USDA Natural Resources
Conservation Service

Ecological site R062XB010SD
Loamy - High Central

Accessed: 05/05/2024

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.

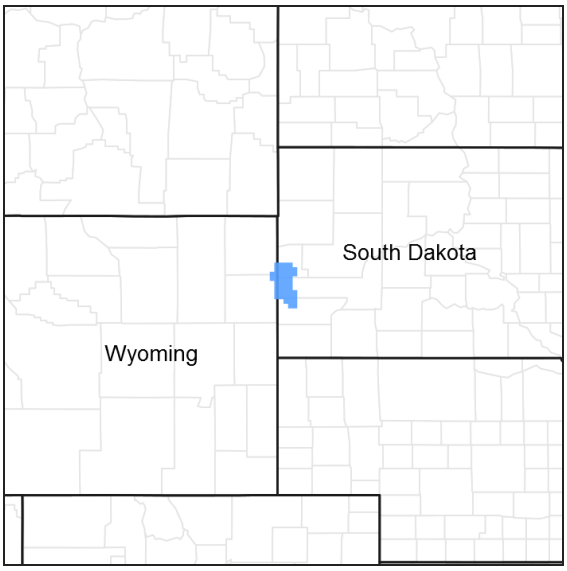

Figure 1. Mapped extent

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) – 25-35” PZ, High Limestone Plateau. The elevation range for 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

The site is located on hillslopes within high mountain valley landscapes in the Black Hills (LRU-B). The soils are loamy with a surface layer thickness less than 15 inches in depth. It does not receive additional water from runoff or overflow. The typical slope range is 0 to 25 percent, but averages around 10 percent. Vegetation in reference site consists primarily of cool-season needlegrasses and rhizomatous wheatgrasses; forbs are common and diverse but

never dominant; and shrubs such as shrubby cinquefoil and western snowberry are often present in the plant community.

Associated sites

R062XB024SD	**Shallow Loamy - High Central** The Shallow Loamy site is commonly associated with the Loamy site but is located on steeper slopes with shallow soil depths.
R062XY043SD	**Valley Loam** The Valley Loam site can be adjacent to the loamy site but typically will be in lower landscape positions and will have deeper, darker soil profiles (> 16" surface layer) and greater production.

Similar sites

R062XC024SD	**Shallow Loamy - South** The Shallow Loamy site will have shallow soil depths and less production.
R062XY043SD	**Valley Loam** The Valley Loam site typically has a deeper and darker soil profile, (> 16” soil surface layer) and is located in a flat “V” or “U” shaped valley. The plant community has more big bluestem and higher production.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Achnatherum richardsonii* (2) *Elymus trachycaulus*

Physiographic features

This site occurs on nearly level to sloping hillslopes, foot slopes, and backslopes within mountain valley landscapes in the Black Hills.

Table 2. Representative physiographic features

Landforms	(1) Mountain valley (2) Hill (3) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,890–2,134 m
Slope	0–25%
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 temperatures, 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-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. 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; the period is shortest at higher elevations and in the northwestern part of the MLRA. Hourly winds are estimated to average about 11 miles per hour (mph) annually. Growth of cool-season plants begins in April, slowing or ceasing growth by mid-August. Warm-season plants begin growth in May, and continue to mid-September. Regrowth of cool-season plants may occur in September and October, depending on the availability of soil moisture. *

Deerfield 3 SE (USC00392231) climate station is not located within LRU-B, but is adjacent to it in LRU-A. The mean annual precipitation 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

The Loamy LRU-B (Central High Country) does not receive additional moisture from streams or wetlands.

Soil features

The soils on this site are moderately deep to very deep and well drained. The surface layer ranges from about 6 to 20 inches in thickness. Surface textures are loamy (specific textures are listed below.) Most of the soils have calcium carbonate in the profile, but they are leached to depths typically greater than 12 inches. The slopes range from 0 to 25 percent.

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

The commonly-occurring soils for this site include Gillum and Jenksdraw.

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

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone
Surface texture	(1) Silt loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	51–102 cm
Surface fragment cover <=3"	0–2%

Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	15.24–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0%
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)	5.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–25%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

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

Fire, or the lack of fire, and introduced non-native cool season grasses, are major drivers, along with grazing and haying, that shape this site as well as adjacent ecological sites. This Loamy site does not appear to be as susceptible to conifer encroachment as other Loamy sites in MLRA 62, however it can occur on the margins. Aspen may also occur on the margins between forest sites and the Loamy site in LRU-B. Kentucky bluegrass, timothy and smooth brome are common cool season grass species throughout MLRA 62. Because the Black Hills have higher precipitation amounts and cooler spring and fall periods than the surrounding MLRA 61, these non-native cool season grasses can easily invade and become established on this site. Improper grazing management, and non-use and/or no fire can cause these species to become the dominant species in the plant communities.

