

Ecological site R055CY010SD Loamy

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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): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles (Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needle and thread (*Hesperostipa comata*), and porcupinegrass (*Hesperostipa spartea*) with Prairie cordgrass (*Spartina pectinata*), and reed canarygrass (*Phalaris arundinacea*) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al., 2007).

US EPA Level IV Ecoregion: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

Ecological site concept

The Loamy ecological site occurs on upland areas. Soils are well drained and have less than 40 percent clay in the surface and subsoil. The surface and subsoil textures typically are loam, silt loam, silty clay loam, clay loam, sandy clay loam, and very fine sandy loam. Some soils are underlain with sand or gravel at about 2 to 3 feet in depth. In some areas the surface layer may consist of stony to extremely stony. Slopes can range from 0 to 25 percent. Vegetation in the Reference State is dominated by the warm-season grass big bluestem and sub-dominated by cool-season needlegrasses. Forbs include cudweed sagewort, prairie coneflower, and western yarrow. Non-native grasses such as smooth brome grass and Kentucky bluegrass or native conifers such as eastern redcedar may invade due to shifts in disturbance regime.

Associated sites

R055CY011SD	Clayey These sites occur on uplands. Soils are well drained and have greater than 40 percent clay in the subsoil. The central concept soil series are Beadle and Stickney, but other series are included.
R055CY012SD	Thin Upland These sites occur on uplands. Soils are well drained and will effervesce with acid at or near the surface. The central concept soil series are Ethan and Betts, but other series are included.
R055CY020SD	Loamy Overflow These sites occur in upland swales. Soils are moderately well drained which have water flow into and over or through the site. The central concept soil series are Bonilla and Prosper but other series are included.

Similar sites

R055CY011SD	Clayey The Clayey site is in a similar landscape position, but the soils have greater than 40 percent clay in the surface or subsoil. The Clayey site will have more green needlegrass and less big bluestem than a Loamy site.
R055CY020SD	Loamy Overflow The Loamy Overflow site occurs in upland swales. Soils are moderately well drained which have water flow into and over or through the site. The Loamy Overflow site will have more big bluestem and higher production than a Loamy site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Nassella viridula</i>

Physiographic features

This site occurs on nearly level to steeply sloping uplands.

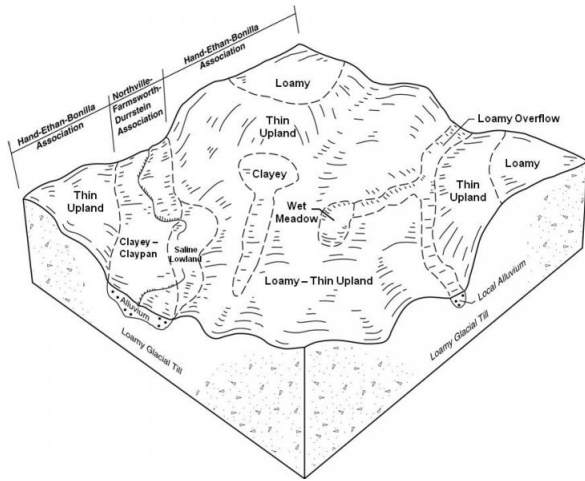


Figure 2. Catena of the Loamy Site in MLRA 55C.

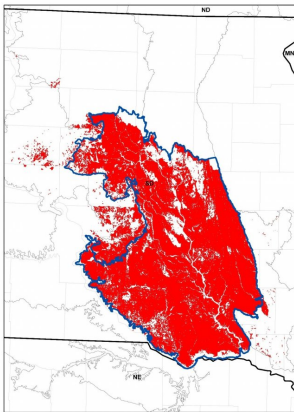


Figure 3. Distribution Map of the Loamy Site within MLRA 55C. In many cases, data is not spatially consistent across political boundaries due to the method with which soils were mapped; e. g. county subsets.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Till plain (3) Outwash plain
Flooding frequency	None
Ponding frequency	None
Elevation	396–610 m
Slope	0–15%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55C is considered to have a continental climate: Cold winters and hot summers, low 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 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, SD). The range of normal average monthly temperatures between the coldest and warmest

months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 mph during the summer. Daytime winds are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. 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 (characteristic range)	122-127 days
Freeze-free period (characteristic range)	137-146 days
Precipitation total (characteristic range)	559-635 mm
Frost-free period (actual range)	114-130 days
Freeze-free period (actual range)	133-151 days
Precipitation total (actual range)	533-660 mm
Frost-free period (average)	124 days
Freeze-free period (average)	142 days
Precipitation total (average)	610 mm

Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (6) ALEXANDRIA [USC00390128], Alexandria, SD
- (7) ACADEMY 2NE [USC00390043], Platte, SD
- (8) ARMOUR [USC00390296], Armour, SD
- (9) MARION [USC00395228], Marion, SD
- (10) MENNO [USC00395481], Menno, SD
- (11) WAGNER [USC00398767], Wagner, SD
- (12) TYNDALL [USC00398472], Tyndall, SD

Influencing water features

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

Soil features

The common features of soils in this site are loam to silty clay loam textured subsurface soils (occasionally clay), with slopes ranging from 0 to 15 percent. The soils in this site are well-drained and formed in till and loess. The loam to silty clay loam surface layer is 6 to 15 inches thick. The soils have a moderate to slow infiltration rate. Some soils crack when dry. When these soils are wet, surface compaction can occur with heavy traffic. This site typically should show slight to no evidence of rills, wind scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. Subsurface soil layers are nonrestrictive to water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 9 percent. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and production. Some soils are underlain with sand or gravel at about 2 to 3 feet in depth. In some areas the surface layer may consist of stony to extremely stony.

