USDA Natural Resources Conservation Service

Ecological site R060AY041SD
Loamy 16-18" P.Z.

Accessed: 05/06/2024

General information

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

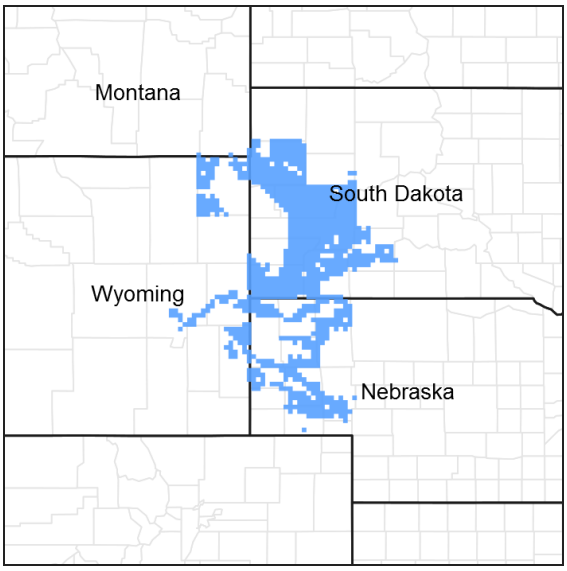


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 060A–Pierre Shale Plains

MLRA Notes:
The Pierre Shale Plains (MLRA 60A) consists of approximately 10,150 square miles, the majority of which is located in South Dakota (70 percent) and small portions are in Montana (2 percent), Nebraska (8 percent), and Wyoming (20 percent). It encircles the Black Hills (MLRA 62)and the Dakota Hogback (MLRA 61). MLRA 60A includes portions of the Oglala, Buffalo Gap, and Thunder Basin National Grasslands. It also includes small sections of the Pine Ridge Indian Reservation, Badlands National Park, and Black Hills National Forest. The Cheyenne and Belle Fourche Rivers flow through the MLRA.

MLRA 60A is in the unglaciated section of the Missouri Plateau, of the Great Plains Province of the Interior Plains. It is an area of old plateaus and terraces that have been deeply eroded. Cretaceous Pierre Shale underlies almost all of this MLRA. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clay. These clays shrink as they dry and swell as they receive moisture. Soils are shallow to very deep and generally are well drained and clayey.

Elevations generally range from 2,620 to 3,610 feet throughout the MLRA, but can range up to 4,260 feet. The average annual precipitation for the western side of the MLRA is 13 to 16 inches, whereas the eastern side receives 16 to 18 inches. A suite of ecological sites have been written specifically for these two precipitation zones. The Locator Map shows the break between the two precipitation zones.

This area supports a mixed natural prairie vegetation consisting of both cool- and warm-season grasses and forbs. Wyoming big sagebrush occurs primarily in the drier western portion of the MLRA; however, small remnant stands can be found in the eastern portion. Dominant land uses of the area primarily are ranching and, to a lesser extent, farming. Major resource concerns to this MLRA are wind erosion and surface water quality.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 60A – Pierre Shale Plains.

EPA - Level IV Ecoregions of the Continental United States: 43e – Sagebrush Steppe, 43g Semiarid Pierre Shale Plains, and 43k – Dense Clay Prairie.

Ecological site concept

The Loamy 16-18” PZ (precipitation zone) ecological site occurs on the eastern side of the MLRA. It is located on upland landscapes and does not receive additional moisture from run off or overflow. The typical slopes range is from 0 to 15 percent. The surface texture of the soils are loam to silty clay loam. Carbonates can be found between 10 to 25 inches below the surface. The vegetation in Reference consists of a mix of cool- and warm-season grasses; however, mid-statured cool-season grasses tend to be the dominant group. Western wheatgrass and needle and thread are the dominant cool-season grasses, sideoats grama, little bluestem, blue grama, and buffalograss are the dominant warm-season grasses. Forbs are common and diverse; shrubs are present but are in minor amounts. This site is susceptible to invasion of non-native, cool-season grasses.

Associated sites

R060AY009SD	**Sandy** The Sandy site can be located adjacent to the Loamy 16-18” PZ site.
R060AY012SD	**Thin Upland** The Thin Upland site can be located on steeper slopes adjacent to the Loamy 16-18” PZ site.
R060AY020SD	**Loamy Overflow** The Loamy Overflow site can be located on drainageways adjacent to the Loamy 16-18” PZ site.
R060AY022SD	**Loamy Terrace** The Loamy Terrace site can be located on a stream or river terrace adjacent to the Loamy 16-18” PZ site.
R060AY024SD	**Shallow Loamy** The Shallow Loamy site can be located on steep slopes above the Loamy 16-18” PZ site.
R060AY040SD	**Clayey 16-18" P.Z.** The Clayey 16-18” PZ site can be located adjacent to the Loamy 16-18” PZ site.

Similar sites

R060AY022SD	**Loamy Terrace** The Loamy Terrace site will have a similar plant community but with more shrubs, scattered trees, and higher production.
R060AY040SD	**Clayey 16-18" P.Z.** The Clayey 16-18” PZ site will have similar production with more green needlegrass and less needle and thread.
R060AY020SD	**Loamy Overflow** The Loamy Overflow site will have less needle and thread, more big bluestem, and higher production.

Table 1. Dominant plant species

Tree	Not specified

Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Hesperostipa comata subsp. comata*

Physiographic features

This site occurs on gently undulating to rolling uplands.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Pediment (3) Plain
Flooding frequency	None
Ponding frequency	None
Elevation	762–1,311 m
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate in this MLRA is typically the drier portion of the Northern Great Plains, where sagebrush steppes to the west yield to grassland steppes to the east. Annual precipitation in the wetter portion of the MLRA ranges from 16 to 18 inches per year, with most occurring during the growing season. Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permit rapid incoming and outgoing radiation. Cold air masses from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but the more severe storms occur during late fall, late winter, and spring. The normal average annual temperature is about 47°F. January is the coldest month, with average temperatures ranging from about 18°F (Newell, SD) to about 23°F (Oelrichs, SD). July is the warmest month, with average temperatures ranging from about 72°F (Newell, SD) to about 74°F (Oelrichs, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 53°F. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour. Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and can continue to early or mid-September. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	119 days
Freeze-free period (average)	148 days
Precipitation total (average)	457 mm

Climate stations used

- (1) SAINT ONGE 2 S [USC00397418], Belle Fourche, SD
- (2) RAPID CITY RGNL AP [USW00024090], Rapid City, SD
- (3) ARDMORE 1 NW [USC00390236], Edgemont, SD
- (4) OELRICHS [USC00396212], Oelrichs, SD
- (5) WASTA [USC00398911], Owanka, SD

Influencing water features

No significant water features influence this site.

Soil features

The soils in this site are well drained and formed in residuum, alluvial materials, and eolian deposits. The surface layer is 4 to 11 inches thick. The texture of the subsurface soils range from loam to clay. The soils have a moderate infiltration rate. This site typically should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are not restrictive 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.

