USDA Natural Resources
Conservation Service

# Ecological site R085AY186TX
# Steep Adobe 30-38" PZ

Last updated: 9/21/2023
Accessed: 05/03/2024

## 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): 085A–Grand Prairie

The Grand Prairie MLRA is characterized by predominately loam and clay loam soils underlain by limestone and shale. Topography transitions from steeper ridges and summits of the Lampasas Cut Plain on the southern end to the more rolling hills of the Fort Worth Prairie to the north. The Arbuckle Mountain area in Oklahoma is also within this MLRA.

## Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA Ag Handbook 296.

## Ecological site concept

These sites occur on steep, shallow calcareous soils over limestone. The reference vegetation includes little bluestem and other native tallgrasses, midgrasses and forbs with scattered live oak and Texas oak. Other shrub species occur and may become dominant without the use of prescribed fire or other brush management. Due to the steep slopes and calcareous soils, production on these sites may be less than adjacent sites.

## Associated sites

| | |
|---|---|
| R085AY183TX | **Redland 30-38" PZ**<br>The Redland site often occurs downslope from the Steep Adobe site. It differs from the Steep Adobe site by having slopes <8%, clayey soils, and hard limestone bedrock. |

## Similar sites

| | |
|---|---|
| R085AY187TX | **Steep Rocky 30-38" PZ**<br>The Steep Rocky site is similar to the Steep Adobe site in that both sites are located on similar topography and underlain by limestone. It differs from Steep Adobe by its darker, more fertile soil, higher production potential, and occurrence dominantly along larger streams and rivers. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Quercus fusiformis*<br>(2) *Quercus buckleyi* |
| Shrub | Not specified |
| Herbaceous | (1) *Schizachyrium scoparium* |

## Physiographic features

This site occurs on side slopes and nose slopes of hillslopes in the Grand Prairie. Characteristic of this site are benched outcrops of strongly cemented limestone typically 6 to 24 inches in thickness followed by thicker intervals of calcareous mudstone at vertical intervals of 4 to 50 feet. Slopes can be as high as 40 percent in some areas.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Hills > Ridge<br>(2) Hills > Hill<br>(3) Hills > Hillslope |
| Runoff class | Medium to high |
| Elevation | 152–579 m |
| Slope | 12–40% |
| Aspect | Aspect is not a significant factor |

## Climatic features

The climate is subhumid subtropical and is characterized by hot summers and relatively mild winters. Tropical maritime air controls the climate during spring, summer and fall. In winter and early spring, frequent surges of Polar Canadian air cause sudden drops in temperatures and add considerable variety to the daily weather. The average first frost should occur around November 5 and the last freeze of the season should occur around March 19.

The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is from the south and highest windspeeds occur during the spring months.

Approximately two-thirds of annual rainfall occurs during the April to September period. Rainfall during this period generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. The driest months are usually July and August.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | 194-208 days |
| Freeze-free period (characteristic range) | 216-243 days |
| Precipitation total (characteristic range) | 813-965 mm |
| Frost-free period (actual range) | 190-209 days |
| Freeze-free period (actual range) | 209-245 days |
| Precipitation total (actual range) | 787-991 mm |
| Frost-free period (average) | 201 days |
| Freeze-free period (average) | 230 days |
| Precipitation total (average) | 889 mm |

## Climate stations used

- (1) BENBROOK DAM [USC00410691], Fort Worth, TX

- (2) CLEBURNE [USC00411800], Cleburne, TX
- (3) WHITNEY DAM [USC00419715], Clifton, TX
- (4) DENTON MUNI AP [USW00003991], Ponder, TX
- (5) DECATUR [USC00412334], Decatur, TX
- (6) EVANT 1SSW [USC00413005], Evant, TX
- (7) BROWNWOOD 2ENE [USC00411138], Early, TX
- (8) LAMPASAS [USC00415018], Lampasas, TX

## Influencing water features

This site is not influenced by water from wetland or streams.
Due to the steep slopes and shallow soils, this site sheds water to adjacent lower areas. The presence of tall and midgrasses should help facilitate infiltration of water into the soil.

## Wetland description

NA

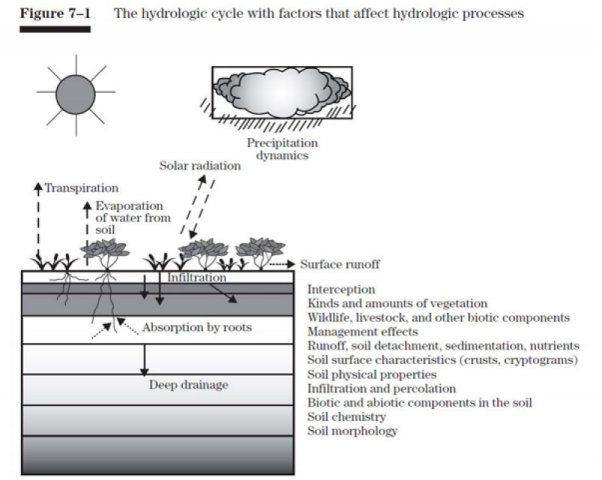



**Figure 8.**

## Soil features

Representative soil components for this ecological site include: Brackett, Real, and Somervell

