Ecological site R078BY089TX
Shallow
19-26" PZ

Last updated: 9/15/2023
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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.

MLRA notes

Major Land Resource Area (MLRA): 078B–Central Rolling Red Plains, Western Part

MLRA 78B is characterized by strongly dissected, rolling plains with prominent ridges and valleys and rolling to steep irregular topography. Loamy soils are generally well drained, range from shallow to deep, and developed in sediments of Triassic and Permian age.

LRU notes

NA

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 shallow loam soils on uplands. The reference vegetation includes midgrasses with forbs and few woody species. Abusive grazing practices can lead to a shift in the plant community. Without periodic fire or alternative brush management, woody species may increase on the site.

Associated sites

R078BY071TX	**Clay Flat 19-26" PZ** The Clay Flat site may be adjacent.
R078BY072TX	**Clay Loam 19-26" PZ** The Clay Loam site is often down slope.
R078BY091TX	**Very Shallow 19-26" PZ** The Very Shallow site is often adjacent to the site.

Similar sites

R078BY091TX	**Very Shallow 19-26" PZ** The Very Shallow site is similar in that both are located on similar topography.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bouteloua curtipendula* (2) *Bothriochloa barbinodis*

Physiographic features

These soils are on two sets of landforms on this rolling plains landscape. Shallow soils with petrocalcic horizons are primarily on depositional landforms, including nearly level to gently sloping alluvial fans, broad plains, and high stream terraces. Shallow soils with sandstone bedrock are primarily on erosional landforms, including erosional remnants, ridges, knolls, and escarpments. Slopes range from 0 to 5 percent. Elevation ranges from 1000 to 2800 feet.

Landforms: Alluvial fan, broad plain, high stream terrace for soils with petrocalcic horizon. Erosional remnant, ridge, knoll, escarpment for soils with sandstone bedrock.

Table 2. Representative physiographic features

Landforms	(1) Plains > Ridge (2) Plains > Terrace
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	310 – 850 m
Slope	0 – 50 %
Aspect	Aspect is not a significant factor

Climatic features

The climate of the western rolling plains is dry, sub-humid with hot summers and mild winters. Temperatures often reach 100 degrees F for several consecutive days during summer. Cold spells with temperatures less than 20 degrees F only last short periods of time. The soil is not frozen below the 3-inch depth for more than 2 to 3 days. Humidity is low during the winter and early spring months. Sometimes relative humidity is high enough to make summer days uncomfortable. Most of the precipitation comes in the form of rain and occurs during the spring and early summer principally. May is the wettest month followed by June. July and August are dryer and much hotter.

Rainfall often comes as intense showers of relatively short duration. Rainfall rate per hour is often high and runoff is significant. Infiltration is diminished due to lack of opportunity time. The growing season begins in April and ends with the first killing frost in Nov. There is little snowfall with the average being about 10 inches. Rainfall averages about 22 inches.

There is a 70% chance that yearly precipitation will fall between 16 and 24 inches. About 55% of the time, the yearly rainfall is below the mean. Dry spells during the growing season are common and long-term droughts occur in cycles of about 20 years. Native vegetation is principally warm season.

Table 3 Representative climatic features

Frost-free period (characteristic range)	190-190 days
Freeze-free period (characteristic range)	200-220 days
Precipitation total (characteristic range)	580-610 mm
Frost-free period (actual range)	180-200 days
Freeze-free period (actual range)	200-220 days
Precipitation total (actual range)	560-640 mm
Frost-free period (average)	190 days
Freeze-free period (average)	210 days
Precipitation total (average)	580 mm

- (1) PADUCAH [USC00416740], Paducah, TX
- (2) WELLINGTON [USC00419565], Wellington, TX
- (3) JAYTON [USC00414570], Jayton, TX
- (4) SNYDER [USC00418433], Snyder, TX
- (5) ROBERT LEE [USC00417669], Robert Lee, TX

Influencing water features

None.

Wetland description

NA

Soil features

This ecological site consists of soils that are shallow to a petrocalcic horizon or sandstone bedrock with siltstone or shale interbeds. They are well-drained, moderately permeable soils. Soils with petrocalcic horizons formed in loamy, calcareous alluvial and eolian sediments, while soils with sandstone bedrock formed in loamy residuum.

Major Soil Taxonomic Units correlated to this site include: Mereta and Quinlan soil series.

The parent material occurs from loamy, calcareous alluvial or eolian sediments or loamy residuum derived from sandstone with siltstone and shale interbeds. Parent material origin was derived from mixed sources for Quarternary sediments or Permian and Triassic sandstone for residuum.