Changes will occur in plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species. Management actions, severe disturbances, such as periods of well-below average precipitation, severe defoliation, excessive haying or no fire and no use can also cause significant shifts in plant communities and/or species composition.

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

The Reference State illustrate what is thought to have existed prior to European settlement. It is very difficult to locate a Reference plant community with the introduction and spread of non-native cools season grasses. Plant community phase 2.1 is most similar to the Reference State but because of the persistence of non-native cools season grasses a restoration pathway to the Reference State is not believed to be achievable.

State and transition model

Loamy – 062XB010SD LRU B 2/12/16

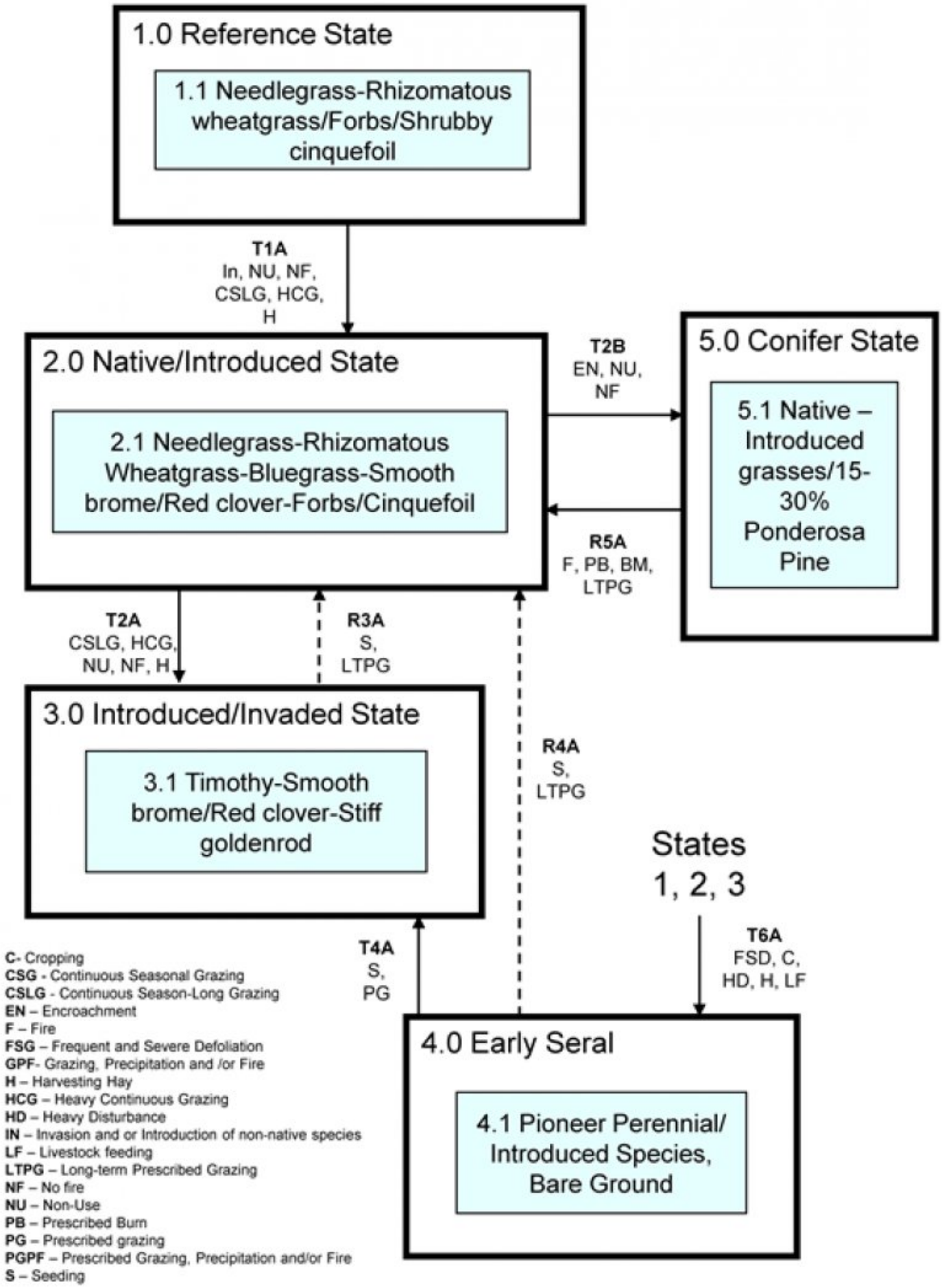

Figure 6. Loamy LRU-B - 062XB010SD

Diagram Legend - Loamy - LRU-B - 062XB010SD

T1A	Introduction or invasion of non-native cool-season grasses, no use, no fire, continuous season long-grazing, heavy continuous grazing and/or excessive haying.
T2A	Continuous season-long grazing, heavy continuous grazing, no use, no fire, and/or excessive haying.
T2B	Encroachment of conifers, no use and no fire.
T4A	Seeding, followed by prescribed grazing.
T6A	Frequent and severe defoliation, cropping, heavy disturbance, excessive haying, livestock feeding area.
R3A	Seeding, followed by long-term prescribed grazing
R4A	Seeding, followed by long-term prescribed grazing
R5A	Fire, prescribed burn, brush management, long-term prescribed grazing

Figure 7. Loamy - LRU-B - 062XB010SD

State 1
Reference State

This state represents what is believed to represent the natural range of variability and plant community dynamics of this ecological site prior to European settlement. The Reference State is unlikely to occur with the introduction of non-native cool-season grasses which are common throughout the MLRA. This site was dominated by cool-season grasses, a diverse forb component and various shrubs. In pre-European times the primary disturbances included fire, insects and grazing by large ungulates and small mammals. Favorable growing conditions occurred during the spring, and warm months of June and July. Routine and/or occasional fires, reduced tree cover and contributed to the ecological processes that maintained the reference plant community.

Community 1.1
Needlegrass-Rhizomatous wheatgrass/Forbs/Shrubby cinquefoil

Figure 8. Loamy LRU-B Central High Country - Near PCP 1.1

Interpretations are based primarily on the Needlegrass-Rhizomatous wheatgrass/Forb/Shrubby cinquefoil plant community phase. This is also considered to be the Reference or historic plant community. The potential vegetation consists of about 70 percent grass and grass-like plants, 20 percent forbs, and 10 percent shrubs. Total annual production for a normal growing year is approximately 2,700 lbs. /Ac. The community is dominated by cool-season grasses including Richardson’s needlegrass, green needlegrass, porcupine grass, bearded wheatgrass, slender wheatgrass, Columbia needlegrass, western wheatgrass and Pumpelli bromegrass. The dominant warm-season grass is prairie dropseed. Other grasses and grass-like include; prairie Junegrass and Richardson’s sedge. Forbs

