USDA Natural Resources Conservation Service

Ecological site F062XY057SD
Cool Fringe Mixed Hardwood Forest

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Accessed: 05/13/2025

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, 2006: Ag Handbook 296).

LRU notes

For development of ecological sites, MLRA 62 is divided into three Land Resource Units (LRUs) 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, and the next letter “Y” identifies the LRU. Note: The organization of Ecological Site IDs will likely change in the future.

The North, LRU-A includes the northern Black Hills and Bear Lodge Mountains. It receives between 22 and 30 inches of annual precipitation and has a frigid soil temperature regime.

The High Central, LRU-B includes the high elevation central core of the Black Hills, which receives between 25 to 35 inches of annual precipitation and has a cryic soil temperature regime.

The South, LRU-C includes the southern portion of the Black Hills and receives between 17 to 21 inches of annual precipitation and has a frigid soil temperature regime.

One additional grouping of ecological sites that are common to the entire MLRA are designated with a “Y” in the ecological site ID.

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 Cool Fringe Mixed Hardwood Forest ecological site consists of a run-in landscape position where excess water occurs and occupies drainages, gulley’s, ravines and occasional flats or shallow depressions on areas of the Black Hills and Bear-lodge mountains of MLRA 62. This habitat type often consists of denser woodland type habitat with mixed species composition of hardwood trees ranging in tree size classes up to 20 inches diameter. The primary species consist of aspen and paper birch along with varying proportions of possible ironwood, green ash, and American elm. Often found along fringes of the High Elevation Cool Slopes and Valleys ecological sites transitioning to Valley Loam ecological sites- the mixed hardwood ecological site occupies a small niche in the Black Hills where Ponderosa Pine or White Spruce are not the dominant or expected climax community.

Associated sites

F062XB056SD	**Highland Cool Valley Slopes and Depressions** This site is often found upslope of the mixed hardwood site, often occurring on rockier soils with steeper slopes.

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides* (2) *Betula papyrifera*
Shrub	(1) *Corylus cornuta* (2) *Amelanchier alnifolia*
Herbaceous	(1) *Carex* (2) *Oryzopsis asperifolia*

Physiographic features

The Cool Fringe Mixed Hardwood Forest ecological site occupies drainages, gulley's, ravines and gently sloping toe-slopes/flats or shallow depressions. This site often occupies a run-in type landscape with excess water moving into the system from adjacent uplands. Slopes may be flat/gently sloping and can occur at nearly any elevation throughout the MLRA, though more common in higher elevation areas above 5,200 feet and on the fringes of spruce or pine dominated forests along valley bottoms.

Table 2. Representative physiographic features

Hillslope profile	(1) Toeslope
Landforms	(1) Hills > Depression (2) Hillslope
Runoff class	Low to medium
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to rare
Elevation	1,585–2,195 m
Slope	0–30%
Ponding depth	0 cm
Water table depth	51–203 cm
Aspect	NW, N, NE

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)	51-85 days
Freeze-free period (characteristic range)	93-116 days
Precipitation total (characteristic range)	533-762 mm
Frost-free period (actual range)	25-92 days
Freeze-free period (actual range)	64-124 days

Precipitation total (actual range)	508-762 mm
Frost-free period (average)	67 days
Freeze-free period (average)	101 days
Precipitation total (average)	610 mm

