Ecological site R056AY104ND
Choppy Sands

Accessed: 04/19/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 48a Glacial Lake Agassiz Basin; 48b Beach Ridges and Sand Deltas; 48c Saline Area; 48d Lake Agassiz Plains.

Associated sites

R056AY090ND	**Sands**
R056AY091ND	**Sandy**
R056AY096ND	**Subirrigated Sands**

Similar sites

R056AY090ND	**Sands**

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Calamovilfa longifolia*

Physiographic features

This site typically occurs on rolling to very steep uplands

Table 2. Representative physiographic features

Landforms	(1) Lake plain
Flooding frequency	None
Ponding frequency	None
Elevation	650–1,000 ft
Slope	15–45%
Water table depth	0–60 in

Aspect	Aspect is not a significant factor

Climatic features

MLRA 56 is considered to have a continental climate – cold winters and relatively hot summers, low to moderate humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the northern Great Plains and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 18 to 23 inches per year. The average annual temperature is about 40°F. January is the coldest month with average temperatures ranging from about 1°F (Pembina, North Dakota (ND)) to about 11°F (Wheaton, Minnesota (MN)). July is the warmest month with temperatures averaging from about 68°F (Pembina, ND) to about 73°F (Wheaton, MN). The range of normal average monthly temperatures between the coldest and warmest months is about 65°F. This large annual range attests to the continental nature of this area's climate. Winds are estimated to average about 13 miles per hour annually, ranging from about 15 miles per hour during the spring to about 11 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 cool season plants begins in early to mid March, slowing or ceasing in late June. Warm season plants begin growth about mid May and continue to early or mid September. Green up of cool season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	143 days
Freeze-free period (average)	162 days
Precipitation total (average)	23 in

Influencing water features

No significant water features influence this site.

Soil features

These soils are deep to very deep, somewhat excessive to excessively drained, and coarse textured. Saturated hydraulic conductivity is rapid to very rapid and available water capacity is very low to moderate. Salinity and sodicity is none. This site is on side slopes and ridges on moderately sloping to very steep eolian sands. Slope ranges from 15 to 45 percent. It is not uncommon to have slight pedestalling of plants due to the inherent instability of the soils. Due to inherent high infiltration rates of these soils, water flow paths are very short, irregular in appearance or discontinuous. There is a risk of rills, and eventually gullies, if vegetative cover is not adequate. Wind erosion is the greatest risk.

Major soil series 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 site:
http://www.nrcs.usda.gov/technical/efotg/

Table 4. Representative soil features

Surface texture	(1) Fine sand (2) Loamy sand (3) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid

Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3 in
Calcium carbonate equivalent (0-40in)	0–3%
Electrical conductivity (0-40in)	0–3 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

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 Sand Bluestem/Prairie Sandreed/Prairie Junegrass/Bur Oak Plant Community Phase (1.1). 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.

