USDA Natural Resources Conservation Service

Ecological site R055BY073ND
Shallow Loamy

Accessed: 05/19/2024

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.

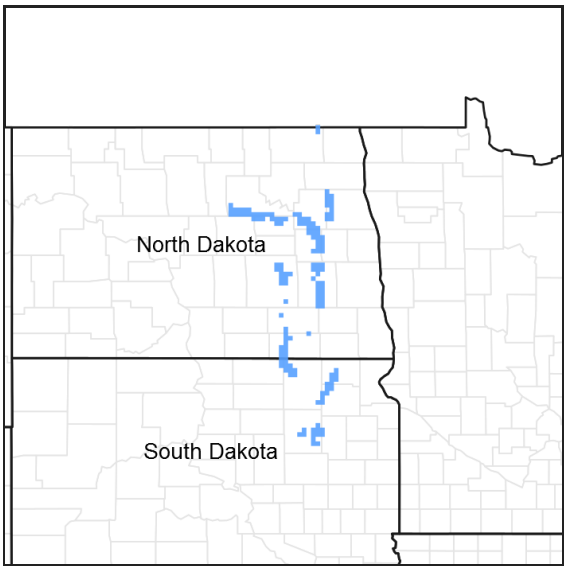


Figure 1. Mapped extent

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.

Classification relationships

Level IV Ecoregions of the Conterminous United States: 46c – Glacial Lake Basins; 46d – Glacial Lake Deltas; 46e – Tewaukon Dead Ice Moraine; 46f – End Moraine Complex; 46i – Drift Plains; 46j – Glacial Outwash; 46n – James River Lowland.

Associated sites

R055BY056ND	**Clayey**
R055BY059ND	**Loamy Overflow**
R055BY062ND	**Sandy**
R055BY064ND	**Loamy**

Similar sites

R055BY068ND	**Thin Loamy** (R055BY068ND) – Thin Loamy (TLy) Found on similar landscape positions. Soils are shallow, with weathered bedrock or shale occurring within 10 to 20 inches of the surface.

R055BY064ND	**Loamy** (055BY064ND) – Loamy (Ly) Found on dry uplands, upslope from Loamy Overflow site, down slope from Thin Loamy or Shallow Loamy sites; similar landscape position as Sandy, Sands, Clayey sites. Soil will ribbon greater than 1 inch and up to 2 inches. Indicator species are western wheatgrass, green needlegrass and blue grama, with fringed sagewort and western snowberry being the dominant shrubs. Higher production, different landscape position, less little bluestem, plains muhly, and sideoats grama, more western wheatgrass and green needlegrass.]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Hesperostipa spartea*

Physiographic features

This site occurs on moderately sloping to very steep uplands.

Table 2. Representative physiographic features

Landforms	(1) Till plain (2) Lake plain
Elevation	305–640 m
Slope	0–60%
Water table depth	107–203 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 significant water features influence this site.

Soil features

These soils are shallow, well drained, and medium to moderately fine textured. These soils have strongly calcareous subsoil or are calcareous to the surface. Saturated hydraulic conductivity is moderate to moderately slow and available water capacity is very low to low. Salinity and sodicity is none. This site is on side slopes and ridges on moderately sloping to very steep residual uplands. Slope ranges from 0 to 60 percent. It is not uncommon to have some pedestalling of plants due to the inherent instability of the soils. Water flow paths are broken, irregular in appearance or discontinuous. There is a risk of rills and eventually gullies if vegetative cover is not adequate. Sub-surface soil layers are restrictive to water movement and root penetration.

Major soil series correlated to this ecological site can be found in Section II of the Natural Resources Conservation Service Field Office Technical Guide or the following web site:
Access Web Soil Survey (http://websoilsurvey.nrcs.gov/app/) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Sandy loam (2) Loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	25–51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–20%
Available water capacity (0-101.6cm)	2.54–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
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)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

The site developed under Northern Great Plains climatic conditions, and included natural influence of large herding herbivores, frequent fire and other biotic and abiotic factors that typically influence soil/site development. Changes will occur in the plant communities due to weather fluctuations and/or management actions. Under adverse impacts, a slow decline in vegetative vigor and composition will occur. Under favorable conditions the site has the potential to resemble the reference state. Interpretations for this site are based on the Bluestem/Needlegrass/Sideoats Grama Community Phase (1.1). This Reference State 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

