USDA Natural Resources Conservation Service

Ecological site R072XY108KS Loamy Lowland

Accessed: 05/10/2025

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

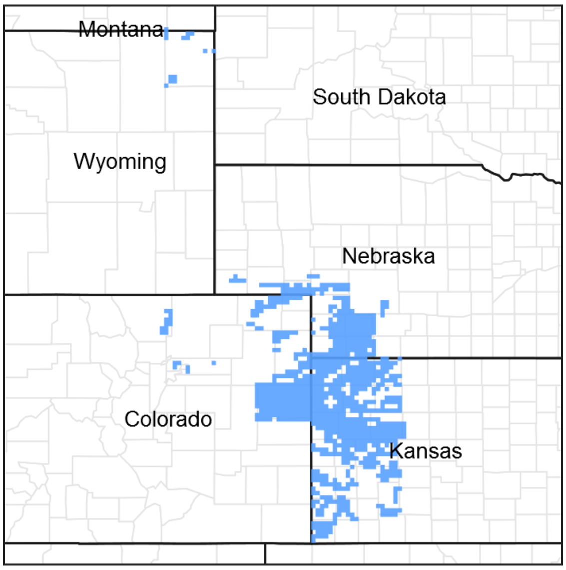


Figure 1. Mapped extent

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): 072X–Central High Tableland

Major Land Resource Area (MLRA) 72--Central High Tableland. This area is in Kansas (54 percent), Nebraska (25 percent), and Colorado (21 percent). A very small part of the area is in Wyoming. The area makes up about 34,550 square miles (89,535 square kilometers). It includes the towns of Garden City, Goodland, and Colby, Kansas; Imperial, North Platte, Ogallala, and Sidney, Nebraska; and Holyoke and Wray, Colorado. Interstate 70 bisects the area, and Interstates 76 and 80 follow the south side of the South and North Platte Rivers, respectively. The Cimarron National Grasslands occur in the southwest corner of the MLRA.

Classification relationships

Major land resource area (MLRA): 072-Central High Tableland

Ecological site concept

Alluvial soils make up the parent material of this ecological site. This site occurs on flood plains or low stream terraces and is characterized by a seasonal or perennial high water table greater than 6 feet from the surface. The soils characteristic of this site are deep and well drained that formed in calcareous alluvial sediments.

Associated sites

R072XY100KS	**Loamy Tableland** The Loamy Tableland ESD occurs on broad upland divides and can be found adjacent to this site.
R072XY101KS	**Limy Slopes** Limy slopes ESD is on the Breaks landscape located adjacent to this site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Pascopyrum smithii*

Physiographic features

The Loamy Lowland ecological site occurs on nearly level to gently sloping floodplains of river valleys that have a flooding frequency ranging from none to frequent. It receives some additional water in the form of run-in from adjacent uplands.

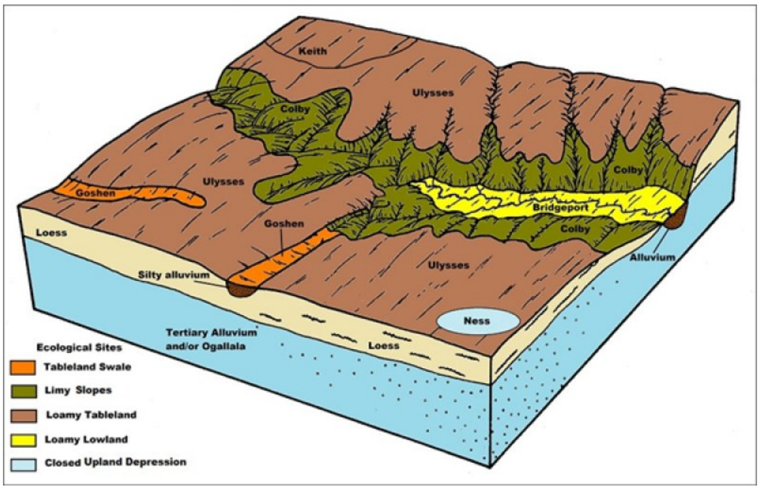


Figure 2. MLRA72 block diagram

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	2,300–5,000 ft
Slope	0–4%
Ponding depth	0 in
Water table depth	60 in

Climatic features

The average annual precipitation in this area is 14 to 25 inches (355 to 635 millimeters). It fluctuates widely from year to year. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The maximum precipitation occurs from late spring through early autumn. Precipitation in winter occurs as snow. The annual snowfall ranges from about 16 inches (40 centimeters) in the southern part of the area to 35 inches (90 centimeters) in the northern part. The average annual temperature is 46 to 57 degrees F (8 to 14 degrees C). The freeze-free period averages 158 days and ranges from 135 to 210 days, increasing in length from northwest to southeast. Climate data comes from the Natural Resources Conservation Service (NRCS) National Water and Climate Center. The data set is from 1981-2010.

Table 3. Representative climatic features

Frost-free period (average)	144 days
Freeze-free period (average)	158 days
Precipitation total (average)	19 in

Climate stations used

- (1) TRENTON DAM [USC00258628], Trenton, NE
- (2) GOODLAND [USW00023065], Goodland, KS
- (3) HEALY [USC00143554], Healy, KS
- (4) SYRACUSE 1NE [USC00148038], Syracuse, KS
- (5) LEOTI [USC00144665], Leoti, KS
- (6) ULYSSES 3NE [USC00148287], Ulysses, KS
- (7) ENDERS LAKE [USC00252741], Enders, NE
- (8) KIMBALL 2NE [USC00254440], Kimball, NE
- (9) SIDNEY MUNI AP [USW00024030], Sidney, NE

Influencing water features

This site is made up of alluvial soils that have a water table greater than 6 feet from the surface. Fluctuations with this water table occur, and there could be times throughout the year that it is less than 6 feet from the surface. Water influences this site due to landform position. This site is adjacent to streams and is in a receiving position for run-in water.

