USDA Natural Resources
Conservation Service

Ecological site R058DY029SD
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.

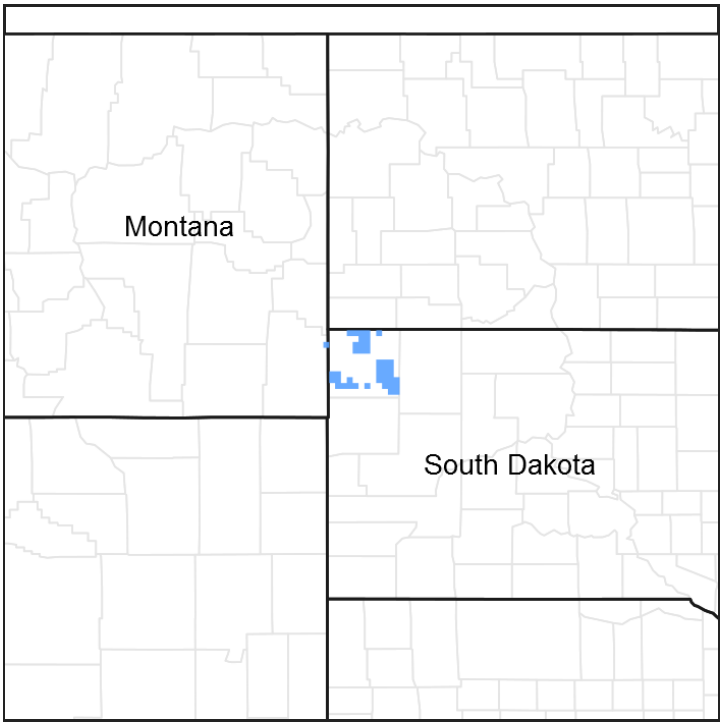

Figure 1. Mapped extent

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): 058D–Northern Rolling High Plains, Eastern Part

The Northern Rolling High Plains, Eastern Part (MLRA 58D) is shared between South Dakota (65 percent), Montana (21 percent), and North Dakota (14 percent). The MLRA is

approximately 2,755 square miles. The small towns of Buffalo and Camp Crook, South Dakota, and Marmarth, North Dakota, are all within the boundary of this MLRA, and Baker, Montana, is on the northern most edge. Portions of the Little Missouri National Grassland and Custer National Forest are also in the MLRA. Portions of the Little Missouri River and the headwaters of major tributaries that eventually form the Grand and Moreau Rivers in South Dakota are also in this area.

The Northern Rolling High Plains, Eastern Part consists of Cretaceous marine and continental sediments of shale, siltstone, and sandstone. The continental and marine Hell Creek Formation is under approximately 85 percent of the MLRA, and the Fox Hills Sandstone forms the southern boundary of the MLRA. Tertiary deposits are in scattered areas throughout the MLRA. These deposits consist of the Paleocene Ludlow and Tongue River Formations, the Oligocene White River Group, and the Miocene Arikaree Group. These Tertiary deposits are resistant and positioned above the Cretaceous beds. Ponderosa pine growing in areas of these Tertiary formations further distinguishes these formations from the other formations in the MLRA. Pleistocene and Holocene river sand and gravel deposits are also on the valley floors and on the terraces along the larger rivers in the area. A large Quaternary eolian deposit is directly south of the town of Buffalo.

The average elevation of MLRA 58D ranges from 2,300 feet to 4,000 feet, increasing gradually from east to west. Harding Peak is the highest point at 4,019 feet. In places, flat-topped, steep-sided buttes rise sharply above the gently rolling plains below.

The dominant soil orders in this MLRA are Alfisols, Entisols, Inceptisols, and Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime that borders on aridic, and mixed mineralogy. They are shallow to very deep, generally well drained, and loamy or clayey.

Annual precipitation is 14 to 17 inches and can fluctuate widely from year to year. The majority of rainfall occurs early in the growing season. Some high-intensity thunderstorms occur mid to late summer. The native vegetation in this MLRA consists primarily of grasses and forbs with a small component of trees and shrubs along streams. Ponderosa pine grow on the upper slopes and on the top of some of the higher buttes. Open grasslands are characterized by western wheatgrass, green needlegrass, blue grama, and buffalograss. Wyoming big sagebrush grows on clayey soils in the western part of the MLRA.

More than four-fifths of the MLRA is privately owned ranches running cattle, sheep, or both. Less than 5 percent of the area is federally owned. The major resource concerns are water quality, wind erosion, and water erosion (USDA, NRCS. 2006. Ag Handbook 296).

Classification relationships

USDA
Land Resource Region G—Western Great Plains Range and Irrigated Region:

Major Land Resource Area (MLRA) 58D— Northern Rolling High Plains, Eastern Part

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Forested Buttes—43d
Sagebrush Steppe—43e

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains - Palouse Dry Steppe Province—331:
Missouri Plateau Section—331M
Sagebrush Steppe Subsection—334Mi

Ecological site concept

The Stony Hills ecological site is found primarily in the White River geological formation which makes up the Slim Buttes and Short Pine Hills areas, along with other outcrops in MLRA 58D. It is located on upland landscapes and does not receive additional moisture from runoff or overflow. Slopes typically range from 9 to 40 percent. Soils are deep (20 inches or greater in depth), well drained, and formed in colluvium and residuum weather from sandstone. The surface layer is 3 to 5 inches thick with a very fine sandy loam texture. The subsurface textures are loam to sandy loam and are gravelly, very gravelly, or very cobbly.