Table 4. Representative soil features

Parent material	(1) Alluvium – sandstone and siltstone (2) Eolian deposits – shale
Surface texture	(1) Loam (2) Clay loam (3) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	10 – 50 cm
Soil depth	30 – 50 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	2.79 – 10.41 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 20 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The reference plant community of the Shallow Ecological Site in the 19-26” PZ zone of MLRA 78B is a fire-influenced Midgrass Prairie Community (1.1) with scattered tallgrasses, occasional woody plants and a good variety of forbs. Pre-settlement influences included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts and frequent fires. Wildfires occurred at 7-12 years intervals or less (Frost 1994) maintaining woody species at less than five percent canopy on this relatively level site. The soils of the site vary from shallow clay to clay loams. The soils have good plant-soil-moisture relationships, but moisture-holding capacity is moderate, often limiting productivity. Long-term droughts, occurring three to four times per century, such as the one occurring in the 1950s, may cause shifts in vegetation by causing woody plant die-off.

Sideoats grama is the dominant species throughout the MLRA contributing as much as 25 percent of the plant production. Other characteristic midgrasses found in the reference community include cane and silver bluestem, Arizona cottontop and vine-mesquite. Tallgrasses such as little and sand bluestem and Indiangrass occur in small amounts in more favorable soil-moisture locations such as limestone outcrops and drains. Buffalograss and curlymesquite are common shortgrasses. Frequent fires favor grasses over woody plants and forbs, but there are a wide variety of forbs present. In reference condition, a few trees, primarily live oak and hackberry, occupy rock crevices and deeper soil pockets on areas protected from wildfires and shrubs provide an estimated two to three percent canopy cover.

The Midgrass Prairie Community (1.1) was relatively stable and resilient within the climate, soil and fire regime until the advent of animal husbandry and fencing in the late 1800s. Not understanding the limits of rangeland productivity, European settlers overstocked the area with domesticated livestock almost universally. As overgrazing occurred on the Shallow site, there was a reduction of the less grazing resistant tall and midgrasses, a decline in mulch and organic matter, and consequently a reduction in intensity and frequency of fires. The shift in plant cover and decline in soil properties favored woody plant encroachment. The woody and grassland vegetation invaders were generally endemic species released from competition. In the resulting Midgrass/Shortgrass Community (1.2) the more palatable tall and midgrasses gave way to less palatable midgrasses and shortgrasses. Grasses still dominated annual herbage production, but the encroaching woody species increased in the proportion of production compared to the Midgrass Community (1.1).

When the Midgrass/Shortgrass Community (1.2) is continually overgrazed and fire is excluded, the ecological succession transitions into a community that is dominated by woody plants. More grazing resistant, Texas wintergrass, buffalograss and less palatable forbs begin replacing the midgrasses. As the midgrass cover declines, litter, mulch and soil organic matter decline and bare ground, erosion and other desertification processes increase. The microclimate in the grassland areas becomes more arid. Increasing woody dominants are primarily mesquite and juniper. Rest from grazing will generally not restore the grassland community when the woody plant community exceeds 10 to 15 percent canopy on this site and/or the plants reach fire resistant size (about four feet in height). When this threshold crossing occurs, the site transitions into the Shortgrass/Mixed-Brush Community (2.1). This threshold also marks the beginning of a new state, the Shrubland State.

Mesquite and/or juniper dominate the Shortgrass/Mixed-Brush Community (2.1) and the shrubs begin to form thickets. The grass component is a mixture of low palatability midgrasses, shortgrasses and low quality forbs. With continued livestock overgrazing, the better midgrasses are replaced by grazing resistant shortgrasses, such as buffalograss, curlymesquite, threeawns and western ragweed. Cool-season grasses such as Texas wintergrass and annual bromes also increase.

During this stage, the process of retrogression can be reversed with relatively inexpensive brush control practices and good grazing management that allows the application of prescribed burning. If these practices are not applied, the woody canopy will continue to increase in dominance and ground cover and a woody-plant dominated community, the Mixed–Brush/Shortgrass Shrubland Community (2.2), occurs. Once the brush canopy exceeds 30 to 35 percent, annual production for the understory is very limited and is generally made up of unpalatable shrubs, grasses and forbs within tree/shrub interspaces. Brushy species such as mesquite, juniper, prickly pear, tasajillo and condalia often form thickets. Shortgrasses, cool-season grasses and annuals persist, but in weakened condition.

