

Ecological site R078CY112TX Red Clay (South) 23-30" 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.

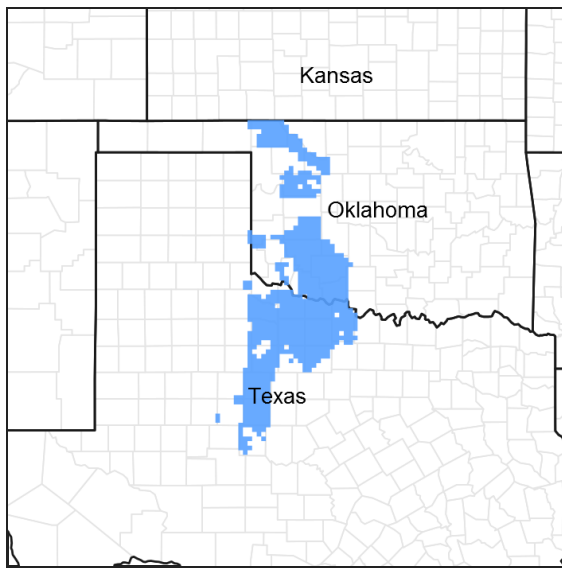


Figure 1. Mapped extent

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): 078C—Central Rolling Red Plains, Eastern Part

MLRA 78C is characterized by moderately dissected, rolling plains with prominent ridges and valleys and numerous terraces adjacent to dissecting streams. Loamy and clayey soils are generally deep, well drained, and developed in calcareous and gypsiferous sediments of 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

This site occurs on dense clay soils on uplands. The reference vegetation is native mid and shortgrasses with forbs and few shrubs. The site may be at risk of mesquite or juniper invasion without prescribed fire or other brush

management strategies. Continuous abusive grazing practices may lead to a decrease in palatable grasses and eventually and increase in soil erosion.

Associated sites

R078CY114TX	Shallow Red Clay 23-31" PZ Shallow Red Clay is often adjacent to this site and lower in total annual production.
R078CY096TX	Clay Loam 23-30" PZ Clay Loam site is often down slope from Shallow Clay and has higher annual production.

Similar sites

R078CY114TX	Shallow Red Clay 23-31" PZ Shallow Red Clay is similar in that both sites are located on similar topography and an eroded Shallow Clay could resemble a Very Shallow Clay.
R078CY065OK	Red Clay (North) Similar soils. Cooler climate.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) <i>Bouteloua curtipendula</i> (2) <i>Pleuraphis mutica</i>

Physiographic features

This site was formed in residuum from claystone bedrock. Water runs off the surface very rapidly. Slopes are complex and are 1 to 30 percent. These soils are on gently sloping to steep escarpments. Elevation ranges from 900 to 2500 feet.

Table 2. Representative physiographic features

Landforms	(1) Plains > Hill (2) Plains > Ridge
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	274–762 m
Slope	1–30%
Water table depth	191–203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 78C lies within the subtropical sub-humid climate regime, which typically has dry winters with hot and not as humid summers. This regime is characterized by rapid changes in temperature; marked extremes, both daily and annual; and rather erratic rainfall.

This region lies in the path of polar air masses that move down from the north during the winter. With the passage of cold fronts during the fall and winter, abrupt temperature drops sometimes occur. While the area is subject to a wide range of temperature, winters are generally mild. Low humidity and good wind movements characterize the summers.

Wind speeds average more than eleven miles an hour with prevailing southern winds. Rather strong winds can occur in all months of the year. While strong gusty winds occur, severe dust storms are rare.

Normal rainfall averages 23 to 30 inches a year but distribution of rainfall patterns are so erratic short dry periods are common. The majority of the rainfall occurs as showers, rather than general rain events between March and November. Dry periods of three to four weeks can be expected during this time as well. Even if these dry conditions occur, complete crop failures seldom results. May is the wettest month and December is the driest. Effective precipitation is low due to high temperatures, amounts received and intensity.

Table 3. Representative climatic features

Frost-free period (characteristic range)	171-203 days
Freeze-free period (characteristic range)	191-229 days
Precipitation total (characteristic range)	635-686 mm
Frost-free period (actual range)	166-205 days
Freeze-free period (actual range)	190-232 days
Precipitation total (actual range)	635-686 mm
Frost-free period (average)	188 days
Freeze-free period (average)	209 days
Precipitation total (average)	660 mm

Climate stations used

- (1) MEDICINE LODGE [USW00003957], Medicine Lodge, KS
- (2) MUTUAL [USC00346139], Mutual, OK
- (3) CLINTON SHERMAN AP [USW00003932], Dill City, OK
- (4) LAKE KEMP [USC00414982], Seymour, TX
- (5) ABILENE RGNL AP [USW00013962], Abilene, TX

Influencing water features

None.

