USDA Natural Resources
Conservation Service

Ecological site R078CY111TX
Shallow 23-30" PZ

Last updated: 9/15/2023
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General information

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

MLRA notes

Major Land Resource Area (MLRA): 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. Vegetation consists of native grasses and shrubs with scattered infestations of mesquite. Current land uses are rangeland, pastureland, wildlife habitat, and cropland. Dryland crops include cotton, wheat, and grain sorghum.

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

Theses sites occur over shallow soils that support shortgrass and midgrass plant communities.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

These nearly level to gently sloping soils are on outwash plains, ancient stream terraces and alluvial fans. The soil formed in calcareous clay loams and clays several feet thick. Slopes range from 0 to 8 percent. Elevation ranges from 900 to 2,800 feet.

Table 2. Representative physiographic features

Landforms	(1) Plains > Ridge (2) Plains > Hillslope
Runoff class	Low to high

Flooding frequency	None
Ponding frequency	None
Elevation	274–853 m
Slope	0–8%
Water table depth	183 cm
Aspect	Aspect is not a significant factor

Climatic features

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

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

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

Normal rainfall averages 23 to 30 inches a year but distribution of rainfall patterns are so erratic short dry periods are common. The majority of the rainfall occurs as showers, rather than general rain events between March and November. Dry periods of three to four weeks can be expected during this time as well. Even if these dry conditions occur, complete crop failures seldom results.

May is the wettest month and December is the driest. Effective precipitation is low due to high temperatures, amounts received and intensity.

Table 3. Representative climatic features

Frost-free period (characteristic range)	164-198 days
Freeze-free period (characteristic range)	193-224 days
Precipitation total (characteristic range)	660-686 mm
Frost-free period (actual range)	161-200 days
Freeze-free period (actual range)	191-226 days
Precipitation total (actual range)	635-737 mm
Frost-free period (average)	182 days
Freeze-free period (average)	209 days
Precipitation total (average)	660 mm

