USDA Natural Resources Conservation Service

Ecological site R102DY011SD
Clayey

Last updated: 8/14/2024
Accessed: 05/12/2025

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.

MLRA notes

Major Land Resource Area (MLRA): 102D–Prairie Coteau

This area makes up about 7,867 square miles (20,375 square kilometers), consisting mostly of nearly level to undulating till plains with potholes and moraines. Elevation ranges from 1,150 to 2,130 feet (350 to 650 meters). The average annual precipitation is 22 to 29 inches (559 to 734 millimeters). The average annual temperature is 42 to 45 degrees F (6 to 7 degrees C). The dominant soil order in this MLRA is Mollisols. The soils in this area dominantly have a frigid temperature regime, and an aquic or udic moisture regime. They are generally very deep and loamy. Soils range from well drained to very poorly drained. Parent materials are dominantly fine-loamy till to clayey material, with smaller amounts of outwash, glaciofluvial deposits, eolian deposits, alluvium, and, to a lesser extent, loess and organic materials.

Classification relationships

Fenneman (1916) Physiographic Regions
Division - Interior Plains
East:
Province - Central Lowland
Section - Western Lake / Dissected Till Plains (12b/12e)

USFS (2007) Ecoregions
Domain - Humid Temperate
Division - Prairie
Province - Prairie Parkland (Temperate)
Section - North-Central Glaciated Plains (251B)

EPA Ecoregions (Omernik 1997)
I - Great Plains (9)
II - Temperate Prairies (9.2)
III - Aspen Parkland/Northern Glaciated Plains (9.2.1)

Ecological site concept

The Clayey ecological site occurs on upland areas. Soils are well drained and have greater than 40 percent clay in the surface and/or subsoil. The surface and subsoil textures typically are silty clay or clay. Some soils have a loamy surface and a clayey subsoil. In some areas the surface layer may consist of stony to extremely stony. Slopes can range from 0 to 20 percent. Vegetation in the Reference State includes needlegrasses, bluestems, western wheatgrass, and gramas. Forbs include goldenrods, sageworts, heath aster, and scurfpeas. Non-native grasses such as Kentucky bluegrass and smooth brome may invade the site due to changes in disturbance regime.

Associated sites

R102DY012SD	**Thin Upland** These sites occur on uplands. Soils are well drained and will effervesce with acid at or near the surface.

Similar sites

R102DY010SD	**Loamy** The Loamy site is in a similar landscape position, but the soils have less than 40 percent clay in the surface and/or subsoil.

Table 1. Dominant plant species

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

Physiographic features

This site occurs primarily on upland plains.

Table 2. Representative physiographic features

Landforms	(1) Plain
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,000–2,000 ft
Slope	0–6%
Water table depth	40 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is 22 to 28 inches. Half or more of the precipitation falls during the growing season. Rainfall typically occurs during high-intensity, convective thunderstorms in summer. In the western part of the MLRA, rainfall is less abundant and not always adequate for full maturation of crops. Precipitation in winter is typically snow. The average annual temperature is 42 to 45 degrees F. The freeze-free period averages 142 days and ranges from 131 to 150 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	116-129 days
Freeze-free period (characteristic range)	140-150 days
Precipitation total (characteristic range)	24-27 in
Frost-free period (actual range)	110-131 days
Freeze-free period (actual range)	132-151 days
Precipitation total (actual range)	23-28 in
Frost-free period (average)	122 days
Freeze-free period (average)	144 days

