

Ecological site R030XB231CA

Shallow To Moderately Deep Petrocalcic Fan Remnants (Provisional)

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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

Major Land Resource Area (MLRA) 30, Mojave Desert, 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 climate of the area is hot and dry. Hyperthermic and thermic soil temperature regimes are common with exceptions at higher elevations (generally above 5000 feet) where mesic, cryic and frigid soil temperature regimes may occur. Typic aridic soil moisture regimes are common and widespread throughout the MLRA. Elevations range from below sea level to over 12,000 feet in the higher mountain areas found within the MLRA. Due to the extreme elevational range found within this MLRA, Land Resource Units (LRUs) were designated to group the MLRA into similar land units. LRU Description The XB 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. Elevations range from 1800-5000 feet and precipitation ranges from 4-9 inches/year, but is generally between 5-6 inches. This LRU is characterized primarily by summer precipitation, which ranges from 18-35% but averages 25%. Summer precipitation falls between July and September in the form of rain, and winter precipitation falls starting in November and ends between February and March, also mostly in the form of rain; however it does receive between 0 and 3 inches of snow, with an average of 1 inch. The soil temperature regime is thermic and the soil moisture regime is typic-aridic. Vegetation includes creosote bush (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), Mojave yucca (*Yucca schidigera*) Joshua tree (*Yucca brevifolia*), chollas, cactus, big galleta grass (*Pleuraphis rigida*) and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush (*Coleogyne ramosissima*) is a common dominant shrub.

Ecological site concept

This site occurs on gently sloping alluvial fan remnants at elevations of approximately 3300 to 3900 feet. Soils have loamy to coarse loamy textures, and are shallow to moderately deep to a petrocalcic horizon. The soil moisture regime is typic aridic and the soil temperature regime is thermic. Creosote bush (*Larrea tridentata*) and winterfat (*Krascheninnikovia lanata*) are the dominant shrubs of the reference plant community, and big galleta (*Pleuraphis rigida*) is an important grass. Burrobush (*Ambrosia dumosa*) is an important secondary shrub that becomes more abundant as perennial grasses are lost with grazing. This species is more competitive on the shallow soils of this site than on adjacent deeper soils. Production reference value (RV) is 492 pounds per acre, and ranges from 332 to 691 pounds per acre depending on annual precipitation. Winterfat is more abundant on adjacent higher elevations, but does well on these well-drained moderately alkaline soils. Creosote bush is a dominant on most surrounding landforms at this elevation. Big galleta is less abundant on this site than on adjacent deeper soils with higher water holding capacity, but becomes dominant with disturbance that removes shrub competition.

Associated sites

R030XB107NV	COARSE GRAVELLY LOAM 5-7 P.Z. Occurs on adjacent fan remnants with steeper slopes. Blackbrush (<i>Coleogyne ramosissima</i>) and big galleta (<i>Pleuraphis rigida</i>) are dominant in undisturbed states.
R030XY222CA	Typic Aridic Ephemeral Drainageway Order 3 4-7" p.z. This site occurs on adjacent large ephemeral drainageways. Desert willow (<i>Chilopsis linearis</i>) and catclaw acacia (<i>Acacia greggii</i>) are important species.

R030XY227CA	Sandy Thermic Narrow Channels This site occurs on adjacent small ephemeral drainageways. Mojave desert plum (<i>Prunus eremophila</i>) and catclaw acacia (<i>Acacia greggii</i>) are characteristic species.
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Similar sites

R030XB043NV	CLAYPAN 5-7 P.Z. This site occurs on soils with an argillic horizon and a very deep petrocalcic horizon. Winterfat is trace if present, and big galleta is dominant.
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Larrea tridentata</i> (2) <i>Krascheninnikovia lanata</i>
Herbaceous	(1) <i>Pleuraphis rigida</i>

Physiographic features

This ecological site occurs on fan remnants with slopes of 1 to 4 percent. Elevations range from 3380 to 3870 feet. Runoff class is negligible to very low.

