Ecological site R081CY362TX
Steep Adobe 29-35 PZ

Last updated: 9/19/2023
Accessed: 10/12/2024

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.

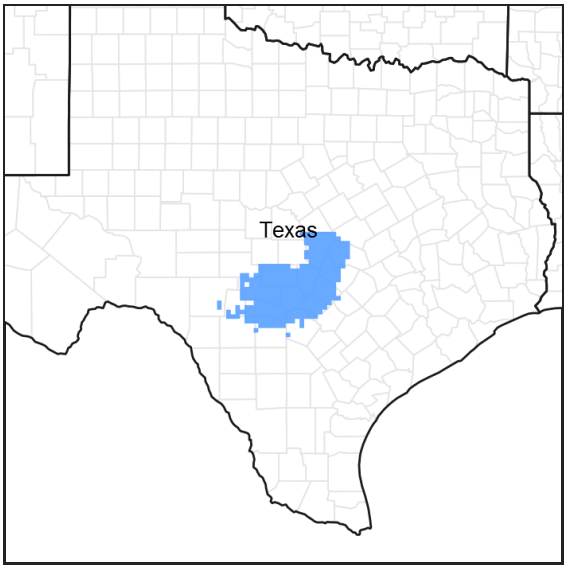


Figure 1. Mapped extent

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): 081C–Edwards Plateau, Eastern Part

This area represents the eastern part of the Edwards Plateau region. Limestone ridges and canyons and nearly level to gently sloping valley floors characterize the area. Elevation is 400 feet (120 meters) at the eastern end of the area and increases westward to 2,400 feet (730 meters) on ridges. This area is underlain primarily by limestones in the Glen Rose, Fort Terrett, and Edwards Formations of Cretaceous age. Quaternary alluvium is in river valleys.

Classification relationships

Major Land Resource Area (MLRA) and Land Resource Unit (LRU) (USDA-Natural Resources Conservation Service, 2006)
National Vegetation Classification/Shrubland & Grassland/2C Temperate & Boreal Shrubland and Grassland/M051 Great Plains Mixedgrass Prairie & Shrubland/ G133 Central Great Plains Mixedgrass Prairie Group.

Ecological site concept

These sites occur on gravelly clay loam soils on steep slopes. The reference vegetation includes a savannah of live oak and Texas red oak with midgrasses, tallgrasses, forbs and few shrubs. Without periodic fire or other brush

management, juniper and other woody species will likely increase across the site.

Associated sites

R081CY355TX	**Adobe 29-35 PZ** The Adobe site has less slope, higher production but less woody plant diversity.
R081CY363TX	**Steep Rocky 29-35 PZ** The Steep Rocky site has larger boulders and is underlain with indurated bedrock.
R081CY357TX	**Clay Loam 29-35 PZ** The Clay Loam ecological site is down slope and has deeper soils.

Similar sites

R081CY363TX	**Steep Rocky 29-35 PZ** The plant communities of Steep Rocky do not have the woody plant diversity as the Steep Adobe site.
R081CY355TX	**Adobe 29-35 PZ** Same soil series but on less slope.

Table 1. Dominant plant species

Tree	(1) *Quercus buckleyi* (2) *Quercus fusiformis*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Muhlenbergia reverchonii*

Physiographic features

This site is located in the 81C, Eastern Edwards Plateau Major Land Resource Area (MLRA). It is classified as an upland site. Slope gradient range from 8 to 60 percent but most are above 12 percent. This site was formed in residuum from weathered limestone. Elevation of this site ranges from 1200 to 2200 feet above mean sea level. This site has a distinctive “bench-like” appearance with “stair-stepping” occurring with the limestone ledges. This is characteristic of the Glen Rose formation.

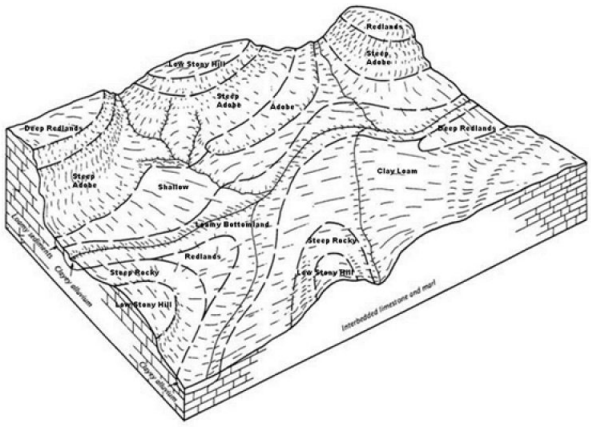


Figure 2. Diagram revealing the landscape position of the St

Table 2. Representative physiographic features

Landforms	(1) Plateau > Ridge
Runoff class	High to very high
Flooding frequency	None

Ponding frequency	None
Elevation	1,200–2,200 ft
Slope	12–60%
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	8–60%

Climatic features

The climate is humid subtropical and is characterized by hot summers and relatively mild winters. The average first frost should occur around November 15 and the last freeze of the season should occur around March 19.

The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is southeast.

Drought is calculated as 75% below average rainfall. It should be noted that timing of rainfall may be more significant than average rainfall.

Approximately two-thirds of annual rainfall occurs during the April to September period. Rainfall during this period generally falls during thunderstorms, and fairly large amount of rain may fall in a short time. Hurricanes provide another source of extremely high rains in a short time. A review of the rainfall records suggest that rainfall is below “normal” at least 60 percent of the time. Therefore, the erratic nature of the rainfall should be considered when developing any land management plans.

The impact of droughts in the Edwards Plateau cannot be under-estimated. Not only are droughts devastating to the land but also to those that manage the land. Droughts occur roughly every 20 years but not always. A severe drought in 2012 coupled with extreme heat resulted in a die off of juniper over millions of acres as well as other native plants.