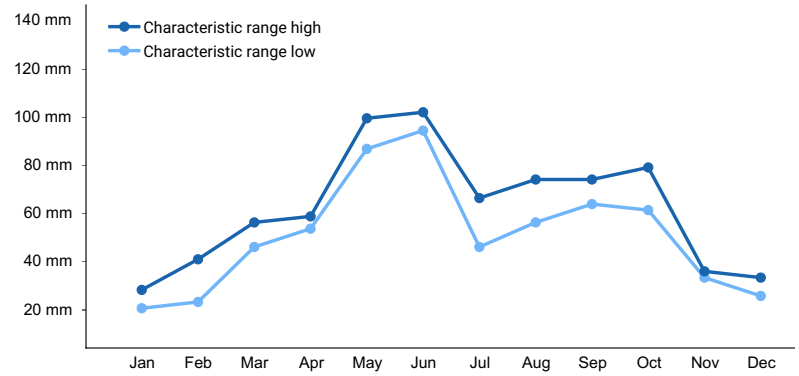


Figure 1. Monthly precipitation range

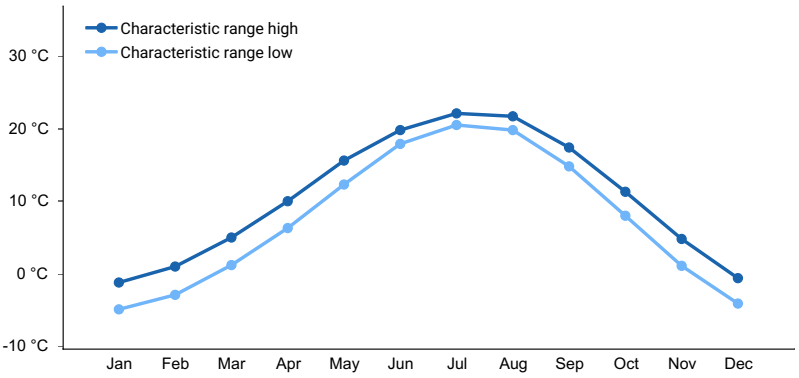


Figure 2. Monthly minimum temperature range

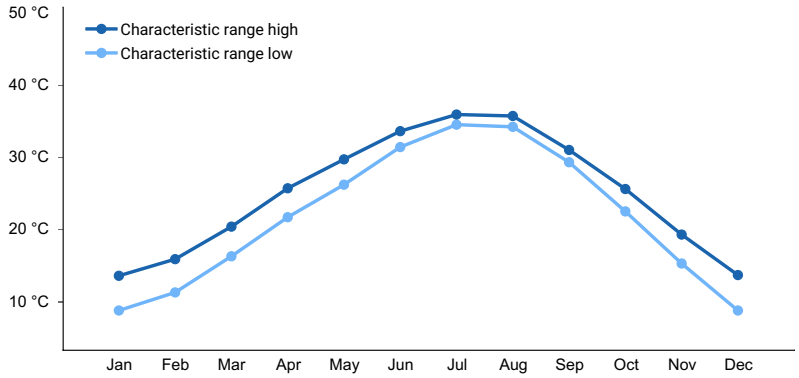


Figure 3. Monthly maximum temperature range

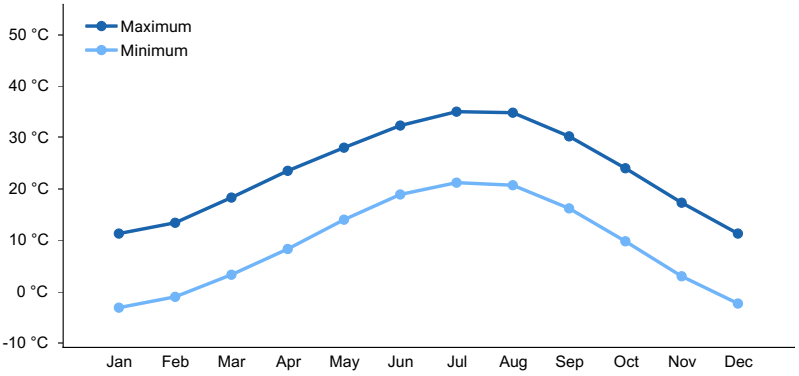


Figure 4. Monthly average minimum and maximum temperature

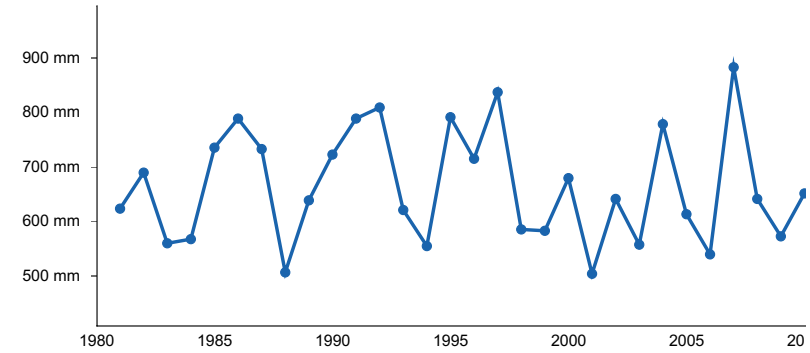


Figure 5. Annual precipitation pattern

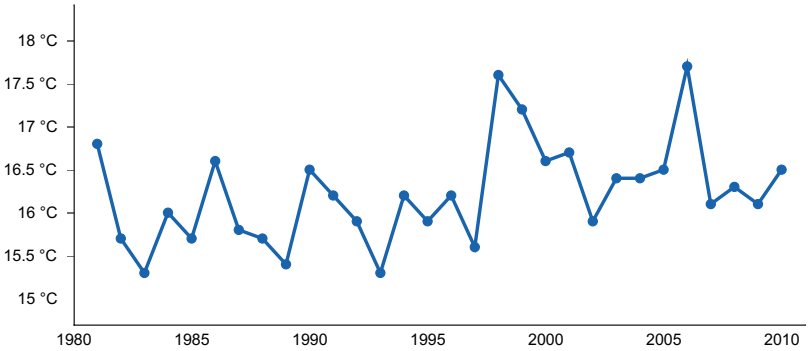


Figure 6. Annual average temperature pattern

Climate stations used

- (1) COLDWATER [USC00141704], Coldwater, KS
- (2) MUTUAL [USC00346139], Mutual, OK
- (3) ERICK [USC00342944], Erick, OK
- (4) ALTUS AFB [USW00003981], Frederick, OK
- (5) STAMFORD 1 [USC00418583], Stamford, TX
- (6) WINTERS 1 NNE [USC00419847], Winters, TX

Influencing water features

NA

Wetland description

NA

Soil features

They are well drained, moderate to moderately slowly permeable soils that formed in loamy, calcareous, alluvium or residuum. Well drained.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Residuum–limestone and sandstone
Surface texture	(1) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderate

Soil depth	10–51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–4%
Available water capacity (0-101.6cm)	1.52–9.65 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	3–22%
Subsurface fragment volume >3" (Depth not specified)	0–3%

Ecological dynamics

The reference community of the Shallow Ecological Site in the 23-30” PZ was a fire influenced Midgrass Prairie (1.1) with scattered oak motts or trees. Pre-settlement influences included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts and frequent fires (Archer 1994). It is postulated that wildfires re-occurred at four to six years intervals (Frost 1998) maintaining woody species at less than five percent canopy on this relatively level site. The soils of the site vary from shallow clays to shallow clay loams with pockets and crevices of deeper soils. Moisture holding capacity is relatively limited and often limits productivity. Long-term droughts, occurring three to four times per century, such as one occurring in the 1950s, may cause shifts in vegetation by causing woody plant die-off.

The frequent fires favored grasses over woody plants and forbs. Sideoats grama was the dominant or co-dominant species on the site throughout the MLRA. Other midgrasses found in climax include cane and silver bluestems, green sprangletop, vine mesquite and Arizona cottontop. Tallgrasses, such as big bluestem and Indiangrass occupied limestone outcrops, crests of hills and drainages. Trees, primarily live oak and hackberry occupied rock crevices and deeper soil pockets on areas protected from wildfires. Trees and shrubs covered about five percent of the ground area in historic climax. There was also a wide variety of forbs and legumes present (See Species Composition Table for plants and plant groups thought to have been found on the site by early American settlers).

The Midgrass Prairie Community (1.1) was relatively stable and resilient within the climate, soil and fire regime until European settlement and the advent of fencing and animal husbandry in the mid 1800s. Not understanding the limits of rangeland productivity, European settlers overstocked the area with domesticated livestock almost universally. As continuous overgrazing occurred, there was a reduction of the less grazing resistant tall grasses, a decline in mulch and organic matter, and a reduction in intensity and frequency of fires (Brown and Smith 2000). The shift in plant cover and decline in soil properties favored woody plant encroachment. The woody invaders were generally endemic species released from competition. The more palatable or grazing intolerant species gave way to midgrasses/shortgrasses. Low palatability midgrasses and forbs began replacing the more preferred tallgrasses, midgrasses and forbs. Grasses still dominated primary production, but the encroaching woody species increased in amount of annual production in the resulting Mixed-grass Prairie Community (1.2) compared to the Midgrass Prairie Community (1.1).

When the Mixed-grass Prairie Community (1.2) is continually overgrazed and fire is excluded, it continues a transition toward a community that is dominated by woody plants. The more palatable tallgrasses, midgrasses and forbs are replaced by more grazing resistant species such as less palatable shortgrasses, forbs and woody plants. As grass cover declines, litter, mulch and soil organic matter decline and bare ground, erosion and other desertification processes increase. The increasing woody dominants are primarily mesquite and juniper. Rest from grazing will generally not restore the grassland community when the woody plant community exceeds 15 percent

canopy and the woody invaders reach fire resistant size (about four feet in height). The Mixed-grass Prairie Community (1.2) transitions into the Shortgrass/Mixed-brush Community (2.1) when this threshold is crossed. This threshold also marks the beginning of a new state, the Woodland State (2).

