Ecological site R063AY021SD
Clayey Overflow

Accessed: 04/25/2024

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.

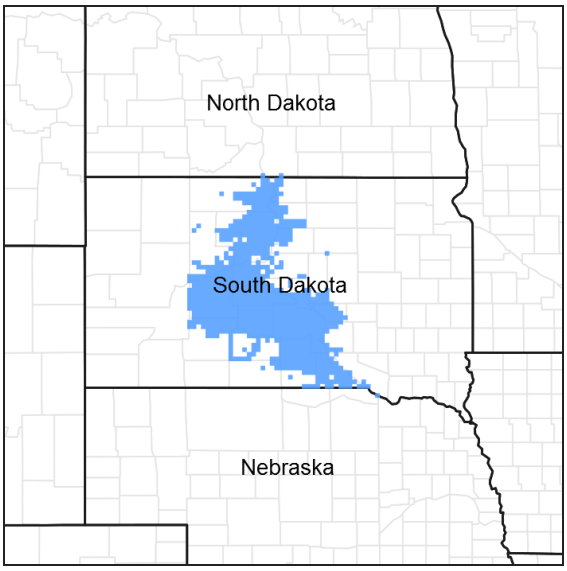

Figure 1. Mapped extent

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): 063A–Northern Rolling Pierre Shale Plains

MLRA 63A is approximately 10,160 square miles in size, the majority of which is in South Dakota and a very small portion in North Dakota. The MLRA extends west of the northern half of the South Dakota reach of the Missouri River. All five of the major rivers draining western South Dakota cross this area. From north to south, these are the Grand, Moreau, Cheyenne, Bad, and White Rivers.

Elevation range from 1,300 to 1,640 feet on the bottom land along the Missouri River to 1,640 to 2,950 feet on the shale plain uplands. Cretaceous Pierre Shale underlies almost all of this area. This is a marine sediment having layers of volcanic ash that has been altered to smectitic clays. These clays shrink as they dry and swell as they get wet. Tertiary and Quaternary river deposits, remnants of erosion from the Black Hills uplift, cap isolated highlands in this area. Deposits of alluvial sand and gravel occur on the valley floors adjacent to the major streams in the area. The average annual precipitation in this area is 15 to 20 inches.
The vegetation in this area is a transition from eastern tall grass prairie to a western mixed grass prairie, (USDA-NRCS, Ag Handbook 296).

Classification relationships

Land Resource Region (LRR): G - Western Great Plains Range and Irrigated Region, Major Land Resource Area (MLRA): 63A Northern Rolling Pierre Shale Plains, (USDA-NRCS, Ag Handbook 296).

Level IV Ecoregions of the Conterminous United States, 2013: 43c – River Breaks and 43f – Subhumid Pierre Shale Plains.

Ecological site concept

The Clayey Overflow Ecological Site occurs throughout the MLRA. It is located on Stream Orders 2 or greater. This site is a run-in site and receives additional moisture through runoff from adjacent sites and overflow during occasional flooding. Typical slope range is from 0 to 2 percent. The soil surface layer is 5 to 11 inches in depth with a texture range of silty clay loam to clay. 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 of a mix of cool and warm-season tall and mid grasses. Western wheatgrass, green needlegrass are dominant, big bluestem and switchgrass are sub-dominant. Forbs are common and very diverse. Patches of western snowberry, American plum, chokecherry and willow are almost always present. Major tree species include: plains cottonwood, willow, green ash, boxelder and hackberry. 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

R063AY011SD	**Clayey**
R063AY015SD	**Thin Claypan**
R063AY018SD	**Dense Clay**

Similar sites

R063AY010SD	**Loamy** Loamy [less green needlegrass; more needleandthread]
R063AY011SD	**Clayey** Clayey [more big bluestem; less production]

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on nearly level areas that receive additional water from the overflow of intermittent streams or runoff from adjacent slopes.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain (3) Stream terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	1,600–2,700 ft
Slope	0–2%
Water table depth	42–80 in

