USDA Natural Resources Conservation Service

# Ecological site R064XY026NE
# Loamy Overflow

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## General information

**Provisional**. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

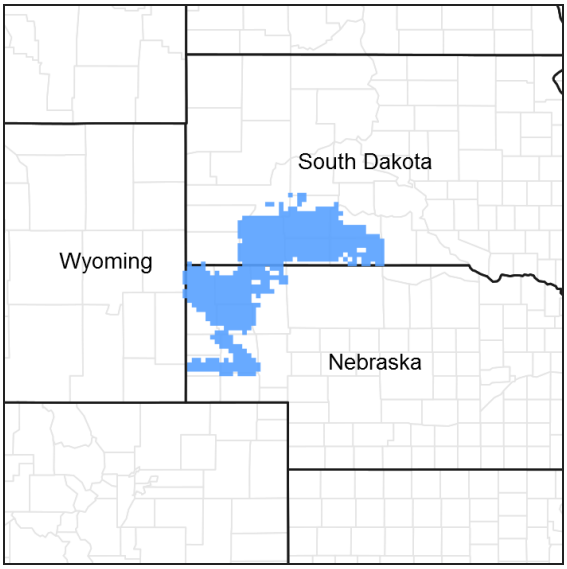


**Figure 1. Mapped extent**

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 is 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; however, 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 Loamy Overflow ecological site occurs throughout MLRA 64. It is located on Stream Orders 2 or greater. This site is a run-in site and receive additional moisture through overflow during flooding and high-water events, and to a minor extent, runoff from adjacent sites. The slopes range is from 0 to 5 percent. The soil surface layer is 3 to 15 inches in depth with a texture range of very fine sandy loam, loam, and silt clay loam. The natural vegetation will gradually shift from almost exclusively herbaceous species in the upper reaches of a drainage to a mix of species including; grasses, forbs, shrubs and trees, in the lower reaches.

Vegetation in reference consists primarily of warm- and cool-season tall and mid grasses. Big bluestem is the dominant warm-season grass, while western wheatgrass and needlegrasses are the dominant cool-season grasses. Forbs are common and very diverse. Patches of western snowberry, American plum, chokecherry, silver sage, and willow are almost always present. Trees species can exist throughout the site but are more likely to occur in the lower reaches. Major tree species include: plains cottonwood, green ash, bur oak, boxelder, and hackberry. This site is susceptible to encroachment of eastern redcedar form the surrounding uplands and breaks and from the invasion of non-native trees, including Russian olive and saltcedar. When disturbed, this site is very susceptible to invasion of non-native cool-season grasses, Canada thistle, hound’s tongue, and other weedy forbs.

## Associated sites

| | |
|---|---|
| R064XY037NE | **Thin Upland**<br>The Thin Upland ecological site can be found on steep upland slopes adjacent to the Loamy Overflow Site. |
| GX064X01X028 | **Loamy Terrace**<br>The Loamy Terrace ecological site can be found on the floodplain terrace immediately above the Loamy Overflow site. |
| GX064X01X015 | **Loamy 14-17" PZ**<br>The Loamy 14-17” PZ ecological site can be found on upland landscapes adjacent to the Loamy Overflow site. |
| GX064X01X036 | **Loamy 17-20" PZ**<br>The Loamy 17-20” PZ ecological site can be found on upland landscapes adjacent to the Loamy Overflow site. |

## Similar sites

| | |
|---|---|
| R064XY027NE | **Clayey Overflow**<br>The Clayey Overflow ecological site will occur on very similar landscapes positions with clayey soils. The plant community will have less bluestems and more rhizomatous wheatgrass than the Loamy Overflow site. Forage production will be nearly equal. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | Not specified |
| Herbaceous | (1) *Andropogon gerardii*<br>(2) *Pascopyrum smithii* |

## Physiographic features

The Loamy Overflow ecological site occurs on nearly level lowlands and drainageways that receive additional water from overflow of streams or runoff from adjacent slopes.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Flood plain<br>(2) Stream terrace |
| Runoff class | Negligible to high |
| Flooding duration | Very brief (4 to 48 hours) to brief (2 to 7 days) |
| Flooding frequency | Rare to frequent |
| Ponding frequency | None |
| Elevation | 884–1,524 m |
| Slope | 0–5% |
| Water table depth | 107–183 cm |
| 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 14 to 20 inches per year. 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 70 °F (Keeline 3 W, WY: 1953–1986) 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 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) | 92-120 days |
| Freeze-free period (characteristic range) | 119-139 days |
| Precipitation total (characteristic range) | 406-483 mm |
| Frost-free period (actual range) | 87-122 days |
| Freeze-free period (actual range) | 110-149 days |
| Precipitation total (actual range) | 381-508 mm |
| Frost-free period (average) | 107 days |
| Freeze-free period (average) | 130 days |
| Precipitation total (average) | 432 mm |

## Climate stations used

- (1) ALLIANCE 1WNW [USC00250130], Alliance, NE
- (2) HARRISON 20 SSE [USW00094077], Harrison, NE
- (3) HARRISON [USC00253615], Harrison, NE
- (4) HEMINGFORD [USC00253755], Hemingford, NE

- (5) INTERIOR 3 NE [USC00394184], Interior, SD
- (6) MARTIN [USC00395281], Martin, SD
- (7) WOOD [USC00399442], Wood, SD
- (8) LUSK 2 SW [USC00485830], Lusk, WY
- (9) TORRINGTON 29N [USC00488997], Jay Em, WY
- (10) CHADRON 3NE [USC00251578], Chadron, NE

## Influencing water features

This Loamy Overflow ecological site is located adjacent to intermittent and/or perennial streams and receives occasional flooding.

Stream Type: B6, C6, (Rosgen System)

## Wetland description

Not Applicable.

## Soil features

The soils of this site are very deep, moderately well to well-drained soils that formed in stratified alluvium on floodplains. These soils have slow to moderate permeability. The surface layer will vary from 3 to 15 inches deep and have one of the following textures: very fine sandy loam, loam, silt loam, or silty clay loam. These areas receive additional water from overflow of intermittent streams or runoff from adjacent slopes. Available water capacity is typically high. The general fertility level and organic content of these soils is medium to high. This site should show slight to no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Subsurface soil layers are not restrictive to water movement and root penetration.

Major soils correlated to the Loamy Overflow ecological site: Craft, Goshen, Haverson, Lohmiller, McCook, and Mobridge.

These soils are mainly susceptible to water erosion. Headcuts may develop if adequate vegetative cover is not maintained. A drastic loss of the soil surface layer on this site 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 for details specific to your area of interest, or go online to access USDA’s Web Soil Survey.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Alluvium |
| Surface texture | (1) Silt loam<br>(2) Silty clay loam<br>(3) Loam |
| Family particle size | (1) Loamy |
| Drainage class | Moderately well drained to well drained |
| Permeability class | Slow to moderate |
| Soil depth | 203 cm |
| Available water capacity (0-101.6cm) | 15.24–20.32 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0–25% |
| Electrical conductivity (0-101.6cm) | 0–8 mmhos/cm |

| | |
|---|---|
| Sodium adsorption ratio (0-101.6cm) | 0–10 |
| Soil reaction (1:1 water) (0-101.6cm) | 6.1–9 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–10% |
| Subsurface fragment volume >3" (Depth not specified) | 0–5% |

## Ecological dynamics

The Loamy Overflow 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.

Downcutting of the drainageway or stream channel will eventually leave the overflow site on a higher and drier landscape position. In this case the site will be described as the Loamy Terrace Ecological Site (R064XY028NE).

