USDA Natural Resources
Conservation Service

Ecological site R085AY565TX
Pink Caliche 30-38" PZ

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General information

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

Figure 1. Mapped extent

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

MLRA notes

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

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

Classification relationships

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

Ecological site concept

These sites occur on moderately deep, loamy soils over limy sandstone and caliche. The reference vegetation includes tall/midgrasses with scattered forbs and oak trees. Without fire or brush management, the woody species may increase and dominate the site. The soils of this site can have fertility issues and can be droughty.

Associated sites

R085AY182TX	**Low Stony Hill 30-38" PZ** The Low Stony Hill site is often adjacent to the Pink Caliche site. It differs from the site by not having the characteristic pink to reddish-brown soils of the Pink Caliche site and has higher clay content, more surface rocks, shallower soils, and has no to very few water flow patterns.

Similar sites

R085AY176TX	**Adobe 30-38" PZ** The Adobe Site differs from the Pink Caliche site because rather than moderately deep characteristic pink to reddish-brown soils, the Adobe site has limestone derived soils with a limestone rock or marl at a depth of 8 to 40 inches.

R085AY182TX	**Low Stony Hill 30-38" PZ** The Low Stony Hill site has similar slope, landscape position, topography, and low water-holding capacity to the Pink Caliche site. It differs from the site by not having the characteristic pink to reddish-brown soils of the Pink Caliche site and has shallower soils, higher clay and rock fragment content, and no to very few water flow patterns.

Table 1. Dominant plant species

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

Physiographic features

This site occurs on side slopes, nose slopes, and crests of hillslopes in the basal Cretaceous sandstones of the Travis Peak Formation in the Grand Prairie. This site is located in upland areas proximal to the Colorado and Lampasas River Valleys. Slopes are typically less than 12 percent.

Table 2. Representative physiographic features

Landforms	(1) Hills > Ridge (2) Hills > Hill (3) Hills > Hillslope
Runoff class	Low to medium
Elevation	800–1,600 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

These sites shed water to adjacent areas downslope. The presence of deep rooted tall and midgrass species helps facilitate infiltration of rainfall into the soil profile. These sites are not associated with wetlands.

Wetland description

NA

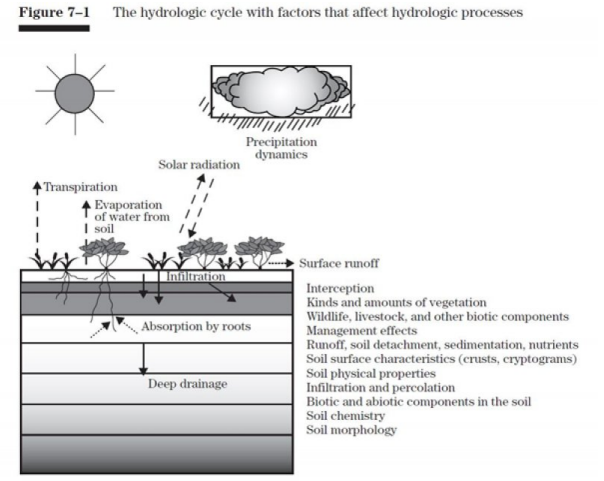


Figure 8.

Soil features

Representative soil components for this ecological site include: Doudle

The site is characterized by moderately deep, well drained soils underlain by calcareous sandstone or petrocalcic horizon of the Travis Peak Formation.

Table 4. Representative soil features

Parent material	(1) Residuum–calcareous sandstone
Surface texture	(1) Cobbly loam (2) Cobbly very fine sandy loam (3) Cobbly silt loam
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	22–40 in

Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	4–6 in
Calcium carbonate equivalent (0-40in)	40–60%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	5–20%

Ecological dynamics

The Pink Caliche 30-38" PZ ecological site is a live oak (*Quercus virginiana*) savannah site. The reference plant community of the Pink Caliche site is a fire-influenced mosaic of tallgrass and oak plant communities, interspersed with a high diversity of perennial forbs and tall and midgrasses. Grass-dominated areas make up 80% or more of the area and mix with groups (mottes) of oak trees (10-20% of the area) to create a mosaic of grass and shrub communities. 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.

