USDA Natural Resources Conservation Service

Ecological site R054XY031ND
Loamy

Accessed: 02/08/2025

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.

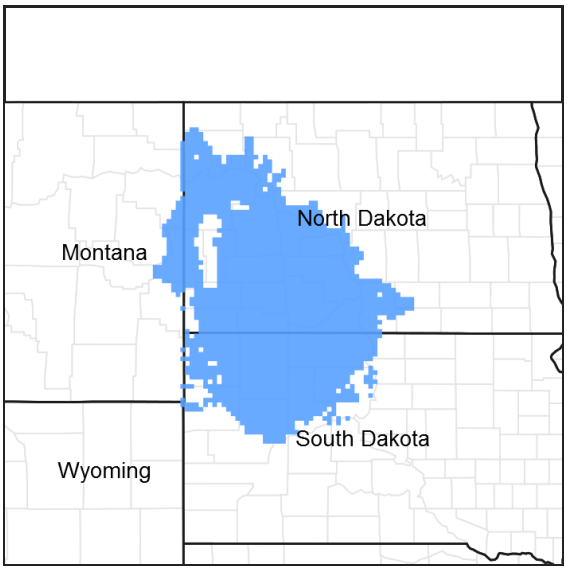


Figure 1. Mapped extent

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): 054X–Rolling Soft Shale Plain

MLRA 54 is a large MLRA covering 29,280 square miles approximately 18.7 million acres. MLRA 54 crosses 3 states with 64% in North Dakota, 33% in South Dakota, and 3% in Montana. Most of the Standing Rock Indian Reservation, and northwest third of the Cheyenne River Indian Reservation and the Grand River National Grasslands.
MLRA 54 is dominantly unglaciated, but the eastern and northern edges have been glaciated. The area is an old, moderately dissected, rolling plain with some local badlands, buttes, and isolated hills. Elevation is 1,650 feet in the east with a gradual slope to 3,600 feet in the west. The Missouri Rivers runs along the north and east side of the MLRA.
The area is underlain by soft, calcareous shales, siltstones and sandstones of the Tertiary Fort Union Formation and the Fox Hills and Hell Creek units.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 43a – Missouri Plateau.

Ecological site concept

Soils are greater than 20 inches deep.

Subsoils are silt loam to clay loam which forms a ribbon 1 inch to less than 2 inches long. Surface textures are loam to silt loam which forms a ribbon 1 inch to less than 2 inches long.
Slopes are 2 to 20 percent.
This site occurs on dry uplands, upslope from Loamy Terraces or Loamy Overflow; down slope from Thin Loamy or Shallow Loamy.
Indicator species are western wheatgrass, some green needlegrass, blue grama with fringed sagewort and western snowberry.

Associated sites

R054XY020ND	**Clayey**
R054XY021ND	**Claypan**
R054XY023ND	**Loamy Overflow**
R054XY026ND	**Sandy**
R054XY030ND	**Shallow Loamy**
R054XY033ND	**Thin Claypan**
R054XY038ND	**Thin Loamy**
R054XY041ND	**Loamy Terrace**

Similar sites

R054XY030ND	**Shallow Loamy** [Somewhat excessively well-drained soils more than 10 less than 20 inches to sedimentary bedrock that restricts root penetration. Surface layer will ribbon less than 2 inches and greater than 1 inch. Upslope from thin loamy or loamy sites and some times down slope form very shallow ecological sites. Indicator species: little bluestem, plains muhly, needle grasses and sideoats grama, with dotted gayfeather, pasqueflower, purple coneflower and purple prairie clover, and shrubs like broom snakeweed. This site has less production, different landscape position, a restrictive layer above twenty inches, more little bluestem, plains muhly, and sideoats grama, less western wheatgrass and green needlegrass.]
R054XY026ND	**Sandy** [Does not receive additional moisture. Found on dry uplands upslope from sandy terraces or loamy overflow sites, down slope from limy sands or shallow sandy sites. Similar landscape position as loamy, sands, clayey sites; will ribbon up to 1 inches. Indicator species are prairie sandreed with western wheatgrass and green needlegrass intermixed. This site has prairie sandreed and sand bluestem; more needleandthread and sedges, less blue grama, green needlegrass and western wheatgrass, similar production, similar landscape position, different soil texture.]
R054XY020ND	**Clayey** [Does not receive additional moisture. Found on dry uplands, upslope from loamy or clayey terraces or loamy overflow sites, down slope from thin loamy, shallow loamy or shallow clayey sites. Similar landscape position as sandy, sands, and loamy sites. Will ribbon greater than 2 inches. Indicator species: dominated by of western wheatgrass and green needlegrass. This site has more green needlegrass and western wheatgrass, similar production, similar landscape position, different soil texture.]
R054XY041ND	**Loamy Terrace** [Well drained soils on a river or stream terrace in a position that will flood occasionally (once in ten years) with no apparent water table. Down slope from loamy, sandy, clayey, and sands, and upslope form subirrigated ecological sites. Indicator species are western wheatgrass evenly mixed with green needlegrass, American vetch, and western snowberry or silver sagebrush, and with possible trees. This site has less western wheatgrass and blue grama, more green needlegrass and big bluestem, more productions and different landscape position that receives extra moisture due to occasional flooding.]

