USDA Natural Resources
Conservation Service

Ecological site R055CY020SD
Loamy Overflow

Last updated: 1/31/2024
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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.

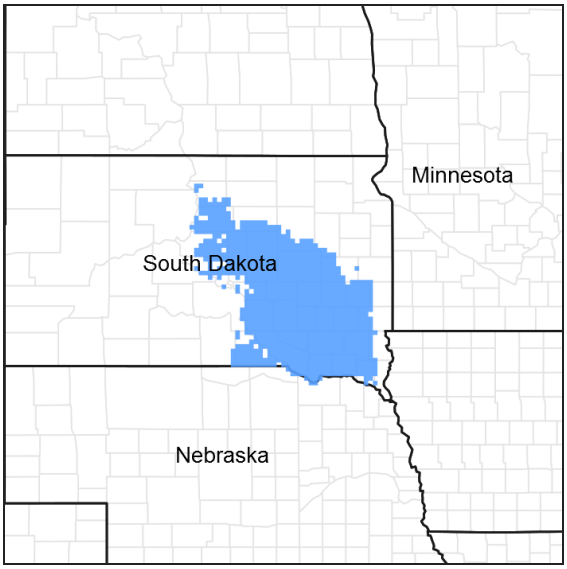

Figure 1. Mapped extent

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 Overflow ecological site occurs in upland swales which receive additional run off moisture from adjoining slopes. Soils are moderately well drained which have water flow into and over or through the site, and have less than 40 percent clay in the surface and subsoil.

Vegetation in the Reference State is co-dominated by cool and warm-season grasses including big bluestem, green needlegrass, and western wheatgrass. Non-native grasses such as smooth bromegrass and Kentucky bluegrass or native conifers such as Eastern Redcedar may invade due to shifts in disturbance regime.

Associated sites

R055CY010SD	**Loamy** These sites occur on upland areas. The soils are well drained and have less than 40 percent clay in the surface and subsoil. The central concept soil series are Clarno, Hand, and Houdek, 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 Betts and Ethan, but other series are included.

Similar sites

R055CY010SD	**Loamy** The Loamy site occurs in a backslope landscape position. Soils are well drained and do not have water flow into and over or through the site. The Loamy site will have less big bluestem and lower production than a Loamy Overflow site.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on nearly level lowlands and drainageways.

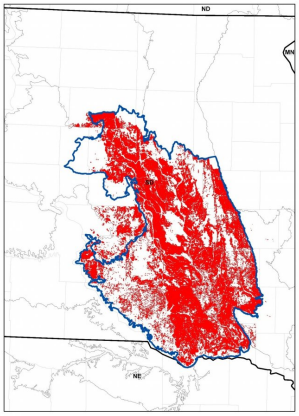

Figure 2. Site Distribution Map for the Loamy Overflow Site in MLRA 55C.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Drainageway (3) Swale
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	396–610 m
Slope	0–4%
Water table depth	76–203 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)	123-129 days
Freeze-free period (characteristic range)	138-151 days
Precipitation total (characteristic range)	559-660 mm

Frost-free period (actual range)	114-131 days
Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	533-686 mm
Frost-free period (average)	125 days
Freeze-free period (average)	144 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) DE SMET [USC00392302], De Smet, SD
- (6) HOWARD [USC00394037], Howard, SD
- (7) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (8) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (9) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (10) MITCHELL [USC00395669], Mitchell, SD
- (11) MITCHELL 2 N [USC00395671], Mitchell, SD
- (12) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (13) ALEXANDRIA [USC00390128], Alexandria, SD
- (14) BRIDGEWATER [USC00391032], Bridgewater, SD
- (15) MARION [USC00395228], Marion, SD
- (16) MENNO [USC00395481], Menno, SD
- (17) TYNDALL [USC00398472], Tyndall, SD
- (18) WAGNER [USC00398767], Wagner, SD
- (19) ARMOUR [USC00390296], Armour, SD
- (20) ACADEMY 2NE [USC00390043], Platte, SD

Influencing water features

This section is under construction.