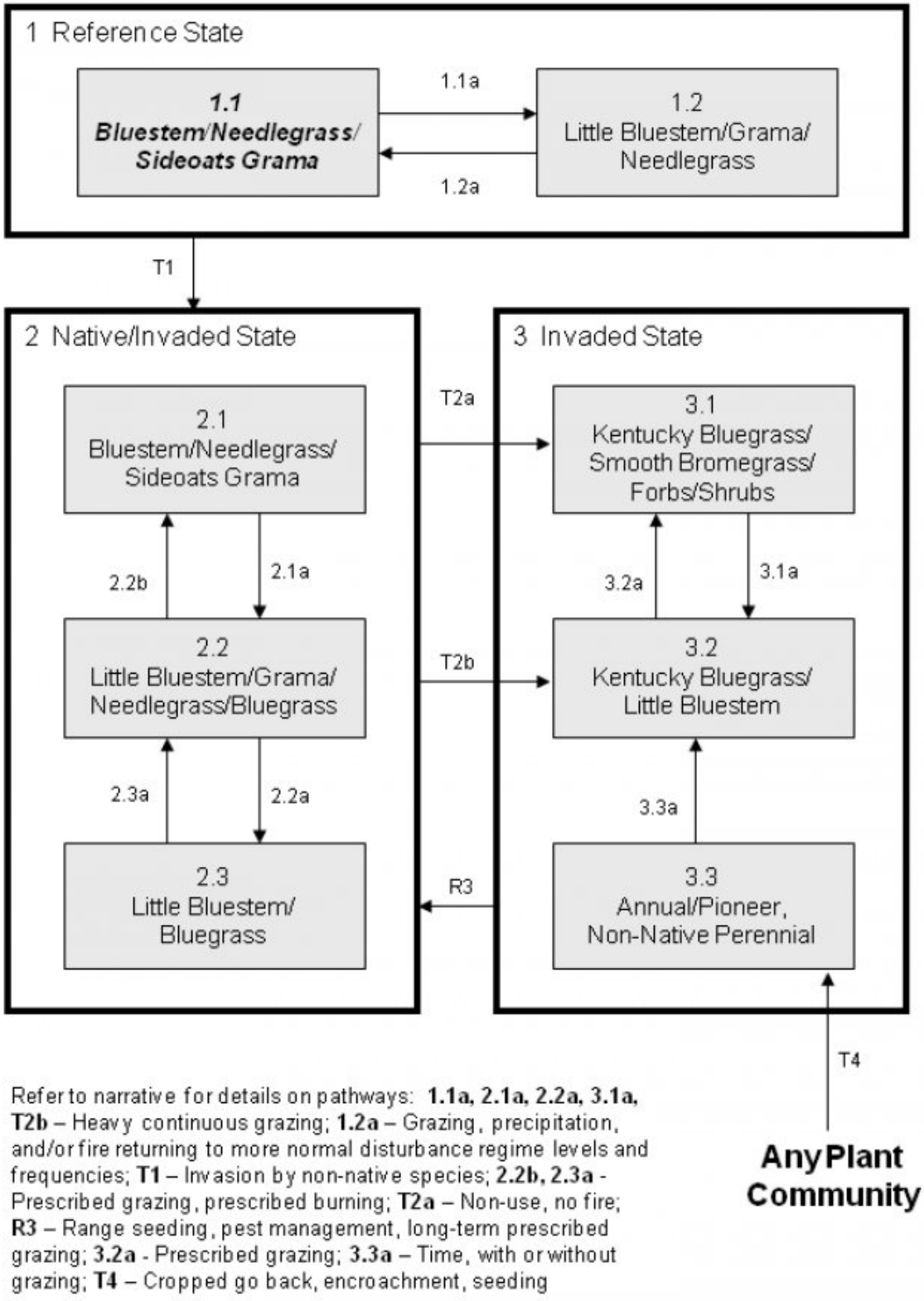
accounts also have been considered. Community phases, community pathways, states, transitions, thresholds and restoration pathways have been determined through similar studies and experience.