Common soils correlated the Loamy 16-18" PZ Ecological Site include: Altvan, Norka, Nuncho, Nunn, Recluse, Satanta, and Savo.

Access Web Soil Survey http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Clay loam (3) Silt loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	51–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

Invasion of non-native cool-season grasses, primarily smooth brome and Kentucky bluegrass can alter the dynamics of this site. Once these species establish it is unlikely the plant community will return to the Reference State (1.0).

Long-term non-use, in combination with above average precipitation, may transition a native/non-native cool-season grass plant community phase (PCP) to a predominantly non-native PCP.

Encroachment of ponderosa pine, Rocky Mountain juniper, and eastern red cedar may occur from associated sites, and can shift site characteristics. These shifts can alter the site dynamics and potential. Ponderosa pine and Rocky Mountain juniper may occur in small amounts on several PCPs without adversely affecting the site dynamics.

The PCP which interpretations are primarily based is the Western Wheatgrass-Needlegrass Plant Community (1.1). This has been determined by studying rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes.

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

State and transition model

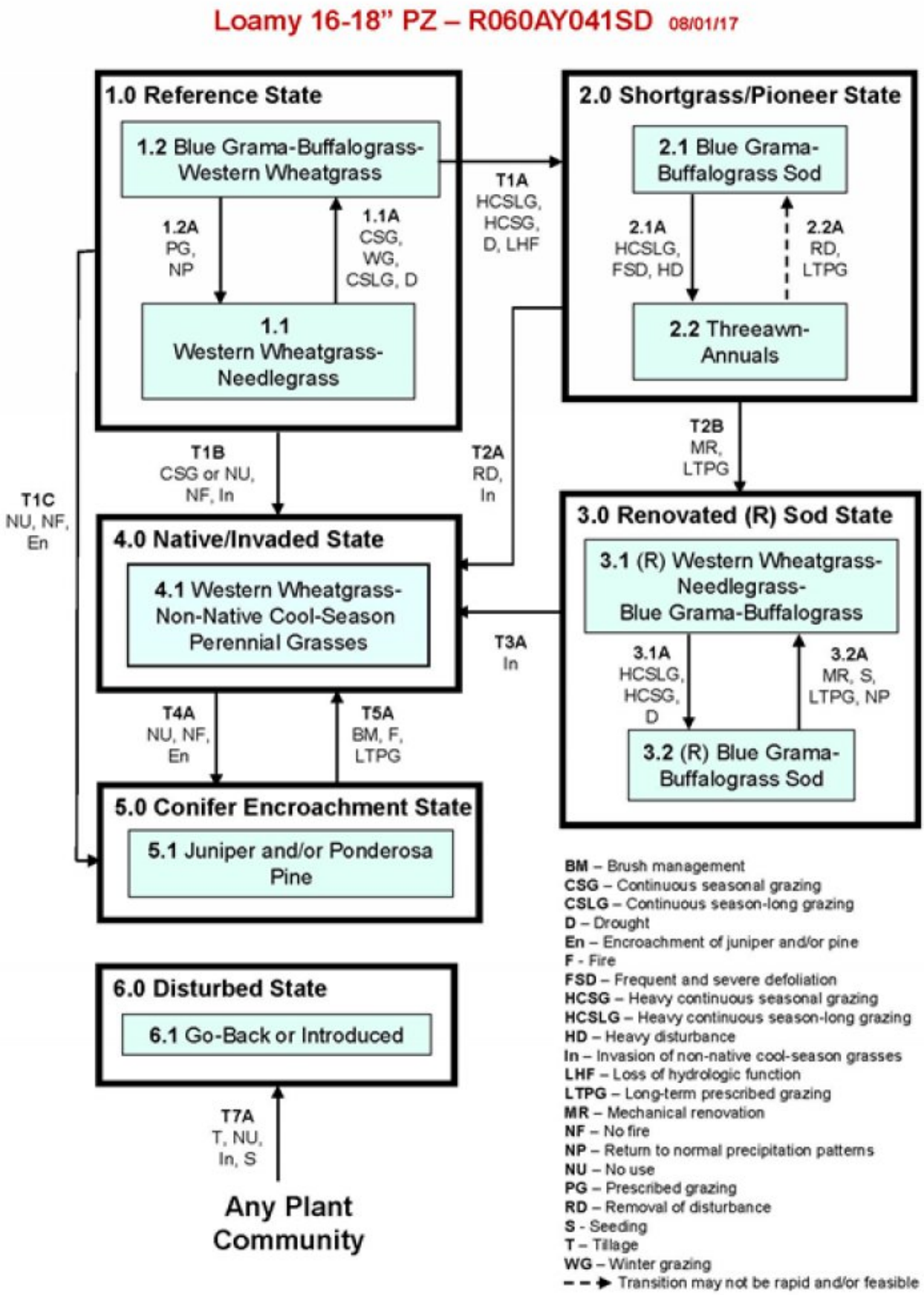


Figure 6. Loamy 16-18" PZ - R060AY041SD.

