USDA Natural Resources Conservation Service

Ecological site F042CY020TX
Limestone Mountain (North Aspect) 20-26" PZ

Accessed: 05/10/2025

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.

Associated sites

F042CY021TX	**Limestone Mountain (South Aspect) 20-26" PZ** The Limestone Mountain (South Aspect) occurs on mountain slopes and ridgetops, at elevations generally above 2,286 m. Aspects are predominantly south facing or neutral. Soils are mostly shallow to limestone bedrock, gravelly, and loamy. The reference plant community is a ponderosa pine savanna.
R070CY102NM	**Shallow Limestone** Shallow Limestone occurs on limestone hills with 10 to 50 percent slope gradient. Soils are shallow to limestone bedrock. HCPC is mixed prairie grassland with scattered forbs, shrubs, and trees.
R070CY109NM	**Loamy** Loamy is a flood plain, stream terrace, arroyo, or basin floor with nongravelly or cobbly soils. HCPC is mixed prairie grassland with scattered shrubs, forbs, and trees.
R070CY115NM	**Breaks** Breaks are escarpments with slopes ranging 40-95 percent gradient. Soils are shallow to bedrock. HCPC is a mountain shrubland with few scattered trees.
R042CY745TX	**Limestone Canyon Bottomland** Limestone Canyon is a flood plain, stream terrace, arroyo, or basin floor with very gravelly or cobbly soils. HCPC is mainly riparian woodlands but vegetation is variable due to different soil conditions.

Similar sites

F042CY021TX	**Limestone Mountain (South Aspect) 20-26" PZ** The Limestone Mountain (South Aspect) occurs on mountain slopes and ridgetops, at elevations generally above 2,286 m. Aspects are predominantly south facing or neutral. Soils are mostly shallow to limestone bedrock, gravelly, and loamy. The reference plant community is a ponderosa pine savanna.

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii var. glauca* (2) *Quercus gambelii*
Shrub	(1) *Amelanchier utahensis* (2) *Fendlera rupicola*
Herbaceous	(1) *Muhlenbergia pauciflora*

Physiographic features

The site occurs on mountainsides and ridges. Aspect is predominantly north facing. Slope gradient range from 10 to

95 percent. Runoff is high on 10 to 20 percent slopes and very high on slopes over 20 percent.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	6,200–8,700 ft
Slope	10–95%
Aspect	N, NE

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 is in early May and the first killing frost is in early October.

Both temperature and precipitation favor warm-season species. However, about 40 percent of the precipitation is favorable to cool-season species. This allows the cool-season plants to occupy an important component of this site. The effective precipitation of this site is increased, due to its position on the landscape, by runoff from adjoining sites. This site also serves as a cold air drainageway. These two factors are both favorable to cool-season species and also increase the variety and production of the vegetative community. Strong winds that carry dust from the west and southwest blow across the area from February to June and dry the soil during a critical period for 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.

Table 3. Representative climatic features

Frost-free period (average)	173 days
Freeze-free period (average)	187 days
Precipitation total (average)	16 in

Influencing water features

Soil features

The site consists of very shallow and shallow, well drained soils that formed in clayey residuum and colluviums weathered from Permian Limestone and Dolomite bedrock.
Soils are typically clay loams and skeletal (>35% by volume subsurface fragments).

Table 4. Representative soil features

Parent material	(1) Colluvium–limestone and sandstone (2) Residuum–dolomite
Surface texture	(1) Gravelly clay loam (2) Very gravelly clay loam (3) Cobbly clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Very slow
Soil depth	6–20 in
Surface fragment cover <=3"	5–10%
Surface fragment cover >3"	20–30%
Available water capacity (0-40in)	2 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–7.4
Subsurface fragment volume <=3" (Depth not specified)	15–20%
Subsurface fragment volume >3" (Depth not specified)	20–30%

Ecological dynamics

The reference plant community or potential for this site is considered to be a Ponderosa pine-Douglas fir-southwestern white pine coniferous forest. Common understory shrubs or small trees include Gambel's oak, Utah serviceberry, mescalero currant. A mix of both warm and cool season grasses including New mexico muhly, mountain muhly, Arizona fescue, and nodding brome comprise the herbaceous grass layer. At the time of European settlement the site was most likely a heterogonous mix of plant communities that reflected the various stages of plant succession following natural disturbances. In addition to natural disturbances, forest composition is highly dependent on topographic position, elevation, and available soil moisture.

The natural disturbance that is the most influential driver of vegetation dynamics is fire. Historically, high frequency and low to mid severity fires shaped the plant communities (Ahlstrand 1980, Sakulich and Taylor 2007). In a fire scar study, Ahlstrand (1980) indentified a mean fire interval of 4.7 years for all fires occurring between 1554 and 1842. Most of these fires were sparked by lightening although some could have been started my Mescalero Apaches who inhabited the area in the 1800s. European settlement that introduced diseases and military campaigns brought an end to the Apache settlements. The reduction of fires slowly initiated during this time period. Other disturbances such as disease, falling of dead trees, and drought also influence the plant communities.

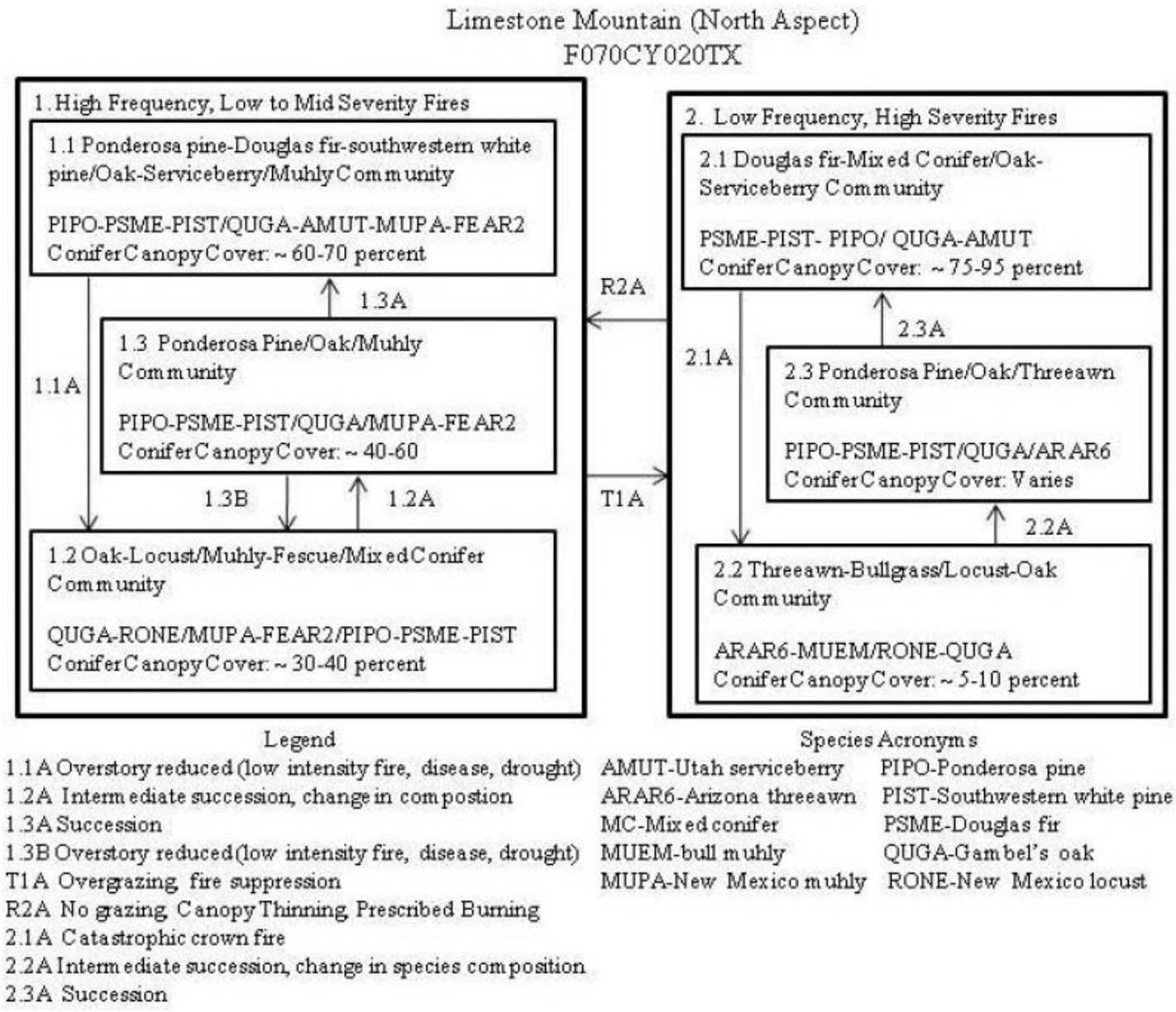
A community phase consisting of Gambel's oak, New Mexico locust, and numerous warm season grasses establishes after disturbances. An intermediate seral stage with numerous ponderosa pine seedlings follows. It is unknown how long these seral stages can persist but precipitation and/or drought most likely plays a role.

At Guadalupe Mountains National Park, sheep and goat grazing began on this site in the 1920s about 40 years later that many similar areas in New Mexico. This coincides with the cessation of fire at the park (Sakulich and Taylor 2007). Overgrazing of livestock will reduce the fine fuels needed to carry fires and thereby increase the density of trees. A combination of fire suppression and fire will shift the dynamics of this forest ecosystem into an alternate

state. A dense forest with abundant litter will be susceptible to large catastrophic fires that can lead to high tree mortality. High severity and low frequency fires would characterize this second state. Post-fire communities will establish but in large acreage and with some differences to the original state. Large sever fires is most likely more detrimental to wildlife than smaller more frequent fires.

The following diagram suggests general pathways that the vegetation on this site might follow. There are other plant communities and states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model



State 1
High Frequency, Low to Mid Severity Fires State

This state is a multi-aged mixed coniferous forest characterized by high frequency, low to mid severity fires. Abundant fine fuels exist with a combination of both warm and cool season grasses and forbs to carry fires. A high frequency of fire would favor ponderosa pine over Douglas-fir in this state (NPS 2005). A total of three seral stages are identified in this state and they most likely occur in a mosaic of patches optimizing wildlife habitat. Forest health is also optimized thereby limiting the extent of diseases.

Community 1.1
Ponderosa Pine-Douglas fir-Southwestern White Pine/Oak-Serviceberry/Muhly Community

Figure 4. Approximate HCPC

This community is the potential or reference plant community. It is characterized by a slight dominance of ponderosa pine in the forest over-story although associated species such as Douglas fir and/or southwestern white pine can dominate favorable micro-sites such as drainageways. Gambel's oak is a common understory tree. Other trees and shrubs include knowlton's hophornbeam, Utah serviceberry, mescalero currant, cliff fendlerbush, and silver mountain mahogany. A combination of mid/tall grasses and warm/cool season grasses dominates the herbaceous layer. The occurrence of natural fires prevents this community from being a closed canopy throughout the extent of the site.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	1200	1500	1800
Grass/Grasslike	600	900	1200
Total	**1800**	**2400**	**3000**

Community 1.2
Oak-Locust/Muhly-Fescue/Mixed Conifer Community

Figure 6. 1.2 Oak-Locust/Muhly-Fescue/Mixed Conifer

This community is characterized by a dominance of Gambel's oak and New Mexico locust with abundant warm shade intolerant warm season grasses such as big bluestem, yellow indiangrass, little bluestem, and numerous muhly grasses. The community is in the early stages of secondary succession caused by fire, disease, and/or drought.

Community 1.3
Ponderosa Pine/Oak/Muhly Community

Figure 7. 1.3 Ponderosa Pine/Oak/Muhly Community

This community is an intermediate seral stage. Lack of fire or other disturbances is allowing succession to occur. Numerous seedlings of ponderosa pine as well as Douglas fir and southwestern white pine are being established. Shade intolerant warm season grasses dominate the grass layer.

Pathway 1.1A
Community 1.1 to 1.2

Ponderosa Pine-Douglas fir-Southwestern White Pine/Oak-Serviceberry/Muhly Community

Oak-Locust/Muhly-Fescue/Mixed Conifer Community

overstory canopy is reduced due to natural disturbances such as low intensity fires, disease, insects, and drought conditions.

Pathway 1.2A
Community 1.2 to 1.3

Oak-Locust/Muhly-Fescue/Mixed Conifer Community

Ponderosa Pine/Oak/Muhly Community

Due to intermediate succession and change of plant species composition, the Oak-Locust/Muhly-Fescue/Pine-Fir Community will shift to the Pine-Fir/Oak Community.

Pathway 1.3A
Community 1.3 to 1.1

Ponderosa Pine/Oak/Muhly Community

Ponderosa Pine-Douglas fir-Southwestern White Pine/Oak-Serviceberry/Muhly Community

The Pine-Fir/Oak Community can shift to the Douglas-fir-Pine/Oak-Serviceberry Community due to Plant Succession.

Pathway 1.3B
Community 1.3 to 1.2

Ponderosa Pine/Oak/Muhly Community

Oak-Locust/Muhly-Fescue/Mixed Conifer Community

Overstory reduced due to natural disturbances such as low intensity fire, disease, and/or drought.

State 2
Low Frequency, High Severity Fires State

This state is characterized low frequency, high severity fires. Overgrazing has been or is a part of this state and a very low grass cover exists. Dense thickets of coniferous exists due to the lack of periodic fires. Numerous young Douglas fir and Gambel oak trees exists in the understory of these thickets. The high density of Douglas fir in understory communities can likely shift the dominance from mixed ponderosa pine and southwestern white pine to Douglas fir (Sakulich and Taylor 2007). Large catastrophic wildfires can cause high tree mortalities in this state.

Community 2.1
Douglas-fir-Mixed Conifer/Oak-Serviceberry Community

Figure 8. Douglas-fir-Mixed Conifer/Oak-Serviceberry

This community is characterized by a dominance of Douglas fir with associated ponderosa pine and southwestern white pine. Gambel's oak is a common understory shrub or small tree. Few shade tolerant grasses exist. Canopy cover of trees can range up to 95 percent. Fine fuels needed to carry low severity fires are very limited.

Community 2.2
Threeawn-Bullgrass/Locust-Oak Community

Overstory of trees is greatly reduced due to a catastrophic crown fire. Mortality of coniferous can be very high with severe fires. Grasses such as Arizona threeawn, common in overgrazed areas will most likely be common as well shade intolerant grasses such as bull muhly. New Mexico locust and Gambel oak will be resprouting. Continued overgrazing will limit the recovery of grasses.

Community 2.3
Pine/Douglas-fir/Oak Community

Pathway 2.1A
Community 2.1 to 2.2

The Douglas-fir-Pine/Oak-Serviceberry/Muhly Community can shift to the Threeawn-Bullgrass/Locust-Oak Community due to catastrophic crown fires on the Douglas-fir and pine species.

Pathway 2.2A
Community 2.2 to 2.3

Intermediate plant succession through time.

Pathway 2.3A

Community 2.3 to 2.1

Due to plant succession, the Pine-Douglas-fir/Oak Community will shift back to the Douglas-fir/Pine/Oak-Serviceberry/Muhly Community.

Transition T1A
State 1 to 2

Due to overgrazing and fire suppression, the High Frequency Low to Mid Severity Fire State will transition into the Low Frequency, High Severity Fire State.

Restoration pathway R2A
State 2 to 1

With the use of Plant Succession, the Low Frequency High Severity Fires State can be restored back to the High Frequency Low to Mid Severity Fires State.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm season tallgrasses**			210–420	
	big bluestem	ANGE	*Andropogon gerardii*	50–200	–
	bullgrass	MUEM	*Muhlenbergia emersleyi*	50–200	–
	little bluestem	SCSC	*Schizachyrium scoparium*	50–200	–
	Indiangrass	SONU2	*Sorghastrum nutans*	50–200	–
2	**Warm season midgrasses**			180–360	
	New Mexico muhly	MUPA2	*Muhlenbergia pauciflora*	75–200	–
	mountain muhly	MUMO	*Muhlenbergia montana*	75–175	–
	pine muhly	MUDU	*Muhlenbergia dubia*	50–150	–
	Arizona threeawn	ARAR6	*Aristida arizonica*	25–75	–
3	**Cool season midgrasses**			210–420	
	Arizona fescue	FEAR2	*Festuca arizonica*	50–150	–
	pinyon ricegrass	PIFI	*Piptochaetium fimbriatum*	25–100	–
	Pringle's speargrass	PIPR2	*Piptochaetium pringlei*	25–100	–
	littleawn needlegrass	ACLO7	*Achnatherum lobatum*	25–100	–
	nodding brome	BRAN	*Bromus anomalus*	25–100	–
	squirreltail	ELEL5	*Elymus elymoides*	25–100	–
Shrub/Vine					
4	**Shrubs**			115–300	
	Utah serviceberry	AMUT	*Amelanchier utahensis*	25–75	–
	silver mountain mahogany	CEMOA	*Cercocarpus montanus var. argenteus*	25–75	–
	cliff fendlerbush	FERU	*Fendlera rupicola*	25–75	–
	Mescalero currant	RIME2	*Ribes mescalerium*	25–75	–
	western white honeysuckle	LOAL	*Lonicera albiflora*	5–15	–
	creeping barberry	MARE11	*Mahonia repens*	5–15	–
5	**Shrub / small tree**			500–900	
	Gambel oak	QUGA	*Quercus gambelii*	400–900	–
	Knowlton's hophornbeam	OSKN	*Ostrya knowltonii*	75–200	–

Animal community

Wildlife that utilized this site includes mule deer, elk, black bears, gray foxes, striped and hog-nosed skunks, porcupine, and mountain lions. Mountain short-horned lizards also utilized this site.
In addition, mountaintop forests provide a unique habitat that attracts a variety of birds including the mountain chickadee, white-breasted nuthatch, dark-eyed junco, bushtit, acorn woodpecker, and the pine siskin. Chickadees and nuthatches are often seen in mixed species flocks flitting through the pines looking for seeds and insects. In the mid 1980’s, Montezuma quail were reintroduced in the Guadalupe Mountains after being eliminated in the mid 1900’s Western screech owl, great-horned owl, and flammulated owl can also be seen or heard in the forests (NPS 2010).

Recreational uses

Hiking and Camping

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, soils data and ecological interpretations gained by field observation.

Other references

Alhstrand, G.M. 1981. High country fire history. P. 1-22 in G.M. Ecology of fire in the Guadalupe Mountains and adjacent Chihuahuan Desert. Carlsbad Caverns and Guadalupe Mountains National Parks, Carlsbad, NM.

Krysl L.J. 2001. Food habits abd dietary overlap of elk and mule deer in Guadalupe Mountains National Park, Texas. Texas Journal of Agriculture and Natural Resources, Vol. 14.

National Park Service. 2005. Fire Management Plan: Guadalupe Mountains National Park, Pine Springs, TX.

National Park Service http://www.nps.gov/gumo/naturescience/animals.htm. Accessed September 2010.

Sakulich J. and A.H. Taylor .2007. Fire regimes and forest structure in a sky island mixed conifer forest, Guadalupe Mountains National Park, Texas, USA.

USDA-USFS- Fire Effects Information System. http://www.fs.fed.us/database/feis/
Accessed September 2010.

Contributors

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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:**

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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):**

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:**