USDA Natural Resources Conservation Service

Ecological site R102AY013SD
Claypan

Accessed: 04/30/2024

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

R102AY010SD	**Loamy**
R102AY011SD	**Clayey**

Similar sites

R102AY011SD	**Clayey** (R102AY011SD) – Clayey [more green needlegrass; less blue grama; higher production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Nassella viridula* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on nearly level to gently sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Plain (2) Till plain (3) Swale
Elevation	305–610 m
Slope	1–3%
Water table depth	102–203 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)	136 days
Freeze-free period (average)	159 days
Precipitation total (average)	610 mm

Influencing water features

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

Soil features

The common features of soils in this site are loam to clay textured subsoils and slopes of one to three percent. The soils in this site are moderately well-drained and formed in clayey till. The loam to clay loam surface layer is six to eight inches thick. The extremely hard clayey Btn horizon has round-topped or “bun shaped” columnar structure. These Btn horizons are high in sodium. This site should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetation is diminished. Low available water capacity and very slow permeability strongly influences the soil-water-plant relationship.
Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam (3) Silt loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained
Permeability class	Very slow to slow
Soil depth	203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.7–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	2–16 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	3–21
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–5%
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.

Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following grazing events causes departure from the 3.1 Wheatgrass/Needlegrass/Bluestem Plant Community Phase. Blue grama will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease.

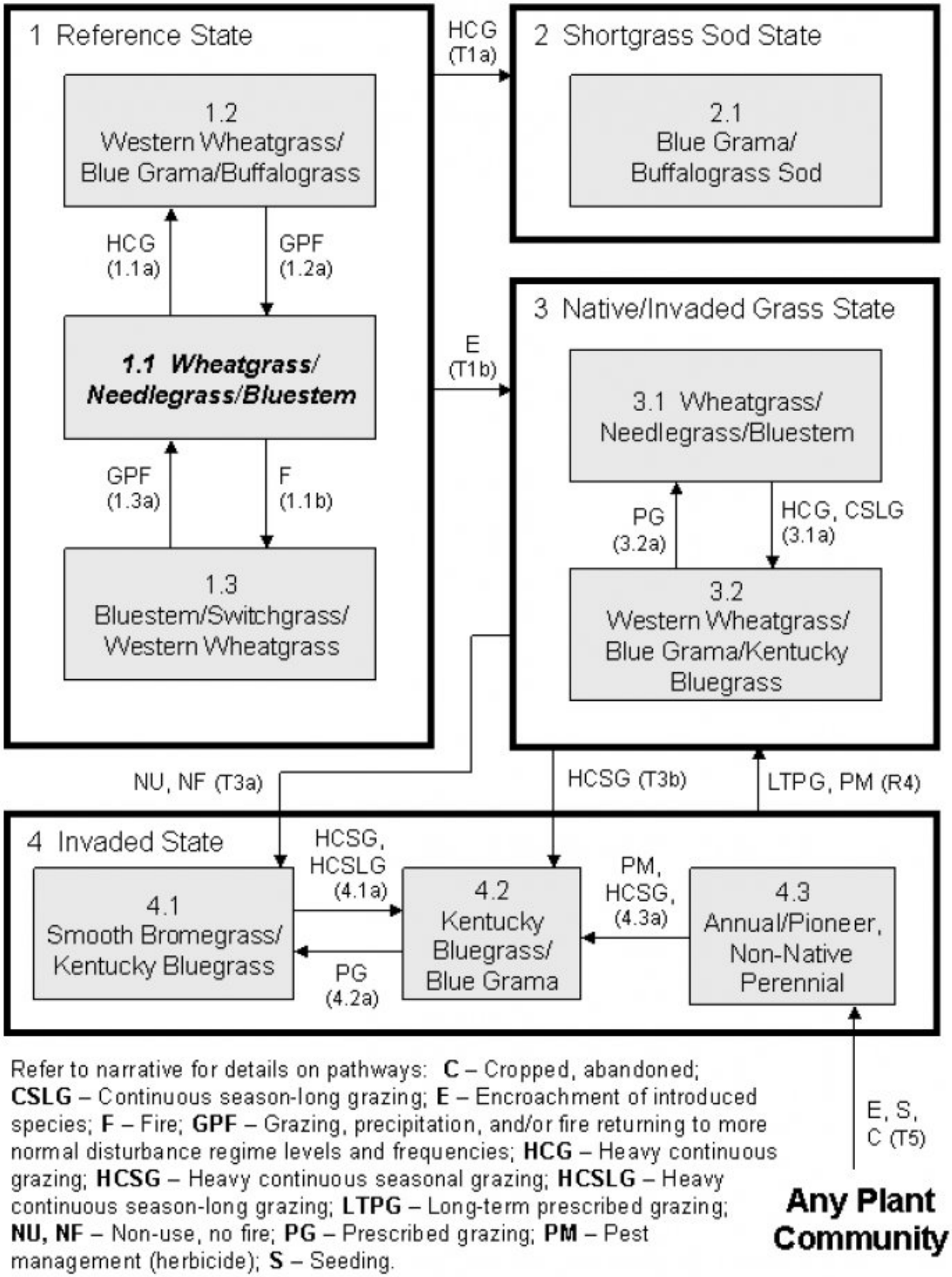
Green needlegrass, needleandthread, porcupine grass, sideoats grama, big bluestem, and little bluestem will decrease in frequency and production. Extended periods of nonuse and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass, smooth bromegrass, green needlegrass, and cheatgrass.