The central concept soil series are Clarno, Hand, and Houdek, but other series are included.

Access Web Soil Survey (<http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Silty clay loam
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	203 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	15.24–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	0–15%

Ecological dynamics

State and Community Phases

The information in this Ecological Site Description, including the state-and-transition model (STM), was developed based on historical data, current field data, professional experience, and a review of the scientific literature. As a result, all possible scenarios or plant species may not be included. Key indicator plant species, disturbances, and ecological processes are described to inform land management decisions.

The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

This ecological site (ES) has been grazed by domestic livestock since they have been introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have changed the ecological dynamics of this site. Heavy, continuous grazing without adequate recovery periods following each grazing occurrence causes departure from the 3.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant

Community Phase. Blue grama (*Bouteloua gracilis*) will increase and eventually develop into a sod. Western wheatgrass will increase initially and then begin to decrease. Green needlegrass, needle and thread, porcupinegrass, sideoats grama (*Bouteloua curtipendula*), big bluestem, and little bluestem (*Shizachyrium scoparium*) will decrease in frequency and production. Extended periods of non-use and/or lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), green needlegrass, and cheatgrass (*Bromus tectorum*). Extended periods of no surface fire could result in the invasion of conifers in which eastern redcedar (*Juniperus virginiana*) and Rocky Mountain juniper (*Juniperus scopulorum*) will increase and could eventually dominate the site.

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 and community phases. The associated plant composition tables 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 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.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Loamy – R055CY010SD

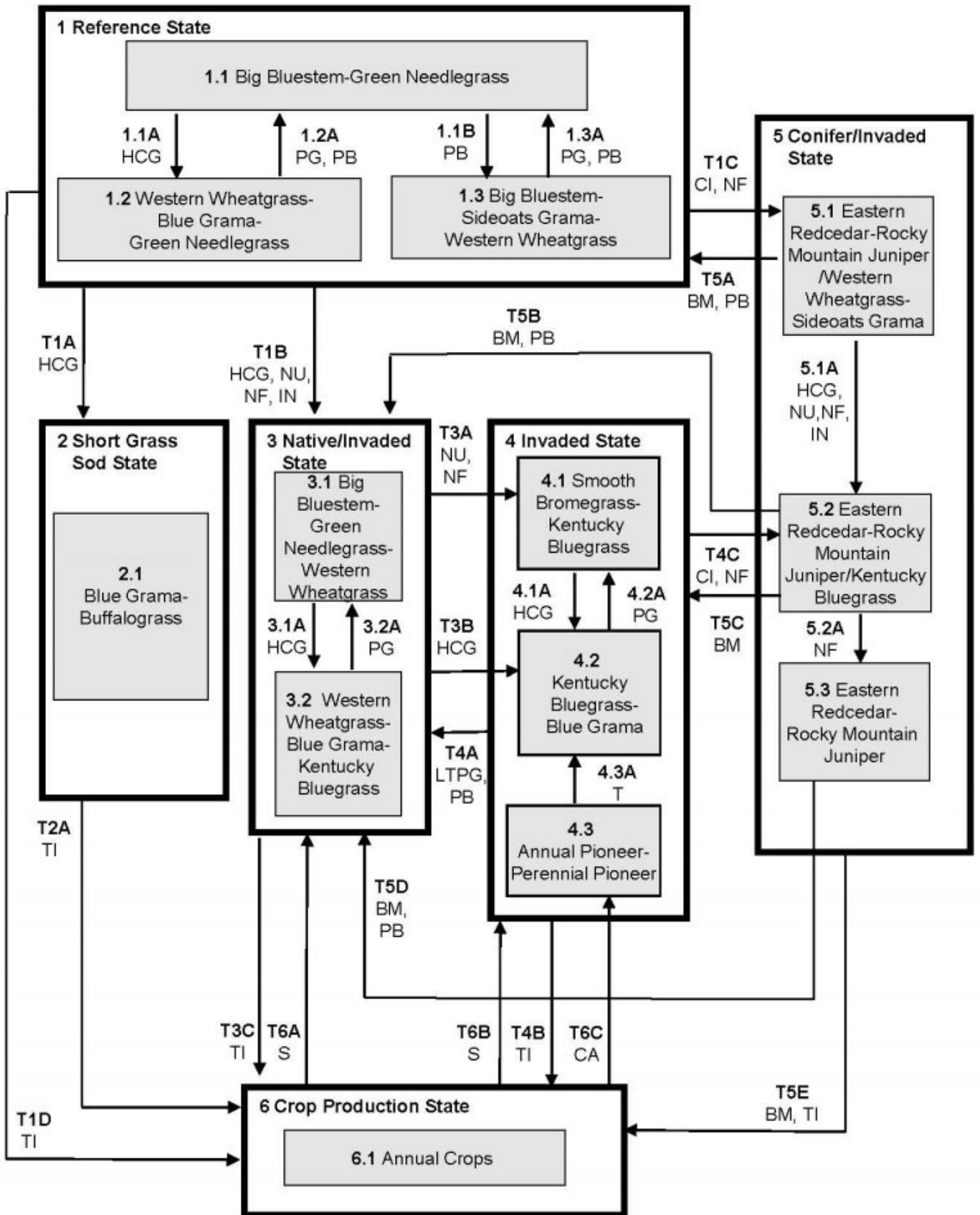


Figure 10. State-and-Transition Model for the Loamy Site in MLRA 55C.

