

Ecological site R077CY026TX

High Lime 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.

MLRA notes

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

MLRA 77C 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 very deep, calcareous, loamy soils on uplands. Due to the high calcium carbonate content, production is limited. The reference vegetation consists of midgrasses and shortgrasses tolerant of the limy soils. Some forbs and few woody species populate the site. 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

R077CY027TX	Playa 16-21" PZ The Playa site is on the floor of playas. These sites are on lower landscape positions and collect runoff moisture from surrounding side slopes and plains. Midgrasses, shortgrasses, and forbs dominate these sites.
R077CY022TX	Deep Hardland 16-21" PZ The Deep Hardland site is on plains, playa slopes, and playa steps. This site is on similar or higher landscape positions. Shortgrasses and Midgrasses dominate on these sites.
R077CY036TX	Sandy Loam 16-21" PZ The Sandy Loam site is on plains, playa slopes, and playa steps. This site is on similar or higher landscape positions. Midgrasses and shortgrasses dominate on these sites.

Similar sites

R077BY722TX	High Lime 12-17" PZ This site occurs on calcareous, loam and clay loam soils on uplands. 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.
R077CY028TX	Limy Upland 16-21" 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.
R077DY040TX	High Lime 12-17" PZ These sites occur on calcareous, sandy loam soils with linear 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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Yucca</i> (2) <i>Atriplex canescens</i>
Herbaceous	(1) <i>Sporobolus airoides</i> (2) <i>Bouteloua gracilis</i>

Physiographic features

The High Lime ecological site consists of very deep, gently sloping to strongly sloping calcareous loamy soils with light colored surfaces and moderately permeable clay loam to sandy clay loam subsoils. Slopes dominantly range from 3 to 12 percent. Due to the slope these sites typically generate runoff and these sites are susceptible to both wind and water erosion if adequate vegetative cover is not present. The site is used almost entirely as a rangeland.

Land Form:

- (1) Convex, linear, and curvilinear dunes on the leeward (eastern) margin of playa or salt lake basins to nearly level to very gently sloping playa terraces
- (2) Interdunes within dune complexes on the leeward side of playa basins or saline lake basins.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Playa dune (2) Plateau > Playa step (3) Plateau > Interdune
Runoff class	Negligible to high
Flooding frequency	None

Ponding frequency	None
Elevation	910 – 1,550 m
Slope	0 – 30 %
Water table depth	200 cm
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 the 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)	150-190 days
Freeze-free period (characteristic range)	190-210 days
Precipitation total (characteristic range)	480-530 mm
Frost-free period (actual range)	150-200 days
Freeze-free period (actual range)	180-210 days
Precipitation total (actual range)	460-580 mm
Frost-free period (average)	170 days
Freeze-free period (average)	200 days
Precipitation total (average)	510 mm

- (1) CAMERON [USC00291332], Grady, NM
- (2) PORTALES [USC00297008], Portales, NM
- (3) BIG SPRING [USW00023041], Big Spring, TX
- (4) AMARILLO [USW00023047], Amarillo, TX
- (5) DENVER CITY [USC00412408], Denver City, TX
- (6) CROSBYTON [USC00412121], Crosbyton, TX
- (7) CLAUDE [USC00411778], Claude, TX
- (8) LAMESA 1 SSE [USC00415013], Lamesa, TX
- (9) PLAINS [USC00417074], Plains, TX

Influencing water features

Water features are not an influencing factor in this site.

Wetland description

N/A

Soil features

These soils are calcareous (limy) throughout and the water holding capacity is moderate to low. The high calcium carbonate content limits the plant community to tolerant plant species. Plant roots will easily penetrate the soil if not severely compacted. Fertility is low these soils have a moderate permeability rate. They yield water to plants readily. If vegetative cover is poor and runoff is excessive, significant wind and water erosion can occur.

Major Soil Taxonomic Units correlated to this site include: Arch clay loam, Arch loam, Arch fine sandy loam, Drake clay loam, Drake loam, and Drake fine sandy loam.

Table 4. Representative soil features

Parent material	(1) Eolian deposits – limestone and sandstone (2) Lacustrine deposits – metamorphic and sedimentary rock
Surface texture	(1) Clay loam (2) Loam (3) Fine sandy loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified

Available water capacity (0-101.6cm)	9.65 – 14.99 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 60 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 8.8
Subsurface fragment volume ≤3" (0-101.6cm)	0 – 10 %
Subsurface fragment volume >3" (0cm)	Not specified

Ecological dynamics

The reference plant community developed under the prevailing climate and conditions over time. This site is not generally a preferred site for grazing by livestock or wildlife due to lower plant palatability influenced by the limy nature of the soil. The high lime content limits the plant community to tolerant plant species. There are only minimal acres of the High Lime site in MLRA-77C of the Texas Panhandle and is considered a minor component of this MLRA. This site developed from the prevailing winds and wind blown deposits on the east and northeastern side of ancient playas and large basins. These playas were flooded periodically and served as temporary watering sites for large numbers of bison and resident pronghorn antelope. Occasional trampling and overgrazing likely occurred. Periodic droughts, fire, and grazing by resident wildlife prevalent in the area as well as nomadic creatures such as bison did influence the plant community.