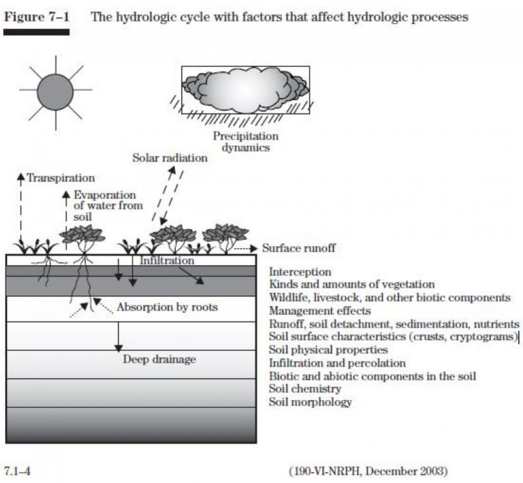


Figure 7. Fig.7-1 from National Range and Pasture Handbook

Soil features

The soils that are correlated to the Loamy Lowland ecological sites are very deep, subject to inundation by floodwaters, and subsequent sedimentation. These soils are stratified and often calcareous to the surface. Textures are dominantly moderately coarse to moderately fine-textured loamy soil material, but sandy textures may occur in the lower part of the root zone. Free water is usually very deep but may be present in the lower part of some profiles during part of the growing season. The content of organic matter is generally low to moderate in the surface layer. Available water capacity is generally high.

The Reference Plant Community should exhibit slight to no evidence of rills, wind-scoured areas, or pedestaled plants. Water flow paths, if any, are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact in the Reference State. Sub-surface soil layers are non-restrictive to water movement and root penetration. These soils are susceptible to wind and water erosion where vegetative cover is inadequate. Channel cutting, deposition, and removals may occur adjacent to streams.

Major soil series correlated to this ecological site include Angelus, Bayard, Bridgeport, Craft, Grigston, Haverson, Hobbs, Hord, Lexsworth, McCook, Merrick, Ralton, and Roxbury.

These attributes represent 0-40 inches in depth or to the first restrictive layer.

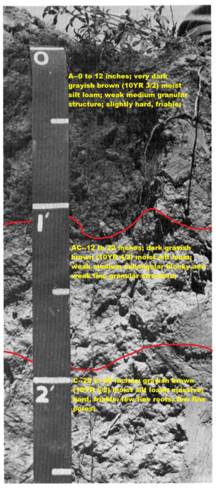


Figure 8. Bridgeport soils profile Thomas Co. KS

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	60–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	8–12.4 in
Calcium carbonate equivalent (0-40in)	0–12%
Electrical conductivity (0-40in)	0–1 mmhos/cm
Sodium adsorption ratio (0-40in)	0–10
Soil reaction (1:1 water) (0-40in)	6.5–8.7
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The interpretive plant community for this site is the Reference Plant Community and is dynamic due to the complex interaction of many ecological processes. The Reference Plant Community has been determined by the study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing strategies. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts have also been used.

This ecological site is made up of a Grassland State, a Sod-bound State and a Tillage State. The Grassland State is characterized by non-broken land (no tillage), both warm and cool season, tall and mid bunchgrasses, sod-forming grasses, forbs, and shrubs. The Sod-bound State is dominated by shortgrass species that form a dense sod. The Tillage State has been mechanically disturbed (broken) by equipment and includes either a variety of reseeded warm season bunch and sod forming grasses or early successional plants to include the latter as well as annual grasses and forbs.

Vegetation changes are expected within this ecological site and will be dependent on the sites geographical location inside Major Land Resource Area (MLRA) 72 the Central High Tablelands. Variation in precipitation east and west is not as affected as is temperature north and south. The northern part of MLRA 72 is characterized by cooler temperatures and shorter growing season in respect to the southern end. As a result, cool season bunchgrasses and sod formers proliferate. Growth of native cool season plants begins about April 15, and continues to about June 15. Native warm season plants begin growth about May 15, and continue to about August 15. Green up of cool season plants may occur in September and October if adequate moisture is available (weather data from National Climate Data Center 1980-2010).

Fires are a part of the natural disturbance regime of this site. This site developed with occasional fires as part of the ecological processes. Historically, it is believed that the fires were infrequent, randomly distributed, and started by lightning at various times throughout the season when thunderstorms were likely to occur. It is also believed that pre-European inhabitants may have used fire as a management tool for attracting herds of large migratory herbivores (bison, elk, deer, and pronghorn). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool in the semi-arid, High Plains area.

The degree of herbivory (feeding on herbaceous plants) has a significant impact on the dynamics of the site. Historically, periodic grazing by herds of large migratory herbivores was a primary influence. Secondary influences of herbivory by species such as, grasshoppers, gophers, and root-feeding organisms impacted the vegetation historically, and continue to this day.

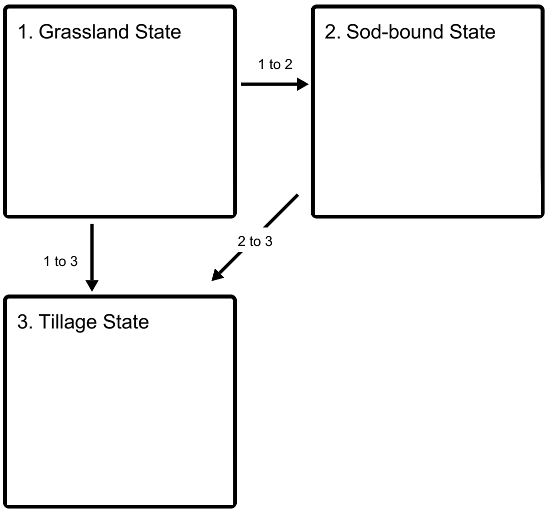
The management of herbivory by humans through grazing of domestic livestock and/or manipulation of wildlife populations has been a major influence on the ecological dynamics of the site. This management coupled with the High Plains climate largely dictates the plant communities for the site.

