USDA Natural Resources Conservation Service

Ecological site R064XY032NE
Sandy 17-20" PZ

Last updated: 12/16/2024
Accessed: 05/11/2025

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.

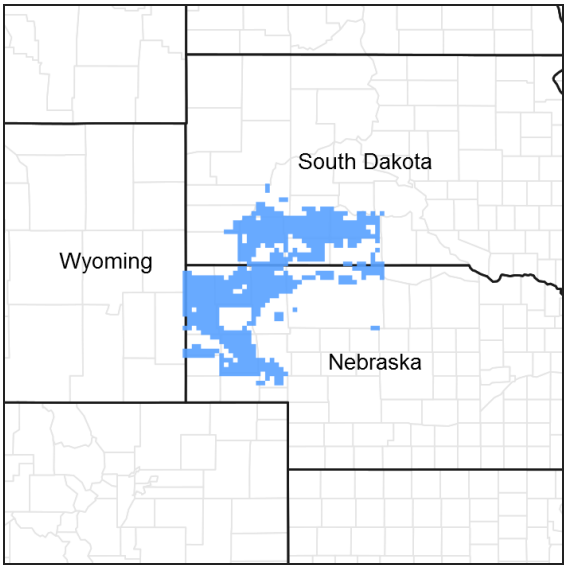


Figure 1. Mapped extent

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): 064X–Mixed Sandy and Silty Tableland and Badlands

The Mixed Sandy and Silty Tableland and Badlands (MLRA 64) is shared almost equally between South Dakota (42 percent) and Nebraska (41 percent). A small portion is in Wyoming (17 percent). The MLRA consists of 11,895 square miles. The towns of Kadoka and Pine Ridge, South Dakota; Chadron and Alliance, Nebraska; and Lusk, Wyoming, are all within the boundaries of this MLRA.

The following areas of special interest are in this MLRA: Agate Fossil Beds National Monument, Chadron State Park, Fort Robinson State Park, and the Pine Ridge Indian Reservation; parts of the Oglala and Buffalo Gap National Grasslands, which are in the Nebraska National Forest; and nearly all of Badlands National Park. The Badlands are internationally renowned for their Oligocene vertebrate fossils.

The northern section of the MLRA consists of old plateaus and terraces that have been deeply eroded by wind, water, and time. The southern section consists of nearly level to broad intervalley remnants of smooth fluvial plains. These two sections are separated by the Pine Ridge escarpment. Elevations gradually increase from 2,950 to 5,073 feet from east to west. The main drainageway through Badlands National Park is the White River. The headwaters of both the White and Niobrara Rivers are in MLRA 64. The Pine Ridge escarpment is at the northernmost extent of the Ogallala Aquifer.

Tertiary continental sediments consisting of sandstone, siltstone, and claystone underlie most of the area. Many of the bedrock units in the southern third of the MLRA are covered by loess. Soils range from shallow to very deep and from generally well drained to excessively drained. They are loamy or sandy. The Badlands consist of stream-laid layers of silt, clay, and sand mixed with layers of volcanic ash.

Average annual precipitation for the area ranges from 14 to 20 inches. Most of the rainfall occurs as frontal storms in the spring and early summer. This area supports a mixture of short-, mid-, and tall-statured warm- and cool-season grasses. On the Pine Ridge escarpment, these plants grow in association with ponderosa pine, Rocky Mountain juniper, western snowberry, skunkbush sumac, common chokecherry, and rose. Wyoming big sagebrush grows in minor amounts in the drier, far western portion of the MLRA, and small remnant stands can be found in the eastern portion of the Oglala National Grassland in Nebraska.

Sixty percent of the MLRA is grassland, 11 percent of which is under Federal management. Twenty-two percent of the area is used as cropland, and 4 percent is forested. Major resource concerns include wind erosion, water erosion, and surface water quality (USDA-NRCS, 2006, Ag Handbook 296).

For development of ecological sites, MLRA 64 is divided into two precipitation zones (PZ): 14 to 17 inches per year and 17 to 20 inches per year. The wetter zone extends from the western end of the Pine Ridge escarpment near Lusk, Wyoming, eastward along the escarpment through Nebraska and into the Big Badlands area of South Dakota. The drier zone extends from Wyoming eastward to Alliance and Oshkosh, Nebraska, south of the Pine Ridge escarpment. MLRA 64 stops at the western edge of the Nebraska Sand Hills (MLRA 65).

A unique geologic area known as the Hartville Uplift is in the far southwest corner of the 14 to 17 inch precipitation zone. The Hartville Uplift is an elongated, north-northwest-oriented, broad domal arch of Laramide age (70-50 million years ago). It extends approximately 45 miles between Guernsey and Lusk, Wyoming, and is 15 miles wide at its widest point. Erosion has exposed a core of granite and Precambrian metasedimentary and metavolcanic rocks (Steele et al., 2018). In addition to the ecological sites in the 14 to 17 inch precipitation zone of MLRA 64, three unique ecological site descriptions were developed to describe the soils and plant community dynamics in the Hartville Uplift.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 64—Mixed Sandy and Silty Tableland and Badlands

U.S. Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
High Plains—25:
Pine Ridge Escarpment—25a.
Flat to Rolling Plains—25d.
Pine Bluffs and Hills—25f.
Sandy and Silty Tablelands—25g.
Northwestern Great Plains—43:
White River Badlands—43h.
Keya Paha Tablelands—43i.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains and Palouse Dry Steppe Province—331:
Western Great Plains Section—331F:
Subsections:
Shale Scablands—331Fb.
White River Badlands—331Fh.
Pine Ridge Escarpment—331Fj.
High Plains—331Fk.
Hartville Uplift—331Fm.
Western Nebraska Sandy and Silty Tablelands—331Fn.
Keye Paha Tablelands—331Ft.

Powder River Basin Section—331G:
Subsection: Powder River Basin—331Ge.

Ecological site concept

The Sandy 17-20” PZ ecological site is throughout the wetter portion of MLRA 64. It is on upland landscapes and does not receive additional moisture from runoff or overflow. Typically, slopes range from 0 to 30 percent. The soils formed in eolian deposits, alluvium, colluvium, or residuum. Soils are deep (greater than 20 inches). The surface layer ranges from loamy sand to very fine sandy loam. The subsurface layers ranges from sand to very fine sandy loam.

Vegetation in the Reference Plant Community (1.1) consists of a mix of cool- and warm-season grasses. Dominant grasses include sand bluestem, little bluestem, prairie sandreed, needle and thread, western wheatgrass, and blue grama. Forbs are common and diverse. Shrubs include leadplant, rose, and yucca. Ponderosa pine and Rocky Mountain juniper can establish on this site, especially on the Pine Ridge escarpment in Nebraska and South Dakota. The Sandy 17-20” PZ site is susceptible to invasion of non-native, cool-season grasses, especially Kentucky bluegrass and annual bromes.

Associated sites

GX064X01X036	**Loamy 17-20" PZ** The Loamy 17-20” PZ ecological site is in landscape positions similar to and adjacent to the Sandy 17-20” PZ site.
R064XY012NE	**Sands** The Sands ecological site is on more sloping landscapes adjacent to or intermixed with the Sandy 17-20” PZ site.
R064XY040NE	**Shallow** The Shallow ecological site is on landscapes above the Sandy 17-20” PZ site. The Shallow site can be the source of ponderosa pine expansion in some areas.

Similar sites

R064XY012NE	**Sands** The Sands ecological site is on steeper, undulating landscape positions. The plant community has more sand bluestem and less blue grama than the Sandy 17-20” PZ site and has no western wheatgrass.
GX064X01X036	**Loamy 17-20" PZ** The Loamy 17-20” PZ ecological site is in landscape positions similar to those of the Sandy 17-20” PZ. The Loamy plant community has less little bluestem and more western wheatgrass.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon hallii* (2) *Hesperostipa comata ssp. comata*

Physiographic features

The Sandy 17-20” PZ ecological site is on nearly level to steeply sloping hillslopes, terraces, and alluvial fans.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Stream terrace (3) Alluvial fan
Runoff class	Negligible to low

Flooding frequency	None
Ponding frequency	None
Elevation	2,900–5,000 ft
Slope	0–30%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 64 has a continental climate consisting of cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature are common in some years. The climate results from MLRA 64 being near the geographic center of North America. There are few natural barriers on the Northern Great Plains. Air masses move freely across the plains and account for rapid changes in temperature.

Average annual precipitation ranges from 17 to 20 inches. The normal average annual temperature is about 47 °F. January is the coldest month with average temperatures ranging from about 21 °F (Wood, SD) to about 25 °F (Hemingford, NE). July is the warmest month with average temperatures ranging from about 72 °F (Hemingford, NE) to about 76 °F (Wood, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. This large annual range attests to the continental nature of the climate of this area. Wind speeds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, strong storms bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	102-113 days
Freeze-free period (characteristic range)	122-133 days
Precipitation total (characteristic range)	19-20 in
Frost-free period (actual range)	93-118 days
Freeze-free period (actual range)	118-146 days
Precipitation total (actual range)	18-20 in
Frost-free period (average)	106 days
Freeze-free period (average)	130 days
Precipitation total (average)	19 in

Climate stations used

- (1) CRAWFORD [USC00251973], Crawford, NE
- (2) CHADRON 3NE [USC00251578], Chadron, NE
- (3) HAY SPRINGS [USC00253710], Hay Springs, NE
- (4) PINE RIDGE AP [USW00094039], Pine Ridge, SD
- (5) PORCUPINE 11 N [USC00396736], Kyle, SD
- (6) MARTIN 5 E [USC00395285], Martin, SD
- (7) LONGVALLEY [USC00394983], Long Valley, SD
- (8) INTERIOR 3 NE [USC00394184], Interior, SD
- (9) GORDON 6N [USC00253355], Gordon, NE

- (10) CEDAR BUTTE 1NE [USC00391539], White River, SD

Influencing water features

No riparian or wetland features are directly associated with the Sandy 17-20” PZ ecological site.