The site is characterized by very shallow to moderately deep, well drained soils formed in residuum weathered from limestone with a high concentration of lime. The high lime content causes nutrient imbalance that can limit the quality of forage.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum–limestone<br>(2) Residuum–mudstone |
| Surface texture | (1) Loam<br>(2) Clay loam<br>(3) Gravelly loam<br>(4) Gravelly clay loam<br>(5) Very gravelly loam<br>(6) Very gravelly clay loam<br>(7) Extremely gravelly loam<br>(8) Extremely gravelly clay loam |
| Drainage class | Well drained |
| Permeability class | Moderate |
| Soil depth | 15–102 cm |

| | |
|---|---|
| Surface fragment cover <=3" | 5–60% |
| Surface fragment cover >3" | 0–60% |
| Available water capacity (0-101.6cm) | 2.54–10.16 cm |
| Calcium carbonate equivalent (0-101.6cm) | 40–85% |
| Electrical conductivity (0-101.6cm) | 0–2 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0–2 |
| Soil reaction (1:1 water) (0-101.6cm) | 7.9–8.4 |
| Subsurface fragment volume <=3" (Depth not specified) | 5–60% |
| Subsurface fragment volume >3" (Depth not specified) | 0–20% |

## Ecological dynamics

The Steep Adobe 30-38” PZ is a Texas oak and live oak savannah site. Areas dominated by grass are mixed with groups of oak trees to create a mosaic of grass and shrub communities. The reference plant community of the Steep Adobe site is a fire-influenced mosaic of tallgrass and oak plant communities, interspersed with a high diversity of perennial forbs and midgrasses. Improper grazing will result in a reduction of tallgrasses and an increase in composition of midgrasses, unpalatable forbs, and woody species.

Continued degradation of the site will result in the site crossing a threshold to a shrubland community characterized by invasive shrubs, mid and shortgrasses, and unpalatable forbs. Bare ground, erosion, and water flow patterns will increase. Forage production will decline. Over time the size and amount of eroded areas will increase as the A horizon erodes.

Precipitation patterns are highly variable. Long-term droughts, occurring three to four times per century, cause shifts in species composition by causing die-off of seedlings, less drought-tolerant species, and/or some woody species. Droughts also reduce biomass production and create open space, which is colonized by opportunistic species when precipitation increases. Wet periods allow tallgrasses to increase in dominance.

Natural vegetation on the uplands in MLRA 85 is predominantly tall warm-season perennial bunchgrasses with lesser amounts of midgrasses and shortgrasses. This Steep Adobe site was historically dominated by little bluestem (*Schizachyrium scoparium*), with other tall grasses such as big bluestem ( *Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*) making up a minor portion of the plant community. Midgrasses such as sideoats grama (*Bouteloua curtipendula*), tall dropseed (*Sporobolus compositus*), cane bluestem (*Bothriochloa barbinodis*), and silver bluestem (*Bothriochloa laguroides* var. torreyana), Texas wintergrass (*Nassella leucotricha*), and slim tridens (*Tridens muticus*) make up about 20% of the production of this site. A wide variety of forbs add to the diverse native plant community. Additionally, several oak (Quercus spp.), elm (Ulmus spp.), and hackberry (Celtis spp.) tree species make up an important part of the savannah community.

The northernmost portion of the Grand Prairie MLRA is still relatively free from the widespread invasion of brush that has occurred in other parts of the state, including the southern part of the MLRA. Juniper (cedar) (Juniperus spp.), honey mesquite (*Prosopis glandulosa*), pricklypear (Opuntia spp.), and scrub oak ( *Quercus sinuata*) have increased to the point of dominance in some locations, especially on shallow, rocky slopes.

Pre-settlement influences included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts, and frequent fires.
Rangeland and pastureland are grazed primarily by beef cattle. Horse numbers are increasing rapidly in the region, and in recent years goat numbers have increased significantly. There are some areas where sheep are locally important. Whitetail deer, wild turkey, bobwhite quail, and dove are the major wildlife species, and hunting leases

