USDA Natural Resources Conservation Service

Ecological site R055BY069ND
Very Shallow

Accessed: 05/14/2025

General information

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

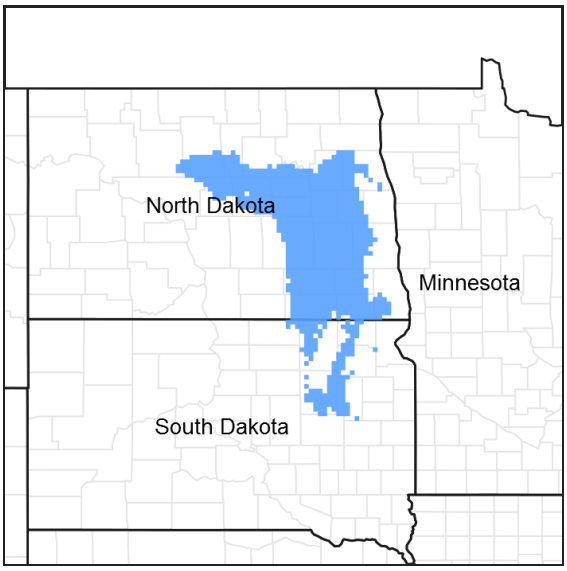


Figure 1. Mapped extent

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

Classification relationships

Level IV Ecoregions of the Conterminous United States: 42a – Missouri Coteau; 42b – Collapsed Glacial Outwash; 42c – Missouri Coteau Slope; 42d – Northern Missouri Coteau; 42f – Southern Missouri Coteau Slope; 42g – Ponca Plains; and 42h – Southern River Breaks.

Associated sites

R055BY063ND	**Shallow Gravel**
R055BY064ND	**Loamy**

Similar sites

R055BY063ND	**Shallow Gravel** (R055BY063ND) – Shallow Gravel [more bluestem; higher production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Hesperostipa comata* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on gently to steeply sloping uplands.

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Outwash terrace (3) Outwash plain
Elevation	305–640 m
Slope	1–45%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55B is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 16 to 21 inches per year. The normal average annual temperature is about 41.5° F. January is the coldest month with average temperatures ranging from about 2° F (Maddock, ND) to about 11° F (Mellette, SD). July is the warmest month with temperatures averaging from about 67° F (Maddock, ND) to about 73° F (Redfield 2 NE, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 64° F. This large annual range attests to the continental nature of this MLRA's climate. Winds 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 and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season plants begin growth in mid May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (average)	140 days
Freeze-free period (average)	161 days
Precipitation total (average)	533 mm

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

The common features of soils in this site are the gravelly loam to gravelly coarse sand textured subsoil and slopes of 1 to 60 percent. The soils in this site are excessively well drained and formed in glaciofluvial materials. The loam or sandy loam surface layer is 4 to 11 inches thick. The soils have a rapid to very rapid infiltration rate. 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. The soil surface is very unstable but intact. Sub-surface soil layers are restrictive to root penetration. These soils are mainly susceptible to water erosion. The hazard of water erosion

increases on slopes greater than about 15 percent. Very low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship. Loss of the soil surface layer can result in a shift in species composition and/or production.

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

Table 4. Representative soil features

Surface texture	(1) Loam (2) Sandy loam
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid to very rapid
Soil depth	13–25 cm
Surface fragment cover <=3"	5–13%
Surface fragment cover >3"	2–30%
Available water capacity (0-101.6cm)	2.54–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	30–60%
Subsurface fragment volume >3" (Depth not specified)	3–10%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, light to severe grazing by bison and other large herbivores, sporadic natural or man-caused wildfire (often of light intensities), 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 describe more typical transitions that will occur, severe disturbances, such as periods of well-below average precipitation, can cause significant shifts in plant communities and/or species composition.