Loamy – R055CY010SD

LEGEND

Loamy – R55CY010SD

BM – Brush management
CA – Cropped and abandoned
CI – Conifer invasion
HCG – Heavy, continuous grazing
IN – Invasion
LTPG – Long-term prescribed grazing
NU – Non-use
NF – No fire
PB – Prescribed burning
PG – Prescribed grazing
S – Seeding
T – Time w/wo disturbances
TI – Tillage

Figure 11. Legend for the Loamy Site in MLRA 55C.

Code	Process
T1A	Heavy continuous grazing
T1B	Heavy continuous grazing, non-use, no fire, invasion
T1C	Conifer invasion, no fire
T1D	Tillage
T2A	Tillage
T3A	Non-use, no fire
T3B	Heavy continuous grazing
T3C	Tillage
T4A	Long term prescribed grazing, prescribed burning
T4B	Tillage
T4C	Conifer invasion, no fire
T5A	Brush management, prescribed burning
T5B	Brush management, prescribed burning
T5C	Brush management
T5D	Brush management, prescribed burning
T5E	Brush management, tillage
T6A	Seeding
T6B	Seeding
T6C	Cropped and abandoned
1.1A	Heavy continuous grazing
1.1B	Prescribed burning,
1.2A	Prescribed grazing with recovery periods, prescribed burning
1.3A	Prescribed grazing with recovery periods, prescribed burning
3.1A	Heavy continuous grazing
3.2A	Prescribed grazing with recovery periods
4.1A	Heavy continuous grazing
4.2A	Prescribed grazing with recovery periods
4.3A	Time w/wo disturbances
5.1A	Heavy continuous grazing, non-use, no fire, invasion
5.2A	No fire

Figure 12. Matrix for the Loamy Site in MLRA 55C.

State 1 Reference State

The Reference State represents the natural range of variability that dominated the dynamics of this ecological site (ES). This state was dominated by warm-season grasses, with cool-season grasses being subdominant. Prior to European settlement of North America, the primary disturbance mechanisms for this site in the reference condition included periods of below and above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Cool-season and taller warm-season grasses would have declined, and short warm-season grasses would have increased. Today, a similar state, the Native/Invaded State (State 3) can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest.

Community 1.1 Big Bluestem-Green Needlegrass

Interpretations are based primarily on the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase (this is also considered to be the Reference Community). This plant community evolved with grazing by large herbivores, frequent surface fires, and periodic flooding events and is suited for grazing by domestic livestock. This plant community can be found on areas that are grazed and where the grazed plants receive adequate periods of rest

during the growing season in order to recover. The potential vegetation was about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The community was dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses included big bluestem, green needlegrass, western wheatgrass, porcupinegrass, Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and little bluestem. Other grass or grass-like species included sideoats grama, blue grama, slender wheatgrass (*Elymus trachycaulus*), prairie dropseed (*Sporobolus heterolepis*), tall dropseed (*Sporobolus compositus*), and sedge (Cyperaceae). This plant community was resilient, and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high tolerance to drought. This was a sustainable plant community in regards to site and soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2365	3049	3654
Shrub/Vine	163	269	415
Forb	163	269	415
Total	2691	3587	4484

Figure 14. Plant community growth curve (percent production by month). SD5503, Southern Black Glaciated Plains, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 1.2

Western Wheatgrass-Blue Grama - Green Needlegrass

This plant community evolved under heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses included western wheatgrass (*Pascopyrum smithii*), blue grama, green needlegrass, and needle and thread. Grasses of secondary importance included sideoats grama, little bluestem, porcupinegrass, big bluestem, and sedge (Cyperaceae). Forbs commonly found in this plant community included cudweed sagewort (*Artemisia ludoviciana*), prairie coneflower (Ratibida), and western yarrow (*Achillea millefolium*). This plant community had similar plant composition to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase. The main difference is that this plant community phase did not have the presence of non-native invasive species such as Kentucky bluegrass and smooth brome grass. When compared to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase, blue grama and sedges increased. Green needlegrass and sideoats grama decreased and production of mid- and tall warm-season grasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. Most of the components of the ecological processes would have been functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

Figure 15. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

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

Community 1.3

Big Bluestem-Sideoats Grama-Western Wheatgrass

This plant community was a result of fire occurring at relatively frequent intervals. This phase could have also resulted from a combination of grazing events immediately following early season fire (i.e., large ungulates attracted to highly nutritious vegetative growth following a fire). These events would have caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire and would have increased in vigor and production leading to a temporary shift to this phase. Needlegrasses would have decreased most significantly amongst the cool-season grasses. The potential vegetation was about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. The community was dominated by warm-season grasses. The major grasses included big bluestem, sideoats grama, western wheatgrass, Indiangrass, switchgrass, and little bluestem. Other grass or grass-like species included green needlegrass, porcupinegrass, needle and thread, blue grama, slender wheatgrass, tall dropseed, and sedges. This plant community was not resistant to change and would have readily shifted back to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase with a return of more normal fire return intervals.