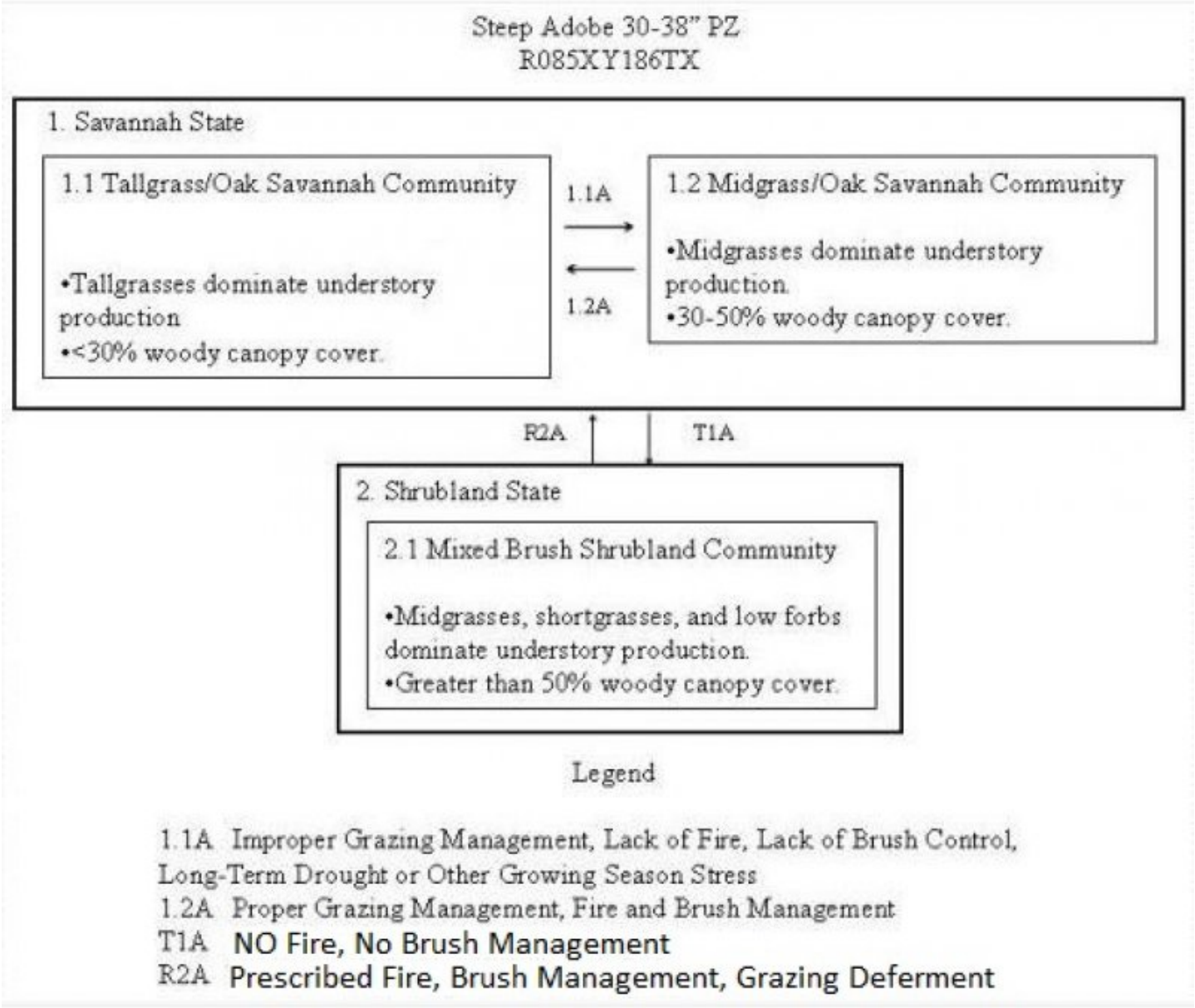
are a major source of income for many landowners in this area. The Steep Adobe site does not lend itself to cultivation.

Rangeland Health Reference Worksheets have been posted for this site on the Texas NRCS website (www.tx.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions (ESD's).

Plant Communities and Transitional Pathways
A state and transition model for the Steep Adobe ecological site is depicted in Figure 1. Thorough descriptions of each state and transition and of each plant community and pathway follow the model. This model is based on available experimental research, field observations, and interpretations by experts. It is likely to change as knowledge increases.

The plant communities will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

## State and transition model




## State 1

## Savannah State - Reference

### Dominant plant species

- Texas live oak (*Quercus fusiformis*), tree
- little bluestem (*Schizachyrium scoparium*), grass

## Community 1.1
## Tallgrass/Oak Savannah Community

**Figure 9. 1.1 Tallgrass/Oak Savannah Community**

The Tallgrass/Oak Savannah Community (1.1) is the reference community and is characterized as a Texas oak and live oak savannah with 20 to 30 percent woody species canopy cover. Little bluestem dominates the herbaceous component of the site, with big bluestem and Indiangrass present as significant components. Other important grasses are sideoats grama, tall grama (*Bouteloua hirsuta* var. pectinata), tall dropseed, slim tridens, silver bluestem, and green sprangletop (*Leptochloa dubia*). Forbs commonly found on the site include dotted gayfeather (*Liatris punctata*), awnless bushsunflower (*Simsia calva*), Maximilian sunflower (*Helianthus maximiliani*), Engelmann's daisy (*Engelmannia peristenia*), halfshrub sundrop (*Calylophus serrulatus*), and bundleflower (Desmanthus spp.). Other shrub and tree species include species of sumac (Rhus spp.), bumelia (Sideroxylon spp.), elbowbush (*Forestiera pubescens*), juniper, ash (Fraxinus spp.), and cherry (Prunus spp.), along with Texas kidneywood (*Eysenhardtia texana*), agarito (*Mahonia trifoliolata*) and yucca (Yucca spp.). Ashe's juniper (*Juniperus ashei*) was historically restricted to rocky ledges and shelves where it was protected from fire. The reference savannah community will transition to the Midgrass/Oak Savannah Community (1.2) under the stresses of improper grazing. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (Indiangrass, big bluestem, Engelmann's daisy). This will initially result in an increase in composition of little bluestem. If improper grazing continues, little bluestem will decrease and midgrasses such as silver bluestem and sideoats grama will increase in composition. Less palatable forbs will also increase at this stage. Without fire and/or brush control, woody species on the site will increase and the site will transition to the Shrubland State. This can occur with or without the understory transitioning to the Midgrass/Oak Savannah Community (1.2). This transition can occur without degradation of the herbaceous community from dominance by tallgrasses to dominance by midgrasses. Because the woody species that dominate in the Shrubland State are native species that occur as part of the Savannah State, the transition to the Shrubland State is a linear process with shrubs starting to increase soon after fire or brush control ceases. Unless some form of brush control takes place, woody species will increase to the 35% canopy cover level that indicates a state change. This is a continual process that is always in effect. Managers need to detect the increase in woody species when canopy is less than 35% and take management action before the state change occurs if they want to maintain the historic plant community. Shrubs begin to increase soon after fire or treatment; slowly at first, followed by a rapid transition to the Shrubland State. The drivers of the transition (lack of fire and lack of brush control) constantly pressure the system towards the Shrubland State. This site typically has heavy grazing pressure on lower slopes and less steep slopes. The steepest portion of the site will receive little grazing pressure from cattle, but may have significant browsing by deer and goats. Once slopes exceed 10%, especially when the surface is covered with rocks, cattle use decreases markedly. The soils of this site are shallow and are usually gravelly or stony. In the absence of plant cover and litter, the soil crusts easily. Due to the slope, runoff is rapid, even under sufficient plant cover. Bare soil composes less than 5 percent of ground cover. Plant basal cover and litter make up the remainder of the ground cover. Soils are strongly calcareous