Wetland description

NA

Soil features

Soils are mapped for each county within the MLRA. Mapunits are representations of the major soil series component(s) and named accordingly. Each Mapunit is spatially represented on a digital soils map as polygons of different shapes and sizes. Within these Mapunits, there are often minor soil series components included. These minor components are soils that occur within a Mapunit polygon but are of small extent (15% or less of the Mapunit area). However, it is difficult to separate these minor soils spatially due to the scale of soil mapping.

Ecological sites are correlated at the component level of the soil survey. Therefore, a single Mapunit may contain multiple Ecological Sites just as it may contain multiple soil components. This is important to understand when investigating soils and Ecological Sites. A soil survey Mapunit may be correlated to a single Ecological Site based on the major component; however, there may be inclusional areas of additional Ecological Sites which are correlated to the minor components of that particular soil Mapunit.

Representative soil components for this site include:

Vernon

The soils for this site are moderately deep clay and clay loams that are impermeable to slowly permeable. Soil depth is less than 40 inches over shaley to clayey red bed deposits. Slopes range from 1-30%. If the soil surface is not protected by vegetation, runoff can be rapid and water erosion can be severe. Fertility is moderate and water holding capacity is moderately low. These soils tend to be droughty and have only a moderate productive capacity.

Table 4. Representative soil features

Parent material	(1) Residuum–claystone
Surface texture	(1) Stony clay (2) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to slow
Depth to restrictive layer	51–102 cm
Soil depth	51–102 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–4%
Available water capacity (0-101.6cm)	4.06–14.22 cm
Calcium carbonate equivalent (0-101.6cm)	5–20%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–25
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	4–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The information contained in the State and Transition Diagram (STD) and the Ecological Site Description was developed using archeological and historical data, professional experience, and scientific studies. The information presented is representative of a very complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals and ecological processes are described to inform land management decisions.

The reference plant community of the Red Clay Ecological Site is a Mixed-grass Prairie Community (1.1). Pre-settlement disturbances included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts and frequent fires. Fires are presumed to have re-occurred at 7-12 years intervals or less in this region (Frost 1994). The frequent fires interacted with droughts to maintain woody species at relatively low levels. Long-term droughts occurring three to four times per century probably caused shifts in vegetation and restricted woody plant development. The soils of the site are only moderately fertile and tend to be droughty making the site only moderately productive. Steep slopes, sparse vegetation and bare ground make the site susceptible to erosion.

Sideoats grama was the dominant species throughout the MLRA contributing as much as 25 to 30 percent of the plant production. It often persists even under grazing and drought, albeit at lowered productivity. Little bluestem was common, especially on deeper soils in the eastern portion.. Other characteristic midgrasses include silver bluestem, Arizona cottontop, meadow dropseed, Texas wintergrass and sometimes tobosa in the western portion of the MLRA. Big bluestem occurred in small amounts in more favorable soil-moisture locations. Buffalograss, blue grama, and curlmesquite were the characteristic shortgrasses. The frequent fires favored grasses over woody

plants and forbs, but there were a diversity of forbs present. In the reference community, shrubs, such as lotebush and daleas occupied deeper soil pockets on areas protected from wildfires. Shrubs provided an estimated three to five percent canopy cover.

The Mixed-grass Prairie Community (1.1) was relatively stable and resilient within the climate, soil, grazing 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 Clay site, there was a reduction of the less grazing resistant tall and mid grasses, 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 Plant Community (1.2) the more palatable tall and midgrasses have given way to less palatable mid and shortgrasses. Sideoats grama and little bluestem often persist in this phase, but at lowered production. Grasses still dominated annual herbage production, but the encroaching woody species have increased in density, stature and production compared to the Mixed-grass Prairie Community (1.1).

