USDA Natural Resources Conservation Service

Ecological site R042AE275TX
Gravelly, Mixed Prairie

Accessed: 05/12/2025

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

R042AE277TX	**Igneous Hill and Mountain, Mixed Prairie** Can be adjacent to and in a higher position.
R042AE279TX	**Loamy Swale, Mixed Prairie** Can be adjacent to and in a lower position.

Similar sites

R042AE281TX	**Shallow, Mixed Prairie** The Shallow (Mixed Prairie) site is less productive and has a higher relative composition of woody plants than the Gravelly (Mixed Prairie) site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on nearly level to sloping alluvial fans and terraces usually extending from the base of igneous hills and mountains. Slopes range from 0-8 percent.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace (3) Mountain valley
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to very rare
Ponding frequency	None
Elevation	4,300–5,900 ft
Slope	0–8%
Water table depth	80 in

Aspect	Aspect is not a significant factor

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)	17 in

Influencing water features

Soil features

The site consists of very deep, well drained loamy soils that formed in gravelly alluvium weathered from igneous materials. Depth to bedrock is greater than 72 inches.

The representative soils and associated map units are:

Brewster Main Part and Presidio County Soil Surveys:
Sanmoss-Medley complex, 1 to 8 percent

Jeff Davis County Soil Survey:
Santo Tomas-Medley association, gently sloping

Fort Bliss Military Reservation, New Mexico and Texas
Enash very gravelly loam, 3 to 8 percent slopes

Table 4. Representative soil features

Parent material	(1) Alluvium–rhyolite
Surface texture	(1) Very gravelly loam (2) Gravelly loam (3) Gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	72 in
Surface fragment cover <=3"	30–50%
Surface fragment cover >3"	0–2%

Available water capacity (0-40in)	4–6 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	15–50%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The reference plant community for the Gravelly (Mixed Prairie) ecological site is a warm season dominated mid and short grass grassland with scattered woody plants and forbs. Plant species composition and production varies with fluctuations in annual weather conditions, elevation, landform position, and the natural variability of the soils.

Depending on elevation, the site can be dominated by either blue or black grama. Blue grama is more dominant at higher elevations whereas black grama is more dominant at lower elevations. Shrubs and trees are generally more concentrated in areas more proximal to the source of run on water (hill or mountainside).

Much of the site likely evolved with historically light grazing. The main native grazers and browsers during the last two hundred years included mule deer, pronghorn antelope, jackrabbits, and potentially some transient desert bighorn sheep. There is a lack of sufficient evidence to determine whether large herbivores such as bison played a significant role in shaping the plant community. Lack of a sufficient source of perennial water may have limited their presence on the site and the surrounding area.

Given the fire sensitivity of black grama, the lower elevation range of the site most likely evolved with infrequent fire. At higher elevations, the blue grama dominated community may have evolved with a higher fire frequency since it is more fire tolerant and is closely associated with the more frequently burned (historically) pinyon-juniper or Mountain Savannah vegetation zone. The natural fires that do occur are typically associated with dry lightning storms in early summer. They generally burn in a patchy mosaic pattern that is governed by terrain and amount of vegetation. Natural fires would have helped temporally suppress woody plants in some areas of the site.

Major ranching activity by settlers began in the Trans-Pecos region in the late 1800s, which coincided with the establishment of the railroad and access to the cattle markets. The majority of the domestic livestock grazing during that time were cattle, sheep, and goats. Currently, cattle are the major domestic livestock grazers.

Improper grazing management will reduce the more palatable grasses and forbs and the amount of bare ground will increase. In some areas, woody plants will increase. In other areas, shrubs may not increase due to climatic limitations.

