USDA Natural Resources Conservation Service

Ecological site R063BY020SD
Loamy Overflow

Last updated: 9/27/2018
Accessed: 05/14/2024

General information

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

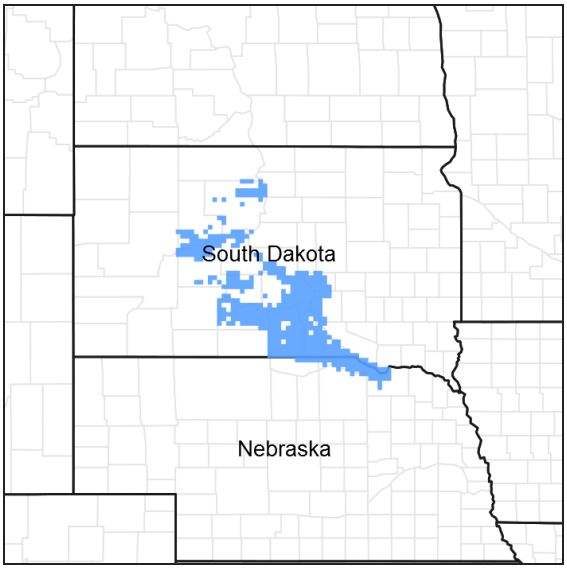


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 063B–Southern Rolling Pierre Shale Plains

MLRA Notes:
The Southern Rolling Pierre Shale Plains (MLRA 63B) is approximately 4,460 square miles in size. The majority of the MLRA is located in South Dakota (82 percent), and the remaining 18 percent is located in Nebraska. Interstate 90 crosses the northern portion through Chamberlin, SD. There are several Indian Reservations, including the Lower Brule, Crow Creek, Santee, and Yankton Reservations.
This MLRA is an area of old plateaus and terraces that have been deeply eroded, with nearly level to rolling long slopes and well-defined dendritic drainage systems. The rivers and creek valleys have smooth floors and steep walls. The majority of the MLRA is located in the unglaciated section of the Missouri Plateau, Great Plains Province. The northeast corner of the MLRA, east of the Missouri River, is located in the glaciated section with higher areas having deposits of glacial drift. The southwestern tip is located in the High Plains Section. Elevations range from 1,310 feet to 1,640 feet on the bottom lands along the Missouri River, and from 1,310 feet to 1,970 feet on the shale plains uplands.
The Missouri and Niobrara Rivers, and the confluence of the White and Missouri Rivers, occur within this MLRA. Lake Francis Case, Fort Randall Dam, and Lewis and Clark Lake are also within MLRA's borders.
Cretaceous Pierre Shale underlies most of the area. This is a marine sediment with layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they become wet, causing significant problems for road and structural foundations. Younger Niobrara chalk occurs in the southern part of the MLRA.

Alluvial sand and gravel underlie the valley floors along major streams.

Soils are shallow to very deep, generally well drained, and with loamy or clayey textures. Annual precipitation is 19 to 26 inches, mostly falling during the growing season, as frontal storms during the spring and convective thunderstorms in summer. The average annual temperature is 45°-50°F. The freeze-free period averages 165 days, and ranges from 145 to 185 days.

Vegetation is a transition between tall prairie grasses and mixed prairie grasses. Green needlegrass, porcupinegrass, western wheatgrass, and big bluestem are the major species. Little bluestem, buffalograss, sideoats grama, and sedges are dominant on the shallow soils. Buffaloberry, skunkbush sumac, and prairie rose are common on steep slopes along the major streams. Prairie cottonwood and a variety of willow species are common on flood plains along the major streams. Green ash, boxelder, chokecherry, bur oak, and buffaloberry occur in draws and narrow valleys. Encroachment of Rocky Mountain juniper and eastern redcedar on to the river breaks is becoming a concern.
The majority of the land is utilized for ranching (60 percent) and farming (27 percent). Major resource concerns for the area are wind erosion, water erosion, maintenance of the content of organic matter and soil productivity, and management of soil moisture.

Classification relationships

USDA - Land Resource Region G – Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA) 63B – Southern Rolling Pierre Shale Plains (USDA-NRCS, Ag Handbook 296).

EPA - Level IV Ecoregions of the Conterminous United States:

Northwestern Glaciated Plains - 42f – Southern Missouri Coteau Slopes, 42g – Ponca Plains, 42h – Southern River Breaks, 42p – Holt Tablelands

North Western Great Plains - 43C – River Breaks, 43f – Subhumid Pierre Shale Plains, 43r – Niobrara River Breaks.

Ecological site concept

The Loamy Overflow ecological site occurs throughout the MLRA. It is located on Stream Orders 2 or greater. This site is a run-in site and receive additional moisture through runoff from adjacent sites and overflow during occasional flooding. Typical slope range is from 0 to 3 percent. The soil surface layer is 4 to 20 inches in depth with a texture range of silty clay loam or silt 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 tree, in the lower reaches. Vegetation in reference consists primarily of warm- and cool-season tall and mid grasses. Big bluestem and switchgrass are the dominate warm-season grasses, western wheatgrass and needlegrasses are the dominant cool-season grasses. Forbs are common and very diverse. Patches of western snowberry, American plum, chokecherry 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. 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

R063BY010SD	**Loamy** The Loamy site can be located adjacent to the Loamy Overflow site, but will be found on upland landscape positions.
R063BY021SD	**Clayey Overflow** The Clayey Overflow site can be located adjacent to the Loamy Overflow site.