R054XY038ND	**Thin Loamy** [Deep and moderately deep entisols, usually calcareous within 4 inches to the surface, found on knobs and/or sideslopes of hills and buttes. Will form a ribbon greater than 1 inches but not more than 2 inches. Up slope of loamy and down slope of thin loamy or shallow loamy ecological sites. Indicator species: western wheatgrass, little bluestem, plains muhly, porcupinegrass and sideoats grama, with Missouri goldenrod, dotted gayfeather, pasqueflower, purple coneflower and purple prairie clover, and shrubs like winterfat and prairie rose. This site has less production, thin “A” horizon, no mollic epipedon, lime within 6 inches to the surface, more little bluestem, porcupinegrass, plains muhly, sideoats grama, less western wheatgrass and green needlegrass, different landscape positions.]
R054XY021ND	**Claypan** [Well drained soils on uplands or terraces that don’t receive extra moisture with a dense sodic subsoil below 6 inches with salts below 16 inches. Indicator species are western wheatgrass with an understory of blue grama, heath aster, and western yarrow along with a few shrubs of fringed sagewort and Nuttall’s Saltbush. This site has less production, less green needlegrass and shrubs, more blue grama and a dense sodic subsoils layer above 20 inches.]

Table 1. Dominant plant species

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

Physiographic features

This site occurs on gently undulating to rolling sedimentary uplands.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Alluvial flat (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,600–3,600 ft
Slope	2–20%
Water table depth	48–72 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 54 is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA’s location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 14 to 18 inches per year. The normal average annual temperature is about 42° F. January is the coldest month with average temperatures ranging from about 13° F (Beach, ND) to about 16° F (Bison, SD). July is the warmest month with temperatures averaging from about 69° F (Beach, ND) to about 72° F (Timber Lake, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57° F. This large annual range attests to the continental nature of this MLRA's climate. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour 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 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season

plants begin growth in mid May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	117 days
Freeze-free period (average)	126 days
Precipitation total (average)	16 in

Climate stations used

- (1) SIDNEY [USC00247560], Sidney, MT
- (2) FT YATES 4 SW [USC00323207], Fort Yates, ND
- (3) HETTINGER [USC00324178], Hettinger, ND
- (4) DUPREE [USC00392429], Dupree, SD

Influencing water features

No significant water features influence this site.

Soil features

The common features to all soils in this site are the silt loam to clay loam textured subsoils and slopes of 2 to 20 percent. The soils in this site are well drained and formed in soft siltstone, sandstone or alluvium. The loam to silt loam surface layer is 5 to 12 inches thick. The soils have a moderate infiltration rate. Waterflow patterns may be present, and there is a risk of rills and eventually gullies if vegetative cover is not adequate. Cryptobiotic crusts are present, but their function is not well understood. Some pedestalling of plants occurs, but it is not very evident on casual observation and occurs on less than 5% of the 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.

Map unit soil components correlated to this ecological site can be found in Section II of the Natural Resources Conservation Service Field Office Technical Guide or the following web sites:
http://soildatamart.nrcs.usda.gov/
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Residuum–siltstone
Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	20–72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–9 in
Calcium carbonate equivalent (0-40in)	0–10%

Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions, and included natural influence of large herding herbivores and frequent fire. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions the site has the potential to resemble the reference state. Interpretations for this site are based on the Reference State. The Reference State 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 considered. Community phases, community pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience.

