USDA Natural Resources
Conservation Service

Ecological site R078CY094TX
Clayey Bottomland 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.

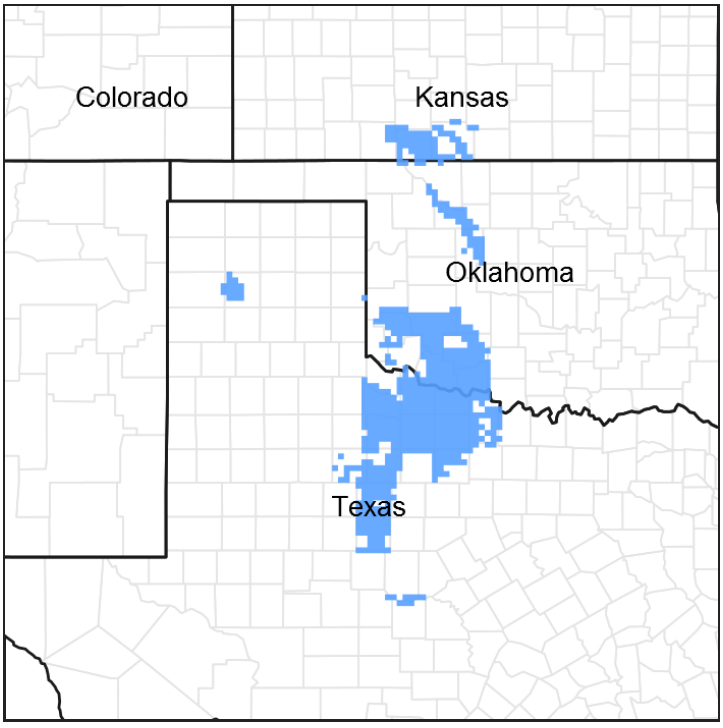


Figure 1. Mapped extent

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

These sites occur on clayey alluvial soils on floodplains. In the reference state, the vegetation is dominated by native midgrasses and forbs, with some scattered woody species. This vegetation type is the product of historical fire and grazing events. If fire is removed from the system, woody species may encroach and begin to dominate ecological processes. Due to the nature of the clay soils, these sites are often less productive than other bottomland sites, especially during long dry periods.

Associated sites

R078CY112TX	**Red Clay (South) 23-30" PZ** Shallow Clay is often adjacent and uphill and has much lower production and fewer woody species.

Similar sites

R078CY103TX	**Loamy Bottomland 23-31" PZ** Loamy Bottomland is found on similar physiographic position. However the Loamy Bottomland is moderately more productive due to the soil differences.
R078CY068OK	**Sandy Bottomland** Sandy Bottomland is found on similar physiographic position, but with sandy soils.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Clayey Bottomland 23” – 30” PZ was formed in calcareous clayey alluvium several feet thick washed largely from clayey soil formed in Permian or Triassic red beds. These soils are on nearly level flood plains of major streams that overflow about once or twice a year to once every 20 years of the Central Rolling Red Plains – Eastern Part (MLRA-78). Slopes range from 0 to 1 percent. Elevation ranges from 1000 to 2500 feet.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Draw (3) River valley > Valley
Runoff class	Medium to high
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	1,000–2,500 ft
Slope	0–1%
Water table depth	30–75 in
Aspect	Aspect is not a significant factor

Climatic features

The Central Rolling Red Plains – Eastern Part (MLRA 78C) lies within the subtropical sub-humid climate regime. Winters are typically dry while summers are hot and sub-humid. 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. The summers are characterized by low humidity and good wind movements.

The prevailing southerly winds average more than eleven miles an hour. 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 that long 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	146-195 days
Freeze-free period (characteristic range)	183-217 days
Precipitation total (characteristic range)	27-28 in
Frost-free period (actual range)	143-199 days
Freeze-free period (actual range)	179-219 days
Precipitation total (actual range)	26-29 in
Frost-free period (average)	175 days
Freeze-free period (average)	200 days
Precipitation total (average)	27 in

Climate stations used

- (1) FREEDOM [USC00343358], Freedom, OK
- (2) TALOGA [USC00348708], Taloga, OK
- (3) CLINTON SHERMAN AP [USW00003932], Dill City, OK
- (4) VERNON [USC00419346], Vernon, TX
- (5) ANSON 3ESE [USC00410268], Anson, 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:
Mangum, Duke, and Hayfork

These soils are very deep, well drained and very slowly permeable. Runoff is high. Water enters the soil rapidly when the soil is dry and has cracks, but after the cracks are closed water movement into the soil is very slow.

