USDA Natural Resources Conservation Service

Ecological site R082AY576TX
Shallow Ridge 25-32 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.

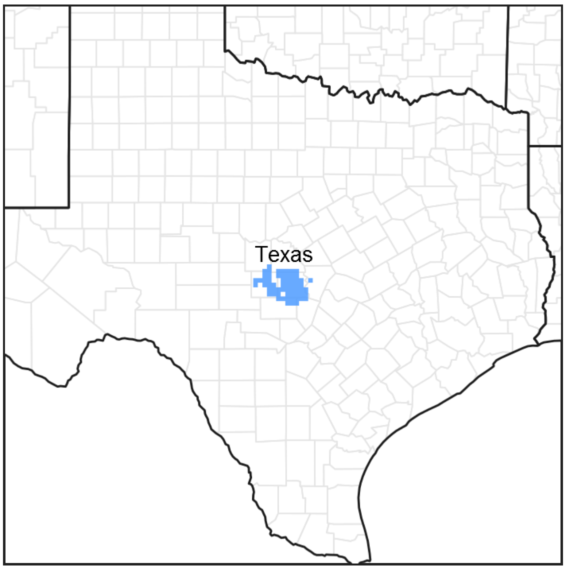


Figure 1. Mapped extent

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): 082A–Texas Central Basin

The 82A MLRA is underlain primarily by igneous, metamorphic, and sedimentary rocks. Igneous and metamorphic outcrops include the Valley Spring Gneiss, Packsaddle Schist, and Town Mountain Granite of Precambrian age. Sedimentary rocks include the Hickory Sandstone and Lion Mountain Sandstone of Cambrian Age and the Hensel Sand of Cretaceous age. Holocene alluvium is on flood plains.

Classification relationships

Major Land Resource Area (MLRA) and Land Resource Unit (LRU) (USDA-Natural Resources Conservation Service, 2006)

Ecological site concept

Shallow Ridge ecological site consists of moderately deep, well drained, moderately slowly permeable soils that formed in loamy and clayey, calcareous sediments.

The reference vegetation is a midgrass oak savannah. The site is composed of three vegetative States: the Savannah, Shrubland, and Eroded States.

Associated sites

R082AY568TX	**Red Savannah 25-32 PZ** This site is correlated to deeper soils therefore has higher production. It is usually located lower in the landscape than the Shallow Ridge.
R082AY375TX	**Serpentine 25-32 PZ** The Serpentine site is shallow over serpentine parent material.

Similar sites

R082AY371TX	**Sandstone Hill 25-32 PZ** The Sandstone Hill site has a sandier surface over sandstone.
R082AY377TX	**Shallow Granite 25-32 PZ** The Shallow Granite site has a sandier surface over granite or gneiss.

Table 1. Dominant plant species

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

Physiographic features

These soils are on nearly level to moderately sloping uplands. Slopes range from 0 to 8 percent. Elevation ranges from 700 to 1,700 feet.

Table 2. Representative physiographic features

Geomorphic position, hills	(1) Interfluve
Landforms	(1) Hills > Hillslope (2) Plateau > Ridge (3) Hills > Ridge
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,000–2,000 ft
Slope	1–8%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	1–12%

Climatic features

The climate for MLRA 82A is humid subtropical and is characterized by hot summers and relatively mild winters. The average first frost should occur around November 11 and the last freeze of the season should occur around

March 21.

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

Approximately two-thirds of the annual rainfall occurs during the April to September period. Rainfall during this period generally falls as thunderstorms, and fairly large amounts of rain may fall in localized areas for a short period of time.

Table 4. Representative climatic features

Frost-free period (characteristic range)	192-193 days
Freeze-free period (characteristic range)	233-242 days
Precipitation total (characteristic range)	25-32 in
Frost-free period (actual range)	192-193 days
Freeze-free period (actual range)	231-244 days
Precipitation total (actual range)	25-32 in
Frost-free period (average)	193 days
Freeze-free period (average)	238 days
Precipitation total (average)	28 in

Climate stations used

- (1) LLANO [USC00415272], Llano, TX
- (2) MASON [USC00415650], Mason, TX

Influencing water features

These upland sites may shed some water via runoff during heavy rain events. The presence of good ground cover and deep-rooted grasses can help facilitate infiltration and reduce sediment loss.

Wetland description

N/A

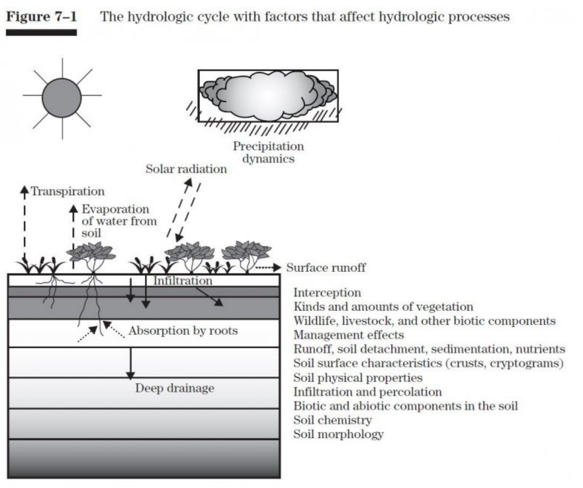


Figure 8.

Soil features

Shallow Ridge ecological site consists of moderately deep, well drained, moderately slowly permeable soils that formed schist or gneiss.

The associated soil series for the Shallow Ridge includes Ligon and Packsaddle.

Table 5. Representative soil features

Parent material	(1) Residuum–schist (2) Residuum–gneiss
Surface texture	(1) Clay loam (2) Cobbly loam (3) Gravelly sandy clay loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	12–40 in
Soil depth	12–40 in
Surface fragment cover <=3"	0–35%
Surface fragment cover >3"	0–35%
Available water capacity (0-40in)	1.5–5.3 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	5.6–7.8
Subsurface fragment volume <=3" (4-40in)	5–10%
Subsurface fragment volume >3" (4-40in)	0–3%

Ecological dynamics

The Shallow Ridge 25-32” PZ reference site is a fire-influenced Midgrass/Oak Savannah interspersed with perennial forbs, mixed shrubs and hardwood mottes. The site consists of three stable states: Savannah State (1.0), Shrubland State (2.0), and Eroded State (3.0).

The Texas Central Basin (MLRA 82A) is a unique geological region within Texas. It is composed largely of Pre-Cambrian granite, gneiss and schist (Bureau of Economic Geology 1981). Depending upon the parent material and topography, a great variety of soils have developed that vary from shallow, fissured, rocky outcrops with minimal soil development to relatively deep, well-developed soils with textures that vary from fine sandy loams to sands to gravelly clay loams to cobbly clay loams and stony clay loams (Goerdel 2000).

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 some woody species. Droughts also reduce biomass production and create open space that is colonized by opportunistic species when precipitation increases. Wet periods allow little bluestem, sideoats grama, and hardwoods to increase in dominance. The site also tends to have many opportunistic plants such as three-awns (Aristida spp.) and annuals that take advantage of the short flush of available water.

