USDA Natural Resources
Conservation Service

Ecological site R030XB096NV
GRAVELLY SAND 3-5 P.Z.

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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.

Ecological site concept

This site occurs on summits and sideslopes of sand sheets overlying erosional fan remnant landforms. Slopes range from 2 to 30 percent, but slope gradients of 2 to 8 percent are most typical. Elevations are 550 to 2200 feet. The soil associated with this site are moderately deep to very deep and somewhat excessively drained. The coarse textured sand sheets are typically less than 20 inches to the underlying material.

This site is part of group concept R030XB148CA.

Associated sites

R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.**
R030XB037NV	**LIMY SAND 5-7 P.Z.**

Similar sites

R030XB037NV	**LIMY SAND 5-7 P.Z.** TIPA rare to absent
R030XB004NV	**SANDY 5-7 P.Z.** More productive site; PLRI3 and ACHY codominant grasses
R030XB063NV	**SANDHILL 5-7 P.Z.** More productive site; TIPA rare to absent
R030XB121NV	**SANDY PLAIN 3-5 P.Z.** TIPA rare to absent
R030XB019NV	**Eroded Fan Remnant Pavette 4-6 P.Z.** less productive site; LATR2 dominant plant on site
R030XB054NV	**SANDY 3-5 P.Z.** More productive site; TIPA rare to absent

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ambrosia dumosa* (2) *Tiquilia palmeri*
Herbaceous	(1) *Pleuraphis rigida*

Physiographic features

This site occurs on summits and sideslopes of sand sheets overlying erosional fan remnant landforms. Slopes

range from 2 to 30 percent, but slope gradients of 2 to 8 percent are most typical. Elevations are 550 to 2200 feet.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet
Elevation	168–671 m
Slope	2–30%

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 about 63 degrees F. The average growing season is about 300 to 340 days.

Table 3. Representative climatic features

Frost-free period (average)	340 days
Freeze-free period (average)	
Precipitation total (average)	127 mm

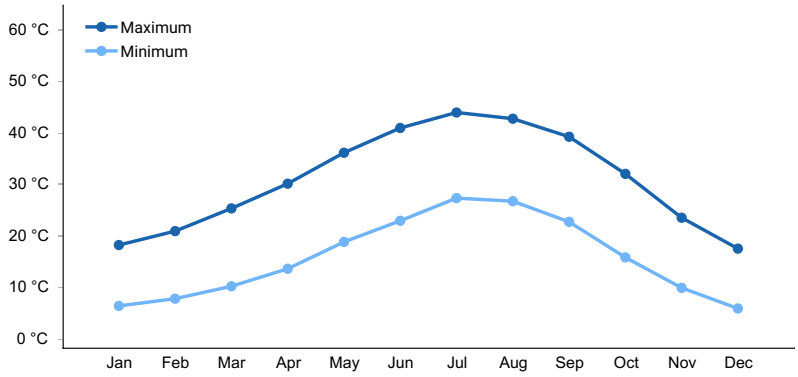


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soil associated with this site are moderately deep to very deep and somewhat excessively drained. The coarse textured sand sheets are typically less than 20 inches to the underlying material. Water intake rates are rapid and available water holding capacity is very low. Runoff is very low to very high. Rock fragments (primarily gravels) at the soil surface range from about 40 percent on summit areas to about 15 percent on sideslopes. Potential for erosion due to wind is moderate to high depending on amount of surface gravels. Soil series associated with this site include Rositas.

Table 4. Representative soil features

Surface texture	(1) Gravelly fine sand (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained

Permeability class	Rapid
Soil depth	102–213 cm
Surface fragment cover <=3"	15–40%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	2.29–6.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–50%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	2–48%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

White bursage and winterfat are common shrubs on this site. Big galleta is a long-lived, rhizomatous, warm-season perennial grass and appears as a clumped growth form as a result of short rhizomes it produces. Big galleta typically undergoes two growth periods to correspond with the bimodal pattern of precipitation that typifies the eastern Mojave Desert. This species is the most drought-tolerant of all the Pleuraphis species. Indian ricegrass, a cool-season bunchgrass, depends on moisture in the early growing season to complete its growth cycle. Winterfat retains its leaves through the winter and are shed in the spring with the initiation of new growth (Carey 1995).

