Ecological site R040XD034CA
Gravelly, Braided, Ephemeral Stream

Accessed: 05/07/2024

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): 040X–Sonoran Basin and Range

MLRA Statement:
Major land resource area (MLRA) 31 is the Lower Colorado Desert. This area is in the extreme southeastern part of California, in areas along the Colorado River, and in Western Arizona. The area is comprised of rough, barren, steep, and strongly dissected mountain ranges, generally northwest to southwest trending that are separated by intermontane basins. Elevation ranges from approximately 275 feet below sea level at the lowest point in the Salton Trough to 2700 feet along low northwest to southeast trending mountain ranges. The average annual precipitation is 2 to 6 inches with high temporal and spatial variability. Winter temperatures are mild, summer temperatures are hot, and seasonal and diurnal temperature fluctuations are large. Monthly minimum temperature averages range from 40 to 80 degrees F (4 to 27 degrees C). Monthly maximum temperature averages range from 65 to 110 degrees F (18 to 43 degrees C) (WRCC 2002). Temperatures are rarely below 28 degrees F, and extremely rarely fall below 24 degrees F. Precipitation is bimodal, with approximately 20 to 40 percent of annual precipitation falling between July and September. This summer rainfall, in combination with very hot temperatures and very few to no days of hard freeze are what characterize this MLRA and distinguish it from the Mojave Desert (MLRA 30).

Site Concept:
This ecological site occurs on mid portions of the fan piedmont, below order 3 or larger drainages, where flow from flash flood events dissipates and sediments are deposited on the fans. This site develops multiple braided channels, because low stream velocity and sediment deposition cause channel migrations. The majority of this site is occasionally flooded, but it includes a main channel with more frequent flooding frequency, and raised islands that rarely flood. Elevations range from 980 to 2900 feet. Soils are very deep gravelly to very gravelly sands. Surface cobbles are typical, and patches of cobbles are interspersed with patches of bare sand. The site is dominated by burrobush (Hymenoclea salsola), desert lavender (Hyptis emoryi), and brittlebrush (Encelia farinosa). Smoketree (Psorothamnus spinosus) is present in active channels. Blue paloverde (Parkinsonia florida) and desert ironwood (Olneya tesota) are scattered throughout.

Data ranges in the physiographic data, climate data, water features, and soil data sections of this Ecological Site Description are based on major and minor components, since it is often only associated with minor components.

Associated sites

R040XD001CA	**Limy Hill 4-6" p.z.** This ecological site is on steep side slopes of alluvial fans, with sparse creosote bush and burrobush.

R040XD009CA	**Gravelly Fan Remnants And Fan Aprons** This ecological site is on nearby fan aprons, which are not prone to flooding. Creosote bush, Schott's dalea, and brittlebush are present.
R040XD030CA	**Extremely Stony Fan Remnants** This ecological site is on stony fan remnants, and teddy bear cholla is common.
R040XD200CA	**Rarely Flooded Fans** This ecological site is in sandier braided washes, with brittlebush dominant.
R040XD201CA	**Cobbly Fan Remnants** This ecological site is on rubble fan remnants with brittlebush and creosote bush dominant.
R040XD202CA	**Stony, Occasionally Flooded Ephemeral Stream** This ecological site is in rubbly drainageways among rubbly fan remnants. Schott's dalea and blue paloverde are dominant.

Similar sites

R030XY128CA	**Broad, Gravelly, Hyperthermic Ephemeral Stream** This ephemeral stream is similar, but is within the adjacent Mojave Desert. Blue paloverde is absent.

Table 1. Dominant plant species

Tree	(1) *Parkinsonia florida* (2) *Olneya tesota*
Shrub	(1) *Hymenoclea salsola* (2) *Hyptis emoryi*
Herbaceous	Not specified

Physiographic features

This ecological site occurs on channels, drainageways, inset fans, and alluvial fans on fan piedmonts. Elevations range from 980 to 2900 feet. Slopes range from 2 to 30 percent, but slopes of 2 to 8 percent are typical.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Channel (3) Inset fan
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to frequent
Elevation	299–884 m
Slope	2–30%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this ecological site is characterized by hot temperatures, aridity, and a bimodal precipitation pattern. Precipitation falls as rain, with 30 percent falling in summer between July and October, and 60 percent falling in winter between November and March. The mean annual precipitation is 2 to 4 inches and mean annual air temperature is 73 to 79 degrees F. The frost free period is 360 to 365 days and the freeze period is 363 to 365 days.

