USDA Natural Resources Conservation Service

Ecological site R085AY182TX
Low Stony Hill 30-38" PZ

Last updated: 9/21/2023
Accessed: 05/10/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 085A–Grand Prairie

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

Classification relationships

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

Ecological site concept

The Low Stony Hill ecosites occurs over shallow cobbly clay soils on uplands. The reference plant community consists of native tall and midgrasses with scattered forbs and up to 20 percent cover of live oak and other shrubs. Without the use of prescribed fire or other brush management, the site often transitions to a shrub dominated state.

Associated sites

R085AY176TX	**Adobe 30-38" PZ** The Adobe site frequently occurs immediately adjacent to this site. It differs from this site by having deeper soils, high lime content, and deeply-cut drainage ways.
R085AY179TX	**Clayey Slope 30-38** The Clay Loam site often occurs downslope from the site. It differs from this site due to its deeper soils, absence of surface limestone fragments, and ability to be cultivated.
R085AY187TX	**Steep Rocky 30-38" PZ** The Steep Rocky site often occurs upslope from the site. It differs from this site by having >12% slope and stones and boulders cover 65% of the soil surface.

Similar sites

R085AY187TX	**Steep Rocky 30-38" PZ** The Steep Rocky site is similar to Low Stony Hill in that both sites have similar soils and species composition. Sites with >12 percent slopes are classified as Steep Rocky while sites with under 12 percent slopes are Low Stony Hill.
R085AY185TX	**Shallow 30-38" PZ** The Shallow site is similar to Low Stony Hill in that both sites are shallow and underlain by limestone bedrock. It differs from the site by having more cobbles and gravel and a much lower calcium carbonate content.
R085AY565TX	**Pink Caliche 30-38" PZ** The Pink Caliche site has similar slope, landscape position, topography, and low water-holding capacity. It differs from Low Stony Hill by having characteristic pink to reddish-brown soils along with deeper soils and shallow water drains dissecting the site.

Table 1. Dominant plant species

Tree	(1) *Quercus fusiformis*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon gerardii*

Physiographic features

This site occurs on interfluves and crests of hillslopes in the Grand Prairie. Characteristic of this site are outcrops of massive indurated limestone. Slopes are typically less than 12 percent.

Table 2. Representative physiographic features

Landforms	(1) Hills > Hill (2) Hills > Ridge (3) Hills > Hillslope
Runoff class	High to very high
Elevation	500–1,900 ft
Slope	1–12%
Aspect	Aspect is not a significant factor

Climatic features

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

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

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

Table 3. Representative climatic features

Frost-free period (characteristic range)	194-208 days
Freeze-free period (characteristic range)	216-243 days

Precipitation total (characteristic range)	32-38 in
Frost-free period (actual range)	190-209 days
Freeze-free period (actual range)	209-245 days
Precipitation total (actual range)	31-39 in
Frost-free period (average)	201 days
Freeze-free period (average)	230 days
Precipitation total (average)	35 in

Climate stations used

- (1) BENBROOK DAM [USC00410691], Fort Worth, TX
- (2) CLEBURNE [USC00411800], Cleburne, TX
- (3) WHITNEY DAM [USC00419715], Clifton, TX
- (4) DENTON MUNI AP [USW00003991], Ponder, TX
- (5) DECATUR [USC00412334], Decatur, TX
- (6) EVANT 1SSW [USC00413005], Evant, TX
- (7) BROWNWOOD 2ENE [USC00411138], Early, TX
- (8) LAMPASAS [USC00415018], Lampasas, TX

Influencing water features

This site is not influenced by water from wetlands or streams. While this site may receive some run off from adjacent sites upslope, it also sheds water to sites down slope. In reference condition, the presence of tallgrasses should allow for good infiltration in the soil.

Wetland description

NA

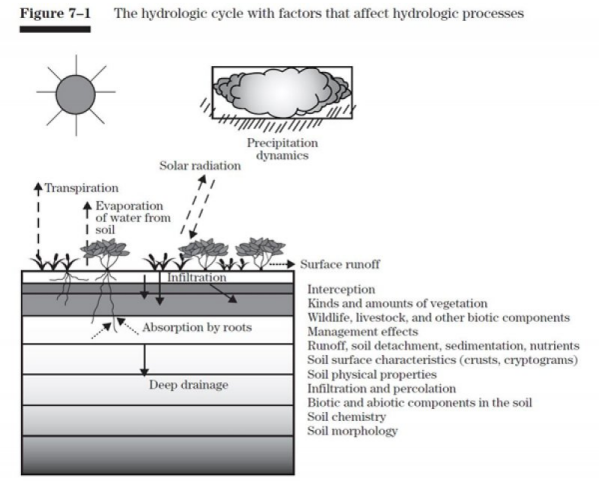


Figure 8.