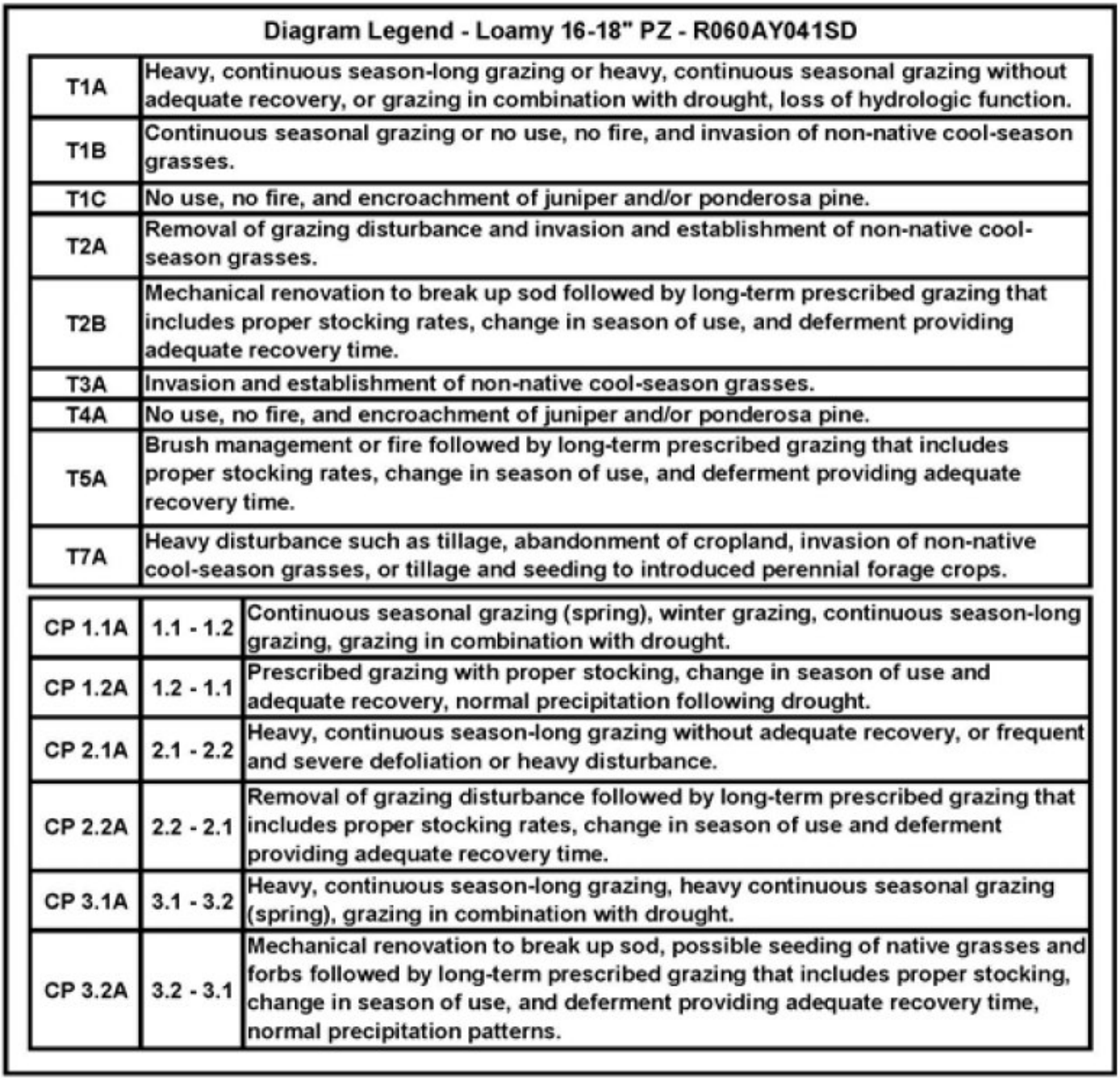


Diagram Legend - Loamy 16-18" PZ - R060AY041SD

T1A	Heavy, continuous season-long grazing or heavy, continuous seasonal grazing without adequate recovery, or grazing in combination with drought, loss of hydrologic function.
T1B	Continuous seasonal grazing or no use, no fire, and invasion of non-native cool-season grasses.
T1C	No use, no fire, and encroachment of juniper and/or ponderosa pine.
T2A	Removal of grazing disturbance and invasion and establishment of non-native cool-season grasses.
T2B	Mechanical renovation to break up sod followed by long-term prescribed grazing that includes proper stocking rates, change in season of use, and deferment providing adequate recovery time.
T3A	Invasion and establishment of non-native cool-season grasses.
T4A	No use, no fire, and encroachment of juniper and/or ponderosa pine.
T5A	Brush management or fire followed by long-term prescribed grazing that includes proper stocking rates, change in season of use, and deferment providing adequate recovery time.
T7A	Heavy disturbance such as tillage, abandonment of cropland, invasion of non-native cool-season grasses, or tillage and seeding to introduced perennial forage crops.

CP 1.1A	1.1 - 1.2	Continuous seasonal grazing (spring), winter grazing, continuous season-long grazing, grazing in combination with drought.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change in season of use and adequate recovery, normal precipitation following drought.
CP 2.1A	2.1 - 2.2	Heavy, continuous season-long grazing without adequate recovery, or frequent and severe defoliation or heavy disturbance.
CP 2.2A	2.2 - 2.1	Removal of grazing disturbance followed by long-term prescribed grazing that includes proper stocking rates, change in season of use and deferment providing adequate recovery time.
CP 3.1A	3.1 - 3.2	Heavy, continuous season-long grazing, heavy continuous seasonal grazing (spring), grazing in combination with drought.
CP 3.2A	3.2 - 3.1	Mechanical renovation to break up sod, possible seeding of native grasses and forbs followed by long-term prescribed grazing that includes proper stocking, change in season of use, and deferment providing adequate recovery time, normal precipitation patterns.

Figure 7. Loamy 16-18" PZ - R060AY041SD.

State 1
Reference State

This State represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. This site in the Reference State (1.0), is dominated by cool-season grasses and subdominant warm-season grass. Grazing and the lack of grazing, fire, and drought are the major drivers between plant communities. Continuous season-long grazing can push this State to a warm-season shortgrass-dominated State. Non-use, no fire, and invasion of non-native cool-season grasses will result in a transition to a Native/Invaded State (4.0).

Community 1.1
Western Wheatgrass-Needlegrass

Figure 8. Loamy 16-18" PZ - PCP 1.1

The plant community upon which interpretations are primarily based is the Western Wheatgrass-Needlegrass Plant Community (1.1). This is also considered the Reference Plant Community. This plant community can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of deferment. The potential vegetation is about 85 to 90 percent grasses or grass-like plants, 5 to 10 percent forbs, and 1 to 5 percent shrubs. Cool-season grasses dominate the plant community. Major grasses include western wheatgrass and needle and thread. Other grasses occurring on the site include green needlegrass, blue grama, little bluestem, sideoats grama, and sedge. Significant forbs include American vetch, cudweed sagewort, scurfpea, western ragweed, and goldenrod. The significant shrub that occurs in patchy mosaics is western snowberry. Other shrubs include rose, leadplant, and broom snakeweed. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Moderate or high available water capacity provides a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1541	2146	2729
Forb	118	247	392
Shrub/Vine	22	73	129
Total	**1681**	**2466**	**3250**

Figure 10. Plant community growth curve (percent production by month). SD6001, Pierre Shale 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 1.2
Blue Grama-Buffalograss-Western Wheatgrass

Figure 11. Loamy 16-18" PZ - PCP 1.2

This plant community develops under continuous seasonal grazing (i.e., grazing an area during the same season every year), or from over utilization during extended drought periods. The potential vegetation is made up of approximately 80 to 90 percent grasses and grass-like species, 5 to 15 percent forbs, and 1 to 5 percent shrubs. The dominant grasses include blue grama, buffalograss, western wheatgrass, needle and thread, and threadleaf sedge. Other grasses may include sideoats grama, prairie Junegrass, red threeawn, and little bluestem. The dominant forbs include scurfpeas, western ragweed, cudweed sagewort, scarlet globemallow, and perennial aster species. Dominant shrubs in this community include western snowberry and wild rose. Broom snakeweed may also be present in significant amounts. Compared to the Western Wheatgrass-Needlegrass Plant Community (1.1), the shortgrass species including blue grama and buffalograss have increased. The cool-season species including western wheatgrass and needlegrasses have decreased in composition. Annual bromes, wooly Indianwheat, and other annual grasses and forbs can invade the site. While plant diversity is relatively high, the structure of the community is dominated by short grasses. This plant community is resistant to change. The dominant herbaceous species are mid- to tall-grasses and are very adapted to grazing; however, these grass species and the more palatable forbs will decrease in the community through long-term overgrazing. Soil erosion is low to moderate. Because of the sod forming habit of the dominant shortgrass species, water infiltration is low, and runoff is moderate to high. Typically the runoff is very clean because of the low potential for soil erosion.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1143	1454	1760
Forb	78	168	258
Shrub/Vine	11	50	90
Tree	–	9	22
Total	**1232**	**1681**	**2130**

Figure 13. Plant community growth curve (percent production by month). SD6003, Pierre Shale Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant.

