

# Ecological site R042CY107NM

## Limestone Hills

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) 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.

### LRU notes

This site does not yet have an LRU designation.

### Ecological site concept

This site occurs on limestone supported slopes such that the soils are generally loamy-

skeletal textures with some amount of secondary carbonates (limy) in the soil materials. They range from aridisols to mollisols, and range from an ustic-aridic to an aridic-ustic moisture regime. Limestone bedrock is common within 50 cm soil depth.

Slopes 15-75%, shallow over limestone , clay loam to sandy loam. Vegetation includes black grama, sideoats grama, little bluestem, muhly, plains lovegrass, needlegrass, blue grama, hairy grama, common wilftail, galleta, western wheatgrass, junegrass, mariola, Indian paintbrush, oak, algerita, catclaw mimosa, skunkbush sumac, juniper piñon, and cliffrose.

Table 1. Dominant plant species

Tree	(1) <i>Juniperus</i> (2) <i>Pinus edulis</i>
Shrub	(1) <i>Quercus</i> (2) <i>Mahonia trifoliolata</i>
Herbaceous	(1) <i>Bouteloua eriopoda</i> (2) <i>Bouteloua curtispendula</i>

Physiographic features

This site occurs as hills, low mountains, and foot slopes of higher mountains. Slopes range from 15 to 75 percent and average 20 percent. Elevation ranges from 5,000 to 7,000 feet above sea level. This site is a complex of soils, rock, aspect and degree of slope. Aspect varies and is important. North and east slopes are cooler and have a better soil moisture relationship; therefore, they produce more forage.

The properties of this site will exist within the ranges of the following soil series, but are not necessarily characterized by their full range.

Winona soils are on plateaus and hills. Slopes are dominantly 2 to 15 percent, but range from 0 to 70 percent. These soils formed in eolian deposits over alluvium from limestone and calcareous sandstone. Elevations range from 4700 to 7100 feet. Well drained; slow to rapid runoff; moderate permeability.

The Deama soils are on hills, ridges, mesas, or plateaus. Slopes range from 0 to 90 percent. The soils formed in colluvium derived mainly from limestone. Elevation ranges from 4,500 to 8,660 feet; Well drained. Permeability of the soil material is moderately slow above a very slowly permeable bedrock. Runoff is high on slopes less than 1 percent and very high on slopes greater than 1 percent

The Tortugas soils are on gently rolling ridges to very steep hills at elevations of 4,000 to 7,500 feet. Slopes are dominantly 5 to 45 percent and range from 0 to 75 percent. These soils formed on and from limestone, calcareous sandstone and shale.

Pinon soils are on knolls, ridges, mesas and hillslopes. Slope gradients range from 1 to 30 percent. These soils formed in alluvium and residuum derived from limestone. Elevation ranges from 5,500 to 6,700 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Hill
Runoff class	Low to very high
Elevation	1,524–2,134 m
Slope	15–75%
Aspect	N, E

## **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 precipitation favor warm-season perennial species. However, about 40 percent of the annual precipitation falls at a time favorable to cool-season plant growth. This allows the cool-season plants to occupy an important component of this site. On the north and east slopes, this cool-season component may dominate the vegetative community. Strong winds that blow from February to June can dry the soil profile quickly during a critical time for cool-season plant 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.

The properties of this site will exist within the ranges of the following soil series, but are not necessarily characterized by their full range.

Winona - The climate is semiarid with a mean annual precipitation of 8 to 14 inches occurring as summer thunderstorms and gentle winter rain and snow. The mean annual air temperature ranges from 46 to 54 degrees F. The mean temperature for July is 71 degrees F. and for December is 31 degrees F. The frost-free period ranges from 120 to 180 days.

Deama - Mean annual precipitation ranges from 12 to 18 inches and mean annual temperature ranges from 45 to 58 degrees F. Frost-free season ranges from 110 to 180 days

Tortugas - The climate is semiarid continental. The mean annual air temperature ranges from 45 degrees to 60 degrees F. The frost-free period ranges from 100 to 220 days. The average annual precipitation ranges from 12 to 24 inches falling mainly in thundershowers in July and August and as gentle rains in December and January.

Pinon - Mean annual temperature ranges from 49 to 56 degrees F., and a mean summer temperature of 64 degrees F. Mean annual precipitation ranges from 10 to 15 inches. The frost-free period ranges from 130 to 170 days. In Colorado these soils have air temperatures ranging from 45 to 48 degrees F. and have a frost-free period of 90 to 130 days with elevations up to 7,400 feet.

**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 is an upland site, and is not associated with water features or wetlands. During heavy rain events, this site may receive run-on moisture from landforms above and contribute runoff to landforms below.

## **Soil features**

The soils on this site are typically shallow over limestone, although pockets of deep soil exist. Surface textures can vary from clay loams to sandy loams and are frequently stony, gravelly, or cobbly. Water intake is moderate to moderately rapid. The water-holding capacity is generally low due to the depth of the soil.