This site is characterized by sandy soils which contribute to higher productivity and cover of perennial grasses. The primary organizing principle, for these ecological sites, is the inverse-texture hypothesis, which predicts that plant communities on coarse textured soils should have higher above-ground net primary productivity than communities on fine textured soils. Sandy or coarse textured soils have greater rates of infiltration and precipitation is percolated deeper into the soil profile. On sandy sites, the surface horizon dries out quickly and forms a barrier to the conductance and evaporation of water held in the deeper soil horizons (Lane et al. 1998). This process protects moisture from being lost to evaporation, increasing the available water in the soil profile and positively contributing to the primary productivity of these sites.

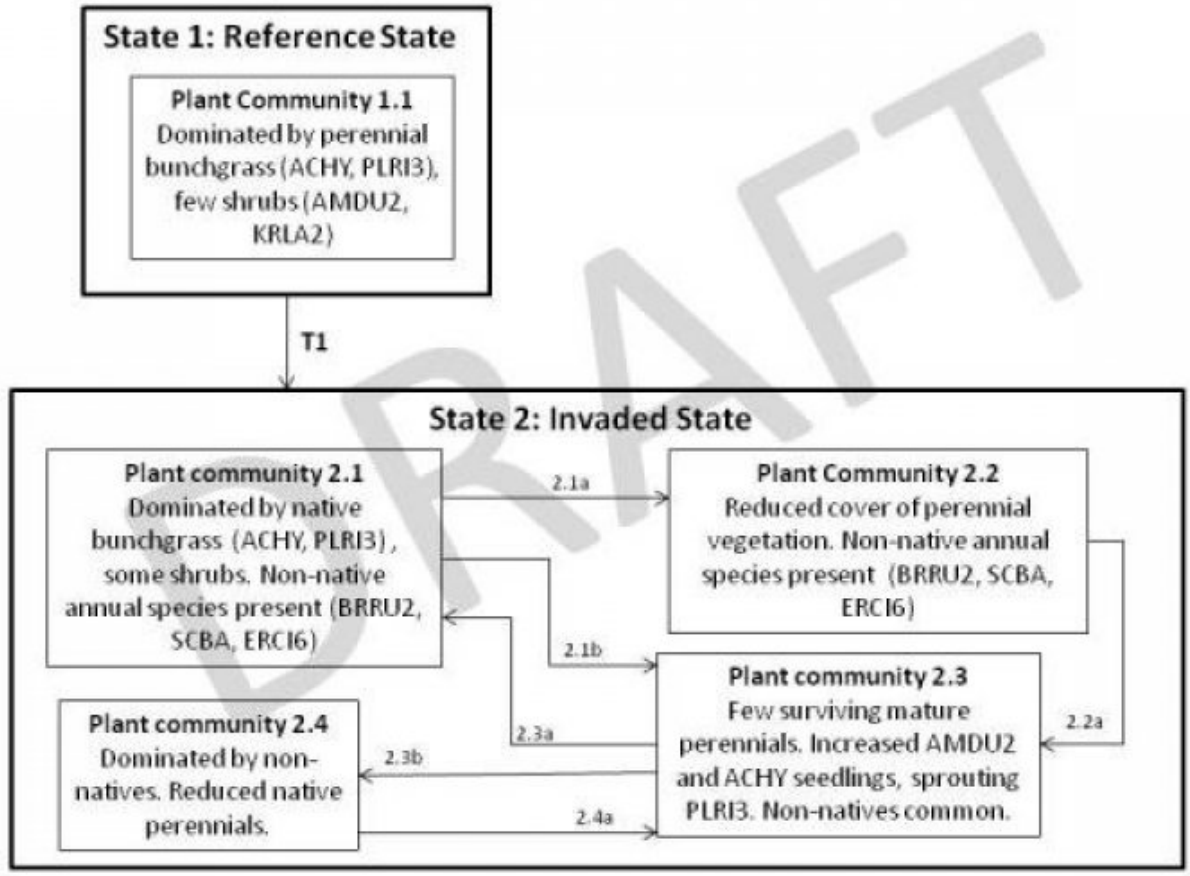
Variation in the timing and amount of rainfall is particularly important in favoring species with different physiological characteristics: there is strong relationship between summer rainfall patterns and desert grasslands (McClaran and Van Devender 1995). Perennial grass recruitment occurs from seeds, rihizomes and stolons. Rainfall and runoff is unevenly distributed across the landscape, contributing to the spatial distribution of functional and structural groups. Desert grasses are intensive exploiters, which mean the extract a large proportion of their moisture from shallow soil horizons (Burgess 1995). Intensive exploiters are very effective competitors for limited moisture and tend to be very resilient. Long-term drought greatly influences plant community dynamics. Drought induced canopy die-back and mortality, is common during periods of below average precipitation, especially among juveniles (Hamerlynck and McAuliffe 2008).

