

# **CALIFORNIA VEGETATION MAP IN SUPPORT OF THE DESERT RENEWABLE ENERGY CONSERVATION PLAN (2014-2016 ADDITIONS)**



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and the  
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## ABSTRACT

Aerial Information Systems (AIS) with assistance from the California Department of Fish and Wildlife (CDFW), the Vegetation Classification and Mapping Program (VegCAMP), and the California Native Plant Society (CNPS) created a fine-scale vegetation map of portions of the Mojave and Sonoran Deserts in California. Approximately 2,195,415 acres spanning desert portions of Inyo, San Bernardino, Riverside, and Imperial Counties were mapped between 2014 and 2016. The primary purpose was to develop an accurate vegetation map for the California desert as it pertains to renewable energy sources and conservation opportunities, helping planners identify high quality habitat and rare communities.

The vegetation classification follows Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS). The classification is based on previous survey and classification work. The map was produced applying heads-up digitizing techniques using a base of 2014 true-color and color infrared one-meter National Agricultural Imagery Program (NAIP) imagery in conjunction with ancillary data and imagery sources. Map polygons are assessed for Vegetation Type, Percent Cover, Exotics, Development Disturbance, and other attributes. The minimum mapping unit (MMU) is 10 acres; exceptions are made for wetlands and certain wash types (which were mapped to a 1 or 5 acre MMU, depending on type) and areas characterized as Land Use polygons (which were mapped to a 2.5 acre MMU).

Field reconnaissance and accuracy assessment enhanced map quality. A total of 88 vegetation classes were mapped. The overall accuracy assessment rating for the final vegetation map was 91.90 percent.

**Keywords:** California Energy Commission, vegetation, desert, renewable energy, photointerpretation

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# CHAPTER 1: Introduction

## 1.1 The Mapping Program

In 2011-2012 Aerial Information Systems (AIS) and the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) created a fine-scale vegetation map covering approximately six million acres of portions of the Mojave and Sonoran Deserts in southern California (Menke et al., 2013). In addition, mapping of 95,981 acres within a portion of Rice and Vidal Valleys in the Colorado Desert portion of the Sonoran Desert was completed by AIS in 2013-2014. The maps were primarily produced to support the Desert Renewable Energy Conservation Plan (DRECP) by helping planners more accurately identify high quality habitat and rare communities as they consider renewable energy sources and conservation opportunities. Previous vegetation maps of the area were either large scale and generalized or they were detailed but covered a limited extent. Between 2014 and 2016, as an extension to supplement those mapping efforts, AIS was tasked to create a fine-scale vegetation map of 2,195,415 acres of desert in Inyo, San Bernardino, Riverside, and Imperial Counties in southern California. Areas mapped include the eastern and central portions of the Mojave Desert as well as the Lower Colorado Valley, also referred to as the Colorado Desert, and the Arizona Upland subdivisions of the Sonoran Desert.

The vegetation classification, which follows Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS), is based on previous surveys and classifications. Non-vegetative classes such as water bodies and land use are included. Field reconnaissance was conducted by staff from AIS, accompanied on a few trips by VegCAMP staff. AIS photointerpreters then created a map representing Vegetation Types (vegetation Alliances) and Percent Cover of different vegetative life forms. Map polygons were assessed for Exotics, Development Disturbance, and other attributes. The minimum mapping unit (MMU) for vegetation is 10 acres; exceptions are made for wetlands and certain wash types, which are mapped to 1 or 5 acre MMUs. Land use polygons are mapped to a 2.5 acre MMU.

The geodatabase was produced using on-screen heads-up digitizing, with the data georeferenced to 2014 true-color and color infrared one-meter National Agricultural Imagery Program (NAIP) base imagery. Ancillary data and imagery sources were used to supplement attribution. The geodatabase passed quality control procedures before being finalized. Accuracy assessments (AA) were conducted by VegCAMP and CNPS staff. Sample allocation locations for accuracy assessment were created by VegCAMP for CNPS field crews to use during the field data sampling and collection. Once the field plot information was entered into a database, the point data was analyzed and scored by VegCAMP.

## 1.2 General Study Area

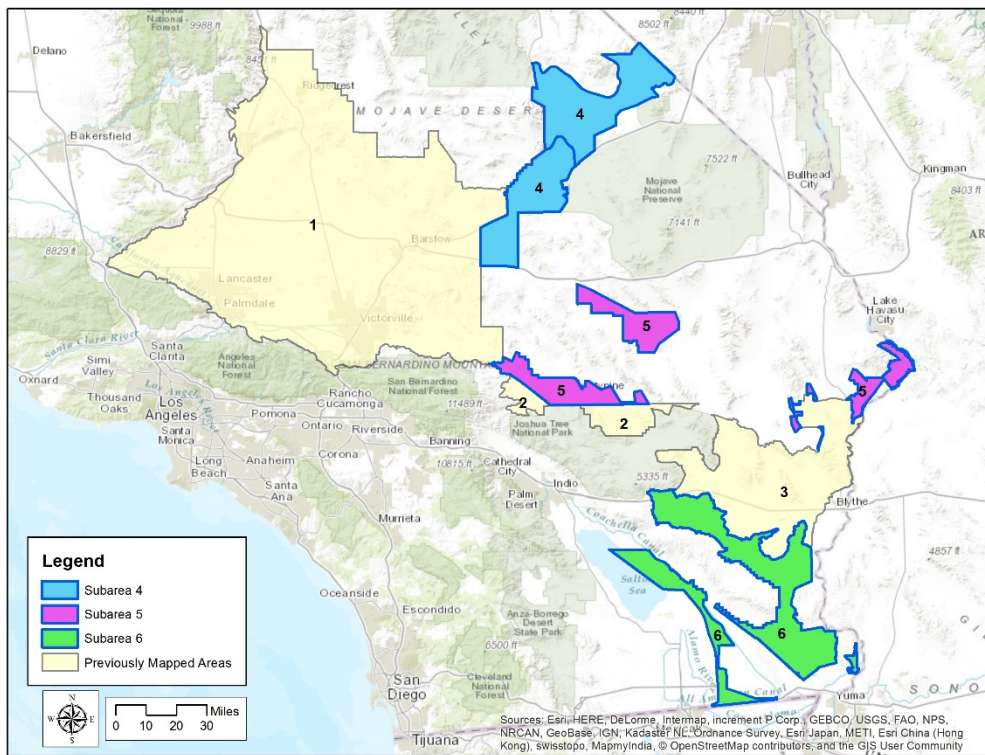
The original 2011-2012 study area was made up of three subareas (1, 2, and 3). The 2014-2016 extension study area is composed of three subareas (4, 5, and 6) grouped together from nine distinct units. The extension subareas range from north to south as shown in **Figure 1**. They cover a total of 2,195,415 acres, extending over portions of the central and eastern Mojave Desert

and the western section of the Sonoran Desert that includes the Colorado Desert and Arizona Upland subdivisions of the Sonoran Desert.

In some cases the boundaries of the subareas followed the borders of federal lands. Bureau of Land Management (BLM) and CDFW provided data layers that represent these boundaries. The CDFW version was used to define the border of subarea boundaries where they follow federal lands. Where this boundary did not match the image base (i.e. visible fencelines) the boundary was adjusted to match the image base.

As mapping progressed, some adjustments were made to the originally proposed boundaries where there was a compelling reason to do so, such as including known stands of sensitive vegetation (e.g. crucifixion thorn (*Castela emoryi*) in Rice Valley).

**Figure 1: Location of the Study Area**



The mapping program’s extended subareas are described below.

- **Subarea 4** – This subarea falls within the Eastern Mojave and the Central Mojave portion of the Mojave Desert. It contains a series of mountains and valleys along or north of the Interstate 15 corridor from the Mojave Valley in the south to Mesquite Valley in the north. In the Mojave Valley east of Yermo, a portion of the western boundary abuts Subarea 1, previously mapped for DRECP.

The southwestern corner of Subarea 4 lies just south of Interstate 40 and extends from west of Troy Lake eastward to a point south of the Cady Mountains.

Turning north, the eastern boundary cuts through the western extent of the Cady Mountains before turning east again at Afton Canyon. In the Mojave Wash, north of Crucero Hill it follows an old railroad grade trending northeast. The boundary then follows the ridgeline of a portion of the north-trending Soda Mountains. It continues northeast along Interstate 15 through Baker before jogging north and northeast around Turquoise Mountain and Squaw Mountain. The boundary cuts through Shadow Valley and skirts the northwest slopes of the Clark Mountains until it turns northwest to follow the Nevada state line in Mesquite Valley.

The northern boundary encompasses a small portion of Inyo County before trending west along the Inyo/San Bernardino County line. It dips south of the Kingston Range before trending northwest to skirt the Dumont Hills and the Sperry Hills.

The western boundary follows Highway 127 south past the Little Dumont Dunes. It jogs northwest along Saratoga Springs Road before traveling south to toe slopes of the Avawatz Mountains. The boundary proceeds south along the eastern flank of the Avawatz until it stairsteps southwest along the perimeter of Fort Irwin Military Reservation. Departing from the Fort Irwin boundary where the latter turns west, the subarea boundary turns east then drops south to Interstate 15 at the Clyde V. Kane Rest Area, then proceeds southwest along the Interstate until reaching the edge of the previously mapped area, turning south until the boundary intersects the southwest corner of Subarea 4.

- **Subarea 5** – This subarea consists of six individual units, all but one of them adjoining previously mapped areas. It contains portions of the Central Mojave Desert and portions of the Sonoran Desert (Colorado Desert and Arizona Upland subdivision). The subarea includes the Landers-Twenty-nine Palms area, the Highway 66-Amboy Road corridor west of Cadiz Valley, and portions of the Whipple Mountains and the Rice and Vidal Valleys.

Two units adjoin the Twenty-nine Palms Marine Corps Air Ground Combat Center (MCAGCC), one to the north and one to the south. Both units are within the Central Mojave portion of the Mojave Desert. Three of the other four units in this subarea are located in the Colorado Desert in Rice Valley and Vidal Valley. The last unit is contiguous and contains a narrow section of the Colorado River Floodplain, the Whipple Mountains (which falls within the Arizona Upland subdivision), and a portion of Vidal Valley that is adjacent to the Whipple Mountains.

In some areas, the boundaries of the MCAGCC as derived from ancillary data were offset from the fenceline seen on the 2014 base imagery. Where this occurred, the subarea boundary was adjusted to match the fenceline seen on the image base.

The unit north of Twenty-nine Palms MCAGCC does not adjoin any previously mapped areas. It is bisected in the west by Highway 66, extending from southeast of Ludlow

down to Amboy. The unit then widens south and east to encompass Bristol Lake. The easternmost boundary of this unit falls just east of Cadiz.

The unit to the southwest abuts part of the southern perimeter of Twentynine Palms MCAGCC. This unit adjoins the previously mapped study in two locations. Its westernmost extent adjoins the southeastern corner of Subarea 1 and covers the area of Homestead Valley. The southern extent abuts Subarea 2 and includes the communities of Sunfair and Twentynine Palms before ending just east of Dale Lake.

There are several units in the Rice Valley/Vidal Valley area that abut previously mapped areas. The southernmost unit in Rice Valley is a very narrow 2000 acre strip to the southeast of Rice Airfield (abandoned) that joins previously mapped areas to the east.

Moving to the northwest another unit originally 6000 acres in size was expanded westward in the south to capture potential mappable stands of crucifixion thorn (*Castela emoryi*). The revised unit is 11,400 acres in size. The expanded portion forms a north-south trending polygon east of the railroad. Traveling north, the unit narrows where it includes the abandoned Rice Airfield, then continues north to eventually form a U-shaped feature around the southern flank of the Turtle Mountains. This unit adjoins previously mapped areas to the east.

Moving to the northeast, another unit of 4500 acres lies in the Vidal Valley east of the southern tip of the Turtle Mountains and borders on previously mapped areas to the south.

The easternmost unit adjoins the previously mapped areas along parts of its southwestern edge, where the San Bernardino/Riverside County line meets the Colorado River. The unit continues northeast, excluding the communities of Big River and Earp but otherwise skirting the Colorado River. The unit encompasses the south and southeast slopes of the Whipple Mountains, and the Parker Dam area, before turning northwest paralleling the Colorado River and ending in the vicinity of Havasu Palms.

- **Subarea 6** – The southernmost portion of the mapping effort is comprised of three units that are entirely within the Colorado Desert in the southeastern corner of the state. This subarea contains the Chuckwalla, Mule, Palo Verde, Cargo Muchacho, Chocolate and Orocopia Mountains; Chuckwalla Bench; portions of the Salton Sea Trough, Pilot Knob and East Mesas; and the area north of Bard in the Chocolate Mountains near the California/Arizona border.

The largest of these three units shares a boundary on its northern side with the previously mapped Colorado Desert area. Its northwesternmost area encompasses an extension of the Chuckwalla Valley just east of Chiriaco Summit, skirting the southern edge of the Eagle Mountains. The western boundary proceeds south through the easternmost extent of the Orocopia Mountains before generally following the northeastern, eastern, and southern boundary of the Chocolate Mountain Aerial



Gunnery Range (CMAGR). A narrow strip of the unit extends northwest to the vicinity of the northern tip of the Sand Hills, near Mammoth Wash. The strip is situated between the southwestern boundary of CMAGR and the railroad/North Algodunes Dunes Wilderness Area boundary trending northwest-southeast.

The boundary jogs northeast to follow railroad and continues southeast to the Ogilby Hills before turning northeast to cut through Pasadena Mountain. It turns north to follow the Little Picacho Wilderness Area boundary, then trends west near the Picacho State Recreation Area before turning north again at Black Mountain. It continues north along State Route 78 past the hills north of Buzzards Peak. The boundary trends northeast before turning due north just west of the Cibola National Wildlife Refuge and the Colorado River. It then rejoins the southern boundary of the previously mapped area.

Another sizable unit in this area is narrower than the first described above, and includes the East Highline Canal and much of the Coachella Canal from the Riverside/Imperial County boundary south to the US/Mexico border. The northwestern portion of this unit includes the Salton Sea shoreline and the communities of Bombay Beach and Niland. The western boundary turns east at Niland before trending southeast, roughly paralleling the East Highline Canal about one- to three-quarters of a mile to the west, until the waterway joins the All American Canal.

The boundary then coincides with the US/Mexico border as far east as Exit 151 on Interstate 8. The boundary parallels the north side of Interstate 8 as it trends northwest, then heads north through the sand dunes approximately two miles east of the East Highline Canal. It skirts around the Holtville Airport before trending west, then north, to form a narrow corridor containing the East Highline Canal. The boundary turns east just south of State Route 78, then turns northwest to follow the trend of the Coachella Canal. East-southeast of Niland the boundary joins the southwestern perimeter of the CMAGR, trending northwest until it reaches the Riverside/Imperial County boundary.

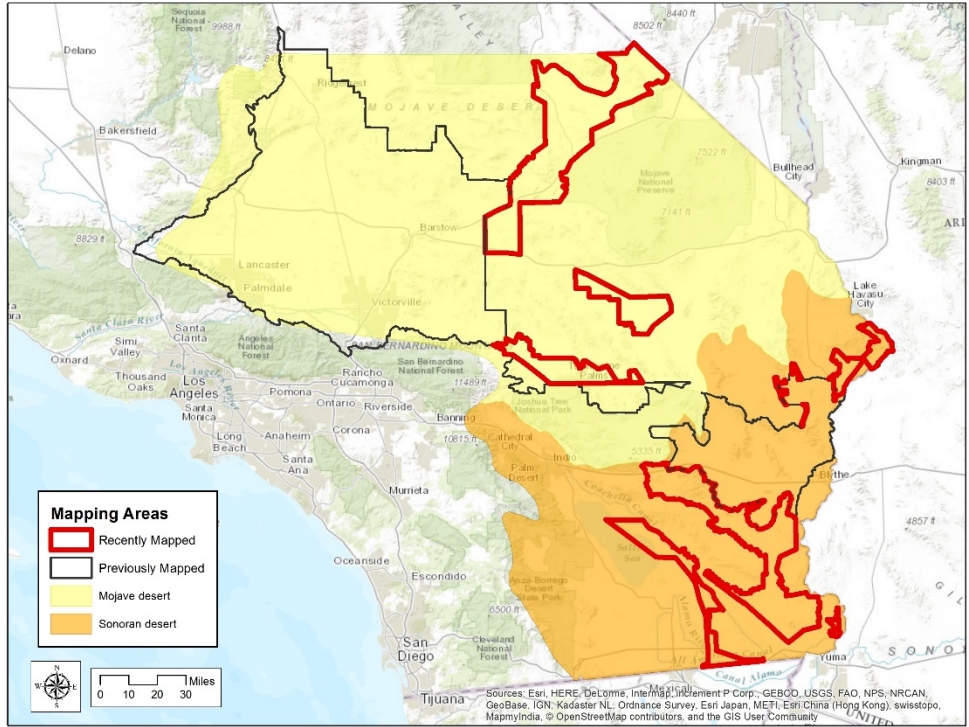
The smallest of the three units is located near the Colorado River north of Bard. The western boundary approximates the ridgeline of the hills east of Mission Wash. Following the boundary northwest, it turns east along the southern boundary of Township 14S, then trends north and east following a dirt road that is also the boundary of the Little Picacho Wilderness Area. South of Ferguson Wash, the boundary turns south, primarily following the line dividing Ranges 23E and 24E until it reaches the All-American Canal. The southern boundary of the unit lies north of 11<sup>th</sup> Street in Bard.

### **1.3 Ecological Regions in the Study Area**

The study area covers portions of the Mojave and the Sonoran Deserts, which are shown in **Figure 2**. The following sections describe the different deserts and their ecological regions found within the study area. Finer distinctions of the ecological zones occurring within the two deserts have been defined by AIS photointerpreters based on biogeographical distinctions, which often

influence vegetation patterns. This enables the photointerpreter to better understand how vegetation correlates to these variables within each zone.

**Figure 2: The Mojave and Sonoran Deserts within the DRECP Study Area in Southern California**



The Mojave Desert is represented by the yellow shading and the Colorado portion of the Sonoran Desert is in orange shading. The previously mapped area is displayed with the black boundary and the current study area is displayed with the red boundary.

### 1.3.1 The Mojave Desert



**Photo Credit: John Fulton**

The Mojave Desert is the smallest of the four major North American deserts, occupying approximately 16 million acres, mainly in southeastern California. Its boundaries are defined in the west by the southern portions of the Sierra Nevada, to the south by the east-west running Transverse Ranges of coastal

southern California, to the east roughly by the Colorado River, and to the north by the basin and range complexes of Nevada and eastern California. It is one of California's largest ecoregions, encompassing approximately 15 percent of the entire state. Portions of the Central and Eastern Mojave Desert are mapped in this study area and are described in greater detail later in the report in section 1.3.3 (Defined Regions within the Study Area).

The Mojave is unique in that it is the only desert receiving most of its precipitation in the cooler winter months, where winter cold is severe enough to produce a short dormant season for the natural vegetation. This pattern of precipitation occurring when plants need it least goes into creating a flora unique to the Mojave Desert where Joshua tree (*Yucca brevifolia*) is the characteristic plant of much of the mid- and higher elevations.

### 1.3.2 The Sonoran Desert

The Sonoran Desert is the third largest of the four major North American deserts, occupying approximately 64 million acres, in Arizona, southeastern California and northwestern Mexico. Its boundaries are defined in the west by the Peninsular Ranges in the Pacific Coast Ranges. To the north, it is bordered by the Mojave Desert. The portion of the Sonoran Desert in the mapping effort is bounded by the Colorado River to the east and southeast, and by the international border to the south.

The westernmost portion of the of the Sonoran Desert, falling within the DRECP mapping study, is known more locally as the Colorado Desert or Colorado portions of the Sonora Desert. This region overall receives less precipitation than areas east of the Colorado River, where summer thunderstorms are more frequent. Weather stations located in Indio, Brawley, and Blythe reflect these hyperarid conditions where precipitation totals range from only 2.8 to 4 inches annually. Contrast this with cities further east, such as Phoenix and Tucson, which receive between 8 and 12 inches yearly.



**Photo Credit: John Fulton**

Several significant vegetation types mapped for this project occur only in the Sonoran Desert portion of the study area. Some of the most representative examples include the extensive stands of blue palo verde (*Parkinsonia florida*) and ironwood (*Olneya tesota*) that occur throughout the region in medium to large washes and as emergent trees to creosote bush (*Larrea tridentata*) scrub. In California's easternmost section, vegetation common to areas in southwestern Arizona reach their westernmost extent in the Whipple Mountains. Stands of foothill palo verde (*Parkinsonia microphylla*) drape the lower foothill slopes east of this mountain range as an emergent tall shrub to creosote bush and brittle bush (*Encelia farinosa*). Percent cover

of this tall shrub in some areas reach 5-10 percent locally. In these stands over 50 individuals of giant saguaro cactus (*Carnegiea gigantea*) were observed in widely scattered locations.

The Sonoran Desert can be divided into seven subdivisions, two of which occur within the DRECP mapping area and are listed below:

- Lower Colorado River Valley - *This is also referred to as the Colorado Desert Subdivision in this report.*
- Arizona Upland – *Represented here as the easternmost portion of California near the town of Parker, Arizona.*

Within these two subdivisions, five zones are defined and described in this report:

- Lower Colorado River Valley (Colorado Desert) Subdivision
  - Colorado River Floodplain Zone
  - Chuckwalla and Chocolate Mountains Zone
  - Rice & Vidal Valleys Zone
  - Salton Sea Trough Zone
- Arizona Uplands Subdivision
  - Whipple Mountains Zone

### 1.3.3 Defined Regions within the Study Area

The study includes a number of areas with similar environmental characteristics, which AIS refers to as “zones.” These zones support different types of vegetation due to a variety of factors including, but not limited to, elevation, topographical characteristics, surface geology and parent material, soil texture and chemistry, and regional and microclimatic patterns. All of these enable the photointerpreters to attain a better understanding of how vegetation reacts under like conditions. The descriptions below are based on areas in the 2014-2016 mapping effort. For locational descriptions of previously mapped portions of these subregions, refer to 2013 *California Vegetation Map in Support of the Desert Renewable Energy Conservation Plan. Final Report.* (Menke et al., 2013).

#### 1.3.3.1 The Central Mojave Desert Region

This region is defined in part by very low precipitation. In the central portions of the Mojave Desert (**Figure 3**), most weather stations within the region receive less than five inches of rainfall annually. Most of the limited precipitation falls in the cooler winter months; however, as one transitions to the east and southeast to both the Eastern Mojave and the Colorado Desert, there is a small summer rainfall season where about a quarter of the annual precipitation falls in the form of widely scattered brief but intense thunderstorms.

The Central Mojave Desert region within the study has three distinct mapping components. The northern component corresponds to the south half of Subarea 4. The other two components correspond to the western two units of Subarea 5.





**Photo Credit:** Edward Reyes

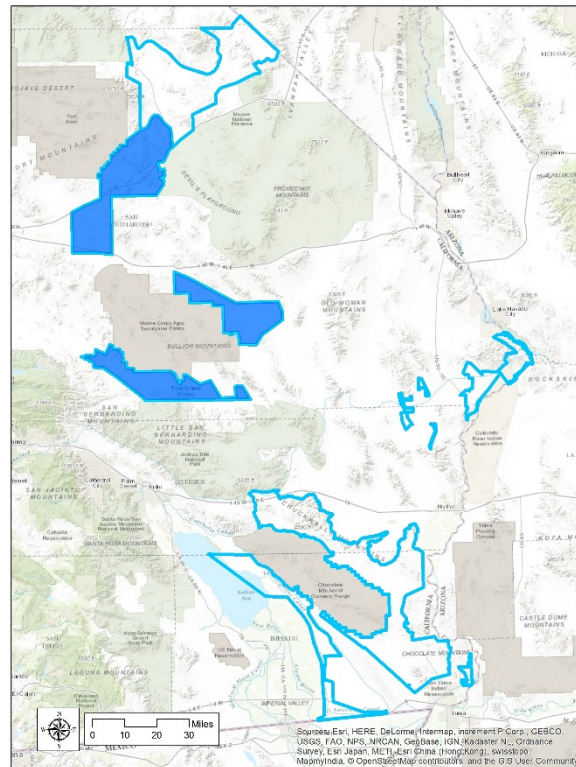
The northern component is defined at its western boundary by the previous mapping effort, a boundary along Fort Cady Road about one mile west of Troy Dry Lake in the Mojave Valley. This mapping component roughly follows the Interstate 15 corridor northeastward to about the town of Baker. Near this location, the boundary is roughly defined by the easternmost portions of the Mojave River watershed. Within this component, several dry lakebeds (including East and

West Cronese, and Red Pass Lakes) support at least a half dozen expressions of alkaline scrub communities dominated by saltbush (*Atriplex* spp.) and/or bush seepweed (*Suaeda moquinii*). Two significant desert ranges, the Cady and Soda Mountains, attain elevations just over 3000 feet (900 meters), not high enough to support any stands of *Yucca* spp. or other mid-elevation shrubs in this hyperarid region.

To the southeast, another defined component to this region follows the historic US Route 66 corridor from just west of the old town site of Siberia southeastward to the Cadiz Junction town site. Nearly a quarter of this component's total acreage is occupied by the sparsely vegetated Bristol Dry Lake. On the northwest edge of this playa, Amboy Crater rises nearly 250 feet (76 meters). Some of the most extensive stands of desert holly (*Atriplex hymenelytra*) in the mapping effort are found on volcanic flows just below the crater. Most of this area is defined by extensive bajadas where creosote bush and white bursage (*Ambrosia dumosa*) dominate the landscape. This is overall the driest section of the entire DRECP area, with stations going as long as 767 days without any measurable rain, the longest ever recorded in the United States.

Further south still, the southernmost defined component within the Central Mojave Desert Region parallels the Little San Bernardino Mountains, the easternmost mountain chain in the Transverse Ranges. Precipitation here is substantially higher than the previously defined components to this region due to its proximity to California's east-west trending Transverse Ranges. Fairly extensive stands of Joshua tree (*Yucca brevifolia*) and black brush (*Coleogyne ramosissima*) in the western portion of this component give way to pinyon, juniper and Muller oak woodlands above 4000 feet (1200 meters). Elevation, and consequently precipitation, drops rapidly toward the eastern portion of this area where it terminates just east of Dale Lake (a playa dominated by two species of saltbush (*Atriplex*) scrub in addition to iodine bush (*Allenrolfea occidentalis*) and bush seepweed, both of which occur in extremely alkaline settings).

**Figure 3: Location of Portions of the Central Mojave Desert Region within the Study Area**



### 1.3.3.2 The Eastern Mojave Desert Region

This region is defined by extreme conditions due mainly to the wide range in elevation.

Elevation ranges from below 1000 feet (300 meters) on the Silver Lake Playa near the town of



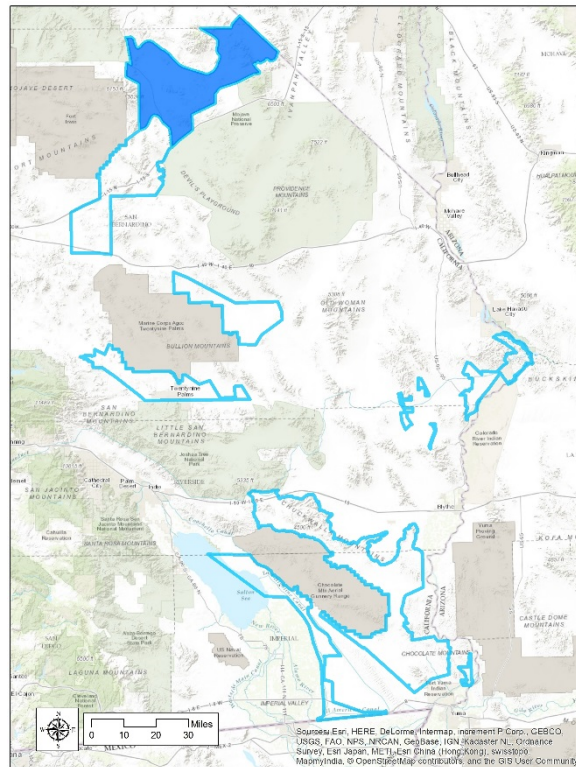
**Photo Credit: John Fulton**

Baker to over 7000 feet (2130 meters) at the summit of Clark Mountain, less than 4 miles outside the mapping area to the south. However, maximum elevations within the mapped area approach only 5000 feet (1500 meters). The wide range in elevation is reflected in the region's climate, where summer temperatures exceed 120 degrees in the Silurian Valley to areas that average over 8 inches of winter snowfall a year in the Clark Mountains. Several of these

high-elevation “dry-subhumid” desert refugia support relic stands of Rocky Mountain white fir (*Abies concolor* var. *concolor*), which occur just outside the mapping area on Clark Mountain and in the Kingston Range.

The region supports some of the most extensive and minimally disturbed stands of Joshua tree woodlands, comprising greater than 84,000 acres in the DRECP mapping area. Vegetation diagnostic of dolomite substrate covers portions of the Mesquite, Turquoise, and Spring Mountains, resulting in the occurrence of uncommon types such as Death Valley joint fir (*Ephedra funerea*), Utah agave (*Agave utahensis*), and Stansbury cliff rose (*Purshia stansburiana*). In the northwest corner of this region, extensive sand dune formations (The Dumont Dunes and the smaller Valjean Dunes) rise 500 feet (150 meters) at their tallest point. Adjacent to the south and east of the Dumont Dunes, some of the most extensive stands of pure white bursage are found on broad sheets of sand. This particular Alliance forms continuous stands covering nearly 6000 acres of desert landscape. Just west of these dunes, and within the mapping boundaries, the Amargosa River empties into the southeasternmost portion of Death Valley.

**Figure 4: Location of Portions of the Eastern Mojave Desert Region within the Study Area**





### *1.3.3.3 The Whipple Mountains Zone of the Arizona Upland Subdivision of the Sonoran Desert*

The Arizona Upland Subdivision of the Sonoran Desert is located primarily in south-central Arizona and northern Sonora, Mexico. This subdivision extends west to the Colorado River where it terminates close to California's easternmost point, just west of the Whipple Mountains.

Within most of this subdivision, a majority of the rainfall occurs during the summer monsoon season, with occasional late fall and winter rain that may last for several days. The terrain is significantly higher than the adjacent Lower Colorado River Valley and supports a diverse assemblage of desert scrub and woodland flora. For this report, we are treating the Whipple Mountains zone as the westernmost extension of this subdivision. It corresponds to the eastern half of the easternmost unit of Subarea 5.



