USDA Natural Resources
Conservation Service

Ecological site F039XA007NM
Montane slopes 12-18"

Accessed: 05/11/2025

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.

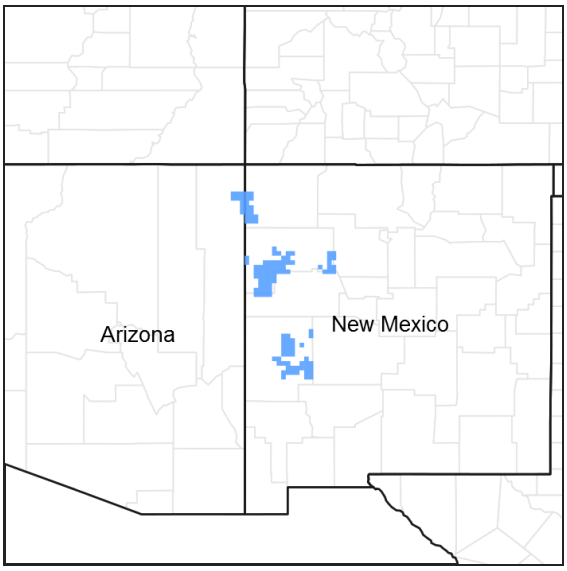


Figure 1. Mapped extent

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.

Table 1. Dominant plant species

Tree	(1) *Pinus ponderosa* (2) *Pinus edulis*
Shrub	Not specified
Herbaceous	(1) *Muhlenbergia montana* (2) *Bouteloua curtipendula*

Physiographic features

The site varies in topographic location. The site can typically be found on ridges and canyon side slopes. It can also be found on hills, alluvial fans, and mountain canyons. The slopes range from 5 to 60%.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Ridge (3) Hill
Flooding frequency	None
Ponding frequency	None

Elevation	6,500–10,250 ft
Slope	5–60%
Aspect	N

Climatic features

The weather stations used for estimating average climate (precipitation, temperature, and freeze- and frost-free days) is: Adobe Ranch; Beaverhead Ranger Station (USFS); Datil; and Horse Springs, NM. These stations are contained in the Western Regional Climate Center database. The averages contain incomplete data due to breaks in weather record keeping.

The weather stations are within climatic division NM-04, Southwestern Mountains. They are located within MLRA 35 and 39, with a precipitation zone of 12 to 18 inches per year.

Most of the precipitation occurs during the summer months. The sites are subjected to winter snowfall and very cold temperatures as well. Tabular data is derived from the climate summarizer for the weather stations identified. Average annual minimum temperature is 28.3 degrees with a maximum of 66.2 degrees.

Table 3. Representative climatic features

Frost-free period (average)	274 days
Freeze-free period (average)	290 days
Precipitation total (average)	18 in

Influencing water features

None, except for down-slope runoff and retention of snow-pack on northerly aspects. This site is not influenced by wetlands or free-flowing streams or seeps.

Soil features

The characteristic soils are Typic Argiborolls and the Tolman, Coni, Smilo, and Adman series.

The Tolman series occurs in a complex soil intermixed with rock outcrops. It is characterized as an extremely cobbly loam, typically found in stable areas between the rock outcrops. It is a loamy-skeletal, mixed, mesic, Lithic Argiboroll. This soil is derived from volcanic tuff.

Typic Argiborolls are extremely variable, derived from colluvium originating from tuff, basalt, and sandstone. It generally occurs on side slopes near canyon bottoms with the Tolman series in the upper reaches of the slope, on north and east aspects.

The Coni series is formed in residuum derived from tuff. It is located usually along piedmont ridges. It is a loamy, mixed, Lithic Argiboroll.

The Smilo series is formed in residuum derived from basalt. It is on alluvial fans in areas of basalt flows. It is a fine, mixed, superactive, frigid Aridic Argiustoll.

The Adman series is formed in residuum derived from basalt and basaltic tuff. It is on basalt flows, hills, and sideslopes. It occurs in association with the Smilo series, and it is a clayey, mixed, superactive, frigid Aridic Lithic Argiustoll.

