USDA Natural Resources Conservation Service

Ecological site R070CY116NM
Shallow Sandstone

Last updated: 10/21/2024
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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.

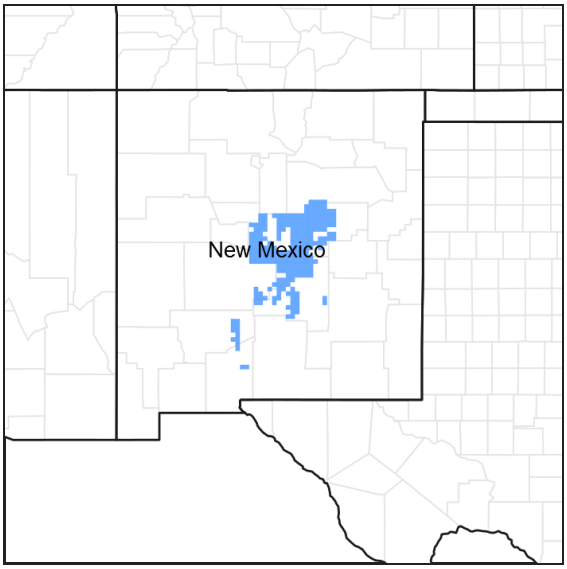

Figure 1. Mapped extent

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): 042C–Central New Mexico Highlands

Major Land Resource Area (MLRA): 070C–Central New Mexico Highlands

Major Land Resource Area (MLRA) 70C - will become 42C - is a high elevation portion of central New Mexico that is the convergence of four major physiographic provinces: Basin and Range, Southern Rocky Mountains, Great Plains, and Colorado Plateau. As such, it contains parts or characteristics of each, though tectonically, as a region, it is the easternmost extent of the Basin and Range Province and, more specifically, a structural expression of the Rio Grande Rift. It consists mostly of rangeland with some forested areas associated with numerous disconnected mountain ranges such as the Guadalupe, Sacramento, and Manzano Mountains. Other major physiographic features include the Galisteo Basin or the enclosed Estancia Basin, the structural Chupadera and Glorieta Mesas, and the piedmonts of the Buchanan and Guadalupe Mesas.

Ecological site concept

This site occurs on shallow to very shallow soils over sandstone plateau bedrock and often have an argillic horizon where soil profiles are thicker than 25 cm. Surface textures are medium to coarse and may be stony or gravelly.

Table 1. Dominant plant species

Tree	(1) *Juniperus* (2) *Pinus edulis*
Shrub	(1) *Rhus trilobata* (2) *Mahonia trifoliolata*
Herbaceous	(1) *Bouteloua curtipendula* (2) *Schizachyrium scoparium*

Physiographic features

This site occurs on upland plains, on top slopes of hills, and on tops of hills and ridges. Slopes range from 0 to 15 percent but are generally less than 9 percent. Direction of slope varies and is not significant. Elevations range from 4,600 to 7,000 feet above sea level.

Travessilla - Parent material: calcareous eolian sediments and residuum weathered from sandstone and shale. Outcrops of sandstone with a minor amount of shale are common on steep slopes. Landform: hills, cuestas, scarps, and mesas. Slopes: 0 to 75 percent. Elevation: 4,700 to 8,000 feet
Encierro soils are on uplands, hills, and mesa tops and have slopes of 5 to 30 percent. They formed in materials weathered from sandstone, limestone, and interbedded shales, and loess. The climate is semiarid. Elevation is 5,500 to 7,000 feet.
The Bernal soils are on mesa tops and upland ridge crests on bedrock controlled landscape. Slopes range from 0 to 30 percent. Elevations are 5,300 to 7,900 feet. The soils formed in moderately fine textured noncalcareous sandy material weathered from the sandstone, with possible minor addition of eolian material.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Ridge (3) Plain
Elevation	1,402–2,134 m
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the area is ‘semi-arid continental.”

The average annual precipitation ranges from 13 to 16 inches. Variations of 5 inches, more or less, are not uncommon. Seventy-five percent of the precipitation falls from April to October. Most of the summer precipitation comes in the form of high-intensity, short-duration thunderstorms.

Temperatures are characterized by distinct seasonal changes and large annual and diurnal temperature changes. The average annual temperature is about 50 degrees F with extremes of -29 degrees F in the winter and 103 degrees F in the summer.

The average frost-free season is 130 to 160 days. The last killing frost falling in early May and the first killing frost in early October.