Similar sites

R063BY021SD	**Clayey Overflow** The Clayey Overflow site will have more cool-season grasses and less shrubs and trees than the Loamy Overflow site, but will have similar production.
R063BY010SD	**Loamy** The Loamy site will have less big bluestem, shrubs, trees, and forage production than the Loamy Overflow site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Nassella viridula*

Physiographic features

This site occurs on nearly level lowlands and drainageways.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Swale (3) Plain
Runoff class	Negligible to medium
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	396–610 m
Slope	1–3%
Water table depth	122–203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 63B is considered to have a continental climate consisting of cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA's location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature. Annual precipitation typically ranges from 18 to 25 inches per year. The average annual temperature is about 48°F. January is the coldest month with average temperatures ranging from about 15°F (Stephan, SD), to about 22°F (Winner, SD). July is the warmest month with temperatures averaging from about 73°F (Stephan, SD), to about 76°F (Winner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 56°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph. 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. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	113-122 days

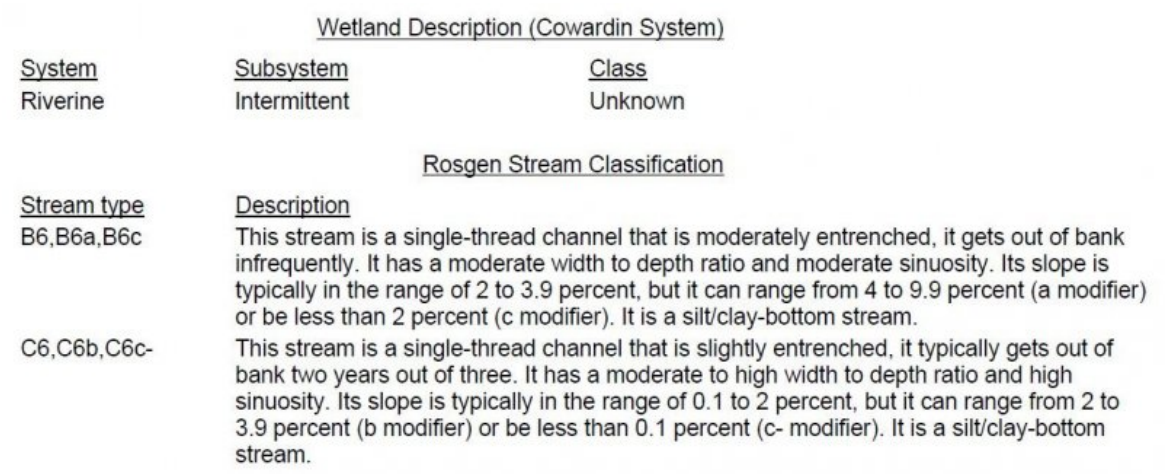
Freeze-free period (characteristic range)	130-154 days
Precipitation total (characteristic range)	533-610 mm
Frost-free period (actual range)	110-126 days
Freeze-free period (actual range)	127-155 days
Precipitation total (actual range)	508-635 mm
Frost-free period (average)	118 days
Freeze-free period (average)	141 days
Precipitation total (average)	584 mm

Climate stations used

- (1) PICKSTOWN [USC00396574], Lake Andes, SD
- (2) LYNCH [USC00255040], Lynch, NE
- (3) WINNER [USC00399367], Winner, SD
- (4) NIOBRARA [USC00255960], Niobrara, NE
- (5) GANN VALLEY 4NW [USC00393217], Gann Valley, SD
- (6) WOOD [USC00399442], Wood, SD
- (7) STEPHAN 2 NW [USC00397992], Highmore, SD

Influencing water features

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



Wetland Description (Cowardin System)

System	Subsystem	Class
Riverine	Intermittent	Unknown

Rosgen Stream Classification

Stream type	Description
B6,B6a,B6c	This stream is a single-thread channel that is moderately entrenched, it gets out of bank infrequently. It has a moderate width to depth ratio and moderate sinuosity. Its slope is typically in the range of 2 to 3.9 percent, but it can range from 4 to 9.9 percent (a modifier) or be less than 2 percent (c modifier). It is a silt/clay-bottom stream.
C6,C6b,C6c-	This stream is a single-thread channel that is slightly entrenched, it typically gets out of bank two years out of three. It has a moderate to high width to depth ratio and high sinuosity. Its slope is typically in the range of 0.1 to 2 percent, but it can range from 2 to 3.9 percent (b modifier) or be less than 0.1 percent (c- modifier). It is a silt/clay-bottom stream.

Figure 8.

Soil features

The common features of soils in this site are the silty clay loam or silt loam textured surface with slopes of 0 to 2 percent that receive run-in water from higher, adjacent areas. The soils in this site are very deep, moderately well to well drained, and formed in local alluvium or loess. The surface layer is 4 to 20 inches thick and has moderate to moderately slow permeability and moderately high saturated hydraulic conductivity. Below the surface layer, the clay content increases, creating an argillic horizon and prismatic structure in most soils. The subsoil has very slow to moderately slow permeability and low to moderately low saturated hydraulic conductivity, and all subsurface layers are nonrestrictive to water movement and root penetration. Many soils have carbonates in the subsoil and some soils will also contain gypsum or other salts, but the salt content will not affect plant growth or vigor. Some soils crack when dry due to moderate to high shrink-swell potential of smectitic clays. When these soils are wet, surface compaction can occur with heavy traffic. This site is not flooded or ponded, but some soils have a zone of water saturation within a depth of 24 to 36 inches.
This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous with numerous debris dams or vegetative barriers. The soil

surface is stable and intact.

Major soils correlated to the Loamy Overflow ecological site include Aowa, Mobridge, and Onita.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of the soil surface layer on this site can result in a shift in species composition and/or production.