If the Midgrass Prairie Community (1.2) is grazed abusively and fire is excluded, the community transitions into one that is dominated by woody plants and shortgrasses. More grazing resistant, Texas wintergrass, buffalograss and less palatable forbs begin replacing the palatable tall and midgrasses. As the grass 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 and more soil is exposed to erosion and invasion by species from adjacent sites. Invading 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 occurs, the site transitions into a new plant community: the Shortgrass/Mixed-brush Community (2.1). This threshold also marks the beginning of a new state, the Shrubland State (2.0).

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 unpalatable forbs. With continued livestock overgrazing, the better midgrasses are replaced by grazing resistant shortgrasses, such as buffalograss, hairy grama, meadow dropseed, sand dropseed, threeawns and western ragweed. Cool-season grasses such as Texas wintergrass and annual bromes also increase, especially following a wet fall and winter. Broom snakeweed, dotted gayfeather, heath aster and annual broomweed are common in this community. 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 the site transitions into the Mixed-brush/Shortgrass/Annuals Community (2.2), a woody-plant dominated community. Once the brush canopy exceeds 25 to 30 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 lotebush often form thickets separated by areas of bare ground and shortgrasses. Cool-season grasses persist in the protection of shrubs, 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 maximum growth 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/Annuals Community (2.2) back to a Grassland State (1). 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 plant community. Severe erosion and soil fertility losses during the retrogression process may prevent the site from returning to historic climax.

Very little of the Shallow Clay 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 Clay site revegetated to native species are managed as rangeland.

State and Transition Diagram:

A State and Transition Diagram for the Red Clay (South) (R078CY112TX) site is depicted below. Thorough descriptions of each state, transition, 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 because of the natural variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal; other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category.

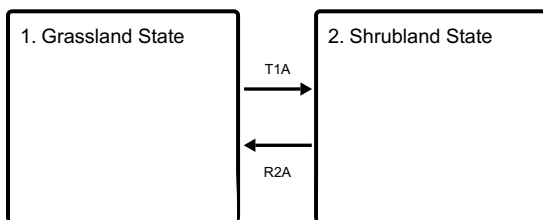
The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Composition by dry weight and percent canopy cover are provided to describing the functional groups. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs).

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on 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

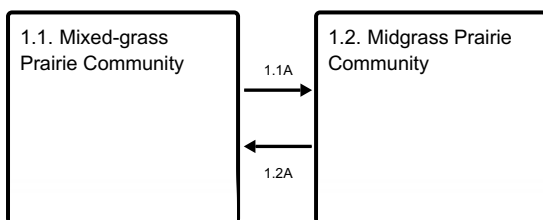
Ecosystem states



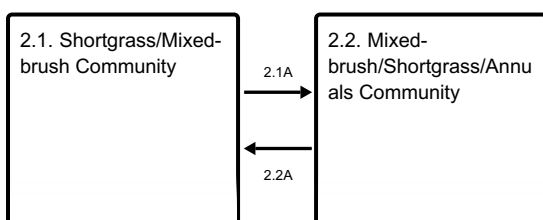
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R2A - Adequate rest from defoliation and removal of woody canopy, followed by reintroduction of historic disturbance regimes

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1 Grassland State

The Mixed-grass Prairie Community (1.1) is the interpretive plant community for the Shallow Clay Ecological Site. It

was open grassland with a mixture of midgrasses and shortgrasses, some tallgrasses and forbs along with scattered shrubs. Feather and black dalea, pricklypear, ephedra, lotebush and agarito were widely scattered in protected areas, but probably made up less than five percent of the plant canopy. Sideoats grama was the dominant or co-dominant grass throughout the site. The most common shortgrasses were buffalograss, blue grama and curly mesquite. Forbs include dotted gayfeather, western ragweed, American basketflower and catclaw sensitivebriar. Productivity of the site is around 1,000 to 3,000 pounds/acre of biomass annually. The Midgrass Community (1.2) is a midgrass dominated grassland being encroached by indigenous or invading woody species that had been previously held at low densities by repeated fires and competition from a vigorous grass component. The preferred tallgrasses and midgrasses are being replaced by the more grazing resistant midgrasses and shortgrasses. Numerous brushy species, including juniper and mesquite, are invading the site. In this plant community type, the increasing woody species are generally less than four feet tall and the woody canopy vary between 5 and 15 percent. Typically, mesquite and/or juniper invade from adjacent sites and indigenous species increase in density. Important grasses are sideoats grama, little bluestem, cane or silver bluestem, Arizona cottontop, Texas wintergrass and Canada wildrye. They give way to less palatable and more grazing resistant shortgrasses. Annual primary production ranges from 800 to 2,500 pounds per acre.