Soil features

Representative soil components for this ecological site include: Eckrant and Tarrant

The site is characterized by very shallow to shallow soils with a high concentration of cobbles or stones.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone (2) Residuum–mudstone
Surface texture	(1) Cobbly clay (2) Very cobbly clay (3) Stony clay (4) Very cobbly silty clay
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	4–20 in
Surface fragment cover <=3"	2–10%
Surface fragment cover >3"	10–30%
Available water capacity (0-40in)	0–2 in
Calcium carbonate equivalent (0-40in)	0–40%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–20%
Subsurface fragment volume >3" (Depth not specified)	25–60%

Ecological dynamics

The Low Stony Hill 30 – 38” PZ site is a live oak savannah site. The reference vegetation is a fire-influenced mosaic of tallgrass and oak plant communities, interspersed with a high diversity of perennial forbs and midgrasses. Improper grazing management will result in a reduction of tallgrasses and an increase in composition of midgrasses, unpalatable forbs, and woody species.

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

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

Reference vegetation on the uplands is predominantly tall warm-season perennial bunchgrasses with lesser amounts of midgrasses and shortgrasses. This tallgrass prairie was historically dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and little bluestem (*Schizachyrium scoparium*). Midgrasses such as sideoats grama (*Bouteloua curtipendula*), Texas wintergrass (*Nassella leucotricha*), hairy grama (*Bouteloua hirsuta*), and dropseeds (Sporobolus spp.) are also abundant in the region. A wide variety of forbs add to the diverse native plant community. Scattered live oak and hackberry (Celtis spp.) trees are also native to the region. The intermittent bottomlands also contain hardwoods including several species of oak (Quercus spp.), elm (Ulmus spp.), and native pecan trees (*Carya illinoinensis*).

The northernmost portion of the Grand Prairie is still relatively free from the widespread invasion of brush that has

occurred in other parts of Texas, and more specifically, in the southern part of the MLRA. Juniper (cedar) (Juniperus spp.), honey mesquite (*Prosopis glandulosa*), pricklypear (Opuntia spp.), and scrub oak (*Quercus sinuata*) have increased to the point of dominance in some locations, especially on shallow, rocky slopes.

Pre-settlement influences included severe droughts, frequent fires, and grazing or browsing by endemic pronghorn antelope, deer and migratory bison.

Wright and Bailey (1982) reported that there are no reliable records of fire frequency in the Great Plains grasslands because there are no trees to carry fire scars from which to estimate fire frequency. A natural fire frequency of 7 to 10 years seems reasonable for this site.

Rangeland and pastureland are grazed primarily by beef cattle. Horse numbers are increasing rapidly in the region, and in recent years goat numbers have increased significantly. There are some areas where sheep are locally important. Whitetail deer, wild turkey, bobwhite quail, and dove are the major wildlife species, and hunting leases are a major source of income for many landowners in this area.

