USDA Natural Resources Conservation Service

Ecological site R081BY325TX
Clay Loam 19-23 PZ

Last updated: 9/19/2023
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General information

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

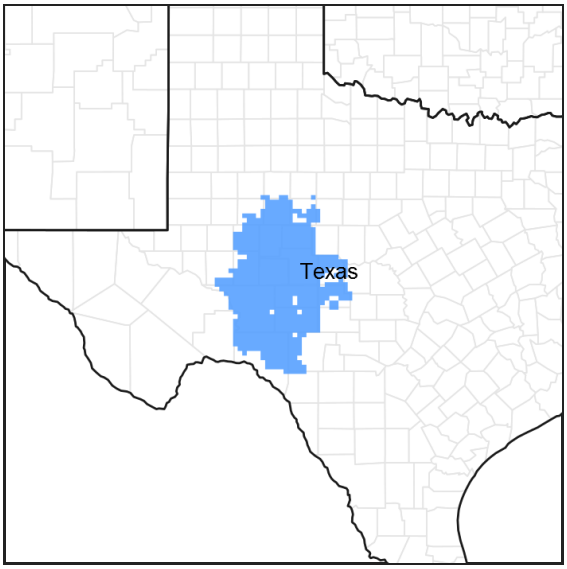


Figure 1. Mapped extent

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): 081B–Edwards Plateau, Central Part

This area is entirely in south-central Texas. It makes up about 11,125 square miles (28,825 square kilometers). The towns of Fredericksburg, Junction, Menard, Rocksprings, and Sonora are in this MLRA. Interstate 10 crosses the middle part of the area. A few State parks and State historic sites are in this MLRA.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 81B

Ecological site concept

The Clay Loam has deep, clay loam textures and has high vegetative production. Soils are generally brown, well drained, and moderately permeable.

Associated sites

R081BY334TX	**Loamy Bottomland 19-23 PZ** The Loamy Bottomland site may be encountered down slope from the Clay Loam site.
R081BY342TX	**Shallow 19-23 PZ** The Shallow site may be encountered on the adjacent slopes.
R081BY593TX	**Limestone Hill 19-23 PZ** The Limestone Hill site may be encountered uphill from the Clay Loam site.
R081BY323TX	**Clay Flat 19-23 PZ** The Clay Flat site is found in similar areas but has higher clay content in depressions.
R081BY336TX	**Low Stony Hill 19-23 PZ** The Low Stony Hill site is uphill and has shallow soils.
R081BY353TX	**Very Shallow 19-23 PZ** The Very Shallow site may be encountered on adjacent slopes or slightly upslope.

Similar sites

R081BY323TX	**Clay Flat 19-23 PZ** The Clay Flat site has higher clay content and is found in depressions.
R081BY333TX	**Loamy 19-23 PZ** The Loamy site has less than 35 percent clay.

Table 1. Dominant plant species

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

Physiographic features

The Clay Loam occurs on stream terraces of piedmont alluvial plains below the limestone hills that are gently sloping to gently undulating. This site is usually found on plain surfaces, stream terraces and valleys. The elevation ranges from 1,500 feet to 2,800 feet above sea level. Slope ranges from 0 to 3 percent. The site is used mostly for rangeland while irrigated vegetables, cotton, corn, and grain sorghum are also planted.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Stream terrace (2) Alluvial plain > Plain (3) River valley > Stream terrace
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	457–853 m
Slope	0–3%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to medium
Flooding frequency	Not specified
Ponding frequency	Not specified

Elevation	Not specified
Slope	Not specified

Climatic features

The climate in the MLRA 81B is subtropical subhumid on the eastern portion and subtropical steppe on the western portion of the MLRA. Winters are dry, and the summers are hot and humid. The precipitation increases from west to east and the temperatures increase from north to south. The area usually receives 65 to 70 percent sunshine each year. The majority of the rainfall occurs during the warm months of April to October. Most precipitation comes from thunderstorms that vary in the amount of water received and the areas covered. Spring is characterized by fluctuating patterns, but mild temperatures prevail. July and August are relatively dry and hot with little weather variability day-to-day. As summer progresses through fall, an increase of precipitation usually occurs in the eastern portions while a decrease of precipitation occurs to the west. Winter temperatures are mild, but polar Canadian air masses bring rapid drops in temperature. These cold spells last 2 or 3 days. Prevailing winds are southerly with March and April the windiest months.

