USDA Natural Resources Conservation Service

Ecological site R081BY336TX
Low Stony Hill 19-23 PZ

Last updated: 9/19/2023
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.

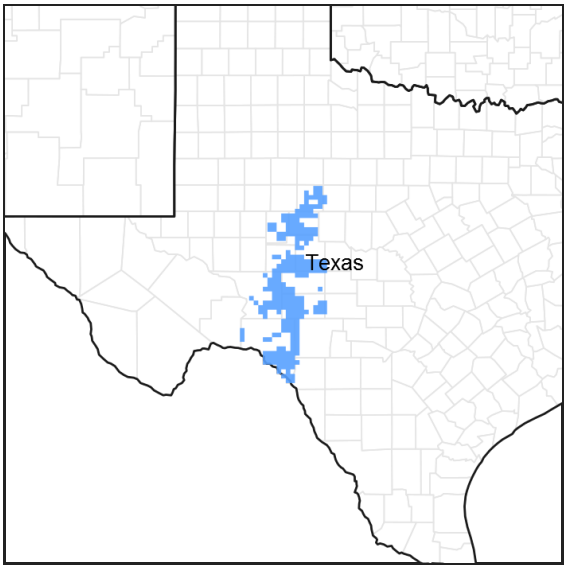


Figure 1. Mapped extent

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): 081B–Edwards Plateau, Central Part

This area is entirely in south-central Texas. It makes up about 11,125 square miles (28,825 square kilometers). The towns of Fredericksburg, Junction, Menard, Rocksprings, and Sonora are in this MLRA. Interstate 10 crosses the middle part of the area. A few State parks and State historic sites are in this MLRA.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 81B

Ecological site concept

The Low Stony Hill sites are comprised of shallow soils with lithic contact. The sites are filled with gravels, cobbles, and flagstones and occur on undulating hills with less than 20 percent slopes.

Associated sites

R081BY593TX	**Limestone Hill 19-23 PZ** The Limestone Hill site are on adjacent slopes.
R081BY325TX	**Clay Loam 19-23 PZ** The Clay Loam site will be encountered down the slope from the Low Stony Hill site.
R081BY349TX	**Steep Rocky 19-23 PZ** The Steep Rocky site occurs in much the same areas with the slopes greater than 20 percent.

Similar sites

R081BY342TX	**Shallow 19-23 PZ** The fact that both of these sites are shallow in nature and are underlain by limestone make them similar.
R081BY349TX	**Steep Rocky 19-23 PZ** The Steep Rocky site has same soils but on slopes greater than 20 percent.
R081BY593TX	**Limestone Hill 19-23 PZ** The Limestone Hill site are very similar.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bouteloua curtipendula* (2) *Schizachyrium scoparium*

Physiographic features

The Low Stony Hill sites are on gently undulating to hilly uplands with an indurate limestone horizon. Rock outcrops are common in areas over eight percent slopes. Slopes range from 1 to 15 percent. This site is usually found on hills and plateaus. The elevation ranges from 1,600 feet to 2,700 feet above sea level. These soils are on nearly level to gently sloping uplands. The site is used entirely for rangeland due to the stony and shallow soils.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Ridge (2) Plateau > Plain
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	488–823 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate in the MLRA 81B is subtropical subhumid on the eastern portion and subtropical steppe on the western portion of the MLRA. Winters are dry, and the summers are hot and humid. The precipitation increases from west to east and the temperatures increase from north to south. The area usually receives 65 to 70 percent sunshine each year. The majority of the rainfall occurs during the warm months of April to October. Most precipitation comes from thunderstorms that vary in the amount of water received and the areas covered. Spring is characterized by fluctuating patterns, but mild temperatures prevail. July and August are relatively dry and hot with little weather variability day-to-day. As summer progresses through fall, an increase of precipitation usually occurs in the eastern portions while a decrease of precipitation occurs to the west. Winter temperatures are mild, but polar Canadian air masses bring rapid drops in temperature. These cold spells last 2 or 3 days. Prevailing winds are southerly with March and April the windiest months.

Table 3. Representative climatic features

Frost-free period (characteristic range)	210-260 days
Freeze-free period (characteristic range)	240-290 days
Precipitation total (characteristic range)	483-610 mm
Frost-free period (actual range)	210-260 days
Freeze-free period (actual range)	240-290 days
Precipitation total (actual range)	483-635 mm
Frost-free period (average)	230 days
Freeze-free period (average)	260 days
Precipitation total (average)	559 mm

Climate stations used

- (1) CARTA VALLEY [USC00411492], Rocksprings, TX
- (2) ELDORADO [USC00412809], Eldorado, TX
- (3) SONORA [USC00418449], Sonora, TX
- (4) OZONA [USC00416734], Ozona, TX
- (5) BIG LAKE 2 [USC00410779], Big Lake, TX

Influencing water features

No wetlands or streams are part of this site.