The vegetation of the region developed under a humid, subtropical climate. Weather variation is great; precipitation is highly variable with seasonal, annual, and multi-year droughts (3-6 years) common as well as seasons and years with well above average precipitation; average conditions rarely exist. Typically the spring and fall are periods of highest precipitation while mid to late summer is usually a hot, droughty period. Winters are moderate with scattered precipitation sometimes in the form of short-lived snow and ice storms (Carr 1969, Bomar 1983).

Climatic variation and topographic variability interact to influence vegetation responses to disturbances such as fire and grazing. The herbaceous savannah species adapted to fire and grazing disturbances by maintaining below-ground perennating tissues. Prior to European settlement, fires would likely have been frequent (approximately every 7-12 years) (Scifres and Hamilton 1993, Frost 1998) and burned any time of year as long as there were ample fuels, dry conditions, and an ignition source.

Fire was a major influence on vegetation structure and composition prior to settlement. Lightning and Native Americans were primary ignition sources, and the latter are considered to have increased the frequency and extent of fire as their populations increased. Fires occurred at all seasons but those that occurred during the hot, dry, late-summer season following fine fuel (grass) accumulation in the spring and early summer were perhaps the most intense and had the greatest influence on the character of the vegetation. Fires were frequent, and any area may have burned once within each 7-12 year interval (Scifres and Hamilton 1993, Frost 1998). Fire generally favors the herbaceous component of the community and hinders the establishment and growth of woody species under intense hot, dry conditions. Some individuals of trees (e.g. oak species) and resprouting shrubs (e.g. mesquite) were able to escape fires, and as they matured, they became fire-resistant components of the vegetation except for infrequent stand-replacing crown fires. These woody species became effectively uncoupled from the herbaceous and shrub layer even if the herbaceous species composition was substantially altered by grazing or other factors. If, however, the oaks were killed or removed it is very difficult for them to reestablish into mature single-stemmed trees due to the resprouting nature of the tree, particularly under current land use conditions. While fire had influenced these communities for millennia, as the land was settled with homesteads and crops were established, fires were purposely prevented or stopped. Most of the remaining rangeland was overgrazed, which reduced fuel loads and hence effectively fire-proofed the plant communities from the effect of fires. This was a primary factor in the increase of woody species within the Central Basin.

While shrublands within MRLA 82 have traditionally been viewed as “degraded” relative to livestock production, it is important to recognize that they are not necessarily degraded from the ecological perspective of primary productivity, biomass accumulation, nutrient cycling, and biodiversity. The productivity of shrublands may be equal to or greater than that of the grassland they replaced. In addition, shrubs help modify soils and microclimate to increase levels of organic matter and nutrients in the upper soils horizons (Boutton et al. 2009, Boutton & Liao 2010). This nutrient enhancement by shrubs can offset grazing-induced losses of soil nutrients and contribute to enhance grass production when shrub cover is reduced. While shrub communities may have adverse impacts on grasses and grassland fauna, other plants and animals may benefit (Archer & Smeins 1991, Bestelmeyer et al. 2003). Thus, while ecosystem biodiversity certainly changes, it does not necessarily decrease with a shift from grass to woody dominance on these sites.

Soil and topographic variation interact with weather variation and land use to produce diverse plant communities across the Central Basin and on the Shallow Ridge Site. Accounts of earlier explorers and settlers suggest the Central Basin was likely a mosaic of grassland, savannah, and woodlands (Foster 1917). In the historic climax plant community, midgrasses dominated the shortgrasses due to their ability to capture the sunlight and shade as well as being favored by the frequent fires. Plant communities vary from open grassland to savannah/parkland to shrubland/woodland to nearly closed canopy forest. Almost all sites have a two or three-layered structure of over-story trees, mid-story shrubs and a ground layer of grasses and forbs.

Historical photographs suggest the nature of the vegetation structure depending on topography, soil properties, and time since the last major disturbances (such as drought or fire). However, the occurrence of extensive grasslands and grassland fauna (pronghorn, for example) is mentioned in numerous historical accounts.

Grasses that historically dominate Central Basin sites include little bluestem (*Schizachyrium scoparium*), sideoats grama (*Bouteloua curtipendula*), meadow dropseed (*Sporobolus compositus*), plains lovegrass (*Eragrostis intermedia*), plains bristlegrass (*Setaria vulpiseta*), Arizona cottontop (*Digitaria californica*), and sand dropseed (*Sporobolus cryptandrus*). Locally abundant tall grasses include Indiangrass (*Sorghastrum nutans*) and switchgrass (*Panicum virgatum*). Short grasses that occur in the understory of mid- and tallgrasses or on shallow soils or disturbed areas include buffalograss (*Bouteloua dactyloides*), common curly-mesquite (*Hilaria belangeri*), hairy grama (*Bouteloua hirsuta*), and red grama (*B. trifida*) (Whitehouse 1933, Riskind and Diamond 1988). The composition and productivity of grassland communities would have varied with annual rainfall, soil depth, and the extent of argillic horizon development.

Historically, overstory species composition consisted of post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), live oak (*Q. virginiana*), honey mesquite (*Prosopis glandulosa* var. glandulosa), Texas hickory (*Carya texana*), elm species (Ulmus spp.) and others. The shrub layer was potentially diverse with saplings of the tree layer along with whitebrush (*Aloysia gratissima*), lotebush (*Ziziphus obtusifolia*), algerita (Mahonia trifoliata), Texas persimmon (*Diospyros texana*), prickly pear cactus (Opuntia spp.) and others.

With the exception of Ashe juniper, all native woody species found in the Central Basin readily resprout following fire. This trait has frustrated managers and played an important role in driving sites towards the Shrubland State. High numbers of fire sprouting shrubs make shrubland communities very resilient.

An important aspect of this site is the relationship of mature hardwood trees to each of the communities. Mature hardwoods are very resilient and remain constant whether surrounded by reference community grasslands, degraded grasslands, native-dominated shrublands, or invasive-dominated shrublands. Their presence or absence is not driven by grazing management and generally only slightly by prescribed fire. They remain relatively stable over a short management period (5-10 years) unless removed by mechanical or chemical means. Throughout this ecological site, mature oaks can occur in any of the communities if they were not historically removed. They are most likely to occur in mottes and remain relatively constant regardless of what is occurring in the rest of the community, particularly in the understory. Communities will have an absence of hardwoods if the hardwoods were harvested, burned, chained, or sprayed at some point. Once the hardwoods are removed, it is not easy to return to the Savannah State due to the difficulty, expense, and time involved.

Hardwoods were frequently removed from this site during the European settlement period due to their high value for construction and firewood. Additionally, many examples exist where hardwoods were removed as part of a broad scale brush removal program. This was done with chaining, herbicides, rootplowing, and other general means.

Oak mottes on this site formed under different conditions than currently found. This may be due to climate shift or increased competition from aggressive shrub species. However, while reestablishment is slow, there are many examples of second-growth hardwood woodlands on this site. Hardwoods eventually reestablish when there is a lack of fire or tree clearing.