and droughty, giving them low water holding capacity and fertility.

**Table 5. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 1261 | 2018 | 2690 |
| Shrub/Vine | 252 | 404 | 538 |
| Forb | 168 | 269 | 359 |
| **Total** | **1681** | **2691** | **3587** |

**Figure 11. Plant community growth curve (percent production by month). TX6020, Tallgrass Oak Savannah Community. The plant community is a fire climax savannah composed of warm-season perennial tallgrasses and scattered post oaks..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 18 | 23 | 17 | 6 | 4 | 16 | 6 | 3 | 2 |

## Community 1.2
## Midgrass/Oak Savannah Community

**Figure 12. 1.2 Midgrass/Oak Savannah Community**

**Figure 13. 1.2 Midgrass/Oak Savannah Community (2)**

The Midgrass/Oak Savannah Community (1.2) typically results from improper cattle grazing management over a long period of time combined with a lack of brush control. Indigenous or invading woody species increase on the site (with or without fire). In the Tallgrass/Oak Savannah Community (1.1), repeated fires and competition from a vigorous grass component keep woody canopy cover restricted to mottes within the savannah and 30 percent or less woody canopy cover. When the Midgrass/Oak Savannah Community (1.2) is continually overgrazed and fire is excluded, the community crosses a threshold to the Shrubland State (2.1), which is dominated by woody plants.

Important grasses are little bluestem, sideoats grama, green sprangletop, silver bluestem, tall dropseed, and Texas wintergrass. Texas wintergrass, seep muhly (*Muhlenbergia reverchonii*), slim tridens, Wright's threeawn ( *Aristida purpurea* var. wrightii), low panicums, low gramas, annual bromes, and less palatable forbs (western ragweed and prairie coneflower) begin replacing the midgrasses. Some of the perennial forbs persist, but less palatable forbs will increase. Woody canopy varies between 30 and 50 percent, depending on the severity of grazing, fire interval, and availability of increaser species. Numerous shrub and tree species will encroach because overgrazing by livestock has reduced grass cover, exposed more soil, and reduced grass fuel for fire. Typically, trees such as oaks and ash will increase in size, while other tree and shrub species such as bumelia, sumacs, elbowbush, agarito, juniper, and pricklypear will increase in density. Brown and Archer (1999) concluded that even with a healthy and dense stand of grasses, woody species will populate the site and eventually dominate the community. To control woody species populations, prescribed grazing and/or browsing and fire can be used to control smaller shrubs and trees. Mechanical removal of larger shrubs and trees may be necessary in older stands. Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Litter and mulch will move off-site as plant cover declines. Increasing woody dominants are oaks and Ashe's juniper. Once the tallgrasses have been eliminated from the site, woody species cover exceeds 30 to 50 percent canopy cover, and the woody plants within the grassland portion of the savannah reach fire-resistant size (about 3 feet in height), the site crosses a threshold into the Shrubland State (2) and the Mixed-Brush Shrubland Plant Community (2.1). Until the Midgrass/Oak Savannah Community (1.2) crosses the threshold into the Shrubland State (2), this community can be managed back toward the Tallgrass/Oak Savannah Community (1.1) through the use of cultural practices including prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of the treatment. Once invasive woody species are established, returning fully to the reference community is difficult, but it is possible to return to a similar plant community. Potential exists for soils to erode to the point that irreversible damage may occur. If soil-holding herbaceous cover decreases to the point that soils are no longer stable, the shrub overstory will not prevent erosion of the A and B soil horizons. This is a critical shift in the ecology of the site. Once the A horizon has eroded, the hydrology, soil chemistry, soil microorganisms, and soil physics are altered to the point where intensive restoration is required to restore the site to another state or community. Simply changing management (improving grazing management, or controlling brush) cannot create sufficient change to restore the site within a reasonable time frame.

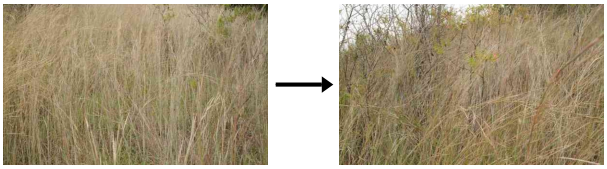
**Table 6. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 874 | 1530 | 2186 |
| Shrub/Vine | 269 | 471 | 673 |
| Forb | 202 | 353 | 504 |
| **Total** | **1345** | **2354** | **3363** |

**Figure 15. Plant community growth curve (percent production by month). TX6021, Tall & Midgrass/Oak Savannah Community. The tallgrasses will start to disappear and be replaced by midgrasses. Invader brush species appears and becomes established..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | 18 | 23 | 17 | 6 | 4 | 16 | 6 | 3 | 2 |