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

Western Wheatgrass-Needlegrass

Blue Grama-Buffalograss-Western Wheatgrass

Continuous season-long grazing, heavy, continuous seasonal grazing, long-term winter grazing that extends in to the early growing season, and/or extended periods of drought will lead to the Blue Grama-Buffalograss-Western Wheatgrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Blue Grama-Buffalograss-Western Wheatgrass

Western Wheatgrass-Needlegrass

With prescribed grazing, which includes moderate grazing pressure during the early spring (prior to May 1) and fall seasons (cool-season regrowth) and with favorable growing conditions this plant community will move towards the Western Wheatgrass-Needlegrass Plant Community (1.1). Periods of non-use or deferment may be a management option.

State 2
Shortgrass/Pioneer State

The Shortgrass State is dominated by shortgrass species and upland sedges. The State is the result of grazing patterns that did not provide adequate recovery time for cool-season wheat grasses and needlegrasses. If heavy disturbance such as, frequent and sever defoliation, and livestock concentration continues, pioneer perennials and annual grass and forb species may become dominant. The hydrologic function of this state is dramatically altered. Runoff is high and infiltration is low. This State is very resistant to change through grazing management alone.

Community 2.1
Blue Grama-Buffalograss Sod

Figure 14. Loamy 16-18" PZ - PCP 2.1

This plant community is the result of heavy overuse and/or continuous seasonal grazing. Blue grama and buffalograss are the dominant species with the balance being a few species of cool-season grasses, warm-season grasses and miscellaneous forbs. Some of the minor species are western wheatgrass, threeawn, sedges, needle and thread, prairie Junegrass, sideoats grama, and annual brome. There are a few forbs such as western ragweed, cudweed sagewort, green sagewort, and scarlet globemallow. The dominant shrubs include broom snakeweed and

fringed sagewort. There is usually less than 10 percent bare ground. When compared to the Western Wheatgrass-Needlegrass Plant Community (1.1), blue grama and buffalograss have increased significantly. The mid- and tall-grasses have declined dramatically. There is a chance that cheatgrass has invaded the site. Annual production has decreased significantly. This plant community is resistant to change, as the dominant shortgrass species are very resistant to over-grazing. The thick sod prevents other species from establishing. This area provides reduced grazing use for livestock or wildlife. The quickest means to make this a productive site again is to do some sort of mechanical treatment, such as pitting or chiseling. Most landowners however will farm the area for two or three years and then replant the area to mixture of tame or native grasses. Runoff will increase and infiltration will decrease. Soil erosion will be minimal due to the sod forming habit of blue grama and buffalograss. This could be advantageous for heavy use areas such as calving/lambing units, however nutrient runoff could be a potential problem.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	516	780	930
Forb	39	90	140
Shrub/Vine	6	27	50
Tree	–	–	–
Total	**561**	**897**	**1120**

Figure 16. Plant community growth curve (percent production by month). SD6005, Pierre Shale 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

Community 2.2
Threeawn-Annuals

Figure 17. Loamy 16-18" PZ - PCP 2.2

This plant community developed under continuous heavy grazing and/or heavy disturbance. The potential plant community is made up of approximately 60 to 80 percent grasses and grass-like species, 10 to 20 percent forbs, and 5 to 20 percent shrubs. The dominant grasses include red threeawn, annual brome grasses, and Scribner panicum. Other grasses may include little bluestem, blue grama, buffalograss, sedges, western wheatgrass, and sixweeks fescue. The dominant forbs include fringed sagewort, fetid marigold, western ragweed, pussytoes, prostrate verbena, and other annual invader-like species. Other plant species, from adjacent ecological sites, can become minor components of this plant community. This plant community is susceptible to invasion of Canada thistle and other non-native species because of the relatively high percentage of bare ground. Compared to the Western Wheatgrass-Needlegrass Plant Community (1.1), red threeawn, annual brome grasses, and the percentage of bare ground has increased. Western wheatgrass, needlegrasses and other cool-season grasses and

grass-like species have decreased as have the warm-season species including sideoats grama, blue grama, and buffalograss. Many annual and perennial forbs, including native and non-native species have invaded the site. This plant community is very resistant to change because of the loss of plant diversity and overall soil disturbance. 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 site can be renovated to improve the production capability, however if management changes are not made the vegetation could revert back to a Threeawn-Annuals PCP (2.2).

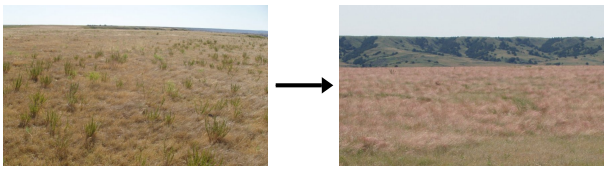
Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	342	569	796
Shrub/Vine	34	99	163
Forb	73	117	163
Total	**449**	**785**	**1122**

Figure 19. Plant community growth curve (percent production by month). SD6003, Pierre Shale Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant.

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

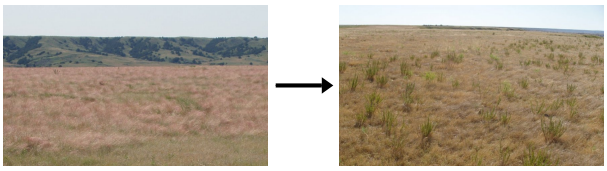
Pathway 2.1A
Community 2.1 to 2.2



Blue Grama-Buffalograss Sod **Threeawn-Annuals**

With heavy continuous season-long grazing, or severe defoliation, this plant community will move toward the Threeawn-Annuals Plant Community (2.2). Forage production, species diversity, and ground cover will decrease.

Pathway 2.2A
Community 2.2 to 2.1



Threeawn-Annuals **Blue Grama-Buffalograss Sod**

Removal of the heavy disturbance and long-term prescribed grazing, including adequate rest periods, and, normal precipitation patterns this plant community will eventually transition back to the Blue Grama-Buffalograss PCP (2.1). This pathway may take an extended period of time and may not in the end meet management objectives.

State 3
Renovated (R) Sod State

The forage production potential of a shortgrass plant community can be quickly improved through mechanical renovation. Mechanical renovation creates microrelief that can restore, hydrologic function by increasing infiltration and decreasing runoff. These factors favor cool-season species such as western wheatgrass, green needlegrass, and a variety of forbs. Mechanical renovation may not be economically feasible and if the management activities that created the plant community are not changed the renovation will not be successful.