Infection of live oak by oak wilt (Ceratocystis fagacearum) has lead to the death of many individuals and mottes. An increase in tree density and the grafting of roots amongst individuals has facilitated the spread of the pathogen, which is transmitted primarily through root connections (Appel 1995).

Ashe juniper (*Juniperus ashei*), which is very abundant on the surrounding limestone derived soils of the Edwards Plateau, is relatively uncommon in the Central Basin, but it is found scattered across the Central Basin as infrequent individuals or mottes. Observation indicates that it has been increasing in population and extent within the Central Basin during the past two decades (Walter and Wyatt 1982). Juniper has the ability to take over large tracts of land as near monocultures, known as “cedar breaks.”

Even reference sites show the influence of introduced species. King Ranch bluestem (*Bothriochloa ischaemum*) has become almost ubiquitous, occurring on sites where it has not been seeded. It tends to replace little bluestem (*Schizachyrium scoparium*) and can function similarly in the community as far as structure, size and soil-holding capacity. However, King Ranch bluestem acts like an invader and moves to unoccupied areas.

The large ungulate fauna of the region prior to settlement consisted of bison (Bos bison), pronghorn antelope (Antilocarpa americana) and white-tailed deer (Odocoileus virginianus). Bison and pronghorn occasionally occurred in large numbers and may have intensively grazed the rangelands for short periods. However, they were largely migratory and free-roaming, so that when the forage became limited they moved on, often not to return for long periods. Their long-term impacts on the plant communities were considered to be relatively minor and may have had positive influences on production and diversity (Knapp et al. 1999, Fuhlendorf and Engle 2001).

While archeological evidence indicates that bison occurred in the region, there is also evidence of centuries of absence (Dillehay 1974). In addition, their numbers may have varied seasonally as herds migrated. When present, bison may have grazed certain areas heavily and then moved on. The infrequent but intense, short-duration grazing by these species suppressed woody species and invigorated herbaceous species (Eidson and Smeins 1999). After a burn, they would intensely graze the burn until no forages remained. Then, they moved off, probably not returning until the next fire cycle, which could have been five to ten years. This suggests heavy short-term grazing followed by long rest periods. Activities of other native herbivores (termites, cutter ants, soil nematodes, kangaroo rats) also influenced vegetation productivity and dynamics.

Currently, white-tailed deer are the primary native large herbivores. At settlement, large numbers of deer occurred, but as human populations increased (with unregulated harvest) their numbers declined substantially. Eventually, laws and restrictions on deer harvest were put in place which assisted in the recovery of the species. Females were not harvested for several decades following the implementation of hunting laws, which helped create population booms. In addition, suppression of fire favored woody plants which provided additional browse and cover for the deer. Due to their impacts on livestock production, large predators (red wolves (Canis rufus), mountain lions (Felis concolor), black bears (Ursus americanus) and eventually coyotes (Canis latrins)) were reduced in numbers or eliminated (Schmidly 2002).

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

Recent increased management of the deer herd, because of their economic importance through lease hunting, has decreased deer populations with the objectives of improving individual deer quality and improving habitat. High fences, controlled harvest based on numbers, sex ratios, condition, and monitoring of habitat quality have been effective in managing the deer herd on individual properties. However, across the Central Basin, excess numbers still exist which may lead to habitat degradation and significant die-offs during stress periods such as extended droughts.

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

Supplemental feeding of deer and exotics can also contribute to range degradation if it allows survival of excess numbers of animals.

Feral hogs have become well established within the Central Basin. Hogs use all of the ecological sites within MLRA 82. They cause considerable damage to soils and vegetation.

The faunal array of the Central Basin changed radically with the introduction of domestic species. Early on, wild mustangs released from early Spanish settlements roamed in large herds and had significant impacts on the vegetation. Later in the 19th century, cattle, sheep, goats, mules, and hogs were introduced. The pristine rangeland appeared to provide unlimited forage but as the ranges were fenced and overstocked they were degraded. Productivity of the rangeland began to decline, carrying capacity was reduced, and periodic die-offs of livestock occurred. Generally, the mid and taller grasses were replaced by short grasses and perennial grasses, and forbs were replaced by annuals. These changes not only reduced production but also in many instances caused permanent alteration of the ecological sites due to soil erosion, organic matter loss, compaction, moisture regime change, and other factors which altered many soil and hydrologic processes. This often precluded their recovery to pre-European conditions (Smith 1899, Smeins, Fuhlendorf and Taylor 1997). Not only did livestock overgraze the forage, but they also contributed to seed dispersal of some woody plants, particularly honey mesquite, which exacerbated its increase on the rangelands.

Historical accounts prior to the 1800s also identify grazing by herds of wild horses, followed by heavy grazing by sheep and cattle as settlement progressed. Grazing on early ranches changed natural graze-rest cycles to continuous grazing and stocking rates exceeded the carrying capacity. By the early 1800s cattle, sheep, and goat numbers appear to have been quite high in the Central Basin, resulting in heavy, year-round grazing (Lehman

1969). Sheep numbers peaked at 10.8 million head in 1943 and stood at about 1.2 million in 2000. Goat numbers in Texas around 1900 were around 100,000. They peaked in 1965 at 4.6 million and were 345,000 in 2000 (Texas Online). The Central Basin and Edwards Plateau region, because of its climate and diverse vegetation, was the mainstay of the Texas sheep and goat industry.

Today, beef cattle and horses are the primary grazers in the area. Goats used primarily for meat production are locally important, and their numbers have increased. Sheep remain a minor but still important part of livestock grazing in the Central Basin. White-tailed deer, wild turkey, bobwhite quail, and doves are major commercial wildlife species, and hunting leases are a major source of income for many landowners. While the Central Basin ecological sites have changed in many ways since settlement, opportunities exist to produce products and provide income while conserving and sustaining the long-term stability and productivity of the area.

Homesteads and communities developed along with ranching, and many ecological sites within MLRA 82 were converted to cropland for wheat (Triticum spp.), oats (Avena spp.), forage, and peanuts (*Arachis hypogaea*), and other products needed for local consumption or for cash crops. This conversion effectively eliminated the native plant communities due to land clearing and the harvest of larger trees, used for building construction among other uses.

Over time, as many of the croplands became degraded, and along with the rangeland that had been overused, introduced forages were brought in to assist with soil and water conservation and to increase productivity. Coastal bermudagrass (*Cynodon dactylon*), Kleingrass (*Panicum coloratum*), Wilman lovegrass (*Eragrostis superba*) and King Ranch bluestem were widely planted on many acres of old cropland and in areas with deeper soils. The latter, while effective as a soil stabilizer, has become invasive in many areas where it is unwanted and is difficult to control.