## Pathway 1.1A
## Community 1.1 to 1.2



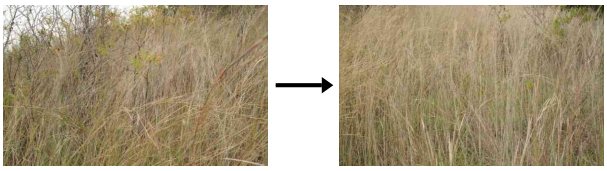
**Tallgrass/Oak Savannah Community**

**Midgrass/Oak Savannah Community**

The Tallgrass/Oak Savannah Community requires fire and/or brush control to maintain woody species cover below

30%. This community will shift to the Midgrass/Oak Savannah Community when there is continued growing season stress on palatable grass species. These stresses include improper grazing management that creates insufficient critical growing season deferment, excess intensity of defoliation, repeated, long-term growing season defoliation, long-term drought, and/or other repeated critical growing season stress. Increaser species (midgrasses and woody species) are generally endemic species released by disturbance. Woody species canopy exceeding 30% and/or dominance of tallgrasses falling below 50% of species composition indicate a transition to the Midgrass/Oak Savannah Community. The reference community can be maintained through the implementation of brush management combined with properly managed grazing that provides adequate growing season deferment to allow establishment of tallgrass propagules and/or the recovery of vigor of stressed plants. The driver for community shift 1.1A for the herbaceous component is improper grazing management. The driver for the woody component is lack of fire and/or brush control.

### Pathway 1.2A
### Community 1.2 to 1.1



**Midgrass/Oak Savannah Community**

**Tallgrass/Oak Savannah Community**

The Midgrass/Oak Savannah Community will return to the Tallgrass/Oak Savannah Community with brush control and grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. The understory and overstory components can act independently when canopy cover is less than 50%, i.e., an increase in shrub canopy cover can occur while proper grazing management creates an increase in desirable herbaceous species. The understory component may return to dominance by tallgrasses in the absence of fire (at least until shrub canopy cover reaches 50%). Reduction of the woody component to 30% or less canopy cover will require inputs of fire and/or brush control. The driver for community shift 1.2A for the herbaceous component is proper grazing management, while the driver for the woody component is fire and/or brush control.

**Conservation practices**

| |
|---|
| Brush Management |
| Prescribed Burning |
| Prescribed Grazing |

## State 2
## Shrubland State

**Dominant plant species**

- Texas live oak (*Quercus fusiformis*), tree
- Ashe's juniper (*Juniperus ashei*), tree
- Texas wintergrass (*Nassella leucotricha*), grass

### Community 2.1
### Mixed-Brush Shrubland Community

The Mixed-Brush Shrubland Community (2.1) is the result of many years of fire exclusion and/or a lack of proper brush management. It may or may not have been accompanied by improper grazing management, although improper grazing management can increase the rate of degradation. Oaks, Ashe’s juniper, and/or honey mesquite dominate the Mixed-Brush Shrubland Community (2.1), which has greater than 50 percent woody canopy cover. It is now essentially a dense shrubland with remnant grasses under the canopy and within interspaces. Once the brush canopy exceeds 50 percent, annual production for the understory is limited and is generally made up of unpalatable shrubs, grasses, and forbs within tree and shrub interspaces. Common understory shrubs are

