USDA Natural Resources Conservation Service

Ecological site R048AY008NM
Mountain Brush

Last updated: 3/05/2024
Accessed: 05/17/2024

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.

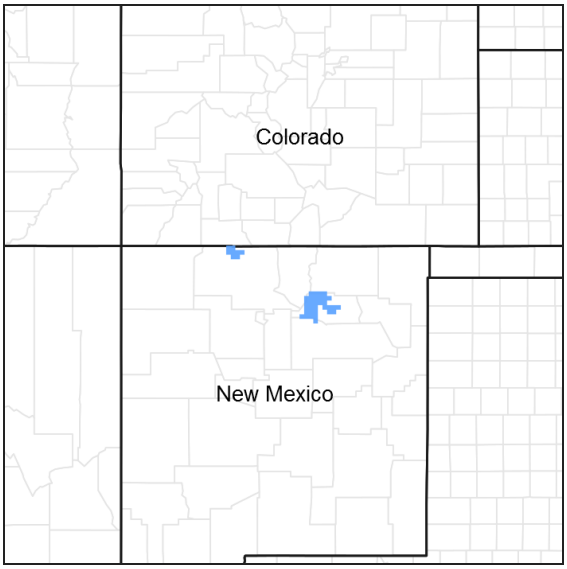


Figure 1. Mapped extent

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): 048A–Southern Rocky Mountains

This area is in Colorado (76 percent), New Mexico (11 percent), Utah (8 percent), and Wyoming (5 percent). It makes up about 45,920 square miles (119,000 square kilometers). The towns Jemez Springs, Los Alamos, Red River and Eagle Nest, New Mexico, are in this MLRA. This MLRA has numerous national forests, the Carson National Forest and part of the Santa Fe National Forest in New Mexico. The Jemez, Picuris, Santa Clara, and Taos Indian Reservations are in this MLRA. Most of this area is in the Southern Rocky Mountains Province of the Rocky Mountain System. Small parts of the southwest corner and some isolated areas farther west are in the Canyon Lands Section of the same province and division. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. The ranges include the Sangre de Cristo Mountains, Jemez Mountains, and Tusas Mountains. Elevation typically ranges from 6,500 to 13,167 feet (1,980 to 1,039 meters) in this area. The Rio Grande is a National Wild and Scenic River in northern New Mexico, which is in the southern part of this MLRA.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. The rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks, which in many places are flanked by steeply dipping Mesozoic sedimentary rocks. Younger igneous rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area. Representative formations in this area are the Silver Plume and Pikes Peak granites, San Juan Volcanics, and Mancos Shale. Many of the

highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

LRU notes

This site is part of the RM-1 sub-resource area. This site is found on the east side of Sangre de Cristo mountains.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA AgHandbook 296.

Ecological site concept

This site is located on the sides of basalt-capped mesas and escarpments of sandstone, basalt, shale and limestone. This site is formed on the upland leading away from vertical basalt escarpments and basalt-capped mesas. They are formed from a variety of materials derived from sandstone, basalt, shale and limestone. Rock outcrop is common and may occupy from 15 percent to 50 percent of the area. Slopes range from 5 to 25 percent. The exposure is mainly to the east, south and west. However, this site may occur on the drier north-facing slopes. North and east-facing slopes are generally more productive and tend to grow more woody vegetation. Elevation ranges from 7,500 to 9,000 feet above sea level.

The soils on this site are shallow, well drained over sandstone, shale, basalt and limestone. Rock outcrops are common and occupy the nearly vertical basalt escarpments, ridges and benches of exposed sandstone, limestone and shale. Rubbleland occurs at the base of the basalt escarpments. The surface textures is usually clay loam and the subsoils are clay loam and clayey shale. The surface runoff is medium too rapid and the erosion hazard is severe. Effective rooting depth is from 12 to 20 inches.