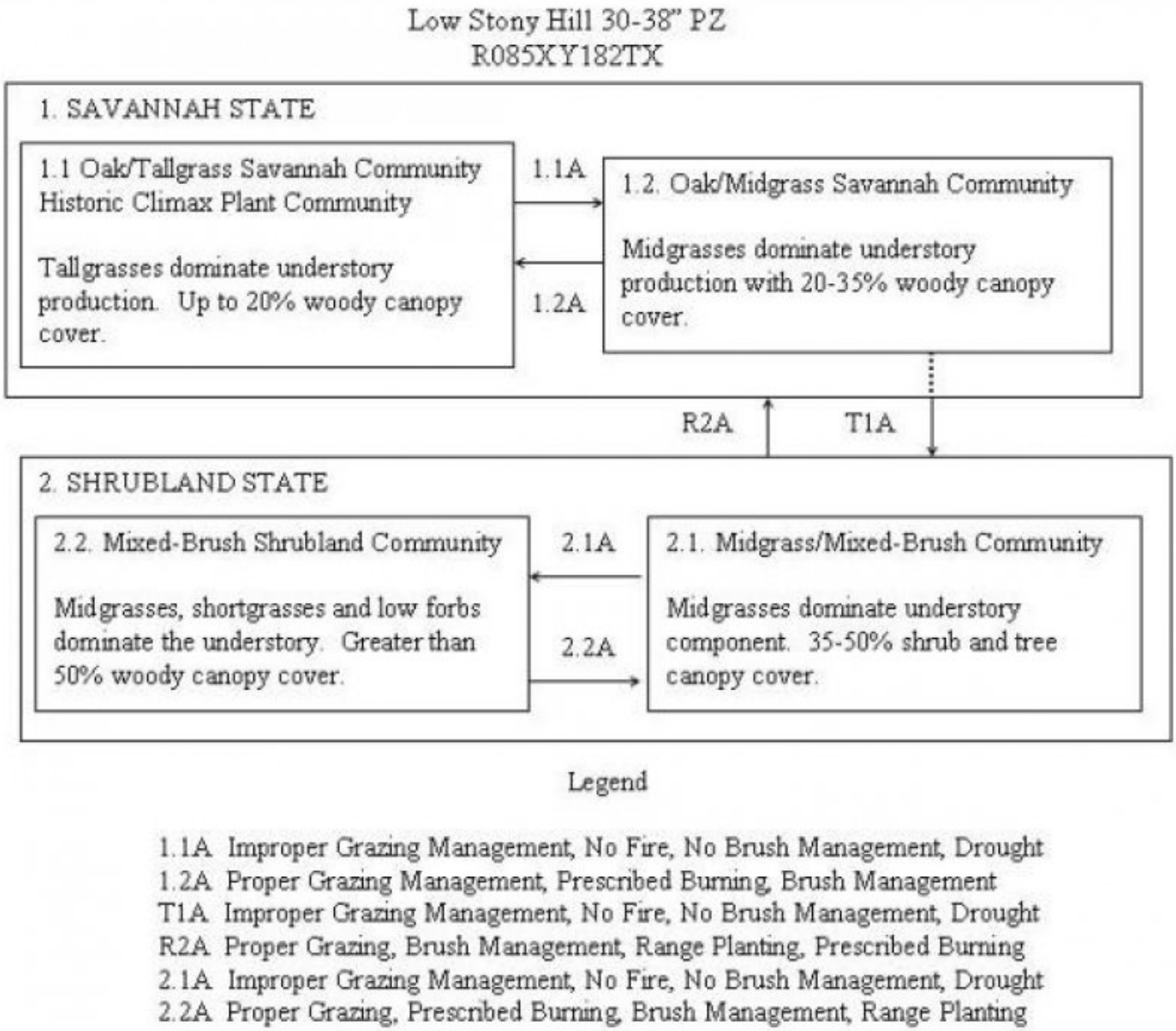
The Low Stony Hill site does not lend itself to cultivation. However some areas within the Low Stony Hill site have been seeded with kleingrass (*Panicum coloratum*), King Ranch bluestem (*Bothriochloa ischaemum*), and other Old World bluestems (Bothriochloa spp.), either as monocultures or interseeded with native species.

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

Plant Communities and Transitional Pathways

A vegetation state and transition model for the Low Stony Hill ecological site is depicted in Figure 1. A thorough description of each transitional pathway (denoted in the figure by arrows) and plant community types are listed in subsequent parts of this report.