Continuous season-long grazing (during the typical growing season of May through October) and/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 Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1). Rhizomatous wheatgrass increases initially and will eventually decrease with continuous grazing. Grasses such as big bluestem, prairie cordgrass, and switchgrass will decrease in frequency and production. Introduced species such as Kentucky bluegrass, smooth brome, and cheatgrass invade the site as a result of inadequate recovery periods between grazing events and overstocking. Where trees dominate the site, woody regeneration will decline, and grasses and forbs will become dominant in the understory. It is thought that the Reference State (1.0) is an herbaceous-dominated site located on higher landscape positions where trees encroach from the adjacent Thin Breaks site and flooding events are infrequent. Where the Loamy Overflow site occupies lower landscape positions adjacent to streams, the plant community will typically be dominated by a mixed hardwood overstory. Major drivers of the Loamy Overflow ecological site are flooding, no-flooding, fire, no-fire, grazing, non-use, invasion of non-native woody plants and non-native cool-season grasses, and land-use conversion.

Interpretations are primarily based on the Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community. It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been 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

# Loamy Overflow R064XY026NE 1/31/19

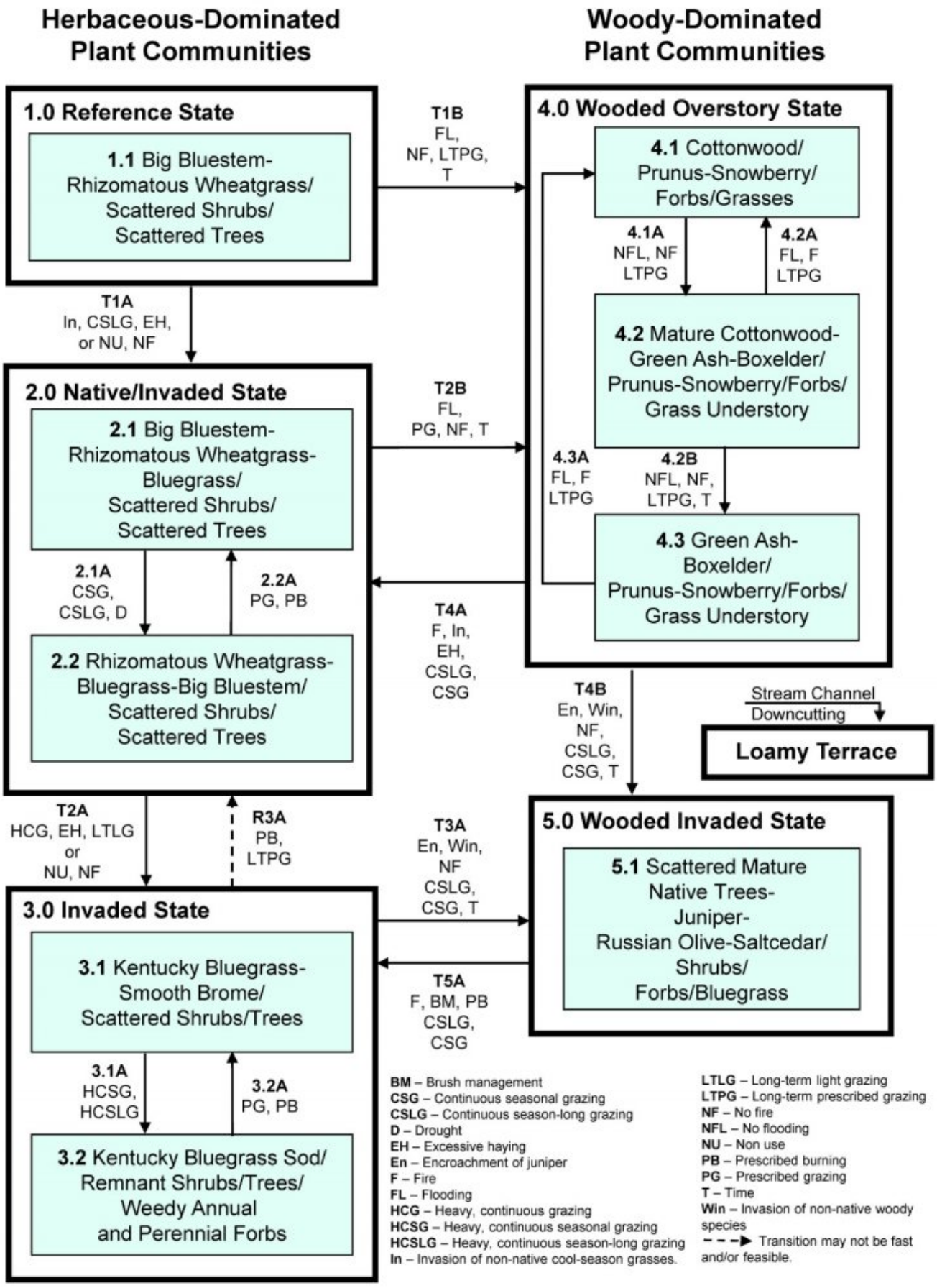

Diagram Legend - Loamy Overflow - R064XY026NE

| | |
|---|---|
| T1A | Continuous season-long grazing or excessive haying, invasion and establishment of non-native, cool-season grasses will cause this transition. Extended periods of non-use and no fire can also cause this transition. |
| T1B | Flooding and no fire, followed by long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides time for seedling establishment. |
| T2A | Heavy, continuous grazing, excessive haying, or long-term light grazing will cause this transition. Extended periods of non-use and no fire can also cause this transition. |
| T2B | Flooding and no fire, followed by prescribed grazing that included proper stocking, change in season of use, and deferment which provides time for seedling establishment. |
| T3A | Encroachment of juniper trees and/or invasion of non-native woody species, no fire, continuous season-long grazing, or continuous seasonal grazing, and time. |
| T4A | Fire, invasion of non-native, cool-season grasses, excessive haying, continuous season-long grazing, or continuous seasonal grazing. |
| T4B | Encroachment of juniper trees and/or invasion of non-native woody species, no fire, continuous season-long grazing, or continuous seasonal grazing, and time. |
| T5A | Fire, prescribed burning, and/or mechanical or chemical brush management, continuous season-long grazing or continuous seasonal grazing. |

| | |
|---|---|
| R3A | Long-term prescribed grazing with proper stocking rates, change in season of use, and time for adequate recovery, or possibly prescribed burning followed by long-term prescribed grazing. This transition may not be fast or feasible. |

| | | |
|---|---|---|
| 2.1A | 2.1 - 2.2 | Continuous seasonal grazing, continuous season-long grazing and/or heavy grazing in combination with drought. |
| 2.2A | 2.2 - 2.1 | Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery. Possibly prescribed burning followed by prescribed grazing. |
| 3.1A | 3.1 - 3.2 | Heavy, continuous seasonal grazing, or heavy, continuous season-long grazing. |
| 3.2A | 3.2 - 3.1 | Prescribed grazing with proper stocking, change in season of use, and adequate time for recovery. Possibly prescribed burning followed by prescribed grazing. |
| 4.1A | 4.1 - 4.2 | No flooding, no fire, long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration and time. |
| 4.2A | 4.2 - 4.1 | Flooding or fire, long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration. |
| 4.2B | 4.2 - 4.3 | No flooding, no fire, long-term prescribed grazing that included proper stocking, change in season of use, and time. |
| 4.3A | 4.3 - 4.1 | Flooding, fire, long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration. |

## State 1
## Reference State

The Reference State represents the best estimate of the natural range of variability that dominated the dynamics in this ecological site prior to European settlement. The Reference State may exist, but is unlikely to function within the natural range of variability due to the spread of Kentucky bluegrass and smooth brome onto this site. In the Reference State, this site is dominated by warm- and cool-season grasses, and various shrub and tree species that are scattered across the site. Grazing or the lack of grazing, flooding or lack of flooding, fire, excessive haying, and invasion of non-native cool-season grasses are the major drivers of this State. Flooding and no fire on this site can cause a transition to the Woody Overstory State (4.0).