The natural disturbance regime consisted of frequent fires caused both by natural and Native American ignition sources. These fires occurred during any season of the year, but were concentrated in the spring and late summer or early fall. Lightening fires occurred most frequently in July and August while fires started by Native Americans occurred in April, September and October. Large ungulate grazing was heavy and occurred often, but usually for short durations. Grazing may have been severe when occurring after a fire event. The grazing and fire interaction especially when coupled with drought events, set up the dynamics discussed and displayed in the following state and transition diagram and descriptions.

This ecological site has been grazed by domestic livestock since introduced into the area. The introduction of domestic livestock and the use of fencing and reliable water sources have radically changed the disturbance regime of this site. Heavy continuous grazing and/or continuous seasonal (spring) grazing, without adequate recovery periods following each grazing occurrence causes this site to depart from the reference plant community. Species such as western wheatgrass and blue grama and, if present, Kentucky bluegrass will initially increase. Little bluestem will initially remain in the plant community but will decline with continued disturbance. Western wheatgrass will increase initially and then begin to decrease. Porcupine grass and/or green needlegrass, plains muhly and sideoats grama will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama and/or Kentucky bluegrass if present to dominate and pioneer perennials and annuals to increase. The resulting plant community is relatively stable and competitive advantage prevents other species from establishing. Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth bromegrass. Remnant little bluestem plants may be present but are reduced in vigor. Shrubs such as western snowberry and silverberry increase in this situation, especially in areas prone to snow accumulation and drift.

Following the state and transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states/community phases. The plant composition tables shown below have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and/or states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

State and transition model



Refer to narrative for details on pathways: **1.1a, 2.1a, 2.2a, 3.1a, T2b** – Heavy continuous grazing; **1.2a** – Grazing, precipitation, and/or fire returning to more normal disturbance regime levels and frequencies; **T1** – Invasion by non-native species; **2.2b, 2.3a** - Prescribed grazing, prescribed burning; **T2a** – Non-use, no fire; **R3** – Range seeding, pest management, long-term prescribed grazing; **3.2a** - Prescribed grazing; **3.3a** – Time, with or without grazing; **T4** – Cropped go back, encroachment, seeding

State 1
Reference

This state represents the natural range of variability that dominated the dynamics of this ecological site. This state was dominated by warm-season grasses, with cool-season grasses being subdominant. In pre-European times, the primary disturbance mechanisms for this site in the reference condition included periods of below and/or above average precipitation, periodic fire, and herbivory by insects and large ungulates. Timing of fires and herbivory coupled with weather events dictated the dynamics that occurred within the natural range of variability. In some locations, this site likely received relatively heavy grazing pressure. Tall warm-season grasses would have declined, and cool-season bunchgrasses and short to mid-statured warm-season grasses would have increased. Today, a similar state (State 2) 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.

Community 1.1
Bluestem/Needlegrass/Sideoats Grama

Interpretations are based primarily on the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (this is also considered to be climax). The potential vegetation was about 80 percent grasses or grass-like plants, 10 percent forbs, and 8 percent shrubs. The community was dominated by warm-season grasses, with cool-season grasses being subdominant. The major grasses included little bluestem, big bluestem, Indiangrass, sideoats grama, porcupine grass, and green needlegrass. Other grass or grass-like species included plains muhly, prairie sandreed, Canada wildrye, slender wheatgrass, needleandthread, western wheatgrass, blue grama, and threadleaf sedge. This plant community was resilient and well adapted to the Northern Great Plains climatic conditions. The diversity in plant species allowed for high drought tolerance. This was a sustainable plant community in regards to site/soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2096	2690
Shrub/Vine	112	185	280
Forb	112	185	280
Total	**1681**	**2466**	**3250**

Figure 5. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	5	20	38	25	8	3	0	0	0

Community 1.2
Bluestem/Grama/Needlegrass

This plant community evolved under heavy continuous grazing due to proximity to perennial water sources or from over utilization during extended drought periods. The potential plant community was made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses included little bluestem, blue grama, and needleandthread. Grasses of secondary importance included western wheatgrass, prairie sandreed, plains muhly, blue grama, and threadleaf sedge. Forbs commonly found in this plant community included goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), little bluestem and blue grama increased. Production of tall warm-season and mid cool-season bunchgrasses was reduced. This plant community was moderately resistant to change. The herbaceous species present were well adapted to grazing; however, species composition could be altered through long-term overgrazing. If the herbaceous component was intact, it tended to be resilient if the disturbance was not long-term. Most of the components of the ecological processes would have been functioning at optimum levels. However, the vigor and reproductive capability of the tall warm-season grasses would have been reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allowed for an increase in shorter-statured (and shallower rooted) species.