Soils correlated to this site include:
Krakon

Associated sites

R048AY005NM	**Mountain Malpais** This site is characterized by flat to moderately steep topography. It is frequently found as mesa, mountains slopes and ridges where the basalt caps are present. The site’s terrain may be interrupted by extrusions of the basalt, leaving a rough or choppy appearance to the topography. The basaltic stone cover typically exists over a portion of the site where igneous extrusions occur. Boulders on the surface are common. The dominant slope range is from 3 to 30 percent, but it some site range up to 55 percent. The exposure varies but has little significance on plant production. Elevation ranges from 6,800 to 9,000 feet above sea level. These soils are well drained, very shallow to shallow, and formed in debris from basalt and other volcanic rock or metamorphic rock. The surface texture is cobbly, very cobbly silt loam; stony, very stony, very cobbly loam; stony, very stony silt loam; and cobbly sandy loam. The texture of the subsoil layers ranges from very stony silt loam, very cobbly loam to extremely stony clay. The effective rooting depth is 6 to 20 inches.

R048AY006NM	**Mountain Meadow** The site occurs as lower lying drainageways, flood plains, swales or other depressional areas where extra moisture accumulates as a result of runoff from surrounding higher sites. A high water table is characteristic of this site particularly in the spring and a portion of the area may have open water during this season. Springs or seeps bring the water table to the subsoil or even to the surface, in which instance the site may colloquially be called a “cienaga”. Slopes vary from flat to gently sloping, not to exceed 5 percent. The exposure varies and is not significant. Elevation ranges from 7,000 to 9,500 feet above sea level. These soils consist of deep to very deep soils and poorly to very poorly drained. The surface texture ranges from a very fine sandy loam to a mucky silty clay and clay surface layers. They have an active water table, which varies from the surface to 3 feet below the surface. They are normally non-saline and have high organic content. These soils have moderate to moderately slow permeability. Available water-holding capacity is moderate. The effective rooting depth is 20 inches to more than 60 inches.
R048AY007NM	**Mountain Shale** This site is located in mountainous terrain on mountain slopes and hillslopes. Slopes are dominantly moderately steep to steep with gradients varying from 15 to 75 percent. Topography varies from relatively uniform slopes of considerable length to short, steep, choppy terrain. Elevation ranges from 7,000 to 9,000 feet above sea level. This site consists of soils that are shallow to moderately deep and are well drained. The surface texture is very stony clay, very stony clay loam, cobbly loam, and stony silty clay loam soils. The soils are derived from shale parent material. The effective rooting depth is 5 to 40 inches. Shale and sandstone outcrops are common. The subsoil is typically compacted clay, which restricts root penetration.

Similar sites

R048AY009NM	**Mountain Breaks** This site occurs on mesa and canyon side-slopes and other mountain breaks. The site consists of productive areas interspersed with areas of low production, rock outcrop and badland. Slopes and exposure vary. Slopes range from 9 to 45 percent. Elevation ranges from 9,100 to 10,500 feet above sea level. Soil depths is deep. Surface texture is generally a gravelly loam. Subsoils range from gravelly clay loam, gravelly sandy clay loam to very gravelly sandy clay loam. The soil profile is generally high in rock fragments. Boulders are scattered about the site. There usually are pockets on the site where run-in of precipitation results in good soil-moisture relationships. This ecological site used to have the ID number of R048BY001NM in RM-2 subresource area in 1982.
R048AY013NM	**Mountain Slopes** This site occurs on valley sides and hills ranging from relatively uniform, long slopes to short and choppy. Exposure is usually southern and/or western, which creates a relatively droughty site. Slopes range from 15 to 45 percent. Elevation ranges from 7,200 to 8,600 feet above sea level. The soils are generally moderately deep to deep over interbedded shale and sandstone parent materials. Surface textures is usually a loam. Subsoils range from sandy clay loam, clay loam to clay. This ecological site used to have the ID number of R048BY006NM in RM-2 subresource area in 1982.
R048AY238CO	**Brushy Loam** This site occurs on hills, mountains, complex landslides, and benches. Slopes is between 3 to 35%. Soils are moderately deep to deep (20 to 60+ inches), soils derived from colluvium, residuum, slope alluvium and alluvium from sandstone and shale. Soil surface texture is loam or clay loam with fine-textured subsurface. It is a Gambel’s oak – slender wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Quercus gambelii* (2) *Cercocarpus montanus*
Herbaceous	(1) *Muhlenbergia montana* (2) *Festuca arizonica*