Maximum and minimum monthly climate data for this ESD were generated by the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data from the following climate stations (results are weighted averages; numbers in square brackets represent relative weights):

42598, Eagle Mountain, CA (Period of record = 1933 to 2011) [2]

43855, Hayfield Reservoir, CA (Period of record = 1933 to 2011) [1]

The data from multiple weather were combined to most accurately reflect the climatic conditions of this ecological site.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	102 mm

Influencing water features

This site is subject to frequent and occasional large flash flood events.

Soil features

The soils associated with this ecological site are very deep, somewhat excessively to excessively drained, and formed in alluvium from gneiss, granitoid, or igneous parent material. The surface textures are gravelly loamy coarse sand, gravelly coarse sand, extremely gravelly coarse sand, very cobbly coarse sand, loamy fine sand, and sandy loam. Subsurface horizons are composed of coarse sands and sands with very or extremely gravelly modifiers. Surface rock fragments less than 3 inches in diameter range from 20 to 84 percent cover, and fragments greater than 3 inches range from 1 to 37 percent cover. Subsurface (depths of 1 to 59 inches) percent by volume of rock fragments less than 3 inches ranges from 20 to 50, and greater that 3 inch fragments range from 0 to 14.

This ecological site is correlated with the Chemwash, Rizzo and Carsitas soil series. The Chemwash and Rizzo soils are Sandy skeletal, mixed, hyperthermic Typic Torriorthents. These soils both have greater than 35 percent rock fragments, but the Rizzo soils are dominated by >5 mm diameter rock fragments and Chemwash has smaller (3 to 5 mm) sized rock fragments in the particle control section. The Carsitas soils are mixed, hyperthermic, Typic Torripsamments. The Carsitas soils have two C horizons composed of layers of gravelly sand from 0 to 10 inches and gravelly coarse sand below 10 inches. It does not have large rock fragments and more developed soil horizons are absent.

This ecological site has been correlated to the following map units and soil components in the Joshua Tree National Park Soil Survey Area (CA794):

Map unit ID; Map unit name; Component; Percent
1504; Rizzo association, 4 to 15 percent slopes, rubbly; Rizzo; frequently flooded, rubbly; 7
1555; Goldrose-Carsitas-Chemwash complex, 4 to 8 percent slopes; Chemwash; rarely flooded; 25; and Chemwash; occasionally flooded; 2
2404; Rizzo complex, 2 to 8 percent slopes, channeled; Rizzo; occasionally flooded; 60
and Rizzo; very rarely flooded; 35
and Rizzo; frequently flooded; 3
2409; Rizzo-Chemwash-Carsitas complex, 4 to 8 percent slopes; Carsitas; occasionally flooded, braided; 25
2421; Carsitas complex, 4 to 8 percent slopes; Carsitas; rarely flooded; 25 and Carsitas; occasionally flooded, braided; 10
2431; Chemwash complex, 2 to 8 percent slopes; Chemwash; rarely flooded; 10 and Chemwash; frequently flooded, braided; 60
2440; Rizzo complex, 8 to 15 percent slopes; Rizzo; occasionally flooded; 30
2835; Rock outcrop-Blackeagle complex, 30 to 75 percent slopes; Rizzo; frequently flooded; 1

Table 4. Representative soil features

Surface texture	(1) Gravelly loamy coarse sand (2) Gravelly coarse sand (3) Extremely gravelly loamy coarse sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	150 cm
Surface fragment cover <=3"	20–84%
Surface fragment cover >3"	1–37%
Available water capacity (0-101.6cm)	2.03–6.1 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	20–50%
Subsurface fragment volume >3" (Depth not specified)	0–14%

Ecological dynamics

This ecological site occurs on upper to medial portions of the fan piedmont, below order 3 or larger drainages, where flow from flash flood events dissipates and sediments are deposited on the fans. This site develops multiple braided channels because low stream velocity and sediment deposition causes channel migrations. The majority of this site is occasionally flooded, but it includes a small main channel with more frequent flooding frequency, and raised islands that rarely flood

Soil disturbance from flash flood events is the primary driver of plant community dynamics within this ecological site. Ephemeral streams lack permanent flow except in response to rainfall events (Bull 1997, Levick et al. 2008). These ephemeral streams are characterized by extreme and rapid variations in flooding regime, and a high degree of temporal and spatial variability in hydrologic processes (Bull 1997, Stanley et al. 1997, Shaw and Cooper 2008, Levick et al. 2008).