Drought cycles were part of the natural disturbance regime and contribute to the range of variability of the vegetation within the site. Droughts have historically had a major impact upon the vegetation of this MLRA as well as this site. The species composition changes according to the duration and severity of the drought cycle (Albertson and Weaver 1946).

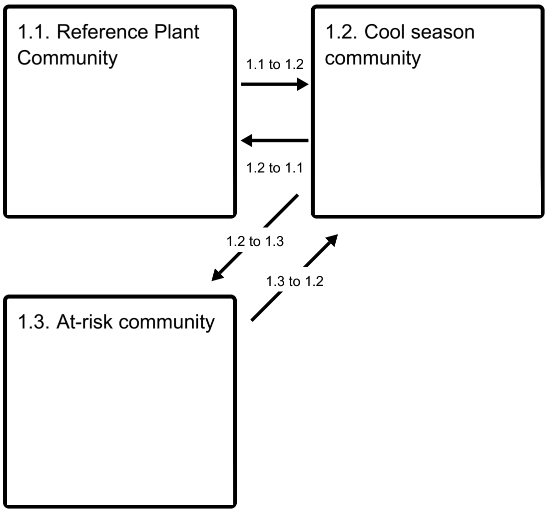
This site occurs on nearly level bottomland adjacent to streams and receives runoff from adjacent sites. It is a site preferred by livestock which can lead to grazing distribution concerns. Landscape position is conducive to livestock over utilization and management of this ecological site by itself can generate challenges. Water locations, salt placement, and other aids help distribute grazing. Other management techniques such as concentrated grazing and/or grazing systems also help distribute grazing more evenly. The general response of this site to heavy, long term continuous grazing pressure without adequate rest and recovery is to gradually lose the vigor and reproductive potential of the reference tall and mid-grass species and shift the plant community toward less palatable species, cool season dominant species, and/or short-grass species.

State and transition model

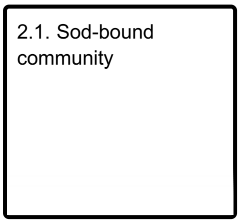
Ecosystem states



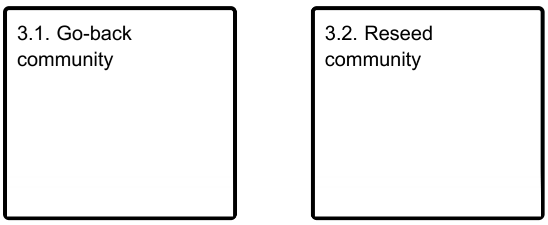
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Grassland State

The Grassland State is supported by empirical data and is defined by three native plant communities that are a result of periodic fire, drought, herbivore, and ungulate grazers. These events are part of the natural disturbance regime and climatic process that contribute to the development of the site. The Reference Plant Community consist of tall and mid, warm and cool season grasses, forbs, and shrubs. Plant community 1.2 is dominated by western wheatgrass, sideoats grama, blue grama, and combined with a minor component (2-10 percent composition by weight) of Reference Community lant species. Plant community 1.3 is the At-risk Plant Community. This plant community is most vulnerable to exceeding the resilience limits of the Grassland State and transitioning to an alternative state. This plant community is dominated (40-100 percent composition by weight) by blue grama and buffalograss. Sub dominant (10-40 percent composition by weight) species include western wheatgrass, sand dropseed, and threeawns. Heavy continuous use throughout the year and the growing season combined with inadequate rest and recovery of the dominant Reference Plant Community species will reduce the production of the dominant plant species and allow western wheatgrass, sideoats grama, and blue grama to increase. To a small extent, some buffalograss will also increase. After the vegetation is reduced to western wheatgrass and heavy continuous grazing of the dominant plant species continues, blue grama, buffalograss, sand dropseed, and threeawns will increase. There also could be an increase in species such as kochia, Russian thistle, and other undesirable annuals. The following paragraphs are narratives for each of the described plant communities. These plant communities may not represent every possibility, but they probably are the most prevalent and repeatable plant communities that exist on this ecological site. The plant composition table shown below has been developed from the best available knowledge at the time of this revision. As more data is collected, some of these plant communities may be adjusted or removed and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities will be determined by the decision-makers and will meet minimum quality criteria established by NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Community 1.1
Reference Plant Community