Soil features

The soils in this site are moderately well to somewhat poorly drained and formed in alluvium. The loam to silty clay loam surface layer is 9 to 32 inches thick. Dark colors are very deep in these soils. The soils have a moderately slow to moderate infiltration rate. This site should show no evidence of rills, wind scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact.

Soil series are Bonilla and Prosper.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and production.

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
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to moderately well drained
Permeability class	Moderately 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)	17.78–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–20%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–5%

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-Western Wheatgrass Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they were 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. Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the interpretive plant community. Species such as western wheatgrass will initially increase. Big bluestem, little bluestem (*Schizachyrium scoparium*), and green needlegrass will decrease in frequency and production. Heavy, continuous grazing causes Kentucky bluegrass (*Poa pratensis*) to increase and eventually develop into a sod condition. Extended periods of non-use and no surface fire will result in a plant community having high litter levels which favors an increase in Kentucky bluegrass and smooth bromegrass (*Bromus inermis*). In time, shrubs such as western snowberry (*Symphoricarpos occidentalis*) and chokecherry (*Prunus virginiana*) will also increase. 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 Overflow – R055CY020SD

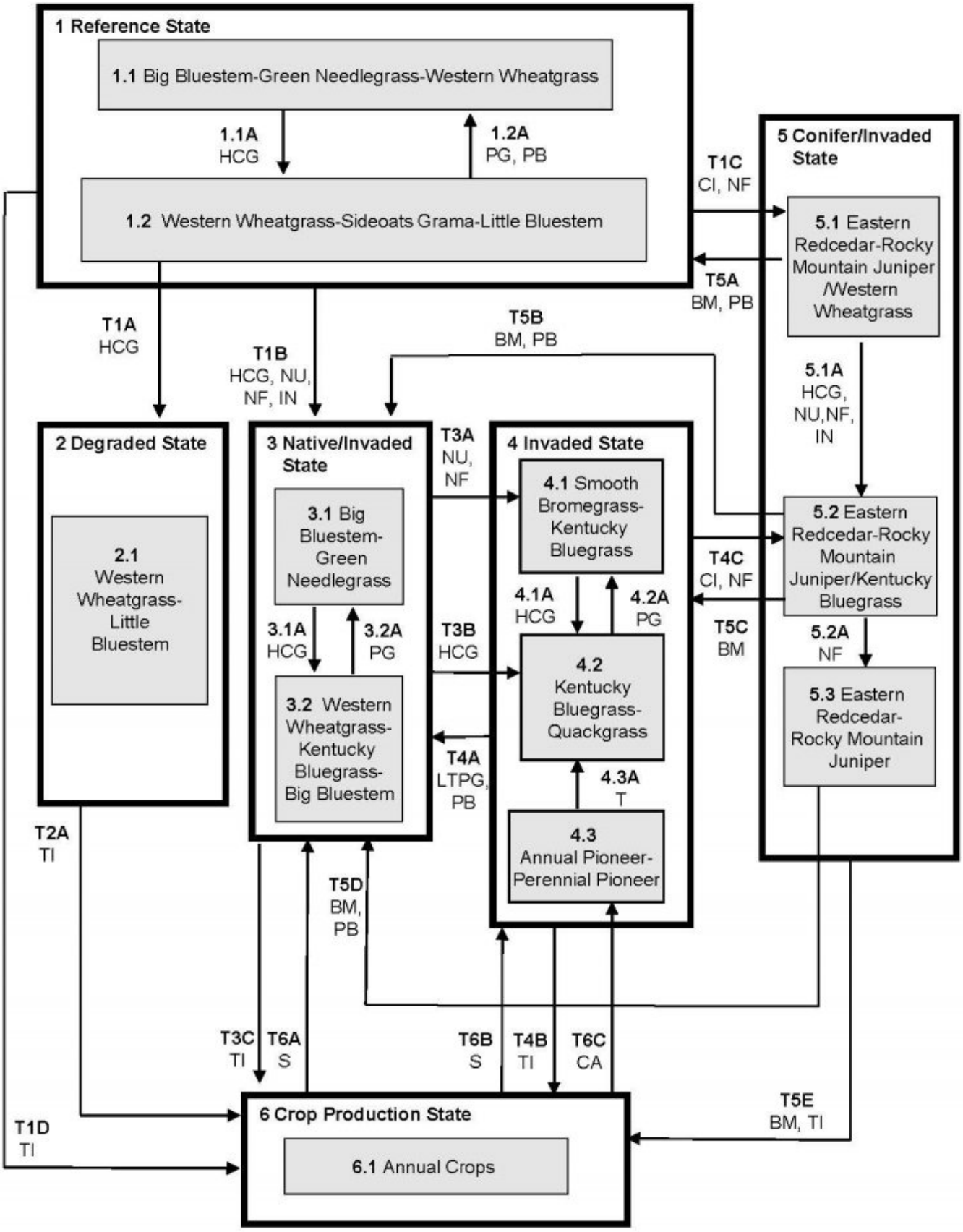

Figure 9. State-and-Transitional Model for the Loamy Overflow Site in MLRA 55C.

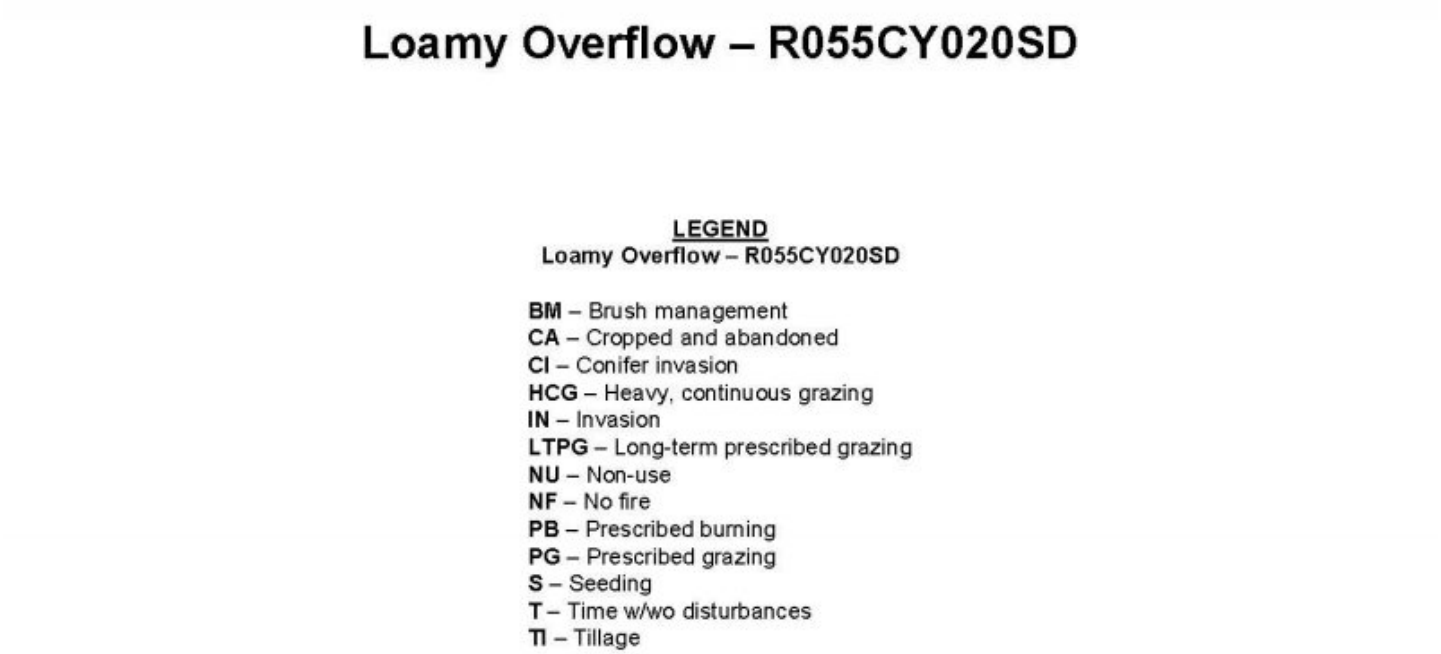

Figure 10. Legend for the Loamy Overflow Site in MLRA 55C.