This site often experiences channel avulsion (defined as the “diversion of the majority of the surface flow to a different channel, with total or partial abandonment of the original channel” [Field, 2001]). As sediment deposits in the active drainageway the likelihood of channel avulsion increases because of decreased drainageway volume. Cycles of channel avulsion on alluvial fans are an ongoing and long-term process in the development of alluvial fans, and can occur after any substantial overland flow event when existing channel capacity is rapidly and dramatically exceeded. Channel avulsion of the main channel would cause high mortality of vegetation in the old channel due to water stress and lack of regeneration, but would initiate development of xeroriparian communities in the newly created channel.

The majority of this area is a broad, extensively braided drainageway. There are barren active channels dominated by fine sands and gravels, and low relief sediment bars with higher vegetative cover and larger rock fragments, primarily cobbles. The drought-tolerant vegetation that exists on ephemeral streams and drainageways is referred to as xeroriparian vegetation. It is distinct from the surrounding landforms due to a difference in species composition, size, and production (Levick et al. 2008, Johnson et al. 1984). Xeroriparian vegetation is present because the increased availability of water and flood disturbances in these drainageways. The braided area is dominated by burrobush, desert lavender, and brittlebush but a variety of shrubs and forbs are present. The main active channel has low cover of smoketree. Two notable larger trees, blue paloverde and desert ironwood, are scattered across the drainageway. Blue paloverde is a relatively fast growing, shorter lived tree which is confined to washes in the drier parts of the Sonoran Desert. It needs greater moisture than the average precipitation that this ecological site provides, and its hard shelled seeds need physical scarification from floods or a long time of weathering in the soils to enable germination. Desert ironwood is long lived, slow growing tree with very dense wood, which is also largely confined to washes in this area of the Sonoran Desert.

Many of the species present in this ecological site (Blue paloverde, desert ironwood, Schott’s dalea, and desert lavender) are near their northern limit of distribution along the border of the Mojave and Sonoran Desert. These species are restricted to the warmer Sonoran Desert, and its biomodal precipitation pattern and absence of frost. The dominant species are frost-intolerant and rely on summer precipitation for seed germination. Climate data from the climate stations listed above indicate that temperatures below 28 degrees F may occur between late Dec to mid February, but do not occur every year. In the cooler areas (Hayfield Reservoir) temperatures may fall to the low 20s, approximately every 3 years. The Eagle Mountain station indicates closer to a 10-year period between frosts. Both stations indicate a prolonged period of freezing temperatures in January, 1950, with temperatures as low as 14 degrees F. at Hayfield Reservoir. The prolonged low temperatures in 1950 would likely have caused some mortality throughout this area. Less severe freezes of shorter durations or less severe temperatures will cause die back of frost-sensitive younger stems and branches, but may not kill the mature or hardened plants. The dynamics of frost is not included in the state and transition model (STM), because the incidence of frost is uncommon, and this site exists because of the relatively frost free conditions of this area.

Another climatic driver of this ecological site is summer precipitation. This area receives approximately 30 percent of its precipitation from July to October, from monsoons coming up from Mexico. Summer precipitation is important for the germination and survival of desert ironwood, blue paloverde, and desert lavender. Winter precipitation is important for seed production for desert ironwood and other species. Summer rains and warmer temperatures are needed to initiate germination for desert ironwood, desert lavender, and blue paloverde. Without summer rains and warmer temperatures some of these species would not regenerate well if at all.

Precipitation in this ecological site is very limited, with approximately 2 to 4 inches falling in a given year. The amount of total precipitation, and the timing and frequency of precipitation, highly is variable from year to year. In addition, the spatial distribution of precipitation is variable, as squalls may downpour on one area, but completely miss adjacent mountains or valleys. Hereford et al. (2004) describes shifts from dry to wet periods which may last several decades. During wetter cycles plant species show increased cover, size, and regeneration, while during drier periods and droughts, regeneration is low and shorter-lived shrubs have high mortality (Miriti et al. 2007). In the State-and-Transition model below, the drought phase is referring to severe droughts which cause high mortality, lack of regeneration and affect plant community composition. Although it is somewhat ambiguous to define, the Reference plant community phase implies that the area is receiving average (2 to 4 inches) or higher precipitation, and vegetation is not in decline due to drought.

