USDA Natural Resources Conservation Service

Ecological site R077BY014TX
Deep Hardland 12-17" PZ

Last updated: 9/11/2023
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General information

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

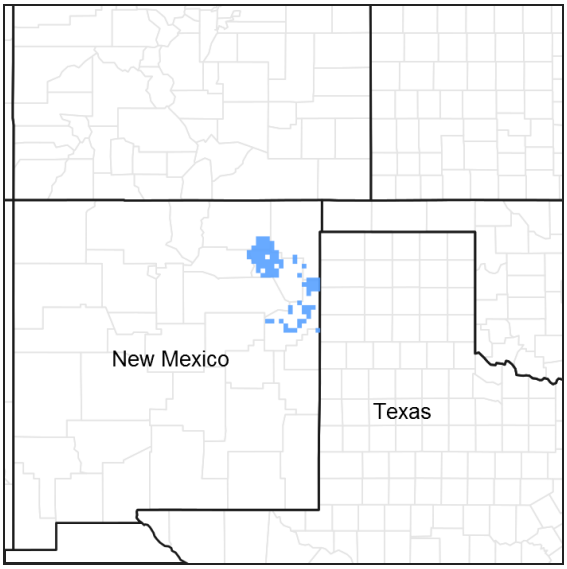


Figure 1. Mapped extent

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

MLRA notes

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

MLRA 77B is characterized by nearly level to gently sloping plains with a minimal number of playa depressions and moderately sloping breaks along drainageways. Loamy and sandy soils are generally deep and occur in a mesic soil temperature regime and ustic soil moisture regime bordering on aridic. Current land use is dominantly rangeland with minor 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 deep clay loam soils on uplands. Generally the slopes are between 0 to 5 percent. The reference vegetation consists of shortgrasses with few midgrasses and forbs. Abusive grazing practices can lead to an altered plant community. Without periodic fire or other brush management, woody species may increase across the site.

Associated sites

R077BY016TX	**Limy Upland 12-17" PZ** Generally adjacent and upslope of the deep hardland site. The soils are loamy in texture and highly calcareous. Shortgrasses dominate, but has a good mixture of midgrasses on the site. More productive than the deep hardland site.
R077BY722TX	**High Lime 12-17" PZ** Generally adjacent, downslope or upslope of the deep hardland site. The soils are loamy to clayey in texture and contain more calcium carbonate. Midgrasses dominate, but has a good mixture of shortgrasses. In some cases small areas of bare ground can be in the center of a depression where water has ponded for long periods. Generally less productive than the deep hardland site.

Similar sites

R077EY055TX	**Hardland Slopes 16-24" PZ** This site has deep, to very deep clay to clay loam soils like the deep hardland site. Slopes will be steeper (1-12%) with a plant community dominated by shortgrasses, less productive.
R077AY001TX	**Deep Hardland 16-22" PZ** This site has deep to very deep clay to clay loam soils like the deep hardland site in MLRA 77B. Mean annual precipitation is higher (16 to 24 inches). Shortgrasses dominate but has some midgrasses on the site. More productive than the deep hardland site in MLRA 77B.
R077BY016TX	**Limy Upland 12-17" PZ** Generally adjacent and upslope of the deep hardland site. The soils are loamy in texture and highly calcareous. Shortgrasses dominate, but has a good mixture of midgrasses on the site. More productive than the deep hardland site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Chrysothamnus viscidiflorus* (2) *Gutierrezia sarothrae*
Herbaceous	(1) *Bouteloua gracilis* (2) *Bouteloua dactyloides*

Physiographic features

The Deep Hardland site occurs on nearly level to gently sloping plains. Surface runoff is negligible to low, depending on slope, which is usually less than 3 percent. This generally depends on the amount of vegetative cover and intensity of the precipitation event.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Plain
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	2,460–4,750 ft
Slope	0–5%
Water table depth	80 in
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)	140-147 days
Freeze-free period (characteristic range)	169-172 days
Precipitation total (characteristic range)	16-17 in
Frost-free period (actual range)	139-148 days
Freeze-free period (actual range)	168-175 days
Precipitation total (actual range)	16-18 in
Frost-free period (average)	144 days
Freeze-free period (average)	171 days
Precipitation total (average)	17 in

Climate stations used

- (1) CLAYTON MUNI AIR PK [USW00023051], Clayton, NM
- (2) DALHART 6 SW [USC00412235], Hartley, TX
- (3) AMISTAD 5 SSW [USC00290377], Amistad, NM
- (4) ROSEBUD 7NW [USC00297585], Mosquero, NM
- (5) MCCARTY RCH [USC00295516], Nara Visa, NM

Influencing water features

Water features are not an influencing factor in this site.