### Community 1.1
### Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees

Interpretations are based primarily on the Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community. This is also considered to be the Reference Plant Community (1.1). This site evolved with

grazing by large herbivores and occasional prairie fires. This plant community can be found on areas with a history of proper grazing management, including adequate recovery periods between grazing events. The potential vegetation will consist of approximately 85 percent grasses or grass-like plants, 10 percent forbs, and 5 percent shrubs and trees. The plant community is dominated by both warm- and cool-season grasses. Major grasses include big bluestem, rhizomatous wheatgrasses. Other grasses and grass-likes include switchgrass, Canada wildrye, green needlegrass, prairie Junegrass, and blue grama. Forbs consist of American licorice, American vetch, aster species, and goldenrod. Woody species included in the plant community are western snowberry, silver buffaloberry, silver sagebrush, leadplant, and rose. Wyoming big sagebrush may occur on this site in the far western portion of the MLRA. Scattered plains cottonwood, green ash, and American elm also may occur. The potential for tree regeneration or establishment is relatively low. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow are functioning at the sites potential. Plant litter is properly distributed with some movement off-site and natural plant mortality is low. The diversity in plant species allows for high tolerance to drought. Run-off from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship.

**Table 5. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 2275 | 2993 | 3234 |
| Forb | 163 | 252 | 364 |
| Shrub/Vine | 28 | 101 | 174 |
| Tree | – | 17 | 39 |
| **Total** | **2466** | **3363** | **3811** |

**Figure 9. Plant community growth curve (percent production by month). NE6408, Pine Ridge/Badlands, lowland cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant, lowland.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 12 | 20 | 25 | 19 | 11 | 5 | 3 | | |

## State 2
## Native/Invaded State

The Native/Invaded State is very similar to the Reference State (1.0). It is still dominated by native mid- and tall warm- and cool-season grasses, but invasive non-native cool-season grasses are now present in all community phases of this State. These non-native cool-season grasses can comprise up to 30 percent of total annual air-dry production. The primary disturbance mechanisms for this State include grazing by domestic livestock, infrequent fires, and flooding. Timing and intensity of grazing events coupled with weather dictate the dynamics that occur within this State. The cool-season native grass can decline and an increase in introduced sodgrasses will occur. Many times, the Native/Invaded State appears as a mosaic of community phases caused primarily by continuous season-long grazing. This State represents the more common range of variability that exists with higher levels of grazing management but in the absence of periodic fire followed by short-term intensive grazing. The Native/Invaded State is dominated by cool- and warm-season grasses. It can be found on areas that are properly managed with grazing and prescribed burning, and sometimes on areas that receive occasional short periods of rest. Warm-season species can decline and a corresponding increase in cool-season grasses will occur.

### Community 2.1
### Big Bluestem-Rhizomatous Wheatgrass-Bluegrass/Scattered Shrubs/Scattered Trees

This plant community is the result of continuous season-long grazing without adequate recovery periods between each grazing event during the growing season, or excessive haying and invasion of non-native cool-season grasses. It can also be caused by extended periods of non-use and no fire. It is similar to the Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1), but it can also contain up to 30 percent (air-dry weight) of non-native cool-season grasses such as Kentucky bluegrass and smooth brome. The

potential vegetation consists of about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. The community is dominated by warm- and cool-season grasses. The major grasses include big bluestem, rhizomatous wheatgrass, and switchgrass. Other grasses that occur within this community include Canada wildrye, green needlegrass, prairie Junegrass, and blue grama. Major forbs and shrubs include American licorice, rose, goldenrod, purple prairie clover, silver buffaloberry, silver sagebrush, western snowberry, and leadplant. Wyoming big sagebrush may occur on this site in the far western portion of the MLRA. Scattered plains cottonwood, green ash, and American elm also may occur. This plant community is resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allows for high tolerance to drought. This is a sustainable plant community regarding site and soil stability, watershed function, and biologic integrity.

**Table 6. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 2057 | 2340 | 2572 |
| Forb | 135 | 280 | 448 |
| Shrub/Vine | 50 | 168 | 308 |
| Tree | – | 13 | 34 |
| **Total** | **2242** | **2801** | **3362** |

**Figure 11. Plant community growth curve (percent production by month). NE6408, Pine Ridge/Badlands, lowland cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant, lowland.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 12 | 20 | 25 | 19 | 11 | 5 | 3 | | |

## Community 2.2
## Rhizomatous Wheatgrass-Bluegrass-Big Bluestem/Scattered Shrubs/Scattered Trees

This plant community phase has shifted to cool-season rhizomatous midgrasses with lesser amounts of tall warm-season and mid- cool-season bunchgrasses. The vegetation is about 80 percent grasses and grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. Dominant grasses include rhizomatous wheatgrass, Kentucky bluegrass, and smooth brome with minor amounts of needlegrasses, big bluestem, and switchgrass. Major forbs include western ragweed, goldenrods, and western yarrow. Snowberry, silver buffaloberry, silver sagebrush, and rose are the dominant shrubs. Scattered cottonwood, green ash, and American elm trees may be present. Energy capture by this plant community phase has shifted from late spring and summer to early spring through early summer. This plant community is moderately resistant to change. The herbaceous species present 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 7. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 1872 | 2230 | 2438 |
| Forb | 123 | 193 | 280 |
| Shrub/Vine | 22 | 141 | 280 |
| Tree | – | 13 | 28 |
| **Total** | **2017** | **2577** | **3026** |

**Figure 13. Plant community growth curve (percent production by month). NE6407, Pine Ridge/Badlands, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant, lowland.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 8 | 25 | 30 | 15 | 10 | 2 | 5 | | |

### Pathway 2.1A
### Community 2.1 to 2.2

Continuous seasonal grazing (grazing at moderate to heavy stocking levels at the same time of year each year), or continuous season-long grazing, or heavy grazing in combination with drought will shift this community to the Rhizomatous Wheatgrass-Bluegrass/Scattered Shrubs/Scattered Trees Plant Community (2.2).

### Pathway 2.2A
### Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing, possibly including periodic rest, will convert this plant community to the Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (2.1). Prescribed burning may also be needed to suppress the cool-season invasive grasses.

## State 3
## Invaded State

This State is the result of invasion and dominance of introduced species. The Invaded State is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade-tolerant, introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen, which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns, thereby shifting competitive advantage to shade-tolerant introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D., et al., 2014).

### Community 3.1
### Kentucky Bluegrass-Smooth Brome/Scattered Shrubs/Trees

This plant community developed under continuous season-long grazing. It is dominated by Kentucky bluegrass, annual brome and other annual grasses and forbs. The dominant forbs include common mullein, western ragweed, scurfpeas, cudweed sagewort, and verbenas. Dominant shrubs in this community include snowberry, and rose. Compared to the Western Wheatgrass/Kentucky Bluegrass, Remnant Big Bluestem Plant Community, Kentucky bluegrass increases significantly and western wheatgrass and big bluestem has decreased significantly. Plant diversity and productivity has declined. This plant community is resistant to change, and if disturbed, it is resilient. Bluegrass will increase under grazing pressure. Cool, moist climatic conditions will also tend to increase bluegrass production. Soil erosion is low. Compared to the Big Bluestem/Western Wheatgrass Plant Community, infiltration is reduced, and runoff increases. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity.