The Reference Plant Community serves as the basis for all other interpretations. The potential vegetation of this site is a mix of warm season tallgrasses, cool season grasses and warm season mid and shortgrasses. This community is comprised of approximately 85 percent grasses and grass-like plants, 10 percent forbs, and 5 percent shrubs. Big bluestem, switchgrass, eastern gamagrass, prairie cordgrass, and Indiangrass are the dominant species in this community making up approximately 45 percent of the total annual production per acre per year (ac/yr). Sub-dominant species making up approximately 25 percent of the total annual production include western wheatgrass, Canada wildrye, green needlegrass, vine mesquite, slender wheatgrass, and needle and thread. The Reference Community has a very diverse forb population that makes up 10 percent of the total annual production per ac/yr. The shrub community is a minor component making up 5 percent of the total annual production per ac/yr. Shrubs include fourwing saltbush, winterfat, false indigo, American plum, leadplant, prairie sagewort, plains pricklypear, twistspine prickly pear, rubber rabbitbrush, golden currant, prairie rose, western snowberry, and coralberry. Prescription grazing that allows for adequate recovery periods after each grazing event and a forage and animal balance will maintain the species composition and biotic integrity of this plant community. Multiple years of spring grazing followed by summer deferment will reduce the cool season component (western wheatgrass) of this plant community and increase the warm season component (big bluestem, switchgrass, and Indiangrass). To the contrary, multiple years of spring deferment and summer grazing will increase the cool season component and decrease the warm season component of this plant community. This plant community is vastly diverse and especially productive. The abundance and diversity of vegetation found on this site allows for excellent capture and storage of precipitation and increased infiltration rates. Plant litter, lack of large areas of bare ground, and a shrub component of less than 5 percent of the total annual production/acre will promote the proper function of the water and mineral cycles. Decomposition of roots, high infiltration rates, and high litter cover allows for the proper function of the nutrient cycle in the Reference Plant Community. Total annual production ranges from 2,500 to 4,000 pounds of air-dried vegetation per acre per year and will average 3,500 pounds.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2125	2975	3400
Forb	250	350	400
Shrub/Vine	125	175	200
Total	**2500**	**3500**	**4000**

Figure 10. Plant community growth curve (percent production by month).
KS7202, Warm season dominant, cool season sub-dominant.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	3	10	40	35	10	2	0	0	0

Community 1.2
Cool season community

This plant community developed under heavy, continuous season long grazing that did not allow for the rest and recovery of dominant Reference Plant Community species. There are no prescription fires implemented. Big bluestem, switchgrass, eastern gamagrass, prairie cordgrass, and Indiangrass have decreased in abundance. Because of its rhizomatous nature and season of grazing, western wheatgrass has increased to fill the voids left by the decrease of dominant Reference Community species. This community is dominated by western wheatgrass, sideoats grama, and blue grama. Big bluestem and other highly palatable species have decreased due to heavy uninterrupted grazing pressure during the growing season and/or throughout the year. The total annual production of this site is approximately 3,000 pounds per acre (air-dry weight).

Community 1.3
At-risk community

The At-risk community phase is vulnerable to degradation. It is most vulnerable to exceeding the resilience limits of the Grassland State and transitioning to the Sod-bound State. An At-risk community phase is considered to be a stage in a transition process that is reversible if management is changed. This plant community evolved with heavy, continuous grazing during the growing season and/or throughout the year without adequate recovery periods between each grazing event, during the growing season. Prescription fire has been removed as a management tool. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. Remnant tall grasses and palatable forbs and shrubs may still be present at trace amounts, but have significantly decreased in abundance, and likely make up less than 2 percent of the total annual production of the site. Western wheatgrass, sideoats grama, big bluestem, switchgrass, and Indiangrass have been eliminated or reduced to trace amounts. In addition, green needlegrass, fourwing saltbush, and winterfat have also been reduced to trace amounts in the western areas of the MLRA. The palatable forb species component has been reduced. Blue grama and buffalograss have increased in abundance making up greater than 40 percent of the plant community, and are beginning to take on a dense sod appearance. Sand dropseed, Fendler threeawn, sixweeks fescue, plains prickly pear, and hairy goldenaster have also increased. This plant community is at risk of losing key species that were present in the Plant Community 1.2 and the Reference Plant Community. Once these key species are removed and other plants have increased, it will take a long time, if at all, to bring them back by management alone. This restoration needs further field investigations and documentation. Total aboveground carbon has been reduced due to decreases in forage and litter production. Reduction of rhizomatous wheatgrass, nitrogen fixing forbs, shrub component, and increased warm season shortgrasses has begun to alter the species composition, and the biotic integrity of this community. Water and nutrient cycles are being impaired. This site is becoming increasingly arid, there is a reduction in interception, and an increase in evaporation and runoff. Total annual production can vary from 900 to 2200 pounds of air-dry vegetation per acre and will average 1300 pounds during an average year.

Pathway 1.1 to 1.2
Community 1.1 to 1.2

This community pathway is driven by short term management (<10 years) devoid of a forage and animal balance, lack of prescription fires, and heavy continuous grazing without adequate recovery periods between grazing events. These drivers will convert the Reference Plant Community to a community of western wheatgrass, sideoats grama, and blue grama. Drought, in combination with this type of management or spring deferment and summer grazing will quicken the rate at which the Reference Community pathways to community phase 1.2.

Pathway 1.2 to 1.1
Community 1.2 to 1.1

This community pathway is driven by management incorporating long-term (>10-20 years) prescription grazing that includes a forage and animal balance, prescription fires at a frequency of 1 in 10 years, and adequate rest and recovery periods of the dominate Reference Community species. This type of management will shift the plant community dominated by western wheatgrass to a community dominant of those species found in the Reference Plant Community.

Pathway 1.2 to 1.3
Community 1.2 to 1.3

This community pathway is driven by long term management (>20 years) without a forage and animal balance, an absence of prescription fires, and heavy continuous grazing without adequate recovery periods between grazing events. These drivers will convert Plant community 1.2 to a community dominant of blue grama and buffalograss. Western wheatgrass, sand dropseed, and threeawns will make up the sub-dominant species. Drought, in combination with this type of management will quicken the rate at which Community 1.2 pathways to the At-risk Community.

Pathway 1.3 to 1.2
Community 1.3 to 1.2

This community pathway is driven by management that incorporates long-term prescription grazing (>40 years), a forage and animal balance, the use of prescribed fires, and adequate rest, and recovery periods of the dominate Reference Plant Community species (if remnants remain), and/or the midgrasses (sideoats grama) in plant community 1.2. This type of management will favor plant community 1.2 and 1.1 (dependent upon the remnant amounts).