Table 4. Representative climatic features

Frost-free period (characteristic range)	220-260 days
Freeze-free period (characteristic range)	227-269 days
Precipitation total (characteristic range)	32-37 in
Frost-free period (actual range)	187-260 days
Freeze-free period (actual range)	224-332 days
Precipitation total (actual range)	31-37 in
Frost-free period (average)	235 days
Freeze-free period (average)	257 days
Precipitation total (average)	34 in

Climate stations used

- (1) MEDINA 1NE [USC00415742], Medina, TX

- (2) SAN ANTONIO/SEAWORLD [USC00418169], San Antonio, TX
- (3) KERRVILLE 3 NNE [USC00414782], Kerrville, TX
- (4) BLANCO [USC00410832], Blanco, TX
- (5) CANYON DAM [USC00411429], Canyon Lake, TX
- (6) BURNET MUNI AP [USW00003999], Burnet, TX
- (7) AUSTIN GREAT HILLS [USC00410433], Austin, TX
- (8) GEORGETOWN LAKE [USC00413507], Georgetown, TX
- (9) PRADE RCH [USC00417232], Leakey, TX

Influencing water features

This being an upland site, it is not influenced by water from a wetland or a stream. These upland sites may shed some water via runoff during heavy rain events. The presence of good ground cover and deep rooted grasses can help facilitate infiltration and reduce sediment loss.

Wetland description

N/A

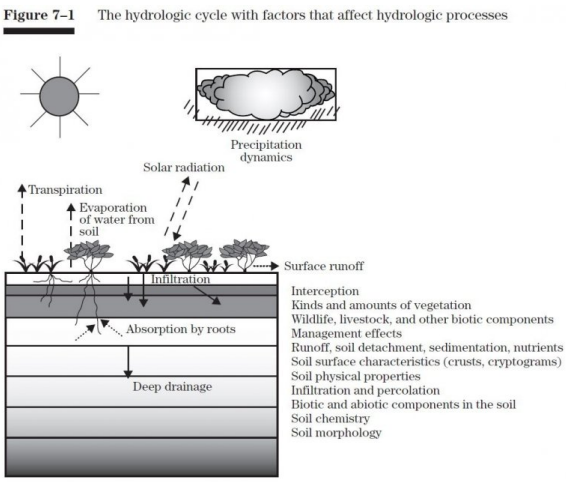


Figure 9.

Soil features

The representative soils of this site are very shallow, shallow, and moderately deep, usually gravelly, light-colored loam and clay loam over soft limestone. Because of slope, runoff is rapid even under good plant cover. In the absence of plant cover and residues, the soils crust readily. The soil formed in residuum over interbedded limestone and marl. These soils are strongly calcareous and have low water holding capacity. For these reasons, the site is droughty. Forage grown on this site is usually low in plant nutrients, especially phosphorus.

In a representative profile, the surface layer is a pale brown gravelly clay loam ranging from 0 to 15 inches in depth. The substratum in the Kerrville Series is 15 to 24 inches of marl with indurated limestone bedrock at 24 to 30 inches. In the Real and Brackett Series, the substratum ranges from 13 to 60 inches of interbedded marl. In these two series, after 20 inches, the potential for hitting indurated limestone bedrock increases with depth.

Most map units contain slopes that are convex and range from 8 percent to 30 percent slopes on Steep Adobe sites. Kerrville and Brackett soils may range from 20 percent to 60 percent. Horizontal outcrops of limestone give the slopes a stair-stepped or benched appearance. Angular limestone pebbles and cobbles are on the surface of some areas. Sites with less than 20 percent slopes are more accessible to vehicle and livestock traffic.

Due to the scale of mapping, there are inclusions of minor components of other soils within these mapping units. Before performing any inventories, conduct a field evaluation to ensure the soils are correct for the site.

The representative soil series associated with the Steep Adobe ecological site are Brackett, Kerrville, and Real.

Table 5. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Gravelly clay loam (2) Clay loam (3) Gravelly loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	6–40 in
Soil depth	6–40 in
Surface fragment cover <=3"	5–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	0.6–3.1 in
Calcium carbonate equivalent (0-40in)	40–80%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (4-40in)	5–45%
Subsurface fragment volume >3" (4-40in)	0–10%

Ecological dynamics

The reference plant community on the Steep Adobe site is a Texas oak and live oak (*Quercus buckleyi*/*Quercus fusiformis*) Savannah Community. The Texas oak usually occurs in bands perpendicular to the slope. Plants such as little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), and sideoats grama (*Bouteloua curtipendula*) dominate the inner spaces. Also prevalent but in smaller amounts are tall grama (Bouteloua pectinata), slim (*Tridens muticus*) and rough tridens (*Tridens muticus* var. elongates), seep muhly (*Muhlenbergia reverchonii*), canyon muhly (Muhlenbergia x involuta), and Lindheimer muhly (*Muhlenbergia lindheimeri*). The historic shrub and tree community comprised as much as a 20 percent canopy consisting of Texas oak, live oak, sumac (Rhus spp.), catclaw (Mimosa spp.), madrone (Arbutus texana), juniper (Juniperus spp.), and other associated species. Numerous forbs such as zexmenia (Wedelia hispida), dalea (Dalea spp.), sundrop (Calylophus spp.), bundleflower (Desmanthus spp.), and gayfeather (Liatris spp.) frequent the site.

Underlying geology, whether it is non-fractured limestone or fractured limestone determines the woody plant composition. (Fractured limestone favors larger and denser trees, whereas non-fractured limestone features shorter woody species and lower densities. The Woodland phase occurred primarily on north slopes).