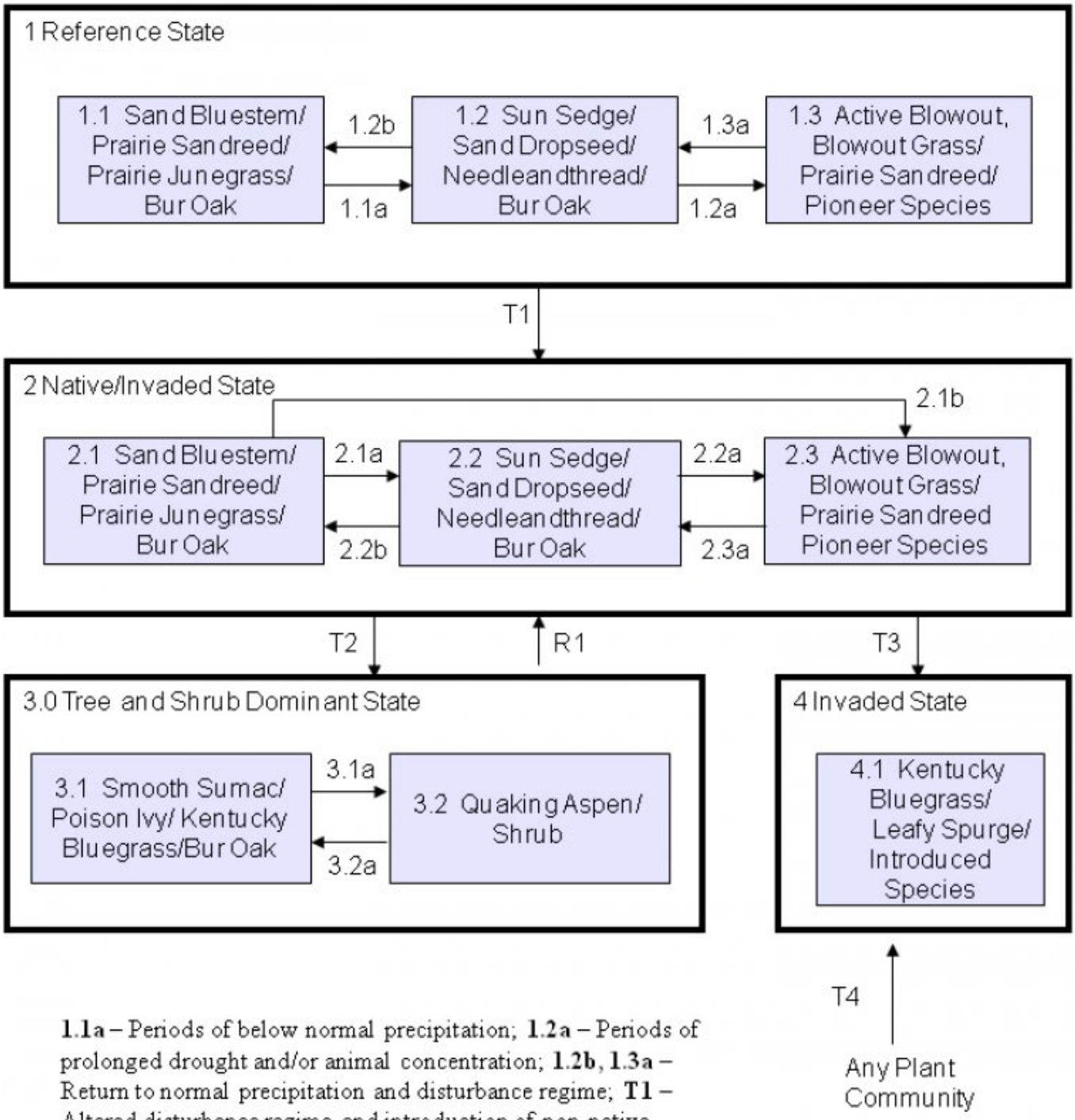
The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightening fires occurred most frequently in July and August while 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. 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, elimination of fire, and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy season-long grazing, without adequate recovery periods following each grazing occurrence, causes this site to depart from the reference plant community. Sun sedge, sand dropseed, needleandthread and Kentucky bluegrass if present, will begin to increase. Sand bluestem, prairie sandreed and prairie Junegrass will decrease in frequency and production. Needleandthread will increase initially and then begin to decrease. In time, heavy continuous grazing will likely cause upland sedges, sand dropseed, blue grama and/or Kentucky bluegrass, if present, to dominate and pioneer perennials and annuals to increase. Bare ground and basal gaps will increase creating the potential for active wind erosion and the establishment of blowouts. Extended periods of non-use and/or lack of fire will result in a plant community shift from an herbaceous dominated community to a community dominated by shrubs such as smooth sumac and poison ivy. Kentucky bluegrass may dominate the remaining herbaceous plant community.

Due to a general invasion of exotic species (such as Kentucky bluegrass and smooth bromegrass) across the MLRA within his site, returning to the 1.1 Sand Bluestem/Prairie Sandreed/Prairie Junegrass/Bur Oak Plant Community Phase may not be possible. Today, the 2.1 Sand Bluestem/Prairie Sandreed/Prairie Junegrass/Bur Oak 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



1.1a – Periods of below normal precipitation; **1.2a** – Periods of prolonged drought and/or animal concentration; **1.2b**, **1.3a** – Return to normal precipitation and disturbance regime; **T1** – Altered disturbance regime and introduction of non-native species; **2.1a** – Season-long grazing and/or periods of below normal precipitation; **2.2a** – Excessive disturbance (i.e. off-road vehicle) and/or prolonged drought; **2.2b** – Prescribed grazing; **2.3a** – Return to normal precipitation, prescribed grazing; **T2** – Non-use, no fire; **3.1a** - no fire or grazing; **3.2a** – long-term absence of fire ; **R1** – brush control (herbicide, mechanical, prescribed fire), range seeding; **T3** – Dominance by invasive species; **T4** – Cropped go-back with continuous grazing.