Table 2. Representative physiographic features

Landforms	(1) Fan remnant
Flooding frequency	None
Elevation	1,030 – 1,180 m
Slope	0 %
Aspect	Aspect is not a significant factor

Climatic features

Influencing water features

Soil features

The soils associated with this ecological site are very shallow to moderately deep over a petrocalcic horizon, and formed in alluvium derived from igneous, sedimentary, and metamorphic rock. They are well drained with slow to moderately rapid permeability. The soil moisture regime is typic aridic and the soil temperature regime is thermic. Surface rock fragments smaller than 3 inches in diameter range from 20 to 22 percent, and larger fragments generally are not present. The surface texture is sandy loam. Subsurface textures are fine

sandy loam, cemented loamy sand, and cemented sandy loam, and sandy loam. Subsurface rock fragments smaller than 3 inches in diameter range from 5 to 13 percent by volume, and larger fragments are typically not present (for a depth of 0 to 39 inches). The dominant soils correlated to this site include Baldspot (loamy, mixed, superactive, thermic, shallow calcic Petrocalcids) and Bluesnake (coarse-loamy, mixed, superactive, thermic, calcic Petrocalcids). A minor component of Yorktain (fine-loamy, mixed, superactive, thermic, argic Petrocalcids) is also correlated to this site. Baldspot soils are very shallow to shallow over a thick cemented petrocalcic horizon, and are derived from igneous and sedimentary rock. Bluesnake soils are moderately deep and are derived from metamorphic and sedimentary rock, and Yorktain soils are moderately deep and derived from limestone and dolomite.

This ecological site has been correlated with the following mapunits and soil components in the Mojave National Preserve soil survey area (CA795):

Mapunit symbol ; Mapunit name ; Component ; Phase ; Percent

208 ; Bluesnake loamy sand, 1 to 4 percent slopes ; Bluesnake ; ; 90

405 ; Baldspot sandy loam, 1 to 4 percent slopes ; Baldspot ; ; 85

204 ; Noshade fine sandy loam, 1 to 4 percent slopes ; Baldspot ; ; 6

402 ; Yorktain complex, 1 to 4 percent slopes ; Yorktain ; cool ; 5

Table 3. Representative soil features

Surface texture	(1) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderately rapid
Soil depth	20 – 100 cm
Surface fragment cover <=3"	20 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	2.03 – 9.65 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified

Soil reaction (1:1 water) (0-101.6cm)	6.1 – 8.6
Subsurface fragment volume <=3" (Depth not specified)	10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Abiotic factors

This site occurs on gently sloping alluvial fan remnants at elevations of approximately 3300 to 3900 feet. Soils have loamy to coarse loamy textures, and are shallow to moderately deep to a petrocalcic horizon. The soil moisture regime is typic aridic and the soil temperature regime is thermic. Creosote bush and winterfat are the dominant shrubs of the reference plant community, and big galleta is an important grass. Burrobush is an important secondary shrub that becomes more abundant as perennial grasses are lost with grazing. This species is more competitive on the shallow soils of this site than on adjacent deeper soils. Production reference value (RV) is 492 pounds per acre, and ranges from 332 to 691 pounds per acre depending on annual precipitation. Winterfat is more abundant on adjacent higher elevations, but does well on these well-drained moderately alkaline soils. Creosote bush is a dominant on most surrounding landforms at this elevation. Big galleta is less abundant on this site than on adjacent deeper soils with higher water holding capacity, but becomes dominant with disturbance that removes shrub competition.

Disturbance dynamics

The disturbances impacting this plant community are fire, invasion by non-native annual species, livestock grazing, and land-clearing for dryland farming.