Figure 6. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	5	20	38	25	8	3	0	0	0

Pathway 1.1a
Community 1.1 to 1.2

Repeated heavy grazing either due to proximity to water or following short term fire intervals followed by intense grazing will shift the dominance to shorter statured grasses such as blue grama and upland sedges. This shift may have been facilitated by periods of below normal precipitation.

Pathway 1.2a
Community 1.2 to 1.1

A return to normal precipitation patterns, grazing and fire regime allows for recovery of mid statured cool and tall warm-season grasses.

State 2
Native/Invaded

This state is similar to the reference state. The invasion of introduced cool-season sodgrasses has altered the natural range of variability for this ecological site. This state still has a strong component of warm and cool season bunch grass species, but invasive introduced cool-season sodgrasses are now present in all community phases of this state. The primary disturbance mechanisms for this state include grazing by domestic livestock and infrequent fires. Timing of fires and grazing coupled with weather events dictate the dynamics that occur within this state. The warm-season native grass can decline and an increase in introduced sod grasses will occur. Many times, this state appears as a mosaic of community phases caused primarily by continuous season-long grazing.

Community 2.1
Bluestem/Needlegrass/Sideoats Grama

This community phase most closely resembles plant phase 1.1in appearance and ecological functions (e.g., hydrologic, biotic and soil/site stability). The warm-season dominated community is maintained with grazing systems that allow for adequate recovery periods following grazing events, and potentially the combination of grazing and prescribed burning which closely mimics the natural disturbance regime. This community phase is dominated by mid warm-season and mid cool-season bunch grasses such as little bluestem, porcupine grass, green needlegrass, and sideoats grama. Other grass and grass-likes species occurring include needleandthread, prairie Junegrass, western wheatgrass, slender wheatgrass, bearded wheatgrass, blue grama, and sedge. Grasses and grass-like species comprise about 85% of the plant community production. A variety of leguminous and non-leguminous perennial forbs include such as prairie coneflower, gayfeather, scurfpea and goldenrod. Forbs would constitute about 10% of the plant community. Shrubs such as leadplant, rose and fringed sagewort would comprise about 5% of the plant community. The ecological processes are functioning at levels very close to those of plant community phase 1.1. Slight departure might be noted within the functional/structural indicator due to the present of a functional/structural group(s) not expected for the site. The basic difference between this community phase and 1.1 of the Reference State is the presence of minor amounts of introduced cool-season grasses and forbs. This is likely a naturally nitrogen deficient plant community, but perhaps less so than the Reference State. A change in the nutrient cycle on this ecological site possibly due to the introduction of non-native leguminous species such as sweet clover may be a causative factor leading to the eventual dominance of cool-season introduced grasses in the Invaded State.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1457	2096	2690
Shrub/Vine	112	185	280
Forb	112	185	280
Total	**1681**	**2466**	**3250**

Figure 8. Plant community growth curve (percent production by month). ND5504, Central Black Glaciated Plains, warm-season dominant, cool-season sub-dominant.. Warm-season dominant, cool-season sub-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	1	5	20	38	25	8	3	0	0	0

Community 2.2
Little Bluestem/Grama/Needlegrass/Bluegrass

This plant community is a result of heavy continuous grazing or from over utilization during extended drought periods. The potential plant community is made up of approximately 75 percent grasses and grass-like species, 20 percent forbs, and 5 percent shrubs. Dominant grasses include little bluestem, blue grama, and Kentucky bluegrass. Grasses of secondary importance include western wheatgrass, plains muhly, needleandthread, and threadleaf sedge. Forbs commonly found in this plant community include goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), production of tall and mid warm-season grasses is reduced while the production of the short statured warm and cool season grasses has increased. 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. Most of the components of the ecological processes are functioning at optimum levels. However, the vigor and reproductive capability of the tall and mid warm-season and mid cool season bunchgrasses are reduced due to grazing pressure or a combination of stressors. A reduction of this dominant functional group allows for an increase in shorter-statured (and shallower rooted) species. The introduction of non-native invasive species such as Kentucky bluegrass and smooth bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers, and the structure will begin to be modified. These changes favor the shallow-rooted species, and hasten their eventual dominance if steps are not taken to reduce these species.

Figure 9. Plant community growth curve (percent production by month). ND5503, Central Black Glaciated Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	2	6	21	40	20	6	4	1	0	0

Community 2.3
Little Bluestem/Bluegrass

This plant community is a result of heavy continuous grazing or of over utilization during extended drought periods. The potential plant community is made up of approximately 70 percent grasses and grass-like species, 25 percent forbs, and 5 percent shrubs. Dominant grasses and grass-likes include Kentucky bluegrass and threadleaf sedge with remnant little bluestem plants still present and readily visible although reduced in extent. Grass species of secondary importance include blue grama, western wheatgrass, and needleandthread. Forbs commonly found in this plant community include goldenrod, cudweed sagewort, heath aster, scurfpea, western ragweed, pussytoes, and western yarrow. When compared to the Bluestem/Needlegrass/Sideoats Grama Plant Community Phase (1.1), Kentucky bluegrass and sedge have increased. Production of mid and tall warm- and cool-season grasses is reduced. 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. A reduction of the dominant functional

groups as found in the interpretive plant community phase allows for an increase in shorter-statured (and shallower rooted) species. The introduction of non-native invasive species such as Kentucky bluegrass and smooth bromegrass results in alterations to the soil profile. Organic matter levels tend to decrease and begin to be concentrated more in the surface layers, and the structure will begin to be modified. These changes favor the shallow-rooted species, and hasten their eventual dominance if steps are not taken to reduce these species.

Figure 10. 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 2.1a
Community 2.1 to 2.2

Heavy continuous grazing or heavy late seasonal grazing coupled with stocking levels well above the carrying capacity for extended portions of the growing season will shift the competitive advantage to the more grazing tolerant mid and short statured species.

Pathway 2.2b
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) will shift the competitive advantage back toward the taller statured components of the plant community. This pathway may be expedited by including prescribed burning along with prescribed grazing.

Pathway 2.2a
Community 2.2 to 2.3

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), or a combination of disturbances such as extended periods of below average precipitation coupled with periodic heavy grazing will a shift towards a community dominated by the most grazing tolerant species.

Pathway 2.3a
Community 2.3 to 2.2

This community pathway is initiated by implementation of prescribed grazing management which includes adequate recovery periods following each grazing event, and stocking levels which match the available resources. If properly implemented, this will shift the competitive advantage from the introduced cool-season species to the mid warm and cool-season bunchgrass species. Kentucky bluegrass will remain in this community at varying amounts dependant on the level of management. Caution should be exercised when initiating this restoration pathway to ensure the Kentucky bluegrass doesn’t increase, resulting in unexpectedly crossing the threshold to State 3, Invaded State.

State 3
Invaded

This state is a result of encroachment mainly by invasive introduced cool-season grasses. The ecological processes are not functioning, especially the biotic processes and the hydrologic functions. The introduced cool-season grasses cause reduced infiltration and increased runoff. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30% of the plant community and native grasses represent less than 40% of the plant community composition. The opportunity for high intensity spring burns is severely reduced by early green up and increased moisture and humidity at the soil surface and grazing pressure cannot cause a reduction in sodgrass dominance. Production is limited to the sod forming species. Infiltration continues to decrease and runoff increases, and energy capture into the system is restricted to early season low producing species. Nutrient cycling is limited by the shallow root depths of the dominant species.

Community 3.1
Kentucky Bluegrass/Smooth Bromegrass/Forbs/Shrubs

This plant community phase is a result of extended periods of non-use and no fire or occasionally light levels of grazing over several years. It is characterized by dominance of smooth bromegrass and Kentucky bluegrass. 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. 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. The dominance of these introduced species has been shown to alter the biotic component of the soil, as well as organic matter levels and eventually the soil structure. These alterations perpetuate the dominance of Kentucky bluegrass and smooth bromegrass, and tend to make establishment of native species extremely difficult.

Figure 11. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 3.2
Kentucky Bluegrass/Little Bluestem

This plant community phase is a result of heavy continuous grazing or a combination of disturbances such as extended periods of below-average precipitation combined with heavy continuous grazing. It is characterized by a dominance of Kentucky bluegrass and sedges, and occasionally with a remnant population of little bluestem. The dominance is at times so complete that other species are difficult to find on the site. A relatively thick root mat or layer can sometimes accumulate at 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 and shifted to early and mid spring. Biological activity in the soil is likely reduced significantly in this phase.

Figure 12. Plant community growth curve (percent production by month). ND5501, Central Black Glaciated Plains, cool-season dominant. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	24	45	10	3	5	2	0	0

Community 3.3
Annual/Pioneer, Non-Native Perennial Plant Community Phase

This plant community developed under continuous heavy grazing or other excessive disturbances such as abandonment after cropping, seeding of introduced species, or invasion and dominance of noxious weed species. The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include non-native invasive and/or early seral species. In the case of a seeding, refer to the corresponding Forage Suitability Group description for adapted species and expected production (production estimates in the Forage Suitability Group description may be unrealistically high due to the degraded soil condition of the site at this phase).

Pathway 3.1a
Community 3.1 to 3.2

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and at the same time of year each year) will favor the highly grazing tolerant species such as Kentucky

bluegrass.

Pathway 3.2a
Community 3.2 to 3.1

Non-use and no fire for extended periods of time (typically for 10 or more years) will result in the accumulation of excessive plant litter. This will change the micro-climate and sunlight capture at the soil surface and shift the competitive advantage to the highly shade tolerant species such as Kentucky bluegrass and/or smooth bromegrass.

Pathway 3.3a
Community 3.3 to 3.2

With the passage of time, probably regardless of the type of management, this plant community will gradually convert to dominance by Kentucky bluegrass.

Transition T1
State 1 to 2

This is the transition from the native warm-season grass dominated reference state to a state that has been invaded by introduced cool-season grass species. When propagules of Kentucky bluegrass are present, this transition occurs as natural and/or management actions favor a decline in the composition of warm and cool season bunch grasses and an increase in cool-season sodgrasses. This transition is compounded by a change in the historic grazing and fire regime where native herbivores would follow periodic fires with grazing. This historic grazing/fire sequence has largely been replaced by chronic season-long or heavy late season grazing. Complete rest from grazing and suppression of fire can also lead to this transition. The threshold between states is crossed when Kentucky bluegrass, smooth brome, and other introduced species become established on the site. These species typically are part of functional/structural groups that were not present in the Reference State.

Transition T4
State 1 to 3

This transition occurs with cessation of cropping practices from any plant community, being applied on this ecological site.

Transition T4
State 1 to 3

This transition occurs with cessation of cropping practices from any plant community, being applied on this ecological site.

Transition T4
State 2 to 3

This transition occurs with cessation of cropping practices from any plant community, being applied on this ecological site.

Transition T4
State 2 to 3

This transition occurs with cessation of cropping practices from any plant community, being applied on this ecological site.

Transition T4
State 2 to 3

This transition occurs with cessation of cropping practices from any plant community, being applied on this ecological site.

Transition T2a
State 2 to 3

Non-use and no fire for extended periods of time (typically for 10 or more years) will result in the accumulation of excessive plant litter. This will change the micro-climate and sunlight capture at the soil surface and shift the competitive advantage to the highly shade tolerant species such as Kentucky bluegrass.

Transition T2b
State 2 to 3

Heavy continuous grazing (stocking levels well above carrying capacity for extended portions of the growing season, and often at the same time of year each year), or a combination of disturbances such as extended periods of below average precipitation coupled with heavy grazing will likely shift this community across a threshold leading to an increase in grazing tolerant introduced species.