Wetland description

N/A

Soil features

The soils are well drained internally, but permeability is moderately slow. The parent materials are residuum weathered from limestone. The surface layer is dark grayish-brown, calcareous clay, clay loam, or silty clay about 7 to 16 inches thick. The bedrock underneath the surface layer is 12 to 70 inches thick. Gravelly, cobbly, and very cobbly surface texture modifiers indicate fragments in the soil profile that makes it difficult to cultivate for cropland and pastureland. Runoff is slow to rapid due to the differences in the slopes that can occur. The available water capacity is low and averages 10 to 60 percent calcium carbonate. Soils correlated with this ecological site include: Tarrant and Zorra.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Cobbly clay (2) Very flaggy clay (3) Gravelly loam (4) Very cobbly silty clay
Family particle size	(1) Clayey-skeletal (2) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow
Depth to restrictive layer	10–51 cm
Soil depth	10–51 cm

Surface fragment cover <=3"	10–30%
Surface fragment cover >3"	5–30%
Available water capacity (0-101.6cm)	0.25–2.54 cm
Calcium carbonate equivalent (0-101.6cm)	10–60%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	15–30%
Subsurface fragment volume >3" (10.2-101.6cm)	20–50%

Ecological dynamics

The Low Stony Hill uniquely developed because of the soils, topographic location, climate, periodic droughts, and fire. The resulting plant community complex is a savannah of mid and tallgrasses, associated forbs, and scattered mottes of woody species. The resulting plant community complex was a savannah of mostly mid-grasses, associated forbs, and scattered mottes of woody species. The dominant grasses were sideoats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), and feathery bluestems (Bothriochloa spp.). Big bluestem (Andrpogon gerardii) and Indiangrass (Sorgastrum nutans) were scattered in small amounts in the wetter areas. Typical forbs included velvet bundleflower (Desmanthus spp.), Engelmann's daisy (*Engelmannia peristenia*), gaura (Gaura spp.), and countless perennial forbs. Live oak (*Quercus virginiana*) and hackberry (Celtis spp.) typify the woody species. Shrubs include Vasey shin oak (*Quercus pungens* var. vaseyana), sumacs (Rhus spp.), greenbriar (Smilax spp.), elbowbush (*Forestiera pubescens*), and bumelia (Sideroxylon spp.). The endemic woody plants, which historically covered less than 10 percent of the soil surface, were either resistant to fire or occupied rocky areas and steep slopes where fires were less frequent or intense.

Historically, the grassland savannah community was kept open by fires set periodically by lightning or Native Americans. The endemic woody plants, which historically covered less than 10 percent of the soil surface, were either resistant to fire or located where fires were less frequent or intense. Hydrologically the site was more mesic than the climatic regime indicates because of the stony soils. Periodic overgrazing by migrating herds of bison and endemic herds of pronghorn antelope probably occurred during droughts. However, long rest periods after drought due to movement out of the area by bison and antelope, or die off during drought, allowed the resilient grassland/savannah vegetation to re-establish itself and maintain the structure.

The demise of the Native American Indians and cessation of periodic intense fires changed the ecological dynamics of the vegetation. With European settlement in the 1800's, the frequency and intensity of fire diminished and intense grazing by cattle, sheep and goats began a transition towards a short-grass savannah with increasing woody species. The major forces influencing the transition to a woodland are continued overgrazing by livestock and the decrease in frequency and intensity of fire. As livestock and wildlife numbers increase and grazing use exceeds the plants ability to sustain defoliation, the more palatable, and generally more productive, species decline in stature, productivity, and density.

If overgrazing continues, the more palatable mid and tallgrasses give way to less palatable species such as Texas grama (*Bouteloua rigidiseta*), curlymesquite (*Hilaria belangeri*), tridens (Tridens spp.), dropseeds (Sporobolus spp.), lovegrasses (Eragrostis spp.), feathery bluestems (Bothriochloa spp.), and Texas wintergrass (*Nassella leucotricha*). The better-quality forbs are replaced with less palatable species such as sages (Salvia spp.), orange zexmenia (Wedelia hispida), dalea (Dalea spp.), leafflower (Clematis spp.), and annuals. The woody species that had been kept in check by fire and grass competition, such as oak (Quercus spp.) and mesquite (*Prosopis glandulosa*) begin increasing in number and density. Less palatable shrubby species, such as prickly pear (Opuntia

spp.), Texas persimmon (Diosopyros texana), algerita (Mahonia trifoliata), shin oak (*Quercus sinuata*), and Texas mountain laurel (*Sophora secundiflora*) increase in density and stature. The site also becomes open to invasion of species, such as redberry juniper (*Juniperus pinchotii*), Ashe juniper (*Juniperus asheii*), and mesquite from adjacent sites. The increase in density and size of the woody vegetation brings about a new plant community, the Mixed-grass/Mixed-brush Savannah Community (1.2).

In the Mixed-grass/Mixed-brush Savannah Community (1.2), ecological processes change so little that the pathway back to the reference community can be accomplished without major conservation practices. Good grazing management alone will not reverse retrogression. Some form of woody plant control, such as prescribed burning or individual plant treatment (IPT), must accompany the grazing strategy. The vegetation type has shifted to more woody, but herbaceous vegetation production is still the largest component. This phase is recognized for its advantage to browsers, so historically, goat and sheep husbandry increased along with other browsing animals such as white-tailed deer. This overgrazing, and the concomitant decrease in frequency and intensity of fires, caused the reference plant community to transition toward a woodland plant community.

If the combination of heavy continuous grazing by livestock and wildlife and decrease in number of fires continues, oaks, junipers, and mesquite along with unpalatable shrubs become dominant at the detriment of the herbaceous species. Understory shrubs, such as catclaw acacia (*Acacia greggii*), algerita, pricklypear, and yucca (Yucca spp.), increase. Shin oak may dominate in some areas. Buffalograss (*Bouteloua dactyloides*), curlymesquite, threeawns (Aristida spp.), hairy grama (*Bouteloua hirsuta*), hairy tridens (*Erioneuron pilosum*), and annuals replace the midgrass dominants. Loss of herbaceous cover and increased bare ground precludes effective burning and encourages accelerated erosion. Soil and litter movement will occur during flood producing rains and water infiltration into the soil decreases. When woody plant canopy reaches 25 to 30 percent, and warm-season grasses provide less than 50 percent of the herbage production, the transition toward a new state, the Woodland State (2) is complete. Once this threshold is reached in the transition, proper grazing management and prescribed burning cannot reverse the transition toward woodland.