Precipitation total (average)	26 in

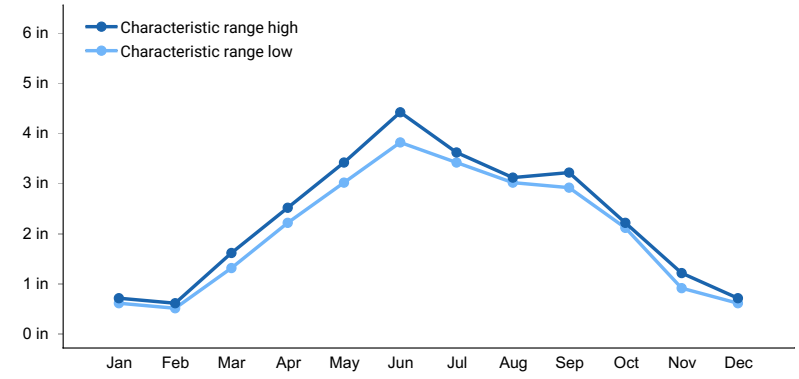


Figure 1. Monthly precipitation range

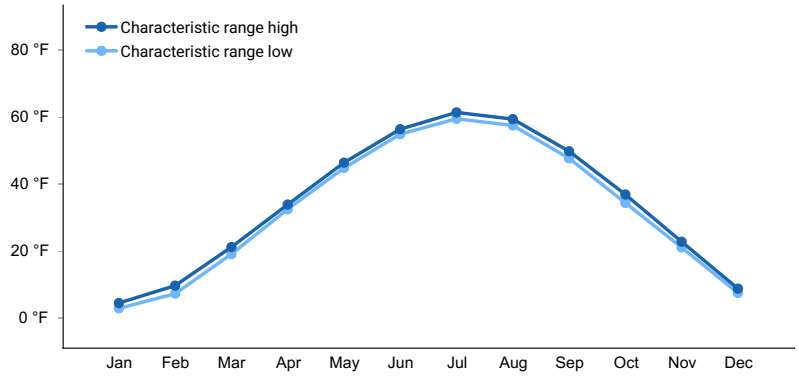


Figure 2. Monthly minimum temperature range

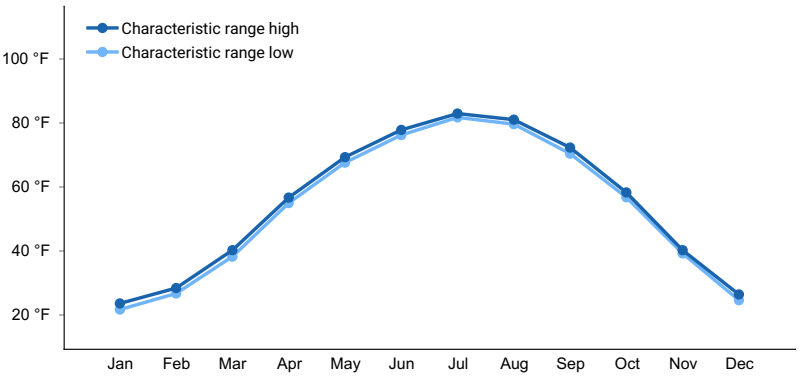


Figure 3. Monthly maximum temperature range

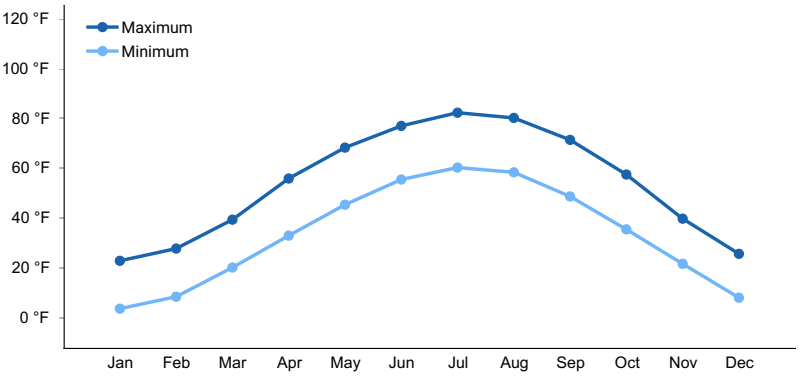


Figure 4. Monthly average minimum and maximum temperature

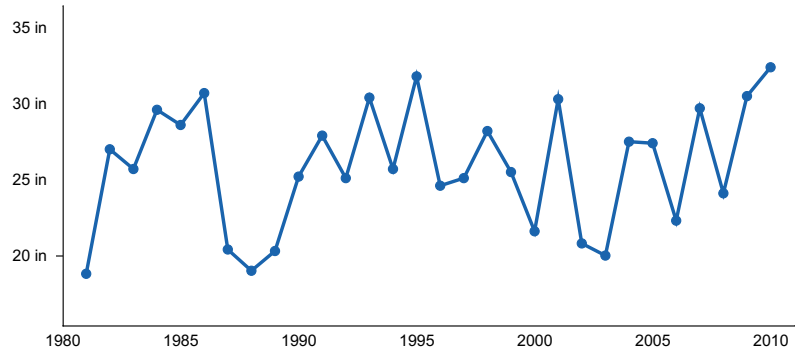


Figure 5. Annual precipitation pattern

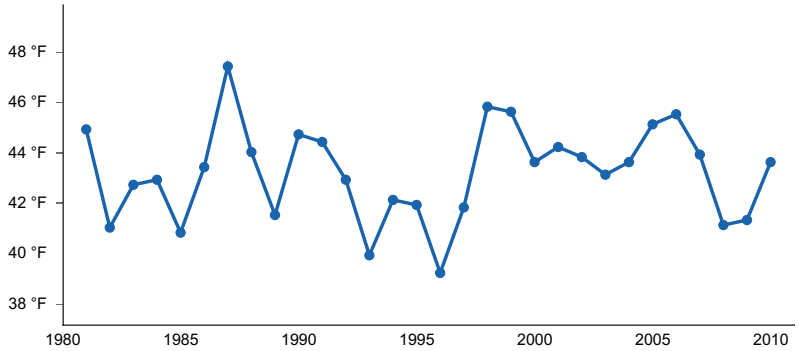


Figure 6. Annual average temperature pattern

Climate stations used

- (1) WEBSTER [USC00399004], Webster, SD
- (2) WAUBAY NWR [USC00398980], Waubay, SD
- (3) WATERTOWN 1W [USC00398930], Watertown, SD
- (4) CASTLEWOOD [USC00391519], Castlewood, SD
- (5) ARLINGTON 1 W [USC00390281], Arlington, SD
- (6) BROOKINGS 2 NE [USC00391076], Brookings, SD
- (7) CLEAR LAKE [USC00391777], Clear Lake, SD
- (8) ASTORIA 4S [USC00390422], White, SD
- (9) TYLER [USC00218429], Tyler, MN

Influencing water features

No wetland features are associated with this site.

Soil features

Soils are formed in clayey glaciolacustrine deposits and clayey till. Surface textures are primarily silty clay and loam.

Table 4. Representative soil features

Parent material	(1) Glaciolacustrine deposits (2) Till
Surface texture	(1) Silty clay (2) Loam
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to slow
Soil depth	80 in
Surface fragment cover <=3"	0%

Surface fragment cover >3"	0%
Available water capacity (0-40in)	6.1–6.2 in
Soil reaction (1:1 water) (0-10in)	5.6–7.8
Subsurface fragment volume <=3" (0-60in)	0–2%
Subsurface fragment volume >3" (0-60in)	0%

Ecological dynamics

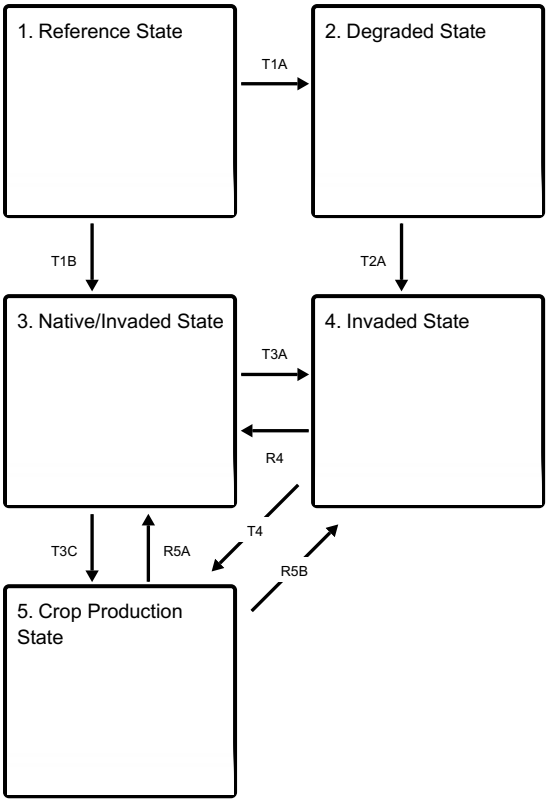
The site which is located in the Prairie Pothole Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase. This community phase and the Reference State have 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 considered.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dynamics of this site. Heavy continuous 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 cause departure from the 3.1 Green Needlegrass-Little Bluestem-Western Wheatgrass Plant Community Phase. Green needlegrass, little bluestem (*Schizachyrium scoparium*), and the tall warm-season grasses will decrease, while western wheatgrass, sideoats grama (*Bouteloua curtipendula*), and blue grama (Bouteloua gracillis) will increase. Eventually, blue grama, quackgrass (*Elymus repens*), and Kentucky bluegrass (*Poa pratensis*) may develop into a sod. 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 and smooth bromegrass (Bromus inermus).

