USDA Natural Resources
Conservation Service

Ecological site R070CY106NM
Hills

Last updated: 10/21/2024
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.

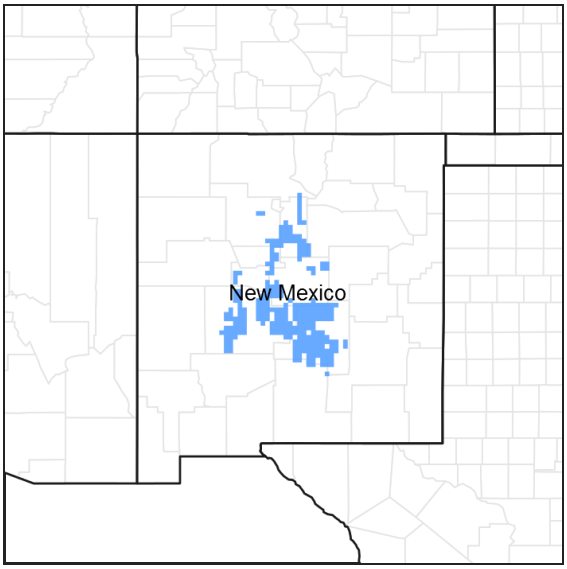


Figure 1. Mapped extent

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.

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 as rolling to steep hills and mountain footslopes, with loamy skeletal to clayey skeletal soils.

Slopes 15-75% shallow to moderately deep over acid igneous bedrock. Vegetation includes sideoats grama, black grama, blue grama, little bluestem, silver bluestem, needlegrasses, ricegrasses, muhleys, threeawn, tridens, planes lovegrass, wild buckwheat, Indian paintbrush, common yarrow, piñon, juniper, skunkbush sumac, oak, and mountain mahogany

Table 1. Dominant plant species

Tree	(1) *Juniperus* (2) *Pinus edulis*
Shrub	(1) *Rhus trilobata* (2) *Quercus*
Herbaceous	(1) *Bouteloua curtipendula* (2) *Bouteloua eriopoda*

Physiographic features

This site occurs as rolling to steep hills and mountain footslopes. Slopes range from 15 to 75 percent but average 20 to 30 percent. Aspect of slope varies and seldom is significant. North and east slopes may have a higher plant density and production than south and west slopes. Elevation ranges from 5,000 to 7,000 feet above sea level.

The properties of this site will exist within the ranges of the following soil series, but are not necessarily characterized by their full range.
Ilefonso soils formed mostly on mesas, eroded fan remnants, escarpments, fan terraces, and hills. The soils formed from alluvium, colluvium and eolian materials derived from quartzite, monzonite, granite, basalt, gneiss, schist and limestone. Elevation ranges from 5,000 to 7,000 feet. Slope ranges from 0 to 75 percent. Well drained. Permeability is moderately rapid. Runoff is negligible on slopes less than 1 percent, very low on 1 to 5 percent slopes, low on 5 to 20 percent slopes, and medium on slopes greater than 20 percent
Stroupe soils - Parent material: colluvium derived from igneous and sandstone bedrock; Landform: mountain sideslopes, footslopes and shoulder slopes; Slope: 5 to 70 percent; Elevation: 5,500 to 7,800 feet; Well drained. Permeability is slow. Runoff is high on 5 to 20 percent slopes and very high on slopes greater than 20 percent.
Pena soils formed in alluvial deposits derived from igneous and sedimentary rocks. These soils are on bajadas, terraces, and knolls. Recent washes and arroyos have dissected the old sediments. Slopes range from 0 to 65 percent. Elevations are 4,300 to 7,800 feet.
Puertecito soils are on slopes of mountains, plateaus, mesas and hills. Slopes range from 1 to 60 percent. Elevation ranges from 5200 to 7600 feet. Well drained; very rapid runoff, moderately slow permeability.
Mokiak soils are on mountain slopes at elevations of 4,300 to 6,700 feet. Slope gradients are 15 to 70 percent. These soils formed in residuum and colluvium weathered from gneiss and schist. Well-drained; medium runoff; moderate permeability.