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

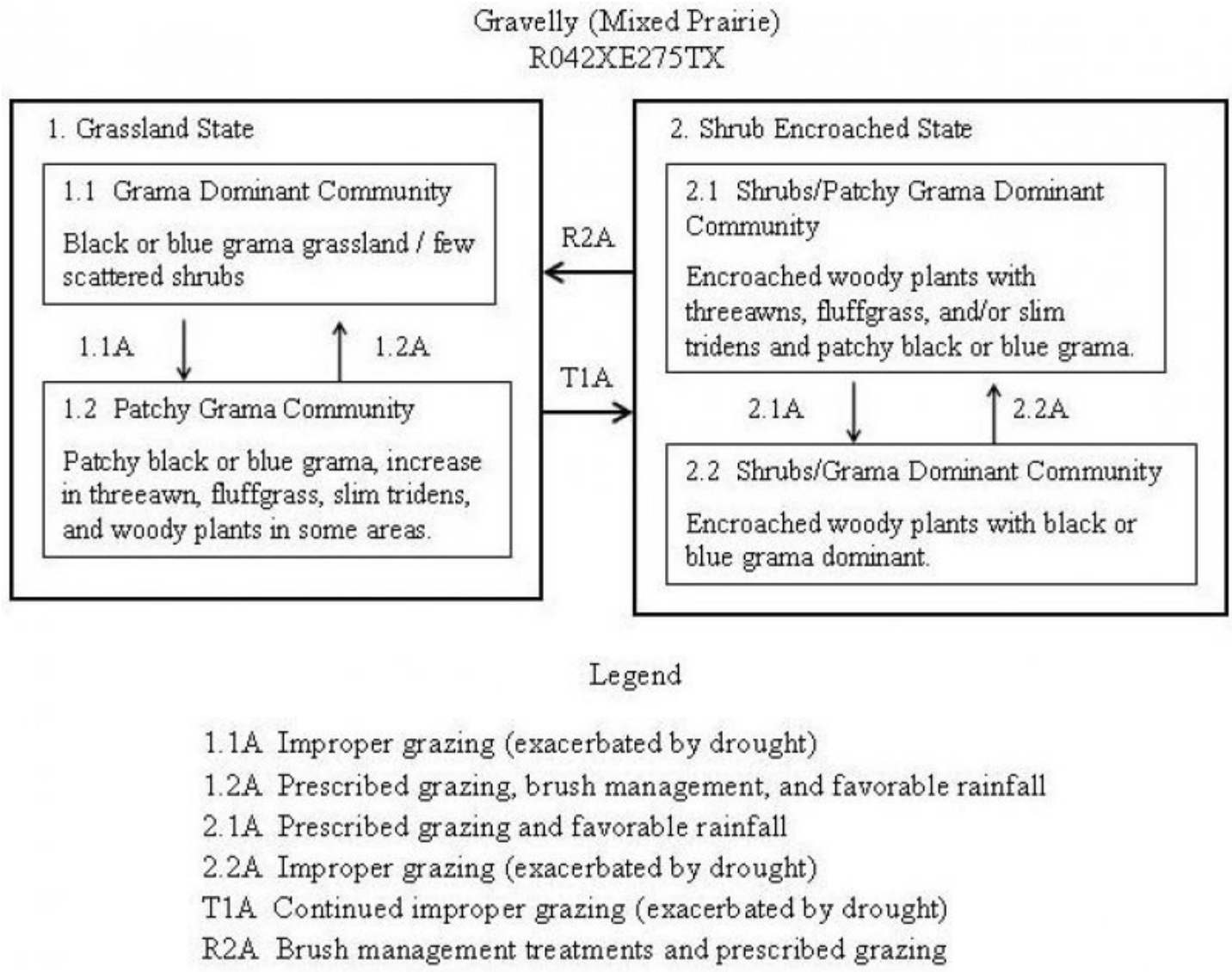


Figure 4. Gravelly (Mixed Prairie) - State & Transition Diag

State 1
Grassland State

Community 1.1
Grama Dominant Community

Figure 5. 1.1 Black grama Grassland Community (HCPC 1)

Figure 6. 1.1 Blue grama Grassland Community (HCPC 2)