The resulting Midgrass/Shortgrass Community (1.1) is a mixture of midgrass and shortgrass species with a few tallgrass species that can tolerate the limy nature of the soils. On some high lime sites, salinity can have a major influence on plant community composition. Only a few forbs and woody plants are typically found on this site. The dominant grasses are sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), vine mesquite (*Panicum obtusum*), western wheatgrass (*Pascopyrum smithii*), and alkali sacaton (*Sporobolus airoides*). Small amounts of little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*) and sand bluestem (*Andropogon hallii*) can be found scattered throughout the site. Typical associated forbs include plains blackfoot daisy (*Melampodium leucanthum*), curlycup gumweed (*Grindelia squarrosa*) and dotted gayfeather (*Liatris punctata*) as well as numerous other annual and perennial forbs. Yucca (*Yucca glauca*), plains pricklypear (*Opuntia* spp.), and fourwing saltbush (*Atriplex canescens*) are often present with a few cholla cactus (*Cylindropuntia imbricata*) on parts of the site.

Periodic overgrazing and trampling by migrating herds of bison and resident herds of pronghorn antelope probably occurred only during wet periods when the playas and basins accumulated run-off water. This provided ideal watering and loafing areas for large numbers of herbivores. However, once the playas dried up, the herds would move out of the area. Long rest periods followed until the next big rainfall event. These rest periods allowed the vegetation to recover and maintain its historic climax plant community structure.

Fire has also played a part in the ecology of this site as with all plains sites. The main effect of fire on the High Lime site was to reduce old decadent plant cover from previous years, stimulate new shoots and increase diversity. Fire thus aided the nutrient cycle. Fire may have also helped in favoring the perennials over the annual species.

The major forces influencing transition away from the reference plant community are continued overgrazing by livestock and the decrease in the frequency and intensity of fire. As livestock and wildlife numbers increase and grazing use exceeds a plant's ability to withstand defoliation, the more palatable and generally more productive species decline in stature, productivity, and density.

If excessive grazing continues, ecological retrogression occurs. As retrogression proceeds, this will bring about the Shortgrass/Midgrass/Annuals Community (1.2) with decreased amounts of low vigor sideoats grama and blue grama. Less palatable species such as alkali sacaton will increase along with inland saltgrass (*Distichlis spicata*), dropseed species (*Sporobolus* spp.) and perennial three-awn species (*Aristida* spp.). The better quality perennial forbs will be replaced with less desirable annual and perennial forbs.

The Shortgrass/Midgrass/Annuals Community (1.2) is reversible with proper grazing management and prescribed burning. The primary benefit of prescribed burning would be to reduce the excessive biomass of alkali sacaton and inland saltgrass and promote new sideoats grama and blue grama seedlings. Woody shrub canopies have generally not increased to the point where brush management is needed. Some areas may need selective brush management by chemical or mechanical means. There will be an increase in the percent bare ground scattered throughout the site.

If long-term heavy grazing continues, a threshold will be crossed to a Shrubs/Shortgrass/Annuals Community (2.1). This site will develop bare areas (>50 percent bare ground) and an increase in annuals. Some high lime sites may be invaded by broom snakeweed (*Gutierrezia sarothrae*) and mesquite (*Prosopis glandulosa*). Once established, these woody plants can increase to the point of domination. High Lime sites in the southern portion of MLRA 77C may be dominated by four-wing saltbush with heavy densities of mesquite scattered throughout the site. Salinity and lime content of the soil influences the woody invasion more than any other factor. Western ragweed (*Ambrosia psilostachya*) and sagewort (*Artemisia* spp.) may increase in some areas. The short and midgrass species that do remain will be in low vigor. The plant community is so degraded that it cannot reverse retrogression without extensive energy and management inputs. Restoration will require prescribed grazing with rest periods during the growing season, re-seeding bare areas with adapted native grass species, and chemical brush and pest management. Full recovery and maintenance of the reference community requires continued proper grazing management as well as occasional brush and pest management. Prescribed burning is also a useful tool in managing the reference community if adequate fine fuel is available to carry out an effective burn.

As mentioned earlier, this site is not preferred by livestock for grazing. The low palatability of the forage is influenced by the limey nature of the soil. Therefore, if livestock are being forced to overgraze this less preferred site, then there is obviously a grazing management problem on the surrounding associated sites. Livestock generally will not frequent this site unless all other available forage in the pasture has been removed.

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

Narrative:

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.