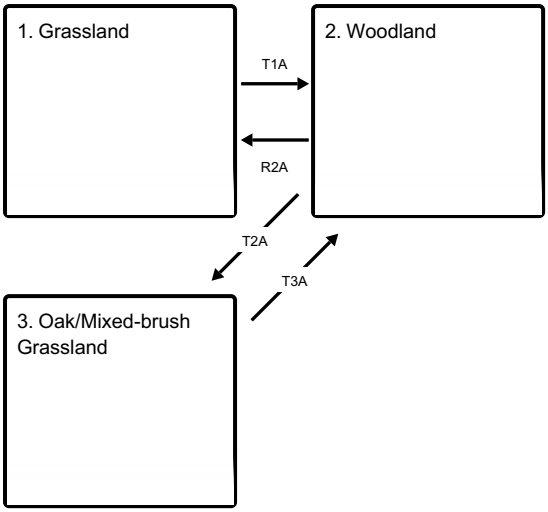
Oaks dominate the overstory in the Oak/Mixed-brush Shortgrass Community (2.1), but juniper, mesquite, Texas persimmon, algerita, pricklypear, yucca and condalia (Condalia spp.) are common and often form thickets. Without repeated fires, juniper can become dominant even without grazing. Shortgrass and forb diversity and production continues to decline while shrubs, cool-season grasses and weedy annuals increase as the canopy becomes denser. The herbaceous component is further reduced through shading and moisture competition from woody vegetation. The Oak/Mixed-brush Shortgrass Community (2.1) is less productive for cattle but provides adequate food and cover for goats and deer. When browsers and forb preferring species such as goats, sheep, and deer (white-tailed or exotics) prevail, low-palatability grasses, forbs, and shrubs dominate the understory. When grazing is primarily by cattle, the most desirable grasses give way to weeds and shrubs. The process is intensified during periodic droughts unless animal numbers are reduced.

Continuous overgrazing by livestock and deer, along with periodic droughts, eventually transition to a community phase in which oaks and juniper and/or mesquite are so dominant that only remnants of grassland vegetation. This phase is identified as the Oak/Juniper/Mesquite Woodland Community (2.2). Many of the interspaces are caused by very shallow soil over solid rock. Oaks, juniper, and sometimes mesquite dominate the overstory. The shrub component often contains pricklypear, algerita, shin oak, javelinabush (Condalia eriocoides), and Texas persimmon. The understory and interspaces support remnants of reference vegetation, generally in low vigor and productivity due to shading and competition for water and nutrients. Desertification including erosion, loss of soil organic matter, and more xeric microclimate conditions prevail. The plant community is so degraded that it cannot reverse without extensive energy and management inputs. Restoring the Oak/Juniper/Mesquite Woodland Community (2.2) to grassland requires extensive brush control, range planting, grazing management, and prescribed burning.

Manipulation of the Oak/Juniper/Mesquite Woodland Community (2.2) with extensive brush control, including prescribed burning, brings about a man-induced state, the Oak/Mixedbrush Grassland State (3). It resembles the reference community, but woody species distribution and stature depend upon management goals and brush control methods used. The transition of the Oak/Mixed-brush Grassland to open grassland like the reference can be aided by reseeding with native species, prescribed burning, and proper grazing. With time and proper management this plant community can resemble the reference community in productivity and functioning of ecological processes.

State and transition model

Ecosystem states



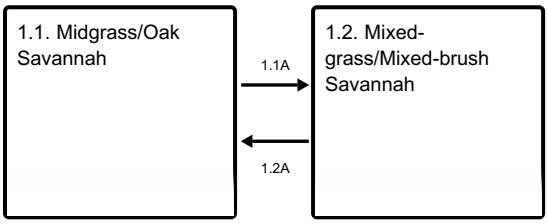
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R2A - Reintroduction of historic disturbance return intervals

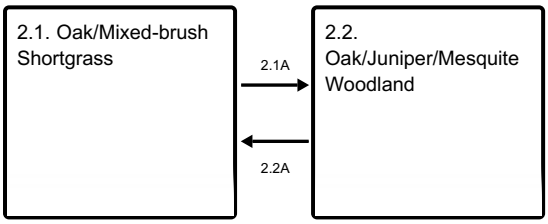
T2A - Removal of woody canopy followed by range seeding

T3A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

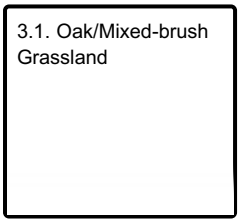
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Grassland

Dominant plant species

- sideoats grama (*Bouteloua curtipendula*), grass
- little bluestem (*Schizachyrium scoparium*), grass