State and transition model



State 1
Savannah State - Reference

Dominant plant species

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

Community 1.1
Oak/Tallgrass Savannah Community

Figure 9. 1.1 Oak/Tallgrass Savannah Community

The Oak/Tallgrass Savannah Community (1.1) is the reference community and is characterized as a live oak savannah with less than 20 percent live oak canopy cover. Live oak will be the most abundant along water courses, ledges, and escarpments. Little bluestem dominates the herbaceous component of the site. Other important grasses are Indiangrass, big bluestem, switchgrass, Canada wildrye (*Elymus canadensis*), silver bluestem (*Bothriochloa laguroides* var. torreyana), sideoats grama (*Bouteloua curtipendula*), tall dropseed (*Sporobolus compositus*), and Texas wintergrass. Forbs commonly found on the site include awnless bushsunflower (*Simsia calva*), Engelmann's daisy (*Engelmannia peristenia*), orange zexmenia (Wedelia texana), dotted gayfeather (*Liatris punctata*), and halfshrub sundrop (*Calylophus serrulatus*). Other shrub and tree species found in this plant community(1.1) include species of bumelia (Sideroxylon spp.), sumac (Rhus spp.), hackberry, juniper, and elm, along with elbowbush (*Forestiera pubescens*), saw greenbrier (*Smilax bona-nox*), and Texas kidneywood (*Eysenhardtia texana*). Ashe's juniper (*Juniperus ashei*) was historically restricted to rocky ledges and shelves, where it was protected from fire. The reference savannah community will transition to the Oak/Midgrass Savannah Community (1.2) under the stresses of improper grazing. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (Indiangrass, big bluestem, Engelmann's daisy). This will initially result in an increase in composition of little bluestem. If improper grazing continues, little bluestem will decrease and midgrasses such as silver bluestem and sideoats grama will increase in composition. Less palatable forbs will also increase at this stage. The soil surface of this site is characterized by up to 50 percent cover by hard, honeycombed limestone. Bare soil composes 10 percent or less of the ground cover. Plant basal cover and litter make up the remainder of the ground cover. Infiltration is high and runoff is low. Although the limestone on the soil surface increases runoff and leads to the development of water flow patterns, runoff is eventually intercepted by plants within the site. Soils are high in organic matter and the heavy plant cover contributes to increasing organic matter and soil building.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2400	3240	4080
Tree	300	405	510
Forb	150	202	255
Shrub/Vine	150	203	255
Total	**3000**	**4050**	**5100**

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

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

Community 1.2
Oak/Midgrass Savannah Community

The Oak/Midgrass Savannah Community (1.2) typically results from improper cattle grazing management over a long period of time. Indigenous or invading woody species increase on the site (with or without fire). In the Oak/Tallgrass Savannah Community (1.1), repeated fires and competition from a vigorous grass component keep woody canopy cover restricted to mottes within the savannah and 20 percent or less woody canopy cover. When the Oak /Midgrass Savannah Community (1.2) is continually overgrazed and fire is excluded, the community crosses a threshold to a state that is dominated by woody plants, the Mixed-Brush/Midgrass Community (2.1). Important grasses are big bluestem, Indiangrass, little bluestem, sideoats grama, silver bluestem, composite dropseed, and Texas wintergrass. More grazing-resistant shortgrasses, such as Texas wintergrass and buffalograss (*Bouteloua dactyloides*), and less palatable forbs begin replacing the midgrasses. Some of the reference community perennial forbs persist, but less palatable forbs will increase. Woody canopy varies between 20 and 35 percent, depending on the severity of grazing, fire interval, and availability of increaser species. Numerous shrub and tree species will encroach because overgrazing by livestock has reduced grass cover, exposed more soil, and reduced grass fuel for fire. Typically, trees such as oaks (Quercus spp.), elms, hackberry, and hawthorn (Crataegus spp.) will increase in size, while other tree and shrub species such as bumelia, sumacs, elbowbush, agarito (*Mahonia trifoliolata*), honey mesquite, juniper, and pricklypear (Opuntia spp.) will increase in density. Brown and Archer (1999) concluded that even with a healthy and dense stand of grasses, woody species will populate the site and eventually dominate the community. To control woody species populations, prescribed grazing and/or browsing and fire can be used to control smaller shrubs and trees. Mechanical removal of larger shrubs and trees may be necessary in older stands. The time frame for woody species to dominate a healthy community with proper grazing management is not precisely known, but reference sites indicate this will take over 50 years (and possibly hundreds of years). Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Some mulch and litter movement may occur during rainstorms, but little soil movement occurs due to gentle slopes in this vegetation type. Litter and mulch will move off-site as plant cover declines. Increasing woody dominants are oaks and honey mesquite. Once the tallgrasses have been eliminated from the site, woody species cover exceeds 35 percent canopy cover, and the woody plants within the grassland portion of the savannah reach fire-resistant size (about 3 feet in height), the site crosses a threshold into the Shrubland State (2) and the Mixed-Brush/Midgrass Community (2.1). Until the Oak /Midgrass Savannah Community (1.2) crosses the threshold into the Mixed-Brush/Midgrass Community (2.1), this community can be managed back toward the tallgrass community (1.1) through the use of cultural practices including prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of treatment. Once woody species begin to establish, returning fully to community 1.1 is difficult, but it is possible to return to a similar plant community. Potential exists for soils to erode to the point that irreversible damage may occur. If soil holding herbaceous cover decreases to the point that soils are no longer stable, the shrub overstory will not prevent erosion of the A and B soil horizons. This is a critical shift in the ecology of the site. Once the A horizon has eroded, the hydrology, soil chemistry, soil microorganisms, and soil physics are altered to the point where intensive restoration is required to restore the site to another state or community. Simply changing management (improving grazing management or controlling brush) cannot create sufficient change to restore the site within a reasonable time frame.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1625	2275	2925
Shrub/Vine	500	700	900
Forb	375	525	675
Total	**2500**	**3500**	**4500**