Natural vegetation on the uplands is predominantly tall warm-season perennial bunchgrasses with lesser amounts of midgrasses and shortgrasses. This tallgrass prairie site was historically dominated by little bluestem (*Schizachyrium scoparium*) with some other tall grasses, such as Indiangrass (*Sorghastrum nutans*) also present. Midgrasses such as sideoats grama (*Bouteloua curtipendula*), tall dropseed (*Sporobolus compositus*), cane bluestem (*Bothriochloa barbinodis*), silver bluestem (*Bothriochloa laguroides*), Texas wintergrass (*Nassella leucotricha*), and slim tridens (*Tridens muticus*) make up about 25% of the production of this site. A wide variety of forbs add to the diverse native plant community. Additionally, several oak (Quercus spp.), elm (Ulmus spp.), and hackberry (Celtis spp.) tree/shrub species make up an important part of the savannah community.

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

Pre-settlement influences included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts, and frequent fires. 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 Pink Caliche site does not lend itself to cultivation. However there are areas within the Pink Caliche site where kleingrass (*Panicum coloratum*), King Ranch bluestem (*Bothriochloa ischaemum*), and other Old World bluestems (Bothriochloa spp.) have been seeded, either as monocultures or interseeded with native species.

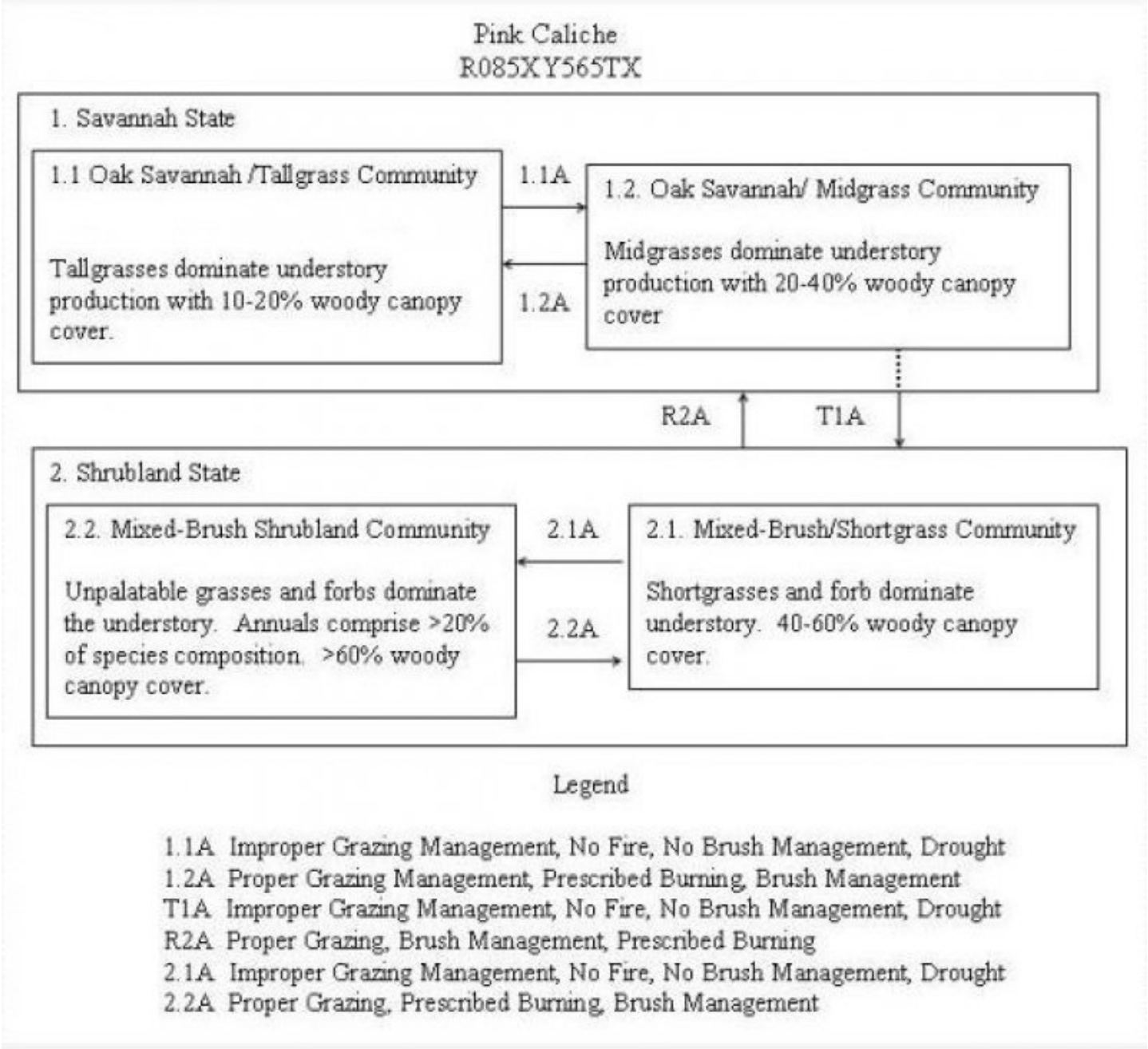
Rangeland Health Reference Worksheets have been posted for this site on the Texas NRCS website (www.tx.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions.