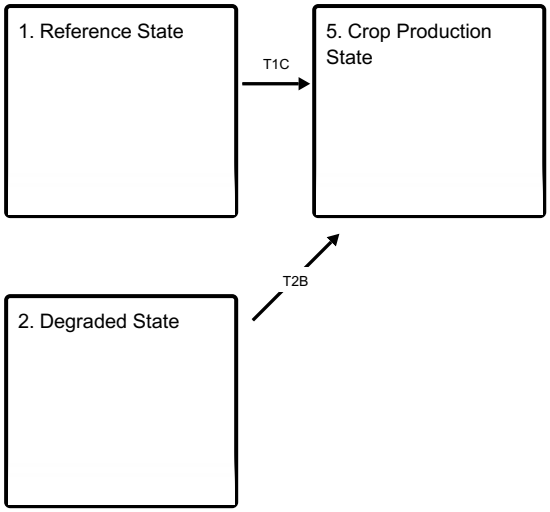
Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model

Ecosystem states



States 1, 5 and 2 (additional transitions)



T1A - Heavy continuous grazing

T1B - Heavy continuous grazing, no fire, non-use, invasion

T1C - Tillage

T2A - Invasive encroachment

T2B - Tillage

T3A - Non-use, no fire, heavy continuous grazing

T3C - Tillage

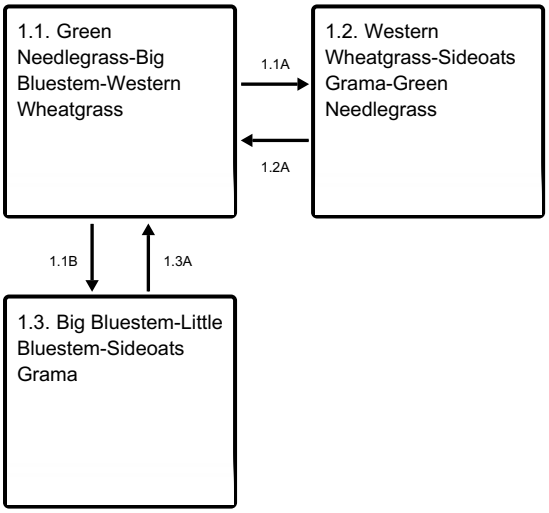
R4 - Long-term prescribed grazing, prescribed burning

T4 - Tillage

R5A - Seeding

R5B - Seeding, abandonment of cropping

State 1 submodel, plant communities



1.1A - Heavy continuous grazing

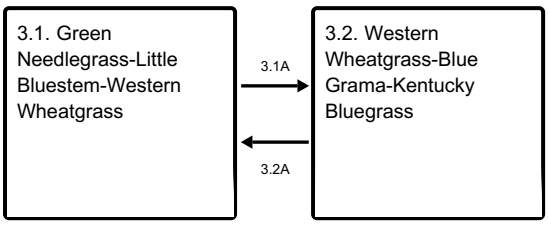
1.1B - Prescribed burning

1.2A - Prescribed grazing with recovery periods, prescribed burning

1.3A - Prescribed grazing with recovery periods, prescribed burning

State 2 submodel, plant communities

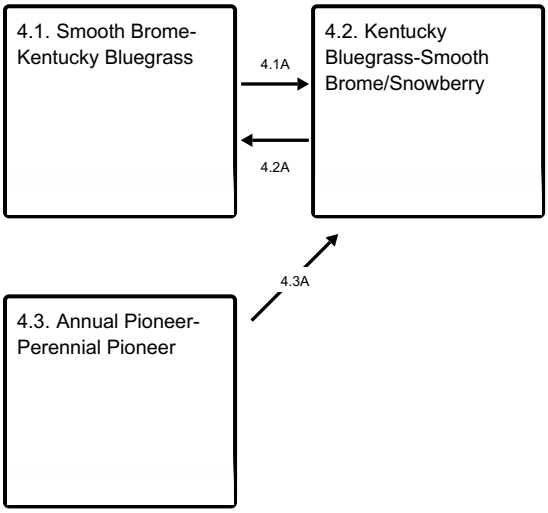
State 3 submodel, plant communities



3.1A - Heavy continuous grazing

3.2A - Prescribed grazing with recovery periods

State 4 submodel, plant communities

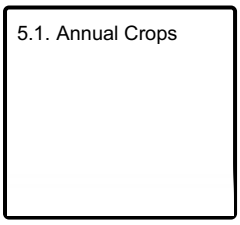


4.1A - Heavy continuous grazing

4.2A - Prescribed grazing with recovery periods

4.3A - Time without disturbances

State 5 submodel, plant communities



State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state was codominated by cool- and warm-season grasses. Before European settlement, the primary disturbance mechanisms for this site in the reference condition included periodic fire, grazing by large herding ungulates, and

fluctuations in the water table and ponding frequency and duration. Frequent surface fires (3 to 5 years) and grazing 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 cool-season bunchgrasses and short to mid-statured warm-season grasses would have increased. Today, a similar state, the Native/Invaded 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.

