

## **Ecological site R030XB113NV SANDSTONE HILL 3-5 P.Z.**

Last updated: 3/10/2025  
Accessed: 05/10/2025

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### **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.

### **MLRA notes**

Major Land Resource Area (MLRA): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas.

The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity.

In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave.

Arid Eastern Mojave Land Resource Unit (XB)

### **LRU notes**

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Arid Eastern Mojave LRU where precipitation is bi-modal, occurring during the winter months and summer months. The Arid Eastern Mojave LRU is designated by the 'XB' symbol within the ecological site ID. This LRU is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. This LRU is essentially equivalent to the Eastern Mojave Basins and Eastern Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions

Elevations range from 1650 to 4000 feet and precipitation is between 4 to 8 inches per year. This LRU is

distinguished from the Arid Western Mojave (XA) by the summer precipitation, falling between July and September, which tends to support more warm season plant species. The 'XB' LRU is generally east of the Mojave River and the 117 W meridian (Hereford et. al 2004). Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, cacti, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

## Ecological site concept

This ecological site occurs on hill and mountain landforms below 3000 feet. Soils are derived from gypsiferous sedimentary rocks with very shallow depth to a lithic contact. Although small amounts of secondary gypsum may be visible in the soil profile, these soils do not have a gypsic horizon like the associated soils around them.

## Associated sites

R030XB017NV	<b>LIMY HILL 3-5 P.Z.</b>
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## Similar sites

R030XB079NV	<b>GYPSIC SLOPE 3-5 P.Z.</b> Desert holly and seepweed codominant shrubs; less productive site
R030XB026NV	<b>GYPSIC LOAM 3-5 P.Z.</b> Desert holly and Fremont's dalea codominant shrubs: less productive site
R030XA060NV	<b>GYPSIC LOAM 3-5 P.Z.</b> Seepweed and wolfberry codominant shrubs with desert holly
R030XB038NV	<b>GRAVELLY PEDIMENT 3-5 P.Z.</b> PLRI3 minor spp.; less productive site
R030XB116NV	<b>SHALLOW PEDIMENT 3-5 P.Z.</b> Desert holly dominant plant; less productive site

**Table 1. Dominant plant species**

Tree	Not specified
Shrub	(1) <i>Atriplex hymenelytra</i> (2) <i>Ambrosia dumosa</i>
Herbaceous	(1) <i>Pleuraphis rigida</i>

## Physiographic features

This site occurs on low sandstone hills having a northerly exposure. Slopes range from 8 to 75 percent, but slope gradients of 15 to 50 percent are most typical. Elevations are 1560 to about 3000 feet.

**Table 2. Representative physiographic features**

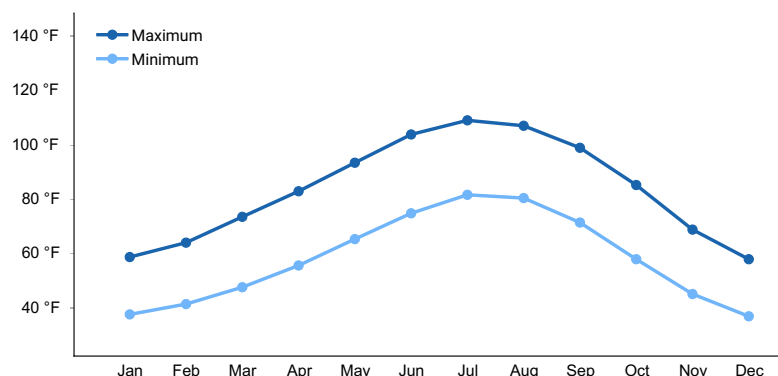
Landforms	(1) Hill
Elevation	1,560–3,000 ft
Slope	15–50%
Aspect	N

## 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 69 to 74 degrees F. The average growing season is about 300 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 soil associated with this site are very shallow, well drained soils that formed in colluvium and residuum derived from sedimentary rocks. Soils are coarse textured and water intake rates are moderate. Available water capacity is very low, runoff is very high, and the soils are well drained. Soil series included in this site include Ramshead.

**Table 4. Representative soil features**

Parent material	(1) Colluvium–sandstone
Surface texture	(1) Extremely flaggy sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	4–14 in
Surface fragment cover <=3"	15–20%
Surface fragment cover >3"	50–55%
Available water capacity (0-40in)	0.4–0.5 in
Calcium carbonate equivalent (0-40in)	5–15%
Electrical conductivity (0-40in)	2–8 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	15–70%

Subsurface fragment volume >3" (Depth not specified)	0–55%
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## Ecological dynamics

Desert holly is a long-lived evergreen desert shrub. This species is especially well adapted to the Mojave Desert environment. It has demonstrated some remarkable examples of drought resistance by surviving more than a week at -6Megapascals of water potential in the rooting zone. This phenomenon is aided by root association with endomycorrhizae (Cibils et al. 1998). Desert holly is most photosynthetically active during the winter months, at this time leaves are displayed horizontally to ensure optimal C4 photosynthesis. During the summer months, the leaves are highly reflective and angled, which effectively lowers leaf temperature and transpiration (Mooney et al. 1977). A thick coating of white, salt-filled epidermal hairs also decrease the effects of the intense sun (Pavlik 2008). Salt accumulations on the surface of leaves can also act as an herbivore deterrent (Cibils et al. 1998). These special leaf characteristics allow desert holly to remain evergreen in an extremely hot and dry environment.

White bursage is a drought-deciduous, rhizomatous shrub with stiff branches forming dense crown (Marshall 1994). White bursage is a pioneering species due to its ability to reproduce vegetatively and sexually (Marshall 1994).

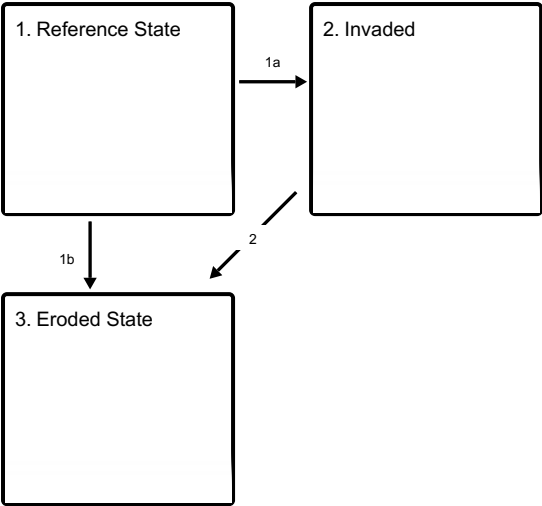
Disturbances associated with these sites consist of anthropogenic impacts. Historically, these sites would have rarely, if ever, experienced fires due to the sparse vegetative cover. Anthropogenic disturbances may cause soil compaction and disrupt the soil surface which decreases infiltration and overall stability of the soil. Reproduction and vigor of native plants suffer under these conditions. Rills are common, indicating water erosion is an important process. Biological soil crusts account for a significant portion of the ground cover. Once these crusts are disturbed, recovery is a slow process and may take decades for the crusts to recover to their pre-disturbance thickness (USGS 2006). Long-term degradation will lead to loss of site integrity.

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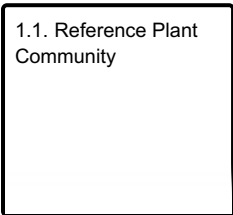
Fire generally kills white bursage. Range ratany is top-killed by fire. Range ratany resprouts from the root crown after fire. Fires in creosotebush scrub were an infrequent event in pre-settlement desert habitats, because fine fuels from winter annual plants were probably sparse, only occurring in large amounts during exceptionally wet winters. Fire kills many creosotebush. Creosotebush is poorly adapted to fire because of its limited sprouting ability. Creosotebush survives some fires that burn patchily or are of low severity. Fire most likely top-kills big galleta. Big galleta sprouts from rhizomes following fire. Damage to big galleta from fire varies, depending on whether big galleta is dormant when burned. If big galleta is dry, damage may be severe. However, when plants are green, fire will tend to be less severe and damage may be minimal, with big galleta recovering quickly.

## State and transition model

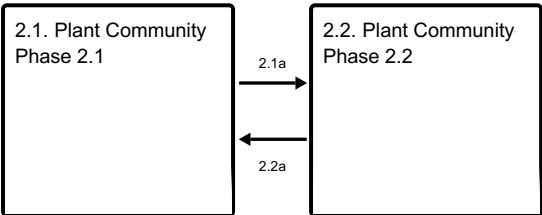
Ecosystem states



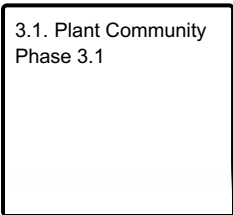
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1  
Reference State

This state represents the natural range of variability under pristine conditions and is dominated by drought tolerant native shrubs. Primary natural disturbance mechanisms affecting this ecological site are long-term drought and insect attack. Historically, wildfire was infrequent and patchy due to low fuel loading, resulting in long-lived stable plant communities. Timing of disturbance combined with weather events determines plant community dynamics.

Community 1.1  
Reference Plant Community

The reference plant community is dominated by desert holly. White bursage and big galleta are other important plant species in this community. Potential vegetative composition is about 15% perennial grasses, 5% forbs, and 80% shrubs. Approximate ground cover (basal and crown) is 10 to 20 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	160	320	480
Grass/Grasslike	30	60	90
Forb	10	20	30
<b>Total</b>	<b>200</b>	<b>400</b>	<b>600</b>

## 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-natives that cannot be removed from the system. The presence of non-natives has reduced the ecological resilience of the site. Following a disturbance this state relies on the availability of an offsite seed source. These non-natives have the potential to significantly alter disturbance regimes from their historic range or 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 similar to the Reference Plant Community with a trace of non-natives in the understory. At this time ecological function has not been compromised, however, ecological resilience is reduced by the presence of non-natives. ATHY and AMDU persist after invasion by non-native annuals, but the other shrubs and desirable grasses may be unsuccessful in competing with the non-natives.

### Community 2.2 Plant Community Phase 2.2

The plant community is characterized by loss of vegetation and soil crust. Relatively steep slopes and very high surface runoff make this site susceptible to erosion. Presence of rills and gullies has increased. This plant community is identified as "at risk". If disturbances are not controlled, site integrity will be lost and an irreversible threshold will be crossed.

#### Pathway 2.1a Community 2.1 to 2.2

Continued disturbance reduces cover of native shrubs and microbiotic soil crust.

#### Pathway 2.2a Community 2.2 to 2.1

Removing disturbances allows microbiotic soil crust to recover and native species to regenerate from seed.

## State 3 Eroded State

The Eroded State is characterized by severely decreased soil stabilization and increased rills and gullies. A biotic threshold has been crossed, with the loss of long-lived native vegetation and 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

This plant community is characterized by active erosion. Heavy and continued disturbance has removed vegetation and microbiotic soil crust. Bare ground is dominant.

### Transition 1a State 1 to 2

Introduction of non-native species through anthropogenic disturbances, including OHV use, dry land farming, grazing, linear corridors, mining, military training operations, and settlements.

### Transition 1b State 1 to 3

Anthropogenic disturbance removes vegetation and soil crust leading to increased erosion.

### Transition 2 State 2 to 3

Continued disturbance removes existing vegetation and remaining soil crust, leading to severe erosion.

## 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	Primary Perennial Grasses			40–100	
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	40–100	
2	Secondary Perennial Grasses			1–32	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	2–12	—
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	2–12	—
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	2–12	—
3	Annual Grasses			1–12	
Forb					
4	Perennial forbs			8–32	
5	Annual forbs			1–20	
Shrub/Vine					
6	Primary shrubs			203–440	
	desertholly	ATHY	<i>Atriplex hymenelytra</i>	120–200	—
	burrobush	AMDU2	<i>Ambrosia dumosa</i>	80–140	—
	jointfir	EPHED	<i>Ephedra</i>	1–40	—
	creosote bush	LATR2	<i>Larrea tridentata</i>	1–20	—
7	Secondary shrubs			1–40	
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	4–12	—
	cattle saltbush	ATPO	<i>Atriplex polycarpa</i>	4–12	—
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	4–12	—

## Animal community

Livestock Interpretations:

This site has limited value for livestock grazing, due to the low forage production, steep slopes and stony surfaces.

Big galleta is considered a valuable forage plant for cattle and domestic sheep. Its coarse, rigid culms make it relatively resistant to heavy grazing and trampling. 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. Range ratany is an important forage species for all classes of livestock. Palatability of range ratany is rated fair to good for cattle and sheep. Creosotebush is unpalatable to livestock. Consumption of creosotebush may be fatal to sheep.

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. Range ratany is an important forage species for deer. Mule deer browse range ratany year-long with seasonal peaks. Mule deer peak use is from February to April and from August to October. Creosotebush is unpalatable to most browsing wildlife.

### Hydrological functions

Available water capacity is very low, runoff is very high. Permeability is moderate.

### 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 to photographers and for nature study. This site is used for hiking and has potential for upland and big game hunting.

### Other products

White bursage is a host for sandfood, a parasitic plant. Sandfood was a valuable food supply for Native Americans. The Papago Indians used an infusion of the twigs externally for treating sore eyes and internally for dysentery. The roots provided them with a red dye for wool and other materials. The dye was also used as an ink. Creosotebush has been highly valued for its medicinal properties by Native Americans. It has been used to treat at least 14 illnesses. Twigs and leaves may be boiled as tea, steamed, pounded into a powder, pressed into a poultice, or heated into an infusion.

### Other information

Big galleta's clumped growth form stabilizes blowing sand. White bursage may be used to revegetate disturbed sites in southwestern deserts and serves as a nurse plant for creosotebush. Once established, creosotebush may improve sites for annuals that grow under its canopy by trapping fine soil, organic matter, and symbiont propagules. It may also increase water infiltration and storage.

### Type locality

Location 1: Clark County, NV	
Township/Range/Section	T20S R67E S6
UTM zone	N
UTM northing	4012330
UTM easting	721162
Latitude	36° 13' 50"
Longitude	114° 37' 21"
General legal description	Lake Mead National Recreation Area, Clark County, Nevada. About 1 mile east of Pinto Ridge on the east side of Pinto Valley. W Longitude 114°03'33" N Latitude 36°07'40"



## Other references

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## Contributors

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## 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	07/15/2010
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Rills are none to rare. Rock fragments armor the surface.

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2. **Presence of water flow patterns:** Water flow patterns none to rare.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are none.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground to 20%; surface rock fragments to 70%; shrub canopy 10-20%.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** A few wind-scoured spots may occur, but will be isolated and small in areal extent.

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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 storms. Persistent litter (large woody material) will remain in place except during catastrophic events.

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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):** Soil stability values should be 1 to 4. (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 structure is typically moderate medium platy. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically less than 1 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Shrub canopy and associated litter break rain drop impact.

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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

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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: deep-rooted, warm-season, perennial bunchgrass >> perennial forbs > annual forbs > deep-rooted, cool-

season, perennial bunchgrass = annual grasses

Other:

Additional:

- 
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; some of the mature bunchgrasses ( $\pm 25\%$ ) 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 (February thru April)  $\pm 400\text{lbs/ac}$ .
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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 red brome, fillaree, and Mediterranean grass.
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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years.
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