**Table 8. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 448 | 913 | 1709 |
| Forb | 106 | 168 | 230 |
| Shrub/Vine | 6 | 34 | 62 |
| Tree | – | 6 | 17 |
| **Total** | **560** | **1121** | **2018** |

**Figure 15. Plant community growth curve (percent production by month).**

**NE6406, Pine Ridge/Badlands, lowland cool-season dominant. Cool-season dominant, lowland.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 13 | 28 | 28 | 12 | 5 | 6 | 3 | | |

### Community 3.2
### Kentucky Bluegrass Sod/Remnant Shrubs/Trees/Weedy Annual and Perennial Forbs

This plant community phase is a result of heavy, continuous seasonal grazing or heavy, continuous season-long grazing. It is characterized by a dominance of Kentucky bluegrass. The bluegrass dominance is at times so complete that other species are difficult to find on the site. A relatively thick duff layer can sometimes accumulate at or above the soil surface. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. Infiltration is greatly reduced, and runoff is high. Production will be significantly reduced when compared to the interpretive plant community. The period that palatability is high is relatively short, as Kentucky bluegrass matures rapidly. Energy capture is also reduced. Biological activity in the soil is likely reduced significantly in this phase. This plant community is resistant to change, and if disturbed, it is resilient. Bluegrass will increase under grazing pressure. Cool, moist climatic conditions will also tend to increase bluegrass production. Soil erosion is low. Compared to the Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1), infiltration is reduced, and runoff increases. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity.

### Pathway 3.1A
### Community 3.1 to 3.2

Heavy, continuous seasonal grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) or heavy, continuous season-long grazing will convert this plant community to the Kentucky Bluegrass Sod/Remnant Shrubs/Trees/Weedy Annual and Perennial Forbs Plant Community (3.2).

### Pathway 3.2A
### Community 3.2 to 3.1

Prescribed burning followed by prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing, possibly including periodic rest, may convert this plant community to the Kentucky Bluegrass-Smooth Brome/Scattered Shrubs/Trees Plant Community (3.1).

## State 4
## Wooded Overstory State

The Wooded Overstory State is the result of the establishment of a tree overstory and shrub mid-story canopy. This State is more common on the lower reaches of the site. The dynamics of the Wooded Overstory State are largely due to flooding and successional changes, starting with cottonwood and shrub establishment, and eventually the development of a green ash and boxelder plant community. The successional process can restart following another flooding event. Water control structures which limit flooding, livestock grazing, heavy wildlife browse, fire, the introduction of non-native, cool-season grasses, and encroachment of juniper can alter the dynamics of this site, resulting in old remnant stands of trees with little, if any regeneration. Downcutting of the drainageway or stream channel will eventually leave the overflow site on a higher and drier landscape position. In this case the site will be described as the Loamy Terrace Ecological Site (R064XY028NE).

### Community 4.1
### Cottonwood/Prunus-Snowberry/Forbs/Grasses

This plant community typically occurs after a flooding event. Flooding reduces herbaceous competition through scouring of the soil surface, which provides a site for regeneration and establishment of cottonwood and shrubs. Prescribed grazing, which prevents targeted grazing of cottonwood seedlings, is necessary for this plant community to establish. Trees will range from seedlings to saplings, and the herbaceous understory will still be productive as a

result of the filtered canopy of the deciduous trees. Understory shrubs, primarily plum, chokecherry, and snowberry will likely establish. However, other species, including silver buffaloberry, silver sagebrush, big sagebrush, and currants can occur and make up a significance percentage of the shrub layer.

**Figure 16. Plant community growth curve (percent production by month). NE6406, Pine Ridge/Badlands, lowland cool-season dominant. Cool-season dominant, lowland.**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 13 | 28 | 28 | 12 | 5 | 6 | 3 | | |

### Community 4.2
### Mature Cottonwood-Green Ash-Boxelder/Prunus-Snowberry/Forbs/Grass Understory

This plant community develops over time with prescribed grazing and no flooding or fire. Mature cottonwood trees and woody shrubs provide a suitable microclimate for establishment of other deciduous trees. Green ash and boxelder are typically the first trees to establish, but other species such as hackberry and possibly bur oak will establish as well. Regeneration of woody species will normally be evident (i.e., seedlings and saplings should be present). The herbaceous plant community will remain relatively productive, but will be reduced somewhat from the Reference Plant Community (1.1). This is due mainly to the competition from the woody shrub understory.

### Community 4.3
### Green Ash-Boxelder/ Prunus-Snowberry/Forbs/Grass Understory

This plant community develops over time, with prescribed grazing and no flooding. Mature cottonwood trees will likely remain in lesser numbers, but the dominant trees will normally consist of green ash and boxelder. At times there will be a mix of all three species; however, some areas will be dominated by one or two of these species. Woody shrubs will remain in the understory, but typically in lesser amounts than in the previous two plant communities. While somewhat reduced, the herbaceous understory will remain relatively productive. The trees will mostly be in the mature stage, but regeneration will normally be evident (i.e., seedlings and saplings should be present).

### Pathway 4.1A
### Community 4.1 to 4.2

No flooding, no fire, and long-term prescribed grazing that manages the herbaceous understory, but is not detrimental to woody regeneration, will allow this plant community to develop into the Mature Cottonwood-Immature Green Ash-Boxelder/Prunus-Snowberry/Forbs/Grass Understory Plant Community (4.2). Existing saplings must be large enough to avoid damage by livestock and wildlife for this pathway to occur.

### Pathway 4.2A
### Community 4.2 to 4.1

Flooding, and possibly fire, which opens-up the herbaceous understory and allows for woody regeneration, followed by long-term prescribed grazing that manages for woody regeneration and establishment will shift this plant community back to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1).

### Pathway 4.2B
### Community 4.2 to 4.3

No flooding, no fire, and long-term prescribed grazing that manages the herbaceous understory but is not detrimental to woody regeneration, and time will transition this plant community to the Green Ash-Boxelder/Prunus-Snowberry/Forbs/Grass Understory Plant Community (4.3).

### Pathway 4.3A
### Community 4.3 to 4.1

Flooding, and possibly fire, which opens up the herbaceous understory and allows for woody regeneration, followed

by long-term prescribed grazing that manages for woody regeneration and establishment will shift this plant community back to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1).

### State 5
### Wooded Invaded State

The Woody Invaded State developed as a result of continuous season-long grazing, or continuous seasonal grazing and no fire combined with the invasion and establishment of Russian olive, saltcedar, or juniper trees on this Loamy Overflow ecological site. With time, the cottonwood, boxelder, and ash trees that survive become mature, with little or no regeneration. This is due mainly to grazing of seedlings and saplings. Wildlife browse can also contribute to the loss of native tree and shrub regeneration. Grazing that limits regeneration also results in a reduction of the desirable native herbaceous species, often resulting in a dominance of species such as bluegrass and smooth brome, and forbs such as western ragweed, Canada thistle, burdock, and hound's tongue.

### Community 5.1
### Scattered Mature Native Trees-Juniper-Russian Olive-Saltcedar/Shrubs/Forbs/Bluegrass

This plant community developed due to the lack of natural occurring flooding events, native woody regeneration, and continuous season-long grazing without adequate recovery periods. Older mature trees remain, including cottonwood, boxelder, and green ash. The trees are scattered, and the site may have a "park-like" appearance with few trees and reduced understory. If grazed during the winter, the increased durations of livestock loitering can result in manure accumulations and soil compaction which will reduce the vigor of the native understory plant community. Kentucky bluegrass and smooth brome continue to persist as dominant grass species at reduced production rates. The presence of non-desirable forb species such as Canada thistle, burdock, and hound's tongue can be prolific and difficult to control. When invaded by Russian olive and/or saltcedar these species will increase dramatically over time and will eventually dominate the site.

### Transition T1A
### State 1 to 2

Continuous season-long grazing and/or excessive haying, or non-use and no fire, and the invasion of non-native cool-season grasses will transition the Reference Plant Community (1.1) to the Native/Invaded State (2.0).

### Transition T1B
### State 1 to 4

Flooding, followed by long-term prescribed grazing, and no fire are necessary to shift this plant community to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1). Flooding reduces herbaceous competition through scouring of the soil surface and provides a site for regeneration to occur. Once a flooding event occurs during the proper time, a long-term period of prescribed grazing is necessary to establish and maintain a woody plant community. Grazing during the mid-summer growing season typically has an adverse effect on woody regeneration. This State is more likely to occur and persist on the mid- to lower reaches of a drainage.