pricklypear, agarito, sumacs, and elbowbush. With continued heavy cattle grazing and/or browsing and no brush control, the trees and shrubs can exceed 70 percent canopy cover, and potentially reach almost 100 percent cover. Excessive grazing by other deer or goats will create a community dominated by large trees. Few remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. Characteristic grasses are threeawns (Aristida spp.), buffalograss (*Bouteloua dactyloides*), cedar sedge (*Carex planostachys*), hairy grama (*Bouteloua hirsuta*), and fall witchgrass (*Digitaria cognata*). Texas wintergrass and annuals are found in and around tree/shrub cover. Grasses and forbs make up 40 percent or less of the annual herbage production. Common forbs include dotted gayfeather, western ragweed (*Ambrosia psilostachya*), sensitive-briar (Mimosa spp.), Mexican sagewort (*Artemisia ludoviciana* ssp. mexicana), and queen's-delight (*Stillingia sylvatica*). At its most extreme, this community takes on a woodland appearance, large woody species with understory dominated by low production grasses, sedges, and forbs that have low palatability and high shade tolerance. Sideoats grama and other desirable midgrasses decrease to the point that grasses no longer form the dominant component. Shortgrasses such as red lovegrass (*Eragrostis secundiflora*), purple threeawn (*Aristida purpurea*), tumblegrass (*Schedonnardus paniculatus*), and tumble windmill grass (*Chloris verticillata*) increase. Forbs such as curlycup gumweed (*Grindelia squarrosa*), western ragweed, silverleaf nightshade (*Solanum elaeagnifolium*), and thistles increase in species composition. Unpalatable forbs such as western ragweed increase in species composition. Annual herbage production decreases due to a decline in soil structure and organic matter. Biomass shifts toward the woody component. Plant vigor and productivity of the grassland component is reduced due to competition for nutrients and water from woody plants. Without some form of brush control, the community loses its savannah appearance with invasive shrubs beginning to fill the open grassland portion of the savannah. The oak mottes remain, but are no longer the only areas with trees. There is a continued decline in diversity of the grassland component and an increase in woody species such as sumac. Unpalatable woody species have increased in size and density. Honey mesquite is an early increaser throughout the MLRA. Redberry juniper (*Juniperus pinchotii*) occurs only in the southern counties of the MLRA and eastern redcedar (*Juniperus virginiana*) occurs only in the northern portion. Ashe's juniper occurs mostly in the southern portion, but can be found throughout the MLRA. Excessive cattle grazing tends to create a different response and structure to the community than does excessive deer or goat grazing. Excessive cattle grazing tends to accelerate invasion of shrubs because it creates conditions where young shrubs increase in vigor and size while palatable grasses decrease in vigor and abundance. Excess deer or goat grazing tends to create a dominance of large trees by removing both young shrubs and the young growth that grow below the browse line on larger shrubs and trees. In areas where high deer densities occur, heavy browsing can decrease preferred woody plants. While large trees will continue to increase in size, they will have very little production below the browse line. The site becomes dominated by large trees with little forage available for livestock or wildlife. Large trees with little understory provide much less soil protection than do dense stands of grass. As soils erode, understory species have reduced potential to revegetate the site. The bare area under the browse line creates a situation that provides poor forage conditions and poor visual cover for wildlife. If irreversible soil damage has occurred, it may be possible to remove brush and seed the site to a grassland community. However, it is very difficult and expensive to restore the site to reference conditions due to the loss of organic matter, soil horizons, soil microbes, and soil structure necessary to maintain the reference community. The shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and organic mulch are reduced, exposing more of the soil surface to erosion in interspaces. The percent of exposed limestone bedrock increases with erosion. However, within the woody canopy, hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. The Mixed-Brush Shrubland Community (2.1) provides good habitat cover for wildlife, but only limited forage or browse is available for livestock or wildlife. At this stage, highly intensive restoration practices are needed to return the shrubland to a grassland. Alternatives for restoration include brush control and range planting, proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community. As the grassland vegetation declines, more soil is exposed, leading to crusting and erosion. Due to the shallow depth to limestone bedrock and steep slope, erosion can be severe. Higher rainfall interception losses by the increasing woody canopy combined with increased evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces, but soil conditions improve under the woody plant cover. Soil loss can occur during rainfall events. Annual primary production is approximately 1,000 to 2,000 pounds per acre. In this plant community, annual production is balanced between herbaceous plants and woody species. Browsing animals such as goats and deer can find fair food value if browse plants have not been grazed excessively. Forage quantity and quality for cattle is low. Unless brush management takes place, woody canopy will continue to increase until it exceeds 75 percent. This trend cannot be reversed with proper grazing management alone.

**Table 7. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Grass/Grasslike | 504 | 757 | 1009 |
| Shrub/Vine | 448 | 673 | 897 |
| Forb | 168 | 252 | 336 |
| **Total** | **1120** | **1682** | **2242** |

**Figure 17. Plant community growth curve (percent production by month). TX6023, Oak/Juniper/Mesquite Complex. Oak/Juniper/Mesquite complex having greater than twenty percent woody canopy dominated by juniper and mesquite..**

| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3 | 8 | 20 | 25 | 19 | 5 | 3 | 10 | 4 | 1 | 1 |

## Transition T1A
## State 1 to 2

Shrubs make up a portion of the plant community in the Savannah State, hence woody propagules are present. Therefore, the Savannah State is always at risk for the transition to the Shrubland State in the absence of fire. The mean fire return interval in the Savannah State is 7-10 years. Even with proper grazing and favorable climate conditions, lack of fire for 20-30 years will allow woody species to increase in canopy to reach the 50% threshold level. Introduction of aggressive woody invader species (i.e. juniper or mesquite) increase the risk and accelerate the rate at which this transition state is likely to occur. This transition can occur from any community within the Savannah State, it is not dependant on degradation of the herbaceous community, but on the lack of some form of brush control. Improper grazing, prolonged drought, and a warming climate will provide a competitive advantage to shrubs which will accelerate this process. Tallgrasses will decrease to less than 5% species composition.

## Restoration pathway R2A
## State 2 to 1

Restoration of the Shrubland State to the Savannah State requires substantial energy input. Mechanical or herbicidal brush control treatments can be used to remove woody species. A long-term prescribed fire program may sufficiently reduce brush density to a level below the threshold of the Savannah State, particularly if the woody component is dominated by species that are not fire sprouters. Chemical or hand brush control in combination with prescribed fire, proper grazing, and favorable growing conditions may be the most economical means of creating and maintaining the desired plant community. If remnant populations of tallgrasses, midgrasses, and desirable forbs are not present at sufficient levels, range planting will be necessary to restore a desirable herbaceous plant community. The driver for Restoration Pathway R2A is fire and/or brush control combined with natural restoration of the herbaceous community or active management of the herbaceous restoration process (range seeding). Restoration may require aggressive treatment of invader species.