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
1.2A	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 11. Matrix for the Loamy Overflow 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. Prior to European settlement in 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. Tall warm-season grasses would have declined and shorter 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-Western Wheatgrass

Interpretations are based primarily on the 1.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant Community Phase (this is also considered to be the Reference Community). The potential vegetation was about 82 percent grasses or grass-like plants, 10 percent forbs, and 8 percent shrubs. The community was dominated by warm-season grasses. The major grasses included big bluestem, green needlegrass, western wheatgrass, switchgrass (*Panicum virgatum*), and little bluestem. Other grass or grass-like species included Indiangrass (Sorghastum nutans), porcupinegrass, sideoats grama (*Bouteloua curtipendula*), sedge (Cyperacea), slender wheatgrass (*Elymus trachycaulus*), Canada wildrye (*Elymus canadensis*), and green muhly (*Muhlenbergia racemosa*). 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	3088	3825	4237
Forb	191	328	516
Shrub/Vine	84	217	404
Total	**3363**	**4370**	**5157**

Figure 13. 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

Community 1.2
Western Wheatgrass-Sideoats Grama-Little Bluestem

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 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses included western wheatgrass, sideoats grama, little bluestem, big bluestem, and green needlegrass. Grasses and grass-like species of secondary importance included sedge, switchgrass, Indiangrass, porcupinegrass, slender wheatgrass, and Canada wildrye. 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-Kentucky Bluegrass-Big Bluestem 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 bromegrass. When compared to the 1.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant Community Phase, western wheatgrass, sideoats grama and sedges (Cyperaceae) increased. Green needlegrass and big bluestem decreased and production of 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 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

Pathway 1.1A
Community 1.1 to 1.2

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

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, prescribed burning 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-Western Wheatgrass Plant Community Phase.

State 2
Degraded State

The Degraded State is the result of heavy, continuous grazing, and in the absence of periodic fire due to fire suppression. This state is dominated by western wheatgrass and little bluestem. Taller cool-season species will decline, and a corresponding increase in short statured grass will occur. Once the threshold is crossed, a change in grazing management alone cannot restore the degraded state.

Community 2.1
Western Wheatgrass-Little Bluestem

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 grass and grass-like species included western wheatgrass and little bluestem. Grasses of secondary importance included sideoats grama, green needlegrass, and big bluestem. Forbs commonly found in this plant community included cudweed sagewort, green sagewort (*Artemisia campestris*), Missouri goldenrod (*Solidago missouriensis*), and western yarrow. When compared to the 1.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant Community Phase, western wheatgrass and little bluestem were dominant on this plant community. This vegetation state was very resistant to change, especially if the disturbance continued and the short-statured species such as sedge increased. The herbaceous species present were well adapted to grazing. This plant community was less productive than other phases. The thick sod prevented other species from getting established.

Figure 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

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
Big Bluestem-Green Needlegrass

This plant community phase is similar to the 1.1 Big Bluestem-Green Needlegrass-Western Wheatgrass Plant Community Phase but it also contains minor amounts of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass (up to about 15 percent by air-dry weight). The potential vegetation is about 82 percent grasses or grass-like plants, 10 percent forbs, and 8 percent shrubs. This community is dominated by warm-season grasses. The major grasses include big bluestem, green needlegrass, western wheatgrass, switchgrass, and little bluestem. Other grass or grass-like species include Indiangrass, porcupinegrass, sideoats grama, sedge, slender wheatgrass, Canada wildrye, Kentucky bluegrass, smooth bromegrass, and green muhly. 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 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

Community 3.2
Western Wheatgrass-Kentucky Bluegrass-Big Bluestem

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 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses include western wheatgrass, Kentucky bluegrass, and big bluestem. Grasses of secondary importance include sideoats grama, little bluestem, green needlegrass, porcupinegrass, smooth bromegrass, 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-Western Wheatgrass Plant Community Phase, western wheatgrass has increased and big bluestem has decreased. Needlegrasses have decreased and production of mid- and tall warm-season grasses has also been reduced. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. 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 bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers and the structure will begin to be modified. These changes favor the shallow-rooted species and hasten their eventual dominance if steps are not taken to reduce these species.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1961	2668	3206
Shrub/Vine	140	235	359
Forb	140	235	359
Total	**2241**	**3138**	**3924**

