Ecological site R030XB109NV
GYPSIC BARREN 3-5 P.Z.

Last updated: 3/10/2025
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.

Ecological site concept

This site occurs on basin floors and fan remnants on all exposures. Slopes range from 0 to 50 percent, but slope gradients of 2 to 15 percent are typical. Elevations are 1200 to about 3300 feet. The soils are typically very shallow to moderately deep to the underlying material. The soils associated with this site are very high in gypsum.

this site is part of group concept R030XB115NV.

Associated sites

R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.**

Similar sites

R030XB026NV	**GYPSIC LOAM 3-5 P.Z.** PSFR-ATHY codominant shrubs
R030XB117NV	**GYPSIC SAND 3-5 P.Z.** ACGR and ATCA2 important shrubs
R030XA060NV	**GYPSIC LOAM 3-5 P.Z.** ATHY-SUAED codominant shrubs
R030XB079NV	**GYPSIC SLOPE 3-5 P.Z.** ATHY-SUAED codominant shrubs

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Psorothamnus fremontii* (2) *Petalonyx parryi*
Herbaceous	Not specified

Physiographic features

This site occurs on basin floors and fan remnants on all exposures. Slopes range from 0 to 50 percent, but slope gradients of 2 to 15 percent are typical. Elevations are 1200 to about 3300 feet.

Table 2. Representative physiographic features

Landforms	(1) Basin floor (2) Fan remnant
Elevation	1,200–3,300 ft

Slope	0–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate of the Mojave Desert has extreme fluctuations of daily temperatures, strong seasonal winds, and clear skies. The climate is arid and is characterized with cool, moist winters and hot, dry summers. Most of the rainfall falls between November and April. Summer convection storms from July to September may contribute up to 25 percent of the annual precipitation. Average annual precipitation is 3 to 5 inches. Mean annual air temperature is 64 to 75 degrees F. The average growing season is about 240 to 360 days.

Table 3. Representative climatic features

Frost-free period (average)	360 days
Freeze-free period (average)	
Precipitation total (average)	5 in

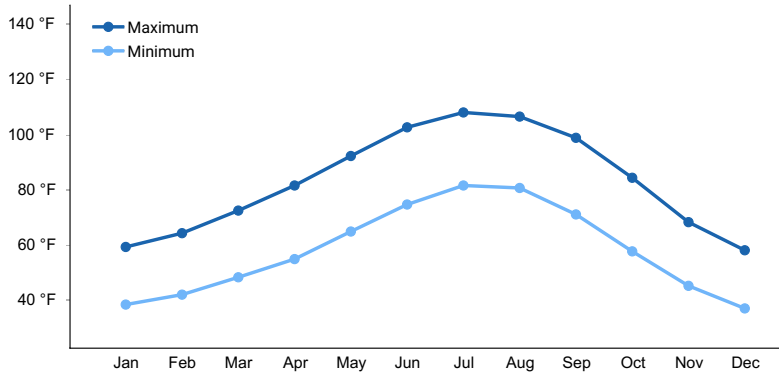


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils are typically very shallow to moderately deep to the underlying material. The soils associated with this site are very high in gypsum. They are formed in residuum from sandstone, siltstone, gypsum or lacustrine deposits. Permeability is very slow to moderately rapid and the soils are well drained to somewhat excessively drained. Available water capacity is very low to low and runoff is very low to very high. Soil series associated with this site include Callville, Drygyp, Guardian, Hardbasin, and Whitebasin.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and siltstone
Surface texture	(1) Gravelly sandy loam (2) Sandy loam (3) Extremely gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow to moderately rapid
Soil depth	5–59 in
Surface fragment cover <=3"	0–5%

Surface fragment cover >3"	0%
Available water capacity (0-40in)	0.2–3.1 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	2–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–2
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	3–16%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

A biological soil crust provides a surface cover ranging from 35 to over 90 percent. They provide a major source of fixed carbon and nitrogen and provide important resource reserves. Colonization patterns of cyanobacteria partially depends on the texture of gypsum, they tend to colonize below the microtopographic depressions, were water can pond and infiltrate the gypsum (Dong et al. 2007). As ecological condition deteriorates, the crust is disrupted and decreases in total ground cover.

Gypsic soils are generally weakly aggregated which can result in serious erosion. The severity of the erosion is dependent on the gypsum content (FAO 1990). Gypsiferous soils are generally structureless, low in organic matter, and may become unstable in water making them a poor medium for plant growth. Gypsic horizons, however, can also be strongly aggregated and form hard crusts that control erosion and sometimes impede the downward movement of water and extension of roots (FAO 1990). The continuous petrogypsic horizon plays a significant role in plant community dynamics by increasing the available water holding capacity of the soil.

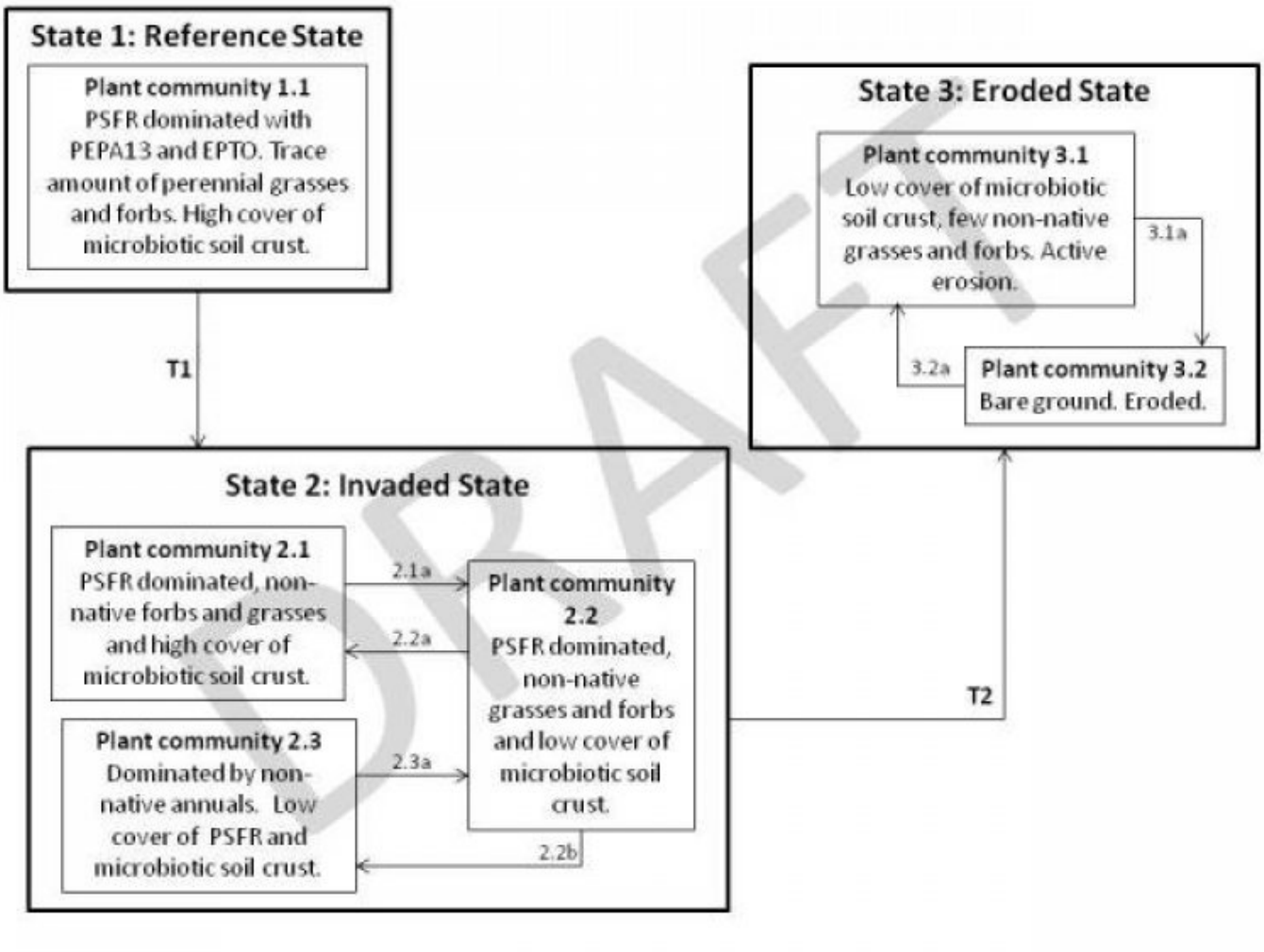
Gypsic crusts formed from sulfate minerals are common across this ecological site. Crusts form in the soils due to the lack of sufficient water to remove soluble salts (Dong et al. 2007). Microtopography created by crusts can form microcatchments for water, positively influencing soil moisture, causing suspended sediment to settle out, as well as, reinforcing the formation of soil crusts. Interactions between microboitic crusts and vascular plants are complex. They can be mutualistic, competitive, or neutral (Williams 1994). Soil crusts can encourage seedling establishment and survival, due to increased water holding capacity and availability of macronutrients (Belnap 1995). Crusts can also act as a competitor. Seeds may require morphological adaptations in order to penetrate and establish in well developed microbiotic crusts (Williams 1994). This relationship will help keep non-natives out of the system, under undisturbed conditions, while native plants will thrive because they have evolutionary adaptations to persist in this environment.

Fire is rare on these ecological sites because of low fuel loads, although, North American species of saltbush are highly tolerant of fire and resprouting may occur. Anthropogenic impacts including OHV’s are the primary disturbance impacting the vegetation on this site. Microbiotic soil crusts are well adapted to growing in severely limited environments, but are poorly adapted to compressional disturbances such as recreational activities including biking and hiking (USGS 2006). Recreational activities disturb the soil and break up microbiotic surfaces leading to increased wind and water erosion, decreased infiltration, soil stability, nutrient availability and changes in the plant community composition. In addition to damaging the microbiotic soil crust, increased anthropogenic disturbance results in soil compaction. Soil compaction reduces soil aggregates and pore spaces which are important for soil stability and infiltration (Belnap 1995). Vigor and reproduction of native plants, including shadscale, will suffer under these conditions. Anthropogenic disturbances are vectors or propagule introduction of non-native species. Potential invasive species on this site include redstem stork’s bill, African mustard and red brome.

Fires in the Mojave Desert are infrequent and of low severity because production of annual and perennial herbs seldom provides a fuel load capable of sustaining fire. Fire generally kills white bursage. However, most white

bursage plants burned because their canopies contained numerous small branches in proximity to herbaceous fuels. Torrey's ephedra has medium fire tolerance and is similar to Nevada ephedra. Fire typically destroys aboveground parts of Anderson wolfberry, but the degree of damage to the plant depends on fire severity.

State and transition model



State 1
Reference State

This state represents the natural range of variability under pristine conditions. Primary natural disturbance mechanisms affecting this ecological site are long-term drought and insect attack. Historically, this state experienced an extended fire return interval, which resulted in long-lived stable plant communities. These communities were sparsely vegetated, therefore soil stability was primarily provided by microbiotic soil crust.

Community 1.1
Reference Plant Community

The reference plant community is dominated by Fremont dalea, Torrey ephedra, Parry sandpaper plant, and white bursage. Silverleaf sunray, California bearpoppy, and desert pepperweed are other important plant species associated with this site. Potential vegetative composition is about 85% shrubs and 15% native forbs and grasses. Approximate ground cover (basal and crown) is less than 5 percent (~3%). Fremont's dalea is a deciduous shrub and has the ability to sprout from the root crown following fire. Dalea species have nitrogen-fixing capabilities and may increase the soil nitrogen level (Eskew and Ting 1978). Desert holly is remarkably drought resistant and has been known to survive extended periods of time even with negative water potential in the rooting zone. Parry's sandpaper plant is an evergreen shrub known for its rough sandpaper like foliage.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	30	64	106
Grass/Grasslike	3	6	10
Forb	2	5	9
Total	**35**	**75**	**125**

State 2
Invaded

The Invaded State is characterized by the presence of non-natives in the understory. A biotic threshold has been crossed with the introduction of non-native annuals that cannot be removed from the system. Ecological resiliency has been reduced by the presence of non-native annual species that have the potential to alter disturbance regimes significantly from their natural or historic range of disturbances alter disturbance regimes significantly from their natural or historic range of variability. Introduced annuals such as red brome, schismus and redstem stork's bill have invaded the reference plant community and have become a dominant component of the herbaceous cover. This invasion of non-natives is attributed to a combination of factors including: 1) surface disturbances, 2) changes in the kinds of animals and their grazing patterns, 3) drought, and 4) changes in fire history.

Community 2.1
Plant Community Phase 2.1

This plant community is compositionally similar to the Reference Plant Community with an understory of non-native annual species. In the absence of disturbance, ecological processes of this plant community have not been compromised by the presence of non-native species. PSFR and ATHY persist after invasion by non-native annuals, but other shrubs and desirable grasses may be unsuccessful in competing with the non-natives.

Community 2.2
Plant Community Phase 2.2

This plant community is characterized by reduced cover of microbiotic crust. Disturbances causing soil trampling removes microbiotic soil crust decreasing the stability of the site. Woody perennials persist through increased disturbance, however, native forbs and grasses experience decreased vigor and reproductive capacity. Non-native species remain in the understory.

Community 2.3
Plant Community Phase 2.3

This plant community is characterized by the loss of deep-rooted perennial vegetation. The soil surface is continually disturbed decreasing the cover of microbiotic crust. Non-native annuals take advantage of the increased available resources. This plant community is identified as “at risk”. The loss of microbiotic soil crust and perennial vegetative cover has reduced the ecological resistance and resilience. Management of this plant community should be focused on removing disturbances and protecting remnants of native vegetation.

Pathway 2.1a
Community 2.1 to 2.2

Anthropogenic disturbances disturb microbiotic soil crust reducing stability of the site.

Pathway 2.2a
Community 2.2 to 2.1

Management decision that decrease disturbance over the long term allow microbiotic crust to recover.

Pathway 2.2b
Community 2.2 to 2.3

Continued disturbance removes Fremont's dalea and other shrubby vegetation. Non-native annuals increase and microbiotic crusts are unable to recover.

Pathway 2.3a
Community 2.3 to 2.2

With time Fremont's dalea reestablishes from seed.

State 3
Eroded State

The Eroded State is characterized by reduced soil stabilization do to loss of vegetative cover and microbiotic soil crust. A biotic threshold has been crossed, with the loss of microbiotic soil crust leading to active soil erosion. This state is characterized by a new ecological equilibrium, one that includes reduced nutrient cycling and infiltration.

Community 3.1
Plant Community Phase 3.1

Vegetation is dominated by non-native annuals. Soil stability on the site is severely reduced. Active erosion easily occurs, including down cutting and the relocation of soil down slope, even during typical rainfall events.

Community 3.2
Plant Community Phase 3.2

This plant community is characterized by total loss of perennial vegetation and microbiotic soil crust. Gullies and rills are common to severe. Ecological processes have been greatly altered.

Pathway 3.1a
Community 3.1 to 3.2

Continued disturbance or large rainfall event increases the level of erosion.

Pathway 3.2a
Community 3.2 to 3.1

Non-native annuals germinate and establish even on a severely eroded site.

Transition 1
State 1 to 2

Introduction of non-natives due to anthropogenic impacts, including OHV use, dry land farming, grazing, linear corridors, mining, military training operations and settlements.

Transition 2
State 2 to 3

Severe and continuous disturbance or long term drought decreases microbiotic soil crust and vegetative cover.

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	**Perennial grasses**			1–4	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–2	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–2	–
	big galleta	PLRI3	*Pleuraphis rigida*	0–2	–
Forb					
2	**Perennial forbs**			1–11	
	southwestern ringstem	ANLE5	*Anulocaulis leiosolenus*	0–2	–
	California bearpoppy	ARCA4	*Arctomecon californica*	0–2	–
	Preuss' milkvetch	ASPR6	*Astragalus preussii*	0–2	–
	silverleaf sunray	ENAR	*Enceliopsis argophylla*	0–2	–
	Palmer's phacelia	PHPA13	*Phacelia palmeri*	0–2	–
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	0–2	–
3	**Annual forbs**			1–4	
Shrub/Vine					
4	**Primary shrubs**			39–84	
	Fremont's dalea	PSFR	*Psorothamnus fremontii*	15–26	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	8–19	–
	Parry's sandpaper plant	PEPA13	*Petalonyx parryi*	11–19	–
	burrobush	AMDU2	*Ambrosia dumosa*	2–8	–
	desert pepperweed	LEFR2	*Lepidium fremontii*	2–6	–
	water jacket	LYAN	*Lycium andersonii*	1–6	–
5	**Secondary shrubs**			2–11	
	catclaw acacia	ACGR	*Acacia greggii*	1–2	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	1–2	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	1–2	–
	cattle saltbush	ATPO	*Atriplex polycarpa*	1–2	–
	creosote bush	LATR2	*Larrea tridentata*	1–2	–
	woody crinklemat	TICA3	*Tiquilia canescens*	1–2	–
	Mojave woodyaster	XYTO2	*Xylorhiza tortifolia*	1–2	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the very low forage production. White bursage is of intermediate forage value. It is fair to good forage for horses and fair to poor for cattle and sheep. However, because there is often little other forage where white bursage grows, it is often highly valuable to browsing animals and is sensitive to browsing. Torrey’s ephedra is important winter forage for cattle and sheep. Torrey’s ephedra is moderately palatable to all domestic livestock especially as winter browse. Anderson wolfberry is sometimes used as forage by livestock and feral burros.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:

White bursage is an important browse species for wildlife. Torrey’s ephedra is an important browse species for big game. Torrey’s ephedra is moderately palatable to many big game species, especially as winter browse.

Hydrological functions

Available water capacity is very low and runoff is medium.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities for photographers and for nature study.

Other products

White bursage is a host for sandfood, a parasitic plant. Sandfood was a valuable food supply for Native Americans. Native Americans used the fleshy berries of Anderson wolfberry either fresh or boiled and then dried them for later use.

Other information

White bursage may be used to revegetate disturbed sites in southwestern deserts. Anderson wolfberry is also used as an ornamental valued chiefly for its showy red berries.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T19S R67E S3
General legal description	Approximately 3 miles west of Echo Bay. Landscapes immediately above Echo Wash, Lake Mead National Recreation Area, Clark County, Nevada.

Other references

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Contributors

GKB

Approval

Kendra Moseley, 3/10/2025

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)	P Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	07/19/2010
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare, but may be evident in areas recently subjected to summer convection storms.

2. **Presence of water flow patterns:** Water flow patterns are none to rare. A few waterflow patterns may be evident in areas recently subjected to summer convection storms. Where flow patterns are observed, they are short in length and stable.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare with occurrence typically limited to areas within water flow patterns.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground variable depending on amount of surface rock fragments and microbiotic crust.

5. **Number of gullies and erosion associated with gullies:** None

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during catastrophic events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 1 to 3. (To be field tested.)

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface soil structure is typically thick to moderate thin platy. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is less than 1percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Sparse shrub canopy, associated litter, and microbiotic crust break raindrop impact. Medium to fine textured surface soils have moderately rapid infiltration.

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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):** None. Platy or massive sub-surface horizons or gypsic horizons are not to be interpreted as compacted layers.

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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: Mojave Desert shrubs

    Sub-dominant: perennial forbs > perennial bunchgrasses = annual forbs

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; mature bunchgrasses commonly (±15%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (Trace)

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ±75lbs/ac.

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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:** Invaders on this site include annuals such as red brome, filaree, Mediterranean grass and African mustard.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average growing season years.