Ecological site R042AE278TX
Limestone Hill and Mountain, Mixed Prairie

Accessed: 05/18/2024

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.

Associated sites

R042AE275TX	**Gravelly, Mixed Prairie** This site is located on lower piedmont slopes.
R042AE277TX	**Igneous Hill and Mountain, Mixed Prairie** This site can be located adjacent to the Limestone Hill & Mountain (Mixed Prairie).

Similar sites

R042AC249TX	**Limestone Hill and Mountain, Desert Grassland** This site is similar in landform and parent material, but is located at a lower elevation and vegetation zone.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on hills, mountains, footslopes, and plateaus. Slopes range from 5 to 70 percent, averaging about 25 percent. Direction of slopes affects the kind and amount of vegetation present. Aspect influences vegetation composition and production. Elevation ranges from 4500 to 6500 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain
Flooding frequency	None
Ponding frequency	None
Elevation	1,372–1,981 m
Slope	5–70%
Aspect	N, S

Climatic features

The average annual precipitation ranges from 15 to 17 inches and the annual total is highly variable from 8 to 30 inches. Most of the precipitation occurs as widely scattered thunderstorms of high intensity and short duration during the summer. Occasional precipitation occurs as light rainfall during the cool season. Annual snowfall ranges from 1-3 inches.

Mean annual air temperature is 61° F. Frost-free period ranges from 199 to 215 days (April-October). However, the optimal growing season occurs July through September as this period coincides with greater rainfall.

The average relative humidity in mid-afternoon is about 25 percent. Relative humidity is higher at night, and the average at dawn is about 57 percent. The sun shines 81 percent of the time in summer and 75 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, around 11 miles per hour, in March and April. The annual Class-A pan evaporation is approximately 82 inches.

Table 3. Representative climatic features

Frost-free period (average)	215 days
Freeze-free period (average)	230 days
Precipitation total (average)	432 mm

Influencing water features

Soil features

The soils on this site are very shallow to shallow. The surface textures are cobbly loams, underlain by limestone bedrock, which occasionally outcrops. The soils are well drained with moderately slow to very slow permeability. Available water holding capacity is very low. Although the soils are limited in their ability to hold moisture, they have a good plant-soil-air-moisture relationship making rainfall highly effective. The steep slopes make the soils susceptible to water erosion if unprotected by plant cover.

Big Bend National Park Soil Survey:
Altuda very cobbly silt loam, 10 to 30 percent slopes.
Altuda-Rock outcrop complex, 20 to 70 percent slopes. (Altuda component)

Brewster County Main Part Soil Survey:
Altuda very cobbly silt loam, 10 to 30 percent slopes. (Altuda component)
Altuda-Rock outcrop complex, 20 to 70 percent slopes. (Altuda component)

Fort Bliss Military Reservation, New Mexico and Texas
Altuda-Rock outcrop complex, 5 to 15 percent slopes. (Altuda component)
Altuda-Rock outcrop complex, 15 to 35 percent slopes. (Altuda component)
Altuda-Rock outcrop complex, 35 to 65 percent slopes. (Altuda component)

Table 4. Representative soil features

Parent material	(1) Residuum–limestone
Surface texture	(1) Cobbly loam (2) Very cobbly loam (3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	13–51 cm
Surface fragment cover <=3"	15–35%

Surface fragment cover >3"	10–40%
Available water capacity (0-101.6cm)	1.52–2.54 cm
Calcium carbonate equivalent (0-101.6cm)	15–60%
Electrical conductivity (0-101.6cm)	0–5 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	7.8–8.5
Subsurface fragment volume <=3" (Depth not specified)	20–40%
Subsurface fragment volume >3" (Depth not specified)	15–50%

Ecological dynamics

The distribution of vegetation within the site is highly dependent on local environment. Elevation, soil moisture, aspect, slope, latitude, variability of the soils, and amount of rock outcrop are the major factors driving species composition and distribution. The Historic Climax Plant Community (HCPC) for the site is composed primarily of a diversity of short and midgrasses, numerous perennial forbs, and scattered trees and shrubs. More trees naturally occur on north facing slopes than south facing slopes.