Figure 18. 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-Kentucky Bluegrass-Big Bluestem 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 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. This state is characterized by the dominance of Kentucky bluegrass and smooth bromegrass, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade tolerant introduced grass species. The nutrient cycle is also impaired and the result is typically a higher level of nitrogen which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns thereby shifting competitive advantage to shade tolerant introduced grass species. Studies indicate that soil biological activity is altered and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. Once the state is well established, even drastic events such as high intensity fires driven by high fuel loads of litter and thatch will not result in more than a very short-term reduction of Kentucky bluegrass. These events may reduce the dominance of Kentucky bluegrass, but due to the large amount of rhizomes in the soil, there is no opportunity for the native species to establish before Kentucky bluegrass rebounds.

Community 4.1
Smooth Bromegrass-Kentucky Bluegrass

This plant community phase is a result of extended periods of nonuse and no fire or occasionally light levels of

grazing over several years. It is characterized by dominance of smooth bromegrass and to a lesser extent Kentucky bluegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface and eventually a thatch-mat layer may develop. 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, 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	2455	3237	3542
Shrub/Vine	174	392	706
Forb	174	294	460
Total	**2803**	**3923**	**4708**

Figure 20. 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-Quackgrass

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 quackgrass. 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	1250	1614	1872
Forb	95	252	471
Shrub/Vine	–	151	347
Total	**1345**	**2017**	**2690**

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 4.3

Annual Pioneer-Perennial Pioneer

This plant community developed under continuous, heavy grazing or other excessive disturbances. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable but often include 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-Quackgrass 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-Quackgrass Plant Community Phase.

Conservation practices

Integrated Pest Management (IPM)

State 5
Conifer/Invaded State

The Conifer/Invaded 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/or 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

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-likes include big bluestem, green needlegrass, western wheatgrass, sideoats grama and little bluestem. As the canopy increases, warm-season grasses tend to decrease as the cool-season grasses increase. Forbs will be diverse. Trees species will include eastern redcedar and Rocky Mountain juniper. When compared to the 1.1 Big Bluestem-Green Needlegrass-Western Wheatgrass 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 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 and eventually a thatch-mat layer may develop at the surface as well. 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 dominate 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, no surface fire 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 Western Wheatgrass-Little Bluestem Plant Community Phase within the Degraded State (State 2).

Transition T1B
State 1 to 3

Non-use, no surface fire 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 or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition 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 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 or noxious species, abandonment of cropping, or seeding of introduced or native improved varieties of forage species may lead this plant community phase over a threshold to the Invaded State (State 4), and more specifically to the 4.3 Annual/Pioneer, Non-native Perennial Plant Community Phase. In

the case of a seeding, refer to the corresponding Forage Suitability Group (FSG) description for adapted species and expected production (production estimates in the FSG description may be unrealistically high due to the degraded condition of the site at this phase).

Transition 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-Quackgrass 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), prescribed burning (occurring every 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

Prescribed Grazing
Integrated Pest Management (IPM)

Transition T4C
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 T4B
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), prescribed burning (occurring 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 Plant Community Phase within the Conifer/Invaded State (State 5) over a threshold to the Reference State (State 1).

Restoration pathway T5B
State 5 to 3

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

Restoration pathway T5C
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 T5E
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 T6B
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**			1311–1967	
	big bluestem	ANGE	*Andropogon gerardii*	1093–1967	–
	switchgrass	PAVI2	*Panicum virgatum*	131–656	–
	Indiangrass	SONU2	*Sorghastrum nutans*	87–437	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–219	–
2	**Cool-Season Bunchgrasses**			437–874	