State 2
Sod-bound State

The Grassland State ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold into the Sod-bound State. The designation of the Sod-bound State denotes changes in infiltration, runoff, bulk density, and species composition. The changes in soil properties, water movement, and the plant community affects changes in the ecosystem affecting the hydrologic functionality, biotic integrity, and soil and site stability. With long term, heavy, continuous grazing, buffalograss and blue grama will become the dominant species and have a sod-bound appearance. Unable to withstand the grazing pressure, only a remnant population of western wheatgrass remains. Species diversity has been reduced further. Water infiltration is reduced due to the sod nature of the buffalograss and blue grama. There is an increase in runoff within this plant community. Vegetation type affects the amount and structure associated cover, therefore the infiltration rate differs among vegetation types. The amount of cover, and hence the rate of infiltration, is usually greatest under trees and shrubs, followed in decreasing order by bunchgrass, shortgrass, and bare ground (Blackburn 1975; Thurow et al. 1986). Specific dynamic soil property changes between the Grassland State and the Sod-bound State has been documented. As plant community cover decreases from bunchgrasses to more of the sod grasses there is a decrease in infiltration, interception, and an increase in surface runoff (Thurow et al. 1986). There is no known timeframe or restoration pathway success from this state to the grassland state. Experience suggests that long-term prescription grazing to include a forage and animal balance, adequate recovery periods following each grazing event over long periods of time will gradually move this plant community toward the grassland state. This process is not well documented and may take greater than 40 years. This alternative state will be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Community 2.1
Sod-bound community

The Sod-bound community evolved with long term, heavy continuous grazing. Most, if not all of the key grass, forb, and shrub species are absent. Western wheatgrass may persist in trace amounts, greatly reduced in vigor and not readily seen. Blue grama and buffalograss dominate the community with a tight “sodbound” structure. Fendler threeawn, sand dropseed, sixweeks fescue. and hairy goldenaster have increased. This plant community is resistant to change due to grazing tolerance of buffalograss and blue grama. A significant amount of production and diversity has been lost when compared to the Reference Plant Community. Loss of cool and tall warm season grasses, shrub component, and nitrogen fixing forbs have negatively impacted energy flow and nutrient cycling.

Water infiltration is reduced significantly due to the massive shallow root system “root pan”, characteristic of blue grama and buffalograss. Soil loss may be obvious where flow paths are connected. Blue grama provides this site with a unique feature in that the leaves on blue grama remain semi-dormant during drought periods but resume growing each time adequate moisture is available during the growing season. Reseeding of blue grama is unlikely because young seedlings seldom survive the extended drought periods that are common on this site. Blue grama does maintain itself by tillering. This also provides blue grama with another unique feature of being able to withstand drought and heavy grazing use. Typically blue grama is a bunchgrass but quickly forms a sodbound condition when heavily grazed. It will take a very long time (>40 years) to restore this plant community back to the Reference Plant Community with management.

State 3
Tillage State

The Grassland State ecosystem has been driven beyond the limits of ecological resilience and has crossed a threshold into the Tillage State. The designation of the Tillage State denotes changes in infiltration, runoff, bulk density, aggregate stability, and species composition. The changes in inherent soil properties, water movement, and the plant community affects changes in the ecosystem affecting the hydrologic functionality, biotic integrity, and soil and site stability. This group includes two separate vegetation states that are highly variable. They are derived through two distinct management scenarios, and are not related successionally. Infiltration, runoff, and soil erosion varies depending on the vegetation present. The Tillage State consist of abandoned cropland that has been naturally revegetated (go-back) or planted/seeded to grassland. Many reseeded plant communities were planted with a local seeding mix under the Conservation Reserve Program (CRP) or were planted to a monoculture of sideoats grama. Go-back communities are difficult to define due to the variability of plant communities that exist. Many of these communities are represented by the genus Aristida (three-awns). This is an alternative state because the ecological functions i.e., dynamic soil properties and plant communities, are not fully restored to that of the Reference State. Tillage can destroy soil aggregation. Soil aggregates are an example of dynamic soil property change. Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion (Brady, Weil, 2008). This alternative state should be tested through long term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Community 3.1
Go-back community

The Go-back plant community is created when the soil is tilled or farmed (sodbusted), and abandoned. All of the native plants are killed, soil organic matter/carbon reserves are reduced, soil structure is changed, and a plowpan or compacted layer can be formed. This compaction layer decreases water infiltration. Synthetic chemicals may remain as a residual from farming operations. In early successional stages, this community is not stable. Erosion is a concern within this plant community. An annual plant community such as Russian thistle, kochia, annual bromes, foxtail (bristlegrass), and other introduced annuals invade. These plants give some protection from erosion and start to rebuild the content of organic matter. This plant community is gradually replaced by early perennial species such as threeawn and dropseed. Western wheatgrass, buffalograss, or blue grama can become established depending upon whether a remnant seed source is available. Eventually other perennial warm and cool season species can establish. This successional process takes many years as the soil is being developed and will require prescribed grazing.

Community 3.2
Reseed community

This plant community can vary considerably depending on how eroded the soil was, the species seeded, the stand that was established, how long ago the stand was established, and the management of the stand since establishment. Prescription grazing that allows adequate recovery periods will be necessary to maintain productivity and desirable species. There are several factors that make seeded rangeland a different grazing resource than native rangeland. Factors such as species selected, stand density, improved or selected varieties, and harvest efficiency all impact the production level and palatability. This results in uneven grazing distribution when both seeded and native rangelands are in the same grazing unit. Therefore, the seeded rangeland should be managed as a separate grazing unit where prohibited. Species diversity on seeded rangeland is often lower and native forb species generally take longer to re-establish.