### Transition T2A
### State 2 to 3

Heavy, continuous grazing, excessive haying, or long-term light grazing will cause a transition the Invaded State (3.0). Extended periods of non-use and no fire will also result in the expansion of non-native cool-season grasses on this site. The ecological threshold can be identified by the percentage of non-native cool-season species in the plant community. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community composition and native grasses represent less than 40 percent (Toledo, D., et al., 2014). Smooth brome is assumed to follow a similar ecological threshold but is not documented scientifically.

### Transition T2B
### State 2 to 4

Flooding and no fire, followed by prescribed grazing and including proper stocking, change in season of use, and adequate time for recovery will likely transition this site to the Woody Overstory State (4.0). Timed grazing is very important and must be followed for many years for saplings to attain a height at which livestock will not damage or kill the trees. Wildlife browse can also be a concern if the management objective is to improve the overstory canopy. The Wooded Overstory State (4.0) is more likely to occur on the mid- to lower reaches of a drainageway.

### Restoration pathway R3A
### State 3 to 2

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) may lead this plant community phase over a threshold to the Native/Invaded State (2.0). Prescribed burning may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time, possibly up to ten years or more, and recovery may not be attainable. Success depends upon whether native reproductive propagules remain intact on the site.

### Transition T3A
### State 3 to 5

Encroachment of juniper trees from upland sites, or invasion of non-native trees, no fire for extended periods of time, continuous season-long grazing, or continuous seasonal grazing and time will cause a transition to the Wooded Invaded State (5.0). Canopy cover increases as trees increase in size, which alters microclimate and reduces fine fuel amounts, resulting in reduced fire intensity and frequency.

### Transition T4A
### State 4 to 2

Fire, invasion of non-native, cool-season grasses, excessive haying, continuous season-long grazing, or continuous seasonal grazing resulting in little woody regeneration, and time will transition this State to the Native/Invaded State (2.0).

### Transition T4B
### State 4 to 5

Encroachment of juniper from upland sites, and/or invasion of non-native trees, coupled with no fire and continuous season-long grazing or continuous seasonal grazing will transition this State (4.0) to the Wooded Invaded State (5.0).

### Transition T5A
### State 5 to 3

Fire, prescribed burning, or brush management to remove Russian olive and saltcedar, and continuous season-long grazing, or continuous seasonal grazing will transition this plant community to the Invaded State (3.0).

## Additional community tables

**Table 9. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Rhizomatous Wheatgrass** | | | 673–1009 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 673–1009 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–168 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–168 | – |
| 2 | **Cool-Season Bunchgrasses** | | | 168–336 | |

| | | | | | |
|---|---|---|---|---|---|
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 168–336 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 67–168 | – |
| 3 | **Tall Warm-Season Grasses** | | | 1009–1345 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 1009–1513 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 168–504 | – |
| | prairie cordgrass | SPPE | *Spartina pectinata* | 0–34 | – |
| 4 | **Other Native Grasses and Grass-likes** | | | 168–336 | |
| | sedge | CAREX | *Carex* | 168–336 | – |
| | Canada wildrye | ELCA4 | *Elymus canadensis* | 67–168 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 34–168 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 34–168 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–168 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 34–168 | – |
| | marsh muhly | MURA | *Muhlenbergia racemosa* | 0–135 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–101 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 34–101 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–101 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–67 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–67 | – |
| **Forb** | | | | | |
| 6 | **Forbs** | | | 168–336 | |
| | Forb, annual | 2FA | *Forb, annual* | 0–101 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–101 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 0–101 | – |
| | great ragweed | AMTR | *Ambrosia trifida* | 0–101 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 34–101 | – |
| | aster | ASTER | *Aster* | 34–101 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–101 | – |
| | scarlet beeblossom | OESU3 | *Oenothera suffrutescens* | 0–101 | – |
| | American licorice | GLLE3 | *Glycyrrhiza lepidota* | 34–101 | – |
| | starry false lily of the valley | MAST4 | *Maianthemum stellatum* | 0–101 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–101 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–101 | – |
| | goldenrod | SOLID | *Solidago* | 34–101 | – |
| | nettle | URTIC | *Urtica* | 0–101 | – |
| | vervain | VERBE | *Verbena* | 0–101 | – |
| | American vetch | VIAM | *Vicia americana* | 34–101 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 0–67 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Shrubs** | | | 34–168 | |
| | American plum | PRAM | *Prunus americana* | 0–168 | – |
| | chokecherry | PRVI | *Prunus virginiana* | 0–168 | – |

| | | | | | |
|---|---|---|---|---|---|
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 34–168 | – |
| | golden currant | RIAU | *Ribes aureum* | 0–101 | – |
| | rose | ROSA5 | *Rosa* | 34–101 | – |
| | Subshrub (<.5m) | 2SUBS | *Subshrub (<.5m)* | 0–101 | – |
| | leadplant | AMCA6 | *Amorpha canescens* | 0–101 | – |
| | silver buffaloberry | SHAR | *Shepherdia argentea* | 0–101 | – |
| | silver sagebrush | ARCA13 | *Artemisia cana* | 34–101 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–34 | – |
| **Tree** | | | | | |
| 8 | **Trees** | | | 0–34 | |
| | Tree | 2TREE | *Tree* | 0–34 | – |
| | boxelder | ACNE2 | *Acer negundo* | 0–34 | – |
| | common hackberry | CEOC | *Celtis occidentalis* | 0–34 | – |
| | hawthorn | CRATA | *Crataegus* | 0–34 | – |
| | green ash | FRPE | *Fraxinus pennsylvanica* | 0–34 | – |
| | plains cottonwood | PODEM | *Populus deltoides ssp. monilifera* | 0–34 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–34 | – |
| | American elm | ULAM | *Ulmus americana* | 0–34 | – |

**Table 10. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Rhizomatous Wheatgrass** | | | 560–841 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 773–1031 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–140 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–140 | – |
| 2 | **Cool-Season Bunchgrasses** | | | 56–140 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 28–140 | – |
| | green needlegrass | NAVI4 | *Nassella viridula* | 28–56 | – |
| 3 | **Tall- Warm-Season Grasses** | | | 560–841 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 420–841 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 140–280 | – |
| | prairie cordgrass | SPPE | *Spartina pectinata* | 0–28 | – |
| 4 | **Other Native Grasses and Grass-likes** | | | 140–280 | |
| | sedge | CAREX | *Carex* | 140–280 | – |
| | Canada wildrye | ELCA4 | *Elymus canadensis* | 56–140 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 28–140 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 28–140 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–129 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 28–84 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–84 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–84 | – |