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

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess
Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately slow
Soil depth	203 cm
Surface fragment cover <=3"	0–3%
Available water capacity (0-101.6cm)	17.78–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–4%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, occasional flooding, and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to short-term weather variations, impacts of native and/or exotic plant and animal species, and management actions. While the following plant community descriptions specify more typical transitions between communities that will occur, severe disturbances, such as periods of well below-average precipitation, can cause significant shifts in plant communities and/or species composition.

In the upper reaches of this site, continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the Reference State. Species such as western wheatgrass will initially increase. Big bluestem, little bluestem, and green needlegrass will decrease in frequency and production. Heavy, continuous grazing causes Kentucky bluegrass and/or smooth bromegrass to increase and eventually develops into a sod condition. Extended periods of non-use and no fire will result in a plant community with high litter levels, which favors an increase in Kentucky bluegrass and smooth bromegrass. Tree and shrub species such as western snowberry, American plumb and choke cherry occur naturally on this site, but in minor amounts.

On the lower reaches of this site, trees and shrubs are very common and make up a substantial part of the plant communities. Flooding or no flooding, grazing or no grazing, fire, and wildlife browse are the primary drivers of the system.

The plant community upon which interpretations are primarily based is the Big Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1), which is considered to be Reference Plant Community. The Reference Community has been determined by studying 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 is a diagram that illustrates the common plant community phases that can occur on the site and the transition pathways between communities. These are the most common plant community phases based on current knowledge and experience, and changes may be made as more data is collected. Narratives following the diagram contain more detail pertaining to the ecological processes.

State and transition model

Loamy Overflow R063BY020SD 1/4/18

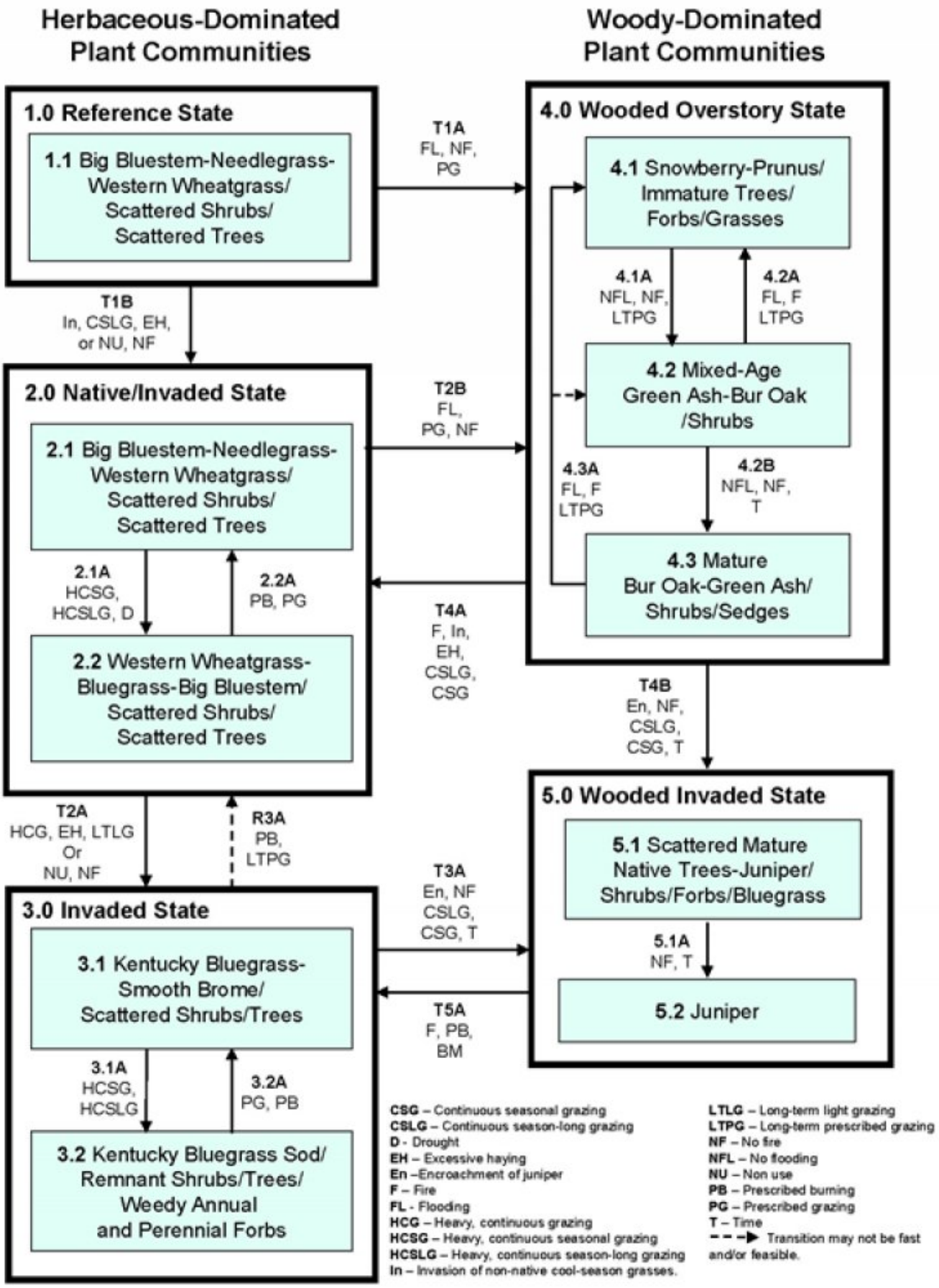


Diagram Legend - Loamy Overflow - R063BY020SD

T1A	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.
T1B	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.
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, 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, no fire, continuous season-long grazing, or continuous seasonal grazing, and time.
T5A	Fire, prescribed burning, and/or mechanical brush management.