Table 4. Representative climatic features

Frost-free period (characteristic range)	210-240 days
Freeze-free period (characteristic range)	240-280 days
Precipitation total (characteristic range)	483-610 mm
Frost-free period (actual range)	210-240 days
Freeze-free period (actual range)	240-280 days
Precipitation total (actual range)	483-635 mm
Frost-free period (average)	225 days
Freeze-free period (average)	260 days
Precipitation total (average)	559 mm

Climate stations used

- (1) CARTA VALLEY [USC00411492], Rocksprings, TX
- (2) ELDORADO [USC00412809], Eldorado, TX
- (3) SONORA [USC00418449], Sonora, TX
- (4) OZONA [USC00416734], Ozona, TX
- (5) BIG LAKE 2 [USC00410779], Big Lake, TX

Influencing water features

These sites are found on uplands in rangelands and do not have water features.

Wetland description

N/A

Soil features

The soils are moderately deep or very deep, well drained, moderately slowly permeable and formed in calcareous loamy and clayey alluvium derived from limestone. In a representative profile, the parent material is calcareous alluvium weathered from limestone hills. The surface layer is dark grayish-brown, calcareous silty clay loam about 26 to 56 inches thick. Internal drainage is well drained and permeability is moderately slow. Soil series correlated to this site include: Angelo, Nuvalde, Rio Diablo, and Valera.

Table 5. Representative soil features

Parent material	(1) Alluvium–limestone
Surface texture	(1) Silty clay loam (2) Clay loam (3) Silty clay
Family particle size	(1) Fine-silty (2) Fine
Drainage class	Well drained
Permeability class	Moderately slow
Depth to restrictive layer	152–203 cm
Soil depth	152–203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	12.45–20.07 cm
Calcium carbonate equivalent (0-101.6cm)	5–40%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (10.2-101.6cm)	0–15%
Subsurface fragment volume >3" (10.2-101.6cm)	0–1%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Slow to moderate
Depth to restrictive layer	51–203 cm
Soil depth	51–203 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Calcium carbonate equivalent (0-101.6cm)	5–60%
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (10.2-101.6cm)	Not specified
Subsurface fragment volume >3" (10.2-101.6cm)	Not specified

Ecological dynamics

The dynamics of the site are influenced by the varied semi-arid climate, topography, herbivory, periodic drought, and recurring fires. Most precipitation comes during the summer growing season (April to October) as convective rainstorms of short duration and high intensity. Hard freezes and severe extended droughts occur infrequently, but their effects influence the vegetation composition in the years following and magnify the effects of herbivory and fire.

The reference plant community of the Clay Loam site in MLRA 81B was a fire influenced Midgrass Prairie Community (1.1). The site is responsive to fire because of its nearly level topographic location, dry hot summers, dry winters and few barriers to fire. Fires, started by lightning or native Americans, would likely have been frequent, occurring every 7 to 12 years. Fires influenced the Clay Loam site by maintaining the fire climax grassland community with scattered mottes of trees and shrub vegetation. The soils have good water holding capacity and often receive extra runoff from upslope, making the site more productive than climate predicates. In reference conditions, the site is not subject to severe wind or water erosion. The semiarid climate with infrequent droughts predicates mid and short grasses that can withstand the droughts.

Since European settlement of the area in the 1800's, many of the reference species have declined or increased, depending on their response to herbivory, reduction in frequency and intensity of fires, and land-use practices. Under heavy continuous livestock grazing, successional patterns tend to go toward woody and cool-season vegetation and more arid microclimates. Exact causes of vegetation change toward more woody species are subject to debate, but suspected causes include continued overgrazing, reduction of frequency and intensity of fire, changes in climate, and increases in atmospheric carbon dioxide concentration and nitrogen deposition since the industrial revolution. Regardless of the cause or causes of vegetation changes, overgrazing is a major factor in retrogression and plant species change due to selective removal of photosynthetic tissue by grazing herbivores.

When retrogression is livestock induced, the initial response is the decline of the dominants and an increase in less palatable subdominants. Initially, the mid and tallgrasses give way to less palatable mid and shortgrasses such as Arizona cottontop (*Digitaria californica*), cane bluestem (*Bothriochloa barbinodis*), silver bluestem (*Bothriochloa laguroides*), dropseeds (Sporobolus spp.), and less palatable forbs such as western indigo (*Indigofera miniata*), Hairy tubetongue (Siphonoglossa pilosella), and daleas (Dalea spp.). This opens the grass cover to increases or invasion by deep-rooted woody species such as live oaks (*Quercus virginiana*), mesquite (Prosopsis glandulosa), sumacs (Rhus spp.), juniper (Juniperus spp.), acacia (Acacia spp.), algerita (Mahonia trifoliata), and javelinabush (Condalia eriocoides).