Community 1.1

Mixed-grass Prairie Community



Figure 8. 1.1 Mixed-grass Prairie Community

The Mixed-grass Prairie Community (1.1) is the interpretive plant community for the Shallow Clay Ecological Site. It was open grassland developed under a dry, sub-humid climate with hot dry summers and mild winters. Herbivory by migrating bison and indigenous antelope and deer influenced the plant composition and structure, but not as much as frequent and intense wild fires, which kept woody species in check. Infrequent long-term droughts also helped shape the grassland structure. The community was a mixture of midgrasses and shortgrasses, some tallgrasses and forbs along with scattered shrubs. Feather and black dalea, pricklypear, ephedra, lotebush and agarito were widely scattered in protected areas, but probably made up less than five percent of the plant canopy. Big bluestem and little bluestem occupied favorable micro-sites and were locally dominant. Sideoats grama was the dominant or co-dominant grass throughout the site. Also occurring on the site, but in smaller amounts, were cane and silver bluestems, Arizona cottontop, Texas wintergrass, alkali sacaton, meadow dropseed and tobosa. Tobosa seldom occurs east of the 25-inch precipitation line in this region, however. The most common shortgrasses were buffalograss, blue grama and curly mesquite. Curly mesquite is not common in the northern portion of the MLRA. A few of the many forbs found in climax were dotted gayfeather, Dakota verbena, western ragweed, gaura, American basket flower and catclaw sensitivebriar. See the following species composition tables for the approximate composition of the Mixed-grass Prairie Community. Productivity of the site is relatively low because of the shallow clay soils and poor soil-plant- water relationships. The site tends to be droughty and requires attentive management to maintain productivity and prevent erosion. It is estimated that the Mixed-grass Prairie Community (1.1) produced around 1,000 to 3,000 pounds of above ground biomass annually, depending upon the amount of precipitation, topographic position and soil depth. Grasses accounted for as much as 85 percent of the annual production and forbs 10 percent. The vegetation of the site was seasonally well balanced for grazing because of the presence of cool-season species. A moderate cover of grasses and mulch aided in the infiltration of rainfall into the slowly permeable soil and reduced runoff. The Mixed-grass Prairie Community (1.1) furnished good habitat for grazing type wildlife such as bison, pronghorn antelope and cattle. Beginning in the 1870s and continuing through the 1950s

most areas of the site were subjected to heavy continuous grazing by livestock. With continuous overgrazing, decrease in intensity and frequency of fires and no brush management, this plant community transitions into a Midgrass Prairie Community (1.2) with noxious brush and weeds invading. Proper stocking, prescribed grazing and prescribed burning are necessary if the site is to be maintained as a Mixed-grass Prairie Community (1.1). Few areas of the site can be found in historic climax condition.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	953	1905	2466
Forb	112	224	336
Shrub/Vine	56	90	112
Tree	–	–	–
Total	1121	2219	2914

Figure 10. Plant community growth curve (percent production by month). TX2276, Mid/Shortgrasses with Forbs. Warm-season mid and shortgrasses, cool-season grasses, and forbs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	4	8	25	25	14	6	8	5	2	1

Community 1.2 Midgrass Prairie Community



Figure 11. 1.2 Midgrass Prairie Community

The Midgrass Community (1.2) is the result of overgrazing by livestock over a long period of time. It is midgrass dominated grassland being encroached by indigenous or invading woody species that had been previously held at low densities by repeated fires and competition from a vigorous grass component. The preferred tallgrasses and midgrasses are being replaced by the more grazing resistant midgrasses and shortgrasses. Numerous brushy species, including juniper and mesquite, are invading because overgrazing by livestock has reduced grass cover, exposed more soil and reduced fine fuel for fire. In this plant community type, the increasing woody species are generally less than four feet tall and still subject to control by fire and improved grazing management. The woody canopy varies between 5 and 15 percent depending on severity of grazing, time since burned and availability of invading species propagules. Typically, mesquite and/or juniper invade from adjacent sites and indigenous species increase in density. Species such as lotebush, dalea, pricklypear, tasajillo, broom snakeweed and agarito increase in density. Important grasses are sideoats grama, little bluestem, cane or silver bluestem, Arizona cottontop, Texas wintergrass and Canada wildrye. Under moderate to heavy grazing, sideoats grama is reduced first closely followed by little bluestem. Eventually both give way to less palatable and more grazing resistant shortgrasses such as vine mesquite, buffalograss, slim and rough tridens, meadow dropseed and curly-mesquite. Sideoats grama does however maintain dense stands but remains in very low vigor and production on this site: even when abused. Most of the climax perennial forbs persist. Annual primary production ranges from 800 to 2,500 pounds per acre,

