USDA Natural Resources Conservation Service

Ecological site R077CY028TX
Limy Upland 16-21" PZ

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General information

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

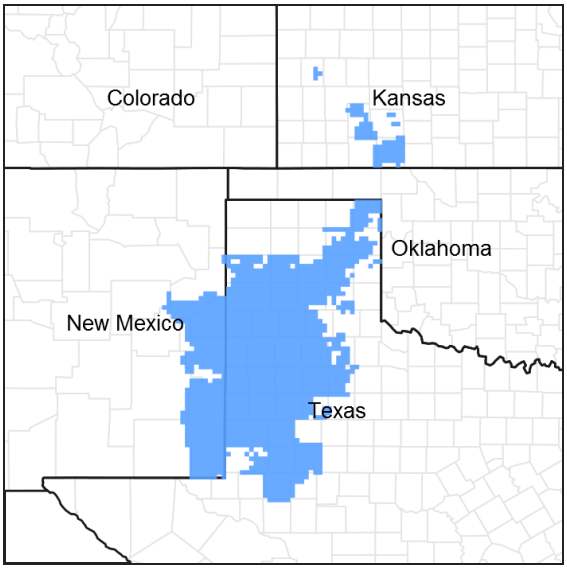


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 077C–Southern High Plains, Southern Part

This unit is characterized by nearly level plains with numerous playa depressions, moderately sloping breaks along drainageways, and a steep escarpment along the eastern margin. From southwest to northeast, soils grade from coarse-textured to fine-textured. Soils are generally deep and occur in a thermic soil temperature regime and ustic soil moisture regime bordering on aridic. Current land use is dominantly cropland.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA Ag Handbook 296.

Ecological site concept

This site occurs on calcareous loamy soils on uplands. Reference vegetation includes midgrasses, shortgrasses, forbs and few woody species. Abusive grazing practices can lead to a shift in the plant community. Without fire or other brush management, woody species may increase across the site.

Associated sites

R077CY022TX	**Deep Hardland 16-21" PZ** The Deep Hardland site is on plains and playa slopes. This site is associated with Limy Upland sites. The Limy Upland sites are on similar or slightly higher landscape positions. Shortgrasses and Midgrasses dominate on these sites.
R077CY036TX	**Sandy Loam 16-21" PZ** The Sandy Loam site is on plains and playa slopes. This site is associated with Limy Upland sites. The Limy Upland sites are on similar or slightly higher landscape positions. Midgrasses and shortgrasses dominate on these sites.
R077CY023TX	**Draw 16-21" PZ** The Draw site is on floodplains and drainageways and associated with the Limy Upland sites on higher landscape positions. The Draw sites collect runoff moisture from surrounding plains. Midgrasses and shortgrasses dominate these sites but have some tallgrasses as well.

Similar sites

R077CY026TX	**High Lime 16-21" PZ** These sites occur on calcareous, sandy loam soils on dune-like topography. The reference plant community consists of midgrasses and shortgrasses with a few forbs and shrubs. Plants adapted to high lime soil conditions dominate the site.
R077DY042TX	**Limy Upland 12-17" PZ** These sites occur on calcareous, loamy soils on uplands. The reference vegetation consists of midgrasses and shortgrasses with few forbs and very few shrubs. Plants adapted to high lime soil conditions dominate the site. Mean annual precipitation is lower (15 to 17 inches) on this site and less productive than the Limy Upland site in MLRA 77C.
R077EY057TX	**Limy Upland 16-24" PZ** These sites occur on calcareous, loamy soils on uplands. The reference vegetation consists of midgrasses and shortgrasses with few forbs and very few shrubs. Plants adapted to high lime soil conditions dominate the site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Yucca* (2) *Gutierrezia sarothrae*
Herbaceous	(1) *Bouteloua curtipendula* (2) *Bouteloua gracilis*

Physiographic features

The site occurs as nearly level to strongly sloping plains, slightly concave plains associated with playa lake basins, slightly convex playa steps, and adjacent to draws or escarpments. It is an upland plains site with slopes ranging from nearly level to strongly sloping.