Both temperature and moisture favor warm-season perennial plant communities. However, about 40 percent of the precipitation falls at a time favorable to cool-season plant growth. This allows the cool-season species to occupy a very important component in this plant community. Vegetation responds well to light rains, due to the shallow soil depth. Heavy rains produce excess runoff and cause flash floods. Strong winds from the west and southwest blow across the area from February to June, causing the soil to dry out during a critical growth period for cool-season species. The wind also causes the soil to blow and can cause plant damage and reduce growth.

Climate data was obtained from http://www.wrcc.sage.dri.edu/summary/climsmnm.html web site using 50% probability for freeze-free and frost-free seasons using 28.5 degrees F and 32.5 degrees F respectively.

Travessilla - Mean annual precipitation: 10 to 16 inches, but has ranged higher. Mean annual temperature: 49 to 57 degrees F. Frost-free period is typically 115 to 170 days.
Encierro - The mean annual temperature is about 49 to 54 degrees F. The mean annual precipitation is about 12 to 18 inches. The frost-free season is 150 to 180 days.
Bernal - The climate is semiarid continental. At the type location, the mean annual temperature is about 46 degrees to 52 degrees F. The average annual precipitation is about 12 to 16 inches. The precipitation pattern is characterized by a marked summer maximum resulting from thunderstorms. The frost-free season is 120 to 160 days.

Table 3. Representative climatic features

Frost-free period (average)	173 days
Freeze-free period (average)	187 days
Precipitation total (average)	406 mm

Influencing water features

This site is not influenced by water from a wetland or stream. During heavy rain events, this site may receive run-on moisture from landforms above and contribute runoff to landforms below.

Soil features

The soils of this site are shallow to very shallow over sandstone. Surface textures are medium to coarse and may be stony or gravelly. Water intake rate is rapid to moderately slow. The water-holding capacity is generally low. These soils can be severely damaged by wind and/or water erosion.

The Travessilla series consists of very shallow and shallow, well drained soils that formed in calcareous eolian sediments and material weathered from sandstone. These soils are on hills, cuestas, scarps, and mesas with slopes ranging from 0 to 75 percent. TAXONOMIC CLASS: Loamy, mixed, superactive, calcareous, mesic Lithic Ustic Torriorthents
The Encierro series consists of shallow, well drained soils that formed in materials derived from the underlying bedrock and loess. Encierro soils are on hills and mesa tops with slopes of 5 to 30 percent. TAXONOMIC CLASS: Clayey, mixed, superactive, mesic Lithic Argiustolls
The Bernal series consists of shallow to sandstone bedrock, well drained soils that formed in material weathered from sandstone. Bernal soils are on mesa tops and upland ridge crests, and have slopes of 0 to 25 percent. TAXONOMIC CLASS: Loamy, mixed, superactive, mesic Aridic Lithic Argiustolls

Table 4. Representative soil features

Surface texture	(1) Stony fine sandy loam (2) Gravelly sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow to moderately rapid
Soil depth	15–51 cm
Surface fragment cover <=3"	15–35%
Surface fragment cover >3"	15–35%
Available water capacity (0-101.6cm)	2.54–5.08 cm
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm

Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	15–35%
Subsurface fragment volume >3" (Depth not specified)	15–35%

Ecological dynamics

Slopes 0-15% usually less than 10%. Shallow to very shallow over sandstone, medium to coarse texture. Vegetation includes little bluestem, sideoats grama, black grama, blue grama, hairy grama, galleta, needlegrasses, Indian ricegrass, bottlebrush squirreltail, western wheatgrass, common wolftail, Indian paintbrush, fetid marigold, scarlet globemallow, piñon, juniper skunkbush sumac, oak, and sagebrush.

Grazing:
This site is not suited to heavy yearlong or continuous growing season grazing. This site responds best to a system of grazing which rotates the season of use. As this site deteriorates there will be a decrease in plants such as little bluestem, sideoats grama, black grama, needleandthread, New Mexico feathergrass, Indian ricegrass, western wheatgrass, skunkbush sumac, and Bigelow sagebrush. As this occurs, there will be a corresponding increase in plants like blue grama, sand dropseed, spike dropseed, threeawn, pinyon and juniper. If deterioration continues, woody species will dominate with an understory of very low-vigor, unproductive blue grama. Bare ground increases, which causes an increase in water runoff and soil erosion. Mechanical brush control is usually not feasible, due to the shallow soil. When this site is in the above condition, recovery using improved grazing management alone may be difficult achieve.
Travessilla - Rangeland. Juniper, pinyon, squawbush, oakbrush, blue grama, sideoats grama and snakeweed are the principal plants.
Encierro - Native vegetation is primarily blue grama, sideoats grama, sacahuista, and some pinyon, juniper, gray oak, and mountain mahogany.
Bernal - Rangeland. Principal native plants are blue grama, sand dropseed, and galleta, and commonly with an overstory of pinyon and juniper.