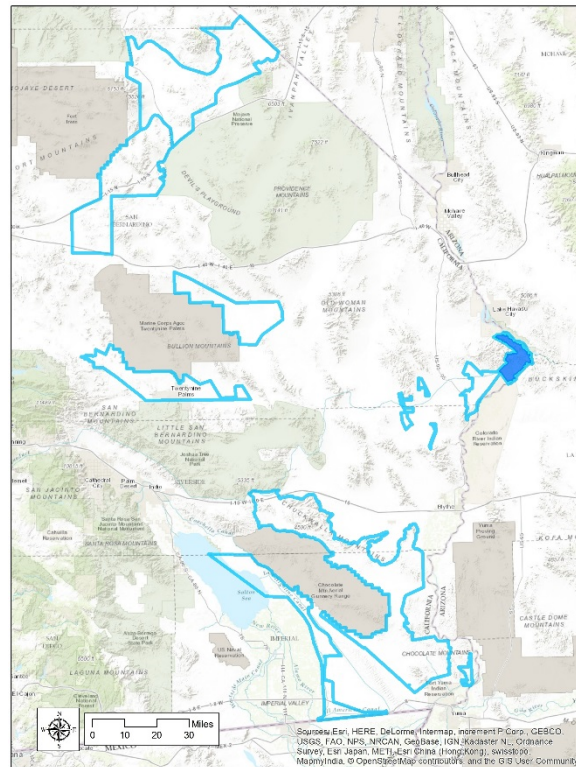
*Photo Credit: John Fulton*

The Whipple Mountains zone is home to several noteworthy plants that are common in the Arizona Uplands Subdivision. These plants extend westward beyond the Colorado River to form rare stands that occur only in this part of California. Two of these species, the foothill palo verde and the giant saguaro, occur solely in this region of the state. Of the two, only the foothill palo verde forms mappable stands, in this zone totaling over 16,000

acres in all. Within these stands, occasional individuals of giant saguaro cactus can be seen dotting the landscape.



**Figure 5: Location of Portions of the Whipple Mountains Zone within the Study Area**



**1.3.3.4 The Colorado River Floodplain Zone of the Lower Colorado River Valley Subdivision of the Sonoran Desert**



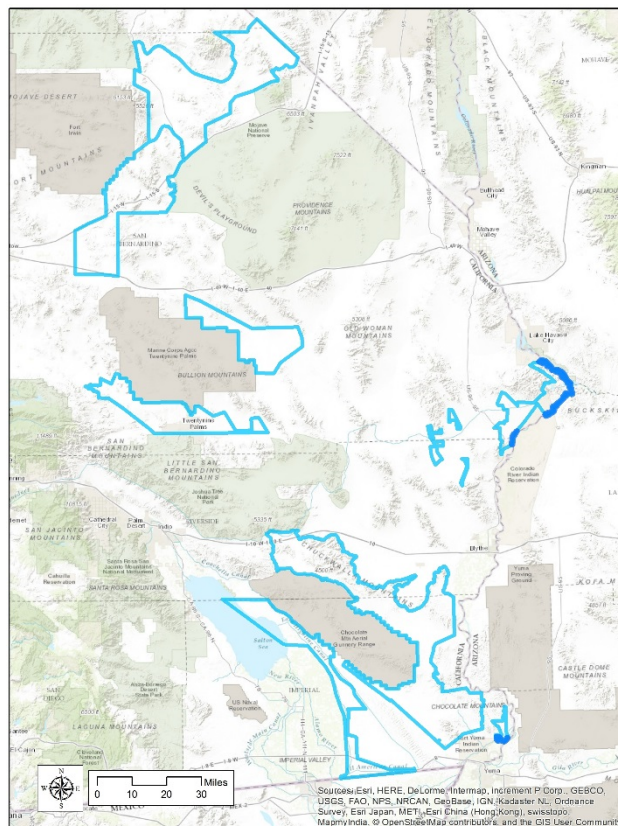
**Photo Credit: John Fulton**

This zone occurs within the Lower Colorado River Valley subdivision of the Sonoran Desert portion of the study area. For the 2014-2016 mapping effort (**Figure 6**) this zone is limited primarily to a narrow corridor along the Colorado River east and south of the Whipple Mountains. It is found in the easternmost unit of Subarea 5. A small section of this zone also occurs far to the south, in the southeast unit of Subarea 6, and parallels the All American Canal for about

four miles near the city of Yuma. For the most part, the zone averages significantly less than a mile in width. Nearly all the zone's vegetation is determined by its proximity to the Colorado River rather than by the scant rainfall that is characteristic of the entire region's climate.

Some of the desert's mesquite (*Prosopis glandulosa*) bosques occur within this region, occupying nearly 330 acres primarily in extremely narrow stands along the breakpoint between the active floodplain and adjacent bluff. Stands of tamarisk (*Tamarix* spp.) thickets have replaced native riparian vegetation throughout the active floodplain where current stands are estimated at nearly 250 acres. However, tamarisk is also often a significant component of mappable stands of naturally occurring riparian vegetation, including arrow weed (*Pluchea sericea*) thickets along with mesquite and various chenopod scrub stands. Much of the vegetation on the active floodplain has undergone multiple disturbances where early replacement stands include species such as bush seepweed, quail bush (*Atriplex lentiformis*), and arrow weed. On some of the hypersaline sites, iodine bush occurs in patches, especially adjacent to Parker Dam Road, southwest of Parker Dam.

**Figure 6: Location of Portions of the Colorado River Floodplain Zone within the Study Area**



### 1.3.3.5 The Salton Sea Trough Zone of the Lower Colorado River Valley Subdivision of the Sonoran Desert

This zone is the only area in the mapping effort where significant portions fall below sea level. The zone experiences fewer days below freezing than any other region within the DRECP mapping area. Precipitation is extremely low with all three nearby weather stations (Brawley, El Centro, and Indio) averaging less than 3 ½ inches annually. The zone corresponds to the



Photo Credit: John Fulton

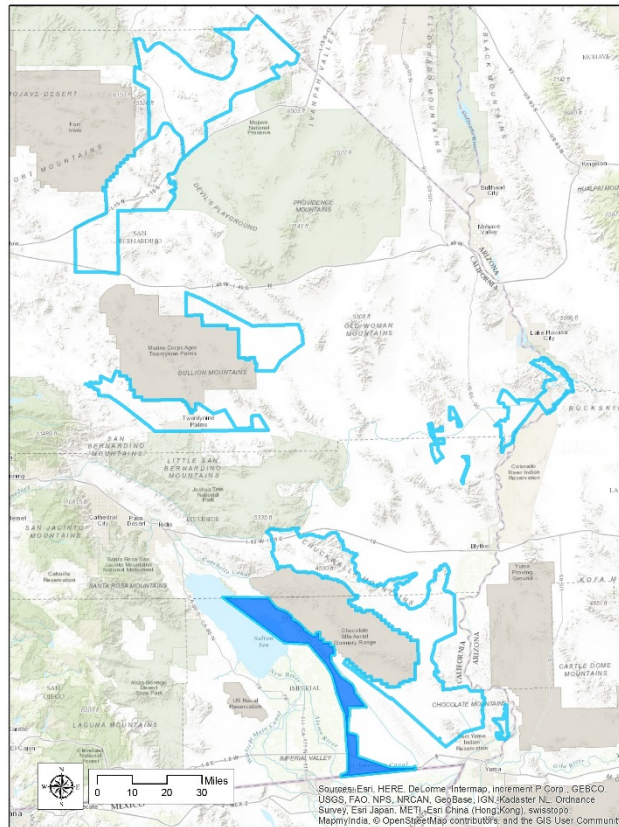
western unit of Subarea 6. It roughly follows State Route 111 and the adjacent East Highline and Coachella Canals along a narrow band averaging 1 to 3 miles in width from the Riverside–Imperial County line southward to the international border where it turns eastward, paralleling the All American Canal to the base of the Algodones Dunes.

Vegetation occurring upslope on the bajadas east of the East Highline Canal reflects this hyperarid setting, resulting in woody plant cover averaging less than 5 percent, especially in a broad band of alkaline “mud hills” in the northern section. Further south, on gently sloping bajadas above the ancient lake bed, the landscape is dominated by large areas of continuous sandy substrate. In these highly permeable settings, stands of creosote bush are frequently lacking the typical understory low shrub component of white bursage. Species better adapted to this setting, such as longleaf joint fir (*Ephedra trifurca*), frequently co-dominate and at times, form stands on their own.

The western portions of this zone are dominated by riparian and wetland vegetation associated with the higher water table and numerous canals that cross the landscape. In these areas, nonnative species such as *Tamarix (ramosissima or chinensis)* and ravenegrass (*Saccharum ravennae*) occur in close proximity to native vegetation composed of arrow weed scrub and common reed (*Phragmites australis*) in narrow bands often following the margins of the canals.



**Figure 7: Location of Portions of the Salton Sea Trough Zone within the Study Area**



**1.3.3.6 The Chuckwalla and Chocolate Mountains Zone of the Lower Colorado River Valley Subdivision of the Sonoran Desert**

The Chuckwalla and Chocolate Mountains zone encompasses nearly 660,000 acres of land stretching across the entire Chuckwalla Range southeastward to include the Palo Verde Mountains and portions of the Chocolate Mountains. Much of the southern boundary is coincidental with the Chocolate Mountain Aerial Gunnery Range. A small separate component to this zone lies in the extreme southeast part of California and encompasses the



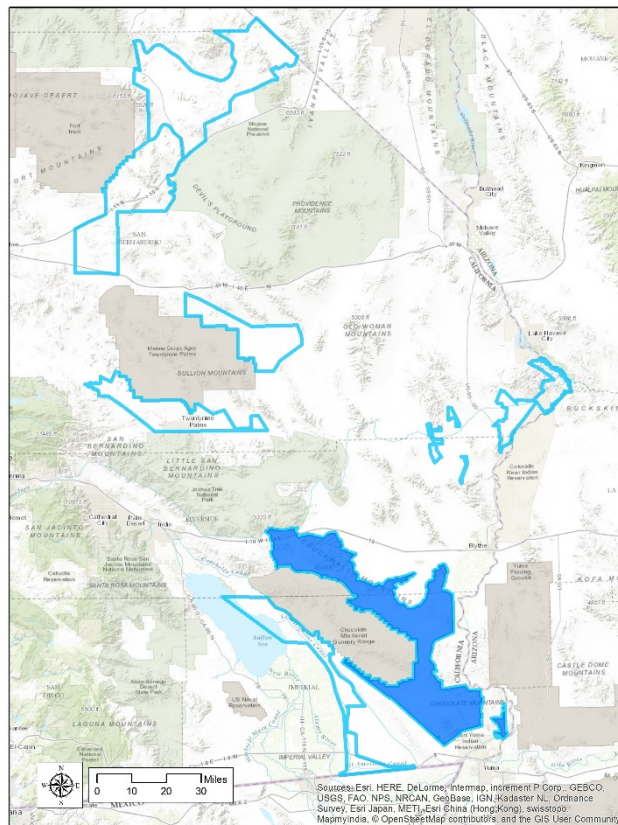
**Photo Credits: John Fulton**

southeasternmost portions of the Chocolate Mountains. The zone corresponds to the central and

largest unit of Subarea 6. Elevations range from below 1000 feet (300 meters) in the southern and northeast sections, to over 4500 feet (1370 meters) in the Chuckwalla Mountains. On the mid and upper fans and adjacent low toe slopes of the Chuckwalla Range, in settings above 2500 feet (760 meters), conditions are favorable for mid-elevation desert species such as Mojave yucca (*Yucca schidigera*) to attain a cover density greater than 1-2 percent, and thus be mappable. In this same general area, along drier margins of Milpitas Wash, small patches of the rare Munz's cholla (*Cylindropuntia munzii*), in stands well under an acre, were observed during field reconnaissance.

Also in this area, and further south as well, on cobble-strewn upper fans and toe slopes of the Chocolate Mountains, vast stands strongly dominated by teddy bear cholla (*Cylindropuntia bigelovii*) stretch across the landscape in continuous stands, several of which are nearly 1000 acres in size. Within the numerous washes bisecting the lower bajadas of this zone, extensive stands dominated by blue palo verde and ironwood continue uninterrupted in bands frequently stretching over 5 miles long. This zone contains more than 75,000 acres mapped to this dual-species wash Alliance.

**Figure 8: Location of Portions of the Chuckwalla Mountains and Chocolate Mountains Zone within the Study Area**



### 1.3.3.7 The Rice and Vidal Valleys Zone of the Lower Colorado River Valley Subdivision of the Sonoran Desert

This zone contains four distinct units, the largest one encompassing approximately 53,000 acres immediately southwest of the Whipple Mountains Zone. Almost the entire zone is comprised of extensive mid and lower bajadas covering portions of the Vidal, Ward, and Rice Valleys. It corresponds to the eastern four units of Subarea 5, but includes only the western half of the easternmost unit. The westernmost unit to this subregion is home to a rare stand of crucifixion thorn, the largest known stand within the state, measuring approximately 200 acres in size.



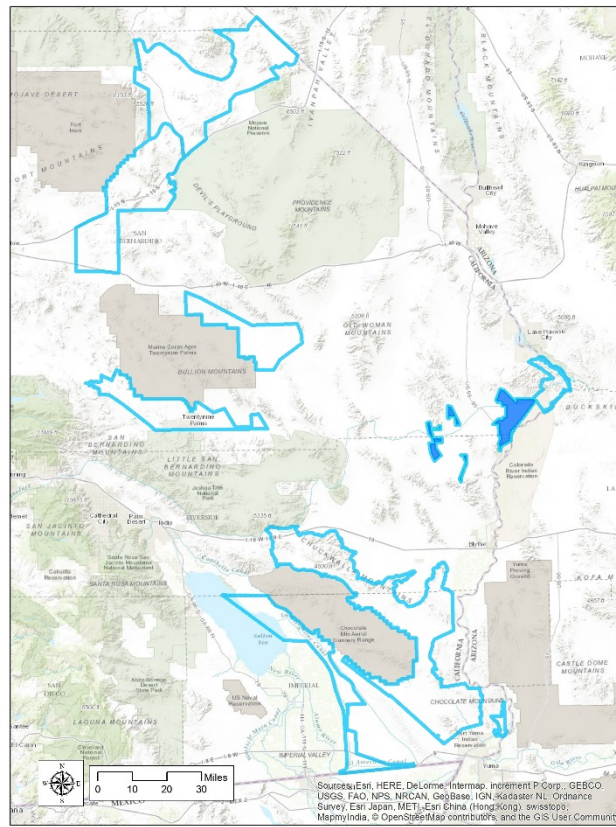
**Photo Credit:** John Fulton

Significant portions of this zone are bisected with numerous washes containing stands of ironwood and blue palo verde. Upland vegetation is dominated by three Alliances containing a component of creosote bush. These stands may have creosote bush as the single species dominating, or may be co-dominated by the smaller shrubs white bursage or

brittle bush. Significant areas within this zone, especially in the two small units south of State Route 62, contain a sandy substrate where big galleta grass (*Pleuraphis rigida*), and/or longleaf joint fir dominate or co-dominate with creosote bush.



Figure 9: Location of Portions of the Rice and Vidal Valleys Zone within the Study Area



# CHAPTER 2: Methodology

## 2.1 Overview

The mapping effort began with the compilation of a preliminary mapping classification. Then the project staff of experienced photointerpreters conducted field reconnaissance visits to prepare for the photointerpretation effort. Using geographic information system (GIS) technology, they applied their knowledge and observations of desert vegetation to create a map of vegetation types. Codes representing a suite of other attributes were assigned to the vegetation polygons. Several quality control and accuracy assessment (AA) procedures were implemented prior to finalizing the geodatabase. A more detailed discussion of these methodology components follows.

## 2.2 Project Materials

### 2.2.1 Computer Software/Hardware

The mapping effort was conducted using Dell workstations with dual monitors. The extra monitor was helpful in viewing ancillary image sources and ground photos while the map was being created on the primary monitor. The maps were produced using Esri's ArcGIS software. The final map was delivered in ArcGIS 10.3 file geodatabase format.

### 2.2.2 Imagery

The digital orthophoto base imagery for the mapping project was true-color and color infrared 1-meter NAIP imagery from 2014. Another set of true-color digital imagery available through ArcGIS online (variable dates depending on scale viewed) was used as supplemental imagery to aid in the vegetation mapping effort. The vegetation mappers were able to bring this georeferenced imagery set directly into their ArcMap sessions.

The photointerpreters also referred to imagery available from the Internet, such as Google Earth, Google Maps, and Bing Maps. Google Earth imagery allowed for viewing imagery from previous months and years, which was helpful in assessing long-term trends and varying phenological appearances of the vegetation. The Google Maps street view option was sometimes used where available. Although these supplemental sources were used, all delineations, in addition to all floristic and structural attributes, were based on the 2014 NAIP imagery as previously stated.

In some instances, photointerpreters mapped to more recent conditions than shown on the 2014 base imagery. This occurred exclusively in agriculture lands near the Salton Sea. This was done because the field reconnaissance team noticed large areas of cleared land that had been created after the 2014 base imagery was flown. These areas were flagged in the field and subsequently evaluated back in the office. Polygon for these situations were mapped if the boundaries could be seen on the post-2014 imagery (usually Google Earth) or determined by using features such as fencelines or roads. For example, if an area cleared after 2014 was bounded by several roads, then the roads were used to map the polygon boundaries as seen on the 2014 base imagery.

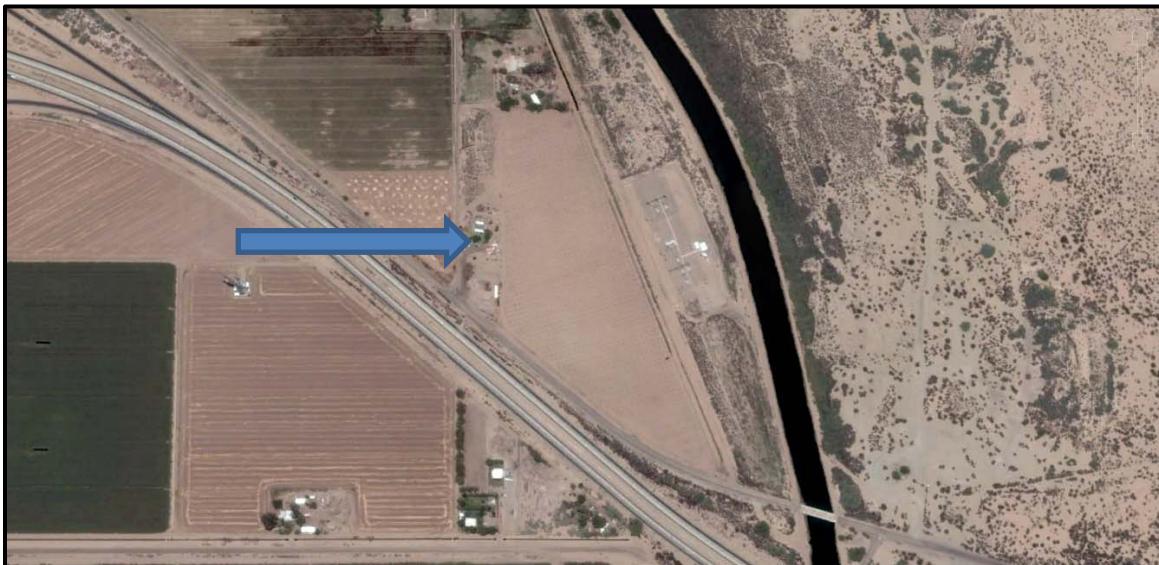


Therefore, some polygons in the Salton Sea area will not match the 2014 base imagery. See Figure 10.

**Figure 10: 2014 NAIP Imagery vs 2015 Google Earth Imagery**



Vegetated area as depicted on 2014 NAIP. The blue arrows shows the same location in 2014 (above) and 2015 (below).



Area as depicted on 2015 Google Earth imagery.

### 2.2.3 Ancillary Data

The distribution of vegetation on the landscape is influenced by a variety of environmental factors, such as geology, soils, topography, and fire history. Digital data sources addressing these factors helped the photointerpreters in the delineation of vegetation map units. Existing maps of vegetation were also a valuable reference. All of these data sources were georeferenced and viewed by the mappers within their ArcMap sessions.

The following sources, some of which were provided by CDFW or partnering agencies, were used regularly throughout the mapping effort:

- CalFIRE – downloaded from <http://frap.cdf.ca.gov/data/frapgisdata-subset.php>
- CA State Geology Maps – downloaded from <http://datagateway.nrcs.usda.gov>
- CNPS-BLM Workshop data collection waypoints – obtained from CNPS
- Digital Elevation Models – via ArcGIS Online
- DRECP Vegetation Map (Areas A, B, C, D) – received from CDFW
- Federal Lands – downloaded from <http://www.nationalatlas.gov/atlasftp.html>
- Geology\_USGS – downloaded from <http://ngmdb.usgs.gov>
- Indian Lands – downloaded from <http://www.nationalatlas.gov/atlasftp.html>
- Joshua Tree National Park Vegetation – received from Park personnel
- MDEP (Central Mojave Vegetation Data) – received from CDFW
- Microphyll Map (2012) – received from CDFW
- National Parks – downloaded from <https://irma.nps.gov>
- Northern & Eastern Colorado Desert (NECO) vegetation data field waypoints – received from CNPS
- Topographic map Digital Raster Graphics – via ArcGIS Online
- Wetlands – downloaded from <http://www.fws.gov/wetlands/Data/State-Downloads.html>
- Wilderness – downloaded from <http://www.blm.gov/wo/st/en.html>

## 2.3 Mapping Classification

The map classification is the same as that of the original DRECP mapping project (Menke et al., 2013), which is based largely on work done in the area for previous and ongoing projects: Vegetation Mapping of Anza-Borrego Desert State Park and Environs (1998), the Mojave Desert Ecosystem Program's Vegetation Database (2004), Vegetation of Joshua Tree National Park (2013), and Vegetation Classification and Mapping at Lake Mead National Recreation Area (in progress), Mojave National Preserve (in progress) and Death Valley National Park (in progress).

VegCAMP provided the initial vegetation classification hierarchy. Based on the most current NVCS system, VegCAMP compiled the vegetation information from the aforementioned projects and arranged it into a classification. Refinements to this initial classification were made as mapping proceeded. *A Manual of California Vegetation* (Sawyer, Keeler-Wolf, and Evens, 2009) was consulted as a reference to guide the revisions. Any potential classification changes

encountered by AIS as the mapping progressed were brought to the attention of VegCAMP staff for possible classification revision.

## 2.4 Field Reconnaissance

Field reconnaissance visits serve two major functions. First, they enable photointerpreters to relate the vegetation on the ground at each observation site to the signatures on the aerial imagery. Second, with guidance from ecologists in the field, the photointerpreters become familiar with the flora, vegetation assemblages, and local ecology of the study area. At the same time, ecologists gain understanding from the photointerpreters' perspective about assessing vegetation through the framework of map creation.

Between August 2014 and December 2015, AIS conducted twelve field reconnaissance trips dispersed throughout the mapping area with one crew per trip. The trips are summarized in **Table 1**.

**Table 1: Summary of Field Reconnaissance Trips**

<b>Trip No.</b>	<b>Dates</b>	<b>Staff from:</b>	<b>Location</b>
1	August 4-9, 2014	AIS/VegCAMP	Silurian, Mesquite, Shadow, and Death Valleys; Turquoise and Shadow Mountains; Kingston Range (Subarea 4)
2	November 17-21, 2014	AIS	Cronese, Silurian, and Death Valleys; Soda Mountains (Subarea 4)
3	January 26-30, 2015	AIS	Mojave and Mesquite Valleys; Silurian Hills; Turquoise, Shadow, and Mesquite Mountains (Subarea 4)
4	March 30 - April 3, 2015	AIS/VegCAMP	Vidal, Smoketree, and Chuckwalla Valleys; Whipple, Chuckwalla, Palo Verde, Mule, Cargo Muchacho, and Chocolate Mountains; East Mesa (Subareas 5, 6)
5	June 1-5, 2015	AIS	Mojave, Silurian, Shadow, and Death Valleys; Silurian, Shadow, and Cady Mountains; Kingston Range (Subarea 4)
6	June 16-18, 2015	AIS	Cronese and Mesquite Valleys; Mesquite Mountains, (Subarea 4)
7	August 3-4, 2015	AIS	Twentynine Palms; Highway 66-Amboy Road Corridor; Bristol Lake (Subarea 5)
8	August 24-28, 2015	AIS/VegCAMP	Vidal and Smoketree Valleys; Colorado River Floodplain; Whipple, Chuckwalla, Palo Verde, and Chocolate Mountains; Salton Sea Trough (Subareas 5, 6)

<b>Trip No</b>	<b>Dates</b>	<b>Staff from:</b>	<b>Location</b>
9	September 10-11, 2015	AIS	Salton Sea Trough; Cargo Muchacho and Chocolate Mountains; Colorado River Floodplain (Subarea 6)
10	September 28 - October 2, 2015	AIS	Orocopia, Mule, Palo Verde, and Chuckwalla Mountains; Smoketree and Chuckwalla Valleys; Chuckwalla Bench (Subarea 6)
11	November 2 - 6, 2015	AIS	Landers-Twenty-nine Palms; Cadiz Valley; Highway 66-Amboy Road Corridor; Bristol Lake (Subarea 5)
12	December 2-3, 2015	AIS	Salton Sea Trough; Rice Valley (Subareas 5, 6)

Prior to each trip, AIS staff reviewed imagery on-screen to identify and select potential reconnaissance sites in close proximity to roads. Sites were selected to represent different vegetation types and percent cover, as well as variations in geography, landform, and abiotic factors such as percent slope, aspect, shape of the slope, and elevation. Multiple sites were chosen to provide alternatives in case one or more sites were to prove inaccessible. Project staff created hardcopy plots of the base imagery and annotated them with road information for navigation in the field. The plots were usually generated at a scale of 1:26,000, with a few areas also plotted at 1:12,000 to provide more detail. AIS staff planned field routes to maximize the number of vegetation types and ecological regions visited while taking into consideration time constraints and accessibility.

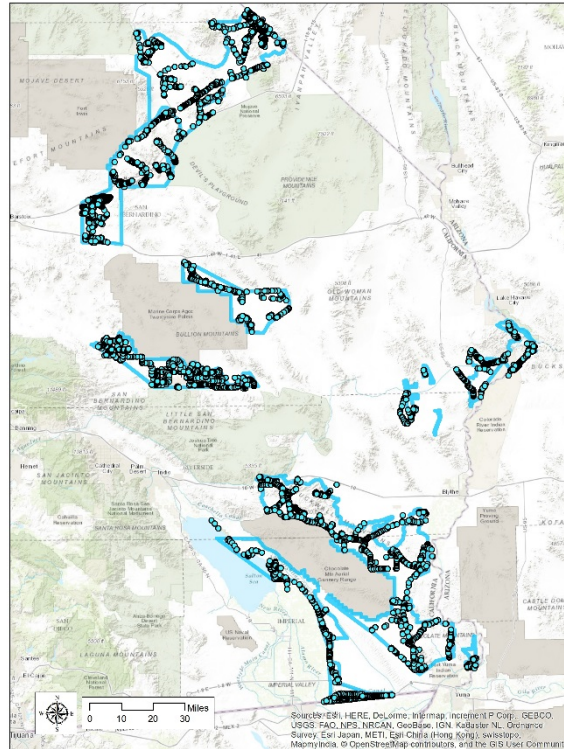
During reconnaissance, crews traversed the areas in 4WD vehicles and stopped at the preselected sites. Areas encountered in transit between initially selected sites, and areas of noteworthy or unusual significance, were sometimes added in the field as observation points. Also, observation points were frequently taken to mark the transition between vegetation types, with the intent of helping photointerpreters determine the edges of stands. A single observation point may have contained information about two or more stands. It was also possible for a given stand to be assessed in multiple places. Some stands of vegetation were remotely observed at a distance with the aid of binoculars. The location of these remote stands was determined using a compass and laser rangefinder. Field crew members recorded each location visited on a GPS unit and logged pertinent information on field sheets.

In addition to the hardcopy plots and the GPS unit, the field crew also used the Collector application for ArcGIS on Android computer tablets to facilitate navigation and data collection. Imagery, roads and any other pertinent ancillary data were loaded onto the tablet prior to the field trip. The tablet was primarily used for navigation purposes, but when appropriate, observation points regarding vegetation were taken on the tablet, which were then used to aid in the mapping process.

At many observation points, the crew took digital color ground photos. The photo number, photo direction, corresponding field point, and other pertinent information were recorded and available for reference during the mapping effort. The field data and ground photos were essential for correlating conditions seen on the aerial imagery to conditions on the ground.

Field crews from AIS collected approximately 574 reconnaissance observations as shown in **Figure 11**.

**Figure 11: Location of Reconnaissance Observation Points**



The blue points represent AIS reconnaissance observations.

## 2.5 Photointerpretation Mapping Procedures

There are two distinct aspects of the photointerpretation mapping process. In what can be called the “photointerpretation process,” the photointerpreter applies his or her understanding of photo signature and knowledge of the geographic characteristics of ground features to formulate a reasoned decision about how to represent a feature and what to call it. The “mapping process” involves the creation of the digital geodatabase through the use of computer hardware and software. In other words, the mapping process captures for subsequent users a permanent record of the results of the photointerpretation process. Both aspects happen simultaneously as a map is created.



### 2.5.1 Photointerpretation Process

Photointerpretation is the process of identifying map units based on their photo signature. All land cover features have a photo signature. These signatures are defined by the color, texture, tone, size, and pattern exhibited on the aerial imagery. By observing the context and extent of the photo signatures associated with specific land cover types, the photointerpreter is able to identify and delineate the boundaries between plant communities or signature units.

It should be noted that vegetation stature as well as the scale and resolution of the aerial imagery determine the visibility of individual plants, and the degree to which they can be photointerpreted. Trees and shrubs are usually visible as individuals on high-resolution digital imagery. However, grasses (other than bunch grass clumps) are rarely seen as individual plants.

Environmental factors such as elevation, slope, and aspect also play an important part in the photointerpretation decision-making process. Knowledge of these factors, and how plant communities respond to them, guides a photointerpreter in choosing from among Alliances with similar photo signatures. Beyond this, such knowledge enables vegetation mappers to create biogeographical models of expected vegetation communities where the vegetation types are indistinct on the imagery. This ecological approach produces a more accurate product than would be created by relying solely on extracting information from the imagery, which is subject to variations in clarity and ground conditions.

The detailed descriptions of each vegetation type found in Chapter 3 include numerous examples of the types of information the photointerpreters incorporate into their understanding of the models. To give some examples, one shrub Alliance may favor rocky slopes, while another is found at the perimeters of dry lakes. Some Alliances flourish on disturbed sites, while others cannot tolerate the cool temperatures at higher elevations. And, some Alliances are ubiquitous and found in a variety of settings.

The descriptions also discuss the relative percent cover of various plant species in the Alliance. Frequently, complicated relationships exist between the relative covers of plants, such as in Alliances named for indicator species having lower percent cover than other species present. Thus, both environmental setting and rules regarding relative cover factor into the intelligent delineation of vegetation polygons.

### 2.5.2 Mapping Process

Just as the use of mental models by experienced photointerpreters contributed to the production of a high-quality vegetation map, the use of tried-and-true mapping procedures allowed for the map to be produced in a highly efficient manner. For example, the study area was divided into modules that corresponded to USGS 1:24,000 topographic quadrangles or portions thereof. This expedited project work flow by enabling several staff members to work on the mapping effort simultaneously.

Each vegetation mapper brought one of the modules into his or her ArcMap session. Using an on-screen heads-up digitizing method, the photointerpreters had at their disposal a suite of standard and custom ArcMap tools to facilitate the creation of polygons. The photointerpreters

generally viewed the imagery at scales ranging from 1:1000 to 1:3000. They used variations in signature to draft boundaries separating areas of different vegetation types and/or distinct categories of percent cover of several stature levels. To assist in boundary placement and coding decisions, photointerpreters also referenced supplemental imagery, vegetation field data, and other data such as elevation contours and fire history. These sources were displayed in the ArcMap sessions as needed.