Figure 16. Plant community growth curve (percent production by month). SD5504, Southern Black Glaciated Plains, warm-season dominant, cool-season . Warm-season dominant, cool-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	18	24	25	15	7	1	0	0

Pathway 1.1A Community 1.1 to 1.2

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

Pathway 1.1b Community 1.1 to 1.3

Prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels, along with occasional grazing events immediately following early season fire caused a reduction in cool-season grasses and an increase in warm-season grasses. The warm-season grasses were more tolerant of shorter return intervals of fire, and would increase in vigor and production, leading to a temporary shift to the 1.3 Big Bluestem-Sideoats Grama-Western Wheatgrass Plant Community Phase.

Pathway 1.2a Community 1.2 to 1.1

Prescribed grazing, and/or prescribed burning occurring at relatively frequent intervals (every 3 to 5 years), a return to normal disturbance regime levels and frequencies, or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase.

Pathway 1.3a Community 1.3 to 1.1

Prescribed grazing (alternating season of use and providing adequate recovery periods), periodic light to moderate grazing possibly including periodic rest occurring at relatively frequent intervals (every 3 to 5 years), and a return to normal disturbance regime levels may convert this plant community to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase.

State 2 Shortgrass Sod State

The Shortgrass Sod State evolved under heavy, continuous season grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like

species, 10 percent forbs, and 5 percent shrubs. Dominant grasses typically included Blue grama and buffalograss. Grasses of secondary importance included sedge and western wheatgrass. Forbs commonly found in this plant community included cudweed sagewort, green sagewort (*Artemisia campestris*), and western yarrow. When compared to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase, tall warm-season grasses were reduced, and the more grazing tolerant species such as blue grama and buffalograss were dominant on this plant community. With the exception of western wheatgrass, cool-season grasses decreased significantly. This vegetation state was very resistant to change, especially if the disturbance continued and the short-statured species such as blue grama increased. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases.

Community 2.1 Blue Grama-Buffalograss

This plant community evolved under heavy continuous season grazing or from over utilization during extended drought periods. The potential plant community was made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses typically included Blue grama and buffalograss. Grasses of secondary importance included sedge and western wheatgrass. Forbs commonly found in this plant community included cudweed sagewort, green sagewort (*Artemisia campestris*), and western yarrow. When compared to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase, tall warm-season grasses were reduced, and the more grazing tolerant species such as blue grama and buffalograss were dominant on this plant community. With the exception of western wheatgrass, cool-season grasses decreased significantly. This vegetation state was very resistant to change, especially if the disturbance continued and the short-statured species such as blue grama increased. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases.

Figure 17. Plant community growth curve (percent production by month). SD5505, Southern Black Glaciated Plains, warm-season dominant.. Warm-season dominant..

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

State 3 Native/Invaded State

The Native/Invaded State represents the more common range of variability that exists with higher levels of grazing management, but in the absence of periodic fire due to fire suppression. This state is dominated by cool- and warm-season grasses. It can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. Taller warm-season species can decline and a corresponding increase in short-statured grass will occur.

Community 3.1 Bluestem/Needlegrass/Wheatgrass

This plant community phase is similar to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase, but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth brome grass (up to about 15 percent by air-dry weight). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. This community is co-dominated by cool- and warm-season grasses. The major grasses include western wheatgrass, green needlegrass, big bluestem, porcupinegrass, needle and thread, Indiangrass, switchgrass, and little bluestem. Other grass or grass-like species include sideoats grama, blue grama, slender wheatgrass, prairie dropseed, tall dropseed, and sedges. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community in regards to site and soil stability, watershed function, and biologic integrity.

Figure 18. Plant community growth curve (percent production by month). SD5503, Southern Black Glaciated Plains, cool-season/warm-season codominant.. Cool-season, warm-season codominant..

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

Community 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass

This plant community is a result of heavy, continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and Kentucky bluegrass. Grasses of secondary importance include side oats grama, little bluestem, green needlegrass, needle and thread, porcupinegrass, big bluestem, buffalograss, smooth brome grass, and sedge. Forbs commonly found in this plant community include cudweed sagewort, prairie coneflower, and western yarrow. When compared to the 1.1 Big Bluestem-Green Needlegrass Plant Community Phase, Blue grama has increased. Green needlegrass and sideoats grama have decreased and production of mid- and tall warm-season grasses is reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of non-native invasive species such as Kentucky bluegrass and smooth brome grass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers and the structure will begin to be modified. These changes favor the shallow-rooted species and hasten their eventual dominance if steps are not taken to reduce these species.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1872	2507	2998
Forb	123	211	319
Shrub/Vine	22	84	157
Total	2017	2802	3474

Figure 20. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

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

Pathway 3.1A Community 3.1 to 3.2

Heavy, continuous grazing which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites will shift this community to the 3.2 Western Wheatgrass-Blue Grama-Kentucky Bluegrass Plant Community Phase.