Exposures are not well defined due to minimal relief.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Plain (2) Plateau > Interdune (3) Plateau > Playa slope (4) Plateau > Playa step
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None

Elevation	701–1,615 m
Slope	0–12%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Climate is semi-arid dry steppe. Summers are hot with winters being generally mild with numerous cold fronts that drop temperatures into the single digits for 24 to 48 hours. Temperature extremes are the rule rather than the exception. Humidity is generally low and evaporation high. Wind speeds are highest in the spring and are generally southwesterly. Canadian and Pacific cold fronts come through the region in fall, winter and spring with predictability and temperature changes can be rapid. Most of the precipitation comes in the form of rain and during the period from May through October. Snowfall averages around 15 inches but may be as little as 8 inches or as much as 36 inches. Rainfall in the growing season often comes as intense showers of relatively short duration. Long-term droughts occur on the average of once every 20 years and may last as long as five to six years (during these drought years moisture during the growing season is from 50 to 60 percent of the mean). Based on long term records, approximately 60 percent of years are below the mean rainfall and approximately 40 percent are above the mean. May, June and July are the main growth months for perennial warm-season grasses. Forbs make their growth somewhat earlier.

Table 3. Representative climatic features

Frost-free period (characteristic range)	155-187 days
Freeze-free period (characteristic range)	189-206 days
Precipitation total (characteristic range)	483-559 mm
Frost-free period (actual range)	148-198 days
Freeze-free period (actual range)	184-211 days
Precipitation total (actual range)	457-559 mm
Frost-free period (average)	172 days
Freeze-free period (average)	198 days
Precipitation total (average)	508 mm

Climate stations used

- (1) PORTALES [USC00297008], Portales, NM
- (2) BIG SPRING [USW00023041], Big Spring, TX
- (3) AMARILLO [USW00023047], Amarillo, TX
- (4) DENVER CITY [USC00412408], Denver City, TX
- (5) FLOYDADA [USC00413214], Floydada, TX
- (6) CAMERON [USC00291332], Grady, NM
- (7) CLAUDE [USC00411778], Claude, TX
- (8) LAMESA 1 SSE [USC00415013], Lamesa, TX
- (9) PLAINS [USC00417074], Plains, TX
- (10) SILVERTON [USC00418323], Silverton, TX

Influencing water features

Water features are not an influencing factor in this site.

Wetland description

N/A

Soil features

These soils have disseminated secondary calcium carbonates present throughout the soil profile. Some have argillic subsurface horizons and all have calcic horizons. Subsurface carbonates are in the form of films, threads, concretions, masses, and nodules.

Major Soil Taxonomic Units correlated to this site include: Bovina loam and clay loam, Crossroads fine sandy loam, Mansker loam and clay loam, Midessa fine sandy loam, Pep loam and clay loam, Portales loam and clay loam, Posey fine sandy loam and loam, and Tulia loam and clay loam.

Table 4. Representative soil features

Parent material	(1) Eolian deposits–metamorphic and sedimentary rock
Surface texture	(1) Clay loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Fine-loamy (2) Coarse-loamy
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	51–203 cm
Soil depth	51–203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.67–14.73 cm
Calcium carbonate equivalent (0-101.6cm)	2–70%
Electrical conductivity (0-101.6cm)	0–3 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.8
Subsurface fragment volume <=3" (0-101.6cm)	0–50%
Subsurface fragment volume >3" (0-101.6cm)	0–1%

Ecological dynamics

The Reference Plant Community consists of mid and shortgrasses with few tallgrasses. Some perennial forbs are present with small numbers of annual forbs and a few scattered woody shrubs. Productivity is moderate with most of the production coming from sideoats grama (*Bouteloua curtipendula*) and blue grama (*Bouteloua gracilis*). Lesser amounts of buffalograss (*Bouteloua dactyloides*), hairy grama (*Bouteloua hirsuta*), sand dropseed (*Sporobolus cryptandrus*), and perennial three-awn (Aristida wrightii) are found on the site. Vine mesquite (*Panicum obtusum*) and western wheatgrass (*Pascopyrum smithii*) are found growing in depressional areas. Small pockets of sand bluestem (*Andropogon hallii*) and Indiangrass (*Sorghastrum nutans*) may be found scattered throughout the site. Little bluestem (*Schizachyrium scoparium*) will occur in small amounts where the soil becomes shallower. The more commonly found forbs are dotted gayfeather (*Liatris punctata*), scarlet globemallow (*Sphaeralcea coccinea*), Engelmann's daisy (*Engelmannia peristenia*), baby white aster (*Chaetopappa ericoides*), halfshrub sundrop (Calyophus serrulatus), trailing ratany (*Krameria lanceolata*) and annual forbs. The primary woody species found are yucca (*Yucca glauca*) and broom snakeweed (*Gutierrezia sarothrae*), with an occasional catclaw mimosa

(*Mimosa aculeaticarpa* var. biuncifera) and plains pricklypear (Opuntia polycantha); however, trees are seldom found on this site.