Photointerpreters assigned each polygon the appropriate attribute code string: Vegetation Type (Map Unit), six different Percent Cover types, Exotics, Roadedness Disturbance, Development Disturbance, Anthropogenically Altered Disturbance, Altered Hydrologic Regime Modifier, *Olneya tesota* – *Parkinsonia florida* (OLTE\_PAFL) Presence Modifier, Land Use, and Method ID. The map classification is presented in Appendix A.

A custom menu enabled code values to be assigned efficiently, minimizing the possibilities for entry errors. The codes themselves were entered as numeric values, which are easier to input and manipulate than alphanumeric codes or drop-down menus. Numeric code values also allow for the hierarchical grouping of like vegetation communities, reminding the mapper at a glance which Alliances are found in a particular hierarchical grouping. Once the geodatabase neared completion, the numeric code values were replaced with the actual vegetation type names.

The modules were edge-matched and checked for invalid codes and topology errors. As mapping progressed, modules within a subarea unit were joined together. These database units were subject to further processing, edge-match checks, and review by a senior staff member before being delivered to VegCAMP for AA allocation, prior to AA data collection by CNPS. Quality control procedures implemented during the mapping effort and before final delivery of the data improved the consistency and accuracy of the overall database. Quality control and accuracy assessment will be discussed in greater detail in later sections of this report.

### 2.5.3 Mapping Criteria

As discussed above, reference sources, photointerpretation training, knowledge of vegetation communities, as well as the use of appropriate GIS tools, are all essential in creating a quality vegetation map. However, without the establishment and refinement of mapping criteria, a given vegetation map could be riddled with discrepancies, as different staff members approach the task with different assumptions and styles. Guidelines and rules regarding exceptions, special situations, and minimum feature size are discussed and disseminated to all staff members before and during the mapping effort. This creates a clear and consistent product. Establishing criteria also makes the mapping process more efficient, as individual photointerpreters do not have to pause too long to consider how best to capture the more common ambiguous situations that are confronted.

The specific criteria for each attribute type are discussed below under the appropriate heading.

### 2.5.3.1 Vegetation Type (Map Unit)

The final map contains 77 Alliances and Alliance-level types such as Provisional Alliances, Semi-natural Stands, and Mapping Units, and 11 miscellaneous classes relating to features such as agriculture, water, and urban disturbance. When the photointerpreter could not confidently classify a polygon at the Alliance level, the polygon was assigned a broader Group-level or Macrogroup-level code. There are 10 Macrogroup and Group level types mapped in the study area. This was most common with herbaceous communities, whose differences at the Alliance level are often not readily discernible on imagery. Each map unit is described in Chapter 3; the map classification is presented in Appendix A; and a summary table of polygon counts and acreage by map unit is presented in Appendix B.

#### 2.5.3.1.1 Vegetation Mapping Considerations

Minimum polygon size is an important consideration when creating and viewing a vegetation geodatabase. The choice of an MMU is influenced by the clarity of the imagery, the purpose of the data, and time and budget constraints. MMU can vary for different categories of features being mapped.

The map classification presented in Appendix A indicates the MMU for each map unit class. In this project, the MMU for upland vegetation is 10 acres. This encompasses the majority of the stands mapped. Exceptions were created for vegetation stands of special significance. In this mapping effort, riparian vegetation, wetlands, and certain wash types were mapped to a 1 acre MMU. Another exception to the upland vegetation MMU involved stands of allscale scrub (*Atriplex polycarpa*), California joint fir (*Ephedra californica*), and cheesebush (*Ambrosia salsola*) occurring in washes, where they were mapped with a 5 acre MMU. Where these three types occurred outside of washes, a 10 acre MMU was applied. Polygons representing land use were mapped with a 2.5 acre MMU, with the exception of the rural area near and around Twentynine Palms, where land use was mapped to 1.5 acres (see Appendix C for more detail).

CDFW's long-range goal is to map vegetation for the entire state of California. This is accomplished as funding or need allows, one area or project at a time. The desert vegetation geodatabase created in this project is to be incorporated into the Statewide vegetation mapping effort. The general Statewide mapping criteria specifies an MMU of two acres, but an exception was made to map to a 10 acre MMU instead of two acres for desert vegetation types.

In addition to the MMU variance with the Statewide classification, the desert mapping effort had a different set of criteria regarding percent cover. In Statewide mapping criteria, a life form generally needs to account for at least 8 to 10 percent cover in order for an Alliance of that life form to be mapped (Menke et al., 2011). In the desert, due to the sparse distribution of vegetation, the threshold for designating an Alliance of a certain life form is generally 2 to 3 percent cover. However, tree types in the desert study area, such as the Fremont cottonwood (*Populus fremontii*), red willow (*Salix laevigata*) and black willow (*Salix gooddingii*) types, were mapped using a 5 to 10 percent cover criteria due to their distribution in desert and non-desert settings.



A summary of the minimum mapping units for this mapping effort is presented in **Table 2**.

**Table 2: Minimum Mapping Units**

Mapped Feature	Minimum Mapping Unit
Riparian vegetation; wetlands; certain wash types	1 acre
Water: perennial streams and lakes/ponds, dammed ephemeral ponds, Colorado River Aqueduct, All American Canal, East Highline Canal, Coachella Canal	1 acre
Land use: agriculture, built-up, water impoundment features	2.5 acres
<i>Atriplex polycarpa</i> , <i>Ephedra californica</i> and <i>Ambrosia salsola</i> in washes	5 acres
Upland vegetation	10 acres
Vacant areas within settlements; agriculture and water within urban windows	10 acres
Flood control basins (smaller ones are mapped as built-up land use)	10 acres
Urban windows	1 square mile

The establishment of an MMU entails the need for making rules for aggregating stands below MMU. In general, similar life forms are aggregated together: tree-dominated types are aggregated with other tree-dominated types, shrub types with other shrub types, and herbaceous types with other herbaceous vegetation types. However, if possible, wetland vegetation types are not aggregated with upland types, even if they are in the same life form. Another guideline is that a unit below MMU is aggregated with the vegetation type that completely surrounds it. Finally, if a unit that is below MMU is the same life form as two adjacent larger stands, and the adjacent stand types are very dissimilar in environment, the unit may be aggregated with the more similar adjacent type.

In addition to establishing MMU size, guidelines were established for the minimum mapping width (MMW) of a map polygon. The rule of thumb was to make the minimum width roughly half the width of a square MMU box. AIS made exceptions to map wetland types below the MMW in order to capture the vegetation along the Colorado River and the canals in the Imperial Valley area. The appropriate MMUs were still observed. As an example, because of the highly fractured and disturbed characteristics of the wetland and riparian vegetation associated with (nearby and adjacent to) the East Highline and the All American Canals, the vegetation there was mapped to a 15 meter MMW, which is half the DRECP project standard width for

riparian and wetland vegetation. This guideline did not preclude the creation of polygons where a small section fell below the minimum width, as long as the greater portion of the polygon met the stated criteria.

Another type of mapping consideration pertains to sparsely vegetated to nonvegetated types. It was assumed that all vegetation polygons contained some unvegetated or barren areas. On the other hand, sparsely vegetated to nonvegetated types were not mapped in the database unless they met the minimum mapping resolution and could exist as standalone polygons. Examples of these include: Unvegetated wash and river bottom Mapping Unit, Massive sparsely vegetated rock outcrop Mapping Unit, and Sparsely vegetated playa (Ephemeral annuals) Mapping Unit.

#### 2.5.3.1.2 Miscellaneous Classes

The relationship between vegetation and land use is sometimes complicated. This project's mapping classification is structured to accommodate these complications. As mentioned above, some of the Vegetation Type (Map Unit) categories were reserved for land use types such as agriculture, urban disturbance, and water features. However, Land Use was also an attribute of vegetation polygons, along with Exotics, Roadedness Disturbance, etc. A polygon that had a land use code value in Vegetation Type (Map Unit) was automatically populated with a corresponding land use code value in the Land Use layer.

Why represent land use in two different ways? It has to do with the possibility of natural vegetation and land use occurring on the same plot of land. For instance, in the desert setting, this may involve a residential area with houses and natural vegetation intermingled. For planning purposes it is important to represent the housing as well as showing the continuity of a natural vegetation community. With the existence of the Land Use layer, a polygon can be coded as the Joshua tree woodland Alliance – a vegetation type – but in the Land Use layer, the same polygon can be coded as having an Urban component. If only a vegetation layer were mapped, the photointerpreter would have to choose between calling out a vegetation type or a land use. One or the other would be lost. Modifications to the mapping rules for this scenario do exist in certain areas and are described in Appendix C.

In this project the concept of an “urban window” was also applied. Urban window, one of the Miscellaneous Classes in the vegetation map unit classification, is defined as a fully developed contiguous area of built-up and disturbed lands greater than one square mile in size. Natural vegetation stands may exist within an urban window, but they generally are not viable candidates for mitigation due to the surrounding urbanization. Therefore, natural vegetation was not mapped within an urban window unless it formed an area at least 10 acres in size and was not split by roads or other manmade features. Other special criteria rules developed for representing features in or adjoining urban windows are described in Appendix C.

Agriculture was another type of feature covered in the Miscellaneous Classes. Woody agriculture (orchards, vineyards) was distinguished from row agriculture. An important consideration in mapping agriculture in the desert is deciding whether a plot of land that was

farmed in the past should still be considered as active agriculture. A currently inactive plot of agricultural land may have been abandoned permanently, or it may just be in a fallow phase before farming resumes. To handle the uncertainty in such cases, a decision was made to review image sets covering the years 2009 to 2014. If the imagery showed that the land had been actively farmed in any of those years, then it was mapped as agriculture.

Because of its importance in the desert setting, water was mapped with an MMU of one acre. Distinctions were made between perennial stream channels, lakes and ponds, aqueducts and canals (including the Colorado River Aqueduct, Coachella Canal, All American Canal, and the East Highline Canal), and water impoundment features.

It should be noted that percent cover was not evaluated for most of the Miscellaneous Classes. A thorough discussion of the rules applied to each of the Miscellaneous Classes can be found in Appendix C.

#### 2.5.3.2 *Percent Cover*

Percent cover, also referred to as “density,” is a quantitative estimate of the aerial extent of the living plants for each vegetation layer within a stand. Cover is the primary metric used to quantify the importance or abundance of a life form and/or species.

Photointerpreters assessed the total cover of vegetation associated with each of the following: conifers, hardwoods, Joshua trees, trees as a whole (including Joshua trees), shrubs, and herbaceous plants. Appendix D includes six tables that present the ranges of percent cover used for each of these categories, along with relevant notes. These tables are adapted from *2012 Vegetation Map in Support of the Desert Renewable Energy Conservation Plan, Interim Report 1.1* (VegCAMP, 2012).

To determine the vegetative cover, photointerpreters assigned percentages to the different life forms visible on the imagery, including nonvegetated areas. The total percent cover of trees, shrubs, herbaceous and nonvegetated areas had to add up to 100 percent. The cover percentages were then converted into the appropriate cover category.

Photointerpreters formed separate polygons when there were changes from one cover class to another within a vegetation type or mapping unit as long as the resulting polygons were at least double the size of the applicable MMU. A given vegetation polygon might have been subdivided due to cover differences regardless of which strata the cover difference occurred in. For example, two adjacent polygons in the geodatabase may have had the same hardwood tree vegetation type assigned but different cover categories for shrubs (for example, >0-1% versus >5-15%).

The photointerpreters considered the coverage pattern of each life form before assigning a cover code to the polygon. To ensure consistency, it was helpful to compare percent cover values of polygons with clumped and unevenly distributed vegetation to those of similar-sized polygons with an even distribution of plant cover.

#### 2.5.3.2.1 Percent Cover Mapping Considerations

It is important to note that the photointerpreters could only accurately quantify the vegetation that is visible on the aerial imagery. Therefore, “bird’s eye” total cover was mapped, meaning that the cover of understory layers which were obscured by overstory layers was not included. For this reason, total cover for shrubs and herbaceous plants may be underestimated if their extent was hidden under the crowns of trees and may differ from assessments done on the ground by field crews.

Where the cover of a particular life form is very sparse, it can be difficult to decide between a cover class “0” (None or Not observable) and “1” (>0 to 1 percent). The photointerpreters looked for the consistent presence of very sparse types throughout a polygon before assigning it a cover class of “1.”

In the desert environment, it is rare for cover to exceed 25 percent. However, denser cover is sometimes found among riparian stands and tamarisk. Where overstory cover did happen to exceed 40 percent, it was considered too dense to give a reliable estimate of lower tier canopy or understory percent cover. In these situations the code assigned for percent cover for the understory life forms would be “Not applicable/Not assigned.” This same criterion is used in the Statewide mapping effort.

The date that the aerial photography mission is flown influences the percent cover assigned to vegetation types. Subsequent field verification and accuracy assessments must take into consideration the following factors that can cause apparent discrepancies between the percent cover evident on the imagery and percent cover seen in the field:

- Seasonality - The percent cover of most plants is variable due to their annual growth cycle. Depending on whether the aerial imagery was taken during the wet season or the dry season, a mapped unit could show a different percent cover on the aerial imagery than is observed during an on-site visit at a different time of the year. Differences in leafiness (cold deciduous, drought deciduous) can affect plant cover determination. Leaf-on conditions obscure the understory. Imagery of leaf-off conditions would allow photointerpretation of the understory, but make it difficult to identify the overstory species since there is no foliage present.
- Annual variability - The environmental conditions at the time of the imagery (wet vs. drought years, flooding, etc.) may contrast with the conditions seen during on-site field visits thus resulting in differences of the percent cover assigned to a polygon in the field versus those assigned during photointerpretation.
- Dead vegetation –When vegetation is dead, it is not counted in the cover class analysis; however, vegetation in a stressed phenology state is included in the cover class density. Both dead and stressed vegetation were encountered during this mapping effort. Determining the difference between dead and stressed vegetation solely through photointerpretation was difficult, so field information reflecting the conditions on the ground were used when possible. Where dead vegetation was so dense that it obscured the understory vegetation, then the understory vegetation cover class was coded with a value that correlated to a value of “Not applicable/Not assigned.” For example, if a

tamarisk stand was mostly dead, but the living portion was a cover of 12 percent and the dead portion was a cover of 35 percent, it resulted in a shrub cover class value of “3” (>5 – 15%). Since the dead portion of the tamarisk stand and the living portion were dense enough that the ground beneath couldn’t be evaluated, the herbaceous cover class resulted in a value of “9” (Not applicable/Not assigned).

### 2.5.3.3 Exotics

Photointerpreters assigned each existing polygon a code reflecting the level of impact by exotic invasive species such as Mediterranean grass (*Schismus* spp.) or tamarisk (*Tamarix* spp.).

Polygons were not created or split because of differences in the presence of exotics. **Table 3**, adapted from *2012 Vegetation Map in Support of the Desert Renewable Energy Conservation Plan, Interim Report 1.1* (VegCAMP, 2012), presents the map classes for Exotics.

**Table 3: Map Classes for Exotics**

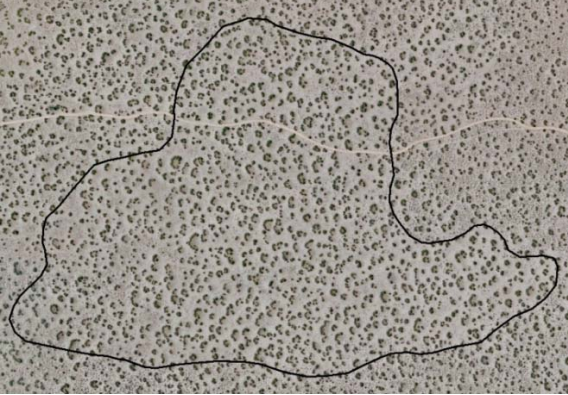


Code	Range	Discussion
0	None visible	Sparse herbaceous vegetation with a minimal to low relative cover of exotic species; based on field data, no evidence of exotics in sampling, no evidence of exotics on imagery and based on modeling, assumed not present or not regular in the stand. This is expected on desert pavement, very steep bouldery slopes, and coarse rocky slopes, with no tawny or reddish <i>Schismus</i> spp. signature, etc.
1	Patches of exotics visible, but cover not significant (relative cover to total <33%)	Sparse to moderate cover of herbaceous vegetation with a low to moderately high relative cover of exotic species. Patches of exotics are visible, but cover is not significant. <i>Larrea tridentata-Ambrosia dumosa</i> without high roadedness or degraded understory usually fall in this class. <i>Schismus</i> spp. or <i>Tamarix</i> spp. may be visible in relatively small discrete patches (less than half of the substrate signature), but do not present an extensive signature.
2	Exotics (particularly herbaceous) significant and cover may exceed dominant vegetation strata (relative cover <66%)	Exotics are significant and cover may exceed the dominant vegetation strata. A “haze” of <i>Schismus</i> spp. (tawny) is uniform in the understory of shrubby or tree overstory; or an ochre “haze” of <i>Brassica</i> spp. is found in sandy soil. Areas of higher disturbance are likely to be in this category.
3	Stand characterized by exotics (vegetation type is “exotic”) (relative cover >66%)	This is reserved primarily for Alliance-level calls which are defined by exotics; stands are characterized by exotic vegetation (as defined by the map unit). Examples of this are stands of <i>Arundo donax</i> and <i>Tamarix</i> spp.
9	Not applicable/Not assigned	Exotics are not applicable when the MapUnit is 9300, 9310, 9320, 9800, 9801, 9803, 9804, 9805.

#### 2.5.3.4 *Roadedness Disturbance*

Roadedness Disturbance is defined as the level of impact in a polygon by paved and unpaved roads, off highway vehicle (OHV) trails, railroads, berms, and covered aqueduct. Impact is defined by the proportion of any polygon that is contiguously without these features, as shown in **Table 4**. The table is adapted from VegCAMP (2012). Roads following polygon boundaries were not included in the assessment. Each existing vegetation polygon was assigned a Roadedness Disturbance class. Polygons were not created or split because of differences in roadedness.

The Roadedness Disturbance code reflects the combination of the amount of roads in the polygon and the roads' effect on the contiguous space that has no roads – that is, where the roads fall within the polygon. This definition of roadedness has the advantage of helping to identify roadless areas, but the disadvantage of being scale independent. For example, any polygon with a road more or less bisecting it will be assigned a code of Moderate, regardless of size. This means that a very large polygon with a “Moderate” Roadedness Disturbance code might still contain an extensive roadless area.

**Table 4: Map Classes for Roadedness Disturbance**

Code	Range	Example
0	None visible	
1	Low: at least 2/3 (67% to 100%) of the vegetation polygon area is roadless	
2	Moderate: between 1/3 and 2/3 (33% to 66%) of the vegetation polygon is intersected by roads of any kind	
3	High: less than 1/3 (<33%) of the vegetation polygon lacks roads of any kind	
9	Not applicable/Not assigned	Roadedness is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805, 9320 (non OHV).



### 2.5.3.5 Development Disturbance

Development Disturbance accounts for the level of impact by structures and settlements that are smaller than the MMU criteria for land use. Structures may include buildings, tanks, trailers, metal electrical towers, communication towers, and utility and mining structures. This attribute includes paved parking lots and collapsed structures. Note that it also includes debris such as junked vehicles, major trash dumping, etc., the removal of which could result in a vegetation stand that could be in very good to pristine ecological condition. Disturbance that does not involve these types of features is accounted for in Anthropogenically Altered Disturbance. Polygons were not created or split because of differences in development disturbance, but existing vegetation polygons were assigned a Development Disturbance class. **Table 5**, adapted from Appendix F of *2013 California Desert Vegetation Map and Accuracy Assessment in Support of the Desert Renewable Energy Conservation Plan* (VegCAMP, 2013), presents the map classes for Development Disturbance.

**Table 5: Map Classes for Development Disturbance**

Code	Range	Discussion
0	None visible	There are no noticeable junk piles, isolated homes, structures, etc. within the polygon.
1	Low; less than 2% of polygon affected	Junk piles, structures, cement pads, etc. are inconsistently distributed at very low density.
2	Moderate; between 2% to 5% of the polygon affected	Multiple examples of dispersed junk, buildings, or other structures, etc. are visible throughout the polygon. There may be a dense concentration of development within a single or few parts of the vegetation polygon.
3	High; more than 5% of polygon affected	Multiple examples are evenly distributed in a vegetated polygon; typically meets the 2.5 acre threshold to map a "Built-up and Urban Disturbance" (9300) polygon. However, mines or open pits coded as 9300 may be assigned a Development Disturbance code of 0, 1, 2, or 3 depending on the amount of structures or debris present in the polygon.
9	Not applicable/Not assigned	Development Disturbance is not applicable when the MapUnit is 9200, 9210, 9220, 9801.

### 2.5.3.6 Anthropogenically Altered Disturbance

This indicates the level of impact on vegetation through tillage, scraping, grazing, mining, etc. Disturbance from structures, pavement, or debris is not included here but is addressed in Development Disturbance. Anthropogenically Altered Disturbance captures past disturbances in the landscape that are still visible through their impact on vegetation, but do not have enough of an impact to change the vegetation type or percent cover range. For example, striations from former cultivation may be present on parcels of land that have not been under agriculture for decades. Anthropogenically altered disturbance is typically bounded by a straight-line feature such as a fenceline or road, implying man-induced activity. Not included are small clearings caused by OHV traffic at road intersections, fire effects, and powerline tower pedestal clearings.

Polygons were not created or split because of differences in anthropogenically altered disturbance, but existing vegetation polygons were assigned one of the classes presented in **Table 6**, which was adapted from Appendix F of VegCAMP (2013).

**Table 6: Map Classes for Anthropogenically Altered Disturbance**

Code	Range	Discussion
0	None visible	No ghost lines of tilling, differential effects of enclosure/exclosure fencing, effects of grazing/browsing, etc. are visible.
1	Less than 33% of polygon is affected and/or impact is seen but does not affect vegetation cover or type	Less than 1/3 of a vegetation polygon has visible evidence of clearing, prior agricultural activity or other effects.
2	Between 33% to 66% of polygon is affected	A vegetation polygon has more than 1/3 but less than 2/3 visible effects of clearing, prior agricultural or other effects.
3	More than 66% of polygon affected	A vegetation polygon has more than 2/3 visible effects of clearing, prior agricultural or other effects.
9	Not applicable/Not assigned	Anthropogenic alteration is not applicable when the MapUnit is 9801 or 9320 (caused by high OHV activity).

#### 2.5.3.7 Altered Hydrologic Regime Modifier

This attribute denotes where a wash or sheet flow has been diverted from its natural path by restricted sheet flow or active channel flow crossing under a road, railroad, berm, etc., resulting in a vegetation difference downslope. The effect must create a boundary-forming break in vegetation type, shrub cover, tree cover, or herbaceous cover along the impediment. The modifier is only attributed to the polygon downslope of the impediment. The upslope portion on the polygon boundary must at least in part follow the hydrologic impediment. Drainage ditches conveying flow off the side of a road (though often visible on imagery) are not considered unless they make a boundary-forming break in the vegetation.

Examples of how impediments can result in an observable difference in vegetation type or cover include: 1) washes have contracted or have been diverted or eliminated on the downslope side of the impediment, 2) natural sheet flow has been diverted, modified or eliminated on the downslope side, or 3) the impediment caused water from wash or sheet flow to be impounded upslope.

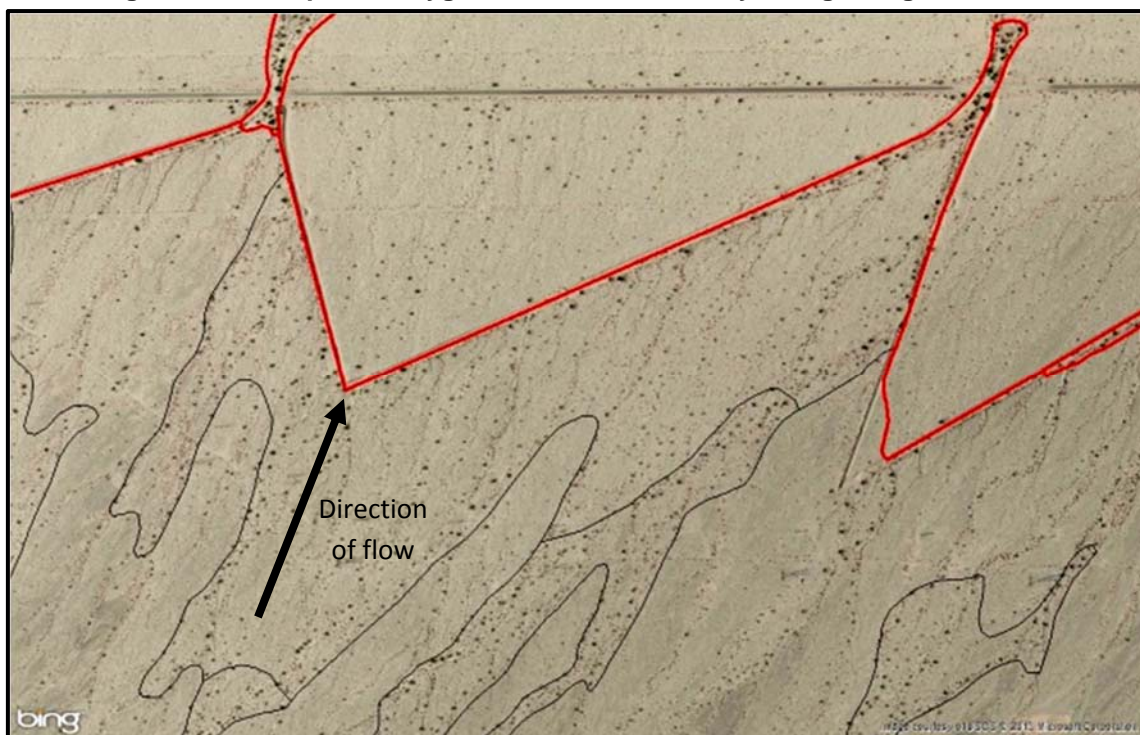
Since the Altered Hydrologic Regime Modifier was applied only where mappable changes in vegetation type or cover were observed across an impediment, an existing polygon was not split solely because part of it was subject to a diversion of surface flow. The map classes for Altered Hydrologic Regime Modifier are presented in **Table 7**.

**Table 7: Map Classes for Altered Hydrologic Regime Modifier**

Code	Definition	Discussion
0	Not affected	Neither the vegetation type nor percent cover is affected by hydrologic impediment that follows a portion of polygon boundary.
1	Affected	Vegetation type and/or percent cover is affected by hydrologic impediment that follows polygon boundary. Only the polygon downslope from the impediment is considered affected.
9	Not applicable/Not assigned	Altered Hydrologic Regime Modifier is not applicable when the MapUnit is 9300, 9310, 9800, 9801, 9803, 9804, 9805.

Figure 12 presents an example of polygons coded with the Altered Hydrologic Regime Modifier.

**Figure 12: Example of Polygons with the Altered Hydrologic Regime Modifier**



This example shows portions of polygons (in red above) which were assigned an Altered Hydrologic Regime Modifier. The embankments, the “V” shaped portions of the polygon, funnel sheet wash flow out of their natural channel into small diversion ditches. The resultant hydrologic modification changes the vegetation, in this example, from a series of *Olneya* washes upslope (south) to a sparse cover of *Larrea tridentata* with a widely scattered sparse emergent cover of *Olneya* (to the north).

#### 2.5.3.8 Ironwood – Blue Palo Verde Presence Modifier (OLTE\_PAFL)

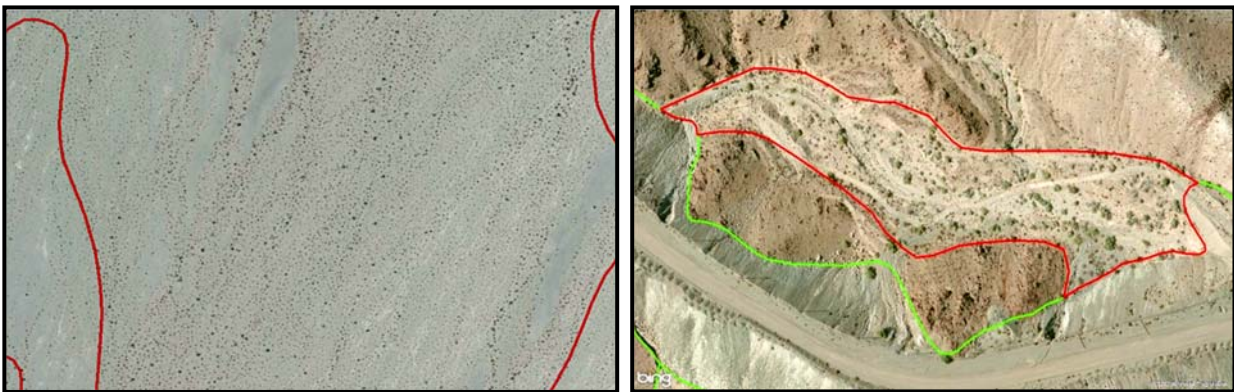
This attribute denotes the consistent presence of ironwood (*Olneya tesota*) and/or blue palo verde (*Parkinsonia florida*) in mapped polygons within the study area, the only occurrence of which is in the Colorado Desert region and Arizona Upland subdivision of the Sonoran Desert. The modifier was added to accurately represent the vast expanses of sparse ironwood and/or

blue palo verde emerging from the canopy of creosote bush, white bursage, and brittle bush shrub types on broad alluvial fans and bajadas, as well as in small rivulets dissecting sparsely vegetated desert pavement.

The photointerpreters determined whether the polygon contained a presence of either or both of the two key species. Although cover can be in trace amounts (below 1 percent), it must be consistent across most of the mapped polygon. All polygons mapped as the *Parkinsonia florida*-*Olneya tesota* Alliance also received the OLTE\_PAFL modifier value of “1” (Present).

**Figure 13** presents an example where the modifier was applied, and **Table 8** summarizes the map classes.

**Figure13: Example of Polygon with OLTE\_PAFL Modifier**



The image at left represents an example of a portion of a *Larrea tridentata* – *Ambrosia dumosa* Alliance polygon coded with the OLTE\_PAFL modifier. *Olneya tesota* occurs consistently in the polygon as the larger, darker dots ranging in cover between 0.5 and 1 percent. By contrast, the image at right shows a *Parkinsonia florida* – *Olneya tesota* Alliance stand in a wash.

**Table 8: Map Classes for OLTE\_PAFL Modifier**

Code	Definition	Discussion
0	Not present	Mapped polygons do not have <i>Olneya tesota</i> or <i>Parkinsonia florida</i> present consistently throughout the stand in at least trace amounts.
1	Present	Mapped polygons have <i>Olneya tesota</i> or <i>Parkinsonia florida</i> present consistently throughout the stand in at least trace amounts.

### 2.5.3.9 Land Use

Land use is the human use of the land and is embodied through such features as urban centers, towns, mining, agriculture, and individual settlements. As mentioned in Section 2.5.3.1.2, in this mapping effort land use was represented both as a possible vegetation class and as a separate attribute of a vegetated polygon. Every attempt was made to correlate the coding within both layers.

A land use polygon was mapped if it was at least 2.5 acres in size. The criteria used for mapping land use are presented in Appendix C.