Community 3.1
(R) Western Wheatgrass-Needlegrass-Blue Grama-Buffalograss

With proper management after renovation (R), this plant community will have similar plant composition and growth curve characteristics as the Reference PCP (1.1), however, the production will likely be slightly higher, depending on the degree of alteration. Proper grazing management must be implemented to maintain this plant community.

Community 3.2
(R) Blue Grama-Buffalograss Sod

This plant community will be similar to the Blue Grama-Buffalograss Sod Plant Community (2.1) in most respects. The main difference is the microrelief created by the renovation. Depending on the renovation technique, the microrelief can remain on the landscape for many decades making vehicular travel across the landscape uncomfortable if not extremely difficult.

Pathway 3.1A
Community 3.1 to 3.2

Heavy, continuous season-long grazing or heavy continuous seasonal grazing and drought will shift this plant community to the renovated (R) Blue Grama-Buffalograss Sod Plant Community (3.2). Proper grazing management must be included in order to derive the benefits of renovation.

Pathway 3.2A
Community 3.2 to 3.1

This plant community can be returned to (R) Western Wheatgrass-Needlegrass-Blue Grama-Buffalograss Plant Community Phase (3.1) through another mechanical renovation treatment, and possibly seeding, followed by long-term prescribed grazing and normal precipitation patterns. The 2nd mechanical treatment may make travel across the landscape difficult for vehicles and livestock.

State 4
Native/Invaded State

This State has been invaded by smooth brome and/or Kentucky bluegrass, but not at the levels where the plant communities are dominated by these species. Long-term non-use, in combination with above average precipitation, may transition a native/non-native cool-season grass plant community phase (PCP) to a predominantly non-native PCP. This scenario has been observed on this ecological site in small acreage field but not on larger tracts of land. This transition can be observed in the adjacent MLRAs. MLRA 63A – Northern Rolling Pierre Shale Plains, MLRA 61 – Black Hills Foot Slopes, and MLRA 62 – Black Hills. Once these species are establish it is unlikely that an invaded plant community can be returned to the Reference State (1.0).

Community 4.1
Western Wheatgrass-Non-Native Cool-Season Grasses

Figure 20. Loamy 16-18" PZ - PCP 4.1

This plant community developed under continuous seasonal grazing or under extended periods of non-use and no fire where a heavy litter layer builds up that can favor cool-season species and invasion of smooth brome, Kentucky bluegrass, annual brome and other invaders. Initially, the dominant grasses include bluegrass, western wheatgrass, needle and thread, and green needlegrass. Other grasses may include blue grama, buffalograss, threeawn, and prairie junegrass. Sedges will flourish in the understory. The dominant forbs include western ragweed, scurfpeas, cudweed sagewort, and verbenas. Dominant shrubs in this community include snowberry, rose, and plains pricklypear. This plant community is resistant to change, and if disturbed, it is resilient. Bluegrass will increase under grazing pressure. Cool, moist climatic conditions will also tend to increase bluegrass production. Soil erosion is low. Compared to the Reference PCP (1.1), infiltration is reduced, and runoff increases. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity of the site.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	796	1533	2034
Forb	84	179	280
Shrub/Vine	17	54	95
Tree	–	27	56
Total	**897**	**1793**	**2465**

Figure 22. Plant community growth curve (percent production by month). SD6001, Pierre Shale 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

State 5
Conifer Encroachment State

This state is greatly influenced by conifers. Primarily ponderosa pine in the northern portion of the MLRA and pine and or rocky mountain juniper in the southern portion. Ponderosa pine canopy was found to significantly reduce precipitation reaching the soil surface (average of 30 percent) due to interception in area of intermediate and dense canopy (Wrage, 1994). This state will develop when conifers encroach onto the site from adjacent forest sites or ecological sites that have been invaded. Encroachment and the establishment of conifers on this site is primarily the result of no fire and grazing management that reduced the competitive nature of the native herbaceous plant community. Once conifers become established on this site, non-native cool-season grasses will increase, especially in the shaded areas. The site in general will become more droughty, but the shallow-rooted cool-season species will be able to outcompete the deeper rooted native species for available moisture.

Community 5.1
Juniper-Ponderosa Pine

Historically, ponderosa pine was confined to ridges and steep shallow slopes located adjacent to this ecological site. Currently, ponderosa pine and juniper are expanding on to this ecological site due to the suppression of fire. The juniper/pine canopy is greater than 30 percent of mature trees. The understory production is made up of about 30 to 60 percent grasses and grass-like species, 5 to 10 percent forbs, and 5 to 20 percent shrubs. Dominant grasses include western wheatgrass, bluegrass, and needle and thread. Other grasses present include little bluestem, green needlegrass, threeawn, prairie Junegrass, Canada wildrye, and annual brome. Forbs commonly found include western ragweed, verbena, cudweed sagewort, fringed sagewort, and pussytoes. When compared to the Western Wheatgrass-Needlegrass Plant Community (1.1), ponderosa pine or juniper increases significantly. The grass component decreases dramatically. Annual production also decreases significantly. While the juniper/pine canopy provides excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased production. This vegetation state is resistant to change. A

significant reduction of juniper/pine can only be accomplished through brush management, wildfire, or prescribed burning. The vegetation in the understory is capable of enduring fire; however, very hot fires will have a detrimental effect to the plant community. Reclamation of juniper/pine-dominated areas can be costly and prove to be temporary without proper management (i.e., prescribed burning and prescribed grazing).

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	398	583	768
Shrub/Vine	39	112	185
Tree	84	135	185
Forb	39	67	95
Total	**560**	**897**	**1233**

Figure 24. Plant community growth curve (percent production by month). SD6011, Pierre Shale Plains, heavy conifer canopy. Mature ponderosa pine/juniper overstory. .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	11	24	27	12	5	4	3	2	1

State 6
Disturbed State

This State can be transitioned to from any Plant Community. The two separate vegetative Plant Communities are highly variable in nature. They are derived through different management scenarios, and are not related successionally. Infiltration, runoff, and soil erosion varies depending on the vegetation present on the site.

Community 6.1
Go-Back or Introduced

The Go-Back Plant Community can be reached whenever severe mechanical disturbance occurs (e.g., tilled and abandoned land, either past or present). During the early successional stages, the species that mainly dominate are annual grasses and forbs, later replaced by both native and introduced perennials. The species vary greatly, sometimes being dominated by threeawn, annual brome, crested wheatgrass, buffalograss, dropseed, broom snakeweed, verbena, sweet clover, mullein, and nonnative thistles. Other plants that commonly occur on the site include western wheatgrass, deathcamas, prickly lettuce, mare’s-tail, kochia, foxtail, and sunflowers. Bare ground is prevalent due to the loss of organic matter and lower overall soil health. The Introduced Plant Community normally consists of those areas seeded to pubescent or intermediate wheatgrass, alfalfa, crested wheatgrass, or other introduced species. Refer to the associated Forage Suitability Group description in the Field Office Technical Guide (FOTG) for adapted species.