Table 4. Representative soil features

Parent material	(1) Alluvium–claystone
Surface texture	(1) Clay (2) Silty clay
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very slow to moderately slow
Soil depth	70–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3.2–7.9 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–6
Soil reaction (1:1 water) (0-40in)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

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 Clayey Bottomland Ecological Site occupies narrow bands of well drained soils on nearly level flood plains of rivers and streams. The site is inundated once or twice a year. Small depressions, apparently from old channels, occur throughout. The soils are fertile, but the fine soil texture often restricts plant growth.
The reference plant community is a fire induced midgrass and shortgrass prairie with a few scattered shrubs and trees along the drainage ways. This is considered the reference plant community for the Clay Bottomland ecological site. This plant community evolved under frequent fire and periodic heavy grazing by bison, pronghorn antelope and deer. It is postulated that fires occurred as often as four to six-year intervals in this region (Frost 1998) prior to European settlement. The frequent fires favored grasses over woody plants and forbs. The fires likely were more influential in shaping the plant community into an open Mixed-Grass Prairie Plant Community (1.1) than grazing by bison and pronghorns and periodic droughts.

Midgrasses, such as tobosa , alkali sacaton, sideoats grama and vine-mesquite and shortgrasses, such as buffalograss and blue grama, characterized the Mixed-Grass Prairie Plant Community (1.1). Texas wintergrass and western wheatgrass were also common. Tobosa was often dominant in the western, or drier side, of the MLRA and absent east of the 25-inch rainfall line. Smartweed and sedges occupied the wetter depressions and alkali sacaton the areas with excessive salt accumulation. Trees, such as hackberry, American elm, bumelia, western soapberry and a very few shrubs and vines were scattered along the drainages.

The Mixed-Grass Prairie Community (1.1) was relatively stable and resilient within the climate, soil and fire regime until European settlement in the 1800s. The mid 1800’s brought elimination of the bison herd, removal of the American Indian and a large increase of domestic livestock. The development of the windmill and barbed wire fencing during the 1880s promoted overgrazing throughout the region. Overstocking by domesticated livestock induced a reduction of palatable grasses and forbs. Total herbage production declined as the grazing resistant shortgrasses and forbs began replacing the midgrasses and climax forbs. Tobosa and buffalograss were major increasers under grazing. There was a concomitant decline in vegetative ground cover, mulch and soil organic matter. The shift in composition of the plant cover and decline in soil properties favored woody plant encroachment. This, along with the reduction in intensity and frequency of fires, allowed invasion of species from adjacent sites or the increase of more grazing resistant endemic species. Under the above scenario, the reference plant community transitioned into a Shortgrass Community (1.2). In this plant community grasses dominate but the encroaching woody species contribute an increasing amount to the total annual production.
If the Shortgrass Community (1.2) is continuously overgrazed and fire is excluded the

transition toward woody plant dominance continues. The primary encroaching woody species are mesquite and pricklypear. Salt cedar can also become invasive on this site. Tobosa (in the west), buffalograss and other unpalatable or more grazing resistant grasses increase and palatable forbs and midgrasses continue to decline. Grass cover, litter and soil organic matter decline as bare ground, erosion and other desertification processes increase. The microclimate in the grassland areas becomes more arid. When the woody plant component reaches approximately 15% percent canopy, grazing management strategies, such as rest from grazing, generally will not reverse the transition to shrubland. A combination of proper grazing and prescribed burning should be successful in maintaining the grass dominant community, however. With continued livestock grazing and no brush management the Shortgrass Community (1.2) will transition into a Shortgrass/Mixed-Brush Community (2.1), where woody plants dominate.

Mesquite dominates the woody cover of the Shortgrass/Mixed-Brush Community (2.1). Pricklypear and lotebush are characteristic understory shrubs. American elm and hackberry trees increase in size, but are infrequent. The grass component is a mixture of midgrasses, shortgrasses and low quality forbs, initially. Tobosa is typically the dominant grass west of the 25-inch precipitation line while buffalograss dominates to the east. With continued livestock overgrazing, tobosa and buffalograss are gradually replaced by less palatable species such as threeawn and meadow dropseed. Cool-season grasses such as Texas wintergrass and Japanese brome also increase. During this stage, the transition to shrubland can be reversed by mechanical and/or chemical brush control methods and prescribed grazing management that provides fine fuel loadings necessary for prescribed burning at four- to six-year intervals. Prescribed burning generally does not kill mesquite once plants reach >2 years of age, but fire can suppress mesquite of any age if the fire can cause top kill. Prescribed burning systems have been developed to aid in enhancing and utilizing this vegetation type.