The hierarchical format of the classification is such that more detailed classes may be added at lower levels of the hierarchy for future more detailed land use mapping efforts. For example, the Urban (1000) class could be subdivided further into Residential (1100), Commercial (1200), Industrial (1300), Transportation/Communication (1400), and so on. The land use code assignment was mostly at an Anderson Level I (Anderson et al., 1972) with lower levels for specific categories, as shown below:

- 0000 = Not assigned/Not assessed
- 1000 = Urban
  - 1436 = Water Transfer (major canals, aqueducts and agricultural channels)
  - 1850 = Wildlife Preserves & Sanctuaries
- 2000 = Agriculture (includes nurseries)
  - 2100 = Non-woody Row & Field Crops
  - 2200 = Orchards & Vineyards
- 9800 = Undifferentiated Water
  - 9810 = Water Impoundment Feature (includes settling ponds, salt evaporators, sewage treatment ponds, recharge basins; may or may not contain water at time of imagery)

In this work effort, the definition of the 1436 land use code was expanded from applying only to the California and Colorado Aqueducts. It now includes major canals such as the Coachella, All American, and East Highline Canals. The canals and aqueducts are assigned a Map Unit code of "Major Canals and Aqueducts" (9804). The land use code of 1436 was also applied to mappable corridors in the agricultural areas of the Imperial Valley that contained one or more agricultural channels (on the topographic maps, these are often lateral drains that have been named). These corridors in the agriculture areas are coded with a Map Unit value of "Agriculture" (9200).

The Wildlife Preserves and Sanctuaries (1850) land use code was added for this work effort to denote the managed wetlands in the Imperial Wildlife Area, near the Wister Unit.

### 2.5.3.10 Method ID

This attribute was used to indicate how the MapUnit coding decision was reached for a polygon by identifying what type of field data (if any) was used to support the vegetation type assignment. For polygons that did not have any corresponding point data, the value of "photo interpretation" was assigned.



The following is a list of the values used:

- 1 - Rapid Assessment (current project)
- 2 – Relevé
- 3 - Field Verification
- 4 - Photo Interpretation
- 5 - Adjacent Stand: Information or Ground Photo
- 6 - Reconnaissance (current project)
- 7 - Other Information
- 8 - Older Plot Data
- 9 - Older Recon Data
- 10 - Accuracy Assessment
- 60 – Additional Recon Information

#### 2.5.4 Quality Control

Quality control was an iterative process, conducted at many phases of the mapping effort. For the entire duration of the project, photointerpreters consulted with one another as each module was mapped. This sharing of perspectives and examples ensured consistency in the mapping decisions made throughout the study area.

Completed modules were subjected to a series of automated checks. Any instances of invalid codes, uncoded polygons, adjoining polygons with the same code, or topology problems were flagged for correction by the photointerpreter. Another type of automated check verified that illogical combinations of codes were not used. For instance, a polygon coded as a Joshua tree type could not have a “None or Not observable” code in Percent Cover by Joshua Tree. Additionally, each photointerpreter reviewed his or her completed module for consistent application of codes and MMU considerations. When adjoining completed modules were edge-matched, any mapping discrepancies found at the edges between modules were corrected and, if necessary, changes were applied throughout the modules. The same held true for edge-matching to the area previously mapped for DRECP.

When all the modules in a subarea unit were joined together, a senior photointerpreter reviewed the data for registration of linework to the base imagery and for code accuracy and consistency. Automated final checks were again conducted for invalid codes and code field correlations. Topological errors were checked, as were any edge-match problems. Another round of quality control was conducted after AA results had been applied to each of the subarea units.

When edge-matching to previously mapped areas in the DRECP study, every effort was made to make the transition as seamless as possible. Occasionally discrepancies were encountered, so the following guidelines were established to handle them:

1. If the edge-match differences are **minor** – small offset in boundary placement preference, judgment call in code assignment, only a small polygon in the current project is affected, etc. – match the data in the current project to the previously mapped area.

2. If the edge-match difference impacts a small polygon at the edge of the previously mapped area, which attaches to a large polygon in the current project, and the coding on the prior map would possibly be wrong for the current large polygon:
  - a. *In most cases*, it will be preferable to change the code in the previously mapped area to match the current data.
  - b. *In some cases*, it may be preferable to leave the previously mapped data as is.
3. If the edge-match difference impacts a large polygon, in either or both databases, in most cases it will be preferable to feather in a code change by adding a boundary in the current dataset close to the study area boundary. If possible, use a natural feature to create the break.
4. Edge-matching the Method ID attribute:
  - a. For polygons in the current dataset that are relatively small extensions of polygons in the old project: apply the Method ID value from the old project.
  - b. For polygons in the current dataset that have data points, but the continuation of the polygon in the previously mapped area did not: use the appropriate Method ID for the current polygon and update the Method ID in the old project.

At the end of the project, all of the individual database units were joined together into the final geodatabase that included the areas previously mapped for DRECP. One last quality control review, conducted on this completed geodatabase prior to the final delivery, ensured that the database was seamless and had been processed correctly.

## **2.6 Accuracy Assessment**

Accuracy assessment begins with the allocation of polygons selected to be visited in the field. The allocations were performed by VegCAMP and designed to ensure that a representation of most, if not all, of the mapped vegetation types were assessed. The allocated polygons were chosen in part based on their accessibility by road. Vegetation stands within the selected polygons were then assessed in the field and the findings were recorded by CNPS field crews.

From October 2015 through March 2016, CNPS made 574 field accuracy assessments. Field assessments were conducted by CNPS soon after the joined subareas were delivered to CDFW and allocation polygons were selected.

In the office, data from the field AA forms were entered into an Access database by CNPS staff. VegCAMP ecologists using the field survey Access database and accompanying ground photos scored the vegetation type recorded by the photointerpreter. Cover and disturbance attributes were not scored, but the findings were provided as feedback to the photointerpreters.

Each assessment could receive a maximum of 5 points, with points given depending on how closely the photointerpreter (PI) matched the type reported from the AA. **Table 9**, adapted from VegCAMP (2013), shows how these points were assigned.

**Table 9: Accuracy Assessment Scoring Criteria**

Code	Reason for Score	Score
A	PI completely correct.	5
B	The PI chose the correct Group OR the next level up in the hierarchy.	4
C	Threshold/transition between PI call and Final call. This was used when cover values of the dominant or indicator species were close to the values that would key to the PI's type (e.g., an AA call of <i>Yucca brevifolia</i> Alliance for a stand with 1% evenly distributed <i>Yucca brevifolia</i> over <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> would get this score if the PI call was <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> Alliance with <1% <i>Yucca brevifolia</i> ).	4
D	Correct Macrogroup OR next level up in hierarchy.	3
E	Based on close ecological similarity. Ecological similarity addresses assessed and mapped calls that contained vegetation with overlapping diagnostic species but were not technically closely related in the NVCS hierarchy. This was common in stands that contain a mix of species of late and early seral vegetation types and also common in zones of overlap between ecoregions.	3
F	Correct Division.	2
G	Some floristic/hydrologic similarity. This addresses cases in which the mapped and the assessed vegetation type had different diagnostic species, but bore some similarity in ecological traits based on predicted and actual setting such as hydrologic regime, overall climate, or successional state.	2
H	Correct only at Life form.	1
I	No similarity above Formation and incorrect life form.	0
J	Survey removed because significant change in polygon (e.g., the stand was burned, developed, or cleared since the date of the base imagery).	No score
K	Survey removed because inadequate portion (<10%) of the polygon was viewed by the AA field crew.	No score
L	Survey removed because field/PI data is incomplete, inadequate or confusing (e.g., cover values were not provided for key species in the stand).	No score
M	Supplementary record, not scored (for multiple point assessments where the AA call was the same at multiple points).	No score

Once a subarea had been scored, the accuracy assessment results were reviewed by senior photointerpreters. In some cases the photointerpreter flagged a specific AA finding for follow-up discussion and review with the AA ecologist staff, resulting in either accepting or modifying the AA call or throwing the AA point out of the analysis. Once AA review was completed, the photointerpreters revised the polygons based on the AA results.

The database received an overall accuracy score of 91.90%. However, because the geodatabase was modified based on AA results prior to finalization, the accuracy of the completed overall map is actually higher (by an undetermined amount). A more detailed discussion of accuracy assessment, including user and producer accuracy, can be found in *Addendum to the 2013 California desert vegetation map and accuracy assessment in support of the Desert Renewable Energy Conservation Plan. Final Report.* (VegCAMP, 2016).

# CHAPTER 3: Map Unit Descriptions

## Explanation of Map Unit Descriptions

This chapter contains descriptions for each of the Vegetation Types (Map Units) represented in the final geodatabase for the 2014-2016 project, which is an extension of the original 2011-2012 vegetation mapping effort. Please refer to Chapter 3 of Menke et al. (2013) for map unit descriptions covering the original mapping project area.

The descriptions for the majority of vegetation types have the following components:

A **screenshot** of aerial imagery and a **ground photo** are featured on the first page. The screenshots give the reader a sense of the photo signatures. The stand of vegetation being described is outlined in red. The ground photos, taken by staff during field visits, show the appearance of the plants on the landscape.

The second page includes a **Description**, which discusses the expected locations, percent cover considerations, and other factors; **Photointerpretation Signature**, which describes the tone, texture, pattern, etc. commonly seen on the aerial imagery; and a listing of **Types with Similar Photointerpretation Signatures**. The signature traits that differentiate each vegetation type in the list from the vegetation type being described are addressed.

Following the Types with Similar Photointerpretation Signatures is a **distribution map** and a brief discussion of the **Distribution** of the vegetation type in the study area. For vegetation types with only a few, small polygons in the entire study area, the size of the polygons on the distribution map was enhanced so that their locations could be seen. The distribution map shows the vegetation type occurrence in the current mapping effort, the 2013-2014 Rice Valley Extension mapping, and the original 2011-2012 mapping project.

Following the distribution map discussion is an **elevation range** chart showing the percentages of elevation values for a given vegetation type within the study area. This was derived by extracting the elevation data (10 meter pixels) from the Digital Elevation Models (DEMs) in the National Elevation Dataset, available from the USGS, using the areal extent of the vegetation type. Along the vertical axis is the percentage of pixels occurring in the established elevation ranges. Along the horizontal axis are the elevation ranges, in increments of 250 meters. Note that elevation values below sea level are included in the 0 to 250 meter elevation range. This chart is not an elevation profile of the vegetation type, nor does it represent the geographic distribution of its elevation range. The chart includes the full extent of the vegetation type as mapped in the current mapping effort, the 2013-2014 Rice Valley Extension, and the original 2011-2012 mapping project.

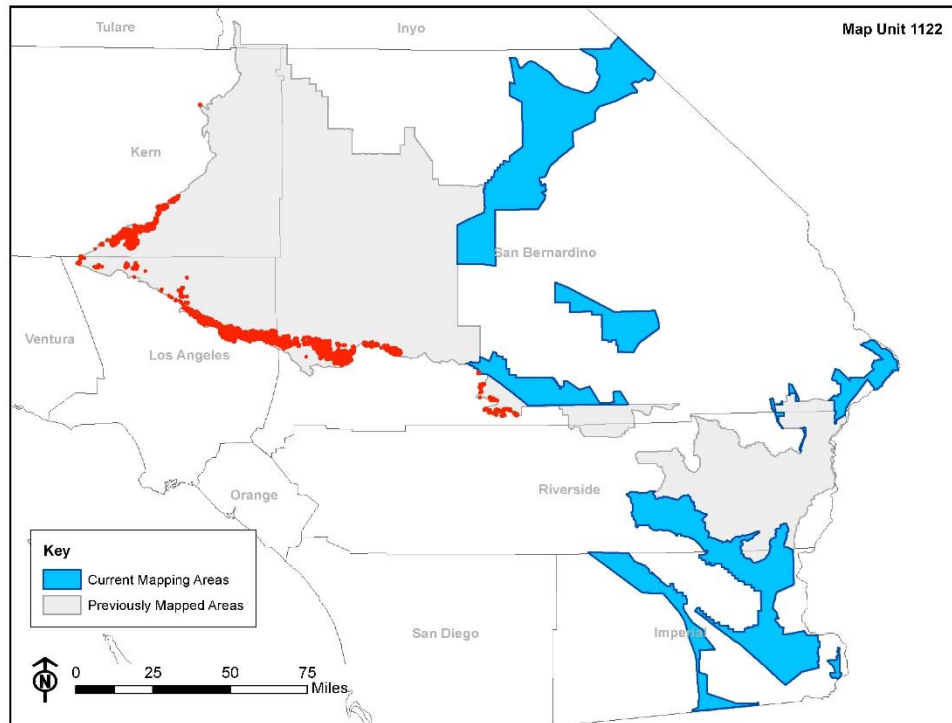
Descriptions for vegetation types in the Miscellaneous Classes are similar to the standard descriptions, but the ground photo, list of Types with Similar Photointerpretation Signatures, and elevation range chart have been omitted.

Some vegetation types have a very limited presence in the study area at sizes above MMU. For these types it was not possible to formulate the standard in-depth descriptions. Instead, they are represented only with a distribution map (with enhanced polygons) and a brief discussion. In other cases, some of these limited types are more prevalent in the original 2011-2012 mapping area. In these instances, they are again represented here only with a distribution map (with enhanced polygons) and a brief discussion. Please refer to Menke et al. (2013) for the full map unit descriptions.



## 1122 – *Juniperus californica* Alliance

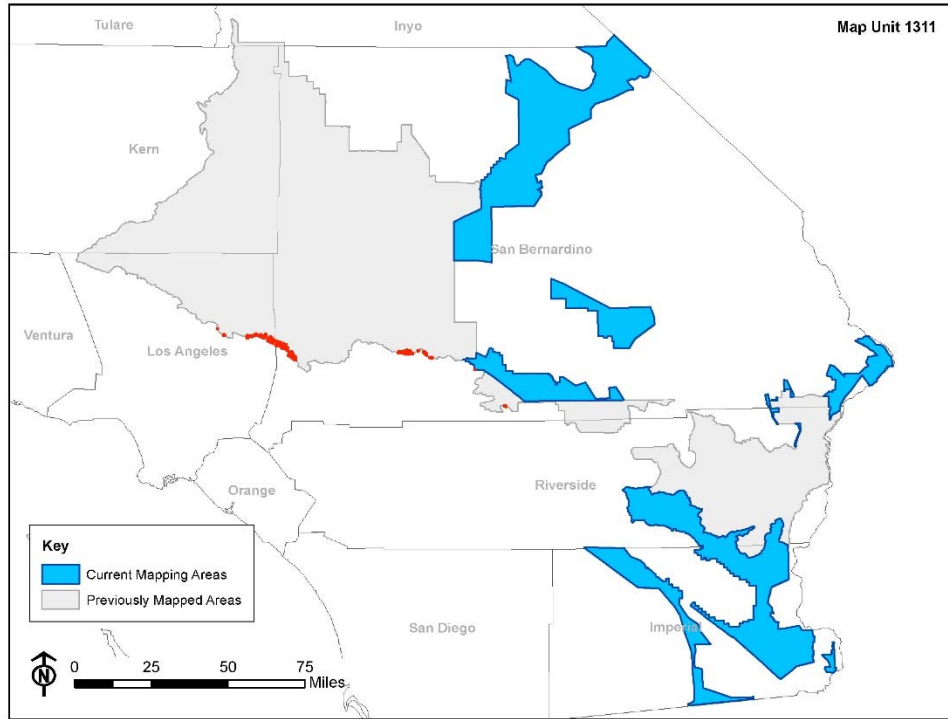
California juniper woodland Alliance



**DISTRIBUTION:** Within the original study area, *Juniperus californica* occurs exclusively along the Foothills and adjacent fans of the Transverse Ranges from the Little San Bernardino Mountains west to the Sierra Pelona, and in similar settings in the Tehachapi Mountains. In the Western Mojave Desert, stands descend slightly on to lower slopes in the Antelope Valley at elevations down to 2500 feet (760 meters). Within the 2014-2016 mapping region, this type is found only in one small area at the 4500 foot level (1370 meters) adjacent to the Bighorn Mountain & Whitewater River National Recreation Area.

## 1311 – *Pinus monophylla* Alliance

Singleleaf pinyon woodland Alliance



**DISTRIBUTION:** *Pinus monophylla* occurs in two disjunct stands in the original study area: the drier eastern population near Cushenbury Canyon in the San Bernardino Mountains, and the more extensive western stands ranging from north of Lone Pine Canyon west to Pleasant View Ridge in the San Gabriel Mountains. Within the 2014-2016 mapping region, this type is found only in one small area on a north-trending slope at the 4400 foot level (1340 meters) adjacent to the Bighorn Mountain & Whitewater River National Recreation Lands.

**1411 – *Populus fremontii* Alliance**  
Fremont cottonwood forest Alliance



The photo depicts a stand of *P. fremontii* adjacent to the All American Canal north of Bard, California.



The photo shows an emergent *P. fremontii* tree along the banks of the Mojave River.

#### 1411 – *Populus fremontii* Alliance

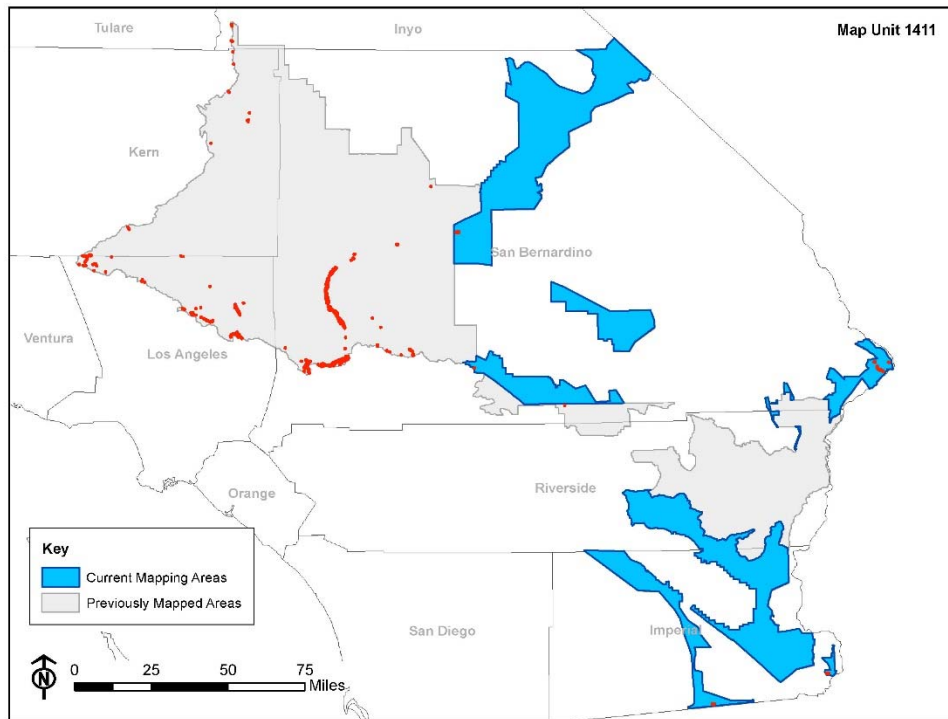
**DESCRIPTION:** In this Alliance *Populus fremontii* is dominant or co-dominant with over 5 percent absolute cover in the tree canopy. Stands occur along streams, springs, and valleys with a subsurface water supply. *P. fremontii* occurs with *Salix* spp., *Forestiera pubescens*, and *Baccharis* spp. among other species. Stands co-dominated by tree willows such as *Salix gooddingii* or *S. laevigata* are mapped as this Alliance. *Platanus racemosa* and *Salix laevigata*, if present, are each usually less than 5 percent cover. *S. gooddingii* may be co-dominant, and shrubby *Salix lasiolepis* or *Baccharis* spp. may be present at low to high cover in the understory.

**PHOTOINTERPRETATION SIGNATURE:** Stands occur in open to dense patches along riparian corridors. During leaf-on conditions, signature colors range from a medium to dark green. Crowns are generally large and variable in shape, tending to be rounded with distinct edges. Taller trees in open settings yield distinct shadowing. During leaf-off conditions the signature has a light gray to white, wispy appearance due to the exposed light-colored branches. Young stands in thicket-like settings tend to have a more even, smooth texture.

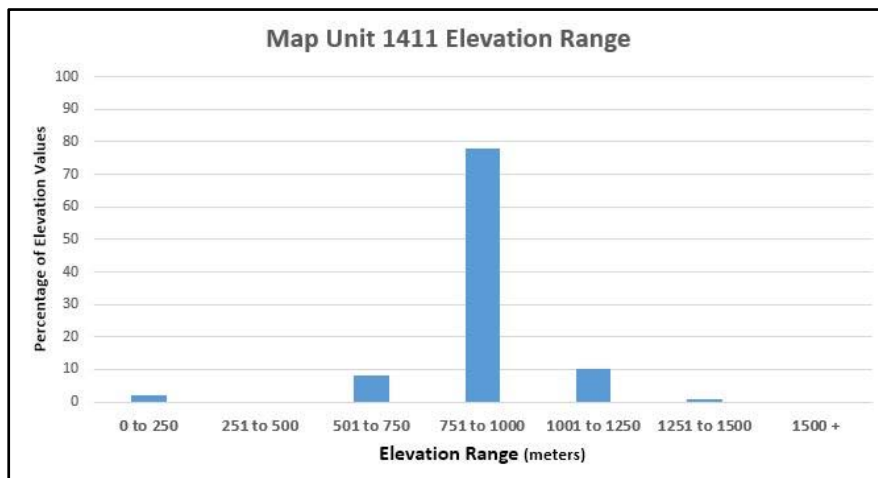
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Salix laevigata* Alliance (1412) – This species generally has a smaller, more distinct crown and can display multiple crowning in larger individuals. *Salix laevigata* also tends to have a brighter and lighter green color than *Populus fremontii*. However, it is extremely difficult for photointerpreters to ascertain relative abundance of the two species in a stand and therefore at times it is difficult to make a determination between the two Alliances.

1411 – *Populus fremontii* Alliance



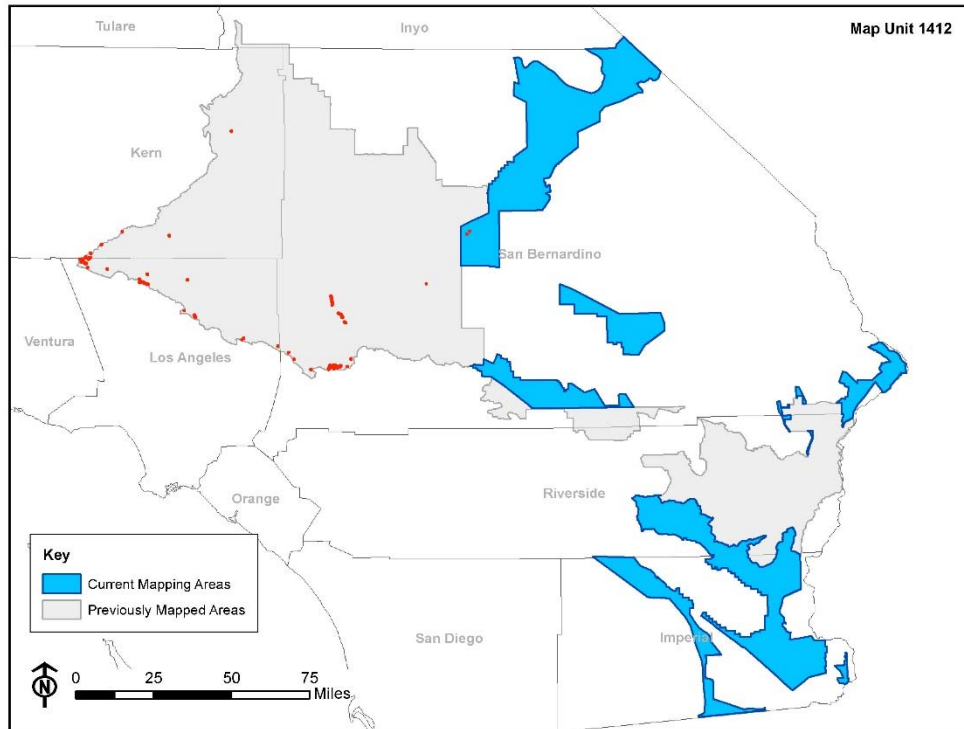
**DISTRIBUTION:** Stands are more well developed along the Mojave River from the Mojave Narrows Regional Park north to Helendale and along Horsethief Canyon to where it empties into the Mojave River Forks Reservoir. Isolated stands occur frequently along small washes draining the Transverse Ranges from Gorman east to State Route 18. Although small clusters of cottonwood were observed, no mappable stands occur in the Colorado Desert portion of the study area. Within the 2014-2016 mapping region, *Populus fremontii* occurs in narrow stands along drainages watered by the Copper Basin Reservoir in the eastern portion of the Whipple Mountains.





## 1412 – *Salix laevigata* Alliance

Red willow thickets Alliance

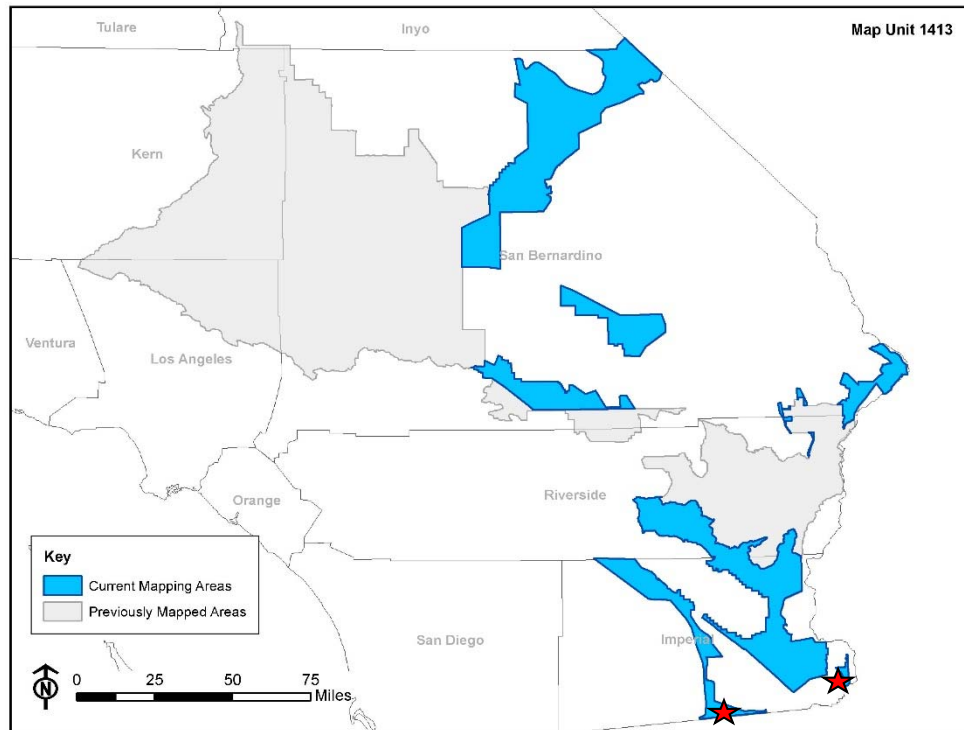


**DISTRIBUTION:** The majority of mapped stands are scattered along springs, dammed lakes and/or major drainages flowing out of the San Bernardino, San Gabriel or Tehachapi Mountains. The only significant stands occurring in the Mojave Desert's interior are found along the Mojave River from the Mojave Narrows area continuing downstream near La Delta north of Victorville. This type is not mapped in the Colorado Desert portion of the mapping area. Within the 2014-2016 mapping region, *Salix laevigata* is mapped only within the Camp Cady Wildlife Area.