Mesquite and/or juniper dominate the Shortgrass/Mixed-brush Community (2.1) and condalia, pricklypear and tasajillo begin to form an understory. The grass component is a mixture of midgrasses, shortgrasses and low quality forbs. With continued livestock overgrazing, the better midgrasses will be replaced by grazing resistant shortgrasses and forbs such as buffalograss, threeawns and slim tridens. Cool-season grasses such as Texas wintergrass and annual bromes also increase. Annual broomweed becomes a problem in moist winter-spring years.

During this phase the process of retrogression can be reversed relatively easily with brush control and good grazing management that allows the application of prescribed burning. If these practices are not applied, the woody canopy will continue to increase in dominance and ground cover and the plant community transitions into a dense woody plant dominated community, the Mixed–brush/Shortgrass/Annuals Community (2.2). Once canopy cover exceeds 30 to 35 percent overstory, annual production for the understory becomes limited and is generally made up of unpalatable shrubs, grasses and forbs within tree/shrub interspaces. Brushy species such as mesquite, juniper, algerita, pricklypear and condalia become the dominant species. Low vigor shortgrasses, cool season grasses, forbs and annuals make up the herbaceous understory.

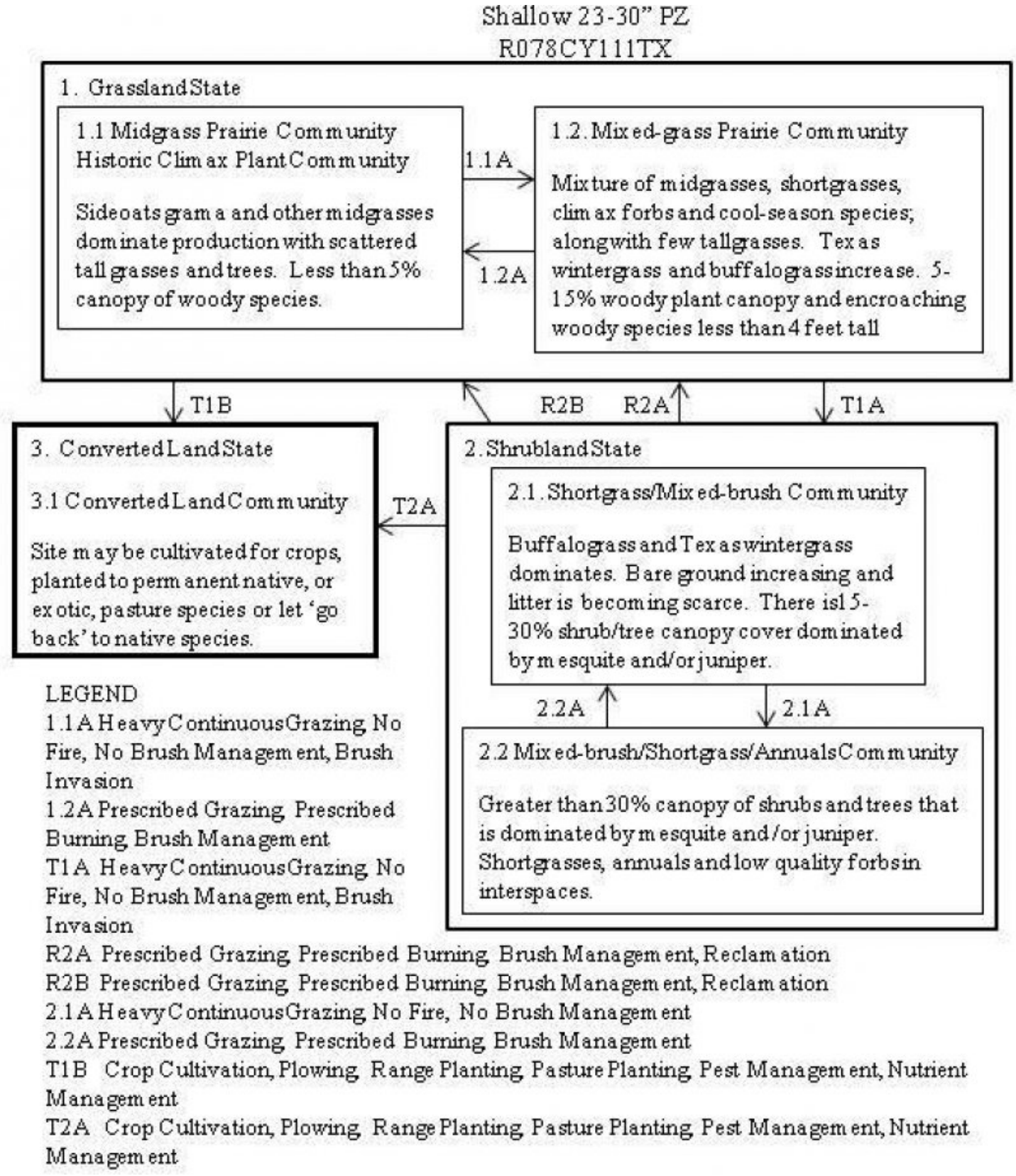
Until maximum ground cover by woody species is reached erosion continues in the interspaces. Considerable litter and soil movement occurs during heavy rains. Exposed soil crusts readily, creating opportunity for further soil and wind erosion due to run-off. The microclimate becomes drier as interception losses increase with canopy cover. Once canopy cover reaches potential, however, the hydrological processes, energy flow and nutrient cycling stabilize under the woodland/shrubland environment (Thurow 1991).

Major expense and energy inputs are required to restore the Shrubland State (2) to a Grassland State (1). Generally, mechanical or herbicidal brush management practices such as dozing and individual plant treatments (IPT) along with other conservation practices such as range planting, grazing deferment, prescribed grazing and prescribed burning are necessary for to restore the Shrubland State. Severe erosion and soil fertility losses during the retrogression process may prohibit the site from returning to historic climax.