Wetland description

None.

Soil features

These very deep soils are part of the Blackwater Draw geologic formation. Slopes dominantly range from 0 to 5 percent. They are moderate in fertility, have a moderate level of water storage capacity, have a moderate infiltration rate, and generally exhibit low runoff depending on slope and vegetative cover. They yield water to plants readily and are subject to wind erosion without good cover. Plant roots easily penetrate the soil.

Major Soil Taxonomic Units correlated to this site include: Dumas clay loam and Dumas loam.

Table 4. Representative soil features

Parent material	(1) Eolian deposits–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Clay loam

Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4–7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.1–7.9
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

The reference plant community for this site is a shortgrass dominated community (1.1). A few midgrasses can be found in small depressions along with a small number of moisture dependent forbs; few woody plants are found. Occasionally cholla cactus (*Cylindropuntia imbricata*), pricklypear (Opuntia polycantha), or yucca (Yucca spp.) may be present, usually only 1 to 2 percent of the total plant community. Blue grama (*Bouteloua gracilis*) dominates with lesser amounts of buffalograss (*Bouteloua dactyloides*) present. Western wheatgrass (*Pascopyrum smithii*) and vine mesquite (*Panicum obtusum*) may occur in low places that catch and hold more moisture. The major perennial forbs are scarlet globemallow (*Sphaeralcea coccinea*), lyreleaf greeneyes (*Berlandiera lyrata*), slimleaf scurfpea (*Pediomelum linearifolium*), prairie coneflower (*Ratibida columnifera*), and baby white aster (*Chaetopappa ericoides*). Annual forbs are more abundant in years of above average spring rainfall. As a rule, forbs contribute around 2 to 5 percent of the total production. This site is not highly diverse as the clayey soils along with relatively low rainfall limit the range of species adapted to the site. Drought tolerant species prevail. Bison historically grazed the site and the plants are palatable to cattle. The highly palatable forage and level terrain make this a choice grazing site even though production is only moderate. Pronghorns prefer this site, especially in spring when forbs are more abundant.

Fire plays a major role in maintaining the reference community. In general, woody plants are suppressed and grasses are perpetuated. Fire also influences grazing patterns. Animals were attracted to the re-growth of herbage in burned areas. Forbs become more profuse for a time following fire and attracted animals such as pronghorns that prefer forbs to grass. Fire in combination with a favorable growing season will generally tend to sustain the perennial shortgrass community. In contrast, fire in combination with drought can be a transitional pathway that can result in some plant community changes. Grasses which thrive on disturbance, such as sand dropseed (*Sporobolus cryptandrus*) and silver bluestem (*Bothriochloa laguroides*), increase. Perennial forbs and shrubs may increase for a period of time. Fire can cause adverse effects to the perennial grass community under high fuel loads and summer heat conditions. Generally, this site does not produce the amounts of fine fuel needed to generate the amount of heat needed to kill woody vegetation. An exception to this may be plains pricklypear. The good palatability of the forage on this site makes it unnecessary to consider burning for improving forage quality. Prescribed fire is not often applicable as a management tool on this site.

The reference plant community for this site developed under a grazing ecology. Large herbivores grazed the grasslands and moved on seeking fresh forage. On the high plains plateau, the frequency of grazing was greatly influenced by availability of water. There are historical accounts of Spanish conquistadors encountering buffalo as

the parties crossed the plains. Large amounts of water were needed to support the huge bison herds. During dry times the herds most likely grazed the edge of the plains near the breaks leading to the creeks and rivers. When grazing did occur it was probably severe. Recovery periods likely were long with the animals not returning to the same spot for several years.

This is a preferred site for domestic livestock and overgrazing can easily occur. When continued overgrazing occurs over a long period of time, blue grama will develop a low vigor, stunted appearance. This is a response to constant grazing pressure. Continued heavy grazing pressure brings about a new plant community; the Low Vigor Shortgrass Community (1.2). The soil becomes more compacted, rainfall infiltration is reduced, and water runoff increases. Western wheatgrass, the only cool-season grass present, decreases under grazing pressure. Long-term abuse coupled with drought will often leave the turf open in places.

Broom snakeweed (*Gutierrezia sarothrae*) occurs in the reference plant community. The amount present fluctuates according to climatic conditions. However, once the plant gains a foothold, it seems to no longer be cyclic and predominates year after year.