Historically, these sites would have experienced infrequent, stand replacing fires, carried by a relatively high cover of perennial grasses and shrubs (Brooks and Minnich 2006). Degree of fire damage is largely dependent on the seasonality of the burn. Plants in dormancy or during drought years may be adversely affected. Fire generally kills white bursage. However, most white bursage plants burned because their canopies contained numerous small branches in proximity to herbaceous fuels. Winterfat is either killed or top-killed by fire, depending on fire severity. Severe fire can kill the perennating buds located several inches above the ground surface and thus kills the plant. In

addition, severe fire usually destroys seed on the plant. Low-severity fire scorches or only partially consumes the aboveground portions of winterfat and thus does not cause high mortality. Range ratany is top-killed by fire. Range ratany resprouts from the root crown after fire. White ratany is partially or completely top-killed by fire. White ratany resprouts from the root crown after fire. 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.

Recreation impacts, such as trampling and OHV use can decrease the abundance and vigor of these native species, increase the nutrient availability, and provide pathways for propagule introduction (Webb et al. 2009). Loss of vegetative cover from natural or anthropogenic disturbances will result in establishment of non-native annual species (Sahara mustard, red brome, Mediterranean grass, red-stem filaree). The transition from natives to non-natives will result in increased erosion, increased susceptibility to fire and decreased habitat quality.

State and transition model



State 1
Reference State

This state represents the natural range of variability under pristine conditions. This state is dominated by perennial bunchgrasses and primary natural disturbance mechanisms affecting this ecological site are wildfire, long-term drought and insect attack. Timing for disturbance in combination with weather events determines plant community dynamics. This site may experience light to moderate grazing by wildlife. Additional run-in moisture aids in maintaining the community phases of this state, by favoring a greater dominance by grasses with a lesser component of shrubs. This site is distinguished by higher ecological resistance and resilience due to the increased annual production, additional moisture, and higher amounts of organic matter when compared to the surrounding

sites.

Community 1.1
Reference Plant Community

The reference plant community is dominated by white bursage, Palmer tiquilia (Coldenia), and big galleta. Potential vegetative composition is about 40% grasses, 10% annual and perennial native forbs and 50% shrubs. Approximate ground cover (basal and crown) is about 8 to 14 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	168	224	280
Grass/Grasslike	135	179	224
Forb	34	45	56
Total	**337**	**448**	**560**

State 2
Invaded

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. These non-natives annuals are highly flammable and promote wildfires where fires historically have been infrequent. AMDU and TIPA persist after invasion by non-native annuals. A biotic threshold has been crossed by the introduction of non-native annuals that cannot be removed from the system and will alter disturbance regimes significantly from their natural or historic range of disturbances. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of non-native annual species.

Community 2.1
Plant Community Phase 2.1

The plant composition is similar to the Reference Plant Community. Ecological function has not changed but the resilience has decreased due to the presence of non-native annuals.

Community 2.2
Plant Community Phase 2.2

This plant community is characterized by a reduction in perennial grass cover and an increase of non-native annuals and bare ground. Heavy disturbance has decreased the perennial vegetative cover that is beneficial for soil stabilization and nutrient cycling.

Community 2.3
Plant Community Phase 2.3

This plant community is characterized by few surviving mature perennials. Disturbance tolerant shrubs and rhizomatous bunchgrasses are scattered through the plant community. Loss of mature vegetation will encourage seedling growth of burrobush and Indian ricegrass. Seed is provided by surrounding unburned areas. Non-native annuals are common throughout the site.

Community 2.4
Plant Community Phase 2.4

This plant community is characterized by the dominance of non-native annuals; perennial vegetative cover is

severely reduced.

Pathway 2.1a
Community 2.1 to 2.2

Frequent and repeated disturbance, heavy grazing, small fire, or prolonged drought will decrease abundance of perennial bunchgrasses.

