USDA Natural Resources Conservation Service

Ecological site R030XB137CA
Granitic Loam

Accessed: 07/17/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

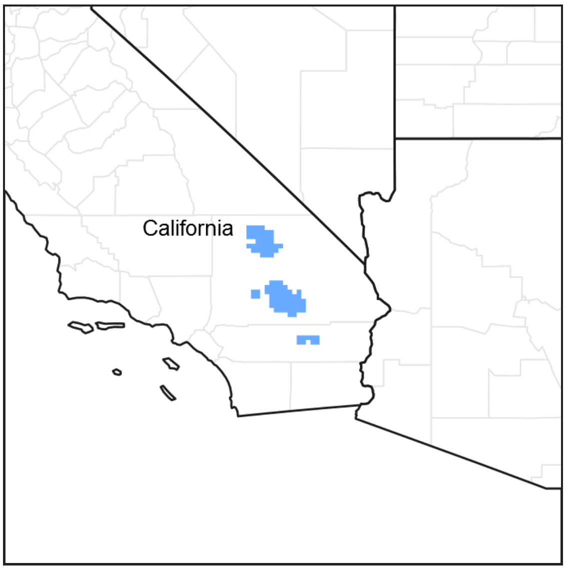

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

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

MLRA Description:

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 (primarily hyperthermic and thermic; however at higher elevations, generally above 5000 feet, mesic, cryic and frigid) and dry (aridic). 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:

This LRU (designated by 'XB') 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 to 5000 feet and precipitation ranges from 4 to 9 inches per year, but is generally between 5-6 inches. This LRU is characterized primarily by the summer precipitation it receives, ranging 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, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, chollas, cactus, 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 sand sheets, fan aprons, fan aprons over fan remnants, and fan remnants at elevations of 1300 to 4200 feet. This site benefits from additional run-in moisture from adjacent upslope areas; the typical surface flooding regime is very rare sheet flow. Soils are very deep stratified coarse sands, or have an argillic horizon below sandy or sandy loam horizons.

Production reference value (RV) is 405 pounds per acre, and ranges from 193 to 590 pounds per acre with variability due to annual precipitation and grass and annual forb production. The reference plant community consists of widely spaced creosote bush (Larrea tridentata) over big galleta (Pleuraphis rigida) and burrobush (Ambrosia dumosa). Additional run-in supports big galleta, and deep sandy soils support creosote bush. The additional run-in, and argillic horizon found in many of the soils correlated with this site supports burrobush.

Classification relationships

Mojave Creosotebush Scrub (Holland, 1986)

Larrea tridentata - Ambrosia dumosa Shrubland Alliance, specifically the Larrea tridentata - Ambrosia dumosa/Pleuraphis rigida Sandy Association (Sawyer et al. 2009)

Associated sites

R030XB005NV	**Arid Active Alluvial Fans** This site occurs on adjacent fan remnants. Creosote bush (Larrea tridentata) and burrobush (Ambrosia dumosa) are dominant.
R030XB136CA	**Dry Wash** This site occurs on adjacent ephemeral washes. Burrobrush (Hymenoclea salsola) and creosote bush (Larrea tridentata) are important species.
R030XB148CA	**Sandy Plain** This site occurs on adjacent sand sheets. Big galleta (Pleuraphis rigida) and creosote bush (Larrea tridentata) are dominant.
R030XB150CA	**Sandhill 3-5" P.Z.** This site occurs on adjacent sand hills. Big galleta (Pleuraphis rigida) and creosote bush (Larrea tridentata) are dominant.
R030XB218CA	**Moderately Deep To Very Deep Loamy Fan Remnants** This site occurs on adjacent fan aprons over fan remnants. Burrobush (Ambrosia dumosa), Hall's shrubby spurge (Tetracoccus hallii), and creosote bush (Larrea tridentata) are co-dominant.
R030XY159CA	**Gravelly Outwash** This site occurs on adjacent fan aprons. Desertsenna (Senna armata) and creosote bush (Larrea tridentata) are dominant.