A study of early photographs of this region reveals that today, these sites are much denser with woody cover and less covered with grasslike vegetation. Early accounts consistently describe this region as a vast expanse of hills covered with "cedar" from San Antonio to Austin. Accounts also describe an abundance of clean, flowing water, and abundant wildlife. These accounts seem to describe heavy wooded areas in mosaic patterns occurring along the highs and lows of the landscape. The shallow soils of the Steep Adobe site are located on the foot slopes of hills in the area. These adobe soils are laid over soft limestone and are predominated by open prairie grassland species in the historic plant community. This site historically became more wooded as slope increased.

The pre-settlement landscape is different than the landscape seen today. Observations and anecdotal records of early settlers and explorers were usually not site specific but do provide insight as to the general appearance of an

area. One example is the Teran expedition in 1691 spoke of “great quantities of buffaloes” in the area. By 1840 the Bonnell expedition reflected that “buffalo rarely range so far to the south” (Inglis, 1964). In the Helotes, Texas area an early settler, Arnold Gugger who wrote in his journal about the mid to late 1800s, “in those days buffaloes were in droves by the hundreds…..and antelopes were three to four hundred in a bunch….and deer, turkeys at any amount (Massey).

The plant communities of this site are dynamic and vary in relation to grazing, fire, and rainfall. Studies of the pre-European vegetation of the general area suggested 47 percent of the area was wooded (Wills, 2006).
Many research studies document the interaction of bison grazing and fire (Fuhlendorf, et al., 2008.). Bison would come into an area, graze it down, leave and then not come back for many months or even years. Many times this grazing scheme by buffalo was high impact and followed fire patterns and available natural water. This long deferment period allowed the taller grasses and forbs to recover from the high impact bison grazing. This relationship created a diverse landscape. Historic herbivory by bison may have been limited on this site because of the nutrient tie-up in the grasses and the slopes.

Fire was a major influence prior to European settlement. Fire occurred from lightning strikes whenever there were accumulations of fuel load and the grass was dry enough to burn. Fires would burn extensively and unrestrained except when rainfall would put it out or there were topographical changes that served as firebreaks. Native Americans also used fire at their discretion. It is estimated that a fire frequency of 3 to 10 years was possible (Frost, 1998). It is presumed that bison were attracted to the post burned areas, leaving unburned areas relatively ungrazed. Over time, the ungrazed areas would accumulate fuel until a random fire would occur. This usually occurs in a dry year following a period of favorable rainfall. A fire/grazing interaction would result in a mosaic of grass/woody species over the landscape depending upon time since the last burn.

Overgrazing with a corresponding reduction of periodic fire has changed these communities and altered the fire regime. Because of the basic topography of this site, contemporary grazing by cattle is less than on flatter more accessible sites. However, this site is accessible to grazing from animals such as deer, sheep, and goats.

Slope and geologic structure played a major role in the type, formation, and composition of the woody plant community. On flatter slopes (12 to 20 percent) soils are deeper, grass cover was better, and fire occurred more frequently than on steeper and rockier slopes which ranged from 20 to 60 percent. When fires did occur on the steeper slopes, they may have occurred more often on the southern slopes since predominant winds in this area are from the south. The presence of limestone escarpments (benches) running on contour to the slope often slowed or stopped less intensive fires and resulting in mosaic vegetative patterns. Periodic fires set either by Native Americans or by lighting kept oaks (Quercus spp.), Ashe juniper (*Juniperus ashei*), prairie sumac (*Rhus copallinum*), and other woody species suppressed and confined to protected areas. The structure of the trees was probably somewhat different historically than the contemporary structure as live oak takes on a more “thicketized” growth form than a tree form under a fire regime.

Ashe juniper will increase regardless of grazing. Juniper will establish with grazing and without unless goats are utilized. Goat and probably sheep will eat young juniper and when properly used, are an effective tool to maintain juniper (Taylor, 1997; Anderson et al., 2013). The main role of excessive grazing relative to juniper is the removal of the fine fuel needed to carry an effective burn. Ashe juniper is a non-resprouting species.

Small areas may exhibit water seepage or spring flow following long periods of rainfall because of small underground water-filled cavities slowly draining through the fractured rock and soil profile from the upper elevation. The muhly (Muhlenbergia spp.) grass species may dominate the seep areas. Some Eastern gamagrass will add to the mosaic pattern of the site.

Heavy continuous grazing by sheep, goats, and deer reduces the palatable forbs and browse plants. Low successional, unpalatable grasses, forbs, and shrubs have taken the place of the more desirable plant species over much of the sites’ range. The diversity of native forbs and grasses for this site are potentially greater than on the more accessible flatter slopes should proper management occur. Because of this plant diversity, no attempt in this document is made to list them all. The major key plants, however, are listed.

The screwworm fly (Cochilomyia hominivorax) was essentially eradicated by the mid-1960s, and while this was immensely helpful to the livestock industry, this removed a significant control on deer populations (Teer, Thomas, and Walker, 1965; Bushland, 1985).

Progressive management of the deer herd, because of their economic importance through lease hunting, has the objective of improving individual deer quality and improving habitat. Managed harvest based on numbers, sex ratios, condition, and monitoring of habitat quality has been effective in managing the deer herd on individual properties. However, across the Edwards Plateau, excess numbers still exist which may lead to habitat degradation and significant die-offs during stress periods such as extended droughts.

The Edwards Plateau is home to a variety of non-indigenous (exotic) ungulates, mostly introduced for hunting (Schmidly, 2002). These animals are important sources of income to some landowners, but as with the white-tailed deer, their populations must be managed to prevent degradation of the habitat for themselves as well as for the diversity of native wildlife in the area. Many other species of medium- and small-sized mammals, birds, and insects can have significant influences on the plant communities in terms of pollination, herbivory, seed dispersal, and creation of local disturbance patches, all of which contribute to the plant species diversity.