Transition T1A
State 1 to 2

With heavy continuous seasonal grazing this plant community will move towards the Shortgrass/Pioneer State (2.0). This would be typical of calving/lambing pastures where the unit is continuously utilized during the late winter through mid-spring. This transition will result in decreased forage production and plant species diversity. This transition can also occur with heavy continuous season-long grazing at high utilization levels. The shift to a shortgrass-dominated plant community will adversely affect hydrological function (high run-off and low filtration) and a return to the Reference State (1.0) through management alone is unlikely.

Transition T1B
State 1 to 4

Continuous seasonal grazing, or non-use and no fire and invasion of non-native cool-season grasses, including

smooth brome and Kentucky bluegrass, will lead to a Western Wheatgrass-Non-Native Cool-Season Perennial Grass Plant Community (4.1).

Transition T1C
State 1 to 5

Encroachment (or escaped) of conifers, non-use, and no fire will lead to a Juniper-Ponderosa Pine Plant Community (5.1). This occurs when this plant community is protected from natural fires, or controlled burning.

Transition T7A
State 1 to 6

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species result in a transition to the Disturbed State (6.0). This transition can happen from any plant community on this site.

Transition T2B
State 2 to 3

Mechanical renovation such as pitting, light disking, chiseling and possible inter-seeding in combination with long-term prescribed grazing may help improve the productivity of the site. This pathway will convert the plant community to the Renovated Sod State (3.0).

Transition T2A
State 2 to 4

If these plant communities are invaded by non-native cool-season grasses and the heavy disturbance causing the frequent defoliation is removed these plant communities are likely to transition to the Native/Invaded State (4.0).

Transition T7A
State 2 to 6

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species result in a transition to the Disturbed State (6.0). This transition can happen from any plant community on this site.

Transition T3A
State 3 to 4

If this State is invaded by non-native cool-season grasses this plant community is likely to transition to the Native/Invaded State (4.0)

Transition T7A
State 3 to 6

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species result in a transition to the Disturbed State (6.0). This transition can happen from any plant community on this site.

Transition T4A
State 4 to 5

Encroachment (or escaped) of conifers, non-use, and no fire will lead to a Juniper-Ponderosa Pine Plant Community (5.1). This occurs when this plant community is protected from natural fires, or has no controlled burning.

Transition T7A
State 4 to 6

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species result in a

transition to the Disturbed State (6.0). This transition can happen from any plant community on this site.

Transition T5A
State 5 to 4

Wildfire or prescribed burning, or mechanical brush management will move this plant community to the Native/Invaded State (4.0).

Transition T7A
State 5 to 6

Heavy disturbance including tillage, abandoned cropland, or seeding to improved pasture species result in a transition to the Disturbed State (6.0). This transition can happen from any plant community on this site.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			616–863	
	western wheatgrass	PASM	*Pascopyrum smithii*	493–740	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	123–247	–
2	**Needlegrass**			370–493	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	247–493	–
	green needlegrass	NAVI4	*Nassella viridula*	0–247	–
3	**Warm Season Short Grasses**			123–247	
	blue grama	BOGR2	*Bouteloua gracilis*	123–247	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–49	–
4	**Native Grasses & Grass-likes**			247–493	
	sideoats grama	BOCU	*Bouteloua curtipendula*	123–247	–
	sedge	CAREX	*Carex*	123–247	–
	little bluestem	SCSC	*Schizachyrium scoparium*	25–123	–
	big bluestem	ANGE	*Andropogon gerardii*	0–123	–
	Grass, perennial	2GP	*Grass, perennial*	0–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–49	–
	threeawn	ARIST	*Aristida*	0–25	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–25	–
5	**Non-native Grasses**			–	
Forb					
6	**Forbs**			123–247	
	scurfpea	PSORA2	*Psoralidium*	25–123	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	25–74	–
	pussytoes	ANTEN	*Antennaria*	0–74	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–74	–
	vervain	VERBE	*Verbena*	0–74	–
	American vetch	VIAM	*Vicia americana*	25–74	–
	spiderwort	TRADE	*Tradescantia*	0–49	

	spiderwort	TRADE	*Tradescantia*	0–49	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–49	–
	Forb, perennial	2FP	*Forb, perennial*	0–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–49	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–25	–
	textile onion	ALTE	*Allium textile*	0–25	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	false boneset	BREU	*Brickellia eupatorioides*	0–25	–
	corn gromwell	BUAR3	*Buglossoides arvensis*	0–25	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–25	–
	dotted blazing star	LIPU	*Liatris punctata*	0–25	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–25	–
	beardtongue	PENST	*Penstemon*	0–25	–
Shrub/Vine					
7	**Shrubs**			25–123	
	snowberry	SYMPH	*Symphoricarpos*	25–123	–
	leadplant	AMCA6	*Amorpha canescens*	0–123	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–74	–
	rose	ROSA5	*Rosa*	0–74	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–49	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–49	–
	pricklypear	OPUNT	*Opuntia*	0–25	–

Table 12. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			168–336	
	western wheatgrass	PASM	*Pascopyrum smithii*	168–336	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–84	–
2	**Needlegrass**			34–168	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	34–135	–
	green needlegrass	NAVI4	*Nassella viridula*	0–84	–
3	**Warm Season Short Grasses**			336–588	
	blue grama	BOGR2	*Bouteloua gracilis*	252–504	–
	buffalograss	BODA2	*Bouteloua dactyloides*	84–168	–
4	**Native Grasses and Grass-likes**			84–252	
	sedge	CAREX	*Carex*	84–168	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	17–84	–
	dropseed	SPORO	*Sporobolus*	0–84	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–50	–

	threeawn	ARIST	*Aristida*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–50	–
	big bluestem	ANGE	*Andropogon gerardii*	0–34	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	17–34	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–17	–
5	**Non-native Grasses**			17–135	
	cheatgrass	BRTE	*Bromus tectorum*	17–84	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–84	–
Forb					
6	**Forbs**			84–252	
	scurfpea	PSORA2	*Psoralidium*	17–84	–
	pussytoes	ANTEN	*Antennaria*	17–67	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–50	–
	vervain	VERBE	*Verbena*	17–50	–
	American vetch	VIAM	*Vicia americana*	17–50	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	17–50	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	17–34	–
	tarragon	ARDR4	*Artemisia dracunculus*	17–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–34	–
	textile onion	ALTE	*Allium textile*	17–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–34	–
	spiderwort	TRADE	*Tradescantia*	0–34	–
	goatsbeard	TRAGO	*Tragopogon*	17–34	–
	milkvetch	ASTRA	*Astragalus*	0–17	–
	false boneset	BREU	*Brickellia eupatorioides*	0–17	–
	corn gromwell	BUAR3	*Buglossoides arvensis*	0–17	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–17	–
	dotted blazing star	LIPU	*Liatris punctata*	0–17	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–17	–
	beardtongue	PENST	*Penstemon*	0–17	–
	goldenrod	SOLID	*Solidago*	0–17	–
Shrub/Vine					
7	**Shrubs**			17–84	
	prairie sagewort	ARFR4	*Artemisia frigida*	17–84	–
	snowberry	SYMPH	*Symphoricarpos*	17–84	–
	rose	ROSA5	*Rosa*	0–50	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–34	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	pricklypear	OPUNT	*Opuntia*	0–17	–
Tree					