Similar sites

R030XB007NV	**GRANITIC LOAM 5-7 P.Z.** Same ecological site
R030XB150CA	**Sandhill 3-5" P.Z.** Sandhill 3-5" P.Z. [AMDU2 minor shrub; more productive site]
R030XB018NV	**GRANITIC LOAM 3-5 P.Z.** Granitic Loam 3-5" P.Z. [ENFA important shrub]
R030XB148CA	**Sandy Plain** Sandy Plain 3-5" P.Z. [more productive site; AMDU2 minor shrub]

R030XB134CA	**Cobbly Claypan 5-7" P.Z.** Cobbly Claypan 5-7" P.Z. - More productive site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Larrea tridentata* (2) *Ambrosia dumosa*
Herbaceous	(1) *Pleuraphis rigida*

Physiographic features

This site occurs on sand sheets, fan aprons, fan aprons over fan remnants, and fan remnants. This site benefits from additional run-in moisture from adjacent upslope areas. Elevations are 1300 to 4200 feet. Slopes range from 0 to 30 percent, but slope gradients under 8 percent are typical. Surface flooding may be none to rare, but a very rare flooding regime is typical. Runoff class is very low to low.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Fan apron (3) Fan remnant
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	396–1,280 m
Slope	0–30%
Aspect	Aspect is not a significant factor

Climatic features

The climate on this site is arid characterized by warm, moist winters (30 to 60 degrees F) and hot, dry summers (70 to 100 degrees F). The average annual precipitation ranges from 2 to 7 inches with most falling as rain from November to March. Approximately 25% of the annual precipitation occurs from July to September as a result of summer convection storms. Mean annual air temperature is 61 to 73 degrees F.

The average frost-free period is 240 to 360 days.

Table 3. Representative climatic features

Frost-free period (average)	360 days
Freeze-free period (average)	365 days
Precipitation total (average)	178 mm

Influencing water features

This site benefits from additional run-in moisture from adjacent upslope areas.

Soil features

The dominant soils associated with this ecological site are very deep, and formed in alluvium derived from granitic sources. Surface textures are coarse sand, loamy sand, gravelly sandy loam, very gravelly loamy sand, and sand.

Subsurface textures are loamy fine sand, gravelly loamy coarse sand, loamy fine sand, loamy sand and sandy loam.. Surface gravels (< 3 mm in diameter) range from 0 to 50 percent, typically with no larger fragments. Subsurface gravels by volume (for a depth of 0 to 59 inches) range from 3 to 40 percent, typically with no larger fragments present. Soils are well to somewhat excessively drained with moderately rapid to very rapid permeability.

This ecological site is associated with major components (15 percent or greater) of the following soil series: Cajon (Mixed, thermic Typic Torripsamments); Gravesumit (Coarse-loamy, mixed, superactive, thermic Typic Calciargids); Helendale (Coarse-loamy, mixed, superactive, thermic Typic Haplargids); Goldivide (Coarse-loamy, mixed, superactive, thermic Typic Haplargids); and Rositas stony (Mixed, hyperthermic Typic Torripsamments). It is correlated with minor components of Bluepoint (Mixed, thermic, Typic Torripsamment); Arizo overblown (Sandy-skeletal, mixed, thermic Typic Torriorthents); Joshua (Fine-loamy, mixed, superactive, thermic Argidic Argidurids); Livefire (Sandy, mixed, thermic Typic Torriorthents); Daisy (Loamy, mixed, superactive, thermic Arenic Calciargids); Granitepass (Coarse-loamy, mixed, superactive, calcareous, thermic Typic Torriorthents); and higher order Typic Torriorthents.

The Cajon soils consist of layers of stratified sand. Gravesumit, Goldivide and Helendale soils have an argillic horizon. In Gravesumit soils the argillic occurs at depths of 10 inches, and is up to 60 inches thick; this horizon is also calcic. In Goldivide soils the argillic occurs at depths of 16 to 33 inches, and in Helendale soils occurs at depths of 1 to 10 inches, and is up to 48 inches thick (Bt-Bt5 horizons). The Rositas soils formed in eolian materials and occur on sandsheets, and are not typical for this ecological site. When correlated with this ecological site they have a stony phase, and are more stable.

This ecological site is correlated with the following soil survey areas, map units and soil components (Soil survey area; Mapunit symbol; Mapunit name; Component; phase; percent):