Plant Communities and Transitional Pathways

A state and transition model for the Pink Caliche ecological site is depicted in Figure 1. A thorough description of each state and associated transition and of each plant community and associated pathway follows the model. This model is based on the available experimental research, field observations, and interpretations by experts, but is likely to change as knowledge increases. Plant community dynamics vary across the MLRA reflecting the range of variability in conditions (precipitation, elevation, aspect, and soils) and each plant community reflects that natural variability over space and time. ESDs attempt to communicate highly complex biological processes in a land management context. Therefore, ESDs do not attempt to describe the specific attributes exhibited for each state or community, but describe representative values that are important to ecological dynamics.

State and Transition Model Legend: Pink Caliche R085XY565TX.

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 Savannah/Tallgrass Community

Figure 9. 1.1 Oak Savannah/Tallgrass Community

The Oak Savannah/Tallgrass Community (1.1) is the reference community and is characterized as a live oak savannah with up to 20 percent woody species canopy cover. The live oaks in this community are medium-sized and scattered throughout the site with a tall and midgrass understory. Both percent species composition by weight and percent canopy cover are used in this ESD. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover drives the transitions between community and states because of the influence of shade and interception of rainfall. Species composition by weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in species composition for the site. Calculating similarity index requires use of species composition. Little bluestem dominates the herbaceous component of the site, with sideoats grama, silver bluestem, tall grama (*Bouteloua hirsuta* var. pectinata), and tall dropseed (*Sporobolus compositus*) present as significant components. Big bluestem (*Andropogon gerardii*) and Indiangrass are present in this community. Other important grasses are hairy dropseed (*Sporobolus compositus* var. drummondii), and Texas wintergrass, plains lovegrass (*Eragrostis intermedia*), and sand dropseed (*Sporobolus cryptandrus*). Forbs commonly found on the site include orange zexmenia (Wedelia texana), greenthread (Thelesperma spp.), catclaw sensitive-briar (*Mimosa nuttallii*), dotted gayfeather (*Liatris punctata*), and western ragweed (*Ambrosia psilostachya*). Shrub and tree species found include live oak, Texas oak (*Quercus texana*), species of hackberry, bumelia (Sideroxylon spp.), and elbowbush (*Forestiera pubescens*), along with prairie flameleaf sumac (*Rhus lanceolata*), prickly ash (*Zanthoxylum hirsutum*), and saw greenbrier (*Smilax bona-nox*). The reference Oak Savannah/Tallgrass Community (1.1) will transition to the Oak Savannah/Midgrass Community (1.2) under the stresses of improper grazing management. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (e.g. Indiangrass and Engelmann's daisy). Little bluestem will initially increase in composition on this site. 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 soils of this site are variable and moderately deep. Limestone or sandstone fragments are common on the surface. Infiltration is high and runoff is low. Bare soil composes 10 percent or less of the ground cover. Plant basal cover and litter make up the remainder of the ground cover. The soils are droughty and have a low water holding capacity. This site produces plants that are low in phosphorus and palatability. These soils respond rapidly to proper management practices, but deteriorate rapidly when abused.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2125	2444	2763
Shrub/Vine	250	287	325
Forb	125	144	162
Total	**2500**	**2875**	**3250**