State 1
Reference

Transition from Reference State (State 1) T1 to Native/Invaded State (State 2) This state represents the natural range of variability that dominated the dynamics of this ecological site. This state was dominated by warm-season grasses with minor amounts of cool-season grasses and forbs. The primary disturbance mechanisms for this site in the reference condition included frequent fire and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Mid and tall statured grass species would have declined with a corresponding increase in short statured warm-season grasses and cool-season grass-like species. Due to their fire tolerance, scattered, single stem oak trees would have been present on the site in all plant community phases. However, oak regeneration would have been reduced in the active blowout phase. Blowouts would have occurred as a result of prolonged drought and/or adjacent to areas of high animal impact, such as near perennial water sources. Slight shifts would have occurred in the timing of energy capture, hydrologic function and nutrient cycling between plant community phases 1.1 and 1.2 within State 1. Hydrologic function, energy capture and nutrient cycling would have been reduced in community phase 1.3 but would not have departed beyond the point of recovery.

Community 1.1
Sand Bluestem/Prairie Sandreed/Prairie Junegrass/Bur Oak

This community phase was the most dominant both temporally and spatially. The prevailing climate and weather patterns favored the development of this community phase. Tall statured warm-season grasses such as sand bluestem and prairie sandreed would have been co-dominant with mid statured warm- cool-season grasses such as needleandthread, porcupine grass, and little bluestem Other grasses and grass-likes species would have included sideoats grama, Canada wildrye, sand dropseed, prairie Junegrass, blue grama, and sun sedge. A variety of perennial forbs including bracted spiderwort, dotted gayfeather, goldenrod, green sagewort, hairy goldaster, silky prairie clover and sunflower were present. Shrubs included fringed sagewort, leadplant, Juneberry, chokecherry, smooth sumac and rose. In this community phase, grasses and grass-likes would have constituted about 85 to 95 percent, forbs 5 to 10 percent, shrubs 5 to 10 percent and trees 1 to 5 percent of the annual production. Single stemmed oaks would have been scattered across the site with oak mottes occurring on some north facing slopes. These mottes were dominated by bur oak trees of varying age class with an herbaceous understory of Sprengel's sedge. This represents the plant community phase upon which interpretations are primarily based and is described

in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. Community dynamics, nutrient cycling, water cycle and energy flow were functioning at near optimum levels. A good component of bunchgrasses, minimal bare ground, plant litter in contact with the soil surface, soil texture and deep rooted plants would have resulted in high infiltration rates and minimal runoff. Due to the balance between warm and cool season grasses, energy capture would have been spread across the entire growing season. Natural plant mortality was low. The diversity in plant species allowed for high drought tolerance. Bare ground was 15 percent or less, occurring in small, non-connected patches. Average soil stability readings would have been 5 or greater.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1300	1785	2270
Shrub/Vine	100	157	215
Forb	100	158	215
Total	**1500**	**2100**	**2700**

Figure 5. Plant community growth curve (percent production by month). ND5604, Red River Valley of the North, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

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 1.2
Sun Sedge/Sand Dropseed/Needleandthread/Bur Oak

Grasses and grass-like species would have still dominated this phase but the overall productivity of these species would have been reduced and the number and amount of forbs would have increased. Needleandthread, blue grama, sand dropseed and sedges would have increased. Prairie sandreed and the bluestems would have decreased but still would have been present. Forb species such as green sagewort, goldenrod, western ragweed, western yarrow and prairie coneflower would have increased. Regeneration of bur oak was reduced. The shift to the shallower rooted, short statured blue grama and sedges, coupled with an increase in bare ground, results in higher soil surface temperatures as compared to plant community phase 1.1. Due to soil texture, infiltration rates would have been similar to community phase 1.1. While the timing of energy capture would have remained similar to that of plant community phase 1.1, total energy capture may have been slightly reduced due to a decrease in overall leaf area.

Figure 6. Plant community growth curve (percent production by month). ND5602, Red River Valley of the North, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	23	42	15	5	4	1	0	0

Community 1.3
Active Blowout/Blowout Grass/Prairie Sandreed/Pioneer Species

This plant community phase was not stable. It consisted of bare areas that were continually eroded by wind. Vegetation was spare and scattered. Patches of sand bluestem and prairie sandreed would have been scattered across the site with blowout grass and other pioneer perennial and annual species such as sand bur and annual sunflower, comprising the majority of the vegetation. Active wind erosion was very evident with soil deposition on leeward side of blowouts common. Excessive soil erosion in isolated instances may result in a change in ecological site depending upon depth to water table. As erosion progresses, subirrigated sands and/or subirrigated ecological sites may develop within the choppy sands ecological site complex. Annual production, plant litter, and energy capture would have been greatly reduced as compared to plant community phase 1.1. Bare ground would have exceeded 90 percent.