The site occurs on slightly to moderately sloping areas on upland plains where some small amount of geologic erosion may have occurred and the soils are somewhat “thinner” than those of the associated Deep Hardland ecological site that occurs on the more level terrain. Higher calcium carbonate content throughout the soil profile accounts for the amount of sideoats grama growing on this site. This differs from the closely associated Deep Hardland site that is dominated by blue grama. The forb component is more apparent in years of above average rainfall. Pronghorn favor this site because of the variety of forbs present. Cryptogamic crusts are more common on this site than on nearby Deep Hardland sites. Production on this site is quite close to that of the Deep Hardland sites. The two main indicator plants on the Limy Upland ecological site are sideoats grama and yucca. Yucca has a tendency to increase on limy upland sites that have had regular spring and early summer deferment for many years with good yucca seed production. Yucca blooms are very palatable to deer, pronghorn and cattle.

Fire played a role in the ecology of this site as well as all other high plains sites. The general role of fire was to sustain natural grassland and suppress shrubby species. Fire helped to keep a balance between the grasses, forbs and shrubs. However, in the shortgrass region, fire was probably secondary to climate in promoting the historic vegetative state. A drier climate (<20 inches annual precipitation) creates a situation where the subsoil is dry more often than it is wet. Plant roots grow in response to moisture and this dryer climate favors shortgrasses with fibrous root systems or short rhizomatous grasses. Yucca is a major increaser on this site and natural fire no doubt kept yucca suppressed significantly. Annual forbs are stimulated by fire and diversity is generally increased. Heavy grazing after a fire can have a negative effect if conditions are dry and remain so for an extended period.

Periodic grazing and trampling by migrating herds of bison and elk as well as resident herds of pronghorn antelope occurred during drought periods. Bison moved about in large herds over the region somewhat regulated by water sources and fire frequency. However, long rest periods followed once the large herds of bison moved out of the area, allowing the resilient grassland to re-establish and maintain its reference community structure.

Variations in climatic factors, especially the amount and timing of precipitation, greatly influence the productivity of ecological sites and are largely responsible for the fluctuations in the amount of vegetative growth from one season to the next. It is not unusual for fluctuations of greater than 50 percent to occur from one year to another. These types of climatic variation are part of the overall environment in which the reference plant community developed. However, it needs to be pointed out that long-term drought (4 to 6 years of rainfall 50 percent below the mean) can act in concert with other forces to affect changes in plant communities. For instance, extended drought weakens plants and makes them more susceptible to the effects of overgrazing. Drought conditions coupled with fire can be damaging and need long periods of time to fully recover. Extremely dry summers followed by wet winters can favor cool-season annual grasses at the expense of perennial warm-season species. A well-adapted, healthy community could better withstand such rigors of drought. However, even they experience damage that would result in some departure from the former stable state. Usually, the departure would be temporary.

When domestic livestock were brought to the plains in the 1870’s, it was largely an open range situation. By 1890, however, most of the area had been fenced and livestock were confined to theses areas continually.

The major forces influencing the transition to the Shrub/Shortgrass community is continued over-grazing by livestock and the decrease in the frequency and intensity of fire. As livestock and wildlife numbers increase and grazing use exceeds a plants ability to sustain defoliation, the more palatable and generally more productive species decline in stature, productivity and density. Early day settlers often had little information upon which to base stocking rates. In many cases, more animals were grazed than the grassland resources could safely support. The tendency of this site is to become a shortgrass dominant site if long-term grazing abuse occurs. This will lead to a decline in the vigor of sideoats grama and other desirable mid and tallgrass species. Blue grama and buffalograss will increase because they are better able to withstand grazing pressure. With constant grazing pressure, the blue grama will eventually become sod bound and lose its bunch grass appearance.