| | | | | | |
|---|---|---|---|---|---|
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–56 | – |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–56 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 28–56 | – |
| | marsh muhly | MURA | *Muhlenbergia racemosa* | 0–56 | – |
| 5 | **Non-Native Cool-Season Grasses** | | | 140–420 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 56–280 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 28–280 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 28–56 | – |
| | field brome | BRAR5 | *Bromus arvensis* | 0–28 | – |
| **Forb** | | | | | |
| 6 | **Forbs** | | | 140–420 | |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 28–84 | – |
| | aster | ASTER | *Aster* | 28–84 | – |
| | scarlet beeblossom | OESU3 | *Oenothera suffrutescens* | 0–84 | – |
| | vervain | VERBE | *Verbena* | 0–84 | – |
| | nettle | URTIC | *Urtica* | 0–84 | – |
| | starry false lily of the valley | MAST4 | *Maianthemum stellatum* | 0–84 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–84 | – |
| | great ragweed | AMTR | *Ambrosia trifida* | 0–84 | – |
| | Forb, annual | 2FA | *Forb, annual* | 0–84 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 0–84 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 28–84 | – |
| | American licorice | GLLE3 | *Glycyrrhiza lepidota* | 28–84 | – |
| | goldenrod | SOLID | *Solidago* | 28–84 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 0–84 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 0–84 | – |
| | common yarrow | ACMI2 | *Achillea millefolium* | 0–56 | – |
| | common mullein | VETH | *Verbascum thapsus* | 0–28 | – |
| | American vetch | VIAM | *Vicia americana* | 0–28 | – |
| | burdock | ARCTI | *Arctium* | 0–28 | – |
| | curly dock | RUCR | *Rumex crispus* | 0–28 | – |
| | thistle | CIRSI | *Cirsium* | 0–28 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Shrubs** | | | 56–280 | |
| | silver sagebrush | ARCA13 | *Artemisia cana* | 28–140 | – |
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 28–140 | – |
| | American plum | PRAM | *Prunus americana* | 0–140 | – |
| | Subshrub (<.5m) | 2SUBS | *Subshrub (<.5m)* | 0–84 | – |
| | rose | ROSA5 | *Rosa* | 28–84 | – |
| | silver buffaloberry | SHAR | *Shepherdia argentea* | 0–56 | – |
| | chokecherry | PRVI | *Prunus virginiana* | 0–56 | – |
| | golden currant | RIAU | *Ribes aureum* | 0–56 | – |

| | | | | | |
|---|---|---|---|---|---|
| | leadplant | AMCA6 | *Amorpha canescens* | 0–56 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–28 | – |
| **Tree** | | | | | |
| 8 | **Trees** | | | 0–28 | |
| | boxelder | ACNE2 | *Acer negundo* | 0–28 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–28 | – |
| | green ash | FRPE | *Fraxinus pennsylvanica* | 0–28 | – |
| | common hackberry | CEOC | *Celtis occidentalis* | 0–28 | – |
| | hawthorn | CRATA | *Crataegus* | 0–28 | – |
| | plains cottonwood | PODEM | *Populus deltoides ssp. monilifera* | 0–28 | – |
| | eastern redcedar | JUVI | *Juniperus virginiana* | 0–28 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–28 | – |
| | Russian olive | ELAN | *Elaeagnus angustifolia* | 0–28 | – |
| | saltcedar | TARA | *Tamarix ramosissima* | 0–28 | – |
| | Tree | 2TREE | *Tree* | 0–28 | – |
| | American elm | ULAM | *Ulmus americana* | – | – |

**Table 11. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Rhizomatous Wheatgrass** | | | 773–1031 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 773–1031 | – |
| | thickspike wheatgrass | ELLAL | *Elymus lanceolatus ssp. lanceolatus* | 0–77 | – |
| | slender wheatgrass | ELTR7 | *Elymus trachycaulus* | 0–77 | – |
| 2 | **Cool-Season Bunchgrasses** | | | 26–129 | |
| | green needlegrass | NAVI4 | *Nassella viridula* | 0–129 | – |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 26–129 | – |
| 3 | **Tall- Warm-Season Grasses** | | | 129–387 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 129–387 | – |
| | prairie cordgrass | SPPE | *Spartina pectinata* | 0–26 | – |
| | switchgrass | PAVI2 | *Panicum virgatum* | 0–26 | – |
| 4 | **Other Native Grasses and Grass-Likes** | | | 26–129 | |
| | sedge | CAREX | *Carex* | 26–129 | – |
| | Canada wildrye | ELCA4 | *Elymus canadensis* | 0–129 | – |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 0–129 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 26–77 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 26–77 | – |
| | marsh muhly | MURA | *Muhlenbergia racemosa* | 0–56 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 26–52 | – |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 0–52 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–52 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–52 | – |

| | | | | | |
|---|---|---|---|---|---|
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 0–52 | – |
| | prairie Junegrass | KOMA | *Koeleria macrantha* | 0–26 | – |
| 5 | **Non-Native Cool-Season Grasses** | | | 258–644 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 258–644 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 26–129 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 26–129 | – |
| | field brome | BRAR5 | *Bromus arvensis* | 0–52 | – |
| **Forb** | | | | | |
| 6 | **Forbs** | | | 129–258 | |
| | American licorice | GLLE3 | *Glycyrrhiza lepidota* | 26–129 | – |
| | common mullein | VETH | *Verbascum thapsus* | 26–129 | – |
| | aster | ASTER | *Aster* | 26–129 | – |
| | Forb, annual | 2FA | *Forb, annual* | 26–129 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 26–129 | – |
| | western yarrow | ACMIO | *Achillea millefolium var. occidentalis* | 26–77 | – |
| | thistle | CIRSI | *Cirsium* | 26–77 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 26–77 | – |
| | goldenrod | SOLID | *Solidago* | 26–77 | – |
| | upright prairie coneflower | RACO3 | *Ratibida columnifera* | 26–77 | – |
| | scarlet beeblossom | OESU3 | *Oenothera suffrutescens* | 28–77 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 26–77 | – |
| | vervain | VERBE | *Verbena* | 26–77 | – |
| | American vetch | VIAM | *Vicia americana* | 26–77 | – |
| | Forb, annual | 2FA | *Forb, annual* | 0–77 | – |
| | burdock | ARCTI | *Arctium* | 0–52 | – |
| | nettle | URTIC | *Urtica* | 0–52 | – |
| | curly dock | RUCR | *Rumex crispus* | 0–52 | – |
| | false boneset | BREU | *Brickellia eupatorioides* | 0–26 | – |
| | starry false lily of the valley | MAST4 | *Maianthemum stellatum* | 0–26 | – |
| | great ragweed | AMTR | *Ambrosia trifida* | 0–26 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Shrubs** | | | 26–258 | |
| | rose | ROSA5 | *Rosa* | 26–129 | – |
| | silver sagebrush | ARCA13 | *Artemisia cana* | 26–129 | – |
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 26–129 | – |
| | silver buffaloberry | SHAR | *Shepherdia argentea* | 0–77 | – |
| | American plum | PRAM | *Prunus americana* | 0–52 | – |
| | chokecherry | PRVI | *Prunus virginiana* | 0–52 | – |
| | Shrub (>.5m) | 2SHRUB | *Shrub (>.5m)* | 0–52 | – |
| | golden currant | RIAU | *Ribes aureum* | 0–26 | – |
| | leadplant | AMCA6 | *Amorpha canescens* | 0–26 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–26 | – |

| | | | | | |
|---|---|---|---|---|---|
| **Tree** | | | | | |
| 8 | **Trees** | | | 0–26 | |
| | boxelder | ACNE2 | *Acer negundo* | 0–26 | – |
| | bur oak | QUMA2 | *Quercus macrocarpa* | 0–26 | – |
| | green ash | FRPE | *Fraxinus pennsylvanica* | 0–26 | – |
| | common hackberry | CEOC | *Celtis occidentalis* | 0–26 | – |
| | hawthorn | CRATA | *Crataegus* | 0–26 | – |
| | plains cottonwood | PODEM | *Populus deltoides ssp. monilifera* | 0–26 | – |
| | eastern redcedar | JUVI | *Juniperus virginiana* | 0–26 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–26 | – |
| | Russian olive | ELAN | *Elaeagnus angustifolia* | 0–26 | – |
| | saltcedar | TARA | *Tamarix ramosissima* | 0–26 | – |
| | Tree | 2TREE | *Tree* | 0–26 | – |