In the Mixed-grass Savannah Community (1.2), primary production shifts from a midgrass prairie toward woody species and shortgrasses. Woody plant cover increases to 10 to 35 percent at the expense of the grass community, but primary production is stable, if not increased. The deeper-rooted woody plants are able to draw water from deeper soil depth. Litter and soil organic matter have changed little. The site takes on a look of a short and midgrass prairie being invaded by shrubs. At this stage, the trend toward shrubs can be reversed to a midgrass prairie with proper grazing management and brush management practices such as prescribed burning and individual plant treatment (IPT). If overgrazing continues and fire is reduced in intensity and frequency, the brush canopy will increase in size and density until the overstory canopy exceeds 40 percent. When this increase in overstory canopy occurs, the Mixed-Brush/Shortgrass Community (2.1) found in the Brushland State is entered.

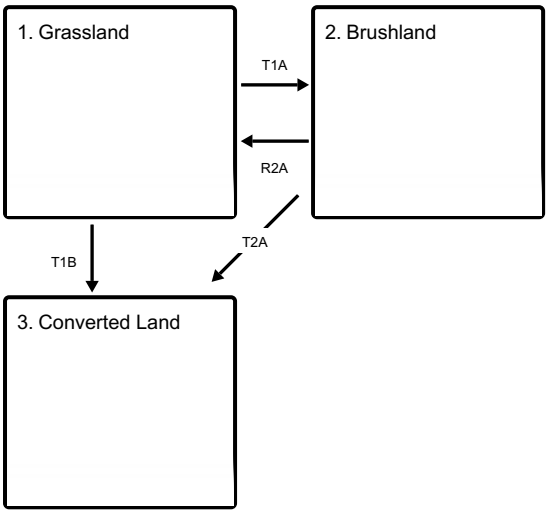
Continued selective grazing causes the shorter grasses and low-quality annuals and forbs to replace the subdominant midgrasses and palatable forbs. Buffalograss (*Bouteloua dactyloides*), curlymesquite (*Hilaria belangeri*), Texas wintergrass (*Nassella leucotricha*), and low quality annual forbs will dominate the herbaceous understory. The overstory is dominated by live oaks, mesquite, or juniper. Mesquite and/or juniper generally dominate. In this state, common understory shrubs are pricklypear (Opuntia spp.), javelinabush (Condalia spp.), algerita (Mahonia trifoliata), bluewood condalia (*Condalia hookeri* var. hookeri), yucca (Yucca spp.), and acacia. Grass and forb production is severely reduced. Desertification is taking place resulting in the lowering of soil organic matter, decreased infiltration and water holding capacity. Shorter plants and less litter bring about more exposure of the soil surface to erosion.

Once the threshold of 40 percent woody plant cover is reached, the transition cannot be reversed without extensive brush management, range planting and grazing management. Without these expensive inputs, the Mixed-Brush/Shortgrass Community (2.1) continues to decline as a forage resource. The Mixedbrush/Shortgrass

Community (2.1) can be restored with considerable input of energy and expense. With intensive brush management, range planting, prescribed grazing, and prescribed burning, the site can be returned to near reference conditions. Other alternatives include planting crops or pasture. The Converted Land Community (3.1) is a rather stable community if cropping is continuous and grazing management and brush management is practiced on pastureland. If cropland or pasture management is abandoned, these vegetative states revert to what is generally described as Abandoned or Go Back Land Community (3.2). The Go Back Land Community initially reflects the Mid and Shortgrass Savannah Community (1.2), because the community will initially support annual grasses and forbs along with invading mesquite, prickly pear, and other species. Loss of fertility, soil organic matter, and ground cover make these communities more susceptible to erosion.