Pathway 3.2A Community 3.2 to 3.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing possibly including periodic rest will convert this plant community to the 3.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant Community Phase.

Conservation practices

Prescribed Grazing

State 4 Invaded State

The Invaded State is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green-up and increased moisture and humidity at the soil surface, and grazing pressure cannot cause a reduction in sod-grass 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 dominant species.

Community 4.1 Smooth Bromegrass-Kentucky Bluegrass

This plant community phase is a result of extended periods of non-use and no fire or occasionally light levels of grazing over several years. It is characterized by dominance of smooth bromegrass and to a lesser extent Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface and eventually a thatch-mat layer may develop. Nutrient cycling is greatly reduced and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced. The dominance of these introduced species has been shown to alter the biotic component of the soil as well as organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass and tend to make establishment of native species extremely difficult.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2236	3013	3654
Forb	163	359	639
Shrub/Vine	67	215	415
Total	2466	3587	4708

Figure 22. Plant community growth curve (percent production by month).
SD5501, Southern Black Glaciated Plains, cool-season dominant.. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

Community 4.2 Kentucky Bluegrass-Blue Grama

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass and Blue Grama. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface and eventually a thatch-mat layer may develop at the surface as well. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. Infiltration is greatly reduced and

runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1373	1849	2259
Forb	196	336	532
Shrub/Vine	–	56	123
Total	1569	2241	2914

Figure 24. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

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

Community 4.3 Annual/Pioneer, Non-Native Perennial Plant

This plant community developed under continuous, heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable but often include non-native invasive and early seral species. Plant diversity is low (plant richness may be high, but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow-rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the vegetation could revert back to early seral species.

Pathway 4.1A Community 4.1 to 4.2

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

Pathway 4.2A Community 4.2 to 4.1

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

Conservation practices

Prescribed Grazing

Pathway 4.3A Community 4.3 to 4.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 4.2 Kentucky Bluegrass-Blue Grama Plant Community Phase.

Conservation practices

Integrated Pest Management (IPM)

State 5

Conifer-Invaded State

This state is dominated (canopy exceeds 20 percent of total surface area) by areas where trees have become established or have encroached onto the site due to the absence of periodic fire. This state is dominated by eastern redcedar and Rocky Mountain juniper with cool-season grasses being subdominant. The plant community can develop into a closed canopy that impedes the reproductive capability of the major native perennial grass species. A single eastern redcedar tree with a 7 foot crown diameter eliminates the equivalent of 3 pounds of forage. Further, the forage potential of a pasture with 250 mature eastern redcedar trees per acre (or one tree every thirteen feet) is reduced by 50 percent. It is suggested that reducing stocking rates by 10 percent for every 50 trees per acre. The increase in tree canopy which is a result of a disruption of the natural, and human related fire regimes that occurred prior to European settlement of North America, which kept trees from encroaching much of the grasslands.

Community 5.1

Eastern Redcedar-Rocky Mountain Juniper-Western Wheatgrass-Sideoats Grama

This plant community evolved due to the invasion of conifers, such as eastern redcedar and Rocky Mountain juniper. This phase was a result of the absence of periodic fire. These events may cause a reduction in warm-season grasses and an increase in cool-season grasses and allow for the encroachment of conifers. The potential plant community is made up of approximately 50 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and 30 percent trees. Dominant grasses and grass-like species include big bluestem, western wheatgrass, blue grama, and sideoats grama. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses increase. Forbs will be diverse. Tree species will include eastern redcedar and Rocky Mountain juniper. When compared to the 1.1 Big Bluestem-Green Needlegrass Plant Community, coniferous trees have increased significantly and herbaceous component has decreased. This plant community is susceptible to the encroachment of eastern redcedar and Rocky Mountain juniper.

Community 5.2

Eastern Redcedar-Rocky Mountain Juniper-Kentucky Bluegrass

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing or non-use and/or no surface fire for extended periods of time (typically for 10 or more years). When compared to the 5.1 Eastern Redcedar-Rocky Mountain Juniper/Western Wheatgrass-Sideoats Grama Plant Community, the amount of non-native invasive cool-season grasses such as Kentucky bluegrass and smooth bromegrass have increased significantly. It is characterized by a dominance of Kentucky bluegrass, smooth bromegrass, and blue grama. The dominance of Kentucky bluegrass is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Production is limited to the sod forming species. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. 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 dominant species. Biological activity in the soil is likely reduced significantly in this phase.

Community 5.3

Eastern Redcedar-Rocky Mountain Juniper

This plant community phase is a result of no surface fire for extended periods of time (typically for 10 or more years). Coniferous trees have increased significantly, and the herbaceous component has decreased. With the dominance of the coniferous trees such as eastern redcedar and Rocky Mountain juniper, the canopy covers the area and grass species are unable to survive. Grass production for livestock is severely limited. Prescribed burning

before the juniper species reach maturity and are still susceptible to fire (< 5 foot in height), or mechanical brush management can be used to maintain or recover 5.3 Eastern Redcedar-Rocky Mountain Juniper Plant Community Phase.