Aspect	Aspect is not a significant factor

Climatic features

MLRA 63A is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and abundant sunshine. Extreme temperature fluctuations are also common. 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 ranges from 16 to 20 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 11°F (Pollock, South Dakota (SD)), to about 22°F (Cedar Butte, SD). July is the warmest month with temperatures averaging from about 72°F (Pollock, SD), to about 76° F (Cedar Butte, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°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 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 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 (average)	130 days
Freeze-free period (average)	151 days
Precipitation total (average)	19 in

Climate stations used

- (1) COTTONWOOD 2 E [USC00391972], Kadoka, SD
- (2) KENNEBEC [USC00394516], Kennebec, SD
- (3) POLLOCK [USC00396712], Pollock, SD
- (4) CEDAR BUTTE 1NE [USC00391539], White River, SD

Influencing water features

Rosgen Stream Classification

Soil features

The soils in this site are moderately well to well drained and formed in calcareous clayey alluvium. The silty clay to clay surface layer is 5-8 inches thick. The soils have a slow infiltration rate. Subsoil textures range from silty clay to clay and are stratified. This site typically 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 stable and intact.
These soils are mainly susceptible to water erosion. The hazard of water erosion increases where vegetative cover is not adequate. A drastic loss of soil surface layer on this site can result in a shift in species composition and/or production.
Soil correlated to Clayey Overflow Ecological Site: Wendte
The geographic setting of Wendte is on low stream terraces and flood plains.
Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/) for specific local soils information.

Table 4. Representative soil features

Parent material	(1) Alluvium–calcareous siltstone
Surface texture	(1) Silty clay (2) Clay (3) Silty clay loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Slow
Soil depth	80 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–8 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under Northern Great Plains climatic conditions, natural influences of large herbivores, occasional fire, 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 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. As this site deteriorates, species such as blue grama will increase, and introduced species such as Kentucky bluegrass, smooth brome and Canada thistle will invade the site. Grasses such as slender wheatgrass, green needlegrass, big bluestem, rhizomatous wheatgrasses, prairie cordgrass, and switchgrass will decrease.

Continuous season-long grazing (during the typical growing season of May through October) and/or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Western Wheatgrass-Green Needlegrass Plant Community (1.1). Western wheatgrass increases initially and will eventually decrease with continuous grazing. Grasses such as green needlegrass, big bluestem, and switchgrass will decrease in frequency and production. Where trees occur, woody regeneration will decline and grasses and forbs will become dominant in the understory.

Salt accumulation from adjacent uplands affecting this site will cause inland saltgrass to increases and salt sensitive species will decrease.