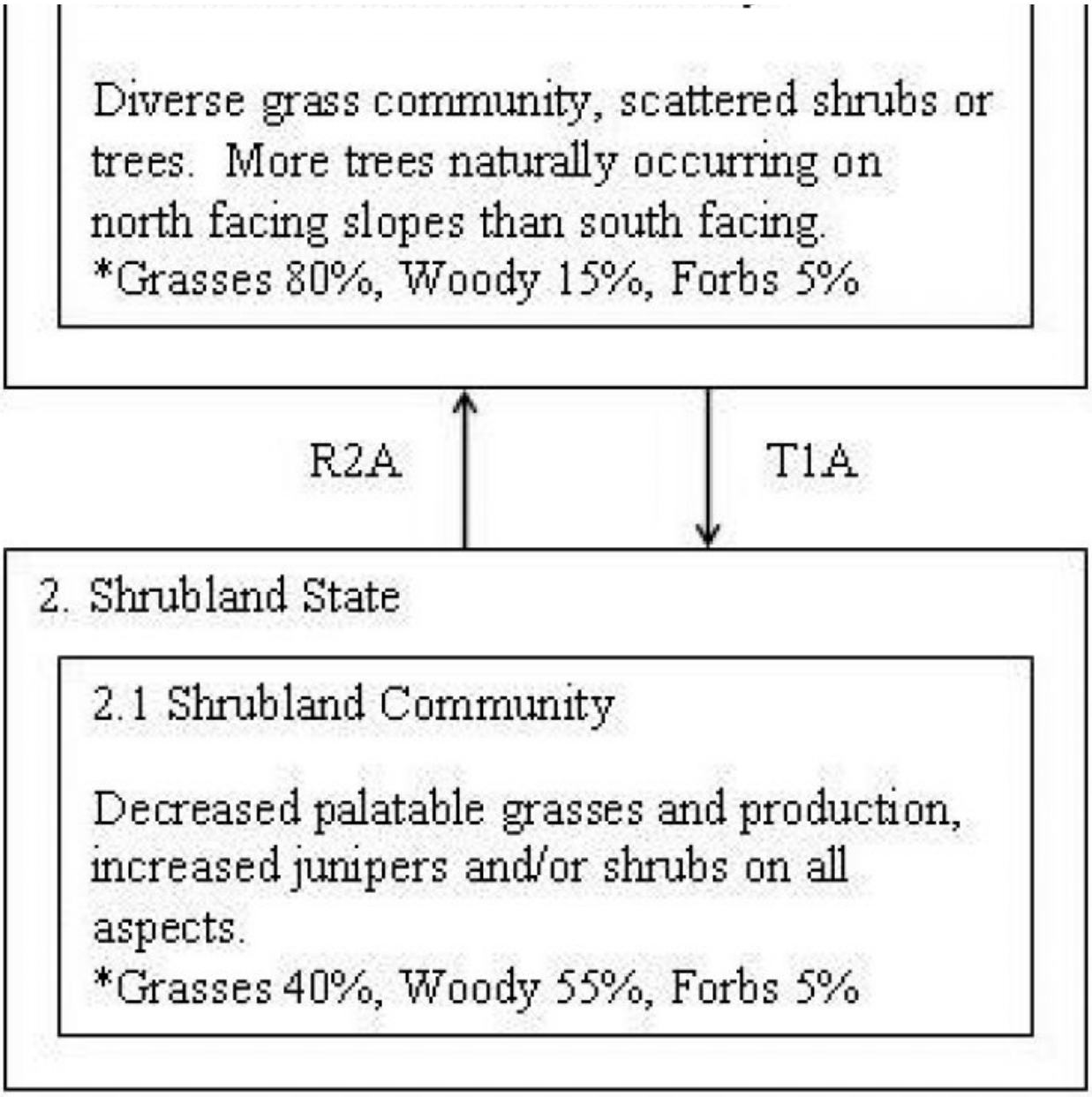
Historically, the site has evolved with native herbivores such as mule deer, desert bighorn sheep, and pronghorn antelope (on low relief areas). Bison were not documented in the historical record as being present in any significant amount due to contributing factors such as lack of water and steep topography. Small lightning induced fires were mostly likely common mainly because of the adequate amount of fine fuels present.