If overgrazing continues and brush control practices are not applied, the woody canopy will increase in size and density until a dense woody plant dominant community develops. Dominance occurs at about 30 to 35 percent woody plant canopy cover. At this threshold, the grassland component will not produce enough fine fuel for fires to effectively suppress the woody plants. At this point, the site completes the transition into a new plant community type, the Mixed-Brush/Shortgrass/Annuals Community (2.2).

The Mixed-Brush/Shortgrass/Annuals Community (2.2) is dominated by mesquite and mixed-brush to the exclusion of most climax herbaceous species except tobosa, Texas wintergrass, buffalograss and annuals in the woody plant interspaces. Once canopy cover exceeds 35 to 50 percent woody plants, forage production is very limited except in wet periods when annuals provide extra forage. Shortgrasses and cool-season grasses and forbs are present but sparse due to shading and competition from the woody plants. Japanese brome is often a persistent cool-season annual, especially during wet periods. Mesquite and understory brush continue to increase in size and density regardless of grazing management. Large areas of bare ground may appear between woody plants where small depressions occur. Desertification, including erosion, continues in the

interspaces until maximum ground cover by woody species is approached. Once shrub cover reaches potential, the hydrologic processes, energy flow and nutrient cycling stabilize under the woody vegetation environment.

Major expense and energy are required to restore the Mixed-Brush/Shortgrass/Annuals Community (2.2) back to a grassland plant community state. Restoration of site in this stage is very difficult to accomplish because of soil characteristics. An integrated approach is required. Mechanical or herbicidal treatments such as dozing, individual plant treatments (IPT), herbicide spraying and range planting followed by grazing deferment, prescribed grazing and prescribed burning, are essential for the site to return to near the postulated historic climax community. The brushy species, namely mesquite, are hard to control with herbicides on this site. Re-invasion occurs due to the residual seed bank. Mechanical control such as grubbing or root plowing can destroy the perennial grass cover and more often than not, annuals or broom snakeweed prevails for two or three years, even with reseeding. The restoration process may take several years of repeated treatments. Therefore, maintaining the site in at least the Shortgrass/Mixed–Brush (2.1) stage, or better, the Shortgrass Community (1.2) stage, through proper stocking and brush management, including the use of prescribed burning, is recommended.
The following State and Transition Model graphically depicts the ecological dynamics described. This model is not a precise model but a generalization of the different plant communities that can exist on a site and how community change occurs.

State and Transition Diagram:
A State and Transition Diagram for the Clay Bottomland (R078CY094TX) 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.

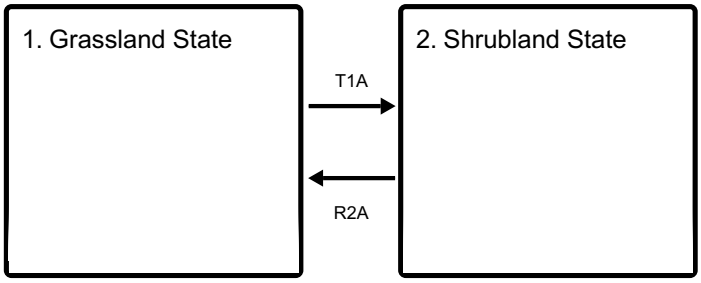
Composition by dry weight and percent canopy cover are provided to describing the functional groups. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs).

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

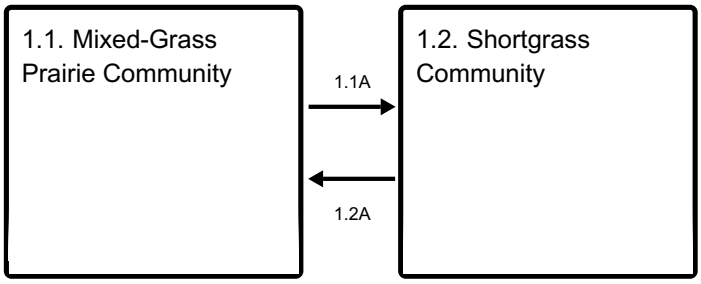
Ecosystem states



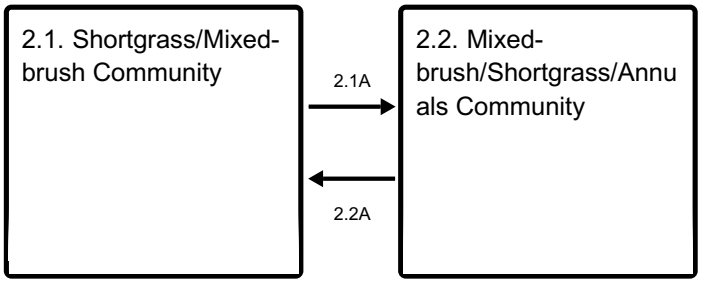
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

