USDA Natural Resources Conservation Service

Ecological site R087AY004TX
Deep Redland

Last updated: 9/21/2023
Accessed: 05/17/2024

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.

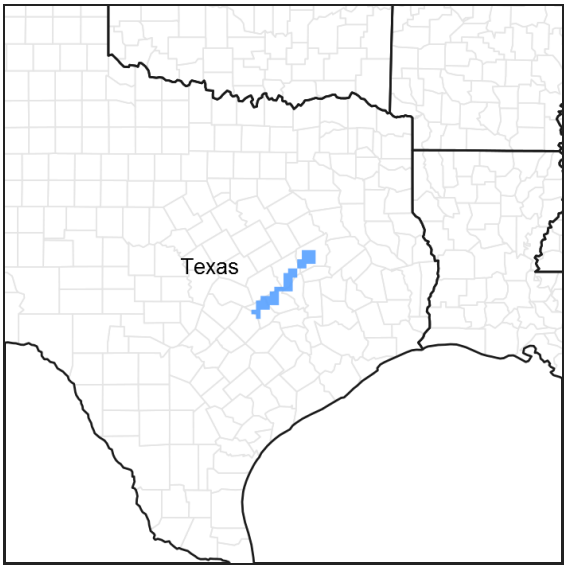


Figure 1. Mapped extent

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): 087A–Texas Claypan Area, Southern Part

This area is entirely in south-central Texas. It makes up about 10,535 square miles (27,295 square kilometers). The towns of Bastrop, Bryan, Centerville, College Station, Ennis, Fairfield, Franklin, Giddings, Gonzales, Groesbeck, La Grange, Madisonville, and Rockdale are in this MLRA. Interstate 45 crosses the northern part of the area, and Interstate 10 crosses the southern part. A number of State Parks are located throughout this area. The parks are commonly associated with reservoirs.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 87A

Ecological site concept

The site is characterized by very deep soils greater than 80 inches with high vegetative growing potential. The soils are loamy and have a reddish color.

Associated sites

R087AY002TX	**Sandstone Hill** Sandstone Hill
R087AY006TX	**Sandy** Sandy
R087AY007TX	**Deep Sand** Deep Sand
R087AY008TX	**Very Deep Sand** Very Deep Sand

Similar sites

R087AY005TX	**Sandy Loam** Sandy Loam

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Celtis laevigata*
Shrub	(1) *Ilex vomitoria* (2) *Callicarpa americana*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Sorghastrum nutans*

Physiographic features

This site typically occurs on gently sloping uplands. Slopes range from 1 to 12 percent, but are usually less than 8 percent. The runoff class is negligible to medium, largely dependent on the slope.

Table 2. Representative physiographic features

Landforms	(1) Plains > Ridge
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	61–229 m
Slope	1–8%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	1–12%

Climatic features

The climate for MLRA 87A is humid subtropical and is characterized by hot summers, especially in July and August, and relatively mild winters. The summer months have little variation in day-to-day weather except for occasional thunderstorms that dissipate the afternoon heat. The moderate temperatures in spring and fall are characterized by

long periods of mild days and cool nights. The average annual precipitation in this area is 41 inches. Most of the rainfall occurs in spring and fall. The freeze-free period averages about 276 days and the frost-free period 241 days.

Table 4. Representative climatic features

Frost-free period (average)	241 days
Freeze-free period (average)	276 days
Precipitation total (average)	1,041 mm

Climate stations used

- (1) BELLVILLE 6NNE [USC00410655], Bellville, TX
- (2) LA GRANGE [USC00414903], La Grange, TX
- (3) MADISONVILLE [USC00415477], Madisonville, TX
- (4) SMITHVILLE [USC00418415], Smithville, TX
- (5) CROCKETT [USC00412114], Crockett, TX
- (6) FAIRFIELD 3W [USC00413047], Fairfield, TX
- (7) GONZALES 1N [USC00413622], Gonzales, TX
- (8) SOMERVILLE DAM [USC00418446], Somerville, TX
- (9) COLLEGE STN [USW00003904], College Station, TX
- (10) BARDWELL DAM [USC00410518], Ennis, TX
- (11) ELGIN [USC00412820], Elgin, TX
- (12) FRANKLIN [USC00413321], Franklin, TX

Influencing water features

A stream does not influence the plant community of this site.

Wetland description

Wetlands are not associated with this site.