Until maximum ground cover by woody species is reached, erosion continues in the interspaces. Considerable litter and soil movement occurs during heavy rains. The exposed soil crusts readily, creating opportunity for further soil and wind erosion. The microclimate becomes drier as interception losses increase with canopy cover. Once canopy cover reaches potential however, the hydrologic processes, energy flow and nutrient cycling stabilize under the shrubland environment.

Major expense and energy inputs are required to restore the Mixed-Brush/Shortgrass Shrubland Community (2.2) back to the Grassland State. Generally, mechanical or herbicidal brush management practices such as dozing and individual plant treatments (IPT) along with other conservation practices such as range planting, grazing deferment, prescribed grazing and prescribed burning are necessary for the ecological site to return to the reference community. Severe erosion and soil fertility losses during the retrogression process may prohibit the site from returning to the reference community.

Very little of the Shallow site has been put to crop cultivation. The site is highly erodible and should be cultivated with care, if at all. Most fields previously cultivated for crops have been returned to native or introduced grass species. Various introduced grass species planted include old world bluestem or Kleingrass. Most areas of the Shallow site re-vegetated to these introduced grasses are managed as rangeland.

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.

The following State and Transition Diagram depicts the ecological dynamics described above.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrass**			359-717	
	sideoats grama	BOCU	*Bouteloua curtipendula*	359-717	–
2	**Tallgrasses**			252-572	
	big bluestem	ANGE	*Andropogon gerardii*	0-572	–
	sand bluestem	ANHA	*Andropogon hallii*	0-572	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0-572	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0-572	–
3	**Midgrasses**			286-572	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	0-572	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	0-572	–
	Arizona cottontop	DICA8	*Digitaria californica*	0-572	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	0-572	–
	vine mesquite	PAOB	*Panicum obtusum*	0-572	–
4	**Mid/Shortgrasses**			168-336	
	threeawn	ARIST	*Aristida*	0-336	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0-336	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0-336	–
	fall witchgrass	DICO6	*Digitaria cognata*	0-336	–
	slim tridens	TRMU	*Tridens muticus*	0-336	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	0-336	–
5	**Cool-season grasses**			168-336	
	Canada wildrye	ELCA4	*Elymus canadensis*	0-336	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	0-336	–
Forb					
6	**Forbs**			168-336	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0-336	–

	white sagebrush	ARLU	*Artemisia ludoviciana*	0-336	–
	aster	ASTER	*Aster*	0-336	–
	milkvetch	ASTRA	*Astragalus*	0-336	–
	croton	CROTO	*Croton*	0-336	–
	prairie clover	DALEA	*Dalea*	0-336	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0-336	–
	bundleflower	DESMA	*Desmanthus*	0-336	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	0-336	–
	beeblossom	GAURA	*Gaura*	0-336	–
	hoary false goldenaster	HECA8	*Heterotheca canescens*	0-336	–
	trailing krameria	KRLA	*Krameria lanceolata*	0-336	–
	dotted blazing star	LIPU	*Liatris punctata*	0-336	–
	menodora	MENOD	*Menodora*	0-336	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0-336	–
	yellow nailwort	PAVI4	*Paronychia virginica*	0-336	–
	smartweed leaf-flower	PHPO3	*Phyllanthus polygonoides*	0-336	–
	leafflower	PHYLL	*Phyllanthus*	0-336	–
	groundcherry	PHYSA	*Physalis*	0-336	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0-336	–
	white rosinweed	SIAL	*Silphium albiflorum*	0-336	–
	awnless bushsunflower	SICA7	*Simsia calva*	0-336	–
	fanpetals	SIDA	*Sida*	0-336	–
	queen's-delight	STSY	*Stillingia sylvatica*	0-336	–
	vervain	VERBE	*Verbena*	0-336	–
Shrub/Vine					
7	**Shrubs/Vines**			50-101	
	acacia	ACACI	*Acacia*	0-101	–
	snakewood	CONDA	*Condalia*	0-101	–
	jointfir	EPHED	*Ephedra*	0-101	–
	stretchberry	FOPU2	*Forestiera pubescens*	0-101	–
	algerita	MATR3	*Mahonia trifoliolata*	0-101	–
	fragrant sumac	RHAR4	*Rhus aromatica*	0-101	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	0-101	–
	sumac	RHUS	*Rhus*	0-101	–
	bully	SIDER2	*Sideroxylon*	0-101	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	0-101	–
Tree					
8	**Trees**			34-67	
	hackberry	CELTI	*Celtis*	0-67	–
	live oak	QUVI	*Quercus virginiana*	0-67	–
	elm	ULMUS	*Ulmus*	0-67	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Many types of grassland insects, reptiles, birds and mammals use the plant community of the Shallow Ecological Site, either as their base habitat or from the adjacent sites. Small mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Predators include coyote, red fox, gray fox, bobcat and occasionally mountain lion. Game birds, songbirds, and birds of prey were indigenous or frequent users. Most are still plentiful. Bison and pronghorn antelope, however, are no longer present, but white-tailed deer utilize the Shallow site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Midgrass-Shortgrass Community (2) and Mixed-Brush/Shortgrass (3) plant communities. Deer, turkey, quail and dove hunting is an important sport, or commercial enterprise, providing considerable income to land owners. The site in reference condition is very suited to primary grass eaters such as bison and cattle. As retrogression occurs, and woody plants invade, it becomes better habitat for sheep, goats, deer and other wildlife because of the browse and cool season grasses. Predators, however, may preclude sheep and goats. Livestock should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. If the animal numbers are not kept in balance with herbage and browse production through grazing management and good wildlife population management, the late Mixed-Brush/Shortgrass Community (4) will have little to offer as habitat except cover.

