USDA Natural Resources Conservation Service

# Ecological site R062XB024SD
# Shallow Loamy - High Central

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.

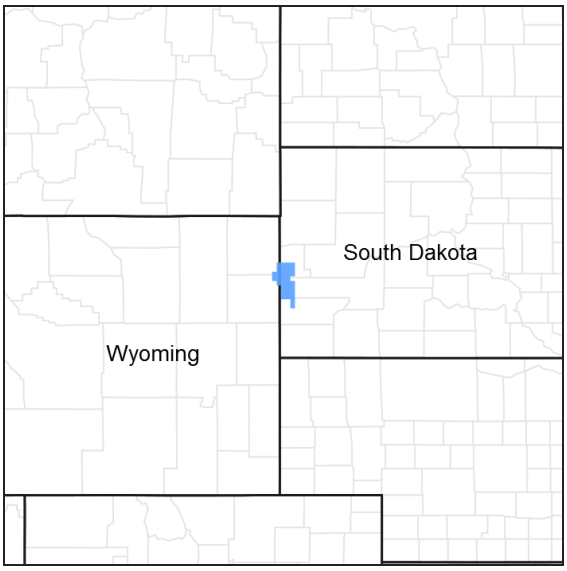



**Figure 1. Mapped extent**

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, (USDA, NRCS. Ag Handbook 296), LRU: B (Central High Country) - 25-35 PZ, Physiographic Area - High Limestone Plateau. The elevation range in LRU-B is 6,200 to 7,000 feet above sea level.
Level IV Ecoregions of Conterminous United States, 2013: 17b Black Hills Plateau.

## Ecological site concept

This site was previously referred to as a High Country Shallow range site. The site is located on upland landscapes within the central portion of the Black Hills, in Land Resource Unit (LRU)-B. The soils are shallow, 10 to 20 inches in depth, with a restrictive limestone bedrock layer which impedes water movement and rooting depth. The surface layer is loamy and ranges from 3 to 7 inches in depth. The soils typically are calcareous to the surface. The slopes

can range from 2 to 30 percent. The site does not receive additional water from runoff or overflow. Vegetation in the Reference State consists primarily of cool-season grass species, with warm-season species as a minor component. The dominant grasses include bearded wheatgrass, western wheatgrass,Columbia needlegrass, prairie Junegrass, and needleandthread or porcupinegrass. Plains muhly and prairie dropseed are the dominant warm-season grasses. Forbs are common and diverse but never dominant, and shrubs such as shrubby cinquefoil and common juniper are often present in the plant community. Ponderosa pine or Black Hills spruce can be present in Reference condition, but are sparsely scattered across the site and typically do not exceed 1 percent canopy cover. This site is very susceptible to pine encroachment.

## Associated sites

| | |
|---|---|
| R062XB010SD | **Loamy - High Central**<br>The Loamy 62B site has deep soils and located on shallower slopes above the Shallow Loamy site. |
| R062XY043SD | **Valley Loam**<br>The Valley Loam ecological site can be adjacent to shallow loamy site in a lower positions on the landscape. |

## Similar sites

| | |
|---|---|
| R062XB010SD | **Loamy - High Central**<br>The Loamy 62B site will have a similar plant community but with more production, fewer forbs and shrubs. The Loamy site appears to be more susceptible to conifer encroachment than the Shallow Loamy in this LRU. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Potentilla fruticosa*<br>(2) *Juniperus communis* |
| Herbaceous | (1) *Elymus trachycaulus subsp. subsecundus*<br>(2) *Stipa nelsonii* |

## Physiographic features

This site occurs on gently sloping to very steep summits, shoulders, and backslopes in the Black Hills.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Ridge<br>(2) Mountain slope<br>(3) Structural bench |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 1,890–2,134 m |
| Slope | 2–60% |
| 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 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-B (Central High Country) is 25 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. 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. The 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.
* Deerfield 3 SE (USC00392231) climate station is not located within LRU-B, but is adjacent to it in LRU-A. The mean annual precipitation recorded at this station is less than what LRU-B actually receives.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (average) | 99 days |
| Freeze-free period (average) | 112 days |
| Precipitation total (average) | 533 mm |

## Climate stations used

- (1) DEERFIELD 3 SE [USC00392231], Hill City, SD

## Influencing water features

This site does not receive additional water from runoff or overflow.

## Soil features

The soils on this site are shallow and well to somewhat excessively drained. The surface layer ranges from about 3 to 7 inches thick. Encroachment of ponderosa pine and/or Black Hills spruce is not common, but may occur in some areas. If present, the mineral soil surface could be covered with 1 to 2 inches of pine needles and duff. Most soils on this site are calcareous to the surface. The slopes range from 2 to 30 percent; slopes may exceed 30 percent in localized situations.