Soil features

The soils are very deep, slightly acid to neutral clay loams and fine sandy loams. They are characterized by dark, reddish brown surfaces and dark subsoils. The soils are moderately slow to slowly permeable. They are inherently fertile and can hold large amounts of water. This is a productive site when the soil is in good physical condition and covered with deep-rooted perennial plants. When plant cover is inadequate, soil condition deteriorates and the steep part of the site is very erosive. Soils correlated to this site include: Flynn, Lexton, and Margie.

Table 5. Representative soil features

Parent material	(1) Residuum–glauconitic sandstone
Surface texture	(1) Fine sandy loam (2) Sandy loam (3) Sandy clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to very slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

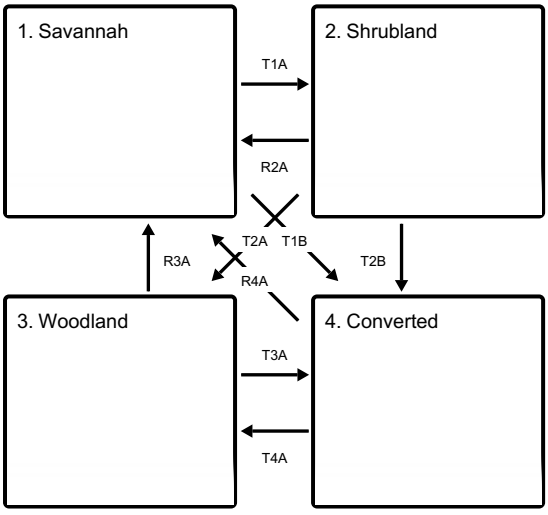
Available water capacity (0-101.6cm)	12.7–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	6–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The Deep Redland ecological site evolved and was maintained by the grazing and herding effects of native wild large ungulates, periodic fires, and climatic fluctuations. Conversion of this site to cropland and the subsequent abandonment of cropping removed the natural native vegetation, organic matter and fertility, and allowed woody species to dominate the site. Continuous grazing by confined domestic livestock and the suppression of fire on non-cropland sites removes little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and forbs such as Engelmann's daisy (Engelmannia pinnitifida) and prairie clover (Dalea spp.). Less productive grasses and forbs will replace these plants. With continued continuous grazing, no brush management, and the absence of periodic fires, a community dominated by woody species such as winged elm (*Ulmus alata*), mesquite (*Prosopis glandulosa*), yaupon (*Ilex vomitoria*), post oak (*Quercus stellata*), and eastern red cedar (*Juniperus virginiana*) will replace the savannah.

State and transition model

Ecosystem states



T1A - Heavy continuous grazing, no brush management, abandonment

T1B - Brush management, crop cultivation, pasture planting

R2A - Brush management, prescribed grazing, prescribed burning

T2A - Heavy continuous grazing, no brush management, abandonment

T2B - Brush management, crop cultivation, pasture planting

R3A - Brush management, range planting, prescribed grazing

T3A - Brush management, crop cultivation, pasture planting

R4A - Range planting, prescribed grazing, prescribed burning

T4A - Heavy continuous grazing, no brush management, abandonment

State 1 submodel, plant communities

1.1. Tallgrass/Oak Savannah

State 2 submodel, plant communities

2.1. Oak Scrub/Shrubland

State 3 submodel, plant communities

3.1. Post Oak/Elm Woodland

State 4 submodel, plant communities

4.1. Converted Land

State 1
Savannah

One community exists in the Savannah State, the 1.1 Tallgrass/Oak Savannah Community. The State is dominated by warm season perennial grasses and the overstory canopy cover is less than 25 percent.

Community 1.1
Tallgrass/Oak Savannah

The characteristic plant community of this site is the reference plant community. This is a fire climax site of post oak and blackjack oak along with associated woody species that shade 20 to 25 percent of the ground. The herbaceous component is tall and mid-grasses and is dominated by little bluestem, Indiangrass, and big bluestem, which usually make up 50 to 75 percent of the total annual yield. Purpletop tridens (*Tridens flavus*), beaked panicum (*Panicum anceps*), Florida paspalum (*Paspalum floridanum*), switchgrass, tall dropseed (*Sporobolus compositus*), and thin paspalum (*Paspalum setaceum*) also occur. Cool-season forage plants occurring on this site include Canada wildrye (*Elymus canadensis*), Engelmann's daisy, and sedges (Carex spp.). A variety of shrubs, vines, and forbs occur in this community. Grazing prescriptions that permit acceptable grazing periods and allow adequate rest periods along with prescribed fire every three to five years are important in the maintenance of the herbaceous plant community and the savannah landscape structure. Continuous overgrazing, or over rest, and the absence of fire tend to allow a vegetative shift towards woody species such as eastern persimmon (*Diospyros virginiana*), eastern red cedar, and winged elm. Without corrective measures, this shift will continue to the Shrubland State.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2690	4035	5044
Tree	336	504	673
Shrub/Vine	168	252	336
Forb	168	252	336
Total	**3362**	**5043**	**6389**

State 2
Shrubland

One community exists in the Shrubland State, the 2.1 Oak Scrub/Shrubland Community. The herbaceous production is not as great compared to the Savannah State, and overstory canopy has increased between 25 and 50 percent.