**Table 12. Community 3.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Rhizomatous Wheatgrass** | | | 22–56 | |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 22–56 | – |
| 2 | **Cool-Season Bunchgrasses** | | | 0–11 | |
| | needle and thread | HECOC8 | *Hesperostipa comata ssp. comata* | 0–11 | – |
| 3 | **Tall- Warm-Season Grasses** | | | 11–22 | |
| | big bluestem | ANGE | *Andropogon gerardii* | 11–22 | – |
| | prairie cordgrass | SPPE | *Spartina pectinata* | 0–11 | – |
| 4 | **Other Native Grasses and Grass-likes** | | | 11–56 | |
| | sedge | CAREX | *Carex* | 22–90 | – |
| | Grass, perennial | 2GP | *Grass, perennial* | 0–34 | – |
| | sand dropseed | SPCR | *Sporobolus cryptandrus* | 11–34 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 11–22 | – |
| | marsh muhly | MURA | *Muhlenbergia racemosa* | 0–11 | – |
| 5 | **Non-Native Cool-Season Grasses** | | | 392–560 | |
| | Kentucky bluegrass | POPR | *Poa pratensis* | 336–392 | – |
| | smooth brome | BRIN2 | *Bromus inermis* | 56–168 | – |
| | cheatgrass | BRTE | *Bromus tectorum* | 56–112 | – |
| | field brome | BRAR5 | *Bromus arvensis* | 11–56 | – |
| **Forb** | | | | | |
| 6 | **Forbs** | | | 112–224 | |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 56–168 | – |
| | thistle | CIRSI | *Cirsium* | 11–112 | – |
| | vervain | VERBE | *Verbena* | 22–56 | – |
| | Forb, annual | 2FA | *Forb, annual* | 22–56 | – |
| | Forb, perennial | 2FP | *Forb, perennial* | 11–56 | – |
| | common yarrow | ACMI2 | *Achillea millefolium* | 11–56 | – |

| | | | | | |
|---|---|---|---|---|---|
| | American licorice | GLLE3 | *Glycyrrhiza lepidota* | 0–56 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 22–56 | – |
| | curly dock | RUCR | *Rumex crispus* | 0–56 | – |
| | goldenrod | SOLID | *Solidago* | 11–56 | – |
| | white sagebrush | ARLU | *Artemisia ludoviciana* | 22–56 | – |
| | aster | ASTER | *Aster* | 22–56 | – |
| | scarlet beeblossom | OESU3 | *Oenothera suffrutescens* | 0–34 | – |
| | nettle | URTIC | *Urtica* | 0–34 | – |
| | burdock | ARCTI | *Arctium* | 0–34 | – |
| | common mullein | VETH | *Verbascum thapsus* | 0–34 | – |
| | great ragweed | AMTR | *Ambrosia trifida* | 0–22 | – |
| **Shrub/Vine** | | | | | |
| 7 | **Shrubs** | | | 11–56 | |
| | rose | ROSA5 | *Rosa* | 11–56 | – |
| | western snowberry | SYOC | *Symphoricarpos occidentalis* | 11–56 | – |
| | silver sagebrush | ARCA13 | *Artemisia cana* | 11–56 | – |
| | American plum | PRAM | *Prunus americana* | 11–34 | – |
| | Subshrub (<.5m) | 2SUBS | *Subshrub (<.5m)* | 0–22 | – |
| | Wyoming big sagebrush | ARTRW8 | *Artemisia tridentata ssp. wyomingensis* | 0–11 | – |
| | silver buffaloberry | SHAR | *Shepherdia argentea* | 0–11 | – |
| **Tree** | | | | | |
| 8 | **Trees** | | | 0–11 | |
| | boxelder | ACNE2 | *Acer negundo* | 0–11 | – |
| | green ash | FRPE | *Fraxinus pennsylvanica* | 0–11 | – |
| | plains cottonwood | PODEM | *Populus deltoides ssp. monilifera* | 0–11 | – |
| | eastern redcedar | JUVI | *Juniperus virginiana* | 0–11 | – |
| | Rocky Mountain juniper | JUSC2 | *Juniperus scopulorum* | 0–11 | – |
| | Russian olive | ELAN | *Elaeagnus angustifolia* | 0–11 | – |
| | saltcedar | TARA | *Tamarix ramosissima* | 0–11 | – |

## 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 Loamy Overflow ecological site provides the upland grassland cover in addition to the associated forb, shrub, and tree component. It was typically part of an expansive grassland landscape that included combinations of Badlands, Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Sandy, Overflow, Subirrigated, and Terrace ecological sites.

Although this ES is primarily dominated by big bluestem and western wheatgrass, this site can support a plant community composed of various age classes of elm, green ash, bur oak, hackberry, cottonwood, and boxelder; with a shrub component of American plum, rose, chokecherry, western snowberry, golden currant, and silver buffaloberry. Woody plant encroachment may occur from the adjacent Thin Breaks sites. The presence or absence of this tree/shrub component is an important factor influencing wildlife species composition. This site is subject to invasion of grass species such as annual brome, cheatgrass, and Kentucky bluegrass. Woody species such as Russian olive and Tamarisk (saltcedar) may invade this site.

This site provides habitat for grassland- and shrub thicket-nesting birds, small rodents, bats, mammalian predators, and a variety of reptiles, amphibians, and insects. Within the MLRA, this site provides the suitable habitat for numerous riparian-associated species. This site provides foraging and brood-rearing habitat for upland game birds such as the sharp-tailed grouse. However, due to the presence of invasive grass and/or woody species, reproduction of the ground nesting birds is reduced.

Big Bluestem-Rhizomatous Wheatgrass-Scattered Shrubs/Scattered Trees Plant Community (1.1 and 2.1): This site is dominated by big bluestem and western wheatgrass with a shrub community generally dominated by American plum, rose, chokecherry, western snowberry, golden currant, and silver buffaloberry, favoring grazers and mixed-feeders such as deer. Plant communities associated with shrub thickets and low shrubs provide habitat for songbirds such as brown thrasher, yellow warbler, gray catbird, Say’s phoebe, loggerhead shrike, Lazuli bunting, and yellow-breasted chat. Raptors such as red-tailed hawk, Ferruginous hawk, Swainson’s hawk, American kestrel, and great-horned owl may use this site. Insects, such as pollinators, play a limited role in maintaining the forb community but do provide a significant forage base for birds and various bats, especially species such as the Western small-footed Myotis, the fringe-tailed Myotis, and the Townsend’s big-eared bat. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat. Other mammalian predators that utilize this plant community include the coyote, mink, long-tailed and least weasels, and spotted and striped skunks.

This site provides a diversity of grasses, forbs, and shrubs for small and large herbivores including shrews, voles, mice, spotted ground squirrel, desert cottontail rabbit, white- and black-tailed jackrabbits, and deer. This Loamy Overflow ecological site provides excellent nesting and brood-rearing habitat for sharp-tailed grouse and turkey, and excellent fawning habitat for white-tailed deer. The relatively tall stature of this plant community provides suitable thermal, protective, and escape cover for small and large mammals. 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 to this site along with lesser numbers of various lizard species.

Rhizomatous Wheatgrass-Bluegrass-Big Bluestem/Scattered Shrubs/Scattered Trees Plant Community (2.2): Resulting from continuous season-long grazing, Kentucky bluegrass will become dominant. Forb, shrub, and tree diversity and abundance remain relatively unchanged Tree-dependent wildlife species will remain on the site. Songbirds such as brown thrasher and raptors such as red-tailed hawk, Swainson’s hawk, American kestrel, and great-horned owl will use this site. This site will continue to attractor pollinators and other insects, thereby still providing a suitable forage base for birds and bats. This plant community will continue to provide areas suitable for sharp-tailed grouse. Species such as the horned lark, long-billed curlew, upland sandpiper, and white-tailed jackrabbit will increase in locations where shrub species decline. This site continues to provide suitable habitat for various snakes, toads, and lizards. The interspersion of short and tall vegetation provides adequate thermal, protective, and escape cover. Predators that utilize this plant community include the coyote, American badger, red fox, and long-tailed weasel.