Restoration pathway R3
State 3 to 2

Long-term prescribed grazing with proper stocking rates, animal densities and adequate recovery periods between grazing events may lead this plant community phase over a threshold to the Native/Invaded State (State 2). It may be possible using selected plant materials and agronomic practices to approach something very near the functioning of the Native/Invaded State (State 2). Application of chemical herbicides, possibly in conjunction with prescribed burning, and the use of mechanical seeding methods using adapted varieties of the dominant native grasses are possible and can be successful. After establishment of the native grasses, management objectives must include the maintenance of those species, the associated reference state functions and continued treatment of the introduced sodgrasses or the seeding will revert to 3.1.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			493–863	
	little bluestem	SCSC	*Schizachyrium scoparium*	247–616	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	123–370	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	49–247	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	25–123	–
2	**Cool-season Bunchgrasses**			370–863	
	porcupinegrass	HESP11	*Hesperostipa spartea*	247–616	–
	green needlegrass	NAVI4	*Nassella viridula*	49–247	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	25–123	–
	Canada wildrye	ELCA4	*Elymus canadensis*	25–74	–
3	**Tall Warm-season Grasses**			247–493	
	big bluestem	ANGE	*Andropogon gerardii*	123–370	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	25–123	–
	Indiangrass	SONU2	*Sorghastrum nutans*	25–123	–
4	**Wheatgrass**			49–123	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	25–123	–
	western wheatgrass	PASM	*Pascopyrum smithii*	25–123	–
5	**Other Native Grasses**			49–123	

	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	25–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–74	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–49	–
6	**Grass-likes**			49–123	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	25–74	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	25–74	–
Forb					
7	**Forbs**			123–247	
	Forb, native	2FN	*Forb, native*	25–74	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	25–74	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	25–49	–
	blazing star	LIATR	*Liatris*	25–49	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–49	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–49	–
	scurfpea	PSORA2	*Psoralidium*	25–49	–
	eastern pasqueflower	PUPA5	*Pulsatilla patens*	25–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	25–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	white heath aster	SYER	*Symphyotrichum ericoides*	25–49	–
	American vetch	VIAM	*Vicia americana*	25–49	–
	purple prairie clover	DAPU5	*Dalea purpurea*	25–49	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–25	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–25	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–25	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–25	–
	onion	ALLIU	*Allium*	0–25	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–25	–
Shrub/Vine					
8	**Shrubs**			123–247	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–99	–
	leadplant	AMCA6	*Amorpha canescens*	25–99	–
	prairie sagewort	ARFR4	*Artemisia frigida*	25–49	–
	chokecherry	PRVI	*Prunus virginiana*	0–49	–
	smooth sumac	RHGL	*Rhus glabra*	0–49	–
	rose	ROSA5	*Rosa*	25–49	–
	snowberry	SYMPH	*Symphoricarpos*	25–49	–
	American plum	PRAM	*Prunus americana*	0–25	–

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Mid Warm-season Grasses**			493–863	
	little bluestem	SCSC	*Schizachyrium scoparium*	247–616	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	123–370	–
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	49–247	–
	prairie dropseed	SPHE	*Sporobolus heterolepis*	25–123	–
2	**Cool-season Bunchgrasses**			370–863	
	porcupinegrass	HESP11	*Hesperostipa spartea*	247–616	–
	green needlegrass	NAVI4	*Nassella viridula*	49–247	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	25–123	–
	Canada wildrye	ELCA4	*Elymus canadensis*	25–74	–
3	**Tall Warm-season Grasses**			247–493	
	big bluestem	ANGE	*Andropogon gerardii*	123–370	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	25–123	–
	Indiangrass	SONU2	*Sorghastrum nutans*	25–123	–
4	**Wheatgrass**			49–123	
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	25–123	–
	western wheatgrass	PASM	*Pascopyrum smithii*	25–123	–
5	**Other Native Grasses**			49–123	
	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	blue grama	BOGR2	*Bouteloua gracilis*	25–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–74	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–49	–
6	**Grass-likes**			49–123	
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	25–74	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	25–74	–
7	**Non-Native Grasses**			25–99	
	smooth brome	BRIN2	*Bromus inermis*	0–49	–
	Kentucky bluegrass	POPR	*Poa pratensis*	25–49	–
	Grass, perennial	2GP	*Grass, perennial*	0–25	–
Forb					
8	**Forbs**			123–247	
	Forb, native	2FN	*Forb, native*	25–74	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	25–74	–
	stiff sunflower	HEPA19	*Helianthus pauciflorus*	25–49	–
	blazing star	LIATR	*Liatris*	25–49	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–49	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–49	–