Pathway 1.1a
Community 1.1 to 1.2

This pathway was initiated by prolonged drought and may have been intensified by repeated heavy grazing, either due to proximity to water or following short term fire intervals followed by intense grazing. The competitive advantage shifted to the more grazing tolerant mid statured bunchgrasses such as needleandthread and sand dropseed, short statured grass-likes and warm-season short statured grasses like blue grama.

Pathway 1.2b
Community 1.2 to 1.1

A return to normal precipitation patterns, grazing and fire regime would have allowed for recovery of tall statured warm-season species and mid statured warm- and cool-season bunch grasses. As the plant community recovered, basal gaps would have decreased and plant litter would have increased.

Pathway 1.2a
Community 1.2 to 1.3

Excessive disturbances such as prolonged drought, wildlife trailing or burrowing, heavy grazing by wildlife due to proximity to a perennial water source, would have significantly reduced perennial plant cover, reduced soil surface cover and increased basal gap distance. This, coupled with the repeated disturbances, would have increased the amount of soil erosion due to wind resulting in a blowout condition. These blowouts may have been relatively small and isolated or depending upon the extent of the disturbance mechanism (i.e. long term drought), covered larger areas.

Pathway 1.3a
Community 1.3 to 1.2

Several years of normal or above normal precipitation and a reduction or elimination of the grazing disturbance would have allowed the sand bluestem, blowout grass and pioneer annuals and perennials to increase in number and extent. This additional cover (plant litter and basal) would have altered the wind patterns at the soil surface and the site/community would shift toward community phase 1.2

State 2
Native/Invaded

This state is similar to the reference state in appearance and function. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site. This state still has a strong component of warm and cool season grass species, but invasive introduced cool-season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include periods of above and below normal precipitation, grazing by domestic livestock, and rare to infrequent fire. Periods of above normal precipitation facilitate the invasion and expansion of the introduced species. Due to the reduction in fire frequency, the oak mottes increase in canopy cover, allowing the establishment of more shade tolerant shrub and trees species.

Community 2.1
Sand Bluestem/ Prairie Sandreed/Prairie Junegrass/Bur Oak

This community phase most closely resembles plant phase 1.1 in appearance and ecological function (e.g., hydrologic, biotic and soil/site stability). This 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. Tall statured warm-season grasses such as sand bluestem and prairie sandreed are co-dominant with mid statured warm- and cool-season grasses such as needleandthread, porcupine grass, little bluestem, sideoats grama, and sand dropseed. Other grasses and grass-likes species include Canada wildrye, prairie Junegrass, blue grama, and sun sedge. Trace amounts of Kentucky bluegrass and/or other introduced grasses and/or forbs are also present. A variety of perennial forbs including bracted spiderwort, dotted gayfeather, goldenrod, green sagewort, hairy goldaster, silky purple prairie clover and sunflower are present. Shrubs include fringed sagewort, Juneberry, chokecherry, leadplant and rose. In this community phase, grasses and grass-likes constitute about 85 to 95 percent, forbs 5 to 10 percent, shrub 5 to 10 percent and trees are 1 to 5 percent of the annual production. This plant community phase is described in the “Plant Community Composition and Group Annual Production” portion of this ecological site description. 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. The ecological processes are functioning at levels very close to those of plant community phase 1.1. Slight departure may be noted within the functional/structural indicator due to the presence of a functional/structural group(s) not expected for the site. Due to the harvesting of oak trees during settlement, the majority of oaks found in this state are multi-stemmed. Due to the altered fire regime, oak mottes on north facing slopes have increased in size and canopy cover.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1300	1785	2270
Shrub/Vine	100	157	215
Forb	100	158	215
Total	**1500**	**2100**	**2700**

Figure 8. Plant community growth curve (percent production by month). ND5604, Red River Valley of the North, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

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 2.2
Sun Sedge/Sand Dropseed/Needleandthread/Bur Oak

Grasses and grass-like species still dominate this phase but the overall productivity of these species is reduced and the number and amount of forbs has increased. Prairie sandreed, sand bluestem, sideoats grama, little bluestem and porcupine grass decrease but are still present. Short statured grasses such as blue grama, and grass-likes as well as sand dropseed and Kentucky bluegrass increase in amount and extent. Forbs such as green sagewort, goldenrod, western ragweed, western yarrow and prairie coneflower also increase. Invasive forbs such as leafy spurge may be present in small, isolated patches. Oak regeneration is somewhat reduced. The shift to the shallower rooted, short statured blue grama and sedges coupled with an increase in bare ground results in higher soil surface temperatures as compared to plant community phase 1.1. Due to soil texture, infiltration rates would be similar to community phase 1.1. While the timing of energy capture would remain similar to that of plant community phase 1.1, total energy capture is slightly reduced due to a decrease in overall leaf area.