Early records suggest cattle, sheep, goats, and horses were introduced into the southwest from Mexico in the mid-1500's. However, extensive ranching began in the Trans-Pecos region in the 1880s. Sheep and goats grazed this site extensively up to the mid 1900s. Direct fire suppression and overutilization of plant resources in some areas most likely began during this time.

The impact of improper grazing within this site specifically will lead to a reduction of palatable grasses and forbs and an increase of woody plants such as juniper and catclaw acacia. In addition, direct fire suppression will also allow the woody plants to increase.

The following diagram suggests general pathways that the vegetation on this site might follow. There are other plant communities and states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model



Legend

T1A Fire Suppression, Improper Grazing Management

R2A Prescribed Burning, Brush Management, Prescribed Grazing

*Approximate percentage of composition by air dry weight. A representative value between north and south facing slopes.

Figure 4. MLRA 42 - Limestone Hill & Mtn (Mixed Prairie) - S

State 1

Grass/Shrubland State

Community 1.1
Midgrass/Mixed-shrubs/Forbs Community

Figure 5. 1.1 Midgrass/Mixed-shrubs/Forbs Community

The distribution of vegetation within the site is highly dependent on local environment. Elevation, soil moisture, aspect, slope, latitude, variability of the soils, and amount of rock outcrop are the major factors driving species composition and distribution. The Historic Climax Plant Community (HCPC) for the site is composed primarily of a diversity of short and midgrasses, numerous perennial forbs, and a few trees and shrubs and is the reference plant community. Areas lacking significant rock outcrops are predominately a grassland plant community with scattered trees and shrubs. Areas with significant rock outcrops generally support more woody plants such as oaks, junipers, and a higher diversity of shrubs and forbs. Cooler, north facing slopes will generally support a greater cover of pinyon pines and junipers than south facing slopes. Ocotillo and lechuguilla are generally found at lower elevations or in drier locations. Extended dry weather causes an overall decline in grass cover and production and can cause some retrogression. However, the HCPC evolved with plants that have drought tolerance. Long-term retrogression resulting from improper grazing management will result in a reduction of palatable grasses and ultimately litter accumulation. This will reduce the likelihood of natural fires because of the reduction of fine fuels. Direct fire suppression will also continue to allow woody plants such as catclaw acacia and juniper to increase. The plant communities will eventually transition to a woody plant dominated community (2.1). Conservation practices such as prescribed grazing and prescribed fire can help maintain ecological integrity within the reference plant community. Stocking rates need to be flexible and maintained at or below carrying capacity because of sporadic rainfall.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	538	717	897
Shrub/Vine	74	99	123
Forb	34	45	56
Tree	27	36	45
Total	**673**	**897**	**1121**

Figure 7. Plant community growth curve (percent production by month). TX0011, Grassland/Shrub Community. Grass Dominant with Shrubs Community..

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

State 2
Shrubland State

Community 2.1
Shrubland Community

Hillside in the foreground is Altuda soil dominated by woody plants.

Influence of rock outcrop on adjacent plant production.

Figure 8. 2.1 Shrubland Community

This state is the result of both overutilization of plant resources by domestic livestock and direct fire suppression. Plants that increase include redberry juniper, mariola, catclaw acacia, prickleleaf dogweed, and lechuguilla. Palatable grasses that decrease following improper grazing include blue, black, and sideoats grama, green sprangletop, and Arizona cottontop. The site can be fairly resilient following disturbances mostly because of the climate zone. Recovery of many grasses can be achieved following a prescribed grazing system. Brush management practices such as herbicide application and grubbing can be applied in areas not limited by slope gradient. Prescribed fire can be applied after adequate amounts of fine fuels have accumulated. However, fire will only suppress many woody plants since many resprout following both warm-season and cool-season burns.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	269	359	448
Shrub/Vine	202	269	336
Tree	168	224	280
Forb	34	45	56
Total	**673**	**897**	**1120**

Figure 10. Plant community growth curve (percent production by month). TX0008, Shrub Dominant Community. Shrub Dominant – Growth is predominately shrubs with some grasses from June through November with peak growth from August to November..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	2	2	12	12	18	20	15	15	1

Transition T1A
State 1 to 2

Fire suppression and Improper grazing management will shift to Shrubland State.