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

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

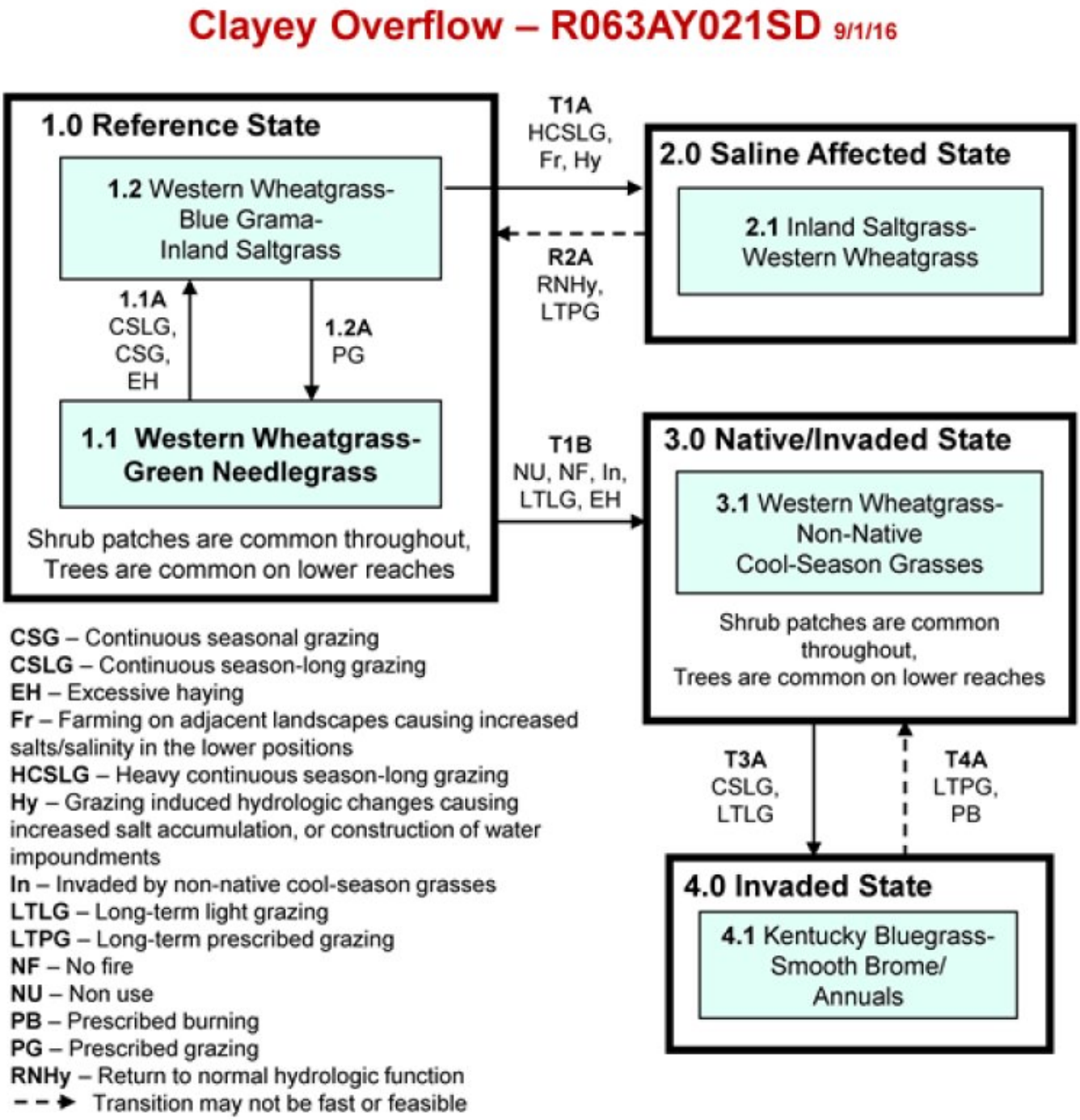

Figure 6. Clayey Overflow - R063AY021SD

Diagram Legend - Clayey Overflow - R063AY021SD		
T1A	Heavy continuous season-long grazing, higher than normal precipitation patterns, farming of adjacent landscapes causing increased salinity in run-in sites, grazing induced hydrologic changes causing increases salt accumulation, or salinity caused through construction of water impoundment structures.	
T1B	Invasion and establishment of non-native cool-season grasses, no use, no fire, or long-term light grazing or excessive haying.	
T3A	Continuous season-long grazing without adequate time for recover or long-term light grazing.	
T4A	Long-term prescribed grazing possible in combination with prescribed burning. Transition may take a significant amount of time and in the end may not meet management objectives.	
R2A	Return of normal hydrologic function, followed by long-term prescribed grazing with change is season of use and time for adequate recovery, normal precipitation patterns.	
CP 1.1A	1.1 - 1.2	Continuous seasonal grazing (spring), winter grazing, continuous season-long grazing, excessive haying.
CP 1.2A	1.2 - 1.1	Prescribed grazing with proper stocking, change is season of use and adequate time for recovery.

Figure 7. Clayey Overflow - R063AY021SD

State 1
Reference State

This State represents what is believed to exist prior to European settlement In Reference, this site is dominated by cool- and warm-season season grasses, and various shrub and tree species that are scattered across the site. Grazing or the lack of grazing, flooding or lack of flooding, salt accumulation, fire, excessive haying and invasion of non-native cool-season grasses are the major drivers of State.