Pathway 2.1b
Community 2.1 to 2.3

Large fire will initially remove shrubs and perennial grasses.

Pathway 2.2a
Community 2.2 to 2.3

A decreased level of disturbance or a year with increased precipitation will encourage a flush of vegetative growth.

Pathway 2.3a
Community 2.3 to 2.1

Controlling disturbance on this site allows perennials to mature, successfully reproduce and return to dominance.

Pathway 2.3b
Community 2.3 to 2.4

Increased fire, resulting from a continuous bed of fine fuels reduces perennial vegetative cover.

Pathway 2.4a
Community 2.4 to 2.3

Reducing the level of disturbance initiates native species regeneration.

Transition 1
State 1 to 2

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

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			67–157	
	big galleta	PLRI3	*Pleuraphis rigida*	67–157	–
2	**Secondary Perennial Grasses**			9–36	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–13	–
	threeawn	ARIST	*Aristida*	2–13	–
	low woollygrass	DAPU7	*Dasyochloa pulchella*	2–13	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2–13	–
3	**Annual Grasses**			1–13	
Forb					
4	**Perennial Forbs**			9–22	
5	**Annual Forbs**			1–45	
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	1–45	–
Shrub/Vine					
6	**Primary Shrubs**			251–426	
	burrobush	AMDU2	*Ambrosia dumosa*	135–202	–
	Palmer's crinklemat	TIPA	*Tiquilia palmeri*	90–157	–
	white ratany	KRGR	*Krameria grayi*	9–22	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	9–22	–
7	**Secondary Shrubs**			22–67	
	sweetbush	BEJU	*Bebbia juncea*	4–13	–
	button brittlebush	ENFR	*Encelia frutescens*	4–13	–
	creosote bush	LATR2	*Larrea tridentata*	4–13	–
	wirelettuce	STEPH	*Stephanomeria*	4–13	–
	Mojave yucca	YUSC2	*Yucca schidigera*	4–13	–

Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. 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. Winterfat is an important forage plant for livestock in salt-desert shrub rangeland and subalkaline flats. Winterfat palatability is rated as good for sheep, good to fair for horses, and fair for cattle. Abusive grazing practices have reduced or eliminated winterfat on some areas even though it is fairly resistant to browsing. Grazing season has more influence on winterfat than grazing intensity. Early winter grazing may actually be beneficial. 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. White ratany is important forage for all classes of livestock. White ratany decreases in response to grazing. Under heavy grazing pressure white ratany produces phenolic acids to reduce herbivory by reducing the palatability.

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. Winterfat is an important forage plant for wildlife in salt-

desert shrub rangeland and subalkaline flats. Animals that browse winterfat include mule deer, Rocky Mountain elk, desert bighorn sheep, and pronghorn antelope. 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. It is one of the most important browse species for mule deer and desert bighorn sheep. Black-tailed jack rabbits rely almost exclusively on white ratany during the winter.

Hydrological functions

Runoff is very low to wery high. Permeability is rapid.

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.

Other information

Big galleta's clumped growth form stabilizes blowing sand. White bursage may be used to revegetate disturbed sites in southwestern deserts.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T31S R66E S35
General legal description	About two miles north of Laughlin, on river terraces along west side of Colorado River, Clark County, Nevada.

Other references

Brooks M. L. and R.A Minnich. 2006. Southeastern deserts bioregion. In: Sugihara, N.G., van Wagtendonk, J.W., Shaffer, K.E., Fites-Kaufman, J.Thode, A.E. (Eds.). Fire in California’s Ecosystems. The University of California Press, Berkeley, 576 pp.

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Robberecht, R. 1988. Big galleta grass - a warm-season bunchgrass in the Sonoran and Mojave Deserts. Rangelands 10.2: 58-60.

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Contributors

BLS/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.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground to 30-50%.

5. **Number of gullies and erosion associated with gullies:** Gullies are none.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to slight. If observed, wind scour spots are isolated and of small extent.

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.

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 5 on the sandy soil textures found on this site. (To be field tested.)

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

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., Indian ricegrass and big gallets] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact.

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

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 bunchgrasses >> perennial forbs > annual forbs > deep-rooted, cool season, perennial bunchgrasses > 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 (<20%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (10-15%) and depth of litter is ±¼ inch.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season ±400 lbs/ac.

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 Mediterranean grass, Red brome, mustards and filaree.

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years.