Figure 13. Plant community growth curve (percent production by month). TX6021, Tall & Midgrass/Oak Savannah Community. The tallgrasses will start to disappear and be replaced by midgrasses. Invader brush species appears and becomes established..

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

Pathway 1.1A
Community 1.1 to 1.2

The Oak Savannah/Tallgrass Plant Community will shift to the Oak Savannah/Midgrass Plant Community when there is continued growing season stress on palatable grass species. These stresses include insufficient critical growing season deferment, excess defoliation intensity, repeated, long-term growing season defoliation, and/or long-term drought. Increaser species (midgrasses and woody species) are generally endemic species released from competition. Woody species canopy exceeding 20% and/or dominance of tallgrasses falling below 50% of species composition indicate a transition to the Oak Savannah/Midgrass Plant Community. Reference vegetation can be maintained through implementation of managed grazing that provides adequate growing season deferment to allow establishment of tall grass propagules and/or the recovery of vigor of stressed individual plants. Proper grazing management may be combined with fire and/or brush management to create a shift towards or maintain the reference community.

Pathway 1.2A
Community 1.2 to 1.1

The Oak Savannah/Midgrass Plant Community will return to the Oak Savannah/Tallgrass Plant Community under grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity as long as the seedbank or seed source is still present. Favorable moisture conditions will facilitate or accelerate this transition. The understory component may return to dominance by tallgrasses in the absence of fire, however, reduction of the woody component to 20% or less canopy cover will require inputs of fire and/or brush control.

State 2
Shrubland State

Dominant plant species

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

Community 2.1
Mixed-Brush/Midgrass Community

The Mixed-Brush/Midgrass Community (2.1) presents a 35 to 50 percent woody plant canopy. Live oak is the dominant species within the oak mottes with honey mesquite and juniper invading former grassland areas. The community loses its savannah appearance with invasive shrubs beginning to fill the open grassland portion of the savannah. Oak mottes remain, but are no longer the only areas with trees. This community type is the result of continuous improper grazing by livestock and a lack of fire. In areas where high deer densities occur, heavy browsing can decrease preferred woody plants. There is a continued decline in diversity of the grassland component and an increase in woody species such as sumac. Unpalatable forbs such as western ragweed (*Ambrosia psilostachya*) increase in species composition. Annual herbage production decreases due to a decline in soil structure and organic matter and has shifted toward the woody component. All unpalatable woody species have increased in size and density. Honey mesquite is an early increaser throughout the MLRA. Redberry juniper (*Juniperus pinchotii*) occurs only in the southern counties of the MLRA and eastern redcedar (*Juniperus virginiana*) occurs only in the northern portion. Ashe’s juniper occurs mostly in the southern portion, but can be found throughout the MLRA. Many of the reference community (1.1) shrubs are still present. Sideoats grama and other midgrasses decrease to the point that grasses no longer form the dominant component. Shortgrasses such as buffalograss and Texas wintergrass increase. Remnants of the palatable grasses and forbs along with unpalatable invaders occupy the interspaces between trees and shrubs. Cool-season species such as Texas wintergrass, plus other grazing-resistant species, can be found under and around woody plants. Plant vigor and productivity of the grassland component is reduced due to competition for nutrients and water from woody plants. Common herbaceous species include threeawns (Aristida spp.), hairy grama (*Bouteloua hirsuta*), and Mexican sagewort (*Artemisia ludoviciana* ssp. mexicana). Buffalograss, western ragweed, and curly-mesquite (*Hilaria belangeri*) are persistent increasers until shrub density reaches maximum canopy. As the grassland vegetation declines, more soil