	green needlegrass	NAVI4	*Nassella viridula*	219–874	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	87–437	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–219	–
3	**Wheatgrass**			219–656	
	western wheatgrass	PASM	*Pascopyrum smithii*	219–656	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–219	–
4	**Mid Warm-Season Grasses**			219–656	
	little bluestem	SCSC	*Schizachyrium scoparium*	219–656	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	87–437	–
5	**Other Native Grasses**			87–219	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	44–219	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	44–131	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–87	–
6	**Grass-likes**			219–437	
	sedge	CAREX	*Carex*	87–437	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–131	–
7	**Forbs**			219–437	
	Forb, native	2FN	*Forb, native*	44–131	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	44–131	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	44–131	–
	false boneset	BREU	*Brickellia eupatorioides*	0–87	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	44–87	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–87	–
	scurfpea	PSORA2	*Psoralidium*	44–87	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	44–87	–
	white heath aster	SYER	*Symphyotrichum ericoides*	44–87	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	44–87	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	44–87	–
	dotted blazing star	LIPU	*Liatris punctata*	44–87	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	0–44	–
	swamp verbena	VEHA2	*Verbena hastata*	0–44	–
	meadow zizia	ZIAP	*Zizia aptera*	0–44	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–44	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–44	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–44	–
	northern bedstraw	GABO2	*Galium boreale*	0–44	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–44	–
Shrub/Vine					
8	**Shrubs**			87–350	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	44–175	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–131	–

	leadplant	AMCA6	*Amorpha canescens*	44–131	–
	American plum	PRAM	*Prunus americana*	0–131	–
	chokecherry	PRVI	*Prunus virginiana*	0–131	–
	golden currant	RIAU	*Ribes aureum*	0–131	–
	rose	ROSA5	*Rosa*	44–87	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	44–87	–

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**			63–471	
	big bluestem	ANGE	*Andropogon gerardii*	63–471	–
	switchgrass	PAVI2	*Panicum virgatum*	0–94	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–94	–
2	**Cool-Season Bunchgrasses**			63–314	
	green needlegrass	NAVI4	*Nassella viridula*	63–314	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–94	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–63	–
3	**Wheatgrass**			314–785	
	western wheatgrass	PASM	*Pascopyrum smithii*	314–785	–
4	**Mid Warm-Season Grasses**			0–157	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–157	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–94	–
5	**Other Native Grasses**			31–157	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–94	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–94	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–63	–
6	**Grass-likes**			94–471	
	sedge	CAREX	*Carex*	94–471	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
7	**Non-Native Grasses**			314–785	
	Kentucky bluegrass	POPR	*Poa pratensis*	157–628	–
	smooth brome	BRIN2	*Bromus inermis*	0–314	–
	quackgrass	ELRE4	*Elymus repens*	0–314	–
	brome	BROMU	*Bromus*	0–157	–
Forb					
8	**Forbs**			157–314	
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–157	–
	Forb, introduced	2FI	*Forb, introduced*	0–126	–
	sweetclover	MELIL	*Melilotus*	0–126	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–126	–

	scurfpea	PSORA2	*Psoralidium*	31–94	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–94	–
	Forb, native	2FN	*Forb, native*	31–94	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	31–94	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	31–94	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–63	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–31	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–31	–
	dotted blazing star	LIPU	*Liatris punctata*	0–31	–
	curly dock	RUCR	*Rumex crispus*	0–31	–
	common dandelion	TAOF	*Taraxacum officinale*	0–31	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–31	–
	swamp verbena	VEHA2	*Verbena hastata*	0–31	–
Shrub/Vine					
9	**Shrubs**			157–314	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–251	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–94	–
	American plum	PRAM	*Prunus americana*	0–63	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	31–63	–
	rose	ROSA5	*Rosa*	31–63	–
	chokecherry	PRVI	*Prunus virginiana*	0–31	–
	leadplant	AMCA6	*Amorpha canescens*	0–31	–