## 1413 – *Salix gooddingii* Alliance

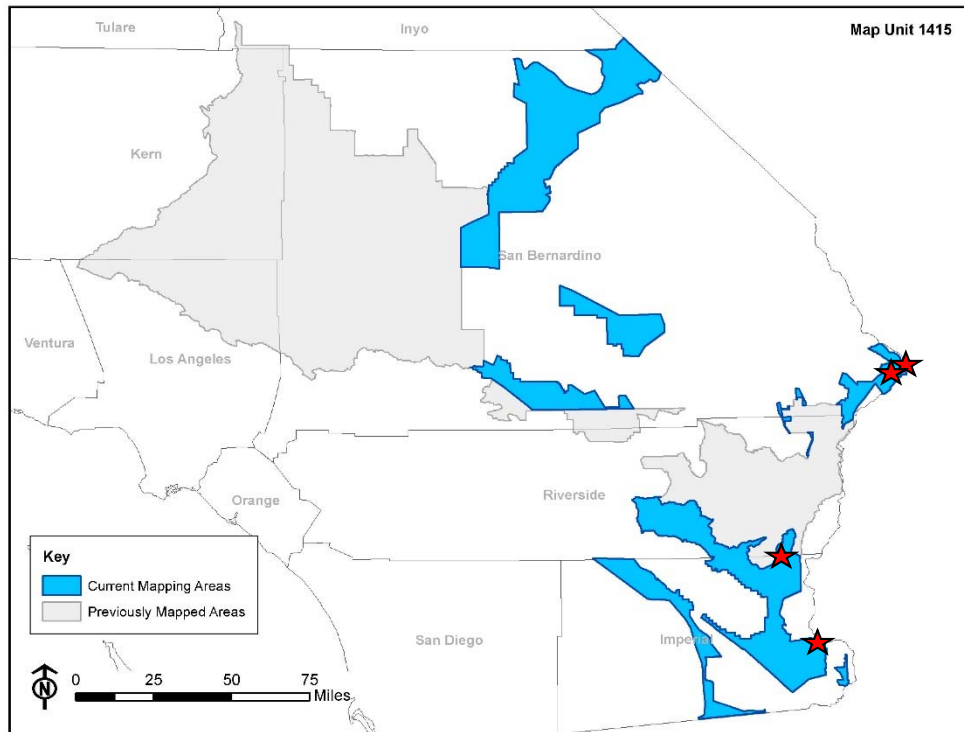
Black willow thickets Alliance



**DISTRIBUTION:** Although *Salix gooddingii* is a component to several of the cottonwood stands along the Mojave and Colorado Rivers, this Alliance is mapped only in a few locations in the study area. All four stands mapped are adjacent to the All American Canal in two separate ecoregions: the Colorado River Floodplain zone and the Salton Sea Trough zone. Based on reconnaissance field data, *S. gooddingii* was observed more frequently along the Colorado River, while *S. laevigata* was noted on more occasions along the western portions of the Mojave River in addition to seasonal creeks flowing north out of the San Gabriel Mountains. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

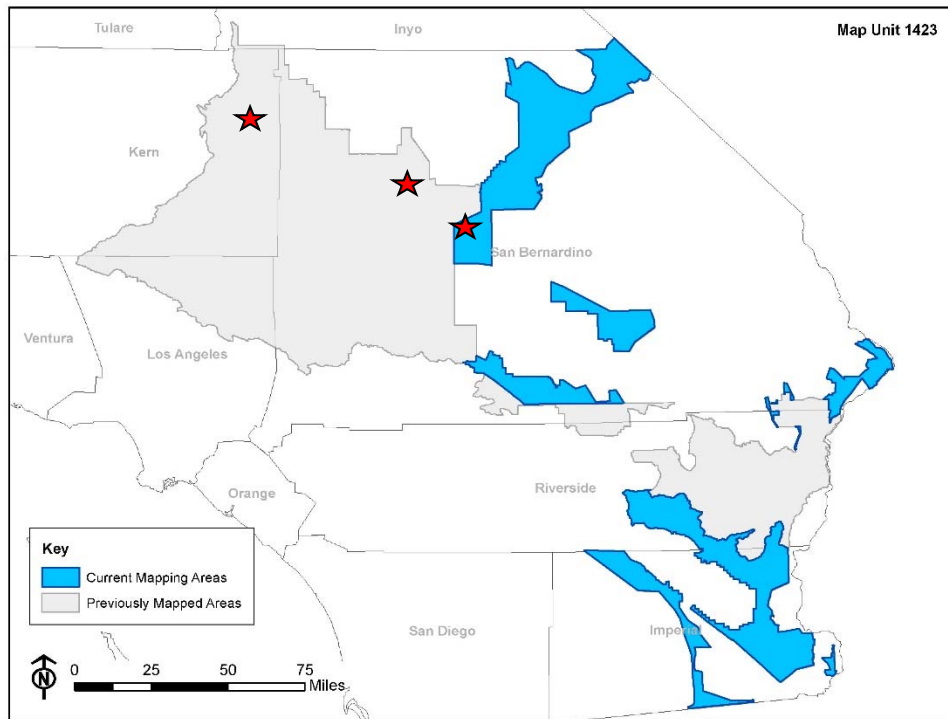
## 1415 – *Washingtonia filifera* Alliance

California fan palm oasis Alliance



**DISTRIBUTION:** Within the 2014-2016 mapping region, *Washingtonia filifera* occurs in dense stands along the Copper Basin, Desilt, and Gene Washes in the Whipple Mountains. A small spring dominated by these palms occurs at Clapp Spring in the Palo Verde Mountains. Reconnaissance efforts in the Whipple Mountains noted stands frequently co-dominating with *Populus fremontii*. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

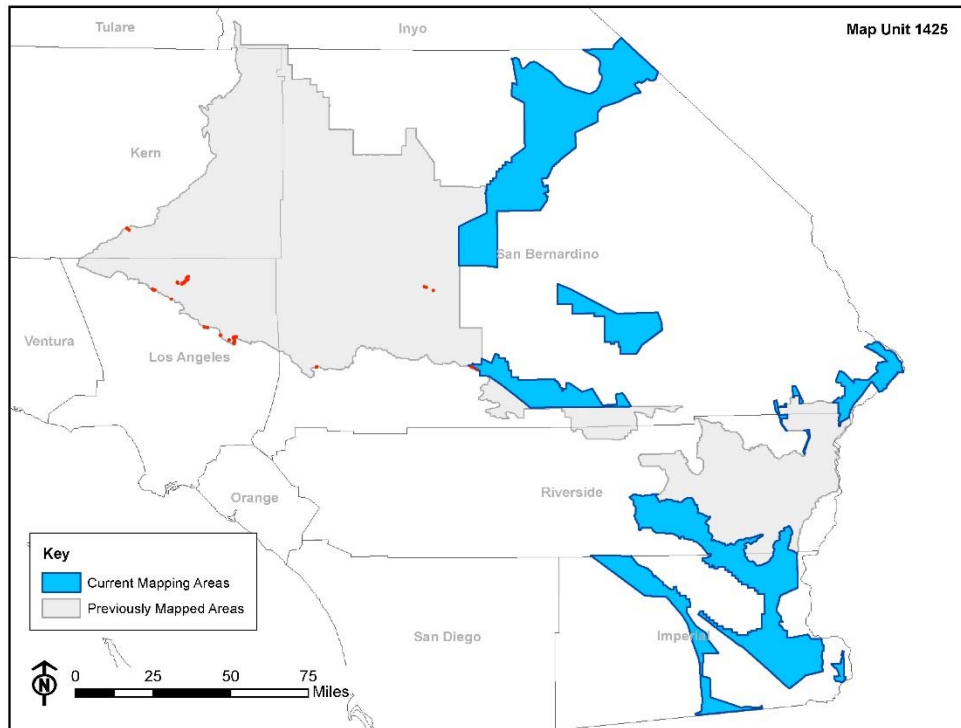
**1423 – *Baccharis sergiloides* Alliance**  
Broom baccharis thickets Alliance



**DISTRIBUTION:** Stands of this Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Stands are small and associated with watercourses in the higher desert mountains. They are more common in the northeastern Mojave Desert. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

## 1425 – *Forestiera pubescens* Alliance

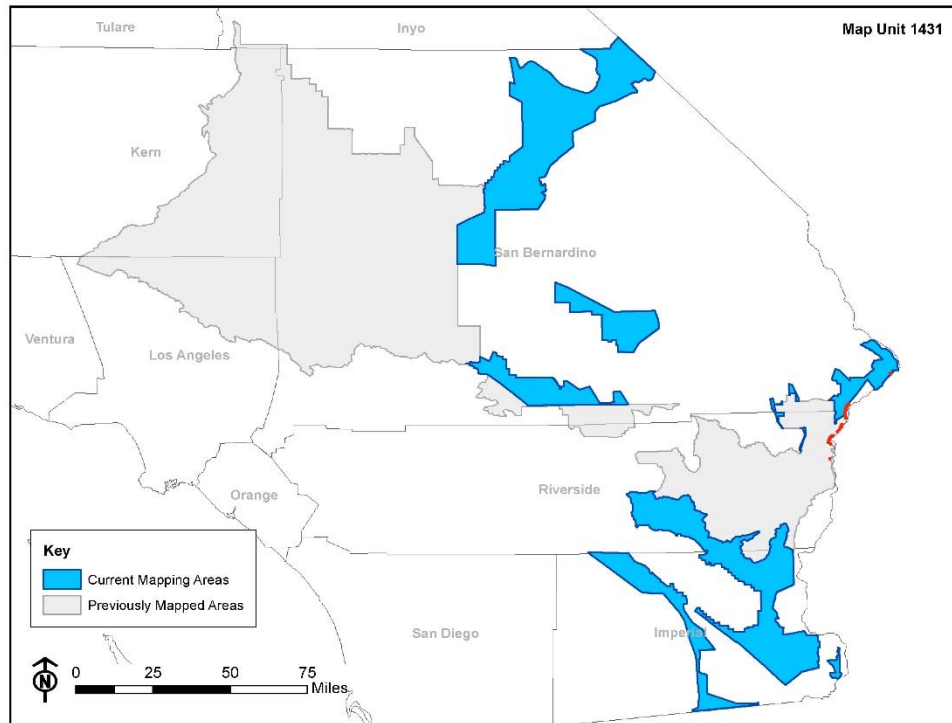
Desert olive patches Alliance



**DISTRIBUTION:** Scattered stands occur along the flats above Amargosa Creek northwest of Lancaster. However, most stands occur along the foothills of the San Gabriel Mountains, usually tucked in narrow canyon drainages in the uppermost fans and adjacent hills. There is also a concentration of stands contained in the floodplain of Pallet Creek west of Valyermo. Within the 2014-2016 mapping region, small patches of one or two acres occur only in spring-fed canyons along the eastern edge of the Bighorn Mountain and Whitewater River National Recreation Lands.

## 1431 – *Arundo donax* Semi-natural Stands

Giant reed breaks Semi-natural Stands

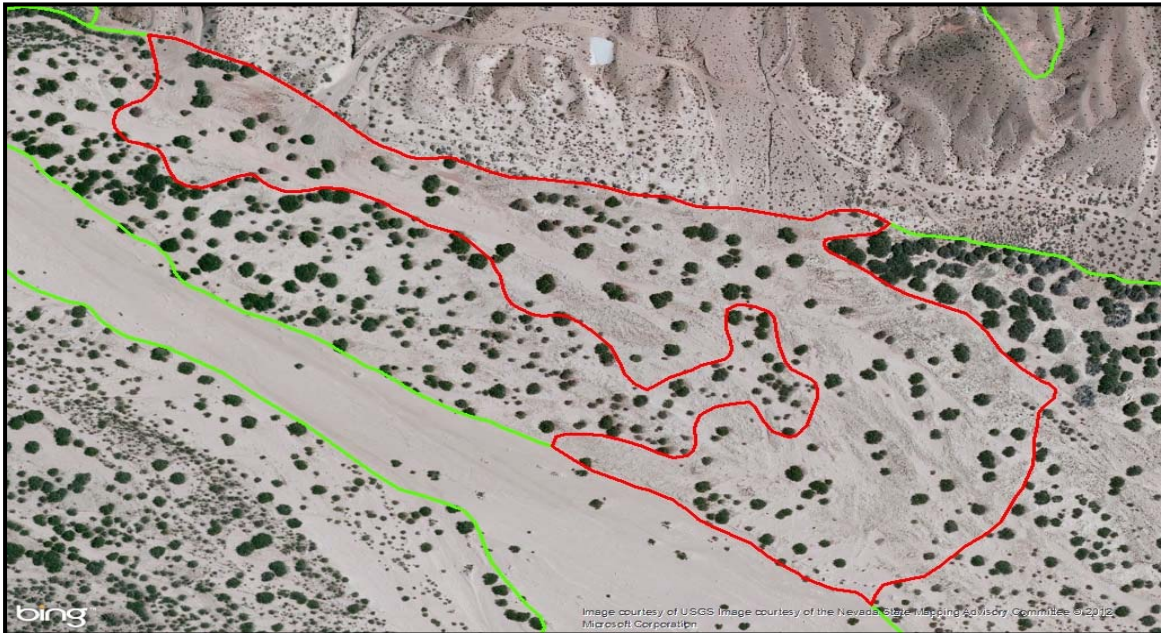


**DISTRIBUTION:** Mappable stands of *Arundo donax* Semi-natural Stands occur along the margins of the Colorado River Floodplain Zone in the original study area. Widely scattered isolated patches and individual canes occur in flooded sites throughout the remainder of the study area, especially along the Mojave River, where a removal program is currently underway. Within the 2014-2016 mapping region, small patches of this tall grass occur along the permanently flooded margins of the Colorado River south and east of the Whipple Mountains.



## 1432 – *Tamarix* spp. Semi-natural Stands

Tamarisk thickets Semi-natural Stands



This area on the Mojave River shows a sparse cover of *Tamarix* occurring directly adjacent to the river channel along with two other, more densely vegetated *Tamarix* stands.



In this photo *Tamarix* spp. is seen in late-season flower colonizing in clonal groups along the hummocky banks of the Mojave River.



#### 1432 – *Tamarix* spp. Semi-natural Stands

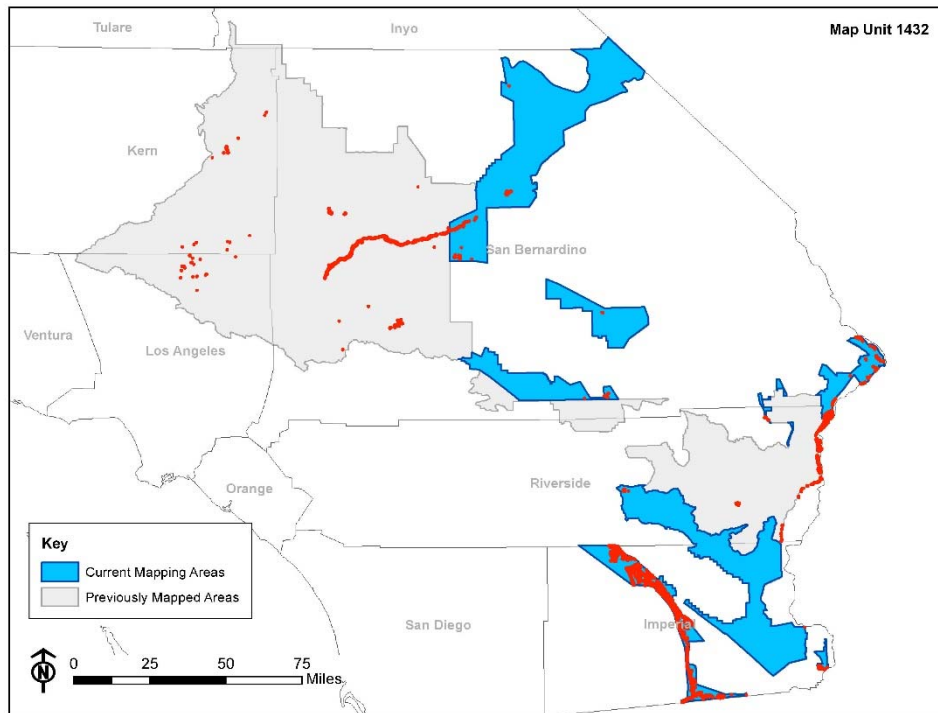
**DESCRIPTION:** In these semi-natural stands the vegetation is strongly dominated by tall shrubby invasive *Tamarix* spp., such as *T. ramosissima*, *T. chinensis*, or other similar species. *Tamarix* spp. constitutes more than 60 percent of the relative cover. These stands do not include the less invasive, taller *T. aphylla*, which is mapped to the more generalized exotic tree category (9500) in the mapping classification. In stands where *Prosopis glandulosa* is consistent in the tall shrub layer with *Tamarix*, the stand is mapped to *Prosopis* even when *Tamarix* dominates the stand.

**PHOTOINTERPRETATION SIGNATURE:** Stands occur in very open to very dense cover and are typically found along man-made canals, in riparian washes and in disturbance areas. Structural characteristics vary considerably, from stands containing sparse short shrubs along sandy river flats to dense tall thickets adjacent to the active channel. Individual shrubs have dense, irregularly shaped crowns, and vary considerably in size. Color tone varies from green to gray to brown, depending on the age, health, and leaf phase of a particular stand.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

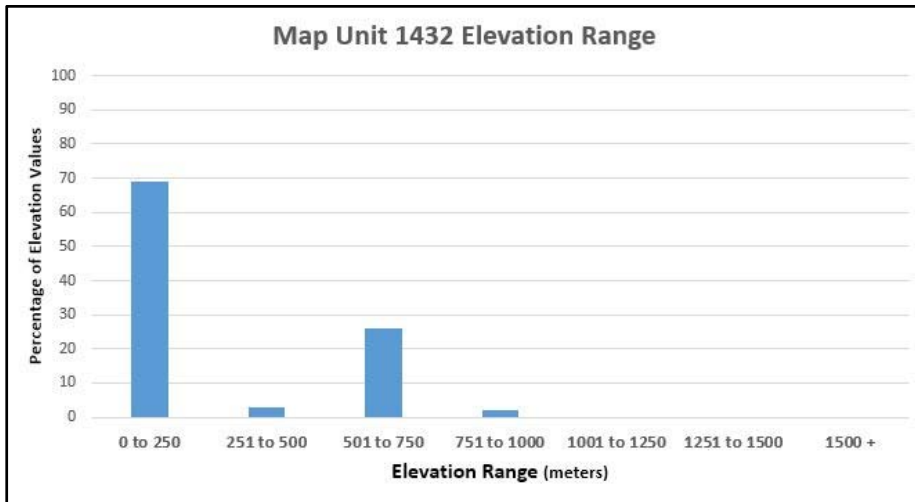
- *Pluchea sericea* Alliance (4221) – Stands dominated by a dense cover of *Pluchea* thickets often contain young sapling *Tamarix* in the stand in varying cover. Texture and crown characteristics in these settings between the two species are similar. Color ranges overlap, with *P. sericea* tending to be more of a blue-green, while *Tamarix* has a mixture of colors including portions of the stand which may be a rusty brown.
- *Prosopis glandulosa* Alliance (4222) – Stands on the Mojave and Colorado Rivers are more likely to occur along the base of the bluff. *Prosopis glandulosa* is more likely to occur as a component to a stand co-dominated by *Tamarix* along old river meanders in the Colorado River floodplain; off the meanders, *Tamarix* strongly dominates the canopy over extensive areas. The more consistently rounded crowns of *Prosopis* can be easily identified even in dense stands where *Tamarix* dominates. Signature color ranges from bright green to gray depending on time of year and percent of the crown that is alive. In addition to these factors, the signature color for *Tamarix* is more dependent upon the age of the stand.

## 1432 – *Tamarix* spp. Semi-natural Stands



**DISTRIBUTION:** This map unit is common in two settings: (1) along the Mojave and Colorado Rivers, and (2) adjacent to dry lake beds in the Mojave Desert that are near agriculture. In both situations, stands of *Tamarix* spp. are closely related to human disturbance and occur within close proximity to groundwater. Stands occur along the Mojave River from Helendale and continue downstream all the way to where it crosses the study area boundary. Some of the largest, most extensive stands occur along the Colorado River, spanning the eastern edge of the Colorado Desert portion of the study area. Within the 2014-2016 mapping region, stands occur in all subareas in similar settings to previous mapping efforts. Stands are especially common in the Salton Trough along major canals and larger washes. Large stands also form continuous bands along the margins of the Salton Sea, especially adjacent to the Imperial State Wildlife Refuge where fresh water drains into the sea.

1432 – *Tamarix* spp. Semi-natural Stands



**1433 – *Saccharum ravennae* Mapping Unit**  
Ravennagrass Mapping Unit



A stand of *Saccharum ravennae* (red polygon) is noted above with emergent exotic palm trees, located in Imperial county on the East Mesa, east of the East Highline Canal. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



In this photo *Saccharum ravennae* is mixing with dead *Pluchea* and *Tamarix* spp. near the East Highline Canal.

#### 1433 – *Saccharum ravennae* Mapping Unit

**DESCRIPTION:** *Saccharum ravennae* strongly dominates the tall herbaceous canopy. *Pluchea sericea* was noted in reconnaissance visits as a subdominant shrub in the understory, often with a presence of *Tamarisk*. Stands were observed in semi-permanently to permanently flooded settings in small stands often adjacent to standing water. Herbaceous cover was generally very high.

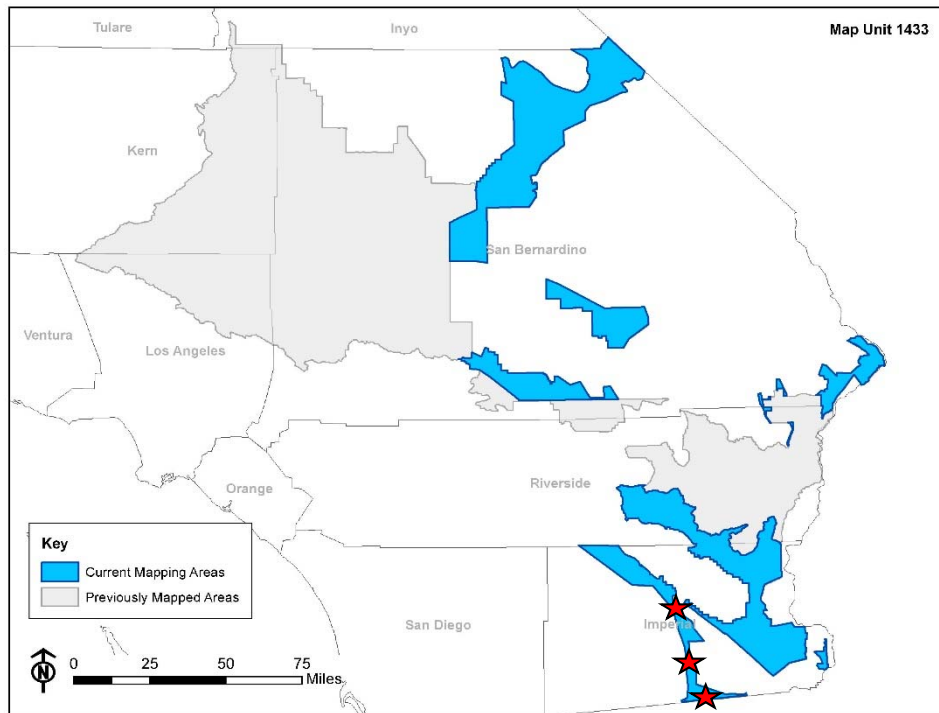
**PHOTOINTERPRETATION SIGNATURE:** Stands occur in dense cover; frequently adjacent to and along perennial man-made canals in the Salton Trough. The plant is very similar in appearance and settings to pampas grass (*Cortaderia selloana*). Structural characteristics are fairly consistent across stands and overall signature varies little regionally. Stand texture is stipple-like, similar to *Typha* spp. Color is typically a consistent bright straw tone.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

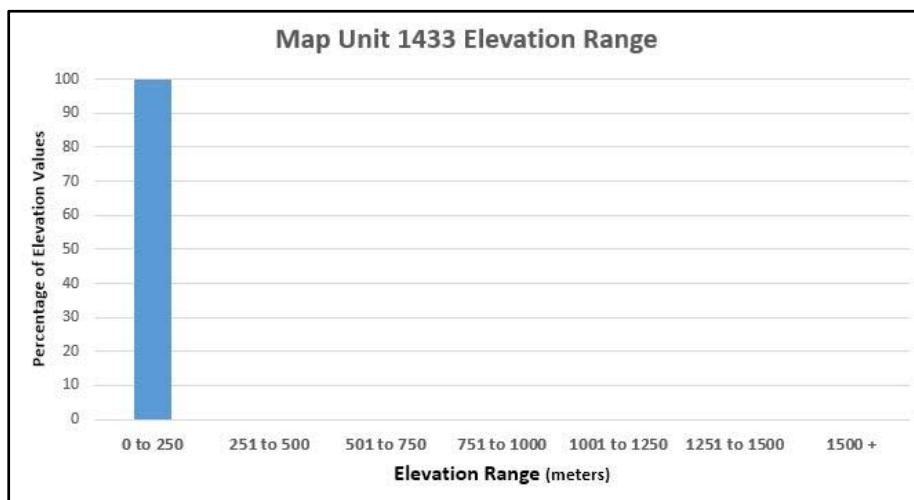
- *Typha* (*angustifolia*, *domingensis*, *latifolia*). Alliance (3415) – Color and texture are similar; however, texture patterns are interrupted by the frequent presence of *Pluchea* and/or *Tamarisk*.
- *Pluchea sericea* Alliance (4221) – Stands of *S. ravennae* are frequently invaded by this shrub. Signature characteristics of *P. sericea* are distinct (see descriptions for this type); however, in stands where *S. ravennae* dominates, a component of this shrub makes the overall signature more mottled with varying tones trending toward the blue-greens.



**1433 – *Saccharum ravennae* Mapping Unit**

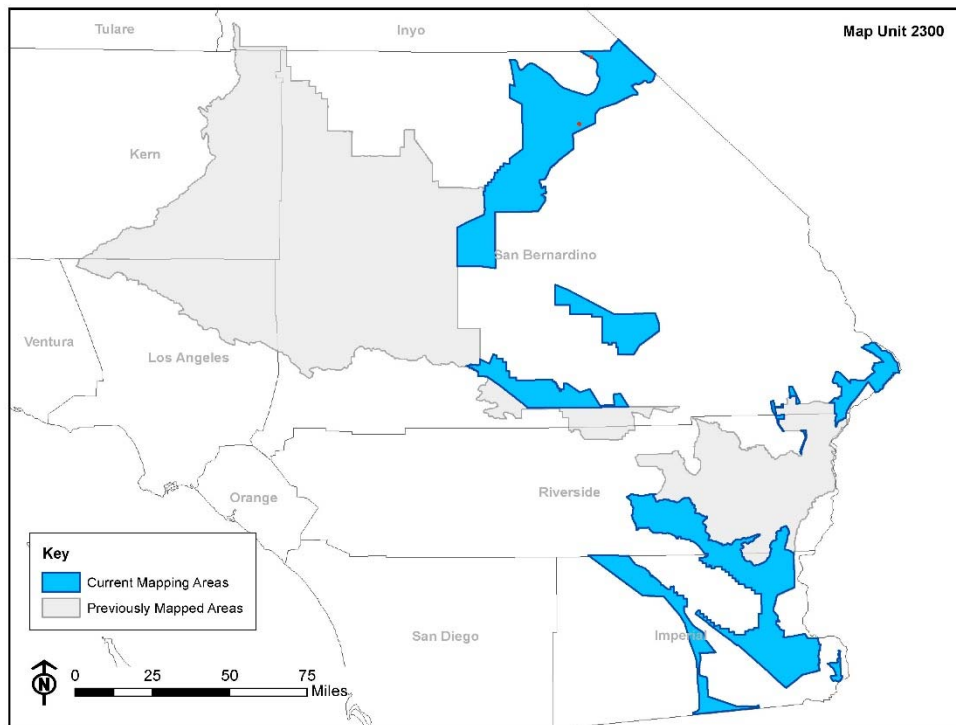


**DISTRIBUTION:** Stands of this Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Mappable stands were found only along the All American and East Highline Canals. Reconnaissance sightings noted small stands occurring adjacent to standing water, frequently within larger areas of *Pluchea sericea* and/or *Tamarisk*. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



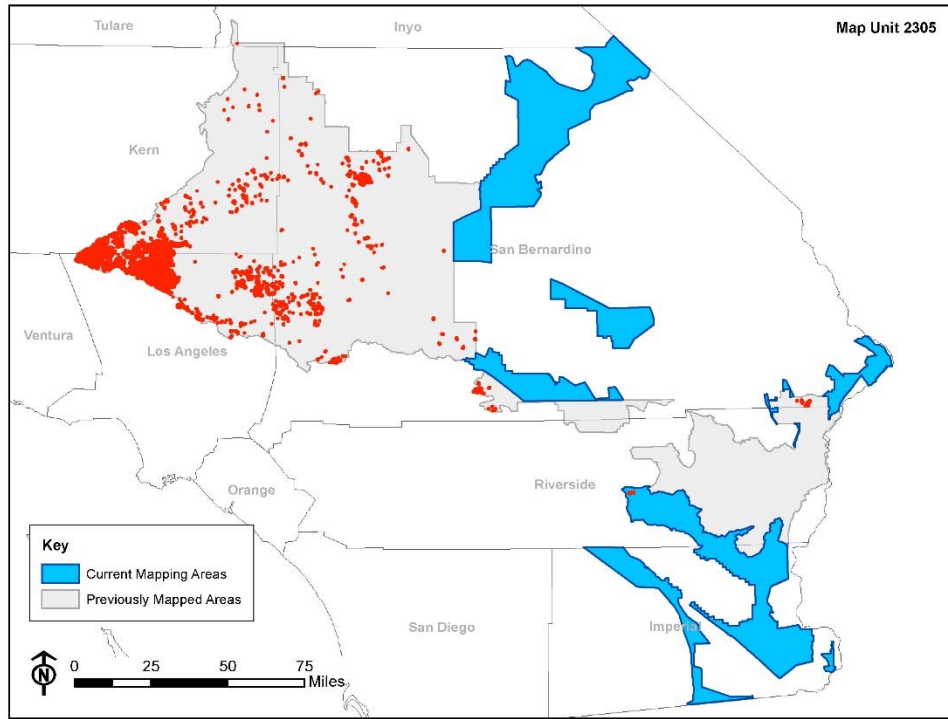


## 2300 - California Annual and Perennial Grassland Macrogroup



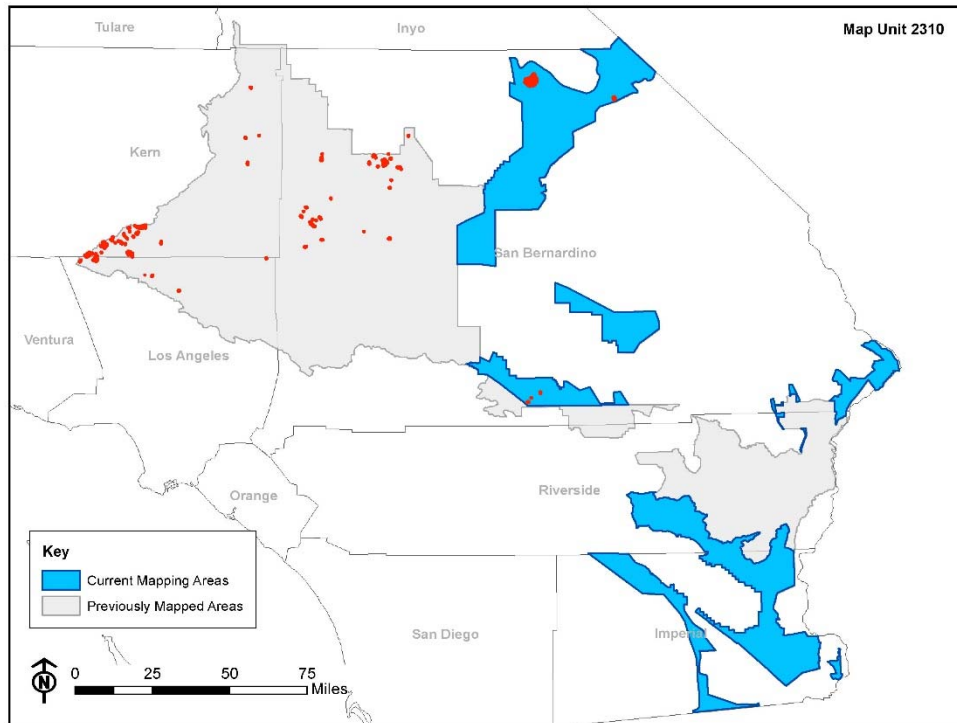
**DISTRIBUTION:** These stands are mapped at the Macrogroup level. Interpreting to finer levels in the National Vegetation Classification hierarchy cannot reliably be achieved from existing imagery or by modeling based on environmental features. The only areas mapped as this Macrogroup occur in the Eastern Mojave region and total 21 acres.

## 2305 – California annual and perennial grassland Mapping Unit (Native component)



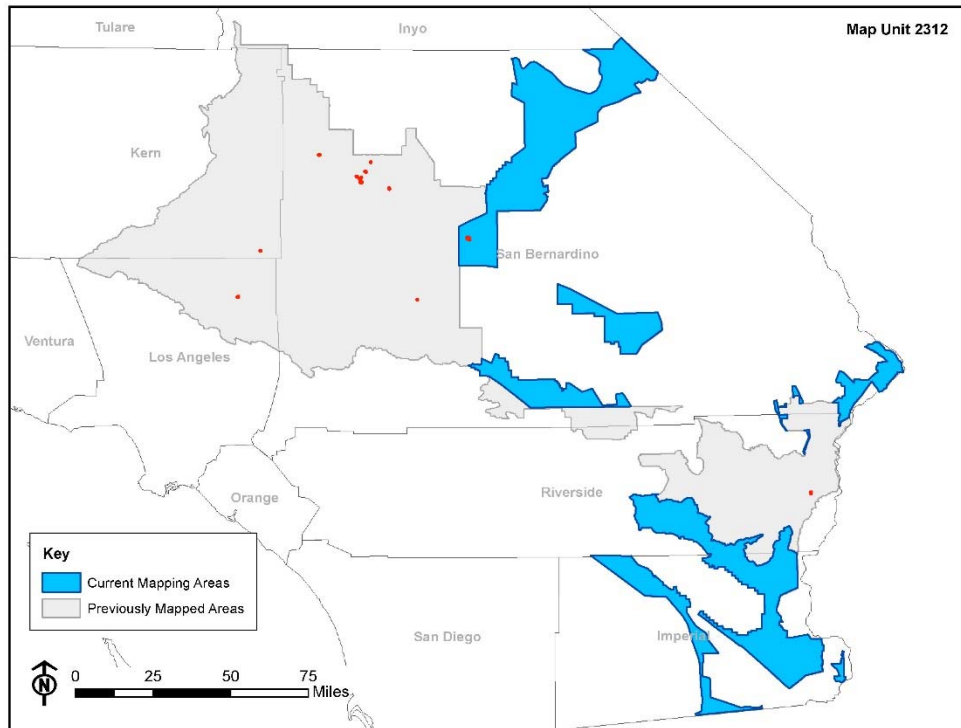
**DISTRIBUTION:** This mapping unit is widely distributed throughout most of the region west of the Mojave River, becoming very common in the western portion of the Antelope Valley from Lancaster to Gorman. Within the 2014-2016 mapping region, the only areas mapped as this mapping unit occurred along the southern margins of Hayfield Dry Lake north of Interstate 10.