The vegetation in the Reference State (1.0) consists of a mixture of cool- and warm-season grasses. Little bluestem, needle and thread, big bluestem, and green needlegrass are the dominant grasses. Forbs are common and diverse. Common shrubs include leadplant, rose, skunkbush sumac, and western snowberry. Ponderosa pine and hardwood trees can be a significant component in some plant communities.

Associated sites

R058DY028SD	**Shallow Sandy** The Shallow Sandy ecological site is found on the same landscapes adjacent to the Stony Hills site.
R058DY024SD	**Shallow Loamy** The Shallow Loamy ecological site is found on the same landscapes adjacent to the Stony Hills site.
R058DY026SD	**Thin Sandy** The Thin Sandy ecological site is found similar landscape positions as the Stony Hills ecological site.

Similar sites

R058DY024SD	**Shallow Loamy** The Shallow Loamy ecological site will have less little bluestem and less vegetative production than the Stony Hills ecological site.
R058DY028SD	**Shallow Sandy** The Shallow Sandy ecological site will have more prairie sandreed and more vegetative production than the Stony Hills ecological site.
R058DY026SD	**Thin Sandy** The Thin Sandy ecological site will have more prairie sandreed and sand bluestem than the Stony Hills ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium var. scoparium* (2) *Hesperostipa comata ssp. comata*

Physiographic features

The Stony Hills ecological site occurs on moderately steep to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Upland > Hill (2) Upland > Hillslope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	701–1,219 m
Slope	9–40%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 58D is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland to the east. Average annual precipitation ranges from 14 to 17 inches with most falling in the early growing season. Some high intensity, convective thunderstorms occur in the summer. Precipitation in winter occurs as snow. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This wide range is due to the high elevation and

dry air, which permit rapid incoming and outgoing radiation. Outbreaks of cold air from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter but have the most severe effect on ranching operations during late winter and in spring.

The normal average annual temperature is about 44 °F. January is the coldest month with average temperatures ranging from about 12 °F (Marmarth, North Dakota) to about 20 °F (Baker, Montana). July is the warmest month with temperatures averaging from about 70 °F (Marmarth, North Dakota) to about 76 °F (Baker, Montana). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. Wind speeds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime winds. Strong storms may bring brief periods of high winds with gusts of more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	97-111 days
Freeze-free period (characteristic range)	121-129 days
Precipitation total (characteristic range)	381-432 mm
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	406 mm

Climate stations used

- (1) BAKER 1 E [USC00240412], Baker, MT
- (2) LADNER 9SW [USC00394671], Camp Crook, SD
- (3) BUFFALO ASOS [USW00094037], Buffalo, SD
- (4) BUFFALO 13 ESE [USW00094081], Reva, SD
- (5) CAMP CROOK [USC00391294], Camp Crook, SD
- (6) REDIG 11 NE [USC00397062], Buffalo, SD
- (7) HOOVER [USC00393945], Newell, SD

Influencing water features

No significant water features influence the Stony Hills ecological site.

Soil features

Soils common to the Stony Hills ecological site have a very fine sandy loam textured surface layer. The surface layer is 3 to 5 inches thick. Slopes range from 9 to 40 percent. The soils in this site are formed in colluvium and residuum weathered from sandstone. They are well drained with moderately rapid infiltration rates. The soils on this site are modified by cobbles and stones that occur in the profile and at the surface. The texture of the subsurface layer's ranges from loam to sandy loam and are gravelly, very gravelly, or very cobbly. Subsurface soil layers are non-restrictive to water movement and root penetration.

This site should show slight to no evidence of rills, or wind-scoured areas. Plant pedestalling occurs occasionally, but no exposed roots should occur. Water flow paths are typically not present but when visible, they are broken and irregular in appearance or discontinuous. The soil surface is stable and intact.

Major Soil correlated to the Stony Hills ecological site include, Rockoa, Slimbutte and Vanocker.

The Rockoa, Slimbutte, and Vanocker soils mapped in MLRA 58D, is found exclusively in the White River geological formation which makes up the Slim Buttes and other formations in the area. The Vanocker and Rockoa soils will likely have a Conifer State (3.0). The Slimbutte soil will typically have scattered ponderosa pine but is unlikely to develop a Conifer State.

The Vanocker soil mapped in MLRA 58D have significantly different soil characteristics than what is documented in the Official Series Descriptions (OSD). The OSD classifies Vanocker as a Loamy-skeletal, mixed, superactive, frigid Hapludalfs with an "Oe" horizon and a "Bt" horizon as typical of an Alfisol which developed under a forest canopy. In the Harding County Soil Survey, Vanocker is described as being more similar to a loamy-skeletal Entisol with a thin "O" horizon but without a "Bt" horizon.

Rockoa is also listed as a Loamy-skeletal, mixed, superactive, frigid Hapludalfs in the OSD but there are questions if a forest soil has actually developed in the geologic formation where it is mapped in MLRA 58D.

The map units in MLRA 58D with Rockoa or Vanocker components will require further soil investigations.

These soils are susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 20 percent.

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–sandstone and siltstone (2) Residuum–sandstone and siltstone
Surface texture	(1) Very fine sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	102–203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	12.7 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	40–65%
Subsurface fragment volume >3" (Depth not specified)	10–55%

Ecological dynamics

The Stony Hills ecological site developed under the Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or human-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil and site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, severe disturbances, such as periods of well below-average precipitation, can cause significant shifts in plant

communities and species composition.

As this site deteriorates, species such as threadleaf sedge and fringed sagewort will increase. Mid-grasses such as prairie sandreed and little bluestem will decrease in frequency and production.

The plant community upon which interpretations are primarily based is the Prairie Sandreed-Needle and Thread-Bluestem Plant Community (1.1). This plant community has been determined by studying 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 have also been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.
Within the Slim Buttes and other formation in the area, there is a potential for a Conifer State (3.0) with a plant community (3.1) consisting of ponderosa pine, possible Rocky Mountain juniper, shrubs, and an herbaceous understory.

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 – R058DY029SD 1/24/20

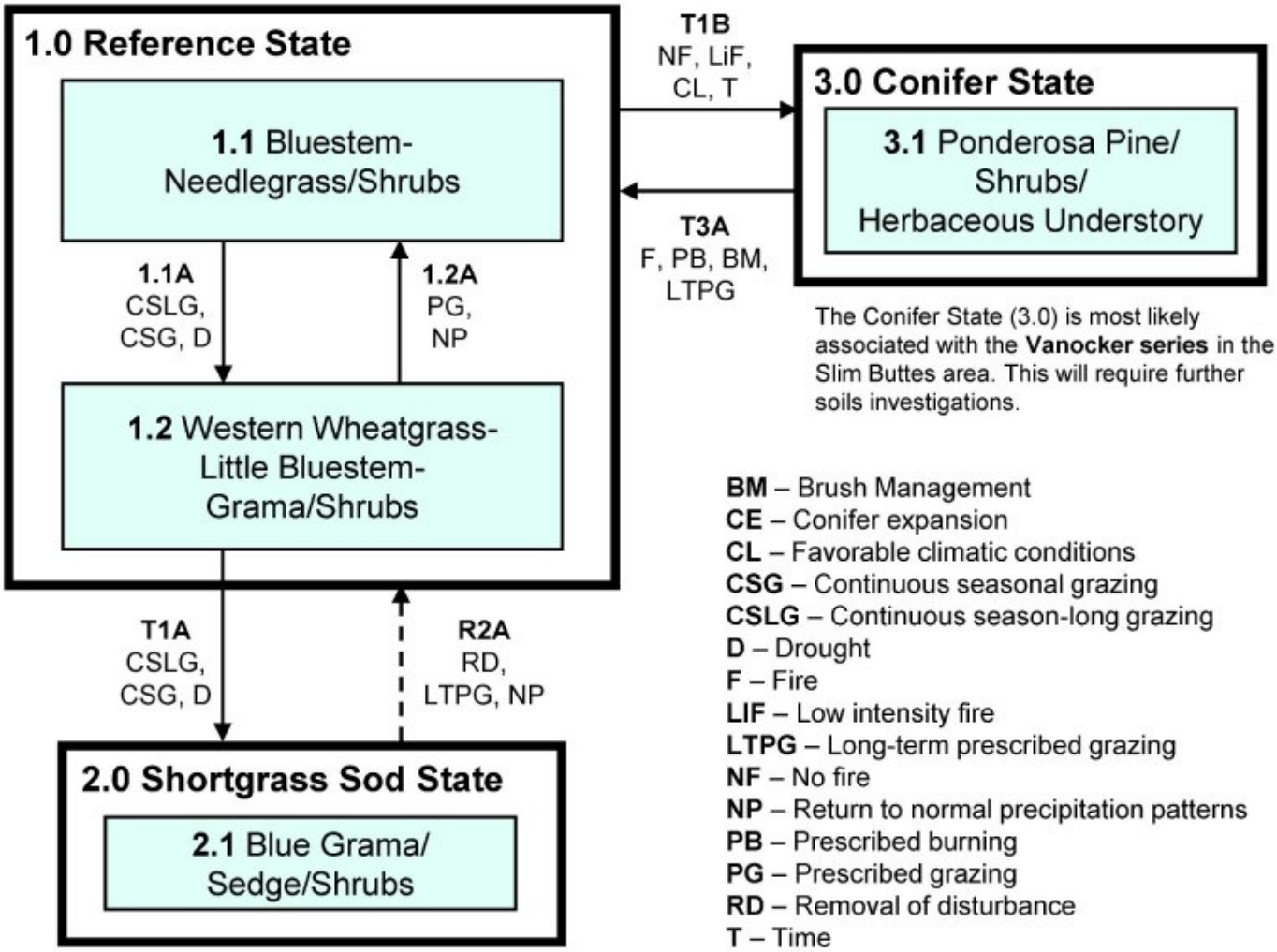

Diagram Legend: Stony Hills - R058DY029SD

T1A	1.0 to 2.0	Continuous season-long grazing; continuous seasonal grazing (early spring); or heavy grazing in combination with drought.
T1B	1.0 to 3.0	Long-term no fire or low intensity fires; unique climatic conditions that allow pine to germinate and establishes; and time for pine to mature.
T3A	3.0 to 1.0	Stand removing fires; prescribed burning; brush management; long-term prescribed grazing.
R2A	2.0 to 1.0	Removal of management-induced disturbance; long-term prescribed grazing with proper stocking rates, change is season of use, and time for adequate recovery; and a return to normal precipitation patterns following drought. This transition may not be fast or in the end meet management goals.
1.1A	1.1 to 1.2	Continuous season-long grazing; continuous seasonal grazing (early spring); or heavy grazing in combination with drought.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change is season of use, and adequate time for recovery; a return to normal precipitation patterns.

State 1
Reference State

The Reference State represents what is believed to show the natural range of variability that dominated the dynamics of the Shallow Sandy ecological site prior to European settlement. This site in the Reference State (1.0) is dominated by warm-season grasses and cool-season grasses subdominant. In pre-European times, the primary disturbance mechanisms included frequent fire and grazing by large herding ungulates. Timing and intensity of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Taller warm- and cool-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 prescribed burning and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- rose (*Rosa*), shrub
- skunkbush sumac (*Rhus trilobata*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- big bluestem (*Andropogon gerardii*), grass
- green needlegrass (*Nassella viridula*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- prairie sandreed (*Calamovilfa longifolia*), grass
- porcupinegrass (*Hesperostipa spartea*), grass
- Canada wildrye (*Elymus canadensis*), grass
- sedge (*Carex*), grass
- eastern pasqueflower (*Pulsatilla patens*), other herbaceous
- dotted blazing star (*Liatris punctata*), other herbaceous
- false boneset (*Brickellia eupatorioides*), other herbaceous
- prairie clover (*Dalea*), other herbaceous
- purple coneflower (*Echinacea*), other herbaceous
- prairie coneflower (*Ratibida*), other herbaceous
- scarlet beeblossom (*Oenothera suffrutescens*), other herbaceous

Community 1.1
Bluestem-Needlegrass/Shrubs

Interpretations are based primarily on the Bluestem-Needlegrass/Shrubs Plant Community, which is also considered to be the Reference Plant Community (1.1). This plant community can be found on areas that are properly managed with grazing, and sometimes on areas receiving occasional short periods of deferment. A mixture of cool- and warm-season grasses dominate this plant community. The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, 5 percent shrubs, and 2 to

10 percent trees. Major grasses include little bluestem, big bluestem, green needlegrass, and needle and thread. Other grasses and grass-like species include sideoats grama, western wheatgrass, blue grama, prairie dropseed, porcupine grass, Canada wildrye, and sedge. Significant forbs include American pasqueflower (early spring flowering), dotted gayfeather, false boneset, prairie clover, prairie coneflower, purple coneflower, and scarlet gaura. Significant shrubs found in this plant community include sliver sagebrush, rose, skunkbush sumac, and western snowberry. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. Community dynamics, nutrient cycle, water cycle, and energy flow are functioning properly. Plant litter is properly distributed with very little movement offsite and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1227	1594	2068
Shrub/Vine	95	151	207
Tree	39	121	207
Forb	95	151	207
Total	**1456**	**2017**	**2689**

Figure 9. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

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

Community 1.2
Western Wheatgrass-Little Bluestem-Grama/Shrubs

This plant community develops under continuous season-long grazing; continuous seasonal grazing; or from over utilization during extended drought periods. The potential vegetation is about 75 percent grasses or grass-like plants, 5 percent forbs, 10 percent shrubs, and 2 to 10 percent trees. The dominant grasses include western wheatgrass, little bluestem, blue grama, and sideoats grama. Other significant grasses or grass-like species include porcupine grass, slender wheatgrass, hairy grama, prairie Junegrass, and bottlebrush squirreltail. Forbs commonly found in this plant community include cudweed sagewort, green sagewort, scurfpea, goldenrod, spiny phlox, western ragweed, and white prairie aster. Significant shrubs include sliver sagebrush, rose, skunkbush sumac, and western snowberry. Compared to the Bluestem-Needlegrass/Shrubs Plant Community (1.1), Little bluestem, big bluestem, prairie dropseed, needle and thread, and green

needlegrass have decreased in abundance and vigor Western wheatgrass initially increases in this plant community phase. Blue grama and sedge increase, and non-native species invade the plant community. Although production remains relatively high, little bluestem plants often become “wolfy,” and largely not grazed due to lower palatability. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. Also, certain species or classes of livestock will readily consume the little bluestem in any condition and result in a shift away from this plant community phase. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	835	1240	1530
Shrub/Vine	73	118	163
Tree	28	94	163
Forb	73	118	163
Total	**1009**	**1570**	**2019**

Figure 11. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

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; continuous seasonal, or heavy grazing in combination with drought will lead to the Bluestem-Needlegrass/Shrubs Plant Community (1.1) to the Western Wheatgrass-Little Bluestem-Grama/Shrub Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with proper stocking rates, change in season of use, and adequate time for plant recovery; and a return to normal precipitation patterns following drought will convert the Western Wheatgrass-Little Bluestem-Grama/Shrubs Plant Community (1.2) to the Bluestem-Needlegrass/Shrubs Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2
Shortgrass Sod State

The Shortgrass Sod State (2.0) is dominated by shortgrass species, upland sedges, and shrubs. This State is the result of grazing management that does not provide adequate recovery time for cool-season needlegrass, wheatgrass, and tall and mid-statured warm-season grasses. The hydrologic function of this state is dramatically altered. Runoff is high and infiltration is low. This State is very resistant to change through grazing management alone.

Dominant plant species

- silver sagebrush (*Artemisia cana*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- skunkbush sumac (*Rhus trilobata*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- tarragon (*Artemisia dracunculus*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- Cuman ragweed (*Ambrosia psilostachya*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- prairie sagewort (*Artemisia frigida*), other herbaceous

Community 2.1
Blue Grama/Sedge/Shrubs

This plant community develops under long-term continuous season-long grazing, or long-term continuous seasonal grazing, often with concentrated use in the early part of the growing season (as in calving/lambing pastures). It is made up of approximately 75 percent grasses (primarily short grass and grass-like species), 5 percent forbs, 10 percent shrubs, and 5 to 10 percent trees. Compared to the Bluestem-Needlegrass/Shrubs Plant Community (1.1), the grazing tolerant blue grama and sedges replace little bluestem, western wheatgrass, and the needlegrasses. Sideoats grama remains in the plant community but is less productive because of competition and grazing pressure. Due to low palatability, cudweed sagewort, green sagewort, scurfpea, western ragweed, and western yarrow become more prevalent in the plant community. Fringed sagewort can become the dominant shrub in this plant community. Other shrubs commonly found in this plant community include silver sagebrush, western snowberry, and skunkbush sumac. This plant community is resistant to change. The herbaceous species present are less palatable and more grazing tolerant than the dominant species in the Bluestem-

Needlegrass/Shrubs Plant Community (1.1). The dominant grass and grass-like species typically have short, compact rooting systems near the soil surface. This results in reduced infiltration and increased runoff. Onsite soil erosion may remain low, but the increased runoff may have damaging effects on adjacent ecological sites.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	588	919	1250
Shrub/Vine	50	84	118
Tree	17	67	118
Forb	17	50	84
Total	**672**	**1120**	**1570**

Figure 13. Plant community growth curve (percent production by month). SD5804, Northern Rolling High Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant, uplands..

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

State 3
Conifer State

The Conifer State is primally found in the areas that have the White River geological formations such as Slim Buttes. This state occurs when ponderosa pine become established or expand on this site. As conifer canopy cover increases, the herbaceous component will decrease, bare ground increases and pine needles build up and create a duff layer. As competition from herbaceous species decrease, conifers can establish more readily under the canopy. Heavy grazing can contribute to this transition, but it may also occur independently without human influence other than through fire suppression. The Slim Buttes area is drier than the Black Hills (MLRA 62) where expansive stands of ponderosa pine occur, and pine regenerates readily following fire. MLRA 58D is located on the eastern edge of the ponderosa pine range. MLRA 58D probably does not have consistent climatic conditions necessary for ponderosa pine germination and regeneration. Those conditions may be episodic as they are in the drier American southwest. Regeneration of ponderosa pine in New Mexico, Arizona, and western Nebraska are strongly episodic and the basis of these pulses are at least partly controlled by climate. Ponderosa pine in the Southwest require a warm wet spring and an above-average water supply throughout the year for germination to occur and seedlings to establish. One study from northern Arizona showed a large cohort of ponderosa pine that established within a two-year period between 1919 and 1920 when optimal combination of temperature and precipitation factors occurred. This episodic event was not repeated for 73 years (Savage,

M., et al, 1996). Successful establishment of ponderosa pine in the Great Plains is unpredictable and requires a combination of sufficient seed availability, adequate year-long soil moisture, a lack of persistent drought, and no fire that affects seedling survival (Kaye et al., 2010). The Conifer State on the Stony Hills ecological sites may be limited in extent, especially in those plant communities having a large ponderosa pine component. As high intensity, medium to large sized wildfires occur, these plant communities may become less common as grassland communities replace these woodlands.

Dominant plant species

- ponderosa pine (*Pinus ponderosa*), tree
- prairie sagewort (*Artemisia frigida*), shrub
- western snowberry (*Symphoricarpos occidentalis*), shrub
- chokecherry (*Prunus virginiana*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass
- sedge (*Carex*), grass
- Canada wildrye (*Elymus canadensis*), grass
- green needlegrass (*Nassella viridula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- pussytoes (*Antennaria*), other herbaceous

Community 3.1
Ponderosa Pine/Shrubs/Herbaceous Understory

Historically, ponderosa pine and juniper were confined to ridges and steep, north- or east-facing slopes that were located adjacent to rock outcrops. This plant community has developed due to fire suppression and the expansion of ponderosa pine on the ecological site. Ponderosa pine canopy make up approximately 15 percent mature trees in this plant community. The understory is made up of about 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses and grass-likes include needle and thread, little bluestem, sideoats grama, blue grama and sedge. Grasses of secondary importance include Canada wildrye, green needlegrass and western wheatgrass. Forbs commonly found in this community include cudweed sagewort, western yarrow, and pussytoes. Shrubs can include fringed sagewort, western snowberry, and chokecherry. When compared to the Bluestem-Needlegrass/Shrubs Plant Community (1.1), ponderosa pine increases. The grass component decreases as pine and juniper needles increases. Annual herbaceous production has also decreased. While the conifer canopy provides excellent protection from the weather for both livestock and wildlife, it is not capable of supporting large numbers of wildlife and livestock due to decreased production. This plant community is resistant to change. A significant reduction

of conifers can only be accomplished through fire, or mechanical removal. The vegetation in the understory is capable of enduring fire without a detrimental effect to the site and the associated plant community.

Figure 14. Plant community growth curve (percent production by month). SD5811, Northern Rolling High Plains, heavy conifer canopy.. Mature ponderosa pine/juniper overstory..

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

Transition T1A
State 1 to 2

Continuous season-long grazing; or continuous seasonal grazing (early spring); or heavy grazing in combination with drought; will transition the Reference State (1.0) to the Shortgrass Sod State (2.0). This transition is most likely to occur from the Western Wheatgrass-Little Bluestem-Grama/Shrubs Plant Community (1.2).

Transition T1B
State 1 to 3

Long-term fire suppression or periodic low intensity fires; favorable climatic conditions that allow for pine regeneration and establishment, expansion of conifers, and time will transition the Reference State (1.0) to the Conifer State (3.0).

Restoration pathway R2A
State 2 to 1

Removal of disturbances; long-term prescribed grazing, and favorable climatic conditions, which allow for adequate plant recovery periods, may allow for a transition from the Shortgrass Sod State (2.0) to the Reference State (1.0). This transition may not be rapid or in the end meet management goals.

Conservation practices

Prescribed Grazing

Transition T3A
State 3 to 1

Prescribed burning or wildfire followed by long-term prescribed grazing will move this plant community towards the herbaceous dominated Reference State (1.0). Mechanical removal of pine/juniper, through bush management, followed by long-term prescribed grazing may also allow the understory to develop and transition to the Reference State

(1.0). Trees located on the steeper escarpments and deeper canyons may escape most fires and provide a seed source for ponderosa pine expansion in the future.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid- Warm-Season Grasses**			404–706	
	little bluestem	SCSC	*Schizachyrium scoparium*	303–605	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	40–202	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	20–161	–
2	**Tall Warm-Season Grasses**			101–303	
	big bluestem	ANGE	*Andropogon gerardii*	101–202	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	20–101	–
3	**Cool-Season Bunchgrass**			101–404	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	40–303	–
	green needlegrass	NAVI4	*Nassella viridula*	40–202	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–101	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–101	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–101	–
4	**Rhizomatous Wheatgrass**			101–303	
	western wheatgrass	PASM	*Pascopyrum smithii*	101–303	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–101	–
5	**Short Warm Season Grasses**			40–202	
	blue grama	BOGR2	*Bouteloua gracilis*	40–202	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–101	–

6	**Other Native Grasses**			20–101	
	Grass, perennial	2GP	*Grass, perennial*	0–81	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	20–61	–
	squirreltail	ELEL5	*Elymus elymoides*	0–40	–
7	**Grass-Likes**			20–101	
	threadleaf sedge	CAFI	*Carex filifolia*	20–101	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–61	–
8	**Non-Native Cool-Season Grasses**			–	
Forb					
9	**Forbs**			101–202	
	Forb, native	2FN	*Forb, native*	20–81	–
	spiny phlox	PHHO	*Phlox hoodii*	20–40	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–40	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	20–40	–
	pussytoes	ANTEN	*Antennaria*	20–40	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	20–40	–
	scurfpea	PSORA2	*Psoralidium*	20–40	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–40	–
	dotted blazing star	LIPU	*Liatris punctata*	20–40	–
	false boneset	BREU	*Brickellia eupatorioides*	20–40	–
	goldenrod	SOLID	*Solidago*	20–40	–
	milkvetch	ASTRA	*Astragalus*	20–40	–
	prairie clover	DALEA	*Dalea*	20–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	20–40	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	20–40	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	20–40	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–20	–
	old man's whiskers	GETR	*Geum triflorum*	0–20	–
	beardtongue	PENST	*Penstemon*	0–20	–
	field sagewort	ARCA12	*Artemisia campestris*	0–20	–

	sego lily	CANU3	*Calochortus nuttallii*	0–20	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–20	–
Shrub/Vine					
10	**Shrubs**			101–202	
	silver sagebrush	ARCA13	*Artemisia cana*	0–101	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–81	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–61	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–40	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	20–40	–
	leadplant	AMCA6	*Amorpha canescens*	20–40	–
	rose	ROSA5	*Rosa*	20–40	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–40	–
	soapweed yucca	YUGL	*Yucca glauca*	0–20	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–20	–
Tree					
11	**Trees**			40–202	
	ponderosa pine	PIPO	*Pinus ponderosa*	20–202	–
	Tree, deciduous	2TD	*Tree, deciduous*	0–161	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–101	–
	Tree	2TREE	*Tree*	0–61	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid- Warm-Season Grasses**			78–314	
	little bluestem	SCSC	*Schizachyrium scoparium*	78–235	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–126	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	0–63	–
2	**Tall Warm-Season Grasses**			0–78	
	big bluestem	ANGE	*Andropogon gerardii*	0–78	–

	prairie sandreed	CALO	*Calamovilfa longifolia*	0–78	–
3	**Cool-Season Bunchgrass**			16–157	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	16–110	–
	green needlegrass	NAVI4	*Nassella viridula*	0–78	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–47	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–31	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–16	–
4	**Rhizomatous Wheatgrass**			157–314	
	western wheatgrass	PASM	*Pascopyrum smithii*	157–314	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–47	–
5	**Short Warm Season Grasses**			78–235	
	blue grama	BOGR2	*Bouteloua gracilis*	78–235	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–126	–
6	**Other Native Grasses**			16–78	
	Grass, perennial	2GP	*Grass, perennial*	0–63	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–47	–
	squirreltail	ELEL5	*Elymus elymoides*	0–31	–
7	**Grass-Likes**			31–157	
	threadleaf sedge	CAFI	*Carex filifolia*	31–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–47	–
8	**Non-Native Cool-Season Grasses**			0–78	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–78	–
	cheatgrass	BRTE	*Bromus tectorum*	0–78	–
	smooth brome	BRIN2	*Bromus inermis*	0–78	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–78	–
	field brome	BRAR5	*Bromus arvensis*	0–31	–
Forb					
9	**Forbs**			78–157	
	Forb, native	2FN	*Forb, native*	16–78	–
	Forb, introduced	2FI	*Forb, introduced*	0–78	–

	scurfpea	PSORA2	*Psoralidium*	16–47	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	16–47	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	16–47	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–31	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	16–31	–
	dotted blazing star	LIPU	*Liatris punctata*	0–31	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	16–31	–
	goldenrod	SOLID	*Solidago*	16–31	–
	field sagewort	ARCA12	*Artemisia campestris*	0–31	–
	milkvetch	ASTRA	*Astragalus*	16–31	–
	spiny phlox	PHHO	*Phlox hoodii*	16–31	–
	pussytoes	ANTEN	*Antennaria*	16–31	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–16	–
	prairie clover	DALEA	*Dalea*	0–16	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–16	–
	false boneset	BREU	*Brickellia eupatorioides*	0–16	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	0–16	–
Shrub/Vine					
10	**Shrubs**			78–157	
	silver sagebrush	ARCA13	*Artemisia cana*	0–78	–
	prairie sagewort	ARFR4	*Artemisia frigida*	16–63	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–63	–
	soapweed yucca	YUGL	*Yucca glauca*	0–47	–
	rose	ROSA5	*Rosa*	16–47	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–47	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–47	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–31	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–31	–
	leadplant	AMCA6	*Amorpha canescens*	0–31	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–16	–

Tree					
11	**Trees**			31–157	
	ponderosa pine	PIPO	*Pinus ponderosa*	31–157	–
	Tree, deciduous	2TD	*Tree, deciduous*	0–126	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–78	–
	Tree	2TREE	*Tree*	0–47	–

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid- Warm-Season Grasses**			0–90	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–67	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–56	–
2	**Tall Warm-Season Grasses**			0–11	
	big bluestem	ANGE	*Andropogon gerardii*	0–11	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–11	–
3	**Cool-Season Bunchgrass**			0–56	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–22	–
4	**Rhizomatous Wheatgrass**			0–56	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–56	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–11	–
5	**Short Warm-Season Grasses**			224–448	
	blue grama	BOGR2	*Bouteloua gracilis*	224–392	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–112	–
6	**Other Native Grasses**			11–56	
	Grass, perennial	2GP	*Grass, perennial*	0–45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	11–34	–
	squirreltail	ELEL5	*Elymus elymoides*	0–22	–
7	**Grass-Likes**			112–280	

	threadleaf sedge	CAFI	*Carex filifolia*	112–280	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–34	–
8	**Non-Native Cool-Season Grasses**			11–112	
	cheatgrass	BRTE	*Bromus tectorum*	11–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–56	–
	smooth brome	BRIN2	*Bromus inermis*	0–56	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–56	–
	field brome	BRAR5	*Bromus arvensis*	0–22	–
Forb					
9	**Forbs**			22–78	
	Forb, native	2FN	*Forb, native*	11–45	–
	Forb, introduced	2FI	*Forb, introduced*	0–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	11–34	–
	goldenrod	SOLID	*Solidago*	11–22	–
	field sagewort	ARCA12	*Artemisia campestris*	0–22	–
	milkvetch	ASTRA	*Astragalus*	11–22	–
	pussytoes	ANTEN	*Antennaria*	11–22	–
	scurfpea	PSORA2	*Psoralidium*	11–22	–
	spiny phlox	PHHO	*Phlox hoodii*	11–22	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	11–22	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–22	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	11–22	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–11	–
Shrub/Vine					
10	**Shrubs**			56–112	
	prairie sagewort	ARFR4	*Artemisia frigida*	11–67	–
	silver sagebrush	ARCA13	*Artemisia cana*	11–56	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	11–45	–
	soapweed yucca	YUGL	*Yucca glauca*	0–45	–
	creeping juniper	JUHO2	*Juniperus horizontalis*	0–45	–

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–34	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–22	–
	rose	ROSA5	*Rosa*	11–22	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–22	–
Tree					
11	**Trees**			22–112	
	ponderosa pine	PIPO	*Pinus ponderosa*	11–112	–
	Tree, deciduous	2TD	*Tree, deciduous*	0–90	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–56	–
	Tree	2TREE	*Tree*	0–34	–

Animal community

Wildlife Interpretations
MLRA 58D lies within the drier portion of the northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass- and shrubland 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 small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the gray wolf, mountain lion, and grizzly bear, and smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. The bison was a historical keystone species, but had been extirpated in this area as a free-ranging herbivore. The loss of the bison and reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 58D, the Stony Hills ecological site provides upland grassland cover with an associated forb component. It was typically part of an expansive grassland landscape that

included combinations of Loamy, Shallow Loamy, Shallow Clayey, Thin Loamy, Claypan, Sands,
Sandy, Sandy Claypan, Clayey, and Thin Claypan ecological sites.

This site provided habitat for species requiring unfragmented grassland. Important habitat features, and components found commonly or exclusively on this site may include sharp-tailed grouse leks; upland nesting habitat for grassland birds, forbs and insects for brood habitat; and a forage source for small and large herbivores. Many grassland and shrub steppe nesting bird populations are declining. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of the Stony Hills ecological site remains intact and provides increasingly important habitat for conifer dwelling species, grassland and shrub steppe nesting birds, small rodents, coyotes, and a variety of reptiles, amphibians, and insects. Changes in historic fire regime and domestic grazing have impacted the forb/shrub/tree/grass percentages.