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 Savannah/Midgrass Community

Figure 12. 1.2 Oak Savannah/Midgrass Community

The Oak Savannah/Midgrass Community Phase (1.2) typically results from long-term improper cattle grazing management and/or long-term lack of fire. Indigenous or invading woody species increase on the site (with or without fire). In the Oak Savannah/Tallgrass Plant 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 Savannah/Midgrass 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/Shortgrass Community (2.1). Important grasses are little bluestem, sideoats grama, silver bluestem, hairy grama, and Texas cupgrass. Texas wintergrass, buffalograss (*Bouteloua dactyloides*), and less palatable forbs begin replacing the midgrasses. Some of the 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 the grass cover, exposed more bare soil, and reduced grass fuel for fire. Typically, trees such as oaks and elms will increase in size, while shorter stature tree and shrub species such as agarito, honey mesquite, juniper, catclaw acacia, pricklypear, and yucca (Yucca 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, and 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 unknown, but reference sites indicate this will take approximately 25 years. Prior to human disturbance the site transitioned between communities 1.1 and 1.2 in response to variation in fire, drought, and grazing impacts. Given time, proper management, and favorable growing conditions community 1.2 will transition back to 1.1. Continued site degradation will lead to increases in plant bare ground, which will increase soil erosion. Litter and mulch will decrease for two reasons. First, there will be less litter as herbaceous production declines. Second, the litter present will be moved off site as the amount of runoff and length of water flow patterns increase because the number of plant bases interrupting flow will decrease. The site crosses a threshold into the Mixed-Brush/Midgrass Plant Community (2.1) within the Shrubland State (2) once tallgrasses have decreased to less than 5% composition and woody species canopy cover exceeds 40 percent. At this point, woody plants within the grassland portion of the savannah will have reached a fire-resistant size (over 3 feet in height). Until the Oak Savannah/Midgrass Plant Community (1.2) crosses the threshold into the Mixed-Brush/Midgrass Community (2.1), this community can be managed so that it transitions back to community(1.1) through the use of cultural practices including prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of the treatment. Once woody species become established, returning fully to the reference community is difficult, but it is possible to return to a similar plant community. Potential exists for soils to erode to the point that irreversible damage may occur. If soil-holding herbaceous cover decreases to the point that soils are no longer stable, the shrub overstory will not prevent erosion of the A and B soil horizons. This is a critical shift in the ecology of the site.

Once the A horizon has eroded, the hydrology, soil chemistry, soil microorganisms, and soil physics are altered to the point where intensive restoration is required to restore the site to another state or community. Simply changing the management of the site (improving grazing management or controlling brush) cannot create sufficient change to restore the site within a reasonable time frame. This level of erosion indicates that a threshold has been crossed to the Shrubland State.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1080	1200	1320
Shrub/Vine	360	400	440
Forb	360	400	440
Total	**1800**	**2000**	**2200**

Figure 14. 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

Oak Savannah/Tallgrass Community

Oak Savannah/Midgrass Community

Improper Grazing Management, Lack of Fire, Lack of Brush Control, Long-Term Drought or Other Growing Season Stress. 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 intensity of defoliation, repeated, long-term growing season defoliation, long-term drought, and/or other repeated critical growing season stress. Increaser species (midgrasses and woody species) are generally endemic species released from competition as the vigor of tallgrasses declines. 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. Community 1.1 can be maintained through the implementation of managed grazing that provides adequate growing season deferment to allow establishment of tallgrass propagules and/or the recovery of the vigor of stressed plants. Proper grazing management may be combined with fire and/or brush management to create a shift towards or maintain the reference community. The driver for community shift 1.1A for the herbaceous component is improper grazing management on sites with grazing. Increased competition from invader midgrasses and forbs and increasing shrub cover can play a role in driving herbaceous shifts. The driver for the woody component is lack of fire and/or brush control.