CA699 Twenynine Palms Marine Corps Air Ground Combat Center
CA699;100;Cajon-Pipeflat association, 2 to 8 percent slopes;Cajon;;60
CA699;103;Cajon-Calcio-Edalph complex, 2 to 4 percent slopes;Cajon;;55
CA699;105;Cajon-Arizo-Bluepoint complex, 2 to 8 percent slopes;Cajon;;40
CA699;107;Cajon complex, 2 to 4 percent slopes;Cajon;;50
CA699;108;Cajon loamy sand, 2 to 8 percent slopes;Cajon;;85
CA699;237;Edalph-Cajon association, 4 to 30 percent slopes;Cajon;sloping;35
CA699;261;Twobitter-Cajon-Arizo complex, 2 to 8 percent slopes;Cajon;;30
CA699;270;Arizo extremely gravelly loamy sand, 2 to 8 percent slopes;Arizo;overblown;2
CA699;278;Arizo extremely gravelly loam, 8 to 15 percent slopes;Arizo;overblown;3
CA699;360;Cajon-Gravesumit-Haleburu complex, 2 to 50 percent slopes;Bluepoint;stony;2
CA699;110;Bluepoint sand, 2 to 8 percent slopes;Cajon;;7
CA699;121;Eastrange-Gayspass-Edalph complex, 8 to 50 percent slopes;Cajon;;4
CA699;151;Rositas sand, 4 to 30 percent slopes;Cajon;;2
CA699;160;Bluepoint association, 4 to 30 percent slopes;Cajon;;1
CA699;170;Pipeflat loamy sand, 2 to 4 percent slopes;Cajon;;4
CA699;200;Narea-Macagce-Edalph complex, 0 to 8 percent slopes;Cajon;;7
CA699;203;Narea-Desfirex-Edalph complex, 2 to 8 percent slopes;Cajon;;5
CA699;205;Bluepoint-Pipeflat-Cajon association, 0 to 4 percent slopes;Cajon;;15
CA699;222;Badlands-Eastrange association, 8 to 30 percent slopes;Cajon;;6
CA699;223;Gayspass complex, 8 to 30 percent slopes;Cajon;;3
CA699;230;Edalph loamy sand, 2 to 8 percent slopes;Cajon;;4
CA699;231;Calcio-Edalph-Calcio, dry complex, 0 to 8 percent slopes;Cajon;rarely flooded;5
CA699;294;Arizo complex, 2 to 4 percent slopes;Cajon;rarely flooded;6
CA699;298;Arizo complex, 2 to 4 percent slopes, frequently flooded;Cajon;rarely flooded;6
CA699;300;Narea-Edalph-Macagce complex, 0 to 30 percent slopes;Cajon;;6
CA699;361;Cajon coarse sand, 0 to 4 percent slopes;Cajon;;3
CA699;372;Calcio-Edalph-Desfirex complex, 2 to 4 percent slopes;Cajon;;7
CA699;601;Urban land-Cajon complex, 2 to 8 percent slpoes;Cajon;;35
CA699;144;Sunrock-Lava flows complex, 8 to 30 percent slopes, extremely stony;Rositas;;2
CA699;210;Kentonmill-Lava flows complex, 0 to 2 percent slopes;Rositas;;2
CA699;120;Eastrange gravelly sandy loam, 8 to 30 percent slopes;Typic Torriorthents;moist;4
CA699;276;Arizo, dry-Twobitter association, 2 to 8 percent slopes;Typic Torriorthents;occasionally flooded;3

CA699;279;Arizo sand, 2 to 4 percent slopes;Typic Torriorthents;;3

CA794 Joshua Tree National Park
CA794;4064;Gravesumit-Helendale complex, 2 to 4 percent slopes;Gravesumit;;55; Helendale;sandy surface;35
CA794;4275;Pinkcan-Werewolf-Gocougs association, 2 to 8 percent slopes;Gravesumit;;2; Joshua;;3

CA698 Mojave Desert Area, West Central Part
CA698;4602;Ironped-Gravesumit-Typic Haplocalcids association, 2 to 15 percent slopes;Gravesumit;;20
CA698;3511;Arizo extremely gravelly loamy sand, 2 to 8 percent slopes;Arizo;overblown;2
CA698;3501;Cajon coarse sand, 0 to 4 percent slopes;Cajon;;3
CA698;3550;Olympus-Cajon complex, 2 to 8 percent slopes;Cajon;;1
CA698;4020;Narea-Edalph-Macagce complex, 0 to 30 percent slopes;Cajon;;6
CA698;4150;Gayspass complex, 8 to 30 percent slopes;Cajon;;3
CA698;4003;Daisy-Gravesumit-Cajon complex, 2 to 4 percent slopes;Daisy;;1
CA698;3515;Arizo sand, 2 to 4 percent slopes;Typic Torriorthents;;3