Figure 9. Plant community growth curve (percent production by month). ND5602, Red River Valley of the North, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	23	42	15	5	4	1	0	0

Community 2.3
Active Blowout/Blowout Grass/Prairie Sandreed/Pioneer Species

This plant community phase is unstable. It consists of bare areas that were continually eroded by wind. Vegetation is spare and scattered. Patches of sand bluestem and prairie sandreed may be scattered across the site with blowout grass and other pioneer perennial and annual species like sandbur comprising the majority of the vegetation. Introduced forbs such as leafy spurge and Russian thistle may be present. Bare ground is common (greater than 95 percent) and with active wind erosion very evident. Soil deposition on leeward side of blowouts is common. This community phase generally occupies small, isolated areas (2 acres or less).

Pathway 2.1a
Community 2.1 to 2.2

Season-long grazing will shift the competitive advantage away from the tall warm-season rhizomatous grasses and mid statured warm- and cool-season grasses to more grazing tolerant short statured grasses, grass-likes and forbs.

Periods of below normal precipitation will intensify the impact of the grazing and further facilitate this transition. Prolonged periods of drought would also result in this shift, with or without the grazing pressure.

Pathway 2.1b
Community 2.1 to 2.3

Sand Bluestem/ Prairie Sandreed/Prairie Junegrass/Bur Oak

Active Blowout/Blowout Grass/Prairie Sandreed/Pioneer Species

Excessive disturbance related to off road vehicle use or livestock trailing removes plant cover resulting in a direct shift to plant community phase 2.3.

Pathway 2.2a
Community 2.2 to 2.1

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 away from the introduced cool-season species and back to the tall statured warm-season rhizomatous grasses and mid statured warm- and cool-season grasses. The addition of properly timed prescribed burning may expedite this shift.

Conservation practices

Prescribed Burning

Pathway 2.2b
Community 2.2 to 2.3

Excessive disturbances such as livestock trailing/loafing due to proximity to a perennial water source or off road vehicle use and/or prolonged drought would significantly reduce perennial plant cover, reduce soil surface cover and increase basal gaps. This, coupled with the repeated disturbances, increases the amount of wind erosion resulting in a blowout condition.

Pathway 2.3a
Community 2.3 to 2.2

Implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources will allow the remaining vegetation to re-colonize and stabilize the site. Depending upon the level of grazing management, fencing, seeding, mulching and complete deferment of the site for a couple of growing seasons may be necessary to speed the transition. Variation in seasonal precipitation may speed or delay recovery.

Conservation practices

Prescribed Grazing

State 3
Tree and Shrub Dominant

The appearance of this state is characterized by a shift in dominance from herbaceous to shrub and tree species with lesser amounts of grass and forbs. Smooth sumac or poison ivy become the dominant shrubs within the herbaceous portion of the site. Remnant warm- and cool-season grasses and forbs are still found within these shrubs but in reduced amounts due to increased shading. Kentucky bluegrass is present but may or may not be the

dominant herbaceous species. Chokecherry and Juneberry thickets become more common near the edges of the oak mottes as do young trees such as green ash and hackberry.

Community 3.1
Smooth Sumac/Poison Ivy/Kentucky Bluegrass/Bur Oak

This plant community phase represents the shift from a herbaceous dominated plant community with scattered oaks and oak mottes to one dominated by shrubs such as smooth sumac or poison ivy with a herbaceous understory dominated by Kentucky bluegrass and leafy spurge. Remnant native grasses and grass-likes would include sand dropseed, needleandthread, blue grama and sun sedge. Forbs would include western ragweed, green sagewort, and cudweed sagewort. As the canopy cover of this shrub layer increases, the herbaceous plant community shifts from the remnant warm- and cool-season native species to the more shade tolerant Kentucky bluegrass. Existing oak mottes would increase in size as shrubs such as Juneberry, chokecherry, and western snowberry, usually associated with the exterior fringe of the oak motte, expand outward into the adjacent herbaceous dominated plant community. As the shrub component increases, herbaceous production declines. This, combined with the shading effect of the shrubs, limits the effectiveness of prescribed burning as a restoration tool. This plant community phase represents a major shift from the reference plant community in functional/structural plant groups. Energy capture has shifted from spring and summer to mid spring and early summer.