Prior to European settlement, fire in this ecological site was likely relatively rare due to low abundance of fine fuels between shrubs, and patchy perennial grasses (e.g. Brown and Minnich 1986, Brooks and Matchett 2006, Brooks et al. 2007). The low moisture holding capacity in these shallow to moderately deep soils do not support an abundant annual community, but one or multiple years of heavy winter precipitation such as occurs during El Nino events (Hereford et al. 2006), or heavy summer precipitation could lead to a relatively heavy standing crop of native annuals in intershrub spaces, providing a continuous fine fuel layer that could carry a fire (Brown and Minnich 1986, Minnich 2003). Years of heavy summer or early fall precipitation that lead to high production in big galleta, also increasing fire likelihood (Minnich 2003). The dominant shrubs, creosote bush and winterfat, are killed by moderate to high severity fire (Carey 1995, Brooks et al. 2007), and typically take many years to recolonize after a stand-clearing fire (e.g Brown and Minnich 1986, Brooks et al. 2007, Engel and Abella 2011, Steers and Allen 2011). Following fire, big galleta gains dominance in this site, and annuals greatly increase in abundance with release from competition with shrubs, and this increase in fine fuels increases the likelihood of repeat burning.

Naturalization of non-native annual species such as red brome (*Bromus rubens*), common Mediterranean grass (*Schismus barbatus*), cheatgrass (*Bromus tectorum*), and redstem storks bill (*Erodium cicutarium*) with European exploration and settlement from the 1860s through the 1900s (e.g. Brooks and Chambers 2011) caused a transition from the reference state, which contained only native species, to a state that included non-native species (State 2). Invasion by non-native annual grasses is thought to have increased flammability of invaded Mojave Desert shrublands by providing higher levels of fine fuels (e.g. Brown and Minnich 1986, Brooks et al. 2004, Brooks and Chambers 2011). After fire, these communities appear to be more susceptible to invasion by exotic grasses, which may lead to a grass-fire cycle (D'Antonio and Vitousek 1992). In this ecological site, abundance of native annuals and big galleta was found to be more significant after disturbance than invasion by non-native annuals, although non-native annuals certainly have the potential to become a problem. Winterfat re-establishment is greatly suppressed by the presence of abundant annual grasses and can also be suppressed by native perennial grasses, which typically recover well after fire (Woodmansee and Potter 1971, Hild et al. 2007); thus recurrent fire can prevent winterfat recovery.

Ranching was established in the eastern Mojave desert in approximately 1875 (Nystrom 2003). Grazing occurred unregulated in the area until the passage of the Taylor Grazing Act in 1934, which divided public land into allotments that were regulated by the Bureau of Land Management (BLM), and among other things, called for fenced ranges and multiple developed water sources (http://www.blm.gov/wy/st/en/field_offices/Casper/range/taylor.1.html). The Federal Land Policy and Management Policy Act of 1976 (FLPMA) brought further regulations, including 10-year grazing permits. In 1994 the California Desert Protection Act created the Mojave National Preserve, and the National Park Service took over management of grazing allotments in much of the eastern Mojave Desert where this site occurs. All of the area occupied by this ecological site within the Mojave National Preserve was retired from grazing in

Heavy cattle grazing in the arid west has been shown to have numerous negative effects on vegetative communities, including decreases in cryptogram crust cover, seedling survival, total biomass, perennial grass and shrub cover, and litter cover (Jones 2000). In addition, soils and hydrology may be impacted, with reduced infiltration, increased runoff and erosion (e.g. Rauzi and Hanson 1966, Rauzi and Smith 1973, Jones 2000), and soil compaction (Rauzi and Hanson 1966, Abdel-Magid et al. 1987). Grazing in winterfat dominated communities has been demonstrated to increase soil compaction, lower soil aggregate stability, increase bare ground cover and decrease winterfat, biological crust, and litter cover (Rasmussen and Brotherson 1986, Matney 2010). Grazing may cause shifts in species composition from more palatable to less palatable species, and to species more tolerant of mechanical disturbance, or with a shorter life-cycle (Rasmussen and Brotherson 1986). Ten years of monitoring (1970 to 1980) of a grazing system where sites were rested every other year in the Arizona strip of the Mojave Desert, which has similar climatic and environmental characteristics as this site, found an upward trend in winterfat and burrobush cover, and typically (but not always) downward trends on big galleta cover (Hughes 1982). Higher utilization, e.g. above 50 percent, caused loss of native perennial grasses (Hughes 1982), potentially causing a permanent shift to a degraded state. This state has not been observed in this ecological site, and is not included in the state-and-transition model; however, land managers should be aware that the potential for a permanent transition with sustained heavy grazing exists.