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 is an open prairie dominated by mid and shortgrasses. Trees such as hackberry, western soapberry and American elm grew along the drainage ways. The plant community provided good ground cover and protection from erosion during infrequent flooding events. Smartweed and low growing sedges were found in the small depressions made by old drainages. Tobosa was the dominant grass in the drier western portion of the MLRA with sideoats grama, vine mesquite, and cane or silver bluestem, Arizona cottontop and white tridens common midgrasses throughout. Buffalograss and blue grama were common shortgrasses. Texas wintergrass and western

wheatgrass were important parts of the cool-season grass component. Alkali sacaton was common where soil salt accumulations were high. Reference community forbs included western ragweed, heath aster, gaura, verbena, and annual forbs. Reference community shrubs were scarce but probably included fire resistant species such as wolfberry, ephedra, greenbriar and lotebush. Mesquite was probably also present but kept as scattered multi-stemmed shrubs by repeated wildfires. The Shortgrass Community (1.2) is a shortgrass dominated grassland community being invaded by woody species that previously have been held at low densities by repeated fires, infrequent droughts and competition from a vigorous grass component. Woody species, including pricklypear and mesquite, increased in density wherever continuous heavy grazing reduced grass cover, exposed soil and reduced fine fuel necessary for effective fires. Tobosa and buffalograss become dominant where they were present originally. Blue grama, white tridens, alkali sacaton, vine mesquite, and the feathery bluestems persist in this vegetation type. Texas wintergrass may increase on some areas, especially in and around woody plants, in response to shading or possibly climate change toward more cool-season precipitation. Western wheatgrass generally declines with overgrazing. Most of the perennial forbs found in the reference community remain in this plant community, although in lesser amounts. Saline conditions may occur in overgrazed areas, resulting in increased amounts of alkali sacaton. Salt cedar can become invasive on this site.

Community 1.1
Mixed-Grass Prairie Community

The Mixed-Grass Prairie Community (1.1) is the interpretative plant community for the Clayey Bottomland Ecological Site in MLRA 78C. It was an open prairie dominated by mid and shortgrasses. Trees such as hackberry, western soapberry and American elm grew along the drainage ways. The plant community provided good ground cover and protection from erosion during infrequent flooding events. Smartweed and low growing sedges were found in the small depressions made by old drainages. Species composition varied from east to west in the MLRA, and from south to north, because of precipitation and latitude differences. Tobosa was the dominant grass in the drier western portion of the MLRA with sideoats grama, vine mesquite, and cane or silver bluestem, Arizona cottontop and white tridens common midgrasses throughout. Buffalograss and blue grama were common shortgrasses with lesser amounts of Reverchon bristlegrass, sand dropseed, fall witchgrass, plains bristlegrass and Hall’s panicum. Texas wintergrass and western wheatgrass were important parts of the cool-season grass component. Alkali sacaton was common where soil salt accumulations were high and sedges were present in most depressions. Forbs included western ragweed, heath aster, gaura, verbena, greenthread, trailing ratany and annual forbs. Shrubs were scarce but probably included fire resistant species such as wolfberry, ephedra, greenbriar and lotebush. Mesquite was probably also present but kept as scattered multi-stemmed shrubs by repeated wildfires. (See plant community composition table below for complete listing of probable climax species.) The Mixed-Grass Prairie Community (1.1) produced as much as 2,000 to 2700 pounds herbage in good moisture years and as little as 700 pounds in dry years. Production was often limited by the tight, droughty soils but could also exceed expectation during favorable

growing conditions. Grasses and forbs contributed up to 95 percent of the total annual production in historic climax conditions. The midgrasses aided in the infiltration of rainfall into the very slowly permeable soil and reduced runoff. The depressions probably received more extra moisture from adjacent areas than from infrequent flooding events. Litter and organic matter buildup was limited by the dry climate and low herbage production. The Mixed-Grass Prairie Community (1.1) furnished good forage for grass-eating type animals such as bison before settlement and for horses and cattle after settlement. Near reference grassland conditions can be maintained with proper stocking, prescribed grazing and frequent prescribed burning. Stocking rates must consider the kind of livestock and balance their numbers with current annual forage production and competition from other herbivores. Flexibility in animal numbers is important because of the tight nature of the soil and infrequent flooding events. Livestock overgrazing, decrease in intensity and frequency of fires and no brush management will allow this plant community to transition into a Shortgrass Community (1.2), which is relatively open grassland with various amounts of invading shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	665	1615	2565
Forb	35	85	135
Shrub/Vine	0	0	10
Tree	0	0	0
Total	**700**	**1700**	**2710**