State and transition model

Ecosystem states



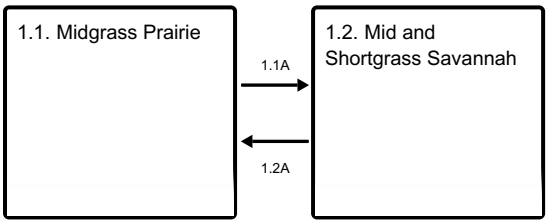
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

T1B - Extensive soil disturbance followed by seeding

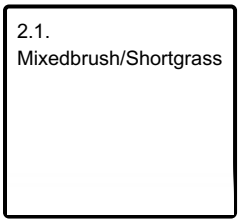
R2A - Reintroduction of historic disturbance return intervals

T2A - Extensive soil disturbance followed by seeding

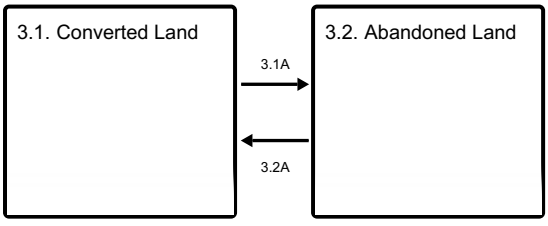
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Grassland

Dominant plant species

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

Community 1.1
Midgrass Prairie

Figure 8. 1.1 Midgrass Prairie Community

The reference plant community is a fire-dependent midgrass community with less than five percent woody plant cover. The vegetative composition is 85 to 90 percent grasses, 5 to 10 percent forbs, and generally less than five percent trees and shrubs. Scattered trees or mottes of live oak (*Quercus virginiana*), hackberry (Celtis spp.), and western soapberry (*Sapindus saponaria* var. drummondii) interrupt the mostly open grassland. The typical Midgrass Prairie Community (1.1) was dominated by sideoats grama (*Bouteloua curtipendula*). Little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), and Indiangrass (Sorgastrum nutans) were present in small amounts in more mesic locations. Subdominant species included cane and silver bluestems (Bothriochloa spp.), bristlegrass (Setaria spp.), Arizona cottontop (*Digitaria californica*), dropseeds (Sporobolus spp.), slim tridens, and rough tridens (Tridens spp.). Vine mesquite (*Panicum obtusum*), buffalograss (*Bouteloua dactyloides*), and curlymesquite (*Hilaria belangeri*) were the primary shortgrasses. The primary cool-season grasses were Texas wintergrass (Nassella leoucotricha), Canada wildrye (*Elymus canadensis*), and western wheatgrass (*Pascopyrum smithii*). Climax forbs included catclaw sensitivebriar (Mimosa nutallii), western indigo (Indigo spp.), bundleflower (Desmanthus spp.), snoutbean (Rhynchosia spp.), western ragweed (Ambrosia cumanensis), Engelmann's daisy (*Engelmannia peristenia*), and dalea (Dalea spp.). Scattered mottes of live oak (*Quercus virginiana*), hackberry (Celtis spp.), and western soapberry (*Sapindus saponaria* var. drummondii) with several understory shrubs covered approximately five percent of the site. Typical shrubs and vines included bumelia, white shin oak, ephedra (Ephedra spp.), greenbriar (Smilax spp.), pricklyash (Zanthoxylum spp.), and white honeysuckle (*Lonicera albiflora*). This plant community evolved under the influence of the climate, short duration heavy use by large migrating herbivores followed by long rest periods and fire at 7 to 12-year intervals. This community can be maintained in stable condition with proper grazing management and prescribed burning. Overgrazing by any type of herbivores in conjunction with a decrease in intensity and frequency of burning will allow the transition to other vegetative states to occur.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1905	3620	4192
Forb	224	426	493
Shrub/Vine	67	128	148
Tree	45	85	99
Total	**2241**	**4259**	**4932**

Figure 10. Plant community growth curve (percent production by month). TX3615, Midgrass Dominant with Shortgrass and Scattered Shrubs. Midgrass dominant vegetation with shortgrasses and scattered shrubs..

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

Community 1.2
Mid and Shortgrass Savannah

Figure 11. 1.2 Mid and Shortgrass Savannah Community

The Mid and Shortgrass Savannah Community (1.2) reflects the influence of suppression of fires and the effects of grazing on the more palatable species. The indigenous and invading woody plant canopy has increased due to an increase of species such as mesquite, juniper, acacia, algerita, and condalia. The more palatable tall and midgrasses are being replaced by subdominants such as cane and silver bluestem, bristlegrass, curlymesquite, Texas wintergrass, and less palatable forbs and annuals. Forage production is not detrimentally affected but primary production is shifting from grasses to woody species. Woody plant cover increases to 10 to 35 percent at the expense of the grass community. Nutrient cycling and water use is shifting toward the deeper-rooted woody perennials. Soil organic matter and litter are slightly less than in the reference community. The Midgrass Prairie Community (1.1) is also representative, in structure and species, of the community found on this site after brush management practices have been applied. The Mid and Shortgrass Savannah Community (1.2) is reversible with grazing management and prescribed burning practices until brush canopy exceeds 40 percent. When woody plant canopy exceeds 40 percent, the plant community crosses over to a threshold identified as the Brushland State. The Mixedbrush/Shortgrass Community (2.1) within the Shrubland State is not reversible to the Mixed Prairie Community (1.1) without extensive and expensive inputs.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1530	2331	2914
Shrub/Vine	471	717	897
Forb	235	359	448
Tree	118	179	224
Total	**2354**	**3586**	**4483**

Figure 13. Plant community growth curve (percent production by month). TX3610, Midgrass Savannah with woody encroachment. Midgrass savannah with woody encroachment. Tallgrasses decline in population and increase of woody canopy to 20%..