depending on precipitation. Forage production is predominantly grass. Heavy continuous grazing has reduced plant cover, litter and mulch and has increased bare ground slightly exposing the soil to some erosion. There could be some mulch and litter movement during rainstorms. Unless proper grazing and prescribed burning are initiated at this stage, the woody species continue to increase in size and density. When the canopy of the woody plants becomes dense enough (15-20 % canopy) and big enough (greater than four feet) to suppress grass growth and resist fire damage, a threshold in ecological succession is reached. The Midgrass Prairie Community (1.2) transitions into the Shortgrass/Mixed-brush Community (2.1). Once this vegetation type occurs, normal range management practices, such as proper grazing and prescribed burning, cannot reverse the trend to woody plant dominance.

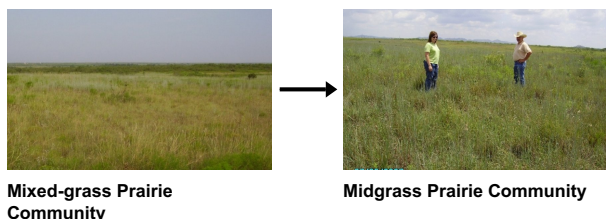
Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	717	1480	2242
Shrub/Vine	135	277	420
Forb	45	93	140
Tree	–	–	–
Total	897	1850	2802

Figure 13. Plant community growth curve (percent production by month). TX2279, Midgrass Prairie Community. Warm-season mid and shortgrasses with cool-season species and shrubs invading..

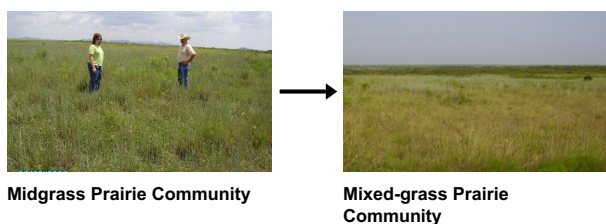
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	6	16	22	20	10	4	3	6	5	4	2

**Pathway 1.1A
Community 1.1 to 1.2**



Without proper grazing management that adjusts animal numbers, including deer, to annual forage production and judicious prescribed burning, the Mixed-grass Prairie Community will transition (regress) to a Midgrass Prairie Community (1.2).

**Pathway 1.2A
Community 1.2 to 1.1**



With Prescribed Grazing, Prescribed Burning, and Brush Management conservation practices implemented, the shift from the Midgrass Prairie Community to the Mixed-grass Prairie Community can occur.

Conservation practices

- Brush Management
- Prescribed Burning

State 2 Shrubland State

The Shortgrass/Mixed-brush Community (2.1) supports a 15 to 25% percent woody plant canopy of mixed-brush species. Mesquite is often the dominant overstory and pricklypear and lotebush the most common shrubs. Plant composition and production shifts toward a grazing resistant shortgrass and woody component as selective grazing reduces the preferred species. All, except the more palatable woody species, increase in size and density. Many of the climax shrubs are present. Remnants of climax grasses, such as little bluestem, sideoats grama, buffalograss and unpalatable invaders occupy the interspaces between trees and shrubs. Cool-season grasses such as Texas wintergrass and annual brome can be found under and around woody plants. Mesquite and/or redberry juniper dominate the Mixed-brush/Shortgrass/Annuals Community (2.2), which is a mixed-brush shrubland. Common understory shrubs are pricklypear, agarito, dalea, lotebush, yucca and tasajillo. With continued heavy grazing and no brush control, the trees and shrubs can approach 60 percent ground cover. Shortgrasses and low quality annual and perennial forbs occupy the woody plant interspaces. Texas wintergrass and cool-season annuals, particularly annual brome and annual broomweed, are found in and around tree/shrub cover. The cool-season species flourish following a wet fall and winter. Grasses and forbs make up 25 percent or less of the annual herbage production. Forbs are also commonly found in this community.