Figure 9. 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
Shortgrass Community

Figure 10. 1.2 Shortgrass Community

The Shortgrass Community (1.2) is a shortgrass dominated grassland community being invaded by woody species that previously have been held at low densities by repeated fires, infrequent droughts and competition from a vigorous grass component. When European settlement brought livestock grazing, woody species, including pricklypear and mesquite, increased in density wherever continuous heavy grazing reduced grass cover, exposed soil and reduced fine fuel necessary for effective fires. Selective grazing by livestock and deer and the differential response of plants to defoliation caused changes in composition of the Mixed-Grass Prairie Community (1.1). As retrogression occurs the more palatable midgrasses and forbs are replaced by less palatable or more grazing tolerant species. Tobosa and buffalograss become dominant where they were present originally. Blue grama, white tridens, alkali sacaton, vine mesquite, and the feathery bluestems persist in this vegetation type. Texas wintergrass may increase on some areas, especially in and around woody plants, in response to shading or possibly climate change toward more cool-season precipitation. Western wheatgrass generally declines with overgrazing. Most of the perennial forbs found in the reference community remain in this plant community, although in lesser amounts. Saline conditions may occur in overgrazed areas, resulting in increased amounts of alkali sacaton. Salt cedar can become invasive on this site. The encroaching woody species are generally less than four feet tall and subject to control by prescribed burning enhanced by proper stocking and grazing management. The woody canopy varies between five and 15 percent depending on length and severity of grazing, timing and frequency of fires and seed availability of invading species. Typically, mesquite, pricklypear, lotebush, wolfberry and bumelia were early and persistent encroaching woody species. Annual primary production is reduced slightly relative to the reference community, ranging from 500 to 2500 pounds per acre depending on precipitation amounts and soil conditions. Grasses remain the dominant producers of forage. Heavy continuous grazing reduces plant cover, litter and mulch and increases bare ground exposing the soil to some erosion. There could be some mulch and litter movement during flooding events. The change in species composition is small initially, but unless proper grazing and periodic burning occur, the invading species continue to

increase in size and density. Once the woody plants become dense enough (>15 %) to suppress grass growth and/or big enough (> 4 feet) to resist fire damage, a threshold in ecological succession is crossed. This threshold occurs when the fine fuel load provided by grasses is too low to control brush effectively with fire. The Shortgrass Community (1.2) transitions into the Shortgrass/Mixed-brush Community (2.1) when this occurs.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	400	1200	2000
Shrub/Vine	50	150	250
Tree	25	75	125
Forb	25	75	125
Total	**500**	**1500**	**2500**

Figure 12. Plant community growth curve (percent production by month). TX2289, Shortgrass Community. Warm-season shortgrass community with some cool-season component..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	6	13	23	20	4	5	15	6	3	1

Pathway 1.1A
Community 1.1 to 1.2

Livestock overgrazing, decrease in intensity and frequency of fires and no brush management will allow this plant community to transition into a Shortgrass Community (1.2), which is relatively open grassland with various amounts of invading shrubs.

Pathway 1.2A
Community 1.2 to 1.1

Near historic climax grassland conditions from the Shortgrass Community can be maintained with proper stocking, prescribed grazing and frequent prescribed burning.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shrubland State

The Shortgrass/Mixed-brush Community (2.1) supports a 15 to 40 percent woody plant cover dominated by mesquite with a shortgrass herbaceous layer. All, but the more palatable woody species, have increased in size and density. The typical woody plant cover is mesquite dominated with pricklypear, wolfberry, lotebush, ephedra and broomweed as common understory shrubs. Western soapberry, hackberry and mesquite increase along the stream edge. Tobosa dominates the herbaceous layer in the interspaces between trees and shrubs in the western portion of the MLRA where it was present originally. Buffalograss becomes dominant elsewhere. Remnants of grasses and forbs and less palatable species such as alkali sacaton, vine-mesquite, meadow dropseed, threeawn, silver bluestem, white tridens and annuals occur in the woody plant interspaces. The Mixed-brush/Shortgrass/Annuals Community is a mesquite-dominated shrubland with tree species along the stream line. Remnants of the climax grassland vegetation, mostly tobosa and/or buffalograss, cool season grasses and annuals, occupy the shrub interspaces. The woody plant cover is dominated by mesquite with pricklypear, tasajillo, lotebush and wolfberry common understory shrubs. Tobosa remains dominant in the herbaceous layer initially, but with heavy continuous grazing gives way to buffalograss and other less palatable grasses, such as threeawn, meadow dropseed, white tridens, bristlegrass and weedy annuals.