In the 1940s, mechanical and herbicide treatments began to replace fire as a control of increasing density of woody plants on the rangeland. This activity was common practice for several decades until the 1980s, when these treatments became less cost-effective. It was clear that brush management practices were treating symptoms rather than underlying problems in addition to their undesirable environmental and wildlife consequences. Sites cleared of brush regenerated rapidly and often formed thickets that were denser and of lower diversity than the original stands. This realization coupled with the fact that brush management treatments were typically expensive and short-lived, lead to the development of Integrated Brush Management Systems (Scifres et al. 1985). This approach takes a holistic, large-scale, long-term, socioeconomic, ecosystem-based approach to brush management and recognizes multiple-use options for rangeland resources including alternate classes of livestock, lease hunting, exotic game ranching, carbon credits and ecotourism.

Grazing and fire are two factors that critically influence the relative abundance of grasses and woody plants through time. The resulting reduction in abundance of late seral grasses lead to a decline in soil organic matter, a reduction in fire frequency/intensity (due to lack of fine fuels), and a shift in dominance from midgrasses (little bluestem and sideoats grama) to shortgrasses (hooded windmillgrass (*Chloris cucullata*) and buffalograss) and forbs (Mexican sagewort (*Artemisia ludoviciana* ssp. mexicana) and croton (Croton spp.)). These changes would have favored woody plants, most of which are unpalatable to livestock, and enabled them to establish and maintain dominance.

Mesquite, whitebrush, juniper, lotebush, algerita, persimmon, prickly pear, and lime pricklyash (Zanthoxylum fagar) now dominate much of the Central Basin. These woody plants are not ‘new arrivals’ but rather, are native to the region and have increased in size and abundance within their historic ranges. Factors promoting their increase in abundance since European settlement are the subject of active debate. Such factors may involve an interactive combination of changes in climate, intensification of grazing; follow up brush management and reductions in fire frequency/intensity accompanied by increases in atmospheric CO2 concentrations and nitrogen deposition since the industrial revolution (Archer 1994).

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 (ESDs).

State and Transition Model:
A State and Transition Model for the Shallow Ridge Ecological Site (R082AY576TX) is depicted in Figure 1. Thorough descriptions of each state, transition, plant community, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely

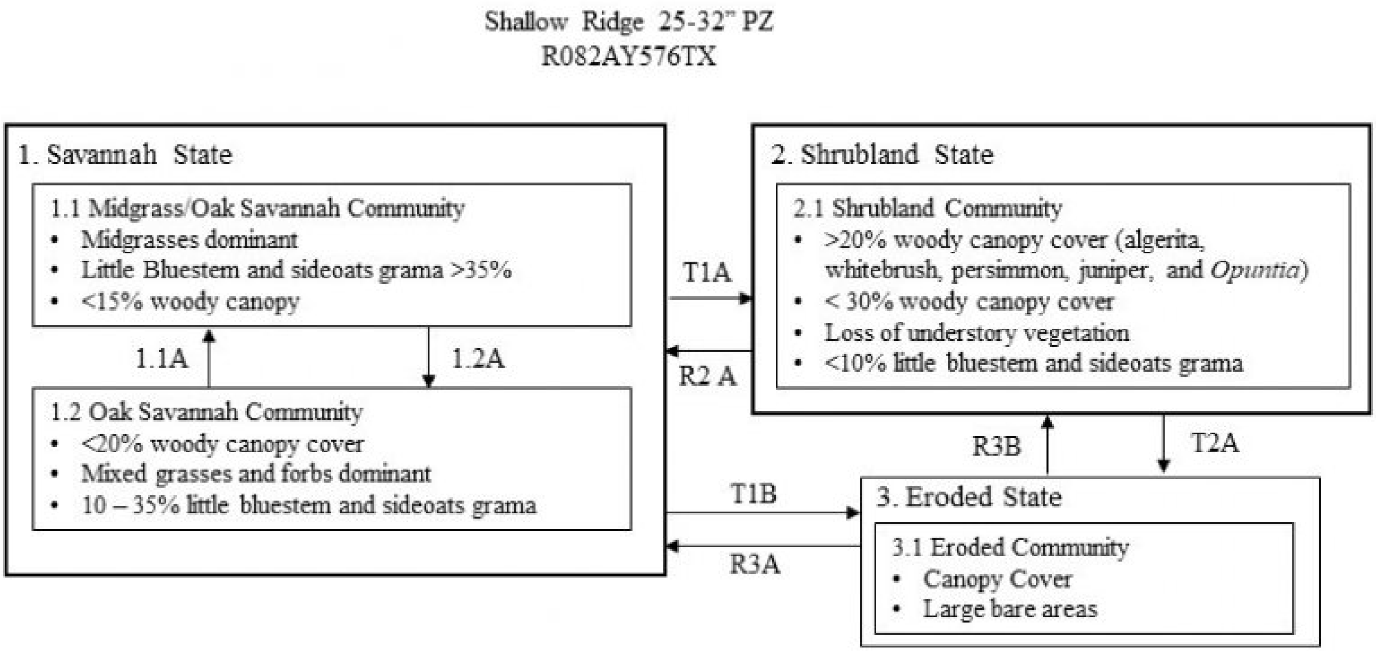
to change as knowledge increases.

Plant communities will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The Savannah State is the reference state for this site. It is not necessarily the management goal but can be. Other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category. The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent canopy cover are 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 communities and states because of the influence of shade and interception of rainfall. Species composition by dry weight is used for describing the herbaceous community and the community as a whole. Woody species are included in species composition for the site. Calculating similarity index requires the use of species composition by dry weight.

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

State and transition model



Legend

1.1A	Improper Grazing Management, Lack of Fire, Lack of Brush Control, Long-Term Drought
1.2A	Proper Grazing Management, Fire (Natural or Prescribed), Brush Management
T1A	Improper Grazing Management, Lack of Fire and Brush Management
T1B	Improper Grazing Management, Long-Term Drought, Loss of Soil
T2A	Improper Grazing Management, Long-Term Drought, Loss of Soil
R2A	Brush Management, Prescribed Burning, Proper Grazing Management
*R3A	Range Restoration (see narrative for R3A)
*R3B	Range Seeding, No Fire, No Brush Management (see narrative for R3B)

State 1

Savannah State

The Savannah State consists of two plant communities: the Midgrass/Oak Savannah Community (1.1) and the Oak Savannah Community (1.2). The Midgrass/Oak Savannah Community occurred on this ecological site in a dynamically shifting mosaic over time with the Oak Savannah Community. The two communities in the Savannah State shifted between one another depending on the frequency and intensity of grazing, drought, and other growing season stresses. Unlike most other Central Basin sites, the woody component is relatively constant and not driven by fire. The understory has large gaps and limited production so that it does not provide continuous fine fuels. Without continuous fine fuels, fires rarely burn hot enough to reduce the canopy cover of single-stemmed mature trees and shrubs. Fire has some influence on this site but mainly along the "seams" where the fine fuels are found. Grazing management can drive the shift between the two communities in the Savannah State. Prior to settlement, Shallow Ridge sites had a savannah appearance with open areas dominated by mid grasses (little bluestem and sideoats grama) interspersed with scattered mottes dominated by oaks. The Midgrass/Oak Savannah (1.1) may have up to 15 percent canopy cover while the Oak Savannah (1.2) will have up to 20 percent woody canopy. This transition to the Oak Savannah Community (1.2) is dependent on the degradation of the herbaceous community. With proper grazing and favorable climate conditions, little bluestem and other midgrasses will remain the dominant component of the understory.