Yucca will increase on the site if the grass cover is weakened and the yucca makes seed for several years. With the weakened grass cover, broom snakeweed will often gain a major foothold on the site. On some of the western portions of MLRA 77C, cholla cactus (*Cylindropuntia imbricata*) has increased on some deep hardland and limy upland sites. The decrease in density and stature of the mid and tallgrasses, an increase in shortgrasses, and an increase of yucca and other woody vegetation brings about a new plant community, the Midgrass/Shortgrass/Shrub

Community (1.2).

In the Midgrass/Shortgrass/Shrub Community (1.2), the transition back to the reference community is possible with proper grazing management and chemical brush and pest management. Prescribed burning could be used if the conditions allow. The production of vegetation has shifted from mostly herbaceous vegetation to increasing amounts of woody shrubs. Herbaceous vegetation is still the largest production in this phase. Nutrient cycling, the water cycle, watershed protection and biological functions have changed little.

If heavy grazing continues with no form of brush and pest management, a threshold will be crossed to a Shortgrass/Shrub Community (2.1). In this state, typical vegetation will be low vigor, blue grama with increasing amounts of low quality shortgrasses. Bare areas will increase with annuals filling the voids. Perennial three-awn will invade this site when the more desirable grasses are weakened and/or removed. Yucca, and occasionally broom snakeweed, will increase dramatically. Nutrient cycling, the water cycle, watershed protection and biological functions have been severely reduced. The plant community is so degraded that it cannot reverse retrogression without extensive energy and management inputs. Restoration of the Shortgrass/Shrub Community (2.1) will require prescribed grazing with rest periods during the growing season, re-seeding bare areas with adapted native grass species, chemical and/or mechanical brush management, and some form of pest management. With the reduced amounts of grass fuel, prescribed burning is usually not an option in this phase.

When long-term, abusive grazing occurs, this site will regress to the Shrub/ Shortgrass/Annuals Community (3.1). In this degraded state, yucca and broom snakeweed will dominate the site (>50 percent). Typical herbaceous vegetation will be perennial three-awn, low quality shortgrasses, and low vigor, sod bound blue grama. The large, connected bare areas will have numerous annual species present. The loss of herbaceous cover and increased bare ground encourages accelerated erosion. Nutrient cycling, the water cycle, watershed protection and biological functions are not functioning well in this phase. Restoration of the Shortgrass/Annuals Community (3.1) to reference conditions will require major energy, economic and management inputs. Conservation practices required include prescribed grazing with several consecutive (3-4 years) rest periods during the growing season, re-seeding bare areas with adapted native grass species, and chemical brush and pest management. Prescribed burning is not an option in this phase. Full recovery and maintenance of the reference community requires continued proper grazing management as well as occasional brush and pest management.

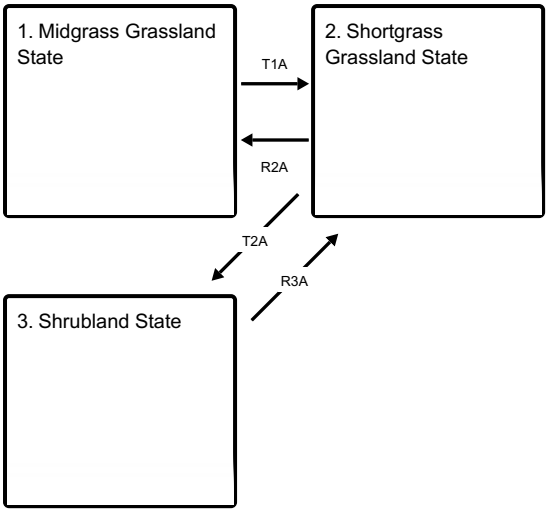
NOTE: Rangeland Health Reference Worksheets have been posted for this site on the Texas NRCS website (www.tx.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions.

STATE AND TRANSITIONAL PATHWAYS: (DIAGRAM)
The following diagram suggests some pathways that the vegetation on this site might take in response to various treatment or natural stimuli over time. There may be other states not shown on the diagram. Those shown are some of the most commonly seen. This information is intended to illustrate the changes in vegetative states that can occur in a given set of circumstances, and may not happen this way in all cases. Local professional guidance should be sought when making plans to manipulate plant communities for specific purposes.