Hydrological functions

The Shallow Ecological Site is a well-drained, moderately slowly permeable shallow upland with nearly level to gentle slopes. Runoff is negligible on 0 to 1 percent slopes, very low on 1 to 3 percent slopes, and low on 3 to 5 percent slopes. However, soil crusting can cause erosion from bare ground on steeper slopes if plant cover is removed. In reference condition, the grassland vegetation intercepte and utilized much of the incoming rainfall in the soil solum. Only during extended rains or heavy thunderstorms is there much runoff. Litter and soil movement is slight. Standing plant cover, duff and organic matter decrease and surface runoff increases as the Midgrass Prairie Community (1.1) transitions to the Midgrass/Shortgrass Community (1.2). These processes continue in the interstitial spaces in the Shortgrass/Mixed-Brush Community (2.1). Evaporation and interception losses are higher, resulting in less moisture reaching the soil. If, overgrazing continues the plant community deteriorates further and desertification processes continue. Biomass production is reduced relative to HCPC and production has shifts from primarily grasses to primarily woody plants. The deeper-rooted woody plants are able to extract water from greater depths than the short grasses, so less water will be available for down-slope movement. The woody plants compete for moisture with the remaining grasses and forbs further reducing production and ground cover in openings. Openings in the advanced Mixed-Brush/Shortgrass (Shrubland state) occur only on very shallow soil areas. Decreased litter and more bare ground allow erosion from soils in openings between trees. Once the Mixed-Brush/Shortgrass Shrubland Community (2.2) canopy surpasses 70 percent the hydrological and ecological processes, nutrient cycling and energy flow, stabilize within the woody plant canopy.

Recreational uses

The Shallow site occurs in narrow bands with Very Shallow, Clay Flat and Clay Loam sites. Together, these sites are well suited for many outdoor recreational uses including recreational hunting, hiking, camping, equestrian and bird watching. The Shallow site, along with adjacent uplands, provides diverse scenic beauty and many opportunities for recreation and hunting.

Wood products

Posts and specialty wood products are made from juniper, mesquite, live oak and many shrubs. Mesquite and oak are use for firewood and charcoal.

Other products

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

Other information

None.

Inventory data references

Information presented was derived from the revised Shallow Range Site, literature, field observations and personal contacts with range-trained personnel. Photos by J.L. Schuster.

Other references

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Acknowledgments

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

Rangeland health reference sheet

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

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Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **Slight to moderate.**

2. **Presence of water flow patterns:** **Slight to moderate.**

3. **Number and height of erosional pedestals or terracettes:** **Slight to moderate.**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **35 to 40% bare ground.**

5. **Number of gullies and erosion associated with gullies:** **Slight to moderate.**

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

7. **Amount of litter movement (describe size and distance expected to travel):** **Slight to moderate.**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** **Water erosion hazards are moderate to severe.**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** **Shallow clays and clay loam surface; weak fine granular structure; few fine roots; hard, friable; calcareous moderately alkaline; moderate permeability; well drained; good plant-soil moisture; moderate SOM.**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** **Low vegetative cover and percent slopes makes this site susceptible to erosion. This site has very slow permeability, runoff is medium to high depending on slope and available water holding capacity is moderate to high.**

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 tallgrasses >

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

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Plant mortality and decadence is minimal.

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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):** 1,500 to 3,000 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:** Mesquite, lotebush, tasajillo, and pricklypear can be invasive.

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17. **Perennial plant reproductive capability:** All plant species should be capable of reproduction except during periods of prolonged drought conditions, heavy natural herbivory or intense wildfires.