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 rills, or they could be broken, irregular in appearance, or discontinuous. The soil surface is stable and intact under normal conditions. There is a restrictive layer of bedrock (typically limestone, less commonly sandstone) at about 10 to 20 inches in depth. This material usually is fractured at intervals of about 6 to more than 20 inches apart. Although fractured, this bedrock impedes water movement and root penetration. These soils mainly are 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 is Rockerville, cool. It is a taxadjunct to the Rockerville series because it has cooler soil temperatures than are typical.

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


**Figure 6. General Soil Profile for SwLy-B**

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum–limestone and siltstone |
| Surface texture | (1) Gravelly silt loam<br>(2) Silt 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) | 1–20% |
| 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) | 7.4–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 25–60% |
| Subsurface fragment volume >3" (Depth not specified) | 0–30% |

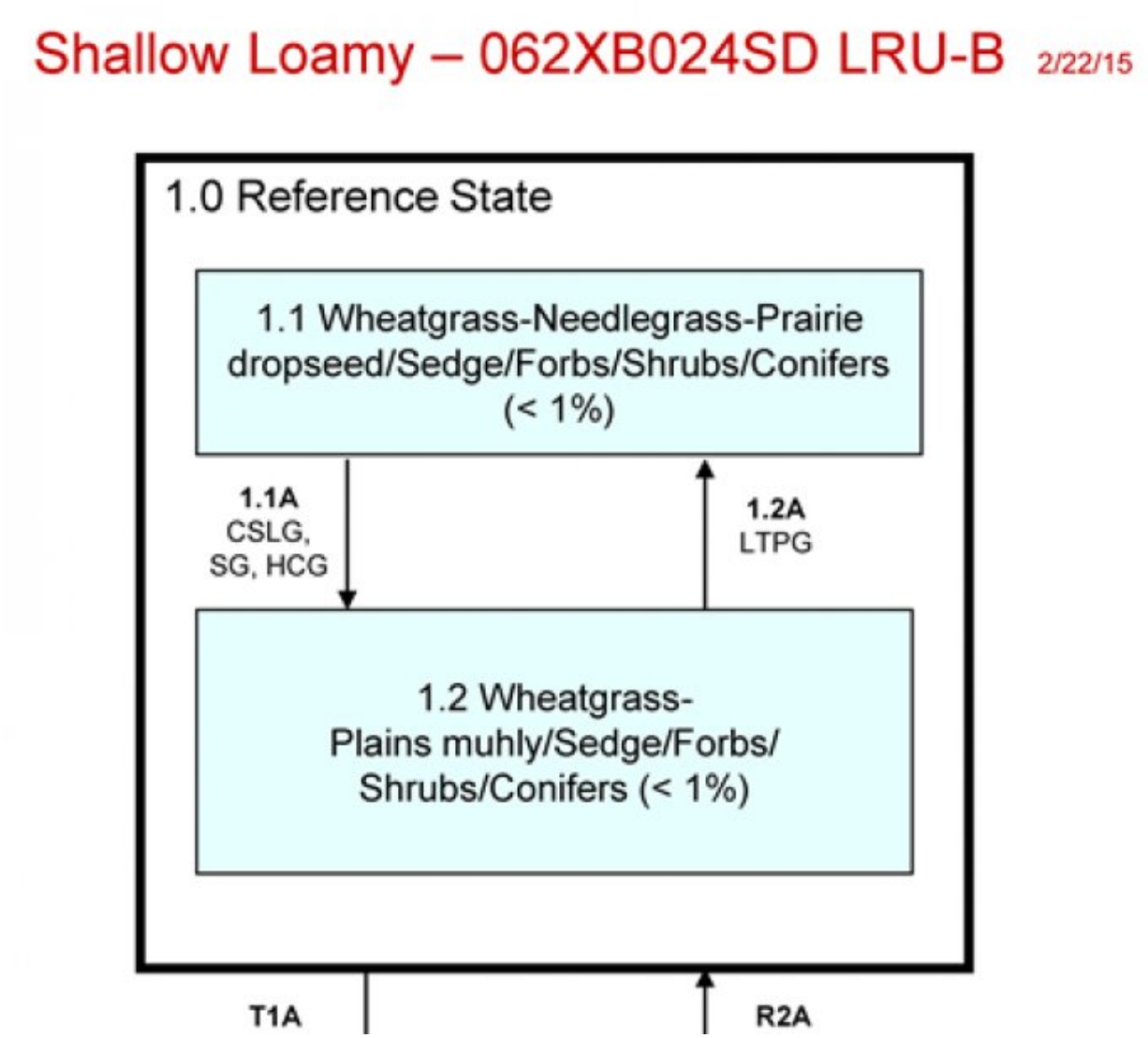
## Ecological dynamics

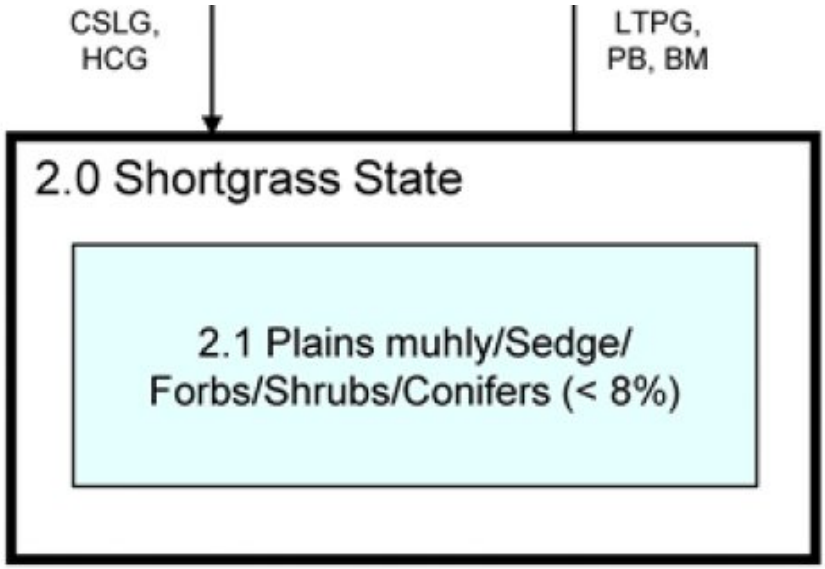
Black Hills vegetation types consist of a mixture of forest and grasslands resulting from the varied topography, geology, soils, climate and natural disturbances. Frequent fires, periodic drought, and episodic infestations of mountain pine beetles all contribute to the maintenance of large open grasslands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

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

as a grassland and the plant communities were free of non-native cool-season grasses.
Fire, or the lack of fire, grazing and potential conifer encroachment shaped this site and adjacent ecological sites. Between 1388 and 1900, fire intervals in the Black Hills ranged from 16 to 20 years (Brown and Hull-Sieg, 1996). In the absence of fire, ponderosa pine and/or Black Hills spruce can encroach on this site, but it appears to be uncommon in this LRU. The reason is not fully understood, but competition with cool-season grasses which dominate the site could be hindering the establishment of pine seedlings.
Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. Severe disturbances, such as periods of well-below average precipitation, severe defoliation, or no fire and no use can also cause significant shifts in plant communities and species composition. The historic native vegetation on this site consisted of mixed prairie grasses occurring on ridges and uplands. The vegetation predominately is cool-season grasses mixed with warm-season grasses, sedges, shrubs and a diverse forb community. Bearded wheatgrass, western wheatgrass, Columbia needlegrass, needleandthread, porcupinegrass, and prairie Junegrass are the dominant cool-season grasses. Plains muhly and prairie dropseed are the dominant warm-season grasses. Subdominant cool-season species include Richardson needlegrass and threadleaf sedge. Kentucky bluegrass and timothy can be present, but typically do not dominate the plant community. Forbs make up a significant proportion of the mixture. Common forbs include stemless hymenoxys, Indian paintbrush, dotted gayfeather, cudweed sagewort, stiff goldenrod, prairie coneflower, hairy goldaster, hood phlox, and pussytoes. Shrubs include shrubby cinquefoil, common juniper, fringed sagewort, and skunkbush sumac. Ponderosa pine or Black Hills spruce can be present, but are sparsely scattered across the site. Rocks and rock fragments are very noticeable, and bare ground can be present but is 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**






**BM** - Brush Management
**CSG** - Continuous Seasonal Grazing
**CSLG** - Continuous Season-Long Grazing
**EN** – Encroachment
**HCG** – Heavy Continuous Grazing
**IN** – Invasion and or Introduction of non-native species
**LTPG** – Long-term Prescribed Grazing
**NF** – No fire
**NU** – Non-Use
**PB** – Prescribed Burn
**PG** – Prescribed grazing
**PGPF** – Prescribed Grazing, Precipitation and/or Fire
**SG** - Seasonal Grazing

**Figure 7. Shallow Loamy - 062XB024SD - LRU-B**

**Diagram Legend - Shallow Loamy - 062XB024SD**

| | | |
|---|---|---|
| T1A | Continuous season long grazing or heavy continuous grazing | |
| R2A | Long term prescribed grazing, prescribed burning or mechnical brush management | |
| 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 mid stature cool season needlegrasses and wheatgrasses and increase the short-stature grasses and sedges. |
| 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 needlegrasses and wheatgrasses. |

**Figure 8. Shallow Loamy - 062XBSD - LRU-B**

## 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 cool-season grasses with warm-season grasses being subdominant. A diverse group of forbs make up a significant portion of the plant community and shrubs are common. 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, inhibits conifer encroachment 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.