Dominant plant species

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

Community 1.1
Midgrass/Oak Savannah Community

Figure 9. 1.1 Midgrass/Oak Savannah Community

Figure 10. 1.1 Midgrass/Oak Savannah Community (1)

Figure 11. 1.1 Midgrass/Oak Savannah Community (2)

The Midgrass/Oak Savannah Community (1.1), or reference community, is a savannah characterized by expanses of grassland dominated by little bluestem and sideoats grama interspersed with oak-dominated mottes. Another characteristic of this site are outcrops of lichen-covered soils and occasional large bare granite outcrops. The woody component of this site is relatively fire-resistant since this site is generally ill-suited to carry a hot fire. Woody canopy can be dense in the oak mottes, but overall the site has up to 15 percent woody canopy cover. The Midgrass/Oak Savannah Community requires fire and/or brush control to maintain the savannah appearance with woody species cover below 15 percent. Examples of the site within the Central Basin that have remained in this community have been maintained with a combination of fire and goat grazing. Little bluestem, sideoats grama, plains bristlegrass (*Setaria vulpiseta*), yellow Indiangrass, purpletop, and to a lesser extent, big bluestem (*Andropogon gerardii*) dominate the herbaceous component of the site. Forbs found on the site include Mexican sagewort (*Artemisia ludoviciana* ssp. mexicana), bundleflower (Desmanthus spp.), sensitive briar (Mimosa spp.), and western ragweed (*Ambrosia psilostachya*) among others. Shrub and tree species found in the Midgrass/Oak Savannah Community include pricklypear (Opuntia spp.), honey mesquite (*Prosopis glandulosa*), whitebrush (*Aloysia gratissima*), species of oaks (Quercus spp.), pecan or hickory (Carya spp.), and elm (Ulmus spp.). Shrubs increase in the open areas of the savannah and in the understory of the mottes. This pressure to move towards a woodland or shrubland community if further increased when aggressive, invasive shrubs become a part of the community.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1230	1530	1835
Forb	65	85	100
Tree	55	65	80
Shrub/Vine	15	20	25
Total	**1365**	**1700**	**2040**

Figure 13. Plant community growth curve (percent production by month). TX4410, Mid/Tallgrass Oak Savannah with <5% Woody Canopy. Mid and tallgrasses with oak savannah having less than 5% woody canopy cover..

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

Community 1.2
Oak Savannah Community

Figure 14. 1.2 Oak Savannah Community

Figure 15. 1.2 Oak Savannah Community (2)

The Oak Savannah Community (1.2) typically results from short-term improper livestock grazing management and lack of fire over a long period and may be exacerbated by drought or other growing season stresses. Growing-season stress from overgrazing and/or long-term continuous grazing at high stocking levels causes the reduction in vigor and in the survival of the dominant palatable midgrass (little bluestem). Less palatable grasses and forbs increase in the herbaceous community. This shift is indicated when little bluestem falls below 35 percent species composition. Drought can interact with grazing to accelerate this shift. Heavy continuous grazing will also reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Litter and mulch will move off-site as plant cover declines. This community shows a reduction of the dominant grasses, but the remaining individuals have the potential to regain vigor and increase in size and number under favorable conditions. Once the key species fall below 10 percent of species composition, it is unlikely that they have sufficient reproductive capability (seed source, tillering, or resprouting) to recover dominance in a reasonable time frame without extra energy being added to the system. The Oak Savannah Community (1.2) retains the potential to shift back to the Midgrass/Oak Savannah Community (1.1). Yet, the Oak Savannah Community (1.2) is “at risk” to cross the threshold to the Shrubland State (2.0). The difference between the shift between communities within the same state and a transition to another state is that the community shift can occur with a change in management. Once a threshold has been crossed to a new state, a change in management that changes or removes the factor that caused the decline will not be enough to drive the community back across the threshold to the previous state. Dominant grasses in this community are sideoats grama, plains lovegrass, and silver bluestem (*Bothriochloa laguroides* ssp. Torreyana). King Ranch bluestem occurs on many examples of this site, even in areas where it was not seeded. The woody component will include the same hardwoods from the Midgrass/Oak Savannah Community (1.1). Other shrub species in this community may include lotebush, algerita, pricklyash, persimmon, mesquite, and prickly pear.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	670	840	1010
Shrub/Vine	135	170	200
Forb	95	120	145
Tree	60	70	85
Total	**960**	**1200**	**1440**

Figure 17. Plant community growth curve (percent production by month). TX4412, Shortgrass/Mixed-brush Community. Shortgrass dominant with mixed-brush species..

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 Community

Oak Savannah Community

The driver for community shift 1.1A is improper grazing management and lack of fire and/or brush control to maintain the woody component as mottes of mature oak and other hardwoods. Midgrasses and tallgrasses decline as the understory is degraded, and shortgrasses dominate. Native woody species canopy up to 20 percent indicates a shift to the Oak Savannah Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Oak Savannah Community

Midgrass/Oak Savannah Community

Proper grazing management (and to a lesser extent, fire) drive community shift 1.2A. The shift from Oak Savannah Community (1.2) can return to the Midgrass/Oak Savannah Community (1.1) with proper grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. When little bluestem makes up 10 to 35 percent of species composition, proper grazing management and prescribed fire can create relatively rapid (5-10 year) shifts in the herbaceous component. Little bluestem responds particularly well to dormant season grazing and periodic fires. It needs disturbance to prevent it from becoming decadent.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shrubland State

This state contains a single community, the Shrubland Community (2.1). The Shrubland State (2.0) is characterized by a shortgrass-dominated understory with scattered trees and shrubs. Bare ground, erosion, and water flow patterns will increase as the understory is degraded. Forage production will decline. The hardwoods that made up a portion of the plant community in the Savannah State will likely be present in the Shrubland State unless they were removed by brush control. The transition to the Shrubland State will probably not cause an increase in the number or biomass production of hardwoods. However, because the production of herbaceous species will decline, the relative species composition of shrubs and trees will increase. If the hardwoods were removed, they will be slow to reestablish. They are more likely to reestablish as shrubs, rather than trees. Trees and shrubs remain a part of the community, but woody species composition may vary greatly. The woody component may be similar to the woody component in the Midgrass/Oak Savannah community (1.1). Mature oaks occur in mottes with scattered brush, though the woody component is more frequently made up of many species of widely scattered shrubs.