Community 3.2
Quaking Aspen/Shrub

Increasing tree and shrub canopy cover will eventually suppress oak regeneration, allowing more shade tolerant species such as basswood and green ash to increase. Red cedar and buckhorn may also invade. Quaking aspen may also invade onto the site from adjacent subirrigated sands and subirrigated ecological sites.

Pathway 3.1a
Community 3.1 to 3.2

Smooth Sumac/Poison Ivy/Kentucky Bluegrass/Bur Oak

Quaking Aspen/Shrub

Lack of disturbance, primarily fire, shifts the competitive advantage to the taller, fast growing tree species such as quaking aspen. As aspen canopy increases, shade tolerant understory species increase. Increased canopy cover also serves to further decrease fire intensity and frequency.

Pathway 3.2a
Community 3.2 to 3.1

Quaking Aspen/Shrub

Smooth Sumac/Poison Ivy/Kentucky Bluegrass/Bur Oak

Long-term absence of fire results lack of quaking aspen regeneration. Over mature aspen trees become decadent and eventually die resulting in a more open canopy which shifts the plant community towards 3.1.

State 4
Invaded

This state is characterized by an almost total dominance of introduced grass and forb species. Remnant native species may still be found on the site but in only minor amounts. Once established, this is a very stable state.

Community 4.1
Kentucky Bluegrass/Leafy Spurge/Introduced Species

This community phase is recognized by the dominance of Kentucky bluegrass and leafy spurge. The lack of disturbance allows plant litter amounts to increase further shifting the competitive advantage to these introduced species. Tall, mid and short statured warm- and cool-season native species begin to decline until they are completely displaced from the plant community. Research would indicate that leafy spurge alters soil microbiology in a manner which inhibits the growth of native species. This effectively reduces any potential for restoration to a native dominated plant community without very significant intervention. When compared to the reference plant community, energy capture has shifted to early spring through early summer. Overall production has declined. Plant diversity has declined significantly as has nutrient cycling. The number of functional/structural groups has been dramatically reduced and dominant groups replaced by ones not expected for the site. Rooting structure of the plant community has changed from a variety of deep rooted native grass and forb species with both fibrous and tap roots,

to a single, shallow rooted, sod forming grass and rhizomatous forb with the majority of the rooting mass in the upper 1 foot of the soil profile. Infiltration and runoff remain essentially the same as the reference plant community due primarily to soil texture.

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 and/or forb 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 season rhizomatous grasses 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. Following settlement, this historic grazing/fire sequence was largely replaced with season-long grazing by domestic livestock. 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

Transition from Native/Invaded State (State 2) T2 to Tree and Shrub Dominant State (State 3) Complete rest from grazing and elimination of fire are the two major contributors to this transition. Removal of these two disturbances shifts the competitive advantage within the herbaceous portion of the plant community to non-native species such as Kentucky bluegrass and leafy spurge. The lack of repeated fire events permits the shrubs such as smooth sumac to expand from the edges of the oak mottes into the adjacent herbaceous communities. Once established, this facilitates further expansion of the tree and shrub components. As shrub and tree canopy cover increases the potential for disturbance by fire decreases due to lack of fine fuels and reduction in fire behavior.

Transition T3
State 2 to 4

Transition from Native/Invaded State (State 2) T3 to Invaded State (State 4) The invasion of leafy spurge onto this site initiates this pathway. As leafy spurge becomes established on the site, it limits use by livestock and changes the micro climate at the soil surface facilitating a shift from the native herbaceous species to a community dominated by introduced grass and forb species. It is speculated the application of certain herbicides in an effort to control leafy spurge may facilitate the increase in Kentucky bluegrass.

Restoration pathway R1
State 3 to 2

Initial use of herbicides and/or mechanical brush control to reduce smooth sumac and other shrubs will permit adequate fine fuel loads to establish permitting the application of prescribed fire to further control sprouting shrubs species. Depending upon level of remnant native grasses and forbs, range seeding may be necessary to re-establish the herbaceous plant community.