Community 2.1 Shortgrass/Mixed-brush Community



Figure 14. 2.1 Shortgrass/Mixed-brush Community

The Shortgrass/Mixed-brush Community (2.1) supports a 15 to 25% percent woody plant canopy of mixed-brush species. Mesquite is often the dominant overstory and pricklypear and lotebush the most common shrubs. Redberry juniper may also invade and become dominant in the southern portion of the MLRA. The Shortgrass/Mixed-brush Community is the result of selective overgrazing by livestock and deer and the differential response of plants to defoliation over a long period of time. Fire has also been reduced as a disturbance factor because of suppression and a paucity of fine fuel available for hot fires. With abusive livestock grazing, there is a continued decline in diversity of the grassland component and an increase in woody and cool-season species. Considerable bare ground occurs during the transition from grassland to shrubland and the site is subject to erosion. With continued overgrazing, annual herbage production is reduced in the grassland component due to decline in plant species structure and soil conditions. Plant composition and production shifts toward a grazing resistant shortgrass and woody component as selective grazing reduces the preferred species. All, except the more palatable woody species, increase in size and density. Mesquite is an early increaser throughout the MLRA. Redberry juniper invades, particularly in the southern portion of the MLRA. Many of the climax shrubs are present. Pricklypear, lotebush, dalea, agarito, and catclaw acacia increase in density and frequency in this plant type. Remnants of climax grasses, such as little bluestem, sideoats grama, buffalograss and unpalatable invaders occupy the interspaces between trees and shrubs. Little bluestem and sideoats grama often persist under heavy grazing and respond quickly during wet cycles and with proper grazing and brush control. These two grasses are more persistent in the northern portions of the site than in the southern portions. Cool-season grasses such as Texas

wintergrass and annual brome, plus other grazing resistant climax species, can be found under and around woody plants. Because of grazing pressure and competition for nutrients and water from the woody plants the grassland component lacks plant vigor and productivity. Common herbaceous species include hairy grama, three-awns, sand and meadow dropseed, heath aster and dotted gayfeather. Buffalograss, western ragweed and tobosa are persistent until shrub density reaches maximum canopy. As the grassland vegetation declines, more soil is exposed leading to erosion on steeper slopes. Higher interception losses by the increasing woody canopy combined with evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces but soil conditions improve under the woody plant cover. Some soil loss can occur during heavy rainfall events and old erosion scars may be present. Total plant production declines somewhat, being approximately 800 to 2,500 pounds per acre, depending on precipitation. The deeper rooting shrubs are able to increase production if erosion has not depleted the soil. Generally, only about 50 percent of annual production comes from the grassland component. Browsing animals such as goats and deer can find fair food value if browse plants have not been overgrazed continuously. Forage quantity and quality for cattle is relatively low. The trend cannot be reversed with good grazing management alone. Woody species will eventually dominate the site. Brush control practices are necessary to maintain this vegetation type or to return the community back to grassland. Without brush control practices, the woody species continue to grow in size and density until the site transitions into a Mixed-brush/Shortgrass/Annuals (2.2) community.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	379	1166	1749
Shrub/Vine	179	359	538
Forb	90	179	269
Tree	45	90	135
Total	693	1794	2691

Figure 16. Plant community growth curve (percent production by month). TX2282, Shortgrasses/Cool-Season grasses/Mixed Brush Community. Warm-season native grassland with some cool-season grasses and mixed brush approaching 50% woody species..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	5	5	15	20	15	5	5	12	7	5	3

Community 2.2 Mixed-brush/Shortgrass/Annuals Community



Figure 17. 2.2 Mixed-brush/Shortgrass/Annuals Community

Mesquite and/or redberry juniper dominate the Mixed-brush/Shortgrass/Annuals Community, which is a mixed-brush shrubland. It is the result of many years of overgrazing, lack of periodic fires and little brush management. Common understory shrubs are pricklypear, agarito, dalea, lotebush, yucca and tasajillo. With continued heavy