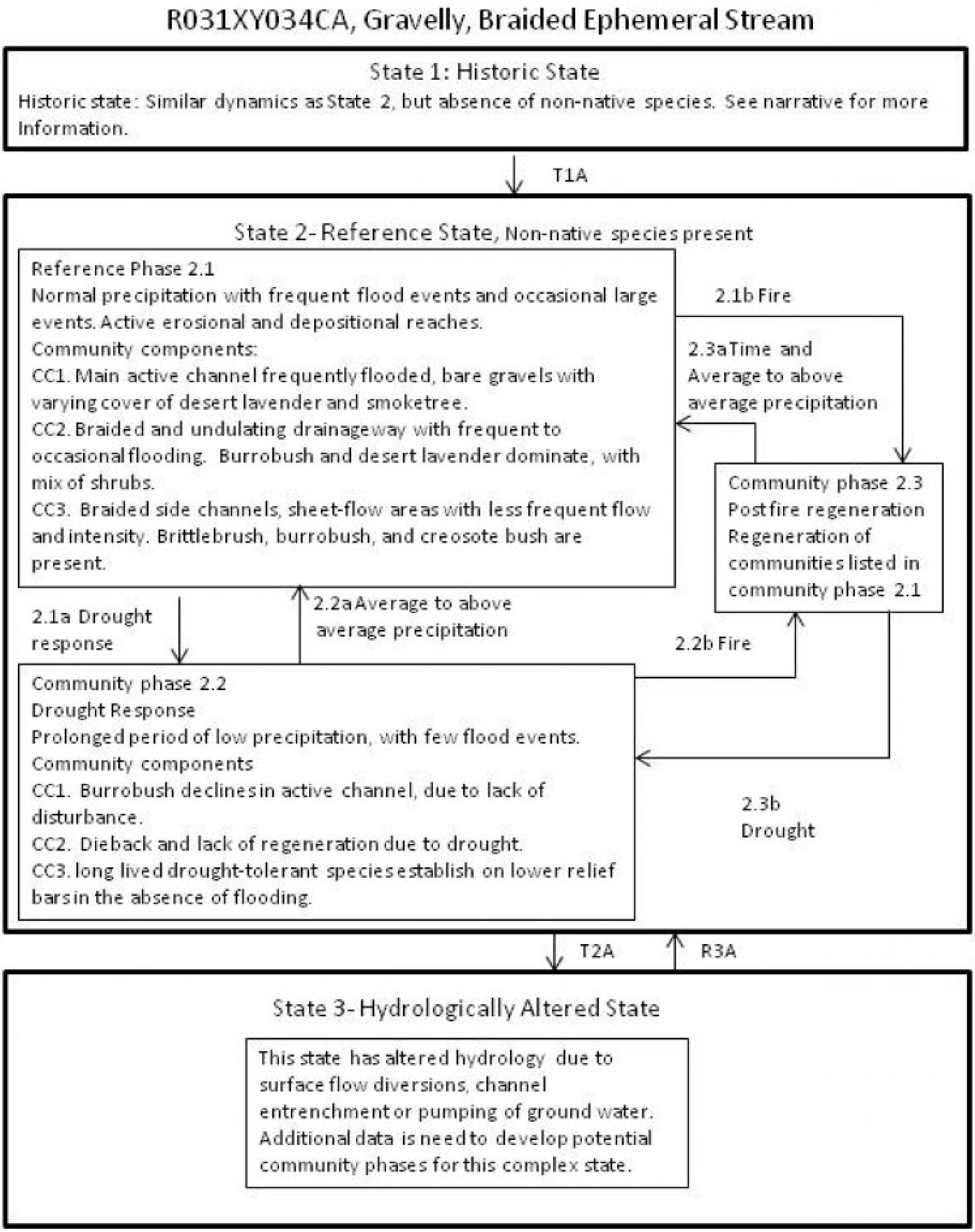
When precipitation events occur, these ephemeral streams provide important hydrologic functions, such as maintaining water quality by allowing energy dissipation during high water flow. They transport nutrients and sediments, store sediments and nutrients in deposition zones, provide temporary storage of surface water, and longer duration storage of subsurface water. These streams are important ecologically because they provide water and habitat for a variety of plant and animal species. The structure and forage provided by xeroriparian vegetation, and the availability of water (although brief), significantly increases animal abundance along ephemeral streams relative to upland areas. The open channels also provide important migration corridors for wildlife (Levick et al. 2008).

Historically fire was very uncommon in these ephemeral drainages; however the presence of continuous and flashy fuels from non-native grasses in adjacent upland sites can increase the possibility of fire. Invasion by non-native annual grasses has increased the flammability of desert vegetation communities (Brooks 1999, Brooks et al. 2004), and after fire, desert ecosystems appear to be more susceptible to invasion by exotic grasses, leading to a grass-fire cycle (D'Antonio and Vitousek 1992). Very wet (El Nino) years followed by severe drought produce conditions where large areas where of creosote scrub may burn (Brown and Minnich 1986).