CA697 National Training Center, Fort Irwin, California
CA697;392;Gravesumit-Cajon-Livefire complex, 2 to 4 percent slopes;Cajon;;30
CA697;295;Goldivide extremely gravelly-Granitepass-Goldivide complex, 2 to 8 percent slopes;Goldivide;;15
CA697;140;Rositas complex, 4 to 30 percent slopes;Rositas;stony;35
CA697;252;Livefire complex, 0 to 4 percent slopes;Bluepoint;;4
CA697;155;Hollyhills-Spider association, 2 to 30 percent slopes;Cajon;;7
CA697;224;Arizo-Granitepass-Bikelake complex, 2 to 8 percent slopes;Goldivide;;2
CA697;225;Arizo very gravelly sandy loam, 2 to 4 percent slopes;Goldivide;;2
CA697;305;Nasagold gravelly fine sandy loam, 0 to 4 percent slopes;Goldivide;ocasionally flooded;3
CA697;344;Goldivide complex, 2 to 4 percent slopes;Goldivide;;40
CA697;427;Venusite-Uxo association, 2 to 15 percent slopes;Goldivide;;6
CA697;440;Popups-Cronese association, 2 to 8 percent slopes;Goldivide;rarely flooded;4
CA697;392;Gravesumit-Cajon-Livefire complex, 2 to 4 percent slopes;Granitepass;;3
CA697;295;Goldivide extremely gravelly-Granitepass-Goldivide complex, 2 to 8 percent slopes;Livefire;;3

Table 4. Representative soil features

Parent material	(1) Alluvium–granite
Surface texture	(1) Coarse sand (2) Loamy sand (3) Gravelly sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to very rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–50%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	3.3–11.94 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–9

Subsurface fragment volume <=3" (Depth not specified)	3–40%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Abiotic Drivers

This ecological site occurs on sand sheets, fan aprons, fan aprons over fan remnants, and fan remnants at elevations of 1300 to 4200 feet. This site benefits from additional run-in moisture from adjacent upslope areas; the typical surface flooding regime is very rare sheet flow. Soils are very deep stratified coarse sands, or have an argillic horizon below sandy or sandy loam horizons.

Big galleta is a very drought-tolerant C4 grass that occurs on a range of soil types, but is dominant only on sandy soils (McAuliffe 1994). Big galleta exhibits rapid growth in response to warm season moisture, with growth highest in sandy soils where soil moisture is most readily available (Austin et al. 2004). Big galleta cover and biomass also increases in areas receiving additional run-on (NRCS data). The regular additional run-on in this site promotes continuous dominance by big galleta in the reference plant community

Burrobush is a short-lived, shallow-rooted, drought-deciduous shrub that co-exists with creosote bush over vast areas of North American Deserts. Burrobush becomes more dominant on older soils with greater horizon development, because well-developed argillic, petrocalcic or silicate duripans impede water infiltration, and increase the temporal availability of water at shallower depths. In the Mojave and Sonoran Deserts, creosote bush reaches maximum dominance and growth on young, coarse textured, weakly developed soils where water infiltration is rapid, deep water storage is large, and root growth is unimpeded (McAuliffe 1994, Hamerlynk et al. 2002, Hamerlynk and McAuliffe 2003, 2008). The very rare flooding regime on associated soils without significant horizon development also allows burrobush to maintain high densities on this site. The additional moisture supports growth of burrobush, while the regular low-level soil disturbance increases establishment opportunities. The argillic horizons typical of many of the soils correlated with this ecological site help to prolong the availability of water at shallow depths during the winter cool season, which enhances habitat for burrobush.

Disturbance Dynamics

The primary disturbances influencing this ecological site are drought, invasion by non-native annual plants, and fire, all of which interact. Drought is an important shaping force in Mojave Desert plant communities (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007). Short-lived perennial shrubs and perennial grasses demonstrate the highest rates of mortality (Webb et al. 2003, Bowers 2005, Hereford et al. 2006, Miriti et al. 2007), and annual species remain dormant in the soil seedbank (Beatley 1969, 1974, 1976). Long-lived shrubs and trees are more likely to exhibit branch-pruning, and or limited recruitment during drought (e.g. Hereford et al. 2006, Miriti et al. 2007), leading to reduced cover and biomass in drought-afflicted communities.

Non-native annual grasses (red brome [*Bromus rubens*], cheatgrass [*Bromus tectorum*] and Mediterranean grass [Schismus species]) have become naturalized throughout the Mojave Desert over the past century (Rickard and Beatley 1965, D'Antonio and Vitousek 1992, Brooks 1999, Reid et al. 2006, Norton et al. 2007). Annual grass cover and production is directly related to winter precipitation (Beatley 1969, Brooks and Berry 2006, Hereford et al. 2006, Allen et al. 2009, DeFalco et al. 2010, Rao and Allen 2010), and several years of drought may reduce the abundance of non-native annuals in the soil sandbank (Minnich 2003). Non-native annual cover and biomass is highest on sandy soils (Rao et al. 2010), because of the higher availability of water in these soils (Noy-Meir, 1973, Austin et al. 2004). This ecological site is susceptible to high densities and production of invasive annuals.