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:

State and transition model



State 1
Grassland State

The Midgrass Prairie Community (1.1) is the interpretive plant community for the site. It was a fire induced midgrass prairie with scattered tallgrasses, scattered woody plants and a good variety of forbs. The tallgrasses usually occurred in the vicinity of limestone outcrops, drainages or the crests of hills. Live oak, hackberry and elm trees were widely scattered in draws. The Midgrass Prairie Community produces from 1500 to 3000 pounds of biomass annually. The Mixed-grass Prairie Community (1.2) is midgrass dominated grassland being encroached by indigenous or invading woody species. Numerous woody species, including juniper and mesquite, are increasing in density because overgrazing by livestock has reduced grass cover, exposed some soil and reduced fine fuel for fire.

In this phase, the increasing woody species are generally less than four feet tall and still subject to control or suppression by fire and prescribed grazing management. The woody canopy varies between 5 and 15 percent depending on severity of grazing, time since burned and availability of invading species. The preferred tallgrasses are being replaced by the more grazing resistant midgrasses although little bluestem often persists. Important grasses are sideoats grama, tall and meadow dropseed, vine mesquite, plains lovegrass, Texas cupgrass and Arizona cottontop. Texas wintergrass and buffalograss generally increase. Most of the climax perennial forbs persist, but in lesser amounts, being replaced by weedy forbs. Annual primary production ranges from 1000 to 3000 pounds per acre.

Community 1.1
Midgrass Prairie Community

The Midgrass Prairie Community (1.1) is the interpretive plant community for the site. It was a fire induced midgrass prairie with scattered tallgrasses, scattered woody plants and a good variety of forbs. The tallgrasses usually occurred in the vicinity of limestone outcrops, drainages or the crests of hills. Live oak, hackberry and elm trees were widely scattered in draws. Sumacs, elbowbush, ephedra, bumelia and pricklyash were typical shrubs. Tallgrasses such as little bluestem, big bluestem and Indiangrass occupied favorable micro-sites and were locally abundant. Sideoats grama was the most abundant grass throughout the site. Also occurring on the site, but in smaller amounts, were the feathery bluestems, Arizona cottontop, Texas wintergrass Texas cupgrass, vine mesquite and a number of shortgrasses. Buffalograss, perennial threeawns and slim and white tridens were common shortgrasses. Common forbs included gaura, Louisiana sagewort, trailing ratany, awnless bushsunflower, Engelmann's daisy, catclaw sensitivebriar and bundleflower. The Midgrass Prairie Community produces from 1500 to 3000 pounds of biomass annually, depending upon the amount of precipitation. Grasses make up to 85 percent of species composition, with about 10% being by cool-season species. With continuous overgrazing, decrease in intensity and frequency of fires and no brush management, this plant community will transition very quickly to the Mixed-grass Prairie Community (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1429	2382	2858
Forb	168	280	336
Tree	50	84	101
Shrub/Vine	34	56	67
Total	**1681**	**2802**	**3362**

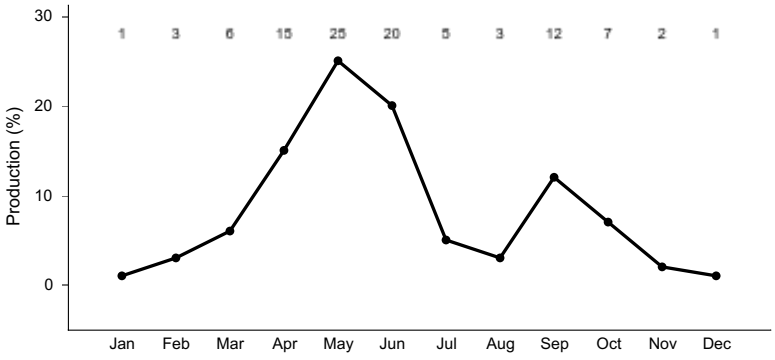


Figure 8. Plant community growth curve (percent production by month). TX2280, Midgrass Prairie Community. Warm-season native grassland with some cool-season grasses..

Community 1.2
Mixed-grass Prairie Community

The Mixed-grass Prairie Community (1.2) is midgrass dominated grassland being encroached by indigenous or invading woody species. Woody species had been held at low densities by repeated fires and competition from a vigorous grass component, but are now encroaching. Numerous woody species, including juniper and mesquite, are

increasing in density because overgrazing by livestock has reduced grass cover, exposed some soil and reduced fine fuel for fire. In this phase, the increasing woody species are generally less than four feet tall and still subject to control or suppression by fire and prescribed grazing management. The woody canopy varies between 5 and 15 percent depending on severity of grazing, time since burned and availability of invading species. Typically, oaks increase in size and mesquite and/or juniper increase in density. Brushy species such as bumelia, Texas persimmon, sumacs, lotebush, elbowbush, and feather dalea increase in density. The prairie becomes grassland being encroached by previously suppressed woody species. The preferred tallgrasses are being replaced by the more grazing resistant midgrasses although little bluestem often persists. Important grasses are sideoats grama, tall and meadow dropseed, vine mesquite, plains lovegrass, Texas cupgrass and Arizona cottontop. Texas wintergrass and buffalograss generally increase. Most of the climax perennial forbs persist, but in lesser amounts, being replaced by weedy forbs. Annual primary production ranges from 1000 to 3000 pounds per acre, depending on precipitation and the soil series. Forage production is predominantly grass. Heavy continuous grazing has reduced plant cover, litter and mulch and has increased bare ground slightly exposing the soil to some erosion. There could be some mulch and litter movement during rainstorms but due to gentle slopes little soil movement would take place in this vegetation phase. The changes in composition are small initially, but unless proper grazing and prescribed burning are initiated at this stage the secondary species continue to increase in size and density. When the canopy of the woody plants becomes dense enough (5-15 % canopy) and tall enough (greater than 4 feet) to suppress grass growth and resist fire damage, a threshold in ecological succession is reached. The Mixed-grass Prairie Community (1.2) becomes the Shortgrass/Mixed-brush Community (2.1). Normal range management practices, such as proper grazing and prescribed burning, cannot reverse the trend to woody plant dominance.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	818	1261	2466
Shrub/Vine	112	168	336
Forb	112	168	336
Tree	78	84	224
Total	**1120**	**1681**	**3362**