A State and Transition Model for the Steep Adobe Ecological Site (R081CY362TX) is depicted in this report. Descriptions of each state, transition, plant community, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

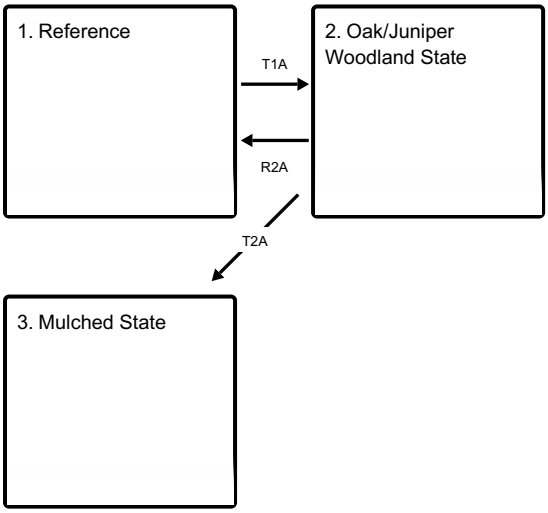
Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal. Other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category. 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.

Both percent species composition by weight and percent canopy cover are described as are other metrics. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover can drive the transitions between communities and states because of the influence of shade and interception of rainfall. Species composition by dry weight is used for describing the herbaceous community and the community as a whole. Woody species are included in species composition for the site. Calculating similarity index requires the use of species composition by dry weight.

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown in the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model

Ecosystem states

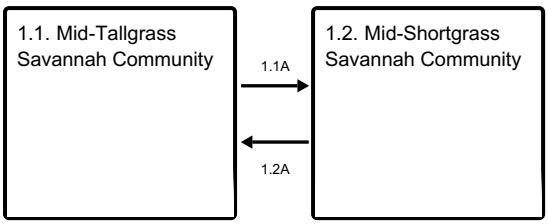


T1A - Absence of disturbance and natural regeneration over time

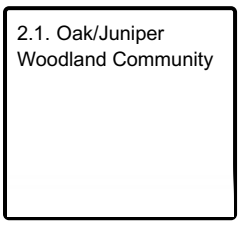
R2A - Mechanical removal of juniper, followed by reintroduction of natural disturbance regimes

T2A - Mechanical conversion of juniper to mulch

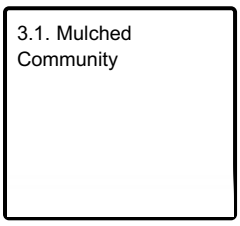
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

The reference state is considered to be representative of the natural range of variability under pre-Euro settlement conditions. This state is characterized by a Mid and Tallgrass Savannah community.

Dominant plant species

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

Community 1.1
Mid-Tallgrass Savannah Community

Figure 10. Steep Adobe ecological site. Kendall County, Texas

Figure 11. 1.1 Mid-Tallgrass Savannah Community

Figure 12. 1.1 Mid-Tallgrass Community (2)

The Mid-Tallgrass Savannah (1.1) will be the reference community as it is perceived to have been the most extensive community. The data for this community is derived from old range site descriptions, professional consensus, and professional interpretation of collected data. This community is composed of mid and tall grasses plus scattered live oaks, Texas oaks, shrubs, forbs, and juniper. Percent canopy for this site is variable depending on the geologic formations which influence vegetation types. The overstory canopy averages about 20 percent for the site, with isolated areas being very dense and others being very open. Common woody species will be live oak, Texas oak, Ashe juniper, Bigelow oak (*Quercus sinuata* var. breviloba), sumac walnut (Juglans spp.), madrone, and several associated species. Tall and mid grasses dominate the open areas throughout the site while far less herbaceous cover may exist in the shrub and tree community. Because of slope direction and exposure, woody species will vary. For example, Lacey (*Quercus laceyi*), Bigelow oak, and Ashe juniper are found more on the north facing slopes while the drier shrubland or thinner woody species occurs on the south facing slopes. Some seeps or spring flow would be present to add to the mosaic pattern of the site. Periodic fires and limited grazing by bison and other herbivores were natural processes that maintained this mosaic plant community. Under reference conditions the understory is dominated by warm-season midgrasses, tallgrasses and perennial forbs. When species such as little bluestem, Indiangrass, sideoats grama, and Engelmann daisy (*Engelmannia peristenia*) are grazed out of the plant community, herbaceous species are replaced by Wright's threeawn (Aristida wrightii), canyon and seep muhly, and Ashe juniper. If heavy grazing continues for many years, retrogression of the plant community will occur and species such as Ashe juniper and other low succession species will increase. With no brush control and continued overgrazing, all palatable plants will disappear and juniper and oaks will dominate the site. It should be noted that Ashe juniper will also increase independently of grazing as its seeds are spread by birds and other animals. Ashe juniper (which originally occurred as a mosaic along more protected rocky, craggy outcrops on the steeper portions of the side where it was protected from historic fires) may increase to form a dense canopy and will suppress other vegetation. Soil, plant, and watershed health indicators are negatively impacted when the site is allowed to deteriorate. The integrity of the Reference Plant Community can be maintained with a few management practices. Brush control, proper stocking rates, and deferments can allow the site to respond positively relative to plant and soil health. Hand cutting of juniper and/or prescribed burning are examples of viable practices for the flatter slopes of this site. Individual Plant Treatment (IPT) alternatives are other options which may be effective. The Reference

Plant community is a stable community with sunlight energy cycling through several functional groups such as warm season grasses, cool season grasses, trees, and shrubs. Erosion does occur naturally along steeper drains but for the most part, the site is stable.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	600	810	1680
Tree	200	360	560
Shrub/Vine	150	270	420
Forb	50	100	140
Total	**1000**	**1540**	**2800**