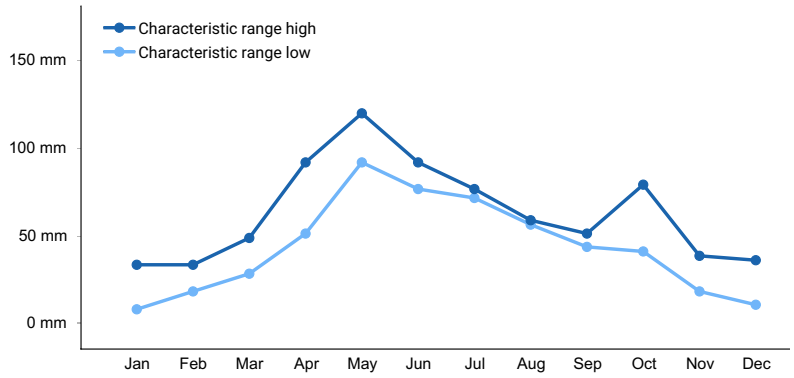


Figure 1. Monthly precipitation range

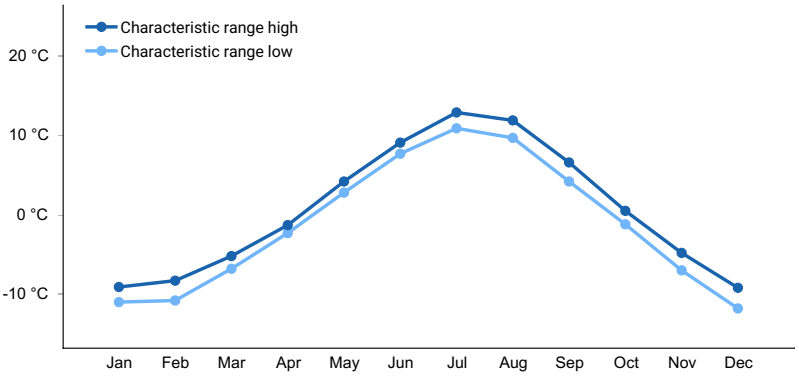


Figure 2. Monthly minimum temperature range

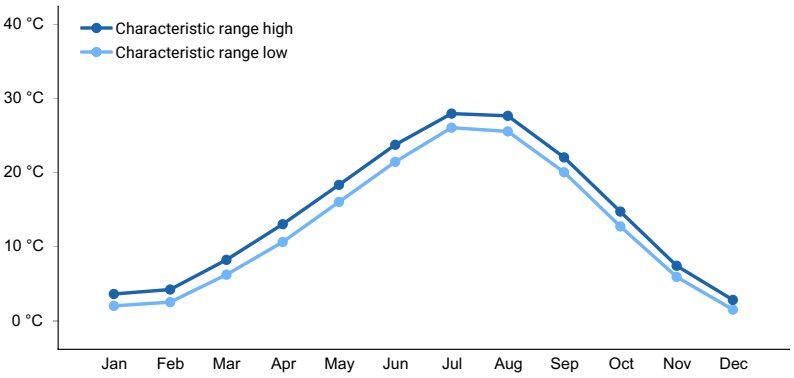


Figure 3. Monthly maximum temperature range

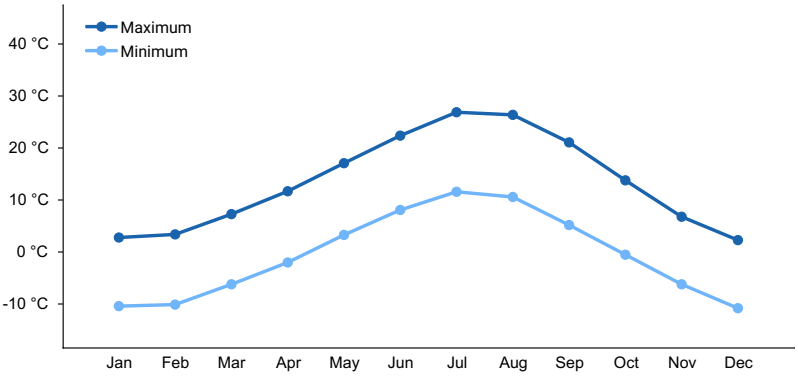


Figure 4. Monthly average minimum and maximum temperature

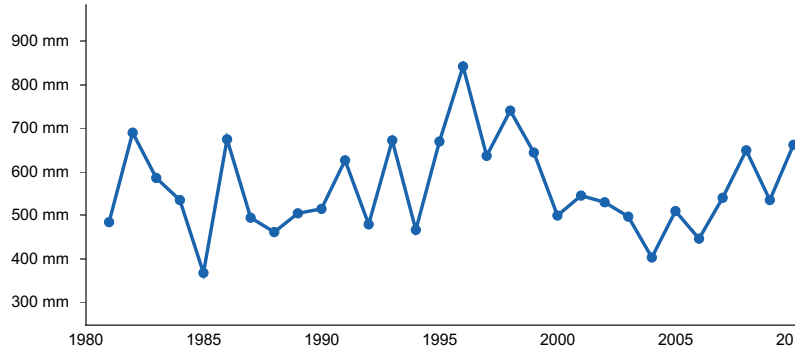


Figure 5. Annual precipitation pattern

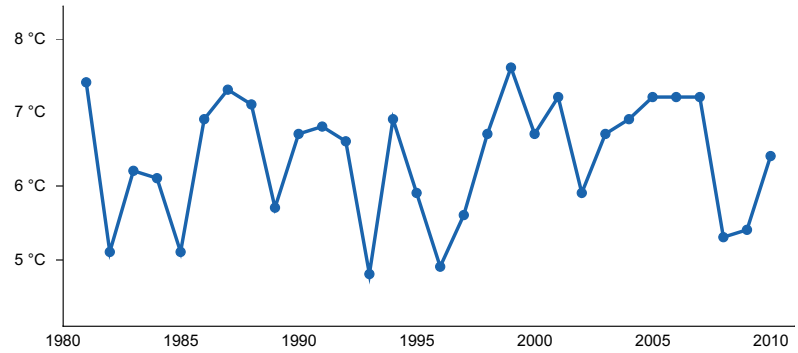


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DEERFIELD 3 SE [USC00392231], Hill City, SD
- (2) LEAD [USC00394834], Lead, SD
- (3) DEADWOOD [USC00392207], Deadwood, SD
- (4) CUSTER [USC00392087], Custer, SD
- (5) HILL CITY [USC00393868], Hill City, SD

Influencing water features

Water is received primarily through precipitation, seasonal streams/drainages, and runoff from adjacent uplands. Water leaves the site primarily through evapotranspiration, runoff, and groundwater recharge. In sites that contain ephemeral streams, depending on water availability and drought years, vegetation may be very dense and represent more of a riparian ecological site.

Wetland description

Not Applicable.

Soil features

This site is represented by the Goldmine soil series in LRU A, and the moist phase of any soil in LRU B (which do not officially exist yet). The Cool Fringe Mixed Hardwood Forest ecological site occupies run in landscapes and a small niche on the fringes of sloped coarse and skeletal soils dominated by spruce or pine. forests that meet the finer minerology of prairie/grassland soils. Organic matter on similar sites documented range from 2.2 to 8.7 percent (Battaglia, 2002).

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Alluvium
Surface texture	(1) Loamy fine sand (2) Loamy coarse sand
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	152–203 cm