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

Pathway 1.1A
Community 1.1 to 1.2

Midgrass Prairie **Mid and Shortgrass Savannah**

This plant community evolved under the influence of the climate, short duration heavy use by large migrating herbivores followed by long rest periods and fire at 7 to 12-year intervals. This community can be maintained in stable condition with proper grazing management and prescribed burning. Overgrazing by any type of herbivores in conjunction with a decrease in intensity and frequency of burning will allow the transition to other vegetative states to occur.

Pathway 1.2A
Community 1.2 to 1.1

Mid and Shortgrass Savannah **Midgrass Prairie**

Prescribed grazing, prescribed burning, and brush Management (IPT) are some desirable conservation practices to revert back to the Midgrass Prairie Community from the Mid/Shortgrass Savannah Community.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing

State 2
Brushland

Dominant plant species

- oak (*Quercus*), tree

- juniper (*Juniperus*), tree
- mesquite (*Prosopis*), shrub

Community 2.1
Mixedbrush/Shortgrass

Figure 14. 2.1 Mixedbrush/Shortgrass Community

Continued overgrazing causes a shift from a Mid and Shortgrass Savannah Community (1.2) with 10 to 35 percent woody cover to a Mixedbrush/Shortgrass community (2.1) with over 40 percent canopy cover. The tree and brush canopy of the Mixedbrush/Shortgrass Community (2.1) exceeds 40 percent. Mesquite, and sometimes juniper, dominates the overstory with 50 percent species composition from trees. Common understory shrubs which makes up of 20 percent species composition are pricklypear, algerita, condalia, yucca, and tasajillo (*Cylindropuntia leptocaulis*). Shortgrasses and low-quality forbs replace the palatable midgrasses. Grasses, which makes up of 25 percent species composition, that are common for this plant community include Texas wintergrass, curlymesquite, buffalograss, Hall's panicum (*Panicum hallii*), rough tridens (*Tridens muticus* var. muticus) slim tridens (*Tridens muticus*), tobosagrass (Pleuraphis muticus), and fall witchgrass (*Digitaria cognata* var. cognata). Common forbs, which makes up of 10 percent species composition, include dotted gayfeather (*Liatris punctata* var. punctata), orange zexmenia (Wedelia hispida), croton (Croton spp.), Western ragweed, prairie coneflower (*Ratibida columnifera*), and broomweed (Gutierrezia spp.). Annual broomweed (*Gutierrezia texana*) is also generally present. The tree and shrub canopy acts to intercept rainfall and increase evapotranspiration losses creating a more xeric microclimate and reducing soil moisture and infiltration. Desertification is ongoing. Soil fauna and litter are reduced exposing more soil surface to erosion in interstitial spaces. Without major brush management and grazing management inputs, the Brushland State cannot be reversed into a Grassland State. Without proper management, it will continue to thicken until it reaches maximum woody plant cover and stabilizes with the climate and soil. Although this state provides good habitat cover for wildlife, only limited preferred forage or browse is available for livestock or wildlife.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	897	1681	2186
Grass/Grasslike	448	841	1093
Shrub/Vine	359	673	874
Forb	90	168	219
Total	**1794**	**3363**	**4372**

Figure 16. Plant community growth curve (percent production by month). TX3618, Mixedbrush/Shortgrass Community. Yearlong green forage due to shrubs and cool season species growth in winter and spring. Peak rainfall period from April through September provides most productivity during summer growing season..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	7	8	14	18	12	6	4	13	2	7	4

State 3
Converted Land

Dominant plant species

- kleingrass (*Panicum coloratum*), grass
- weeping lovegrass (*Eragrostis curvula*), grass