Table 4. Representative soil features

Surface texture	(1) Extremely cobbly loam (2) Stony sandy loam (3) Gravelly
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	5–60 in

Surface fragment cover <=3"	25–35%
Surface fragment cover >3"	5–30%
Available water capacity (0-40in)	0.05–0.14 in
Electrical conductivity (0-40in)	1–2 mmhos/cm
Subsurface fragment volume <=3" (Depth not specified)	15–20%
Subsurface fragment volume >3" (Depth not specified)	40–45%

Ecological dynamics

This ecological site's plant communities are influenced by elevation, climate, and edaphic features. The site is driven by aspect and generally occurs on north aspects.

This ESD details the plant community dynamics at the mid-elevation, for north aspects only.

At warmer and dryer (lower elevations) locations of this ecological site, ponderosa pine remains in the overstory, although woodlands species (twoneedle pinyon, juniper, gray oak) may occur in greater density.

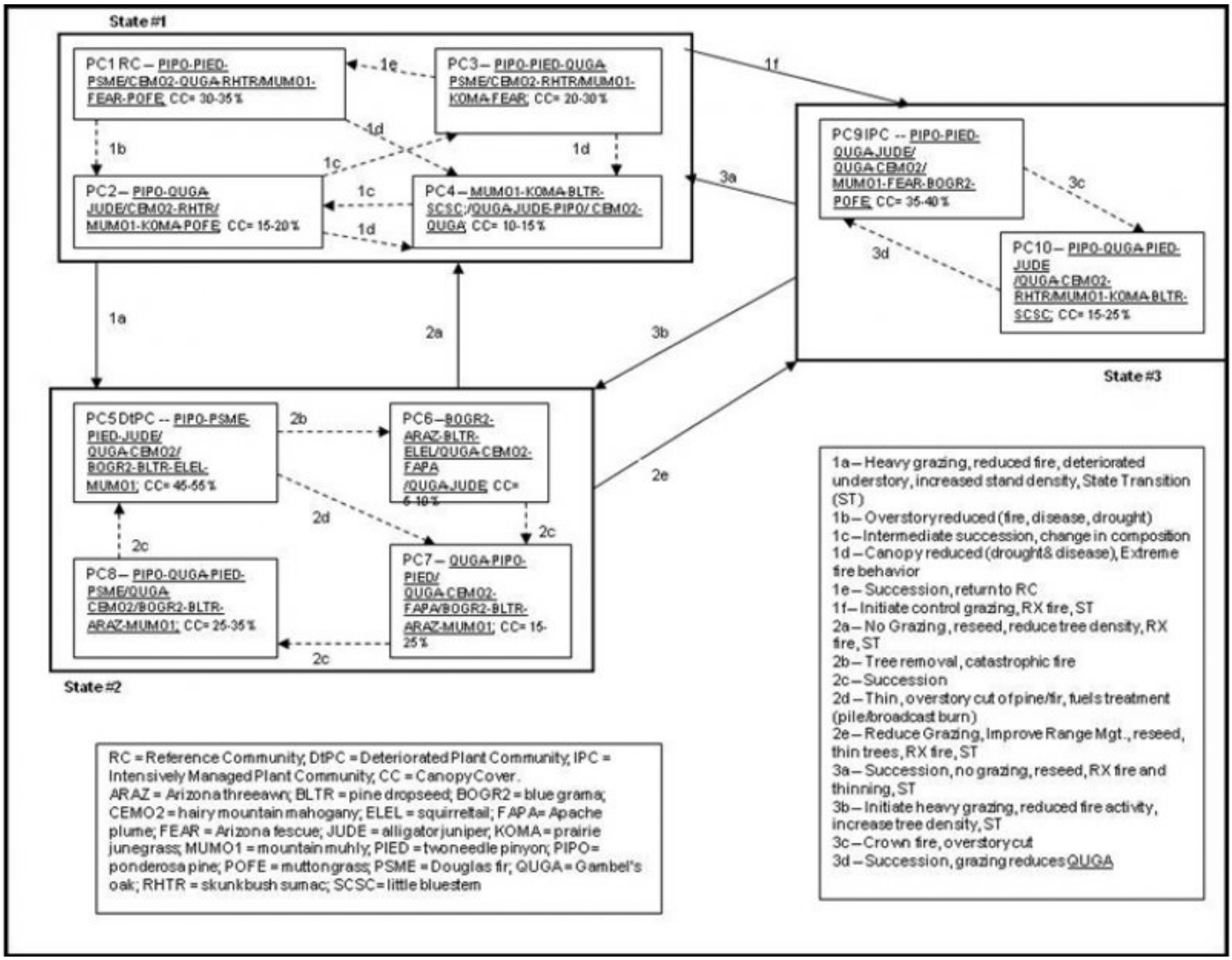
At cooler and wetter (higher elevations, northerly aspects), locations, this site may support a mixture of ponderosa pine, Gambel oak, and Douglas fir with incidental occurrences of southwestern white pine. Quaking aspen may also be found on certain slopes at the highest elevations along narrow drainages or seeps. Typically the site is comprised of a ponderosa pine-twoneedle pinyon-Douglas fir plant community. Alligator juniper varies in density but occurs throughout the site. Gambel oak may occur in greater proportion on northeast aspects.