Restoration pathway R2A
State 2 to 1

Prescribed Grazing, Brush Management, and Prescribed Burning can restore to Grass/Shrubland State.

Conservation practices

Brush Management

Prescribed Burning
Prescribed Grazing

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-season midgrasses**			151–280	
	sideoats grama	BOCU	*Bouteloua curtipendula*	95–224	–
	curlyleaf muhly	MUSE	*Muhlenbergia setifolia*	34–112	–
	slimflower muhly	MUTE	*Muhlenbergia tenuiflora*	34–112	–
2	**Warm-season tall/midgrasses**			135–224	
	green sprangletop	LEDU	*Leptochloa dubia*	67–168	–
	little bluestem	SCSC	*Schizachyrium scoparium*	56–140	–
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	45–112	–
3	**Warm-season shortgrasses**			81–135	
	blue grama	BOGR2	*Bouteloua gracilis*	45–112	–
	black grama	BOER4	*Bouteloua eriopoda*	39–84	–
4	**Warm-season midgrasses**			61–101	
	Arizona cottontop	DICA8	*Digitaria californica*	28–84	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	11–39	–
	tanglehead	HECO10	*Heteropogon contortus*	11–28	–
	streambed bristlegrass	SELE6	*Setaria leucopila*	11–28	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–28	–
5	**Cool-season midgrasses**			28–56	
	southwestern needlegrass	ACEM4	*Achnatherum eminens*	17–45	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	17–45	–
6	**Warm-season mid/shortgrasses**			28–56	
	hairy grama	BOHI2	*Bouteloua hirsuta*	9–28	–
	bristly wolfstail	LYSE3	*Lycurus setosus*	9–22	–
	slim tridens	TRMU	*Tridens muticus*	6–17	–
	fall witchgrass	DICO6	*Digitaria cognata*	6–17	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	6–17	–
	threeawn	ARIST	*Aristida*	6–17	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	3–11	–
7	**Warm-season midgrasses**			17–34	
	oneflower grama	BOUN	*Bouteloua uniflora*	6–17	–
	Warnock's grama	BOWA	*Bouteloua warnockii*	6–17	–
	New Mexico muhly	MUPA2	*Muhlenbergia pauciflora*	6–17	–
8	**Annuals**			0–11	
	Forb, annual	2FA	*Forb, annual*	0–11	–
Forb					
9	**Perennial Forbs**			34–50	

	croton	CROTO	*Croton*	3–9	–
	buckwheat	ERIOG	*Eriogonum*	3–6	–
	Gregg's tube tongue	JUPI5	*Justicia pilosella*	3–6	–
	tansyaster	MACHA	*Machaeranthera*	3–6	–
	mallow	MALVE	*Malvella*	3–6	–
	evening primrose	OENOT	*Oenothera*	3–6	–
	baccharisleaf beardtongue	PEBA	*Penstemon baccharifolius*	3–6	–
	Texas snoutbean	RHSET	*Rhynchosia senna var. texana*	3–6	–
	vervain	VERBE	*Verbena*	3–6	–
	desert zinnia	ZIAC	*Zinnia acerosa*	3–6	–
	Forb, perennial	2FP	*Forb, perennial*	3–6	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	3–6	–
	damianita	CHME3	*Chrysactinia mexicana*	3–6	–
	pricklyleaf dogweed	THAC	*Thymophylla acerosa*	1–3	–
10	**Annuals**			0–6	
	Forb, annual	2FA	*Forb, annual*	0–2	–
	bladderpod	LESQU	*Lesquerella*	0–2	–
Shrub/Vine					
11	**Tall Shrubs**			40–67	
	Mohr oak	QUMO	*Quercus mohriana*	6–17	–
	desert myrtlecroton	BEOB	*Bernardia obovata*	6–13	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	4–11	–
	littleleaf sumac	RHMI3	*Rhus microphylla*	4–11	–
	evergreen sumac	RHVI3	*Rhus virens*	4–11	–
	resinbush	VIST	*Viguiera stenoloba*	3–9	–
	Texas swampprivet	FOAN	*Forestiera angustifolia*	3–9	–
	ocotillo	FOSP2	*Fouquieria splendens*	0–9	–
	catclaw acacia	ACGR	*Acacia greggii*	3–9	–
	Mearns' mock orange	PHME4	*Philadelphus mearnsii*	3–9	–
	woolly butterflybush	BUMA	*Buddleja marrubiifolia*	2–6	–
	algerita	MATR3	*Mahonia trifoliolata*	2–6	–
	fragrant sumac	RHAR4	*Rhus aromatica*	2–6	–
	jointfir	EPHED	*Ephedra*	1–3	–
12	**Subshrubs**			13–22	
	featherplume	DAFO	*Dalea formosa*	3–6	–
	black prairie clover	DAFR2	*Dalea frutescens*	3–6	–
	littleleaf ratany	KRER	*Krameria erecta*	3–6	–
	mariola	PAIN2	*Parthenium incanum*	0–6	–
	showy menodora	MELO2	*Menodora longiflora*	2–4	–
	rough menodora	MESC	*Menodora scabra*	2–4	–
	gumhead	GYGL	*Gymnosperma glutinosum*	1–3	–
13	**Fibrous and Succulents**			20–34	