R3A	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.

CP 2.1A	2.1 - 2.2	Heavy, continuous seasonal grazing, heavy, continuous season-long grazing and/or extended periods of drought.
CP 2.2A	2.2 - 2.1	Prescribed grazing with proper stocking, change in season of use and adequate recovery, possibly prescribed burning followed by prescribed grazing.
CP 3.1A	3.1 - 3.2	Heavy, continuous seasonal grazing, or heavy, continuous season-long
CP 3.2A	3.2 - 3.1	Prescribed grazing with proper stocking, change in season of use and adequate recovery, possibly prescribed burning followed by prescribed grazing.
CP 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.
CP 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.
CP 4.2B	4.2 - 4.3	No flooding, no fire, and time.
CP 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.
CP 5.1A	5.1 - 5.2	No fire, and time.

State 1
Reference State

This State represents what is believed to exist 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 in this MLRA. Historically, this State ranged from a tall, warm-season grass-dominated site to one dominated by deciduous saplings and shrubs depending upon disturbance regime. Grazing or the lack of grazing, flooding or lack of flooding, fire, excessive haying, invasion of non-native cool-season grasses, and encroachment of juniper are the major drivers. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within State. Dominance during the herbaceous phases of this State shifted between warm-season and cool-season grasses. Although slight shifts may occur in timing of energy capture, hydrologic function, and nutrient

cycling between plant community phases within the Reference State, overall the ecological processes were functioning at near-optimum levels. High basal density and deep root systems resulted in low runoff rates and high infiltration rates. Small areas of trees and shrubs may have existed within this State due to irregularity of burn patterns. Small areas which escaped fire may have permitted trees and/or shrubs to become established. These areas may have served as a seed source for further expansion of the woody-dominated plant community as the fire frequency was altered after settlement.

Community 1.1
Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees

The plant community upon which interpretations are primarily based is the Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees plant community. This community evolved with grazing by large herbivores, occasional prairie fire, and flooding. The vegetation was about 80 percent grasses and grass-like plants, 10 percent forbs, 8 percent shrubs, and 2 percent trees. Major grasses included big bluestem, green needlegrass, Indiangrass, switchgrass and western wheatgrass. Other grasses that occurred within this community included porcupine grass, Canada wildrye, and slender wheatgrass. Major forbs and shrubs included American licorice, sunflower, goldenrod, western snowberry, chokecherry, and plum. Scattered plains cottonwood, green ash, bur oak, American elm, and other native tree species will likely occur. This plant community was well adapted to the Northern Great Plains climatic conditions. Individual species varied greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle, and energy flow were properly functioning. Due to the diversity of warm- and cool-season species within this plant community phase, energy capture was spread more evenly throughout the growing season compared to other plant community phases within this state. Plant litter was properly distributed, in contact with the soil surface and with very little movement offsite. Natural plant mortality was very low. The diversity in plant species allowed for high drought tolerance. Runoff from adjacent sites and moderate or high available water capacity provided 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	2673	3296	3828
Forb	168	286	448
Shrub/Vine	73	191	353
Tree	–	38	78
Total	**2914**	**3811**	**4707**

Figure 10. Plant community growth curve (percent production by month). SD6304, Pierre Shale Plains, warm-season dominant, cool-season subdominant. Warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

State 2
Native/Invaded State

This State is very similar to the Reference State. The Native/Invaded State is still dominated by mid- and tall native warm- and cool-season grasses, but invasive non-native cool-season sodgrasses are now present in all community phases of this State. These non-native cool-season grasses make up to 15 percent of total annual air-dry production. The primary disturbance mechanisms for this State include grazing by domestic livestock and infrequent fires. 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 this 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/or prescribed

burning, and sometimes on areas receiving occasional short periods of rest. Warm-season species can decline and a corresponding increase in cool-season grasses will occur.

Community 2.1
Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees

Figure 11. Loamy Overflow - PCP 2.1.

This plant community phase is very similar to Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1), but it also contains up to 15 percent by air-dry weight of non-native invasive grass species such as Kentucky bluegrass and smooth bromegrass. 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-season grasses, and cool-season grasses are subdominant. The major grasses include big bluestem, green needlegrass, Indiangrass, switchgrass, and western wheatgrass. Other grasses that occur within this community include porcupinegrass, Canada wildrye, and slender wheatgrass. Major forbs and shrubs include American licorice, sunflower, goldenrod, and western snowberry. Scattered green ash, American elm, and other native tree species may also occur. Refer to the Big Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees Plant Community (1.1) for details of the plant composition for this community phase. 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 in regard to site/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	2673	3296	3828
Forb	168	286	448
Shrub/Vine	73	191	353
Tree	–	38	78
Total	**2914**	**3811**	**4707**

Figure 13. Plant community growth curve (percent production by month). SD6304, Pierre Shale Plains, warm-season dominant, cool-season subdominant. Warm-season dominant, cool-season subdominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	17	25	25	15	7	1	0	0

Community 2.2
Western Wheatgrass-Bluegrass-Big Bluestem/Scattered Shrubs/Scattered Trees

This plant community phase is characterized by a shift to mid- cool-season rhizomatous grasses 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. Dominant grasses would include western wheatgrass and Kentucky bluegrass with minor amounts of needlegrasses, big bluestem, and switchgrass. Major forbs would include western ragweed, goldenrods, and western yarrow. Chokecherry and snowberry would be the dominant shrubs. Scattered 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	2040	2683	3026
Shrub/Vine	62	188	359
Forb	140	235	359
Tree	–	31	67
Total	**2242**	**3137**	**3811**

Figure 15. Plant community growth curve (percent production by month). SD6302, Pierre Shale Plains, cool-season dominant, warm-season subdominant.. Cool-season dominant, warm-season subdominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 2.1A
Community 2.1 to 2.2

Heavy, continuous seasonal grazing (grazing at moderate to heavy stocking levels at the same time of year each year), or heavy, continuous season-long grazing, or a combination of disturbances (such as extended periods of below-average precipitation coupled with periodic heavy grazing) will shift this community to the Western Wheatgrass-Bluegrass-Big Bluestem/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.