Invasion by non-native annual grasses has increased the flammability of Mojave Desert vegetation communities by providing a continuous fine fuel layer between widely spaced shrubs (Minnich, 1986, Brooks 1999, Brooks et al. 2004, Rao and Allen 2010, Rao et al. 2010). After fire, these communities appear to be more susceptible to invasion by exotic grasses, leading to a grass-fire cycle (D'Antonio and Vitousek 1992). Productive stands of big galleta may also fuel fire (Minnich 2003, Brooks et al. 2007). This site is susceptible to fire due to its invasibility by non-native annual grasses and productive big galleta.

State and transition model

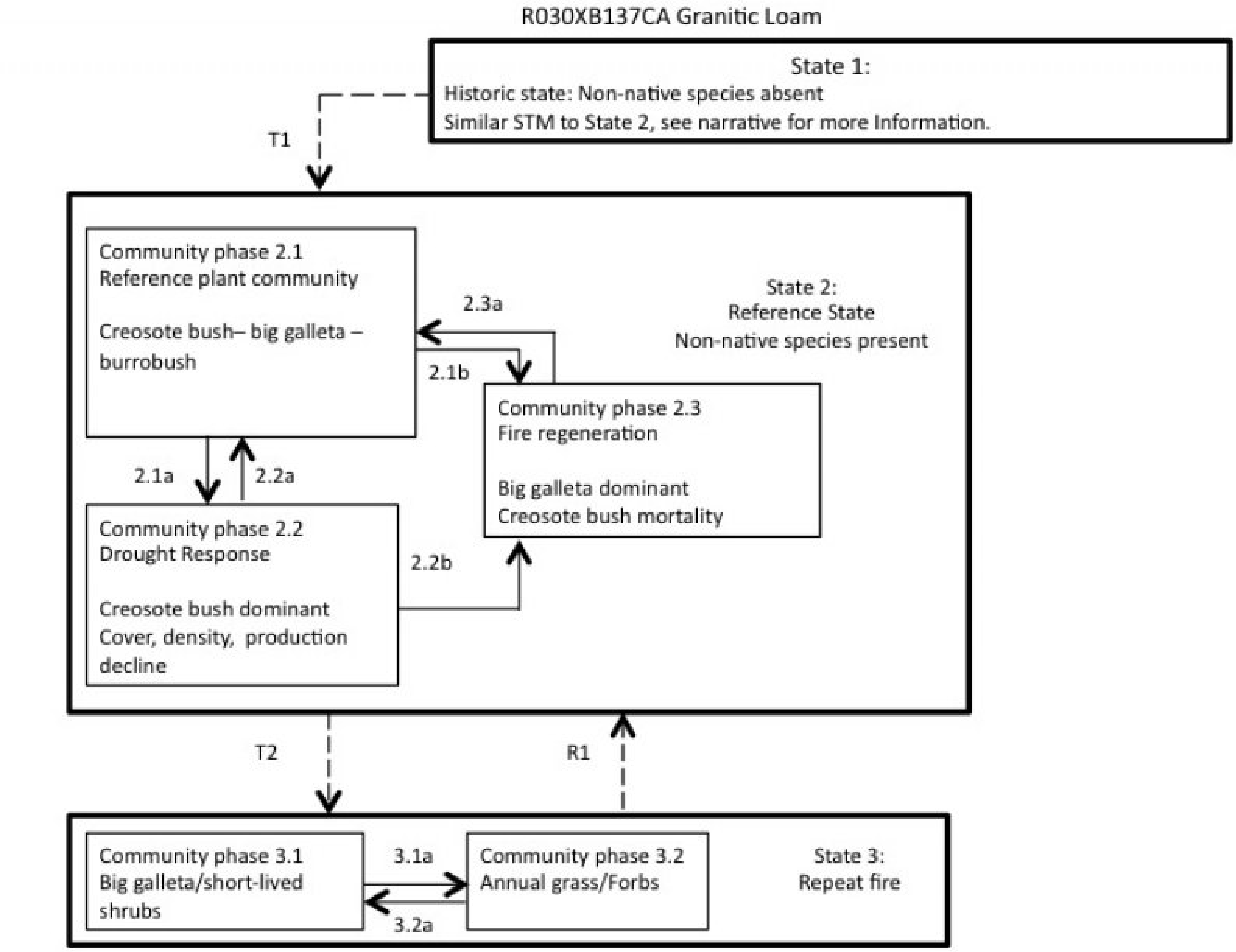

Figure 3. R030XB137CA

State 1
Historic State

State 1 represents the historic range of variability for this ecological site. This state no longer exists due to the ubiquitous naturalization of non-native species in the Mojave Desert. Periodic drought was the natural disturbance influencing this ecological site. Data for this State does not exist, but dynamics and composition would have been similar to State 2, except with only native species present. See State 2 narrative for more detailed information.