is exposed, leading to crusting and erosion. Due to the shallow depth to the limestone bedrock, erosion can be severe. Higher rainfall interception losses by the increasing woody canopy combined with increased evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces, but soil conditions improve under the woody plant cover. Soil loss can occur during rainfall events. Annual primary production is approximately 1000 to 3000 pounds per acre. In this plant community, annual production is balanced between herbaceous plants and woody species. Browsing animals such as goats and deer can find fair food value if browse plants have not been grazed excessively. Forage quantity and quality for cattle is low. Unless brush management and proper grazing management are applied at this stage, woody canopy will increase until it exceeds 50 percent, indicating a conversion to the Mixed-Brush Shrubland Community (2.2). The trend for increased shrub cover cannot be reversed with proper grazing management alone.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	450	900	1350
Tree	400	800	1200
Forb	150	300	450
Total	**1000**	**2000**	**3000**

Figure 15. Plant community growth curve (percent production by month). TX6022, Oak/Juniper/Midgrass Community. Consists of midgrasses with ten to twenty percent canopy of woody plants..

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

Community 2.2
Mixed-Brush Shrubland Community

The Mixed-Brush Shrubland Community (2.2) is the result of many years of improper grazing, lack of periodic fires, and/or a lack of proper brush management. Oaks, honey mesquite, and/or juniper dominate the Mixed-Brush Shrubland Community (2.2), which has greater than 50 percent woody canopy cover. It is now essentially a dense shrubland with remnant grasses under the canopy and within interspaces. Once the brush canopy exceeds 50 percent, annual production for the understory is very limited and is generally made up of unpalatable shrubs, grasses, and forbs within tree and shrub interspaces. Common understory shrubs are pricklypear, agarito, sumacs, and elbowbush. With continued heavy cattle grazing and/or browsing and no brush control, the trees and shrubs can exceed 70 percent canopy cover, and potentially reach almost 100 percent cover. Excessive browsing by deer or goats will create a community dominated by large trees. Few remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. Characteristic grasses are curly-mesquite, buffalograss, and fall witchgrass (*Digitaria cognata*). Texas wintergrass and annuals are found in and around tree/shrub cover. Grasses and forbs make up 35 percent or less of the annual herbage production. Common forbs include dotted blazing star (*Liatris punctata*), orange zexmenia (Wedelia texana), croton (Croton spp.), western ragweed, Mexican sagewort, and sensitive-briar (Mimosa spp.). At its most extreme, this community takes on a woodland appearance, large woody species with understory dominated by low production grasses, sedges, and forbs that have low palatability and high shade tolerance. Excessive cattle grazing tends to create a different response and structure to the community than does excessive deer or goat grazing. Excessive cattle grazing tends to accelerate invasion of shrubs because it creates conditions where young shrubs increase in vigor and size while palatable grasses decrease in vigor and abundance. Excess deer or goat grazing tends to create a dominance of large trees by removing both young shrubs and the young growth that grow below the browse line on larger shrubs and trees. While large trees will continue to increase in size, they will have very little production below the browse line. The site becomes dominated by large trees with little forage available for livestock or wildlife. Large trees with little understory provide much less soil protection than do dense stands of grass. As soils erode, understory species have reduced potential to revegetate the site. The bare area under the browse line creates a situation that provides poor forage conditions and poor visual cover for wildlife. If irreversible soil damage has occurred, it may be possible to remove brush and seed the site to a grassland community. The resulting grassland will not look or function like the reference community (1.1). Instead, it is likely to be dominated by few introduced midgrasses and produce less biomass. It is very difficult and expensive to restore the site to reference conditions due to the loss of organic

matter, soil horizons, soil microbes, and soil structure. Rangeland health functions will depart substantially from reference conditions. The shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and organic mulch are reduced, exposing more of the soil surface to erosion in interspaces. The percent of exposed limestone bedrock increases with erosion. However, within the woody canopy, hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. The Mixed-Brush Shrubland Community (2.2) provides good habitat cover for wildlife, but only limited forage or browse is available for livestock or wildlife. At this stage, highly intensive restoration practices are needed to return the shrubland to a grassland. Alternatives for restoration include brush control and range planting, proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	240	600	800
Grass/Grasslike	100	250	375
Forb	60	150	225
Total	**400**	**1000**	**1400**

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

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

Pathway 2.1A
Community 2.1 to 2.2

Without fire (natural or human-caused) and/or brush control, woody density and canopy cover will increase in the Mixed-Brush/Midgrass Plant Community until it converts into the Mixed-Brush Shrubland Plant Community. Improper grazing and/or long-term drought (or other growing season stress) will accelerate this transition. Woody species canopy exceeding 50% indicate this transition. Improper grazing or other long-term growing season stress can increase the composition of shortgrasses and low-growing (or unpalatable) forbs in the herbaceous component. Even with proper grazing, in the absence of fire the woody component will increase to the point that the herbaceous component will shift in composition toward shortgrasses and forbs suited to growing in shaded conditions with little available soil moisture.

