USDA Natural Resources Conservation Service

Ecological site R062XA024SD
Shallow Loamy - North

Accessed: 05/18/2024

General information

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

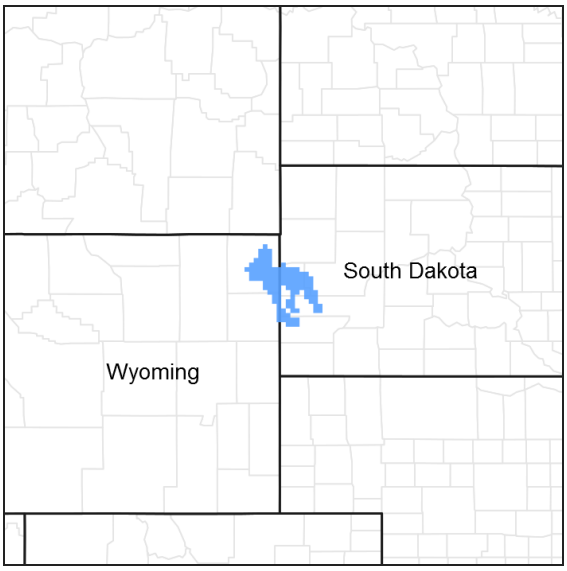

Figure 1. Mapped extent

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

MLRA notes

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

The Black Hills, MLRA 62, is a unique, low lying mountain range situated in the midst of a mixed short to mid-grass prairie. It has geophysical and Biological attributes that are unlike the surrounding area. The Black Hills Foothills, MLRA 61, is a transition zone that essentially rings the Black Hills. MLRA 62 is approximately 3,040 square miles in size, 74 percent of which is located in South Dakota and 26 percent in Wyoming.

Classification relationships

Land Resource Region (LRR): G - Western Great Plains Range and Irrigated Region, MLRA: 62 - Black Hills, LRU: A (North) - 22-30 PZ, Central Crystalline, Low Limestone and Siltstone Plateau and Bear Lodge Mountains. The elevation range in LRU-A is 3,800 to 6,200 feet above sea level.
Level IV Ecoregions of Conterminous United States, 2013: 17b Black Hills Plateau.

Ecological site concept

This site is located on upland landscapes in the northern portion of the Black Hills Land Resource Unit (LRU)-A. Soils on this site are shallow, between 10 and 20 inches in depth, with a loamy surface layer ranging from 2 to 6 inches in depth. Most soils on this site are calcareous to the surface. The soils are well to excessively drained, with

a restrictive bedrock layer of sandstone or limestone, which impedes water movement and rooting depth. The slopes can range from 2 to 60 percent. The site does not receive additional water from runoff or overflow. Vegetation in the Reference State is dominated by tall- and mid-height warm-season grasses, with cool-season grasses subdominant. The dominant grasses include little bluestem, big bluestem, and sideoats grama. Western wheatgrass and needlegrasses also comprise a significant amount of the plant community. Forbs are common and diverse, but never dominant. Shrubs such as western snowberry, skunkbush sumac, and prairie rose are often present in the plant community. Ponderosa pine can be scattered throughout the site, but will not exceed 2 percent canopy cover. This site is very susceptible to pine encroachment.

Associated sites

R062XA010SD	**Loamy - North** The Loamy ecological site can be adjacent to shallow loamy, and often is at lower positions on the landscape.
R062XY012SD	**Thin Upland** The Thin Upland site typically is located on steeper slopes adjacent to the Shallow Loamy site. The soils are moderate to deep, with a high percentage of carbonates to the surface.
R062XY029SD	**Stony Hills** Stony Hills ecological site can be adjacent to Shallow Loamy and often higher is on the landscape.

Similar sites

R062XY012SD	**Thin Upland** The Thin Upland site has more little bluestem and sideoats grama, and less big bluestem.
R062XY029SD	**Stony Hills** The Stony Hills site has more big bluestem and more lead plant, and a higher potential for ponderosa pine and higher production.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on gently sloping to very steep summits, shoulders, and backslopes in the Black Hills.
This site occurs on all aspects, but may be more common on east- and south-facing slopes (approximately 50 to 225 degrees of aspect).

Table 2. Representative physiographic features

Landforms	(1) Ridge (2) Mountain slope (3) Structural bench
Flooding frequency	None
Elevation	1,158–1,890 m
Slope	2–60%
Ponding depth	0 cm
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 62 is in a microclimate caused by the influence of increased elevation, which leads to increased precipitation, moderate air temperature, and lower wind velocities as compared to the surrounding Great Plains. In general, the Black Hills climate is a continental type, cold in the winter and hot in the summer. Annual precipitation in MLRA 62 typically increases with elevation, and decreases from west to east and north to south. The average annual precipitation range for LRU-A (North) is 22 to 30 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. The annual average snowfall ranges from 23 inches at the lower elevations in the south to 54 inches at the higher elevations in the central part of MLRA 62. Average annual temperature ranges from 36 to 48 degrees F. January is the coldest month, with an average temperature of 22°F in the central part and 25°F in the southern part of MLRA 62. July is the warmest month, with an average daily temperature of 67°F in the central part and 73°F in the southern part of this MLRA. The frost free-period ranges from 129 to 168 days: it is shortest at higher elevations and in the northwestern part of the MLRA. Hourly winds are estimated to average about 11 miles per hour (mph) annually. Growth of cool-season plants begins in April, slowing or ceasing growth by mid-August. Warm-season plants begin growth in May, and continue to mid-September. Regrowth of cool-season plants may occur in September and October, depending upon soil moisture availability.

Table 3. Representative climatic features

Frost-free period (average)	107 days
Freeze-free period (average)	130 days
Precipitation total (average)	635 mm

Climate stations used

- (1) MT RUSHMORE NATL MEM [USC00395870], Keystone, SD
- (2) PACTOLA DAM [USC00396427], Rapid City, SD
- (3) LEAD [USC00394834], Lead, SD

Influencing water features

The Shallow Loamy (North) site is not influenced by additional moisture from streams or wetlands.

Soil features

The soils on this site are shallow and well to somewhat excessively drained. The surface layer ranges from 2 to 6 inches thick. Encroachment of ponderosa pine is common in many areas, thereby causing the mineral soil surface to be covered with 1 to 2 inches of pine needles and duff. Surface textures are variable and are listed below. Most soils on this site are calcareous to the surface. There are a few places where the soil parent material is derived from noncalcareous sources (primarily sandstone or schist), and the soils are noncalcareous. The slopes range from 2 to 80 percent.

This site typically shows slight to no evidence of rills, wind-scoured areas, or pedestalled plants. If present, water flow paths could include long, continuous, shallow gullies, or they could be broken, irregular in appearance, or discontinuous. The soil surface is stable and intact. There is a restrictive layer of bedrock (typically sandstone or limestone) at about 10 to 20 inches in depth, which impedes water movement and root penetration. These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 10 percent, and is more common on soils with few rock fragments. 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.

The commonly-occurring soils for this site include Corpening, Pactola, shallow, and Rockerville. Pactola, shallow is a taxadjunct to the Pactola series. Corpening and Pactola, shallow occur in the North and South LRUs. Rockerville occurs throughout the MLRA.

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

Table 4. Representative soil features

Parent material	(1) Residuum–limestone and sandstone
Surface texture	(1) Channery loam (2) Channery silt loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	25–51 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–7%
Available water capacity (0-101.6cm)	2.54–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–75%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

The vegetation of the shallow loamy ecological site is part of the Black Hills ecosystem consisting of a mixture of forests and grasslands resulting from the interaction of a varied topography, geology, climate and natural disturbance. Frequent fires, periodic droughts, and episodic mountain pine beetle infestations are also thought to have contributed to maintain this park-like forest structure of large prairie areas scattered throughout the Black Hills. Ponderosa pine is a fire adapted species as it has evolved to coexist and flourish with fire; particularly frequent, low-intensity fires that consume mostly small seedlings, prune lower branches from large trees, and reduce woody fuels debris on the forest floor. The result is a mosaic of conditions ranging from open grassland areas to groups of young seedlings to clumps and groups of large older trees. When large crown fires did occur, they probably did not completely consume all trees within the landscape, but left large healthy trees as sources of seeds to eventually recolonize the burnt areas (Shepperd and Battaglia, 2002). Between 1388 and 1900, fire intervals in the Black Hills ranged from 16 to 20 years (Brown and Hull-Sieg, 1996).

With the advent of fire suppression over the past 120 years, forests density has increased and grassland areas decreased across the whole landscape. Historical records indicated the presence of large areas covered by tall grasses on the outer edges and slopes of the limestone plateau but did not mention ponderosa pine encroachment. McIntosh (1949) conducted botanical field work in the Black hills during the summers of 1924 to 1930 and noted that pines were invading the grassland. Gardner and Thompson (1972) also mentioned that pine encroachment was most evident on areas dominated by warm season grasses. Today, ponderosa pine encroachment is still quite evident on the shallow loamy ecological site where trees seem to germinate and survive well on the rocky and gravelly soils in the absence of fire.

This site developed under Black Hills climatic conditions with short-term weather variations, light to severe grazing by bison, elk and small mammals, sporadic natural or man-caused wildfire (often of light intensities), and other biotic and abiotic factors that typically influence soil/site development.

The historic native vegetation on this site consisted of mixed prairie grasses occurring on ridges and uplands. The vegetation was predominately warm season grasses mixed with some cool-season grasses portraying a mixed

grass prairie characteristic. Little bluestem is the dominant species. Big bluestem and sideoats grama are in association with little bluestem. Subdominant cool season grasses include needlegrasses and rhizomatous wheatgrasses. In the understory, are blue grama, hairy grama, and threadleaf sedge. Kentucky bluegrass is present but typically does not dominate the plant community. Forbs make up a significant proportion in the mixture. Common forbs include cudweed sagewort, scurfpeas, coneflowers, gayfeather, asters along with hood phlox and pussytoes in the understory. Shrubs include fringed sagewort, broom snakeweed, green sagewort, prairie rose, and a few yucca plants scattered on the landscape. A few ponderosa pine and juniper are often scattered across the site. Rocks, and rock fragments are very noticeable and bare ground can be present but not common.
The following diagram illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes will be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

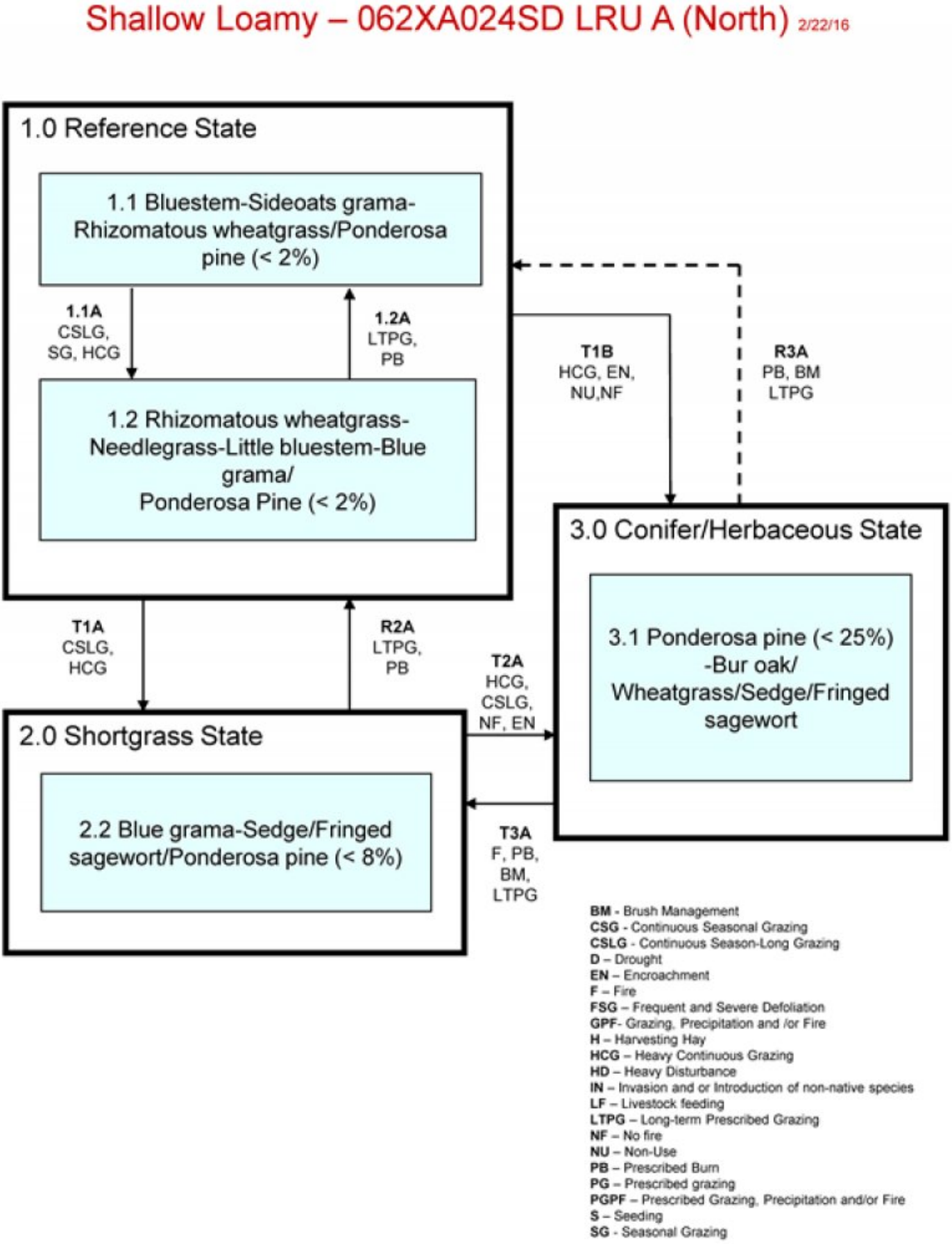

Figure 6. Shallow Loamy - 062XA024SD - LRU-A

Diagram Legend - Shallow Loamy North - 062XA024SD

T1A	Continuous season long grazing or heavy continuous grazing
T1B	Heavy continuous grazing, conifer encroachment, no use or no fire
T2A	Heavy continuous grazing, continuous season long grazing, conifer encroachment, or no fire
T3A	Fire, prescribed burn, mechanical brush management, followed by long term prescribed grazing

R2A	Long term prescribed grazing, prescribed burning
R3A	Prescribed burning, mechanical brush management, followed by long term prescribed grazing

CP 1.1A	1.1 - 1.2	Continuous season long grazing, seasonal grazing occurring at the same time every year or heavy continuous grazing will decrease the tall and mid stature warm season grass species and increase the mid-stature cool season grasses.
CP 1.2A	1.2 - 1.1	Long-term prescribed grazing that provided adequate recovery and change in season of use, along with normal precipitation regime and fire can restore the tall warm season components.

Figure 7. Shallow Loamy - 062XA024SD - LRU-A

State 1
Reference State

This state represents the natural range of variability that dominates the dynamics in this ecological site. This site is dominated by warm-season grasses, with cool-season grasses being subdominant. In pre-European times the primary disturbances included fire and grazing by large ungulates and small mammals. Favorable growing conditions during the spring as well as the warm months of June and July along with routine or occasional fires, reduces tree cover and contributes to the ecological processes that maintain the reference plant community. Today a similar state can be found in areas where proper livestock use has occurred and where the encroachment of trees, especially ponderosa pine, has been limited.

Community 1.1
Bluestem-Sideoats grama-Rhizomatous wheatgrass/Ponderosa pine (< 2%)

Figure 8. SwLy North - PCP 1.1 (Spring)

Figure 9. SwLy North - PCP 1.1 (Summer)

Interpretations are based primarily on the Bluestem-Sideoats grama-Rhizomatous wheatgrass plant community phase. This is also considered to be the reference or historic community. The potential vegetation is about 80 percent grass, 10 percent forbs, and 10 percent trees and shrubs. Average annual production for this plant community phase on a median year is 1,700 lbs/Ac. The community is dominated by tall and mid-height warm-season grasses with cool-season grasses being subdominant. The dominant grasses include little bluestem, big bluestem, and sideoats grama. Western wheatgrass and needlegrasses also comprise a significant amount of the plant community. Ponderosa pine can be scattered throughout the site but will not exceed 2 percent canopy cover. Other grasses include prairie dropseed, tall dropseed, blue grama, sedge and slender wheatgrass. This plant community is productive and resilient to disturbances such as drought and fire. This is a sustainable plant community in regards to soil/site stability, watershed function, and biological integrity.

Community 1.2
Rhizomatous wheatgrass-Needlegrass-Little bluestem-Blue grama/Ponderosa pine (< 2%)

This plant community is a result of heavy continuous grazing, seasonal grazing with no change in season of use between grazing years, or continuous season-long grazing by livestock. The potential plant community is made up of approximately 70 percent grasses, 15 percent forbs, and 15 percent shrubs and trees. Dominant grasses include western wheatgrass, beardless wheatgrass, needleandthread, green or Columbia needlegrass and little bluestem. Short warm-season grasses such as blue grama and hairy grama present in the understory. Sideoats grama, tall dropseed, and prairie dropseed may also be present. Invasive, non-native grasses such as Kentucky bluegrass, may contribute to biomass production but do not dominate this ecological site. Forbs contribute substantially to the biomass production in this plant community. Big bluestem has decreased dramatically and may be nearly absent from the site. Ponderosa pine can be scattered throughout the site but will not exceed 2 percent canopy cover. The herbaceous species within this plant community are well-adapted to grazing.

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing or heavy continuous grazing with stocking rates above the carrying capacity for the entire growing season or seasonal grazing during the middle of the growing season every year will cause a decrease in big bluestem, little bluestem and sideoats grama. Rhizomatous wheatgrass and needlegrass will increase initially but will decrease in the plant community if grazing management is not changed.

Pathway 1.2A
Community 1.2 to 1.1

Long-term prescribed grazing that provides adequate recovery and change in season of use, along with normal precipitation regime and periodic fire can restore the tall warm-season component of this plant community.

State 2
Shortgrass State

This state is dominated by short-grass species and sedges and is the result of continuous season-long grazing or heavy continuous grazing. Desirable species have been over utilized and removed or greatly reduced in the plant community. The site is has increased runoff and depending on percent bare ground the site can be susceptible to erosion. This state can be very resistant to change.

Community 2.1
Blue grama-Sedge/Fringed sagewort/Ponderosa pine (< 8%)

This plant community develops under continuous, season-long grazing or heavy continuous grazing. The transition may be accelerated by over-utilization during extended drought periods. This plant community is composed of approximately 65 percent grasses, 15 percent forbs, and 20 percent shrubs and conifers. Dominant grasses and grass-like plants include, blue grama, hairy grama, thread-leaf sedge, plains muhly, sideoats grama, and prairie junegrass. Other grasses include rhizomatous wheatgrass, needlegrass's, little bluestem and sand dropseed. Cheatgrass, field brome, smooth brome, and Kentucky bluegrass may also invade the site. Forbs commonly found in this plant community include prairie coneflower, dotted gay feather, and common mares-tail. Shrubs commonly found on this site include fringed sagewort, broom snakeweed, soapweed yucca, and prairie rose. When compared to the Reference State, short statured grasses have increased significantly and become more dominant on the site. Shrubs become more common on the site as herbaceous species become reduced in vigor and cover. It is also common for Ponderosa pine to increase in this plant community.

State 3
Conifer/Herbaceous State

This state is dominated by conifer and is a result of heavy continuous grazing and lack of frequent fire or no use and no fire resulting in encroachment of conifers. Areas of intermediate and dense ponderosa pine canopy was found to reduce precipitation reaching the forest floor by an average of 30 percent (Wrage, 1994). Native warm-season grasses such as bluestems, sideoats grama, blue grama and cool-season grasses such as wheatgrasses and needlegrasses declined as overstory canopy cover increases. Shade tolerant grasses, such as poverty oatgrass, bluegrasses, and rough-leaved ricegrass increase. Forbs such as cudweed, sagewort and shrubs such as wood rose increased under intermediate canopy closure (< 25 percent). In the absence of fire, this plant community phase will be resistant to change. Ponderosa pine canopy can continue to increase over time, reducing herbaceous production and increasing bare ground. This state will have lower water infiltration rates, increased runoff, and potential for soil erosion. The resulting plant community is less productive for grazing animals than the other states.