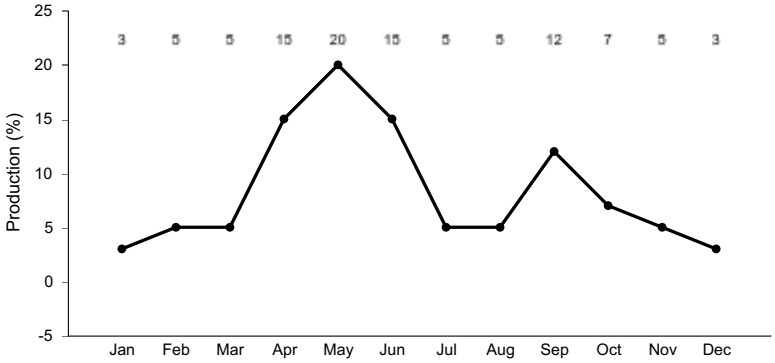


Figure 10. Plant community growth curve (percent production by month). TX2281, Mid/Shortgrass with Invading Shrubs. Warm-season native grassland with some cool-season grasses and invading shrubs approaching 15% composition..

Pathway 1.1A
Community 1.1 to 1.2

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

Pathway 1.2A
Community 1.2 to 1.1

With the implementation of Prescribed Grazing and Prescribed Burning conservation practices, the Mixed-grass

Prairie Community can be reverted back to the Midgrass Prairie Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Shrubland State

The Shortgrass/Mixed-brush Community (2.1) presents a 15 percent or greater woody plant canopy of mixed-brush, including oak, mesquite and juniper as the dominant species. There is a continued decline in diversity of the grassland component and an increase in woody species and unpalatable forbs. All, except the more palatable woody species, have increased in size. Mesquite is an early increaser throughout the MLRA. Ashe juniper and redberry juniper have increased considerably on non-burned sites in recent years. Many of the climax shrubs are present. The Mixed-brush/Shortgrass/Annuals Community (2.2) is the result of many years of mesquite and/or juniper domination. The trees and shrubs can approach 70 percent ground cover with continued heavy grazing. Common understory shrubs are pricklypear, algerita, sumacs, lotebush, yucca, Texas persimmon, elbowbush, pricklyash, croton and tasajillo. Shortgrasses and low quality annual and perennial forbs occupy the woody plant interspaces.

Community 2.1
Shortgrass/Mixed-brush Community

The Shortgrass/Mixed-brush Community (2.1) presents a 15 percent or greater woody plant canopy of mixed-brush, including oak, mesquite and juniper as the dominant species. It is the result of selective overgrazing by livestock and deer and the differential response of plants to defoliation. Climate change, including increased atmospheric carbon dioxide is also thought to be a factor. There is a continued decline in diversity of the grassland component and an increase in woody species and unpalatable forbs. Primary production has decreased due to decline in soil structure and organic matter and has shifted toward the woody component. All, except the more palatable woody species, have increased in size. Mesquite is an early increaser throughout the MLRA. Ashe juniper and redberry juniper have increased considerably on non-burned sites in recent years. Many of the climax shrubs are present. Typically lotebush, algerita, Texas persimmon, pricklypear, pricklyash, and sumac increase under continuous overgrazing on this site. Remnants of climax grasses and forbs and unpalatable invaders occupy the interspaces between trees and shrubs. Cool-season grasses such as Texas wintergrass, plus other grazing resistant climax species, can be found under and around woody plants. Because of grazing pressure and competition for nutrients and water from the woody plants the grassland component shows general lack of plant vigor and productivity. Buffalograss and Texas wintergrass are persistent increasers until shrub density reaches maximum canopy. Other common grasses include threeawns, slim tridens, white tridens, meadow dropseed, hairy grama, sedges, Texas grama and red grama. Forbs include Queen’s delight, prairie coneflower, gaura, Indian mallow, half-shrub sundrop, goldenrod, dwarf morningglory, heath aster, bush sunflower and Louisiana sagewort. As the grassland vegetation declines, more soil is exposed which can lead to crusting and erosion. During this phase, erosion can be severe on higher slopes. Higher interception losses by the increasing woody canopy combined with evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces but soil conditions are improved under the woody plant cover. Some soil loss can occur during heavy rainfall events. Annual primary production is approximately 1000 to 2500 pounds per acre. In this plant community, annual production is balanced between herbaceous plants and woody plants. Browsing animals such as goats and deer can find fair food value if browse plants have not been grazed excessively. Forage quality for cattle is low. Unless brush management and good grazing management are applied at this stage, the transition toward the Mixed-brush/Shortgrass/Annuals Community (2.2) will continue. The trend cannot be reversed with good grazing management alone.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	448	785	1121
Shrub/Vine	336	588	841
Tree	224	392	560
Forb	112	196	280
Total	**1120**	**1961**	**2802**

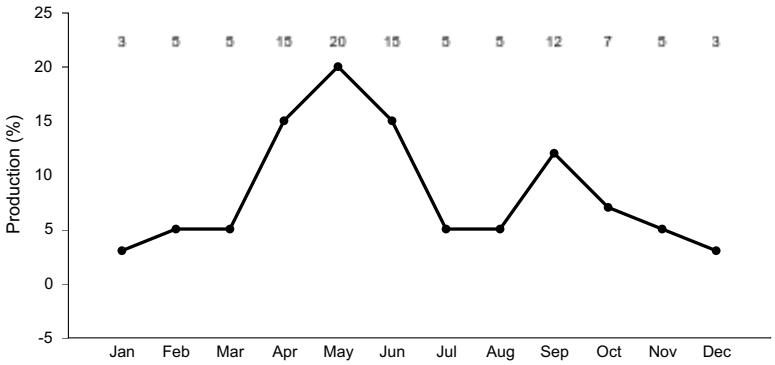


Figure 12. Plant community growth curve (percent production by month). TX2282, Shortgrasses/Cool-Season grasses/Mixed Brush Community. Warm-season native grassland with some cool-season grasses and mixed brush approaching 50% woody species..