Pathway 5.1A **Community 5.1 to 5.2**

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, heavy continuous grazing, or invasion of non-native plant species will shift this plant community to the 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase.

Pathway 5.2A **Community 5.2 to 5.3**

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will shift this plant community to the 5.3 Eastern Redcedar-Rocky Mountain Juniper Plant Community Phase.

State 6 **Crop Production State**

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

Community 6.1 **Annual Crops**

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

Transition T1A **State 1 to 2**

Heavy, continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year, typically beginning early in the season) will convert this plant community to the 2.1 Blue Grama-Buffalograss Plant Community Phase within the ShortGrass Sod State (State 2).

Transition T1b **State 1 to 3**

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

Transition T5 **State 1 to 4**

Encroachment of non-native invasive and noxious species, abandonment of cropping, or seeding of introduced and native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T1C

State 1 to 5

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and invasion of conifer will likely lead this state over a threshold leading to the 5.1 Eastern Redcedar-Rocky Mountain Juniper/Western Wheatgrass-Sideoats Grama Plant Community Phase within the Conifer/Invaded State (State 5).

Transition T1D

State 1 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Transition T5

State 2 to 4

Encroachment of non-native invasive and noxious species, abandonment of cropping, or seeding of introduced and native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition T2A

State 2 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Transition T3A

State 3 to 4

Non-use and/or no surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, will likely lead this state over a threshold leading to the 4.1 Smooth Bromegrass-Kentucky Bluegrass Community Phase within the Invaded State (State 4). Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season and often at the same time of year each year), will likely lead this state over a threshold leading to the 4.2 Kentucky Bluegrass-Blue Grama Community Phase within the Invaded State (State 4). Grazing repeatedly in the early growing season can expedite this shift by causing mechanical disturbance due to trampling.

Transition T3C

State 3 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Restoration pathway T4A

State 4 to 3

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest) coupled with prescribed burning occurring at relatively frequent intervals (3 to 5 years), and a return to normal disturbance regime levels may lead this plant community phase over a threshold to the Native/Invaded State (State 3).

Conservation practices

Transition T4B State 4 to 5

No surface fire for extended periods of time (typically for 10 or more years) causing litter levels to become high enough to reduce native grass vigor, diversity, and density, and invasion of conifer will likely lead this state over a threshold leading to the 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5).

Transition T4A State 4 to 6

Tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Community Phase within the Crop Production State (State 6).

Restoration pathway T5A State 5 to 1

Brush management, which would include the mechanical removal of the conifers, coupled with prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels may lead this 5.1 Eastern Redcedar-Rocky Mountain Juniper/Western Wheatgrass-Sideoats Grama Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Reference State (State 1).

Restoration pathway T5B & T5D State 5 to 3

Brush management, which would include the mechanical removal of the conifers, coupled with prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels may lead this 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Native/Invaded State (State 3). Brush management, which would include the mechanical removal of the conifers, coupled with prescribed burning occurring at relatively frequent intervals (every 3 to 5 years) and a return to normal disturbance regime levels may lead this 5.3 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Native/Invaded State (State 3).

Restoration pathway R5C State 5 to 4

Brush management, which would include the mechanical removal of the conifers may lead this 5.2 Eastern Redcedar-Rocky Mountain Juniper/Kentucky Bluegrass Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Invaded State (State 4).

Transition T5A State 5 to 6

Brush management, which would include the mechanical removal of the conifers, coupled with tillage will cause a shift over a threshold leading to the 6.1 Annual Crops Plant Community Phase within the Crop Production State (State 6).

Restoration pathway T6A State 6 to 3

Seeding may lead this Crop Production State (State 6) over a threshold to the Native/Invaded State (State 3).

Restoration pathway R6B State 6 to 4

Seeding may lead this Crop Production State (State 6) over a threshold to the Invaded State (State 4) Cropping followed by abandonment may lead this plant community phase over a threshold to the Invaded State (State 4) and more specifically to the 4.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Tall Warm-Season Grasses			538–1076	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	359–897	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	72–359	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	72–359	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	0–179	–
2	Needlegrass			538–1076	
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	179–897	–
	green needlegrass	NAVI4	<i>Nassella viridula</i>	179–897	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	72–359	–
3	Wheatgrass			359–717	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	359–717	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	72–359	–
4	Mid Warm-Season Grasses			179–538	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	179–538	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	72–359	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	36–179	–
5	Short Warm-Season Grasses			36–179	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	36–179	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–108	–
6	Other Native Grasses			36–179	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–179	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	36–108	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	0–36	–
7	Grass-likes			36–179	
	sedge	CAREX	<i>Carex</i>	36–179	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–108	–
Forb					
8	Forbs			179–359	
	Forb, native	2FN	<i>Forb, native</i>	36–143	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	36–72	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–72	–