Community 3.1
Ponderosa pine/Bluegrass-Sedge-Wheatgrass/Fringed sagewort Plant Community

Figure 10. SwLy North - PCP 3.1 Ponderosa Pine

This plant community is characterized by the dominance of conifers as a result of heavy continuous season-long grazing, and no fire, or no use and no fire. Ponderosa pine make up approximately 30 percent of the plant community, and shrubs approximately 15 percent. Grasses and forbs make up approximately 55 percent of the plant community. Dominant grass and grass-like plants include Kentucky bluegrass, slender wheatgrass, needleandthread, rough-leaved rice grass, and upland sedge. Dominant forbs include cudweed sagewort,

coneflower, and dotted gayfeather. Prevalent shrubs include fringed sagewort, wild rose, poison ivy, and skunkbush sumac. Most of these shrubs rarely exceed one foot in height. Ponderosa pine is the dominant tree species; and Rocky Mountain juniper is sometimes present as a subordinate tree, but does not dominate.

Transition 1A
State 1 to 2

Continuous season-long grazing or heavy continuous grazing will cause a transition from the Reference State to a plant community dominated by shortgrass species in the Shortgrass State. Ponderosa pine may increase on this site but typically not greater than 8 percent canopy cover.

Transition 1B
State 1 to 3

Heavy continuous season-long grazing with stocking rates well above the carrying capacity for the entire growing season combined with the absence of fire to control conifer seedling establishment, or no use, no fire and conifer encroachment will lead toward a conifer dominated state, State 3. More shade tolerant grasses will become dominant in this state.

Restoration pathway 2A
State 2 to 1

Long-term prescribed grazing which provides growing season grazing deferment along with stocking rates not exceeding carrying capacities and periodic fire or prescribed burning will restore this plant community to the Reference State. The Shortgrass State can be resistant to change and grazing deferments and favorable growing conditions will in time help reestablish the plant community however management goals may not be achieved.

Transition 2A
State 2 to 3

Continuous season-long grazing or heavy continuous grazing with stocking rates above the carrying capacity for the entire growing season combined with the absence of fire to control shrub and conifer seedlings' establishment, or no use, no fire and encroachment will lead toward a conifer dominated state, State 3.

Restoration pathway 3A
State 3 to 1

Fire or prescribed burning or mechanical brush management, plus long-term prescribed grazing may move the Conifer State back to the Reference State depending upon the plant community and climatic conditions. This could be a long-term process and the results may not be achieved or meet management goals. Seeding may be successful following wildfire; however, it is recommended to use native species that replicate the structural functional groups in PCP 1.2.

Transition 3A
State 3 to 2

Depending upon the existing herbaceous plant species in the understory, prescribed fire and/or mechanical brush management to remove conifers and long-term prescribed grazing may transition the Conifer State to the Shortgrass State. Grazing deferments and favorable growing conditions will in time help to reestablish the plant community; however, management goals may not be achieved.

Additional community tables

Other information

Revision Notes:
"This PROVISIONAL ecological site concept has been QCd and QAd to ensure that the site meets the NESH

standards for a provisional ecological site that provides basic compiled information in one location. This site should not be considered an Approved ESD, as it is only the foundational site concepts and requires further data collection —specifically high-intensity data characterizations and full 232 soil descriptions—and further site investigations and final STM reviews before it can be used as an Approved ESD meeting NESH standards”

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

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel also were used. Those involved in developing this site include Lakhdar Benkobi, ESI/SRIC, NRCS; Stan Boltz, Range Management Specialist, NRCS; Dan Brady, Soil Scientist, NRCS; Mitch Faulkner, Range Management Specialist, NRCS; Roger Gates, Associate Professor/Rangeland Management Specialist, West River Ag Center; Rick Peterson, Ecological Site Specialist, NRCS; Matthew, Scott, Botanist - USFS Hell Canyon District Ranger; L. Michael Stirling, Range Management Specialist, NRCS; and Jim Westerman, Soil Scientist, NRCS.

Other references

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Contributors

Peterson Rick L
Westerman James

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	
Approved by	
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):**

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

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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):**

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

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17. **Perennial plant reproductive capability:**