Table 7. Ground cover

Tree foliar cover	15-25%
Shrub/vine/liana foliar cover	3-8%
Grass/grasslike foliar cover	10-25%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	55-65%
Surface fragments >0.25" and <=3"	5-25%
Surface fragments >3"	0%
Bedrock	1-5%
Water	0%
Bare ground	0-5%

Table 8. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	1-10%	0-1%
>0.5 <= 1	–	1-3%	1-15%	1-3%
>1 <= 2	–	5-8%	10-15%	3-5%
>2 <= 4.5	–	3-5%	50-60%	–
>4.5 <= 13	10-20%	–	–	–
>13 <= 40	15-25%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 14. Plant community growth curve (percent production by month). TX3622, Mid and Shortgrass Savannah, 10% canopy. Mid and shortgrasses dominate the site with less than 20 percent forbs, shrubs, and woody plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	3	5	13	23	15	4	5	15	7	5	3

Community 1.2
Mid-Shortgrass Savannah Community

Figure 15. 2009 Steep Adobe ecological site, along Scenic Loo

Figure 16. . 2013 Steep Adobe ecological site, along Scenic L

Figure 17. Steep Adobe ecological site, revealing a pocket of

Figure 18. . 2009 Steep Adobe ecological site, along Scenic

Figure 19. 2013 Steep Adobe ecological site, along Scenic Loo

The data for this plant community was derived from limited field data collection and professional consensus. The Mid-Shortgrass Savannah Community (1.2) still resembles the Mid-Tallgrass Savannah Community (1.1) plant structure to the casual observer. However, this community represents a decline of the previously dominate mid and tall grasses and perennial forbs and palatable shrubs. There are still some remnants of historic plants such as little bluestem, sideoats grama, dropseeds, perennial forbs, and shrubs. Less palatable annual and perennial forbs increase. Shrub canopy has slightly increased overall but has a higher proportion of less palatable species. Driving this shift is the suppression of fire. Because of the steepness of this site and the surface rock, cattle accessibility is limited. Sheep, goats, and browsing wildlife species are more suited to this site. Overgrazing/browsing can contribute to loss of fuel which results in long term fire suppression. Droughts, of course, will accelerate the shift. Again, the non-fractured geology produces somewhat shorter vegetation with lighter densities than fractured sites. Overstory canopy averages 20 percent. More Ashe juniper plants (small plants, many times occurring under oak trees) are apparent as are some occasional scrubby mesquite seedlings. The Ashe juniper, which originally occurred in small amounts among the rocky, stepped, craggy outcrops are beginning to form a canopy which suppresses other vegetation. Grasslike vegetation is significantly reduced because of the competition for sunlight and moisture that Ashe juniper and other woody species rob. Improper grazing/browsing management also contributes to a loss of high successional species and allows invaders or lower successional species to proliferate. However, as woody canopy cover increase to maximum cover, cedar sedge will usually be one of the last existing plants before the soil becomes bare of grasslike vegetation and is covered with a thick mat of woody vegetation leaves and juniper duff. The photos show a community at risk of crossing a threshold. Notice the juniper growing underneath the live oak thickets and in the openings. At this stage, juniper and other brush species can still be managed with a relatively low input type of practice such as fire and individual plant treatment. In a short time, the juniper will have grown to the height and density that low input type of management is no longer an option. Photo 5 shows the beginning of juniper encroachment within a pocket of sotol. The hydrology of this site is changing as the canopy of woody plants is entrapping more rainfall and the lack of herbaceous cover is retaining less rainfall for infiltration. Seeps and/or spring flows are showing reduction accordingly. This plant community can be restored to something resembling the Mid-Tallgrass because some of the historic plants remain in a low vigor state. Prescribed grazing along with the use of prescribed burning and possible some Individual Plant Treatment type of brush

management can restore the site. Prescribed burning will be effective until juniper exceeds about 4 feet in height. Continued maintenance will be needed on a 3- to 8-year basis to prevent the juniper from coming back.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	450	810	1260
Tree	250	450	700
Shrub/Vine	200	360	560
Forb	100	180	280
Total	**1000**	**1800**	**2800**

Table 10. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	40-60%
Surface fragments >0.25" and <=3"	5-25%
Surface fragments >3"	0%
Bedrock	0-10%
Water	0%
Bare ground	0-5%

Table 11. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	1-10%	0-1%
>0.5 <= 1	–	1-3%	1-15%	1-3%
>1 <= 2	–	5-8%	10-15%	3-5%
>2 <= 4.5	–	5-15%	20-50%	–
>4.5 <= 13	10-15%	–	–	–
>13 <= 40	10-25%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 21. Plant community growth curve (percent production by month). TX3622, Mid and Shortgrass Savannah, 10% canopy. Mid and shortgrasses dominate the site with less than 20 percent forbs, shrubs, and woody plants..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	3	5	13	23	15	4	5	15	7	5	3

Pathway 1.1A
Community 1.1 to 1.2

Mid-Tallgrass Savannah Community

Mid-Shortgrass Savannah Community

The shift from the Mid-Tallgrass community (1.1) to a Mid-Shortgrass Community (1.2) is driven primarily by a lack of periodic burning. Overgrazing can contribute to the shift by removing fuel load and removing a healthy, competitive grass cover.

Pathway 1.2A
Community 1.2 to 1.1

Mid-Shortgrass Savannah Community

Mid-Tallgrass Savannah Community

The shift back to a Mid-Tallgrass Community (1.1) can be achieved by prescribed grazing, periodic fires, and possibly some Individual Plant Treatment to manage small shrubs.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Oak/Juniper Woodland State

The Oak/Juniper Woodland state has juniper and oak as co-dominates.

Dominant plant species

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

Community 2.1
Oak/Juniper Woodland Community

Figure 22. 2.1 Oak/Juniper Woodland Community

Figure 23. Steep Adobe ecological site, along Toutant Beaureg

Figure 24. Steep Adobe ecological site. Brackett Soil.