Community 2.1
Oak Scrub/Shrubland

This plant community is a transitional community between the Savannah and Woodland State. It develops in the absence of fire, mechanical, or chemical brush management treatments. It is usually the result of abandonment following either cropping or yearly continuous grazing. Trees and shrubs begin to encroach onto introduced pastureland or replace the grassland component of the savannah community. In addition to the naturally occurring oaks, other woody species such as eastern persimmon, winged elm, and eastern red cedar increase in density and canopy coverage (25 to 50 percent). Remnants of little bluestem and Indiangrass may still occur but the herbaceous component of the community becomes dominated by lesser producing grasses and forbs. Initially, species such as brownseed paspalum (*Paspalum plicatulum*), tall dropseed, and fall witchgrass (*Digitaria cognata*) replace the taller grasses. As the site continues to transition, the plants which increase or invade on the site include sandbur (Cenchrus spp.), red lovegrass (*Eragrostis secundiflora*), Yankeeweed (Eupatorium compostifolium), bullnettle (*Cnidoscolus texanus*), croton (Croton spp.), snake cotton (Froelichia spp.), prickly pear (Opuntia spp.), queen's delight (*Stillingia texana*), beebalm (Monarda spp.), and baccharis (Baccharis spp.). Prescribed burning on a three to five year interval in conjunction with prescribed grazing may be a viable option for returning this community to a Tallgrass/Oak Savannah Community. Once the canopy cover reaches 50 percent a greater, the herbaceous layer is greatly affected, and there may note be enough fine fuel to carry an adequate fire. When this threshold is exceeded, mechanical or chemical brush control becomes necessary to move back towards the Savannah State.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1076	1614	2152
Tree	538	807	1076
Shrub/Vine	448	673	897
Forb	224	308	392
Total	**2286**	**3402**	**4517**

State 3
Woodland

One community exists in the Woodland State, the Post Oak/Elm Woodland Community. The site is characterized by little herbaceous production. The overstory canopy is over 50 percent and shrubs also limit light to the surface.

Community 3.1
Post Oak/Elm Woodland

This plant community is a closed overstory (50 to 80 percent) woodland dominated by post oak, winged elm, blackjack oak, black hickory (*Carya texana*), eastern red cedar, and water oak (*Quercus nigra*). Understory shrubs and sub-shrubs include yaupon, farkleberry (*Vaccinium arboreum*), possumhaw (*Ilex decidua*), and American beautyberry (*Callicarpa americana*). Woody vines also occur and include Alabama supplejack (*Berchemia scandens*), poison ivy (Toxicondendron radicans), grape (Vitis spp.), greenbriar (Smilax spp.), trumpet creeper (*Campsis radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and peppervine (Ampelopsis arborea). A herbaceous understory is almost nonexistent but shade-tolerant species including longleaf woodoats (*Chasmanthium sessiliflorum*), broadleaf woodoats (*Chasmanthium latifolium*), cedar sedge (Carex spp.), ironweed (Veronia baldwinii), and goldenrod (Solidago spp.) may occur in small amounts. Prescribed fire may be used to convert this site back to the Savannah State but generally takes many consecutive years of burning due to light fine fuel loads. Chemical brush control on a large scale is usually not a treatment option on this site due to the herbicide resistance of yaupon; however, individual plant treatment with herbicides on small acreage is a viable option. Mechanical treatment of this site, along with seeding, is the most viable option for reversion back to a tall grass savannah, although the economic viability of this option is questionable.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1177	1765	2354
Shrub/Vine	673	1009	1345
Grass/Grasslike	280	404	560
Forb	84	129	168
Total	**2214**	**3307**	**4427**

State 4
Converted

The Converted Land State contains one community, the 4.1 Converted Land Community. The state is characterized by the land manager farming crops or planted grasses.