Conservation practices

Prescribed Burning
Prescribed Grazing

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 Bromegrass/Scattered Shrubs/Trees

This plant community phase is a result of heavy, continuous grazing, excessive haying, or extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and smooth bromegrass. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface through non-use. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. When dominated by smooth bromegrass, infiltration is moderately reduced and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration is greatly reduced and runoff is high. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1833	2369	2561
Shrub/Vine	269	471	751
Forb	140	235	359
Tree	–	63	140
Total	**2242**	**3138**	**3811**

Figure 17. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

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.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1126	1594	1995
Forb	179	303	471
Shrub/Vine	39	101	179
Tree	–	20	45
Total	**1344**	**2018**	**2690**

Figure 19. Plant community growth curve (percent production by month). SD6301, Pierre Shale Plains, cool-season dominant.. Cool-season dominant on uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

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).

Conservation practices

Prescribed Burning
Prescribed Grazing

State 4
Wooded Overstory State

This State is the result of the establishment of a tree over-story 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.

Community 4.1
Snowberry-Prunus/Immature Trees/Forbs/Grasses

This plant community phase is dominated by woody plant species. Visually, saplings of green ash, boxelder and cottonwood will be prominent, and shrub species will be the most productive component of this plant community phase. Herbaceous species constitute a subdominant component in the early stages of this phase, declining as tree canopy increases. The vegetation was about 30 to 40 percent grasses and grass-like plants, 5 to 10 percent forbs, 40 to 50 percent shrubs, and 5 to 15 percent trees. As canopy levels increase, the grass component will decrease significantly, especially the warm-season component. Litter levels increased as well, and the soil surface continued

to become cooler and more moist.

Community 4.2
Mixed-Age Green Ash-Bur Oak/Shrubs

This plant community phase is characterized by a dominance of green ash and bur oak with lesser amounts of American elm, boxelder, hackberry, and occasional plains cottonwood. Shrubs may include leadplant, chokecherry, American plum, western snowberry, and gooseberry. The herbaceous understory will still be relatively productive in this phase. When compared to the Reference Plant Community (1.1), the warm-season component will be somewhat reduced and the cool-season component will be somewhat increased. This phase is characterized by a relatively full canopy cover and the trees are of mixed age but nearing maturity. Regeneration will normally be evident (i.e., seedlings and saplings should be present). As the trees mature and canopy cover increases, herbaceous production declines and shrubs/vines associated with mature woodlands may begin to occupy the understory.

Community 4.3
Mature Bur Oak-Green Ash/Shrubs/Sedges

This plant community phase is characterized by a dominance of bur oak and green ash, with lesser amounts of American elm, hackberry, and boxelder. The tree canopy has become essentially closed at this phase and the understory is significantly reduced. Shrubs and/or vines may include chokecherry, American plum, poison ivy, American bittersweet, and gooseberry. The herbaceous understory will largely consist of sedges, Canada wildrye, and scattered needlegrasses, and will be significantly reduced in production. Non-native species such as Kentucky bluegrass will likely begin to invade and become evident. When compared to the Reference Plant Community (1.1), the tall and mid- warm- and cool-season grasses will be greatly reduced. This phase is characterized by a nearly closed tree canopy and the trees are of mostly a single age class. Regeneration of trees may occur in protected areas but will be greatly reduced.

Pathway 4.1A
Community 4.1 to 4.2

No flooding, no fire, and long-term prescribed grazing can result in favorable conditions for establishment of trees within the shrub cover, and would lead to the Mixed-Age Green Ash-Bur Oak/Shrubs Plant Community (4.2).

Conservation practices

Prescribed Grazing

Pathway 4.2A
Community 4.2 to 4.1

Flooding and fire of sufficient intensity while trees are still susceptible to damage will shift this plant community back to Snowberry-Prunus/Immature Trees/Forbs/Grasses Plant Community (4.1).

Pathway 4.2B
Community 4.2 to 4.3

No flooding and no fire with time and relatively normal disturbance levels (light to moderate grazing and possible periodic fire) this plant community will move towards the Mature Bur Oak-Green Ash/Shrubs/Sedges Plant Community (4.3).

Pathway 4.3A
Community 4.3 to 4.1

Depending upon the severity of the disturbance, flooding, and/or fire, following with long-term prescribed grazing will lead to the Mixed-Age Green Ash-Bur Oak/Shrubs Plant Community (4.2) or the Snowberry-Prunus/Immature Trees/Forbs/Grasses Plant Community (4.1). To transition to PCP 4.1, flooding and/or fire must open the tree

canopy and scour the understory in order for woody regeneration to occur.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 5
Wooded Invaded State

This State is characterized by over-mature deciduous trees and a lack of regeneration, or the invasion and dominance of eastern redcedar. Shrubs are generally decadent and decreasing, and the herbaceous understory is greatly reduced in number of species and production. In addition, invasive species such as Kentucky bluegrass, smooth bromegrass, cheatgrass, and field bromegrass become established and increase significantly. The hydrologic functions of the Woody Invaded State are often impaired, as the shallow-rooted sod-forming grasses and grass-like species reduce infiltration and increase runoff. This exacerbates the effect of competition by decreasing soil moisture and further reducing the likelihood of regeneration of the deciduous trees.