Nutrient cycling, the water cycle, watershed protection and biological functions have been somewhat reduced. Careful grazing management and chemical and/or mechanical brush control of invading woody/cacti competition can restore this site to the reference community.

If long-term abusive grazing continues, a threshold will be crossed to a Shrub/Annuals Community (2.1). In this degraded state, blue grama loses its bunch grass characteristics and assumes a sod bound appearance because of grazing pressure. The shortgrass species are so resistant to grazing that it is uncommon for them to be killed out, but they can be weakened dramatically. Weedy and/or halfshrub species such as broom snakeweed may increase and dominate this site along with perennial threeawn (*Aristida purpurea*) and annuals. In the western portions of MLRA 77B, cholla and other cacti species may increase and possibly dominate the site. 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. A major threshold has been crossed. Restoration of phase (2.1) to historic climax will require prescribed grazing with rest periods during the growing season for several years. Re-seeding bare areas with adapted native species, and chemical and/or mechanical brush management and some form of pest management will be necessary. Prescribed grazing along with the control of invading competition will usually restore this site within a few years provided judicious grazing management is applied. This site is perhaps one of the most resilient sites in MLRA 77B.

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.

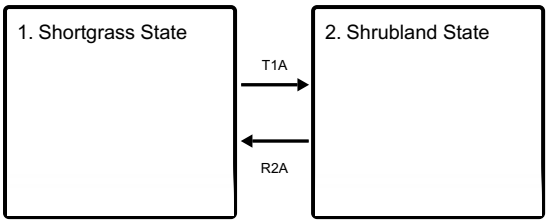
STATE AND TRANSITIONAL PATHWAYS:

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. 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. This means that once changes have progressed to some certain point, the balance of the community has been altered to the extent that a return to the former state is not possible, that is, not possible unless some form of energy is applied to make it happen.

These changes take place on all ecological sites, but some sites support communities that are more resistant to change than other sites. Also, some sites are more resilient. They tend to be able to 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 or mechanical brush management to decrease the amount of woody 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 upon the desired result.

State and transition model

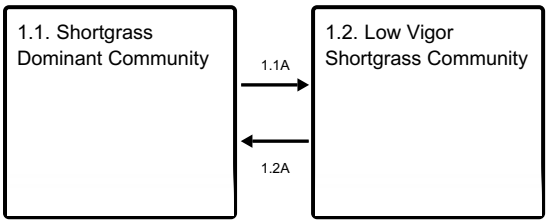
Ecosystem states



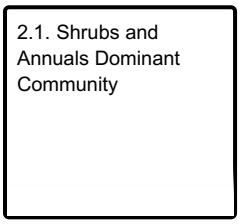
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

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

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Shortgrass State

The reference plant community is a shortgrass dominated community with blue grama being the dominant grass with lesser amounts of buffalograss (average of 60-70% blue grama and 15-25% buffalograss). There are approximately 5% forbs and almost no woody shrubs or trees present. Abusive grazing practices will shift this plant community to the Low Vigor Shortgrass (1.2) community. However, with prescribed grazing, the community will recover. Blue grama and buffalograss will still dominate the site but total production will be reduced. The percent bare ground will start to increase. Broom snakeweed, cholla and other cacti species may increase on the site.

Community 1.1
Shortgrass Dominant Community

Figure 8. 1.1 Shortgrass Dominant Community

The interpretive or "reference" plant community for this site is a Shortgrass Dominated Community with good vigor of blue grama being the dominant grass with lesser amounts of buffalograss (average of 60-70 percent blue grama and 15-25 percent buffalograss). There are a few other species of shortgrasses present making up from 5-10 percent of total production. Western wheatgrass and vine mesquite are often present in depressions and on slopes above playa lakes. There are approximately 5 percent forbs and almost no woody shrubs or trees present. There may be a few scattered pricklypear plants throughout the site. Abusive grazing practices will shift this plant community to the Low Vigor Shortgrass (1.2) community. However, with prescribed grazing, the community will recover. The amount of time required depends upon favorable climatic conditions.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	900	1350	1800
Forb	40	80	120
Shrub/Vine	30	40	60
Microbiotic Crusts	10	15	20
Tree	0	0	0
Total	**980**	**1485**	**2000**

Figure 10. Plant community growth curve (percent production by month). TX0759, Shortgrass Dominant Community. Shortgrass dominant with growth from April to October and peak growth from May to July..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	4	7	19	24	17	8	11	5	2	1

Community 1.2
Low Vigor Shortgrass Community

Figure 11. 1.2 Low Vigor Shortgrass Community

As retrogression occurs, this plant community is composed of low vigor blue grama and buffalograss with an increase in shrubs such as broom snakeweed, cholla and pricklypear along with annual forbs. Blue grama and buffalograss will still dominate the site but total production will be reduced. The percent bare ground will start to increase. Nutrient cycling, the water cycle, watershed protection and biological functions have been reduced. The transition back to reference is possible with several years of proper grazing management. Chemical and/or mechanical brush management may be needed to reduce the increased canopy of invasive plants.