### Conservation practices

| |
|---|
| Brush Management |
| Prescribed Burning |
| Prescribed Grazing |
| Range Planting |

## Additional community tables

**Table 8. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 1 | **Tallgrasses** | | | 757–1614 | |
| | little bluestem | SCSC | *Schizachyrium scoparium* | 673–1435 | – |
| | Indiangrass | SONU2 | *Sorghastrum nutans* | 168–392 | – |
| | big bluestem | ANGE | *Andropogon gerardii* | 168–392 | – |
| 2 | **Midgrasses** | | | 252–538 | |
| | sideoats grama | BOCU | *Bouteloua curtipendula* | 224–504 | – |
| | tall grama | BOHIP | *Bouteloua hirsuta var. pectinata* | 168–448 | – |
| | composite dropseed | SPCOC2 | *Sporobolus compositus var. compositus* | 168–448 | – |
| | cane bluestem | BOBA3 | *Bothriochloa barbinodis* | 112–252 | – |
| | silver beardgrass | BOLAT | *Bothriochloa laguroides ssp. torreyana* | 112–252 | – |
| | Texas wintergrass | NALE3 | *Nassella leucotricha* | 56–168 | – |
| 3 | **Mid/Shortgrasses** | | | 168–359 | |
| | slim tridens | TRMU | *Tridens muticus* | 168–359 | – |
| | slim tridens | TRMUE | *Tridens muticus var. elongatus* | 168–359 | – |
| | Wright's threeawn | ARPUW | *Aristida purpurea var. wrightii* | 84–179 | – |
| | fall witchgrass | DICO6 | *Digitaria cognata* | 84–179 | – |
| | green sprangletop | LEDU | *Leptochloa dubia* | 84–179 | – |
| | muhly | MUIN | *Muhlenbergia ×involuta* | 84–179 | – |
| | Reverchon's bristlegrass | SERE3 | *Setaria reverchonii* | 84–179 | – |
| 4 | **Shortgrasses** | | | 84–179 | |
| | buffalograss | BODA2 | *Bouteloua dactyloides* | 84–179 | – |
| | hairy grama | BOHI2 | *Bouteloua hirsuta* | 84–179 | – |
| | sedge | CAREX | *Carex* | 84–179 | – |
| | seep muhly | MURE2 | *Muhlenbergia reverchonii* | 84–179 | – |
| **Forb** | | | | | |
| 5 | **Forbs** | | | 168–359 | |
| | awnless bushsunflower | SICA7 | *Simsia calva* | 112–269 | – |
| | prairie clover | DALEA | *Dalea* | 112–269 | – |
| | bundleflower | DESMA | *Desmanthus* | 112–269 | – |
| | coastal indigo | INMI | *Indigofera miniata* | 112–269 | – |
| | trailing krameria | KRLA | *Krameria lanceolata* | 112–269 | – |
| | dotted blazing star | LIPU | *Liatris punctata* | 112–269 | – |
| | sensitive plant | MIMOS | *Mimosa* | 112–269 | – |
| | yellow puff | NELU2 | *Neptunia lutea* | 112–269 | – |
| | scurfpea | PSORA2 | *Psoralidium* | 112–269 | – |
| | white rosinweed | SIAL | *Silphium albiflorum* | 28–56 | – |
| | Cuman ragweed | AMPS | *Ambrosia psilostachya* | 28–56 | – |
| | compassplant | SILA3 | *Silphium laciniatum* | 28–56 | – |
| **Shrub/Vine** | | | | | |
| 6 | **Shrubs/Vines/Trees** | | | 168–359 | |
| | Texas red oak | QUBU2 | *Quercus buckleyi* | 168–359 | – |

| | | | | | |
|---|---|---|---|---|---|
| | Texas live oak | QUFU | *Quercus fusiformis* | 168–359 | – |
| | bastard oak | QUSIB | *Quercus sinuata var. breviloba* | 168–359 | – |
| | Ashe's juniper | JUAS | *Juniperus ashei* | 84–179 | – |
| 7 | **Shrubs/Vines/Trees** | | | 84–179 | |
| | black prairie clover | DAFR2 | *Dalea frutescens* | 84–179 | – |
| | Texas kidneywood | EYTE | *Eysenhardtia texana* | 84–179 | – |
| | ash | FRAXI | *Fraxinus* | 84–179 | – |
| | plum | PRUNU | *Prunus* | 84–179 | – |
| | sumac | RHUS | *Rhus* | 84–179 | – |
| | bully | SIDER2 | *Sideroxylon* | 28–56 | – |
| | yucca | YUCCA | *Yucca* | 28–56 | – |
| | algerita | MATR3 | *Mahonia trifoliolata* | 28–56 | – |
| | catclaw mimosa | MIACB | *Mimosa aculeaticarpa var. biuncifera* | 28–56 | – |
| | stretchberry | FOPU2 | *Forestiera pubescens* | 28–56 | – |

## Animal community

This site is one of the preferred sites for deer in the Grand Prairie. The topography, protective cover, and many palatable browse plants make this site especially suited for deer. Several species of songbirds and small animals are endemic to the site.

## Hydrological functions

The Steep Adobe ecological site occurs on moderately steep to hilly loam and clay loam soils. Due to slope, runoff is rapid even under good plant cover. Areas without sufficient cover of plants or litter crust rapidly. The site is strongly calcareous with a soft limestone or marl at 10 to 20 inches causing the site to be quite droughty. Soils have low water and fertility holding capacity.

Water erosion can occur where the site is not protected by vegetation. In the Savannah State grassland vegetation intercepts and utilizes much of the rainfall. In the Shrubland State shrub canopy intercepts much of the rainfall, but that which strikes the ground may cause erosion due to increase in bare soil. Evaporation losses are higher in the Shrubland State, which when combined with interception losses, results in less moisture reaching the rooting zone.

As the site transitions away from the Tallgrass/Oak Savannah community (1.1) the amount of bare ground will increase from essentially none to over 20 percent in the Shrubland State. Accordingly, infiltration will decline and runoff and erosion will increase. Standing plant cover, litter, and soil organic matter decrease as site transitions from the Savannah State to the Shrubland State.