Dominant plant species

- oak (*Quercus*), tree
- juniper (*Juniperus*), tree
- Texas persimmon (*Diospyros texana*), shrub
- whitebrush (*Aloysia gratissima*), shrub

Community 2.1
Shrubland Community

Figure 18. 2.1 Shrubland Community (1)

Figure 19. 2.1 Shrubland Community (2)

The Shrubland Community is characterized by a degraded understory, frequently with a shrub component having woody canopy cover greater than 25 percent. The community loses its savannah appearance with native shrubs beginning to fill the open grassland portion of the savannah. Shade from overstory is a driving factor. Production of the overstory canopy has increased by a similar amount to the decrease in herbaceous production. Unpalatable woody species have increased in size and density. This community results from the lack of effective brush control and improper livestock grazing management over a long period. One factor that creates overgrazing is the failure to adjust the stocking rate downward as woody cover increases (loss of grazeable acres). Increased woody cover results in less forage being available. Unless stocking rates are reduced, the stocking pressure on the remaining forage increases, which increases the likelihood of palatable plants being overgrazed, losing vigor, and being grazed out of the community. At the same time, less palatable plants gain a comparative advantage and increase their representation in species composition. The Shrubland Community supports a lower diversity of uses than the Midgrass/Oak Savannah Community (1.1) it replaces. Native forbs occur at a low frequency so that grazing management alone will not allow these species to reestablish as the dominant herbaceous species. Generally, the shrubs preclude the establishment of remnant reference community plants. In this plant community, annual production is dominated by woody species. Goats and deer can find fair food value if browse plants have not been grazed excessively. Forage quantity and quality for cattle is low. Grazeable acreage is only 30 to 50 percent of the total area. The Shrubland Community typically has multiple shrub species: Texas persimmon, mesquite, whitebrush, catclaw, yucca, and/or juniper. Heavy continuous grazing will cause midgrasses to give way to shortgrasses such as hairy grama. Texas wintergrass, three-awns, and annual grasses and forbs increase in relative abundance. Unpalatable invaders may occupy the interspaces between trees and shrubs. With continued grazing, this community will become dominated by red grama, hairy grama, three-awns, hairy tridens (*Erioneuron pilosum*), slim tridens (*Tridens muticus*), and annual forbs. Drought interacts with grazing to trigger midgrass to shortgrass transitions. Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Litter and mulch will move off-site as plant cover declines. Without brush control, the woody canopy may increase until canopy cover approaches 50 percent. The Shrubland Community (2.1) typically produces much less forage than the communities in the Savannah State (1.0). Total production can be highly variable. If soil structure, chemistry, and fertility remain intact, total production may be similar to that of the Midgrass/Oak Savannah Community (1.1). Most of the production will come from trees and shrubs (about 75 percent of species composition). The shift to the Shrubland Community (1.2) is often associated with soil degradation. Once soil degradation occurs, the site's ability to produce biomass declines. The Annual Production table below reflects production on degraded soils. Because improper grazing management causes reductions in root production and rooting depth, aboveground production becomes more erratic and more dependent on rainfall as plants are less effective at accessing stored soil water. Reductions in aboveground cover and root biomass make this community more prone to runoff and erosion. Reduction in ground cover leads to higher soil temperatures that, in conjunction with a reduction in leaf and root biomass inputs, cause declines in soil organic matter. This reduces soil water holding capacity and fertility that create feedback to further affect species composition and production. Woody plants may not increase in size or density but will increase in relative species composition due to the decline in production of the herbaceous component.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	320	400	480
Grass/Grasslike	240	300	360
Forb	160	200	240
Tree	80	100	120
Total	**800**	**1000**	**1200**

Figure 21. Plant community growth curve (percent production by month). TX4416, Shrubland Community, 30+% Woody Canopy. Shrubs dominate the site with heavy continuous grazing and no brush management. Woody canopy exceeds 30%. Grasses are in further decline..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	5	10	18	15	5	9	15	9	5	5

State 3
Eroded State

This state includes a single community, the Eroded Community (3.1), which is characterized by significant soil loss. The Eroded Community is currently the most common community on Shallow Ridge sites. Unless managers practice effective, ongoing grazing management this community will remain. Because of the availability of invasives with low palatability, this site rarely stays barren. There are examples that are degraded but not dominated by brush but these examples tend to be quickly reinvaded by annual forbs and grasses as well as low-palatability shrubs. Much of this site has been disturbed to the point that significant soil loss has occurred. Once the A Horizon is eroded (partially or completely), nutrient cycling is disrupted and difficult to restore. Loss of soil is accompanied by disruption (or loss) of soil mycorrhiza. Steeper portions of this site are subject to severe erosion when the plant cover is disturbed. Some examples of the site have eroded to the granite bedrock. The Eroded State has the potential to be a terminal state. Due to the relatively high risk of severe soil erosion of the sandy loam soils, this site can erode to the point where there is a loss of soil functionality. When this level of erosion occurs, the site loses soil structure, soil fertility, organic matter, and/or soil microflora. There are examples of the loss of the A and B horizons and some with the soil eroded to bedrock. Once the site loses soil horizons or soil functions, it is very difficult or impossible to return the site to one of the other States, resulting in State 3 being a terminal state. Return to another state will be the result of site restoration efforts, not typical management changes.

Community 3.1
Eroded Community

Figure 22. 3.1 Eroded Community

Figure 23. 3.1 Eroded Community (2)

The Eroded Community (3.1) is characterized by a variety of shrubs and a small component of the herbaceous community with few palatable perennial grass species present. The shrubs may be dense in areas where shrubs can find adequate moisture in the eroded soils. This community occurs where a significant loss of soil depth, function, or fertility has occurred. Due to their aggressive nature, invasive shrubs, grasses, and forbs reestablish relatively quickly following disturbance if there is adequate soil left. This community is frequently associated with significant soil erosion and/or disturbance. Erosion creates a loss of soil structure and fertility and in severe conditions may expose bedrock. Soils may erode to the point that they can no longer be managed back to any of the other states.

Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	160	200	240
Grass/Grasslike	130	160	190
Shrub/Vine	30	40	50
Tree	0	0	0
Total	**320**	**400**	**480**

Figure 25. Plant community growth curve (percent production by month). TX4418, Eroded Community. Eroded Community with <15% herbaceous canopy cover..

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

Transition T1A
State 1 to 2

The drivers for Transition T1A are improper grazing management and lack of fire or brush control. The understory is dominated by shortgrasses, unpalatable grasses and forbs, and annual grasses and forbs. This transition is indicated by the decrease of dominant reference state midgrasses (little bluestem and sideoats grama) to less than 10 percent of species composition of the herbaceous community. Once these species are lost from the community or present only in trace amounts, grazing management alone usually cannot cause a transition to the reference state. Evidence from sites with long-term growing season deferment (30+ years) shows that recovery is possible back across this threshold unless erosion has removed the soil horizons or function. Regardless of the composition and vigor of the herbaceous component, this community will shift to the Shrubland State without effective brush control. Without adequate brush control, it will shift to the Shrubland Community in a relatively short time (5-15 years). The open areas of the savannah will have shrubs sprout every year. As these plants mature, they will fill in the open areas. Once canopy cover of woody species reaches 20 percent, the site has shifted to the Shrubland Community. This shift can occur even with proper grazing management and if the herbaceous component remains vigorous. Brown and Archer (1999) concluded that even with a healthy and dense stand of grasses, woody species would populate the site and eventually dominate the community. As the herbaceous understory is degraded to shortgrasses, fine fuel load declines, reducing the ability to carry a brush-killing fire. This increases the risk that the site will transition to the Shrubland State (2.0)