## 2310 – California annual forb/grass vegetation Group



**DISTRIBUTION:** The Group level is assigned to the vegetation type only when the photo signature and ecological characteristics make photointerpretation and modeling/extrapolation inconclusive for a specific Alliance call. Stands are scattered in locations throughout the western Mojave Desert and are more common in the western Antelope Valley. Scattered stands occur in alkaline settings in Edwards AFB and Superior Valley. Within the 2014-2016 mapping region, 5051 acres of this map unit were identified and mapped, mainly occurring adjacent to the Dumont Dunes in the Eastern Mojave region and along the margins of small playas in the Yucca Valley area.

## 2312 – *Amsinckia (menziesii, tessellata)* Alliance Fiddleneck fields Alliance



**DISTRIBUTION:** Stands of this Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Stands that were not field verified were likely coded to California annual and perennial grassland Mapping Unit (Native component) (2305) or to Mediterranean California naturalized annual and perennial grassland Group (2330). Within the 2014-2016 mapping effort, 128 acres were identified and mapped on upper alluvial fans just west of the Cady Mountains.

## 2330 – Mediterranean California naturalized annual and perennial grassland Group



The above image depicts annual grassland dominated by *Salsola tragus*, south of Dumont Dunes. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



*Salsola tragus* strongly dominates this example of Mediterranean annuals in cover below 15 percent. This site is located next to an agriculture field in Mesquite Valley.

## 2330 – Mediterranean California naturalized annual and perennial grassland Group

**DESCRIPTION:** Stands are strongly dominated by non-native herbaceous species, lacking evenly distributed diagnostic native plants (which usually constitute less than 5 percent of relative cover). Annual *Bromus*, *Schismus*, *Avena*, *Brassica* and other non-natives are strongly dominant, with little regular cover of native herb species. This applies to multiple species of *Brassica* and related mustards including *Sisymbrium* sp. The species composition of this type varies from west to east in the mapping area. Eastward, there is greater probability of high cover of *Brassica tournefortii* (Saharan mustard) and *Sisymbrium irio*. Westward, there is more likelihood of relatively pure stands of *Bromus rubens* and *Schismus* spp. along with *Sisymbrium altissimum*.

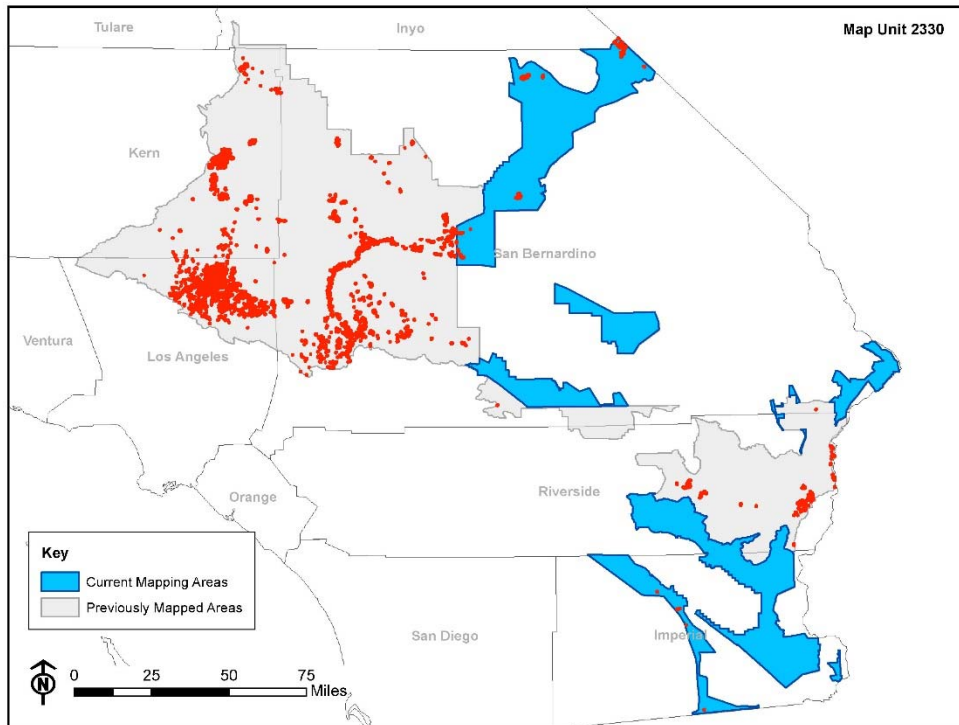
**PHOTOINTERPRETATION SIGNATURE:** Stands tend to have a highly variable signature both in patterning and color. Texture is generally very smooth. Since most available image sources were flown long after the annuals had senesced, signature color in this mapping effort tended to have differing hues of tans, browns and grays. This high degree of variability corresponds both to species diversity and elapsed time in which the plants have undergone the final weeks of their annual growth cycle.

### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- California annual and perennial grassland Mapping Unit (Native component) (2305) – It is extremely difficult to discern the presence of native forbs and grasses in herbaceous vegetation; therefore, photointerpreters must rely primarily on the intensity, duration and nature of human-related activities affecting the stand. Stands containing a native component tend to occur away from extensive urban areas and large areas that were recently cultivated. The major exceptions to this rule are the showy flower fields and bunch grasses found in former dry-land farming sites in the western Antelope Valley.
- Sparse early seral stands of shrub cover (may include types from 2212, 2214, 2215, 2221, 4111, 4113, 5211, 5212, 5215, 5415, 5416) – Many examples of early post-disturbance cleared fields contain a sparse and inconsistent cover of shrubs such as *Eriogonum fasciculatum*, *Ericameria nauseosa*, *Ericameria cooperi*, and *Eriodictyon* spp. to mention a few. This cover may vary considerably between image datasets created in different years, and also between the baseline imagery dates and when subsequent field verification was undertaken.

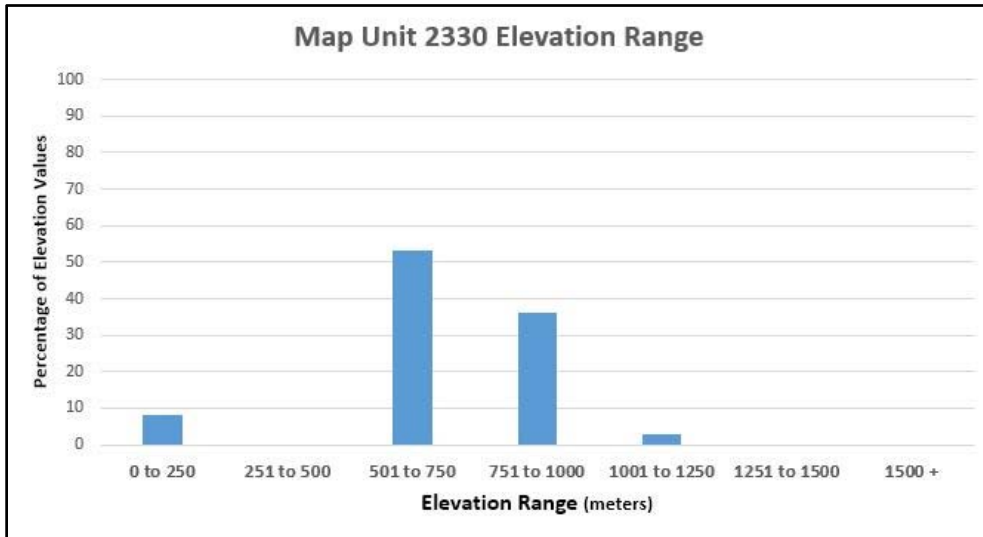


**2330 – Mediterranean California naturalized annual and perennial grassland Group**



**DISTRIBUTION:** This mapping unit is found throughout most of the study area with the exception of portions of the Colorado Desert, Yucca Valley and western Antelope Valley. Highest concentrations occur in and around the heavily urbanized areas of Lancaster, Palmdale, Victorville, and Hesperia, and also along the Mojave River. Within the 2014-2016 mapping region, this type is mapped primarily in the Central and Eastern Mojave regions. In the Central Mojave region, nonnative grasslands occur adjacent to old agricultural fields near the Mojave River, east of Newberry Springs and just south of East Cronese Lake near Interstate 15. Several stands also were noted in the northeasternmost edge of the mapping area by Mesquite Lake in the Eastern Mojave region.

2330 – Mediterranean California naturalized annual and perennial grassland Group



## 3400 – Western North American Freshwater Marsh Macrogroup



The above image depicts a portion of the Imperial Wildlife Area (Wister Unit). Vegetation includes *Crypsis schoenoides*, *Bolboschoenus maritimus* and *Typha* spp. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



This picture depicts *Crypsis schoenoides* surrounded by *Bolboschoenus maritimus* and *Typha* spp. with emergent *Tamarix* spp.

### 3400 – Western North American Freshwater Marsh Macrogroup

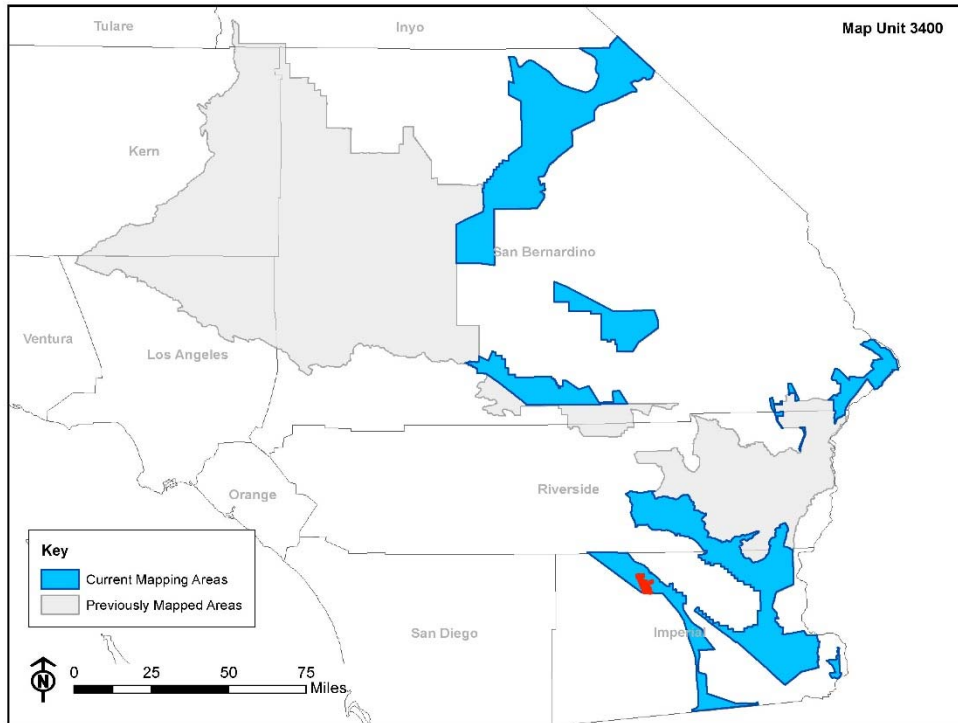
**DESCRIPTION:** Stands of this Macrogroup are dominated by tall to short herbs and graminoids. Within the 2014-2016 mapping region, this Macrogroup is mapped exclusively in the Imperial State Wildlife Area (Wister Unit) and is defined by the presence of species used for managed wetland purposes. Species composition varies considerably from year to year depending on flooding practices for the particular season. This makes it difficult to classify these areas to the Alliance level. Common species within these managed wetlands include *Crypsis schoenoides*, *Typha angustifolia*, and *T. latifolia*. Within these managed wetlands, small areas of vegetation in different Macrogroups may occur such as *Bolboschoenus maritimus* and *Phragmites australis*.

**PHOTOINTERPRETATION SIGNATURE:** Vegetation within this Macrogroup is characterized by a signature denoting anthropogenic disturbance. Stands of vegetation are arranged within each impoundment pond based on manmade flooding regimes. All photointerpretation patterns and textures are aggregated into the human-developed entity, which in this case is the impoundment feature containing the managed wetlands. Therefore, all signature characteristics vary considerably across the mapped feature. Defining margins are often narrow berms, roads and agricultural areas.

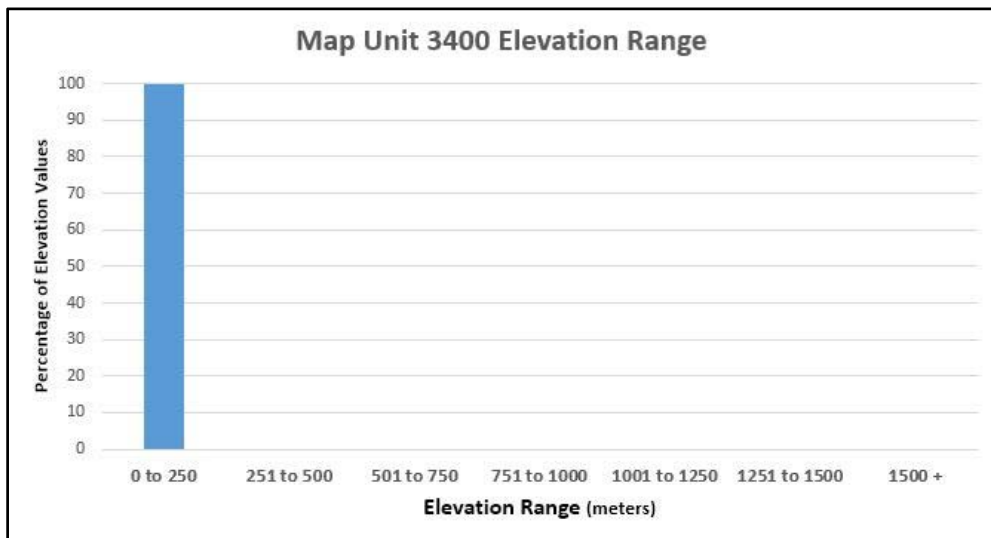
**TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- Agriculture (9200): Young grain crops and early spring fallow fields often yield a signature similar to early development of wetlands in managed wildlife areas. Setting and ownership are crucial factors in determining whether the vegetation will be used for managed wetland purposes.

**3400 – Western North American Freshwater Marsh Macrogroup**

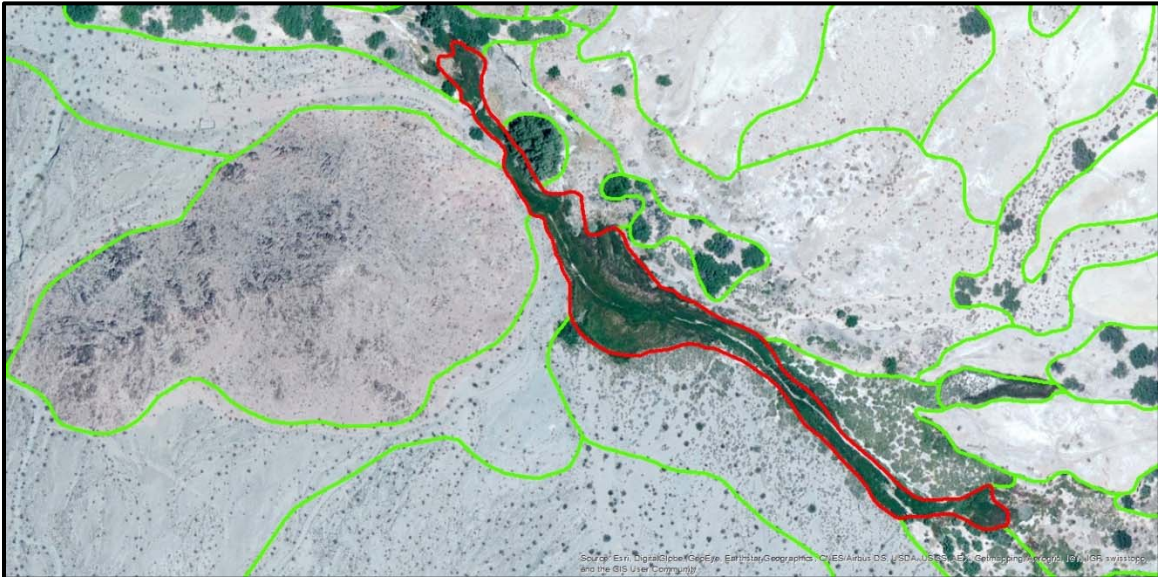


**DISTRIBUTION:** Stands are mapped exclusively in the Imperial State Wildlife Area (Wister Unit) in the Salton Sea Trough zone.





**3411 – *Phragmites australis* Alliance**  
Common reed marshes Alliance



This image depicts an example of *Phragmites australis* occurring in Salt Creek.



In this photo, *Phragmites australis* forms a linear stand along Salt Creek. Note that the yellow arrow points to the *Phragmites australis*.



### 3411 – *Phragmites australis* Alliance

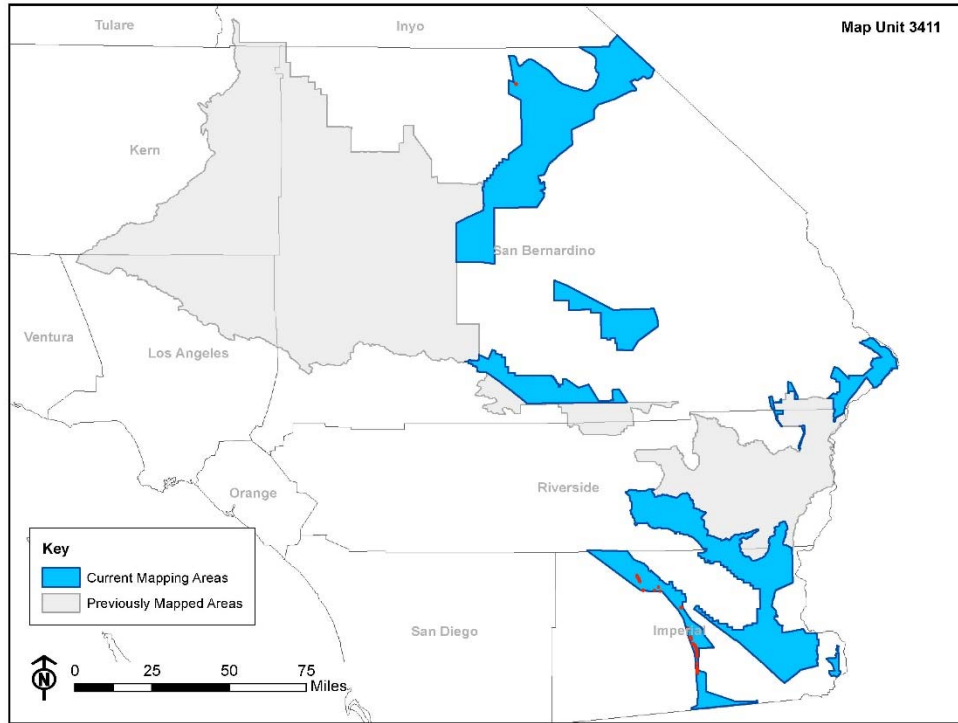
**DESCRIPTION:** In this Alliance, *Phragmites australis*, the tall stoloniferous wetland grass, dominates the stand. Most stands are small and occur adjacent to permanent water sources such as springs, flowing streams and rivers (VegCAMP, 2012). Most are below mappable size for this project, with the exception of the larger stands along the East Highline and All American Canals. Hybrids between the native races of the American Southwest and non-native Eurasian races are likely in some areas and make conservation prioritization difficult without detailed taxonomic study. Most stands in isolated wetlands appear native (VegCAMP, 2012).

**PHOTOINTERPRETATION SIGNATURE:** Signature characteristics within stands assigned to this Alliance vary considerably depending on the age of the stand, time of the growing season and pureness of the stand. All examples tend to have a smooth to finely stippled texture that can be slightly mottled depending on the presence of certain shrub species such as *Tamarix* and/or *Pluchea sericea*. Early-season examples tend to be a brighter green, while older stands yield less bright hues.

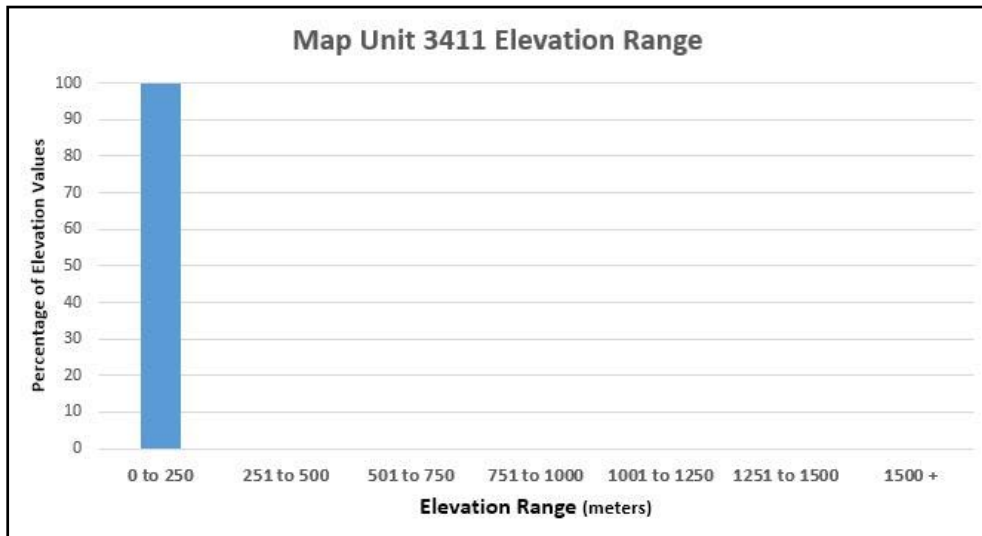
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Arundo donax* Semi-natural Stands (1431): Stands are difficult to separate both in the field and from imagery. It was determined that stands occurring within the mapping area along the Colorado River were for the most part *Arundo donax*, while those in the Salton Trough were most likely *Phragmites*.

**3411 – *Phragmites australis* Alliance**

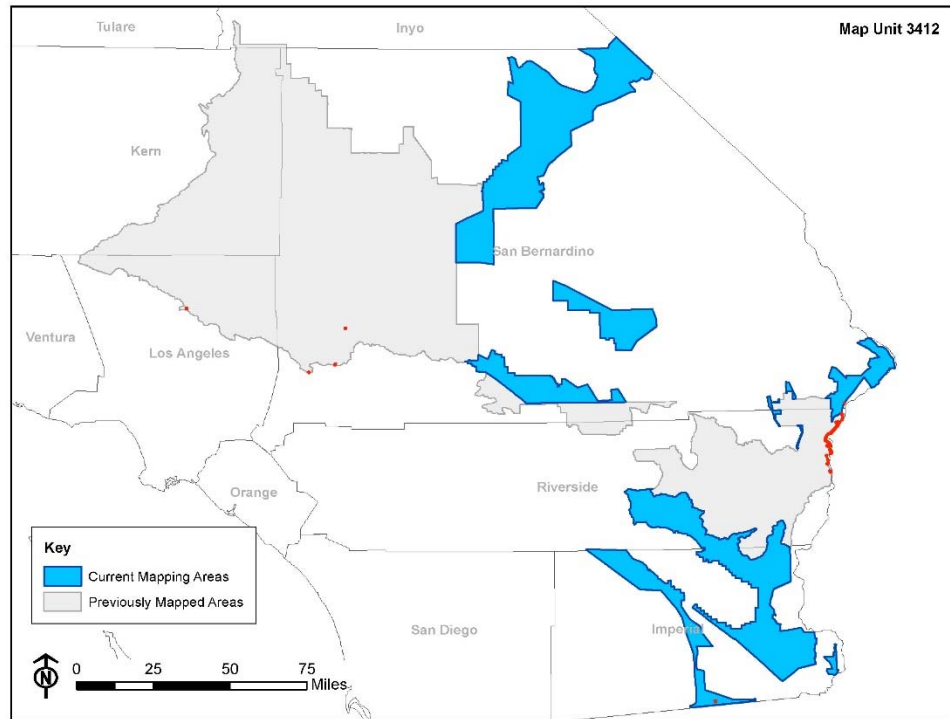


**DISTRIBUTION:** Stands are restricted for the most part to the Salton Sea Trough zone, primarily along the East Highline Canal. One example was noted in reconnaissance and subsequently mapped along Salt Creek in the East Mojave Desert region. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



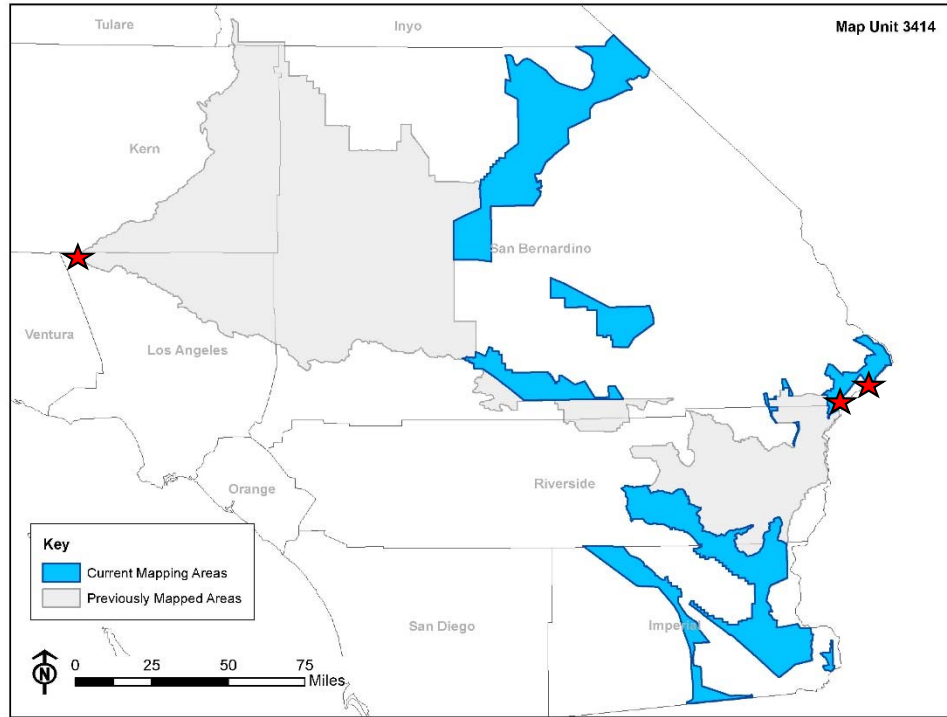
## 3412 – *Schoenoplectus (acutus, californicus)* Mapping Unit

Hardstem bulrush, California bulrush Mapping Unit



**DISTRIBUTION:** Stands are mapped in isolated locations throughout the study area, with over 90 percent occurring along the Colorado River. Within the 2014-2016 mapping region, only 27 acres were mapped along the Colorado River in the Whipple Mountains zone. Small stands below MMU were observed both during reconnaissance and on the imagery but were not mapped.

### 3414 – *Schoenoplectus californicus* Alliance California bulrush marsh Alliance



**DISTRIBUTION:** Stands of this Alliance were infrequently mapped in the study area and are only mapped based on ground surveys or verification. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Within the 2014-2016 mapping region, only 12 acres were mapped along the Colorado River in the Whipple Mountains zone. Small stands below MMU were observed both during reconnaissance and on the imagery but were not mapped. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

**3415 – *Typha* (*angustifolia*, *domingensis*, *latifolia*) Alliance**  
Cattail marshes Alliance



The image depicts a patch of *Typha* on the upstream side (right) of a small island in the Colorado River. An area of *Schoenoplectus* occurs immediately to the west in some slower-moving water.



In this photo, *Typha* dominates in a small pond displaying midsummer growth. In new and high season growth phases, it is difficult to distinguish bulrush species from cattail.

### 3415 – *Typha* (*angustifolia*, *domingensis*, *latifolia*) Alliance

**DESCRIPTION:** *Typha* spp. dominate the stands of this Alliance. Most stands growing in water with slightly alkaline or saline chemistry are *T. domingensis*. Stands of *T. latifolia* have only been inventoried in fresh water at Lost Lake in the Cajon Pass region.

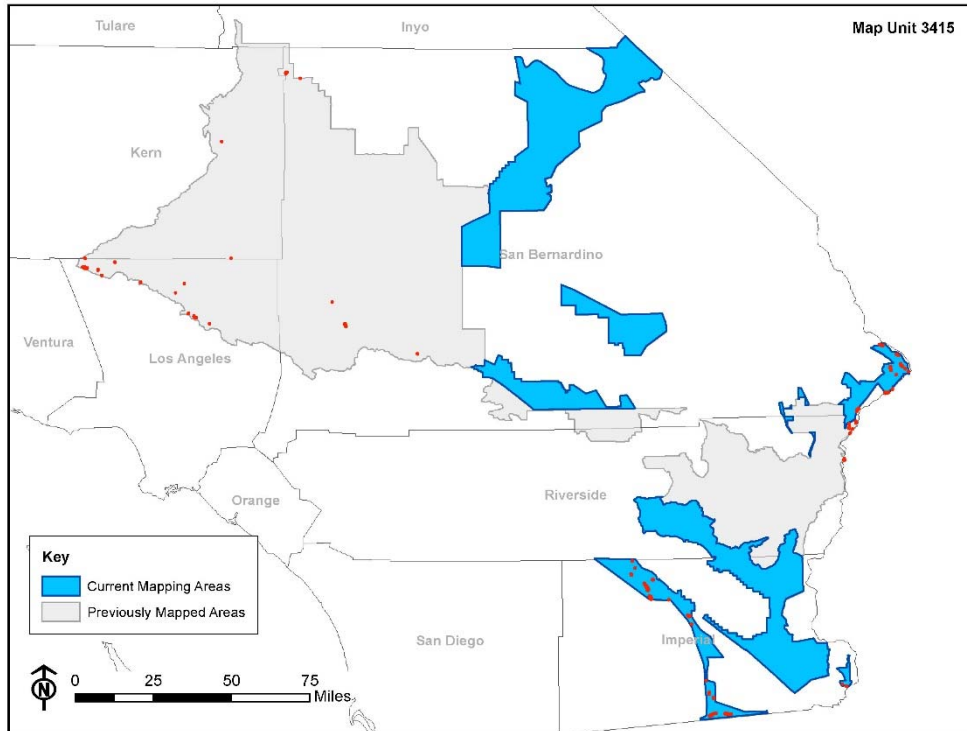
**PHOTOINTERPRETATION SIGNATURE:** Stands occur in most small perennial farm ponds and along the margins of reservoirs. The key to this and the *Schoenoplectus* mapping unit are their interface with perennial water. In most circumstances, the interface is between dense cover and open water. Postseason growth in senesced conditions tends to yield a light tan signature. Full mature growth often has a stippled texture.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

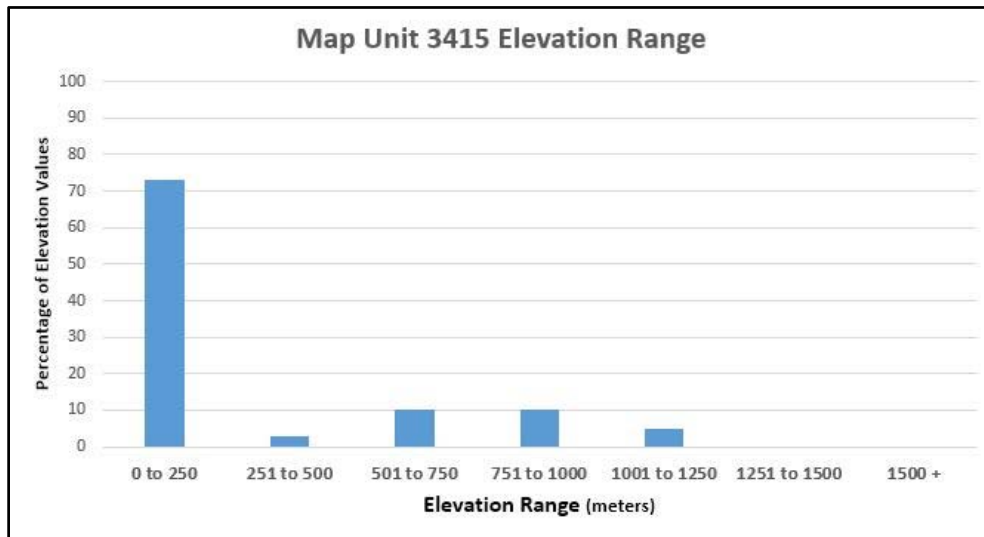
- *Schoenoplectus* (*acutus*, *californicus*) Mapping Unit (3412) – There are no distinguishing ecological characteristics detectable using remote sensing techniques that may help in separating out this mapping unit from *Typha*. However, most mapped stands occur along the Colorado River, whereas stands of *Typha* are more likely found along margins of irrigation ponds and small reservoirs. *Typha* is associated with recent disturbance and with higher nutrient loads than *Schoenoplectus* (*acutus*, *californicus*). Stands tend to have a darker gray or brown signature color in typical senesced growth phases. Patterning tends to vary more across the stand, reflecting the previous year's growth cover characteristics.