Transition 1 to 2
State 1 to 2

The triggers for this transition are overgrazing, long term (>20 years) management without a forage and animal balance, heavy continuous grazing in the growing season and/or throughout the year and inadequate recovery periods between grazing events. This type of management will convert the grassland state to a state of blue grama and buffalograss sod. Blue grama and buffalograss are the dominant species making up greater than 40 percent of the composition by weight. Drought, in combination with this type of management will quicken the rate of state transition. The hydrologic cycle and soil function of the site are the ecological process effected. Soil dynamic property changes include an increase bulk density and a decrease in aggregate stability.

Transition 1 to 3
State 1 to 3

This transition is triggered by a management action as opposed to a natural event. Mechanical tillage is the event that contributes directly to the loss of state resilience and is the result in a shift between the grassland state and the tillage state. Ecological structure and function has been compromised. The effects of tillage include changes in soil structure, aggregate stability, bulk density, nutrient availability, plant cover, hydrologic function, and temperature. This alternative state should be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Transition 2 to 3
State 2 to 3

This transition is triggered by a management action as opposed to a natural event. Mechanical tillage is the event that contributes directly to the loss of state resilience and is the result in a shift between the grassland state and the tillage state. Ecological structure and function has been compromised. Soil properties affected by tillage include: plant cover, nutrient availability, structure and aggregate stability, hydrologic function, temperature and bulk density. This alternative state should be tested through long-term observation of ecosystem behavior and repeated application of conservation and restoration practices. This state should be re-evaluated and refined continually.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm season tallgrass**			775–1600	
	big bluestem	ANGE	*Andropogon gerardii*	600–1000	–
	switchgrass	PAVI2	*Panicum virgatum*	175–300	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–150	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	0–150	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–100	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–25	–
2	**Cool season grasses**			190–800	
	western wheatgrass	PASM	*Pascopyrum smithii*	175–300	–
	Canada wildrye	ELCA4	*Elymus canadensis*	15–150	–
	green needlegrass	NAVI4	*Nassella viridula*	0–120	–
	vine mesquite	PAOB	*Panicum obtusum*	0–100	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–75	–

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–75	–
	Fendler threeawn	ARPUL	*Aristida purpurea var. longiseta*	0–25	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–15	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–15	–
3	**Warm season midgrass**			50–250	
	little bluestem	SCSC	*Schizachyrium scoparium*	50–150	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–120	–
4	**Warm season shortgrass**			30–250	
	blue grama	BOGR2	*Bouteloua gracilis*	15–150	–
	buffalograss	BODA2	*Bouteloua dactyloides*	15–120	–
5	**Sedges**			15–75	
	sedge	CAREX	*Carex*	15–75	–
Forb					
6	**Forb/Legume**			45–350	
	American vetch	VIAM	*Vicia americana*	5–25	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	5–25	–
	Carelessweed	CYXA2	*Cyclachaena xanthiifolia*	5–25	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	10–25	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	10–20	–
	scarlet beeblossom	OESU3	*Oenothera suffrutescens*	10–20	–
	prairie groundsel	PAPL12	*Packera plattensis*	0–15	–
	beardtongue	PENST	*Penstemon*	0–15	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–15	–
	Missouri milkvetch	ASMI10	*Astragalus missouriensis*	0–15	–
	narrowleaf milkvetch	ASPE5	*Astragalus pectinatus*	0–15	–
	false boneset	BREU	*Brickellia eupatorioides*	0–15	–
	yellowspine thistle	CIOC2	*Cirsium ochrocentrum*	0–15	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	0–15	–
	Carolina larkspur	DECAV2	*Delphinium carolinianum ssp. virescens*	0–15	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	0–15	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–15	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–15	–
	dotted blazing star	LIPU	*Liatris punctata*	0–15	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–15	–
	prairie coneflower	RATIB	*Ratibida*	0–15	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	0–15	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–15	–
	white heath aster	SYERE	*Symphyotrichum ericoides var. ericoides*	0–15	–
	hoary verbena	VEST	*Verbena stricta*	0–15	–
	common yarrow	ACMI2	*Achillea millefolium*	0–15	–
Shrub/Vine					
7	**Shrubs**			30–175	

7	**Shrubs**			50–175	
	fourwing saltbush	ATCA2	*Atriplex canescens*	15–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	15–50	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–15	–
	American plum	PRAM	*Prunus americana*	5–15	–
	golden currant	RIAU	*Ribes aureum*	0–15	–
	prairie rose	ROAR3	*Rosa arkansana*	0–15	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–15	–
	coralberry	SYOR	*Symphoricarpos orbiculatus*	0–15	–
	rubber rabbitbrush	ERNAG	*Ericameria nauseosa ssp. nauseosa var. glabrata*	0–15	–
	leadplant	AMCA6	*Amorpha canescens*	0–15	–
	false indigo	AMORP	*Amorpha*	5–15	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–15	–

Animal community

Wildlife Interpretations

Reference Plant Community

The structural diversity in the plant community found on the Reference Plant Community is attractive to a number of wildlife species. Common bird species expected include Cassin’s and Brewer’s sparrow, chestnut collared longspur, lark bunting, western meadowlark, and ferruginous and Swainson’s hawks. The combination of mid-tall grasses and shrubs provides habitat for greater and lesser prairie chicken. Scaled quail may also use this community.

White-tailed and black-tailed jackrabbit, badger, pronghorn, coyote, swift fox, plains pocket gopher, long-tailed weasel, and several species of mice are mammals that commonly use this plant community. Reptiles using this community include western rattlesnake, bullsnake, plains garter snake western hognose snake, racer, western box turtle, and six-lined racerunner.