Transition T1B
State 1 to 3

Abusive grazing or other soil-disturbing activities including rock harvest can cause severe soil degradation. In some cases, this erosion can be extreme enough to result in the loss of the entire soil layer. Long-term drought may trigger this transition from the Savannah State (1.0) or exacerbate the effects of inappropriate grazing management on the Shallow Ridge site. When the Shallow Ridge site is subjected to inappropriate management, the effects may be seen in a loss of vegetative cover followed by a loss of soil. Soil Erosion can be extreme enough to result in the loss of the A (and even B) horizons. Severe soil degradation can be caused by abusive grazing, mismanaged brush control, or other soil-disturbing activities including rock harvest or gravel mining. This loss of soil accompanies the loss of the vegetative cover associated with this site. If soil erosion is severe enough, the return to a previous state may not be possible.

Restoration pathway R2A
State 2 to 1

The driver for Restoration Pathway R2A is fire and/or brush control combined with the restoration of the herbaceous community. Establishment of native grasses is difficult and dependent upon natural seeding from remnant patches and seed banks. This site is often too shallow for effective reseeding. A long-term prescribed fire program may sufficiently reduce brush density to a level below the threshold of the Savannah State (1.0). Proper grazing management and stocking rates maintain the herbaceous layer in this state. With proper grazing management, midgrasses can regain dominance on the site and undesirable trends in soil organic matter, fertility, temperature, and erosion can be arrested and reversed. The extent to which the original Midgrass/Oak Savannah Community (1.1) can be re-established will depend on the extent to which soil physical and chemical properties were altered during retrogression (Heitschmidt and Stuth 1991).

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

Transition T2A
State 2 to 3

The driver for this transition is abusive management. The effects may be seen in a loss of vegetative cover followed by a loss of soil. In some cases, this erosion can be extreme enough to result in the loss of the A (and even B) horizons. Abusive grazing or other soil-disturbing activities including rock harvest can cause severe soil degradation. This loss of soil results in or accompanies the loss of the vegetative cover associated with this site. Long-term drought may also trigger this transition from the Shrubland State (2.0) or exacerbate the effects of inappropriate grazing management on the Shallow Ridge site.

Restoration pathway R3A
State 3 to 1

*The likelihood of returning to the Savannah State (1.0) is improbable, and restoration would require extensive and intensive restoration efforts. Range restoration techniques can be used to restore this site on high-value lands (such as mining reclamation). This will likely require replacement of topsoil and planting of native species, though the site is often too shallow for effective reseeding. A return to reference condition should not be expected, and savannah conditions are only possible with continued inputs and management over a long period of time.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T3A
State 3 to 2

The Eroded State is frequently a terminal state unless range restoration processes are put in place. Restorations to the Shrubland State (2.0) are uncommon when there has been a pronounced degradation of soil chemistry and structure and a severe decline of native plant communities. Without prescribed fire or brush management, woody species may repopulate and eventually dominate the site.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-season Midgrasses**			1090–1630	
	little bluestem	SCSC	*Schizachyrium scoparium*	345–980	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	300–700	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	200–500	–
	Indiangrass	SONU2	*Sorghastrum nutans*	120–240	–
	big bluestem	ANGE	*Andropogon gerardii*	120–240	–
	green sprangletop	LEDU	*Leptochloa dubia*	75–200	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	100–200	–
	purpletop tridens	TRFL2	*Tridens flavus*	60–120	–
	vine mesquite	PAOB	*Panicum obtusum*	60–120	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	60–120	–
	Arizona cottontop	DICA8	*Digitaria californica*	60–120	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	60–120	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	60–120	–
	composite dropseed	SPCO16	*Sporobolus compositus*	60–120	–
2	**Warm-season Shortgrasses**			70–100	
	threeawn	ARIST	*Aristida*	70–100	–
	buffalograss	BODA2	*Bouteloua dactyloides*	70–100	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	70–100	–
	red grama	BOTR2	*Bouteloua trifida*	70–100	–
	hooded windmill grass	CHCU2	*Chloris cucullata*	70–100	–
	fall witchgrass	DICO6	*Digitaria cognata*	70–100	–
	curly-mesquite	HIBE	*Hilaria belangeri*	70–100	–
	Hall's panicgrass	PAHA	*Panicum hallii*	70–100	–
3	**Cool-season grasses**			40–60	
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	40–60	–
	Canada wildrye	ELCA4	*Elymus canadensis*	40–60	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	40–60	–
4	**Grasslikes**			30–45	
	sedge	CAREX	*Carex*	30–45	–
Forb					
5	**Forbs**			65–100	
	Forb, annual	2FA	*Forb, annual*	65–100	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	65–100	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	65–100	–
	croton	CROTO	*Croton*	65–100	–
	bundleflower	DESMA	*Desmanthus*	65–100	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	65–100	–
	dotted blazing star	LIPU	*Liatris punctata*	65–100	–

	sensitive plant	MIMOS	*Mimosa*	65–100	–
Shrub/Vine					
6	**Shrubs**			15–20	
	whitebrush	ALGR2	*Aloysia gratissima*	15–20	–
	Texas persimmon	DITE3	*Diospyros texana*	15–20	–
	Texas kidneywood	EYTE	*Eysenhardtia texana*	15–20	–
	algerita	MATR3	*Mahonia trifoliolata*	15–20	–
	pricklypear	OPUNT	*Opuntia*	15–20	–
	mesquite	PROSO	*Prosopis*	15–20	–
	skunkbush sumac	RHTR	*Rhus trilobata*	15–20	–
	sumac	RHUS	*Rhus*	15–20	–
	blackberry	RUBUS	*Rubus*	15–20	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	15–20	–
	gum bully	SILAL3	*Sideroxylon lanuginosum ssp. lanuginosum*	15–20	–
Tree					
7	**Trees**			55–80	
	pecan	CAIL2	*Carya illinoinensis*	55–80	–
	hybrid hickory	CARYA	*Carya*	55–80	–
	blackjack oak	QUMA3	*Quercus marilandica*	55–80	–
	post oak	QUST	*Quercus stellata*	55–80	–
	live oak	QUVI	*Quercus virginiana*	55–80	–
	elm	ULMUS	*Ulmus*	55–80	–

Animal community

The Shallow Ridge site provides at least a portion of the habitat for many species of reptiles, birds, mammals, and insects. Game birds, songbirds, and birds of prey were indigenous or frequent users, and most are still plentiful. Quail and doves frequent this site depending upon the vegetative community. Small mammals that use the site include armadillos, opossum, raccoons, rodents, jackrabbits, cottontail rabbits, and skunks. Its use by deer is limited by browse and cover in climax condition. As ecological condition declines and woody plants increase and invade, it becomes more habitable for deer. Deer prefer many of the forbs and legumes that grow on the site.

