USDA Natural Resources Conservation Service

Ecological site R038XB102NM
Gravelly

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.

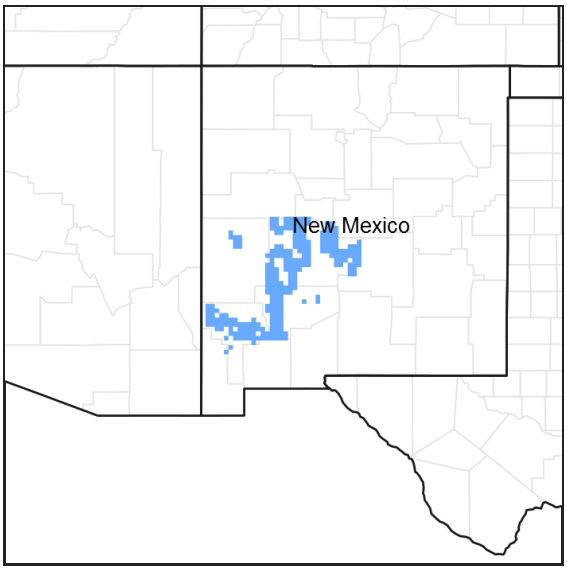


Figure 1. Mapped extent

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.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This site occurs on nearly level to moderately sloping alluvial fans and upland slopes. Slopes average less than 15 percent. This site is frequently dissected by shallow, dry washes and is found at elevations ranging from about 5,000 to 6,800 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan
Elevation	5,000–6,800 ft
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation varies from about 12 inches to just over 16 inches. Substantial fluctuations from year to year are common, ranging from a low of about 6 inches to a high of over 30 inches. Approximately one-half of the annual precipitation comes in the form of rainfall during the months of July, August, and September, although wintertime precipitation in the form of snow, sleet, or rain is sometimes significant. Spring and late fall months are normally dry.

The average frost-free period ranges from about 165 to 190 days and extends from approximately the third or fourth week in April to mid October. Average annual air temperatures are about 56 degrees F. Summer maximums can exceed 100 degrees F and winter minimums on occasion go below zero. Monthly mean temperatures generally exceed 70 degrees F for the period of June through August.

Growing conditions favor warm-season perennial vegetation, although late winter and late summer precipitation is adequate to foster a significant cool-season component in the potential plant community. Occasional wet springs also create good conditions for annual forb production, but frequent winds from the west and southwest are common during this time of year and tend to deplete soil moisture at a critical time for the growth of these plants.

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)	187 days
Freeze-free period (average)	211 days
Precipitation total (average)	16 in

Influencing water features

This site is not influenced by water from a wetland or stream.

Soil features

The soils that characterized this site are gravelly and very gravelly and deep to shallow. They have water intake rates that are moderate to high if vegetative cover is adequate. They are usually, but not always, noncalcareous to slightly calcareous at the surface, with varying amounts of carbonates found in the subsoils.

Table 4. Representative soil features

Surface texture	(1) Gravelly very fine sandy loam (2) Cobbly sandy loam (3) Sandy clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	16–60 in
Surface fragment cover <=3"	15–60%
Surface fragment cover >3"	15–60%
Available water capacity (0-40in)	1–6 in
Electrical conductivity (0-40in)	0–4 mmhos/cm

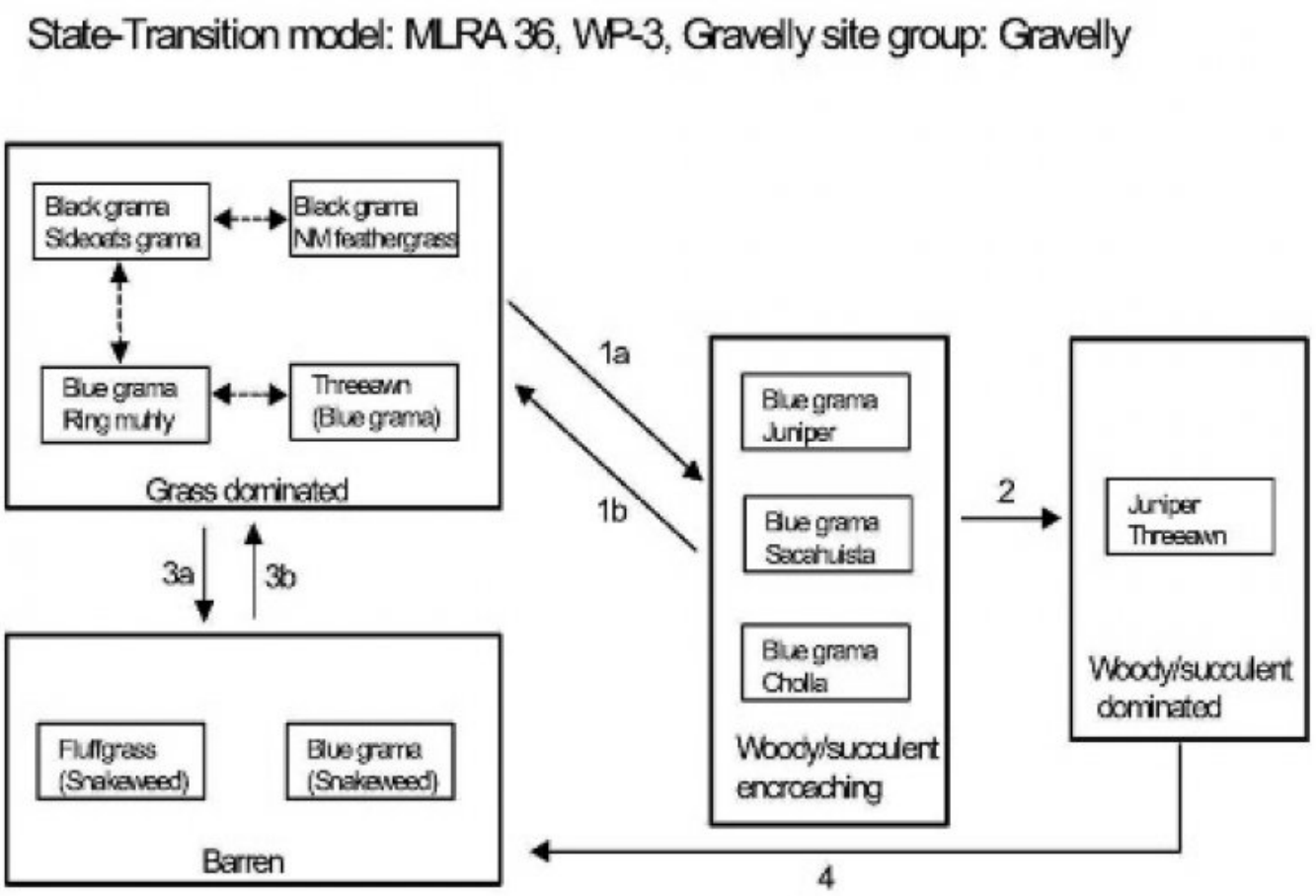
Soil reaction (1:1 water) (0-40in)	6.1–9
Subsurface fragment volume <=3" (Depth not specified)	4–57%
Subsurface fragment volume >3" (Depth not specified)	1–3%

Ecological dynamics

Gravelly sites occur in association with hills and breaks sites. The historic community type of the gravelly site is dominated by black grama (*Bouteloua eriopoda*), New Mexico feathergrass (Stipa neomexicana), and sideoats grama (*Bouteloua curtipendula*). Yuccas (Yucca sp.), sacahuista (Nolina spp.), winterfat (*Krascheninnikovia lanata*), or mariola (*Parthenium incanum*) may also occur. Blue grama (*Bouteloua gracilis*) and hairy grama (*B. hirsuta*) are common. Under heavy grazing pressure and/or drought, blue and hairy grama, wolftail (Lycurus spp.), threeawns (Aristida spp.) and Hall’s panicum (Panicum halli) may increase in representation as grass cover declines. Reduced competition from grass, a decline in fire frequencies with or without a loss of grass cover, or perhaps regional increases in the relative amount of winter rainfall may lead to significant increases in the abundance of woody plants and succulents, usually one-seed juniper (*Juniperus monosperma*) as well as sacahuista (Nolina spp.) and shrub liveoak (Quercus spp.). The presence of gravelly soils at the bases of hills dominated by juniper may increase the likelihood of juniper invasion of gravelly sites relative to other sites. Juniper competes with grasses and may lead to persistent reductions in grass abundance. Subsequent erosion (in some cases) may retard the capacity of grasses to reestablish following woody plant removal.

No systematic studies of communities, states or transitions have been performed in the gravelly site.

State and transition model



State 1
Historic Climax Plant Community

Community 1.1
Historic Climax Plant Community

Grassland State: Black grama and sideoats grama are consistent dominants in sustainably-grazed grasslands, with New Mexico feathergrass cover fluctuating with variation in winter-spring precipitation. Grass and forb cover is near 24% and over half of the ground cover is gravel or bare soil. Retrogression caused by heavy grazing leads to increases in bare ground and increasing representation of blue grama, ring muhly (*Muhlenbergia torreyi*), and wolftail. At high grazing pressures or in harsh conditions, threeawns often dominate. Green sprangletop (*Leptochloa dubia*), cane bluestem (*Bothriochloa barbinodis*), plains bristlegrass (*Setaria leucopila*), and bottlebrush squirreltail (*Elymus elymoides*) are often eliminated by heavy grazing. Under current climate, fire is probably necessary to maintain this state (thus the grassland may be a disclimax; Johnsen 1962). Diagnosis: Black grama is dominant or co-dominant with sideoats grama and sometimes New Mexico feathergrass. Bare patches are small (> 0.5 m) and infrequent, as are signs of erosion.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	458	786	1105
Forb	44	74	104
Total	**502**	**860**	**1209**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	20%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	3%

Figure 5. Plant community growth curve (percent production by month). NM0602, R038XB102NM Gravelly HCPC. R038XB102NM Gravelly HCPC Mixed warm/cool-season grassland with scattered half-shrubs..

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
Transition to woody/succulent-enroaching state

Community 2.1
Transition to woody/succulent-enroaching state

ADDITIONAL STATES Transition to woody/succulent-encroaching state (1a): The reduction of grass cover and fine fuels due to grazing, or changes in fire frequency and/or climate independent of changes in grass cover, may facilitate the establishment of juniper or other woody/succulent adults by reducing disturbance rates. The formation of bare ground patches due to grazing may also decrease competition by grass for water and facilitate establishment. These mechanisms probably work in tandem (Johnsen 1962, Gottfreid et al. 1995). Finally, livestock may increase rates of juniper seed dispersal into grasslands, although seed dispersal by native birds and mammals is probably sufficient for juniper establishment (Johnsen 1962). Key indicators of approach to threshold: Decreased fire frequency, increases in bare ground, decreases in litter cover and grass cover, the presence and growth of tree/cactus seedlings. Transition to barren state (3a): Heavy grazing, persistent reductions in grass cover, and associated erosion causes this transition. Key indicators of approach to threshold: Reduction in grass cover, increases in the size and frequency of bare patches, reduction in soil stability, pedestalling of grasses.

State 3
Woody-succulent encroaching

Community 3.1
Woody-succulent encroaching

Woody/succulent encroaching: Grass cover is often reduced and sacahuista plants increase in density or oak or juniper species invade. Mesquite (*Prosopis glandulosa*) may invade at lower elevations. Cholla may also invade. It is unclear why different species encroach or invade in different situations, but it is likely due to differences in soils, aspect, dispersal pathways, and elevation within this site. West of Silver City, sacahuista encroachment seems to be more common. Vegetation under mature tree canopies is usually sparse. Much of the erosion from bare intercanopy patches is usually intercepted by vegetated patches downslope within this state. Fire must be applied to maintain this state. Diagnosis: Cover of shrubs, succulents, and/or trees exceeds 20% and grass cover is interrupted by large (> 1 m) bare patches associated with shrub or tree-dominated patches. Transition to woody/succulent-encroaching state (2): Continued fire suppression and/or reduced fuel loads allows the development of mature trees. Over time, competitive exclusion of grasses by trees (amplified by grazing disturbance) increases bare ground to a second threshold (that defines the woodland state) beyond which erosion rates may increase rapidly (Davenport et al. 1998). Generally, the probability of crossing this threshold is greater on more erodible soils and steeper slopes. Loss of organic matter, decreased infiltration, and changes to soil structure inhibit the subsequent reestablishment of grasses. Key indicators of approach to threshold: Increasing size and density of trees, reduction in grass cover, increases in the size and frequency of bare patches, reduction in soil stability, pedestalling of grasses. Transition to grass-dominated state (1b): Tree removal (cabling, grubbing, or herbicides) or shrub removal followed by management of grazing to maintain continuous ground cover and maintenance of fuel levels to facilitate fire.

State 4
Woody/succulent dominated

Community 4.1
Woody/succulent dominated

Woody/succulent dominated: This state is characterized by severely reduced grass cover (mostly threeawns or blue grama) and moderate trees/acre). Fuel loads may be too low and trees too large to support fire management. Juniper root systems may monopolize soil water additions. Grass tends to be organized as patches separated by large bare areas. Erosion from bare patches may be extreme and resources may not be intercepted by local vegetation patches. Diagnosis: Grasses are isolated as patches, if present, and bare areas are continuous. Shrubs, trees, or succulents are the dominant vegetation. Transition to barren state (4): The removal of junipers via cabling and/or herbicides would produce a barren state if soil degradation inhibited the recovery of grasses.

State 5
Barren

Community 5.1
Barren

Barren: Grass cover is very low, dominated either by fluffgrass (*Dasyochloa pulchella*) or blue grama. Snakeweed (Xanthocephalum spp.) may be common depending upon climatic conditions. Erosion rates are high and probably similar to that of the Woody- succulent dominated state, although the cover of trees or succulents is low in this state. Stable barren conditions are rare in WP-3 and are more likely to occur at lower elevations near the transition to SD-2. Diagnosis: Bare ground is interconnected, evidence of erosion is abundant. Blue grama or fluffgrass is the dominant perennial vegetation. Diagnosis: Bare ground is interconnected, evidence of erosion is abundant. Blue grama or fluffgrass is the dominant perennial vegetation. Information sources and theoretical background: Communities, states, and transitions are based upon information in the ecological site description and observations by Gene Adkins and Bill Schwebke, NRCS. Several hypotheses are represented in the explanations for transitions at this site. For juniper invasion thresholds, the favored hypothesis is the fire hypothesis. This holds that frequent fires prevent tree establishment or growth to maturity in healthy grasslands. Fire-free periods of 85-90 years may result in the development of mature juniper woodlands (Tirmenstein 1989 and references therein). If fine fuels produced by grass are reduced below a threshold amount, there may be insufficient fuel to carry fire, or insufficient heat from fire to kill trees or shrubs. According to this hypothesis, trees are better competitors than grasses and can come to dominate grasslands without disturbance (Johnsen 1962). The competition, fire and climate hypotheses may be complementary. The competition hypothesis holds that grassland maintenance depends upon the competitive exclusion of tree seedlings due to limitations in water or nutrients (Johnsen 1962). There may be a threshold grass density below which the probability of juniper establishment increases rapidly, leading to a

transition to the woodland state. Junipers compete with grasses directly for water in shallow soil layers in intercanopy areas (Breshears et al. 1997) and juniper removal prior to soil loss can result in dramatic recovery of grass cover (e.g. Aro 1971). Dispersal limitation of junipers to grasslands is believed to have been historically unimportant. The climate hypothesis holds that the current advance of junipers throughout the west is a natural part of long-term cycle of advances and retreats due to fluctuating climate. Belsky (1996) points out, however, that the current advance (during a dry phase) is not consistent with recorded advances during wet phases. Changes in the seasonality of precipitation to wetter winters, however, may be an important factor because junipers are C3 plants. The competition, fire and climate hypotheses may be complementary. Once junipers become established, the erosion hypothesis holds that persistent reduction in grass and litter cover, perhaps in conjunction with trampling, will eventually lead to persistent changes in soil fertility or structure that prohibit the capacity of grasses to reestablish (Allen 1989). Furthermore, erosion degrades the ability of grasses to resist erosion due to pedestalling and increasing environmental harshness to grass, leading to accelerated erosion in a positive feedback (Allen 1989, Gottfried et al. 1995). Soil erosion levels may be highly variable within an area due to soil texture, slope, and land use, thus the ability to recover grasslands upon removal of competing junipers is also variable (Davenport et al. 1999).

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				278–324	
	black grama	BOER4	*Bouteloua eriopoda*	278–324	–
2				93–185	
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	93–185	–
3				93–139	
	sideoats grama	BOCU	*Bouteloua curtipendula*	93–139	–
4				46–93	
	blue grama	BOGR2	*Bouteloua gracilis*	46–93	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	46–93	–
5				46–93	
	common wolfstail	LYPH	*Lycurus phleoides*	46–93	–
	Hall's panicgrass	PAHA	*Panicum hallii*	46–93	–
	plains bristlegrass	SEVU2	*Setaria vulpiseta*	46–93	–
6				46–74	
	threeawn	ARIST	*Aristida*	46–74	–
	ring muhly	MUTO2	*Muhlenbergia torreyi*	46–74	–
	tobosagrass	PLMU3	*Pleuraphis mutica*	46–74	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	46–74	–
7				9–46	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	9–46	–
	squirreltail	ELEL5	*Elymus elymoides*	9–46	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	9–46	–
	green sprangletop	LEDU	*Leptochloa dubia*	9–46	–
8				9–28	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	9–28	–
Forb					

9				9–46	
	buckwheat	ERIOG	*Eriogonum*	9–46	–
	white locoweed	OXSES	*Oxytropis sericea var. sericea*	9–46	–
	goldenweed	PYRRO	*Pyrrocoma*	9–46	–
	desertsenna	SEAR8	*Senna armata*	9–46	–
	threadleaf ragwort	SEFLF	*Senecio flaccidus var. flaccidus*	9–46	–
	verbena	VEPO4	*Verbena polystachya*	9–46	–
10				9–28	
	Forb, annual	2FA	*Forb, annual*	9–28	–
11				9–28	
	Forb, perennial	2FP	*Forb, perennial*	9–28	–
Tree					
12				9–28	
	soaptree yucca	YUEL	*Yucca elata*	9–28	–
Shrub/Vine					
13				9–46	
	sacahuista	NOMI	*Nolina microcarpa*	9–46	–
14				9–46	
	featherplume	DAFO	*Dalea formosa*	9–46	–
	mormon tea	EPVI	*Ephedra viridis*	9–46	–
	Apache plume	FAPA	*Fallugia paradoxa*	9–46	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	9–46	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	9–46	–
	mariola	PAIN2	*Parthenium incanum*	9–46	–

Animal community

Habitat for Wildlife:

This site provides habitat which can support a resident animal community characterized by pronghorn antelope, black-tailed jackrabbit, Merrian’s kangaroo rat, white-throated woodrat, white-footed mouse, badger, hog-nosed skunk, meadowlark, loggerhead shrike, Scott’s oriole, scaled quail, Chihuahuan whiptailed lizard, prairie spadefoot toad, prairie rattlesnake, and striped whipsnake.

Where arroyo cutbanks occur, rock wrens nest and white-footed mouse burrow.

Hydrological functions

The runoff curve numbers are determined by
field investigations using hydrologic cover conditions and hydrologic soil groups.
Hydrologic Interpretations
Soil Series----------Hydrologic Group
Abrazo----------D
Datil----------B
Dean----------B
Golddust----------C
Gustspring Rocky----------C
Ildefonso----------B
Ladron----------B

Luzena----------D
Magdalena----------D
Muzzler----------D
Oro Grande----------D
Paymaster----------B
Santa Fe----------D
Scholle----------B
Sedillo----------B
Tesajo----------B

Recreational uses

This site offers potential for horseback riding, nature observation, and hunting for pronghorn antelope and scaled quail. When favorable spring moisture conditions occur, a colorful display of wildflowers may be seen.

Wood products

This site has no significant value for wood products.

Other products

Grazing:
This site is suitable for grazing in all seasons of the year. Although most of the herbage is produced during the summer months, green forage in the form of forbs and cool- eason grasses is produced in significant amounts during the spring months whenever moisture is adequate.

This site is adapted for cattle, sheep, and horses, generally without regard to class of livestock or season of use, although the cool-season grasses (primarily New Mexico feathergrass) tend to disappear in the event of continuous, year-long grazing by any of these animals. As advanced retrogression occurs, such plants as sacahuista, blue grama, ring muhly, broom snakeweed, and sometimes oak brush tend to take over the site, replacing black grama, New Mexico feathergrass, and sideoats grama. The site does, however, recover reasonably well under good grazing management except when woody plants have invaded or increased to the point that brush control is required.

Other information

Guide to Suggested Initial Stocking Rate Acres per Animal Unit Month
Similarity Index----------Ac/AUM
100 - 76----------2.7 – 3.6
75 – 51----------3.3 – 6.0
50 – 26----------5.7 – 9.5
25 – 0----------9.5+

Type locality

Location 1: Grant County, NM
Location 2: Catron County, NM
Location 3: Hidalgo County, NM
Location 4: Sierra County, NM
Location 5: Socorro County, NM

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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:**

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:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