Community 1.1
Historic Reference Community

This community phase no longer exists due to the naturalization of non-native species in the Mojave Desert. The historic reference community composition would have been similar to community phase 2.1, but without non-native species.

State 2
Reference State

State 2 represents the current range of variability for this site. Non-native annuals, including Mediterranean grass, red brome and red-stem stork's bill (*Erodium cicutarium*) are naturalized in this plant community. Their abundance varies with precipitation, but they are at least sparsely present (as current years growth or present in the soil seedbank).

Community 2.1
Reference Plant Community

Figure 4. Community Phase 2.1

Figure 5. Community Phase 2.1

The reference plant community has an open two-tiered canopy less than 2 meters tall with creosote bush in the upper tier over big galleta and burrobush. Secondary shrubs may include white ratany (*Krameria grayi*), peach thorn (*Lycium cooperi*), California ephedra (*Ephedra californica*), button brittlebush (*Encelia frutescens*), Mojave yucca (*Yucca schidigera*), branched pencil cholla (*Cylindropuntia ramosissima*), and Wiggin's cholla (*Cylindropuntia echinocarpa*). At the southern limit of the range of this ecological site, Hall's shrubby spurge (*Tetracoccus hallii*) and lotebush (*Ziziphus obtusifolia*) may occur as trace species. Vegetative composition is approximately 60% shrubs, 25% grasses and 15% forbs. Perennial forbs and subshrubs may include California croton (*Croton californicus*), wishbone bush (*Mirabilis laevis* var. villosa), desert globemallow (*Sphaeralcea ambigua*), and brownplumed wirelettuce (Stephanomaria pauciflora). Annuals are seasonally present and may include bristly fiddleneck (*Amsinckia tessellata*), western Mojave buckwheat (*Eriogonum mohavense*), and birdcage evening primrose (*Oenothera deltoides*), among others. Approximate ground cover (basal and crown) is 5 to 15 percent. This site is stable in this condition.

Forest overstory. Allow no more than 5% of each species of this group, and no more than 15% in aggregate

Forest understory. Allow no more than 3% of each species of the grasses group, and no more than 5% in aggregate

Allow no more than 2% of each species of the forbs group, and no more than 8% in aggregate

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	163	280	359
Forb	3	62	168
Grass/Grasslike	50	112	135
Total	**216**	**454**	**662**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	3-8%
Grass/grasslike foliar cover	2-5%
Forb foliar cover	0-1%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Figure 7. Plant community growth curve (percent production by month). CA3004, Burrobush XB. Growth starts in early spring, flowering and seed set occur by July. Dormancy occurs during the hot summer months. With sufficient summer/fall precipitation, some vegetation may break dormancy and produce a flush of new growth..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	25	35	20	0	0	10	5	0	0	0

Figure 8. Plant community growth curve (percent production by month). CA3024, Big galleta. Some green up in spring; dormant May and June; most growth occurs after summer rains..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	5	20	10	0	0	15	40	10	0	0	0

Community 2.2
Drought Response

This community phase is characterized by strong dominance by creosote bush due mortality of big galleta and burrobush, and an overall decline in cover and production due to branch-pruning and lack of recruitment of longer-lived species including creosote bush, and lack of emergence of annual forbs and grasses. Big galleta may suffer very high rates of drought-induced mortality (Webb et al. 2003; Hereford et al. 2006); however, big galleta can respond very quickly to brief, intermittent rain during rare summer monsoonal events, which may sometimes buffer big galleta populations in the absence of more predictable winter rains. Burrobush may also suffer high rates of drought-induced mortality, with up to 68 percent mortality following one year of severe drought (Miriti et al. 2007). Creosote bush is an evergreen species capable of utilizing moisture at any time of the year. This ability buffers populations from the effects of drought that occur as the absence of the winter rains (the primary source of moisture for this ecological site). Further, creosote bush germinates in response to moisture during the warm season, so may still recruit if warm season rains occur during winter drought (Hereford et al. 2006). Creosote bush exhibits branch-pruning during severe drought, but mortality during drought in the Mojave Desert is very low (Webb et al. 2003, Hereford et al. 2006).