Cool Season community, At-risk community; Sod-bound community; Tillage State.

The loss of taller grasses in these plant communities results in a shift of bird species away from the Reference Plant Community birds. Lark bunting, chestnut-collared longspur, western meadowlark, and Cassin’s and Brewer's sparrow stop using these communities altogether. With the exception of the hawk species, most Reference community bird species would be only occasional users of these communities. On sites with adequate drainage, typical shortgrass prairie species such as horned lark, killdeer, long-billed curlew, McCown's longspur, mountain plover, burrowing owl, black-tailed prairie dog, and ferruginous hawk are dominant species.

Jackrabbit, black-tailed prairie dog, thirteen-lined ground squirrel, and desert cottontail rabbit are frequent users of these communities. Reptiles using these communities exclusively are short-horned lizard and lesser earless lizard. Other reptiles using these communities include the species listed for the
Reference Plant Community.

Seeded Rangeland

The wildlife species expected on seeded rangeland would be those listed for the plant community the seeding most resembles.

Other Potential Species

The plains spadefoot is the only common species of frog or toad inhabiting grasslands in Eastern Colorado. This species requires water for breeding. Tiger salamanders may be found on grassland sites, but require a water body for breeding. Either of these species may be found in any plant community if seasonal water requirements are met. Mule and white-tailed deer may use this ecological site, however the shrub cover is too low to provide escape or hiding cover. On ecological site locations near riparian areas, deer will use the vegetation for feeding. Big brown bats will use any plant community on this ecological site if a building site is in the area. The gray wolf, black-footed ferret, and wild bison used this ecological site in historic times. The wolf and ferret are thought to be extirpated from Eastern Colorado. Bison are currently found only as domestic livestock.

Grazing Interpretations

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide yearlong forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

Calculating Safe Stocking Rates: Proper stocking rates should be incorporated into a grazing management strategy that protects the resource, maintains or improves rangeland health, and is consistent with management objectives. In addition to usable forage, safe stocking rates should consider ecological condition, trend of the site, past grazing use history, season of use, stock density, kind and class of livestock, forage digestibility, forage nutritional value, variation of harvest efficiency based on desirability preference of plant species, and/or grazing system and site grazability factors (such as steep slopes, site inaccessibility, or distance to drinking water).

Often the current plant community does not entirely match any particular Community Phase as described in this ecological site description. Because of this, a resource inventory is necessary to document plant composition and production. Proper interpretation of inventory data will permit the establishment of a safe initial stocking rate.

No two years have exactly the same weather conditions. For this reason, year-to-year and season-to season fluctuations in forage production are to be expected on grazing lands. Livestock producers must make timely adjustments in the numbers of animals or in the length of grazing periods to avoid overuse of forage plants when production is unfavorable and to make advantageous adjustments when forage supplies are above average.

Initial stocking rates should be improved through the use of vegetation monitoring and actual use records that include number and type of livestock, the timing and duration of grazing, and utilization levels. Actual use records over time will assist in making stocking rate adjustments based on the variability factors.

Average annual production must be measured or estimated to properly assess useable forage production and stocking rates.

Hydrological functions

The hydrologic characteristics of various vegetation types can be expected to confer some competitive advantages to vegetation types with the greatest infiltration rates. Much of the water that flows overland does not reach a stream and leave the site. Rather, it flows for a short distance until it reaches an area of higher infiltration capacity that can accommodate both the falling precipitation and the overland flow. The net result of this process is that some areas receive more water than others. Since the infiltration capacity of some vegetation types is greater than others, the result is that in a vegetation mosaic the mineral soil near some species may receive more water from a storm producing a runoff event than soil near other species.

Storm characteristics influence the amount of runoff. Low intensity rainfall events results in precipitation reaching the soil at a slower rate than the rate at which it can enter the soil. Consequently, the precipitation from these storms is able to soak into the ground soon after it strikes the soil. Conversely, during the high-intensity rain associated with summer thunderstorms, the rainfall rate exceeds the rate at which water can enter the soil (Heitschmidt and Stuth, 2003).

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 present on the site.

Other products

None noted.

Other information

Site Development and Testing Plan.

Future work (for approved ESD) includes field visits to verify ES site concepts with field staff. Field staff include but are not limited to project office leader, area soil scientist, state soil scientist, ecological site specialist, state rangeland conservationist, area rangeland management specialist, and local field personnel. Field visits are to be determined by spatial extent of the site as well as personal knowledge of the site. Activity during field visits will include but are not limited to identifying the soil, landform, plant community, and verifying existing site concepts.

Inventory data references

Information presented here has been derived from NRCS clipping data, numerous ocular estimates and other inventory data. Field observations from experienced range personnel was used extensively to develop this ecological site description.

Those NRCS individuals involved in developing the Loamy Lowland ecological sites North and South in the early 2000s include Carol Eakins, Chuck Markley, Jeff Nichols, and Mary Schrader from Nebraska; Joan Gienger, Ted Houser, Tim Watson, Amanda Shaw, Susan Francis, Jon Deege, and Robert Schiffner from Kansas; Josh Saunders and Harvey Sprock from Colorado.