When modifications affect the hydrologic function of this ephemeral stream system, this ecological site has the potential to transition to a hydrologically altered state (State 3). Once this threshold is crossed, it is extremely difficult to repair the hydrologic system.

Modifications to hydrology such as surface flow alterations, ground water depletion, and loss of the xeroriparian vegetation can have irreversible impacts on hydrologic processes (Nishikawa et al. 2004, and Levick et al. 2008). An increase in cover of impermeable surfaces (such as pavement, homes, malls, etc.) reduces the amount of runoff that can infiltrate into the soil, creating higher surface runoff and greater peak flows. The runoff is collected in ditches, culverts, and drainage networks, and diverted to the nearest ephemeral stream. In some areas, retaining walls are built along ephemeral streams to reduce damage to property from flood events. These confined channels reduce the ability for the stream to spread out and decrease flow velocity to allow sediment deposition. As a result, the channels will generally incise, with a higher volume of concentrated flows. These processes eventually cause higher peak flows due to increased runoff and concentrated flows. Higher flow velocities may cause uprooting, stem breakage or scour under the roots of xeroriparian vegetation. This loss of root structure along the stream increases scour potential, and the loss of above ground vegetation will increase flow velocity. When the xeroriparian community is lost, important animal species dependent upon this community may be lost from the area as well. Ground water drawdown from household wells (Nishikawa et al. 2004) can deplete the water source for phreotophytes, such as desert lavender, blue paloverde, ironwood, and smoketree and may eliminate these species in affected areas.

State and transition model



R031XY034CA, Gravelly, Braided Ephemeral Stream

State 1: Historic State

Historic state: Similar dynamics as State 2, but absence of non-native species. See narrative for more Information.

State 2- Reference State, Non-native species present

Reference Phase 2.1
Normal precipitation with frequent flood events and occasional large events. Active erosional and depositional reaches.
Community components:
CC1. Main active channel frequently flooded, bare gravels with varying cover of desert lavender and smoketree.
CC2. Braided and undulating drainageway with frequent to occasional flooding. Burrobush and desert lavender dominate, with mix of shrubs.
CC3. Braided side channels, sheet-flow areas with less frequent flow and intensity. Brittlebrush, burrobush, and creosote bush are present.

Community phase 2.2
Drought Response
Prolonged period of low precipitation, with few flood events.
Community components
CC1. Burrobush declines in active channel, due to lack of disturbance.
CC2. Dieback and lack of regeneration due to drought.
CC3. long lived drought-tolerant species establish on lower relief bars in the absence of flooding.

Community phase 2.3
Post fire regeneration
Regeneration of communities listed in community phase 2.1

State 3- Hydrologically Altered State

This state has altered hydrology due to surface flow diversions, channel entrenchment or pumping of ground water. Additional data is need to develop potential community phases for this complex state.

Figure 4. R031XY034CA model

State 1
Historic State

State 1 represents the historic-natural condition for this ecological site. It is similar to State 2, but has only native species. If we were to include dynamics for this state it would be the same as displayed in State 2. The presence of non-native species is minimal in State 2, and has not altered the hydrology or fire frequency.

State 2
Reference State

This state represents the most common and most ecologically intact condition for this ecological site at the present time.