Community 1.1
Midgrass/Oak Savannah

Figure 8. 1.1 Midgrass/Oak Savannah Community

The reference community is a fire-induced open grassland savannah reflecting the influence of frequent fires on vegetation development. Live oak, bumelia (*Sideroxylon lanuginosum*), and hackberry trees, along with numerous shrubby species, in mottes or as scattered individual plants, make up the woody overstory. Woody plants probably occupied 10 percent or less of the site. The grassland vegetation provides a continuous cover of grasses and forbs. Little bluestem, sideoats grama, the feathery bluestems, and Texas cupgrass (*Eriochloa sericea*) are the most abundant and productive grasses. Big bluestem and Indiangrass (Sorgastrum nutans) dominate only on deeper soils or during wet cycles. There is a wide diversity of grasses and many forb species. Most energy and nutrient cycling are contained in the narrow grass/soil interface and evapotranspiration was minimal. Water percolation below the grass-rooting zone was minimal and occurred only at rock outcrops and fissures in the limestone layer. Overland flow of water is minimal. Ground cover of standing vegetation, litter, and rock is near 100 percent. Water and wind erosion are negligible due to the dense ground cover. The plant community reflects the influence of the climate, soils, and topography.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1076	2242	2690
Forb	135	280	336
Shrub/Vine	67	140	168
Tree	67	140	168
Total	**1345**	**2802**	**3362**

Figure 10. Plant community growth curve (percent production by month). TX3605, Midgrass/Oak Savannah with less 10% canopy. Warm season rangeland with peaks in annual production from herbaceous layer in May and in September..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Community 1.2
Mixed-grass/Mixed-brush Savannah

Figure 11. 1.2 Mixed-grass/Mixed-brush Savannah Community

This Mixed-grass/Mixed-brush Savannah Community (1.2) is the first phase in the transition toward the Oak/Juniper Grassland Community (2.1). Woody species, especially juniper, mesquite, and shrubs, are increasing in size, but are not seriously impacting forage production. Invading brushy species are generally less than five feet tall and provide less than 15 percent canopy. This phase may, in fact, present more desirable conditions for livestock, wildlife, and recreational use than the reference phase. Overgrazing has reduced the more palatable species and opened the grass cover for the invasion of the woody species that had been held in check by competition and fire. The oaks, junipers, mesquite, pricklypear, algerita, sumacs, condalia, and several other shrubby species increase in density and stature. Less palatable grasses, such as silver bluestem, cane bluestem, bristlegrasses (Setaria spp.), sand dropseed (*Sporobolus cryptandrus*), and less palatable forbs such as guara, knotweed leafflower (*Phyllanthus polygonoides*), and orange zexmenia (*Wedelia acapulcensis* var. hispida) are replacing the dominants of the reference community. Nutrient and energy cycling is shifting toward woody plants. Herbage production is slightly less, averaging from 2,100 to 3,100 pounds per acre of annual production. Litter and ground cover are beginning to decrease, however, exposing more soil to erosion and encroachment by previously suppressed species. Proper grazing and prescribed burning can easily improve or maintain this plant community and prevent the transition toward the Oak/Mixedbrush Shortgrass Community (2.1). Without brush management and proper grazing, the woody species will continue to encroach until the woody species dominate. This threshold occurs when woody plant cover exceeds 25 to 30 percent.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	947	1894	2259
Shrub/Vine	342	437	521
Tree	235	291	347
Forb	235	291	347
Total	**1759**	**2913**	**3474**

Figure 13. Plant community growth curve (percent production by month). TX3606, Midgrass/Oak/Mixedbrush Savannah. Warm season species begin growth in late April. Their peak growth is in late May with a lesser peak in September. Cool season species initiate fall/winter growth after September solstice and rains..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Pathway 1.1A
Community 1.1 to 1.2

Midgrass/Oak Savannah

Mixed-grass/Mixed-brush Savannah

Heavy abusive grazing, no fire, and no brush management have allowed the plant community to be shifted from the Midgrass/Oak Savannah Community to the Mixed-grass/Mixed-brush Savannah Community.

Pathway 1.2A
Community 1.2 to 1.1

Mixed-grass/Mixed-brush Savannah

Midgrass/Oak Savannah

With the application of conservation practices such as prescribed grazing and prescribed burning, the Mixed-grass/Mixed-brush Savannah Community can revert to the Midgrass/Oak Savannah Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Woodland

Dominant plant species

- juniper (*Juniperus*), shrub
- mesquite (*Prosopis*), shrub

Community 2.1
Oak/Mixed-brush Shortgrass

Figure 14. 2.1 Oak/Mixed-brush Shortgrass Community

The Oak/Mixed-brush Shortgrass Community (2.1) is a woodland state with 25 to 40 percent woody plant canopy and shortgrasses. Oak, juniper, or mesquite are the dominants in the overstory. Pricklypear, algerita, shin oak, javelinabush, Texas persimmon, sacahuista (*Nolina texana*), and other shrubby species are common. The prevalent species will depend on the soil and grazing history. For example, heavy browsing by goats or deer would

reduce the presence of palatable species such as kidneywood, shin oak, bumelia, and greenbriar. Few of the dominant reference midgrasses and forbs are present. Shortgrasses such as buffalograss, three-awns, and curlymesquite are common in the grassland component. Texas wintergrass is often common in this plant community. Shortgrasses and unpalatable forbs provide a large portion of the forage resource. The moisture regime is more xeric than normal because of evaporation and interception losses. There is reduced ground water recharge or overland flow except during heavy rainfall events. Litter and soil movement occur in the interspaces during flooding rains. Major energy and economic inputs are required to change the Oak/Mixed-brush Shortgrass Community (2.1) back to reference state. Brush management, prescribed grazing, prescribed burning, and perhaps range seeding will be necessary. The planned use of the land will dictate the practices applied and their intensity. Unless brush management and grazing management is applied, the woodland canopy will continue to thicken. Once the canopy exceeds 40 to 50 percent, very little herbaceous biomass is produced. Only shade-tolerant species such as cedar sedge and Scribner's dichanthelium (*Dichanthelium oligosanthes*) survive in the understory. Shortgrasses, such as three-awns) curlymesquite, hairy tridens (*Erioneuron pilosum*), and hairy grama (*Bouteloua hirsuta*) survive in the interstitial spaces. At this point, the Oak/Mixed-brush Shortgrass Community (2.1) becomes the Oak/Juniper/Mesquite Woodland Community (2.2).