Figure 25. Steep Adobe ecological site. Brackett Soil

Figure 26. Steep Adobe ecological site. Brackett Soil

Figure 27. Steep Adobe ecological site

Figure 28. Steep Adobe ecological site. Brackett Soil.

The description of this plant community comes from old range site descriptions and some professional interpretation of field data. In the Oak/Juniper Woodland Community (2.1) a threshold has been crossed whereby it will take major inputs and mechanical energy to restore the site back to a Savannah State (1). Many open areas that were once tall or mid-grass communities are now covered with woody species such as Ashe juniper and live oak. There can still be remnants of Texas madrone, blackcherry (*Prunus serotina*), and walnut. Shrubs commonly growing in the area are Texas kidneywood (*Eysenhardtia texana*), sumac (Rhus spp.), algerita (Mahonia trifoliata), Texas persimmon (*Diospyros texana*), elbowbush (*Forestiera pubescens*), sotol, prickly ash, and hawthorn species (Crataegus spp.). This community phase is dominated by warm-season shortgrasses and forbs with greater than 20 percent canopy of shrubs and trees. Historically dominant grasses are being replaced by Wright's threeawn, hairy grama, red grama, cedar sedge (*Carex planostachys*), hairy tridens (*Erioneuron pilosum*), and other short grasses. There is a complete shift in the hydrologic and mineral cycling. The juniper entraps more than 25 percent (Thurow, 1997) of the annual rainfall. The lack of herbaceous vegetation absorbs little of the rainfall and the runoff is beginning to carry some sediments, although some erosion is probably geologic. This is a harsh site and once the site reaches this stage, it is difficult to restore. Proper gazing management alone will not restore this community. Where slopes will permit, selective brush control measures such as hand cutting followed by necessary deferments and possibly seeding can shift the community towards a grassland/woodland mosaic community. The elimination of infrequent wildfires plus the lack of brush management has allowed Ashe juniper and other woody species to overtake this site. Any ground disturbance type brush management may trigger some amounts of willow baccharis (*Baccharis salicina*).

Table 12. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	600	1080	1680
Shrub/Vine	300	540	740
Forb	50	90	140
Grass/Grasslike	50	90	140
Total	**1000**	**1800**	**2700**

Table 13. Soil surface cover

Tree basal cover	0-5%
Shrub/vine/liana basal cover	0-1%
Grass/grasslike basal cover	0-5%
Forb basal cover	0-3%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	30-85%

Surface fragments >0.25" and <=3"	5-45%
Surface fragments >3"	5-15%
Bedrock	2-5%
Water	0%
Bare ground	0-5%

Table 14. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-10%	0-5%
>0.5 <= 1	–	0-5%	0-10%	0-10%
>1 <= 2	–	0-5%	0-5%	0%
>2 <= 4.5	5-15%	5-15%	–	–
>4.5 <= 13	10-50%	–	–	–
>13 <= 40	50-25%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 30. Plant community growth curve (percent production by month). TX3778, Oak/Juniper Woodland Community. Oak/Juniper Hillside Community.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	7	13	20	15	7	5	10	7	5	5

State 3
Mulched State

The Mulched State results from heavy equipment reducing thick stands to varying degrees of surface mulch.

Dominant plant species

- Texas live oak (*Quercus fusiformis*), tree

Community 3.1
Mulched Community

Figure 31. Steep Adobe ecological site. Brackett Soil.

Figure 32. . Steep Adobe ecological site. Brackett Soil

This plant community is a result of using mechanical mulching to reduce canopy and structure of dense woody species which is usually juniper. The objective of this treatment is to facilitate the movement of people in the landscape and to provide protective ground cover. The amounts of mulch on the ground and the orientation of the mulch are dependent upon the amount of woody cover treated and the time since treatment. The mulch tends to settle over time and is very resistant to deterioration. This community can structurally appear very similar to the reference plant community but without the herbaceous cover. The understanding of how this plant community reacts over time is unknown but studies are currently underway to monitor. One result is that the soil is protected for a long time. There will be a need for maintenance to treat juniper and other species as they re-establish.

Table 15. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	1530	1870	2720
Shrub/Vine	90	110	160
Forb	90	110	160
Grass/Grasslike	54	66	96
Total	**1764**	**2156**	**3136**

Transition T1A
State 1 to 2

This Transition reflects the crossing of a threshold into a different vegetative state. This transition is driven by a lack of fire, no brush management and no prescribed grazing.

Restoration pathway R2A
State 2 to 1

The recovery is driven by significant inputs of energy from equipment such as skid loaders, bulldozers, or other brush management equipment. Slope and rockiness will preclude some equipment. Only hand equipment can be used on the steeper slopes. Usually at this state, prescribed fire is a high risk option.

Transition T2A
State 2 to 3

Mechanical conversion of primarily juniper canopy to a mulch cover restores the energy flow to the remaining species, usually oak. The hydrologic cycle retains nearly all the rainfall because of the heavy mulch. Little evaporation takes place.