Community 2.2
Mixed-Brush/Shortgrass/Annuals Community

The Mixed-brush/Shortgrass/Annuals Community (2.2) is the result of many years of overgrazing by livestock. Mesquite and/or juniper dominate. The trees and shrubs can approach 70 percent ground cover with continued heavy grazing. Common understory shrubs are pricklypear, algerita, sumacs, lotebush, yucca, Texas persimmon, elbowbush, pricklyash, croton and tasajillo. Short-grasses and low quality annual and perennial forbs occupy the woody plant interspaces. Characteristic grasses are Texas wintergrass, buffalograss, Hall's panicum, Texas grama, red grama, hairy tridens, slim tridens, threeawns, meadow dropseed, and fall witchgrass. Grasses and forbs make up 35 percent or less of the annual forage production. Forbs commonly found in this community include dotted gayfeather, orange zexmania, croton, western ragweed, prairie coneflower, filaree, gray goldaster, curlycup gumweed and broomweed. The Mixed-brush/Shortgrass/Annuals provides cover for wildlife but limited preferred forage or browse is available for livestock or wildlife. Alternatives for restoration include brush management and range planting to return vegetation back to near historic climax. Grazing management and prescribed fire are also necessary to maintain the desired community. Without considerable inputs in brush control and range planting plus proper grazing management, the shrubland will continue to thicken until the site stabilizes with the climate and soil factors. Restoration to the historic climax community may not be possible if erosion has depleted the historic soil properties. Brush control with herbicides is generally unsatisfactory in this region with mixed brush, and mechanical methods that cause considerable soil disturbance and range plantings can be risky. A proliferation of annuals often follows disturbances such as root plowing and dozing even with range seeding.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	280	493	1121
Shrub/Vine	560	981	841
Tree	168	291	560
Forb	112	196	280
Total	**1120**	**1961**	**2802**

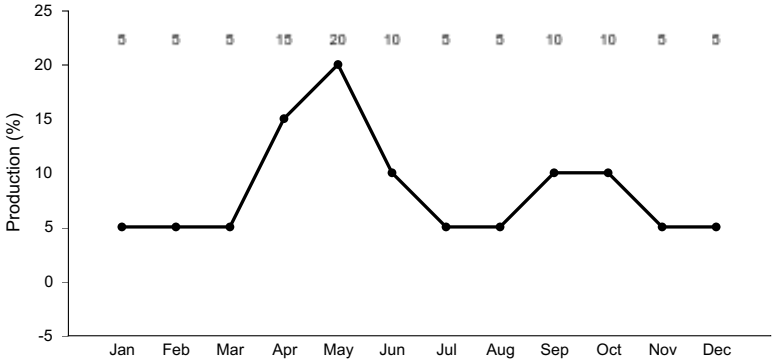


Figure 14. Plant community growth curve (percent production by month). TX2283, Mesquite/Cool-season grasses/Annuals Community. Cool-season grasses, annuals, and mixed brush. Woody species comprise approximately 65% composition..

Pathway 2.1A
Community 2.1 to 2.2

With heavy continuous grazing pressure, no fires, and no brush management practices implemented, the Shortgrass/Mixed-brush Community can be shifted to the Mixed-brush/Shortgrass/Annuals.

Pathway 2.2A
Community 2.2 to 2.1

With Brush Management and Prescribed Grazing, the Mixed-brush/Shortgrass/Annuals Community can be shifted back to the Shortgrass/Mixed-brush Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 3
Converted Land State

The Converted Land Community has been cultivated for cropland or pastureland purposes. Small grain or forage sorghum may be cropped. Permanent native and introduce pasture may also be planted. Sometimes the community may be abandoned and let “go back” to native species encroached by woody species.

Community 3.1
Converted Land Community

This site, due to shallow soils, is not recommended for cultivation. However, some sites in the past were farmed and planted to crops or planted to permanent pasture. The permanent pasture could include kleingrass, old world bluestems or other perennial plants. Even though a Shallow site may have been cultivated for a substantial period of time, the site can return to something resembling the HCPC. The return of a cultivated field to the HCPC depends on the soil integrity. Many things affect soil integrity, such as the amount of A horizon remaining, erosion, loss of organic matter, soil type, and others. There are many examples of idled cultivated fields that closely resemble the HCPC. Remnant terraces usually reveal the fact that the fields were cultivated at some time. It is sometimes difficult to determine if fields were cultivated others were not if successfully reseeded. The most obvious clue is the lack of native forb diversity. If the cultivated land is abandon, woody plants and early successional herbaceous herbaceous plants will establish. Without brush management, prescribed grazing or prescribed fires, the plant community will revert back to the Mixed-brush/Shortgrass/Annuals Community (2.2) Annual Production by Plant Type Table: The plant production in the Converted Land is highly variable. If planted to permanent pasture and not fertilized, production will resemble the HCPC. If fertilized, the plant community will produce more than the HCPC depending upon level of fertility and rainfall. Total production and composition of an abandon land is very difficult to predict and should be determined on-site.

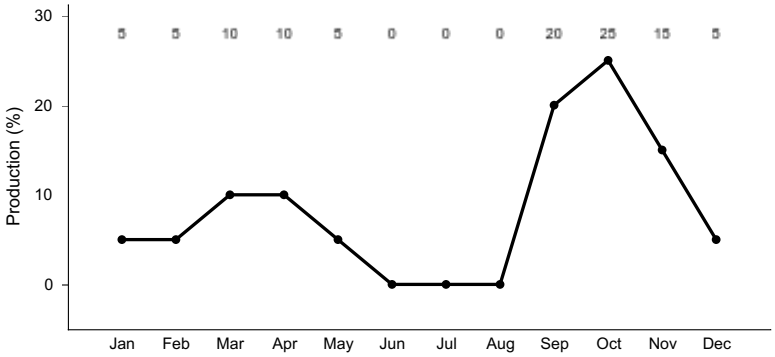


Figure 15. Plant community growth curve (percent production by month). TX2252, Small Grains. Cool-season small grain crops..