	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	36–72	–
	Illinois bundleflower	DEIL	<i>Desmanthus illinoensis</i>	0–72	–
	blacksamson echinacea	ECAN2	<i>Echinacea angustifolia</i>	0–72	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	36–72	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	36–72	–
	stiff sunflower	HEPA19	<i>Helianthus pauciflorus</i>	36–72	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	36–72	–
	Nuttall's sensitive-briar	MINU6	<i>Mimosa nuttallii</i>	36–72	–
	beardtongue	PENST	<i>Penstemon</i>	36–72	–
	scurfpea	PSORA2	<i>Psoralegium</i>	36–72	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	36–72	–
	goldenrod	SOLID	<i>Solidago</i>	36–72	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	36–72	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–36	–
	American vetch	VIAM	<i>Vicia americana</i>	0–36	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–36	–
	groundplum milkvetch	ASCR2	<i>Astragalus crassicaarpus</i>	0–36	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	0–36	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–36	–
Shrub/Vine					
9	Shrubs			179–359	
	snowberry	SYMPH	<i>Symphoricarpos</i>	72–287	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	36–179	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–108	–
	rose	ROSA5	<i>Rosa</i>	36–72	–

Table 10. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Tall Warm-Season Grasses			56–280	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	56–280	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	0–84	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	0–84	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus var. compositus</i>	0–84	–
2	Needlegrass			56–280	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	56–280	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–140	–
	porcupinegrass	HESP11	<i>Hesperostipa spartea</i>	0–140	–
3	Wheatgrass			280–841	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	280–841	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	0–140	–
4	Mid Warm-Season Grasses			0–140	
	sideoats grama	BOCU	<i>Bouteloua curtinendula</i>	0–140	–

	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	0–140	–
	prairie dropseed	SPHE	<i>Sporobolus heterolepis</i>	0–28	–
5	Short Warm-Season Grasses			280–560	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	280–560	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–140	–
6	Other Native Grasses			28–140	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–140	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	28–84	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	0–56	–
7	Grass-like			56–280	
	sedge	CAREX	<i>Carex</i>	56–280	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–84	–
8	Non-Native Grasses			280–701	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	140–560	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–280	–
	quackgrass	ELRE4	<i>Elymus repens</i>	0–280	–
	brome	BROMU	<i>Bromus</i>	0–140	–
Forb					
9	Forbs			140–280	
	Forb, introduced	2FI	<i>Forb, introduced</i>	0–140	–
	sweetclover	MELIL	<i>Melilotus</i>	0–112	–
	goldenrod	SOLID	<i>Solidago</i>	28–84	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	28–84	–
	Forb, native	2FN	<i>Forb, native</i>	28–84	–
	absinthium	ARAB3	<i>Artemisia absinthium</i>	0–84	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	28–84	–
	western yarrow	ACMIO	<i>Achillea millefolium</i> var. <i>occidentalis</i>	28–56	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	28–56	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	0–56	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–56	–
	prickly lettuce	LASE	<i>Lactuca serriola</i>	0–56	–
	scurfpea	PSORA2	<i>Psoraleidum</i>	28–56	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–28	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	0–28	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–28	–
	beardtongue	PENST	<i>Penstemon</i>	0–28	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	0–28	–
	scarlet beeblossom	GACO5	<i>Gaura coccinea</i>	0–28	–
Shrub/Vine					
10	Shrubs			28–140	
	snowberry	SYMPH	<i>Symphoricarpos</i>	28–140	–

	rose	RUSA5	Rosa	0–56	–
	Shrub (>.5m)	2SHRUB	Shrub (>.5m)	0–56	–
	leadplant	AMCA6	<i>Amorpha canescens</i>	0–28	–

Table 11. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Tall Warm-Season Grasses			0–72	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–72	–
	composite dropseed	SPCOC2	<i>Sporobolus compositus</i> var. <i>compositus</i>	0–72	–
2	Needlegrass			0–359	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–359	–
3	Wheatgrass			0–359	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–359	–
4	Short Warm-Season Grasses			0–108	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–108	–
5	Other Native Grasses			36–179	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–179	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	36–72	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes</i> var. <i>scribnerianum</i>	0–36	–
6	Grass-likes			36–179	
	sedge	CAREX	<i>Carex</i>	36–179	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–108	–
7	Non-Native Grasses			1076–2331	
	smooth brome	BRIN2	<i>Bromus inermis</i>	717–2152	–
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	359–897	–
	quackgrass	ELRE4	<i>Elymus repens</i>	0–538	–
	brome	BROMU	<i>Bromus</i>	0–179	–
Forb					
8	Forbs			179–538	
	sweetclover	MELIL	<i>Melilotus</i>	36–287	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	36–179	–
	goldenrod	SOLID	<i>Solidago</i>	36–179	–
	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	36–143	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	36–143	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	36–143	–
	prickly lettuce	LASE	<i>Lactuca serriola</i>	0–108	–
	absinthium	ARAB3	<i>Artemisia absinthium</i>	0–108	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	0–108	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–108	–
	Forb, native	2FN	<i>Forb, native</i>	0–72	–

	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	36–72	–
	scurfpea	PSORA2	<i>Psoralegium</i>	36–72	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	0–36	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–36	–
Shrub/Vine					
9	Shrubs			72–359	
	snowberry	SYMPH	<i>Symphoricarpos</i>	36–359	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–72	–
	rose	ROSA5	<i>Rosa</i>	36–72	–