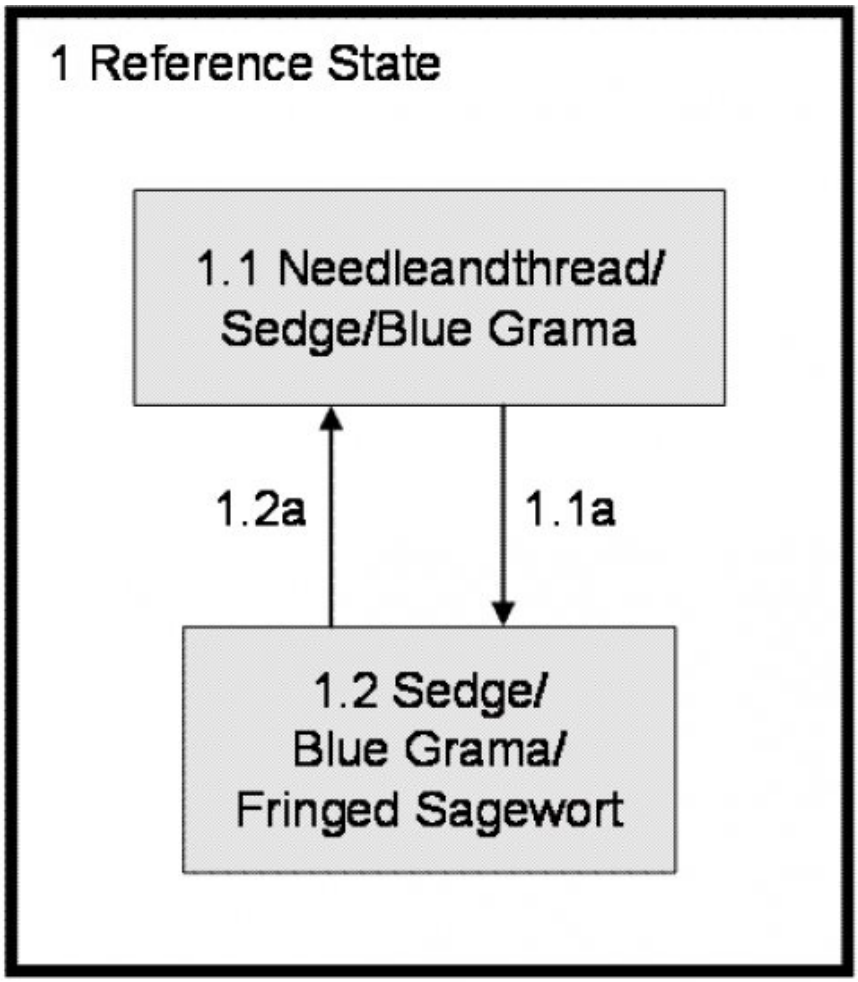
This ecological site is naturally resilient, and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more intensive disturbances such as farming. However, continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence can cause this site to depart from the Needleandthread/Sedge/Blue Grama Plant Community Phase. Sedges and gramas can increase and eventually develop into a sod, while many of the mid statured grasses will decrease (e.g., needleandthread and western wheatgrass). Even with these disturbances, many of the mid statured grasses will remain in the community at reduced levels, allowing recovery to occur once the disturbances are removed.

Interpretations are primarily based on the Needleandthread/Sedge/Blue Grama Plant Community Phase (1.1). 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 community phases,

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



1.1a – Continuous seasonal grazing or heavy continuous grazing;
1.2a – Prescribed grazing.

State 1
Reference

This state represents the natural range of variability that dominates the dynamics of this ecological site. This state is dominated by cool-season grasses, with warm-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included grazing by large herding ungulates and fluctuations in levels of precipitation. Grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this state 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. The dominant tall and mid grass species can decline and a corresponding increase in short statured species will occur.