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	448	1121	1345
Tree	448	1121	1345
Shrub/Vine	280	336	448
Forb	112	280	336
Total	**1288**	**2858**	**3474**

Figure 16. Plant community growth curve (percent production by month). TX3611, Oak/Juniper Grassland. Oak/Juniper grassland with 20% canopy of oaks, junipers and shrubs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	5	8	13	18	12	5	3	12	10	7	4

Community 2.2
Oak/Juniper/Mesquite Woodland

Figure 17. 2.2 Oak/Juniper/Mesquite Woodland Community

Overgrazing and absence of fires continues the transition toward a woodland community. Only rock surfaces and very shallow soil over rock fragments prevent 100 percent woody plant cover. The Oak/Juniper/Mesquite Woodland Community (2.2) occurs when oaks (generally in mottes), juniper and/or mesquite exceed 50 percent canopy cover. The woody species occupy all but the very shallow soils and exposed rock surfaces. In this community, the herbaceous understory consists of shade tolerant grasses, typically sedges (Carex spp.), Texas wintergrass, Scribner's dichanthelium, red grama (*Bouteloua trifida*), hairy tridens, shade-tolerant forbs, and annuals. Juniper

and/or mesquite often dominate the overstory, although live oak or Vasey shin oak dominate in some areas. Shrubs such as pricklypear, elbowbush, Texas persimmon, algerita, pricklyash (Zanthoxylum spp.), and condalia persist. Soil erosion is taking place in the interstitial spaces, especially on steeper slopes. The microclimate is more xeric due to increased interception losses and surface runoff. During the transition, erosion occurrs, fertility decreases, microbial populations declines, and infiltration is lowered. Restoration of this state requires major brush management, range seeding, and grazing management. Because of the loss of soil fertility through erosion, the resulting man-induced state, known as the Oak/Mixed-brush Grassland Community (3.1), may be similar to the reference community, but not exactly the same. This man-induced plant community has lowered soil fertility and the absence of many reference species limit productivity.

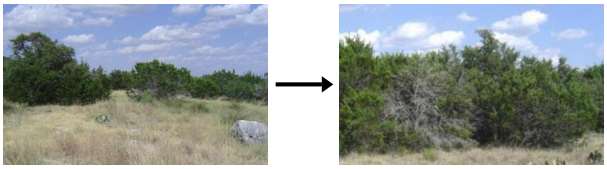
Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	448	1121	1401
Grass/Grasslike	224	560	701
Shrub/Vine	179	448	560
Forb	45	112	140
Total	**896**	**2241**	**2802**

Figure 19. Plant community growth curve (percent production by month). TX3608, Closed Canopy Oak/Juniper Woodland. Yearlong green forage due to shrubs and cool season species growth in winter and spring. Peak rainfall period from April through September provides most production during summer growing season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	7	8	14	18	12	6	4	13	2	7	4

Pathway 2.1A
Community 2.1 to 2.2



Oak/Mixed-brush Shortgrass

Oak/Juniper/Mesquite Woodland

Heavy abusive grazing, no fire, and no brush management would bring in a shift from the Oak/Mixed-brush Shortgrass Community to the Oak/Juniper/Mesquite Woodland Community.

Pathway 2.2A
Community 2.2 to 2.1

Oak/Juniper/Mesquite Woodland

Oak/Mixed-brush Shortgrass

With prescribed grazing, prescribed burning, and brush management, the Oak/Juniper/Mesquite Woodland Community can revert back to the Oak/Mixed-brush Shortgrass Community.

Conservation practices

Brush Management

Prescribed Burning
Prescribed Grazing

State 3
Oak/Mixed-brush Grassland

Dominant plant species

- oak (*Quercus*), shrub

Community 3.1
Oak/Mixed-brush Grassland

Figure 20. 3.1 Oak/Mixed-brush Grassland Community

The Oak/Mixed-brush Grassland Community results from intensive accelerating brush control practices and seeding to re-introduce reference species. Many of the oaks and other desirable tree species can be left during selective brush control as single trees or in mottes. Mesquite and juniper trees may also be left depending on management priorities and brush control practices. Valued understory shrub species, such as bumelia, shin oak, elbowbush, Texas kidneywood, and pricklyash, may also be retained. Species composition of the grassland component may resemble the reference community, but many years of selective grazing in most cases reduce the dominants and generally only shortgrasses and shade-tolerant species are present. If the grassland component is in a low seral stage, native species are often seeded to duplicate composition. Seeding native species such as sideoats grama, green sprangletop, Indiangrass, little bluestem, Engelmann’s daisy, bundleflower, and awnless bushsunflower speed up the transition. Productivity of this community may begin to approach the original production values but will be less if there has been severe soil and fertility loss. The Oak/Mixed-brush Grassland Community (3.1) can be maintained in a productive and stable state with judicious application of proper grazing by livestock and deer, prescribed burning, and individual plant treatments. Lacking these practices, especially with overgrazing, the community composition will shift back to the Oak/Juniper Shortgrass Community (2.1).

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	947	1894	2259
Shrub/Vine	342	437	521
Tree	235	291	347
Forb	235	291	347
Total	**1759**	**2913**	**3474**

Figure 22. Plant community growth curve (percent production by month). TX3611, Oak/Juniper Grassland. Oak/Juniper grassland with 20% canopy of oaks, junipers and shrubs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	5	8	13	18	12	5	3	12	10	7	4

Transition T1A
State 1 to 2

Heavy abusive grazing and no fires have led to the shift from the Grassland State to the Woodland State.