Wetland description

Not Applicable.

Soil features

The soils in this site commonly have a surface layer of loamy very fine sand to very fine sandy loam 3 to 30 inches thick. Slopes range from 0 to 30 percent. The soils are well drained or somewhat excessively drained. They formed in eolian deposits, alluvium, colluvium, or residuum. The subsurface layer generally ranges from loam to fine sand. This site typically has slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Waterflow paths are broken, irregular in appearance, or discontinuous and obstructed by numerous debris dams or vegetative barriers. The surface of the soil is stable and intact. Subsurface soil layers are not restrictive to water movement and root penetration.
Major Soils Correlated to the Sandy 17-20” PZ Ecological Site: Anselmo, Bayard, Busher, Jayem, Manter, Ponderosa, Sarben, and Tuthill

In MLRA 64, some sandy soils in the 17 to 20 inch precipitation zone have the potential to support conifer (forest-like) plant communities. The Ponderosa soil is on the Pine Ridge escarpment in Nebraska. Other sandy soils that are in the MLRA, adjacent to the Shallow (R064XY040NE) ecological site, and support ponderosa pine may also develop forest-like plant communities.

The soils of this ecological site are susceptible to wind and water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Loss of 50 percent or more of the surface layer can result in a shift in species composition and production.
More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center or use the Web Soil Survey online for details specific to your area of interest.

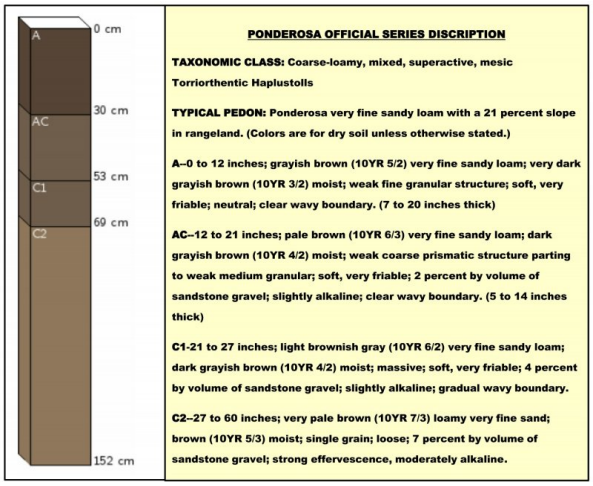


Figure 8.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Colluvium–sedimentary rock (3) Residuum–sandstone (4) Eolian deposits

Surface texture	(1) Fine sandy loam (2) Very fine sandy loam (3) Loamy very fine sand (4) Loam
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to rapid
Soil depth	20–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–7 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–9
Soil reaction (1:1 water) (0-40in)	5.6–8.4
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

The Sandy 17-20” PZ ecological site developed under Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer), without adequate recovery periods following each grazing occurrence, causes this site to depart from the Bluestem-Prairie Sandreed Plant Community (1.1). Species such as western wheatgrass, prairie sandreed, needle and thread, prairie Junegrass, Scribner’s panicum, and sedges increase. Continued deterioration results in a community dominated by warm-season shortgrass, sand dropseed, and sedges. Warm-season grasses such as sand bluestem, big bluestem, little bluestem, and eventually prairie sandreed decrease in frequency and production.

Plant communities in the Sandy 17-20” PZ ecological site can include minor amounts of ponderosa pine and Rocky Mountain juniper if these species grow on adjacent sites. On the Pine Ridge escarpment, areas of the Sandy 17-20” PZ ecological site, primarily those with north- or east-facing slopes, have the potential to develop into open ponderosa pine woodlands or savannas. Studies indicate that ponderosa pine first established in this area sometime between the early 1700s and the 1800s (Tolstead, 1947; Kaye et al., 2010).

Fire frequency is believed to have been every 5 to 15 years prior to 1900. Because of fire suppression activities, the stand density of ponderosa pine in some stands in the Pine Ridge area has increased along with excessive ladder fuels. As a result, the potential for large crown fires has increased (Nebraska Forest Service, 2013). This increase is evidenced by fires in 1989, 2006, and 2012 that had a combined burn area of more than 200,000 acres. Very hot fires can have a detrimental effect on this site and the associated plant communities. Once hot fires remove ponderosa pine from the plant communities, the pine may not regenerate for many decades, if ever. If pockets of ponderosa pine endure after fire, ponderosa pine does not disappear from the Pine Ridge landscape. Regeneration,

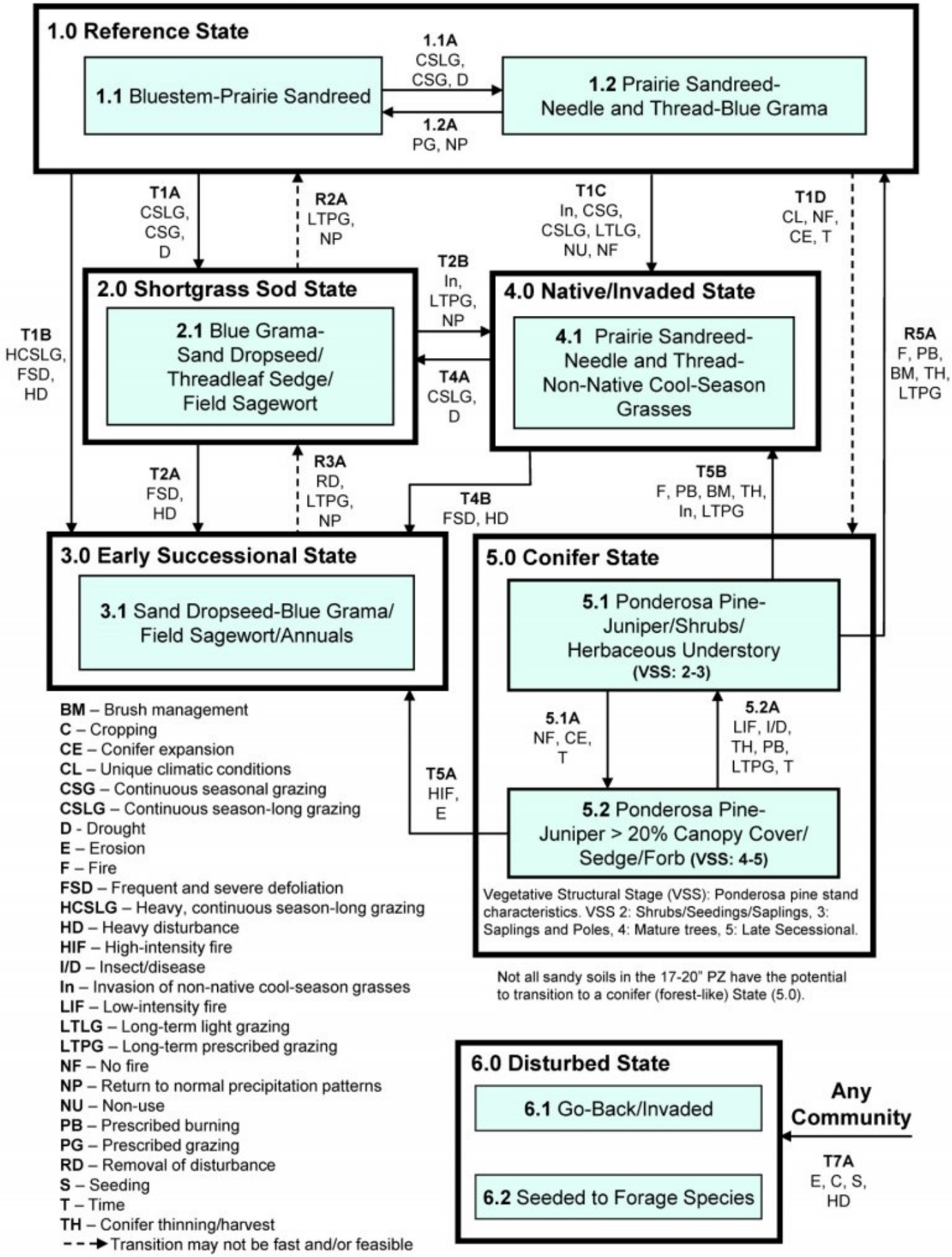
however, is slow, and a return of pine woodlands takes a very long time (Gaarder, 2013). Rock outcrops and deep draws on the Pine Ridge provide refugia during fire. Surviving mature trees provide a seed source for future regeneration.

Interpretations of this site are primarily based on the Bluestem-Prairie Sandreed Plant Community (1.1). The community was determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Also studied were trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts. Plant communities, states, transitional pathways, and thresholds were determined through similar studies and experience.