Community 4.1
Converted Land

Conversion of this site to cropland occurred from the middle 1800's to the early 1900's. Some remains in cropland today, typically cotton (Gossypium spp.), corn (*Zea mays*), sorghum (Sorghum spp.), and soybeans (*Glycine max*). Ditching, land leveling, and levee construction has significantly changed the topography and hydrology on many acres of this site. While restoration of this site to a semblance of the reference plant community is possible with seeding and prescribed grazing, complete restoration of the reference community in a reasonable time is very unlikely. Following crop production, this site is often planted to native or introduced grasses and legumes for livestock grazing or hay production. Typical species planted include improved Bermudagrass varieties, bahiagrass, switchgrass, dallisgrass, kleingrass (*Panicum coloratum*), old world bluestems (Bothriochloa spp.) annual ryegrass (Lolium multiflorum), and white clover. Many of the introduced species (bahiagrass, Bermudagrass, and dallisgrass) are invasive-moving by wind, water, and animals. Once established, they are extremely difficult to remove and will hinder the reestablishment of native species. The establishment and maintenance of these species requires cultivation, fertilization, weed control, and prescribed grazing management.

Transition T1A
State 1 to 2

The Savannah State will transition to the Shrubland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 25 percent and grasses shift composition to more shade-tolerant species.

Transition T1B
State 1 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the

transition is the land manager's decision to farm the site.

Restoration pathway R2A
State 2 to 1

Restoration back to the Savannah State requires brush management, prescribed grazing and/or prescribed fire. Mechanical or chemical controls can be used to remove the woody overstory species and shrubs. Prescribed grazing may require destocking and/or deferment.

Transition T2A
State 2 to 3

The Shrubland State will transition to the Woodland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 50 percent and grasses shift composition to more shade-tolerant species.

Transition T2B
State 2 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the transition is the land manager's decision to farm the site.

Restoration pathway R3A
State 3 to 1

The Converted Land State contains one community, the 4.1 Converted Land Community. The state is characterized by the land manager farming crops or planted grasses.

Transition T3A
State 3 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the transition is the land manager's decision to farm the site.

Restoration pathway R4A
State 4 to 1

The restoration to State 1 can occur when the land manager ceases agronomic practices. Range planting of native species found in the reference community will be required to bring back a similar community as the State 1 plant composition. The extent of previous soil disturbances will determine how much seedbed preparation will be needed, as well as the ability to be restored. Proper grazing and brush management will be required to ensure success.

Transition T4A
State 4 to 3

The Converted Land State will transition to the Woodland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 50 percent and grasses shift composition to more shade-tolerant species.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			1345–2690	
	little bluestem	SCSC	*Schizachyrium scoparium*	673–1345	

	little bluestem	SCSC	*Schizachyrium scoparium*	673–1345	–
	Indiangrass	SONU2	*Sorghastrum nutans*	673–1345	–
2	**Tall/midgrasses**			673–1345	
	big bluestem	ANGE	*Andropogon gerardii*	112–448	–
	beaked panicgrass	PAAN	*Panicum anceps*	112–448	–
	Florida paspalum	PAFL4	*Paspalum floridanum*	112–448	–
	purpletop tridens	TRFL2	*Tridens flavus*	112–448	–
3	**Mid/Shortgrasses**			504–1009	
	sideoats grama	BOCU	*Bouteloua curtipendula*	504–1009	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	504–1009	–
	sedge	CAREX	*Carex*	504–1009	–
	longleaf woodoats	CHSE2	*Chasmanthium sessiliflorum*	504–1009	–
	cylinder jointtail grass	COCY	*Coelorachis cylindrica*	504–1009	–
	Canada wildrye	ELCA4	*Elymus canadensis*	504–1009	–
	Hall's panicgrass	PAHA	*Panicum hallii*	504–1009	–
	thin paspalum	PASE5	*Paspalum setaceum*	504–1009	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	504–1009	–
Forb					
4	**Forbs**			140–280	
	Virginia dayflower	COVI3	*Commelina virginica*	140–280	–
	ticktrefoil	DESMO	*Desmodium*	140–280	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	140–280	–
	lespedeza	LESPE	*Lespedeza*	140–280	–
	littleleaf sensitive-briar	MIMI22	*Mimosa microphylla*	140–280	–
	yellow puff	NELU2	*Neptunia lutea*	140–280	–
	prairie snoutbean	RHLA5	*Rhynchosia latifolia*	140–280	–
	fuzzybean	STROP	*Strophostyles*	140–280	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	140–280	–
5	**Forbs**			28–56	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	28–56	–
	croton	CROTO	*Croton*	28–56	–
Shrub/Vine					
6	**Shrubs/Vines**			168–336	
	American beautyberry	CAAM2	*Callicarpa americana*	168–336	–
	parsley hawthorn	CRMA5	*Crataegus marshallii*	168–336	–
	yaupon	ILVO	*Ilex vomitoria*	168–336	–
	southern dewberry	RUTR	*Rubus trivialis*	168–336	–
	cat greenbrier	SMGL	*Smilax glauca*	168–336	–
	muscadine	VIRO3	*Vitis rotundifolia*	168–336	–
Tree					
7	**Trees**			336–673	