Table 12. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Needlegrass			0–112	
	green needlegrass	NAVI4	<i>Nassella viridula</i>	0–112	–
2	Wheatgrass			0–112	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–112	–
3	Short Warm-Season Grasses			224–785	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	224–785	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	0–112	–
4	Other Native Grasses			22–112	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	0–112	–
	Scribner's rosette grass	DIOLS	<i>Dichanthelium oligosanthes var. scribnerianum</i>	0–45	–
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	0–22	–
5	Grass-likes			45–224	
	sedge	CAREX	<i>Carex</i>	45–224	–
	Grass-like (not a true grass)	2GL	<i>Grass-like (not a true grass)</i>	0–67	–
6	Non-Native Grasses			560–1121	
	Kentucky bluegrass	POPR	<i>Poa pratensis</i>	448–1009	–
	quackgrass	ELRE4	<i>Elymus repens</i>	45–336	–
	smooth brome	BRIN2	<i>Bromus inermis</i>	0–224	–
	brome	BROMU	<i>Bromus</i>	22–179	–
Forb					
7	Forbs			224–448	
	sweetclover	MELIL	<i>Melilotus</i>	22–269	–
	Forb, introduced	2FI	<i>Forb, introduced</i>	22–224	–
	absinthium	ARAB3	<i>Artemisia absinthium</i>	22–179	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	22–112	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	22–112	–
	goldenrod	SOLID	<i>Solidago</i>	22–112	–
	prickly lettuce	LASE	<i>Lactuca serriola</i>	22–90	–
	western yarrow	ACMIO	<i>Achillea millefolium var. occidentalis</i>	22–67	–

	white heath aster	SYER	<i>Symphyotrichum ericoides</i>	22–67	–
	yellow salsify	TRDU	<i>Tragopogon dubius</i>	22–67	–
	hoary verbena	VEST	<i>Verbena stricta</i>	0–67	–
	scurfpea	PSORA2	<i>Psoraleidium</i>	22–67	–
	Forb, native	2FN	<i>Forb, native</i>	0–45	–
	rush skeletonplant	LYJU	<i>Lygodesmia juncea</i>	0–22	–
Shrub/Vine					
8	Shrubs			0–112	
	snowberry	SYMPH	<i>Symphoricarpos</i>	0–112	–
	rose	ROSA5	<i>Rosa</i>	0–22	–

Animal community

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ES description). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

Bluestem/Needlegrass/Wheatgrass (1.1 & 3.1)

Average Annual Production (lbs./acre air-dry): 3,200

Stocking Rate* (AUM/acre): 0.88

Western Wheatgrass/Blue Grama/Kentucky Bluegrass (3.2)

Average Annual Production (lbs./acre air-dry): 2,500

Stocking Rate* (AUM/acre): 0.69

Smooth Bromegrass/Kentucky Bluegrass (4.1)

Average Annual Production (lbs./acre air-dry): 3,200

Stocking Rate* (AUM/acre): 0.88

Kentucky Bluegrass/Blue Grama (4.2)

Average Annual Production (lbs./acre air-dry): 2,000

Stocking Rate* (AUM/acre): 0.55

Annual/Pioneer, Non-Native Perennial (4.3)

Average Annual Production (lbs./acre air-dry): 900

Stocking Rate* (AUM/acre): 0.25

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B, with localized areas in hydrologic group C. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are typically present on this site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Ecological Site Correlation Issues and Questions:

- Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There are 9 SCS-Range-417's collected from 1985-1987 in Aurora, Charles Mix, and Hand counties in SD.

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source	Sample Period	State	County
SCS-Range-417 (5018546003)	7/25/1985	SD	Aurora
SCS-Range-417 (0018546059)	9/19/1985	SD	Hand
SCS-Range-417 (0018646059)	10/2/1985	SD	Hand
SCS-Range-417 (5038546023)	10/3/1985	SD	Charles Mix
SCS-Range-417 (0038646023)	9/3/1986	SD	Charles Mix
SCS-Range-417 (0038746023)	10/8/1986	SD	Charles Mix
SCS-Range-417 (2008646003)	10/8/1986	SD	Aurora
SCS-Range-417 (0408746059)	10/14/1987	SD	Hand

Other references

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Approval

Suzanne Mayne-Kinney, 1/31/2024

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Additional Information Acknowledgment: Jason Hermann (Jason.Hermann@usda.gov), Area Rangeland Management Specialist, USDA-NRCS, Redfield, SD.

This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft as of 11/12/2020.

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Rangeland health reference sheet

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

Author(s)/participant(s)	David Schmidt, Tim Nordquist, Stan Boltz
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Date	12/07/2004
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than five percent and less than two inches in diameter.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

-
7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 6. Typically high root content, organic matter, and granular structure. Soil surface is very resistant to erosion.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep rooted native grasses enhance infiltration and reduce runoff.
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident.
-
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 = mid and tall cool-season bunchgrasses >
- Sub-dominant: Mid cool-season rhizomatous grasses > mid warm-season grasses >
- Other: Forb = shrubs > short cool-season grasses/grass-likes > short warm-season grasses.
- Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.
-
14. **Average percent litter cover (%) and depth (in):** Litter cover is in contact with soil surface.
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2,400–4,000 lbs./acre air-dry weight, average 3,200 lbs./acre air-dry weight.
-
16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not**

invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Refer to State and Local Noxious Weed List, also Kentucky bluegrass, smooth brome grass.

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