include goldenrod, lupine, American vetch, yarrow, prairie smoke, and blue-eyed grass. The dominant shrub is shrubby cinquefoil. This plant community was productive and resilient to disturbances such as drought and fire. It was a sustainable plant community in regards to soil/site stability, watershed function, and biological integrity.

State 2
Native Invaded State

This state represents what is most typically found on this site. The natural range of variability is influences by the presence of non-native cool-season grasses, especially Kentucky bluegrass, smooth brome and timothy that can dominate the dynamics of this ecological site. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species. (Toledo, D. et al., 2014). Proper grazing management and periodic burning will maintain the productivity of this state. Heavy grazing without adequate recovery, excessive haying, extended periods of non-use and no fire can put this state at risk of crossing a threshold.

Community 2.1
Needlegrass-Rhizomatous wheatgrass-Bluegrass-Smooth brome/Red clover-Forbs/Cinquefoil

Figure 9. Loamy LRU-B (Central High Country) PCP 2.1

This plant community phase most closely resembles the PCP 1.1; however, non-native cool-season grasses have invaded the site and will persist in the plant community under the current Black Hills climatic conditions. The potential vegetation consists of about 70 percent grass and grass-like plants, 20 percent forbs, and 10 percent shrubs. Total annual production for a normal growing year is variable due to the amount of non-native cool-season grasses, but could average approximately 2,400 lbs./ac. The community is dominated by cool-season grasses. The dominant cool-season grasses include Richardson’s needlegrass, green needlegrass, bearded wheatgrass, and porcupine grass. Kentucky bluegrass, smooth brome, and other non-native cool-season grasses can make up 5 to 10 percent of the plant community. Other grasses include prairie dropseed, slender wheatgrass, and Richardson’s sedge. Forbs are diverse and include red clover, yarrow, biscuit root, cinquefoil, prairie smoke, goldenrod, lupine, and cudweed sagewort. The dominant shrub is Shrubby cinquefoil. This plant community is productive and resilient to disturbances such as drought and fire. It is a sustainable plant community in regards to soil/site stability, watershed function, and biological integrity. Management strategies must include techniques that will not cause Kentucky bluegrass, smooth brome, and other non-native cool-season grasses to increase significantly as this could put the plant community at risk of transition to the Introduced/Invaded State.