8	**Trees**			0–17	
	juniper	JUNIP	*Juniperus*	0–17	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–17	–

Table 13. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			18–45	
	western wheatgrass	PASM	*Pascopyrum smithii*	18–45	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–9	–
2	**Needlegrass**			0–45	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–45	–
	green needlegrass	NAVI4	*Nassella viridula*	0–9	–
3	**Warm Season Short Grasses**			359–538	
	blue grama	BOGR2	*Bouteloua gracilis*	179–493	–
	buffalograss	BODA2	*Bouteloua dactyloides*	90–269	–
4	**Native Grasses and Grass-likes**			90–179	
	sedge	CAREX	*Carex*	45–90	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	9–72	–
	threeawn	ARIST	*Aristida*	9–45	–
	dropseed	SPORO	*Sporobolus*	9–45	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–27	–
	Grass, perennial	2GP	*Grass, perennial*	0–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	9–18	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–9	–
	big bluestem	ANGE	*Andropogon gerardii*	0–9	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–9	–
5	**Non-native Grasses**			18–90	
	cheatgrass	BRTE	*Bromus tectorum*	18–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–45	–
Forb					
6	**Forbs**			45–135	
	pussytoes	ANTEN	*Antennaria*	9–45	–
	tarragon	ARDR4	*Artemisia dracunculus*	9–45	–
	scurfpea	PSORA2	*Psoralidium*	18–45	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	9–27	–
	white heath aster	SYER	*Symphyotrichum ericoides*	9–27	–
	goatsbeard	TRAGO	*Tragopogon*	9–27	–
	vervain	VERBE	*Verbena*	9–27	–
	American vetch	VIAM	*Vicia americana*	9–27	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–27	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	9–27	–

	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–18	–
	Forb, perennial	2FP	*Forb, perennial*	0–18	–
	textile onion	ALTE	*Allium textile*	9–18	–
	goldenrod	SOLID	*Solidago*	0–9	–
	milkvetch	ASTRA	*Astragalus*	0–9	–
	corn gromwell	BUAR3	*Buglossoides arvensis*	0–9	–
	fetid marigold	DYPA	*Dyssodia papposa*	0–9	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–9	–
	dotted blazing star	LIPU	*Liatris punctata*	0–9	–
Shrub/Vine					
7	**Shrubs**			9–45	
	prairie sagewort	ARFR4	*Artemisia frigida*	9–45	–
	snowberry	SYMPH	*Symphoricarpos*	0–45	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	9–27	–
	pricklypear	OPUNT	*Opuntia*	9–27	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–9	–

Table 14. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			8–39	
	western wheatgrass	PASM	*Pascopyrum smithii*	8–39	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–8	–
2	**Needlegrass**			0–39	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–39	–
	green needlegrass	NAVI4	*Nassella viridula*	0–8	–
3	**Warm Season Short Grasses**			0–39	
	blue grama	BOGR2	*Bouteloua gracilis*	0–39	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–16	–
4	**Native Grasses and Grass-likes**			314–588	
	threeawn	ARIST	*Aristida*	392–549	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–39	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–16	–
	Grass, perennial	2GP	*Grass, perennial*	0–16	–
	sedge	CAREX	*Carex*	0–8	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–8	–
5	**Non-native Grasses**			16–78	
	cheatgrass	BRTE	*Bromus tectorum*	16–78	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–16	–
Forb					
6	**Forbs**			78–157	
	vervain	VERBE	*Verbena*	16–78	–
	Forb, perennial	2FP	*Forb, perennial*	0–78	–
	fetid marigold	DYPA	*Dyssodia papposa*	16–63	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–39	–
	pussytoes	ANTEN	*Antennaria*	0–39	–
	textile onion	ALTE	*Allium textile*	0–24	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	8–24	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–16	–
	goatsbeard	TRAGO	*Tragopogon*	0–8	–
	milkvetch	ASTRA	*Astragalus*	0–8	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–8	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–8	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–8	–
Shrub/Vine					
7	**Shrubs**			39–157	
	prairie sagewort	ARFR4	*Artemisia frigida*	39–118	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8–24	–
	pricklypear	OPUNT	*Opuntia*	0–16	–

Table 15. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			359–897	
	western wheatgrass	PASM	*Pascopyrum smithii*	269–717	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	90–269	–
2	**Needlegrass**			90–359	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	36–179	–
	green needlegrass	NAVI4	*Nassella viridula*	36–179	–
3	**Warm Season Short Grasses**			18–143	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–90	–
	blue grama	BOGR2	*Bouteloua gracilis*	18–90	–
4	**Native Grasses and Grass-likes**			90–359	
	sideoats grama	BOCU	*Bouteloua curtipendula*	18–90	–
	sedge	CAREX	*Carex*	36–90	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	36–90	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	18–90	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–54	–
	Grass, perennial	2GP	*Grass, perennial*	0–54	–
	big bluestem	ANGE	*Andropogon gerardii*	0–54	–
	dropseed	SPORO	*Sporobolus*	0–36	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–36	–
	threeawn	ARIST	*Aristida*	0–18	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–18	–
5	**Non-native Grasses**			269–717	
	Kentucky bluegrass	POPR	*Poa pratensis*	269–717	–
	cheatgrass	BRTE	*Bromus tectorum*	18–179	–
	smooth brome	BRIN2	*Bromus inermis*	0–90	–
Forb					
6	**Forbs**			90–269	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	18–143	–
	scurfpea	PSORA2	*Psoralidium*	18–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	36–90	–
	vervain	VERBE	*Verbena*	36–72	–
	American vetch	VIAM	*Vicia americana*	18–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	18–54	–
	goldenrod	SOLID	*Solidago*	18–54	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–36	–
	pussytoes	ANTEN	*Antennaria*	0–36	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–36	–
	Forb, perennial	2FP	*Forb, perennial*	0–36	–
	textile onion	ALTE	*Allium textile*	18–36	–
		TRARE	*Tragopogon*		

	spiderwort	TRADE	*Tradescantia*	0–36	–
	goatsbeard	TRAGO	*Tragopogon*	18–36	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–18	–
	milkvetch	ASTRA	*Astragalus*	0–18	–
	false boneset	BREU	*Brickellia eupatorioides*	0–18	–
	corn gromwell	BUAR3	*Buglossoides arvensis*	0–18	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–18	–
	dotted blazing star	LIPU	*Liatris punctata*	0–18	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–18	–
	beardtongue	PENST	*Penstemon*	0–18	–
Shrub/Vine					
7	**Shrubs**			18–90	
	snowberry	SYMPH	*Symphoricarpos*	18–90	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–36	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–36	–
	pricklypear	OPUNT	*Opuntia*	0–36	–
	rose	ROSA5	*Rosa*	0–36	–
Tree					
8	**Trees**			0–54	
	juniper	JUNIP	*Juniperus*	0–54	–
	ponderosa pine	PIPO	*Pinus ponderosa*	0–54	–