Dominant plant species

- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- snowberry (*Symphoricarpos*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- green needlegrass (*Nassella viridula*), grass
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- needleleaf sedge (*Carex duriuscula*), grass
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous

Community 1.1
Green Needlegrass-Big Bluestem-Western Wheatgrass

Interpretations are based primarily on the Green Needlegrass-Bluestem-Wheatgrass Plant Community Phase (this is also considered to be climax). The potential vegetation was about 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. The community was codominated by cool- and warm-season grasses. The major grasses included green needlegrass, big bluestem, western wheatgrass, little bluestem, porcupine grass (*Hesperostipa spartea*), and sideoats grama. Other grass or grass-like species included slender wheatgrass (*Elymus trachycaulus*), Indiangrass (*Sorghastrum nutans*), tall dropseed (*Sporobolus compositus*), prairie dropseed (*Sporobolus heterolepis*), switchgrass (*Panicum virgatum*), blue grama, buffalograss (*Bouteloua dactyloides*), and needleleaf sedge (*Carex duriuscula*). 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2260	2920	3430
Forb	145	248	385
Shrub/Vine	95	132	185
Total	**2500**	**3300**	**4000**

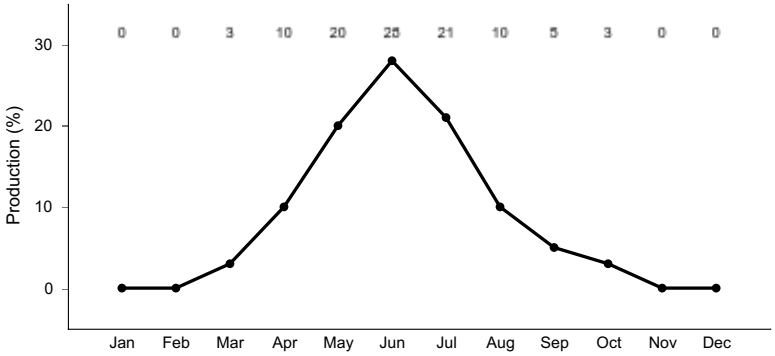


Figure 8. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

Community 1.2
Western Wheatgrass-Sideoats Grama-Green Needlegrass

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, 15 percent forbs, and 10 percent shrubs. Dominant grasses included western wheatgrass, sideoats grama, blue grama, and green needlegrass. Grasses of secondary importance included big bluestem, little bluestem, buffalograss, slender wheatgrass, needleleaf sedge, and porcupinegrass. Forbs commonly found in this plant community included goldenrod (Oligoneuron), cudweed sagewort (*Artemisia ludoviciana*), heath aster (*Symphyotrichum ericoides*), scurfpea (Psoralidium), western ragweed (*Ambrosia psilostachya*), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of nonnative invasive cool-season species. When compared to the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase, western wheatgrass, sideoats grama, and blue grama increased. Production of tall warm-season grasses and needlegrasses 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.

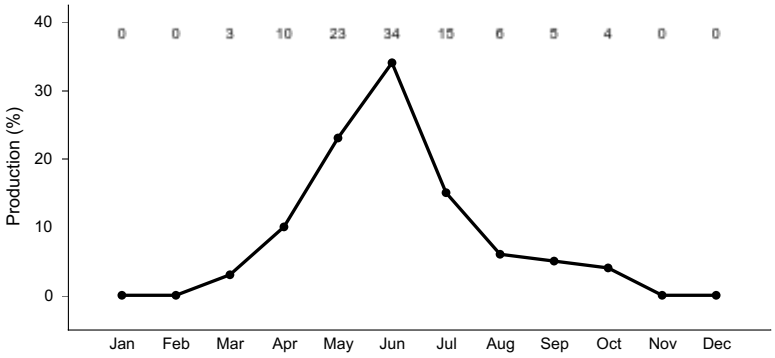


Figure 9. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Community 1.3
Big Bluestem-Little Bluestem-Sideoats Grama

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 big bluestem, little bluestem, sideoats grama, Indiangrass, switchgrass, tall dropseed, and prairie dropseed. Other grass or grass-like species included green needlegrass, porcupine grass, western wheatgrass, blue grama, slender wheatgrass, and needleleaf sedge. This plant community was not resistant to change and would have readily shifted back to the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase with a return of more normal fire return intervals.

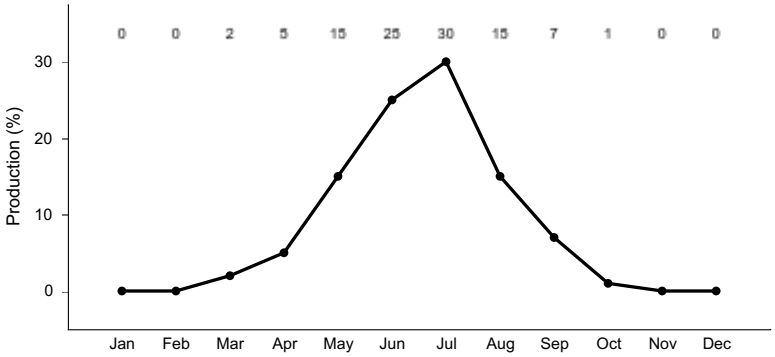


Figure 10. Plant community growth curve (percent production by month). SD0205, Rolling Till Prairie, warm-season dominant.. Warm-season dominant..

Pathway 1.1A
Community 1.1 to 1.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 1.2 Western Wheatgrass-Sideoats Grama-Green Needlegrass Plant Community Phase.

Pathway 1.1B
Community 1.1 to 1.3

Prescribed Burning occurring at relatively frequent intervals (3 to 5 years), 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 Big Bluestem-Little Bluestem-Sideoats Grama Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, and/or prescribed burning 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 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase.

Pathway 1.3A
Community 1.3 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest and/or prescribed burning with late season fire or at infrequent intervals (greater than 5 years) will convert this plant community to the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase.