Pathway 2.2A
Community 2.2 to 2.1

Brush management and/or fire can reduce the woody component below the transition level of 50% brush canopy. Continued fire and/or brush management will be required to maintain woody density and canopy below 50%. If the herbaceous component has transitioned to shortgrasses and low forbs, proper grazing (combined with favorable moisture conditions) will be necessary to facilitate the shift of the understory component to the midgrass-dominated Mixed-Brush/Midgrass Plant Community. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions.

Transition T1A
State 1 to 2

The Savannah State is resistant to shrub dominance. However, shrubs make up a portion of the plant community in this state, therefore propagules are present. The mean fire return interval in the Savannah State is 7-10 years. Even with proper grazing and favorable climate conditions, lack of fire for 50-100 years will allow woody species to increase in canopy to reach the 35% threshold level. Improper grazing, prolonged drought, and warming climate will

provide a competitive advantage to shrubs which will accelerate this process. Tallgrasses will decrease to less than 5% species composition.

Restoration pathway R2A
State 2 to 1

Restoration of the Shrubland State to the Savannah State requires substantial energy input. Mechanical or herbicidal brush control treatments can be used to remove woody species. A long-term prescribed fire program may sufficiently reduce brush density to a level below the threshold of the Savannah State, particularly if the woody component is dominated by species that are not fire sprouters. Brush control in combination with prescribed fire, proper grazing, and favorable growing conditions may be the most economical means of creating and maintaining the desired plant community. If remnant populations of tallgrasses, midgrasses, and desirable forbs are not present at sufficient levels, range planting will be necessary to restore the reference plant community.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrass**			1050–1785	
	little bluestem	SCSC	*Schizachyrium scoparium*	1050–1785	–
2	**Tallgrasses**			1050–1785	
	big bluestem	ANGE	*Andropogon gerardii*	1000–1700	–
	Indiangrass	SONU2	*Sorghastrum nutans*	700–1400	–
	switchgrass	PAVI2	*Panicum virgatum*	500–900	–
3	**Mid/Shortgrasses**			300–510	
	sideoats grama	BOCU	*Bouteloua curtipendula*	250–450	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	200–400	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	200–400	–
	Canada wildrye	ELCA4	*Elymus canadensis*	200–400	–
	green sprangletop	LEDU	*Leptochloa dubia*	200–400	–
	vine mesquite	PAOB	*Panicum obtusum*	200–400	–
	buffalograss	BODA2	*Bouteloua dactyloides*	200–350	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	150–300	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	150–300	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	150–250	–
	slim tridens	TRMUM	*Tridens muticus var. muticus*	150–250	–
	seep muhly	MURE2	*Muhlenbergia reverchonii*	150–250	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	150–250	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	150–250	–
	cedar sedge	CAPL3	*Carex planostachys*	150–250	–
	fall witchgrass	DICO6	*Digitaria cognata*	150–250	–
	threeawn	ARIST	*Aristida*	100–200	–
Forb					
4	**Forbs**			150–255	
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	150–250	–
	awnless	SICA7	*Simsia calva*	100–225	–