Bluestem-Needlegrass/Shrubs (1.1) and Western Wheatgrass-Little Bluestem-Grama/Shrubs (1.2): The predominance of grasses plus high diversity of forbs and high abundance of shrubs and increased presence of evergreen tree species in this community favors grazers and mixed-feeders, such as deer and pronghorn. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds. Grassland nesting birds and sharptailed grouse may be present. Woodland dwelling birds such as red-headed woodpecker, sapsuckers, phoebes, western wood-pewee, vireos, nuthatches, thrushes, and grosbeaks may be present in lesser numbers. Diverse prey populations are available for raptors such as ferruginous hawk, Swainson’s hawk, golden eagle, and prairie falcon.

The diversity of grasses, forbs, and shrubs provide high nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrel, white-tailed jackrabbit, and deer. The higher stature of this plant community provides thermal, protective, and escape cover for herbivores and grassland birds. Mammals such as bobcats, porcupines, mountain lions, and various bat species may be present and benefit from the structure and composition this plant community provides. Other predators utilizing this plant community include coyote, American badger, red fox, and long-tailed weasel. This plant community provides habitat for herptiles such as the spade foot toad, bull snake, and western rattlesnake.

The plant community shifts to a western wheatgrass, little bluestem, and grama community under continuous seasonal grazing and a low fire frequency. However, there is no substantial shift in the wildlife community.

Blue Grama/Sedge/Shrubs Plant Community (2.1): This plant community results from

heavy, continuous grazing later in the growing season and a low fire frequency. Grama species (e.g., blue and hairy) and various sedge species will dominate. Forb and shrub species diversity and abundance are substantially reduced. Species such as horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit may be present. The shorter stature of this plant community limits suitable thermal, protective, and escape cover. Other predators utilizing this plant community include the coyote, American badger, red fox, and long-tailed weasel.

Extreme impairment of the ecological processes impacts offsite aquatic habitats through excessive runoff, nutrient, and sediment loads. Elevated surface temperatures resulting from reduced cover and litter will greatly reduce habitat for most amphibian species, grassland birds, and mammals.

Ponderosa Pine/Shrubs/Herbaceous Understory (3.1): Resulting from no fire for multiple years, the plant community is dominated by ponderosa pine with lesser amounts of Rocky Mountain juniper species. The buildup of pine and juniper needles and closing of the forest canopy, can impact the understory vegetation. Grassland nesting birds and their associated predators are substantially reduced. Woodland dwelling birds such as red-headed woodpecker, sapsuckers, phoebes, western wood-pewee, vireos, nuthatches, thrushes, and grosbeaks may be present in lesser numbers. Mammals such as bobcats, porcupines, mountain lions, and various bat species may be common and benefit from the structure and composition this plant community provides. Other predators utilizing this plant community include coyote, red fox, and long-tailed weasel.

Grazing Interpretations
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate estimates of carrying capacity should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

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

Plant Community: Bluestem-Needlegrass/Shrubs (1.1)
Average Production (lb/acre, air-dry): 1,800

Stocking Rate (AUM/acre): 0.49

Plant Community: Western Wheatgrass-Little Bluestem-Grama/Shrubs (1.2)
Average Production (lb/acre, air-dry): 1,400
Stocking Rate (AUM/acre): 0.38

Plant Community: Blue Grama/Sedge/Shrubs (2.1)
Average Production (lb/acre, air-dry): 1,000
Stocking Rate (AUM/acre): 0.27

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values should be reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage 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 (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

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

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups B. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. 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 upland game species. The wide variety of plants that bloom from spring until fall have aesthetic value that appeals to visitors.

Wood products

Ponderosa pine typically does not occupy this site in amounts extensive enough to make timber harvest practical. It does provide aesthetic values and wildlife habitat.

Other products

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

Other information

Revision Notes: “Previously Approved” Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure it meets the 2014 NESH standards for a “Provisional” ecological site description.

This ecological site description (ESD) is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The requirements for approved status changed with the release of the 2014 National Ecological Site Handbook (NESH). The previously approved document fully described the reference state and community phase in the state-and-transition model. All other alternative states were at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected this ESD will continue refinement toward the current “Approved” status.

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 description include: Ryan Beer, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Kent Cooley, Soil Scientist (SS), NRCS; Mitch Faulkner, RMS, NRCS; Cheryl Nielsen, RMS, NRCS; Rick Peterson, RMS, NRCS; Jeff Printz, RMS, NRCS; and Mike Stirling, RMS, NRCS.

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This ecological site description was updated by Rick L. Peterson on January 23, 2020.

The ESDs were available for QC review by Mark Hayek, Emily Helms, Ryan Beer, and Mitch Faulkner.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 2020.

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Rangeland health reference sheet

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

Author(s)/participant(s)	Stan Boltz
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Date	05/07/2010
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Slight to none, typically on steeper slopes and discontinuous.

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2. **Presence of water flow patterns:** None, or barely visible and discontinuous with numerous debris dams when present.

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

typically on steeper slopes.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5 to 20 percent is typical.

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5. **Number of gullies and erosion associated with gullies:** None should be present.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Small size litter classes will generally move short distances, some medium size class litter will move very short distances. Litter debris dams are occasionally present.

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

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 2 to 5 inches thick with light to dark brownish gray colors. Structure should typically be fine granular at least in the upper A-horizon.

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

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

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: Mid warm-season grasses >>

    Sub-dominant: Tall warm-season grasses = Mid/tall cool-season bunchgrasses >

    Other: Wheatgrass = Short warm-season grasses = Forbs = Shrubs > Grass-likes

    Additional:

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

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):** Production ranges from 1,300-2,400 lbs./acre (air-dry weight). Reference value production is 1,800 lbs./acre (air-dry weight).

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds

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

vigorous rhizomes or tillers.