall blazing star	LIAS	*Liatris aspera*	0–45	–
	rough bugleweed	LYAS	*Lycopus asper*	0–45	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–45	–
	Norwegian cinquefoil	PONO3	*Potentilla norvegica*	0–45	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–45	–
Shrub/Vine					
8	**Shrubs**			45–224	
	snowberry	SYMPH	*Symphoricarpos*	45–224	–
	rose	ROSA5	*Rosa*	0–90	–
	willow	SALIX	*Salix*	0–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–90	–
	leadplant	AMCA6	*Amorpha canescens*	0–45	–

Table 12. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-season Grasses**			0–54	
	big bluestem	ANGE	*Andropogon gerardii*	0–54	–
	switchgrass	PAVI2	*Panicum virgatum*	0–27	–
2	**Mid Warm-season Grasses**			0–135	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–135	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–81	–
3	**Cool-season Grasses**			0–81	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–81	–
	green needlegrass	NAVI4	*Nassella viridula*	0–54	–
4	**Other Native Grasses**			0–188	
	blue grama	BOGR2	*Bouteloua gracilis*	0–161	–
	Graminoid (grass or	2GRAM	*Graminoid (grass or grass-like)*	0–81	

	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–81	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–27	–
5	**Grass-likes**			27–215	
	sedge	CAREX	*Carex*	27–188	–
	spikerush	ELEOC	*Eleocharis*	0–135	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–54	–
6	**Non-Native Grasses**			807–1883	
	Kentucky bluegrass	POPR	*Poa pratensis*	538–1614	–
	quackgrass	ELRE4	*Elymus repens*	27–269	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–135	–
	smooth brome	BRIN2	*Bromus inermis*	0–135	–
Forb					
7	**Forbs**			269–538	
	goldenrod	SOLID	*Solidago*	27–215	–
	Forb, introduced	2FI	*Forb, introduced*	27–188	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	27–188	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	27–135	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	27–108	–
	New England aster	SYNO2	*Symphyotrichum novae-angliae*	0–108	–
	white heath aster	SYER	*Symphyotrichum ericoides*	27–81	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–81	–
	Forb, native	2FN	*Forb, native*	0–54	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–54	–
	Norwegian cinquefoil	PONO3	*Potentilla norvegica*	0–27	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	0–27	–
Shrub/Vine					
8	**Shrubs**			0–135	
	snowberry	SYMPH	*Symphoricarpos*	0–135	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–54	–
	rose	ROSA5	*Rosa*	0–27	–

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.

Indiangrass/Big Bluestem/Little Bluestem (1.1 & 2.1)
Average Annual Production (lbs./acre, air-dry):
4200

Stocking Rate* (AUM/acre): 1.15

Little Bluestem/Grama/Forbs/Kentucky Bluegrass (2.2)
Average Annual Production (lbs./acre, air-dry):
3600
Stocking Rate* (AUM/acre): 0.99

Smooth Bromegrass/Kentucky Bluegrass/Little Bluestem (3.1)
Average Annual Production (lbs./acre, air-dry):
4000
Stocking Rate* (AUM/acre): 1.10

Kentucky Bluegrass/Quackgrass/Forbs (3.2)
Average Annual Production (lbs./acre, air-dry):
2400
Stocking Rate* (AUM/acre): 0.66

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 B and C. Infiltration is typically moderately slow and runoff potential for this site varies from negligible to low 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 higher infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by Kentucky 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

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; and Bruce Kunze, Soil Scientist, NRCS.

Other references

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Contributors

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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.

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

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

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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 5% 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. Plant litter remains in place and is not moved by erosional forces.

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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 6. Typically high root content, organic matter, and granular structure. Soil surface is very 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 warm-season bunch grass >> tall warm-season rhizomatous grass

    Sub-dominant: > tall cool-season bunch grass > mid cool-season rhizomatous grass > short cool-season grass = forb

    Other:

    Additional:

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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):** 85-90%, roughly 0.5 inch thick or less. Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3800 – 5000 lbs./acre air-dry weight, average 4,400 lbs./acre air-dry weight

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

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