Community 1.1
Western Wheatgrass-Green Needlegrass Plant Community

Interpretations are based primarily on the Western Wheatgrass-Green Needlegrass Plant Community (this is also considered to be the reference plant community). The potential vegetation is about 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent woody plants (shrubs and trees). The community is dominated by cool-season grasses. The major grasses include western wheatgrass and green needlegrass. Other prominent grasses and grass-likes include slender wheatgrass, big bluestem, switchgrass, sideoats grama, blue grama, buffalograss, tall dropseed, and sedges. Forbs consist of American licorice, heath aster, western yarrow, and cudweed sagewort. Woody species found on this site are American plum, rose, snowberry, and mixed age stands of green ash, boxelder, hackberry and cottonwood. This plant community is productive and diverse. The diversity in plant species allows for high drought tolerance. This is 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 (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2040	2595	3275
Shrub/Vine	25	165	345
Forb	135	225	345
Tree	0	15	35
Total	**2200**	**3000**	**4000**

Figure 9. 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 1.2
Western Wheatgrass-Blue Grama-Inland Saltgrass Plant Community

This plant community is the result of continuous season-long grazing and/or from haying the same area over many years. Management induced salt accumulation may also be affecting this plant community. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs and trees. Western wheatgrass and short, warm-season grasses such as blue grama, buffalograss, and inland saltgrass dominate the site. These grasses can form a sod, limiting production for haying and grazing. Grasses and grass-like plants of secondary importance include green needlegrass, slender wheatgrass, and sedges. Significant forbs found on this site include American licorice, cudweed sagewort, heath aster, scarlet gaura, scarlet globemallow, and western yarrow. A significant amount of production and diversity has been lost when compared to the Western Wheatgrass-Green Needlegrass Plant Community (1.1). Blue grama, inland saltgrass, and buffalograss have increased, while the production of mid and tall, warm-season grasses has reduced. Green needlegrass and western wheatgrass have decreased significantly. This plant community is moderately resistant to change, due to grazing tolerance of blue grama and buffalograss. 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 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1080	1503	1895
Forb	85	180	300
Shrub/Vine	35	108	185
Tree	0	9	20
Total	**1200**	**1800**	**2400**

Figure 11. Plant community growth curve (percent production by month). SD6303, Pierre Shale Plains, cool/warm-season codominant.. Cool-season, warm-season codominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous seasonal grazing (spring or late winter grazing), continuous season-long grazing and/or haying will convert the plant community to the Western Wheatgrass-Blue Grama-Inland Saltgrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing, including proper stocking, change in season of use, and adequate time for recovery, will eventually return this plant community to the Western Wheatgrass-Green Needlegrass Plant Community.

State 2
Saline Affected State

This State developed because of management induced salt accumulation. The State is dominated by salt tolerant, warm- and cool-season grasses. Salt sensitive species have decreased significantly in the plant community. The major drivers of this state are grazing, wetter than normal climatic conditions and land management on adjacent sites that cause a change in hydrology that resulted in increased salinity. Cropping of adjacent sites, saline seeps, water impoundment and excessive grazing on uplands will potential cause salts to accumulate on this site.

Community 2.1
Inland Saltgrass-Western Wheatgrass Plant Community

This plant community develops due to the accumulation of salts. This could be the result of heavy grazing on this and adjacent sites allowing salts to be discharged from the marine sediments, cropping of uplands adjacent to the overflow site, or water impoundment on the drainage. This plant community is made up of about 85 percent grasses and grass-like species, 10 percent forbs, 5 percent shrubs and trees. Dominant grasses include inland saltgrass and western wheatgrass. Other secondary grasses include foxtail barley, thickspike wheatgrass, Nuttall's alkaligrass, and prairie cordgrass. Forbs such as giant sumpweed, povertyweed, Pursh seepweed, and seepweed are the dominant forbs. As long as the herbaceous component remains intact, the plant community tends to be resilient. This plant community is relatively stable and well adapted to increased salinity.

State 3
Native/Invaded State

This State has a significant amount of Kentucky bluegrass or smooth brome in the plant community, but they have not become the dominate species. Kentucky bluegrass makes up less than 30 percent of the plant community composition (by weight). This State is at risk of transitioning to a bluegrass dominated state (Invaded State 4.0).