### Community 1.1

### Wheatgrass-Needlegrass-Prairie dropseed/Sedge/Forbs/Conifer (< 1%) Plant Community

**Figure 9. SwLy - B - PCP 1.1**

Interpretations are based primarily on the Wheatgrass-Needlegrass-Prairie dropseed/Sedge/Forbs/Conifer (< 1%) plant community phase. This is also considered to be the reference or historic community. The potential vegetation is about 75 percent grass, 15 percent forbs, and 10 percent shrubs and trees. Average annual production for this plant community phase on a median year is 1,400 lbs/Ac. The community is dominated by mid-stature cool season grasses with warm season grasses being subdominant. The dominant grasses include bearded wheatgrass, western wheatgrass, Columbia needlegrass prairie junegrass and needleandthread/porcupinegrass. Plains muhly and prairie dropseed are the dominant warm season grasses. Subdominant cool season species include Richardson needlegrass, and threadleaf sedge. Forbs are common and diverse including; stemless hymenoxys, Indian paintbrush, dotted gayfeather, cudweed sagewort, stiff goldenrod, prairie coneflowers, hairy goldasters, hood phlox and pussytoes. Shrubs include, shrubby cinquefoil, common juniper, fringed sagewort, and green sagewort. Ponderosa pine or Black Hills spruce can be present but sparsely scattered across the site and typically will not exceed 1 percent canopy cover. 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
### Wheatgrass-Plains muhly/Sedge/Forb/Shrub/Conifer (<1%) Plant Community


**Figure 10. SwLy-B PCP 1.2**

This plant community is a result of continuous season-long grazing, heavy continuous grazing, or seasonal grazing without a change in season of use. 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, bearded wheatgrass, plains muhly, and sedges. Forbs contribute substantially to the biomass production in this plant community, and are common and diverse. Needlegrasses have decreased dramatically and may be nearly absent from the site. Shrubs species including shrubby cinquefoil and common juniper have increased. Ponderosa pine or Black Hills spruce can be scattered throughout the site but, will not exceed 1 percent canopy cover. The herbaceous species within this plant community are well-adapted to grazing.

### Pathway 1.1A
### Community 1.1 to 1.2

Wheatgrass-Needlegrass-Prairie dropseed/Sedge/Forbs/Conifer (< 1%) Plant Community

Wheatgrass-Plains muhly/Sedge/Forb/Shrub/Conifer (<1%) Plant Community

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 early portion of the growing season every year will cause a decrease in wheatgrasses and needlegrasses, and an increase of plains muhly and sedges.

### Pathway 1.2A
### Community 1.2 to 1.1

Wheatgrass-Plains muhly/Sedge/Forb/Shrub/Conifer (<1%) Plant Community

Wheatgrass-Needlegrass-Prairie dropseed/Sedge/Forbs/Conifer (< 1%) Plant Community

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 wheatgrass and needlegrass components 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 has increased runoff and, depending upon the percentage of bare ground, the site can be susceptible to erosion. This state can be very resistant to change.

### Community 2.1
### Wheatgrass-Plains muhly/Sedge/Forb/Shrub/Conifer (<1%) Plant Community


Figure 11. SwLy-B PCP 2.1

This plant community is a result of continuous season-long grazing, heavy continuous grazing, or seasonal grazing without a change in season of use. 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, bearded wheatgrass, plains muhly, and sedges. Forbs contribute substantially to the biomass production in this plant community. Needlegrasses have decreased dramatically and may be nearly absent from the site. Forbs are common and diverse. Shrubs species including shrubby cinquefoil and common juniper have increased. Ponderosa pine or Black Hills spruce can be scattered throughout the site, but will not exceed 1 percent canopy cover. The herbaceous species within this plant community are well-adapted to grazing.

### 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 will not develop into canopy cover greater than 8 percent.

### 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, can restore this plant community to the Reference State. The Shortgrass State can be resistant to change and grazing deferments, but 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 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

Brown, P. M. and C. Hull-Sieg. 1996. Fire history in interior ponderosa pine communities of the Black Hills, South Dakota, USA, Int. J. Wildland Fire 6(3): 97-105.

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## Contributors

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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 | |
| 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:**

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

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

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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):**

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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:**

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