Table 2. Representative physiographic features

Landforms	(1) Hill
Runoff class	Low to very high
Elevation	1,524–2,134 m
Slope	15–75%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the area is semi-arid continential.

The average annual precipitation ranges from 13 to 16 inches. Variations of 5 inches, more or less are common. Seventy-five percent of the precipitation falls during the frost-free season. Most of the summer moisture falls in the form of high intensity-short duration thunderstorms. Winter precipitation is mostly in the form of snowfalls of less than 6 inches.

Temperatures are characterized by moderately warm summers and fairly cool, dry winters. The average annual temperature is 50 degrees F with extremes of -29 degrees F in the winter to 103 degrees F in the summer.

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

Both temperature and moisture favor warm-season perennial species. However, about 40 percent of the annual precipitation falls at a time favorable for cool-season plant growth. This, along with a natural cold air drainage, allows the cool-season species to occupy an important component of this site. Strong winds blow across this area from the west and southwest from February through June. This can rapidly dry the soil profile 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.
Ildefonso - The mean annual temperature is 48 to 55 degrees F. The mean annual precipitation is 9 to 13 inches. Frost-free period is 120 to 175 days. Some area outside of New Mexico have been correlated with elevations as low as 4500 feet, precipitation as high as 15 inches, temperatures as low as 42 degrees, and frost free period as long as 180 days.
Stroupe - Mean annual air temperature: 45 to 50 degrees F; Mean annual precipitation: 16 to 20 inches; Frost-free period: 120 to 150 days.
Pena - soils occur in a semiarid climate. Mean annual precipitation ranges from 12 to 17 inches with a maximum during July, August, September and October. Mean annual temperature is about 45 to 57 degrees F. The frost-free period is 100 to 180 days.
Puertecito - The average annual precipitation is 10 to 14 inches and the average annual air temperature is 47 to 57 degrees F. The frost-free period is 130 to 180 days.
Mokiak - Mean annual temperature is 47 to 52 degrees F., mean summer temperature is 70 to 74 degrees F , average annual precipitation is 14 inches, and the frost-free period 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 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 typically are shallow to moderately deep over acid igneous bedrock, although pockets of deep soils also occur. Surface textures vary from loam, sandy loam to clay loam and are generally stony, gravelly or cobbly. Permeability is moderate to moderately slow and available water-holding capacity is low.

The Ildefonso series consists of very deep, well drained, moderately rapidly permeable soils that formed in alluvium, colluvium and eolian sediments derived from quartzite, monzonite, granite, basalt, gneiss, schist and limestone. Ildefonso soils are on mesas, fan terraces, eroded fan remnants, escarpments, and hills. Slopes are 0 to 75 percent. The mean annual precipitation is 11 inches and the mean annual temperature is 50 degrees F.
The Stroupe series consists of moderately deep, well drained, slowly permeable soils that formed in colluvium derived from igneous and sandstone bedrock. These moderately sloping to very steep soils are on mountain sideslopes and shoulder slopes. Slope ranges from 5 to 70 percent. Mean annual temperature is about 47 degrees F., and mean annual precipitation is about 18 inches.

The Pena series consists of very deep, well drained, moderately permeable soils formed in alluvial deposits derived from igneous and sedimentary rocks. These soils are on bajadas, terraces and knolls with slopes ranging from 0 to 65 percent. Mean annual precipitation is about 14 inches and the mean annual temperature is about 51 degrees F. Well drained; medium runoff; moderate permeability.
The Puertecito series consists of shallow and very shallow, well drained, moderately slowly permeable soils that formed in alluvium and colluvium derived from volcanic and sedimentary rocks. Puertecito soils are on mountains and hills. Slopes range from 1 to 55 percent. Mean annual precipitation is about 12 inches, and annual temperature is about 52 degrees F.
Mokiak soils have brown, very cobbly sandy loam Al horizons, and yellowish brown and light yellowish brown, very cobbly sandy clay loam B2t horizons over gneiss and schist bedrock at depth of about 38 inches.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam (2) Cobbly sandy loam (3) Stony clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	152–183 cm
Surface fragment cover <=3"	60%
Surface fragment cover >3"	15–35%
Available water capacity (0-101.6cm)	7.62–15.24 cm
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	35–60%
Subsurface fragment volume >3" (Depth not specified)	15–35%

