USDA Natural Resources Conservation Service

Ecological site R042AD007NM
Gravelly, Dry Mixed Prairie

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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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site consists of shallow, well drained soils that formed in alluvium modified by eolian material above and below the very slowly permeable petrocalcic horizon. These soils are on alluvial fans and fan remnants. Slopes range from 2 to 5 percent and may range up to 10 percent. Elevations range from approximately 4700 to 6000 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant (2) Alluvial fan
Flooding frequency	None
Ponding frequency	None
Elevation	1,433–1,829 m
Slope	2–5%

Aspect	Aspect is not a significant factor

Climatic features

Average precipitation for this site is approximately 12 to 14 inches. Variations of 5 inches are not uncommon. Approximately 75 percent occurs from May through October with most of the rainfall occurring from July to September. Most of the summer precipitation comes in the form of high intensity, short duration thunderstorms. Rain and snow of low intensity characterize the limited winter precipitation.

Temperatures are mild. Freezing temperatures are common at night from December through April, however, temperatures during the day are frequently above 50 degrees F. Occasionally in December to February brief periods of 0 degrees F. temperatures may be expected. During June to August some days may exceed 100 degrees F.

The mean annual precipitation figures are derived from rain gauge data collected by the BLM (1971 to 1990), and NOAA weather maps utilizing prism model estimation techniques. There are no permanent weather stations within the boundaries of the Land Resource Unit.

Table 3. Representative climatic features

Frost-free period (average)	180 days
Freeze-free period (average)	185 days
Precipitation total (average)	356 mm

Influencing water features

This site is not influenced by water from wetland or stream.

Soil features

The soils on this site are very shallow to shallow, less than 20 inches in depth. Surface layer is gravelly loam or very gravelly loam. Subsurface textures are gravelly loam, very gravelly loam, gravelly sandy clay loam or very gravelly sandy clay loam. An indurated caliche layer (petrocalcic) occurs at depths of 8 to 20 inches with an average depth of 15 inches from the surface. The soils are well drained and have moderately slow permeability above and below the very slowly permeable petrocalcic horizon. The petrocalcic horizon restricts water movement and plant root penetration. Available water holding capacity is low.

Minimum and maximum values listed below represent the characteristic soils for this site.

Characteristic soils:
Philder

Table 4. Representative soil features

Surface texture	(1) Very gravelly loam (2) Gravelly loam (3) Gravelly sandy clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately slow
Soil depth	36–79 cm
Surface fragment cover <=3"	20–45%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	2.54–5.08 cm
Calcium carbonate equivalent (0-101.6cm)	5–40%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	20–45%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

The Gravelly site is associated with the topographically higher Limestone Hills site from which it can receive extra run-on water. The Gravelly site is also associated with the Shallow Sandy site, where they occur together as a complex on fan piedmonts. The Gravelly site is also found adjacent to the Limy, and Loamy sites. The Limy and Loamy sites are usually in a slightly lower, concave position (Inset fan) while the Gravelly site occupies a more convex landscape position. The soils are gravelly loams shallow to a petrocalcic horizon. This very slowly permeable layer helps to store and keep water perched and available to plants.2 Black grama is the dominant grass species. Blue grama, sideoats grama and sand muhly also occur in significant numbers. Forb production is

variable but is an important component of this site. Common forbs include prickleaf dogweed, globemallow, and croton. Shrubs are a noticeable component of this site and include yucca, prickly pear, creosotebush, tarbush, winterfat, and others. Retrogression within this state is characterized by a decrease in black grama, blue grama, and sideoats, and an increase in dropseeds, sand muhly, and creosotebush. These changes can be influenced by drought or overgrazing. Sideoats grama may increase in representation following periods of increased
precipitation, or on locations adjacent to limestone hills, which receive run-on water. If the theory that fire historically occurred fairly frequent in Chihuahuan Desert grasslands is correct, then the relative density of shrubs for this site may have been kept in check by fire.1 Fire suppression therefore may facilitate shrub expansion and the transition to a shrub dominated state. Years with above normal winter precipitation may also favor the establishment of shrubs.

Drought and overgrazing may assist in shrub establishment and expansion. As grass cover is reduced, organic matter is decreased and the amount of bare ground increases. The bare soil is susceptible to physical crusting, reduced infiltration, litter movement and redistribution, and erosion.