Restoration pathway R2A
State 2 to 1

Prescribed grazing, prescribed burning, range planting, and IPT are several conservation practices that may be implemented in order to revert back to the Grassland State from the Woodland State.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Transition T2A
State 2 to 3

Prescribed grazing, prescribed burning, brush management, and range planting are various conservation practices that can be applied to transition from the Woodland State to the Oak/Mixed-brush Grassland State.

Transition T3A
State 3 to 2

Heavy abusive grazing, no brush management, brush invasion, and no fire would transition back to the Woodland State.

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**midgrasses**			404–1009	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	404–1009	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	404–1009	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	404–1009	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	404–1009	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	404–1009	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	404–1009	–
2	**tallgrasses**			202–504	
	plains lovegrass	ERIN	*Eragrostis intermedia*	202–504	–
	vine mesquite	PAOB	*Panicum obtusum*	202–504	–

	little bluestem	SCSC	*Schizachyrium scoparium*	202–504	–
	Indiangrass	SONU2	*Sorghastrum nutans*	202–504	–
3	**mid/shortgrasses**			135–336	
	fall witchgrass	DICO6	*Digitaria cognata*	135–336	–
	green sprangletop	LEDU	*Leptochloa dubia*	135–336	–
	bristlegrass	SETAR	*Setaria*	135–336	–
4	**shortgrasses**			202–504	
	buffalograss	BODA2	*Bouteloua dactyloides*	202–504	–
	curly-mesquite	HIBE	*Hilaria belangeri*	202–504	–
5	**shortgrasses**			101–252	
	threeawn	ARIST	*Aristida*	101–252	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	101–252	–
	Texas grama	BORI	*Bouteloua rigidiseta*	101–252	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	101–252	–
	Hall's panicgrass	PAHA	*Panicum hallii*	101–252	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	101–252	–
	tridens	TRIDE	*Tridens*	101–252	–
6	**cool-season grasses**			67–168	
	sedge	CAREX	*Carex*	67–168	–
	Canada wildrye	ELCA4	*Elymus canadensis*	67–168	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	67–168	–
	western wheatgrass	PASM	*Pascopyrum smithii*	67–168	–
Forb					
7	**forbs**			135–336	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	135–336	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	135–336	–
	prairie clover	DALEA	*Dalea*	135–336	–
	zarzabacoa comun	DEIN3	*Desmodium incanum*	135–336	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	135–336	–
	buckwheat	ERIOG	*Eriogonum*	135–336	–
	eastern milkpea	GARE2	*Galactia regularis*	135–336	–
	hoary false goldenaster	HECA8	*Heterotheca canescens*	135–336	–
	hymenaea	HYMEN	*Hymenaea*	135–336	–
	trailing krameria	KRLA	*Krameria lanceolata*	135–336	–
	blazing star	LIATR	*Liatris*	135–336	–
	Texas skeletonplant	LYTE	*Lygodesmia texana*	135–336	–
	menodora	MENOD	*Menodora*	135–336	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	135–336	–
	yellow puff	NELU2	*Neptunia lutea*	135–336	–
	narrowleaf Indian breadroot	PELI10	*Pediomelum linearifolium*	135–336	–
	beardtongue	PENST	*Penstemon*	135–336	–
	leafflower	PHYLL	*Phyllanthus*	135–336	–
	snoutbean	RHYNC2	*Rhynchosia*	135–336	–

	mealycup sage	SAFA2	*Salvia farinacea*	135–336	–
	Texas sage	SATE3	*Salvia texana*	135–336	–
	fuzzybean	STROP	*Strophostyles*	135–336	–
	greenthread	THELE	*Thelesperma*	135–336	–
	slender greenthread	THSI	*Thelesperma simplicifolium*	135–336	–
	Texas vervain	VEHA	*Verbena halei*	135–336	–
	creepingoxeye	WEDEL	*Wedelia*	135–336	–
Shrub/Vine					
8	**shrubs/vines**			67–168	
	Texas crabgrass	DITE	*Digitaria texana*	67–168	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	67–168	–
	stretchberry	FOPU2	*Forestiera pubescens*	67–168	–
	acacia	ACACI	*Acacia*	67–168	–
	eastern redbud	CECA4	*Cercis canadensis*	67–168	–
	western white honeysuckle	LOAL	*Lonicera albiflora*	67–168	–
	algerita	MATR3	*Mahonia trifoliolata*	67–168	–
	Texas sacahuista	NOTE	*Nolina texana*	67–168	–
	pungent oak	QUPU	*Quercus pungens*	67–168	–
	sumac	RHUS	*Rhus*	67–168	–
	bully	SIDER2	*Sideroxylon*	67–168	–
	saw greenbrier	SMBO2	*Smilax bona-nox*	67–168	–
	mescal bean	SOSE3	*Sophora secundiflora*	67–168	–
	queen's-delight	STSY	*Stillingia sylvatica*	67–168	–
Tree					
9	**trees**			67–168	
	Ashe's juniper	JUAS	*Juniperus ashei*	67–168	–
	Pinchot's juniper	JUPI	*Juniperus pinchotii*	67–168	–
	honey mesquite	PRGL2	*Prosopis glandulosa*	67–168	–
	bastard oak	QUSI	*Quercus sinuata*	67–168	–
	live oak	QUVI	*Quercus virginiana*	67–168	–
	elm	ULMUS	*Ulmus*	67–168	–

Animal community

This site is used to produce domestic livestock and to provide habitat for native wildlife. Cow-calf operations are the primary livestock enterprise, although stocker cattle are also grazed. Sheep, Angora goats, and Spanish goats were formerly raised in large numbers. Sheep are still present in reduced numbers, while meat goats are now present in fairly high numbers. Boer goats have been introduced, either purebred or crossed with Spanish goats, to obtain a larger meat animal. Reports indicate that Boers do not browse as heavily as earlier breeds.