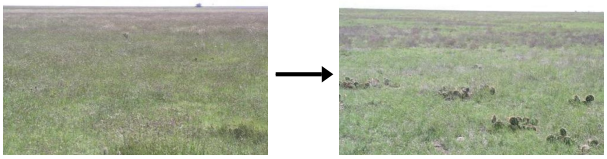
Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	500	750	1000
Forb	100	180	260
Shrub/Vine	100	150	200
Microbiotic Crusts	5	10	20
Tree	0	0	0
Total	**705**	**1090**	**1480**

Figure 13. Plant community growth curve (percent production by month). TX0760, Degraded Shortgrass/Annuals/Shrubs. Low vigor shortgrasses, increase annuals and woody shrubs..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	5	15	30	25	5	3	6	6	2	1

Pathway 1.1A
Community 1.1 to 1.2

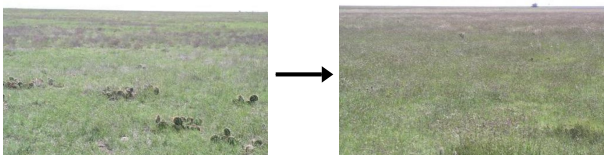


Shortgrass Dominant Community

Low Vigor Shortgrass Community

With heavy continuous grazing, brush invasion, no fire, no brush management, and no pest management, the Shortgrass Dominant Community would shift to the Low Vigor Shortgrass Community.

Pathway 1.2A
Community 1.2 to 1.1



Low Vigor Shortgrass Community

Shortgrass Dominant Community

With the implementation of conservation practices such as Prescribed Grazing, Brush Management, and Pest Management, the Low Vigor Shortgrass Community should shift back to the more productive Shortgrass Dominant Community.

Conservation practices

Brush Management
Prescribed Grazing
Integrated Pest Management (IPM)

State 2
Shrubland State

If long-term heavy grazing continues, a threshold will be crossed to a Shrub/Annuals Community (2.1). In this degraded state, blue grama loses its bunch grass characteristics and assumes a sod bound appearance because of grazing pressure. The shortgrass species are so resistant to grazing that it is uncommon for them to be killed out,

but they can be weakened dramatically. Weedy and/or halfshrub species such as broom snakeweed may increase and dominate this site along with perennial threeawn and annuals. In the western portions of MLRA 77B, cholla and other cacti species may increase and possibly dominate the site.

Community 2.1
Shrubs and Annuals Dominant Community

Figure 14. 2.1 Shrubs and Annuals Dominant Community

In this phase of retrogression a threshold has been crossed. Shrubs and annuals dominate the site with large amounts of bare ground (>40%) scattered throughout the site. Blue grama and buffalograss are in low vigor and the blue grama has lost its bunchgrass characteristic and has assumed a sod bound appearance. Some Deep Hardland sites in the western portion of MLRA 77B may see cholla and other cacti species dominating. Severe infestation of broom snakeweed is also occurring. Production of grass is low, and the community integrity has been compromised. Ecological processes are not functioning as needed. Runoff is increased and infiltration is low. The plant community is so degraded that it cannot reverse retrogression without extensive energy and management inputs. Restoration back to near the reference community 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 along with some form of pest management.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	400	550	700
Shrub/Vine	250	375	500
Forb	140	220	300
Microbiotic Crusts	20	35	50
Tree	0	0	0
Total	**810**	**1180**	**1550**

Figure 16. Plant community growth curve (percent production by month). TX0758, Shrubs/Annuals Dominant Community. Shrubs dominate the site. The understory consist of annual forbs and few grasses. Bare ground has increased to (>40%). .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	2	4	16	30	25	6	5	5	4	2	1

Transition T1A
State 1 to 2

The shift from the Shortgrass State to the Shrubland State occurs due to heavy continuous grazing pressure, brush invasion, no fire, no brush management, and no pest management.

Restoration pathway R2A
State 2 to 1

With the implementation of rangeland conservation practices such as Prescribed Grazing, Brush Management, Pest Management, and Range Planting, the Shrubland State can be able to revert back to the Shortgrass State.