Large portions of this ecological site were cleared for dryland farming and homesteading in the early 1900s to 1920s (Carpenter et al. 1986, Sharp and Moore 2004). Existing vegetation was chained and soils were plowed, but most were abandoned by 1930 (Carpenter et al. 1986). Many of these cleared areas were subsequently grazed until 2000. Recovery of these cleared areas resembles recovery after fire; big galleta is strongly dominant, the dominant shrubs are greatly reduced, overall diversity is higher, and annual species are more abundant.

All tabular data listed for a specific community phase within this ecological site description represent a summary of one or more field data collection plots taken in modal communities within the community phase. Although such data are valuable in understanding the phase (kinds and amounts of ground and surface materials, canopy characteristics, community phase overstory and understory species, production and composition, and growth), they do not represent the absolute range of characteristics or an exhaustive listing of all species that may occur in that phase over the geographic range of the ecological site.

State and transition model

Figure 1. R030XB231CA

Additional community tables

Table 4. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 5. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	Shrubs			280-549	
	creosote bush	LATR2	Larrea tridentata	110-217	10-15
	winterfat	KRLA2	Krascheninnikovia lanata	87-174	4-6
	Nevada jointfir	EPNE	Ephedra nevadensis	58-114	1-3
	burrobush	AMDU2	Ambrosia dumosa	16-31	4-6
	water jacket	LYAN	Lycium andersonii	0-11	0-5
	littleleaf ratany	KRER	Krameria erecta	6-10	1-2
	Mojave yucca	YUSC2	Yucca schidigera	0-4	0-1
	rayless goldenhead	ACSP	Acamptopappus sphaerocephalus	0-4	0-1
	threadleaf snakeweed	GUMI	Gutierrezia microcephala	0-4	0-1
Grass/Grasslike					
2	Perennial Grasses			48-95	
	big galleta	PLRI3	Pleuraphis rigida	37-73	6-10
	bush muhly	MUPO2	Muhlenbergia porteri	12-24	1-3
3	Native Annual Grasses			0-30	
	sixweeks grama	BOBA2	Bouteloua barbata	0-30	0-4

Forb					
4	Perennial Forbs			28-56	
	desert trumpet	ERIN4	<i>Eriogonum inflatum</i>	15-29	1-2
	Mojave woodyaster	XYTO2	<i>Xylorhiza tortifolia</i>	8-16	1-2
	whitestem paperflower	PSCO2	<i>Psilostrophe cooperi</i>	3-6	1-2
	whitemargin sandmat	CHAL11	<i>Chamaesyce albomarginata</i>	0-2	0-1
5	Native Annual Forbs			0-2	
	manybristle chinchweed	PEPA2	<i>Pectis papposa</i>	0-2	0-1
6	Non-native Annual Forbs			0-2	
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-2	0-1
Tree					
7	Trees			0-43	
	Jaeger's Joshua tree	YUBRJ	<i>Yucca brevifolia var. jaegeriana</i>	0-43	0-1