State and transition model

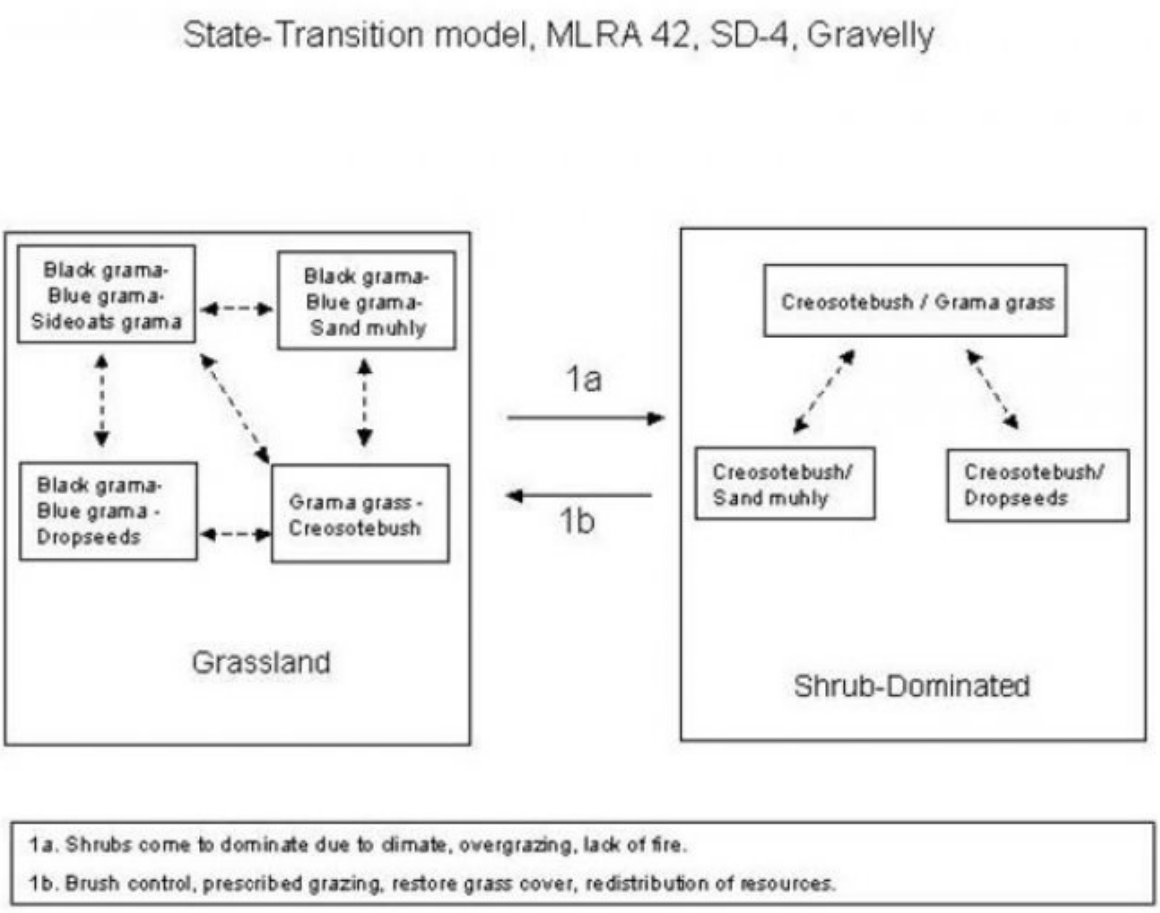

Figure 4. MLRA-42, SD-4, Gravelly

State 1
Historic Climax Plant Community

Community 1.1
Grassland

Figure 5. Grassland

Grasses dominate the historic plant community with shrubs evenly distributed throughout. Black grama and blue grama are the dominant grass species. Sideoats grama, sand muhly, New Mexico feathergrass and dropseeds also occur in significant numbers. New Mexico feathergrass increases in representation on gravelly sites on southern Otero Mesa. It may be that this increase in feathergrass is due to a slight increase in cool season precipitation toward the south along the Otero Mesa Escarpment. Common forbs include prickleaf dogweed, globemallow, and croton. The dominant shrubs include yucca, prickly pear, creosotebush, tarbush, broom snakeweed, and winterfat. Retrogression caused by grazing or drought is characterized by a decrease in black grama, blue grama, sideoats, and winterfat. In response to this decrease, dropseeds, sand muhly and broom snakeweed increase. The calcareous gravelly soils are underlain by a petrocalcic horizon and provide ideal conditions for creosotebush establishment. Natural fire may have historically inhibited the expansion of creosotebush by killing seedlings.5 Reduced fire frequency due to fire suppression or reduction in fuel load by drought or grazing may contribute to creosotebush seedling establishment. Disturbance by drought or grazing can cause a decrease in grass cover and organic matter. As herbaceous cover declines, bare ground and erosion increase and eventually nutrients are redistributed by wind and water around remaining plants. Those nutrient-rich areas surrounding shrubs increase the probability of shrub seedling establishment, while the bare inter-shrub spaces preclude seedling establishment by grasses.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	628	953	1170
Shrub/Vine	78	90	94
Forb	78	78	81
Total	**784**	**1121**	**1345**

Figure 7. Plant community growth curve (percent production by month). NM5808, R042XD007NM-Gravelley-HCPC. R042XD007NM-Gravelley-HCPC.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	3	8	7	18	28	25	6	2	0

State 2
Shrub Dominated

This state is characterized by the dominance of creosotebush. Other shrubs/sub-shrubs that typically increase due to overgrazing, drought and lack of fire include tarbush, prickly pear, and broom snakeweed. Black grama, blue grama, and sideoats, decline while sand muhly dropseeds and threeawns continue to increase.

Community 2.1
Shrub Dominated

Figure 8. Shrub Dominated