Soil depth	152–203 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	2–3%
Available water capacity (0-152.4cm)	7.62–15.24 cm
Soil reaction (1:1 water) (0-152.4cm)	4.2–7.3
Subsurface fragment volume <=3" (0-101.6cm)	20–30%
Subsurface fragment volume >3" (0-101.6cm)	30–35%

Ecological dynamics

The Cool Fringe Mixed Hardwood Forest ecological site occupies a small niche separate of the pine or spruce systems of the Black Hills although there are hardwood states or inclusions within the other systems. The Cool Fridge Mixed Hardwood Forest differs from these other systems because it is not replaced with conifers in the later states. Although they are often found in proximity, the mixed hardwood site occupies a unique position on the landscape consisting of run-in landscape positions often in ravines, gentle slopes/ flats or shallow depressions within higher elevations of the Black Hills and Bearlodge mountains, often occurring just below the Cool Highland Slopes and Valleys ecological site and on the fringes of the Valley Loam ecological site or other coves and areas of increased moisture.

The reference state for this site consists of a mix of hardwood species including an overstory of aspen and paper birch with possible associates of spruce, pine, ironwood, boxelder, green ash, hawthorn, and American elm. This habitat type occurs at elevations from 4,000 to 6,240 feet (1,219 to 1902 m) (Hoffman and Alexander, 1987). Stands in the central Black Hills will frequently have bur oak in the understory as well. A wide variety of shrubs and forbs with few grasses dominate the understory.

Structural variation within this reference state is the result of environmental factors and a set of characteristics that influence a site’s resilience to disturbance. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, insects, disease wind, ice storms) (Caudle et al. 2013).

Hardwood stands evolve from an open canopy, seedling, sapling, pole, immature forest, and eventually to a mature forest. Natural fluctuations in weather patterns allow for a self-sustaining mix of an aspen, birch, shrubs and native

grass and grass-like community.

The primary disturbance mechanisms in hardwood/aspen stands include fire, insect and disease outbreaks, and windstorms. The reference state is self-sustaining and resistant to change beyond it's normal seral community types due to a good adaptation to natural disturbances and a high resilience following those disturbances. When natural disturbances such as fire do occur, the rate of recovery can be quite variable. Intense fires that kill the aspen overstory usually stimulate abundant suckering (DeByle and Winokur, 1985).

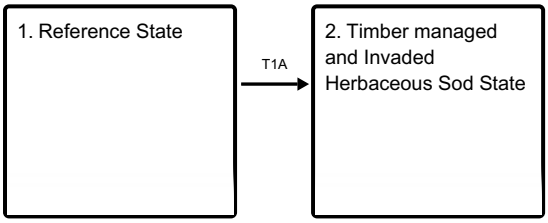
Although aspen stands rely on fire for successful regeneration, aspen stands don’t readily carry fire (Fechner and Barrows 1976, Debyle and Winokur 1985, Debyle et al. 1987). The tree itself is extremely fire sensitive (Baker 1925); with its thin bark most aspens are top-killed by fire, and those left with scarring are usually killed within the next growing season from rot and disease (Bradley et al. 1992,Davidson et al. 1959, Meinecke 1929). Periodic wildfires prevent over-mature aspen stands and maintain a naturally stratified mosaic of even-aged aspen communities in various stages of successional development. Uneven-aged stands form under stable conditions where the overstory gradually disintegrates with disease or age and is replaced by aspen suckers.

Aspen sustainability is threatened by limited regeneration due to the lack of disturbance, shading by conifer trees and/or herbivory. Conifers such as ponderosa pine and white spruce, are shade tolerant and can eventually increase and overtop the aspen trees. The increase in conifers can be attributed to both fire suppression and grazing pressure by livestock and wildlife (Potter 2005, Strand et al. 2009, Bartos and Campbell 1998). Aspen and their root systems persist through conifer infill but diminish as conifers predominate. Continuous browsing by livestock or wildlife may also limit aspen regeneration. Herbivory can reduce community resilience and alter future aspen cover (Rogers et al 2013).

Paper Birch is generally classified as a shallow rooting species, with no tap root, and is considered shade intolerant. Paper birch is short-lived and rarely lives more than 140 years. In addition, although not considered a valuable timber species here, Paper Birch can be tapped in the spring to obtain sap from which syrup, wine, beer, or medicinal tonics can be made(Zasada, Bjorkbom, and Safford 1990).

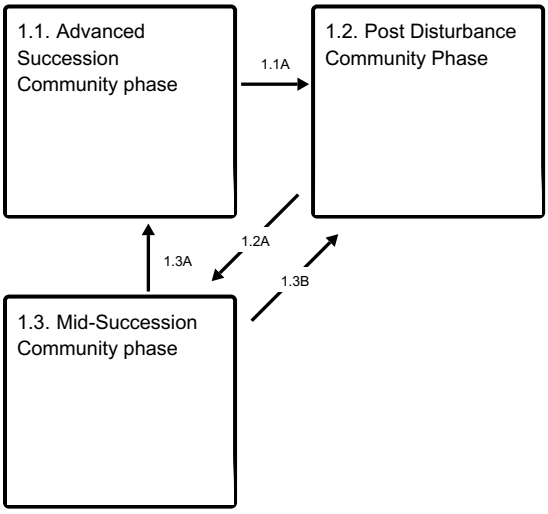
State and transition model

Ecosystem states



T1A - Active management of forest

State 1 submodel, plant communities



1.1A - Severe stand replacing disturbance.

1.2A - Time with minimal disturbance.

1.3A - Time with no disturbance(20+ years).

1.3B - Severe disturbance.

State 2 submodel, plant communities

2.1. Invaded herbaceous Sod State

State 1
Reference State

The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The reference state is a mixed forest consisting of hardwood species such as quaking aspen and paper birch with a strong native under story and minimal composition of conifer species (less than 5 percent). Predominant shrubs may include beaked hazelnut, shiny spirea, service berry, and Oregon grape. Other common species may include Western serviceberry, Oregon grape, wild honeysuckle, chokecherry, pink shinleaf, prickly rose, red raspberry, wild spirea, and white coralberry. Frequent herbaceous species found in the understory include baneberry, wild sarsaparilla, Lindley's aster, wild strawberry, sweet-scented bedstraw, cream peavine, wild lily-of-the-valley, sweetroot, bracken fern, Maryland sanicle, starry false Solomon's seal, purple meadowrue, Canada violet, and rough-leaved ricegrass. (Hoffman and Alexander 1987; Shepperd and Battaglia, 2002). This site has three general community phases: advanced succession community phase, mid-succession community phase, and post disturbance community phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. The ability of these hardwoods to clone themselves, and rhizomatous nature of aspen assist in their perseverance on the landscape. Negative feedback enhances ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought /or insect or disease, and extreme weather everts such as straight-line wind events or tornados. Periodic wildfires prevent over-mature aspen stands and maintain a naturally stratified mosaic of even-aged aspen stands in various stages of successional development. Many aspen stands are even-aged because of the rapid reproduction by suckering after a major disturbance. In the absence disturbance events, aspen stands become uneven-aged. Uneven-aged stands form under stable conditions where the overstory gradually disintegrates with disease or age and is replaced by suckers. Uneven-aged stands also occur where individual clones gradually expand into adjacent grasslands or shrublands.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- white spruce (*Picea glauca*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- ironwood (*Eusideroxylon*), tree
- boxelder (*Acer negundo*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- hawthorn (*Crataegus*), tree
- American elm (*Ulmus americana*), tree
- bur oak (*Quercus macrocarpa*), tree
- beaked hazelnut (*Corylus cornuta*), shrub
- shinyleaf spirea (*Spiraea lucida*), shrub
- prickly rose (*Rosa acicularis*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- creeping barberry (*Mahonia repens*), shrub
- limber honeysuckle (*Lonicera dioica*), shrub
- chokecherry (*Prunus virginiana*), shrub

- American red raspberry (*Rubus idaeus*), shrub
- spirea (*Spiraea*), shrub
- coralberry (*Symphoricarpos orbiculatus*), shrub
- baneberry (*Actaea*), shrub
- roughleaf ricegrass (*Oryzopsis asperifolia*), grass
- wild sarsaparilla (*Aralia nudicaulis*), other herbaceous
- Lindley's aster (*Symphyotrichum ciliolatum*), other herbaceous
- Virginia strawberry (*Fragaria virginiana*), other herbaceous
- sweetscented bedstraw (*Galium odoratum*), other herbaceous
- western brackenfern (*Pteridium aquilinum*), other herbaceous
- Maryland sanicle (*Sanicula marilandica*), other herbaceous
- starry false lily of the valley (*Maianthemum stellatum*), other herbaceous
- purple meadow-rue (*Thalictrum dasycarpum*), other herbaceous
- Canadian white violet (*Viola canadensis*), other herbaceous

Community 1.1
Advanced Succession Community phase

The reference community is aspen or birch overstory with a herbaceous under story. In the aspen/ birch overstory, the trees are single story canopy with an even-aged stand and have reached or are near maximal heights for the site. The trees are decadent to some degree, and range in age from 60 to 120 years old or older. Vegetative shoots and/or saplings of aspen occur in the understory, but they are inconspicuous and have a high mortality rate. The overstory canopy is between 80 to 90 percent Hardwood diameters will be mostly greater than 7” DBH and 60-120+ basal area. Understory species may include a variety of species as listed in the reference state description.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- sedge (*Carex*), grass
- roughleaf ricegrass (*Oryzopsis asperifolia*), grass

Community 1.2
Post Disturbance Community Phase

This community phase is dominated by paper birch and quacking aspen sprouts and seedlings less than 2” DBH in the range under nearly full sunlight. This stage is experienced after a major disturbance such as crown fire, insect damage or disease. If the aspen stand is healthy, this stage will progress quickly. However, if competing brush and herbaceous plants grow for a full season before aspen suckers emerge, or with excessive herbivory from large ungulates, a reduction in growth and survival of aspen suckers may occur. Various amounts of aspen and paper birch regeneration, often greater than 300 trees per acre 1 to 25 years old are present up to the point where they are obviously a major component of the vegetal structure. Understory species may include a variety of species as listed in the reference state description.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- sedge (*Carex*), grass
- needlegrass (*Nassella*), grass
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Community 1.3
Mid-Succession Community phase

This community phase is characterized by a growing canopy of pole sized and/or immature aspen and paper birch between 2-7” DBH. Average age is 25 to 60 years. Rapid growth of the trees, both in height and canopy cover quickly results in an immature forest. As competition becomes intense enough to affect the diameter growth of

dominants, mortality quickly reduces the number of trees in the lower crown classes. Tree canopy cover ranges from 50 to 80 percent reducing the diversity of under story species as well. Seedlings and/or saplings of quaking aspen are common in the understory. Understory consists of sedges, cool season bunch grasses, forbs, oniongrass, carex, roughed-leaf ricegrass and bracken fern.

Dominant plant species

- quaking aspen (*Populus tremuloides*), tree
- paper birch (*Betula papyrifera*), tree
- sedge (*Carex*), grass
- roughleaf ricegrass (*Oryzopsis asperifolia*), grass
- brackenfern (*Pteridium*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Severe Fire and/or weather (ice storms, blow-downs, tornadoes) or insects and disease result in complete or near total removal of overstory tree's allowing for regeneration.

Pathway 1.2A
Community 1.2 to 1.3

Time with minimal disturbance from insects and disease or severe weather.

Pathway 1.3A
Community 1.3 to 1.1

Time with no disturbance (20-40 years).

Pathway 1.3B
Community 1.3 to 1.2

Stand replacing disturbance such as severe weather, fire, or insects and disease.

State 2
Timber managed and Invaded Herbaceous Sod State

The Timber managed and Invaded Herbaceous Sod State is largely the result of historic early European-American settlement of the Black Hills region. Fire suppression was common throughout recent history removing on of the primary ecological drivers of this system. This led to the decrease of this ecological site as it transitioned into conifer. Along with fire suppression these areas were often heavily grazed to supply beef and mutton for mining and logging communities. In later years these sites were often seeded to introduced grasses and clover to increase forage quality or farmed for grain crop production. In many cases the shift in land use from forest to livestock, forage, and crop production remains. Those areas that are not under intensive management resist transitioning back to a forest plant community, even though the soils still exhibit forest attributes. The dominant plants associated with this state are introduced sod-forming grasses, introduced legumes, and weedy forbs. This state is very resistant to change through management alone.

Dominant plant species

- timothy (*Phleum pratense*), grass
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- redtop (*Agrostis gigantea*), grass
- red clover (*Trifolium pratense*), other herbaceous
- white clover (*Trifolium repens*), other herbaceous
- oxeye daisy (*Leucanthemum vulgare*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous

- cinquefoil (*Potentilla*), other herbaceous
- Canada thistle (*Cirsium arvense*), other herbaceous

Community 2.1
Invaded herbaceous Sod State

This plant community is a result of the loss of the overstory hardwood species, followed by heavy continuous grazing, invasion of non-native cool- season grasses, and in some cases seeding to forage or crop species. It is characterized by a dominance of non-native cool- season grasses including timothy, smooth brome, Kentucky bluegrass, and redtop. Forbs will include red and white clover, ox- eye daisy, western yarrow, cinquefoil, and Canada thistle. Native plants have great difficulty becoming established in this plant community.

Transition T1A
State 1 to 2

Active management of forest results in a managed state for this ecological site. This is the most common state you might find this ecological site. In addition, non-native cool season grasses now dominate the understory on many of these sites.

Additional community tables

Inventory data references

Information presented here has been derived from NRCS field observations, literature 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	05/13/2025
Approved by	Suzanne Mayne-Kinney
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:

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

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

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

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:**