Community 2.1
Shortgrass/Mixed-brush Community

Figure 13. 2.1 Shortgrass/Mixed-brush Community

The Shortgrass/Mixed-brush Community (2.1) supports a 15 to 40 percent woody plant cover dominated by mesquite with a shortgrass herbaceous layer. This community is the result of selective grazing by livestock, suppression of fire and the differential response of plants to defoliation. The diversity of the grassland component declines while unpalatable woody plants and forbs increase. All, but the more palatable woody species, have increased in size and density. The typical woody plant cover is mesquite dominated with pricklypear, wolfberry, lotebush, ephedra and broomweed as common understory shrubs.

Western soapberry, hackberry and mesquite increase along the stream edge. Tobosa dominates the herbaceous layer in the interspaces between trees and shrubs in the western portion of the MLRA where it was present originally. Buffalograss becomes dominant elsewhere. Remnants of climax grasses and forbs and less palatable species such as alkali sacaton, vine-mesquite, meadow dropseed, threeawn, silver bluestem, white tridens and annuals occur in the woody plant interspaces. Where present, tobosa remains dominant, but as regression progresses under heavy grazing pressure, tobosa gives way to buffalograss and other less palatable shortgrasses and forbs. Gaura, western ragweed, verbena, greenthread and, prairie coneflower are commonly found in this community. Cool-season grasses, such as Texas wintergrass, Canada wildrye and western wheatgrass, are persistent under and around woody plants where shading occurs. Annual herbage production ranges from approximately 400 to 2,300 pounds per acre, depending on precipitation events, flooding events and dry cycles. Annual herbage production is less than in the Shortgrass Community (1.2) due to decline in soil structure and organic matter. Herbage production is balanced between the grassland component and woody species. As the grassland component declines, more soil is exposed to crusting and erosion. During the middle and end of this plant community phase, considerable soil becomes exposed. Water erosion is not a serious problem because of shallow slopes on the site, but wind erosion can be rather high in bare spots created in depressions. Higher interception loss of water by the increasing woody canopy combined with evaporation losses reduces the effectiveness of rainfall. Litter, soil organic matter and structure decline in the interspaces reducing water infiltration but hydrologic conditions improve under the woody plant cover. When the woody plant cover reaches 35 to 40 percent and the herbaceous component contributes less than 50 percent of the herbage production, the Shortgrass/Mixed-brush Community (2.1) transitions into a Mixed-brush/Shortgrass/Annuals Community (2.2).

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	200	700	1150
Shrub/Vine	100	350	575
Tree	60	210	345
Forb	40	140	230
Total	**400**	**1400**	**2300**

Figure 15. Plant community growth curve (percent production by month). TX2285, Shortgrass/Mixedbrush Community. Shortgrasses, annual grasses and shrubs dominate the plant community..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	6	15	24	18	3	5	15	7	2	1