Figure 7. 1.1 Black/Blue Grama Grassland (HCPC 3)

Figure 8. 1.1 Grassland with Woodies (HCPC 4)

The plant composition will vary depending on environmental variables such as elevation, soil properties, and landform position. Blue grama is more dominant at higher elevations (~4700-5900 ft) or where soil moisture is adequate. Black grama is generally found at lower elevations (~4300-4700 ft) in a mixed prairie/desert grassland transition zone. Commonly associated grasses include sideoats grama, cane bluestem, plains bristlegrass, Arizona cottontop, and plains lovegrass. Shrubs and trees such as butterflybush, lotebush, western honey mesquite, sotol, juniper, and oak are generally more concentrated in areas more proximal to the source of run in water and alluvium (hill or mountainside). Recognition of a blue or black grama dominated community within the site is important since they respond differently to grazing pressure, fire, and fluctuations in seasonal weather patterns. Black grama is a short-lived stoloniferous grass that is more dynamic than the long-lived bunchgrass blue grama especially in its positive response to summer precipitation and warmer temperatures1, 2, 3. Black grama is also more sensitive to fire4 and grazing pressure than is blue grama. Experimental data has shown that blue grama can recover during the course of a summer following clipping and burning, whereas black grama usually requires several years of favorable

moisture without disturbance to recover1. Within this plant community, percent bare ground should be less than 3 percent. A continuous vegetative cover of mostly perennial species will help maintain the integrity of ecosystem processes on the site such as nutrient cycling, energy capture, and hydrologic function. Prescribed fire may be a useful conservation practice in the blue grama grasslands but may not be very applicable in the fire sensitive black grama grasslands. However, black grama can slowly recover from infrequent fires if they are followed by a period of favorable moisture and grazing deferment. The community is suited for a conservative grazing system that maintains the ecological integrity of the site.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	835	1020	1210
Forb	35	45	50
Shrub/Vine	25	28	30
Tree	5	7	10
Total	**900**	**1100**	**1300**

Table 6. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	2-10%
Grass/grasslike foliar cover	55-85%
Forb foliar cover	2-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-30%
Surface fragments >0.25" and <=3"	30-50%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0-1%
Shrub/vine/liana basal cover	1-3%
Grass/grasslike basal cover	10-20%
Forb basal cover	1-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-30%
Surface fragments >0.25" and <=3"	30-50%
Surface fragments >3"	0-5%
Bedrock	0%
Water	0%
Bare ground	1-5%

Table 8. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	1-5%	1-2%
>0.5 <= 1	–	–	35-45%	1-3%
>1 <= 2	–	1-2%	20-35%	–
>2 <= 4.5	–	1-8%	–	–
>4.5 <= 13	0-2%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Figure 10. Plant community growth curve (percent production by month). TX0025, Grama Dominated Prairie with Scattered Shrubs. Black and blue grama dominant prairie with scattered sotol, lotebush, juniper, agarito, and cholla..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	2	3	4	8	12	18	18	17	10	3	3