	netleaf hackberry	CELAR	*Celtis laevigata var. reticulata*	336–673	–
	blackjack oak	QUMA3	*Quercus marilandica*	336–673	–
	post oak	QUST	*Quercus stellata*	336–673	–
	winged elm	ULAL	*Ulmus alata*	336–673	–

Animal community

The historic savannah provided habitat to bison, deer, turkey, migratory birds and large predators such as wolves, coyotes, mountain lions, and black bear. White-tailed deer, turkey, coyotes, bobcats, and resident and migratory birds find suitable habitat in these savannahs today. Domestic livestock and exotic ungulates are the dominant grazers and browsers of this site. As the savannah transitions through the various vegetative states towards woodlands, the quality of the habitat may improve for some species and decline for others. Management must be applied to maintain a vegetative state in optimum habitat quality for the desired animal species.

Hydrological functions

Peak rainfall periods occur in May and June from frontal passage thunderstorms and in September and October from tropical systems as well as frontal passages. Rainfall amounts may be high (three to five inches per event) and events may be intense. The site is subject to erosion where adequate herbaceous cover is not maintained and on heavy use areas such as roads and livestock trails. Gullies following livestock trails to water are common on this site where continuous grazing is practiced and adequate herbaceous cover is not maintained. Extended periods (60 days) of little to no rainfall during the growing season are common. The hydrology of this site may be manipulated through management to yield higher runoff volumes or greater infiltration to groundwater. Management for less herbaceous cover will favor higher surface runoff while dense herbaceous cover and litter will favor ground water recharge. Potential pollution from sediment, pesticides, and both organic and inorganic fertilizers should always be considered when managing for higher volumes of surface runoff.

Recreational uses

Hunting, camping, bird watching, equestrian are common activities.

Wood products

Oaks are used for firewood. Hickory and mesquite are used for barbecue wood. Yaupon is used for landscaping.

Other products

Fruit from dewberries and grapes are harvested.

Inventory data references

These site descriptions were developed as part a Provisional Ecological Site project using historic soil survey manuscripts, available site descriptions, and low intensity field traverse sampling. Future work to validate the information is needed. This will include field activities to collect low, medium, and high-intensity sampling, soil correlations, and analysis of that data. A final field review, peer review, quality control, and quality assurance review of the will be needed to produce the final document.

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Contributors

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Approval

Bryan Christensen, 9/21/2023

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)	Mike Stellbauer, David Polk, and Bill Deauman
Contact for lead author	Mike Stellbauer, Zone RMS, NRCS, Bryan, Texas
Date	05/17/2005
Approved by	Bryan Christensen
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:** Some water flow patterns may be present on this site due to landscape position and slopes.

3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are very uncommon for this site when occupied by the reference community.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect no more than 20 percent bare ground distributed in small patches.

5. **Number of gullies and erosion associated with gullies:** Some gullies associated with seeps, springs, and intermittent streams may be present. Head and side slopes should be stable and covered with vegetation.

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

7. **Amount of litter movement (describe size and distance expected to travel):** This site has slowly permeable sub-soils. On sloping sites, small to medium-sized litter will move short distances with intense storms.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Stability class range is expected to be 3 to 5.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is less than 10 inches thick with colors from brown clay to reddish brown fine sandy loam and generally fine granular structure. SOM is 0.5 to 2.0 percent.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of trees, shrubs, vines, grasses, and forbs, along with adequate litter and little bare ground, provides for maximum infiltration and little runoff under normal rainfall events.

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

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

    Dominant: Warm-season tallgrasses >>

    Sub-dominant: Warm-season midgrasses > Trees >

Other: Shrubs/Vines > Forbs

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There should be little mortality or decadence for any functional group.

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14. **Average percent litter cover (%) and depth (in):** Litter is primarily herbaceous.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3,000 pounds per acre for below average moisture years to 6,000 pounds per acre for above average moisture years.

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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:** Potential invasive species includ bahiagrass, common Bermudagrass, mesquite, eastern persimmon, eastern red cedar, post oak, winged elm, and yaupon.

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17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing, except for periods of prolonged drought conditions, heavy natural herbivory and intense wildfires.