Interpretations are primarily based on the 1.1 Wheatgrass/Needlegrass/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 cool-season grasses, with warm-season grasses being subdominant. In pre-European

times, the primary disturbance mechanisms for this site in the reference condition included 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. Cool-season and taller warm-season grasses would have declined and a corresponding increase in short, warm-season grasses would have occurred. Today, a similar state (State 3) 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
Wheatgrass/Needlegrass/Bluestem Plant Community Phase

Interpretations are based primarily on the Wheatgrass/Needlegrass/Bluestem Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community was dominated by cool-season grasses. The major grasses included western wheatgrass, green needlegrass, porcupine grass, and big bluestem. Other grass or grass-like species included needleandthread, blue grama, switchgrass, little bluestem, sideoats grama, slender wheatgrass, and needleleaf 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	1945	2521	3038
Shrub/Vine	56	175	331
Forb	129	219	331
Total	**2130**	**2915**	**3700**

Figure 7. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 1.2
Western Wheatgrass/Blue Grama/Buffalograss 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 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included western wheatgrass, blue grama, buffalograss, green needlegrass, sideoats grama, and needleandthread. Grasses of secondary importance included little bluestem, porcupine grass, big bluestem, and sedge. Forbs commonly found in this plant community included cudweed sagewort, prairie coneflower, and western yarrow. This plant community had similar plant composition to the 3.2 Western Wheatgrass/Blue Grama/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 Wheatgrass/Needlegrass/Bluestem Plant Community Phase (1.1), blue grama and buffalograss increased. Green needlegrass and porcupine grass decreased and production of mid and tall warm-season grasses was also 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.

Figure 8. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 1.3
Bluestem/Switchgrass/Western Wheatgrass Plant Community Phase

This plant community was a result of fire occurring at relatively frequent intervals. This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. 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 little bluestem, big bluestem, switchgrass, Indiangrass, sideoats grama, and western wheatgrass. Other grass or grass-like species included green needlegrass, porcupine grass, needleandthread, blue grama, slender wheatgrass, tall dropseed, and sedges. This plant community was not resistant to change and would have readily shifted back to the 1.1 Wheatgrass/Needlegrass/Bluestem Plant Community Phase with a return of more normal fire return intervals.