Pathway 1.2A
Community 1.2 to 1.1

Oak Savannah/Midgrass Community

Oak Savannah/Tallgrass Community

Proper Grazing Management, Fire, and Brush Management. 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. 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. The driver for community shift 1.2A for the herbaceous component is proper grazing management. The driver for the woody component is fire and/or brush control. Brush control can also benefit tallgrasses and drive community shift 1.2A for the herbaceous community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Shrubland State

Dominant plant species

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

Community 2.1
Mixed-Brush/Shortgrass Community

Figure 15. 2.1 Mixed-Brush/Shortgrass Community

The Mixed-Brush/Shortgrass Community (2.1) presents a 40 to 60 percent woody plant canopy, with live oak dominating the oak mottes and honey mesquite and Ashe’s juniper (*Juniperus ashei*) invading the former grassland areas. The community loses its savannah appearance with invasive shrubs beginning to fill the open grassland portion of the savannah. The oak mottes remain, but are no longer the only areas with trees. 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 (Rhus spp.). 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. Shortgrasses such as buffalograss (*Bouteloua dactyloides*), purple threeawn (*Aristida purpurea*), and curly-mesquite (*Hilaria belangeri*) dominate the grass component, but grasses no longer form the dominant species component. Remnants of the community (1.1) grasses and forbs along with unpalatable invaders occupy the interspaces between trees and shrubs. Cool-season species such as Texas wintergrass and sedges (Carex spp.), 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. Likely herbaceous species include queen's-delight (*Stillingia sylvatica*), Mexican sagewort (*Artemisia ludoviciana* ssp. mexicana), western ragweed, buckwheat (Eriogonum spp.), and dotted gayfeather (*Liatris punctata*). As tallgrasses decrease, forbs will increase to approximately 20 percent of the species composition. As the grassland vegetation declines, more soil is exposed leading to crusting and erosion. In this vegetation type, erosion can be severe. Higher rainfall interception losses by the increasing woody canopy combined with evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces, but soil conditions may improve again under the canopy of trees and large shrubs. Annual herbage production decreases, due to a decline in soil structure and organic matter, and has shifted toward the woody component. Unpalatable woody species increase in size and density. Honey mesquite is an early increaser throughout the MLRA; on this site it can increase to the point of forming mesquite thickets, particularly after severe damage to the site resulting in removal of competing trees and tall grasses (i.e. failed cultivation or severe grazing to the point of soil loss). 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. Annual primary production is approximately 900 to 1500 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 is applied at this stage, woody canopy will continue to increase and perennial grasses and forbs will be replaced by annual grasses and forbs, causing the community to convert to the Mixed-Brush Shrubland Community (2.2). The trend 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)
Shrub/Vine	495	660	825
Grass/Grasslike	360	480	600
Forb	135	180	225
Total	**990**	**1320**	**1650**

Figure 17. Plant community growth curve (percent production by month). TX6026, Oak/Juniper/Shortgrass Community. Peak biomass production is in April, May, and June, with a lesser peak in September and October. Oaks and juniper dominates with shortgrass understory..

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 management, lack of periodic fires, and/or a lack of proper brush management. Oaks, Ashe's juniper, and/or honey mesquite dominate the Mixed-Brush Shrubland Community (2.2), which has greater than 60 percent woody canopy cover. It is now essentially a dense shrubland with remnant grasses under the canopy and within interspaces or a mosaic of shrub and tree mottes interspersed among low production open areas. Once the brush canopy exceeds 60 percent, annual production for the understory is very limited due to both competition for nutrients and shading and is generally made up of unpalatable shrubs, grasses, and forbs within tree and shrub interspaces. Common understory shrubs are pricklypear, agarito (*Mahonia trifoliolata*), sumac, elbowbush (*Forestiera pubescens*), and catclaw mimosa (*Mimosa aculeaticarpa*). With continued heavy cattle grazing and/or browsing and no brush control, the trees and shrubs can exceed 75 percent canopy cover, and potentially reach almost 100 percent cover. Excessive grazing by other deer or goats will create a community dominated by large trees. Few remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. Characteristic grasses include: Texas wintergrass, buffalograss, curly-mesquite, threeawns (Aristida spp.), sedges, hairy grama, Texas grama (*Bouteloua rigidiseta*), and annual bromes (Bromus spp.). Texas wintergrass and annuals are found in and around tree/shrub cover. Grasses and forbs make up 40 percent or less of the annual herbage production. Common forbs include western ragweed, annual broomweed, upright prairie coneflower, snow-on-the-mountain, silverleaf nightshade, milkweeds (Asclepias spp.), Leavenworth's eryngo (*Eryngium*