Conservation practices

Brush Management
Prescribed Grazing
Invasive Plant Species Control

Additional community tables

Table 7. Community 1.1 plant community composition

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

Grass/Grasslike					
1	**Tall-Warm Season**			315–525	
	sand bluestem	ANHA	*Andropogon hallii*	315–420	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	210–315	–
2	**Cool-Season Bunch**			105–315	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	210–315	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	21–63	–
	Canada wildrye	ELCA4	*Elymus canadensis*	21–42	–
3	**Mid Warm-Season**			210–315	
	little bluestem	SCSC	*Schizachyrium scoparium*	105–210	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	21–105	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	42–105	–
4	**Short Warm-Season**			21–105	
	blue grama	BOGR2	*Bouteloua gracilis*	42–105	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–63	–
5	**Other Native Grasses**			21–105	
	Grass, perennial	2GP	*Grass, perennial*	42–105	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	21–63	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	21–42	–
6	**Grass-likes**			105–210	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	21–105	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	42–105	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0–21	–
Forb					
7	**Forbs**			105–210	
	longbract spiderwort	TRBR	*Tradescantia bracteata*	21–63	–
	field sagewort	ARCA12	*Artemisia campestris*	21–63	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	21–63	–
	Forb, perennial	2FP	*Forb, perennial*	21–63	–
	blazing star	LIATR	*Liatris*	21–42	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	21–42	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	21–42	–
	goldenrod	SOLID	*Solidago*	0–42	–
	silky prairie clover	DAVI	*Dalea villosa*	21–42	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	21–42	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	21–42	–
	flat-top goldentop	EUGR5	*Euthamia graminifolia*	0–42	–
	common sunflower	HEAN3	*Helianthus annuus*	0–42	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	21–42	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–21	–
	milkweed	ASCLE	*Asclepias*	0–21	–
	spotted sandmat	CHMA15	*Chamaesyce maculata*	0–21	–
	thymeleaf sandmat	CHSES	*Chamaesyce serpyllifolia ssp.*	0–21	–

			serpyllifolia		
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–21	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–21	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–21	–
	onion	ALLIU	*Allium*	0–21	–
Shrub/Vine					
8	**Shrubs**			105–210	
	leadplant	AMCA6	*Amorpha canescens*	21–42	–
	prairie sagewort	ARFR4	*Artemisia frigida*	21–42	–
	hawthorn	CRATA	*Crataegus*	0–21	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–21	–
	chokecherry	PRVI	*Prunus virginiana*	0–21	–
	sumac	RHUS	*Rhus*	0–21	–
	currant	RIBES	*Ribes*	0–21	–
	rose	ROSA5	*Rosa*	0–21	–
	blackberry	RUBUS	*Rubus*	0–21	–
	prairie willow	SAHU2	*Salix humilis*	0–21	–
	snowberry	SYMPH	*Symphoricarpos*	0–21	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–21	–
	common pricklyash	ZAAM	*Zanthoxylum americanum*	0–21	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–21	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–21	–
Tree					
9	**Trees**			21–105	
	quaking aspen	POTR5	*Populus tremuloides*	21–105	–
	bur oak	QUMA2	*Quercus macrocarpa*	21–105	–
	common hackberry	CEOC	*Celtis occidentalis*	0–21	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall-Warm Season**			315–525	
	sand bluestem	ANHA	*Andropogon hallii*	315–420	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	210–315	–
2	**Cool-Season Bunch**			105–315	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	210–315	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	21–63	–
	Canada wildrye	ELCA4	*Elymus canadensis*	21–42	–
3	**Mid Warm-Season**			210–315	
	little bluestem	SCSC	*Schizachyrium scoparium*	105–210	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	21–105	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	42–105	–
4	**Short Warm-Season**			21–105	
	blue grama	BOGR2	*Bouteloua gracilis*	42–105	–

	blue grama	BOGRA2	*Bouteloua gracilis*	42–105	
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–63	–
5	**Other Native Grasses**			21–105	
	Grass, perennial	2GP	*Grass, perennial*	42–105	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	21–63	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	21–42	–
6	**Grass-likes**			105–210	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	21–105	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	42–105	–
	Schweinitz's flatsedge	CYSC3	*Cyperus schweinitzii*	0–21	–
7	**Non-Native Grasses**			21–42	
	Kentucky bluegrass	POPR	*Poa pratensis*	21–42	–
	Grass, introduced	2GI	*Grass, introduced*	0–21	–
Forb					
8	**Forbs**			105–210	
	longbract spiderwort	TRBR	*Tradescantia bracteata*	21–63	–
	field sagewort	ARCA12	*Artemisia campestris*	21–63	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	21–63	–
	Forb, perennial	2FP	*Forb, perennial*	21–63	–
	blazing star	LIATR	*Liatris*	21–42	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	21–42	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	21–42	–
	goldenrod	SOLID	*Solidago*	0–42	–
	silky prairie clover	DAVI	*Dalea villosa*	21–42	–
	smooth horsetail	EQLA	*Equisetum laevigatum*	21–42	–
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	21–42	–
	flat-top goldentop	EUGR5	*Euthamia graminifolia*	0–42	–
	common sunflower	HEAN3	*Helianthus annuus*	0–42	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	21–42	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–21	–
	milkweed	ASCLE	*Asclepias*	0–21	–
	spotted sandmat	CHMA15	*Chamaesyce maculata*	0–21	–
	thymeleaf sandmat	CHSES	*Chamaesyce serpyllifolia ssp. serpyllifolia*	0–21	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	0–21	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–21	–
	narrowleaf stoneseed	LIIN2	*Lithospermum incisum*	0–21	–
	onion	ALLIU	*Allium*	0–21	–
9	**Non-Native Forbs**			21–42	
	Forb, introduced	2FI	*Forb, introduced*	0–21	–
	leafy spurge	EUES	*Euphorbia esula*	0–21	–
Shrub/Vine					
10	**Shrubs**			105–210	
	[illegible]	[illegible]	[illegible]	[illegible]	