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**			0–196	
	big bluestem	ANGE	*Andropogon gerardii*	0–196	–
2	**Cool-Season Bunchgrasses**			0–196	
	green needlegrass	NAVI4	*Nassella viridula*	0–196	–
3	**Wheatgrass**			0–196	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–196	–
4	**Other Native Grasses**			0–196	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–196	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–78	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–39	–
5	**Grass-likes**			0–392	
	sedge	CAREX	*Carex*	0–392	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–118	–
6	**Non-Native Grasses**			1177–2550	
	smooth brome	BRIN2	*Bromus inermis*	785–2354	–
	Kentucky bluegrass	POPR	*Poa pratensis*	392–981	–

	quackgrass	ELRE4	*Elymus repens*	0–588	–
	brome	BROMU	*Bromus*	0–196	–
Forb					
7	**Forbs**			196–392	
	sweetclover	MELIL	*Melilotus*	0–235	–
	Forb, introduced	2FI	*Forb, introduced*	0–196	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	39–157	–
	Forb, native	2FN	*Forb, native*	0–118	–
	curly dock	RUCR	*Rumex crispus*	0–118	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	39–118	–
	white heath aster	SYER	*Symphyotrichum ericoides*	39–118	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	39–118	–
	common dandelion	TAOF	*Taraxacum officinale*	0–78	–
	yellow salsify	TRDU	*Tragopogon dubius*	0–78	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	39–78	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–78	–
	scurfpea	PSORA2	*Psoralidium*	39–78	–
Shrub/Vine					
8	**Shrubs**			196–588	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	78–588	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–118	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–118	–
	rose	ROSA5	*Rosa*	39–118	–

Table 12. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			0–40	
	green needlegrass	NAVI4	*Nassella viridula*	0–40	–
2	**Wheatgrass**			0–61	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–61	–
3	**Other Native Grasses**			0–101	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–101	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–20	–
4	**Grass-likes**			202–504	
	sedge	CAREX	*Carex*	202–504	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–101	–
5	**Non-Native Grasses**			504–1110	
	Kentucky bluegrass	POPR	*Poa pratensis*	404–1009	–
	quackgrass	ELRE4	*Elymus repens*	40–303	–
	smooth brome	BRIN2	*Bromus inermis*	0–202	–
	brome	BROMU	*Bromus*	20–161	–
Forb					
6	**Forbs**			101–404	
	Forb, introduced	2FI	*Forb, introduced*	20–202	–
	sweetclover	MELIL	*Melilotus*	0–202	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	20–81	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–81	–
	common dandelion	TAOF	*Taraxacum officinale*	20–81	–
	yellow salsify	TRDU	*Tragopogon dubius*	20–61	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–61	–
	curly dock	RUCR	*Rumex crispus*	0–61	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	20–61	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–61	–
	scurfpea	PSORA2	*Psoralidium*	20–40	–
	Forb, native	2FN	*Forb, native*	0–40	–
Shrub/Vine					
7	**Shrubs**			0–303	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–303	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	rose	ROSA5	*Rosa*	0–40	–

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. Following consultation with 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.

Big Bluestem/Needlegrass (1.1 & 3.1)
Average Annual Production (lbs./acre, air-dry): 3,900
Stocking Rate* (AUM/acre): 1.07

Western Wheatgrass/Kentucky Bluegrass/Big Bluestem (3.2)
Average Annual Production (lbs./acre, air-dry): 2,800
Stocking Rate* (AUM/acre): 0.77

Smooth Bromegrass/Kentucky Bluegrass (4.1)
Average Annual Production (lbs./acre, air-dry): 3,500
Stocking Rate* (AUM/acre):0.96

Kentucky Bluegrass/Sedge (4.2)
Average Annual Production (lbs./acre, air-dry): 1,800
Stocking Rate* (AUM/acre): 0.49

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 (AUM), and on 25 percent harvest efficiency (refer to United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) National Range and Pasture Handbook).

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group 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 an area where short-grasses 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

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.

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Approval

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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.

Rangeland health reference sheet

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

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Date	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 rhizomatous grasses >>

Sub-dominant: Tall cool-season bunchgrasses > mid cool-season rhizomatous grasses = mid warm-season grasses >

Other: Grass-likes = forbs > shrubs > short cool-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.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3,000–4,600 lbs./acre air-dry weight, average 3,900 lbs./acre air-dry weight.

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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:** Refer to State and Local Noxious Weed List, also Kentucky bluegrass, smooth bromegrass.

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