Feral hogs (Sus scrofa) can be found on most Ecological Sites in Texas. Damage is caused by feral hogs each year including, crop damage by rutting up crops, destroyed fences, livestock watering areas, and predation on native wildlife, domestic livestock (small calves, goats, and sheep) and ground-nesting birds. Feral hogs have no natural predators other than humans, thus allowing their population to grow to high numbers (Cearley 2009 & Mapston 2004). Feral hogs have naturalized to rangelands across the state.

Predators including bobcats, coyotes, foxes, and mountain lions can also be found on the site.

The site is suitable for the production of livestock, including cattle, sheep and goats. IN reference condition, the site is very suited to primary grass eaters such as cattle. As retrogression occurs and woody plants invade, the Oak Savannah (1.2) and Shrubland (2.1) plant communities become good habitat for sheep, goats, deer and other wildlife because of the desirable browse and cool season grasses. Cattle, sheep and goats should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. Deer populations must also be kept within limits of the habitat sustainability even if the site is managed exclusively for deer. If the animal numbers are not kept in balance with herbage and browse production through prescribed grazing management and good wildlife population management, the Shrubland Community (2.2) will have little to offer as habitat except cover.

Plant Preference by Animal Kind:
This rating system provides general guidance as to animal forage preference for plant species. It also indicates possible competition between kinds of herbivores for various plants. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. Grazing preference does not necessarily reflect the ecological status of the plant within the plant community. For wildlife, plant preferences for food, and plant suitability for cover are rated. Refer to habitat guides for a more complete description of a species habitat needs.

Legend: P=Preferred D=Desirable U=Undesirable N=Not Consumed T=Toxic X=Used, but not degree of utilization unknown
Preferred – Percentage of plant in animal diet is greater than it occurs on the land
Desirable – Percentage of plant in animal diet is similar to the percentage composition on the land
Undesirable – Percentage of plant in animal diet is less than it occurs on the land
Not Consumed – Plant would not be eaten under normal conditions. It is only consumed when other forages not available. This can also include plants that are unavailable during parts of the year.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal (Hart, 2003). (Note: many plants can be good forage but toxic at certain doses or at certain times of the year. Animals in poor condition are most susceptible.)

Hydrological functions

Shallow Ridge sites tend to be well vegetated with high levels of herbaceous and woody canopy cover and low level of bare ground in all communities. Therefore, most examples are functioning hydrologically. Abusive management can create bare soils (particularly in the case of mismanaged brush control or abandoned farming). Bare soils are subject to erosion. Once the organic layer erodes in the A horizon, soils function less well hydrologically and the risk of further erosion increases.

Soils on this site are well drained and water movement to underground layers is moderately high. Well-drained soils make almost 100 percent of soil water available to plants. However, sandy soils drain quickly and have soil moisture available for less of the growing season.

Sandy loam soils have a high risk of erosion (less than sandy soils but more than most other soil textures). The Shallow Ridge site can have severe erosion when left bare. There is a risk when treating brush or disturbing soils on steeper slopes found on this site.

The Midgrass/Oak Savannah (1.1) tends to retain a highly functioning water cycle. As long as the understory remains intact, bare ground remains very low. Infiltration will be high and runoff low.

If bare ground stays low, the water cycle is expected to function similarly to the Midgrass/Oak Savannah Community (1.1). Domination of the site by woody species may degrade the water cycle in the Shrubland Community (2.2). Interception of rainfall by woody canopy increases, which reduces the amount of rainfall reaching the surface and being available to herbaceous plants. Increased stem flow, due to the funneling effect of the canopy, will increase soil moisture at the base of trees, especially on mesquite. Evergreen species, such as live oak, create increased transpiration, which provides less water for deep percolation. Increases in woody canopy create declines in grass cover, which creates similar causes impacts as those described for overgrazing above. Under the dense canopy of the shrubland, leaf litter builds up. This increases soil organic matter, builds structure, improves infiltration, and reduces surface erosion. These conditions improve the function of the water cycle compared to lower levels of canopy cover.

A shift to the Eroded State (3.0) may reduce canopy cover and increase bare ground. The loss of soil creates conditions (low cover, poor soil structure) that increase the risk of the remaining soil eroding. If bare ground increases, infiltration will decrease and runoff will increase due to reduced ground cover, rainfall splash, soil capping, reduced organic matter, and poor structure. With a combination of a sparse ground cover and intensive rainfall, this site can contribute to an increased frequency and severity of flooding within a watershed.

Recreational uses

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

Wood products

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

Other products

Jams and jellies are made from many fruit-bearing species, such as algerita. 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 and whitebrush.

Inventory data references

Information presented was derived from the site’s previous Range Site Description, NRCS clipping data, literature, field observations, and personal contacts with range-trained personnel.☆

Other references

Reviewers:
Joe Franklin, ZRMS, NRCS, San Angelo, Texas
Kent Ferguson, StRMS, NRCS, Temple, Texas
Justin Clary, RMS, NRCS, Temple, Texas
Mark Moseley, ESI Specialist, NRCS, Boerne, Texas

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Contributors

Herb Senne, State RMS, NRCS, Temple, TX
Jack Alexander, Kimberly Haile, Synergy Resource Solutions, Inc., Dr. Fred Smeins, Texas A&M University. (Phase 1)
Mark Moseley
Edits by Travis Waiser, MLRA Leader, NRCS, Kerrville, TX

Approval

Bryan Christensen, 9/19/2023

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.

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)	Synergy Resource Solutions, Belgrade, Montana
Contact for lead author	Zone Rangeland Management Specialist, NRCS, San Angelo, Texas 325-944-0147
Date	04/06/2011
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** None, except following extremely high intensity storms when short flow patterns may

appear.

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 5 percent bare ground. Very small (<1 square foot) and non-connected areas.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Very little litter movement under normal rainfall intensity. Litter is well distributed and stays in place beneath plant canopies.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is very stable (average soil stability values of > 5).

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-17 inches thick. Clay loam, Fine Sandy Loam, Sandy Clay loam. Brown. Weak fine subangler blocky structure. SOM 0-3%

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High canopy, basal cover and density with small interspaces should make rainfall impact negligible. This site has well drained soils, deep with level to gently sloping (0 to 3 percent slopes) which produces negligible runoff and erosion.

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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 midgrasses >

    Sub-dominant: Warm-season shortgrasses >

    Other: Cool-season grasses > Forbs > Shrubs > Trees > Warm-season Tallgrasses

    Additional: Forbs make up to 5 percent of species composition, shrubs and trees compose up to 5 percent species composition.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses due to their growth habit will exhibit some mortality and decadence, though very slight. Little mortality evident on woody species.

14. **Average percent litter cover (%) and depth (in):** Tree leaf litter may be up to six inches deep.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Representative Value for annual production = 1700 lbs/acre

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

17. **Perennial plant reproductive capability:** All species should be capable of reproducing except for periods of prolonged drought conditions, heavy natural herbivory, and fires.