State and transition model

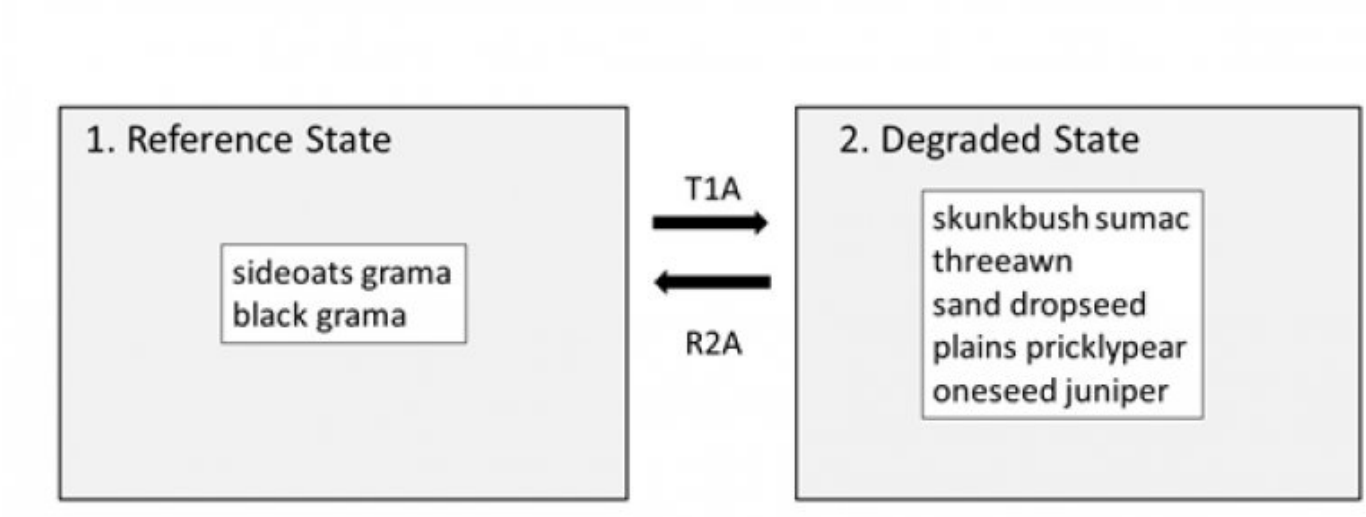

Figure 4. Generalized STM for shallow sites in 70C

State 1
Reference State

This state includes little bluestem, sideoats grama, black grama, and needleandthread,

Characteristics and indicators. Decreasers such as: little bluestem, sideoats grama, black grama, needleandthread, New Mexico feathergrass, Indian ricegrass, western wheatgrass, skunkbush sumac, and Bigelow sagebrush condition,

Resilience management. This site is suitable for grazing by all kinds and classes of livestock during all seasons of the year. This site is not suited to heavy yearlong or continuous growing season grazing. This site responds best to a system of grazing which rotates the season of use.

Community 1.1
Reference Plant Community

This phase is characterized by relatively moderate production and is dominated by short and mid-grasses, with a woody component that increases with elevation. Forb production fluctuates widely from year to year and from season and season. Surface rock is abundant. Other grasses that could appear on this phase include: spike muhly, mountain muhly, metcalf muhly, curlyleaf muhly, ring muhly, mat muhly, sandhill muhly, threeawn, buffalograss, burrograss, alkali sacaton, pine dropseed, pinyon ricegrass, and prairie junegrass. Other shrubs and trees include: rubber rabbitbrush, fourwing saltbush, sand sagebrush, winterfat, broom snakeweed, yucca spp., sacahuista, ephedra spp., and ponderosa pine. Other forbs include: penstemon spp., locoweed, redstem milkvetch, threadleaf groundsel, wooly Indianwheat, and tansymustard.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	269	628	986
Forb	27	63	99
Total	**296**	**691**	**1085**

Table 6. Ground cover

Tree foliar cover	5-10%
Shrub/vine/liana foliar cover	2-3%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	6-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-50%

Figure 6. Plant community growth curve (percent production by month). NM4316, R070CY116NM Shallow Sandstone Reference State. R070CY116NM Shallow Sandstone Reference State Mixed short/mid-grass with woody component, forbs fluctuates yearly and rock is abundant. .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	7	10	15	25	25	8	5	0	0

State 2
Degraded

This state includes blue grama, sand dropseed, spike dropseed, threeawn, pinyon and juniper.