Community 3.1
Western Wheatgrass-Non-Native Cool-Season Grasses Plant Community

This plant community evolved from nonuse and/or no fire or long-term light grazing and the invasion and establishment of non-native cool-season grasses, primarily smooth brome and or Kentucky bluegrass. The potential plant community is made up of approximately 85 percent grasses and grass-like species, 10 percent forbs, and 5 percent shrubs and trees. Western wheatgrass is the dominate grass with Kentucky bluegrass and/or smooth brome being subdominant. Grasses of secondary importance include blue grama, buffalograss, inland saltgrass, and foxtail barley. Forbs commonly found in this plant community include goldenrod, heath aster, western yarrow, western ragweed, and cudweed sagewort. Dominant shrubs include rose and snowberry. When compared to the Western Wheatgrass-Green Needlegrass Plant Community, green needlegrass is significantly reduced and there is an increase in non-native cool-season grasses. Western yarrow, scurfpea, ragweed, and goldenrod have increased. This vegetation state is very resistant to change due to low plant diversity and the presence of the invader species. A significant amount of production and diversity has been lost when compared to the climax community. The loss of desirable species has negatively impacted energy flow and nutrient cycling. It will take a very long time to restore this plant community back to the reference community with improved management. Renovation could be very costly.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1370	1944	2500
Forb	115	240	375
Shrub/Vine	115	204	300
Tree	0	12	25
Total	**1600**	**2400**	**3200**

Figure 13. 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

State 4
Invaded State

This state is the result of invasion and dominance of introduced species. This 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 of the plant community 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 4.1
Kentucky Bluegrass-Smooth Brome/Annuals Plant Community

This plant community developed under continuous heavy grazing or long-term light grazing. The potential plant community is made up of approximately 80 percent grasses and grass-like species, 15 percent forbs, and 5 percent shrubs and trees. The dominant grasses include Kentucky bluegrass and/or smooth brome. Other grasses may include western wheatgrass, foxtail barley, and sedge. The dominant forbs include goldenrod, heath aster, prairie coneflower, scurfpea, thistle, and other annual invader-like species. The dominant shrubs include rose, silver sagebrush, and snowberry. This plant community is susceptible to invasion of Canada thistle and other nonnative species. Compared to the Western Wheatgrass-Green Needlegrass Plant Community, western wheatgrass, needlegrasses, and other cool-season grasses and grass-like species have decreased as have the warm-season species including big bluestem, sideoats grama, blue grama, and buffalograss. This plant community is difficult to return to the Reference State (1.0) because of the loss of plant diversity. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites.

Transition 1A
State 1 to 2

Heavy continuous season-long grazing, farming on adjacent uplands and/or water impoundment on the drainage will cause an increase in salt accumulation on the site and a transition to the Saline Affected State (2.0).

Transition 1B
State 1 to 3

Nonuse and no fire or long-term light grazing or excessive haying and the invasion of non-native cool-season grasses will shift plant community towards the Native/Invaded State (3.0).

Restoration pathway 2A
State 2 to 1

Return of normal hydrologic conditions which stops or reduced accumulation of salts and flushed the existing salts out of the system, long-term prescribed grazing that provide adequate time for recovery.

Transition 3A

State 3 to 4

Continuous season-long grazing or no use and no fire or long-term light grazing or excessive haying will likely move this plant community to the Invaded State (4.0).

Transition 4A
State 4 to 3

Long-term prescribed grazing, including adequate rest periods, and possibly prescribed burning, this plant community may transition back to the Native/Invaded State (3.0) assuming an adequate seed/vegetative source is available. The transition will be slow and in the end may not meet management objectives.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			750–1500	
	western wheatgrass	PASM	*Pascopyrum smithii*	600–1500	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	150–600	–
2	**Cool-Season Bunchgrasses**			150–750	
	green needlegrass	NAVI4	*Nassella viridula*	150–600	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–450	–
3	**Tall/Mid Warm-Season Grasses**			150–300	
	big bluestem	ANGE	*Andropogon gerardii*	0–150	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	30–150	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–150	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–150	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–150	–
	switchgrass	PAVI2	*Panicum virgatum*	0–60	–
4	**Short Warm-Season Grasses**			60–240	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–150	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–150	–
	saltgrass	DISP	*Distichlis spicata*	0–150	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–90	–
5	**Other Native Grasses**			30–150	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–90	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–90	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–30	–
6	**Grass-likes**			150–300	
	sedge	CAREX	*Carex*	60–300	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–90	–
	rush	JUNCU	*Juncus*	0–60	–
	spikerush	ELEOC	*Eleocharis*	0–30	–
Forb					