Natural and prescribed fires are principal drivers in the plant community dynamics. Drought and disease also play roles in changing plant community structure and composition, as well as being a source of fire fuel.
Prior to European settlement, fires would have been understory burns that consumed ground fuels and thinned out seedlings and saplings while pruning young to mid-aged trees. This type of burn would have maintained a savannah or park-like appearance. Crown fires indicate a disrupted fire cycle caused by livestock grazing and over-accumulation of light (leaves/needles) and heavy fuels (wood fiber). Higher densities of shrubs and younger-age trees would create the ladder fuels necessary for crown fires.
Some of the plant communities identified in this ESD are based on field data. For the estimated plant communities, composition and production of plant species and other related data were reconstructed from either similar plant communities or historical accounts and based on ecological principles, historical records, or anecdotal evidence. Photographs herein may depict plant communities of similar structure and function to those described but with minor differences in species composition.
State 1, Plant Community 1 (PC1) is the reference community (RC) of this ecological site. It reflects pre-European settlement conditions. Natural fires are associated with this state and likely occur with a relatively high frequency. The frequency may average between 5 and 20 years, and more frequently if ground fuels (herbaceous plants) and climatic conditions allow for naturally ignited fires to expand. Crown fires are not expected to be common in this state due to the fairly open nature of the stand, but they may be incidental occurrences affecting small groups of trees on steeper slopes or in drainages.
PC1 is dominated by ponderosa pine with pinyon and Douglas fir as subdominant species. Alligator juniper and Gambel oak may be common occurrences in the stands. This state is sustained through periodic natural fires and plant succession. Shifts in the plant community leading to PC2, PC3, and PC4 are a result from the effects of fire, disease, or tree cutting. Plant succession will return the site to PC1.
State 2 is a deteriorated state caused by heavy livestock grazing and a disruption of the natural fire regime. Douglas fir and pinyon increases along with fire hazard severity. Crown fires are likely in this state. Understory species density is reduced, dominated by warm-season plants with remnants of cool-season species. PC5 is the prevalent plant community in State 2. PC5 shifts to PC6, PC7, and PC8 through catastrophic fire, drought and disease, heavy grazing, and plant succession.
State 3 is an intensively managed state which generally depicts the present plant community dynamics in some of the map units. This state involves a moderate level of grazing and both prescribed and natural fires. Gambel oak

and other shrubs are codominants.

Decreases in pinyon and Douglas fir densities occur with a greater fire frequency.
PC9 is an intensively managed plant community (IPC), and it shifts to PC10 by crown fire. Livestock grazing may contribute to a build-up of younger-age classes of trees that provide the ladder fuels for a crown fire. A short prescribed-fire return interval (<10 years), sustains a sparse stand of trees. Natural fires would be less frequent but possibly more severe than in State 1. Succession and land treatments would move the plant community back to PC9.
The stand structure for State 3 is comparable to the RC, although tree densities are higher in State 3. Tree densities may range from 30 to 60 trees per acre and may be as high as 80 trees per acre. The age structure would be comprised of 50 to 70% old trees, 20 to 30% mid-age trees and 10 to 20% young trees.