Community 3.1
Converted Land

Figure 17. 3.1 Converted Land Community - Cropland

Figure 18. 3.1 Converted Land Community - Pastureland

Many early settlers of the MLRA, having a farming background, cultivated small fields on the Clay Loam site and adjacent bottomlands for vegetable crops, grain, forage sorghum, and winter cereals for livestock forage. Many of the Clay Loam sites have been converted to cropland in the past. The climate of the central portion of the Edwards Plateau MLRA 81B is such that summer crops succeed only one in four or five years, so farming is not sustainable. Cropping small acreages is still practiced, however, for summer annual forage crops or winter small grain grazing, either for livestock grazing, grain harvesting, or planting for wildlife food plots on many ranches. Many fields, however, have been abandoned and let ‘go back’ to native range or planted to introduced grasses for pasture use. Abandoned cropland areas, or cleared areas, are often seeded to climax native species or introduced grass species such as Kleingrass (*Panicum coloratum*), blue panicum (*Panicum antidotale*) or weeping lovegrass (*Eragrostis curvula*). Herbage production on those seeded to adapted introduced grasses or native grasses reach peak production within a few years, if a full stand is established. In this case, herbage production will equal the reference conditions if species such as little bluestem or sideoats grama are seeded. Adapted introduced species plantings

such as Kleingrass may surpass reference condition production. The practice of including adapted legumes or other forbs will enhance vegetative productivity and usefulness, especially for wildlife.

Figure 20. Plant community growth curve (percent production by month). TX3600, Cool Season Crops. Cool season species are planted in the fall for winter and spring growth. Species include wheat and oats..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	5	10	10	5	0	0	0	20	25	15	5

Figure 21. Plant community growth curve (percent production by month). TX3601, Warm Season Crops. Warm season species are planted in early spring. Their peak growth is in late May with a lesser peak in September. Forage and Grain sorghum that are planted during the warm season months..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	20	25	20	10	10	5	2	0	0

Figure 22. Plant community growth curve (percent production by month). TX3613, Reclaimed Land. Reclaimed Land seeded with native or introduced species..

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

Community 3.2
Abandoned Land

Abandoned or Go Back Land is a local name used to describe cropland fields that have been abandoned and undergoing secondary succession. The plant community consists of a mixture of native grasses, forbs, and shrubs. The community results from abandoning cropland and leaving the land idle without range planting or brush management. Weeds and brush from the adjacent rangeland will invade the abandoned cropland. The initial composition of abandoned fields on Clay Loam sites is annual, biennial, and weak perennial grasses and forbs. The species depends on the seed source from adjacent rangeland. The rate of succession depends on grazing management and drought frequency, but reestablishment of reference conditions takes many years. Without grazing management and brush management, brush species such as pricklypear, mesquite, and juniper will dominate before a climax grass community can be established. Biomass production will be limited in the early seral stage and increase as the climax community is approached. Brush management and grazing management are required to allow the field to go back to near reference conditions.

Table 10. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	616	1110	1480
Forb	336	605	807
Shrub/Vine	112	202	269
Tree	56	101	135
Total	**1120**	**2018**	**2691**

Figure 24. Plant community growth curve (percent production by month). TX3619, Midgrass/Mixedbrush Community. Midgrass and Mixedbrush summer growth with some cool season grass growth..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	7	13	20	15	7	5	10	7	5	5

Pathway 3.1A

Community 3.1 to 3.2

Invasion of the seeded fields by brush such as mesquite, pricklypear, condalia, yucca, and juniper is common in this MLRA. Drought and reduced soil cover due to cropping and grazing and a nearby seed source trigger the invasions. The shrub seedlings that appear in seeded or abandoned fields are true seedlings established by seeds brought in by animals, water, or wind. The invading brush must be controlled with grazing management, prescribed burning or other brush management methods or the woody invaders will again dominate.

Pathway 3.2A
Community 3.2 to 3.1

With the implementation of various conservation practices such as prescribed grazing, range/pasture/cropland management, pasture planting, range planting, and crop cultivation, the Abandoned Land Community can be reverted to the Converted Land Community.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Transition T1A
State 1 to 2

The Mid and Shortgrass Savannah Community (1.2) is reversible with grazing management and prescribed burning practices until brush canopy exceeds 40 percent. When woody plant canopy exceeds 40 percent, the plant community crosses over to a threshold identified as the Brushland State. The Mixedbrush/Shortgrass Community (2.1) within the Shrubland State is not reversible to the Mixed Prairie Community (1.1) without extensive and expensive inputs.

Transition T1B
State 1 to 3

Brush management, pasture planting, range planting, and crop cultivation are some conservation practices that can shift from the Grassland State to the Converted Land State.