	scurtpea	PSORA2	*Psoralidium*	25–49	–
	eastern pasqueflower	PUPA5	*Pulsatilla patens*	25–49	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	25–49	–
	goldenrod	SOLID	*Solidago*	25–49	–
	white heath aster	SYER	*Symphyotrichum ericoides*	25–49	–
	American vetch	VIAM	*Vicia americana*	25–49	–
	purple prairie clover	DAPU5	*Dalea purpurea*	25–49	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–25	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–25	–
	purple locoweed	OXLA3	*Oxytropis lambertii*	0–25	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	0–25	–
	onion	ALLIU	*Allium*	0–25	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–25	–
	pussytoes	ANTEN	*Antennaria*	0–25	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–25	–
Shrub/Vine					
9	**Shrubs**			123–247	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–99	–
	leadplant	AMCA6	*Amorpha canescens*	25–99	–
	prairie sagewort	ARFR4	*Artemisia frigida*	25–49	–
	chokecherry	PRVI	*Prunus virginiana*	0–49	–
	smooth sumac	RHGL	*Rhus glabra*	0–49	–
	rose	ROSA5	*Rosa*	25–49	–
	snowberry	SYMPH	*Symphoricarpos*	25–49	–
	American plum	PRAM	*Prunus americana*	0–25	–

Animal community

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

Hydrology Functions
Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group D. Infiltration is typically moderate to moderately slow and runoff potential for this site varies from medium to high 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, Kentucky bluegrass, and/or smooth bromegrass 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 and other federal/state agency clipping and inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field-tested by various private, state and federal agency specialists. Those involved in developing this site description include: Stan Boltz, NRCS Range Management Specialist; Michael D. Brand, State Land Dept., Director Surface Management; David Dewald, NRCS State Biologist; Paul Drayton, NRCS District Conservationist; Jody Forman, NRCS Range Management Specialist; Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; Kevin Sedivec, Extension Rangeland Management Specialist; Shawn Dekeyser, North Dakota State University; Rob Self, The Nature Conservancy and Lee Voigt, NRCS Range Management Specialist.

Other references

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (http://hpccsun.unl.edu)
USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (http://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://nasis.nrcs.usda.gov)
USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
USDA, NRCS, Various Published Soil Surveys.
The Nature of Eastern North Dakota: Pre-1880 Historical Ecology. 2006. Severson, Kieth E. and Carolyn Hull Sieg. North Dakota Institute for Regional Studies.

Contributors

Jeff Printz
Megan Baxter

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)	Jeff Printz, Stan Boltz, Lee Voigt, Jody Forman

Contact for lead author	Jeff.printz@nd.usda.gov 701-530-2080
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:** None on slopes < 30%. Rills may be observable on slopes >30% but they would be < 12 inches in length and disconnected.

2. **Presence of water flow patterns:** None on slopes < 30%. On slopes > 30%, water flow patterns are short, irregular, and discontinuous.

3. **Number and height of erosional pedestals or terracettes:** None on slopes < 30%. May be evident on slopes > 30% but only where associated with rills.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground < 10%. Patch size < 2 inches and disconnected.

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 on < 30%. Some short movement of
small sized plant litter may be observed associated with rills on slopes of > 30%.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Average 5 to 6. 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 & tall 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):** No management induced compaction layer present. Bk layer should not be confused for a compacted layer.

---

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 = mid, warm-season grasses >

    Sub-dominant: Tall, warm-season grasses >

    Other: Mid, cool-season rhizomatous = forbs > short, warm-season grasses = shrubs > grass-likes = short, cool-season grasses

    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):** Plant litter is in contact with soil surface.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative value = 2200 lbs/ac air dry with a range of 1500 to 2900 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 weeds, Kentucky bluegrass, smooth bromegrass

---

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