State and transition model



State 1
Plant Community 1 - Reference Community

Community 1.1
Plant Community 1 - Reference Community

Plant Community 1 (PC1) is self-sustaining through periodic natural fires with minimal susceptibility to insect and disease. It is generally comprised of an old-age class of trees dominated by ponderosa pine, with subdominant pinyon and Douglas fir. Understory burns would thin out the stand perpetuating an open, park-like appearance with large, widely spaced trees. Fires would remove seedlings and saplings and thin out pole-sized trees in proximity to

ladder fuels. Pinyon and Douglas fir would compete for space. Favorable moisture periods and denser tree canopy would favor Douglas fir dominance. Open stands would favor pinyon. PC1 moves to PC2 by a partial overstory mortality (fire, insect/disease, drought). PC1 is comprised of 70 to 80% old trees and up to 20% mid-age trees. Seedlings and saplings comprise 0-10% but may be removed by fire. Tree density would range from 20 to 40 trees per acre, with a basal area ranging from 30 to 70 square feet per acre. (Note: The RC projections are derived from reconstructed stand structure analysis using existing data).

Table 5. Ground cover

Tree foliar cover	1%
Shrub/vine/liana foliar cover	3%
Grass/grasslike foliar cover	34%
Forb foliar cover	2%
Non-vascular plants	0%
Biological crusts	0%
Litter	15%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	35%
Bedrock	0%
Water	0%
Bare ground	10%

State 2
Plant Community 2

Community 2.1
Plant Community 2

Plant Community 2 (PC2) is a result of tree mortality caused by drought, disease, or fire. (Note: This is not a stand replacement event, but only a shift in plant species dominance). Residual ponderosa pine may persist, but a decrease in pinyon and Douglas fir is substantial, allowing Gambel oak to increase in density (especially after fire because of resprouting ability). The site may also allow alligator juniper to propagate without competition from other trees. The open stand may become drier and warmer for a period allowing warm-season species to exert dominance. PC2 would move to PC3 as an intermediate stage in progression toward PC1. Increase of canopy cover is needed to aid re-establishment of Douglas fir. Pinyon would likely occupy the site before Douglas fir.

State 3
Plant Community 3

Community 3.1
Plant Community 3

Plant Community 3 (PC3) would begin to resemble PC1, though Douglas fir seedlings and saplings may gradually appear. Cool-season grasses would also begin to surpass warm- season species in density. Occasional understory burns would inhibit the progression of PC3 toward PC1 by reducing young trees. Succession toward PC1 may be lengthy.

State 4
Plant Community 4

Community 4.1
Plant Community 4

Plant Community 4 (PC4) is predominantly grassland derived from an extreme fire caused by high fuel accumulation, hot and dry conditions, and extreme winds. Extreme fire conditions may be preceded by an intense drought and/or extensive insect- and disease-induced mortality which generates the high fuel loadings necessary for a crown fire. Grassland would dominate, with Gambel oak and alligator juniper persisting and increasing in density. The shallow, rocky soil would impede the natural reforestation process and the site is unsuitable for tree planting. Occasional natural fires may remove young trees impeding natural site reforestation. The site would progress toward PC2, then PC3, to eventually PC1. Shifts in herbaceous species composition may coincide with the deforestation and reforestation process. The herbaceous component is a mixture of warm- and cool-season grasses. The following species are expected to be encountered: Arizona fescue; mountain muhly; pine dropseed; prairie junegrass; muttongrass; squirreltail; little bluestem; sedge; and blue grama. Shrubs would consist of Gambel oak, hairy mountain mahogany, and skunkbush sumac. Gray oak and Apache plume may also occur.

State 5
Plant Community 5

Community 5.1
Plant Community 5

Plant Community 5 (PC5) is a deteriorated plant community (DtPC) commonly found in this state. Ponderosa pine dominates the plant community by density and canopy cover with Douglas fir as codominant. Pinyon and alligator juniper exist as subdominant species in this plant community, comprising an understory tree layer with less tree density and canopy cover. Gambel oak becomes stagnant or decadent due to competition with other tree species, grazing impacts, and lack of fire to rejuvenate the species. A greater amount of overstory canopy closure may suppress herbaceous vegetation, but is dependent on crown height. Warm-season grasses may become dominant due to heavy grazing of cool-season species in grazing-accessible areas. Inaccessible areas will be dominated by cool-season species, although at lower density due to canopy cover. PC5 shifts to PC6 or PC7. Canopy cover would range from 45 to 55%. The stand structure would be comprised of about 150 to 200 trees per acre. The age structure would be a mixture of age classes, comprised of 30 to 50% old trees, 30 to 40% mid-aged trees, and 15 to 30% young-age class trees.