Community 2.2
Mixed-brush/Shortgrass/Annuals Community

The Mixed-brush/Shortgrass/Annuals Community (2.2) is a mesquite-dominated shrubland with tree species along the stream line. Remnants of the reference grassland vegetation, mostly tobosa and/or buffalograss, cool season grasses and annuals, occupy the shrub interspaces. This community is the result of long term overgrazing by livestock and wildlife, absence of natural fires and the differential response of plants to defoliation. The woody plant cover is dominated by mesquite with pricklypear, tasajillo, lotebush and wolfberry common understory shrubs. Tobosa remains dominant in the herbaceous layer initially, but with heavy continuous grazing gives way to buffalograss and other less palatable grasses, such as threeawn, meadow dropseed, white tridens, bristlegrass and weedy annuals. Prairie coneflower, western ragweed, gaura, curlycup gumweed, broomweed and verbena are common forbs. Cool-season grasses such as Texas wintergrass and Canada wildrye can be found under and around woody plants. Japanese brome is common, especially following unusually wet winters. As the grassland component declines, more soil is exposed to crusting and wind erosion, especially in depressions. During the beginning and middle of this plant community stage, considerable soil becomes exposed. High interception losses by the increasing woody canopy combined with evaporation losses can reduce the effectiveness of rainfall. Litter, soil organic matter and structure decline in the interspaces reducing water infiltration in the interspaces, but hydrologic conditions improve under the woody plant cover. Annual primary production is approximately 400 to 2000 pounds per acre, primarily by the mesquite, pricklypear and other mixed-brush component. As this plant community nears maturity, the herbaceous component contributes less than 30 percent of the production. Browsing animals such as deer can find fair quality food if deer browsing has not been excessive. Forage quantity and quality for cattle in this plant community are low. Livestock stocking decisions should consider the forage species composition, quantity of available forage and rangeland health in making stocking rate decisions. Unless brush management and effective grazing management are applied, the transition toward dense shrubland will continue until the woody plant community stabilizes. Restoration and conservation practices for the Mixed-brush/Shortgrass/Annuals community for livestock or deer production include: (a) brush management to remove undesirable brush species, (b) range planting of native species to return vegetation back to near climax and (c) establish prescribed grazing and prescribed fire and other conservation practices to maintain the health of the desired plant community. Caution should be applied in choosing brush control and seeding methods. Broadcast herbicides are often ineffective, or prohibited, and mechanical treatments that expose soil leave the site open to infestation of weeds that can persist for several years.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	180	540	900
Grass/Grasslike	100	300	500
Tree	80	240	400
Forb	40	120	200
Total	**400**	**1200**	**2000**

Figure 17. 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

With heavy continuous grazing, no fires, and no brush management, the Shortgrass/Mixed-brush Community will shift into the Mixed-brush/Shortgrass/Annuals Community.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed Grazing, Prescribed Burning, Brush Management, and Range Planting are various conservation practices that are necessary for the shift from the Mixed-brush/ Shortgrass/ Annuals Community to the Shortgrass/Mixed-brush Community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T1A
State 1 to 2

The Shortgrass Community (1.2) transitions into the Shortgrass/Mixed-Brush Community (2.1) when the invading species continue to increase in size and density. Once the woody plants become dense enough (>15 %) to suppress grass growth and/or big enough (> 4

feet) to resist fire damage, a threshold in ecological succession is crossed. This threshold occurs when the fine fuel load provided by grasses is too low to control brush effectively with fire.

Restoration pathway R2A
State 2 to 1

Restoration and conservation practices for the Mixed-brush/Shortgrass/Annuals community for livestock or deer production include: (a) brush management to remove undesirable brush species, (b) range planting of native species to return vegetation back to near reference and (c) establish prescribed grazing and prescribed fire and other conservation practices to maintain the health of the desired plant community. Caution should be applied in choosing brush control and seeding methods. Broadcast herbicides are often ineffective, or prohibited, and mechanical treatments that expose soil leave the site open to infestation of weeds that can persist for several years.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrasses**			175–540	
	tobosagrass	PLMU3	*Pleuraphis mutica*	0–500	–
	alkali sacaton	SPAI	*Sporobolus airoides*	70–175	–
2	**Midgrasses**			175–810	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	25–100	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	25–100	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	25–100	–
	Arizona cottontop	DICA8	*Digitaria californica*	25–100	–
	vine mesquite	PAOB	*Panicum obtusum*	25–100	–
	composite	SPCOC2	*Sporobolus compositus var.*	25–100	–

	dropseed		*compositus*		
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	25–100	–
	white tridens	TRAL2	*Tridens albescens*	25–100	–
3	**Shortgrasses**			245–945	
	buffalograss	BODA2	*Bouteloua dactyloides*	110–500	–
	blue grama	BOGR2	*Bouteloua gracilis*	110–500	–
4	**Shortgrasses**			20–70	
	purple threeawn	ARPU9	*Aristida purpurea*	5–20	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	5–20	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	5–20	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	5–20	–
5	**Cool-season grasses**			20–70	
	Texas wintergrass	NALE3	*Nassella leucotricha*	10–35	–
	western wheatgrass	PASM	*Pascopyrum smithii*	10–35	–
	sedge	CAREX	*Carex*	0–10	–
Forb					
6	**Forbs**			20–70	
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	0–50	–
	trailing krameria	KRLA	*Krameria lanceolata*	0–50	–
	littleleaf sensitive-briar	MIMI22	*Mimosa microphylla*	0–50	–
	knotweed	POLYG4	*Polygonum*	0–50	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–50	–
	vervain	VERBE	*Verbena*	0–50	–
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–30	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–30	–
	Drummond's onion	ALDR	*Allium drummondii*	0–25	–
Shrub/Vine					
7	**Shrubs/Vines**			0–10	
	Christmas	CYLE8	*Cylindropuntia leptocaulis*	0–10	–