	leadplant	AMCA6	*Amorpha canescens*	21–42	–
	prairie sagewort	ARFR4	*Artemisia frigida*	21–42	–
	hawthorn	CRATA	*Crataegus*	0–21	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–21	–
	chokecherry	PRVI	*Prunus virginiana*	0–21	–
	sumac	RHUS	*Rhus*	0–21	–
	currant	RIBES	*Ribes*	0–21	–
	rose	ROSA5	*Rosa*	0–21	–
	blackberry	RUBUS	*Rubus*	0–21	–
	prairie willow	SAHU2	*Salix humilis*	0–21	–
	snowberry	SYMPH	*Symphoricarpos*	0–21	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–21	–
	common pricklyash	ZAAM	*Zanthoxylum americanum*	0–21	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–21	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–21	–
Tree					
11	**Trees**			21–105	
	quaking aspen	POTR5	*Populus tremuloides*	21–105	–
	bur oak	QUMA2	*Quercus macrocarpa*	21–105	–
	common hackberry	CEOC	*Celtis occidentalis*	0–21	–

Animal community

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

-- Under Development --

Recreational uses

-- Under Development --

Wood products

-- Under Development --

Other products

-- Under Development --

Other information

-- Under Development --

Inventory data references

Information presented here has been derived from NRCS and other federal/state agency clipping and 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: Stan Boltz, NRCS State Rangeland Management Specialist; Bernadette Braun, USFS Rangeland Management Specialist; Stacey Swenson, USFS Rangeland Management Specialist; Jeff Printz, NRCS State Rangeland Management Specialist; Dr. Kevin Sedivec, Extension Rangeland Management Specialist; Dr. Shawn Dekeyser, North Dakota State University; Rob Self, The Nature Conservancy; Lee Voigt, NRCS Area Rangeland Management Specialist; Dr. Mark Gonzales, USFS Hydrologist; David Dewald, NRCS State Biologist; Keith Anderson, NRCS Soil Scientist, Fred Aziz; NRCS Area Resource Soil Scientist; and Steve Sieler, NRCS Soil Scientist.

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Contributors

Jeff Printz

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)	Bernadette Braun, Lee Voigt, Jeff Printz
Contact for lead author	jeff.printz@nd.usda.gov 701-530-2080
Date	02/06/2012
Approved by	Jeff Printz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Few rills visible, short (6 to 8 inches in length) and associated with steeper slopes. Generally visible following severe rainfall events.

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2. **Presence of water flow patterns:** Few. Very short (2 to 3 feet) and disconnected.

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3. **Number and height of erosional pedestals or terracettes:** None. Some slight pedestalling of bunchgrasses may be observed on steeper slope ranges but roots will not be exposed.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10 to 15% occurring in small (6 inches or less), non-connected patches.

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5. **Number of gullies and erosion associated with gullies:** None.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Not present in community phase 1.1. Blowouts and associated depositional areas may be present but limited in size following long term drought.

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7. **Amount of litter movement (describe size and distance expected to travel):** None. Short movement (several inches) may be visible in association with water flow patterns.

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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):** Soil aggregate stability should 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/surface layer.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be present. Buried A horizon may sometime be visible but does not constitute a compaction layer.

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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: Tall, warm-season grasses>

    Sub-dominant: Mid, warm-season grasses > mid, cool-season bunchgrasses

    Other: Grass-likes = forbs = shrubs > short, warm-season grasses = trees

    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):** None.

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14. **Average percent litter cover (%) and depth (in):** 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):** Ranges from 1500 to 2700 lbs/ac air dry depending upon growing conditions with a representative value (RV) of 2100 lbs./acre air dry.

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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 weeds, Kentucky bluegrass, smooth bromegrass, buckthorn, eastern red cedar.

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17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers

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