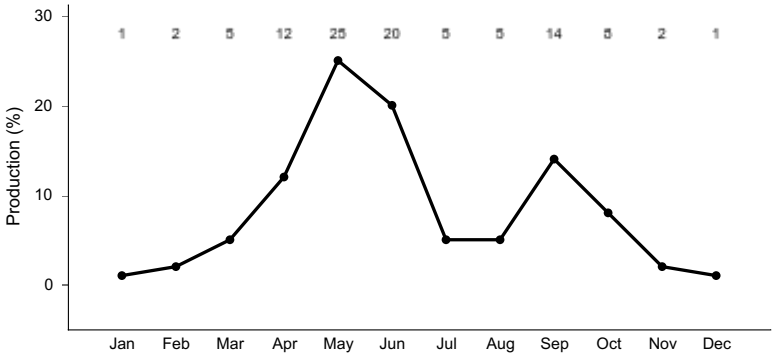


Figure 16. Plant community growth curve (percent production by month). TX2264, Warm-season Pasture Grasses. warm-season pasture grasses having nutrient management, pest management, and prescribed grazing..

Transition T1A
State 1 to 2

Due to heavy continuous grazing, no brush management, and no fires to keep the brush species in check, the Grassland State will transition into the Shrubland State.

Transition T1B
State 1 to 3

The transition to the Converted Land State occurs when crop cultivation practices, plowing, range planting, pasture planting, pest management, and nutrient management are applied to cropland, pastureland or go back land.

Restoration pathway R2A
State 2 to 1

Converting the Woodland State back to the Grassland state requires extensive and expensive reclamation practices. Without major brush control and management inputs, this plant community cannot be returned to grassland. Range planting, prescribed grazing and prescribed burning, must follow intensive mechanical brush control.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting

Transition T2A

State 2 to 3

The transition to the Converted Land State occurs when crop cultivation practices, plowing, range planting, pasture planting, pest management, and nutrient management are applied to cropland, pastureland or go back land.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			336–673	
	big bluestem	ANGE	*Andropogon gerardii*	112–336	–
	little bluestem	SCSC	*Schizachyrium scoparium*	112–336	–
	Indiangrass	SONU2	*Sorghastrum nutans*	112–336	–
	switchgrass	PAVI2	*Panicum virgatum*	0–1	–
2	**Midgrasses**			757–1513	
	sideoats grama	BOCU	*Bouteloua curtipendula*	420–841	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	84–168	–
	Arizona cottontop	DICA8	*Digitaria californica*	84–168	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	84–168	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	84–168	–
	vine mesquite	PAOB	*Panicum obtusum*	84–168	–
	large-spike bristlegrass	SEMA5	*Setaria macrostachya*	0–1	–
	Reverchon's bristlegrass	SERE3	*Setaria reverchonii*	0–1	–
	green sprangletop	LEDU	*Leptochloa dubia*	0–1	–
3	**Shortgrasses**			168–336	
	buffalograss	BODA2	*Bouteloua dactyloides*	50–101	–
	threeawn	ARIST	*Aristida*	39–78	–
	white tridens	TRAL2	*Tridens albescens*	39–78	–
	slim tridens	TRMU	*Tridens muticus*	39–78	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–1	–
	fall witchgrass	DICO6	*Digitaria cognata*	0–1	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	0–1	–
4	**Cool-season grasses**			168–336	
	Texas wintergrass	NALE3	*Nassella leucotricha*	112–224	–
	Canada wildrye	ELCA4	*Elymus canadensis*	56–112	–
	cedar sedge	CAPL3	*Carex planostachys*	0–1	–
Forb					
5	**Forbs**			168–336	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	8–17	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	8–17	–
	milkvetch	ASTRA	*Astragalus*	8–17	–
	croton	CROTO	*Croton*	8–17	–
	purple prairie clover	DAPU5	*Dalea purpurea*	8–17	–

	bundleflower	DESMA	*Desmanthus*	8–17	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	8–17	–
	beeblossom	GAURA	*Gaura*	8–17	–
	hoary false goldenaster	HECA8	*Heterotheca canescens*	8–17	–
	trailing krameria	KRLA	*Krameria lanceolata*	8–17	–
	dotted blazing star	LIPU	*Liatris punctata*	8–17	–
	Florida mimosa	MIQUF	*Mimosa quadrivalvis var. floridana*	8–17	–
	yellow nailwort	PAVI4	*Paronychia virginica*	8–17	–
	leafflower	PHYLL	*Phyllanthus*	8–17	–
	groundcherry	PHYSA	*Physalis*	8–17	–
	skullcap	SCUTE	*Scutellaria*	8–17	–
	awnless bushsunflower	SICA7	*Simsia calva*	8–17	–
	fanpetals	SIDA	*Sida*	8–17	–
	vervain	VERBE	*Verbena*	8–17	–
Shrub/Vine					
6	**Shrubs/Vines**			34–67	
	acacia	ACACI	*Acacia*	3–7	–
	featherplume	DAFO	*Dalea formosa*	3–7	–
	jointfir	EPHED	*Ephedra*	3–7	–
	stretchberry	FOPU2	*Forestiera pubescens*	3–7	–
	algerita	MATR3	*Mahonia trifoliolata*	3–7	–
	fragrant sumac	RHAR4	*Rhus aromatica*	3–7	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	3–7	–
	bully	SIDER2	*Sideroxylon*	3–7	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	3–7	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	3–7	–
Tree					
7	**Trees**			10–20	
	eastern redbud	CECA4	*Cercis canadensis*	10–20	–
	hackberry	CELTI	*Celtis*	10–20	–
	mesquite	PROSO	*Prosopis*	10–20	–
	live oak	QUVI	*Quercus virginiana*	10–20	–
	elm	ULMUS	*Ulmus*	10–20	–

Animal community

Many types of grassland insects, reptiles, birds and mammals used the historic climax plant community of the Shallow Ecological Site, either as their base habitat or from the adjacent sites. Small mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Predators include coyote, red fox, gray fox, bobcat and occasionally mountain lion. Game birds, songbirds, and birds of prey were indigenous or frequent users. Most are still plentiful. Bison and pronghorn antelope, however, are no longer present, but white-tailed and many species of exotic deer utilize the Shallow site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Mixed-grass Prairie Community (1.2) and Shortgrass/Mixed-brush (2.1) plant communities.