Physiographic features

This site is located on the sides of basalt-capped mesas and escarpments of sandstone, basalt, shale and limestone. This site is formed on the upland leading away from vertical basalt escarpments and basalt-capped mesas. They are formed from a variety of materials derived from sandstone, basalt, shale and limestone. Rock outcrop is common and may occupy from 15 percent to 50 percent of the area. Slopes range from 5 to 25 percent.

The exposure is mainly to the east, south and west. However, this site may occur on the drier north-facing slopes. North and east-facing slopes are generally more productive and tend to grow more woody vegetation. Elevation ranges from 7,500 to 9,000 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	2,286–2,743 m
Slope	5–25%

Climatic features

Climate conditions for this site are typical of the lower elevation limits of the Rocky Mountains. Average annual precipitation ranges from 16 to 22 inches. Most of the precipitation received is in the form of rain from heavy thunderstorms during the hottest summer months. Winter and spring moisture is an important facet of this site and determines production of the cool-season species. Summer moisture received during the principal growing season of July, August and September determines the production of the principal warm-season grasses. Summer precipitation accounts for approximately 60 percent of the total annual precipitation, although at a moderately high elevation, the climatic features of this site are not too unlike sites at lower elevations in that precipitation amounts fluctuate greatly from year to year. Annual amounts commonly range from 8 to 35 inches. Spring precipitation in the latter part of March may be sufficient in some years to contribute greatly to the production of both warm and cool-season forage plants.

Air temperatures vary from a monthly mean of 29 degrees F in January to 69 degrees F in July. Daily high temperatures average in the 80’s during the summer. Winter low temperatures fall below the freezing mark much of the time from mid-September through April. Date of the last killing frost is approximately May 15th. The first killing frost is approximately October 3rd. The dates of the last killing frost and the first killing frost vary from lower elevations to the higher elevation points.

The frost-free season ranges from 90 to 140 days, from mid-May through early October. The frost-free period is important only in the limiting of the production of the warm-season species that are present on the site.

Mountain winds are an important part of the climatic complex of this site, because of their indirect effect on soil and moisture and translocation of seed.

Table 3. Representative climatic features

Frost-free period (characteristic range)	34-40 days
Freeze-free period (characteristic range)	86 days
Precipitation total (characteristic range)	406-559 mm
Frost-free period (actual range)	33-42 days
Freeze-free period (actual range)	86 days
Precipitation total (actual range)	406-559 mm
Frost-free period (average)	37 days
Freeze-free period (average)	86 days
Precipitation total (average)	483 mm

Climate stations used

- (1) EAGLE NEST [USC00292700], Eagle Nest, NM
- (2) ANGEL FIRE 1S [USC00290407], Cimarron, NM

Influencing water features

None

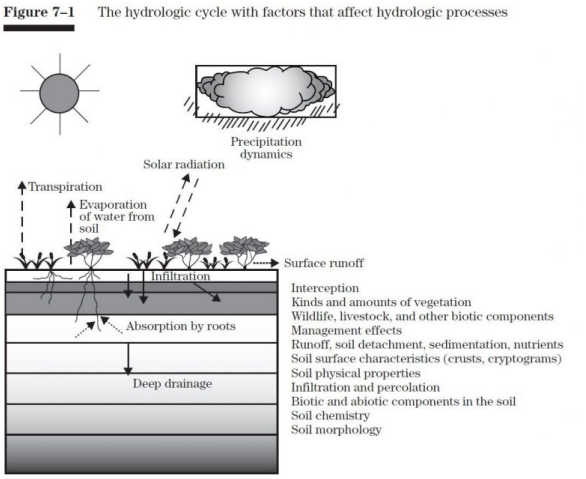


Figure 8.

Soil features

The soils on this site are shallow, well drained over sandstone, shale, basalt and limestone. Rock outcrops are common and occupy the nearly vertical basalt escarpments, ridges and benches of exposed sandstone, limestone and shale. Rubbleland occurs at the base of the basalt escarpments. The surface textures is usually clay loam and the subsoils are clay loam and clayey shale. The surface runoff is medium too rapid and the erosion hazard is severe. Effective rooting depth is from 12 to 20 inches.

Soils correlated to this site include:
Krakon

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Colluvium–shale (3) Residuum–shale
Surface texture	(1) Clay loam (2) Silt loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to slow
Soil depth	20–51 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	5.08–7.62 cm
Calcium carbonate equivalent (Depth not specified)	0–5%
Electrical conductivity (Depth not specified)	0–2 mmhos/cm

Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

State 1, the reference state, represents the historic plant communities of Gambel oak site and the naturally occurring dynamics associated with those communities. This state includes all known biotic communities that would exist under natural disturbance regimes and current climatic conditions. The dominant overstory species is Gambel oak with the understory dominated by the perennial bunchgrasses such as mountain muhly, Arizona fescue and/or western wheatgrass. The plant communities in state 1 are naturally resistant to disturbance and resilient following disturbance due to favorable amounts of precipitation and the ability of Gambel oak to resprout following disturbance. Wildfire is the predominant disturbance affecting ecological processes and is the primary factor driving plant community change in this state. The common fire return interval is 35-100 years and plant recovery following a wildfire is rapid, often with Gambel oak re-sprouting within the same growing season.

Community Phase 1.1 Gambel oak / Perennial Bunchgrasses
This plant community consists of mature Gambel oak trees that dominate the overstory and mountain muhly, Arizona fescue and/or western wheatgrass that dominate the understory. prairie junegrass and muttongrass, as well as other cool season grasses may be present. Common shrubs and forbs are mountain mahogany, snowberry, serviceberry, penstemon, globemallow buckwheat, and a suite of other species adapted to grow either in the interspaces or under the canopy of Gambel oak stands. Bare ground is not common and no non-native plants are present.

Community Phase 1.2 Re-sprouting Oak
This is the post-fire community. This plant community consists of young Gambel oak shoots that are beginning to reestablish following a wildfire. Burned trunks will usually be visible above the new growth. The Gambel oak suckers often form dense thickets of foliage up to several feet in height which effectively intercept sunlight and crowd out potential invaders. Given adequate recovery time of a few months to a year, the interspaces will exhibit native bunchgrasses and forbs, but few shrubs.

Community Phase 1.3 Decadent Oak
Oak has become old and decadent. Fire sensitive tree species such as two-needle pinyon, one-seed juniper and ponderosa pine that have encroached on the site. The percent composition of these tree species is relatively low (3-5%).

State 2 function basically the same as state 1. This state has been seeded with introduced or native species and the seeded species persist on the site.

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates and intensities of fire, herbicide treatment, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

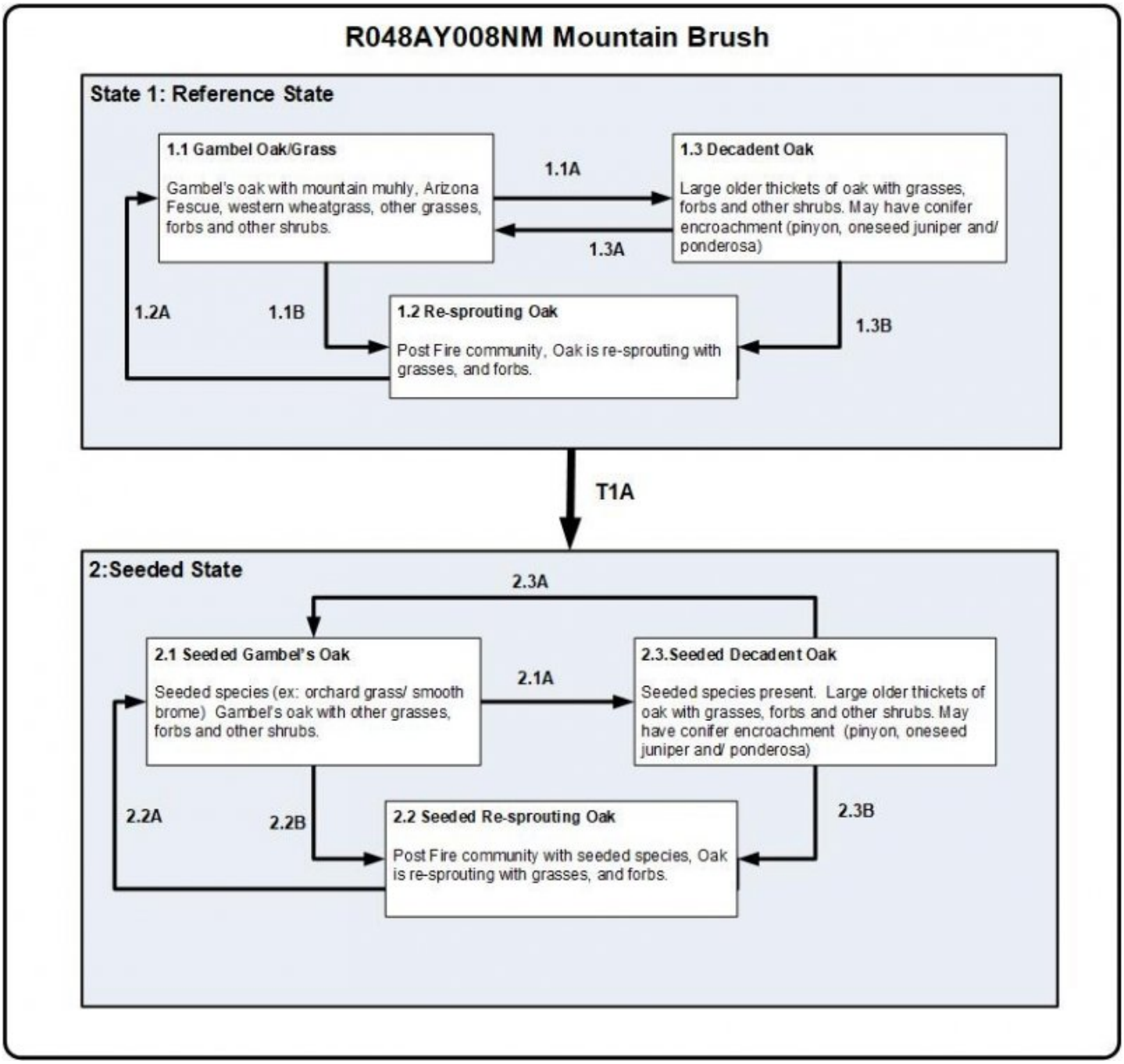
The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram.

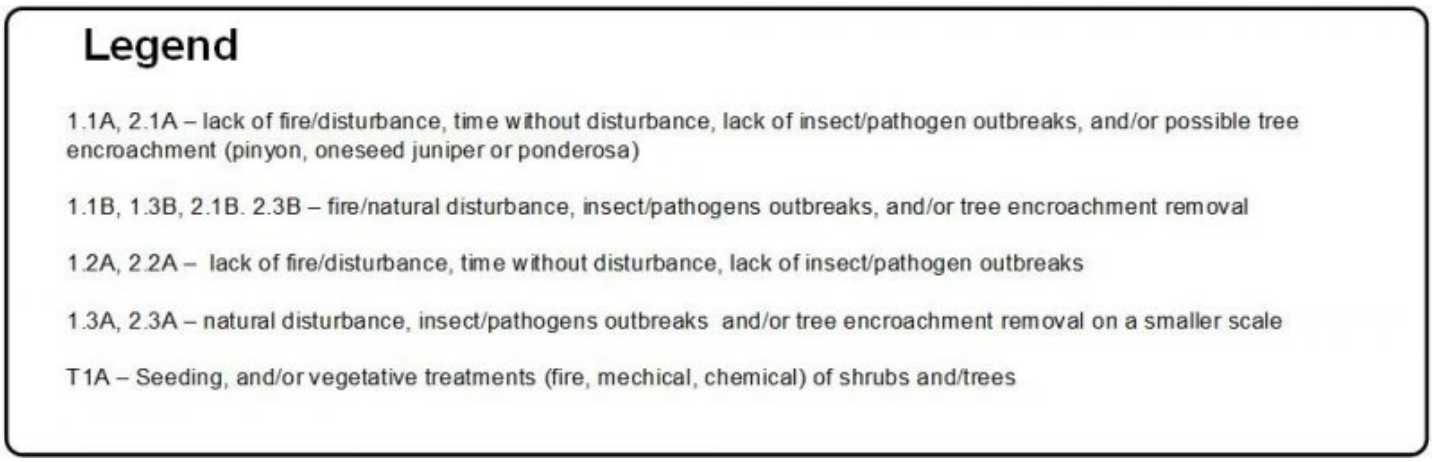
The plant communities shown in this State and Transition Model may not represent every possibility but are

probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added.

The state and transition model was added to comply with the provisional ecological site instruction. It is a very general model.

State and transition model





State 1
Reference State

Continuous grazing during the growing season will cause the potential plant community to deteriorate. Most of the dominant grasses will decrease as ecological condition declines. Species most likely to invade under these conditions are ring muhly, pingue and sleepygrass. Species most likely to increase as the ecological condition declines are Gambel oak, threeawn spp., broom snakeweed and juniper spp. Under a deteriorated plant community, oak brush may completely dominate the plant community. A system of deferred grazing, which varies the time and season of grazing and rest in a pasture in successive years, is needed to maintain or to improve a healthy, well-balanced plant community. Rest during the late spring is needed for the cool-season species such as Arizona fescue, western wheatgrass, prairie junegrass and muttongrass to maintain its vigor and reproduction. This state represents the natural range of variability on the site. The plant communities within the reference state were shaped and maintained by disturbances such as grazing, browsing, drought, wet years, and fire. The removal or alteration of these processes can cause a shift to an alternative state.

Community 1.1
Gambel Oak/Grass

This site is a browse-grass plant community. Woody species give this site the appearance of a shrub-grass plant community. However, grasses comprise approximately 50 percent of the annual yield. Cool-season mid-grasses and bunch grasses dominate the grass production. The main browse plants are Gambel oak, mountainmahogany and snowberry. Woody species occupy approximately 40 percent of the total annual production. Perennial and annual forbs occupy a minor portion of the plant community and make up approximately 10 percent of the total annual production. This site may have scattered ponderosa pine, pinyon pine and juniper throughout the site. Tree overstory canopy occupies less than 5 percent. Other species that could appear include: pine dropseed, nodding brome, ring muhly, sideoats grama, threeawn, broom snakeweed, cinquefoil and winterfat.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	280	504	673
Shrub/Vine	224	404	538
Forb	56	101	135
Total	**560**	**1009**	**1346**

Table 6. Ground cover

Tree foliar cover	5%
Shrub/vine/liana foliar cover	25%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%

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

Figure 10. Plant community growth curve (percent production by month). NM3108, R048AY008NM Mountain Brush HCPC. R048AY008NM Mountain Brush HCPC Mixed browse/grassland with a minor component of forbs. .