State 3
Introduced/Invaded State

This state is the result of invasion and dominance of introduced species. This state is characterized by the dominance of timothy and smooth brome into the system. These species in combination will out-compete the native needlegrasses and wheatgrasses and replace them in the plant community. The nutrient cycle is impaired, resulting in a higher level of nitrogen which favors the introduced species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass

species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance.

Community 3.1
Timothy-Smooth brome/Red clover-Stiff goldenrod

Figure 10. Loamy LRU-B (Central High Country) PCP 3.1

This plant community is dominated by timothy and smooth brome. It developed under heavy and continuous season-long grazing, no use and no fire or excessive haying. The plant community is made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 0-2 percent shrubs. Total annual production is variable but may be similar to the interpretive plant community. This will depend on species composition and management. Biological diversity is greatly diminished, and the energy flow and nutrient cycle is greatly altered. This plant community is very resilient and resistant to change.

State 4
Early Seral State

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

Community 4.1
Pioneer Perennial/Introduced Species, Bare Ground

This plant community developed under continuous heavy grazing or heavy disturbances such as heavy use areas, abandoned cropland, and livestock feeding areas. The potential plant community is very variable. The percentage of bare ground can be very high in this phase of the plant community. This plant community is susceptible to invasion of Canada thistle and other non-native species because of the relatively high percentage of bare ground.

State 5
Conifer State

This state is greatly influenced by conifers: primarily ponderosa pine, but spruce and birch can also be present. The ponderosa pine canopy was found to significantly reduce precipitation reaching the forest floor by an average of 30 percent due to interception in areas of intermediate and dense canopy (Wrage, 1994). This state will develop when conifers encroach onto the site from adjacent forest sites or ecological sites that have been invaded. Encroachment and the establishment of conifers on this site is primarily the result of no fire and grazing management that reduced the competitive nature of the native herbaceous plant community. Once conifers become established on this site, non-native cool-season grasses will increase, especially in the shaded areas.

Community 5.1
Native-Introduced Grasses/15 to 30% Ponderosa Pine

This plant community phase is the result of no use and no fire, or on sites that have had heavy continuous grazing resulting in increased bare ground where pine seedlings can become established. The potential vegetation is approximately 60 percent grasses and grass-like plants, 5 percent forbs, 2 -5 percent shrubs and up to 30 percent conifers. The majority of grasses will be cool-season species with Kentucky bluegrass increasing because of its tolerance to shade.

Transition 1A
State 1 to 2

Invasion and/or encroachment of non-native cool-season grasses such as Kentucky bluegrass, smooth brome, and timothy; no use and no fire; continuous season-long grazing or heavy continuous grazing; and/or excessive haying led this state over a threshold to the Native/Introduced State 2.0.

Transition 6A
State 1 to 4

This transition can occur from States 1, 2, 3 to the Early Seral State with heavy disturbance including frequent and severe defoliation, heavy continuous grazing, excessive haying, livestock feeding areas, or cropping.

Transition 2A
State 2 to 3

Continuous season-long grazing, heavy continuous grazing and/or excessive haying, or no use or no fire can cause a transition to a plant community phase that is dominated by non-native cool-season grasses.

Transition 6A
State 2 to 4

This transition can occur from States 1, 2, 3 to the Early Seral State with heavy disturbance including frequent and severe defoliation, heavy continuous grazing, excessive haying, livestock feeding areas, or cropping.

Transition 2B
State 2 to 5

Encroachment of conifers due to no use and or no fire can transition this plant community to a conifer-dominated state.

Restoration pathway 3A
State 3 to 2

Mechanical and/or chemical treatment followed by seeding of native cool-season grasses may restore the structural functional groups found in the Native/Introduced State. Subsequent management including long-term prescribed grazing and possibly prescribed burning may in time help to re-establish the plant community phase 2.1, however, management goals may not be achieved. This restoration pathway can take many years and in the end may not be successful.

Transition 6A
State 3 to 4

This transition can occur from States 1, 2, 3 to the Early Seral State with heavy disturbance including frequent and severe defoliation, heavy continuous grazing, excessive haying, livestock feeding areas, or cropping.

Restoration pathway 4A

State 4 to 2

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

Restoration pathway 5A
State 5 to 2

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

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 contains 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. This site was previously known as High Country Silty Range Site 062XY033SD in the South Dakota FOTG.

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

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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:**

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

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:**