Community 2.3
Fire regeneration community

This community phase is characterized by severe declines in creosote bush, and an increase in big galleta (10 to 50 percent increase in cover). Initially, the post-burn community is dominated by big galleta, non-native grasses native annuals and native subshrubs. Subshrubs that often become dominant after fire include desert globemallow, brownplume wirelettuce, and desert marigold (*Baileya multiradiata*). With time, shrub cover increases with the recovery of species capable of resprouting (including Mojave yucca, white ratany, California jointfir, and peach thorn), and colonization by short-lived shrubs from off-site seed dispersal (including burrobush, rayless goldenhead [*Acamptopappus sphaerocephalus*], and Cooper's goldenbush [*Ericameria cooperi*]). As shrub cover increases, safe sites for creosote bush recruitment increases. With a long period of time without fire, creosote bush begins to regain dominance as shorter-lived species die out (Vasek 1983, Abella 2009, Vamstad 2009). This community is an at-risk phase, as the increased cover and biomass of big galleta and non-native annual grasses increases the likelihood of repeat burning (D'Antonio and Vitousek 1992, Brooks et al. 2004, Brooks and Matchett 2006). If the fire return interval is less than 20 years, this community is very likely to transition to State 3.

Pathway 2.1a
Community 2.1 to 2.2

This pathway occurs with prolonged or severe drought.

Pathway 2.1b
Community 2.1 to 2.3

This pathway occurs with moderate to severe fire.

Pathway 2.2a
Community 2.2 to 2.1

This pathway occurs with time and a return to average or above average precipitation conditions.

Pathway 2.2b
Community 2.2 to 2.3

This pathway occurs with moderate to severe fire.

Pathway 2.3a
Community 2.3 to 2.1

This community phase occurs with time and the absence of additional disturbance.

State 3
Repeated fire State

This state develops when the fire return interval is less than 20 years. This state has been significantly altered from the natural range of variability found in States 1 and 2. Creosote bush is lost, and big galleta, non-native annual grasses, native sub-shrubs, and short-lived shrubs dominate the community. Annual grasses and forbs are abundant immediately post-fire, with dominance by big galleta, subshrubs and short-lived perennials several years post-fire.

Community 3.1
Big galleta/short-lived shrubs

This community phase develops with time without fire (5-20 years), and is dominated by big galleta, subshrubs (desert globemallow, desert trumpet, brownplume wirelettuce and desert marigold) and short-lived shrubs (burrobush, rayless goldenhead). Longer-lived shrubs that have resprouted may be patchily present. There is high cover of non-native and native annuals during wet years. This community is at high risk of repeat burning due to high cover of fine fuels.

Community 3.2
Annual grass/Forbs

This community phase typically occurs one to five years post-fire. The community is dominated by non-native annual species including red brome, Mediterranean grass and red-stem stork’s bill, and native forbs, including bristly fiddleneck, western Mojave buckwheat and miniature woollystar (*Eriastrum diffusum* (many other native forbs could also be present). Native subshrubs including globemallow, desert trumpet, brownplume wirelettuce and desert marigold may be abundant. Big galleta cover is high, and there may be very sparse cover of resprouting shrubs including Mojave yucca, peach thorn, and California ephedra. Seedlings of short-lived shrubs may be present, and may include burrobush, rayless goldenhead, and Cooper’s goldenbush). This community is at high-risk of repeat burning due to high fine fuel cover. This community is also susceptible to wind and water erosion, due to the loss of stabilizing shrub cover (Bull 1997). This can lead to arroyo development near ephemeral drainage channels. Furthermore, the loss of vegetation structure present in the historic and reference state decreases the suitability of this habitat for wildlife (Brooks et al. 2007, Vamstad 2009).

Pathway 3.1a
Community 3.1 to 3.2

This pathway occurs with fire.

Pathway 3.2a
Community 3.2 to 3.1

This pathway occurs with time without fire (> 5 years).

Transition 1
State 1 to 2

This transition occurred with the naturalization of non-native species in this ecological site. Non-native species were introduced with settlement of the Southwest Desert region in the 1860s.

Transition 2
State 2 to 3

This transition occurs when the fire return interval is less than 20 years.

Restoration pathway 1
State 3 to 2

Restoration of communities severely altered by repeat fire at the landscape scale is difficult. Methods may include aerial seeding of early native colonizers such as desert globemallow, desert trumpet, brownplume wirelettuce, desert marigold, and big galleta. Increased native cover may help to reduce non-native plant invasion, helps to stabilize soils, provides a source of food and cover for wildlife, including desert tortoise (Gopherus agassizii), and provides microsites that facilitate creosote bush establishment. However, the amount of seed required for success is often prohibitive. Large-scale planting of both early colonizers and community dominants tends to be more successful in terms of plant survival, especially if outplants receive supplemental watering during the first two years. Creosote bush can be successfully propagated from seed for outplanting. Pre-emergent herbicides (Plateau) have been used in the year immediately post-fire to attempt to inhibit or reduce brome invasion. How successful this is on a landscape scale, and the non-target effects have not yet been determined.