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	5	10	10	25	30	12	5	0	0

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				81–101	
	mountain muhly	MUMO	*Muhlenbergia montana*	81–101	–
2				81–101	
	Arizona fescue	FEAR2	*Festuca arizonica*	81–101	–
3				81–101	
	western wheatgrass	PASM	*Pascopyrum smithii*	81–101	–
4				81–101	
	prairie Junegrass	KOMA	*Koeleria macrantha*	81–101	–
	muttongrass	POFE	*Poa fendleriana*	81–101	–
5				30–50	
	blue grama	BOGR2	*Bouteloua gracilis*	30–50	–
6				30–50	
	little bluestem	SCSC	*Schizachyrium scoparium*	30–50	–
7				30–50	
	big bluestem	ANGE	*Andropogon gerardii*	30–50	–
9				30–50	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	30–50	–
	squirreltail	ELEL5	*Elymus elymoides*	30–50	–
10				30–50	
	sedge	CAREX	*Carex*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	30–50	–
	pine dropseed	BLTR	*Blepharoneuron tricholepis*	0–17	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	0–17	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–17	–
	threeawn	ARIST	*Aristida*	0–17	–

Forb					
10				30–50	
	buckwheat	ERIOG	*Eriogonum*	30–50	–
	beardtongue	PENST	*Penstemon*	30–50	–
	globemallow	SPHAE	*Sphaeralcea*	30–50	–
	Forb, native	2FN	*Forb, native*	30–50	–
	castilla	CASTI	*Castilla*	30–50	–
	cinquefoil	POTEN	*Potentilla*	0–17	–
Shrub/Vine					
11				121–151	
	Gambel oak	QUGA	*Quercus gambelii*	121–151	–
12				81–101	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	81–101	–
13				30–50	
	sagebrush	ARTEM	*Artemisia*	30–50	–
15				10–30	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	10–30	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	10–30	–
14				81–101	
	serviceberry	AMELA	*Amelanchier*	81–101	–
	snowberry	SYMPH	*Symphoricarpos*	81–101	–
16				30–50	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	30–50	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–17	–
Tree					
17				30–50	
	juniper	JUNIP	*Juniperus*	30–50	–
	twoneedle pinyon	PIED	*Pinus edulis*	30–50	–

Animal community

Grazing:
This site can be grazed during the spring, summer and fall by livestock. Because of the slopes and rock outcrops, a younger class of livestock utilizes this site best. Browsing animals are favored because of the site's potential to produce shrubs and forbs. A large variety of grasses, forbs and shrubs provide a well-balanced feed and good nutrition to all grazing and browsing animals. Distribution of domestic livestock is a problem on this site due to the slopes and rock outcrops. Cattle, horses and sheep tend to graze the flatter slopes, leaving the steeper slopes under grazed. Some of the steeper slopes are not suitable for grazing by domestic livestock because of the high erosion hazard of the soils.

Habitat for Wildlife:

This site provides habitats, which support a resident animal community that is characterized by mule deer, bobcat, mountain cottontail, rock squirrel, western harvest mouse, bush-tailed woodrat, rufous-sided towhee, common raven and scrubjay. There is seasonal use by elk and band-tailed pigeon.

Hydrological functions

Hydrology Functions:
The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Hydrologic Interpretations
Soil Series----------Hydrologic Group
Krakon----------D

Approximate hyrdologic curve number when the cover is optimum: D soils - 84.

Recreational uses

This site provides limited recreation potential due to the steep slopes and stoniness of the soil surface. Hunting for mule deer is fair to good and hunting for small rabbits and turkeys is poor to fair.

Wood products

Production of pinyon pine and juniper provides a limited amount of firewood and fence posts.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month

Similarity Index----------Ac/AUM
100 - 76----------4.3 – 7.3
75 – 51----------5.7 – 11.0
50 – 26----------8.9 – 17.0
25 – 0----------17.0+

Inventory data references

Data collection for this site was done in conjunction with the progressive soil surveys within the State of New Mexico. This site is found in the following soil surveys: Colfax, Taos, Mora, Santa Fe National Forest (Pecos-Las Vegas Ranger District), and San Miguel.

These site descriptions were developed as part of a Provisional ESD project using historic soil survey manuscripts, available range site descriptions.

Other references

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Contributors

Don Sylvester
Elizabeth Wright

Approval

Kirt Walstad, 3/05/2024

Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

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	05/17/2024
Approved by	Kirt Walstad
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:

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):**

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

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:**