State 6
Plant Community 6

Community 6.1
Plant Community 6

Plant Community 6 (PC6) results from catastrophic fire. This site is dominated by a grassland community mixed with interspersed shrubs. The site may become warmer and drier shifting the herbaceous component to a warm-season species-dominated understory. Shrubs would consist of Gambel oak, hairy mountain mahogany, and Apache plume. Residual Gambel oak and alligator juniper may exist in the overstory. PC6 would progress to PC7 through natural succession.

State 7
Plant Community 7

Community 7.1
Plant Community 7

Plant Community 7 (PC7) is an intermediate stage in plant succession. Natural fires would not occur in this plant community due to lack of fuels. As heavy grazing continues, trees continue to establish and the herbaceous component remains dominated by warm-season grasses. Pinyon and Douglas fir begin to establish. Shrubs decrease in vigor and density as the canopy cover increases. PC7 progresses to PC8.

State 8
Plant Community 8

Community 8.1
Plant Community 8

Plant Community 8 (PC8) is a ponderosa pine-dominated plant community with a codominant Gambel oak tree layer. The mid-story is comprised of younger age classes of pinyon and Douglas fir trees as subdominant species. This plant community progresses to PC5 through continued heavy grazing and reduced fire (natural or prescribed). Grazing will keep Gambel oak regeneration in a decadent form. Without fire to help regenerate oak species, the conditions will allow Douglas fir to increase in density and dominance over pinyon and Gambel oak. In time, Douglas fir will surpass pinyon in density and canopy cover as the site becomes cooler and wetter with increasing canopy cover as PC8 shifts to PC5. This plant community may be perpetuated with fuel treatments and prescribed fire while heavy grazing persists in accessible areas. The steep terrain and remoteness render large-scale fuel treatments impractical. The probability of a catastrophic fire in this plant community is low due to variable stand density and moderate canopy cover (25-35%).

State 9
Plant Community 9

Community 9.1
Plant Community 9

Plant Community 9 (PC9) is an intensively managed plant community (IPC) dominated by ponderosa pine with codominant pinyon at times. Gambel oak and alligator juniper are sub-dominant. Frequent fires would stimulate Gambel oak sprouting, making this species more common as a shrub, as well as keep Douglas fir density low. This plant community can be sustained through periodic fires, both natural and prescribed. Controlled grazing allows fine fuels to accumulate and carry a fire. Arizona fescue and mountain muhly would dominate the understory. The openings would contain a mixture of other species such as blue grama, pine dropseed, and Arizona threeawn. Prairie junegrass and muttongrass would remain a substantial component in the understory, but in lower density than in the RC. PC9 moves to PC10 as a result of a high-intensity fire which causes overstory mortality.

State 10
Plant Community 10

Community 10.1
Plant Community 10

Plant Community 10 (PC10) results from intense fire or overstory harvest. A high intensity fire would be uncommon but possible, given severe climatic conditions and steep terrain. PC10 has a residual ponderosa pine stand in the overstory with a substantial increase in Gambel oak. Ponderosa pine would still dominate the overstory since pinyon and young Douglas fir are significantly reduced in density by fire. Gambel oak is rejuvenated by the fire becoming codominant in the overstory as well as the dominant shrub. Alligator juniper competes with pinyon for space as the stand re-populates after the burn. In time, PC10 shifts to PC9, Gambel oak decreases with competition from other trees for space and sunlight. Ungulate (wild and domestic) grazing reduces Gambel oak density.