	sotol	DASYL	*Dasylirion*	11–22	–
	sacahuista	NOMI	*Nolina microcarpa*	11–22	–
	pricklypear	OPUNT	*Opuntia*	1–6	–
	soaptree yucca	YUEL	*Yucca elata*	2–6	–
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	1–6	–
	Havard's century plant	AGHA	*Agave havardiana*	1–3	–
	lechuguilla	AGLE	*Agave lechuguilla*	1–3	–
Tree					
14				27–45	
	Mexican pinyon	PICE	*Pinus cembroides*	2–28	–
	Pinchot's juniper	JUPI	*Juniperus pinchotii*	9–17	–

Animal community

The reference plant community is suited for a prescribed grazing system for the production of livestock, including sheep, goats, and some cattle. Areas with lower relief are more suited for cattle grazing. Steep mountain slopes are more accessible to sheep and goats. High stocking rates and lack of deferment during droughts are some of the leading causes of unhealthy rangelands. Vegetative growth is episodic, reflecting rainfall events. For this reason, stocker type livestock operations may be more suitable than year-round stocking. Livestock should be stocked in proportion to the amount of grazeable grass, forbs, and browse.

Many types of wildlife use the HCPC of this site. Invertebrates, reptiles, birds, and mammals either use the site as their primary habitat or visit from adjacent sites. Common mammals include mule deer, mountain lions, black-tailed jackrabbit, cottontail rabbit, javelina, coyote, skunk, woodrats, and many nocturnal mice. Historically, desert bighorn sheep may have grazed this site. Game birds include scaled quail and dove. Numerous songbirds and raptors also occur in the area. Diversity in both plant species and plant communities over short distances is important for healthy wildlife populations.

Hydrology Functions:
The reference plant community with representative plant species, current soil conditions (soil health), current management, climate, and geomorphology, and slope gradient determine the dynamics of the water cycle. The runoff class is inherently high mostly because of steep slopes and slow permeability. Plant, litter, and rock cover are important factors, which protect the site from erosion. Total production and the types of plant species present also have great impact on hydrologic dynamics (infiltration capacity, runoff, and soil losses). The amount of rock outcrops can have a positive influence on hydrology as they shed precipitation and concentrate it immediately adjacent to the outcrops, thereby supporting vegetative growth even after small rain events. However, overutilization of plant resources can minimize this effect.

With reference to the transitional pathway diagram, the reference plant community is associated with optimum hydrologic function within this site. The high degree of hydrologic function in State 1 is due to the amount of vegetation and dominance of deep-rooted midgrasses. When properly managed, these species provide adequate cover that will minimize runoff. One of the key concepts to high hydrologic function is the structure and morphology of the root system.