grazing and no brush control, the trees and shrubs can approach 60 percent ground cover. Shortgrasses and low quality annual and perennial forbs occupy the woody plant interspaces. Characteristic shortgrasses include curlymesquite, buffalograss, hairy grama, slim tridens, Texas grama, hooded windmillgrass, threeawns and Hall's panicum. Texas wintergrass and cool-season annuals, particularly annual brome and annual broomweed, are found in and around tree/shrub cover. The cool-season species flourish following a wet fall and winter. Grasses and forbs make up 25 percent or less of the annual herbage production. Forbs commonly found in this community include dotted gayfeather, American basketflower, heath aster, annual broomweed, Louisiana sagewort and catclaw sensitivebriar. Initially, the shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and organic mulch are reduced exposing more soil surface to erosion in the inter-shrub spaces. The exposed soil crusts readily and erosion often occurs. However, within the woody canopy hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. The Mixed-brush/Shortgrass/Annuals Community provides good habitat cover for wildlife but only limited preferred forage, or browse is available for livestock or wildlife. Management of the brush to create a more open state such as the Shortgrass/Mixed-brush Community (2.1) or even the Midgrass Prairie (1.2) Community having preferred brush species would optimize the habitat for both cattle and wildlife. Alternatives for restoration include brush control and range planting to return the shrubland into a grassland state. Proper stocking, prescribed grazing and prescribed burning would then be necessary to maintain the desired community.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	874	1311	1749
Grass/Grasslike	336	504	673
Forb	67	101	135
Tree	67	101	135
Total	1344	2017	2692

Figure 19. Plant community growth curve (percent production by month). TX2278, Mixed-Brush/Annuals/Cool-season Grasses. Warm-season mixed-brush species, shortgrasses, and cool-season annuals..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	4	12	17	21	16	3	4	12	5	2	1

**Pathway 2.1A
Community 2.1 to 2.2**



Shortgrass/Mixed-brush Community



Mixed-brush/Shortgrass/Annuals Community

With Heavy Continuous Grazing, No Fires, and No Brush Management, the Shortgrass/Mixed-brush Community will shift to the Mixed-brush/Shortgrass/AnnualsCommunity.

**Pathway 2.2A
Community 2.2 to 2.1**



Mixed-brush/Shortgrass/Annuals Community



Shortgrass/Mixed-brush Community

With the application of various conservation practices including Prescribed Grazing, Prescribed Burning, Brush Management, and Range Planting, the Mixed-brush/Shortgrass/Annuals Community can shift to the Shortgrass/Mixed-brush Community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T1A State 1 to 2

Unless proper grazing and prescribed burning are initiated at this stage, the woody species continue to increase in size and density. When the canopy of the woody plants becomes dense enough (15-20 % canopy) and big enough (greater than four feet) to suppress grass growth and resist fire damage, a threshold in ecological succession is reached. Grassland State transitions into the Shrubland State.

Restoration pathway R2A State 2 to 1

With the application of various conservation practices including Reclamation, Prescribed Grazing, Prescribed Burning, Brush Management, and Range Planting, the Shrubland State can be restored back to the Grassland State.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	Midgrasses			280–841	
1	Midgrasses			168–504	
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	56–168	–
	silver beardgrass	BOLAT	<i>Bothriochloa laguroides ssp. torreyana</i>	56–168	–
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	56–168	–
	vine mesquite	PAOB	<i>Panicum obtusum</i>	56–168	–

	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	56–168	–
2	Shortgrasses			224–504	
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	112–336	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	112–336	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	112–336	–
	curly-mesquite	HIBE	<i>Hilaria belangeri</i>	112–336	–
3	Tallgrasses			56–112	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	0–112	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	0–112	–
4	Short/Midgrasses			168–392	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	56–168	–
	Wright's threeawn	ARPUW	<i>Aristida purpurea var. wrightii</i>	56–168	–
	tumblegrass	SCPA	<i>Schedonnardus paniculatus</i>	56–168	–
	Drummond's dropseed	SPCOD3	<i>Sporobolus compositus var. drummondii</i>	56–168	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	56–168	–
	slim tridens	TRMU	<i>Tridens muticus</i>	56–168	–
	slim tridens	TRMUE	<i>Tridens muticus var. elongatus</i>	56–168	–
5	Cool-season Grasses			56–168	
	Texas wintergrass	NALE3	<i>Nassella leucotricha</i>	56–168	–
Forb					
6	Forbs			112–336	
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	11–34	–
	American star-thistle	CEAM2	<i>Centaurea americana</i>	11–34	–
	prairie clover	DALEA	<i>Dalea</i>	11–34	–
	Indian rushpea	HOGL2	<i>Hoffmannseggia glauca</i>	11–34	–
	trailing krameria	KRLA	<i>Krameria lanceolata</i>	11–34	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	11–34	–
	blazingstar	MENTZ	<i>Mentzelia</i>	11–34	–
	Nuttall's sensitive-briar	MINU6	<i>Mimosa nuttallii</i>	11–34	–
	Drummond's skullcap	SCDR2	<i>Scutellaria drummondii</i>	11–34	–
	vervain	VERBE	<i>Verbena</i>	11–34	–
Shrub/Vine					
7	Shrubs/Vines			0–168	
	catclaw acacia	ACGR	<i>Acacia greggii</i>	0–56	–
	Christmas cactus	CYLE8	<i>Cylindropuntia leptocaulis</i>	0–56	–
	featherplume	DAFO	<i>Dalea formosa</i>	0–56	–
	black prairie clover	DAFR2	<i>Dalea frutescens</i>	0–56	–
	prairie clover	DALEA	<i>Dalea</i>	0–56	–
	clapweed	EPAN	<i>Ephedra antisyphilitica</i>	0–56	–
	algerita	MATR3	<i>Mahonia trifoliolata</i>	0–56	–
	pricklypear	OPUNT	<i>Opuntia</i>	0–56	–
	yucca	YUCCA	<i>Yucca</i>	0–56	–