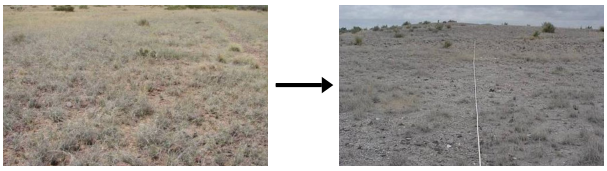
Community 1.2
Patchy Grama Community

Figure 11. 1.2 Patchy Grama Community

This plant community phase is characterized by a decrease in grasses palatable to livestock including blue grama, black grama, and plains bristlegrass; and an increase in less palatable grasses such as threeawns, slim tridens, and fluffgrass. The decreasers are generally found in a patchy mosaic pattern. This transition is driven by improper grazing management and is exacerbated by drought. Indication of shrub encroachment varies by location. Some areas will have limited, if any, woody plant encroachment while other locations may exhibit encroachment of plants such as cane cholla, western honey mesquite, juniper, and various acacias. A 5-10 percent increase in bare ground is also a feature of this site. Depending on precipitation, annual forb production increases within this phase. If the management objective is to maintain the ecological site in the grassland state, this community phase may be considered “at risk” of crossing a compositional threshold into State 2. Hydrologically, this phase may shed more runoff because of a decrease in herbaceous material. However, surface fragments help minimize soil erosion in places such as in the Sanmoss and Enash soils. Also, reduced plant cover can lead to decreased soil organic matter, lower fertility, and higher soil temperatures. Conservation practices such as prescribed grazing especially during favorable weather and growing conditions can help the recovery of this phase. However, the rate of recovery will depend on the extent to which soil properties were altered during retrogression5.

Pathway 1.1A

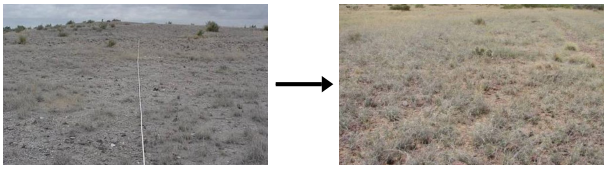
Community 1.1 to 1.2



Grama Dominant Community | Patchy Grama Community

Improper Grazing that was exacerbated by drought conditions lead to a Patchy Grama Community.

Pathway 1.2A
Community 1.2 to 1.1



Patchy Grama Community | Grama Dominant Community

Prescribed Grazing, Brush Management, and favorable rainfall can lead back to Grama Dominant Community.

Conservation practices

Brush Management
Prescribed Grazing

State 2
Shrub Encroached State

Community 2.1
Shrubs/Patchy Grama Dominant Community

Figure 12. 2.1 Shrubs/Patchy Grama Dominant Community

Figure 13. 2.1 Shrubs/Patchy Grama Dominant Community

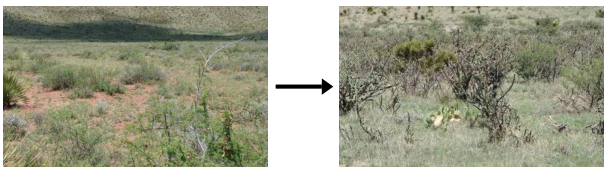
The community phase is characterized by encroaching woody plants with decreased amounts of palatable grasses and increases in less palatable grasses such as threeawns, slim tridens, fluffgrass, and sand dropseed. Woody plant species that encroach vary within the range of the ecological site. Common increasers include cane cholla, catclaw acacia, western honey mesquite, juniper, and in a few areas, mariola. Type of species that encroach will have different management implications. For example, prescribed fire has been known to kill up to 45 percent of cane cholla4, while catclaw acacia and mimosa resprout following fire. Chemical and/ or mechanical control may be an option in places.

Community 2.2
Shrubs/Grama Dominant Community

Figure 14. 2.2 Shrubs/Grama Dominant Community

The community phase is characterized by encroaching woody plants with recovered grama grasses. This phase has transitioned from 2.1 due to the combination of prescribed grazing, which includes grazing deferment, and a period of favorable weather, allowing some recovery of palatable grasses such as blue grama and black grama, and Arizona cottontop, and plains bristlegrass. Brush management treatments such as prescribed fire and/or mechanical/chemical treatments can help facilitate the transition of the community back to the grass dominated State (1).

Pathway 2.1A
Community 2.1 to 2.2



Shrubs/Patchy Grama Dominant Community

Shrubs/Grama Dominant Community

Prescribed Grazing and favorable rainfall leads to Shrubs/Grama Dominant Community.

Conservation practices

Prescribed Grazing

Pathway 2.2A
Community 2.2 to 2.1

Shrubs/Grama Dominant Community

Shrubs/Patchy Grama Dominant Community

With Improper Grazing exacerbated by drought conditions, the Shrubs/Grama Dominant Community reverses back to Shrubs/Patchy Grama Dominant Community.