Restoration pathway R2A
State 2 to 1

Alternatives for restoration include: (a) brush management and seeding to return vegetation and grazing management and prescribed fire to maintain the desired community; (b) brush management, cultivation and cropping with adapted crops and/or (c) brush management and seeding with introduced pasture species followed by proper grazing and pasture management.

Conservation practices

Brush Management
Prescribed Burning
Range Planting
Prescribed Grazing

Transition T2A
State 2 to 3

Brush management, pasture planting, range planting, and crop cultivation are some conservation practices that can shift from the Grassland State to the Converted Land State.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**midgrass**			560–1233	
	sideoats grama	BOCU	*Bouteloua curtipendula*	560–1233	–
2	**tallgrass**			448–986	
	big bluestem	ANGE	*Andropogon gerardii*	448–986	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	448–986	–
	little bluestem	SCSC	*Schizachyrium scoparium*	448–986	–
	Indiangrass	SONU2	*Sorghastrum nutans*	448–986	–
3	**midgrasses/shortgrasses**			336–740	
	threeawn	ARIST	*Aristida*	336–740	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	336–740	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	336–740	–
	tumble windmill grass	CHVE2	*Chloris verticillata*	336–740	–
	fall witchgrass	DICO6	*Digitaria cognata*	336–740	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	336–740	–
	green sprangletop	LEDU	*Leptochloa dubia*	336–740	–
	vine mesquite	PAOB	*Panicum obtusum*	336–740	–
	bristlegrass	SETAR	*Setaria*	336–740	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	336–740	–
	tridens	TRIDE	*Tridens*	336–740	–
	slim tridens	TRMU	*Tridens muticus*	336–740	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	336–740	–
4	**shortgrasses**			448–986	
	buffalograss	BODA2	*Bouteloua dactyloides*	448–986	–
	curly-mesquite	HIBE	*Hilaria belangeri*	448–986	–
5	**cool-season grasses**			112–247	
	Canada wildrye	ELCA4	*Elymus canadensis*	112–247	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	112–247	–
	western wheatgrass	PASM	*Pascopyrum smithii*	112–247	–
Forb					
6	**forbs**			224–493	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	224–493	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	224–493	–
	greeneyes	BERLA	*Berlandiera*	224–493	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	224–493	–

	prairie clover	DALEA	*Dalea*	224–493	–
	bundleflower	DESMA	*Desmanthus*	224–493	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	224–493	–
	eastern milkpea	GARE2	*Galactia regularis*	224–493	–
	Gregg's tube tongue	JUPI5	*Justicia pilosella*	224–493	–
	trailing krameria	KRLA	*Krameria lanceolata*	224–493	–
	dotted blazing star	LIPU	*Liatris punctata*	224–493	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	224–493	–
	evening primrose	OENOT	*Oenothera*	224–493	–
	narrowleaf Indian breadroot	PELI10	*Pediomelum linearifolium*	224–493	–
	snoutbean	RHYNC2	*Rhynchosia*	224–493	–
	wild petunia	RUELL	*Ruellia*	224–493	–
	awnless bushsunflower	SICA7	*Simsia calva*	224–493	–
	fuzzybean	STROP	*Strophostyles*	224–493	–
	vervain	VERBE	*Verbena*	224–493	–
	creepingoxeye	WEDEL	*Wedelia*	224–493	–
Shrub/Vine					
7	**shrubs/vines**			67–148	
	snakewood	CONDA	*Condalia*	67–148	–
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	67–148	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	67–148	–
	jointfir	EPHED	*Ephedra*	67–148	–
	stretchberry	FOPU2	*Forestiera pubescens*	67–148	–
	algerita	MATR3	*Mahonia trifoliolata*	67–148	–
	pricklypear	OPUNT	*Opuntia*	67–148	–
	sumac	RHUS	*Rhus*	67–148	–
	bully	SIDER2	*Sideroxylon*	67–148	–
	greenbrier	SMILA2	*Smilax*	67–148	–
Tree					
8	**trees**			45–99	
	pecan	CAIL2	*Carya illinoinensis*	45–99	–
	hackberry	CELTI	*Celtis*	45–99	–
	little walnut	JUMI	*Juglans microcarpa*	45–99	–
	Texas mulberry	MOMI	*Morus microphylla*	45–99	–
	mesquite	PROSO	*Prosopis*	45–99	–
	live oak	QUVI	*Quercus virginiana*	45–99	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	45–99	–
	elm	ULMUS	*Ulmus*	45–99	–