Range Condition Guides and Technical Range Site Descriptions for Kansas, Loamy Lowland, USDA, Soil Conservation Service, August, 1967

Range Site Description for Kansas, Loamy Lowland, USDA-Soil Conservation Service, September, 1983

Range Site Description for Colorado, Riverbottom, USDA-Soil Conservation Service, December 1976

Guide for determining range condition and suggestive initial stocking rates for Nebraska, Silty Lowland, Vegetative Zone 1 and II, USDA-Soil Conservation Service, April 1983

Range Site Description for Nebraska, Silty Lowland, USDA-Soil Conservation Service, August, 1981 Schacht, Walter H., Larsen, Dana. Section III

Range Sites, Silty Lowland Range Site, The Board of Regents of the University of Nebraska, publication

Ecological Site Description for Kansas, Loamy Lowland North (R072XA013KS) and South (R072XB013KS), located in Ecological Site Information System (ESIS), 2007

Other references

Albertson, F. W. and Weaver, J. E., "Reduction of Un-Grazed Mixed Prairie to Short Grass as a Result of Drought and Dust" (1946). Agronomy & Horticulture -- Faculty Publications. Paper 496.

Andrews, R. and R. Righter. 1992. Colorado Birds. Denver Museum Nat. Hist., Denver, CO. 442 pp.

Armstrong, D.M. 1972. Distribution of mammals in Colorado. Univ. Kansas Museum Nat. Hist. Monograph #3. 415 pp.

Blackburn, W.H., R.O. Meeuwig, and C.M. Skau. 1974. A mobile infiltrometer for use on rangeland. J. Range Manage. 27:322-323.

Brady, N.C. and Weill, R.R., The Nature and Properties of Soils, 14th Edition, 2008, pp. 504–517.

Colorado Breeding Bird Atlas. 1998. Hugh Kingery, Ed., Dist. CO Wildlife Heritage Found. 636 pp.

Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum Nat. Hist. Denver, CO. 467 pp.

Grazing Management, An ecological perspective, Heitschmidt, Rodney K., Stuth, Jerry W., 2003 ISBN: 1-878907-61-1.

Hammerson, G.A. 1986. Amphibians and reptiles in Colorado. CO Div. Wild. Publication Code DOW-M-I-3-86. 131 pp.

High Plains Regional Climate Center(http://hpcc.unl.edu)

Rennicke, J. 1990. Colorado Wildlife. Falcon Press, Helena and Billings, MT and CO Div. Wildlife, Denver CO. 138 pp.

Thurow, T.L., W.H. Blackburn, and C.A. Taylor, Jr. 1986. Hydrologic characteristics of vegetation types as affected by livestock grazing systems, Edwards Plateau, Texas. J. Range Manage. 39:505-509.

USDA, NRCS. National Water and Climate Center, (http://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. 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center.

MLRA 72 Workshop: Quality control review, comments and field verification of Ecological sites, Wray Colorado, April 26-27, 2016. Those individuals include: from Colorado: Julie Elliot, Kimberly Diller, Clark Harshbarger, Kristi Gay, Josh Saunders, Tom Nadgwick, Mike Moore. From Nebraska: Chuck Markley, Jeff Nichols, Kristin Dickinson, Dan Shurtliff. From Kansas: David Kraft, Michelle Bush, Tom Cochran, Roger Tacha, Ted Houser and Chris Tecklenburg (current ESI specialist MLRA72).

Quality assurance review: David Kraft (acting QA for region 5 and 9).

Contributors

Chris Tecklenburg

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Rangeland health reference sheet

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

Author(s)/participant(s)	Chris Tecklenburg Revision 6-20-2016 David Kraft, John Henry, Doug Spencer and Dwayne Rice Original Authors 2-2005 Harvey Sprock, Dan Nosal and Blake Hendon 01/19/05 Loamy Bottomland (formerly Overflow)
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Date	06/20/2016
Approved by	David Kraft
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, if present they are short and not connected.

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):** 2 percent or less bare ground, with bare patches generally less than 2-3 inches in diameter. Extended drought can cause bare ground to increase to 10-20 percent.

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):** Minimal litter movement and short travel distances. Extreme flooding events will cause litter to be displaced and/or captured.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class rating anticipated to be 5-6 in interspace at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** These soils are very deep, stratified and often calcareous to the surface. Textures are dominantly loamy and silty, but sandy textures may occur in the lower part of the root zone. Organic matter is generally low to moderate in the surface layer. A horizon is 0 to 12 inches; very dark grayish brown (10YR 3/2) moist; weak medium granular structure.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Diverse grass, forb, shrub canopy and root structure reduces raindrop impact and slows overland flow providing increased time for infiltration to occur. Extended drought may reduce sod forming cool season grass and tall warm season bunchgrasses causing decreased infiltration and increased runoff following intense storms.

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

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

    Dominant: Warm season tallgrass 46%; big bluestem>> switchgrass > eastern gamagrass = prairie cordgrass > Indiangrass

    Sub-dominant: Cool season grasses 23%; western wheatgrass >> Canada wildrye > green needlegrass = vine mesquite > slender wheatgrass, needle and thread

    Other: Forbs 10%; Warm season midgrass 7%, little bluestem > sideoats grama: Warm season shortgrass 7%, blue grama = buffalograss; Shrubs 5% and sedges 2%

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** The majority of plants are alive and vigorous. Some mortality and decadence is expected for the site. This in part is due to drought, unexpected wildfire or a combination of the two events. This would be expected for both dominant and subdominant groups.

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14. **Average percent litter cover (%) and depth (in):** Litter cover during and following extended drought ranges from 30-40%.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2500 pounds of production per ac/yr for a below average year, 3500 pounds of production per ac/yr for an above average year. Relative value is 4000 pounds of production per ac/yr.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that**

become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Invasive plants should not occur in reference plant community. However, cheatgrass, Russian thistle, kochia, other non-native annuals may invade following extended drought assuming a seed source is available.

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17. **Perennial plant reproductive capability:** Plants on site exhibit the required vigor and growth to be able to reproduce vegetatively or by seed.