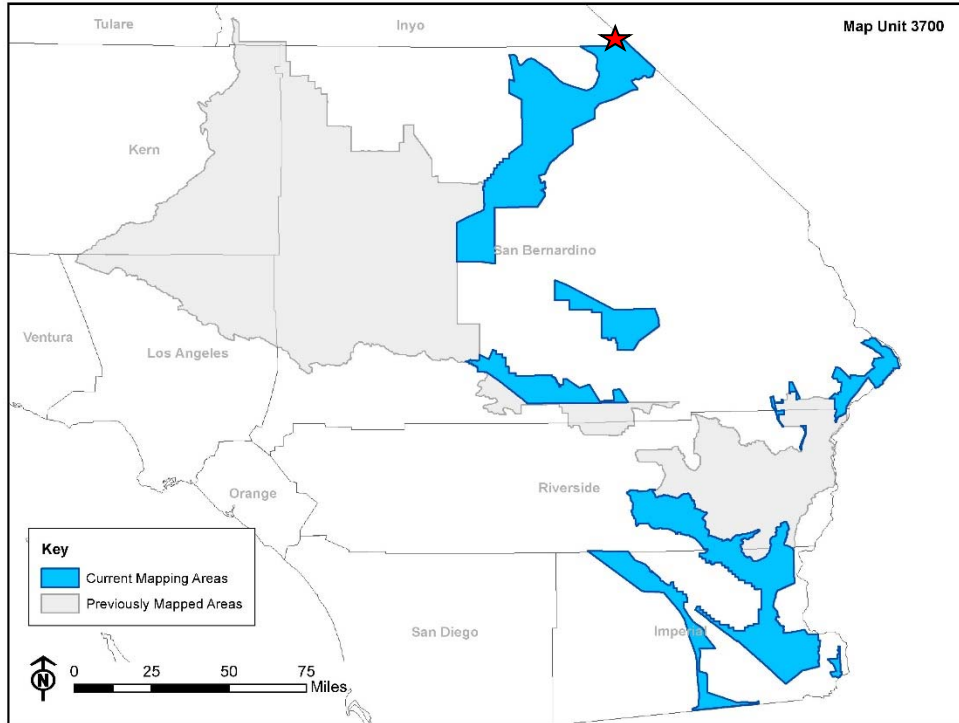
**3415 – *Typha (angustifolia, domingensis, latifolia)* Alliance**



**DISTRIBUTION:** Over half of the mapped stands in the original study area occur in perennial water settings in the western portions of the Antelope Valley along the base of the San Gabriel Mountains and Sierra Pelona. Within the 2014-2016 mapping region, stands are common in small less active lagoons and side channels along the Colorado River in the Whipple Mountains zone and along stagnant canals with permanently standing water adjacent to agricultural lands in the Salton Sea Trough zone.



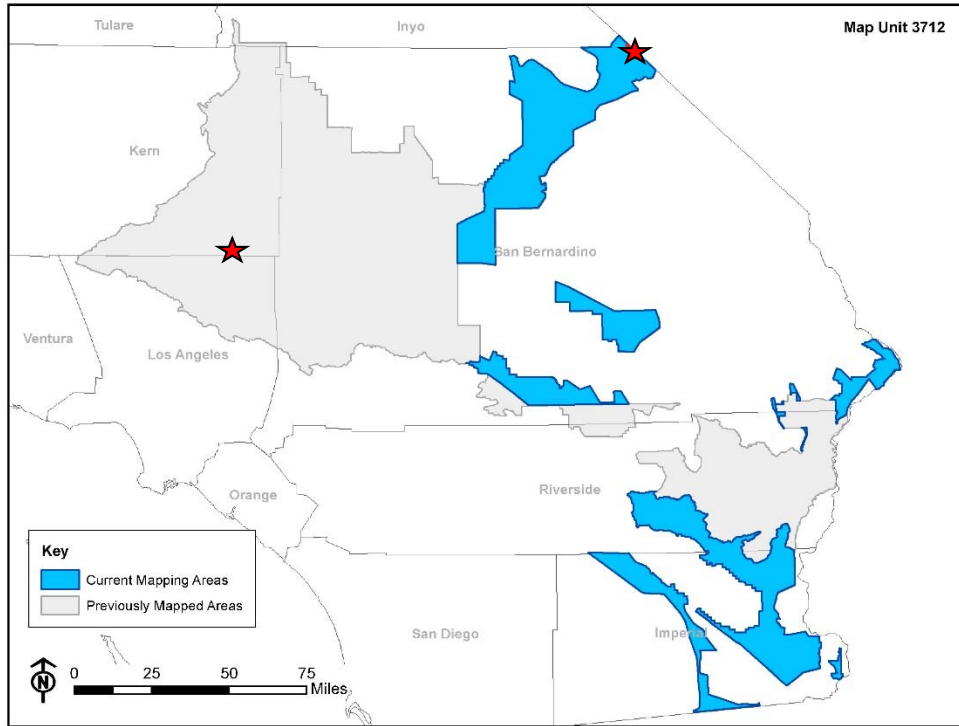
## 3700 – Warm Semi-Desert/Mediterranean Alkali-Saline Wetland Macrogroup



**DISTRIBUTION:** Stands are mapped at the Macrogroup level when the Alliance is not discernible from the imagery. The only stand mapped to this Macrogroup is 18 acres located in Mesquite Valley. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, a star symbol has been placed over the polygon for display purposes.

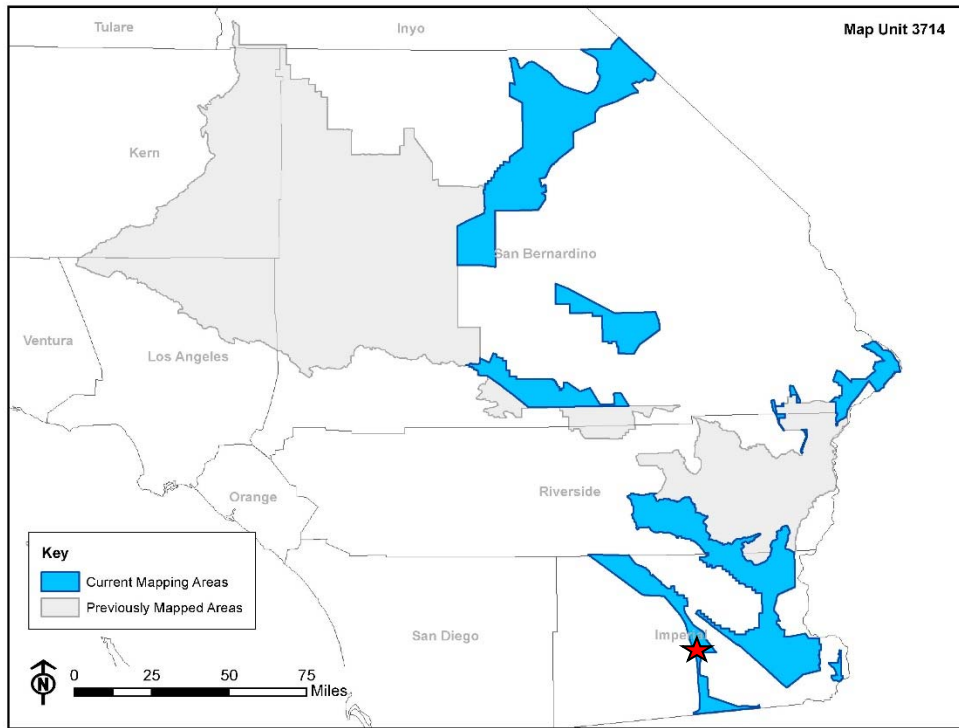
## 3712 – *Sporobolus airoides* Alliance

Alkali sacaton grassland Alliance



**DISTRIBUTION:** Stands of this Alliance were infrequently mapped in the study area. Stands smaller than the minimum mapping unit were encountered in several areas in the Western Mojave Desert near Rosamond and Lancaster. All stands are associated with moist to saturated alkaline soils. However, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Within the 2014-2016 mapping regions, 60 acres of this Alliance are mapped nearby and adjacent to stands of *Atriplex* spp. north of Mesquite Lake in the Eastern Mojave Desert region. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

**3714 – *Juncus cooperi* Alliance**  
Cooper's rush marsh Alliance



**DISTRIBUTION:** Only eight acres are mapped in the 2014-2016 mapping region adjacent to the East Highline Canal in the Salton Sea Trough zone. Small stands were observed during reconnaissance efforts along the western edge of Soda Lake in the Mojave Preserve. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, for display purposes a star symbol has been placed over the area mapped as this Alliance.

**3721 – *Allenrolfea occidentalis* Alliance**  
Iodine bush scrub Alliance



This image shows an isolated stand of *Allenrolfea occidentalis* in the middle of a playa.



The photo shows a “pure” stand of *Allenrolfea occidentalis* occurring in a temporarily flooded, alkaline playa margin.

### 3721 – *Allenrolfea occidentalis* Alliance

**DESCRIPTION:** Polygons mapped as this Alliance typically have *Allenrolfea occidentalis* comprising more than 2 percent absolute cover in the shrub canopy and no other species with greater or equal cover, except *Suaeda moquinii*, *Atriplex confertifolia*, or *A. canescens* (Keeler-Wolf et al., 1998, Thomas et al., 2004). Leaves are usually scale-like and inconspicuous. The stands are commonly restricted to salty basins that may be seasonally inundated or saturated. They can be found in saline playas and on the margins of salt pannes. They also occur on hummocks that are widely spaced on relatively flat playas like China, Bristol and Mesquite Dry Lakes. Stands may also form borders between the edges of stabilized dunes and the edges of playas. In general, stands in the Mojave and Colorado deserts have small, low, widely to intermittently spaced shrubs, but stands at China Dry Lake are denser and have a *Distichlis spicata* understory.

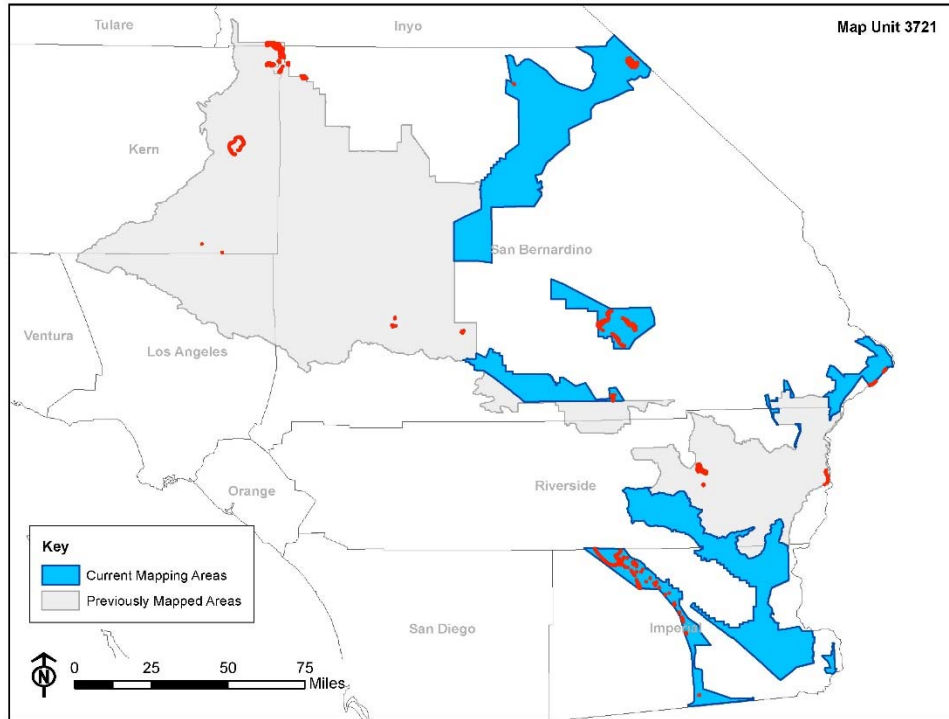
**PHOTOINTERPRETATION SIGNATURE:** The stands are open to sometimes moderately dense in cover, occurring as small dark brown to grey rounded shrubs. These shrubs establish in the most saturated and saline areas of the playa, many times situated on hummocks or the lowest ring of perennial vegetation around desert salt flats. Stands are characterized by a monotypic signature of shrubs due to the inability of most other species to tolerate the salinity and saturation levels, which lowers species diversity. The herbaceous layer is sparse, and saline characteristics of the soil yield a highly reflective signature adjacent to the plants. Stands commonly clone and individual “clones” can often be several meters across.

#### **TYPES WITH SIMILAR PHOTO INTERPRETATION SIGNATURES:**

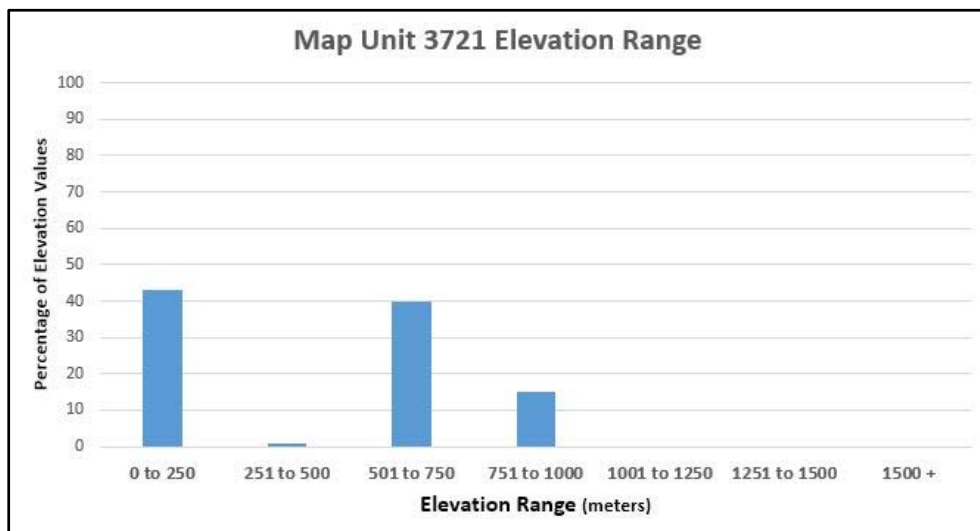
- *Suaeda moquinii* Alliance (3725) – Shrubs can sometimes mix with *Allenrolfea occidentalis* but in low cover and may have a browner color.
- *Atriplex canescens* Alliance (5111) – Cloning appears less frequently in this type and hummocky topography is not isolated to where the individual plants occur.
- *Atriplex confertifolia* Alliance (5112) – The color and texture of these shrubs are almost indistinguishable from *Allenrolfea occidentalis* but *Atriplex confertifolia* prefers slightly less saturated margins of lakes and occurs with a higher diversity and cover of shrubs.



**3721 – *Allenrolfea occidentalis* Alliance**

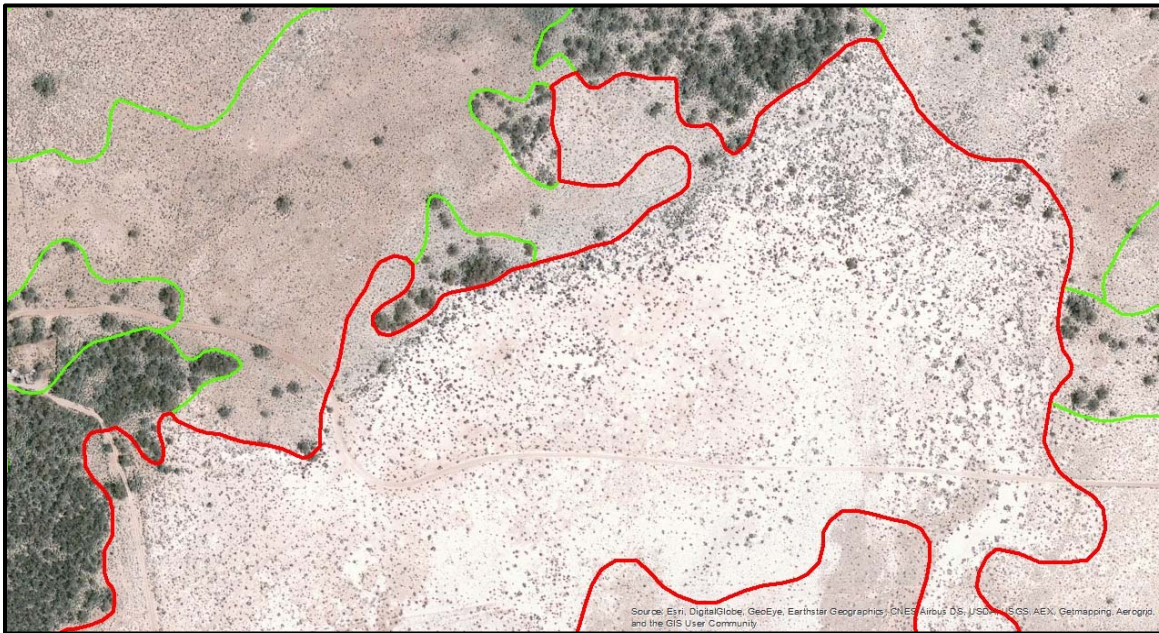


**DISTRIBUTION:** Stands are found along dry lakes throughout the study area, including Buckhorn, China, Koehn, Lucerne, Melville, Palen, Salt Wells Valley, and Rosamond Dry Lakes. This species also occurs along margins of the Colorado River. Within the 2014-2016 mapping region, stands are mapped along the margins and well within the boundaries of Mesquite, Troy, Bristol, and Danby Dry Lakes. Small stands are also mapped in hypersaline conditions where water collects near the Colorado River in the Whipple Mountains zone and in disturbance settings with in the Salton Sea Trough zone. An extensive band also occurs along the margins of the Salton Sea.



## 3722 – *Atriplex lentiformis* Alliance

Quailbush scrub Alliance



In this image, *Atriplex lentiformis* (red polygon) mixes with some *Atriplex confertifolia* and some tufts of *Sporobolus airoides* on a cracked, silty playa near Mesquite Lake. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The foreground shows the blue-gray leaf color of *Atriplex lentiformis* with the clustered, tawny seed heads. In the background, the *A. lentiformis* scrub appears tawny in color with exposed, leafless branches due to desiccation or stress.

### 3722 – *Atriplex lentiformis* Alliance

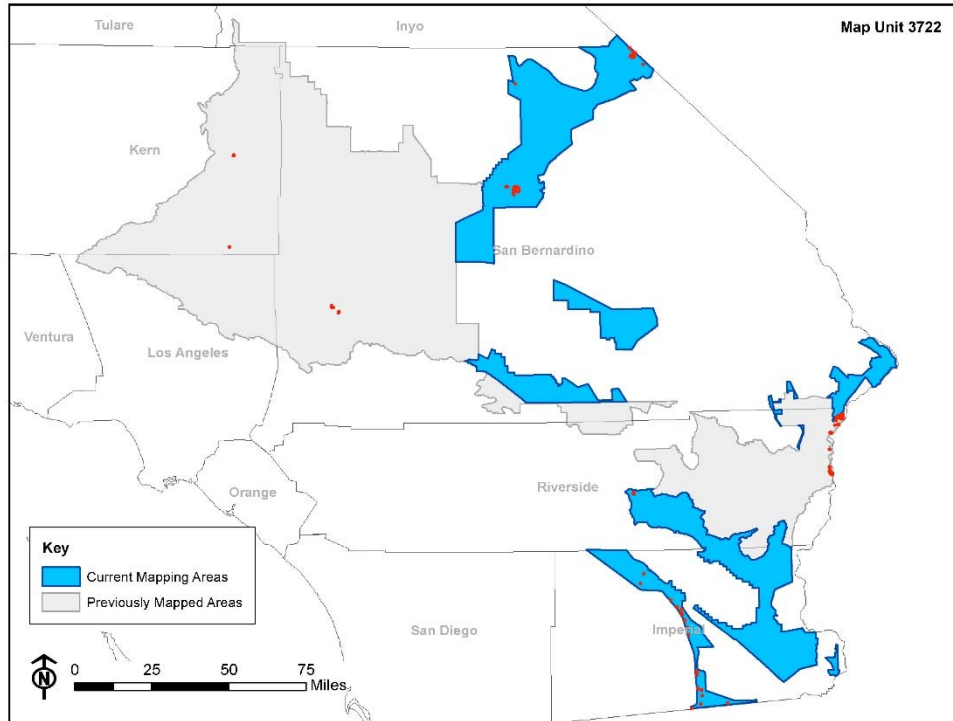
**DESCRIPTION:** Stands of this Alliance are strongly dominated (typically more than 60 percent relative cover) by *A. lentiformis*. Stands are uncommon and are of two kinds. The tall, broad, bushy form of *A. lentiformis* ssp. *lentiformis* occurs on river terraces adjacent to *Populus fremontii* stands near Victorville below the Mojave River narrows where it is mixed with *A. polycarpa* and *A. canescens*. Rare small stands of *A. lentiformis* ssp. *torreyi* occur on the beds of dry lakes. Mapped sites of *A. lentiformis* ssp. *torreyi* are in Edwards AFB and at Koehn Dry Lake. Charlton (in Lichvar et al., 2004) states that *A. lentiformis* ssp. *torreyi* is strongly associated with specific environments and occurs as “pure” stands in clay washes and on the playa edge where drainages empty out into the playa. *A. lentiformis* ssp. *torreyi* is usually associated with *Suaeda moquinii* and/or *Atriplex canescens*, and is commonly associated with *A. confertifolia* or *A. spinifera* in communities adjacent to washes in or near playas. Stands of *A. lentiformis* ssp. *torreyi* with dominant or co-dominant *S. moquinii*, *A. canescens*, *A. confertifolia* or *A. spinifera* would be mapped as one of those Alliances respectively. For this mapping effort, both subspecies are represented under the *Atriplex lentiformis* Alliance.

**PHOTOINTERPRETATION SIGNATURE:** Stands vary in cover from sparse to moderately dense with the plants appearing as small rounded blue gray to tawny-colored shrubs. Stands of *A. lentiformis* usually mix with many other species and can tolerate seasonally saturated, highly alkaline playa margins as well as disturbance-related sites such as old scraped fields and roadsides in addition to fluvial settings on alkaline-trending soils.

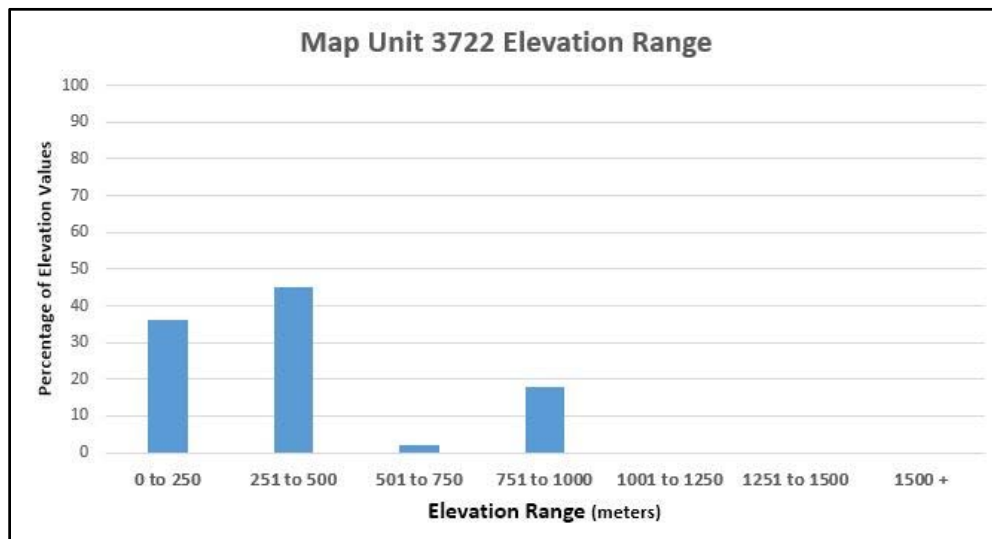
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Suaeda moquinii* Alliance (3725) – Stands of *Atriplex lentiformis* tend to grow in a wider array of settings, especially regarding degrees of alkalinity. Both species are frequently found in disturbance settings. *A. lentiformis* tends to be larger, trends more toward the bluish hues and has a rounder crown.
- *Atriplex polycarpa* Alliance (4113) – Shrubs have less tolerance of alkaline or permanently flooded settings and tend to have a coarser, bluer gray signature.
- *Pluchea sericea* Alliance (4221) – These shrubs always occur in very dense stands and are more tolerant of permanently flooded (fresh or alkaline-trending) settings. The signature has a taller, smoother texture with the color being more of a greener blue.
- *Atriplex confertifolia* Alliance (5112) – In settings where the two species co-occur, *A. lentiformis* tends to have significantly larger crowns, has a grassier understory, and is not as consistently spaced across the landscape.

**3722 – *Atriplex lentiformis* Alliance**

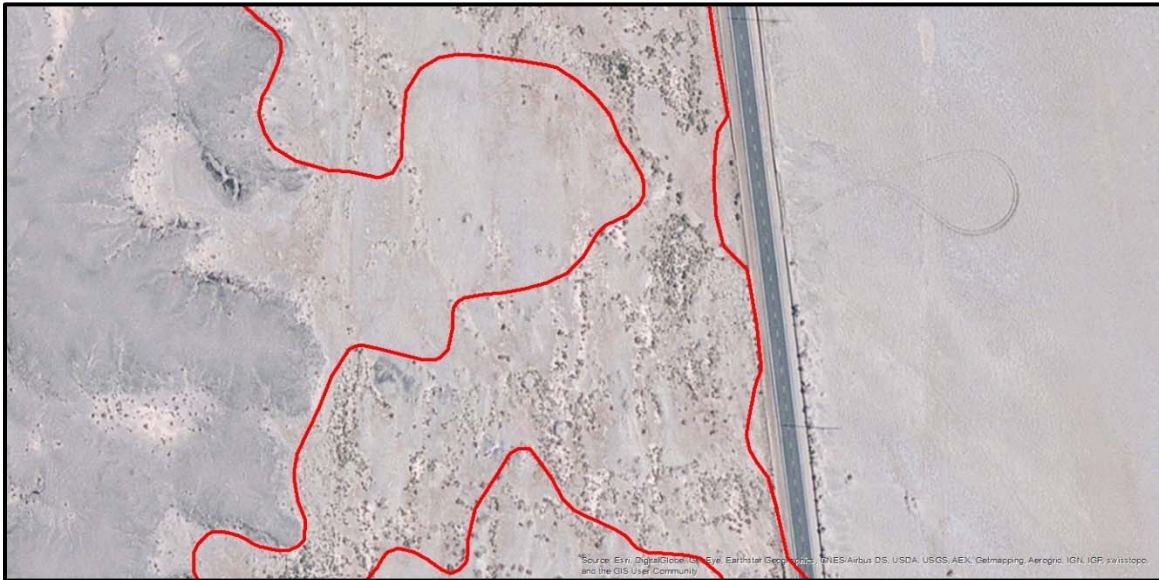


**DISTRIBUTION:** Stands are found in disturbed fluvial settings with alkaline soils along the Mojave and Colorado Rivers. They are also found in small populations on the margins of Koehn and Lucerne Dry Lakes. Within the 2014-2016 mapping region, stands were found along the margins of East Cronese Lake in the Eastern Mojave region and on old agricultural fields along the East Highline Canal in the Salton Sea Trough zone.





**3725 – *Suaeda moquinii* Alliance**  
Bush seepweed scrub Alliance



In the center of the image (in red polygon), to the west of Amboy Road, *Suaeda moquinii* co-dominates the stand with *Allenrolfea occidentalis*: *S. moquinii* appears as small round shrubs that are a brownish red color, and the *A. occidentalis* occurs on small, dense hummocks. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



In this example *Suaeda moquinii* is in the foreground and *Atriplex canescens* is on the hummocks beyond the *S. moquinii*.

### 3725 – *Suaeda moquinii* Alliance

**DESCRIPTION:** This Alliance is mapped where *Suaeda moquinii* dominates or co-dominates the shrub layer, typically with at least 2 percent absolute shrub cover (however, it may have lower cover in shrub stands with a sparse canopy). Stands typically occupy strongly saline or alkaline playas, usually with distinct salt deposits on the soil surface, but they may occur in upland areas adjacent to playas (for example at Lucerne Dry Lake). *S. moquinii* can opportunistically establish in recently disturbed areas and roadsides. Stands often occur in fine-scale drainage patterns formed by cracks in the playa surface. In such situations they are mapped as low cover (1 to 5 percent shrub) over broad areas (as at Coyote Dry Lake). Where wind-blown salts are deposited, *Suaeda moquinii* and *Kochia* may co-occur (Rosamond and China Dry Lakes), and in these cases are mapped as the *Suaeda moquinii* Alliance (there is no *Kochia* Alliance defined yet). If *Suaeda moquinii* and either *Atriplex confertifolia* or *A. lentiformis* ssp. *torreyi* co-dominate, the Alliance is *S. moquinii*. If *S. moquinii* and *Allenrolfea occidentalis* co-dominate, the Alliance is the latter.