leavenworthii), twinleaf senna (*Senna bauhinioides*), and Evax (Evax spp.). At its most extreme, this community takes on a woodland appearance interspersed with large areas of almost denuded rock where soil has eroded away. Particularly if there has been heavy browsing (by deer or goats), the site will be dominated by large trees with a marked browse line and an understory dominated by unpalatable, low production grasses, sedges, and forbs. 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 grows 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. 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. 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 grassland. Alternatives for restoration include: brush control and range planting, proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community. If irreversible soil damage has occurred, it will be very difficult to remove brush and seed the site to a grassland community. Furthermore, it will be very difficult and expensive to restore the site to reference community conditions due to the loss of the organic matter, soil horizons, soil microbes, and soil structure necessary to maintain the that community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	195	325	487
Grass/Grasslike	60	100	150
Forb	45	75	113
Total	**300**	**500**	**750**

Figure 19. 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

Lack of Fire, Lack of Brush Control, Improper Grazing Management, and Severe Drought. Without fire (natural or human-caused) and/or brush control, woody density and canopy cover will increase in the Mixed-Brush/Shortgrass Plant Community until it converts into the Mixed-Brush Shrubland Plant Community. Improper grazing management and/or long-term drought (or other growing season stress) will accelerate this transition. Woody species canopy exceeding 60% indicates this transition. Improper grazing management 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. The driver for community shift 2.1A is lack of fire and/or brush control.

Pathway 2.2A
Community 2.2 to 2.1

Fire and Brush Management. Brush and/or fire management can reduce the woody component below the transition level of 60% brush canopy. Continued fire and/or brush management will be required to maintain woody density and canopy below 60%. If the herbaceous component has transitioned to shortgrasses and low forbs, proper grazing management (combined with favorable moisture conditions) will be necessary to facilitate the shift of the understory component to the midgrass-dominated Mixed-Brush/Shortgrass Plant Community. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions. The driver for community shift 2.2A is fire and/or brush control.

Conservation practices

Brush Management
Prescribed Burning

Transition T1A
State 1 to 2

Transition to Shrubland State. The Savannah State is resistant to shrub dominance. However, shrubs and trees make up a portion of the plant community in this state, therefore propagules are present. The mean fire return interval to maintain a Savannah State is 3-5 years. Even with proper grazing management and favorable climate conditions, lack of fire for 10-15 years will allow woody species to increase in canopy to reach the 40% threshold level. An infusion of invasive species (i.e. juniper or mesquite) will speed up the process. Improper grazing management, prolonged drought, and a warming climate will provide a competitive advantage to shrubs which will accelerate this process. Tallgrasses will decrease to less than 5% species composition. This transition can occur from any of the Grassland State Communities. The driver for Transition T1A is lack of fire and/or brush control. The Grassland State is always at risk for this transition because woody species are present in the grassland plant community. Introduction of aggressive woody invader species (i.e. juniper) increase the risk that this state transition will occur and accelerate the rate at which it is likely to occur.

Restoration pathway R2A
State 2 to 1

Restoration Pathway to Savannah State. 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 management, 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. The driver for Restoration Pathway R2A is fire and/or brush control combined with restoration of the herbaceous community and proper grazing management. Restoration may require aggressive treatment of invader species.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

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	**Tallgrasses**			2125–2750	