Community 2.1
Reference Phase

Figure 5. Community Component 2

Figure 6. Community Component 1

Figure 7. Community Component 3

Figure 8. CC2 with Desert Ironwood

This community phase is dependent upon unimpaired hydrologic function and average to above average precipitation. At any given point along the stream three community components are generally present. The relative spatial extent of these communities varies as the channel morphology fluctuates from flash flood events. Plant composition for the following community components is combined in the tables below, but characteristic features are described below. Three community components are present, including: Community component 1 (CC1) This community is in the main active channel. It is dominated by barren sand and gravels. Smoketree, desert lavender and bladderpod spiderflower (*Cleome isomeris*) have approximately 5 percent combined cover. Smoketree is present in the main active channel, and blue paloverde is common on the channel margins. Smoketree, desert lavender, and blue paloverde are phreatophytes, which means they have deep roots and are rely upon a deep water source for additional moisture (Nilsen et al. 1984). The presence of these phreatophytes indicates the presence of deep water source below the channels, for some duration of the year. Smoketree and blue paloverde have hard seed coats that need physical scarification before they can imbibe water in order to germinate. During floods the seeds are washed down the channel in a mixture of sand and gravels, which scratch, cut, and grind openings in the hard seed coat. When the seed coat is cracked, the flood waters soak into the seed, and initiate germination. The seeds of smoketree may also have growth inhibitors, which are water soluble, and are removed by running water (Bainbridge 2007). Smoketree produces few leaves, is summer deciduous, and conducts most of its photosynthesis through the stem, which helps it withstand drought conditions by preventing water loss through the leaves (Nilsen et al. 1984). Blue paloverde is also stem photosynthetic and summer deciduous (Pavek 1994). Blue paloverde is generally confined to washes, but may exist on more upland sites if soil moisture is sufficient. Desert lavender is found on rocky mountains slopes where additional runon is available, but is confined to washes in more arid zones of its distribution, such as this ecological site. Smoketree, desert lavender, and bluepalove help slow flood waters, and are able to resprout from the root crown after stem breakage. Their deep roots help them remain anchored during floods, and hold soil in place. Forbs are abundant in years of high rainfall, but may be patchily present every year due to run-on. Community component 2 (CC2) This is the most abundant community, and it occurs on the broad, braided occasionally to frequently flooded drainageways. This area has deeper channels which receive more frequent concentrated flow, and rises which receive less frequent sheet floods. Burrobrush is generally dominant, and relatively evenly distributed throughout. Desert lavender has similar cover, but lower annual production, and tends to be in more flooded positions. Blue paloverde and desert ironwood are scattered throughout, usually with less than 2 percent combined cover. Burrobrush is considered a pioneer species, because it readily establishes from on-site and off-site seed after disturbance. It produces abundant seeds, which have high viability. It is believed to live for a few decades, maintaining dominance with reoccurring disturbances which promote flushes of regeneration (Tesky 2003). Desert ironwood is not exclusively a xeroriparian species, but is commonly found along washes. It is not always present within the extent of this ecological site, and it is not clear why it is absent from what appears to be suitable habitat. Perhaps, there is a higher incidence of frost in some of the drainageways. Desert ironwood is an important nurse tree for other shrubs in parts of its range. Dead ironwood trees and stumps take centuries to decompose because of toxic, non-biodegradable chemicals in the wood (Phillips et al. 2000). Other shrubs associated with this community include bladderpod spiderflower, brittlebush, California barrel cactus (*Ferocactus cylindraceus*), Schott's pygmycedar (*Peucephyllum schottii*), Schott's dalea (*Psorothamnus schottii*), Thurber's sandpaper plant (*Petalonyx thurberi* ssp. thurberi), brownplume wirelettuce (*Stephanomeria pauciflora*), beloperone (*Justicia californica*) and jojoba (*Simmondsia chinensis*). Forbs are abundant in years of high rainfall, but may be patchily present every year due to run-on. Associated forbs include: whitemargin sandmat (*Chamaesyce albomarginata*), pincushion flower (*Chaenactis fremontii*), cryptanthas (Cryptantha spp.), buckwheat (Eriogonum sp.), Western Mojave buckwheat (*Eriogonum mohavense*), smooth desertdandelion (*Malacothrix glabrata*), sowthistle desertdandelion (*Malacothrix sonchoides*), birdcage evening primrose (Oenothera deltoids) and chia (*Salvia columbariae*). Community Component 3 (CC3) This community is on braided side channels or on higher topographic positions which receive less frequent or lower intensity floods. Brittlebush and creosote bush becomes more important, and burrobrush becomes less dominant. Similar species as listed in CC2 may be present, as well as an occasional ocotillo (*Fouquieria splendens*). Burrobrush may start to die-off in the absence of flood events and surface disturbance.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	89	123	146
Tree	22	34	62
Forb	–	6	17
Total	**111**	**163**	**225**

Community 2.2
Drought Response

This community develops with prolonged or severe drought. It is difficult to determine the exact duration or intensity of drought that will cause this change, but a one to two year severe drought (of approximately 60 percent or less of average annual precipitation) can cause severe mortality in short lived perennials (Hereford 2008, Miriti 2007, Bowers 2005). During drought years, flood events are unlikely. The plant community components remain similar to those described in Community Phase 2.1, but show a decline in overall health, cover and production due to drought. Shorter lived species (such as burrobrush, sweetbush, brittlebush and bladderpod spiderflower) may suffer high mortality while longer lived species with deeper roots (desert lavender, smoketree, blue paloverde, desert ironwood, creosote bush and Schott’s dalea) may take longer to respond to drought conditions, but may eventually have severe branch die back. Desert ironwood is very drought tolerant, but it may slough off large branches to conserve water. There is evidence that desert ironwood was top-killed by previous droughts, and has resprouted from the lower trunk several times (Phillips et al. 2000). Desert lavender is a deep rooted species that can access deeper water. It adjusts its leaf pubescence to reduce water loss. Brittlebush is an extremely drought-tolerant, drought-deciduous shrub, which can adapt its leaf pubescence similar to desert lavender. With prolonged drought and the absence of flood events, deep rooted phreatophytes along the channel margin will decline. They will initially suffer branch die-back, but if drought conditions persist or channel avulsion diverts flood waters from the previously active channel, they may suffer high mortality. Smoketree and blue paloverde will not regenerate without floods to scarify and soak the seeds. Creosote bush may suffer branch die-back, but may persist in long term drought, and become dominant as other species die off.