Forb					
8	**Forbs**			150–300	
	Forb, native	2FN	*Forb, native*	30–150	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	30–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	30–90	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	30–90	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–90	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–90	–
	American vetch	VIAM	*Vicia americana*	30–60	–
	scurfpea	PSORA2	*Psoralidium*	30–60	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	30–60	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–60	–
	showy milkweed	ASSP	*Asclepias speciosa*	30–60	–
	false boneset	BREU	*Brickellia eupatorioides*	0–60	–
	thistle	CIRSI	*Cirsium*	30–60	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	30–60	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	30–60	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–60	–
	field sagewort	ARCA12	*Artemisia campestris*	0–60	–
	goldenrod	SOLID	*Solidago*	30–60	–
	mint	MENTH	*Mentha*	0–30	–
	stickseed	HACKE	*Hackelia*	0–30	–
	ragwort	SENEC	*Senecio*	0–30	–
Shrub/Vine					
9	**Shrubs**			30–300	
	rose	ROSA5	*Rosa*	30–150	–
	sandbar willow	SAIN3	*Salix interior*	30–150	–
	snowberry	SYMPH	*Symphoricarpos*	30–150	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–150	–
	American plum	PRAM	*Prunus americana*	0–90	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–90	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–60	–
	chokecherry	PRVI	*Prunus virginiana*	0–60	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–30	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–30	–
	pricklypear	OPUNT	*Opuntia*	0–30	–
Tree					
10	**Trees**			0–30	
	Tree	2TREE	*Tree*	0–30	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–30	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–30	–
	willow	SALIX	*Salix*	0–30	–
	American elm	ULAM	*Ulmus americana*	0–30	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			180–630	
	western wheatgrass	PASM	*Pascopyrum smithii*	180–630	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–90	–
2	**Cool-Season Bunchgrasses**			0–90	
	green needlegrass	NAVI4	*Nassella viridula*	0–90	–
3	**Tall/Mid Warm-Season Grasses**			0–54	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–54	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–36	–
	big bluestem	ANGE	*Andropogon gerardii*	0–18	–
4	**Short Warm-Season Grasses**			270–630	
	blue grama	BOGR2	*Bouteloua gracilis*	90–450	–
	saltgrass	DISP	*Distichlis spicata*	90–450	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0–180	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	18–90	–
5	**Other Native Grasses**			36–216	
	foxtail barley	HOJU	*Hordeum jubatum*	18–180	–
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–90	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–18	–
6	**Grass-likes**			18–90	
	sedge	CAREX	*Carex*	0–90	–
	spikerush	ELEOC	*Eleocharis*	0–90	–
	rush	JUNCU	*Juncus*	0–90	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–54	–
7	**Non-Native Grasses**			0–90	
	cheatgrass	BRTE	*Bromus tectorum*	0–90	–
	bluegrass	POA	*Poa*	0–90	–
	smooth brome	BRIN2	*Bromus inermis*	0–54	–
Forb					
8	**Forbs**			90–270	
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	36–126	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	18–90	–
	Forb, introduced	2FI	*Forb, introduced*	0–90	–
	Forb, native	2FN	*Forb, native*	18–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	18–90	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	18–90	–
	scurfpea	PSORA2	*Psoralidium*	18–72	–
	field sagewort	ARCA12	*Artemisia campestris*	0–54	–
	goldenrod	SOLID	*Solidago*	18–54	