A shift to the Shrub/Woodland State (2) will cause a decline in hydrologic function. Increases in junipers and other trees can decrease amount of water available to other plants by rainfall interception and evapotranspiration and stemflow to the base of the tree. Loss of significant herbaceous cover will allow for increased run-off and soil erosion. The inherently high amount of surface fragments does, however, limit the effects of herbaceous loss.

Plant Preference by Animal Kind:

These preferences are somewhat general in nature as the preferences for plants is dependent upon grazing experience, time of year, availability of choices, and total forage supply.

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

Hydrological functions

The reference plant community with representative plant species, current soil conditions (soil health), current management, climate, and geomorphology, and slope gradient determine the dynamics of the water cycle. The runoff class is inherently high mostly because of steep slopes and slow permeability. Plant, litter, and rock cover are important factors, which protect the site from erosion. Total production and the types of plant species present also have great impact on hydrologic dynamics (infiltration capacity, runoff, and soil losses). The amount of rock outcrops can have a positive influence on hydrology as they shed precipitation and concentrate it immediately adjacent to the outcrops, thereby supporting vegetative growth even after small rain events. However, overutilization of plant resources can minimize this effect.

With reference to the transitional pathway diagram, the reference plant community is associated with optimum hydrologic function within this site. The high degree of hydrologic function in State 1 is due to the amount of vegetation and dominance of deep-rooted midgrasses. When properly managed, these species provide adequate cover that will minimize runoff. One of the key concepts to high hydrologic function is the structure and morphology of the root system.

A shift to the Shrub/Woodland State (2) will cause a decline in hydrologic function. Increases in junipers and other trees can decrease amount of water available to other plants by rainfall interception and evapotranspiration and stemflow to the base of the tree. Loss of significant herbaceous cover will allow for increased run-off and soil erosion. The inherently high amount of surface fragments does, however, limit the effects of herbaceous loss.

Recreational uses

Loose surface fragments and slope gradients limit the suitability for hiking and camping.

Wood products

None.

Other products

None.

Other information

None.

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, and soils data. Where empirical data is limiting, technical interpretations were made based of field experience.

Other references

Briske, D. D., J.D. Derner, J.R. Brown, S.D. Fuhlendorf, W.R. Teague, K.M. Havstad, R.L. Gillen, A.J. Ash, and

W.D. Williams. 2008. Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. Rangeland Ecology and Management 61: 3-17.

Owens, M.K., R. Lyons, and C. Kneuper. 2001. Evaporation and interception water loss from juniper communities on the Edwards Aquifer Recharge Area. Final Report, Texas Agricultural Experiment Station and Texas Agricultural Extension Service, Uvalde Research and Extension Center, Uvalde, TX.

Powell, M.A. 2000. Grasses of the Trans-Pecos and Adjacent Areas. Iron Mountain Press, Marathon, TX.

Powell, M.A. 1998. Trees and shrubs of the Trans-Pecos and adjacent areas. University of Texas Press, Austin.

USDA, National Water and Climate Center, “Climate Reports,” http://www.wcc.nrcs.usda.gov/climate/ (accessed January 2007).

USDA, Natural Resources Conservation Service, “Plants Database,” http://plants.usda.gov/ (accessed November 2008).

Warnock, B. H. 1970. Wildflowers of the Big Bend Country. Sul Ross State University, Alpine, TX.

Reviewers:
Jim Clausen, Soil Scientist, NRCS, Marfa, TX
Lynn Loomis, Soil Scientist, NRCS, Marfa, TX
Laurie Meadows, Soil Conservation Technician, NRCS, Marfa, TX
Mark Moseley, Rangeland Management Specialist, NRCS, San Antonio, TX
Craig Thomas, Rangeland Management Specialist, NRCS, Alpine, TX
David Trujillo, Rangeland Management Specialist, NRCS, Las Cruces, NM

Contributors

Michael Margo, RMS, NRCS, Marfa, Texas
Unknown

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)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

---

2. **Presence of water flow patterns:**

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

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

5. **Number of gullies and erosion associated with gullies:**

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

7. **Amount of litter movement (describe size and distance expected to travel):**

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

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

---

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:**

---

17. **Perennial plant reproductive capability:**