Community 2.3
Post Fire Regeneration

Initially annuals and short-lived perennials will dominate the post-fire plant community. Short-lived shrubs capable of quickly colonizing after fire include burrobrush, brittlebrush, and sweetbush. These species produce prolific amounts of seed that are easily wind dispersed. Creosote bush is generally killed by fire, and is slow to re-colonize burned areas due to specific recruitment requirements. Blue paloverde, desert ironwood, and desert lavender have varying success at resprouting from the root crown after being top-killed by fire (Pavek 1994, Brown and Minnich 1986, Brooks et al. 2007, Steers and Allen 2011).

Pathway 2.1a
Community 2.1 to 2.2

This pathway is caused by a prolonged or severe drought.

Pathway 2.1b
Community 2.1 to 2.3

This pathway is caused by moderate to severe fire.

Pathway 2.2a
Community 2.2 to 2.1

This pathway occurs with the return of average to above average precipitation and associated flood events.

Pathway 2.2b
Community 2.2 to 2.3

This pathway occurs as a result of fire. Given low cover of annuals during drought, this pathway is unlikely except in periods immediately following heavy precipitation years.

Pathway 2.3a
Community 2.3 to 2.1

This pathway occurs in response to the passing of time with average to above average precipitation and associated flood events.

Pathway 2.3b
Community 2.3 to 2.2

This pathway occurs in response to the passing of time, with drought conditions and absence of flooding.

State 3
Hydrologically Altered

State 3 represents altered hydrological conditions. Data is needed to develop a successional diagram for this state, since disturbances and the consequences are complex.

Community 3.1
Hydrologically Altered

Figure 10. Altered surface flow

Landform alterations or road development can divert water away from natural drainageways and redirect flow to landforms that are not natural drainageways. In the image above, a road dissects this braided stream capturing flow above the road, redirecting it along the large berm it to several breaks. In the image above, abandonment of channels below the road is evident by the darker colors, as compared to the still active channel above the road. Surface flow has been diverted away from these channels, eliminating flood disturbances. Over time, disturbance or flood-adapted species like burrobush, desert lavender, and smoketree die out. Stable upland species such as brittlebush and creosote bush establish in the abandoned channels. Production and cover may increase, but diversity decreases, and the risk of fire may increase due to the increase in uniform cover of vegetation. Channel entrenchment can develop due to a range of interacting factors (Bull 1997), including the creation of drainage ditches and concentration of flow though culverts or breaks. Incised arroyos may form due to extreme climatic events, especially if they follow a period of drought or a fire that also burns upslope hill communities (Bull 1997). Research in other arid lands ephemeral stream systems has shown that channel entrenchment can lead to mortality in xeroriparian communities in a time span of only decades (Bull 1997 and references therein). Ground water drawdown from household wells (Nishikawa et al. 2004) or the diversion of surface flow in the upper watershed can deplete the water source for deep rooted species such as desert lavender, smoketree, blue paloverde, and desert ironwood.

Restoration pathway T3A
State 3 to 2

Restoration from State 3 back to State 2 would be an intensive task. Individual site assessments would be required to determine proper restoration methods. Some hydrological modifications are not feasible restored, such as ground water depletion. However, impervious pavement, road diversions, and channel armoring can be redesigned to allow proper infiltration and channel flow. Entrenched channels can be built up with check dams, stones, or woody debris to increase the frequency of overflow on to the alluvial fan. Seeds or plants of appropriate plant species may need to be reintroduced to the restored channels, and associated sheet-flow areas.