	Christmas cactus	CYLE6	*Cylindropuntia leptocaulis*	0–10	–
	pricklypear	OPUNT	*Opuntia*	0–10	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–10	–

Animal community

Many types of wildlife used the Clayey Bottomland Ecological Site. Being associated with flood plains and water courses, it probably received concentrated animal use at times. Bison often utilized the site heavily during migrations prior to European settlement. Grassland insects, reptiles, birds and mammals frequent the 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, fox and bobcat. 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. White-tailed deer utilize the Clayey Bottomland site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Shortgrass/Mixed-brush (2.1) plant community.

Hydrological functions

The Clayey Bottomland Ecological Site is a well-drained, very slowly permeable bottomland on nearly level flood plains. It may receive water from surrounding soils and the site may be covered with by water during flooding events. Flooding occurs once or twice a year to once in 20 years. Soil moisture holding capacity is high and percolation is slow. The soil generally cracks to great depth when dry, allowing rapid water intake when rainfall occurs on dry soil. When moist the soil is very slowly permeable, however. The deep soils, with moderate to good water holding capacity, are conducive to high herbage production during above average moisture years but restrictive to growth during normal or dry periods. Essentially no water passes through the soil profile to underground water.

Under reference condition, the grassland vegetation probably intercepted and utilized much of the incoming rainfall in the soil profile. Litter and soil movement was slight. Standing plant cover, duff and organic matter decrease as the Mixed-Grass Prairie Community (1.1) transitions to the Shortgrass Community (1.2). These processes continue in the spaces between woody plants in the Shortgrass/Mixed-brush Community (2.1) and the Mixed-brush/Shortgrass/Annuals Community (2.2). Once the shrubland matures, the hydrologic and ecological processes, nutrient cycling and energy flow stabilize within the woody plant canopy. Evaporation and interception losses are higher, however, resulting in less moisture reaching the soil.

Recreational uses

The Clayey Bottomland site, in conjunction with surrounding sites, is well suited for many outdoor recreational uses including recreational hunting, hiking, camping, equestrian and

bird watching. This site along with adjacent upland sites provides diverse scenic beauty and many opportunities for recreation and hunting.

Wood products

Mesquite is sometimes used for posts and charcoal. It is also used for furniture and specialty products.

Other products

Jams and jellies are made from fruit bearing species. Seeds are harvested from many plants for commercial sale. Grasses and forbs may be 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 Clayey Bottomland 30-40 RSD (8-16-79), an undated NRCS draft Ecological Site Description for Clayey Bottomland PE 31-44, 78C, literature, personal experience, field observations and personal contacts with range-trained personnel. Photos by: J.L. Schuster --taken on Waggoner Ranch, Baylor County, TX.

Special thanks to the following for assistance and guidance with development of this ESD: Reggie Quiett and Cody Bauman NRCS Vernon, TX, Mark Moseley NRCS, San Antonio, Texas and Justin Clary NRCS Temple, Texas.

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Approval

Bryan Christensen, 9/15/2023

Acknowledgments

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

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an

assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Lem Creswell, Zone RMS, NRCS, Weatherford, Texas
Contact for lead author	817-596-2865
Date	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.

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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.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes would have been uncommon for this site when occupied by the natural HCPC.

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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.

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5. **Number of gullies and erosion associated with gullies:** This is a flood plain with occasional out of bank flow. Some gullies may be present on side drains into perennial and intermittent streams. Gullies should be vegetated and stable.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** This is a flood plain with occasional out of bank flow. 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.

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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 resistant to erosion. Stability class range is expected to be 5 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0 to 48 " thick with colors from brown to dark reddish brown clay with generally subangular blocky structure. SOM is approximately 1 to 6%. See Soil survey for specific soil.

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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 with adequate litter and little bare ground provides for maximum infiltration and little runoff under normal rainfall events.

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

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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 > Trees

Additional:

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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.

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14. **Average percent litter cover (%) and depth (in):** 30 to 40% litter cover and 1-3" litter depth. Dominant litter is herbaceous.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 700 to 2700 lbs/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:** Honey mesquite, pricklypear, lotebush, annual broomweed

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