	little bluestem	SCSC	*Schizachyrium scoparium*	2125–2750	–
2	**Tallgrasses**			250–325	
	big bluestem	ANGE	*Andropogon gerardii*	125–325	–
	Indiangrass	SONU2	*Sorghastrum nutans*	125–325	–
3	**Midgrasses**			375–500	
	sideoats grama	BOCU	*Bouteloua curtipendula*	90–500	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	90–400	–
	composite dropseed	SPCO16	*Sporobolus compositus*	90–250	–
	tall grama	BOHIP	*Bouteloua hirsuta var. pectinata*	90–250	–
4	**Mid/Shortgrasses**			375–500	
	plains lovegrass	ERIN	*Eragrostis intermedia*	300–400	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	300–400	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	300–400	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	250–350	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	250–350	–
	buffalograss	BODA2	*Bouteloua dactyloides*	250–350	–
	sedge	CAREX	*Carex*	200–275	–
	curly-mesquite	HIBE	*Hilaria belangeri*	200–275	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	200–275	–
Forb					
5	**Forbs**			125–175	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–175	–
	buckwheat	ERIOG	*Eriogonum*	0–175	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	0–175	–
	fanpetals	SIDA	*Sida*	0–175	–
	queen's-delight	STSY	*Stillingia sylvatica*	0–175	–
	greenthread	THELE	*Thelesperma*	0–175	–
	desert zinnia	ZIAC	*Zinnia acerosa*	0–175	–
Shrub/Vine					
6	**Shrubs/Vines/Trees**			250–325	
	Texas live oak	QUFU	*Quercus fusiformis*	50–325	–
	hackberry	CELTI	*Celtis*	0–325	–
	Texas red oak	QUBU2	*Quercus buckleyi*	50–325	–
	prairie sumac	RHLA3	*Rhus lanceolata*	0–275	–
	bully	SIDER2	*Sideroxylon*	0–250	–
	saw greenbrier	SMBO2	*Smilax bona-nox*	0–250	–
	eastern poison ivy	TORA2	*Toxicodendron radicans*	0–250	–
	yucca	YUCCA	*Yucca*	0–250	–
	Texas Hercules' club	ZAHI2	*Zanthoxylum hirsutum*	0–250	–
	stretchberry	FOPU2	*Forestiera pubescens*	0–250	–
	algerita	MATR3	*Mahonia trifoliolata*	0–250	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0–250	–

Animal community

This site is inhabited by deer, quail, dove, and turkey.

Hydrological functions

Site-specific data indicated that rills are rare, and if present they are very short (<5 feet). Some gullies may be present on side drains into perennial and intermittent streams. Gullies are vegetated and stable. Water flow patterns are uncommon and very short (<5 feet) due to interruption by rocks or plant bases. Deposition or erosion is uncommon for normal rainfall conditions but may occur during intense rainfall events. Pedestals or terracettes are uncommon for this site. This site has essentially no bare ground and any patches are randomly distributed throughout the site in small and non-connected areas. Little litter movement is expected during normal rain events. During storm events, litter may move moderate distances until interrupted by plants and large rocks. The soil surface is resistant to erosion; the stability class range is expected to be 4-6. The understory of tallgrasses, midgrasses, and forbs creates adequate litter and includes little bare ground which provides 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

NA

Inventory data references

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

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Approval

Bryan Christensen, 9/21/2023

Acknowledgments

Site Development and Testing Plan:

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

Rangeland health reference sheet

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

Author(s)/participant(s)	Lem Creswell, Zone RMS, NRCS, Weatherford, Texas
Contact for lead author	817-596-2865
Date	04/14/2008
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are rare, and if present they are very short (<5 feet).

2. **Presence of water flow patterns:** Water flow patterns are uncommon and very short (<5 feet) due to interruption by rocks or plant bases. Deposition or erosion is uncommon for normal rainfall but may occur during intense rainfall events.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** This site has essentially no bare ground and any patches are randomly distributed throughout the site in small and non-connected areas.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Little litter movement is expected during normal rain events. During storm events, litter may move moderate distances until interrupted by plants and large rocks.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** The soil surface under HCPC conditions is resistant to erosion; the stability class range is expected to be 4-6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil texture is mainly loam but ranges from fine sandy loam to clay loam. Limestone or sandstone fragments are common on the surface. Characteristic pink or reddish-brown color. Available water capacity is low and the soils are droughty.

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.

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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.

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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 tallgrasses >>

    Sub-dominant: Warm-season midgrasses >>

    Other: Cool-season midgrasses > Trees > Shrubs/Vines > Forbs > Warm-season shortgrasses

    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 dominantly herbaceous.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2500 - 3250 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:** All perennial plants should be capable of reproducing, except during periods of prolonged drought conditions, heavy herbivory, and wildfires.