Additional community tables

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
1	**Trees**			22–62	
	blue paloverde	PAFL6	*Parkinsonia florida*	22–50	0–3
	smoketree	PSSP3	*Psorothamnus spinosus*	0–17	0–2
	desert ironwood	OLTE	*Olneya tesota*	0–6	0–1
Shrub/Vine					
2	**Native shrubs**			89–146	
	burrobrush	HYSA	*Hymenoclea salsola*	56–146	1–5
	brittlebush	ENFA	*Encelia farinosa*	17–67	1–4
	desert lavender	HYEM	*Hyptis emoryi*	16–28	1–5
	Schott's dalea	PSSC5	*Psorothamnus schottii*	0–22	0–2
	sweetbush	BEJU	*Bebbia juncea*	0–9	0–1
	bladderpod spiderflower	CLIS	*Cleome isomeris*	0–1	0–1
	beloperone	JUCA8	*Justicia californica*	0–1	0–1
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–1	0–1
	Schott's pygmycedar	PESC4	*Peucephyllum schottii*	0–1	0–1
	Thurber's sandpaper plant	PETHT	*Petalonyx thurberi ssp. thurberi*	0–1	0–1
	jojoba	SICH	*Simmondsia chinensis*	0–1	0–1
	brownplume wirelettuce	STPA4	*Stephanomeria pauciflora*	0–1	0–1
	California barrel cactus	FECY	*Ferocactus cylindraceus*	0–1	0–1
	ocotillo	FOSP2	*Fouquieria splendens*	0–1	0–1
Forb					
3	**Native forbs**			0–17	
	cryptantha	CRYPT	*Cryptantha*	0–4	0–1
	buckwheat	ERIOG	*Eriogonum*	0–1	0–1
	Western Mojave buckwheat	ERMO3	*Eriogonum mohavense*	0–1	0–1
	smooth desertdandelion	MAGL3	*Malacothrix glabrata*	0–1	0–1
	sowthistle desertdandelion	MASO	*Malacothrix sonchoides*	0–1	0–1
	birdcage evening primrose	OEDE2	*Oenothera deltoides*	0–1	0–1
	chia	SACO6	*Salvia columbariae*	0–1	0–1
	whitemargin sandmat	CHAL11	*Chamaesyce albomarginata*	0–1	0–1
	pincushion flower	CHFR	*Chaenactis fremontii*	0–1	0–1
4	**non-native forb**			0–1	
	Asian mustard	BRTO	*Brassica tournefortii*	0–1	0–1
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–1	0–1
Grass/Grasslike					
5	**Non-native grass**			0–1	
	Mediterranean grass	SCHIS	*Schismus*	0–1	0–1

Animal community

Small animals live in this ecological site. Animal diversity in this ecological site may be greater than in other areas due to the heterogeneity of the site. Large trees, such as blue paloverde, smoketree, and desert ironwood provide structural diversity and additional food sources that may support a higher diversity of fauna. Ephemeral drainages are important wildlife migration corridors.

Hydrological functions

Ephemeral drainages provide some similar hydrologic functions as perennial streams. A properly functioning system will maintain water quality by allowing energy dissipation during high water flow. These systems transport nutrients and sediments, and store sediments and nutrients in deposition zones. Ephemeral drainages provide temporary storage of surface water, and longer duration storage of subsurface water (Levick et al. 2008).

Recreational uses

Large drainageways in which this ecological site is provide open travel corridors for hiking trails, with a diversity of vegetation and wildlife to observe.

Wood products

Desert ironwood wood is very dense, and has been used for firewood and wood carvings, but due to its slow growth rate and low recruitment it is unsustainable and illegal to collect in some areas (Phillips et al. 2000). Blue paloverde wood is used for fire wood, but is not very strong (Pavek 1994).

Other products

Blue paloverde and desert ironwood seeds are edible after being prepared and cooked properly (Pavek 1994, and Phillips et al. 2000). Desert lavender is used in landscaping, because it has a pleasant aroma and it attracts bees and hummingbirds.

Inventory data references

The following NRCS vegetation plots were used to describe this ecological site:

CC1-Frequently flooded
1249704207

CC2-Occasionally flooded
1248617604- Type location
1249704401- Soil modal, but below aqueduct
1249704404
1250014905
1250015101
1249704211 (oculars only)

CC3-rarely to very rarely flooded
1248617605

Possibly State 3
1249704402 (potentially altered, floods diverted away from plot by HW10)
124861766B (potentially altered, flow diverted away from plot by road)

Type locality

Location 1: Riverside County, CA	
UTM zone	N
UTM northing	3727759

UTM easting	609669
General legal description	The type location is about 1.25 miles west of the Bajada Nature Trail Parking lot, on Cottonwood Springs Road in Joshua Tree National Park.

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Contributors

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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)	
Contact for lead author	
Date	
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:**