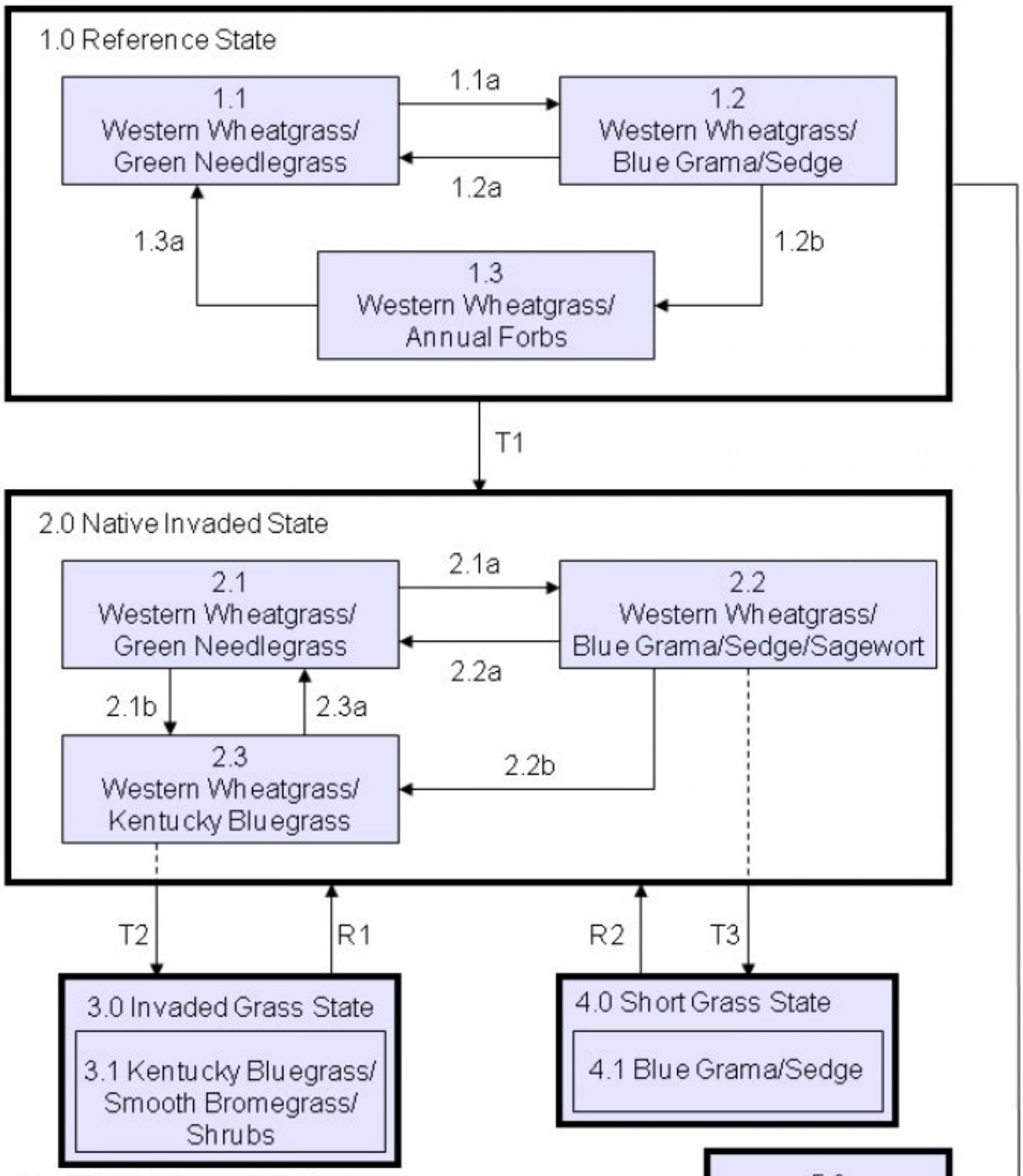
The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightening fires occurred most frequently in July and August while fires started by Native Americans occurred in April, September and October. Large ungulate grazing was heavy and occurred often, but usually for short durations. Grazing may have been severe when occurring after a fire event, or in association with reliable water sources. The grazing and fire interaction especially when coupled with drought events, set up the dynamics discussed and displayed in the following state and transition diagram and descriptions.

This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the reference plant community. Blue grama and Kentucky bluegrass if present, will begin to increase. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama and/or Kentucky bluegrass if present to dominate and pioneer perennials and annuals to increase. The resulting plant community is relatively stable and competitive advantage prevents other species from establishing. Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth bromegrass. Shrubs such as western snowberry increase in this situation, especially in areas prone to snow accumulation and drift.

Due to a general invasion of exotic species (such as Kentucky bluegrass and smooth bromegrass) across the MLRA within this site, returning to the 1.1 Western/Wheatgrass/Green Needlegrass Plant Community Phase may not be possible. Today, the 2.1 Western Wheatgrass/Green Needlegrass Plant Community Phases most resembles the 1.1 Reference Plant Community Phase in appearance and function.