State 2
Degraded State

This state is the result of heavy continuous grazing, and the absence of periodic fire due to fire suppression. This state is dominated by blue grama, buffalograss, and western wheatgrass. The blue gama and buffalograss can form a sod-like layer that effectively blocks introduction of other plants into the system. The western wheatgrass will occur on the outer edges and intermingled within the blue grama and buffalograss sod areas. Taller warm-season species will decline and a corresponding increase in short statured grass will occur. Once the threshold is crossed, a change in grazing management alone cannot restore the degraded state.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- threeawn (*Aristida*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- slimflower scurfpea (*Psoralidium tenuiflorum*), other herbaceous
- western yarrow (*Achillea millefolium var. occidentalis*), other herbaceous

Community 2.1
Blue Grama-Buffalograss-Western Wheatgrass

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 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs. Dominant grasses included blue grama, sideoats grama, buffalograss, western wheatgrass, and needleleaf sedge. Grasses of secondary importance included big bluestem, little bluestem, green needlegrass, slender wheatgrass, tall dropseed, and threeawn (Aristida). Forbs commonly found in this plant community included cudweed sagewort, goldenrod, scurfpea, and western yarrow. When compared to the 1.1 Green Needlegrass-Big BluestemWestern Wheatgrass Plant Community Phase, tall warm-season grasses were reduced, and the more grazing tolerant species such as blue grama, buffalograss, and sideoats grama were dominant on this plant community. With the exception of western wheatgrass, cool-season grasses decreased significantly. This vegetation state was very resistant to change especially if the disturbance continued and the short-statured species such as blue grama increased. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases.

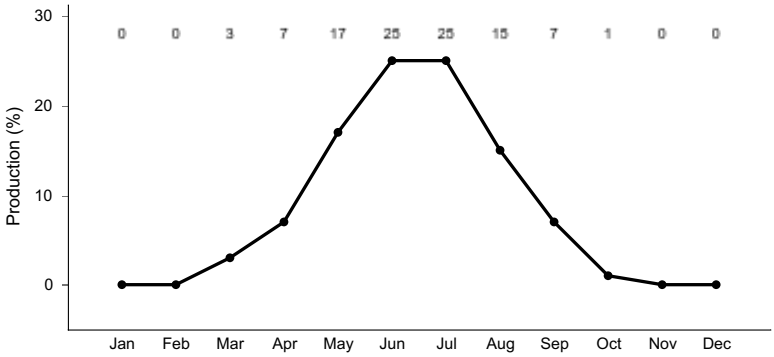


Figure 11. Plant community growth curve (percent production by month). SD0204, Rolling Till Prairie, warm-season dominant, cool-season subdominant.. Warm-season dominant, cool-season subdominant..

State 3
Native/Invaded State

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- and 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.

Dominant plant species

- snowberry (*Symphoricarpos*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- green needlegrass (*Nassella viridula*), grass

- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- goldenrod (*Solidago*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- Canada thistle (*Cirsium arvense*), other herbaceous
- leafy spurge (*Euphorbia esula*), other herbaceous

Community 3.1
Green Needlegrass-Little Bluestem-Western Wheatgrass

This plant community phase is similar to the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass 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 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs. This community is codominated by cool- and warm-season grasses. The major grasses include green needlegrass, big bluestem, little bluestem, western wheatgrass, porcupine grass, and sideoats grama. Other grass or grass-like species include slender wheatgrass, Indiangrass, tall dropseed, prairie dropseed, switchgrass, blue grama, buffalograss, 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.

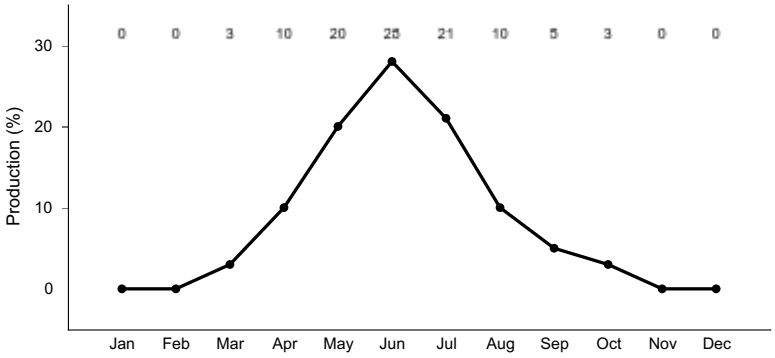


Figure 12. Plant community growth curve (percent production by month). SD0203, Rolling Till Prairie, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

Community 3.2
Western Wheatgrass-Blue Grama-Kentucky Bluegrass

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, 15 percent forbs, and 10 percent shrubs. Dominant grasses include western wheatgrass, sideoats grama, blue grama, green needlegrass, and Kentucky bluegrass. Grasses of secondary importance include big bluestem, little bluestem, buffalograss, slender wheatgrass, needleleaf sedge, and porcupine grass. Forbs commonly found in this plant community include goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, and western yarrow. When compared to the 1.1 Green Needlegrass-Big Bluestem-Western Wheatgrass Plant Community Phase, western wheatgrass, sideoats grama and blue grama increased. Production of tall warm-season grasses and needlegrasses 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.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1835	2184	2445
Forb	115	260	460
Shrub/Vine	50	156	295
Total	**2000**	**2600**	**3200**

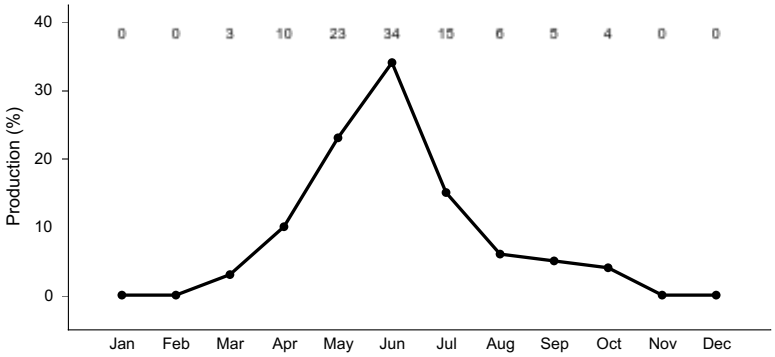


Figure 14. Plant community growth curve (percent production by month). SD0202, Rolling Till Prairie, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant..

Pathway 3.1A
Community 3.1 to 3.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites 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 Green Needlegrass-Little Bluestem-Western Wheatgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

State 4
Invaded State

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.