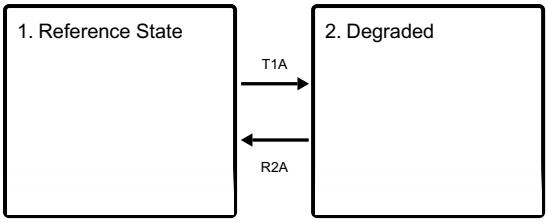
Ecological dynamics

Vegetation includes sideoats grama, black grama, blue grama, little bluestem, silver bluestem, needlegrasses, ricegrasses, muhleys, threeawn, tridens, plains lovegrass, wild buckwheat, Indian paintbrush, common yarrow, piñon, juniper, skunkbush sumac, oak, and mountain mahogany.
Principal vegetation is blue grama, black grama, sideoats grama, hairy grama, banana yucca, cacti, sacahuista and some scattered pinyon juniper with an occasional ponderosa on colder slopes.

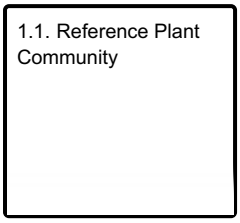
Grazing:
This site is poorly suited for continuous grazing or continued grazing during the growing season and responds best to a system of grazing that rotates the season of use. As this site deteriorates there is a decrease in the amount of sideoats grama, black grama, little bluestem, New Mexico feathergrass, ricegrass, Arizona fescue, muhly, sumac, and mountainmahogany. There is a corresponding increase in blue grama, pinyon, juniper, oak, algerita and bare ground. As deterioration continues, the site will be dominated by pinyon, juniper, algerita, bare ground, and low-vigor sod-type blue grama. In this site erosion can be severe and it is extremely difficult to bring about restoration. This site does not lend itself to mechanical brush management. Goats could be used as an alternative to maintain a healthy balance within the plant community.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1
Reference State

sideoats grama, black grama, little bluestem, New Mexico feathergrass, ricegrass, Arizona fescue, muhly, sumac, and mountain mahogany.

Resilience management. This site is poorly suited for continuous grazing or continued grazing during the growing season and responds best to a system of grazing that rotates the season of use. If the slope is steep enough to limit access, stocking rate should be adjusted. This site does not lend itself to mechanical brush management. Goats could be used as an alternative to maintain a healthy balance within the plant community.

Community 1.1
Reference Plant Community

This phase has an aspect of a mixed grassland-shrub complex with scattered tree-type junipers and pinyons. The shrub and tree component is more visually prevalent on the cooler north and east slopes, while low-growing shrubs and grasses usually prevail on the south and west slopes. The grasses are a mixture of mid and short grasses with a few tall grasses. The forb composition is small, but in years of abundant moisture the forb aspect can be seen. Other grasses that could appear on this phase include: hairy grama, black grama, galleta, Scribner needlegrass, green needlegrass, sleepygrass, pine dropseed, slender wheatgrass, western wheatgrass, bottlebrush squirreltail, Indian ricegrass, bush muhly, ring muhly, Metcalfe muhly, curlyleaf muhly, deergrass, big bluestem, wolftail, and alkali sacaton. Other shrubs include: ponderosa pine, littleleaf sumac, yucca spp., fourwing saltbush, winterfat, rubber rabbitbrush, broom snakeweed, Apacheplume, Bigelow sagebrush, bricklebush, yerba-de-pasmo, cliff fendlerbush, cliffrose, and sacahuista. Other forbs include: hairy aster, golden pea, penstemon, pingue, locoweed spp., scarlet globemallow, fleabane, mariola, and wooly Indianwheat.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	291	656	1020
Forb	34	78	123
Total	**325**	**734**	**1143**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	6-15%
Forb foliar cover	0%

Non-vascular plants	0%
Biological crusts	0%
Litter	5-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-40%

Figure 5. Plant community growth curve (percent production by month). NM4306, R070CY106NM Hills HCPC. R070CY106NM Hills HCPC Mixed grassland-shrub comples 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

As this site deteriorates there is a decrease in the amount of sideoats grama, black grama, little bluestem, New Mexico feathergrass, ricegrass, Arizona fescue, muhly, sumac, and mountainmahogany. There is a corresponding increase in blue grama, pinyon, juniper, oak, algerita and bare ground.