Community 5.1
Scattered Mature Native Trees-Juniper/Shrubs/Forbs/Bluegrass

This plant community phase is characterized by declining over-mature deciduous trees and a gradual increase in the size and density of shade-tolerant conifer species, such as eastern redcedar and Rocky Mountain juniper. The conifer trees have reached sufficient size to withstand all but the most intense crown fires. Eastern redcedar and/or Rocky Mountain juniper attain heights of 6 to 12 feet or greater and begin to fill in the gaps of the secondary stand of conifers. As the conifer density increases, the herbaceous understory decreases, bare ground increases, and the available soil moisture decreases. Bur oak begins to rapidly decline in the stand.

Community 5.2
Juniper

This plant community develops under non-use, no fire, and encroachment by eastern redcedar, Rocky Mountain juniper, and/or occasionally by deciduous trees such as bur oak. The plant community phase is characterized by a dominance of eastern redcedar and/or Rocky Mountain juniper. The understory is nearly absent of herbaceous species, with only a few shrubs lingering in small openings. Bare ground has increased and soil erosion is evident. The tree canopy becomes completely closed, reaching as high as 80 to 90 percent. A significant reduction of juniper can be accomplished through brush management or fire, however, eastern redcedar mortality decreases as tree size increases. This is due to relatively thicker bark, sparse fine fuels beneath the canopy, and greater vertical distance of the upper foliage from lethal temperatures. Prescribed burning can result in an 88 percent mortality when juniper are less than 4 feet in height, but only a 35 percent mortality when trees exceed 7 feet in height (Owensby et al. 1973 and Ortmann et al. 1988). Because eastern redcedar and Rocky Mountain juniper are non-sprouting species, mechanical removal is 100 percent affective if the stem is cut at ground level

Pathway 5.1A
Community 5.1 to 5.2

No fire for extended periods of time and simply the passage of time allows the eastern redcedar and/or Rocky Mountain juniper to increase further in size and density and begin to overtop the deciduous trees leading to the Juniper Plant Community (5.2).

Transition T1B
State 1 to 2

Invasion of non-native grasses such as Kentucky bluegrass and smooth bromegrass, and disruption of natural disturbance regimes such as periodic fire followed by short-term high-intensity grazing or excessive haying will lead this plant community phase over a threshold to the Native/Invaded State (2.0). This occurs as natural and/or management actions (altered grazing and/or fire regime) favor a decline in the composition of the warm-season

native species and an increase in cool-season sodgrasses. Chronic season-long or heavy late season grazing facilitates this transition. Complete rest from grazing and no fire events can also lead to this transition.

Transition T1A
State 1 to 4

Flooding, followed by prescribed grazing, and no fire can transition this plant community to a woody-dominated Wooded Overstory State (4.0). State 4.0 is more likely to occur and persist on the mid to lower reaches of a drainageway.

Transition T2A
State 2 to 3

Heavy, continuous grazing, excessive haying, long-term light grazing, or no use and no fire will cause a transition of the Native/Invaded State to the Invaded State (3.0). 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 in order for saplings to attain a height at which livestock will not damage and/or kill the trees. Wildlife browse can also be a concern if the management objective are 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 10 years or more, and recovery may not be attainable. Success depends on whether native reproductive propagules remain intact on the site.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T3A
State 3 to 5

Encroachment of eastern redcedar from upland sites, 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 micro-climate 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 coupled with no fire, and continuous season-long grazing, or continuous seasonal grazing, will transition the Wooded Overstory State (4.0) to the Wooded Invaded State (5.0).

Transition T5A
State 5 to 3

Wildfire (crown fire) or other catastrophic events (e.g., disease, pests) which result in the removal of the tree canopy will lead across a threshold to the Invaded State (3.0). Prescribed burning and/or mechanical brush management may also be a management option. If a large amount of bare ground is exposed after a fire, the resulting plant community may be similar to the, Kentucky Bluegrass Sod/Remnant Shrubs/Trees/Weedy Annual and Perennial Forbs (3.2), but with a larger percentage of weedy annuals and perennials.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			1143–1715	
	big bluestem	ANGE	*Andropogon gerardii*	953–1715	–
	switchgrass	PAVI2	*Panicum virgatum*	114–572	–
	Indiangrass	SONU2	*Sorghastrum nutans*	76–381	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–191	–
2	**Cool-Season Bunchgrasses**			381–762	
	green needlegrass	NAVI4	*Nassella viridula*	191–762	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	76–381	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–191	–
3	**Wheatgrass**			191–572	
	western wheatgrass	PASM	*Pascopyrum smithii*	191–572	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–191	–
4	**Mid Warm-Season Grasses**			191–572	
	little bluestem	SCSC	*Schizachyrium scoparium*	191–572	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	76–381	–
5	**Other Native Grasses**			76–191	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	38–191	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	38–114	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–76	–
6	**Grass-likes**			191–381	
	sedge	CAREX	*Carex*	76–381	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–114	–
Forb					