Additional community tables

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			163–359	
	creosote bush	LATR2	*Larrea tridentata*	34–179	4–12
	burrobush	AMDU2	*Ambrosia dumosa*	34–168	2–10
	white ratany	KRGR	*Krameria grayi*	3–56	1–7
	button brittlebush	ENFR	*Encelia frutescens*	0–17	0–1
	California jointfir	EPCA2	*Ephedra californica*	0–17	0–1
	peach thorn	LYCO2	*Lycium cooperi*	0–17	0–1
	Wiggins' cholla	CYEC3	*Cylindropuntia echinocarpa*	0–17	0–1
	Mojave yucca	YUSC2	*Yucca schidigera*	0–6	0–1
	branched pencil cholla	CYRA9	*Cylindropuntia ramosissima*	0–2	0–1
Grass/Grasslike					
2	**Perennial Grasses**			50–123	
	big galleta	PLRI3	*Pleuraphis rigida*	50–123	2–7
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–22	–
3	**Non-native grasses**			0–6	
	red brome	BRRU2	*Bromus rubens*	0–6	0–1
	Mediterranean grass	SCHIS	*Schismus*	0–1	0–1
Forb					
4	**Perennial Forbs**			3–56	
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–17	0–1
	California croton	CRCA5	*Croton californicus*	0–17	–
	wishbone-bush	MILAV	*Mirabilis laevis var. villosa*	0–17	–
	desert larkspur	DEPA	*Delphinium parishii*	0–4	0–1
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	0–2	0–1
5	**Native Annual Forbs**			0–112	
	bristly fiddleneck	AMTE3	*Amsinckia tessellata*	0–67	0–3
	Western Mojave buckwheat	ERMO3	*Eriogonum mohavense*	0–4	0–1
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	0–4	–
	woolly desert marigold	BAPL3	*Baileya pleniradiata*	0–3	–
	browneyes	CACL4	*Camissonia claviformis*	0–3	–
	leafy nama	NADE2	*Nama densum*	0–2	–
	miniature woollystar	ERDI2	*Eriastrum diffusum*	0–1	0–1
6	**Non-native annual forbs**			0–39	
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–39	0–9

Animal community

This site provides habitat for small mammals such as pocket mice, Merriam kangaroo rats and desert kangaroo rats. Black-tailed jackrabbits, badgers and coyotes also occur on this site.

Reptiles occurring on this site include zebra-tailed, side-blotched and desert spiny lizards; western whiptails and desert tortoise.

Birds occurring on this site include horned larks, common ravens, cactus wrens, mourning doves, loggerhead shrikes, and black-throated and sage sparrows. Raptors observed include red-tailed hawks and American kestrels.

Hydrological functions

Runoff is low and very low. Hydrologic soil group A - soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well drained to excessively drained sands or gravels. Hydrologic group B - soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well drained to well drained soils with moderately fine to moderately coarse textures.

Soil Series:Cajon
Hydrologic Group:A
Hydrologic Conditions and Runoff Curves:
Good 49; Fair 55; Poor 63

Soil Series:Goldivide
Hydrologic Group:B
Hydrologic Conditions and Runoff Curves:
Good 68; Fair 72; Poor 77

Soil Series:Rositas
Hydrologic Group:A
Hydrologic Conditions and Runoff Curves:
Good 49; Fair 55; Poor 63

Recreational uses

This site is highly valued for open space and those interested in desert ecology. Desert tortoise, flowering wildflowers and shrubs may also attract visitors during the spring.

Other information

Military Operations - Management for this site would be to protect it from excessive disturbance and maintain existing plant cover. Land clearing or other disturbances that destroy the vegetation and soil structure can result in soil compaction, reduced infiltration rates, accelerated erosion, soil blowing and barren areas. The frequency of flash flooding may also increase with increased surface runoff and loss of vegetative cover.

Inventory data references

Sampling technique

_2_ NV-ECS-1
_3_ SCS-Range 417
_10 Other

CA794 Additional production and LPI plots 2010:

POWA51
POWA52
POWA68

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	GK BRACKLEY
Contact for lead author	State Rangeland Management Specialist
Date	03/22/2010
Approved by	
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 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 ±50%; surface rock fragments to ±35%; shrub canopy to 10%; basal area for perennial herbaceous plants ±5%.

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 (<10 ft) 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 4 on the coarse 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 soil structure is typically weak thick 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 to 1 percent.

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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 raindrop impact. Medium to coarse textured surface soils have moderate to 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. Subsoil argillic or calcic 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: warm- season, perennial grasses > cool-season, perennial bunchgrasses > deep-rooted, perennial, forbs > 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 5% and depth (±¼ inch).

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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 ±350lbs/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:** Potential invaders on this site include red brome, filaree and Mediterranean grass.

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