Characteristics and indicators. increasers such as: blue grama, sand dropseed, spike dropseed, threeawn, pinyon and juniper. If deterioration continues, woody species will dominate with an understory of very low-vigor, unproductive blue grama. Bare ground increases, which causes an increase in water runoff and soil erosion.

Resilience management. This site is not suited to heavy yearlong or continuous growing season grazing. This site responds best to a system of grazing which rotates the season of use. Mechanical brush control is usually not feasible, due to the shallow soil. When this site is in the above condition, recovery using improved grazing management alone may be difficult achieve.

Transition T1A
State 1 to 2

Season-long grazing providing little rest and recovery for preferred grazed plants during critical growing periods, coupled with high utilization.

Restoration pathway R2A
State 2 to 1

Legacy text: "Restoration pathway resulting from the implementation of prescribed grazing." It should be noted that prescribed grazing alone may not effectively diminish woody plants here. Brush control may also be required. Future work on this ESD should seek to clarify this.

Conservation practices

Grazing Management Plan - Applied

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				118–235	
	sideoats grama	BOCU	*Bouteloua curtipendula*	118–235	–
	little bluestem	SCSC	*Schizachyrium scoparium*	118–235	–
2				78–118	
	black grama	BOER4	*Bouteloua eriopoda*	78–118	–
3				78–157	
	blue grama	BOGR2	*Bouteloua gracilis*	78–157	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	78–157	–
4				24–39	
	James' galleta	PLJA	*Pleuraphis jamesii*	24–39	–
5				55–78	
	needle and thread	HECO26	*Hesperostipa comata*	55–78	–

	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	55–78	–
6				55–78	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	55–78	–
	squirreltail	ELEL5	*Elymus elymoides*	55–78	–
7				16–39	
	western wheatgrass	PASM	*Pascopyrum smithii*	160–39	–
8				16–39	
	common wolfstail	LYPH	*Lycurus phleoides*	16–39	–
9				39–78	
	spike dropseed	SPCO4	*Sporobolus contractus*	39–78	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	39–78	–
10				39–78	
	plains lovegrass	ERIN	*Eragrostis intermedia*	39–78	–
11				39–78	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	39–78	–
Forb					
12				8–16	
	scarlet Indian paintbrush	CACO17	*Castilleja coccinea*	8–16	–
13				8–16	
	fetid marigold	DYPA	*Dyssodia papposa*	8–16	–
14				8–16	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	8–16	–
15				8–16	
	purple sand verbena	ABAN	*Abronia angustifolia*	8–16	–
16				8–16	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	80–16	–
Tree					
17				39–78	
	juniper	JUNIP	*Juniperus*	39–78	–
	twoneedle pinyon	PIED	*Pinus edulis*	39–78	–
Shrub/Vine					
18				8–16	
	skunkbush sumac	RHTR	*Rhus trilobata*	8–16	–
19				8–16	
	algerita	MATR3	*Mahonia trifoliolata*	8–16	–
20				8–16	
	Bigelow sage	ARBI3	*Artemisia bigelovii*	8–16	–
	big sagebrush	ARTR2	*Artemisia tridentata*	8–16	–
21				8–39	
	oak	QUERC	*Quercus*	8–39	–
22				24–39	
	Shrub, deciduous	2SD	*Shrub, deciduous*	24–39	–

Type locality

Location 1: Lincoln County, NM
Location 2: Chaves County, NM
Location 3: Guadalupe County, NM
Location 4: San Miguel County, NM
Location 5: Santa Fe County, NM
Location 6: Torrance County, NM

Other references

Data collection for this site was done in conjunction with the progressive soil surveys within the Pecos-Canadian Plains and Valleys 70 Major Land Resource Area of New Mexico. This site has been mapped and correlated with soils in the following soil surveys: Chaves, De Baca, Guadalupe, Lincoln, Sna Miguel, Santa Fe, Torrance.

Characteristic Soils Are:
Bernal, Endierro, Rizozo, Travesilla

Contributors

Christine Bishop
Don Sylvester
John Tunberg

Approval

Kendra Moseley, 10/21/2024

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	05/13/2025
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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):**

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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:**

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17. **Perennial plant reproductive capability:**