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 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 will shift this community to the 1.2 Western Wheatgrass/Blue Grama/Buffalograss Plant Community Phase.

Pathway 1.1b
Community 1.1 to 1.3

Fire occurring at relatively frequent intervals and occasional grazing events immediately following early season fire caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would increase in vigor and production leading to a temporary shift to the 1.3 Bluestem/Switchgrass/Western Wheatgrass 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 will convert this plant community to the 1.1 Wheatgrass/Needlegrass/Bluestem Plant Community Phase.

Pathway 1.3a
Community 1.3 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 will convert this plant community to the 1.1 Wheatgrass/Needlegrass/Bluestem Plant Community Phase.

State 2
Shortgrass Sod

Community 2.1
Blue Grama/Buffalograss Sod Plant Community

This plant community evolved under heavy continuous season grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses typically included blue grama and buffalograss. Grasses of secondary importance included sedge and western wheatgrass. Forbs commonly found in this plant community included cudweed sagewort, scurfpea, and western yarrow. When compared to the Wheatgrass/Needlegrass/Bluestem Plant Community Phase (1.1), blue grama and buffalograss were dominant on this plant community. Cool-season grasses decreased significantly. This vegetation state was very resistant to change. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases. The thick sod prevented other species from getting established.

Figure 10. 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

State 3
Native/Invaded Grass

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 cool-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 cool-season species can decline and a corresponding increase in short statured grass will occur.

Community 3.1
Wheatgrass/Needlegrass/Bluestem Plant Community Phase

This plant community phase is similar to the 1.1 Wheatgrass/Needlegrass/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 15 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community is dominated by cool-season grasses, with warm-season grasses being subdominant. The major grasses include western wheatgrass, green needlegrass, porcupine grass, and big bluestem. Other grass or grass-like species include needleandthread, blue grama, switchgrass, little bluestem, sideoats grama, slender wheatgrass, and needleleaf sedge. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Figure 11. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 3.2
Western Wheatgrass/Blue Grama/Kentucky Bluegrass Plant Community Phase

This plant community is a result of heavy continuous grazing, continuous season-long grazing, or from over utilization during extended drought periods. The potential plant community is made up of approximately 80 percent

grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and Kentucky bluegrass. Grasses of secondary importance include sideoats grama, little bluestem, green needlegrass, needleandthread, porcupine grass, big bluestem, buffalograss, smooth bromegrass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. When compared to the Wheatgrass/Needlegrass/Bluestem Plant Community Phase (1.1), blue grama has increased. Green needlegrass and sideoats grama have decreased and production of mid- and tall warm-season grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1239	1705	2152
Forb	90	143	213
Shrub/Vine	17	57	101
Total	**1346**	**1905**	**2466**

Figure 13. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

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 often at the same time of year each year), or continuous season-long grazing, 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 Western Wheatgrass/Blue Grama/Kentucky Bluegrass 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 will convert this plant community to the 3.1 Wheatgrass/Needlegrass/Bluestem Plant Community Phase.

State 4
Invaded

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of Kentucky bluegrass and smooth bromegrass and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. 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 4.1
Smooth Bromegrass/Kentucky Bluegrass 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 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.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1737	2809	3278
Forb	140	235	359
Shrub/Vine	28	94	174
Total	**1905**	**3138**	**3811**

Figure 15. 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 4.2
Kentucky Bluegrass/Blue Grama 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 blue grama. 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	824	1170	1496
Forb	62	135	224
Shrub/Vine	11	40	73
Total	**897**	**1345**	**1793**

Figure 17. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 4.3
Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community developed under continuous heavy grazing or other excessive disturbances (e.g., heavy use areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable but often include 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.

Pathway 4.1a
Community 4.1 to 4.2

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season and at the same time of year each year) or heavy continuous season-long grazing will convert this plant community to the 4.2 Kentucky Bluegrass/Blue Grama Plant Community Phase.