The following state-and-transition diagram illustrates the common plant communities on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Sandy 17-20" PZ – R064XY032NE 11/15/19



BM – Brush management
C – Cropping
CE – Conifer expansion
CL – Unique climatic conditions
CSG – Continuous seasonal grazing
CSLG – Continuous season-long grazing
D - Drought
E – Erosion
F – Fire
FSD – Frequent and severe defoliation
HCSLG – Heavy, continuous season-long grazing
HD – Heavy disturbance
HIF – High-intensity fire
I/D – Insect/disease
In – Invasion of non-native cool-season grasses
LIF – Low-intensity fire
LTLG – Long-term light grazing
LTPG – Long-term prescribed grazing
NF – No fire
NP – Return to normal precipitation patterns
NU – Non-use
PB – Prescribed burning
PG – Prescribed grazing
RD – Removal of disturbance
S – Seeding
T – Time
TH – Conifer thinning/harvest
- - → Transition may not be fast and/or feasible

Diagram Legend: Sandy 17-20" PZ - R064XY032NE

T1A	1.0 to 2.0	Continuous season-long grazing, continuous seasonal grazing; or heavy grazing in combination with drought.
T1B	1.0 to 3.0	Heavy, continuous season-long grazing; frequent and severe defoliation; or heavy disturbance.
T1C	1.0 to 4.0	Invasion of non-native cool-season grasses; continuous seasonal grazing; continuous season-long grazing; long-term light grazing; or extended periods of non-use and no fire.
T1D	1.0 to 5.0	Long-term no fire; favorable climatic conditions; expansion of conifers on the site; and time.
T2A	2.0 to 3.0	Frequent and severe defoliation; or heavy disturbance.
T2B	2.0 to 4.0	Invasion of non-native cool-season grasses; return to normal precipitation patterns; and long-term prescribed grazing with proper stocking rates, change in season of use, and adequate time for recovery.
T4A	4.0 to 2.0	Continuous season-long grazing; or heavy grazing in combination with drought.
T4B	4.0 to 3.0	Frequent and severe defoliation; or heavy disturbance.
T5A	5.0 to 3.0	High-intensity fire; and possibly soil erosion.
T5B	5.0 to 4.0	Invasion of non-native cool-season grasses; fire; prescribed burning; mechanical brush management; timber thinning or harvest; long-term prescribed grazing with proper stocking rates, change in season of use, and adequate time for recovery.
T7A	Any Plant Community	Heavy disturbance, such as soil erosion or tillage; abandonment of cropland; or tillage and seeding to introduced perennial forage crops.

R2A	2.0 to 1.0	A return to normal precipitation patterns following drought; long-term prescribed grazing. This transition may take an extended period of time and in the end not meet management objectives.
R3A	3.0 to 2.0	Removal of management induced disturbance; a return to normal precipitation patterns following drought; long-term prescribed grazing. This transition may take an extended period of time and in the end not meet management objectives.
R5A	5.0 to 1.0	Fire; prescribed burning; mechanical brush management; timber thinning or harvest; long-term prescribed grazing with proper stocking rates, change in season of use, and adequate time for recovery.

1.1A	1.1 to 1.2	Continuous season-long grazing; or continuous seasonal grazing; and extended periods of below normal precipitation.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery; a return to normal precipitation patterns following drought.
5.1A	5.1 to 5.2	Long-term no fire; expansion of conifers; and time.
5.2A	5.2 to 5.1	Low-intensity fire; insect or disease damage; timber thinning or harvest; prescribed burning; and long-term prescribed grazing with proper stocking rates, change in season of use, adequate time for recovery, and time.

State 1
Reference State

The Reference State (1.0) represents the best estimate of the natural range of variability that dominated the dynamics in the Sandy 17-20” PZ ecological site prior to European settlement. This site, in the Reference State, is dominated by warm-season grasses and sub-dominant cool-season grass. Forbs are common and diverse. Shrub species vary depending on precipitation and slope aspect. Ponderosa pine and Rocky Mountain juniper can grow naturally on some soils adjacent to sites that have established conifer plant communities. Grazing or the lack of grazing, fire, and drought are the major drivers between plant communities.

Community 1.1
Bluestem-Prairie Sandreed

Interpretations are based primarily on the Bluestem-Prairie Sandreed Plant Community. This is also considered to be the Reference Plant Community (1.1). This plant community is in areas that are properly managed with grazing and in some areas receiving occasional short periods of rest. The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. Mid- and tall-statured warm-season grasses dominate this plant community. The major grasses include sand bluestem, big bluestem, prairie sandreed, and little bluestem. Dominant cool-season grasses include needle and thread and western wheatgrass. Blue grama, sideoats grama, and sedge grow as an understory. Forbs are common and diverse. Common shrubs include leadplant, rose, and small soapweed. A limited number of ponderosa pine or Rocky Mountain juniper grow in a few areas. The diversity in plant species allows for high drought tolerance. This is a sustainable plant community in terms of soil

and site stability, watershed function, and biologic integrity. This plant community is extremely resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high drought tolerance. Community dynamics, nutrient cycle, water cycle, and energy flow function properly. Plant litter is properly distributed with very little movement off-site, and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1640	2016	2375
Forb	115	180	250
Shrub/Vine	45	144	250
Tree	0	60	125
Total	**1800**	**2400**	**3000**

Figure 10. Plant community growth curve (percent production by month). NE6405, Pine Ridge/Badlands, warm-season dominant. Warm-season dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	7	15	20	30	15	5	5		

Community 1.2
Prairie Sandreed-Needle and Thread-Blue Grama

This plant community evolved under continuous seasonal grazing or continuous season-long grazing. The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. A mixture of warm- and cool-season grasses dominates the site. Prairie sandreed, needle and thread, and blue grama are significant species in this plant community. Sand bluestem and big bluestem decrease compared to the Bluestem-Prairie Sandreed Plant Community (1.1), while prairie sandreed, needlegrasses, and short grasses increase. Forbs and shrubs do not change significantly in composition compared to Plant Community 1.1. Community Phase 1.2 maintains diversity but has lower production levels than Plant Community 1.1. Community Phase 1.2 is resistant to change. The herbaceous species are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1470	1730	1985
Forb	15	110	205
Shrub/Vine	15	110	205
Tree	0	50	105
Total	**1500**	**2000**	**2500**

Figure 12. Plant community growth curve (percent production by month). NE6404, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	15	24	23	15	5	5		

Pathway 1.1A
Community 1.1 to 1.2

Continuous seasonal grazing, continuous season-long grazing, or heavy grazing in combination with drought convert the Reference Plant Community (1.1) to the Prairie Sandreed-Needle and thread-Blue Grama Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing or a return to normal precipitation patterns following drought convert this plant community to the Bluestem-Prairie Sandreed Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2
Shortgrass Sod State

The Shortgrass Sod State (2.0) is dominated by shortgrass species and upland sedges. This state is the result of grazing management that does not provide adequate recovery time for tall- and mid-statured warm- and cool-season grasses. The hydrologic function of this state may be altered. Runoff is high, and infiltration is low. This state is very resistant to change through grazing management alone.

Community 2.1
Blue Grama-Sand Dropseed/Threadleaf Sedge/Field Sagewort

This plant community evolves from long-term continuous seasonal grazing or continuous season-long grazing or from heavy grazing during drought. Shortgrasses, sand dropseed, and sedges are dominant in the plant community. The grazing-tolerant blue grama or hairy grama and sedges replace sand bluestem, big bluestem, little bluestem, and prairie sandreed. Western wheatgrass and needle and thread remain in the plant community but in relatively minor amounts. Because of the grazing pressure, field sagewort, fringed sagewort, scurfpea, and yucca become more prevalent in the plant community. Non-native species, such as cheatgrass or field brome, tend to invade this plant community. This plant community is typically resistant to change. Runoff increases compared to Plant Community 1.0, and infiltration decreases. Continued overuse results in a considerable extent of bare ground and a high potential for erosion.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	825	1183	1435
Forb	65	105	145
Shrub/Vine	10	77	145
Tree	0	35	75
Total	**900**	**1400**	**1800**

Figure 14. Plant community growth curve (percent production by month). NE6403, Pine Ridge/Badlands, cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	10	20	25	20	10	5	5		

State 3
Early Successional State

The Early Successional State (3.0) is dominated by weedy annuals and biennials, sand dropseed, blue grama, and

field sagewort (green sagewort). This state is the result of heavy disturbance, such as frequent and severe defoliation from rodents, or heavy livestock concentrations coupled with grazing management that does not provide adequate time for recovery in the Reference State (1.0) or the Shortgrass Sod State (2.0). State 3.0 can also be the result of a high-intensity fire and subsequent soil erosion in the Conifer State (5.0). The hydrologic function is also likely to be dramatically altered. Runoff is high, and infiltration is low. The Early Successional State (3.0) is very resistant to change through grazing management alone.

Community 3.1
Sand Dropseed-Blue Grama/Field Sagewort/Annuals

This plant community develops where rangeland is grazed year-round at high stocking densities or is subject to frequent and severe defoliation. The plant composition is made up of annuals and a few species of perennial forbs and grasses that are tolerant to frequent and severe defoliation. Dominant species are sand dropseed, blue grama, and field sagewort. Most of the mid-statured grasses have been eliminated or severely reduced in extent. Cheatgrass has invaded the site. Perennial forbs are Cuman ragweed, rush skeletonplant, scurfpea, and hairy false goldenaster. Annual buckwheat, Rocky Mountain beeplant, fringed sagewort, and cactus can be abundant in this community. This plant community can also result if a conifer-dominated plant community is subject to a high-intensity fire that removes most, if not all, of the conifers from the plant community. Initially, weedy species, such as common mullein, thistle, and annual grasses and forbs, occupy the site. In time, upland sedges, shortgrass species, and dropseed become dominant. This transition is most likely to come from the Ponderosa Pine-Juniper > 20 Percent Canopy Cover/Sedges/Forbs Plant Community (5.2). This plant community is resistant to change due to the lack of perennial species and the number of annuals and invaders occupying the site. Soil erosion is high due to the increased extent of bare ground. Infiltration is low, and runoff is high because of the lack of litter and viable plant population.