Dominant plant species

- snowberry (*Symphoricarpos*), shrub
- rose (*Rosa*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- quackgrass (*Elymus repens*), grass
- goldenrod (*Solidago*), other herbaceous
- white heath aster (*Symphyotrichum ericoides*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- Canada thistle (*Cirsium arvense*), other herbaceous
- leafy spurge (*Euphorbia esula*), other herbaceous

Community 4.1
Smooth Brome-Kentucky Bluegrass

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 to a lesser extent 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 and eventually a thatch-mat layer may develop at the 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2110	2595	3110
Forb	135	225	345
Shrub/Vine	55	180	345
Total	**2300**	**3000**	**3800**

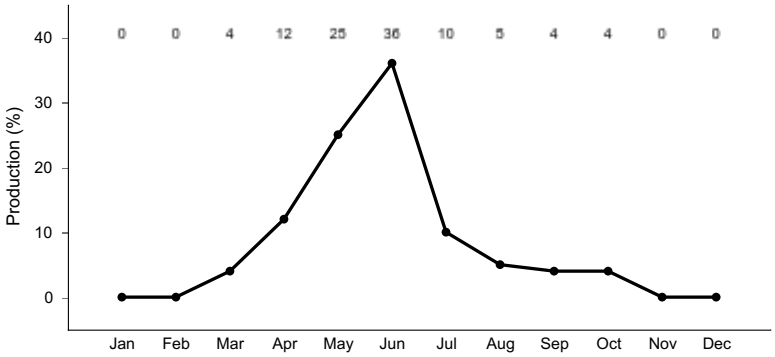


Figure 16. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

Community 4.2
Kentucky Bluegrass-Smooth Brome/Snowberry

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, smooth bromegrass, and snowberry (Symphoricarpos). 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 and a thatch-mat layer may develop at the 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1460	1848	2165
Forb	100	220	385
Shrub/Vine	40	132	250
Total	**1600**	**2200**	**2800**

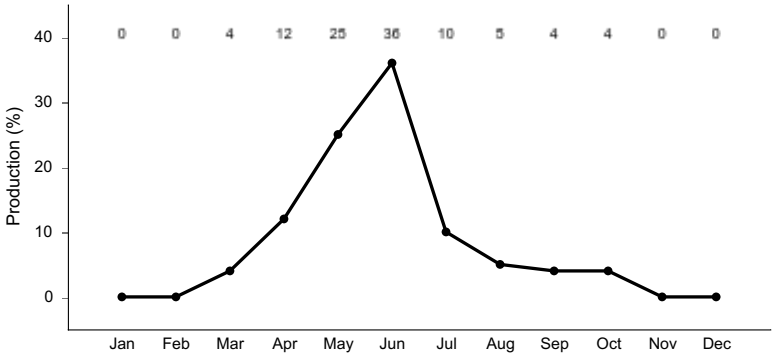


Figure 18. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

Community 4.3
Annual Pioneer-Perennial Pioneer

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. This community can be renovated to improve the production capability; however, if management changes are not made, the vegetation could revert back to early seral species.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1460	1848	2165
Forb	100	220	385
Shrub/Vine	40	132	250
Total	**1600**	**2200**	**2800**

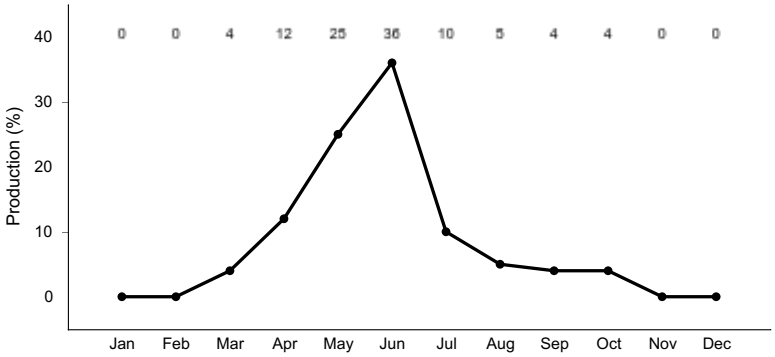


Figure 20. Plant community growth curve (percent production by month). SD0201, Rolling Till Prairie, cool-season dominant.. Cool-season dominant..

Pathway 4.1A
Community 4.1 to 4.2

Heavy continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 4.2 Kentucky Bluegrass-Smooth Bromegrass/Snowberry Plant Community Phase.

Pathway 4.2A
Community 4.2 to 4.1

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

Conservation practices

Prescribed Grazing

Pathway 4.3A
Community 4.3 to 4.2

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 4.2 Kentucky Bluegrass-Smooth Bromegrass/Snowberry Plant Community Phase.

Conservation practices

Integrated Pest Management (IPM)

State 5
Crop Production State

This state is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices. Cropping on this site is enabled during years with drier than normal precipitation or with artificial drainage (surface or subsurface).

Dominant plant species

- corn (*Zea*), grass
- wheat (*Triticum*), grass
- soybean (*Glycine*), other herbaceous

Community 5.1
Annual Crops

This plant community developed with the use of a variety of tillage systems and cropping systems for the production of annual crops including corn, soybeans, wheat, sugar beet and a variety of other crops.

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-Western Wheatgrass Plant Community Phase within the Degraded State.

Transition T1B
State 1 to 3

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and/or heavy continuous grazing or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native-Invaded State (State 3).

Transition T1C
State 1 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops within the Crop Production State (State 5).

Transition T2A
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 T2B
State 2 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops within the Crop Production State (State 5).

Transition T3A
State 3 to 4

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will likely lead this state over a threshold leading to the 4.1 Smooth Bromegrass-Kentucky Bluegrass Plant Community Phase within the Invaded State (State 4). 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), will likely lead this state over a threshold leading to the 4.2 Kentucky Bluegrass-Smooth Bromegrass/Snowberry Plant Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T3C
State 3 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Plant Community Phase within the Crop Production State (State 5).

Restoration pathway R4
State 4 to 3

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning may lead this plant community phase over a threshold to the Native/Invaded State (State 3).

Conservation practices

Prescribed Grazing
Integrated Pest Management (IPM)

Transition T4
State 4 to 5

Tillage will cause a shift over a threshold leading to the 5.1 Annual Crops Plant Community Phase within the Crop Production State (State 5).