Sustainable stocking rates have declined drastically over the past 100 years due to deterioration of the reference plant community. An assessment of vegetation is needed to determine the site’s current carrying capacity. Calculations used to determine livestock stocking rate should be based on forage production remaining after determining use by resident wildlife, then refined by frequent careful observation of the plant community’s response to animal foraging.

A large diversity of wildlife is native to this site. In the reference plant community, migrating bison, grazing primarily

during wetter periods, pronghorn, white-tailed deer and turkey were the more predominant herbivore species. With the subsequent transformation of the plant community, due primarily to the influence of man and climate change, the kind and proportion of wildlife species have been altered.

Except for a few domestic herds, bison have been eliminated. With the eradication of the screwworm fly, increase in woody vegetation and man-suppressed natural predation, deer numbers have increased and are often in excess of carrying capacity. Where deer numbers are excessive, overbrowsing and overuse of preferred forbs causes deterioration of the plant community. Progressive management of deer populations through hunting can keep populations in balance and provide an economically important ranching enterprise. Achieving a balance between brushy cover and more open plant communities on this and adjacent sites is important to deer management. Competition among deer, sheep, and goats must be a consideration in livestock and wildlife management to prevent damage to the plant community.

Various species of exotic wildlife have been introduced on the site, including deer such as axis, sika, fallow, and red; antelope such as sable, oryx, blackbuck, and nilgai, and sheep such as barbados (mouflon) and aoudad with various degrees of success. Their numbers must be included along with livestock and native wildlife, primarily white-tailed deer, in any management plan. Feral hogs may feed on the site. They can be damaging to the plant community if their numbers are not managed. Smaller mammals include many kinds of rodents, jackrabbit, cottontail, raccoon, ringtail, skunk, and armadillo. Mammalian predators include coyote, red fox, gray fox, bobcat, and mountain lion. Wolves were common in earlier times, bears resided in some areas, and an occasional jaguar or ocelot was encountered. Many species of snakes and lizards are native to the site.

Many species of birds are found on this site including game birds, songbirds, and birds of prey. Major game birds that are economically important are turkey, bobwhite quail, scaled (blue) quail and mourning dove. Turkeys prefer plant communities with substantial amounts of shrubs and trees interspersed with grassland. Quail prefer a combination of low shrubs, bunch grass (critical for nesting cover), bare ground, and low successional forbs. The different species of songbirds vary in their habitat preferences. Habitat on this site that provides a large diversity of grasses, forbs, and shrubs 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. Different species of raptors benefit from a diverse plant community as well.

Hydrological functions

The Low Stony Hill site is a well-drained, shallow, stony upland. Its soils are moderately to slowly permeable. Under reference conditions, the savannah vegetation intercepts and utilizes much of the incoming rainfall. The impermeable limestone layer holds water in easy reach of grasses. Only during extended rains is there much runoff. Because of shallow slopes and good ground cover, runoff is slow and clear. Rock outcrops and fissures in the indurated limestone allow limited deep percolation to ground water. The presence of the impermeable layer, stones and rock outcrops enhance the effectiveness of rainfall, especially during small rainfall events. Changes from savannah to woodland has little effect on the water regime, except some accelerated erosion and organic matter loss during the transition. Evapotranspiration loss changes little from the savannah to the woodland, although water pathways do. The shift in water use from savannah vegetation to its use by woodland vegetation is significant.

Recreational uses

The Low Stony Hill site is well suited for many outdoor recreational uses including hunting, hiking, camping, equestrian, and bird watching. The site, along with other adjacent sites, such as Steep Rocky, Shallow, and Clay Loam, provide diverse scenic beauty.

Wood products

Posts and specialty wood products are made from juniper, mesquite, and oak.

Other products

Jams and jellies are made from many fruit bearing species. 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 the many flowering plants.

Inventory data references

Information presented here has been derived from literature, limited NRCS clipping data (417s), field observations, experience, and personal contacts with range-trained personnel. Photos by J. L. Schuster.

Other references

Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: Rates, patterns, and proximate causes. Ecological implications of livestock herbivory in the West, 13-68.

Archer, S. and F. E. Smeins. 1991. Ecosystem-level processes. Grazing Management: An Ecological Perspective. Edited by R.K. Heischmidt and J.W. Stuth. Timber Press, Portland, OR.

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. Journal of Range Management, 56(2):114-126.

Bracht, V. 1931. Texas in 1848. German-Texan Heritage Society, Department of Modern Languages, Southwest Texas State University, San Marcos, TX.

Bray, W. L. 1904. The timber of the Edwards Plateau of Texas: Its relations to climate, water supply, and soil. No. 49. US Department of Agriculture, Bureau of Forestry.

Briske, D. D., S. D. Fuhlendorf, and F. E. Smeins. 2005. State-and-transition models, thresholds, and rangeland health: A synthesis of ecological concepts and perspectives. Rangeland Ecology and Management, 58(1):1-10.

Brothers, A., M. E. Ray Jr., and C. McTee. 1998. Producing quality whitetails, revised edition. Texas Wildlife Association, San Antonio, TX.