Conservation practices

Brush Management
Prescribed Grazing
Range Planting
Integrated Pest Management (IPM)

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Shortgrasses**			750–1500	
	blue grama	BOGR2	*Bouteloua gracilis*	600–1200	–
	buffalograss	BODA2	*Bouteloua dactyloides*	150–300	–
2	**Midgrasses**			90–180	
	vine mesquite	PAOB	*Panicum obtusum*	90–180	–
	western wheatgrass	PASM	*Pascopyrum smithii*	90–180	–
3	**Short/Midgrasses**			60–120	
	sideoats grama	BOCU	*Bouteloua curtipendula*	60–120	–
	black grama	BOER4	*Bouteloua eriopoda*	60–120	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	60–120	–
	Arizona cottontop	DICA8	*Digitaria californica*	60–120	–
	squirreltail	ELELE	*Elymus elymoides ssp. elymoides*	60–120	–
	galleta grass	PLEUR12	*Pleuraphis*	60–120	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	60–120	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	60–100	–
	tumble windmill grass	CHVE2	*Chloris verticillata*	25–75	–
	gummy lovegrass	ERCU	*Eragrostis curtipedicellata*	25–75	–
Forb					
4	**Forbs**			40–120	
	Forb, annual	2FA	*Forb, annual*	40–120	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	40–120	–
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	40–120	–
	rose heath	CHER2	*Chaetopappa ericoides*	40–120	–
	purple prairie clover	DAPUP	*Dalea purpurea var. purpurea*	40–120	–
	Engelmann's daisy	ENPE4	*Engelmannia peristenia*	40–120	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	40–120	–
	dotted blazing star	LIPU	*Liatris punctata*	40–120	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	40–120	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	40–120	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	40–120	–
	stiff greenthread	THFI	*Thelesperma filifolium*	40–120	–
Shrub/Vine					
5	**Shrubs/Vines**			30–60	
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	30–60	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	30–60	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	30–60	–
	yucca	YUCCA	*Yucca*	30–60	–

Animal community

Native animals that occupy this site include scaled quail, pronghorn antelope, coyote, jackrabbit, swift fox, Texas horned lizard, prairie dogs, various small mammals, and grassland birds. It is an open grassland site; 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. Prairie dogs were a part of the natural ecosystem and their towns were extensive in the plains. Before settlement, prairie dogs were able to expand into new territory at will. There were also more natural predators present, such as the black-footed ferret. The towns could spread out and the burrows were likely well spaced. Today prairie dogs often occupy relatively small to several acre tracts of range and over populate through lack of space and predators. When prairie dogs are present, the rangeland is in a low seral stage of succession.

Hydrological functions

This site has very little slope, so runoff is slow. Runoff from the site often supplies nearby playa lakes, and this water eventually flows into the few major draws and streams in the area. With good vegetative cover, runoff contains low sediment. Infiltration is moderately slow and evaporation relatively high. If vegetative 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 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

J.R. Bell, USDA-NRCS Rangeland Management Specialist (retired)
Natural Resources Conservation Service - Range Site Descriptions
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Reviewers:
Clint Rollins, RMS, NRCS, Amarillo, Texas
Mark Moseley, RMS, NRCS, San Antonio, Texas

Kelly Attebury, Soil Scientist, NRCS, Lubbock, Texas
Justin Clary, RMS, NRCS, Temple, Texas

Contributors

Clint Rollins, RMS, NRCS, Amarillo, Texas
J.R. Bell, RMS, NRCS, Texas
Todd Carr, SS, NRCS, Lubbock, Texas

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.

Reviewers:
Clint Rollins, RMS, NRCS, Amarillo, Texas
Mark Moseley, RMS, NRCS, San Antonio, Texas
Kelly Attebury, Soil Scientist, NRCS, Lubbock, Texas
Justin Clary, RMS, NRCS, Temple, Texas

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)	Stan Bradbury, Zone RMS, NRCS, Lubbock, Texas
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.

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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):** 0-10%, small pockets of non-connected areas.

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

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):** None to slight.

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface 0 to 9 inches thick, brown loam to clay loam; moderate medium and fine granular structure; slightly hard; friable; many roots; non-calcareous; neutral pH.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** High canopy basal cover and density with small interspaces should make rainfall impact minimal. This site has moderately permeable soils, runoff slow to moderate; available water capacity is high, and wind erosion is low to moderate.

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 shortgrasses >>

    Sub-dominant:

    Other: Cool-season midgrasses > Warm-season midgrasses = 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.

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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):** 1,300 - 1,700 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:** Pricklypear, yucca and cholla. Broom snakeweed 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 or intense wildfires.