As a site changes in the structure and makeup of the plant community, the changes may be due to management or due to natural occurrences or both. At some point in time thresholds are crossed. Once changes have progressed to a certain point, the balance of the community has been altered to the extent that a return to the former state is generally not possible. Some form of energy must be applied in order to make the community respond in that direction. These changes in plant communities occur on all ecological sites with some sites being more resistant to change than others. Also, some sites seem to be more resilient being able to heal or restore more easily than other sites. Usually, changes in management practices alone, such as different grazing methods, will not result in restoration of former vegetative states. An example of an energy input that might be necessary to effect change might be the implementation of chemical brush management and complete growing season rest to reduce domination of woody shrubs and promote more perennial grasses and forbs. This might have to be done more than once and could take several years. Such a vegetative shift could not be accomplished by regulation of grazing alone. The amount of energy required to effect a change would depend on the present vegetative state and the desired state.

State and transition model

Ecosystem states



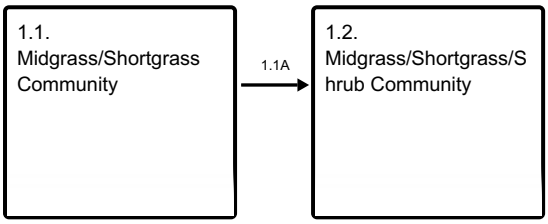
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

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

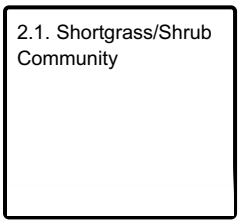
T2A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R3A - Adequate rest from defoliation and removal of woody canopy

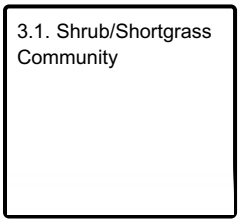
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Midgrass Grassland State

The Midgrass/Shortgrass Community consists of mid and shortgrasses with few tallgrasses. Productivity is moderate with most of the production coming from sideoats grama and blue grama. Lesser amounts of buffalograss, hairy grama, sand dropseed, and perennial three-awn are found on the site. Vine mesquite and western wheatgrass are found growing in depressional areas. Small pockets of sand bluestem and Indiangrass may be found scattered throughout the site. Little bluestem will occur in small amounts where the soil becomes shallower. Some perennial forbs are present with small numbers of annual forbs and a few scattered woody shrubs. The primary woody species found are yucca and broom snakeweed, with an occasional catclaw mimosa and plains pricklypear; however, trees are seldom found on this site. The tendency of this site is to become a shortgrass

dominant site if long-term grazing abuse occurs. This will lead to a decline in the vigor of sideoats grama and other desirable mid and tallgrass species. Blue grama and buffalograss will increase because they are better able to withstand grazing pressure. Cholla, yucca and broom snakeweed will increase due to weakened grass cover and produces seed for several yearsThe decrease in density and stature of the mid and tallgrasses, an increase in shortgrasses, and an increase of yucca and other woody vegetation brings about a new plant community, the Midgrass/Shortgrass/Shrub Community (1.2).

Dominant plant species

- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Midgrass/Shortgrass Community

Figure 8. 1.1 Midgrass/Shortgrass Community

The interpretive or "reference" plant community for this site is a good mixture of highly productive and high vigor midgrasses, shortgrasses along with small amounts of tallgrasses to make up approximately 90 percent of the plant community. Midgrasses tend to dominate over most of the site with sideoats grama being the overall dominant species. Blue grama is the dominant shortgrass species. There is a good variety of perennial forbs making up 3–5 percent of the total plant community. Yucca and broom snakeweed are the primary woody species. Generally these woody species are lightly scattered across the site and make up less than 5 percent of the total annual production. The plant community's ecological processes are in balance with the environment. Most energy and nutrient cycling is contained in the narrow grass/soil interface and evapo-transpiration is minimal. Maintenance of the this community requires continued proper grazing management as well as occasional brush and pest management.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1233	1625	2018
Forb	67	129	191
Shrub/Vine	34	50	67
Tree	–	–	–
Microbiotic Crusts	–	–	–
Total	**1334**	**1804**	**2276**

Figure 10. Plant community growth curve (percent production by month). TX1015, Shortgrass/Midgrass Community. Shortgrasses and midgrasses with majority of growh in May, June and July with lesser amounts in August, September and October..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	3	5	8	23	25	12	5	10	5	3	1

Community 1.2
Midgrass/Shortgrass/Shrub Community

Figure 11. 1.2 Midgrass/Shortgrass/Shrub Community

Some woody shrub encroachment is beginning. As retrogression occurs, the tendency of this site is to become a shortgrass dominant site. Sideoats grama has entered a low vigor state and decreasing. Blue grama and low quality shortgrasses are beginning to increase. There has been an increase in low value perennial and annual forbs, with increasing amounts of yucca and broom snakeweed. The production of vegetation has shifted from mostly herbaceous vegetation to more yucca and woody, although the herbaceous vegetation biomass is still the largest amount. Nutrient cycling, the water cycle, watershed protection, and biological functions have changed some. The transition back to the reference community is reversible with proper grazing management, brush and pest management.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1121	1457	1793
Shrub/Vine	168	252	336
Forb	78	140	202
Microbiotic Crusts	–	–	–
Tree	–	–	–
Total	**1367**	**1849**	**2331**

Figure 13. Plant community growth curve (percent production by month). TX1016, Midgrass/Shortgrass/Shrubs Community. Warm-season mid and shortgrasses, increase of forbs and shrubs, grasses in lower vigor and production..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	5	9	23	24	12	7	10	5	2	1

Pathway 1.1A
Community 1.1 to 1.2

Midgrass/Shortgrass Community

Midgrass/Shortgrass/Shrub Community

With heavy continuous grazing, no fires, and brush invasion, the Midgrass/Shortgrass Community (1.1) will shift to the Midgrass/Shortgrass/Shrub Community (1.2).

State 2
Shortgrass Grassland State

If heavy grazing continues with no form of brush and pest management, a threshold will be crossed to a Shortgrass/Shrub State. Typical vegetation will be low vigor, blue grama with increasing amounts of low quality shortgrasses. Bare areas will increase with annuals filling the voids. Perennial three-awn will invade this site when the more desirable grasses are weakened and/or removed. Yucca, and occasionally broom snakeweed, will increase dramatically. Nutrient cycling, the water cycle, watershed protection and biological functions have been severely reduced.

Dominant plant species

- yucca (*Yucca*), shrub
- threeawn (*Aristida*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 2.1
Shortgrass/Shrub Community

Figure 14. 2.1 Shortgrass/Shrub Community

In this phase of retrogression a threshold has been crossed to the Shortgrass/Shrub Community. In this degraded state, mid and tallgrasses have been replaced with low vigor blue grama, perennial three-awn and low quality shortgrasses. Bare areas have increased with exposed mineral soil having low quality annuals filling the voids. Yucca and broom snakeweed will increase dramatically (>40 percent canopy). On some of the western portions of MLRA 77C, cholla has invaded the limey upland and deep hardland sites to the point of domination. The loss of herbaceous cover and increased bare ground encourages accelerated erosion. Nutrient cycling, the water cycle, watershed protection, and biological functions have been severely reduced. The plant community is so degraded that it cannot reverse retrogression without extensive energy and management inputs. Restoration of Shortgrass/Shrub Community (2.1) will require prescribed grazing with rest periods during the growing season, re-seeding bare areas with adapted native grass species, and chemical and/or mechanical brush management and some form of pest management. With the reduced amounts of grass fuel, prescribed burning is usually not an option in this phase.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	448	616	785
Shrub/Vine	336	448	560
Forb	34	62	90
Microbiotic Crusts	–	3	6
Tree	–	–	–
Total	**818**	**1129**	**1441**

Figure 16. Plant community growth curve (percent production by month). TX1017, Shortgrass/Shrub Community. Warm-season shortgrasses with increased shrubs and annuals..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3	5	15	30	20	5	5	8	5	2	1

State 3
Shrubland State

When long-term, continuous heavy grazing occurs, this site will regress to the Shrub/ Shortgrass/Annuals Community (3.1). In this degraded state, yucca and broom snakeweed will dominate the site (>50 percent). Typical herbaceous vegetation will be perennial three-awn, low quality shortgrasses, and low vigor, sod bound blue grama. The large, connected bare areas will have numerous annual species present. The loss of herbaceous cover and increased bare ground encourages accelerated erosion.

Dominant plant species

- yucca (*Yucca*), shrub

Community 3.1
Shrub/Shortgrass Community

Figure 17. 3.1 Shrub/Shortgrass Community

In this degraded state, yucca and broom snakeweed will dominate the site (>50 percent). Typical herbaceous vegetation will be perennial three-awn, low quality shortgrasses, and low vigor, sod bound blue grama. The large, connected bare areas will have numerous annual species present. The loss of herbaceous cover and increased bare ground encourages accelerated erosion. Nutrient cycling, the water cycle, watershed protection, and biological functions are not functioning well in this phase. Restoration of phase (3.1) to the reference state will require major energy, economic and management inputs. Conservation practices required include prescribed grazing with several consecutive (3-4 years) rest periods during the growing season, re-seeding bare areas with adapted native grass species, and chemical brush and pest management. Prescribed burning is not often an option in this phase due to lack of fuel. Full recovery and maintenance of the reference community requires continued proper grazing

management as well as occasional brush and pest management.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	448	560	673
Grass/Grasslike	336	448	560
Forb	45	73	101
Microbiotic Crusts	15	24	31
Tree	–	–	–
Total	**844**	**1105**	**1365**

Figure 19. Plant community growth curve (percent production by month). TX1042, Shrub/Shortgrass Community. Growth is predominantly shrubs and shortgrasses from April through October with peak growth from May through July..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	3	8	16	25	5	5	10	16	8	3

Transition T1A
State 1 to 2

With heavy continuous grazing, no brush management, no fires (periods greater than twenty years between fires), brush invasion of yucca, pricklypear, and cholla, and no pest management, the Midgrass Grassland State will transition to the Shortgrass/Shrub Community.

Restoration pathway R2A
State 2 to 1

With the application of various conservation practices for rangeland including Brush Management, Prescribed Grazing, Pest Management, Prescribed Burning over a two to three year period, the Shortgrass/Shrub State can be restored to the Midgrass Grassland State.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Integrated Pest Management (IPM)

Transition T2A
State 2 to 3

With heavy continuous grazing pressure by livestock and wildlife, no brush management, and no pest management, the Shortgrass Grassland State will transition to the Shrubland State.

Restoration pathway R3A
State 3 to 2

Conservation practices required include prescribed grazing with several consecutive (3-4 years) rest periods during the growing season, re-seeding bare areas with adapted native grass species, and chemical brush and pest management. Prescribed burning is not an option in this phase.

Conservation practices

Brush Management
Prescribed Grazing
Range Planting

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrass/Shortgrass**			897–1457	
	sideoats grama	BOCU	*Bouteloua curtipendula*	448–729	–
	blue grama	BOGR2	*Bouteloua gracilis*	448–729	–
2	**Midgrasses**			269–426	
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	269–426	–
	little bluestem	SCSC	*Schizachyrium scoparium*	56–168	–
	large-spike bristlegrass	SEMA5	*Setaria macrostachya*	28–112	–
	buffalograss	BODA2	*Bouteloua dactyloides*	28–112	–
	Arizona cottontop	DICA8	*Digitaria californica*	28–112	–
	vine mesquite	PAOB	*Panicum obtusum*	28–112	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	28–84	–
	slim tridens	TRMU	*Tridens muticus*	28–56	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	28–56	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	28–56	–
	hooded windmill grass	CHCU2	*Chloris cucullata*	28–56	–
	tumble windmill grass	CHVE2	*Chloris verticillata*	28–56	–
	ear muhly	MUAR	*Muhlenbergia arenacea*	28–56	–
3	**Cool-season grasses**			34–67	
	Canada wildrye	ELCA4	*Elymus canadensis*	22–56	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	28–56	–
	western wheatgrass	PASM	*Pascopyrum smithii*	28–56	–
4	**tallgrasses**			34–67	
	sand bluestem	ANHA	*Andropogon hallii*	34–67	–
	Indiangrass	SONU2	*Sorghastrum nutans*	34–67	–
Forb					
5	**Forbs**			67–191	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	17–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	17–45	–
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	17–45	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	17–45	–
	rose heath	CHER2	*Chaetopappa ericoides*	17–45	–
	golden prairie clover	DAAU	*Dalea aurea*	17–45	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	17–45	–
	buckwheat	ERIOG	*Eriogonum*	17–45	–

	trailing krameria	KRLA	*Krameria lanceolata*	17–45	–
	dotted blazing star	LIPU	*Liatris punctata*	17–45	–
	plains blackfoot	MELE2	*Melampodium leucanthum*	17–45	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	17–45	–
	James' holdback	POJA5	*Pomaria jamesii*	17–45	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	17–45	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	17–45	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	17–45	–
	stemmy four-nerve daisy	TESC2	*Tetraneuris scaposa*	17–45	–
	stiff greenthread	THFI	*Thelesperma filifolium*	17–34	–
	white milkwort	POAL4	*Polygala alba*	17–34	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	17–34	–
	Forb, annual	2FA	*Forb, annual*	0–28	–
Shrub/Vine					
6	**Shrubs**			34–67	
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	22–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	22–34	–
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	22–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	22–34	–
	soapweed yucca	YUGL	*Yucca glauca*	22–34	–

Animal community

The Limey Upland site is habitat for a variety of plains grassland birds and mammals. Some animals commonly seen on the site include pronghorn, scaled quail, prairie dogs, coyotes, various raptors, and songbirds. These include meadowlark, Texas horned lizard, jackrabbit, and other species that prefer an open plains grassland habitat.

Hydrological functions

This site contributes runoff to draws and larger watercourses lower on the landscape. Runoff is reduced and infiltration is increased with good vegetative cover. Good vegetative cover also results in cleaner runoff and minimal sedimentation the plains region. When cover is poor and sites are ecologically degraded, runoff can be as much as 70 percent. With little infiltration occurring, the soil becomes artificially shallow and production potential is very limited.

Recreational uses

Hunting, Camping, Bird watching, Hiking, Horseback riding

Wood products

None.

Other products

Sometimes native plant species seed are collected for planting materials.

Other information

None.

Inventory data references

NRCS FOTG – Section II of the FOTG Range Site Descriptions and numerous historical accounts of vegetative conditions at the time of
early settlement in the area were used in the development of this site description. Vegetative inventories were made at several site locations
for support documentation.
Inventory Data References (documents):
NRCS FOTG – Section II - Range Site Descriptions
NRCS Clipping Data summaries over a 20 year period

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, Ed M Vavra, W Laycock, R Pieper, pp13-68, Denver, CO: society for Range Management
2. Gould F. 1978. Common Texas Grasses: an illustrated guide. College Station, TX: Texas A & M Press.
3. Hatch, Brown and Ghandi, Vascular Plants of Texas (An Ecological Checklist)
4. Heischmidt RK, Stuth, Eds. 1991 Grazing Management: an ecological perspective. Portland OR: Timberline Press
5. North Rolling Plains RC&D, NRCS, and GLCI. 2006 edition. Common Rangeland Plants of the Texas Panhandle.
6. Scifres CJ, Hamilton WT. 1993. Prescribed burning for brushland management: the South Texas example. College Station, TX: Texas A & M Press.
7. Natural Resources Conservation Service - Range Site Descriptions
8. USDA-Natural Resources Conservation Service - Soil Surveys & Website soil database

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Approval

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Acknowledgments

Site Development and Testing Plan

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

Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

Rangeland health reference sheet

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

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Contact for lead author	806-791-0581
Date	09/04/2007
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** None to slight.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-25%.

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** Slight to moderate.

7. **Amount of litter movement (describe size and distance expected to travel):** None to slight.

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Loamy friable surface and medium SOM.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Basal cover and density with moderate interspaces should make rainfall impact

minimal. This site has moderate permeable soil, runoff is slow to medium and available water holding capacity is medium.

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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 shortgrasses >

    Sub-dominant: Warm-season midgrasses >

    Other: Cool-season midgrasses > Warm-season tallgrasses > Forbs > Shrubs/Vines

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Grasses due to their growth habit will exhibit some mortality and decadence, though minimal.

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,400 to 1,900 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:** Yucca, Cholla, Catclaw, and Pricklypear can become invasive.

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