State 4
Native/Invaded State

The Native/Invaded State (4.0) has been invaded by non-native cool-season grasses but not at the levels to which the plant community is dominated by these species. The majority of species are native to this site, including cool-season mid-grasses, warm-season mid- and tall-grasses, and warm-season short-grasses. Forbs are common and diverse, and shrubs vary in amounts. The Native/Invaded State is the result of long-term non-use in combination with above-average precipitation or the result of continuous seasonal grazing or continuous season-long grazing. Because of the invasion and persistence of non-native cool-season grasses, this state is unlikely to return to the Reference State (1.0).

Community 4.1
Prairie Sandreed-Needle and Thread-Non-Native Cool-Season Grasses

This plant community results from invasion of non-native cool-season grasses, long-term non- use, and no fire or from continuous seasonal grazing or continuous season-long grazing. Non-native species include Kentucky bluegrass, smooth brome, and annual brome grasses. Typically, the non-native species do not occur at a level at which they dominate the site. This plant community closely resembles the Prairie Sandreed-Needle and Thread-Blue Grama Plant Community (1.2). The potential vegetation is about 90 percent grasses or grass-like species, 5 percent forbs, and 5 percent shrubs. Native species include prairie sandreed, needle and thread, blue grama, western wheatgrass, threadleaf sedge, sand dropseed, and little bluestem. Forbs commonly include white sagebrush (cudweed sagewort), prairie coneflower, scurfpea, Cuman ragweed, and field sagewort. Shrubs include rose, leadplant, and fringed sagewort. This plant community is resistant to change due to the presence of non-native cool-season grasses. Soil erosion is low to moderate. The water cycle is functioning, but infiltration is moderate and runoff has increased.

State 5
Conifer State

The Conifer State (5.0) develops if ponderosa pine, Rocky Mountain juniper, or both become established and expand on this site. As conifer canopy cover increases, the herbaceous component declines and more bare ground is exposed. As competition from herbaceous species decrease, conifers tend to establish more readily. Grazing can

contribute to this transition, but the transition may also develop independently without human influence other than fire suppression and through unique climatic conditions. Ponderosa pine regeneration in MLRA 64, specifically on the Pine Ridge escarpment, should not be directly compared to that in the Black Hills (MLRA 62) where ponderosa pine regeneration readily occurs following fire or timber harvest. MLRA 64 is much drier, and optimal conditions for ponderosa pine germination and establishment are not common. In some ways, the regeneration of ponderosa pine is more similar to the regeneration found in the drier American Southwest, where germination and establishment are strongly episodic (pulses) and at least partly controlled by climate. For example, ponderosa pine in the Southwest require a warm wet spring and an above-average water supply throughout the year for germination and seedling establishment. One study from northern Arizona showed a large cohort of ponderosa pine that established within a 2-year period between 1919 and 1920 when an optimal combination of temperature and precipitation factors occurred. This episodic event was not repeated again for 73 years (Savage et al., 1996). Successful establishment of ponderosa pine in the Great Plains is unpredictable and requires a combination of sufficient seed availability, adequate year-long soil moisture, a lack of persistent drought, and no fire that affects seedling survival (Kaye et al., 2010). USDA and the Nebraska National Forest and Grasslands categorize ponderosa pine stand characteristics into six Vegetation Structural Stages (VSS). VSS is a method of describing forest age and tree size from seedling to old forests (M.D. Gould, personal communication, 2019). VSS 1 (Grass/Forb): Forest openings created by disturbances, such as fire or wind throw, 0”–0.9” diameter at breast height (DBH). VSS 2 (Shrubs/Seedlings): Developmental stage dominated by tree seedlings, saplings (1”–4.9” DBH), and shrub species. VSS 3 (Sapling/Pole): Developmental stage dominated by young trees (5”–11.9” DBH). VSS 4 (Mature): Trees that are larger and older than VSS 3 (12”–17.9” DBH). VSS 5 (Late Successional): Trees 18”–23.9” DBH. VSS 6 (Late Successional): Trees 24” DBH and greater. This stage is not likely to exist on the Pine Ridge escarpment (M.D. Gould, personal communication, 2019). These stages can be subdivided into three canopy-closure classes: (a) less than 40 percent, (b) 40 to 70 percent, and (c) greater than 70 percent. As a general rule, the higher the percentage of cover, the higher the potential of catastrophic fire. These vegetation structural stages are referenced in the plant community narratives and state-and-transition model.

Community 5.1
Ponderosa Pine-Juniper/Shrubs/Herbaceous Understory (VSS: 2-3)

Historically, ponderosa pine and juniper were confined to ridges and steep, north- or east-facing slopes adjacent to rock outcrops. Plant Community 5.1 results from fire suppression and the expansion of ponderosa pine and juniper onto the Sandy 17-20” PZ ecological site. Ponderosa pine and juniper are relatively young and primarily consist of saplings, poles, and scattered mature trees. The pine canopy can range from 5 percent to greater than 40 percent. The understory is about 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs. Dominant grasses and grass-like species include needle and thread, little bluestem, sideoats grama, blue grama, and sedge. Grasses of secondary importance include Canada wildrye, green needlegrass, and western wheatgrass. Forbs commonly found in this community include white sagebrush (cudweed sagewort), western yarrow, and pussytoes. Shrubs can include fringed sagewort, western snowberry, chokecherry, American plum, and poison ivy. This plant community is in VSS 2 and 3 of the USDA Nebraska National Forests Vegetation Structural Stages. These stages include stands of pine seedlings and saplings, pole trees, and mid-aged trees with varying extent of canopy cover. Generally, the higher the percentage of cover, the greater the risk of catastrophic fire. Compared to the Bluestem-Prairie Sandreed Plant Community (1.1), this community has increased ponderosa pine or juniper. The grass component decreases as the buildup of pine and juniper needles increases. Annual herbaceous production also decreases. Although the conifer canopy provides excellent protection from the weather for both livestock and wildlife, Plant Community 5.1 is not capable of supporting large numbers of wildlife and livestock due to decreased production. This plant community is resistant to change. A significant reduction of conifers can only be accomplished through fire or mechanical removal. The vegetation in the understory is capable of enduring fire without a detrimental effect to the site and the associated plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	365	650	1015
Tree	45	150	275
Shrub/Vine	45	125	205
Forb	45	75	105
Total	**500**	**1000**	**1600**

Figure 16. Plant community growth curve (percent production by month). NE6411, Pine Ridge/Badlands, heavy conifer canopy. Mature ponderosa pine/juniper overstory.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	10	20	28	15	5	4	4	2	1

Community 5.2
Ponderosa Pine-Juniper > 20% Canopy Cover/Sedges/Forb (VSS 4-5)

This plant community is produced by long-term fire suppression resulting in the expansion of ponderosa pine and juniper on the ecological site. Doak Nickerson, northwest district forester for the Nebraska Forest Service, Chadron, Nebraska, is quoted in the Omaha World-Herald in an article titled “After wildfires, ponderosa pines burned out of Pine Ridge” (Gaarder, 2013). He stated “An acre that once had 30 to 50 ponderosa pines before European settlement might now have 2,000 to 3,000 trees.” The canopy of ponderosa pine and juniper in this plant community can have greater than 70 percent mature trees. A thick duff layer, composed of pine needles and cones, can develop under the pine canopy and limit the growth of the herbaceous understory. The understory is about 75 percent grasses and grass-like species, 10 percent forbs, and 15 percent shrubs and immature trees. Dominant grasses and grass-like species include upland sedges, needle and thread, and little bluestem. Grasses of secondary importance include Canada wildrye and green needlegrass. Common forbs in this community include white sagebrush (cudweed sagewort) and pussytoes. Shrubs can include western snowberry, chokecherry, American plum, creeping barberry, and poison ivy. This plant community is in VSS 4 and 5 of the USDA Nebraska National Forests Vegetation Structural Stages. These stages include mature and late successional stands of trees (averaging an 18-inch DBH) with varying canopy cover. Generally, the higher the percentage of cover, the greater the risk of catastrophic fire. Compared to the Bluestem-Sideoats Grama-Needlegrass-Western Wheatgrass Plant Community (1.1), the plant community has significantly increased ponderosa pine or juniper. The grass component decreases dramatically as the buildup of pine and juniper needles increases. Annual production also decreases significantly. This plant community is resistant to change. A significant reduction of conifers can only be accomplished through fire, mechanical brush management, or thinning. The vegetation in the understory is capable of enduring fire; however, very hot fires have a detrimental effect to the site and the associated plant community that can last for many years.

Figure 17. Plant community growth curve (percent production by month). NE6411, Pine Ridge/Badlands, heavy conifer canopy. Mature ponderosa pine/juniper overstory.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	7	10	20	28	15	5	4	4	2	1

Pathway 1.5A
Community 5.1 to 5.2

Long-term fire suppression, the expansion of conifers in the site, and time are likely to move this plant community to the Ponderosa Pine-Juniper > 20% Canopy Cover/Sedge/Forb (VSS: 4-5) Plant Community (5.2).

Pathway 5.2A
Community 5.2 to 5.1

Insects or disease, low-intensity fires, thinning or timber harvest, or periodic prescribed burning followed by long-term prescribed grazing and time may transition Plant Community 5.2 back to the Ponderosa Pine-Juniper/Shrubs/Herbaceous Understory (VSS 2-3) Plant Community (5.1).