Additional community tables

Table 16. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass**			600–800	
	little bluestem	SCSC	*Schizachyrium scoparium*	100–450	–
	Indiangrass	SONU2	*Sorghastrum nutans*	100–300	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	0–300	–
	big bluestem	ANGE	*Andropogon gerardii*	100–300	–
2	**Midgrasses**			100–150	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	25–100	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	50–100	–
	tall grama	BOHIP	*Bouteloua hirsuta var. pectinata*	50–100	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	50–100	–
	slim tridens	TRMU	*Tridens muticus*	25–75	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	25–75	–
	threeawn	ARIST	*Aristida*	25–75	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	25–75	–
	Reverchon's bristlegrass	SERE3	*Setaria reverchonii*	25–50	–
3	**Mld Grasses**			100–175	
	muhly	MUIN	*Muhlenbergia ×involuta*	50–150	–
	Lindheimer's muhly	MULI	*Muhlenbergia lindheimeri*	50–150	–
	seep muhly	MURE2	*Muhlenbergia reverchonii*	50–150	–
4	**Cool Season Grasses and Grasslikes**			30–50	
	cedar sedge	CAPL3	*Carex planostachys*	25–50	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	25–50	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	25–50	–
Forb					
5	**Forbs**			50–100	
	awnless bushsunflower	SICA7	*Simsia calva*	50–100	–
	queen's-delight	STSY	*Stillingia sylvatica*	50–100	–
	Indian mallow	ABUTI	*Abutilon*	50–100	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	50–100	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	50–100	–
	Berlandier's sundrops	CABE6	*Calylophus berlandieri*	50–100	–
	prairie clover	DALEA	*Dalea*	50–100	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	50–100	–
	bundleflower	DESMA	*Desmanthus*	50–100	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	50–100	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	50–100	–
	eastern milkpea	GARE2	*Galactia regularis*	50–100	–
	Chalk Hill hymenopappus	HYTE2	*Hymenopappus tenuifolius*	50–100	–

	trailing krameria	KRLA	*Krameria lanceolata*	50–100	–
	dotted blazing star	LIPU	*Liatris punctata*	50–100	–
	hoary blackfoot	MECI	*Melampodium cinereum*	50–100	–
	showy menodora	MELO2	*Menodora longiflora*	25–100	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	50–100	–
	narrowleaf Indian breadroot	PELI10	*Pediomelum linearifolium*	50–100	–
	snoutbean	RHYNC2	*Rhynchosia*	50–100	–
	wild petunia	RUELL	*Ruellia*	20–75	–
	smartweed leaf-flower	PHPO3	*Phyllanthus polygonoides*	20–75	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	5–50	–
6	**Annual Forbs**			1	
	prairie broomweed	AMDR	*Amphiachyris dracunculoides*	0–1	–
Shrub/Vine					
7	**Shrubs and Vines**			75–270	
	eastern redbud	CECA4	*Cercis canadensis*	50–100	–
	fragrant sumac	RHAR4	*Rhus aromatica*	50–100	–
	winged sumac	RHCO	*Rhus copallinum*	50–100	–
	evergreen sumac	RHVI3	*Rhus virens*	50–100	–
	gum bully	SILAO	*Sideroxylon lanuginosum ssp. oblongifolium*	50–100	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	50–100	–
	mescal bean	SOSE3	*Sophora secundiflora*	50–100	–
	Eve's necklacepod	STAF4	*Styphnolobium affine*	50–100	–
	grape	VITIS	*Vitis*	15–50	–
	twistleaf yucca	YUPA	*Yucca pallida*	15–50	–
	stretchberry	FOPU2	*Forestiera pubescens*	15–50	–
	Texas barometer bush	LEFR3	*Leucophyllum frutescens*	0–50	–
	algerita	MATR3	*Mahonia trifoliolata*	15–50	–
	scarlet monkeyflower	MICA3	*Mimulus cardinalis*	15–50	–
	Texas sacahuista	NOTE	*Nolina texana*	15–50	–
	roundleaf greenbrier	SMRO	*Smilax rotundifolia*	15–50	–
	American smoketree	COOB2	*Cotinus obovatus*	0–50	–
	Texas sotol	DATE3	*Dasylirion texanum*	0–50	–
	Texas persimmon	DITE3	*Diospyros texana*	15–50	–
	jointfir	EPHED	*Ephedra*	15–50	–
Tree					
8	**Trees**			100–360	
	Texas live oak	QUFU	*Quercus fusiformis*	100–300	–
	bastard oak	QUSIB	*Quercus sinuata var. breviloba*	100–300	–
	Nuttall oak	QUTE	*Quercus texana*	100–300	–
	Texas madrone	ARXA80	*Arbutus xalapensis*	0–200	–
	hackberry	CELTI	*Celtis*	50–200	–
	Ashe's juniper	JUAS	*Juniperus ashei*	50–150	–
	Lacey oak	QULA	*Quercus laceyi*	0–100	

	Lacey oak	QULA	*Quercus laceyi*	0–100	–
	elm	ULMUS	*Ulmus*	25–50	–
	littleleaf leadtree	LERE5	*Leucaena retusa*	25–50	–

Animal community

The site is somewhat accessible to use by cattle but is more accessible to deer, sheep, Angora goats, and meat goats. Global Positioning Systems studies reveal slopes above 11 percent are generally less accessible to cattle while sheep and goats can utilize slopes up to 45 percent. Also revealed is that cattle will avoid a site once it contains about 30 percent surface rocks. (Hanselka, et al., 2009)

Wildlife species which utilize this site for at least a part of their habitat needs are white-tailed deer, raccoon, cottontail rabbit, jackrabbit, Rio Grande turkey, bob-white quail, mourning dove, mountain lion, bobcat, and exotic wildlife species. A large diversity of wildlife is native to this steep site. Sheep and goats were formerly raised in large numbers and are still present in reduced numbers.

An assessment of current vegetation is needed to determine stocking rates. Traditional regional average stocking rates should not be used and can be misleading. Wildlife species should be assessed when calculating carrying capacity.

With the eradication of the screwworm fly in the 1960s, the increase in woody vegetation and insufficient natural predation, white-tailed deer numbers have increased drastically and are often in excess of carrying capacity. Where deer, goats, sheep, and possibly cattle numbers are excessive, overbrowsing and overuse of preferred forbs causes further deterioration of the plant community. Management of deer populations is needed to keep populations in balance. Achieving a balance between woodland and more open plant communities on this site is an important key to deer management. Competition among deer, sheep, and goats can cause damage to preferred vegetation and is an important consideration in livestock and wildlife management. Maintaining cover structure and food for wildlife on theses steeper slopes is extremely important to the wildlife ecology of this site and associated sites below or above.