Pathway 4.2a
Community 4.2 to 4.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest may convert this plant community to the 4.1 Smooth Bromegrass/Kentucky Bluegrass Plant Community Phase.

Conservation practices

Prescribed Grazing

Pathway 4.3a
Community 4.3 to 4.2

Pest management (herbicides) and often heavy continuous seasonal grazing will likely result in an eventual dominance by Kentucky bluegrass which will lead to the 4.2 Kentucky Bluegrass/Blue Grama Plant Community Phase.

Conservation practices

Integrated Pest Management (IPM)

Transition T1a
State 1 to 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, typically beginning early in the season) will convert this plant community to the 2.1 Blue Grama/Buffalograss Sod Plant Community Phase and the Shortgrass Sod State (State 2).

Transition T1b
State 1 to 3

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 Grass State (State 3).

Transition T5
State 1 to 4

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 4) and more specifically to the 4.3 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 T5
State 1 to 4

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 4) and more specifically to the 4.3 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 T5
State 1 to 4

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 4) and more specifically to the 4.3 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 T5
State 2 to 4

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 4) and more specifically to the 4.3 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 T5
State 3 to 4

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 4) and more specifically to the 4.3 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 T5
State 3 to 4

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 4) and more specifically to the 4.3 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 T3b
State 3 to 4

Heavy continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year, typically beginning early in the season) will cause a shift across a threshold leading to the 4.2 Kentucky Bluegrass/Blue Grama Plant Community Phase within the Invaded State (State 4).

Transition T3a
State 3 to 4

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

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	**Cool-season Bunchgrasses**			291–874	
	green needlegrass	NAVI4	*Nassella viridula*	146–729	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	146–583	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–291	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–146	–
2	**Wheatgrass**			291–874	
	western wheatgrass	PASM	*Pascopyrum smithii*	146–874	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	146–583	–
3	**Tall Warm-season Grasses**			291–583	
	big bluestem	ANGE	*Andropogon gerardii*	146–437	–
	switchgrass	PAVI2	*Panicum virgatum*	29–291	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–146	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–146	–
4	**Short Warm-season Grasses**			58–291	
	blue grama	BOGR2	*Bouteloua gracilis*	58–291	–
	saltgrass	DISP	*Distichlis spicata*	0–146	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–146	–
	threeawn	ARIST	*Aristida*	0–58	–
5	**Mid Warm-season Grasses**			58–291	
	sideoats grama	BOCU	*Bouteloua curtipendula*	58–291	

	sideoats grama	BOCU	*Bouteloua curtipendula*	58–291	–
	little bluestem	SCSC	*Schizachyrium scoparium*	58–291	–
6	**Other Native Grasses**			29–146	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–146	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	29–87	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–58	–
7	**Grass-likes**			29–146	
	needleleaf sedge	CADU6	*Carex duriuscula*	29–146	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–87	–
Forb					
8	**Forbs**			146–291	
	Forb, native	2FN	*Forb, native*	29–87	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	29–87	–
	milkweed	ASCLE	*Asclepias*	29–58	–
	false boneset	BREU	*Brickellia eupatorioides*	29–58	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	29–58	–
	purple prairie clover	DAPU5	*Dalea purpurea*	29–58	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	29–58	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–58	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	29–58	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	29–58	–
	goldenrod	SOLID	*Solidago*	29–58	–
	white heath aster	SYER	*Symphyotrichum ericoides*	29–58	–
	American vetch	VIAM	*Vicia americana*	29–58	–
	Nuttall's violet	VINU2	*Viola nuttallii*	0–29	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–29	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	0–29	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–29	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–29	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–29	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–29	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–29	–
	textile onion	ALTE	*Allium textile*	0–29	–
	pussytoes	ANTEN	*Antennaria*	0–29	–
	field sagewort	ARCA12	*Artemisia campestris*	0–29	–
Shrub/Vine					
9	**Shrubs**			58–291	
	leadplant	AMCA6	*Amorpha canescens*	29–146	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–87	–
	snowberry	SYMPH	*Symphoricarpos*	0–87	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–87	–
	rose	ROSA5	*Rosa*	29–58	–