	awnless bushsunflower	SICAT	*Simsia calva*	100–225	
	fuzzybean	STROP	*Strophostyles*	100–200	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	100–200	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	100–200	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	100–200	–
	prairie clover	DALEA	*Dalea*	100–200	–
	bundleflower	DESMA	*Desmanthus*	100–200	–
	ticktrefoil	DESMO	*Desmodium*	100–200	–
	snow on the mountain	EUMA8	*Euphorbia marginata*	100–200	–
	milkpea	GALAC	*Galactia*	100–200	–
	trailing krameria	KRLA	*Krameria lanceolata*	100–200	–
	dotted blazing star	LIPU	*Liatris punctata*	100–200	–
	sensitive plant	MIMOS	*Mimosa*	100–200	–
	yellow puff	NELU2	*Neptunia lutea*	100–200	–
	scurfpea	PSORA2	*Psoralidium*	100–200	–
	snoutbean	RHYNC2	*Rhynchosia*	100–200	–
Tree					
5	**Trees**			300–510	
	Texas live oak	QUFU	*Quercus fusiformis*	300–500	–
	sumac	RHUS	*Rhus*	250–450	–
	elm	ULMUS	*Ulmus*	250–450	–
	hackberry	CELTI	*Celtis*	250–450	–
Shrub/Vine					
6	**Shrubs/Vines**			150–255	
	bully	SIDER2	*Sideroxylon*	100–200	–
	saw greenbrier	SMBO2	*Smilax bona-nox*	100–200	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	100–200	–
	stretchberry	FOPU2	*Forestiera pubescens*	100–200	–
	Ashe's juniper	JUAS	*Juniperus ashei*	50–100	–

Animal community

This site is inhabited by deer, dove, and quail. Cover is adequate and the browse plants, forbs and grasses that grow on the site furnish year-round food supply.

Hydrological functions

Site-specific data indicated that there are no rills in the reference community. Some gullies may be present on side drains into perennial and intermittent streams. Gullies are vegetated and stable. Water flow patterns are common and follow old stream meanders. Deposition or erosion is uncommon for normal rainfall conditions but may occur during intense rainfall events. Pedestals or terracettes are uncommon for this site. Expect no more than 10% bare ground randomly distributed throughout. Under normal rainfall, little litter movement should be expected; however, litter of all sizes may move long distances across limestone outcrops. Soil surface is resistant to erosion. Stability class range is expected to be 4-6. The savannah of tallgrasses, midgrasses, and forbs having adequate litter and little bare ground can provide for maximum infiltration and little runoff under normal rainfall events.

Recreational uses

Recreational uses include recreational hunting, hiking, camping, equestrian, and bird watching.

Wood products

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

Other products

Jams and jellies are made from many fruit bearing species, such as agarito. Seeds are harvested from many plants for commercial sale. Many grasses and forbs are harvested by the dried-plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from many flowering plants, such as honey mesquite.

Other information

None.

Inventory data references

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

Reviewers:
Ricky Linex, biologist, NRCS, Weatherford, Texas
Lem Creswell, RMS, NRCS, Weatherford, Texas
Nathan Haile, RSS, NRCS, Weatherford, Texas

Special thanks to the following personnel for assistance and/or guidance with the development of this ESD: Justin Clary, NRCS, Temple, TX; Mark Moseley, NRCS, San Antonio, TX; Ricky Marks, NRCS, Brownwood, TX; Rhett Johnson, Granbury, TX; Michael and Susannah Wisenbaker, Dallas, TX; Rancho Hielo Brazos, Glen Rose, TX; and Dr. Ricky Fain, Chalk Mountain, TX.

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Contributors

Donald Pendleton
Jack Alexander, Synergy Resource Solutions, Inc. Belgrade, Montana
PES edits by Colin Walden, Stillwater Soil Survey Office

Approval

Bryan Christensen, 9/21/2023

Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

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

Rangeland health reference sheet

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

Author(s)/participant(s)	Lem Creswell, RMS, NRCS, Weatherford, Texas
Contact for lead author	817-596-2865
Date	09/17/2007
Approved by	Bryan Christensen
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-6 inches of Dark brown flaggy silty clay loam with subrounded to angular pebbles, cobbles, and stones. Has a strong fine granular structure. SOM is 1-4%. See soil survey for more information.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of tallgrasses, midgrasses, and forbs 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):** None.

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

    Dominant: Warm-season tallgrasses >>

    Sub-dominant: Warm-season midgrasses > Cool-season midgrasses > Trees >

    Other: Warm-season shortgrasses > Forbs > 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):** Grasses and forbs due to their growth habit will exhibit some mortality and decadence, though very slight. Open spaces from disturbance are quickly filled by new plants through seedlings and reproductive reproduction (tillering).

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 3000 - 5100 pounds per acre

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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, honey mesquite, pricklypear, bermudagrass, johnsongrass, King Ranch bluestem.

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17. **Perennial plant reproductive capability:** Under HCPC, all perennial plants should be capable of reproducing, except during periods of prolonged drought conditions, heavy natural herbivory or intense wildfires.