Table 16. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Rhizomatous Wheatgrasses**			45–135	
	western wheatgrass	PASM	*Pascopyrum smithii*	45–135	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–45	–
2	**Needlegrass**			45–90	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	18–90	–
	green needlegrass	NAVI4	*Nassella viridula*	0–45	–
3	**Warm Season Short Grasses**			9–45	
	blue grama	BOGR2	*Bouteloua gracilis*	9–27	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–18	–
4	**Native Grasses and Grass-likes**			269–583	
	big bluestem	ANGE	*Andropogon gerardii*	0–90	–
	sedge	CAREX	*Carex*	18–90	–
	Canada wildrye	ELCA4	*Elymus canadensis*	9–90	–
	little bluestem	SCSC	*Schizachyrium scoparium*	18–90	–
	dropseed	SPORO	*Sporobolus*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	18–45	–

	sideoats grama	BOCU	*Bouteloua curtipendula*	9–45	–
	Grass, perennial	2GP	*Grass, perennial*	9–45	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–27	–
5	**Non-native Grasses**			45–179	
	Kentucky bluegrass	POPR	*Poa pratensis*	45–135	–
	cheatgrass	BRTE	*Bromus tectorum*	9–90	–
	smooth brome	BRIN2	*Bromus inermis*	0–9	–
Forb					
6	**Forbs**			45–90	
	vervain	VERBE	*Verbena*	9–27	–
	Forb, perennial	2FP	*Forb, perennial*	9–27	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	9–27	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–27	–
	goldenrod	SOLID	*Solidago*	0–27	–
	spiderwort	TRADE	*Tradescantia*	0–18	–
	dotted blazing star	LIPU	*Liatris punctata*	0–18	–
	western marbleseed	ONBEO	*Onosmodium bejariense var. occidentale*	0–18	–
	scurfpea	PSORA2	*Psoralidium*	0–18	–
	pussytoes	ANTEN	*Antennaria*	9–18	–
	American vetch	VIAM	*Vicia americana*	0–18	–
	textile onion	ALTE	*Allium textile*	0–9	–
	milkvetch	ASTRA	*Astragalus*	0–9	–
	false boneset	BREU	*Brickellia eupatorioides*	0–9	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–9	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–9	–
	goatsbeard	TRAGO	*Tragopogon*	0–9	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–9	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–9	–
Shrub/Vine					
7	**Shrubs**			45–179	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–90	–
	rose	ROSA5	*Rosa*	9–45	–
	snowberry	SYMPH	*Symphoricarpos*	18–45	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–27	–
	leadplant	AMCA6	*Amorpha canescens*	0–9	–
Tree					
8	**Trees**			90–179	
	juniper	JUNIP	*Juniperus*	90–179	–
	ponderosa pine	PIPO	*Pinus ponderosa*	18–90	–

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 Ecological Site Description). Therefore, 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.

Plant Community = Western Wheatgrass-Needlegrass 1.1
Average Annual Production (lbs./ac, air-dry) = 2200
Stocking Rate (AUM/ac) = 0.60

Plant Community = Blue Grama-Buffalograss-Western Wheatgrass 1.2
Average Annual Production (lbs./ac, air-dry) = 1500
Stocking Rate (AUM/ac) = 0.41

Plant Community = Blue Grama-Buffalograss Sod 2.1
Average Annual Production (lbs./ac, air-dry) = 800
Stocking Rate (AUM/ac) = 0.22

Plant Community = Threeawn-Annuals 2.2
Average Annual Production (lbs./ac, air-dry) = 700
Stocking Rate (AUM/ac) = 0.19**

Plant Community = Renovated Western Wheatgrass-Needlegrass-Blue Grama-Buffalograss 3.1
Average Annual Production (lbs./ac, air-dry) = 2500
Stocking Rate (AUM/ac) = 0.68**

Plant Community = Renovated Blue Grama-Buffalograss 3.2
Average Annual Production (lbs./ac, air-dry) = 900
Stocking Rate (AUM/ac) = 0.25**

Plant Community = Western Wheatgrass-Non-Native Cool-Season Grasses 4.1
Average Annual Production (lbs./ac, air-dry) = 1600
Stocking Rate (AUM/ac) = 0.44**

Plant Community = Juniper and/or Ponderosa Pine 5.1
Average Annual Production (lbs./ac, air-dry) = 800
Stocking Rate (AUM/ac) = 0.22**

Stocking rates are based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA NRCS, National Range and Pasture Handbook).

** Stocking rates are highly variable and onsite evaluation is required.

Total annual production on-site may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

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 groups B and C. Infiltration is generally moderate, and runoff potential varies from low to moderate 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 exception would be where shortgrasses form a strong sod and dominate the site. Normally 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 opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an aesthetic value that appeals to visitors.

Other products

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

Other information

OTHER INFORMATION

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997, rev.1, 2003 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD does not contain all tabular and narrative entries as required in the current “Approved” level of documentation but it is expected that the “Previously Approved” ESD will continue refinement towards an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is needed to validate the information in this Provisional Ecological Site Description. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

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completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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 description include: Stan Boltz, Range Management Specialist, NRCS; Brandon Brazee, Range Management Specialist, NRCS; Darrel DuVall, Range Management Specialist, NRCS; Jill Epley, Range Management Specialist, NRCS; Cheryl Nielsen, Range Management Specialist, NRCS; Rick Peterson, Range Management Specialist, NRCS; Maxine Rasmussen, Range Management Specialist, NRCS; and Mike Stirling, Range Management Specialist, NRCS.

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Contributors

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Acknowledgments

ESD Updated by Rick L. Peterson on 8/1/17

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)	Stan Boltz, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	06/04/2008
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

2. **Presence of water flow patterns:** None, or barely visible and discontinuous.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 10 percent is typical.

5. **Number of gullies and erosion associated with gullies:** None should 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):** Litter should fall in place. Slight amount of movement of smallest size class litter is possible, but not normal.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 5 to 8 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular at least in the upper A-horizon.

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

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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

    Dominant: Rhizomatous wheatgrasses > mid cool-season bunchgrasses >>

    Sub-dominant: Mid warm-season grasses >

    Other: Short cool-season grasses/grass-likes = short warm-season grasses > forbs > shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,500-2,900 lbs./acre (air-dry weight). Reference value production is 2,200 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:** State and local noxious weeds, Kentucky bluegrass, annual bromes

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