The site in the Grassland State (1) is very suited to primary grass eaters such as cattle. As retrogression occurs and woody plants invade it becomes better habitat for sheep, goats, deer and other wildlife because of the browse and cool season grasses. There have been some cases of photosensitization/swell head, noted in sheep and horses grazing kliengrass on this site. 9

Cattle, sheep and goats should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. If the animal numbers are not kept in balance with herbage and browse production through grazing management and good wildlife population management, the late mixed-brush shrubland phase will have little to offer as habitat except cover.

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

Legend: P=Preferred D=Desirable U=Undesirable N=Not Consumed T=Toxic X=Used, but not degree of utilization unknown
Preferred – Percentage of plant in animal diet is greater than it occurs on the land
Desirable – Percentage of plant in animal diet is similar to the percentage composition on the land
Undesirable – Percentage of plant in animal diet is less than it occurs on the land
Not Consumed – Plant would not be eaten under normal conditions. It is only consumed when other forages not available.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal.

Hydrological functions

The Shallow Ecological Site is a well-drained, moderately permeable upland with nearly level to gentle slopes. The soils have a good plant-soil-moisture relationship, but shallowness to a limestone or caliche layer limits soil moisture holding capacity. Little or no water penetrates to a ground water table except through cracks and crevasses in the caliche layer. Runoff is slow due to gentle slopes if there is a good vegetative cover. However, soil crusting can cause erosion from bare ground on steeper slopes if plant cover is removed.

Under historic climax condition, the grassland vegetation intercepted and utilized much of the incoming rainfall in the soil solum. Only during extended rains or heavy thunderstorms was there much runoff. Litter and soil movement was slight. Standing plant cover, duff and organic matter decrease and surface runoff increases as the Midgrass Prairie Community (1.2) transitions to the Mixed-grass Prairie Community (1.2). These processes continue in the interstitial spaces in the Shortgrass/Mixed-brush Community (2.1) phase. Evaporation and interception losses are higher, resulting in less moisture reaching the soil. If, overgrazing continues the plant community deteriorates further and desertification processes continue. Biomass production is reduced relative to HCPC and production has shifted from primarily grasses to primarily woody plants. The woody plants compete for moisture with the remaining grasses and forbs further reducing production and ground cover in openings. Decreased litter and more bare ground allow erosion from soils in openings between trees. Once the Mixed-brush/Shortgrass/Annuals Community (2.2) canopy surpasses 50 percent the hydrological and ecological processes, nutrient cycling and energy flow, stabilize within the woody plant community.

Recreational uses

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

Wood products

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

use for firewood and charcoal.

Other products

Jams and jellies are made from many fruit bearing species, such as algerita. Seeds can be harvested from many HCPC plants for commercial sale. Grasses and forbs are sometimes 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.

Other references

1. Archer S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. In Ecological implications of livestock herbivory in the West, pp.13-68. Edited by M. Vavra, W. Laycock, R. Pieper, Society for Range Management Publication. , Denver, CO.
2. Brown, J.K. and J.K. Smith (Editors). 2000. Wildland fire in Ecosystems; effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden. UT: U.S.D.A., Forest Service, Rocky Mtn. Sta. 257p.
3. Frost, C. C. 1998. Pre-settlement fire frequency regions of the United States: A first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20
4. Milchunas, D.G. 2006. Responses of Plant Communities to grazing in the southwestern United States. USDA-Forest Service. Rocky Mtn. Sta. GTR. 169
5. Thurow T.L., 1991. Hydrology and erosion. Chapter 6 in: Grazing Management: An Ecological Perspective Edited by: R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, Oregon.
6. USDA/NRCS Soil Survey Manuals for Baylor, Haskell, Jones, Runnels and Wilbarger Counties, Texas.
7. Plant symbols, common names and scientific names according to USDA/NRCS Texas Plant List (Unpublished)
8. Bestelmeyer, B. T., J.R. Brown, K. M. Havsted, R. Alexander, G. Chavez and J. E. Hedrick. 2003. Development and use of state-and-transition models for rangelands. J. Range Management. 56(2): 114-126.
9. Ueckert, D. N. http://cnrit.tamu.edu/discussion/cgrm/messages/5/195.html?1203985716,
10. USDA-NRCS. 1994. The use and management of browse in the Edwards Plateau of Texas, Temple, Texas.

Reviewers and Technical Contributors:
Lem Creswell, RMS, NRCS, Weatherford, Texas
Steve Glasgow, GLS, NRCS, Stillwater, Oklahoma
Justin Clary, RMS, NRCS, Temple, Texas
Lee Knox, RMS, NRCS, Abilene, Texas
Mark Moseley, RMS, NRCS, San Antonio, Texas

Contributors

Dr. Joe Schuster, Range & Wildlife Habitat Consultants, LLC, Bryan, Texas
Joe McEntire, Area Conservationist, NRCS, Abilene, Texas
PES Edits by Tyson Morley, MLRA Soil Scientist, Altus, Oklahoma

Approval

Bryan Christensen, 9/15/2023

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	03/16/2009
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Less than 20% bare ground.

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Little or no litter movement or deposition during normal rainfall events; however, litter of all sizes may move long distances depending on obstructions under intense storm events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface in HCPC is resistant to wind erosion but moderate to severe water hazards. Stability range is expected to be 5-6.

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Low vegetative cover and percent slopes makes this site susceptible to erosion.

This site has moderately slowly permeable, runoff is neglibible to low depending on slope, and available water holding capacity is moderate to high.

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

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

    Dominant: Warm-season midgrasses >

    Sub-dominant: Warm-season tallgrasses >

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

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Perennial grasses will naturally exhibit a minor amount (less than 5%) of senescence and some mortality every year.

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

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1500 to 3000 pounds per acre.

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

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17. **Perennial plant reproductive capability:** All perennial species should be capable of reproducing every year unless disrupted by extended drought, overgrazing, wildfire, insect damage, or other events occuring immediately prior to, or during the reproductive phase.