Transition T1A
State 1 to 2

Continued improper grazing management exacerbated by drought conditions lead to the Shrub Enroached State.

Restoration pathway R2A
State 2 to 1

Brush Management and Prescribed Grazing can restore back to Grassland State.

Conservation practices

Brush Management
Prescribed Grazing

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Midgrasses**			270–390	
	black grama	BOER4	*Bouteloua eriopoda*	270–390	–
	blue grama	BOGR2	*Bouteloua gracilis*	270–390	–
2	**Midgrasses**			225–325	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	100–225	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	100–225	–
3	**Midgrasses**			160–235	
	Arizona cottontop	DICA8	*Digitaria californica*	40–75	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	40–75	–
	green sprangletop	LEDU	*Leptochloa dubia*	40–75	–
	streambed bristlegrass	SELE6	*Setaria leucopila*	40–75	–
4	**Shortgrasses**			90–130	
	threeawn	ARIST	*Aristida*	30–60	–

	threeawn	ARIST	*Aristida*	30–60	
	sand dropseed	SPCR	*Sporobolus cryptandrus*	30–60	–
	slim tridens	TRMU	*Tridens muticus*	30–60	–
5	**Shortgrasses**			70–100	
	hairy grama	BOHI2	*Bouteloua hirsuta*	10–30	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	10–30	–
	creeping muhly	MURE	*Muhlenbergia repens*	10–30	–
	tobosagrass	PLMU3	*Pleuraphis mutica*	10–30	–
	burrograss	SCBR2	*Scleropogon brevifolius*	5–15	–
Shrub/Vine					
6	**Shrubs**			25–30	
	Texas sacahuista	NOTE	*Nolina texana*	5–15	–
	javelina bush	COER5	*Condalia ericoides*	5–10	–
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	1–5	–
	longleaf jointfir	EPTR	*Ephedra trifurca*	1–5	–
	pricklypear	OPUNT	*Opuntia*	1–5	–
	western honey mesquite	PRGLT	*Prosopis glandulosa var. torreyana*	1–5	–
	soaptree yucca	YUEL	*Yucca elata*	1–5	–
	catclaw acacia	ACGR	*Acacia greggii*	1–5	–
	viscid acacia	ACNE4	*Acacia neovernicosa*	1–5	–
	escobilla butterflybush	BUSC	*Buddleja scordioides*	1–5	–
Tree					
7	**Trees**			5–10	
	redberry juniper	JUCO11	*Juniperus coahuilensis*	5–10	–
	Chisos red oak	QUGR2	*Quercus gravesii*	5–10	–
	gray oak	QUGR3	*Quercus grisea*	5–10	–
Forb					
8	**Forbs**			35–50	
	Forb, annual	2FA	*Forb, annual*	0–15	–
	Forb, perennial	2FP	*Forb, perennial*	5–15	–
	grassland croton	CRDI6	*Croton dioicus*	3–5	–
	polkadots	DYLI	*Dyschoriste linearis*	3–5	–
	beeblossom	GAURA	*Gaura*	3–5	–
	Gregg's tube tongue	JUPI5	*Justicia pilosella*	3–5	–
	bladderpod	LESQU	*Lesquerella*	3–5	–
	menodora	MENOD	*Menodora*	3–5	–
	polygala	POLYG	*Polygala*	3–5	–
	woolly paperflower	PSTA	*Psilostrophe tagetina*	3–5	–

Animal community

The reference plant community is suited for conservative livestock grazing, including cattle, horses, burros, goats, and sheep. Livestock should be stocked in proportion to the grazeable grass, forbs, and browse. Improper grazing management, especially during droughts, causes a gradual decline in rangeland health and livestock nutrition.

Wildlife that use this site for at least a portion of their overall habitat needs include mule deer, pronghorn antelope, javelinas, bobcats, coyotes, black-tailed jackrabbits, cottontails, raccoons, ringtails, gray foxes, mice, and ground squirrels. Birds that use this site for at least a portion of their lifecycle include scaled quail, doves, raptors, and numerous song birds. Insects and reptiles also frequent the area.

