USDA Natural Resources Conservation Service

Ecological site R062XC010SD
Loamy - South

Last updated: 8/19/2024
Accessed: 05/21/2025

General information

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

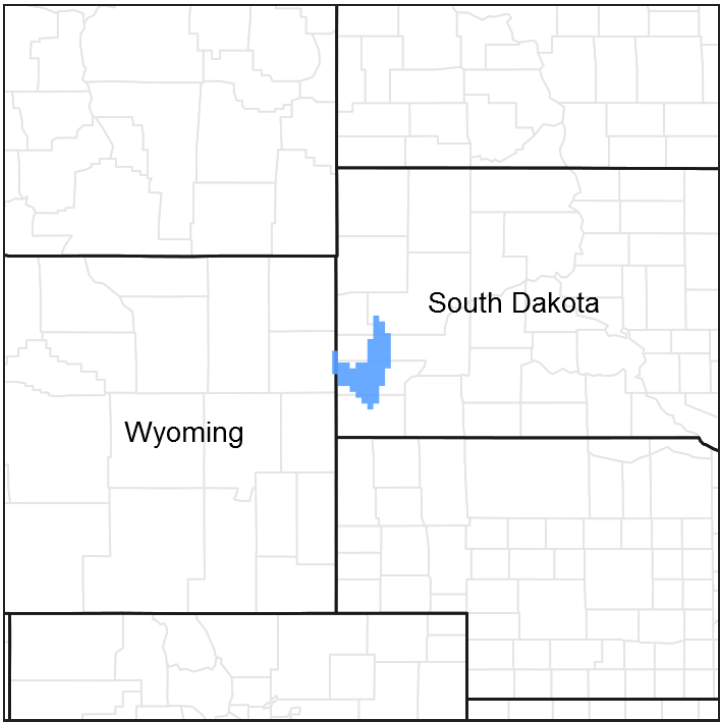

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 062X–Black Hills

The Black Hills (MLRA 62) is a unique, low lying mountain range situated in the midst of a mixed short and mid-grass prairie. It is a true Island in the Plains, as it has geophysical

and biological attributes that are unlike the surrounding area. The Black Hills have strong floristic ties to four of the North American biomes: Cordilleran (Rocky Mountain) Forest, Northern Coniferous Forest, Eastern Deciduous Forest, and Grasslands.

MLRA 62 is approximately 3,040 square miles in size; 74 percent is located in South Dakota, and 26 percent is in Wyoming. The towns of Lead, Deadwood, Hill City, and Custer, South Dakota, are in this area. U.S. Highways 16 and 385 cross the MLRA. The Black Hills National Forest, Custer State Park, Mt. Rushmore National Monument, Jewel Cave National Monument, and Wind Cave National Park are located in this MLRA.

This area forms the core of the Black Hills and the Bear Lodge Mountains where the elevation ranges between 3,600 to 6,565 feet, however, Black Elk Peak (Harney Peak) rises to 7,242 feet. Slopes range from moderately sloping on some of the high plateaus to very steeply sloping along drainageways and on peaks and ridges. Narrow valleys generally are gently sloping to strongly sloping.

The Black Hills uplift is the product of the Laramide mountain-building episodes that produced most of the ranges in the Rocky Mountains. Uplift began near the end of the Cretaceous period, 65 million years ago and ended by 35 million years ago (Froiland 1999). The core of the Black Hills is a plutonic mass of granite with steeply dipping metamorphic rocks, primarily slate and schist, which directly surrounds the granite core. A plateau of Mississippian limestone surrounds the igneous and metamorphic rock core. The Madison limestone is broken around the outer edges of the uplifted area. The Permian Minnekahta limestone forms the outermost boundary of the area. Many other tilted sandstone, shale, and limestone units are exposed like a bathtub ring inside the steeply dipping Madison limestone.

The dominant soil orders in this MLRA are Alfisols (forest soils) and Mollisols (grassland soils). The soils in the area have a frigid or cryic soil temperature regime, a udic or ustic soil moisture regime, and mixed, micaceous, or smectitic mineralogy. They are shallow to very deep, generally well drained, and loamy in texture.

The Black Hills MLRA supports open to dense forest vegetation. Ponderosa pine is the dominant species across the Black Hills. White spruce grows at the higher elevations and along the major drainageways. Bur oak is found intermixed with pine in the northern and eastern fringes of the Black Hills, and Rocky Mountain juniper is most common in the southern portion of the Black Hills. Aspen is of minor extent throughout the Black Hills area. Roughleaf ricegrass, slender wheatgrass, bearded wheatgrass, poverty oatgrass, Richardson’s needlegrass, and mountain ricegrass are the most common native grasses under open forest stands. The most common native shrubs are common snowberry, bearberry, common juniper, Oregon grape, and Saskatoon serviceberry.

MLRA 62 land ownership is approximately 47 percent private and 53 percent federal. Rangeland and forestland are split almost equally between private and federal ownership (47 percent each). Minor areas of land are privately owned cropland and urban

development. The forestland in this area is used mainly for timber production, recreation, and grazing.

The major resource concerns are soil erosion and surface compaction caused by logging, mining, wildfires, grazing, and urban expansion. The quality of ground and surface water is another concern, especially in the northern part of the Black Hills. The primary cause is contamination from mine waste and septic systems in areas of rural development and urban expansion (USDA-NRCS, 2006: Ag Handbook 296).

LRU notes

For development of ecological sites, MLRA 62 is divided into three Land Resource Units (LRU's) or physiographic zones (A, B, C, and Y). Each LRU has a set of ecological sites that represents these zones.

The LRU is identified in the Ecological Site ID: R062XY000SD; "062X" identifies the MLRA, the next letter "Y" identifies the LRU. Note: The organization of Ecological Site ID's will likely change in the future.

LRU-A includes the northern Black Hills and Bear Lodge Mountains (22-30" PZ); LRU-B includes the high elevation central core of the Black Hills (25-35" PZ); and LRU-C includes the southern portion of the Black Hills (17-21" PZ).

The Forest ecological sites are representative of sites in the Black Hills, Bear Lodge Mountains (MLRA-62), and the surrounding Dakota Hogback (MLRA-61). These sites are separated by elevation, soil temperature regimes, and slope.

The Low Mountain area includes all of the Black Hills, Bear Lodge Mountains, and Dakota Hogback below 6,200 feet in elevation (LRU's A and C). The soils in this area have a frigid soil temperature regime.

The High Mountain area includes all of the Black Hills above 6,200 feet elevation (LRU-B). The soils in this area have a cryic soil temperature regime.

Classification relationships

USDA
Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 62—Black Hills

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Black Hills Plateau—17b
Black Hills Core Highlands—17c

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Black Hills Coniferous Forest Province—M334:
Black Hills Section—334A
Black Hills Limestone Plateau-Core Highlands Subsection—M334Ab

Ecological site concept

The site is located on upland landscapes or old stream terraces within the southern portion of the Black Hills (LRU-C). The soils are loamy with a surface layer thickness less than 15 inches in depth. They are well drained without a restrictive layer that impedes water movement or rooting depth. Most soils on this site have calcium carbonates in the profile but are typically located at 12 inches or greater below the surface. It does not receive additional water from runoff or overflow. The typical slope range is from 0 to 15 percent. Vegetation in reference consists of both cool (dominate) and warm season grass species. Cool season grasses include western and bearded wheatgrass, porcupine grass, green needlegrass, and Richardson's and Columbia needlegrass. Warm season grasses include big bluestem, little bluestem, and prairie dropseed. Forbs are common and diverse but never dominant, and shrubs such as western snowberry and leadplant are often present in plant community. Western snowberry typically appears as a patchy mosaic across this ecological site. This site is susceptible to pine encroachment from adjacent sites.

Associated sites

R062XC020SD	**Loamy Overflow - South** The Loamy Overflow site can be located adjacent to the Loamy site however it is directly influenced by additional water.
R062XC024SD	**Shallow Loamy - South** The Shallow Loamy site is commonly associated with the Loamy site but is located on steeper slopes with shallow soil depths.

Similar sites

R062XC011SD	**Clayey - South** The Clayey site will support more green needlegrass and less needleandthread and big bluestem. Snowberry is not common on the Clayey site.
R062XC020SD	**Loamy Overflow - South** The Loamy Overflow site will have more big bluestem and higher production.
R062XY043SD	**Valley Loam** The Valley Loam site typically has a deeper and darker soil profile, more big bluestem and higher production.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on nearly level to sloping footslopes and backslopes in the Black Hills.

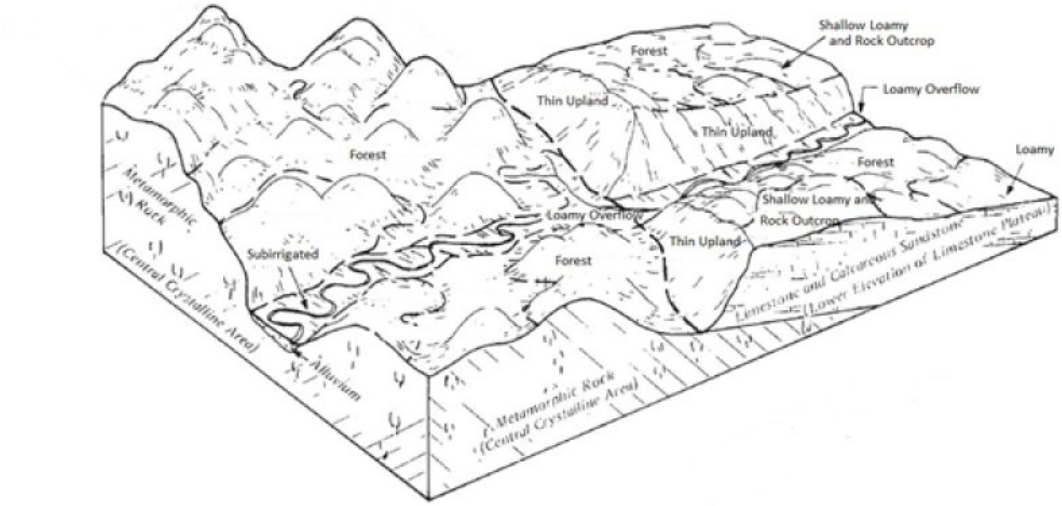

Figure 2. Black Hills Physiographic Features Illistrated

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Terrace (3) Mountain slope
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,158–1,676 m
Slope	0–15%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 62 is in a microclimate caused by the influence of increased elevation which leads to increased precipitation, moderate air temperature, and lower wind velocities as compared to the surrounding Great Plains. In general, the Black Hills climate is a continental type, cold in the winter and hot in the summer.

Annual precipitation in MLRA 62 typically increases with elevation and decreases from west to east and north to south. The average annual precipitation range for LRU-C (South) is 17 to 21 inches. Most of the rainfall occurs as frontal storms early in the growing season, May and June. Some high-intensity, convective thunderstorms occur in July and August.

Precipitation in the winter occurs mostly as snow. The annual average snowfall ranges from 23 inches at the lower elevations in the south to 54 inches at the higher elevations in the central part of MLRA 62.

Average annual temperature ranges from 36 to 48 degrees F. January is the coldest month, with an average temperature of 22 °F in the central part and 25 °F in the southern part of MLRA 62. July is the warmest month, with an average daily temperature of 67 °F in the central part and 73 °F in the southern part of this MLRA. The frost free period ranges from 129 to 168 days. It is shortest at higher elevations and in the northwestern part of the MLRA.

Hourly winds are estimated to average about 11 miles per hour (mph) annually.

Growth of cool-season plants begins in April, slowing or ceasing growth by Mid-August. Warm-season plants begin growth in May, and continue to Mid-September. Regrowth of cool-season plants may occur in September and October depending on soil moisture availability.

Table 3. Representative climatic features

Frost-free period (characteristic range)	92-108 days
Freeze-free period (characteristic range)	116-126 days
Precipitation total (characteristic range)	483-508 mm
Frost-free period (actual range)	84-110 days
Freeze-free period (actual range)	115-129 days
Precipitation total (actual range)	457-508 mm
Frost-free period (average)	99 days
Freeze-free period (average)	121 days
Precipitation total (average)	483 mm

Climate stations used

- (1) HOT SPRINGS [USC00394007], Hot Springs, SD
- (2) CUSTER [USC00392087], Custer, SD
- (3) WIND CAVE [USC00399347], Buffalo Gap, SD

Influencing water features

No riparian areas or wetland features are directly associated with or influence the upland landscape. The terrace landscape position, typically located within a drainage system, does not receive any additional water from stream or wetland features.

Soil features

The soils on this site are moderately deep to very deep and well drained. The surface layer is at least 4 to 8 inches thick, and may range up to 20 inches thick. Surface textures are loamy (specific textures are listed below). Most of the soils have calcium carbonate in the profile, but they are leached to depths typically greater than 12 inches. Slopes are typically 0 to 15 percent, but range up to 25 percent in a few instances.

Water erosion is the primary hazard on this site. Erosion is normally minimal on slopes less than 6 percent, and occurs primarily in the form of sheet erosion when present. Sheet and rill erosion can occur on linear surfaces where slopes range from 6 to about 10 percent. On non-linear (undulating) surfaces, rill erosion is dominant. On slopes greater than about 10 percent, rill erosion can be present on all types of surfaces. Rill erosion can often morph into gully erosion in areas where flow paths concentrate into one on disturbed sites. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production. Although the soils on this site are not normally susceptible to significant wind erosion, site disturbances can increase the hazard locally.

The commonly-occurring soils for this site include Bullflat, Gurney, Norkool, Reicess, and Sugakool. Most of these soils occur in both LRU A and C.

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

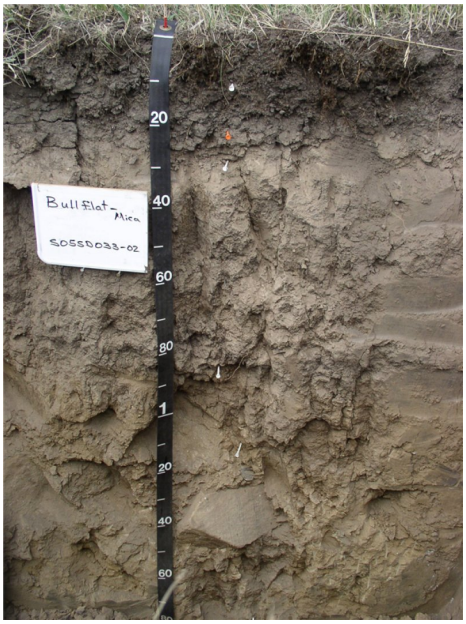

Figure 9. Bullflat Soil Profile (cm)

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone (2) Slope alluvium–shale and siltstone
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	51–203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	7.62–30.48 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–25%

Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

Black Hills vegetation types consist of a mixture of forest and grasslands resulting from the varied topography, geology, soils, climate and natural disturbances. Frequent fires, periodic drought, and episodic mountain pine beetle infestations all contribute to the maintenance of large open grasslands scattered throughout the Black Hills. Ponderosa pine is the dominant tree species in the Black Hills. It is a fire adapted species that coexists with frequent, low-intensity fires that consume small seedlings, prune lower branches from larger trees, and reduce fuel loads on the forest floor.

This site developed under Black Hills climatic conditions with short-term weather variations, light to severe grazing by bison, elk, insects and small mammals, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development. The natural fire regime maintained this site as a grassland and the plant communities were free of non-native cool season grasses.

Fire, or the lack of fire, is one of the major drivers, along with grazing, and introduced non-native cool season grasses that shape this site as well as adjacent ecological sites. Between 1388 and 1900, fire intervals in the Black Hills ranged from 16 to 20 years (Brown, 1996). In the absence of fire, encroachment of ponderosa pine is likely to occur on this site. The Loamy ecological site is not as susceptible to encroachment as the Shallow Loamy site but because they typically adjoin, encroachment occurs and untreated, pine will become established. Competition with the dominant cool season grasses on the Loamy site hinder establishment of pine seedlings, whereas the gravelly and stony soils on the Shallow Loamy site typically dominated by warm season grasses do not provide that direct competition early in the growing season.

Kentucky bluegrass and to a lesser degree smooth brome are common cool season grass species throughout MLRA 62. Because the Black Hills have higher precipitation amounts and cooler spring and fall periods than the surrounding MLRA 61, these non-native cool season grasses can easily become the dominant species on this site. Improper grazing management, and non-use and/or no fire can also cause these species to increase and become the dominant species in plant communities.

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, severe disturbances, such as periods of well-below average precipitation, severe defoliation, excessive haying or no fire and no use can cause significant shifts in plant communities and/or species composition.

The Reference State is difficult to locate in this LRU with the introduction of non-native

cool season grasses. Plant community phase 2.1 is most similar to the Reference State but because of the persistence of non-native cools season grasses a restoration pathway to the Reference State is not believed to be achievable.

Interpretations are primarily based on the Rhizomatous Wheatgrass-Needlegrass-Big Bluestem/Snowberry Plant Community Phase. It has been determined by observing 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 used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar observations and experience.

The following diagram illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes will be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

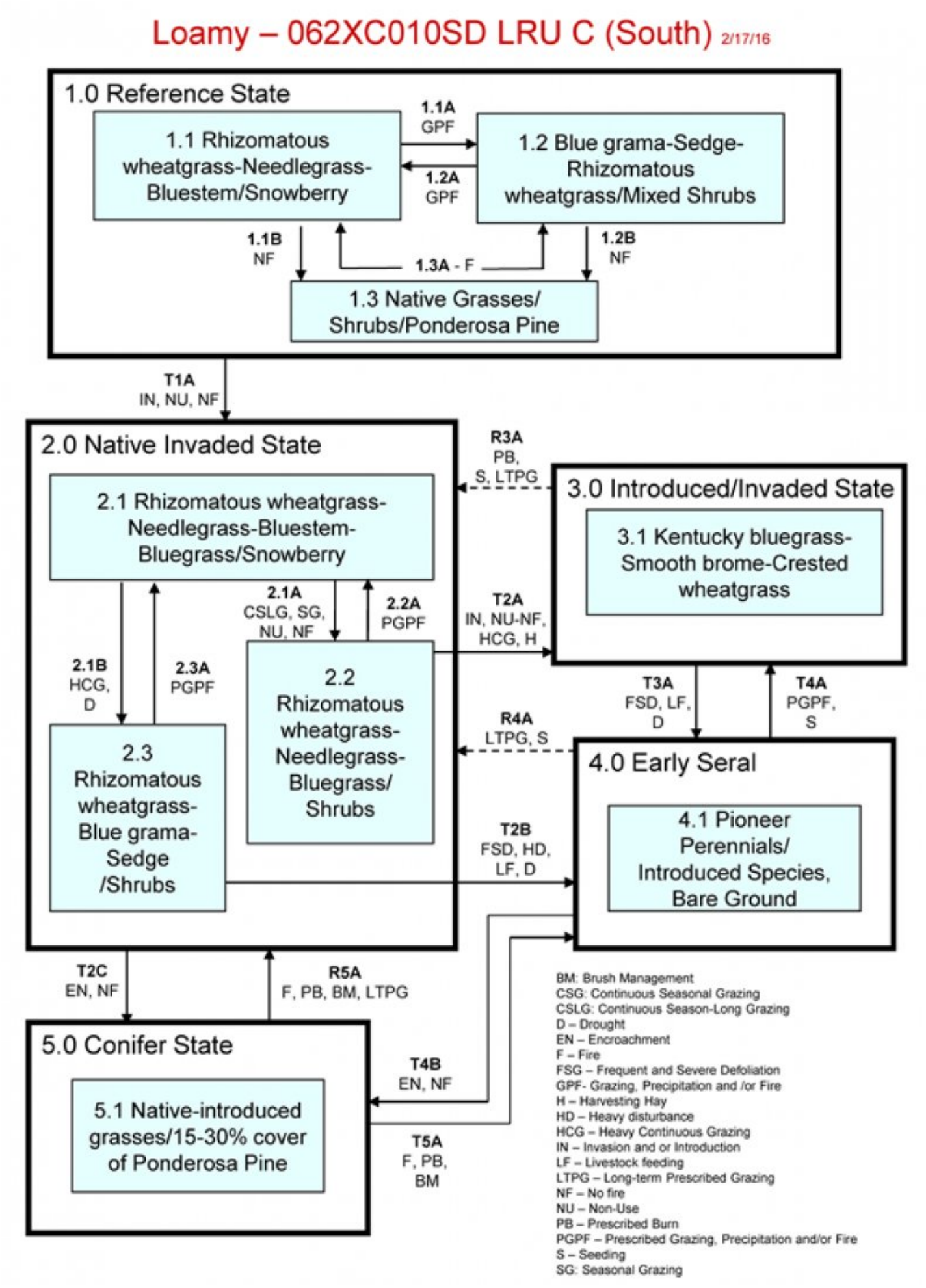

Figure 10. Loamy - LRU-C

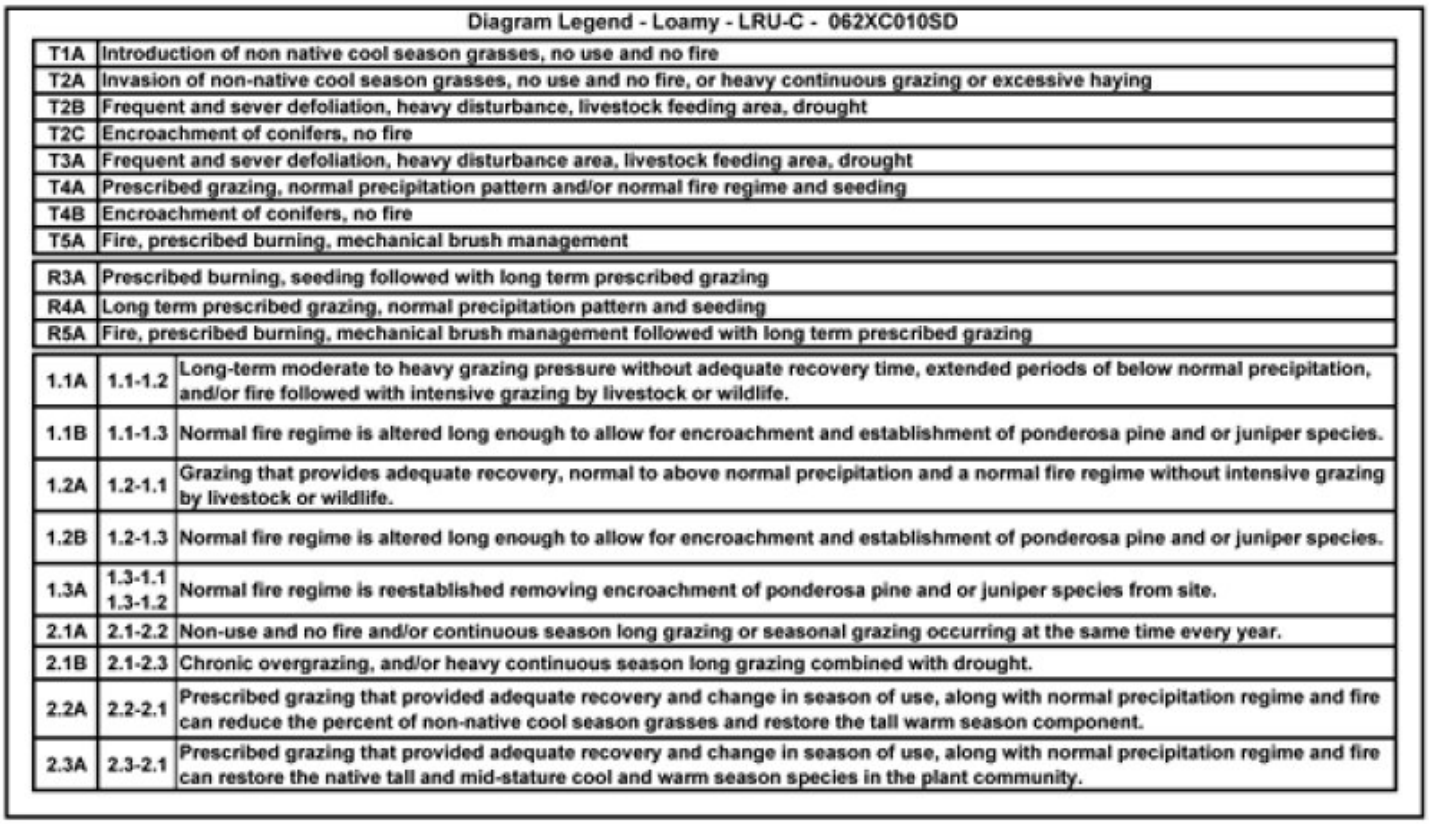

Figure 11. Loamy - LRU-C - 062XC010SD

State 1
Reference

This state represents the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. The Reference State does exist currently but with the introduction and spread of non-native cools season grasses it can be difficult to locate in this LRU. This site was dominated by cool and warm season grasses. In pre-European times the primary disturbances included fire, insects and grazing by large ungulates and small mammals. Favorable growing conditions occurred during the spring, and warm months of June and July. Routine and/or occasional fires, reduced tree cover and contributed to the ecological processes that maintained the reference plant community.

Community 1.1
Rhizomatous Wheatgrass-Needlegrass-Bluestem/Snowberry

Figure 12. CPC: Rhizomatous wheatgrass-Needlegrass-Bluestem/S

Interpretations are based primarily on the Rhizomatous wheatgrass-Needlegrass-Bluestem/Snowberry plant community phase. This is also considered to be the reference or historic plant community. The potential vegetation is about 75 percent grass and grass-like plants, 15 percent forbs, 5 percent shrubs and 0 to 2 percent trees. Total annual production for a normal growing year is approximately 2,800 lbs./ac. The community is dominated by cool-season grasses and tall and mid-height warm season grasses. The dominant cool season grasses include western and bearded wheatgrass, green needlegrass, needleandthread and porcupine grass. Dominant warm season grasses are big bluestem, little bluestem, and sideoats grama. Other grasses include prairie dropseed, tall dropseed, blue grama, slender wheatgrass, plains muhly, and threadleaf sedge. The dominant shrub is western snowberry. This plant community was productive and resilient to disturbances such as drought and fire. It was a sustainable plant community in regards to soil/site stability, watershed function, and biological integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2051	2558	3015
Shrub/Vine	151	314	504
Forb	151	235	336
Tree	–	31	67
Total	**2353**	**3138**	**3922**

Figure 14. Plant community growth curve (percent production by month). SD6202, Black Hills, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant.

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

Community 1.2
Blue grama-Sedge-Rhizomatous wheatgrass/Mixed Shrub

This plant community phase is a result of continuous season-long grazing or chronic overgrazing of livestock and/or wildlife and/or extended periods of below normal precipitation. The potential vegetation is about 65 percent grasses or grass-like plants, 15 percent forbs, and 20 percent shrubs. The community is dominated by warm season shortgrass species, with cool-season grasses being subdominant. Dominant grasses and grass-like species include blue grama, threadleaf sedge, western wheatgrass, and needleandthread. Other grass species include sideoats grama, bearded wheatgrass, plains muhly and three awn. Forbs commonly include cudweed sagewort, goldenrod, hairy golden aster, scurfpea, white prairie aster, and western ragweed. Shrubs have increase in percent composition. They include: western snowberry, fringed sagewort, rose, and green sagewort. This plant community is resilient and well adapted to the Black Hills climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity. However, because blue grama and sedge have increased, runoff and infiltration will begin to be negatively affected.

Community 1.3
Native Grasses/Shrubs/Ponderosa Pine

This plant community phase is the result of no fire or when the normal fire interval has been extend allowing for conifers to encroach onto the site and become established. The herbaceous plant community can resemble the transition between PCP 1.1 and 1.2. Conifers are not the dominant species in this plant community phase (5-15% cover) and most trees will be removed once the natural fire regime is reestablished. This plant community is resilient and well adapted to the Black Hills climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Pathway 1.1A
Community 1.1 to 1.2

Long-term moderate to heavy grazing pressure without adequate recovery time, extended periods of below normal precipitation, and/or fire followed with intensive grazing by livestock or wildlife can move this PCP 1.1 to PCP 1.2.

Pathway 1.1B
Community 1.1 to 1.3

The normal fire regime is altered long enough to allow for encroachment and establishment of ponderosa pine and or juniper species onto PCP 1.3.

Pathway 1.2A
Community 1.2 to 1.1

Grazing that provides adequate recovery, normal to above normal precipitation and a normal fire regime without intensive grazing by livestock or wildlife can move PCP 1.2 back to PCP 1.1.

Pathway 1.2B
Community 1.2 to 1.3

The normal fire regime is altered long enough to allow for encroachment and establishment of ponderosa pine and or juniper species onto PCP 1.3.

Pathway 1.3A
Community 1.3 to 1.1

The normal fire regime is reestablished. Pine and or juniper species are removed from PCP.

State 2
Native Invaded

This state represents what is most typically found on this site. The natural range of variability is influences by the presence of non-native cool season grasses, especially Kentucky bluegrass and smooth brome that can dominate the dynamics of this ecological site. Proper grazing management and periodic burning will maintain the productivity of this state. Heavy grazing without adequate recovery, extended periods of drought or non-use and no fire can put this state at risk of crossing a threshold.

Community 2.1
Rhizomatous wheatgrass-Needlegrass-Bluestem-Bluegrass/Snowberry

This plant community phase closely resembles the PCP 1.1 however non-native cool season grasses have invaded the site and under the current Black Hills climatic conditions will persist in the plant community. The potential vegetation is about 75 percent grass and grass-like plants, 15 percent forbs, 5 percent shrubs and 0 to 2 percent trees. Total annual production for a normal growing year is approximately 2,300 lbs./ac. The community is dominated by cool-season grasses and tall and mid-height warm season grasses. The dominant cool season grasses include western and bearded wheatgrass, needleandthread and porcupine grass. Kentucky bluegrass or other non-native cool season grasses can make up 2 to 5 percent of the plant community. Dominant warm

season grasses are big bluestem, little bluestem, and sideoats grama. Other grasses include prairie dropseed, tall dropseed, blue grama, slender wheatgrass, plains muhly, and threadleaf sedge. The dominant shrub is western snowberry. This plant community is productive and resilient to disturbances such as drought and fire. It was a sustainable plant community in regards to soil/site stability, watershed function, and biological integrity. Management strategies must include techniques that will not cause Kentucky bluegrass and other non-native cool season grasses to increase significantly or this is at risk of transition to the Introduced/Invaded State.

Community 2.2
Rhizomatous wheatgrass-Needlegrass-Bluegrass/Shrub

This plant community evolved under continuous season-long grazing, seasonal grazing with no change in season of use or no use and no fire. This plant community phase is made up of approximately 85 percent grass and grass-like plants, 10 percent forbs, 5 percent shrubs and 0 to 2 percent trees. The community is dominated by cool-season grasses, with much of the warm season grass component being replaced by Kentucky bluegrass and other non-native cool season grasses. The dominant cool season grasses include western and bearded wheatgrass, needleandthread and porcupine grass. Kentucky bluegrass or other non-native cool season grasses can make up 5 to 20 percent of the plant community.

Community 2.3
Rhizomatous wheatgrass-Blue grama-Sedge/Shrubs

This plant community develops under heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 15 percent forbs, and 10 percent shrubs. Dominant grasses include western wheatgrass, blue grama, and threadleaf sedge. Annual brome (cheatgrass and/or field brome) may also invade and become significant. Subdominant grasses include needleandthread, green needlegrass, hairy grama, sideoats grama, and Kentucky bluegrass. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, scurfpea, and western ragweed.

Pathway 2.1A
Community 2.1 to 2.2

Non-use and no fire and/or continuous season long grazing or seasonal grazing occurring at the same time every year can move PCP 2.1 to PCP 2.2.

Pathway 2.1B
Community 2.1 to 2.3

Chronic overgrazing, and/or heavy continuous season long grazing combined with prolonged periods of below normal precipitation can move PCP 2.1 to PCP 2.3.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing that provided adequate recovery and change in season of use, along with normal precipitation regime and fire may reduce the percent of non-native cool season grasses in PCP 2.2 and restore the tall warm season component typical of PCP 2.1.

Pathway 2.3A
Community 2.3 to 2.1

Prescribed grazing that provided adequate recovery and change in season of use, along with normal precipitation regime and fire can restore the native tall and mid-stature cool and warm season species in the plant community typical of PCP 2.1.

State 3
Introduced/Invaded

This state typically occurs as a result of the site becoming dominated by non-native cool season grasses, primarily Kentucky bluegrass and/or smooth brome. This can be due to non-use and no fire which creates a large amount of litter, making the site unsuited for native species. Heavy continuous grazing and or mechanical harvesting can also create this state by over utilization of the native grass species, giving a competitive advantage to the non-native species which are adapted to heavy utilization and are grazing resistant. Preliminary studies indicate that when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition, a threshold has been crossed to an Introduced/Invaded State (3.0). Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species. (Toledo, D. et al., 2014).

Community 3.1
Kentucky bluegrass-Smooth brome-Crested Wheatgrass

This plant community is dominated by Kentucky bluegrass and/or other non-native cool season grasses (> 30 percent of PC). This plant community evolved under no use and no fire or with heavy continuous season-long grazing, or seasonal grazing with no change in season of use. This plant community is made up of approximately 90 percent grasses and grass-like species, 5 percent forbs, and 5 percent shrubs. Dominant grasses include Kentucky bluegrass, smooth brome, and possibly crested wheatgrass. Western wheatgrass and some needlegrass may still be found in the plant community. Forbs commonly found in this plant community include cudweed sagewort, goldenrod, scurfpea, and western ragweed.

State 4
Early Seral

This state is the result of very heavy, concentrated disturbance such as cropping, concentrated rodent activity, or concentrated livestock areas. This State can develop as a result of invasion by highly competitive weed species such as Canada thistle, hound's tongue, leafy spurge, or knapweeds. Extended periods of drought accompanied by heavy grazing can also push an at risk plant community phase to this state. In most cases, this phase is dominated by annual and/or pioneer perennial species. Bare ground is also typically much higher than on any other plant community phase.

Community 4.1
Pioneer perennials/Introduced Species/Bare ground

This plant community developed under continuous heavy grazing or heavy disturbances such as heavy use areas, abandoned cropland, and rodent concentrations. The potential plant community is made up of 60-80 percent grasses and grass-like species, 15 to 35 percent forbs, and 2 to 5 percent shrubs. The dominant grass is often threeawn. Other grasses may include cheatgrass, annual bromegrass (field brome and cheatgrass), sedge, blue grama, sand dropseed, bluegrass, and western wheatgrass. The dominant forbs include fetid marigold, sweetclover, western ragweed, cudweed sagewort, and other invader-like species. The dominant shrubs include fringed sagewort, broom snakeweed and cactus. A wide variety of other early seral plant species can occupy this site in varying amounts. This plant community is susceptible to invasion of Canada thistle and other non-native species because of the relatively high percent of bare ground.

State 5
Conifer

This state is greatly influenced by conifers, primarily ponderosa pine but rocky mountain juniper can also be present. Ponderosa pine canopy was found to significantly reduce precipitation reaching the forest floor by an 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.

Community 5.1
Native-Introduced grasses/Ponderosa pine (15-30% Cover)

This plant community phase is the result of no use and no fire or on site that have had heavy continuous grazing resulting in increased bare ground where pine seedlings can become established. The potential vegetation is approximately 70 percent grasses and

grass-like plants, 5 percent forbs, 5 -10 percent shrubs and up to 30 percent conifers. The majority of grasses will be cool season species with Kentucky bluegrass increasing because of its shade tolerance.

Transition T1A
State 1 to 2

Invasion and/or encroachment of non-native grasses such as Kentucky bluegrass and smooth brome, and disruption of natural disturbance regimes, typically as a result of fire suppression following settlement led this state over a threshold to the Native/Introduced State 2.0.

Transition T2A
State 2 to 3

Introduction or invasion of non-native cool season grass species, non-use and no fire, heavy continuous grazing, or excessive haying of native grass species. This transition is most likely going to occur from PCP 2.2

Transition T2B
State 2 to 4

Severe and frequent defoliation which can be exacerbated by drought, and heavy disturbance areas which can occur around watering sites and livestock feeding areas. This plant community is most likely to transition from PCP 2.3.

Transition T2C
State 2 to 5

Encroachment and establishment of conifer trees due too fire suppression.

Restoration pathway R3A
State 3 to 2

Early season prescribed burning followed by long term prescribed grazing to promote establishment of native species. Chemical and/or mechanical treatment followed by seeding of native species may accelerate the reestablishment of structural functional groups similar to PCP 2.1 however the resulting plant community may not achieve management goals. This restoration pathway can take many years and in the end may not be successful.

Transition T3A
State 3 to 4

Severe and frequent defoliation which can be exacerbated by drought, heavy disturbance areas like those around water sources and livestock feeding areas.

Restoration pathway R4A
State 4 to 2

Removal of severe grazing disturbance (frequency and intensity), normal precipitation and fire regime, and time. Chemical and/or mechanical treatment followed by seeding of native species may accelerate the reestablishment of structural/functional groups similar to PCP 2.1 however the resulting plant community may not achieve management goals. This restoration pathway can take many years and in the end may not be successful.

Transition T4A
State 4 to 3

Removal of severe grazing disturbance (frequency and intensity), normal precipitation regime. Chemical and/or mechanical treatment followed by seeding of native and introduced species.

Transition T4B
State 4 to 5

Encroachment of conifer trees onto the site due to fire suppression.

Restoration pathway R5A
State 5 to 2

Reintroduction of fire or prescribed burning and/or, mechanical brush management to remove encroachment, followed by long term prescribed grazing to promote reestablishment of native species may accelerated the reestablishment of structural/functional groups similar to PCP 2.1 however the resulting plant community may not achieve management goals.

Transition T5A
State 5 to 4

Wild fire, prescribed burn or brush management will treat conifer encroachment on this site and this State will transition back to State 4.0.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)

Grass/Grasslike					
1	**Rhizomatous Wheatgrass**			628–1255	
	western wheatgrass	PASM	*Pascopyrum smithii*	471–1255	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	157–314	–
2	**Cool-Season Bunchgrass**			471–942	
	green needlegrass	NAVI4	*Nassella viridula*	314–785	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–314	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–157	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–157	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–157	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–157	–
3	**Tall Warm-Season Grasses**			157–471	
	big bluestem	ANGE	*Andropogon gerardii*	63–314	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–94	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–94	–
4	**Mid- Warm-Season Grasses**			157–314	
	sideoats grama	BOCU	*Bouteloua curtipendula*	63–314	–
	little bluestem	SCSC	*Schizachyrium scoparium*	31–157	–
5	**Short Warm-Season Grasses**			63–314	
	blue grama	BOGR2	*Bouteloua gracilis*	31–251	–
	buffalograss	BODA2	*Bouteloua dactyloides*	31–126	–
	threeawn	ARIST	*Aristida*	0–63	–
6	**Other Native Grasses**			63–157	
	Grass, perennial	2GP	*Grass, perennial*	0–126	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	31–94	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	31–63	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–31	–
7	**Grass-Likes**			63–157	

	needleleaf sedge	CADU6	*Carex duriuscula*	31–157	–
	threadleaf sedge	CAFI	*Carex filifolia*	31–157	–
	sedge	CAREX	*Carex*	0–94	–
8	**Non-Native Cool-Season Grasses**			–	
Forb					
9	**Forb**			157–314	
	Forb, native	2FN	*Forb, native*	31–126	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	31–63	–
	leafy wildparsley	MUDI	*Musineon divaricatum*	31–63	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	31–63	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	31–63	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	31–63	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	31–63	–
	American vetch	VIAM	*Vicia americana*	31–63	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–63	–
	desert biscuitroot	LOFO	*Lomatium foeniculaceum*	31–63	–
	dotted blazing star	LIPU	*Liatris punctata*	31–63	–
	prairie thermopsis	THRH	*Thermopsis rhombifolia*	31–63	–
	goldenrod	SOLID	*Solidago*	31–63	–
	beardtongue	PENST	*Penstemon*	31–63	–
	prairie clover	DALEA	*Dalea*	31–63	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	31–63	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–31	–
	bellflower	CAMPA	*Campanula*	0–31	–
	buckwheat	ERIOG	*Eriogonum*	0–31	–
	fleabane	ERIGE2	*Erigeron*	0–31	–
	bluebells	MERTE	*Mertensia*	0–31	–
	cinquefoil	POTEN	*Potentilla*	0–31	–
	spiderwort	TRADE	*Tradescantia*	0–31	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–31	–

	[illegible]	[illegible]	*Ambrosia psilostachya*	[illegible]	
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–31	–
Shrub/Vine					
10	**Shrubs**			157–471	
	rose	ROSA5	*Rosa*	31–126	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–94	–
	prairie sagewort	ARFR4	*Artemisia frigida*	31–63	–
	skunkbush sumac	RHTR	*Rhus trilobata*	31–63	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–63	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–63	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	31–63	–
	leadplant	AMCA6	*Amorpha canescens*	0–31	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–31	–
Tree					
11	**Trees**			0–63	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–63	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–31	–
	Tree	2TREE	*Tree*	0–31	–

Other information

Revision Notes: “This PROVISIONAL ecological site concept has been QC’d and QA’d to ensure that the site meets the NESH standards for a provisional ecological site that provides basic compiled information in one location. This site should not be considered an Approved ESD, as it is only the foundational site concepts and requires further data collection—specifically high-intensity data characterizations and further site investigations and final STM reviews before it can be used as an Approved ESD meeting NESH standards.”

Site Development and Testing Plan
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. 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. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

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: Lakhdar Benkobi, ESI/SRIC, NRCS; Stan Boltz, Range Management Specialist, NRCS; Dan Brady, Soil Scientist, NRCS; Gary Brundige, Custer State Park; Beth Burkhart, Botanist – Wind Cave National Park; Mitch Faulkner, Range Management Specialist, NRCS; Roger Gates, Associate Professor/Rangeland Management Specialist, West River Ag Center; Rick Peterson, Ecological Site Specialist, NRCS; Matthew, Scott, Botanist - USFS Hell Canyon District Ranger; L. Michael Stirling, Range Management Specialist, NRCS; Jim Westerman, Soil Scientist, NRCS. All inventory information and data records are compiled within the Rapid City, SD USDA-NRCS Shared “S” network drive.

Other references

Brown, P. M. and C. H. Sieg. 1996. Fire History in Interior Ponderosa Pine Communities of the Black Hills, South Dakota, USA, Int. J. Wildland Fire 6(3): 97-105.

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://www.hprcc.unl.edu/)

Toledo, D., Sanderson, M., Spaeth, K., Hendrickson, J., Printz, J. 2014. Extent of Kentucky Bluegrass and Its Effect on Native Plant Species Diversity and Ecosystem Services in the Northern Great Plains of the United States. Invasive Plant Science and Management. 7(4):543-522. Weed Science Society of America.

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://nasis.nrcs.usda.gov)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, NRCS. National Ecological Site Handbook, 1st Ed, January 2014

Wrage, K. J. 1994. The effects of ponderosa pine on soil moisture, precipitation, and understory vegetation in the Black Hills of South Dakota. 158 p. Thesis.

Contributors

Westerman James
Peterson Rick L.

Approval

Suzanne Mayne-Kinney, 8/19/2024

Acknowledgments

MLRA 62 sites were written to the Provisional Level by Rick L. Peterson, ESS, Rapid City, SSO in FY20.

The ESDs were reviewed for quality control by Emily Helms, John Hartung, Mitch Faulkner, and Ryan Murray.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 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.

Author(s)/participant(s)	
Contact for lead author	
Date	05/21/2025
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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

3. **Number and height of erosional pedestals or terracettes:**

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

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

Sub-dominant:

Other:

Additional:

---

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

---

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

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

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:**

---

17. **Perennial plant reproductive capability:**