A diversity of birds is found on this site including game birds, songbirds, and birds of prey. The different species of songbirds vary in their habitat preferences. In general, a habitat that provides a large variety of grasses, forbs, shrubs, vines, and trees and a complex of grassland, savannah, shrubland, and woodland will support a good variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits, and snakes in balance. The different plant communities of the site will sustain different species of raptors.

Various kinds of exotic wildlife have been introduced on the site including axis, sika, fallow and red deer, aoudad sheep, and blackbuck antelope. Their numbers should be managed in the same manner as livestock and white-tailed deer to prevent damage to the plant community. Feral hogs are present and can cause damage when their numbers are not managed.

Hydrological functions

The soils on this site are well drained with very low water holding capacity. Surface runoff is very rapid causing water erosion because of the slope of the site. The water cycle on this site functions according to the existing plant community and the management of the plant community. The water cycle is most functional when the site is dominated by tall bunchgrass. Increased infiltration, soil organic matter, good soil structure and moderate porosity are present with a good cover of bunchgrass. Quality of surface runoff will be high and erosion and sedimentation rates will be low.

When there are periods of heavy rainfall where the amount of rainfall exceeds the plant covers capacity to retain it or utilize it, some water will move below the root zone of grasses into the limestone fractures. As water moves down below the root zone of the plants, it can contribute to the recharge of some aquifers. Any runoff from such a rainfall event will move downstream and collect in drainage ways. If these drains have geological features with fractures, karst, fissures, and sinkholes then recharge can occur.

Since this site is naturally more wooded than most, it functions well hydrologically as a woodland. Infiltration under mature woodland canopy is high, because of very good litter layer and stem flow, which directs a high percent of

rainfall to the trunk where it soaks directly into fractures. Once the site becomes an Oak/Juniper Woodland State (2), a significant portion of received rainfall is caught in the leaves and branches of juniper where it evaporates before it can enter the soil. This interception loss has been measured as high as 36 percent of the rainfall. Heavy juniper litter has been measured to entrap as much as 43 percent of the rainfall (Thurow, et al., 1997).

When abusive grazing causes loss or reduction of bunchgrass and ground cover, the water cycle becomes impaired. Infiltration is decreased and runoff is increased because of poor ground cover, exposure to rainfall splash, soil capping, low organic matter, and poor structure. With a combination of a sparse ground cover, excessive slopes, and intensive rainfall, this site can contribute to an increased frequency and severity of flooding within a watershed if management is inappropriate. Soil erosion is accelerated, quality of surface runoff is poor and sedimentation increased.

The full impact upon the site when hydro mulched is not fully understood and studies are underway to gain knowledge. However, most rainfall is held on the land with little or no erosion. Plants that do stick up through the mulch are of higher production that non-mulched areas because of the moisture conservation. It will take many years for the mulch to break down depending upon the thickness.

Recreational uses

This site has a high potential for recreational use because of the diversity of wildlife, which can inhabit the site. The tall and mid grasses and scattered oaks produce beautiful fall color variations. Many native plants valuable for landscaping may be found on sites nearer to the reference community. This site is used for hunting, hiking, birding and other nature tourism-related enterprises.

Wood products

Oaks and Ashe juniper may be used for firewood, fencing material, and/or in the specialty wood industry.

Other products

None.

Other information

This rating system provides general guidance as to animal forage preference for plant species. It also indicates possible competition and diet overlap between kinds of herbivores. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. An animal's preference or avoidance of certain plants is learned over time through grazing experience and maternal learning (http://extension.usu.edu/behave/Grazing). Preference does not necessarily reflect the ecological status of the plant within the plant community. For wildlife, plant preferences for food are rated. Refer to detailed habitat guides for a more complete description of a species habitat needs.

Legend
Rating Preference Description
P Preferred Percentage of plant in animal diet is greater than it occurs on the land
D Desirable Percentage of plant in animal diet similar to the percentage composition on the land
U Undesirable Percentage of plant in animal diet is less than it occurs on the land
N Not Consumed Plant would not be eaten under normal conditions. It is only consumed when other forages are not available
T Toxic Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal
X Used Degree of utilization unknown

Inventory data references

Information provided here has been derived from limited NRCS clipping data and from field observations of range management trained personnel.

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Approval

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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.

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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.

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Date	07/08/2009
Approved by	Colin Walden
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:** None, except following extremely high intensity storms where short flow patterns may appear.

3. **Number and height of erosional pedestals or terracettes:** Rare, but could exist in the shallow soil areas.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect no more than 10-15% bare ground randomly distributed throughout in small and non-connected areas.

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 and short, less than one foot.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface for Refernce Community is resistant to erosion. Biological crusts and Nostoc, a blue green algae is common. Stability class range 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 light brownish gray gravelly clay loam with limestone moderately fine subangular blocky structure on the surface. Hard, firm, sticky. 15% limestone frags, 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:** At Reference, the savannah of tallgrasses, midgrasses, forbs and trees having adequate litter and little bare ground can provide 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):** No evidence of compaction.

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 >> Warm-season midgrasses >

Sub-dominant: Trees > Forbs >

Other: Shrubs

Additional: Forbs make up <10 percent species composition, shrubs <10 percent species composition and trees have 10-20 percent annual production.

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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 groups in Reference condition.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1100# for below average moisture and 3000# for average average moisture.

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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:** Ashe Juniper is dominant, Honey mesquite, baccharis, prickly pear, persimmon, agarito, and 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 natural herbivory or intensive wildfires.