Table 6. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Shrub/Vine					
1	Shrubs			336-471	
	creosote bush	LATR2	<i>Larrea tridentata</i>	123-184	2-4
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	47-71	4-6
	Cooper's goldenbush	ERCO23	<i>Ericameria cooperi</i>	43-64	4-6
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	26-38	4-6
	water jacket	LYAN	<i>Lycium andersonii</i>	11-16	1-3
	burrobrush	HYSA	<i>Hymenoclea salsola</i>	8-11	5-7
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	8-11	1-3
	rayless goldenhead	ACSP	<i>Acamptopappus sphaerocephalus</i>	3-4	3-5
	threadleaf snakeweed	GUMI	<i>Gutierrezia microcephala</i>	3-4	1-3
Grass/Grasslike					
2	Perennial Grasses			325-452	
	big galleta	PLRI3	<i>Pleuraphis rigida</i>	221-330	10-15
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	26-39	1-3
	bush muhly	MUPO2	<i>Muhlenbergia porteri</i>	13-20	3-5
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	0-6	0-1
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0-6	0-1
3	Native Annual Grasses			0-262	
	sixweeks grama	BOBA2	<i>Bouteloua barbata</i>	0-262	0-25
4	Non-native Annual Grasses			0-2	
	red brome	BRRU2	<i>Bromus rubens</i>	0-1	0-1
	common Mediterranean grass	SCBA	<i>Schismus barbatus</i>	0-1	0-1
Forb					
5	Perennial Forbs			33-45	
	whitestem paperflower	PSCO2	<i>Psilostrophe cooperi</i>	10-16	3-5
	desert globemallow	SPAM2	<i>Sphaeralcea ambigua</i>	3-6	1-2
6	Native Annual Forbs			0-48	
	Sonoran sandmat	CHMI7	<i>Chamaesyce micromera</i>	0-40	0-6
	largebract spiderling	BOWR	<i>Boerhavia wrightii</i>	0-3	0-1

	bristly fiddleneck	AMTE3	<i>Amsinckia tessellata</i>	0-1	0-1
	little deserttrumpet	ERTR8	<i>Eriogonum trichopes</i>	0-1	0-1
	evening primrose	OENOT	<i>Oenothera</i>	0-1	0-1
	manybristle chinchweed	PEPA2	<i>Pectis papposa</i>	0-1	0-1
7	Non-native Annual Forbs			0-69	
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-69	0-3
Tree					
8	Trees			0-11	
	Jaeger's Joshua tree	YUBRJ	<i>Yucca brevifolia var. jaegeriana</i>	0-11	0-1

Table 7. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

Winterfat provides highly valuable winter forage for native browsers and domestic wildlife (e.g. Carey 1995, Matney 2010). Big galleta is a valuable forage plant for livestock, and is especially palatable after summer rains (Williams 2003). Declines in big galleta were observed with grazing in burned Utah blackbrush communities (Hughes 2002), and in intact creosote bush communities in Arizona (Hughes 1982). Declines in both communities occurred regardless of grazing management system, and are likely due to heavy utilization during periods of drought (Hughes 1982).

Inventory data references

High intensity sampling (Caudle et al. 2013) was used to describe this ecological site. Site characteristics such as aspect, slope, elevation and UTMS were recorded for each plot, along with complete species inventory by ocular percent cover. The line-point intercept method was used to measure foliar cover, groundcover, and vegetation structure. At either 300 or 100 points along a 600- or 400-foot step transect, ground cover and intercepted plant species were recorded by height. The first hit method (Herrick et al. 2009) was used to generate the foliar cover values entered in the community phase composition tables. Annual production was estimated using the double-weight sampling method outlined in the National Range and Pasture Handbook and in Sampling Vegetation Attributes (NRCS 2003 and Interagency Technical Reference 1999 pgs. 102 - 115). For herbaceous vegetation, ten 9.6 square foot circular sub-plots were evenly distributed along a 200 foot transect. For woody and larger herbaceous species production was estimated in four 21 foot X21 foot square plots along the same transect. Weight units were collected for each species encountered in the production plots. The number of weight units for each species is then estimated for all plots. Community Phase 2.1: 2011CA795070 (Type location) 11CA795104 2011CA795067 Community Phase 2.2: 2012CA795091

Type locality

Location 1: San Bernardino County, CA	
Township/Range/Section	T12 R18 S22
UTM zone	N
UTM northing	3886359
UTM easting	679429
General legal description	Approximately 29 miles southeast of Town of Nipton in the Mojave National Preserve.

Other references

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Contributors

Alice Miller

Approval

Marji Patz, 6/12/2025

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)	
Contact for lead author	
Date	08/27/2026
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:

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

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:

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

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

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

16. Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future

establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:

17. Perennial plant reproductive capability:
