USDA Natural Resources Conservation Service

Ecological site R062XY029SD
Stony Hills

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General information

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

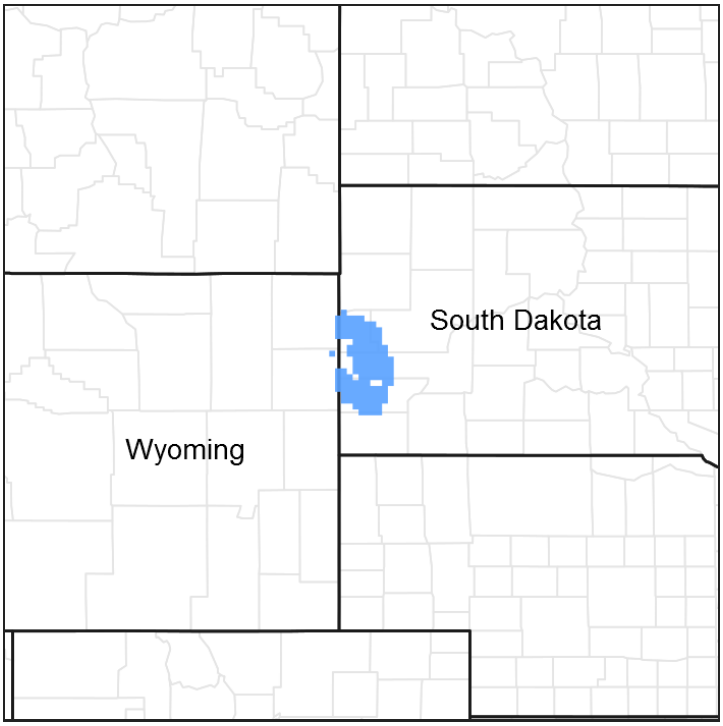


Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 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, Wind Cave National Park, and Jewel Cave National Monument are located in this MLRA.

This area forms the core of the Black Hills and the Bear Lodge Mountains where the elevation generally ranges between 3,600 to 6,565 feet, however, Black Elk Peak (formerly Harney Peak) rises to 7,242 feet. The slopes vary 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, 1990). The core of the Black Hills is a plutonic mass of granite with steeply dipping metamorphic rocks, primarily slate and schist, that 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 are well drained, and are 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 and paper birch are minor components found throughout the Black Hills. Prairie dropseed, roughleaf ricegrass, green needlegrass, poverty oatgrass, Richardson’s needlegrass, slender wheatgrass, and Canada wildrye are the most common native grasses under open forest stands. The most common native shrubs are bearberry, common juniper, grouse whortleberry, poison ivy, 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 both ground and surface water is another concern, especially in the northern part of the Black Hills. The primary cause for concern 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 (LRUs) 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, and the next letter “Y” identifies the LRU. Note: The organization of Ecological Site IDs will likely change in the future.

The North, LRU-A includes the northern Black Hills and Bear Lodge Mountains. It receives between 22 and 30 inches of annual precipitation and has a frigid soil temperature regime.

The High Central, LRU-B includes the high elevation (> 6,200 feet) central core of the Black Hills, which receives between 25 to 35 inches of annual precipitation and has a cryic soil temperature regime.

The South, LRU-C includes the southern portion of the Black Hills and receives between 17 to 21 inches of annual precipitation and has a frigid soil temperature regime.

One additional grouping of ecological sites that are common to the entire MLRA are designated with a “Y” in the ecological site ID.

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 Stony Hills ecological site can be found throughout the lower elevations of MLRA 62 (< 6,200 feet); however, it is most prominent in the southern portion of the Black Hills. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. The typical slopes range is from 0 to 20 percent but can reach up to 40 percent. Soils are deep to very deep, (greater than 20 inches) with a loamy surface layer 7 to 8 inches thick. A key characteristic of this site is the presence of up to 20 percent rounded cobble- and stone-sized rock fragments on the surface. Subsurface textures range from channery clay loam to cobbly clay loam containing up to 70 percent stone fragments .

The vegetation in the Reference State (1.0) consists of warm-season grasses, and subdominant cool-season needlegrass and rhizomatous wheatgrass. Dominant warm-season grasses include big and little bluestem. Forbs are common and diverse. Leadplant and rose are common and can account for significant portions of the total annual production. Ponderosa pine, Rocky Mountain juniper, and in the north, bur oak, may be found scattered across the site but typically will not exceed 5 percent cover. The Stony Hills site is susceptible to invasion of non-native, cool-season grasses.

This site was formally referred to as the Stony Hills and Savanna Range Sites in the South Dakota, Black Hills Technical Guide.

Associated sites

R062XA024SD	**Shallow Loamy - North** The Shallow Loamy – North ecological site is often associated with the Stony Hills ecological site but the Shallow Loamy – North will have shallow soils (10-20”). and lower vegetative production.
R062XC010SD	**Loamy - South** The Loamy - South ecological site is found adjacent to Stony Hills ecological site. The Loamy – South ecological site will have deep soils with few rock fragments. and higher vegetative production.
R062XA010SD	**Loamy - North** The Loamy - North ecological site is found adjacent to Stony Hills ecological site. The Loamy – North ecological site will have deep soils with few rock fragments. and higher vegetative production.
R062XC024SD	**Shallow Loamy - South** The Shallow Loamy – South ecological site is often associated with the Stony Hills ecological site but the Shallow Loamy – South will have shallow soils (10-20”). and lower vegetative production.

Similar sites

R062XA020SD	**Loamy Overflow - North** The Shallow Loamy – North ecological site will have much less rock in the soil profile; less big bluestem; and lower vegetative production than the Stony Hills ecological site.
R062XB024SD	**Shallow Loamy - High Central** The Shallow Loamy - South ecological site will have much less rock in the soil profile; less big bluestem; and lower vegetative production than the Stony Hills ecological site.
R062XY012SD	**Thin Upland** The Thin Upland ecological site will have much less rock, and more carbonates in the soil profile; less big bluestem and ponderosa pine; lower vegetative production than the Stony Hills ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon gerardii*

Physiographic features

The Stony Hills ecological site occurs on gently sloping summits, shoulders, backslopes, and upland terraces in the Black Hills.

Table 2. Representative physiographic features

Landforms	(1) Terrace (2) Ridge (3) Mountain slope
Runoff class	Very low to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,158–1,676 m
Slope	0–40%
Water table depth	203 cm
Aspect	E, S

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 from north to south. The average annual precipitation range for MLRA 62 is 18 to 35 inches. Most of the rainfall occurs as frontal storms early in the growing season, in May and June. Some high-intensity, convective thunderstorms occur in July and August. Precipitation in the winter occurs mostly as snow. Twenty to 40 percent of the annual precipitation falls as snow. The annual average snowfall ranges from 23 inches at the lower elevations in the south, to 54 inches in the higher elevations of the central core of the Black Hills.

The average annual temperature varies from 36°F to 48°F. January is the coldest month, with an average temperature of 22°F in the higher elevation of the central core, 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 core, and 73°F in the southern part of this MLRA. The frost-free period ranges from 143 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 upon soil moisture availability.

The average annual precipitation range for LRU-A (Northern Black Hills and Bear Lodge Mountains) is 20 to 30 inches, and LRU-C (Southern Black Hills) is 18 to 21 inches.

Table 3. Representative climatic features

Frost-free period (characteristic range)	76-110 days
Freeze-free period (characteristic range)	111-130 days
Precipitation total (characteristic range)	457-584 mm
Frost-free period (actual range)	62-115 days
Freeze-free period (actual range)	105-134 days
Precipitation total (actual range)	457-762 mm
Frost-free period (average)	94 days
Freeze-free period (average)	121 days
Precipitation total (average)	559 mm

Climate stations used

- (1) HOT SPRINGS [USC00394007], Hot Springs, SD
- (2) WIND CAVE [USC00399347], Buffalo Gap, SD
- (3) EDGEMONT 23 NNW [USC00392565], Custer, SD
- (4) CUSTER CO AP [USW00094032], Custer, SD
- (5) MT RUSHMORE NATL MEM [USC00395870], Keystone, SD
- (6) HILL CITY [USC00393868], Hill City, SD
- (7) PACTOLA DAM [USC00396427], Rapid City, SD
- (8) RAPID CITY 4NW [USC00396947], Rapid City, SD
- (9) LEAD [USC00394834], Lead, SD
- (10) DEADWOOD 2NE [USC00392209], Whitewood, SD

Influencing water features

No riparian areas or wetland features are directly associated with the Stony Hills ecological site.

Soil features

Soils common to the Stony Hills ecological site are deep to very deep and well drained. The mineral soil surface layer typically is 7 to 8 inches thick. The surface may be covered by up to an inch of pine needles and duff in some areas. Surface textures are loamy. Soil profile characteristics are dependent upon the source of the parent material. Some soils on this site are derived from limestone and calcareous sandstone and therefore have calcium carbonate in the profile, typically occurring between depths of 12 and 20 inches. Other soils are derived from igneous and metamorphic rocks and do not have carbonates. A key characteristic of this site is the presence of cobble- and stone-sized rock fragments on the surface. The surface of the soil may be covered by up to 20 percent cobbles and stones. The slopes range from 0 to 40 percent. Soils are generally nonrestrictive to water movement and root penetration. Representative soils of this ecological site have a frigid temperature regime.

Major soils correlated to the Stony Hills ecological site include, Hilger and Shirttail.

These soils are mainly susceptible to water erosion. Because of the presence of surface rock fragments, the hazard of water erosion on this site is low until slopes exceed about 20 percent.

Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and/or production. Erosion on this site will tend to occur as rills around surface fragments and in areas of concentrated flow.

More information can be found in the various soil survey reports. Contact the local USDA

Service Center for soil survey reports that include more detail specific to your area of interest, or use the internet to access USDA's Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Colluvium–limestone and sandstone (2) Alluvium–schist (3) Residuum–granite
Surface texture	(1) Channery loam (2) Cobbly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to slow
Soil depth	102–152 cm
Surface fragment cover <=3"	1–8%
Surface fragment cover >3"	4–15%
Available water capacity (0-101.6cm)	7.62–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	5.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	30–70%
Subsurface fragment volume >3" (Depth not specified)	5–35%

Ecological dynamics

The Stony Hills ecological site evolved under Black Hills climatic conditions; light to severe grazing by bison, elk, insects, and small mammals; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, fluctuating water table depth and hydrologic systems, effects of native and non-native plant and animal species, and management actions. Severe disturbances, such as periods of well below-average precipitation, severe defoliation, excessive haying, or non-use and no fire can cause significant shifts in plant communities

and species composition.

The natural fire regime maintained this site as a grassland and the plant communities were free of pine encroachment and the invasion of non-native cool-season grasses. Fire, or the lack of fire, grazing, drought, and the introduction of non-native cool-season grasses are major drivers that shape this site as well as adjacent ecological sites.

Continuous seasonal grazing (e.g., every spring or every summer at moderate to heavy stocking levels) without adequate recovery periods following grazing events causes departure from the Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (< 5% Cover) Plant Community (1.1). Little bluestem, needle and thread, and wheatgrass will increase initially and then begin to decrease. Big bluestem and sideoats grama will decrease in frequency and production and sedges will increase.

Extended periods of non-use and lack of fire will result in excessive litter and a plant community dominated by cool-season grasses such as western wheatgrass, needlegrass, and non-native cool-season grasses.

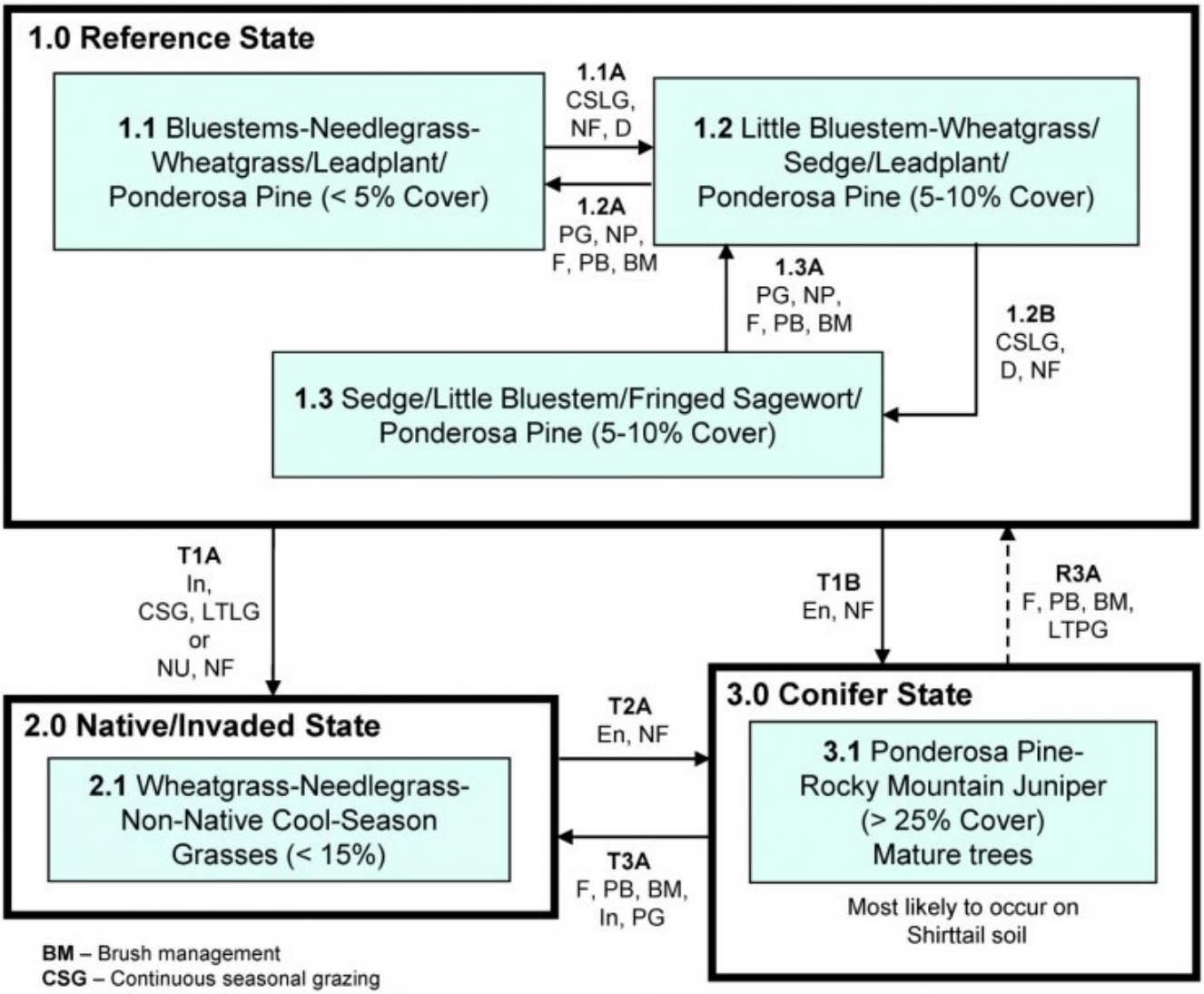
Long-term no fire and the encroachment and establishment of conifer trees will shift the site to a conifer dominated plant community.

Interpretations are primarily based on the Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (< 5% Cover) Plant Community (1.1). It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant community phases, states, transitional pathways, and thresholds have been determined through similar studies and experience.

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

State and transition model

Stony Hills – R062XY029SD 10/9/20



BM – Brush management
CSG – Continuous seasonal grazing
CSLG – Continuous season-long grazing
D – Drought
En – Encroachment of conifers
F – Fire
In – Invasion of non-native cool-season grasses
LTLG – Long-term light grazing
LTPG – Long-term prescribed grazing
NP – Normal precipitation
NF – No fire
NU – No use
PB – Prescribed burning
PG – Prescribed grazing
– – – → Transition may not be fast or feasible

Diagram Legend: Stony Hills - R062XY029SD

T1A	1.0 to 3.0	Invasion of non-native cool-season grasses; continuous seasonal grazing; long-term light grazing; or non-use and no fire.
T1B	1.0 to 2.0	Encroachment of conifers and no fire.
T2A	2.0 to 3.0	Encroachment of conifers and no fire.
T3A	3.0 to 2.0	Fire; prescribed burning; or mechnical brush management to remove conifer encroachment; invasion of non-native cool-season grasses; prescribed grazing with change in season of use, proper stocking rates, and adequate time for plant recovery.

R3A	3.0 to 1.0	Fire; prescribed burning; or mechanical brush management to remove conifer encroachment; long-term prescribed grazing with change in season of use, proper stocking rates, and adequate time for plant recovery. This transition may not be fast or feasible.

1.1A	1.1 to 1.2	Continuous season-long grazing; heavy grazing in combination with drought; no fire.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking rates, change in season of use, adequate time for plant recovery, and a return to normal precipitation patterns following drought. Possibly prescribed burning or mechanical brush management to remove conifer encroachment.
1.2B	1.2 to 1.3	Continuous season-long grazing; heavy grazing in combination with drought; no fire.
1.3A	1.3 to 1.2	Prescribed grazing with proper stocking rates, change in season of use, adequate time for plant recovery, and a return to normal precipitation patterns following drought. Possibly prescribed burning or mechanical brush management to remove conifer encroachment.

State 1
Reference State

The Reference 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 warm-season grasses, with cool-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included occasional fire and grazing by large ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller cool- and warm-season grasses would have declined and a corresponding increase in short statured grass and grass-like species would have occurred. Today, a similar state can be found on areas that are properly managed with grazing and/or prescribed burning, and sometimes on areas receiving occasional short periods of rest. The Reference State (1.0) is very susceptible to invasion of non-native cool-season grasses and the encroachment of conifers from adjacent sites.

Community 1.1
Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (< 5% Cover)

Figure 8. Stony Hills - 062XY029SD - PC 1.1

Interpretations are based primarily on the Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (< 5% Cover) Plant Community. This is also considered to be the Reference Plant Community (1.1). The potential vegetation is about 75 percent grasses or grass-like plants, 10 percent forbs, 10 percent shrubs, and 5 percent trees. The community is dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses include big bluestem, little bluestem, green needlegrass, needle and thread, western wheatgrass, and sideoats grama. Other grasses include porcupine grass, plains muhly, slender wheatgrass, prairie dropseed, and a variety of other grass and grass-like species. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in regard to site and soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1709	2390	3043
Forb	140	219	308
Shrub/Vine	140	219	308
Tree	28	87	151
Total	**2017**	**2915**	**3810**

Figure 10. Plant community growth curve (percent production by month). SD6204, Black Hills, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

Community 1.2
Little Bluestem-Wheatgrass/Leadplant/Ponderosa Pine (5-10% Cover)

This plant community developed under continuous season-long grazing (grazing at moderate to heavy stocking levels for extended portions of the growing), or from over utilization during extended drought periods and no fire. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 10 percent forbs, 10 percent shrubs, and up to 10 percent trees. Dominant grasses include little bluestem, and western wheatgrass. Sub-dominant grasses and grass-like species include sideoats grama, needle and thread, porcupine grass, and threadleaf sedge. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), goldenrod, white prairie aster, and scurfpea. Shrubs will include leadplant, rose, and fringed sagewort. When compared to the Reference Plant Community (1.1), little bluestem, western wheatgrass and sedge have increased, as has conifer cover. Tall warm-season grasses have decreased, and vegetative production has also been reduced. Needle and thread will persist in this phase. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through continued overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Figure 11. Plant community growth curve (percent production by month). SD6203, Black Hills, 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

Community 1.3
Sedge/Little Bluestem/Fringed Sagewort/Ponderosa Pine (5-10% Cover)

Figure 12. Stony Hills - 062XY029SD - PC 1.3

This plant community evolved under, long-term continuous season-long grazing (grazing at moderate to heavy stocking levels for the full growing season each year) or from over utilization during extended periods of drought, and no fire. The potential plant community is made up of approximately 65 percent grasses and grass-like species, 15 percent forbs, 10 percent shrubs, and 10 percent trees. Dominant grass and grass-like species include threadleaf sedge, sun sedge, and little bluestem. Sub-dominant grasses include western wheatgrass, needle and thread, sideoats grama, and prairie Junegrass. Forbs commonly found in this plant community include white sagebrush (cudweed sagewort), goldenrod, pussytoes, and spiny phlox. Fringed sagewort will increase and other shrubs including leadplant, and rose will decrease in composition. When compared to the Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (<5% Cover) Plant Community (1.1), sedges and little bluestem are dominant on this plant community. Tall and mid-grasses have decreased significantly. This vegetation state is very resistant to change due to the increase in the root mat near the surface of the soil which further reduces infiltration. The herbaceous species present are well adapted or resistant to grazing. This plant community is less productive than other plant community phases and can be resistant to change.

Figure 13. Plant community growth curve (percent production by month). SD6203, Black Hills, 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

Continuous season-long grazing (stocking levels above carrying capacity for extended portions of the growing season) or heavy grazing in combination with drought, and no fire will push the Reference Plant Community (1.1) to the Little Bluestem-Wheatgrass-Leadplant/Ponderosa Pine (5-10% Cover) Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing (proper stocking, alternating season of use, and providing adequate recovery periods); or periodic light to moderate grazing possibly including periodic rest; a return to normal precipitation patterns following drought; and fire, or possibly prescribed burning or mechanical brush management to reduce conifer encroachment will convert the Little Bluestem-Wheatgrass/Leadplant/ Ponderosa Pine (5-10% Cover) Plant Community (1.2) to the Bluestem-Needlegrass-Wheatgrass/Leadplant/Ponderosa Pine (< 5% Cover) Plant Community (1.1).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.3

Continuous season-long grazing (stocking levels well above carrying capacity for extended portions of the growing season) or heavy grazing in combination with drought; and no fire will shift the Little Bluestem-Wheatgrass/Leadplant/ Ponderosa Pine (5-10% Cover) Plant Community (1.2) to the Sedge/Little Bluestem/Fringed Sagewort/Ponderosa Pine (5-10% Cover) Plant Community (1.3).

Pathway 1.3A
Community 1.3 to 1.2

Low-intensity fire, prescribed burning or mechanical brush management to treat conifer encroachment followed by prescribed grazing and a return to normal precipitation patterns following drought will convert the Sedge/Little Bluestem/Fringed Sagewort/Ponderosa Pine (5-10% Cover) Plant Community (1.3) to the Little Bluestem-Wheatgrass/Sedge/Leadplant/Ponderosa Pine (5-10% Cover) Plant Community (1.2).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Native/Invaded State

The Native/Invaded State is dominated by native cool- and warm-season grasses, with a subdominant component of non-native cool-season grasses. It can be found on areas that would appear to be properly managed with grazing and possibly prescribed burning. Extended periods of non-use and no fire, or long-term light grazing can result in the invasion and establishment of non-native cool-season grasses onto this site. If the native cool-season grasses decline, a corresponding increase of non-native cool-season grasses can occur. The non-native cool-season grasses will include, Kentucky bluegrass, smooth brome, cheatgrass, and field brome.

Community 2.1
Wheatgrass-Needlegrass-Non-Native Cool-Season Grasses (<15%)

Figure 14. Stony Hills - 062XY029SD - PC 2.1

This plant community develops when non-native cool-season grasses, such as Kentucky bluegrass or smooth brome invade and become established on the site. This may occur due to the sites close proximity to seed sources, expansion from road ditches, improved pastures, other invaded sites, or from contaminated hay. Repeated seasonal grazing (typically during the summer), or long-term light grazing, or extended periods of non-use and no fire, will allow these non-native cool-season grasses to increase in the plant community. Plant litter accumulates in large amounts when this community first develops. Litter buildup reduces mature native plant vigor and density, and seedling recruitment declines. Eventually litter levels become high enough that plant density decreases. Typically, rhizomatous grasses form small colonies because of a lack of tiller stimulation. The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs and 5 to 10 percent conifers. The community is dominated by cool-season grasses. The major grasses include western wheatgrass, needle and thread, green needlegrass, Kentucky bluegrass, and smooth brome. Other grass and grass-like species include little bluestem, sideoats grama, and needleleaf sedge. This is a sustainable plant community in regard to soil and site stability, watershed function, and biologic integrity. However, the presence of Kentucky bluegrass, smooth bromegrass, and other invasive species will begin to alter the soil biotic community and potentially lead to further invasion of non-native species.

Figure 15. 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

State 3
Conifer State

This Conifer State consists of areas where tree canopy increases to a level that impedes the reproductive capability of the major native perennial grass species. The increase in conifer canopy is a result of encroachment from forest sites, or from rangeland sites that have been invaded; and the disruption of the natural historic fire regime that kept the trees in an immature stage. This state is reached when mature conifer canopy reaches approximately 25 percent or more. The canopy typically is dominated by ponderosa pine, but Rocky Mountain juniper may also be present in varying amounts. It appears the Conifer State is most likely to occur on the Shirttail soil series and, to a lesser extent, on Hilger. With continued long-term fire suppression and no brush management, the conifer canopy can eventually become closed with much of the herbaceous understory lost. This loss is partly driven by the interception of precipitation. Ponderosa pine canopy can significantly reduce precipitation reaching the ground due to canopy interception. In areas with intermediate and dense canopy's, the expected reduction can reach 30 percent (Wrage, 1994).

Community 3.1
Ponderosa Pine-Rocky Mountain Juniper (>25% Cover)

This plant community develops where trees from adjacent sites encroach or trees naturally occurring on the site increase and begin to shade out the herbaceous component. Ponderosa pine is the most common species to occupy the site, but encroachment of Rocky Mountain juniper can also occur. These species expand on this site due to suppression of fire and no brush management. The mature tree canopy is 25 percent or greater. The potential plant community is made up of approximately 50 percent grasses and grass-like species, 15 percent forbs, 5 percent shrubs, and 30 percent trees. Dominant grass and grass-like species include western wheatgrass, needlegrass, and non-native cool-season grasses. As the conifer canopy increases, cool-season native grasses tend to decrease, and more shade-tolerant non-native cool-season grasses increase. Forbs commonly found in this community include white sagebrush (cudweed sagewort), white prairie aster, silverleaf scurfpea, and pussytoes. Shrubs will include fringed sagewort, snowberry, and rose. A significant reduction of tree canopy can be accomplished through fire, mechanical brush management, or prescribed burning. The vegetation in the understory is capable of enduring fire; however, very hot crown fires will have a detrimental effect to the plant community.

Figure 16. Plant community growth curve (percent production by month). SD6211, Black Hills, heavy conifer canopy. Mature ponderosa pine 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

Transition T1A
State 1 to 2

The invasion of non-native cool-season grasses; continuous seasonal grazing (stocking levels above carrying capacity for extended portions of the growing season, and at the same time of year each year, typically beginning early in the season); long-term light grazing; or no use and no fire will transition the Reference State (1.0) to the Native/Invaded State (2.0).

Transition T1B
State 1 to 3

Long-term no fire and the encroachment and establishment of conifers will transition the Reference State (1.0) to the Conifer State (3.0).

Transition T2A
State 2 to 3

Encroachment or an increase in canopy cover of native coniferous tree species, and no fire will lead the Native/Invaded State (2.0) over a threshold to the Conifer State (3.0). This threshold will be crossed when tree canopy reaches approximately 25 percent or more of mature trees.

Restoration pathway R3A
State 3 to 1

Fire; or prescribed burning or mechanical brush management in conjunction with long-term prescribed grazing may lead this plant community across a threshold back to the Reference State (1.0). This would have to take place before the trees reach maturity and are still susceptible to fire, and reproductive propagules of the perennial grasses are still present. After trees reach maturity, a stand removing fire or tree removal would be needed to move the Conifer State (3.0) over the threshold back to the Reference State (1.0). This process can take an extended period of time (5 to 10 years), especially if mid-stature cool and warm-season species make up only a small percentage of the plant community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Transition T3A
State 3 to 2

Invasion of non-native cool-season grasses; fire; mechanical brush management; or prescribed burning to remove conifers will transition the Conifer State (3.0) to the

Native/Invaded State (2.0). Once conifers are removed, prescribed grazing will be required to facilitate herbaceous recovery and maintenance.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

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	**Tall Warm-Season Grasses**			291–729	
	big bluestem	ANGE	*Andropogon gerardii*	291–729	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	29–117	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	29–117	–
2	**Mid- Warm-Season Grasses**			437–874	
	little bluestem	SCSC	*Schizachyrium scoparium*	146–729	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	29–146	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	29–146	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–146	–
3	**Cool-Season Bunchgrass**			146–583	
	green needlegrass	NAVI4	*Nassella viridula*	29–291	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	29–291	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–146	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	29–146	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	29–146	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	0–58	–
	Richardson's needlegrass	ACRI8	*Achnatherum richardsonii*	0–58	–
4	**Rhizomatous Wheatgrass**			58–291	

	western wheatgrass	PASM	*Pascopyrum smithii*	58–291	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–146	–
5	**Other Native Grasses**			29–146	
	prairie Junegrass	KOMA	*Koeleria macrantha*	29–146	–
	Grass, perennial	2GP	*Grass, perennial*	0–117	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–58	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–29	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	0–29	–
6	**Grass-Likes**			58–146	
	threadleaf sedge	CAFI	*Carex filifolia*	58–146	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	29–58	–
	Richardson's sedge	CARI	*Carex richardsonii*	29–58	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–58	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			146–291	
	Forb, perennial	2FP	*Forb, perennial*	29–146	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	29–58	–
	dotted blazing star	LIPU	*Liatris punctata*	29–58	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	29–58	–
	goldenrod	SOLID	*Solidago*	29–58	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	29–58	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	29–58	–
	stiff goldenrod	OLRI	*Oligoneuron rigidum*	29–58	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–58	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	0–29	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–29	–
	spiny phlox	PHHO	*Phlox hoodii*	0–29	–

	pussytoes	ANTEN	*Antennaria*	0–29	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–29	–
	beardtongue	PENST	*Penstemon*	0–29	–
	downy Indian paintbrush	CAPU11	*Castilleja purpurea*	0–29	–
	field sagewort	ARCA12	*Artemisia campestris*	0–29	–
Shrub/Vine					
9	**Shrubs**			146–291	
	leadplant	AMCA6	*Amorpha canescens*	58–233	–
	rose	ROSA5	*Rosa*	29–87	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–87	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–58	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–58	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–58	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–29	–
Tree					
10	**Trees**			29–146	
	ponderosa pine	PIPO	*Pinus ponderosa*	29–146	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–29	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–29	–
	Tree	2TREE	*Tree*	0–29	–

Animal community

Wildlife Interpretations
The Black Hills and Bear Lodge Mountains of South Dakota and Wyoming are truly a forested island in a grassland sea. To regional Native Americans they are “Paha Sapa,” or “hills that are black”, and from a distance, the ponderosa pine-covered slopes do appear like black hills (Larson, 1999).

The Black Hills and Bear Lodge Mountains are located in the drier areas of a northern mixed-grass prairie ecosystem in which sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, MLRA 62 consisted of diverse grassland, shrubland, and forest habitats interspersed with varying densities of depressional instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small

mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several species of small mammals and insects, were the primary consumers linking the grassland resources to large predators, such as the gray wolf, mountain lion, grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors.

Beaver inhabited surface waters associated with instream wetlands and woody riparian corridors along streams and drainages. Beaver occupation served as a mechanism to maintain water tables along flood plains and valley floors. During pre-European settlement times, the extent of the wet land sites was likely much more widespread and persistent during dry periods; however, excessive trapping and removal since that time has changed the hydrology and limited the extent of these sites while drying former mesic areas throughout the MLRA.

Grazing Interpretations
Production and accessibility of plant communities described in the Stony Hills ecological site can be highly variable. A complete resource inventory is necessary to document plant composition and production. Accurate estimates of carrying capacity should be calculated using vegetative clipping data, animal preference data, and actual stocking records.

Initial suggested stocking rates should be calculated using a base of 912 lb/acre (air-dry weight) per animal-unit-month (AUM). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow with or without calf, for one month. Use a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test should be used to determine the level of supplementation needed.

Hydrological functions

This site is dominated by soils in hydrologic groups B. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope and ground cover. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

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

Wood products

No appreciable wood products are typically present on this site.

Other products

Harvesting the seeds of native plants on this site can provide additional income.

Other information

Revision Notes: Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure that it meets the 2014 National Ecological Site Handbook (NESH) standards for a provisional ecological site description. This site description should not be considered an Approved ESD, as it contains only the foundational site concepts and requires further data collection, site investigations, and final State-and-Transition Model (STM) reviews before it can be used as an Approved ESD meeting NESH standards.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: Stan Boltz, range management specialist (RMS), NRCS; Dan Brady, soil scientist (SS), NRCS; Mitch Faulkner, RMS, NRCS; Rick Peterson, (RMS), NRCS; Mathew Scott, RMS, USFS; and Jim Westerman, (SS), NRCS. All inventory information and data records are compiled within the Rapid City, SD USDA-NRCS Shared “S” network drive.

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Approval

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

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Rangeland health reference sheet

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

Author(s)/participant(s)	
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:**