Table 10. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			95–286	
	green needlegrass	NAVI4	*Nassella viridula*	38–286	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	19–152	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–95	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–57	–
2	**Wheatgrass**			286–572	
	western wheatgrass	PASM	*Pascopyrum smithii*	286–572	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–191	–
3	**Tall Warm-season Grasses**			0–95	
	big bluestem	ANGE	*Andropogon gerardii*	0–95	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–57	–
	switchgrass	PAVI2	*Panicum virgatum*	0–57	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–57	–
4	**Short Warm-season Grasses**			286–476	
	blue grama	BOGR2	*Bouteloua gracilis*	191–476	–
	buffalograss	BODA2	*Bouteloua dactyloides*	38–229	–
	saltgrass	DISP	*Distichlis spicata*	0–95	–
	threeawn	ARIST	*Aristida*	0–57	–
5	**Mid Warm-season Grasses**			0–95	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–95	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–95	–
6	**Other Native Grasses**			19–95	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–95	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–38	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–38	–
7	**Grass-likes**			19–191	
	needleleaf sedge	CADU6	*Carex duriuscula*	19–191	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–57	–
8	**Non-Native Grasses**			95–476	
	Kentucky bluegrass	POPR	*Poa pratensis*	57–476	–
	brome	BROMU	*Bromus*	19–191	–
	quackgrass	ELRE4	*Elymus repens*	0–95	–
	smooth brome	BRIN2	*Bromus inermis*	0–95	–
Forb					
9	**Forbs**			95–191	
	Forb, introduced	2FI	*Forb, introduced*	0–76	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–76	

	white sagebrush	ARLU	*Artemisia ludoviciana*	19–76	–
	Forb, native	2FN	*Forb, native*	19–57	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	19–57	–
	goldenrod	SOLID	*Solidago*	19–57	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–57	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	19–38	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–38	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–38	–
	field sagewort	ARCA12	*Artemisia campestris*	0–38	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–19	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–19	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	0–19	–
	American vetch	VIAM	*Vicia americana*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
	false boneset	BREU	*Brickellia eupatorioides*	0–19	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–19	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–19	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–19	–
Shrub/Vine					
10	**Shrubs**			19–95	
	snowberry	SYMPH	*Symphoricarpos*	19–57	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–57	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–38	–
	leadplant	AMCA6	*Amorpha canescens*	0–19	–
	rose	ROSA5	*Rosa*	0–19	–

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–251	
	green needlegrass	NAVI4	*Nassella viridula*	0–220	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–94	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–31	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–31	–
2	**Wheatgrass**			0–314	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–314	–
3	**Short Warm-season Grasses**			0–220	
	blue grama	BOGR2	*Bouteloua gracilis*	0–157	–
	saltgrass	DISP	*Distichlis spicata*	0–94	–
	threeawn	ARIST	*Aristida*	0–63	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–63	–
4	**Other Native Grasses**			0–157	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–157	–

	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–31	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–31	–
5	**Grass-likes**			0–157	
	needleleaf sedge	CADU6	*Carex duriuscula*	0–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
6	**Non-Native Grasses**			942–2197	
	smooth brome	BRIN2	*Bromus inermis*	628–2040	–
	Kentucky bluegrass	POPR	*Poa pratensis*	157–785	–
	brome	BROMU	*Bromus*	31–471	–
	quackgrass	ELRE4	*Elymus repens*	0–251	–
Forb					
7	**Forbs**			157–314	
	Forb, introduced	2FI	*Forb, introduced*	0–188	–
	Forb, native	2FN	*Forb, native*	0–94	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–94	–
	goldenrod	SOLID	*Solidago*	31–94	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–94	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–63	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–63	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–63	–
	pussytoes	ANTEN	*Antennaria*	0–31	–
	field sagewort	ARCA12	*Artemisia campestris*	0–31	–
	mouse-ear chickweed	CERAS	*Cerastium*	0–31	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–31	–
Shrub/Vine					
8	**Shrubs**			31–157	
	snowberry	SYMPH	*Symphoricarpos*	31–126	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–63	–
	rose	ROSA5	*Rosa*	31–63	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–31	–