Conservation practices

Brush Management
Prescribed Burning
Forest Stand Improvement

State 6
Disturbed State

Any plant community can transition to the Disturbed State (6.0). The two separate vegetative plant communities found in this state are highly variable. They are derived through different management scenarios and are not related by succession. Infiltration, runoff, and soil erosion vary depending upon the vegetation on the site.

Community 6.1
Go-Back/Invaded

The Go-Back/Invaded Plant Community (6.1) can result whenever severe mechanical disturbance occurs (e.g., areas of tilled and abandoned cropland). During the early successional stages, the species that mainly dominate are annual grasses and forbs, later replaced by both native and introduced perennials. The vegetation in this plant community can vary greatly. In some cases, the community is dominated by threeawn, dropseed, annual brome, crested wheatgrass, smooth brome, broom snakeweed, sweetclover, and non-native thistles. Other common plants can include western wheatgrass, deathcamas, prickly lettuce, kochia, squirreltail, foxtail, and annual sunflower. Bare ground is prevalent in the Go-back/Invaded Community Phase (6.1) due to the loss of organic matter and lower overall soil health.

Community 6.2
Seeded to Forage Species

The Seeded to Forage Species Plant Community (6.2) normally includes those areas seeded to adapted forage species. Refer to the USDA-NRCS electronic field office technical guide for the appropriate Forage Suitability Group description.

Transition T1A
State 1 to 2

Continuous seasonal grazing, continuous season-long grazing without change in season of use, or heavy grazing in combination with drought convert the Reference State (1.0) to the Shortgrass Sod State (2.0).

Transition T1B
State 1 to 3

Frequent and severe defoliation or heavy disturbance, including usage as livestock feeding areas, prairie dog towns, and calving pastures, transition the Reference State (1.0) to the Early Successional State (3.0).

Transition T1C
State 1 to 4

Invasion of non-native cool-season grasses, continuous seasonal grazing, continuous season-long grazing, long-term light grazing, or extended periods of non-use and no fire transition the Reference State (1.0) to the Native/Invaded State (4.0).

Transition T1D
State 1 to 5

Long-term fire suppression, favorable climatic conditions that allow for pine regeneration and establishment, expansion of conifers, and time transition the Reference State (1.0) to the Conifer State (5.0).

Transition T7A
State 1 to 6

Heavy disturbance, including soil erosion, tillage, abandonment of cropland, or seeding to improved pasture species, results in a transition to the Disturbed State (6.0).

Restoration pathway R2A
State 2 to 1

Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing may convert this plant community to the Reference State (1.0). A return to normal precipitation patterns following drought helps with recovery. This transition may not be rapid or meet management objectives.

Conservation practices

Prescribed Grazing

Transition T2A
State 2 to 3

Frequent and severe defoliation or heavy disturbance, including usage as livestock feeding areas, prairie dog towns, and calving pastures, transitions the Shortgrass Sod State (2.0) to the Early Successional State (3.0).

Transition T2B
State 2 to 4

Long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery following grazing and the invasion of non-native cool-season grasses transition the Shortgrass Sod State (2.0) to the Native Invaded State (4.0). A return to normal precipitation patterns following drought will help facilitate this transition.

Conservation practices

Prescribed Grazing

Transition T7A
State 2 to 6

Heavy disturbance, including soil erosion, tillage, abandonment of cropland, or seeding to improved pasture species, results in a transition to the Disturbed State (6.0).

Restoration pathway R3A
State 3 to 2

Removal of any management-induced disturbance coupled with long-term prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery after grazing may convert this plant community to the Shortgrass Sod State (2.0). A return to normal precipitation patterns following drought helps with recovery. This transition may not be rapid or meet management objectives.

Conservation practices

Prescribed Grazing

Transition T7A
State 3 to 6

Heavy disturbance, including soil erosion, tillage, abandonment of cropland, or seeding to improved pasture species, results in a transition to the Disturbed State (6.0).

Transition T4A
State 4 to 2

Continuous season-long grazing moves the Native/Invaded State to the Shortgrass State 2.0. Heavy grazing in combination with expended periods of drought will also facilitate this transition. During this transition, the plant community can have the appearance of a mosaic, with sod and mixed-grass communities intermingled. As the plant community becomes dominated by shortgrasses, runoff increases and infiltration decreases.

Transition T4B
State 4 to 3

Frequent and severe defoliation or heavy disturbance, including usage as livestock feeding areas, prairie dog towns, and calving pastures, results in a transition to the Early Successional State (3.0).

Transition T7A
State 4 to 6

Heavy disturbance, including soil erosion, tillage, abandonment of cropland, or seeding to improved pasture species, result in a transition to the Disturbed State (6.0).

Restoration pathway R5A
State 5 to 1

Prescribed burning or wildfire followed by long-term prescribed grazing move this plant community towards the herbaceous dominated Reference State (1.0). Mechanical removal of pine and juniper, through managing brush, harvesting timber, or thinning, followed by long-term prescribed grazing may also allow the understory to develop and transition to the Reference State (1.0). Trees on the steeper escarpments and in the deeper canyons may escape most fires and provide a seed source for ponderosa pine expansion in the future. This transition is most likely to occur from the Ponderosa Pine-Juniper Cover/Herbaceous Understory (VSS: 2-3) Plant Community (5.1).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Forest Stand Improvement

Transition T5A
State 5 to 3

High-intensity fire and, in some cases, excessive soil erosion cause a transition from the Conifer State (5.0) to the Early Successional State (3.0). Initially, weedy species, including annual grasses and forbs, common mullein, and thistles, become established. Within a relative short time, however, upland sedges and shortgrasses dominate the plant community. Trees on the steeper escarpments and in the deeper canyons may escape most fires and provide a seed source for ponderosa pine expansion in the future. This transition can occur from any plant community within the Conifer State (3.0) but is most likely from the Ponderosa Pine-Juniper > 20% Canopy Cover/Sedge/Forb (VSS: 4-5) Plant Community (5.2).

Transition T5B
State 5 to 4

The invasion of non-native cool-season grasses and either wild fire or prescribed burning move this plant community towards the herbaceous dominated Native/Invaded State (4.0). Mechanical removal of pine and juniper, through managing brush, harvesting timber, or thinning, may also allow the understory to develop and transition to the Native/Invaded State (4.0). Even though non-native cool-season grasses have invaded this plant community, long-term prescribed grazing can maintain this plant community in a productive and sustainable state. The long-term prescribed grazing should include proper stocking, change in season of use, and adequate recovery following grazing events. Trees on the steeper escarpments and in the deeper canyons may escape most fires and provide a seed source for conifer expansion in the future. This transition is most likely to occur from the Ponderosa Pine-Juniper/Shrubs/Herbaceous Understory (VSS: 2-3) Plant Community (5.1).

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid- Warm-Season Grasses**			480–1440	
	prairie sandreed	CALO	*Calamovilfa longifolia*	240–720	–
	sand bluestem	ANHA	*Andropogon hallii*	240–720	–
	big bluestem	ANGE	*Andropogon gerardii*	120–480	–
	little bluestem	SCSC	*Schizachyrium scoparium*	120–480	–
2	**Cool-Season Bunchgrass**			360–600	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	360–600	–
	green needlegrass	NAVI4	*Nassella viridula*	0–120	–
3	**Short Warm-Season Grasses**			120–360	
	blue grama	BOGR2	*Bouteloua gracilis*	120–360	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–120	–
4	**Other Native Grasses**			240–600	
	sideoats grama	BOCU	*Bouteloua curtipendula*	48–240	–
	western wheatgrass	PASM	*Pascopyrum smithii*	120–240	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	24–240	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	24–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	24–120	–
	switchgrass	PAVI2	*Panicum virgatum*	24–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–120	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	24–72	–
	Grass, perennial	2GP	*Grass, perennial*	24–72	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–48	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	–	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	–	–
	Canada wildrye	ELCA4	*Elymus canadensis*	–	–
5	**Native Grass-Likes**			24–72	
	threadleaf sedge	CAFI	*Carex filifolia*	24–72	–
	sedge	CAREX	*Carex*	0–24	–

	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–24	–
6	**Non-Native Cool-Season Grasses**			0	
Forb					
7	**Forbs**			120–240	
	scurfpea	PSORA2	*Psoralidium*	24–72	–
	lupine	LUPIN	*Lupinus*	24–48	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	24–48	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–48	–
	Forb, perennial	2FP	*Forb, perennial*	0–48	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	24–48	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	24–48	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–48	–
	prairie clover	DALEA	*Dalea*	0–24	–
	false boneset	BREU	*Brickellia eupatorioides*	0–24	–
	blazing star	LIATR	*Liatris*	0–24	–
	goldenrod	SOLID	*Solidago*	0–24	–
	field sagewort	ARCA12	*Artemisia campestris*	0–24	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–24	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–24	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–24	–
	common sunflower	HEAN3	*Helianthus annuus*	0–24	–
	Forb, annual	2FA	*Forb, annual*	0–24	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–24	–
	pussytoes	ANTEN	*Antennaria*	0–24	–
	beardtongue	PENST	*Penstemon*	0–24	–
	spiderwort	TRADE	*Tradescantia*	0–24	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–24	–
	Texas croton	CRTE4	*Croton texensis*	0–24	–
	thistle	CIRSI	*Cirsium*	0–24	–
	vervain	VERBE	*Verbena*	0–24	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	–	–
	common mullein	VETH	*Verbascum thapsus*	–	–
Shrub/Vine					
8	**Shrubs**			48–240	
	leadplant	AMCA6	*Amorpha canescens*	24–168	–
	rose	ROSA5	*Rosa*	24–120	–
	soapweed yucca	YUGL	*Yucca glauca*	24–48	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–48	–
	pricklypear	OPUNT	*Opuntia*	0–48	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–48	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–24	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–24	–

	skunkbush sumac	RHTR	*Rhus trilobata*	–	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	–	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	–	–
	currant	RIBES	*Ribes*	–	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	–	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	–	–
	creeping barberry	MARE11	*Mahonia repens*	–	–
	chokecherry	PRVI	*Prunus virginiana*	–	–
	American plum	PRAM	*Prunus americana*	–	–
Tree					
9	**Trees**			0–120	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–120	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–24	–
	common juniper	JUCO6	*Juniperus communis*	–	–
	green ash	FRPE	*Fraxinus pennsylvanica*	–	–
	boxelder	ACNE2	*Acer negundo*	–	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid- Warm-Season Grasses**			500–1000	
	prairie sandreed	CALO	*Calamovilfa longifolia*	300–700	–
	little bluestem	SCSC	*Schizachyrium scoparium*	40–200	–
	sand bluestem	ANHA	*Andropogon hallii*	40–200	–
	big bluestem	ANGE	*Andropogon gerardii*	40–200	–
2	**Cool-Season Bunchgrass**			300–600	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	300–600	–
	green needlegrass	NAVI4	*Nassella viridula*	0–100	–
3	**Short Warm-Season Grasses**			100–400	
	blue grama	BOGR2	*Bouteloua gracilis*	100–400	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–100	–
4	**Other Native Grasses**			300–600	
	western wheatgrass	PASM	*Pascopyrum smithii*	100–300	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	40–200	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–200	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	100–200	–
	switchgrass	PAVI2	*Panicum virgatum*	0–100	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	20–100	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	20–100	–
	Grass, perennial	2GP	*Grass, perennial*	20–60	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–40	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–40	–

	spiked muhly	MUGL3	*Muhlenbergia glomerata*	–	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	–	–
	Canada wildrye	ELCA4	*Elymus canadensis*	–	–
5	**Native Grass-Likes**			100–200	
	threadleaf sedge	CAFI	*Carex filifolia*	100–200	–
	sedge	CAREX	*Carex*	0–20	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–20	–
6	**Non-Native Cool-Season Grasses**			0	
Forb					
7	**Forbs**			20–200	
	field sagewort	ARCA12	*Artemisia campestris*	20–100	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	40–100	–
	scurfpea	PSORA2	*Psoralidium*	20–60	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	20–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–60	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	20–40	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–40	–
	lupine	LUPIN	*Lupinus*	20–40	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	20–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	20–40	–
	Forb, perennial	2FP	*Forb, perennial*	0–40	–
	Forb, annual	2FA	*Forb, annual*	0–20	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–20	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–20	–
	pussytoes	ANTEN	*Antennaria*	0–20	–
	hoary puccoon	LICA12	*Lithospermum canescens*	0–20	–
	spiderwort	TRADE	*Tradescantia*	0–20	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	0–20	–
	Texas croton	CRTE4	*Croton texensis*	0–20	–
	thistle	CIRSI	*Cirsium*	0–20	–
	vervain	VERBE	*Verbena*	0–20	–
	common sunflower	HEAN3	*Helianthus annuus*	0–20	–
	common mullein	VETH	*Verbascum thapsus*	0–20	–
	beardtongue	PENST	*Penstemon*	0–20	–
	prairie clover	DALEA	*Dalea*	0–20	–
	false boneset	BREU	*Brickellia eupatorioides*	0–20	–
	blazing star	LIATR	*Liatris*	0–20	–
	goldenrod	SOLID	*Solidago*	0–20	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	–	–
Shrub/Vine					
8	**Shrubs**			20–200	
	rose	ROSA5	*Rosa*	20–100	–
	leadplant	AMCA6	*Amorpha canescens*	20–100	–

	soapweed yucca	YUGL	*Yucca glauca*	20–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–40	–
	pricklypear	OPUNT	*Opuntia*	0–40	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–20	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–20	–
	skunkbush sumac	RHTR	*Rhus trilobata*	–	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	–	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	–	–
	currant	RIBES	*Ribes*	–	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	–	–
	creeping barberry	MARE11	*Mahonia repens*	–	–
	chokecherry	PRVI	*Prunus virginiana*	–	–
	American plum	PRAM	*Prunus americana*	–	–
Tree					
9	**Trees**			0–100	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–100	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–20	–
	common juniper	JUCO6	*Juniperus communis*	–	–
	green ash	FRPE	*Fraxinus pennsylvanica*	–	–
	boxelder	ACNE2	*Acer negundo*	–	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid- Warm-Season Grasses**			0–140	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–140	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–28	–
	sand bluestem	ANHA	*Andropogon hallii*	–	–
	big bluestem	ANGE	*Andropogon gerardii*	–	–
2	**Cool-Season Bunchgrass**			28–140	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	28–140	–
	green needlegrass	NAVI4	*Nassella viridula*	–	–
3	**Short Warm-Season Grasses**			280–560	
	blue grama	BOGR2	*Bouteloua gracilis*	280–560	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–70	–
4	**Other Native Grasses**			28–112	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	70–140	–
	Grass, perennial	2GP	*Grass, perennial*	0–70	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–70	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	14–42	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var.*	14–42	–

			scribnerianum		
	prairie Junegrass	KOMA	*Koeleria macrantha*	14–28	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–14	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–14	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–14	–
	Canada wildrye	ELCA4	*Elymus canadensis*	–	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	–	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	–	–
	switchgrass	PAVI2	*Panicum virgatum*	–	–
5	**Native Grass-Likes**			140–280	
	threadleaf sedge	CAFI	*Carex filifolia*	140–280	–
	sedge	CAREX	*Carex*	0–140	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–14	–
6	**Non-Native Cool-Season Grasses**			28–140	
	cheatgrass	BRTE	*Bromus tectorum*	28–140	–
	field brome	BRAR5	*Bromus arvensis*	0–70	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–70	–
Forb					
7	**Forbs**			70–140	
	field sagewort	ARCA12	*Artemisia campestris*	28–140	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	14–70	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	14–56	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	14–42	–
	common sunflower	HEAN3	*Helianthus annuus*	0–42	–
	Forb, perennial	2FP	*Forb, perennial*	0–42	–
	Forb, annual	2FA	*Forb, annual*	0–42	–
	vervain	VERBE	*Verbena*	14–42	–
	scurfpea	PSORA2	*Psoralidium*	14–42	–
	thistle	CIRSI	*Cirsium*	0–28	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	0–28	–
	common mullein	VETH	*Verbascum thapsus*	0–28	–
	pussytoes	ANTEN	*Antennaria*	0–28	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	0–14	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–14	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–14	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–14	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–14	–
	blazing star	LIATR	*Liatris*	0–14	–
	goldenrod	SOLID	*Solidago*	0–14	–
	Texas croton	CRTE4	*Croton texensis*	0–14	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	–	–
	hoary puccoon	LICA12	*Lithospermum canescens*	–	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	–	–

	prairie clover	DALEA	*Dalea*	–	–
	false boneset	BREU	*Brickellia eupatorioides*	–	–
	lupine	LUPIN	*Lupinus*	–	–
	beardtongue	PENST	*Penstemon*	–	–
	spiderwort	TRADE	*Tradescantia*	–	–
Shrub/Vine					
8	**Shrubs**			14–140	
	prairie sagewort	ARFR4	*Artemisia frigida*	14–70	–
	pricklypear	OPUNT	*Opuntia*	14–70	–
	soapweed yucca	YUGL	*Yucca glauca*	14–42	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	rose	ROSA5	*Rosa*	0–28	–
	leadplant	AMCA6	*Amorpha canescens*	0–28	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–28	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–14	–
	creeping barberry	MARE11	*Mahonia repens*	–	–
	chokecherry	PRVI	*Prunus virginiana*	–	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	–	–
	skunkbush sumac	RHTR	*Rhus trilobata*	–	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	–	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	–	–
	currant	RIBES	*Ribes*	–	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	–	–
	American plum	PRAM	*Prunus americana*	–	–
Tree					
9	**Trees**			0–70	
	ponderosa pine	PIPO	*Pinus ponderosa*	0–14	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	0–14	–
	common juniper	JUCO6	*Juniperus communis*	–	–
	green ash	FRPE	*Fraxinus pennsylvanica*	–	–
	boxelder	ACNE2	*Acer negundo*	–	–

Table 12. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall & Mid- Warm-Season Grasses**			20–300	
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–150	–
	little bluestem	SCSC	*Schizachyrium scoparium*	10–100	–
	sand bluestem	ANHA	*Andropogon hallii*	0–50	–
	big bluestem	ANGE	*Andropogon gerardii*	10–50	–
2	**Cool-Season Bunchgrass**			20–150	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	20–150	–
	green needlegrass	NAVI4	*Nassella viridula*	0–50	–