	goldenrod	SOLID	*Solidago*	18–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	18–54	–
	showy milkweed	ASSP	*Asclepias speciosa*	18–54	–
	thistle	CIRSI	*Cirsium*	18–54	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–54	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–36	–
	curly dock	RUCR	*Rumex crispus*	0–36	–
	burdock	ARCTI	*Arctium*	0–36	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–18	–
Shrub/Vine					
9	**Shrubs**			36–180	
	snowberry	SYMPH	*Symphoricarpos*	18–126	–
	rose	ROSA5	*Rosa*	18–72	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–72	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	18–72	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–54	–
	American plum	PRAM	*Prunus americana*	0–54	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–54	–
	pricklypear	OPUNT	*Opuntia*	0–36	–
	sandbar willow	SAIN3	*Salix interior*	0–18	–
Tree					
10	**Trees**			0–18	
	Tree	2TREE	*Tree*	0–18	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–18	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–18	–
	willow	SALIX	*Salix*	0–18	–
	American elm	ULAM	*Ulmus americana*	0–18	–

Table 10. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Wheatgrass**			360–840	
	western wheatgrass	PASM	*Pascopyrum smithii*	360–840	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–120	–
2	**Cool-Season Bunchgrasses**			48–240	
	green needlegrass	NAVI4	*Nassella viridula*	24–240	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–120	–
3	**Tall/Mid Warm-Season Grasses**			24–144	
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–120	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–48	–
	marsh muhly	MURA	*Muhlenbergia racemosa*	0–48	–
	switchgrass	PAVI2	*Panicum virgatum*	0–24	–
	big bluestem	ANGE	*Andropogon gerardii*	0–24	–

	sideoats grama	BOCU	*Bouteloua curtipendula*	0–24	–
4	**Short Warm-Season Grasses**			24–144	
	buffalograss	BODA2	*Bouteloua dactyloides*	0–120	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–120	–
	saltgrass	DISP	*Distichlis spicata*	0–48	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	0–48	–
5	**Other Native Grasses**			24–120	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–120	–
	foxtail barley	HOJU	*Hordeum jubatum*	24–120	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–24	–
6	**Grass-likes**			120–240	
	sedge	CAREX	*Carex*	48–240	–
	rush	JUNCU	*Juncus*	0–120	–
	spikerush	ELEOC	*Eleocharis*	0–72	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–72	–
7	**Non-Native Grasses**			240–720	
	bluegrass	POA	*Poa*	120–480	–
	smooth brome	BRIN2	*Bromus inermis*	48–288	–
	cheatgrass	BRTE	*Bromus tectorum*	24–240	–
Forb					
8	**Forbs**			120–360	
	Forb, introduced	2FI	*Forb, introduced*	24–192	–
	Forb, native	2FN	*Forb, native*	24–120	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	24–120	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	24–96	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	24–72	–
	Indianhemp	APCA	*Apocynum cannabinum*	0–72	–
	burdock	ARCTI	*Arctium*	0–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	24–72	–
	showy milkweed	ASSP	*Asclepias speciosa*	24–72	–
	thistle	CIRSI	*Cirsium*	24–72	–
	goldenrod	SOLID	*Solidago*	24–72	–
	white heath aster	SYER	*Symphyotrichum ericoides*	24–72	–
	nettle	URTIC	*Urtica*	0–72	–
	scurfpea	PSORA2	*Psoralidium*	24–72	–
	curly dock	RUCR	*Rumex crispus*	0–72	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–48	–
	field sagewort	ARCA12	*Artemisia campestris*	0–48	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–24	–
	mint	MENTH	*Mentha*	0–24	–
	American vetch	VIAM	*Vicia americana*	0–24	–
	ragwort	SENEC	*Senecio*	0–24	–

Shrub/Vine					
9	**Shrubs**			120–288	
	snowberry	SYMPH	*Symphoricarpos*	48–240	–
	sandbar willow	SAIN3	*Salix interior*	24–120	–
	rose	ROSA5	*Rosa*	24–96	–
	American plum	PRAM	*Prunus americana*	24–96	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–96	–
	chokecherry	PRVI	*Prunus virginiana*	0–72	–
	false indigo bush	AMFR	*Amorpha fruticosa*	0–48	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–48	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–24	–
	pricklypear	OPUNT	*Opuntia*	0–24	–
Tree					
10	**Trees**			0–24	
	Tree	2TREE	*Tree*	0–24	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–24	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–24	–
	willow	SALIX	*Salix*	0–24	–
	American elm	ULAM	*Ulmus americana*	0–24	–

Animal community

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 ecological site description). 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.