Restoration pathway R5A
State 5 to 3

Seeding may lead this Crop Production State (State 5) over a threshold to the Native/Invaded State (State 3).

Restoration pathway R5B
State 5 to 4

Seeding may lead this Crop Production State (State 5) over a threshold to the Invaded State (State 4) Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 4) and more specifically to the 4.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			495–990	
	green needlegrass	NAVI4	*Nassella viridula*	330–990	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	165–495	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–99	–
2	**Tall Warm-season Grasses**			330–990	
	big bluestem	ANGE	*Andropogon gerardii*	231–990	–
	switchgrass	PAVI2	*Panicum virgatum*	0–165	–
	Indiangrass	SONU2	*Sorghastrum nutans*	33–165	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	33–165	–
3	**Mid Warm-season Grasses**			330–825	
	little bluestem	SCSC	*Schizachyrium scoparium*	165–660	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	165–495	–

	prairie dropseed	SPHE	*Sporobolus heterolepis*	33–165	–
4	**Wheatgrass**			264–495	
	western wheatgrass	PASM	*Pascopyrum smithii*	165–495	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	66–330	–
5	**Short Warm-season Grasses**			66–165	
	buffalograss	BODA2	*Bouteloua dactyloides*	33–165	–
	blue grama	BOGR2	*Bouteloua gracilis*	33–165	–
	threeawn	ARIST	*Aristida*	0–66	–
6	**Other Native Grasses**			66–165	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–132	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	33–99	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	33–66	–
7	**Grass-likes**			33–165	
	needleleaf sedge	CADU6	*Carex duriuscula*	33–165	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–99	–
Forb					
8	**Forbs**			165–330	
	Forb, native	2FN	*Forb, native*	33–99	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	33–66	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	33–66	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	33–66	–
	false boneset	BREU	*Brickellia eupatorioides*	0–66	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–66	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–66	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	33–66	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	33–66	–
	blazing star	LIATR	*Liatris*	33–66	–
	Northern Idaho biscuitroot	LOOR	*Lomatium orientale*	33–66	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	33–66	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	33–66	–
	beardtongue	PENST	*Penstemon*	0–66	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	33–66	–
	goldenrod	SOLID	*Solidago*	33–66	–
	white heath aster	SYER	*Symphyotrichum ericoides*	33–66	–
	hoary verbena	VEST	*Verbena stricta*	0–66	–
	American vetch	VIAM	*Vicia americana*	33–66	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–33	–
	wild bergamot	MOFI	*Monarda fistulosa*	0–33	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–33	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–33	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–33	–
	candle anemone	ANCY	*Anemone cylindrica*	0–33	

	candle anemone	ANCY	*Anemone cylindrica*	0–33	–
	pussytoes	ANTEN	*Antennaria*	0–33	–
	onion	ALLIU	*Allium*	0–33	–
Shrub/Vine					
9	**Shrubs**			99–165	
	leadplant	AMCA6	*Amorpha canescens*	33–99	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–66	–
	rose	ROSA5	*Rosa*	33–66	–
	snowberry	SYMPH	*Symphoricarpos*	33–66	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–33	–

Table 11. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			26–260	
	green needlegrass	NAVI4	*Nassella viridula*	26–260	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–130	–
2	**Tall Warm-season Grasses**			0–208	
	big bluestem	ANGE	*Andropogon gerardii*	0–208	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–78	–
3	**Mid Warm-season Grasses**			26–390	
	sideoats grama	BOCU	*Bouteloua curtipendula*	26–390	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–208	–
4	**Wheatgrasses**			130–650	
	western wheatgrass	PASM	*Pascopyrum smithii*	130–650	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–182	–
5	**Short Warm-season Grasses**			130–390	
	blue grama	BOGR2	*Bouteloua gracilis*	52–312	–
	buffalograss	BODA2	*Bouteloua dactyloides*	26–208	–
	threeawn	ARIST	*Aristida*	0–78	–
6	**Other Native Grasses**			52–130	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–130	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	26–52	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	26–52	–
7	**Grass-likes**			26–182	
	needleleaf sedge	CADU6	*Carex duriuscula*	26–182	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–104	–
8	**Non-Native Grasses**			130–390	
	Kentucky bluegrass	POPR	*Poa pratensis*	78–390	–
	smooth brome	BRIN2	*Bromus inermis*	0–208	–
	quackgrass	ELRE4	*Elymus repens*	0–130	–

Forb					
9	**Forbs**			130–390	
	goldenrod	SOLID	*Solidago*	26–104	–
	white heath aster	SYER	*Symphyotrichum ericoides*	26–78	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	26–78	–
	Forb, introduced	2FI	*Forb, introduced*	26–78	–
	Forb, native	2FN	*Forb, native*	26–78	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	26–78	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	26–78	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	26–78	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–52	–
	hoary verbena	VEST	*Verbena stricta*	0–52	–
	American vetch	VIAM	*Vicia americana*	0–26	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–26	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–26	–
	blazing star	LIATR	*Liatris*	0–26	–
	Northern Idaho biscuitroot	LOOR	*Lomatium orientale*	0–26	–
	American bird's-foot trefoil	LOUNU	*Lotus unifoliolatus var. unifoliolatus*	0–26	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–26	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–26	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–26	–
	pussytoes	ANTEN	*Antennaria*	0–26	–
	onion	ALLIU	*Allium*	0–26	–
Shrub/Vine					
10	**Shrubs**			52–260	
	snowberry	SYMPH	*Symphoricarpos*	26–208	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–78	–
	rose	ROSA5	*Rosa*	26–52	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–52	–
	leadplant	AMCA6	*Amorpha canescens*	0–26	–

Table 12. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–210	
	green needlegrass	NAVI4	*Nassella viridula*	0–210	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–60	–
2	**Tall Warm-season Grasses**			0–90	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–90	–
3	**Mid Warm-season Grasses**			0–150	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–120	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–60	–
4	**Wheatgrass**			0–150	

	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–150	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–150	–
5	**Short Warm-season Grasses**			0–90	
	threeawn	ARIST	*Aristida*	0–90	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–90	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–60	–
6	**Other Native Grasses**			0–150	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–150	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–30	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–30	–
7	**Grass-likes**			30–210	
	needleleaf sedge	CADU6	*Carex duriuscula*	30–210	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–90	–
8	**Non-Native Grasses**			1050–2100	
	smooth brome	BRIN2	*Bromus inermis*	300–1800	–
	Kentucky bluegrass	POPR	*Poa pratensis*	300–1800	–
	quackgrass	ELRE4	*Elymus repens*	0–150	–
Forb					
9	**Forbs**			150–300	
	goldenrod	SOLID	*Solidago*	30–90	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–90	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	30–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–90	–
	Forb, introduced	2FI	*Forb, introduced*	30–90	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	30–90	–
	Forb, native	2FN	*Forb, native*	0–60	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	30–60	–
	hoary verbena	VEST	*Verbena stricta*	0–60	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–30	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–30	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–30	–
	blazing star	LIATR	*Liatris*	0–30	–
	Northern Idaho biscuitroot	LOOR	*Lomatium orientale*	0–30	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–30	–
Shrub/Vine					
10	**Shrubs**			60–300	
	snowberry	SYMPH	*Symphoricarpos*	60–300	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–60	–
	rose	ROSA5	*Rosa*	0–60	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–30	–

Table 13. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–44	
	green needlegrass	NAVI4	*Nassella viridula*	0–44	–
2	**Mid Warm-season Grasses**			0–132	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–110	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–44	–
3	**Wheatgrass**			0–88	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–88	–
4	**Short Warm-season Grasses**			0–176	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–154	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–154	–
	threeawn	ARIST	*Aristida*	0–110	–
5	**Other Native Grasses**			0–110	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–110	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–22	–
6	**Grass-likes**			44–330	
	needleleaf sedge	CADU6	*Carex duriuscula*	44–330	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–110	–
7	**Non-Native Grasses**			660–1320	
	Kentucky bluegrass	POPR	*Poa pratensis*	220–1320	–
	smooth brome	BRIN2	*Bromus inermis*	0–220	–
	quackgrass	ELRE4	*Elymus repens*	0–220	–
Forb					
8	**Forbs**			110–330	
	Forb, introduced	2FI	*Forb, introduced*	22–110	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	22–110	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–110	–
	goldenrod	SOLID	*Solidago*	22–110	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	22–88	–
	white heath aster	SYER	*Symphyotrichum ericoides*	22–66	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	22–66	–
	hoary verbena	VEST	*Verbena stricta*	0–44	–
	pussytoes	ANTEN	*Antennaria*	0–22	–
	Forb, native	2FN	*Forb, native*	0–22	–
Shrub/Vine					
9	**Shrubs**			44–220	
	snowberry	SYMPH	*Symphoricarpos*	44–220	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–44	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–44	–
	rose	ROSA5	*Rosa*	0–22	–

Table 14. Community 4.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Bunchgrasses**			0–44	
	green needlegrass	NAVI4	*Nassella viridula*	0–44	–
2	**Mid Warm-season Grasses**			0–132	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–110	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–44	–
3	**Wheatgrass**			0–88	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–88	–
4	**Short Warm-season Grasses**			0–176	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–154	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–154	–
	threeawn	ARIST	*Aristida*	0–110	–
5	**Other Native Grasses**			0–110	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–110	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–22	–
6	**Grass-likes**			44–330	
	needleleaf sedge	CADU6	*Carex duriuscula*	–	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	–	–
7	**Non-Native Grasses**			660–1320	
	Kentucky bluegrass	POPR	*Poa pratensis*	220–1320	–
	smooth brome	BRIN2	*Bromus inermis*	0–220	–
	quackgrass	ELRE4	*Elymus repens*	0–220	–
Forb					
8	**Forbs**			110–330	
	Forb, introduced	2FI	*Forb, introduced*	22–110	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	22–110	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–110	–
	goldenrod	SOLID	*Solidago*	22–110	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	22–88	–
	white heath aster	SYER	*Symphyotrichum ericoides*	22–66	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	22–66	–
	hoary verbena	VEST	*Verbena stricta*	0–44	–
	pussytoes	ANTEN	*Antennaria*	0–22	–
	Forb, native	2FN	*Forb, native*	0–22	–
Shrub/Vine					
9	**Shrubs**			44–220	
	snowberry	SYMPH	*Symphoricarpos*	44–220	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–44	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–44	–

	prairie sagewort	ARLU4	*Artemisia ludoviciana*	0–11	–
	rose	ROSA5	*Rosa*	0–22	–

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.

Green Needlegrass/Bluestem/Wheatgrass (1.1 & 3.1)
Average Annual Production (lbs./ac, air-dry): 3300
Stocking Rate* (AUM/acre): 0.90

Wheatgrass/Grama/Kentucky Bluegrass (3.2)
Average Annual Production (lbs./ac, air-dry): 2600
Stocking Rate* (AUM/acre): 0.71

Smooth Bromegrass/Kentucky Bluegrass (4.1):
Average Annual Production (lbs./ac, air-dry): 3000
Stocking Rate* (AUM/acre): 0.82

Bluegrass/Bromegrass/Snowberry (4.2):
Average Annual Production (lbs./ac, air-dry): 2200
Stocking Rate* (AUM/acre): 0.60

Annual/Pioneer, Non-native Perennial (4.3):
Average Annual Production (lbs./ac, air-dry): 1000
Stocking Rate* (AUM/acre): 0.27

*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 C. Infiltration is typically slow to very slow and runoff potential for this site varies from low to very 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

MLRA 102D was created in 2022 with Agricultural Handbook 296 updated. This area was MLRA 102A prior to this time. Information was copied from MLRA 102A ESDs to create the MLRA 102D ESDs.

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.

Data Source Sample Period State County
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SCS-Range-417 (1008546109) 1985 SD Roberts
SCS-Range-417 (1008646051) 1986 SD Marshall

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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	12/07/2004
Approved by	Suzanne Mayne-Kinney
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):** None.

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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 = tall & mid cool-season grasses

    Sub-dominant: >> forb > mid warm-season rhizomatous grass > short cool-season grass = short warm-season grass = shrubs

    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):** 70-80%, 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):** 2800 – 3800 lbs./acre air-dry weight, average 3,300 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.