Changes in the structure and composition of the plant community may be due to management and/or natural occurrences. At some point thresholds are crossed as indicated by the lined box on the State and Transition Diagram. This suggests that once changes have progressed to a certain point, the plant community has been altered to the extent that a return to the former state is not possible unless some form of energy is applied. These changes take place on all ecological sites. Some sites support communities that are more resistant to change than others. Also, some sites are more resilient and can heal or restore themselves more easily. Usually, changes in management practices alone, such as grazing techniques, will not be sufficient to restore former plant communities. An example of energy input might be the implementation of chemical brush management to decrease the amount of woody/cacti shrubs and increase the amount of grasses and forbs. This shift in community balance could not be brought about with grazing alone. The amount of energy required to bring about a change in plant community balance may vary a great deal depending on the present state and the desired result.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					

1	Midgrass			673-829	
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	673-829	–
2	Mid/Shortgrasses			504-622	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	224-504	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	224-504	–
3	Midgrasses			168-207	
	vine mesquite	PAOB	<i>Panicum obtusum</i>	112-168	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	112-168	–
4	Mid/Shortgrasses			84-101	
	threeawn	ARIST	<i>Aristida</i>	22-56	–
	buffalograss	BODA2	<i>Bouteloua dactyloides</i>	22-56	–
	tumble windmill grass	CHVE2	<i>Chloris verticillata</i>	22-56	–
	saltgrass	DISP	<i>Distichlis spicata</i>	22-56	–
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	22-56	–
	creeping muhly	MURE	<i>Muhlenbergia repens</i>	22-56	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22-56	–
5	Tallgrasses			84-101	
	sand bluestem	ANHA	<i>Andropogon hallii</i>	56-101	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	56-101	–
	little bluestem	SCSCS	<i>Schizachyrium scoparium</i> var. <i>scoparium</i>	56-101	–
Forb					
6	Forbs			84-104	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22-67	–
	bush morning-glory	IPLE	<i>Ipomoea leptophylla</i>	22-45	–
	trailing krameria	KRLA	<i>Krameria lanceolata</i>	22-45	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	22-45	–
	plains blackfoot	MELE2	<i>Melampodium leucanthum</i>	22-45	–
	grassland blazingstar	MEST3	<i>Mentzelia strictissima</i>	22-45	–
	evening primrose	OENOT	<i>Oenothera</i>	22-45	–
	slimflower scurfspea	PSTE5	<i>Psoralea tenuiflorum</i>	22-45	–
	upright prairie coneflower	RACO3	<i>Ratibida columnifera</i>	22-45	–
	rose heath	CHER2	<i>Chaetopappa ericoides</i>	22-45	–
	golden prairie clover	DAAU	<i>Dalea aurea</i>	22-45	–
	curlycup gumweed	GRSQ	<i>Grindelia squarrosa</i>	22-45	–
	Rocky Mountain zinnia	ZIGR	<i>Zinnia grandiflora</i>	22-45	–
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	30-39	–
	Forb, annual	2FA	<i>Forb, annual</i>	0-34	–
	stiff greenthread	THFI	<i>Thelesperma filifolium</i>	11-22	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	11-22	–
Shrub/Vine					
8	Shrubs/Cacti			84-103	
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	56-95	–
	yucca	YUCCA	<i>Yucca</i>	34-84	–
	tree cholla	CYIMI	<i>Cylindropuntia imbricata</i> var. <i>imbricata</i>	34-56	–
	hairspine pricklypear	OPPOP	<i>Opuntia polyacantha</i> var. <i>polyacantha</i>	34-56	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Native animals that utilize this site include scaled quail, pronghorn antelope, coyote, jackrabbit, swift fox, Texas horned lizard, prairie dogs, and various small mammals and grassland birds. It is an open grassland site with very little woody cover surrounding playas and large basins. Therefore, species that require cover will not be resident. For specific guidance on wildlife, Wildlife Habitat Appraisal Guides are available through NRCS for several species.

Hydrological functions

This site consists of deep, gently sloping to moderately sloping soils with moderately permeable loam to clay loam subsoils. Runoff from the site supplies the playa lakes and basins with water. With good cover, runoff contains low sediment. Infiltration is moderately slow and evaporation rate is moderate. If cover is poor, very little water gets into the soil.

Recreational uses

Hunting, Camping, Hiking, Bird watching, Photography, Horseback Riding.

Wood products

None.

Other products

None.

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 site locations for support documentation. Inventory Data References (documents): NRCS FOTG – Section II - Range Site Descriptions NRCS eFOTG - Section III – Electronic Range Health Worksheets NRCS Clipping Data summaries over a 20 year period

Other references

Clint Rollins, USDA-NRCS Rangeland Management Specialist, Amarillo, TX
Thomas C. Byrd, USDA-NRCS Soil Scientist, Lubbock, TX
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Approval

Bryan Christensen, 9/11/2023

Acknowledgments

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

Rangeland health reference sheet

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

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Date	09/04/2007
Approved by	
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): 30-40%.

5. Number of gullies and erosion associated with gullies: 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): Slight to moderate.

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; primarily wind erosion.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Calcareous loamy (limy) soils with low 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 large interspaces make rainfall impact moderate. This site has moderately permeable soils, runoff is slow to medium, and available water holding capacity is moderate to low.

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

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

Dominant: Warm-season midgrasses >

Sub-dominant: Warm-season shortgrasses >

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

Additional:

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.

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

15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):
1,400 to 1,750 pounds per acre.

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, and pricklypear can become invasive.
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17. **Perennial plant reproductive capability:** All plant species should be capable of reproducing, except during periods of prolonged drought conditions, heavy natural herbivory and intense wildfires.
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