	lotebush	ZIOB	<i>Ziziphus obtusifolia</i>	0-56	-
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Animal community

Many types of grassland insects, reptiles, birds and mammals used the plant community of the Red Clay Ecological Site, either as their base habitat or from the adjacent sites. Small mammals included many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Predators included coyote, red fox and gray fox. Grassland 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 Clay site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Midgrass Prairie (1.2) and Shortgrass/Mixed-brush (2.1) plant communities. Deer, turkey, quail and dove hunting is an important sport, or commercial enterprise, providing considerable income to land owners.

The site is very suited to primary grass eaters such as bison and cattle. As woody plants increase, 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/Annuals Community (2.2) will have little to offer as habitat except cover.

Hydrological functions

The Red Clay Ecological Site is a well-drained, slowly permeable shallow upland with nearly level to moderately steep slopes. Soil crusting can cause erosion from bare ground on steeper slopes and severely eroded areas may be present. Some areas of the site are shallow due to past erosion. The site can be droughty due to poor soil-plant-water relationship and low effective rainfall.

Under reference condition, the grassland vegetation intercepted and utilized much of the incoming rainfall in the soil solum. Only during extended rains or heavy thunderstorms was there much runoff. Litter and soil movement was moderate due to normally high amount of bare ground and crusting. Standing plant cover, duff and organic matter decrease and surface runoff increases as the Mixed-grass Prairie Community (1.1) transitions to the Midgrass Prairie 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 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. Decreased litter and more bare ground allow erosion from soils in openings between trees. Once the Mixed-brush/Shortgrass/Annuals Community canopy matures, the hydrological and ecological processes, nutrient cycling and energy flow stabilize within the woody plant canopy.

Recreational uses

The Red Clay site occurs in narrow bands with Shallow Red Clay 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 Clay 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 and many shrubs. Mesquite is used for firewood and charcoal.

Other products

Jams and jellies are made from many fruit bearing species, such as agarito. Seeds can be 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 has been derived from the revised Clay Loam Range Site PE 31-44 a NRCS draft Ecological Site Description for Shallow Clay PE 31-44 78C, literature, personal experience, field observations and personal contacts with range-trained personnel. Photos by: J.L. Schuster.

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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.

Author(s)/participant(s)	Lem Creswell, Zone RMS, NRCS, Weatherford, Texas
Contact for lead author	817-596-2865
Date	12/20/2007
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

3. **Number and height of erosional pedestals or terracettes:** None to slight. Uncommon for this site.
-

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect no more than 20% bare ground randomly distributed throughout.
-

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

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

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

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

values): Soil surface is resistant to erosion. Stability class range is expected to be 5 to 6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-4 inches thick with dark brown clay with generally weak medium blocky structure. SOM is approximately 1-6%. See soil survey for specific soils information.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of trees, shrubs, vines, grasses and forbs along with adequate litter and little bare ground provides for maximum infiltration and little runoff under normal rainfall events.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No evidence of compaction.

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 > Warm-season shortgrasses >

Other: Forbs > Shrubs/Vines

Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There should be little mortality or decadence for any functional group.

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1000 - 3000 lb/ac year

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:** Honey mesquite, pricklypear, lotebush, yucca, japanese bromegrass, annual broomweed, broom snakeweed

17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing except during periods of

prolonged drought conditions, heavy natural herbivory or wildfires.