Creosotebush is the dominant species. Grass cover is no longer uniformly distributed, instead tending to be patchy with large areas of bare ground present. Black grama, sand muhly or dropseeds may be the dominant grass species. Threeawns, and fluffgrass occur at increased densities in comparison to the grassland state. Physical crusts are present in bare areas and erosion is increased by evidence of rills and gully formation.

Transition 1a
State 1 to 2

Climate, overgrazing, erosion and lack of fire are believed to be the key factors causing this transition. Periods of consistent above average winter precipitation favor shrub increase, while warm season grasses are favored when the winters are dry and summers

are wet. 3 Extended periods of drought can severely reduce perennial grass cover, even in the absence of grazing.4 Loss of grass cover reduces competition between grasses and shrub seedlings, creating conditions that favor shrub expansion. Erosion is accelerated by the reduction in cover. Fire is believed to be a natural component of desert grasslands and historically may have limited the expansion of creosotebush and other non-sprouting species. A loss of grass cover as a fuel source will also reduce the ability to utilize fire as a management tool. Key indicators of approach to transition: Reduction in grass cover and increase in size and frequency of bare patches. Increase in amount of creosotebush seedlings. Formation of physical crusts—indicating loss of organic matter and decrease in soil aggregate stability and reduced infiltration. Evidence of litter movement—indicating loss or redistribution of organic matter. Evidence of accelerated erosion such as: formation of pedestals, increase in number and size of rills, formation of or active head cutting of gullies.

Transition 1b
State 2 to 1

Brush management is necessary to remove resource competition from shrubs and increase grass cover. Reestablishing cover will also provide organic matter and fine fuels necessary to carry fire. Prescribed grazing will help ensure proper forage utilization and plant vigor, especially during times of drought. The amount of erosion and loss of soil resources may dictate the degree to which the system is capable of recovery.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				392–448	
	black grama	BOER4	*Bouteloua eriopoda*	392–448	–
2				56–84	
	sideoats grama	BOCU	*Bouteloua curtipendula*	56–84	–
	blue grama	BOGR2	*Bouteloua gracilis*	56–84	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	56–84	–
	Hall's panicgrass	PAHA	*Panicum hallii*	56–84	–
3				112–168	
	sand muhly	MUAR2	*Muhlenbergia arenicola*	112–168	–
	spike dropseed	SPCO4	*Sporobolus contractus*	112–168	–