## Recreational uses

Recreational uses include photography, hiking, camping, horseback riding, bird watching, and off-road vehicle use. This site is preferred by deer, making it a favorite of hunters. Profitable hunting enterprises have been established on this site for quail, deer, dove, and turkey. Fall colors can be spectacular on this site with the sumacs and Texas oaks interspersed with the cured grasses.

## Wood products

Honey mesquite and oak are used for posts, firewood, charcoal, and other specialty wood products.

## Other products

Jams and jellies are made from many fruit bearing species, such as agarito and wild cherry (Prunus serotina). Seeds are harvested from many plants for commercial sale. Many grasses and forbs are harvested by the dried-

plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from many flowering plants, such as honey mesquite.

## Other information

None.

## Inventory data references

Information presented was derived from the revised Steep Adobe Range Site, NRCS clipping data, literature, field observations, and personal contacts with range-trained personnel.

## References

. 2021 (Date accessed). USDA PLANTS Database. http://plants.usda.gov.

Bailey, V. 1905. Biological Survey of Texas. North American Fauna 25:1–222.

## Other references

Other References:
1. Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. In: Ecological implications of livestock herbivory in the West, pp. 13-68. Edited by M. Vavra, W. Laycock, R. Pieper. Society for Range Management Publication, Denver, CO.
2. Archer, S. and F.E. Smeins. 1991. Ecosystem-level Processes. Chapter 5 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
3. Bestelmeyer, B.T., J.R. Brown, K.M. Havstad, R. Alexander, G. Chavez, and J.E. Herrick. 2003. Development and use of state-and-transition models for rangelands. J. Range Manage. 56(2): 114-126.
4. Brown, J.R. and S. Archer. 1999. Shrub invasion of grassland: recruitment is continuous and not regulated by herbaceous biomass or density. Ecology 80(7): 2385-2396.
5. Foster, J.H. 1917. Pre-settlement fire frequency regions of the United States: a first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20.
6. Gould, F.W. 1975. The Grasses of Texas. Texas A&M University Press, College Station, TX. 653p.
7. Hamilton, W. and D. Ueckert. 2005. Rangeland Woody Plant Control: Past, Present, and Future. Chapter 1 in: Brush Management: Past, Present, and Future. pp. 3-16. Texas A&M University Press.
8. Scifres, C.J. and W.T. Hamilton. 1993. Prescribed Burning for Brush Management: The South Texas Example. Texas A&M University Press, College Station, TX. 245 p.
9. Smeins, F., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and Land Use Changes: A Long Term Perspective. Chapter 1 in: Juniper Symposium 1997, pp. 1-21. Texas Agricultural Experiment Station.
10. Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2001. State and transition modeling: and ecological process approach. J. Range Manage. 56(2):106-113.
11. Texas Agriculture Experiment Station. 2007. Benny Simpson's Texas Native Trees (http://aggie-horticulture.tamu.edu/ornamentals/natives/).
12. Texas A&M Research and Extension Center. 2000. Native Plants of South Texas (http://uvalde.tamu.edu/herbarium/index.html).
13. Thurow, T.L. 1991. Hydrology and Erosion. Chapter 6 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
14. USDA/NRCS Soil Survey Manuals for various counties.
15. USDA, NRCS. 1997. National Range and Pasture Handbook.
16. Vines, R.A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.
17. Vines, R.A. 1977. Trees of Eastern Texas. University of Texas Press, Austin, TX. 538 p.
18. Wright, H.A. and A.W. Bailey. 1982. Fire Ecology: United States and Southern Canada. John Wiley & Sons, Inc.

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## Approval

Bryan Christensen, 9/21/2023

## Acknowledgments

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. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

## 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) | Lem Creswell, RMS, NRCS, Weatherford, Texas |
| Contact for lead author | 817-596-2865 |
| Date | 09/17/2007 |
| Approved by | Bryan Christensen |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

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

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2. **Presence of water flow patterns:** Water flow patterns are common and follow old stream meanders. Deposition or erosion is uncommon for normal rainfall but may occur during intense rainfall events.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals and terracettes are uncommon for this site.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect less than 5% bare ground randomly distributed throughout in small and non-connected areas. Most area between plant bases is covered with litter or rock. Disturbed areas heal quickly.

5. **Number of gullies and erosion associated with gullies:** Some gullies may be present on side drains into perennial and intermittent streams. Gullies should be vegetated and stable.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Under normal rainfall, little litter movement should be expected; however, litter of all sizes may move long distances during intense storm events. Minimal and short.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is highly resistant to erosion. Stability class range is expected to be 5-6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 0-4 inches of pale brown gravelly loam, moderately fine and very fine subangular blocky and granular structure on the surface. SOM is approximately 0-3%. See soil survey for specific soils.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of tallgrasses, midgrasses, forbs, and trees with adequate litter and little bare ground provides for high infiltration and low 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):**

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 >> Shrubs/Vines/Trees > Forbs >

    Other: Warm-season shortgrasses

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses, trees, and forbs due to their growth habit will exhibit some mortality and decadence, though very slight due to long-lived nature of plants. Open spaces from disturbance are quickly filled by new plants through seedlings and tillering.

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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):** 1500 to 3200 pounds per acre.

---

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:** Ashe Juniper, Honey mesquite, Prickly pear, Bermudagrass, Johnsongrass, King Ranch bluestem

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

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