The Winona series consists of very shallow and shallow, well drained soils that formed in eolian deposits over alluvium from limestone and calcareous sandstone. Winona soils are on plateaus and hills and have slopes of 0 to 70 percent. The mean annual precipitation is about 11 inches and the mean annual air temperature is about 52 degrees F.

The Deama series consists of shallow and very shallow, well drained soils with moderately slow permeability above very slowly permeable limestone bedrock. They formed in colluvium mainly from limestone. Deama soils are on hills, ridges, plateaus, or mesas. Slope ranges from 0 to 90 percent. Mean annual precipitation is about 15 inches and mean annual air temperature is about 52 degrees F.

The Tortugas series consists of very shallow and shallow, well drained, moderately rapid permeable soils formed from limestone, calcareous sandstone and shale on gently rolling ridges to very steep hills. Slopes are 0 to 75 percent. The mean annual precipitation is about 18 inches and the mean annual air temperature is about 47 degrees F.

The Pinon series consists of soils that are shallow to hard limestone bedrock. They are

well drained, moderately slowly permeable that formed in alluvium and residuum. These soils are on knolls, ridges, mesas and hillslopes. Slope ranges from 1 to 30 percent. Mean annual precipitation is about 13 inches; mean annual temperature is about 53 degrees F.

**Table 4. Representative soil features**

Surface texture	(1) Stony clay loam (2) Gravelly fine sandy loam (3) Cobbly loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	15–51 cm
Surface fragment cover ≤3"	35–60%
Surface fragment cover >3"	35–60%
Available water capacity (0-101.6cm)	7.62–15.24 cm
Electrical conductivity (0-101.6cm)	2–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–4
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume ≤3" (Depth not specified)	15–69%
Subsurface fragment volume >3" (Depth not specified)	15–35%

## Ecological dynamics

Vegetation includes black grama, sideoats grama, little bluestem, muhly, plains lovegrass, needlegrass, blue grama, hairy grama, common wolftail, galleta, western wheatgrass, junegrass, mariola, Indian paintbrush, oak, algerita, catclaw mimosa, skunkbush sumac, alligator juniper, oneseed juniper, twoneedle piñon, and cliffrose.

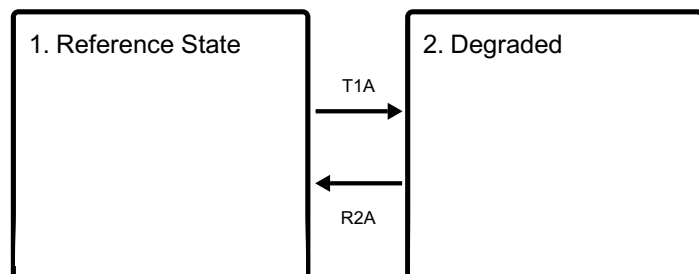
### Grazing:

This site responds best to a system of grazing that rotates the season of use. Under continuous year-long grazing or continuous grazing during the growing season will cause this site to deteriorate. Deterioration of this site is characterized by a decrease in black grama, sideoats grama, little bluestem, New Mexico feathergrass, western wheatgrass, and prairie junegrass. As these species decline there is an increase in species such as

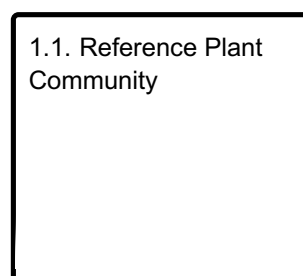
galleta, blue and hairy grama, threeawns, broom snakeweed, algerita, oak spp., juniper and piñon. Mechanical seeding and brush control are rarely justifiable on this site. Because of this, the use of goats or other browsing animals can be a good tool to maintain a healthy, balanced plant community.

## State and transition model

### Ecosystem states



### State 1 submodel, plant communities



## State 1 Reference State

black grama, sideoats grama, little bluestem, New Mexico feathergrass, western wheatgrass, and prairie junegrass

**Resilience management.** This site responds best to a system of grazing that rotates the season of use. On areas of excessively steep slopes, accessibility may become limited and stocking rates should be adjusted accordingly. Mechanical seeding and brush control are rarely justifiable on this site. Because of this, the use of goats or other browsing animals can be a good tool to maintain a healthy, balanced plant community.

## Community 1.1 Reference Plant Community

The potential plant community of this site has a mixed grassland, shrub, half-shrub aspect with only occasional tree-type junipers or pinyon present. Mid- and short grasses dominate the site. Forbs are a minor component of this site. However, during years of abundant spring and fall moisture, a large variety of forbs occur throughout this site. Cool-season grasses and shrubs are more prevalent on the north and east slopes and at higher elevations. Warm-season grasses dominate the west and south slopes and lower elevations. Other grasses that could appear on this site include: cane bluestem, silver

bluestem, big bluestem, Arizona cottontop, green sprangletop, bush muhly, sand dropseed, mesa dropseed, threeawn spp., curly mesquite, false mesquite, bullgrass, tridens spp., Halls panicum, ring muhly, mat muhly, and spike muhly. Other shrubs include: yucca spp., agave spp., sacahuista, winterfat, broom snakeweed, hairy mountainmahogany, cliff fendlerbush, and fourwing saltbush. Other forbs include: locoweed spp., lambert crazyweed, scarlet globemallow, marigold spp., and yarrow.