8	**Forbs**			191–381	
	white sagebrush	ARLU	*Artemisia ludoviciana*	38–114	–
	Forb, native	2FN	*Forb, native*	38–114	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	38–114	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	38–76	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	38–76	–
	false boneset	BREU	*Brickellia eupatorioides*	0–76	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	38–76	–
	dotted blazing star	LIPU	*Liatris punctata*	38–76	–
	scurfpea	PSORA2	*Psoralidium*	38–76	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	38–76	–
	white heath aster	SYER	*Symphyotrichum ericoides*	38–76	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–76	–
	swamp verbena	VEHA2	*Verbena hastata*	0–38	–
	meadow zizia	ZIAP	*Zizia aptera*	0–38	–
	starry false lily of the valley	MAST4	*Maianthemum stellatum*	0–38	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	0–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–38	–
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	0–38	–
	northern bedstraw	GABO2	*Galium boreale*	0–38	–
	flatspine stickseed	LAOC3	*Lappula occidentalis*	0–38	–
Shrub/Vine					
9	**Shrubs**			76–305	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	38–152	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–114	–
	leadplant	AMCA6	*Amorpha canescens*	38–114	–
	American plum	PRAM	*Prunus americana*	0–114	–
	chokecherry	PRVI	*Prunus virginiana*	0–114	–
	golden currant	RIAU	*Ribes aureum*	0–114	–
	rose	ROSA5	*Rosa*	38–76	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	38–76	–
Tree					
10	**Trees**			0–76	
	Tree	2TREE	*Tree*	0–76	–
	boxelder	ACNE2	*Acer negundo*	0–76	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–76	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–76	–
	American elm	ULAM	*Ulmus americana*	0–76	–

Table 11. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			63–471	

	big bluestem	ANGE	*Andropogon gerardii*	63–471	–
	switchgrass	PAVI2	*Panicum virgatum*	0–157	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–94	–
2	**Cool-Season Bunchgrasses**			63–314	
	green needlegrass	NAVI4	*Nassella viridula*	31–251	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–157	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–63	–
3	**Wheatgrass**			471–942	
	western wheatgrass	PASM	*Pascopyrum smithii*	471–942	–
4	**Mid Warm-Season Grasses**			0–157	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–157	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–157	–
5	**Other Native Grasses**			63–157	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	31–157	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–94	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	43–63	–
6	**Grass-likes**			63–314	
	sedge	CAREX	*Carex*	63–314	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
7	**Non-Native Grasses**			314–628	
	Kentucky bluegrass	POPR	*Poa pratensis*	314–628	–
	smooth brome	BRIN2	*Bromus inermis*	31–251	–
	brome	BROMU	*Bromus*	0–157	–
Forb					
8	**Forbs**			157–314	
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–126	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–94	–
	Forb, introduced	2FI	*Forb, introduced*	0–94	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–94	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	31–94	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	31–94	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–94	–
	scurfpea	PSORA2	*Psoralidium*	31–63	–
	Forb, native	2FN	*Forb, native*	31–63	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	31–63	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–31	–
	dotted blazing star	LIPU	*Liatris punctata*	0–31	–
	swamp verbena	VEHA2	*Verbena hastata*	0–31	–
Shrub/Vine					
9	**Shrub**			63–314	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–188	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	31–94	–

	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–94	–
	American plum	PRAM	*Prunus americana*	0–94	–
	chokecherry	PRVI	*Prunus virginiana*	0–63	–
	golden currant	RIAU	*Ribes aureum*	0–63	–
	rose	ROSA5	*Rosa*	31–63	–
	leadplant	AMCA6	*Amorpha canescens*	0–63	–
Tree					
10	**Trees**			0–63	
	Tree	2TREE	*Tree*	0–63	–
	boxelder	ACNE2	*Acer negundo*	0–63	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–63	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–63	–
	American elm	ULAM	*Ulmus americana*	0–63	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			0–157	
	big bluestem	ANGE	*Andropogon gerardii*	0–157	–
	switchgrass	PAVI2	*Panicum virgatum*	0–63	–
2	**Cool-Season Bunchgrasses**			0–314	
	green needlegrass	NAVI4	*Nassella viridula*	0–314	–
3	**Wheatgrass**			0–314	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–314	–
4	**Other Native Grasses**			0–157	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–157	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–31	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–31	–
5	**Grass-likes**			31–157	
	sedge	CAREX	*Carex*	31–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–63	–
6	**Non-Native Grasses**			785–1569	
	smooth brome	BRIN2	*Bromus inermis*	314–1255	–
	Kentucky bluegrass	POPR	*Poa pratensis*	314–1255	–
	brome	BROMU	*Bromus*	0–157	–
Forb					
7	**Forbs**			157–314	
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–157	–
	Forb, introduced	2FI	*Forb, introduced*	0–157	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	31–94	–
	white heath aster	SYER	*Symphyotrichum ericoides*	31–94	–

	Cuman ragweed	AMPS	*Ambrosia psilostachya*	31–94	–
	Forb, native	2FN	*Forb, native*	0–63	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–63	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	31–63	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–63	–
	scurfpea	PSORA2	*Psoralidium*	0–63	–
	swamp verbena	VEHA2	*Verbena hastata*	0–31	–
Shrub/Vine					
8	**Shrubs**			314–628	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–471	–
	American plum	PRAM	*Prunus americana*	0–251	–
	chokecherry	PRVI	*Prunus virginiana*	0–157	–
	golden currant	RIAU	*Ribes aureum*	0–157	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–157	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	31–126	–
	leadplant	AMCA6	*Amorpha canescens*	0–94	–
	rose	ROSA5	*Rosa*	31–94	–
Tree					
9	**Trees**			0–126	
	Tree	2TREE	*Tree*	0–126	–
	boxelder	ACNE2	*Acer negundo*	0–126	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–126	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–126	–
	American elm	ULAM	*Ulmus americana*	0–126	–