	sand dropseed	SPCR	*Sporobolus cryptandrus*	112–168	–
4				56–84	
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	56–84	–
	green sprangletop	LEDU	*Leptochloa dubia*	56–84	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	56–84	–
	alkali sacaton	SPAI	*Sporobolus airoides*	56–84	–
5				22–34	
	threeawn	ARIST	*Aristida*	22–34	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	22–34	–
	ear muhly	MUAR	*Muhlenbergia arenacea*	22–34	–
Forb					
6				17–22	
	Forb, annual	2FA	*Forb, annual*	17–22	–
7				28–39	
	Forb, perennial	2FP	*Forb, perennial*	28–39	–
	croton	CROTO	*Croton*	28–39	–
	bladderpod	LESQU	*Lesquerella*	28–39	–
	globemallow	SPHAE	*Sphaeralcea*	28–39	–
8				9–11	
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	9–11	–
	pricklyleaf dogweed	THAC	*Thymophylla acerosa*	9–11	–
Shrub/Vine					
9				22–34	
	pricklypear	OPUNT	*Opuntia*	22–34	–
	yucca	YUCCA	*Yucca*	22–34	–
10				34–45	
	jointfir	EPHED	*Ephedra*	34–45	–
	American tarwort	FLCE	*Flourensia cernua*	34–45	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	34–45	–
	creosote bush	LATR2	*Larrea tridentata*	34–45	–

	creosote bush	LATR2	*Larrea tridentata*	9–11	
11				9–11	
	littleleaf ratany	KRER	*Krameria erecta*	9–11	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	9–11	–
	mariola	PAIN2	*Parthenium incanum*	9–11	–

Animal community

This site provides habitat, which supports a resident animal community, characterized by pronghorn antelope, coyote, black-tailed jackrabbit, red-tailed hawk, meadow lark, horned lark and prairie rattlesnake. This site also provides nesting, hiding and thermal cover for a variety of small rodents, birds and reptiles and their associated predators.

Hydrological functions

This site normally receives approximately 12-14 inches annual precipitation. Most summer rainfall occurs as brief sometimes-heavy thunderstorms. Soils are shallow to moderately deep and rated as being in hydrologic group D. Slopes range from 2-5 percent. Permeability is moderately slow above the very slowly permeable petrocalcic horizon. The petrocalcic horizon will restrict water movement keeping it perched in the upper profile for short periods of time.

Runoff is very high, and the hazard of water erosion is severe. Available water capacity to the root restricting layer is Very Low.

Recreational uses

This site offers good potential for antelope and predator hunting, wildlife observation and photography. Scenic beauty of this site will especially appeal to those who value wide open prairie grasslands.

Wood products

This site has no significant value for wood products.

Other products

Grazing: This site is suitable for grazing by all kinds and classes of livestock during all seasons of the year. As the site deteriorates there will be an increase in bare ground leaving the exposed soil susceptible to wind and water erosion. This site responds best to a system of management that rotates the season of use. Initial starting stocking rates will be determined with the landowner or decision-maker. They will be based on past use histories and type and condition of the vegetation. Calculations used to determine initial

starting stocking rate will also be based on forage preference ratings.

Other references

1. Brooks, M.L., and D.A. Pyke. 2001. Invasive plants and fire in the deserts of North America. Pages 1–14 in K.E.M. Galley and T.P. Wilson (eds.). Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species.

2. Hennessy, J.T., R.P. Gibbens, J.M. Tromble, and M. Cardenas. 1983. Water properties of caliche. J. Range Manage. 36: 723-726.

3. Moir, W. H. and J. A. Ludwig. 1991. Plant succession and changing land features in desert grasslands. P. 15-18. In P.F. Ffolliott and W.T. Swank (eds.) People and the temperate region: a summary of research from the United States Man and the Biosphere Program 1991. U.S. Dept. State, Publ No. 9839, Nat. Tech. Info. Serv., U.S. Dept. Commerce, Springfield, Illinois. 63 p.

4. Paulsen, H.A. and F.N. Ares. 1962. Grazing values and management of black grama and tobosa grasslands and associated shrub ranges of the southwest. USDA, Forest Service, Tech. Bull. 1270.

5. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, September). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [accessed 9/20/02].

Contributors

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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.

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:**

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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):**

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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:

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

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

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

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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:**

17. **Perennial plant reproductive capability:**