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



Refer to narratives in the Plant Community Section for detailed descriptions of these transitions/pathways. 1.1a – Fall fire followed by intensive grazing; **1.2a** – Return to normal fire & grazing frequencies; **1.2b** – Heavy, short term disturbance by prairie dogs and or long term drought; **1.3a** – Removal of disturbance, return to normal precipitation and disturbance regime; **T1** – Introduction of non-native species; **2.1a** – Heavy, continuous season-long grazing or seasonal grazing; **2.1b** – Non-use, no fire; **2.2a** – Prescribed grazing; **2.2b** – Non-use, no fire; **2.3a** – Prescribed grazing; **T2** – Non-use, no fire; **T3** – Heavy continuous season-long grazing; **T4** – Cessation of annual cropping; **T5** – Long term occupation by prairie dogs; **R1** – Prescribed grazing, prescribed burning with herbicides or range seeding; **R2** – Herbicides and range seeding

State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool season grasses. The primary disturbance mechanisms for this site in the reference condition include frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictate the dynamics that occur within the natural range of variability. Cool season species can decline and a corresponding increase in short warm season grasses will occur.

Community 1.1
Western Wheatgrass/Green Needlegrass

This community phase was the most dominate both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase dominated by cool season grasses such as green needlegrass and western wheatgrass. There were also other needlegrasses and wheatgrasses present as well as small amounts of warm season grasses such as blue grama, sideoats grama, and possibly big bluestem. A variety of leguminous and non-leguminous perennial forbs were present but only in slight amounts. This is the reference plant community phase and is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. This was a naturally nitrogen deficient plant community with a carbon to nitrogen ratio of approximately 40:1. The potential vegetation was about 85% grasses or grass-like plants, 10% forbs, and 5% shrubs. The plant community was dominated by western wheatgrass and green needlegrass. Other grasses and grass-like plants included needleandthread, blue grama, porcupine grass, bearded wheatgrass and sedges. Significant forbs included American vetch, green sagewort, silverleaf scurfpea and Missouri goldenrod. In many areas western snowberry was the principal shrub and occurred in patchy mosaic. In other areas, silver sagebrush was the dominant shrub and occurred more evenly dispersed across the site. Other shrubs included prairie rose, leadplant, winterfat, and fringed sagewort. This plant community was well adapted to the Northern Great Plains climatic conditions. Individual species varied greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow were functioning properly. Plant litter was properly distributed with very little movement off-site and natural plant mortality was very low. Due to the cool-season dominance of this phase, majority of energy capture was primarily in mid- to late spring and early summer. The diversity in plant species allowed for high drought tolerance. Run-off from adjacent sites and moderate or high available water capacity provided a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1265	2148	3025
Forb	115	180	250
Shrub/Vine	20	72	125
Total	**1400**	**2400**	**3400**

Figure 7. Plant community growth curve (percent production by month).

ND5401, Missouri Slope, Native Grasslands, Cool-season Dominant. Cool-season, mid-grass dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 1.2
Western Wheatgrass/Blue Grama/Sedges

This plant community was the result of long-term, heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated spring grazing would have depleted stored carbohydrates, resulting in weakening and eventual decline of the cool-season mid statured bunchgrasses. Blue grama and western wheatgrass were the dominant species, with the appearance of this phase sometimes shifting from a blue grama/western wheatgrass to a western wheatgrass/blue grama. Other grasses and grass-likes included sedges, needleandthread, prairie junegrass and annual grasses. Forbs such as western ragweed, scurfpea, cudweed sagewort and scarlet globemallow may also have been present. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. Due to a decline in the cool-season dominance, energy capture shifted slightly towards early to mid summer. Hydrologic function declined slightly due to reduction in mid statured bunch grasses and increase in blue grama. Bare ground would have increased slightly and litter amounts decreased, resulting in elevated soil surface temperatures. Production was reduced to 85 to 95% of phase 1.1.

Figure 8. Plant community growth curve (percent production by month). ND5404, Missouri Slope, Warm-season Dominant, Cool-season Subdominant. Short warm-season dominant, mid cool-season subdominant & club moss..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	5	20	38	25	8	3	0	0	0

Community 1.3
Western Wheatgrass/Annual Forbs

This plant community phase is characterized by grazing tolerant species and annual forbs. This phase was approximately 30 percent less productive than phase 1.1. Bare ground increased dramatically, litter amounts declined and soil surface temperatures increased. Infiltration rates declined. Less grazing tolerant species were still present but in greatly reduced amounts so this phase still had adequate resilience to return to the 1.1.

Figure 9. Plant community growth curve (percent production by month). ND5407, Missouri Slope, Annual/Pioneer Perennial.. Low successional, cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Pathway 1.1a
Community 1.1 to 1.2

This pathway occurred when events favored the decrease of cool season bunch grasses and the increase of cool season rhizomatous grasses and short statured warm season grasses. Such events included late fall or early spring fires followed by severe grazing. This may have been a common occurrence in the natural range of variability. Spring and early summer drought, especially combined with early season burns or grazing could have also initiated this pathway. Continuous early season burning or continuous early season grazing would also favor this pathway.

Pathway 1.2a
Community 1.2 to 1.1

A reduction in grazing and fire frequency would initiate this pathway. Cool season mid statured bunchgrasses would have regained vigor and the plant community would once again resemble the 1.1 plant community phase.

Pathway 1.2b
Community 1.2 to 1.3

Continued heavy grazing, like that associated with a more permanent water site or short term prairie dog occupation, would have continued to shift the plant community from the one described in phase 1.1 to one characterized by very grazing tolerant western wheatgrass and annual forbs.

Pathway 1.3a
Community 1.3 to 1.1

Removal of the excessive grazing disturbance permitted this plant community to recover the mid statured cool season bunchgrass component and shift towards phase 1.1. This pathway may have resulted from the natural movement of prairie dogs, elimination of the prairie dogs (e.g. plague), or a change grazing patterns relative to the proximity to water.

State 2
Native/Invaded

This state is very similar to the reference state. The invasion of introduced cool season sodgrasses has altered the natural range of variability for this ecological site. This state is still dominated by native cool season grasses, but invasive introduced cool season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing and duration of grazing coupled with weather events dictate the dynamics that occur within this state. The cool season native grass can decline and an increase in introduced sod grasses will occur. Often this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

Community 2.1
Western Wheatgrass/ Green Needlegrass

This community phase most closely resembles the Reference State in appearance and ecological functions (e.g., hydrologic, biotic and soil/site stability). The cool-season dominated community is maintained with grazing systems that allow for adequate recovery periods following grazing events, and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. This community phase closely resembles the Reference State community phase 1.1 (see narrative for 1.1 Western Wheatgrass/Needlegrass). The vegetation is about 85% grasses or grass-like plants, 10% forbs, and 5% shrubs (by weight) with western wheatgrass constituting about 30% of the canopy cover and green needle grass making up about 18% of the canopy cover. The basic difference between this community phase and 1.1 of the Reference State is the presence of minor amounts of introduced cool-season grasses and forbs. This is likely a naturally nitrogen deficient plant community, but perhaps less so than the Reference State. A change in the nutrient cycle on this ecological site is possibly due to the introduction of non-native species and may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.

Figure 10. Plant community growth curve (percent production by month). ND5401, Missouri Slope, Native Grasslands, Cool-season Dominant. Cool-

season, mid-grass dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 2.2
Western Wheatgrass/Blue Grama/Sedge/Sagewort

This community phase occurs when natural or management actions favor the development of a sodgrass community. It is dominated by western wheatgrass, blue grama, upland sedges and fringed sagewort. Western wheatgrass would make up approximately 25 – 30 percent of the canopy cover, blue grama 20 – 25 percent, needleandthread 15 – 20 percent and threadleaf sedge 5 – 10 percent of the canopy cover. Both tap rooted and fibrous rooted perennial forbs increase in this phase, but remain a minor component. Nutrient cycling declines due to a lack of deep root grasses, higher soil surface temperatures due to lack of plant cover, and lack of leguminous forbs, Water cycling also declines due to a decrease in the rooting depth of the plant community, increase in percent of bare ground, and increased soil surface temperatures. These changes result in a plant community producing approximately 60 – 80 percent of biomass produced by phase 1.1.

Community 2.3
Western Wheatgrass/Kentucky Bluegrass

This community phase is characterized by an increase in the introduced cool season sodgrass, Kentucky bluegrass. Western wheatgrass and green needlegrass are secondary species. Warm season grasses are present in minor amounts and tap rooted perennial forbs have decreased. Production and infiltration both decrease and this community phase is at risk of transitioning across a state threshold. With natural or management actions that decrease the composition of the cool season bunchgrasses and increase the composition of Kentucky bluegrass, transition T2 will be initiated.

Figure 11. Plant community growth curve (percent production by month). ND5401, Missouri Slope, Native Grasslands, Cool-season Dominant. Cool-season, mid-grass dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Pathway 2.1a
Community 2.1 to 2.2

Western Wheatgrass/ Green Needlegrass

Western Wheatgrass/Blue Grama/Sedge/Sagewort

Several combinations of events can occur to initiate this pathway. Continuous, heavy season-long grazing or heavy seasonal grazing will favor the shift to sod forming grasses and sedges. Along this pathway, the timing of energy capture shifts from spring and early summer to early spring and mid summer. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling is restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Plant community diversity is reduced with a loss of leguminous forbs and minor grass components.

Pathway 2.1b
Community 2.1 to 2.3

This pathway is initiated with any management action that allows the introduced Kentucky bluegrass to increase. Heavy late season or chronic season long grazing will favor this change. Total rest from grazing and no fire events will also initiate this pathway. The change in plant functional and structural groups and the composition and distribution of the vegetation causes a decrease in production and an increase in runoff with a corresponding decrease in infiltration. Nutrient cycling in restricted as the rooting depth of the vegetation decreases with the change in functional and structural groups. Available nitrogen increases due to invasive legumes (black medic and sweetclover) altering the carbon to nitrogen ratio, favoring non-native, nitrogen dependent species such as Kentucky bluegrass.

Pathway 2.2a
Community 2.2 to 2.1

Western Wheatgrass/Blue Grama/Sedge/Sagewort

Western Wheatgrass/ Green Needlegrass

This community pathway is initiated by implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage from the introduced cool-season species to the native cool-season bunchgrasses. The addition of prescribed burning may expedite this shift. As this pathway continues, the change in composition and distribution of the plant community will increase infiltration and reduce runoff.

Pathway 2.2b
Community 2.2 to 2.3

Complete rest from grazing and no fire events will initiate this pathway. As plant litter accumulates, the competitive advantage is shifted from the native species to the invasive cool season grasses. Shrubs will also begin to increase within this phase. Infiltration rates will begin to decline as deeper rooted native species are replaced by the shallow rooted non-native cool season grasses.

State 3
Invaded

This state is the result of invasion and dominance of Kentucky bluegrass and/or smooth brome. This state is characterized by these two species and an increasing thatch layer that effectively blocks introduction of other plants into the system. Once the state is well established, single disturbance events such as high intensity fires or severe grazing, will not result in more than a very short term reduction of these two species. These events may reduce the dominance of the sodgrasses, but due to the large amount of rhizomes in the soil there is no opportunity for the native species to establish and dominate before the sodgrasses rebound and again dominate the system.

Community 3.1
Introduced Bluegrass/Smooth Bromegrass/Shrubs

This plant community develops after an extended period of 10 or more years of non-use by herbivores and exclusion of fire. Non-native grasses, such as Kentucky bluegrass, crested wheatgrass, and smooth brome tend to invade and may dominate this plant community. Other grasses present in greatly reduced amounts include western wheatgrass, porcupine grass, green needlegrass, and bearded wheatgrass. The common forbs include sweetclover, green sagewort, cudweed sagewort, and American vetch. Western snowberry is the principal shrub and tends to increase in density and cover. Litter buildup reduces plant vigor and density, and native seedling recruitment declines. Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers, native rhizomatous grasses are limited to small colonies, and short statured warm season grasses essentially disappear. Production is reduced to 70 – 80 percent of phase 2.1. This plant community phase is very resistant to change. Soil erosion is low. This plant community can occur in grazed pastures, and is most commonly found in areas most distant from water. This is a typical pattern found in properly stocked pastures grazed season-long.

Figure 12. Plant community growth curve (percent production by month). ND5406, Missouri Slope, Introduced Cool-season Grasses. Introduced cool-season grasses.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	35	35	5	2	8	2	0	0

State 4
Shortgrass

This state is the result of long term repeated disturbances such as long-term drought coupled with severe defoliation or severe long-term defoliation when site is located next to perennial water sources. Repeated disturbances deplete stored carbohydrates, resulting in weakening and eventual death of the cool season mid-grasses resulting is a shift to community phases dominated by short grasses and forbs.

Community 4.1
Blue Grama/Sedge Plant Community

This plant community is the result of heavy, continuous grazing and/or annual, early spring seasonal grazing. Repeated spring grazing depletes stored carbohydrates, resulting in weakening and eventual death of the cool season mid-grasses. Visually and by weight, blue grama and sedge are the dominant species. By canopy cover, blue grama would constitute 3 – 5% while sedges would be 5 -10%. Some western wheatgrass may still be present in the community but the needlegrasses have been greatly reduced. In the western portion of the MLRA, clubmoss may be subdominant (15 – 20 % cover) or possibly dominate by cover (40 – 60%). Other grasses and grass-likes include western wheatgrass (5 – 10% cover), needleandthread (5 – 10% cover), prairie junegrass and annual grasses. Forbs such as western ragweed, scurfpea, cudweed sagewort and scarlet globemallow may also be present. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur. This plant community is 40 to 50% less productive than the reference plant community. Reduced litter and plant vigor result in higher soil temperatures, lowered infiltration rates, and high evapotranspiration rates which gives blue grama a competitive advantage over cool season mid-grasses.

Figure 13. Plant community growth curve (percent production by month). ND5405, Missouri Slope, Warm-season Short Grass. Warm-season, short grass dominant, and some sedge.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	7	18	33	26	10	4	1	0	0

Transition T1
State 1 to 2

This is the transition from the native grass dominated reference state to a state that has been invaded by introduced cool-season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of warm and cool season bunch grasses and an increase in cool-season sodgrasses. This transition is compounded by a change in the historic grazing and fire regime where native herbivores would follow periodic fires with grazing. This historic grazing/fire sequence has

largely been replaced by chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass, smooth brome, and other introduced species become established on the site. These species typically are part of functional/structural groups that were not present in the Reference State.

Transition T2
State 2 to 3

Complete rest from grazing and elimination of fire are the two major contributors to this transition, especially when smooth brome is present. Preliminary studies indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green up 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, energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by root depth of the dominate species.

Transition T3
State 2 to 4

Heavy, continuous season-long grazing shifts the competitive advantage to the highly grazing tolerant short grass and grass-like species. Reduced litter amounts, elevated surface temps and a reduced infiltration combine to favor drought tolerant, short statured species.

Restoration pathway R1
State 3 to 2

This restoration pathway may be initiated with the combination of prescribed burning followed by high levels of prescribed grazing management. The success of this restoration pathway depends on the presence of a remnant population of native grasses in community phase 3.1. This remnant population may not be readily apparent without close inspection. The application of prescribed burning may be needed at relatively short intervals in the early phases of this restoration process. Some previous efforts have shown promise with early season prescribed burning; however, fall burning may also be effective under certain circumstances. Both prescribed grazing and prescribed burning are necessary to successfully initiate this restoration pathway.

Restoration pathway R2
State 4 to 2

Due to the absence of cool season bunchgrasses within phase 4.1, restoration of this community phase to one resembling that of State 2 would require range seeding possibly combined with some type of mechanical treatment.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				960–1440	
	western wheatgrass	PASM	*Pascopyrum smithii*	480–720	–
	green needlegrass	NAVI4	*Nassella viridula*	360–480	–
	blue grama	BOGR2	*Bouteloua gracilis*	120–240	–
2				120–240	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	120–240	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	48–168	–

	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	24–120	–
3	**Other Native Grasses**			24–240	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–120	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	24–120	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–120	–
	Sandberg bluegrass	POSE	*Poa secunda*	24–120	–
	big bluestem	ANGE	*Andropogon gerardii*	0–120	–
	Grass, perennial	2GP	*Grass, perennial*	0–72	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–24	–
4	**Grass-Likes**			24–120	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	24–120	–
	needleleaf sedge	CADU6	*Carex duriuscula*	24–120	–
	threadleaf sedge	CAFI	*Carex filifolia*	24–120	–
Forb					
6	**Forbs**			120–240	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	0–72	–
	common yarrow	ACMI2	*Achillea millefolium*	24–48	–
	dotted blazing star	LIPU	*Liatris punctata*	0–48	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–48	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–48	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	24–48	–
	purple prairie clover	DAPU5	*Dalea purpurea*	24–48	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–48	–
	American vetch	VIAM	*Vicia americana*	24–48	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	24–48	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	24–48	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–48	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–24	–
	old man's whiskers	GETR	*Geum triflorum*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	onion	ALLIU	*Allium*	0–24	–
Shrub/Vine					
7	**Shrubs**			24–120	
	Subshrub (<.5m)	2SUBS	*Subshrub (<.5m)*	0–48	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–48	–
	prairie sagewort	ARFR4	*Artemisia frigida*	24–48	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	24–48	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–24	–
	prairie rose	ROAR3	*Rosa arkansana*	0–24	–
	leadplant	AMCA6	*Amorpha canescens*	0–24	–

Table 7. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)

Animal community

Animal Community – Wildlife Interpretations
1.1 Western Wheatgrass/Needlegrass Plant Community Phase: The predominance of grasses plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as bison, deer, and antelope. Large animal nutrition levels are relatively high year-long with the diversity of grasses, grasslikes, forbs and shrubs. Suitable thermal cover for large herbivores may be limited due to the low quantities of shrubs. The complex plant structural diversity provides habitat for a wide array of small mammals and neotropical migratory birds. Sites adjacent to woody vegetative states may provide foraging and roosting areas for sharp-tailed grouse, as well as potential lek sites. Many small mammals would occur here, including coyote, badger, ground squirrels and jackrabbit. Diverse prey populations are available for raptors such as ferrugious hawk, prairie falcon, golden eagle and Swainson ’s hawk. The mix of grass stature along with scattered shrubs and a variety of forbs provide habitat for many bird species including the western meadowlark, bobolink, baird’s sparrow, savannah sparrow, and chestnut-collared longspur.

1.2 Western Wheatgrass/Blue Grama/Sedge Plant Community Phase: The loss of structural diversity makes this plant community somewhat less attractive to the diverse wildlife species using the Western Wheatgrass/Green Needlegrass Plant Community. This plant community provides limited foraging for antelope and deer due to loss of production. A decrease in residual plant material and litter cover makes this community less attractive for ground-nesting birds. Some prairie bird species, such as lark bunting, grasshopper sparrow, upland sandpiper, and marbled godwit, will benefit from the low structure as foraging sites. Some small mammals such as ground squirrels and fox would benefit from the reduced cover. Upland game-bird habitat quality would be less desirable than the HCPC due to less escape cover. Generally, this plant community is not a target for wildlife habitat management.

3.1 Kentucky Bluegrass/Smooth Bromegrass/Shrubs Plant Community Phase: The lack of diversity among plant species subsequently results in lack of diversity among animal species. Abundant litter accumulations favor rodent populations, such as field mice, and their predator species, such as coyotes, raptors, and snakes. The increase in shrub stands will provide concealment cover from predators for a number of wildlife species including upland game birds, new-born deer fawn and antelope kids. The community may be used for roosting or bedding areas by some birds and larger ungulates in association with their primary habitat. Bird species that are attracted to high ground cover and abundant litter would benefit such as bobolink, western meadowlark, and northern harrier.

5.0 Annual/Pioneer Perennial Introduced: Sparse vegetation and greater coverage of bare ground provides suitable habitat for killdeer, horned larks, lark buntings, and cowbirds. This plant community is beneficial to species, such as the prairie dog and ground squirrel, which have low vegetative cover requirements. Other wildlife species, such as the burrowing owl, prairie rattlesnake, and black-footed ferret, benefit from the subterranean structures created by the burrowing animals. Many native grassland wildlife species are directly or indirectly reliant on prairie dog habitat. Such habitat plays an important role in the overall functioning of the prairie ecosystem.

Animal Community – Grazing Interpretations
This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle but other domestic grazers with differing diet preferences may also be a consideration depending upon management objectives. Often, the current plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

Hydrological functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic groups B, with localized areas in hydrologic group C. Infiltration varies from moderately slow to moderately rapid and runoff potential varies from negligible to high for this site depending on soil hydrologic group and ground cover.

In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where shortgrasses form a dense sod and dominate the site. Areas where ground cover is less than 50% 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 opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the 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 and other inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists. Those involved in developing this site description include: Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; Stan Boltz, NRCS Range Management Specialist; Darrell Vanderbusch, NRCS Resource Soil Scientist; L. Michael Stirling, NRCS Range Management Specialist; Dean Chamrad, NRCS State Range Management Specialist; Josh Saunders, NRCS Range Management Specialist; Kevin Sedivec, Extension Rangeland Management Specialist; Michael D. Brand, State Land Dept. Director Surface Management; David Dewald, NRCS State Biologist; and Brad Podoll, NRCS Biologist.
Data Source Number of Records Sample Period State County
SCS-RANGE-417 27 1968 – 1986 ND; SD Adams, Emmons, Grant,
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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.

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Date	05/12/2011
Approved by	Jeff Printz
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 is 10 to 15%. Bare ground will occur as small areas 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. Existing gullies should be “healed” with a good vegetative cover.

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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):** Plant cover and litter is at 85% or greater of soil surface and maintains soil surface integrity. Stability class anticipated to be 5 or greater.

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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, color and structure 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: High grass canopy and basal cover and small gaps between plants should reduce raindrop impact and slow overland flow, providing increased time for infiltration to occur. Healthy, deep rooted native grasses enhance infiltration and reduce runoff. Infiltration rate is moderate.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be evident.

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

    Dominant: Mid, cool-season rhizomatous grasses = mid, cool-season bunchgrasses

    Sub-dominant: > short, warm-season grasses = forbs > grass-likes = shrubs >

    Other: short, cool-season bunchgrasses

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

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very low.

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14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 2400 lbs/ac with a range of 1400 lbs/ac to 3400 lbs/ac (air dry weight) depending upon growing conditions.

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

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