Ecological site F062XA054SD
Low Elevation Northern Hills Pine Forest(15+% Slope)

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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.

MLRA notes

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

The Black Hills (MLRA 62) is a unique, low lying mountain range situated in the midst of a mixed short and mid-grass prairie. It is a true Island in the Plains, as it has geophysical and biological attributes that are unlike the surrounding area. The Black Hills have strong floristic ties to four of the North American biomes: Cordilleran (Rocky Mountain) Forest, Northern Coniferous Forest, Eastern Deciduous Forest, and Grasslands. MLRA 62 is approximately 3,040 square miles in size; 74 percent is located in South Dakota, and 26 percent is in Wyoming. The towns of Lead, Deadwood, Hill City, and Custer, South Dakota, are in this area. U.S. Highways 16 and 385 cross the MLRA. The Black Hills National Forest, Custer State Park, Mt. Rushmore National Monument, Jewel Cave National Monument, and Wind Cave National Park are located in this MLRA. This area forms the core of the Black Hills and the Bear Lodge Mountains where the elevation ranges between 3,600 to 6,565 feet, however, Black Elk Peak (Harney Peak) rises to 7,242 feet. Slopes range from moderately sloping on some of the high plateaus to very steeply sloping along drainageways and on peaks and ridges. Narrow valleys generally are gently sloping to strongly sloping. The Black Hills uplift is the product of the Laramide mountain-building episodes that produced most of the ranges in the Rocky Mountains. Uplift began near the end of the Cretaceous period, 65 million years ago and ended by 35 million years ago (Froiland 1999). The core of the Black Hills is a plutonic mass of granite with steeply dipping metamorphic rocks, primarily slate and schist, which directly surrounds the granite core. A plateau of Mississippian limestone surrounds the igneous and metamorphic rock core. The Madison limestone is broken around the outer edges of the uplifted area. The Permian Minnekahta limestone forms the outermost boundary of the area. Many other tilted sandstone, shale, and limestone units are exposed like a bathtub ring inside the steeply dipping Madison limestone. The dominant soil orders in this MLRA are Alfisols (forest soils) and Mollisols (grassland soils). The soils in the area have a frigid or cryic soil temperature regime, a udic or ustic soil moisture regime, and mixed, micaceous, or smectitic mineralogy. They are shallow to very deep, generally well drained, and loamy in texture. The Black Hills MLRA supports open to dense forest vegetation. Ponderosa pine is the dominant species across the Black Hills. White spruce grows at the higher elevations and along the major drainageways. Bur oak is found intermixed with pine in the northern and eastern fringes of the Black Hills, and Rocky Mountain Juniper is most common in the southern portion of the Black Hills. Aspen is of minor extent throughout the Black Hills area. Roughleaf ricegrass, slender wheatgrass, bearded wheatgrass, poverty oatgrass, Richardson’s needlegrass, and mountain ricegrass are the most common native grasses under open forest stands. The most common native shrubs are common snowberry, bearberry, common juniper, Oregon grape, and Saskatoon serviceberry. MLRA 62 land ownership is approximately 47 percent private and 53 percent federal. Rangeland and forestland are split almost equally between private and federal ownership (47 percent each). Minor areas of land are privately owned cropland and urban development. The forestland in this area is used mainly for timber production, recreation, and grazing. The major resource concerns are soil erosion and surface compaction caused by logging, mining, wildfires, grazing, and urban expansion. The quality of ground and surface water is another concern, especially in the northern part of the Black Hills. The primary cause is contamination from mine waste and septic systems in areas of rural development and urban expansion (USDA-NRCS Ag Handbook 296).

LRU notes

For development of ecological sites, MLRA 62 is divided into three Land Resource Units (LRU’s) or physiographic zones (A, B, C, and Y). Each LRU has a set of ecological sites that represents these zones. The LRU is identified in the Ecological Site ID: R062XY000SD; “062X” identifies the MLRA, the next letter “Y” identifies the LRU. Note: The organization of Ecological Site ID’s will likely change in the future. LRU-A includes the northern Black Hills and Bear Lodge Mountains (22-30” PZ); LRU-B includes the high elevation central core of the Black Hills (25-35” PZ); and LRU-C includes the southern portion of the Black Hills (17-21” PZ). The Forest ecological sites are representative of sites in the Black Hills, Bear Lodge Mountains (MLRA-62), and the surrounding Dakota Hogback (MLRA-61). These sites are separated by elevation, soil temperature regimes, and slope. The Low Mountain area includes all of the Black Hills, Bear Lodge Mountains, and Dakota Hogback below 6,200 feet in elevation (LRU’s A and C). The soils in this area have a frigid soil temperature regime. The High Mountain area includes all of the Black Hills above 6,200 feet elevation (LRU-B). The soils in this area have a cryic soil temperature regime.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region Major Land Resource Area (MLRA) 62—Black Hills US Environmental Protection Agency (EPA) Level IV Ecoregions of the Conterminous United States: Black Hills Foothills—17a Black Hills Plateau—17b Black Hills Core Highlands—17c USDA Forest Service Ecological Subregions- Sections and Subsections of the Conterminous United States: Black Hills Coniferous Forest Province—M334: Black Hills Section—334A Black Hills Foothills Subsection—M334Aa Black Hills Limestone Plateau-Core Highlands Subsection—M334Ab

Ecological site concept

The Low Elevation Northern Hills(15+% slope) ecological site is a large extent forest site found in the Black Hills, Bear Lodge Mountains, and the surrounding Dakota Hogback. This site is found below 6,200 feet in elevation. The slopes range above 15 percent. There will typically be a light-colored leached “E” horizon positioned above an argillic horizon of translocated clay. The surface and subsurface soil textures range from loamy sand to clayey. Vegetation in the Reference State (1.0) consists of a ponderosa pine overstory with a mixed shrub and herbaceous understory. The herbaceous component may be relatively sparse as slope increases, especially on the warmer south- and west-facing slopes.

Associated sites

F062XY057SD	**Cool Fringe Mixed Hardwood Forest** This site occurs adjacent and is often found on the fringes of meadows, valleys, or areas of increased soil moisture.

Similar sites

F062XB052SD	**Highland Hills Pine Forest(0-15% Slope)** This site occurs in the higher elevations, so cooler temperatures allow for a larger shrub component understory.
F062XC053SD	**Low Elevation Dry Southern Hills Pine Forest** This site is warmer and occurs in the southern reach of the Black Hills, often with a larger grass component.

Table 1. Dominant plant species

Tree	(1) *Pinus ponderosa* (2) *Populus tremuloides*
Shrub	(1) *Mahonia repens* (2) *Juniperus communis*
Herbaceous	(1) *Oryzopsis asperifolia* (2) *Carex*

Physiographic features

The Low Elevation Northern Hills Ecological Site (15+% Slope) occurs most often between 3,200 feet of elevation but up to 6,200 feet.. This site is characterized by rolling hills as well as steeper side slopes and canyon topography encompassing areas in the northern portion of MLRA 62 deemed LRU A.

Table 2. Representative physiographic features

Landforms	(1) Hills > Hillslope (2) Ridge (3) Hill
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	980 – 1,890 m
Slope	20 – 90 %
Ponding depth	0 cm
Water table depth	200 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.

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 (characteristic range)	90-100 days
Freeze-free period (characteristic range)	120-130 days
Precipitation total (characteristic range)	580-760 mm
Frost-free period (actual range)	90-100 days
Freeze-free period (actual range)	120-130 days

Precipitation total (actual range)	510-760 mm
Frost-free period (average)	100 days
Freeze-free period (average)	120 days
Precipitation total (average)	660 mm

- (1) DEADWOOD 2NE [USC00392209], Whitewood, SD
- (2) SUNDANCE [USC00488705], Sundance, WY
- (3) LEAD [USC00394834], Lead, SD

Influencing water features

Riparian areas and wetland features are not associated with this site.

Wetland description

Not Applicable.

Soil features

Soils correlated to this site are Alfisols which developed under a forest canopy and are typically found in long-term forested environments.

Soils correlated to this site will have a frigid soil temperature regime. Typically in the Black Hills, the mean annual soil temperatures below 6,200 feet, is greater than 32 °F but less than 46 °F and the difference between mean summer (June, July, and August) and mean winter (December, January, and February) soil temperatures is 43 °F or more at a depth of 20 inches below the soil surface, and summer air temperatures are warm.

This site is represented by the Citivar, Grizzly, Hickock, Virkula, Vanocker, Sawdust(moist), MCcooley, Tollflat, Mineshaft, Roubaix, Buska, Pactola, and Citadel soils.

More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center for details specific to your area of interest, or go online to access USDA's Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Residuum – igneous and sedimentary rock (2) Colluvium – igneous and sedimentary rock (3) Alluvium – igneous and sedimentary rock
Surface texture	(1) Silt loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Loamy-skeletal (2) Sandy-skeletal

Drainage class	Well drained
Permeability class	Very slow to rapid
Soil depth	50 – 200 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (101.6cm)	2.54 – 16.51 cm
Calcium carbonate equivalent (101.6cm)	0 – 40 %
Electrical conductivity (101.6cm)	Not specified
Sodium adsorption ratio (101.6cm)	Not specified
Soil reaction (1:1 water) (101.6cm)	5.1 – 8.4
Subsurface fragment volume <=3" (101.6cm)	10 – 70 %
Subsurface fragment volume >3" (101.6cm)	10 – 70 %

Ecological dynamics

Dominated by ponderosa pine, the Low Elevation Northern Hills Pine Forest (15+% Slope) ecological site occupies much of the territory of LRU A. There exists a historic reference state, and a managed/invaded state. Given the history of intensive use of the Black Hills and its forestry resources, much of the area today would be found in a managed /invaded state with few areas remaining in the reference state.

The ecological site is characterized by a highly variable uneven age structure canopy of ponderosa pine. Due to an increase in elevation and moisture this ecological site will maintain a hardwood component such as quaking aspen, paper birch or bur oak. Understory species

such as Woods rose, Oregon grape, common juniper, bearberry (kinnikinnick), ironwood (hop-hornbeam), are common. The herbaceous layer may consist of ricegrasses, oatgrasses, yarrow, pasqueflower, a variety of asters and sedges. On this site, productivity varies due to slope percentage, where lower slopes are higher producing than steeper slopes. Sub-shrubs will increase in composition as slopes increase along with bare ground and needle cast.

Ponderosa pine is the dominant tree species in the Black Hills and tends to have dark colored bark (blackjacks) until it reaches 75 to 100 years of age, after which the bark progressively changes to a buff or orange color. Morphologically older trees are marked by the presence of thinning foliar and flat-topped crowns. Additional morphology includes larger lower branching with higher crown- based heights and furrowed or very smooth bark.

Historically spatial heterogeneity was present not only across the Black Hills but also within the smaller dense pine patches (Brown, 2006). This variation of structure consisted of a diverse landscape mosaic that varied from grasslands and stands of ponderosa pine forest with variation in forest structure due to topographically driven microclimates resulting in variation of total tree density, tree group size, proportion of trees in groups versus single random trees, and openness.

Ponderosa pine is a fire-adapted species that is, mostly driven by frequent, low-intensity surface fires that consume small seedlings, prunes lower branches from larger trees, and reduces overall surface fuel loads. With prolific spring rains and higher elevation, the historical fire regime in this ecological site is characterized as one of low-severity with a combination small patch (1-20 acre) of group torching fires and the occasional (>100 years) large patches (20- 200 Ac) group torching fires. Overall, it is estimated that only 3.3 percent of the Black Hills landscape burned as crown fire during 22 landscape fire years between 1529 and 1893 (Brown, 2008). It is estimated that only 3.3 percent of the Black Hills landscape burned as crown fire during 22 landscape fire years between 1529 and 1893 (Brown, 2008). In the central core, low- severity surface fires occurred between 16 and 20 years (Brown, 2008). Frequent surface fires maintained the ecotone between forest and grasslands by killing ponderosa pine seedlings and saplings before they could become established.

In addition to variable fire, pests, and disease- other natural disturbances played a role in the overall maintenance of diversity, structure, and density the Black Hills. The mountain pine beetle (Dendroctonus ponderosae) is an important driver of forest structure. The mountain pine beetle was first described in the Black Hills in 1901 by Andrew D. Hopkins and the first documented epidemic of bark beetles in the Black Hills occurred in 1895 (Graham et al. 2016). These beetles are native in the Black Hills and have cyclical life cycle and emergence, with a continuous endemic and less frequent epidemics in the Black Hills over the last 129 years (Graham et al. 2016). "Mountain pine beetle outbreaks in the Black Hills from 1894 through 2014 had a mean return interval of 20 years and a mean duration of 13 years (Graham et al. 2016)".

At a variable and localized scale additional disturbances include pine engraver beetles and armillaria root rot. Pine engraver beetles are non-aggressive and breed in windthrown ponderosa pine trees, trees damaged by wind, ice storms, or other non-standing trees. Armillaria (Armillaria ostoyae) has been noted across soil types and locations within the Black Hills (Boldt and Van Deusen 1974; Holah1993; Lundquist 1991; Shepperd, Wayne D.; Battaglia, Michael A. 2002).

Studies have shown the current forest contains about the same basal area (ft2/ac) on average as the historic forest. The difference, however, is that the historic forest was dominated by fewer, but much larger trees, than those present today. This suggests that there has been a simplification in structure at stand to landscape scales, with increased tree density leading to fewer gaps and more even spacing and size distributions within groups (Brown, 2008).

Relative increases in tree density and simplification of structure have contributed to greater vertical and horizontal fuel continuity, and thus increased likelihood for incidence and extent of crown fires. More pole-sized trees (5-to-9-inch DBH) within stands also increases the likelihood of bark beetle (Dendroctonus ponderosae) outbreaks. This is a concern in the Black Hills where pine beetle outbreaks have been a major disturbance agent during the 20th and early 21st centuries.

It is also important to note the change in composition in recent decades of ponderosa pine stands, whereby mainly through the mechanism of fire suppression, the dominance of white spruce has grown by an estimated 5% or more from the original 1.5% composition covered historically (Tatina R.E., Hanberry B.B., 2022).

Due to the spread and establishment of non-native cool-season grasses and other anthropogenic disturbances in MLRA 62, the Reference Plant Community (1.1) is nearly non-existent.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Wildlife Interpretations: The Black Hills and Bear Lodge Mountains of South Dakota and Wyoming are truly a forested island in a grassland sea. To regional Native Americans, they are ‘Paha Sapa” or “hills that are black”, and from a distance, the ponderosa pine-covered slopes do appear like black hills (Larson, 1999). The Black Hills and Bear Lodge Mountains are located in the drier areas of a northern mixed-grass prairie ecosystem in which sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, MLRA 62 consisted of diverse grassland, shrubland, and forest habitats interspersed with varying densities of depressional, instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles and amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several species of small mammals and insects, were the primary consumers linking the grassland resources to large predators, such as the gray wolf, mountain lion, and grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors. Ponderosa pine stands provide cavity nesting sites, nesting cover, escape cover, and den sites for a variety of species. Species that increase include elk, white-footed mice, bushy-tailed woodrat, black-billed magpie, Townsend’s solitaire, western meadowlark, Bohemian waxwing, dark-eyed junco, nuthatch, black-capped chickadees, brown thrasher, lark sparrow, crows, and white-crowned sparrow. Species such as meadow voles, spotted ground squirrel, thirteen-lined ground squirrel, northern grasshopper mice, and western harvest mice do not use this site. Grassland nesting songbirds will decline as pine cover increases. Raptors, such as the long-eared owl, increase. Beaver inhabited surface waters associated with instream wetlands and woody riparian corridors occur along streams and drainages. Beaver occupation served as a mechanism to maintain water tables along flood plains and valley floors. During pre-European times, the extent of the wet land sites was likely much more wide-spread and persistent during dry periods, however excessive trapping and removal since that time have changed the hydrology and limited the extent of these sites while drying former mesic areas throughout the MLRA. Grazing Interpretations: The forage production of plant communities can be highly variable due to many slopes being largely inaccessible to cattle. Domestic sheep and goats would likely utilize this ecological site through the growing season and into fall, but are not commonly produced in the Black Hills area. Those areas that are accessible to livestock use require a complete resource inventory to document plant composition and production. Accurate estimates of carrying capacity should be calculated using vegetative clipping data, animal preference data, and actual historic stocking records.

Hydrological functions

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

Recreational uses

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

Wood products

The ponderosa pine and white spruce produced in the Black Hills area are marketable for saw logs and heating fuel pellets. The steeper slopes found on this ecological site may make this resource less accessible to modern timber harvesting equipment. Management of this forest resource for watershed protection, grazing, wildlife, recreation, and timber harvest may be the most critical issues land managers and owners currently face. Land management specialists stress the need to create and manage fire-tolerant forests on a landscape basis. They recommend fuel-mitigation treatments through grazing management, forest thinning, prescribed burning, and timber harvest management. Fire is especially damaging in the forest/urban interface and requires the expansion of defensible space around homes and buildings, and education on “Fire Wise” practices.

Other products

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

Other information

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. All inventory information and data records are compiled within the Rapid City, SD USDA-NRCS Shared “S” network drive.

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Approval

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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	06/11/2025
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):**

   _____

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

    _____

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

    _____

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

    Dominant:

Sub-dominant:

Other:

Additional:

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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:**