Table 12. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–67	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–40	–
	green needlegrass	NAVI4	*Nassella viridula*	0–40	–
2	**Wheatgrass**			0–67	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–67	–
3	**Short Warm-season Grasses**			135–336	
	blue grama	BOGR2	*Bouteloua gracilis*	67–336	–
	buffalograss	BODA2	*Bouteloua dactyloides*	13–135	–

	saltgrass	DISP	*Distichlis spicata*	0–108	–
	threeawn	ARIST	*Aristida*	0–40	–
4	**Other Native Grasses**			13–67	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–67	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13–27	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–13	–
5	**Grass-likes**			40–202	
	needleleaf sedge	CADU6	*Carex duriuscula*	40–202	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–27	–
6	**Non-Native Grasses**			336–673	
	Kentucky bluegrass	POPR	*Poa pratensis*	135–605	–
	brome	BROMU	*Bromus*	27–269	–
	quackgrass	ELRE4	*Elymus repens*	27–161	–
	smooth brome	BRIN2	*Bromus inermis*	0–108	–
Forb					
7	**Forbs**			67–202	
	Forb, introduced	2FI	*Forb, introduced*	13–108	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	13–67	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	13–54	–
	goldenrod	SOLID	*Solidago*	13–54	–
	field sagewort	ARCA12	*Artemisia campestris*	0–40	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	13–40	–
	Forb, native	2FN	*Forb, native*	0–27	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	13–27	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–27	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–13	–
	pussytoes	ANTEN	*Antennaria*	0–13	–
Shrub/Vine					
8	**Shrubs**			13–67	
	prairie sagewort	ARFR4	*Artemisia frigida*	13–40	–
	snowberry	SYMPH	*Symphoricarpos*	0–40	–
	rose	ROSA5	*Rosa*	0–13	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–13	–

Animal community

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

Wheatgrass/Needlegrass/Bluestem (1.1 & 3.1)
Average Annual Production (lbs./acre, air-dry): 2600
Stocking Rate* (AUM/acre): 0.71

Western Wheatgrass/Blue Grama/Kentucky Bluegrass (3.2)
Average Annual Production (lbs./acre, air-dry): 1700
Stocking Rate* (AUM/acre): 0.47

Smooth Bromegrass/Kentucky Bluegrass (4.1)
Average Annual Production (lbs./acre, air-dry): 2800
Stocking Rate* (AUM/acre): 0.77

Kentucky Bluegrass/Blue grama (4.2)
Average Annual Production (lbs./acre, air-dry): 1200
Stocking Rate* (AUM/acre): 0.33

Annual/Pioneer, Non-Native Perennial (4.3)
Average Annual Production (lbs./acre, air-dry): 800
Stocking Rate* (AUM/acre): 0.22

*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 group D. Infiltration is typically slow to very slow and runoff potential for this site varies from negligible to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, and/or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

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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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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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 15% 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.

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 roughly 3-5. Relatively high root content. Soil surface is 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. At less than 8 inches, an extremely dense clay B horizon with round-topped columnar or prismatic structure exists.

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 cool-season rhizomatous grass > tall cool-season bunch grass

    Sub-dominant: > tall warm-season rhizomatous grass = short warm-season grass = short cool-season grass = forbs > shrubs

    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):** 60-70%, 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):** 2200 – 3000 lbs./acre air-dry weight, average 2,600 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 bromegrass

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