Community 1.1

Needleandthread/Sedge/Blue Grama

The Needleandthread/Blue Grama/Sedge Plant Community Phase is the plant community upon which interpretations are primarily based. This is also considered to be climax. This plant community can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use and adequate recovery periods following each grazing event. The potential vegetation is about 80 percent grasses or grass-like plants, 15 percent forbs, and 5 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season grasses being subdominant. The major grass or grass-like species include needleandthread, blue grama, western wheatgrass, and threadleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, slender wheatgrass, sand dropseed, and prairie junegrass. The significant forbs include dotted gayfeather, hairy goldaster, purple coneflower, and prairie clover. Significant shrubs are fringed sagewort and rose. 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. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	796	1357	1805
Forb	73	157	241
Shrub/Vine	28	55	84
Total	**897**	**1569**	**2130**

Figure 5. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	23	42	15	5	4	1	0	0

Community 1.2
Sedge/Blue Grama/Fringed Sagewort

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below-average precipitation. Short grass and grass-like species increase to dominate the site and annual production decreases. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives blue grama and sedges a competitive advantage over cool and warm-season mid-grasses. Blue grama and threadleaf sedge are the dominant grass/grass-like species. Other grasses may include western wheatgrass, needleandthread, prairie junegrass and threeawn. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, heath aster, and western yarrow. Fringed sagewort is the dominant shrub. Non-native species such as Kentucky bluegrass, cheatgrass, and Japanese bromegrass may begin to invade this phase, but will typically not increase to the point of dominance. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needleandthread/Sedge/Blue Grama Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Figure 6. Plant community growth curve (percent production by month). ND5502, Central Black Glaciated Plains, cool-season dominant, warm-season sub-dominant.. Cool-season dominant, warm-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	7	23	42	15	5	4	1	0	0

Pathway 1.1a
Community 1.1 to 1.2

Heavy continuous grazing (grazing the same area for extended portions of the growing season well above recommended stocking rates and without adequate recovery periods), especially when coupled with extended periods of below average precipitation will convert the plant community to the 1.2 Sedge/Blue Grama/Fringed Sagewort Plant Community Phase.

Pathway 1.2a
Community 1.2 to 1.1

Grazing and fire returned to normal disturbance regime levels and frequencies or prescribed grazing (alternating season of use and providing adequate recovery periods) will convert this plant community to the 1.1 Needleandthread/Sedge/Blue Grama Plant Community Phase.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Cool-season Grasses**			235–471	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–471	–
	western wheatgrass	PASM	*Pascopyrum smithii*	31–157	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–78	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	0–78	–
2	**Warm-season Grasses**			235–471	
	blue grama	BOGR2	*Bouteloua gracilis*	78–314	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	16–157	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	16–47	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	16–31	–
3	**Other Native Grasses**			16–78	
	Grass, perennial	2GP	*Grass, perennial*	0–47	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	16–31	–
4	**Grass-likes**			78–235	
	threadleaf sedge	CAFI	*Carex filifolia*	78–204	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–78	–
Forb					
5	**Forbs**			78–235	
	blazing star	LIATR	*Liatris*	16–126	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	16–63	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–63	–
	velvety goldenrod	SOMO	*Solidago mollis*	16–47	–
	prairie clover	DALEA	*Dalea*	16–47	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	16–47	–
	field sagewort	ARCA12	*Artemisia campestris*	16–31	–
	Forb, annual	2FA	*Forb, annual*	16–31	–
	Forb, perennial	2FP	*Forb, perennial*	16–31	–
	white heath aster	SYER	*Symphyotrichum ericoides*	16–31	–

	spiny phlox	PHHO	*Phlox hoodii*	16–31	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	16–31	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	16–31	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–16	–
	cutleaf anemone	PUPAM	*Pulsatilla patens ssp. multifida*	0–16	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–16	–
	onion	ALLIU	*Allium*	0–16	–
	pussytoes	ANTEN	*Antennaria*	0–16	–
	plains milkvetch	ASGI5	*Astragalus gilviflorus*	0–16	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–16	–
Shrub/Vine					
6	**Shrubs**			31–78	
	prairie sagewort	ARFR4	*Artemisia frigida*	16–63	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–47	–
	rose	ROSA5	*Rosa*	16–31	–

Animal community

Animal Community – Wildlife Interpretations
Major Land Resource Area (MLRA) 55B lies within the Northern mixed-grass prairie ecosystem. Prior to European settlement, this area consisted of diverse grassland habitats interspersed with varying densities of depressional wetlands and limited woody riparian corridors. These habitats provided critical life cycle components for many of its users. Many species of grassland birds and herds of roaming bison, elk, and pronghorn were among the inhabitants. These species, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as wolves, mountain lions, and grizzly bears as well as smaller carnivores such as coyotes, bobcats, foxes and raptors. In addition, a wide variety of small mammals, reptiles, amphibians and insects were adapted to this semi-arid climate.

Historically, the Northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, widespread conversion to cropland, elimination of fire, and habitat fragmentation influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. Bison were historically a keystone species but have been extirpated as a free-ranging herbivore. The loss of bison and fire as ecological drivers greatly influenced the character of the remaining native plant community and the habitats that they provide. Fragmentation has reduced habitat quality for area-sensitive species.

Animal Community – Grazing Interpretations
This site is well adapted to managed grazing by domestic livestock. The predominance of herbaceous plants across all plant community phases best lends these sites to grazing by cattle but other domestic grazers with differing diet preferences may also be a consideration depending upon management objectives. Often, the current plant community does not entirely match any particular plant community (as described in the ecological site description). Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of this inventory data will permit the establishment of a safe, initial stocking rate for the type and class of animals and level of grazing management. More accurate stocking rate estimates should eventually be calculated using actual stocking rate information and monitoring data.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups A. Infiltration is typically moderate to moderately slow and runoff potential for this site varies from negligible to low depending on soil hydrologic group, slope and ground cover. In many cases, areas with greater than 75% 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 blue grama and/or sedge will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

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

Wood products

No appreciable wood products are typically present on this site.

Other products

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

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, NRCS; Jeff Printz, Range Management Specialist, NRCS; and Lee Voigt, Range Management Specialist, NRCS.

Other references

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://www.hprcc.unl.edu/)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://www.wcc.nrcs.usda.gov)
USDA, NRCS. National Range and Pasture Handbook, September 1997
USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (http://soils.usda.gov/technical/nasis/)
USDA, NRCS. 2001. The PLANTS Database (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Contributors

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	04/19/2012
Approved by	Jeff Printz

Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Due to the wide slope range associated with this site, the number and extent of rills will vary from none on sites with slopes of < 15% to occasionally present but short (12 to 20 inches) on slopes > 15%.

2. **Presence of water flow patterns:** Due to the wide slope range associated with this site, water flow patterns will vary from barely observable on sites with slopes of < 15% from broken and irregular in appearance on slopes > 15%.

3. **Number and height of erosional pedestals or terracettes:** Not evident on slopes < 15%. Erosional pedestals will be present with terracettes present at debris dams on slopes >15%.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20 to 35%.

5. **Number of gullies and erosion associated with gullies:** None.

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

7. **Amount of litter movement (describe size and distance expected to travel):** None on slopes < 15%. Movement of small size litter
(i.e. forb leaves) for short distances (12 to 24 inches) does occur on slopes > 15%.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 5 or greater. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth, color and structure of A horizon/surface layer.

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 rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration.

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

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: Mid, cool-season bunchgrasses >

    Sub-dominant: Grass-likes = forbs >

    Other: Short, warm-season grasses > mid, cool-season rhizomatous grasses > mid warm-season bunchgrasses = shrubs > short cool-season bunchgrasses

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** None.

14. **Average percent litter cover (%) and depth (in):** In contact with soil surface.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 1400 lbs/ac air dry with a range of 800 to 1900 lbs./acre air dry depending upon growing conditions.

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:** State and local noxious, Kentucky bluegrass, smooth bromegrass

17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to site limitations and climatic condition. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.