Additional community tables

Animal community

These areas have been grazed by livestock since the late 1800s. Slopes, with rock outcrops, vary enough that traversing the landscape may be difficult but not impossible for livestock. Both sheep and cattle with some pack and saddle stock have utilized the lands for over a century with varying intensity. Accessible areas close to developed water sources may be grazed heavier than more distant, less-watered areas.
Very few natural water sources exist on these lands and consequently the grazing impact varies from excessive use to light or no use. Elk and deer forage on these lands, with elk having more effect on herbaceous and browse plants. Historical and current livestock use alters the understory vegetation composition, in turn affecting the fire regime for these lands. Natural fires are uncommon and prescribed fires have been used to reduce accumulated fuels. Wild-fires do occur on these landscapes as a result of drought and severe fire weather conditions such as the Chance Fire in 2000 (Pelona Mountain).

Stocking capacity in State 2 is low due to low forage production. The primary forage species in State 2 is blue grama. Sustainable grazing capacity can be achieved in State 3 with intensive range management. Competition for forage between livestock and wildlife can occur, especially on the cool-season grasses and desirable shrubs. Desirable shrub species are severely hedged and are decadent in State 2.

Hydrological functions

Coarse fragments (gravel, cobble, stone, boulder) and rock outcrops comprise a significant part of the ground cover that protects and binds the soil as well as modifies surface run-off. Rocky outcrops impede the force of surface runoff as well as channel water flow that influences vegetation and soil integrity. On the Faraway and Motoqua soil component within MLRA 39, exposed volcanic tuff channels water down-slope onto benches, drainage areas, and into rock crevices creating what appears to be an elevated moisture regime. The sites support ponderosa pine, Gambel oak, and in some cases, quaking aspen. Faraway and Motoqua soils support a twoneedle pinyon-oneseed juniper plant community in MLRA 35.

Though the soil texture ranges from gravelly and very stony to extremely cobbly, it also includes loam and sandy loam textures.
This soil can be subjected to sheet and gully erosion induced by surface run-off. In State 2, the soil is prone to degradation by heavy grazing that leads to reduced ground cover and accelerated run-off. State 1 and 3 plant communities maintain soil integrity and hydrological function through increased ground cover and nutrient cycling resulting from fires and decomposition.

Recreational uses

This site is not conducive to camping and firewood gathering due to steep terrain, except in localized areas where the terrain is gentle and suitable for vehicle access. The woodland plant community also provides thermal and nesting cover for wildlife and does hunting opportunities at certain times of the year. Much of the terrain is steep enough to provide wilderness-like recreation such as hiking and horseback riding as well as wildlife viewing. Scenic values are high, and changing the vegetative patterns across the site may change the scenic rating significantly.

Wood products

Many of the sites produce a substantial amount of wood fiber due in part to large diameter ponderosa pine and Douglas fir. States 1, 2, and 3 produce different volumes of wood fiber. Merchantable timber can be found in each of the states but the access to the sites may be cost- prohibitive and detrimental to the soil and watershed integrity. For States 2 and 3, wood volume is about 6 to 7.5 cords per acre on north slopes and about 6.5 to 8 cords per acre on south slopes. RC wood production ranges between 6 and 13.5 cords of wood per acre on north slopes due to larger trees. On south slopes, wood fiber would be about 6 to 10 cords per acre. Assuming a 150-year rotation and harvesting only the old trees in the stand, this would result in very low wood production.

Other information

Resident elk herds impact cool-season grasses and shrubs year-round. Livestock grazing continues as the primary use impacting plant community structure and diversity.
The NRCS plant species list was consulted to determine the likelihood of a species occurring within these soil series.
The Faraway and Motoqua soil components were inventoried in MLRA 39 while developing this ESD, with portions comparable to the Breaks/Hills Ecological Site (F035XG003NM), although, alligator juniper occurs as a minor component in MLRA39. Alligator juniper was not present on the Breaks/Hills site. A portion of the Faraway and Motoqua soil component within Map Unit 471 supports a ponderosa pine and Gambel oak plant community mixed with a pinyon-alligator juniper-gray oak component where elevation, aspect, and run-on soil moisture create a wet micro-site.
Within map unit 472 near the Continental Divide, the Abrazo component is mixed with the Faraway and Motoqua components and also supports a ponderosa pine plant community mixed with pinyon and alligator juniper. This site is also located on north aspects and appears to receive higher moisture levels in localized situations due to the higher elevation and proximity to Continental Divide and associated edaphic features.

Contributors

Michael Carpinelli
Noe Gonzalez

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:**

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

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

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

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

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

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

---

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:**