Animal community

Many types of wildlife use Clay Loams in conjunction with adjacent Ecological Sites. Grassland insects, reptiles, birds, and mammals frequent the site. Small mammals include many kinds of rodents, jackrabbit, cottontail rabbit,

raccoon, skunk, opossum and armadillo. Predators include coyote, red fox, gray fox, bobcat and occasionally mountain lion. Many types of birds including game birds, songbirds, and birds of prey are indigenous. Most are still plentiful. Bison and pronghorn antelope, however, are no longer present, but white-tailed and many species of exotic deer utilize the Clay Loam site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Mid and Shortgrass Savannah Community (2). Deer, turkey, quail, and dove hunting is an important sport, or commercial enterprise, providing considerable income to land owners.

The site in reference condition is very suited to primary grass eaters such as cattle. As retrogression occurs and woody plants invade, the site becomes better habitat for sheep, goats, deer and other wildlife because of the browse and cool-season grasses. Cattle, sheep, and goats should be stocked in proportion to the available grass, forb, and browse production, keeping deer competition for forbs and browse in mind. If the animal numbers are not kept in balance with herbage and browse production through proper grazing management and good wildlife population management, the late Mixedbrush/Shortgrass Community will have little to offer as habitat except cover.

Hydrological functions

The Clay Loam ecological site is a well-drained, very shallow to very deep upland. Its soils are moderately to slowly permeable, but runoff is slow due to gentle slopes. Under reference conditions, 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 is slight. Soil cover and organic matter decrease, and surface runoff increases as the Midgrass Prairie Community transitions to the Mid and Shortgrass Savannah Community. These processes continue in the interstitial spaces in the Mixedbrush/Shortgrass Community phase. Once the Mixedbrush/Shortgrass Community canopy surpasses 50 percent the hydrology 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. If overgrazing continues, the shortgrass community deteriorates further, and desertification processes continue. Biomass production is reduced relative to the reference condition and forage production has shifted from primarily grasses to primarily woody plants. The deeper-rooted woody plants are able to extract water from greater depths than grasses of the reference did, so less water will be available for aquifer recharge. 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.

Recreational uses

The Clay Loam site is well suited for many outdoor recreational uses including recreational hunting, hiking, camping, equestrian and bird watching. Clay Loam, along with adjacent upland sites and Loamy Bottomland site, provide diverse scenic beauty and many opportunities for recreating and hunting.

Wood products

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

Other products

Jams and jellies are made from many fruit-bearing species. Seeds may be harvested from 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.

Inventory data references

Information presented was derived from the revised Clay Loam Range Site Description, literature, limited NRCS clipping data (417s), field observations, experience and personal contacts with range-trained personnel. Photos by J. L. Schuster.

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Rangeland health reference sheet

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

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Contact for lead author	325-944-0147
Date	12/01/2005
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** None to slight. Site may receive runoff from adjacent sites.

3. **Number and height of erosional pedestals or terracettes:** None to slight. Minimal pedestals or terracettes due to erosion.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 10 percent bare ground. Small and non-connected areas.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to slight. Wind erosion hazard of soil is slight.

7. **Amount of litter movement (describe size and distance expected to travel):** Minimal movement of fine litter for short distances.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Erosion stability values estimated at 5 to 6. Water erosion hazard of soil is slight.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Angelo soil is grayish brown silty clay loam to 8 inches and brown clay loam in 8 to 14 inches depth. The surface layer is weak fine granular and subangular blocky. Many fine roots and worm casts. SOM is high.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The reference state provides good plant distribution and soil over so provides excellent infiltration. Under normal rainfall runoff is essentially nil but when rainfall exceeds site's ability to hold water, the

runoff is free of erosive action.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Warm-season midgrases

    Sub-dominant: Warm-season tallgrasses Warm-season shortgrasses Forbs

    Other: Cool-season grasses Shrubs/Vines Trees

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal. Grasses will almost always show some mortality and decadence, especially under drought conditions.

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14. **Average percent litter cover (%) and depth (in):** Interspaces between plant canopies essentially covered with various sizes of litter and mulch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2,000 pounds per acre in years with below average moisture, 3,800 pounds per acre in average moisture, and 4,400 pounds per acre in above average moisture years. Site may receive extra moisture from upslope sites and be highly productive in wet years.

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

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17. **Perennial plant reproductive capability:** Good. All species should be capable of reproducing except during periods of prolonged drought, heavy natural herbivory or intense fire. Recovery from these disturbances will take 2 to 5 years.