Plant Preference by Animal Kind:
These preferences are general because plant preference 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 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 unavailable.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts, results in death or severe illness in animal.

Hydrological functions

Plant communities 1.1 (Black or blue grama grasslands/few scattered shrubs) and 2.1 (Encroached woody plants with black or blue grama dominant) provide optimum hydrologic function because of the high canopy cover of perennial grasses. Water runoff is limited and infiltration rates are maximized. A deteriorated herbaceous component with increased bare ground and annuals will allow increased runoff and decreased water infiltration. The inherently high amount of rock fragments on Enash and Sanmoss soils helps minimized soil loss.

Recreational uses

The site can be used for hiking, camping, and hunting.

Wood products

Not Available.

Other products

Not Available.

Other information

Not Available.

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, soils data, animal diet data, and ecological interpretations gained by field observation.

Other references

1. Gosz, R.J. and J.R. Gosz. 1996. Species interactions on the biome transition zone in New Mexico: response of blue grama (Bouteloua gracilis) and black grama (Bouteloua eriopoda) to fire and herbivory. Journal of Arid Environments, 34: 101-114.

2. Peters, D.P.C. 2002. Plant species dominance at a grassland-shrubland ecotone: an individual-based gap dynamics model of herbaceous and woody species. Ecological Modeling 152: 5-32.

3. Nelson, E.W. 1934. The influence of precipitation and grazing upon black grama grass range. Technical Bulletin No. 409. United Stated Department of Agriculture, Washington, D.C.

4. Reynolds, H.G. and J.W. Bohning. 1956. Effects of burning on a desert grass-shrub range in southern Arizona. Ecology, 37: 769-777.

5. Heitschmidt, R.K. and J.W. Stuth, eds. 1991. Grazing management: an ecological perspective. Portland, OR: Timberline Press.

6. Buechner, H.K. 1950. Life history, ecology, and range use of the pronghorn antelope in Trans-Pecos Texas. American Midland Naturalist, 43/2: 257-354.

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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	04/16/2012
Approved by	Kent Ferguson
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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2. **Presence of water flow patterns:** None, except following high intesity storms, when short (less than 1 m) and discontinuous flow patterns may appear. Flow patterns in drainages are linear and continuous.

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3. **Number and height of erosional pedestals or terracettes:** Uncommon for this site under reference conditions.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Under reference conditions, bare ground usually ranges from 1-5%.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** On most of the site, minimal and short distance (<5ft) of litter movement associated with high intense rainfall.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values ranging from 5 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Typically, surface horizon about 10 inches thick, reddish brown with a moderate fine subangular blocky structure. Organic matter contentgreater than 1.0 percent in the upper 20 inches, decreasing regularly with depth.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** A high canopy cover of midgrass bunch and stoliniferous grasses will help minimize runoff and maximize infiltration. Grasses should comprise at least 90% of total plant compostion by weight.

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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:

    Sub-dominant:

    Other:

    Additional: Dominant shortgrasses > subdominant midgrasses > minor short/midgrasses = shrubs > trees > perennial forbs > annual forbs = misc. grasses

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All grasses will show some mortality and decadence in addition to annual forbs. Mid/tall perennial shrubs will show some mortality or decadence only after prolonged and severe droughts. Subshrubs will be less resistant to

severe droughts than mid/tall perennial shrubs.

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14. **Average percent litter cover (%) and depth (in):** Majority of litter cover will occur under plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 900-1300 lbs/ac depending on annual rainfall.

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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:** Dry climate generally prevents non-native species to encroach on this site. However, lehmann's lovegrass is known to invade some locations. Whitethorn acacia, catclaw acacia, and juniper are typical increasers within this site.

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17. **Perennial plant reproductive capability:** All species should be capable of reproducing except during severe droughts.