Brown, J. K. and J. K. Smith. 2000. Wildland fire in ecosystems, effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: US Department of Agriculture, Forest Service, Rocky Mountain Research Station, 257:42.

Davis, W. B. 1974. The Mammals of Texas. Texas Parks and Wildlife Department, 41.

Foster, J. H. 1917. The spread of timbered areas in central Texas. Journal of Forestry 15(4):442-445.

Frost, C. C. 1998. Presettlement fire frequency regimes of the United States: A first approximation. Fire in ecosystem management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, 20:70-81.

Gould, F. W. 1975. The grasses of Texas. The Texas Agricultural Experiment Station, Texas A&M University Press, College Station, TX.

Hatch, S. L. and J. Pluhar. 1993. Texas Range Plants. Texas A&M University Press, College Station, TX.

Hamilton, W. and D. Ueckert. 2005. Rangeland woody plant control--past, present, and future. Texas A&M University Press. College Station, TX.

Hart, C. R., A. McGinty, and B. B. Carpenter. 1998. Toxic plants handbook: Integrated management strategies for West Texas. Texas Agricultural Extension Service, The Texas A&M University, College Station, TX.

Heitschmidt, R. K. and J. W. Stuth. 1991. Grazing management: An ecological perspective. Timberline Press, Portland, OR.

Loughmiller, C. and L. Loughmiller. 1984. Texas wildflowers. University of Texas Press, Austin, TX.

Milchunas, D. G. 2006. Responses of plant communities to grazing in the southwestern United States. Gen. Tech.

Rep RMRS-GTR-169. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station, 126:169.

Niehaus, T. F. 1998. A field guide to Southwestern and Texas wildflowers (Vol. 31). Houghton Mifflin Harcourt, Boston, MA.

Ramsey, C. W. 1970. Texotics. Texas Parks and Wildlife Department, Austin, TX.

Roemer, F. translated by O. Mueller. 1995. Roemer's Texas, 1845 to 1847. Texas Wildlife Association, San Antonio, TX.

Scifres, C. J. and W. T. Hamilton. 1993. Prescribed burning for brushland management: The South Texas example. Texas A&M Press, College Station, TX.

Smeins, F. E., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and land use changes: A long term perspective. Juniper Symposium, 1-21.

Taylor, C. A. and F. E. Smeins. 1994. A history of land use of the Edwards Plateau and its effect on the native vegetation. Juniper Symposium, 94:2.

Thurow, T. L. 1991. Hydrology and erosion. Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.

Tull, D. and G. O. Miller. 1991. A field guide to wildflowers, trees and shrubs of Texas. Texas Monthly Publishing, Houston, TX.

USDA-NRCS. 1997. National range and pasture handbook. Washington, DC: United States Department of Agriculture. Natural Resources Conservation Service, Grazing Lands Technology Institute.

Weniger, D. 1997. The explorers' Texas: The animals they found. Eakin Press, Austin, TX.

Weniger, D. 1984. The explorers' Texas: The lands and waters. Eakin Press, Austin, TX.

Vines, R. A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.

Vines, R. A. 1960. Trees, shrubs and vines of the Southwest. University of Texas Press, Austin, TX.

Contributors

Dr. Joseph Schuster, Range & Wildlife Habitat Consultants, LLC, Bryan, TX
Stanley Reinke
Edits by Travis Waiser, MLRA Leader, NRCS, Kerrville, TX

Approval

Bryan Christensen, 9/19/2023

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Technical assistance:
Charles Anderson, RMS, NRCS, San Angelo, TX
Justin Clary, RMS, NRCS, Temple, TX
Charles Taylor, RMS, Agrilife, Sonora, TX

QC/QA completed by:
Bryan Christensen, SRESS, NRCS, Temple, TX
Erin Hourihan, ESDQS, NRCS, Temple, TX

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)	Joe Franklin, Zone RMS, NRCS, San Angelo, TX
Contact for lead author	325-944-0147
Date	12/02/2005
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** Water flow patterns are few and follow old drainages. Intense rainstorms may cause soil movement and deposition.

3. **Number and height of erosional pedestals or terracettes:** Rare to uncommon. If present, stabilized with vegetation.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 10 percent coverage of well distributed and random areas.

5. **Number of gullies and erosion associated with gullies:** None to few.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Slight to moderate movement of all sizes of litter during runoff producing rainfall. Movement fairly evenly distributed and only for short distances in normal rainfall.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Soil stability ratings estimated at 5 to 6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soils typically are very dark grayish brown clay about six inches thick. They contain much lime and angular fragments of

limestone gravel. SOM is moderate.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The mixed-grass savannah provided adequate cover, litter and organic matter to produce high infiltration and non-erosive runoff. Because of shallow soils, runoff does occur from steeper slopes.

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

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

    Dominant: Warm-season midgrass

    Sub-dominant: Warm-season tallgrass Warm-season Shortgrass

    Other: Forbs = Cool-season grasses Trees Shrubs/Vines

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal under normal weather conditions. Grasses almost always show some decadence and mortality.

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14. **Average percent litter cover (%) and depth (in):** Litter covers most all plant and rock interspaces.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,200 pounds per acre in below average moisture years, 2,500 pounds per acre in normal years and 3,000 pounds per acre in above average moisture years.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Live oak, ashe juniper, redberry juniper, pricklypear, Texas persimmon, shin oak, sacahuista, and agarito.

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17. **Perennial plant reproductive capability:** Good. Only drought, natural herbivory and/or wildfire decrease reproductive capability of any functional group in the reference state.