Resulting from extended periods of non-use or no fire, the plant community will become decadent and buildup litter. As plant litter accumulates, the grassland-nesting bird composition may shift to favor those species that prefer dense litter (non-shortgrass species), otherwise the wildlife community will remain largely unchanged. Sharp-tailed grouse lek sites may decline.

Invaded State 3.0: These plant communities develops under continuous season-long grazing of western wheatgrass. The dominant vegetation includes Kentucky bluegrass, smooth brome, and annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of other non-native species due to soil disturbances and relatively high percent of bare ground. Soil erosion is potentially high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased wildlife abundance and diversity. Since secondary succession is highly variable plant and wildlife species will vary. These plant communities provide habitat for generalist or early successional species.

Wooded State 4.0: Multiple successional changes can occur on lower reaches of drainages when trees establish on the site. However, this wildlife interpretation will only include a discussion of the “Lower and Upper Woody Draw” in general. Long-term prescribed grazing, continuous season-long grazing, continuous seasonal grazing, heavy wildlife browsing, fire, flooding (and no flooding), and time all influence plant community succession. Grass species may decline dramatically, and species composition can shift due to woody competition and disturbances.

Woody vegetation provides excellent nesting cover, escape cover, and den sites for a variety of species. The presence of bur oak, Rocky Mountain juniper, and in the upper reaches of the drainages provides a significant food source for species such as fox squirrel, turkey, and deer. Species such as white-footed mice, bushy-tailed woodrat, porcupine, sharp-tailed grouse, black-billed magpie, Townsend’s solitaire, dark-eyed junco, brown thrasher, lark sparrow, and white-crowned sparrow will also increase. Species such as meadow voles, spotted ground squirrel, northern grasshopper mice, and western harvest mice will not utilize this site. Grassland-nesting songbirds will be significantly reduced. Raptors such as the long-eared owl will increase.

This site provides habitat for other songbirds such as yellow warbler, orange-crowned warbler, yellow-rumped warbler, Wilson’s warbler, gray catbird, Say’s phoebe, loggerhead shrike, Lazuli bunting, yellow-breasted chat, wrens, and chickadees. Other raptors such as red-tailed hawk, Swainson’s hawk, American kestrel, and great-horned owl may continue to use this site. Insects continue to provide a significant forage base for birds and various bats, especially species such as the Western small-footed Myotis, the fringe-tailed Myotis and the Townsend’s big-eared bat. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat. Other mammalian predators utilizing this plant community include the coyote, mink, long-tailed and least weasels, red fox, and spotted and striped skunks.

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: Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees (1.1)
Average Production (lb/acre, air-dry): 3,000
Stocking Rate (AUM/acre): 0.82

Plant Community: Big Bluestem-Rhizomatous Wheatgrass-Bluegrass/Scattered Shrubs/Scattered Trees (2.1)
Average Production (lb/acre, air-dry): 2,500
Stocking Rate (AUM/acre): 0.69

Plant Community: Rhizomatous Wheatgrass-Bluegrass-Big Bluestem/Scattered Shrubs/Scattered Trees (2.2)
Average Production (lb/acre, air-dry): 2,300
Stocking Rate (AUM/acre): 0.63

Plant Community: Kentucky Bluegrass-Smooth Brome/Scattered Shrubs/Trees (3.1)
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 have 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 forage production on this site. This site is dominated by soils in hydrologic group B, with localized areas in hydrologic group C. Infiltration rate is moderately to slow. Runoff potential for this site varies from moderate to high depending upon soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where rhizomatous grasses form a strong 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 hunting, hiking, photography, bird watching and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

## Wood products

Local or individual fire wood can be utilized from this site.

## 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; and George Gamblin, RMS, NRCS.

Five, NRI samples between 2005 and 2014 in Dawes and Box Butte Counties, Nebraska
Five, NRI samples between 2005 and 2013 in Shannon and Jackson Counties, South Dakota

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## Contributors

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## 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.

## 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.

| | |
|---|---|
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| 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.

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2. **Presence of water flow patterns:** None, or barely visible. Evidence of water flow may be present after high overland flow events or flooding from adjacent streams, but vegetation normally remains intact.

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

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

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5. **Number of gullies and erosion associated with gullies:** Typically, none. However limited head cutting may form after high runoff or flooding events. Existing gullies should be stabilized with good vegetative cover.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter of small and medium size classes will move after average to high rainfall events. Litter does not travel far, less than 3 inches (8.5 cm), typically being trapped in small bunches by the extensive vegetative cover. Litter movement may be fairly excessive after major runoff or flooding events. Small woody debris may move up to 6 inches (15 cm). Fine litter may move up to 12 inches (30 cm). Numerous debris dams or vegetative barriers may be present.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** 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.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 3 to 15 inches (7.6-38 cm) thick. Soil colors range from dark gray, grayish brown, dark grayish brown, light brownish gray to pale brown (values of 4 to 6) when dry and dark grayish brown, very dark grayish brown, dark brown to black (values of 2 to 5) when moist. Structure typically is medium to fine granular in the upper A-horizon.

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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, annual brome, smooth brome, and crested wheatgrass and invasive trees such as Russian olive and saltcedar may have an adverse impact on infiltration and runoff.

    Relative composition is approximately 85 percent grasses and grass-like plants, 10 percent forbs, and 5 and shrubs and trees. The grass and grass-like component is composed of C3, rhizomatous grasses (20-35%), C4, rhizomatous tallgrasses (5-25%), C3, bunchgrasses (5-10%), C4, shortgrasses (1-5%), C4 midgrasses (1-5%), and grass-likes (5-10%).

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. When dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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

    Dominant: Phase 1.1
    1. Native, perennial, C3, rhizomatous grass, 600-1050 #/ac, 20-35% (1 species minimum): western wheatgrass, slender wheatgrass, thickspike wheatgrass.
    2. Native, perennial, C4, tallgrass, 150-600 #/ac, 5-25% (2 species minimum).

    Sub-dominant:

    Other: Minor - Phase 1.1
    1. Native, perennial, C3 bunchgrass, 150-300 #/ac, 5-10%: green needlegrass, needle and thread, Canada wildrye, prairie Junegrass, Sandberg bluegrass.
    2. Grass-likes, 150-300 #ac, 5-10%: sedges, other grass-likes.
    3. Native forbs, 150-300 #/ac, 5-10%: forbs present will vary from location to location.
    4. Native, perennial, C4 shortgrass: 30-150#/ac, 1-5: blue grama, buffalograss.
    5. Native, perennial, C4 midgrass, 30-150#/ac, 1-5%: composite dropseed, sideoats grama, little bluestem, marsh muhly.
    6. Shrubs, 30-15 #/ac, 1-5%: shrubs present vary from location to location.

    Trace -Phase 1.1
    1. Native, deciduous trees, 0-30 #/ac, 0-1%: trees present vary from location to location.

Additional: The Big Bluestem-Rhizomatous Wheatgrass/Scattered Shrubs/Scattered Trees Community or Reference Community (1.1) or consists of nine F/S groups. These groups are native, perennial, C3, rhizomatous grass; native, perennial, C4, tallgrass; native, perennial, C3 bunchgrass = grass-likes = native forbs; native, perennial, C4 shortgrass = native, perennial, C4 midgrass = shrubs; native deciduous trees.

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

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14. **Average percent litter cover (%) and depth ( in):** Plant litter cover is evenly distributed throughout the site and is expected to be 50 to 80 percent and at a depth of 0.25 to 0.50 inch (0.65-1.3 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production is 3,000 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 2,200 and 3,400 pounds per acre respectively.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** No non-native invasive species are present. Annual bromes, Kentucky bluegrass, crested wheatgrass, smooth brome, Russian olive, saltcedar, and eastern redcedar 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.

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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.

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