Table 13. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-Season Bunchgrasses**			0–40	
	green needlegrass	NAVI4	*Nassella viridula*	0–40	–
2	**Wheatgrass**			0–101	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–101	–
3	**Other Native Grasses**			0–61	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–61	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–20	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–20	–
4	**Grass-likes**			101–303	
	sedge	CAREX	*Carex*	101–303	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–101	–
5	**Non-Native Grasses**			807–1311	
	Kentucky bluegrass	POPR	*Poa pratensis*	706–1311	–
	smooth brome	BRIN2	*Bromus inermis*	0–161	–

	brome	BROMU	*Bromus*	0–161	–
Forb					
6	**Forbs**			202–404	
	Forb, introduced	2FI	*Forb, introduced*	61–303	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	20–141	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–121	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	20–101	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	20–81	–
	white heath aster	SYER	*Symphyotrichum ericoides*	20–81	–
	Forb, native	2FN	*Forb, native*	0–61	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–20	–
Shrub/Vine					
7	**Shrubs**			40–161	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–101	–
	western poison ivy	TORY	*Toxicodendron rydbergii*	0–61	–
	rose	ROSA5	*Rosa*	20–61	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–40	–
	American plum	PRAM	*Prunus americana*	0–40	–
Tree					
8	**Trees**			0–40	
	Tree	2TREE	*Tree*	0–40	–
	boxelder	ACNE2	*Acer negundo*	0–40	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–40	–
	bur oak	QUMA2	*Quercus macrocarpa*	0–40	–
	American elm	ULAM	*Ulmus americana*	0–40	–

Animal community

Grazing Interpretations:
The following table lists annual suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ESD). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates 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. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

The following stocking rates are based on 912 lbs./acre (air-dry weight) per Animal-Unit-Month (AUM), with a 25 percent harvest efficiency of preferred and desirable forage species. An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow with calf up to 6 months of age for one month (refer to USDA NRCS, National Range and Pasture Handbook).

Plant Community: Big Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees (1.1)
Average Annual Production (lbs./acre, air-dry): 3,400
Stocking Rate (AUM/acre): 0.93

Plant Community: Big Bluestem-Needlegrass-Western Wheatgrass/Scattered Shrubs/Scattered Trees (2.1)
Average Annual Production (lbs./acre, air-dry): 3,400

Stocking Rate (AUM/acre): 0.93

Plant Community: Western Wheatgrass-Bluegrass-Big Bluestem/Scattered Shrubs/Scattered trees (2.2)
Average Annual Production (lbs./acre, air-dry): 2,800
Stocking Rate (AUM/acre): 0.77

Plant Community: Kentucky Bluegrass/Smooth Bromegrass/Shrubs (3.1)
Average Annual Production (lbs./acre, air-dry): 2,800
Stocking Rate (AUM/acre): 0.77

Plant Community: Kentucky Bluegrass Sod/Remnant Shrubs/Trees/ Weedy Annual and Perennial Forbs (3.2)
Average Annual Production (lbs./acre, air-dry): 1,800
Stocking Rate (AUM/acre): 0.49

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

Total annual production on-site 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. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements, and added protein will allow 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 is moderately slow to slow, and runoff potential for this site varies from low 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 shortgrasses form a strong sod and dominate the site.
Dominance by bluegrass and/or smooth bromegrass will result in reduced infiltration and increased runoff. 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 for hydrologic soil groups, runoff quantities, and hydrologic curves, Part 630.).

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

The Loamy Overflow site is a potential source of firewood.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This Provisional ecological site concept has passed Quality Control (QC) and Quality Assurance (QA) to ensure that the site meets the 2014 NESH standards for a Provisional ecological site. This is an updated “Previously Approved” ESD which represents 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, rev.1, 2003

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 does not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected that the “Previously Approved” ESD will continue refinement toward an “Approved” status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, is necessary to validate the information in this Provisional Ecological Site Description. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. The final field review, peer review, quality control, and quality assurance reviews of the ESD will be required to produce the final document.

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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: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Rick Peterson, RMS, NRCS; and Dana Larsen, RMS, NRCS.

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Approval

David Kraft, 9/27/2018

Acknowledgments

ESD updated by Rick L. Peterson on 1/9/18.
Editorial Review by Carla Green Adams.

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
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Date	02/20/2009
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Barely observable or not present.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

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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 less than 5 percent and pathces less than two inches in diameter.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

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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 aggregate stability normally a 6 rating. Typically high root content and organic matter in the soil surface. Soil surface is very resistant to erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is typically granular or parting to granular, and mollic (higher organic matter) colors of A-horizon down to about 8 to 12 inches or deeper. If conditions are other than this, refer to map unit component descriptions for component on which the site occurs.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, deep-rooted native grass and grass-like species enhance infiltration and reduce runoff.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should 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: Tall, warm-season grasses >>

    Sub-dominant: Tall and mid, cool-season bunchgrasses > wheatgrasses (mid cool-season rhizomatous) = mid, warm-

season grasses >

Other: Forbs = grass-like species > shrubs > trees

Additional: Other native grasses occur in other functional groups in minor amounts.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):** 80-90 percent plant litter cover, roughly 0.5 to 1 inch in depth. Litter cover is in contact with the soil surface.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Total annual production ranges from 2,600 to 4,200 pounds/acre, with the reference value being 3,400 pounds/acre (air-dry basis).

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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:** Refer to State and local Noxious Weed List; also Kentucky bluegrass and smooth bromegrass.

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17. **Perennial plant reproductive capability:** Perennial grasses have vigorous rhizomes and/or tillers.