Western Wheatgrass-Green Needlegrass Plant Community (1.1)
Annual Production (lbs./acre air-dry): 3000
Stocking Rate (AUM/acre)*: 0.82

Western Wheatgrass-Blue Grama-Inland Saltgrass Plant Community (1.2)
Annual Production (lbs./acre air-dry): 1800
Stocking Rate (AUM/acre)*: 0.49

Western Wheatgrass-Non-Native Cool-Season Grasses Plant Community (3.1)
Annual Production (lbs./acre air-dry): 2400
Stocking Rate (AUM/acre)*: 0.66

Other Plant Community Phases have highly variable forage production levels. Actual on-site forage inventories will need to be conducted to determine average annual production, stocking rates and timing of grazing.

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM), and on 25 percent harvest efficiency of preferred and desirable species (refer to USDA NRCS, National Range and Pasture Handbook).

Total annual production on site may contain vegetation which is 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 groups C and D. Infiltration and runoff potential for this site varies from moderate to high depending on 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. Areas where ground cover is less than 50 percent 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 varieties of plants that bloom from spring until fall have an aesthetic 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.

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 requirement as an Approved ESD as laid out in the 2003 National Range and Pasture Handbook (NRPH). The document fully describe 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 towards an Approved status.

Site Development and Testing Plan:
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. 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. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site include: April Boltjes, Range Management Specialist (RMS), NRCS; Stan Boltz, RMS, NRCS; Kent Cooley, Soil Scientist, NRCS; Rick Peterson,

RMS, NRCS; and L. Michael Stirling, RMS, NRCS.

Other references

High Plains Regional Climate Center, University of Nebraska. (http://www.hprcc.unl.edu/)
Teledo, D., Sanderson, M., Spaeth, K., Hendrickson, J., Printz, J. 2014. Extent of Kentucky Bluegrass and Its Effect on Native Plant Species Diversity and Ecosystem Services in the Northern Great Plains of the United States. Invasive Plant Science and Management. 7(4):543-522. Weed Science Society of America.
USDA, NRCS. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296, 2006
USDA, NRCS. National Ecological Site Handbook, 1st Ed. January, 2014
USDA, NRCS. National Water and Climate Center. (http://www.wcc.nrcs.usda.gov/)
USDA, NRCS. National Range and Pasture Handbook, September 1997
USDA, NRCS. National Soil Information System, Information Technology Center. (http://nasis.nrcs.usda.gov)
USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center.
USDA, NRCS, Various Published Soil Surveys

Contributors

Betty Bisch
Stan Boltz

Acknowledgments

Rick L. Peterson updated ESD 9/1/16

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
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	05/08/2010
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

---

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

---

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 5 percent is typical.

5. **Number of gullies and erosion associated with gullies:** None typical, however limited headcutting may form after high runoff or flooding events. Existing gullies should be stabilized with good vegetative cover.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None typical, but limited deposition may occur after major runoff or flooding events.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter of small and medium size classes will move after average to high rainfall events. Litter does not travel far, typically being trapped in small bunches by the extensive vegetative cover. Litter movement may be fairly extensive after major runoff or flooding events.

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 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 5 to 11 inches thick with mollic (dark) colors when moist. Structure typically is medium subangular blocky in the upper A-horizon.

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):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

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 rhizomatous grasses >> Mid/tall cool-season bunchgrasses >

    Sub-dominant: Mid/tall warm-season grasses = Grass-likes = Forbs = Shrubs >

    Other: Short warm-season grasses > Mid/short cool-season grasses > Trees

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

---

14. **Average percent litter cover (%) and depth (in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 2,200-4,000 lbs./acre (air-dry weight). Reference value production is 3,000 lbs./acre (air-dry weight).

---

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

---

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.