Characteristics and indicators. As deterioration continues, the site will be dominated by pinyon, juniper, algerita, bare ground, and low-vigor sod-type blue grama. In this site erosion can be severe and it is extremely difficult to bring about restoration.

Transition T1A
State 1 to 2

Production numbers rounded to the nearest 10 lbs/ac.

Restoration pathway R2A
State 2 to 1

Legacy Statement: "Restoration pathway resulting from the implementation of prescribed grazing." It should be noted that prescribed grazing alone may not be sufficient to reduce woody species to levels seen in State 1. Brush control may also be required.

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				101–247	
	sideoats grama	BOCU	*Bouteloua curtipendula*	101–252	–
2				101–146	
	black grama	BOER4	*Bouteloua eriopoda*	101–151	–

3				101–146	
	silver bluestem	BOSA	*Bothriochloa saccharoides*	101–151	–
	little bluestem	SCSC	*Schizachyrium scoparium*	101–151	–
4				101–202	
	needle and thread	HECO26	*Hesperostipa comata*	101–202	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	101–202	–
5				45–101	
	Arizona fescue	FEAR2	*Festuca arizonica*	50–101	–
	pinyon ricegrass	PIFI	*Piptochaetium fimbriatum*	50–101	–
6				45–146	
	mountain muhly	MUMO	*Muhlenbergia montana*	50–151	–
	New Mexico muhly	MUPA2	*Muhlenbergia pauciflora*	50–151	–
	spike muhly	MUWR	*Muhlenbergia wrightii*	50–151	–
7				34–78	
	threeawn	ARIST	*Aristida*	30–81	–
	mat muhly	MURI	*Muhlenbergia richardsonis*	30–81	–
	tridens	TRIDE	*Tridens*	30–81	–
8				45–101	
	plains lovegrass	ERIN	*Eragrostis intermedia*	50–101	–
9				45–101	
	blue grama	BOGR2	*Bouteloua gracilis*	50–101	–
10				11–45	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	11–50	–
Forb					
11				11–34	
	buckwheat	ERIOG	*Eriogonum*	10–30	–
12				11–34	
	scarlet Indian paintbrush	CACO17	*Castilleja coccinea*	10–30	–
13				11–34	
	common yarrow	ACMI2	*Achillea millefolium*	10–30	–
14				11–34	
	Forb (herbaceous, not grass nor grass-like)	2FORB	*Forb (herbaceous, not grass nor grass-like)*	10–30	–
Tree					
15				45–202	
	juniper	JUNIP	*Juniperus*	50–202	–
	twoneedle pinyon	PIED	*Pinus edulis*	50–202	–
	juniper	JUNIP	*Juniperus*	50–202	–
	twoneedle pinyon	PIED	*Pinus edulis*	50–202	–
Shrub/Vine					
16				34–78	
	skunkbush sumac	RHTR	*Rhus trilobata*	30–81	–
17				34–78	
	oak	QUERC	*Quercus*	30–81	–

18				34–78	
	hairy mountain mahogany	CEMOP	*Cercocarpus montanus var. paucidentatus*	30–81	–
19				34–45	
20				11–45	
	prairie sagewort	ARFR4	*Artemisia frigida*	11–50	–
21				34–45	
	Shrub, deciduous	2SD	*Shrub, deciduous*	10–50	–

Type locality

Location 1: Socorro County, NM
Location 2: Chaves County, NM
Location 3: De Baca County, NM
Location 4: Torrance County, NM
Location 5: Lincoln County, NM
Location 6: San Miguel County, NM
Location 7: Guadalupe 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:
Ildefonso, Pena, Stroupe

Other Soils included are:
Mion. Mokiak, Oro Grande, Patos, Romine, Santa Fe, Washoe

Contributors

Christine Bishop
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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	05/12/2025
Approved by	Kendra Moseley
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:

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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:**