**Table 5. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	291	583	874
Forb	34	67	112
<b>Total</b>	<b>325</b>	<b>650</b>	<b>986</b>

**Table 6. Ground cover**

Tree foliar cover	3-8%
Shrub/vine/liana foliar cover	7-15%
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	25-35%

**Figure 5. Plant community growth curve (percent production by month). NM4307, R070CY107NM Limestone Hills HCPC. R070CY107NM Limestone Hills HCPC Mixed grassland/shrubland with scattered trees. .**

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

Continuous year-long grazing or continuous grazing during the growing season will cause

this site to deteriorate. Deterioration of this site is characterized by a decrease in black grama, sideoats grama, little bluestem, New Mexico feathergrass, western wheatgrass, and prairie junegrass.

**Characteristics and indicators.** As these species decline there is an increase in species such as galleta, blue and hairy grama, threeawns, broom snakeweed, algerita, oak spp., juniper and piñon.

## 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

Restoration pathway resulting from the implementation of prescribed grazing.

### Conservation practices

Grazing Management Plan - Applied
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## Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1				90–135	
	black grama	BOER4	<i>Bouteloua eriopoda</i>	90–135	–
2				135–179	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	135–179	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	135–179	–
3				135–269	
	plains lovegrass	ERIN	<i>Eragrostis intermedia</i>	135–269	–
	purple muhly	MURI3	<i>Muhlenbergia rigida</i>	135–269	–
	curlyleaf muhly	MUSE	<i>Muhlenbergia setifolia</i>	135–269	–
4				90–135	
	Scribner needlegrass	ACSC11	<i>Achnatherum scribneri</i>	90–135	–



	needle and thread	HECO26	<i>Hesperostipa comata</i>	90–135	–
	New Mexico feathergrass	HENE5	<i>Hesperostipa neomexicana</i>	90–135	–
5				90–112	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	90–108	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	90–108	–
	common wolfstail	LYPH	<i>Lycurus phleoides</i>	90–108	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	90–108	–
6				45–90	
	mountain muhly	MUMO	<i>Muhlenbergia montana</i>	45–90	–
	New Mexico muhly	MUPA2	<i>Muhlenbergia pauciflora</i>	45–90	–
7				45–90	
	prairie Junegrass	KOMA	<i>Koeleria macrantha</i>	45–90	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	45–90	–
	pinyon ricegrass	PIFI	<i>Piptochaetium fimbriatum</i>	45–90	–
8				45–90	
	Graminoid (grass or grass-like)	2GRAM	<i>Graminoid (grass or grass-like)</i>	45–90	–
<b>Forb</b>					
9				45–67	
	mariola	PAIN2	<i>Parthenium incanum</i>	45–63	–
10				11–22	
	scarlet Indian paintbrush	CACO17	<i>Castilleja coccinea</i>	9–27	–
11				11–22	
	woolly plantain	PLPA2	<i>Plantago patagonica</i>	9–27	–
12				11–22	
	Forb (herbaceous, not grass nor grass-like)	2FORB	<i>Forb (herbaceous, not grass nor grass-like)</i>	9–27	–
<b>Shrub/Vine</b>					
13				45–67	
	oak	QUERC	<i>Quercus</i>	45–63	–
14				22–45	
	algerita	MATR3	<i>Mahonia trifoliolata</i>	27–45	–
15				45–67	

	catclaw mimosa	MIACB	<i>Mimosa aculeaticarpa</i> <i>var. biuncifera</i>	45–63	–
	skunkbush sumac	RHTR	<i>Rhus trilobata</i>	45–63	–
17				22–45	
	Mexican cliffrose	PUME	<i>Purshia mexicana</i>	27–45	–
18				22–45	
	Shrub, deciduous	2SD	<i>Shrub, deciduous</i>	27–45	–
<b>Tree</b>					
16				22–90	
	juniper	JUNIP	<i>Juniperus</i>	27–90	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	27–90	–

## Type locality

Location 1: Chaves County, NM
Location 2: De Baca County, NM
Location 3: Guadalupe County, NM
Location 4: Lincoln County, NM
Location 5: San Miguel County, NM
Location 6: Santa Fe County, NM
Location 7: 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:  
Deama, Tortugas, Pinyon

Other Soils included are:  
Rock, Outcrop, Winona

## Contributors

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Elizabeth Wright

## 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	12/07/2025
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:**

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

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

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

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

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

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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):**

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

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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:**

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17. **Perennial plant reproductive capability:**

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