3	**Short Warm-Season Grasses**			10–150	
	blue grama	BOGR2	*Bouteloua gracilis*	10–150	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–50	–
4	**Other Native Grasses**			50–200	
	western wheatgrass	PASM	*Pascopyrum smithii*	10–100	–
	Canada wildrye	ELCA4	*Elymus canadensis*	10–100	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	10–80	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–50	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	10–50	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	10–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–50	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	10–50	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	10–30	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–20	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–10	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
	switchgrass	PAVI2	*Panicum virgatum*	–	–
5	**Native Grass-Likes**			20–150	
	sedge	CAREX	*Carex*	20–150	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–50	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–10	–
6	**Non-Native Cool-Season Grasses**			10–150	
	Kentucky bluegrass	POPR	*Poa pratensis*	10–150	–
	cheatgrass	BRTE	*Bromus tectorum*	0–50	–
	field brome	BRAR5	*Bromus arvensis*	0–50	–
Forb					
7	**Forbs**			50–100	
	common mullein	VETH	*Verbascum thapsus*	10–50	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–50	–
	lupine	LUPIN	*Lupinus*	10–50	–
	Forb, annual	2FA	*Forb, annual*	0–50	–
	pussytoes	ANTEN	*Antennaria*	0–30	–
	vervain	VERBE	*Verbena*	10–30	–
	Forb, perennial	2FP	*Forb, perennial*	0–30	–
	thistle	CIRSI	*Cirsium*	0–20	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–20	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–20	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–20	–
	common sunflower	HEAN3	*Helianthus annuus*	0–10	–
	blazing star	LIATR	*Liatris*	0–10	–
	goldenrod	SOLID	*Solidago*	0–10	–
	field sagewort	ARCA12	*Artemisia campestris*	0–10	–

	beardtongue	PENST	*Penstemon*	0–10	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–10	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–10	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–10	–
	scurfpea	PSORA2	*Psoralidium*	0–10	–
	spiderwort	TRADE	*Tradescantia*	–	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	–	–
	Texas croton	CRTE4	*Croton texensis*	–	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	–	–
	hoary puccoon	LICA12	*Lithospermum canescens*	–	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	–	–
	prairie clover	DALEA	*Dalea*	–	–
	false boneset	BREU	*Brickellia eupatorioides*	–	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	–	–
Shrub/Vine					
8	**Shrubs**			50–200	
	American plum	PRAM	*Prunus americana*	20–50	–
	rose	ROSA5	*Rosa*	20–50	–
	creeping barberry	MARE11	*Mahonia repens*	10–50	–
	chokecherry	PRVI	*Prunus virginiana*	20–50	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–50	–
	soapweed yucca	YUGL	*Yucca glauca*	0–30	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–30	–
	skunkbush sumac	RHTR	*Rhus trilobata*	10–30	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	10–30	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–30	–
	currant	RIBES	*Ribes*	0–30	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	10–30	–
	pricklypear	OPUNT	*Opuntia*	0–20	–
	leadplant	AMCA6	*Amorpha canescens*	0–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	–
	western sandcherry	PRPUB	*Prunus pumila var. besseyi*	0–10	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–10	–
Tree					
9	**Trees**			50–250	
	ponderosa pine	PIPO	*Pinus ponderosa*	50–200	–
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	10–50	–
	common juniper	JUCO6	*Juniperus communis*	10–20	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–10	–
	boxelder	ACNE2	*Acer negundo*	0–10	–

Table 13. Community 6.2 plant community composition

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

Animal community

Wildlife Interpretations:
MLRA 64 is 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, this MLRA consisted of diverse grassland and shrubland 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 wolf, mountain lion, and grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant and remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox are associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem in which fire, herbivory, and climate functioned as the primary disturbance factors, either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further affected plant and animal communities. The bison was a historical keystone species but has been extirpated in this area as a free-ranging herbivore. The loss of the bison and the reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development reduced habitat quality for area-sensitive species.

Within MLRA 64, the Sandy 17-20” PZ ecological site provides upland grassland cover with an associated forb and shrub component. The site was typically part of an expansive grassland landscape that included combinations of Badlands, Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Shallow, Overflow, Subirrigated, and Terrace ecological sites. The site provided habitat for species requiring unfragmented grassland. Important habitat features and components found commonly or exclusively on this site include sharp-tailed grouse leks; upland nesting habitat for grassland birds; forbs and insects for brood habitat; and a forage source for small and large herbivores. Populations are declining for many bird species that nest in grasslands and shrub steppes. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The majority of this ecological site remains intact and provides increasingly important habitat for birds that nest in grasslands and shrub steppes and for small rodents, coyote, and a variety of reptiles, amphibians, and insects. Invasive species, such as Kentucky bluegrass and cheatgrass, have impacted the biological integrity of the site for some grassland birds. Changes to the historic fire regime and domestic grazing have impacted the composition of forbs, shrubs, and grasses.

Bluestem-Prairie Sandreed (1.1) and Prairie Sandreed-Needle and Thread-Blue Grama (1.2): The predominance of grasses plus a high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as deer and pronghorn. Insects, including pollinators, play a large role in maintaining the forb community and provide a forage base for grassland birds and other species. The complex plant structural diversity provides habitat for a wide array of migratory and resident birds. Grasshopper sparrow, lark bunting, western meadowlark, and sharp-tailed grouse are common and benefit from the structure and composition this plant community provides. Diverse prey populations are available for grassland raptors, such as ferruginous hawk, Swainson’s hawk, golden eagle, and prairie falcon.

The diversity of grasses, forbs, and shrubs provides high nutritional levels for small and large herbivores, including voles, mice, spotted ground squirrel, desert cottontail, white-tailed jackrabbit, black-tailed jackrabbit, and deer. The higher stature of this plant community provides thermal, protective, and escape cover for herbivores and grassland birds. Predators that use this plant community include coyote, American badger, red fox, and long-tailed weasel. This plant community provides limited habitat for amphibians, mostly toads (i.e., Great Plains, Woodhouse’s, and Plains spade-foot). Prey abundance and shade opportunities may attract multiple reptile species, such as gopher snake, milk snake, prairie rattlesnake, and western ornate box turtle. Several species of sand loving lizards, such as the lesser earless lizard, prairie lizard, many-lined skink, and six-lined racerunner, use this site.

Continuous season-long grazing, no fire, or no use result in a shift to a prairie sandreed, needle and thread, and blue grama community. The forb and shrub diversity does not substantially decrease. Juniper and ponderosa pine remain a limited component of the plant community and provide little specialized wildlife habitat. The shift from the Reference Plant Community (1.1) to the Prairie Sandreed-Needle and Thread-Blue Grama Plant Community (1.2) does not result in a significant change to the wildlife community.

Continuous seasonal grazing of the grass component results in a shift to a medium to short height plant community. Forb and shrub abundance increases; however, the plant community changes do not significantly change the wildlife community from that of the Reference Plant Community (1.1).

Blue Grama-Sand Dropseed/Threadleaf Sedge/Field Sagewort (2.1): This community results from continuous season-long grazing where blue grama and sedges eventually dominate. Forb abundance is increased compared to the reference state, and forb diversity is relatively unchanged. Shrub and tree abundance and diversity remain relatively unchanged and do not significantly benefit a specific wildlife group.

A shift to shorter plant structure favors prairie dog expansion and associate species, such as ferruginous hawk, burrowing owl, tiger salamander, and swift fox. Species such as horned lark, long-billed curlew, upland sandpiper, white-tailed jackrabbit, and black-tailed jackrabbit increase due to the loss of the tall grass component. This plant community may provide areas suitable for development of sharp-tailed grouse leks. The short stature of this plant community limits thermal, protective, and escape cover. Predators that use this plant community include coyote, American badger, red fox, and long-tailed weasel.

Conifer State (3.0): This state results from no fire and the expansion of ponderosa pine and juniper. Compared to the reference site, forb diversity is decreased and shrub abundance is increased. Juniper and ponderosa pine increase significantly. Grass species decline dramatically. The grass species composition shifts and can become dominated by invasive species. Ponderosa pine and juniper stands provide nesting cover, escape cover, and den sites for a variety of species. Species that increase include mule deer, 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, 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 are significantly reduced. Raptors, such as the long-eared owl, increase.

If the tree canopy is high enough, then bare ground is likely to increase and excessive runoff, nutrient loads, and sediment loads may impact offsite aquatic habitat.

Grazing Interpretations:
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate estimates of carrying capacity should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/acre (air-dry weight) per animal-unit-month (AUM) with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow, with or without calf, for one month.

Plant Community: Bluestem-Prairie Sandreed (1.1)
Average Production (lb/acre, air-dry): 2,400
Stocking Rate (AUM/acre): 0.66

Plant Community: Prairie Sandreed-Needle and Thread-Blue Grama (1.2)
Average Production (lb/acre, air-dry): 2,000
Stocking Rate (AUM/acre): 0.55

Plant Community: Blue Grama-Sand Dropseed/Threadleaf Sedge/Field Sagewort (2.1)
Average Production (lb/acre, air-dry): 1,400
Stocking Rate (AUM/acre): 0.38

*Plant Community: Ponderosa Pine-Juniper/Shrubs/Herbaceous Understory (VSS: 2-3) (5.1)
Average Production (lb/acre, air-dry): 1,000
**Stocking Rate (AUM/acre): 0.27

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

* Total annual production and stocking rates are highly variable and require onsite sampling.

** Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may have been reduced to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting herbage production on this site. Soils on this site are in Hydrologic Soil Groups A and B. The infiltration rate is moderate. Runoff potential varies from moderate to high, depending on soil hydrologic group and ground cover. In many cases, areas that have greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An exception occurs where shortgrasses form a dense sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. 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 upland game species. The wide variety of plants that bloom from spring until fall have an aesthetic value that appeals to visitors. A wide diversity of species for birders is also appealing.

Wood products

The Pine Ridge escarpment is the primary source of wood products in MLRA 64. Some soils in this area may produce marketable ponderosa pine. Steep slopes, however, may make this resource inaccessible 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.

Before the 1950s, ponderosa pines covered approximately 250,000 acres of the Pine Ridge escarpment. Wildfires have reduced that to less than 120,000 acres. Much of the remaining acreage is also at risk of catastrophic fire because dense stands of pine and cedar have created dense stands of fuel (Gaarder, 2013). Forest and grazing land 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. They also recommend additional access roads for fire protection, the expansion of defensible space around homes and building, and education on “Fire Wise” practices (Nebraska Forest Service, 2014).

Other products

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

Other information

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site description (ESD) has passed Quality Control (QC) and Quality Assurance (QA) to ensure the it meets the 2014 NESH standards for a Provisional ecological site description.

This ESD is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The document fully described the Reference State and Community Phase in the State-and-Transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected that it will continue refinement toward an “Approved” status.

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. Those involved in developing this site include: Stan Boltz, range management specialist (RMS), NRCS; Jill Epley, RMS, NRCS; Rick Peterson, RMS, NRCS; David Steffen, RMS, NRCS; Jeff Vander Wilt, RMS, NRCS; Phil Young, soil scientist, NRCS; Kent Cooley, resource soil scientist, NRCS; George Gamblin, RMS, NRCS; Dr. James O’Rourke, emeritus professor, Chadron State College, and range professional and rancher; Wade Anderson, range professional and rancher; and Jack Butler, scientist emeritus, USDA-Forest Service, Rocky Mountain Research Station, Rapid City, South Dakota.

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C.A. Carpenter, and W.H McNab. 2007. Ecological subregions: Sections and subsections of the conterminous United States. USDA Forest Service, General Technical Report WO-76D. https://www.fs.fed.us/research/publications/misc/73326-wo-gtr-76d-cleland2007.pdf (accessed 31 January 2019).

U.S. Environmental Protection Agency. 2018. EPA level III and level IV ecoregions of the conterminous United States. https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- conterminous-united-states (accessed 26 April 2018).

High Plains Regional Climate Center, University of Nebraska. 2018. http://www.hprcc.unl.edu/ (accessed 6 April 2018).

Steele, Ken, M.P. Fisher, and D.D. Steele. 2018. Fort Laramie and the Hartville Uplift. In: Geology of Wyoming. https://www.geowyo.com/fort-laramie--hartville-uplift.html (accessed 14 November 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Electronic field office technical guide. https://efotg.sc.egov.usda.gov (accessed 12 April 2018).

Soil Survey Staff. 2018. Official soil series descriptions. USDA Natural Resources Conservation Service. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587 (accessed 12 April 2018).

Soil Survey Staff. 2018. Web Soil Survey. USDA Natural Resources Conservation Service. https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx (accessed 12 April 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. Agriculture Handbook 296. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2014. National ecological site handbook, 1st Ed. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcseprd1291232 (accessed 27 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2012. National engineering handbook, part 630. Hydrology chapters from e-Directives. https://directives.sc.egov.usda.gov/viewerFS.aspx?hid=21422 (accessed 17 January 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. Climate data. National Water and Climate Center. http://www.wcc.nrcs.usda.gov/ (accessed 12 April 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 1997. National range and pasture handbook, rev. 1, 2003. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1043055.pdf (accessed 7 November 2018).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. National Soil Information System, Information Technology Center. http://nasis.nrcs.usda.gov (accessed 7 November 2017).

U.S. Department of Agriculture, Natural Resources Conservation Service. 2018. PLANTS database. National Plant Data Team, Greensboro, NC. http://plants.usda.gov (accessed 12 April 2018).

Contributors

Rick L. Peterson
Stan C. Boltz

Approval

Suzanne Mayne-Kinney, 12/16/2024

Acknowledgments

This ecological site was reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS on 2/15/2019.

(1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410;
(2) fax: (202) 690-7442; or
(3) email: program.intake@usda.gov.

USDA is an equal opportunity provider, employer, and lender.

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)	Stan Boltz, Mitch Faulkner, Emily Helms, John Hartung, Ryan Murray, George Gamblin, Rick Peterson, Nadine Bishop, Jeff Nichols
Contact for lead author	jeffrey.nichols@usda.gov
Date	12/12/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills should not be present.

---

2. **Presence of water flow patterns:** Typically, none. Water flow patterns may be present on slopes of 15% or greater. When present, they will be no longer than 2 to 4 inches (5.1 to 10.2 cm), less than 3 inches (7.6 cm) wide, and discontinuous. Water flow patterns, when present, are often associated with animal activity.

---

3. **Number and height of erosional pedestals or terracettes:** None. Pedestals or terracettes should not be present.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically less than 5 percent.

---

5. **Number of gullies and erosion associated with gullies:** None. Gullies should not be present

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind scoured areas and depositional areas should not be present.

---

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount

of movement (less than 6 inches or 15 cm) of fine litter from water is possible, but not normal. Litter movement from wind is not expected.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 3 to 22 inches (7.6 to 55.9 cm) thick. Colors range from brown, dark grayish brown, grayish brown to pale brown (values of 4 to 6) when dry and very dark grayish brown, dark brown, brown, to dark grayish brown (values of 3 to 5) when moist. Structure typically is medium to fine granular at least in the upper A-horizon. If conditions are other than described above, refer to map unit component descriptions for the component on which the site occurs.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid and tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. Invasion of introduced cool-season grasses such as Kentucky bluegrass, smooth brome, annual brome, and crested wheatgrass may have an adverse impact infiltration and runoff.

    Relative composition is approximately 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. The grass component is composed of C4, tallgrasses (20-35%), C3 bunchgrasses (15-25%), C4 midgrasses (10-25%), C4, shortgrasses (5-15%), C3, rhizomatous grasses (5-10%), grass-likes (1-3%).

---

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. A compaction layer should not occur 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: Phase 1.1
    1. Native, perennial, C4, tallgrass, 480-840 #/ac, 20-35%, (4 species minimum): prairie sandreed, sand bluestem, big bluestem, switchgrass.
    2. Native, perennial, C3, bunchgrass, 360-600 #/ac, 15-25% (4 species minimum): needle and thread, prairie Junegrass, Indian ricegrass, green needlegrass, Scribner rosettegrass.
    3. Native, perennial, C4, midgrass, 240-600 #/ac, 10-25% (3 species minimum): little bluestem, sand lovegrass, sand dropseed, sideoats grama.

    Phase 1.2
    1. Native, perennial, C4, tallgrass, 500-800 #/ac, 25-40% (3 species minimum): sand bluestem, big bluestem, prairie sandreed, switchgrass.
    2. Native, perennial, C3, bunchgrass, 300-600 #/ac, 15-30% (3 species minimum): needle and thread, green needlegrass, prairie Junegrass, Indian grass, Canada wildrye.

    Sub-dominant: Phase 1.1
    1. Native, perennial, C4, shortgrass, 120-360 #/ac, 5-15% (1 species minimum): blue grama, hairy grama.

Phase 1.2
1. Native, perennial, C4, shortgrass, 100-400 #/ac, 5-20% (1 species minimum): hairy grama, blue grama.
2. Native, perennial, C4, midgrass, 100-300 #ac, 5-15% (2 species minimum): little bluestem, sand dropseed, sideoats grama, plains muhly.

Other: Minor - Phase 1.1
1. Native, perennial, C3, rhizomatous grass, 120-240 #/ac, 5-10%: western wheatgrass, thickspike wheatgrass.
2. Native forb, 120-240 #/ac (5-10%): forbs present vary from location to location.
3. Shrub, 48-240 #/ac, 2-10%: shrubs present vary from location to location.
4. Native, coniferous tree, 0-120 #/ac, 0-5%: ponderosa pine, Rocky Mountain Juniper.
5. Native grass-like, 24-73 #/ac, 1-3%: threadleaf sedge, other grass-likes.

Minor - Phase 1.2
1. Native grass-like, 100-200 #/ac, 5-10%: threadleaf sedge, other sedges, other grass-likes.
2. Native forb, 20-200 #/ac, 1-10%: species present vary from location to location.
3. Shrub, 20-200 #/ac, 1-10%: shrubs present vary from location to location.
4. Native, coniferous tree, 0-100 #/ac, 0-5%: ponderosa pine, Rocky Mountain juniper, common juniper.

Additional: The Bluestem-Prairie Sandreed Community or Reference Community (1.1) consists of nine F/S groups. These groups, in order of relative abundance, are native, perennial, C4, tallgrass; native, perennial, C3, bunchgrass; native, perennial, C4, midgrass; native, perennial, C4, shortgrass; native, perennial, C3, rhizomatous grass = native forb; shrub; native, coniferous tree, and native grass-like.

The Prairie Sandreed - Needle and Thread - Blue Grama Community (1.2) consists of eight F/S groups. These groups, in order of relative abundance, are native, perennial, C4, tallgrass; native, perennial, C3, bunchgrass; native, perennial, C4, shortgrass; native, perennial, C4, midgrass; native grass-like; native forb = shrub; native, coniferous tree.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Bunchgrasses have strong, healthy centers and few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.

---

14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 50 to 70 percent and at a depth of 0.25 to 0.50 inch (0.65 to 1.3 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production is 2,400 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 1,800 and 3,000 pounds per acre respectively.

---

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:** No non-native invasive species are present. Annual bromes, Kentucky bluegrass, smooth brome, crested wheatgrass, absinth wormwood, hound's tongue, eastern red cedar, and ponderosa pine* are known invasives that have the potential to become dominant or co-dominant on this site. Consult the state noxious weed and

state watch lists for potential invasive species. Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. *On the Ponderosa soil series, open stands of ponderosa are common in the reference plant community and this indicator should be rated with this in mind.

---

17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to recent weather conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.