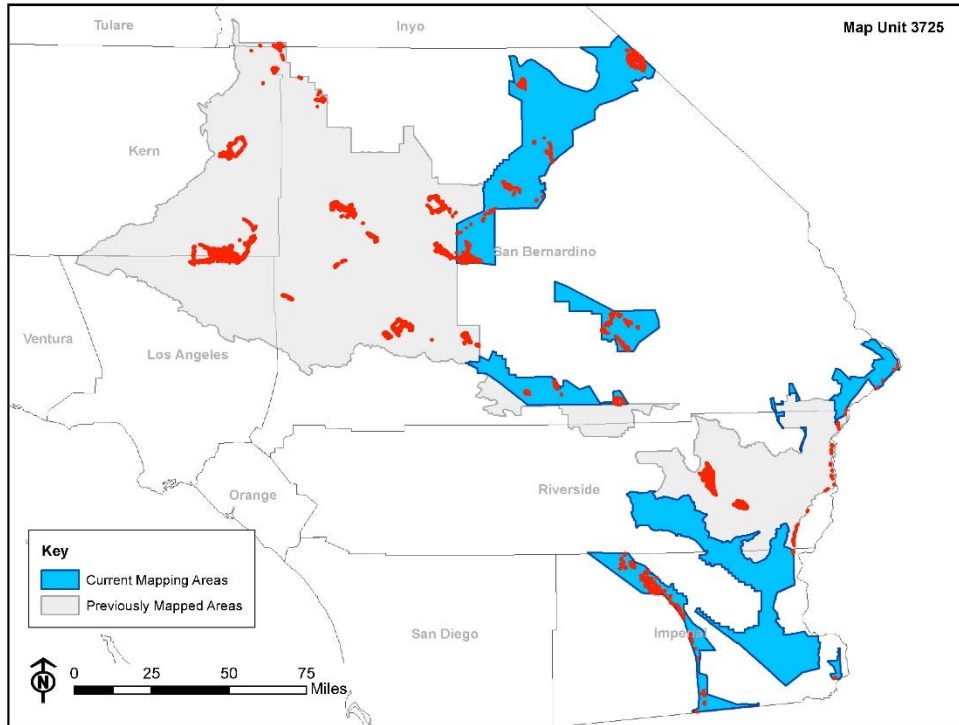
**PHOTOINTERPRETATION SIGNATURE:** Stands range from sparse to dense in cover with individuals appearing as small gray to dark brown shrubs with an irregularly shaped, poorly defined crown edge. Stands along the Colorado River are very dense and appear as a coarse brown mat of shrubs. When occurring in playas, along playa margins or in upland scalds, shrub composition can be very heterogeneous with a wide variability of cover within a single stand. When these shrubs co-occur with other species at low cover, the species are very difficult to discern from one another.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

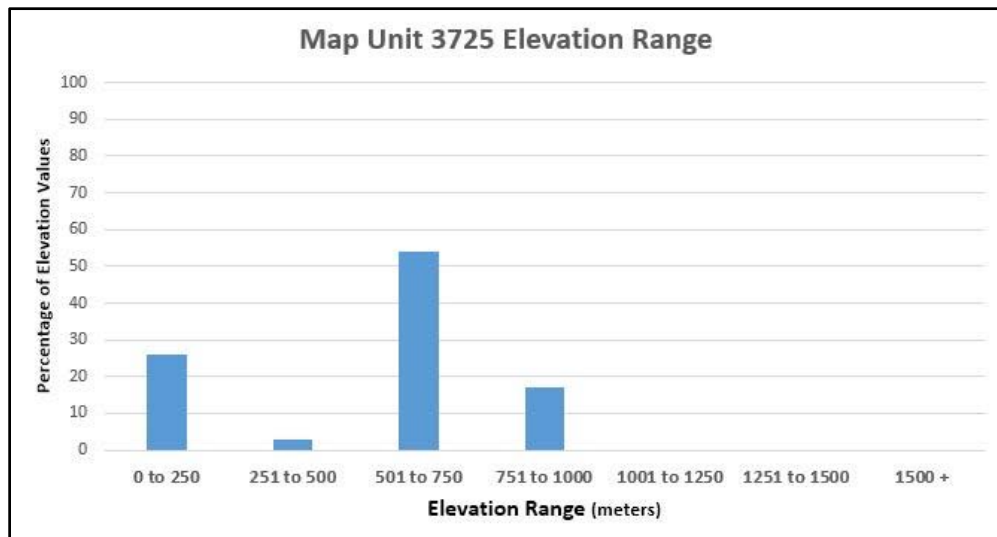
- *Allenrolfea occidentalis* Alliance (3721) – Stands are usually limited to the most saline and saturated portions of a playa.
- *Atriplex lentiformis* Alliance (3722) – Shrubs may have a tawny, puffier crown and are very limited in their relative cover and distribution.
- *Atriplex polycarpa* Alliance (4113) – Shrubs establish in drainages and along edges of larger washes. They tolerate disturbance better. *A. polycarpa* occurs in clumpier, more continuous growth patterns and appears as a bluish gray color.
- *Atriplex canescens* Alliance (5111) – *Atriplex canescens* has a wide tolerance from minimally to hyperalkaline settings. Stands co-occurring with *S. moquinii* in playa settings are extremely difficult to distinguish although more often than not, *A. canescens* will occur on small sandy hummocks that continue on downslope to the margins of the playa.
- *Atriplex confertifolia* Alliance (5112) – Shrubs may have a lighter gray color and may occur in settings richer in species diversity, yielding a more variable signature across the stand.



**3725 – *Suaeda moquinii* Alliance**

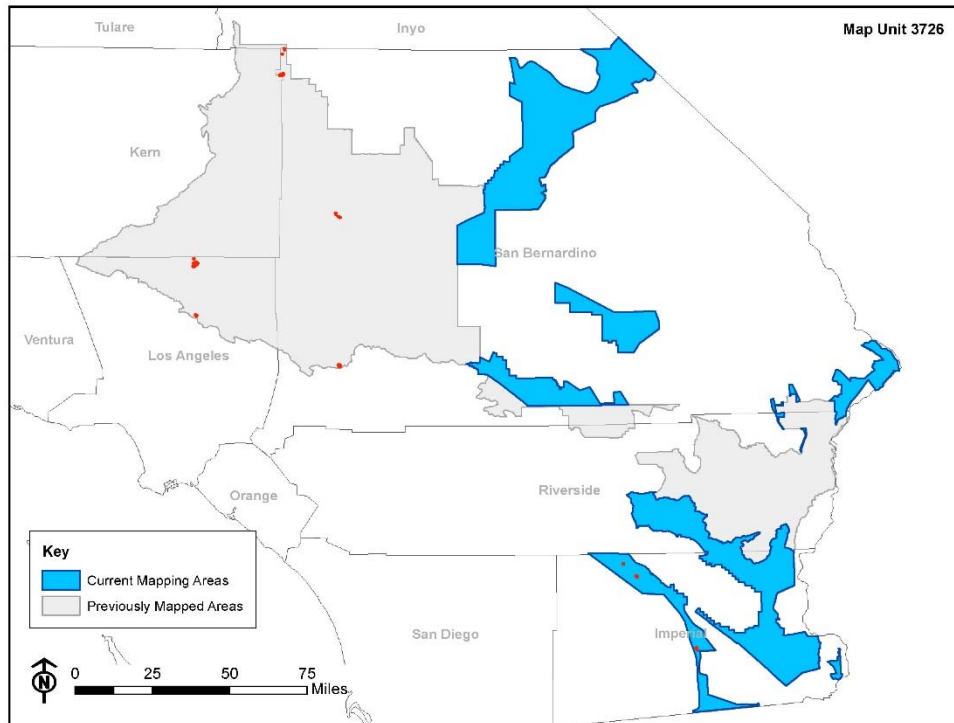


**DISTRIBUTION:** This Alliance occurs in an extremely broad array of edaphic and topographical settings throughout the region. Stands are associated with nearly all the major dry lakes in all regions of the mapping area. Stands also occur in areas of fluvial and anthropogenic disturbance, including the Mojave River and on old agricultural fields in the Salton Sea Trough zone.



## 3726 – *Distichlis spicata* Alliance

Salt grass flats Alliance



**DISTRIBUTION:** This type occurs infrequently over widely scattered locations in the western Mojave Desert, principally along the margins of Harper and Rosamond Dry Lakes. Within the 2014-2016 mapping region, small stands occur on isolated wet areas in the Salton Sea Trough zone. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.

**3728 – *Isocoma acradenia* Alliance**  
Alkali goldenbush Alliance



This image shows a stand of *Isocoma acradenia* (red polygon) between a stand of *Suaeda moquinii* (downslope to the east) and *Larrea tridentata* (upslope to the west) near a dry lakebed. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The photo shows an *Isocoma acradenia* stand with an annual grass understory and scattered *Larrea tridentata*. This stand grades into a *Suaeda moquinii* stand.

### 3728 – *Isocoma acradenia* Alliance

**DESCRIPTION:** Polygons mapped as this Alliance are dominated by *Isocoma acradenia* in the shrub layer. Stands occur on flat to gentle slopes near salty margins of dry lakes and playas or on episodic alkaline outwash deposits from springs and seeps. Stands at China and Lucerne Dry Lakes are not always mappable due to their small size and intermixing with *Atriplex confertifolia*, *A. parryi*, and *Suaeda moquinii*. However, stands on the western edge of Coyote Dry Lake are large enough to map, as are some at China Dry Lake. Stands of *Isocoma* in the Salton Trough often form the boundary between the gently sloping alluvial fans of *Larrea tridentata* upslope and the alkaline soils of the Imperial Valley where *Atriplex spp.* and other salt tolerant plants often dominate.

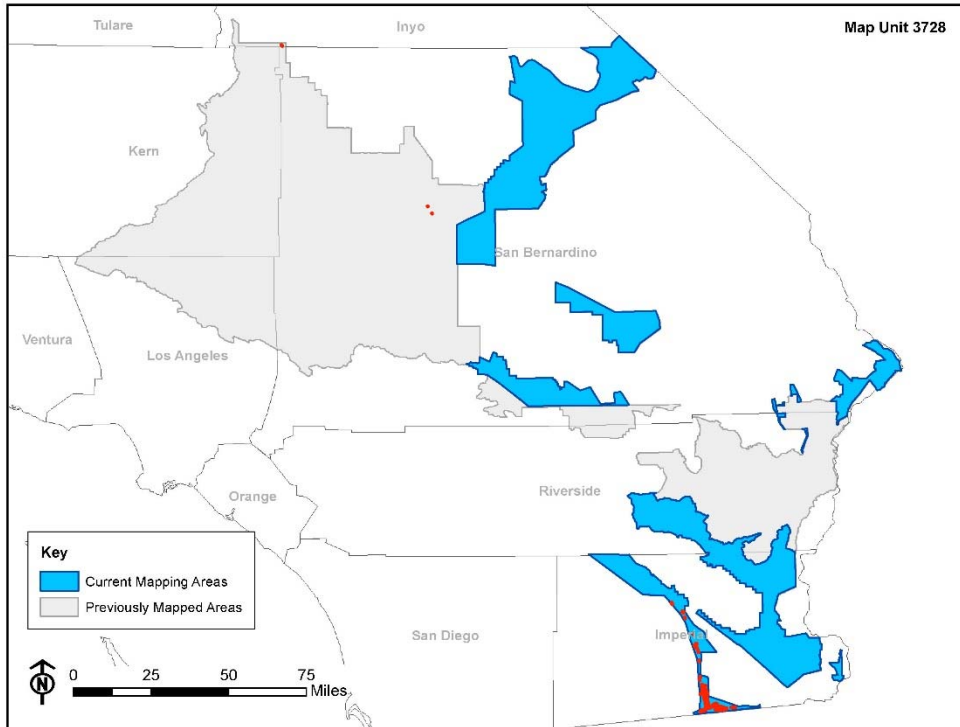
**PHOTOINTERPRETATION SIGNATURE:** The stands are open to sometimes moderately dense in cover, occurring as low, angular shrubs. These shrubs establish upslope of the *Suaeda moquinii* zone next to playas and as transition areas between salt scrub communities and upland desert scrub.

**TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

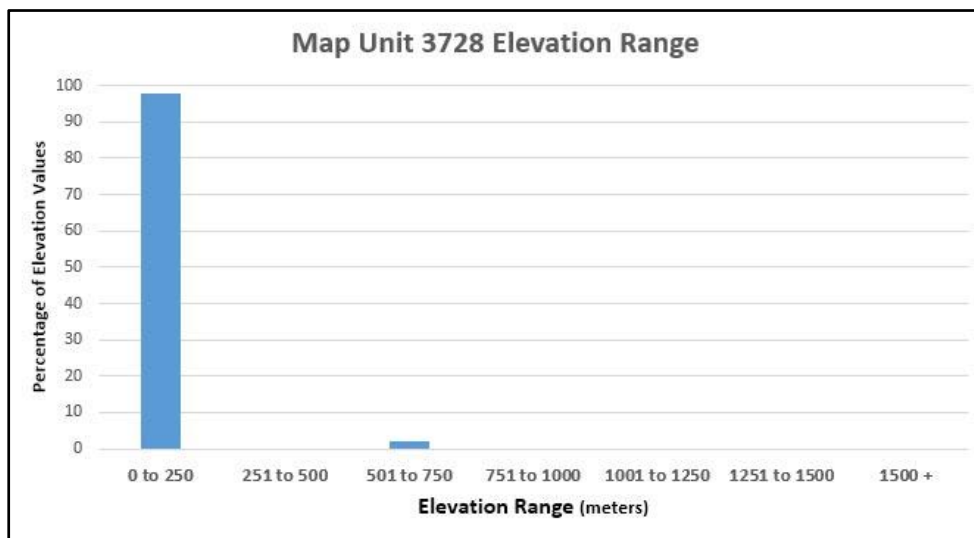
- *Suaeda moquinii* Alliance (3725) – Shrubs can sometimes mix with *Isocoma acradenia* but appear less brown.



**3728 – *Isocoma acradenia* Alliance**



**DISTRIBUTION:** In the original study area there are stands mapped at China Dry Lake and Coyote Dry Lake. Within the 2014-2016 mapping region, this Alliance dominates in narrow bands just east of the East Highline Canal in the Salton Sea Trough zone.



## 4111 – *Ambrosia dumosa* Alliance

White bursage scrub Alliance



The image shows evenly spaced small shrubs of *Ambrosia dumosa* dominating the shrub layer in a stand surrounded by the *Larrea tridentata* - *Ambrosia dumosa* Alliance. The presence of almost pure stands of *Ambrosia dumosa* is commonly a result of a recently cleared or burned stand of vegetation formerly in the *Larrea tridentata* – *Ambrosia dumosa* Alliance.



In the foreground on the rocky alluvial surface are small light gray *Ambrosia dumosa* shrubs, which continue up onto the rocky slopes.



#### 4111 – *Ambrosia dumosa* Alliance

**DESCRIPTION:** In this Alliance *Ambrosia dumosa* comprises more than 2 percent cover and exceeds any other shrub in cover, with the exception of *Grayia spinosa*. Stands lack significant cover of *Larrea tridentata*, or *L. tridentata* cover is patchy and not uniformly distributed and comprises less than 2 percent of absolute cover. Stands are on uplands with relatively fine-textured soil, or on terraces adjacent to medium to large washes. They also may occur on steep slopes with neutral or southerly exposures that are not too bouldery. In the interior mountains of the Colorado Desert *Ambrosia dumosa* is commonly found on a light-colored calcareous substrate. In the Western Mojave Desert (especially the northwestern portion of the mapped area), stands often result from fire or clearing of *L. tridentata* in areas formerly supporting mixed *Larrea tridentata* – *Ambrosia dumosa* communities. In alkaline basins, above *Atriplex spinifera* or *Atriplex polycarpa*, *Ambrosia dumosa* mixes with a high diversity of shrubs, forming a “bathtub ring” below the *Larrea tridentata* – *Ambrosia dumosa* zone on the surrounding fans and bajadas. In these “bathtub ring” settings, when *Ambrosia dumosa* co-dominates with *Krascheninnikovia lanata*, *Ericameria cooperi*, *Tetradymia* spp., or *Eriogonum fasciculatum*, the stands are mapped as the *Ambrosia dumosa* Alliance. However, when *Ambrosia dumosa* co-dominates with *Grayia spinosa* or *Atriplex spinifera*, stands are mapped as those Alliances respectively.

Like several Alliances in the study area (especially noteworthy is the *Atriplex confertifolia* Alliance), *Ambrosia dumosa* has a broad and somewhat bi-modal distribution. *Ambrosia dumosa* individuals occur as a component or dominant shrub in high-elevation settings along the eastern Sierra Nevada foothill slopes and in nearby cold-air basins in the western Mojave Desert above 3000 feet (910 meters). Conversely, stands also occur on light-colored soils of mountain slopes in the Colorado Desert near or adjacent to stands of *Encelia farinosa* in elevations as low as 300-400 feet (90-120 meters). The complex relationships between elevation, cold-air basins and how they govern temperatures, along with disturbance characteristics and edaphic settings, are not yet well understood as a means for predicting the overall distribution of this type.

**PHOTOINTERPRETATION SIGNATURE:** Stands are typically open to moderately dense with evenly spaced small shrubs and very few if any taller shrubs. The crowns are gray to brown in color with a rounded, fairly well-defined edge.

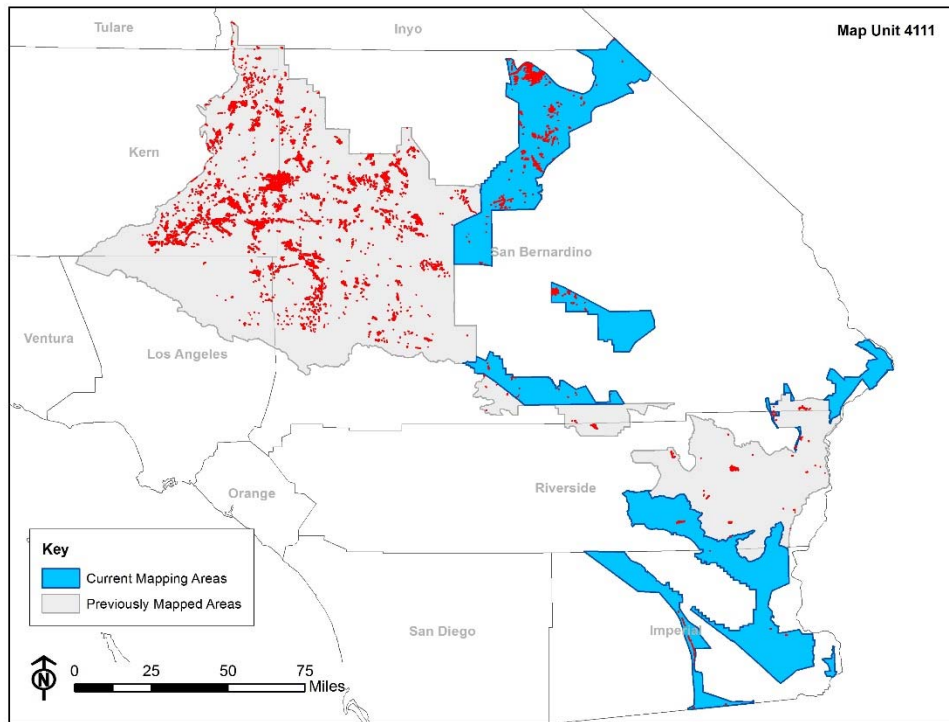
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Atriplex polycarpa* Alliance (4113) – These plants are found in slightly more alkaline settings and are more likely to occur in agricultural-related disturbance near dry lake beds. Crowns are larger and signature color variability is lower, generally a light to medium gray. In natural settings, they are limited to upper alkaline margins around playas and in washes, especially in washes that contain slightly basic soil chemistry.

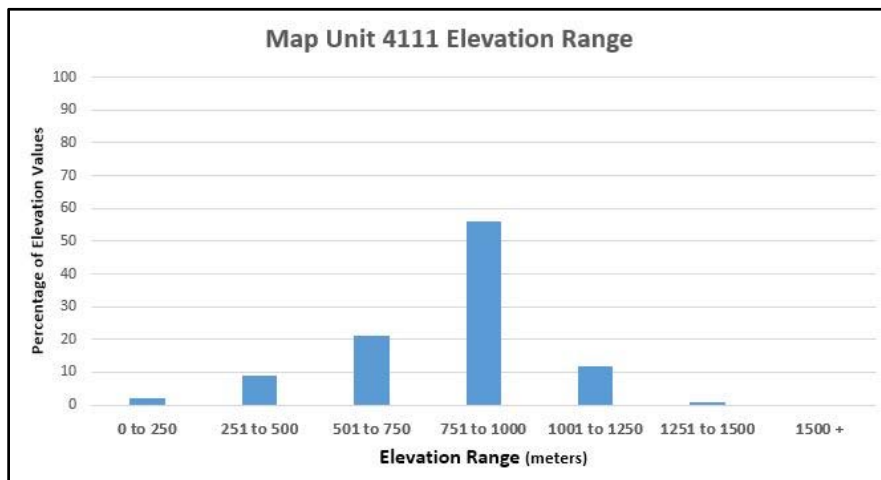
#### 4111 – *Ambrosia dumosa* Alliance

- *Encelia farinosa* Alliance (4114) – Although the ranges of the two Alliances overlap, *Encelia farinosa* favors hotter climates and does not tolerate severe freezes. Distribution is highly restricted in the western Mojave Desert where *Ambrosia dumosa* is abundant. This trend reverses somewhat in the Colorado Desert, where *E. farinosa* is widespread. *E. farinosa* tends to favor dark-colored (volcanic) rock throughout its range. On dark rock, individual shrubs appear very light and tend to have a slightly larger crown on average. Cover often varies considerably across the stand. *E. farinosa* is more likely to be found on mountain slopes rather than alluvial fans.
- *Pleuraphis rigida* Alliance (4122) – Stands of *A. dumosa* at times occur in close proximity to the uncommonly mapped *P. rigida* Alliance. In these settings, *Ambrosia dumosa* has a lighter hue overall and unlike *P. rigida*, rarely clones.
- *Ambrosia salsola* Alliance (4216) – *Ambrosia salsola* has a similar signature but is more likely to occur in fluvial-related disturbances, especially in conjunction with rivulet-strewn sheet flow and lower-energy wash environments. It does not occur on steep or rocky slopes. This Alliance is more likely to colonize anthropogenic clearings rather than burns.
- *Grayia spinosa* Alliance (5411) – This Alliance occurs in colder locations, generally in the lowest portions of cold-air basins, or on gentle to moderate slopes on desert ranges at higher elevations. Shrub size is slightly larger, and species diversity within the stand is higher, creating a variable signature.
- *Atriplex hymenelytra* Alliance (6111) – Stands dominated by this species of *Atriplex* usually occur on dark substrate, often on upper fans or lower slopes that are volcanic in origin. *Atriplex hymenelytra* shrubs are overall somewhat lighter colored, yielding brighter tones.

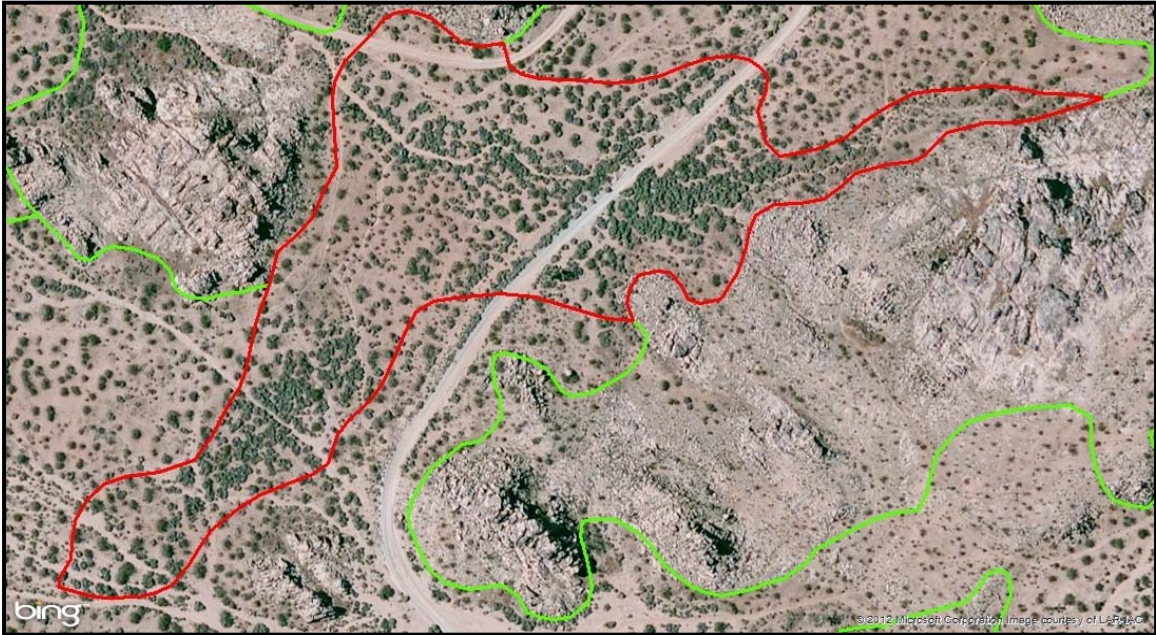
**4111 – *Ambrosia dumosa* Alliance**



**DISTRIBUTION:** This Alliance is found throughout the study area, but primarily in the Western and Central Mojave Desert regions. The Alliance does not occur in the Western Antelope Valley zone or in the foothills of the Sierra Pelona, Tehachapi, San Gabriel, or San Bernardino Mountains. *Ambrosia dumosa* is less common in the Colorado Desert but does occur frequently as a co-dominant with *Larrea tridentata* on lower fans and bajadas. In the 2014-2016 mapping area, stands occur most frequently in the Eastern Mojave Desert region on sandy to gravelly light colored substrate near the Dumont Dunes and occasionally on north-trending slopes of the Soda, Avawatz and Cady Mountains.



**4113 – *Atriplex polycarpa* Alliance**  
Allscale scrub Alliance



The bluish green *Atriplex polycarpa* congregates in dense patches within the highlighted polygon; *Larrea tridentata* and *Ambrosia dumosa* polygons surround.



The photo shows a wispy grayish green *Atriplex polycarpa* occupying a stream terrace.



#### 4113 – *Atriplex polycarpa* Alliance

**DESCRIPTION:** This Alliance is mapped where *A. polycarpa* dominates the shrub layer, usually with at least 2 percent absolute cover of a single stand and more than 50 percent of the relative shrub cover. Stands can occur on broad flats, in washes, on steep volcanic ravines and slopes, and as disturbance stands in human affected areas. This species is typically found scattered along broader washes and on adjacent terraces. It may occur on playa edges, in washes through alkaline areas, or occasionally on uplands with alkaline or somewhat saline substrate. Although found within a wide spectrum of soil chemistry, this species generally favors less alkalinity or salinity than other salt-tolerant scrub and therefore is usually found along the outermost edges of the playa complex. In this Alliance, *Atriplex polycarpa* is always dominant in the shrub canopy if these shrubs are present: *Ambrosia dumosa*, *Ambrosia salsola*, *Atriplex canescens*, *Chamaesyce polycarpa*, *Cleome isomeris*, *Isocoma acradenia*, and *Larrea tridentata*. Emergent *Prosopis glandulosa* trees may be present at low cover. Where *Atriplex spinifera* is co-dominant with *A. polycarpa*, the Alliance is *Atriplex spinifera*.

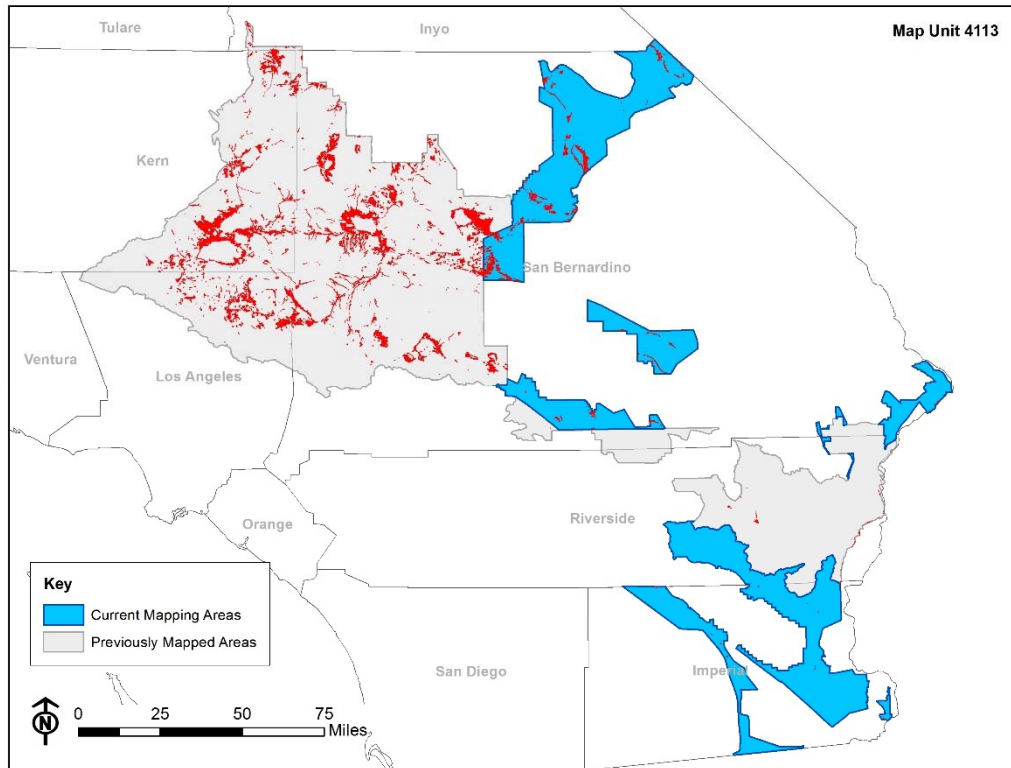
**PHOTOINTERPRETATION SIGNATURE:** Stands range from sparse to dense cover with a wide range of colors that vary from white to dark gray to a bluish gray to brown. Shrubs tend to have a coarser texture when they congregate into dense clumps and/or semi-continuous stands that establish on a wide range of settings.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Ambrosia dumosa* Alliance (4111) – These shrubs are typically smaller sized individuals with a lighter white or gray color and are commonly associated with *Larrea tridentata*. They are more often found farther away from playa systems in non-alkaline settings.
- *Ambrosia salsola* Alliance (4216) – The shrubs also occur in wash or wash terrace settings and disturbance sites. The signature has a similar light gray or tan color with a slightly smaller, more diffuse crown.
- *Atriplex canescens* Alliance (5111) – These shrubs are typically found in sandy, well-drained areas and appear as larger, brownish gray shrubs that are evenly spaced. At higher elevations, *A. canescens* is more often associated with *Yucca brevifolia*. *A. polycarpa* is also less likely to occur near the margins of hyper-alkaline larger playas.
- *Atriplex confertifolia* Alliance (5112) – Very commonly occurring around scalds and playas, these shrubs are smaller in size, grow in more open, spread out patterns and appear tan to gray in color. They are not typically found in wash settings.

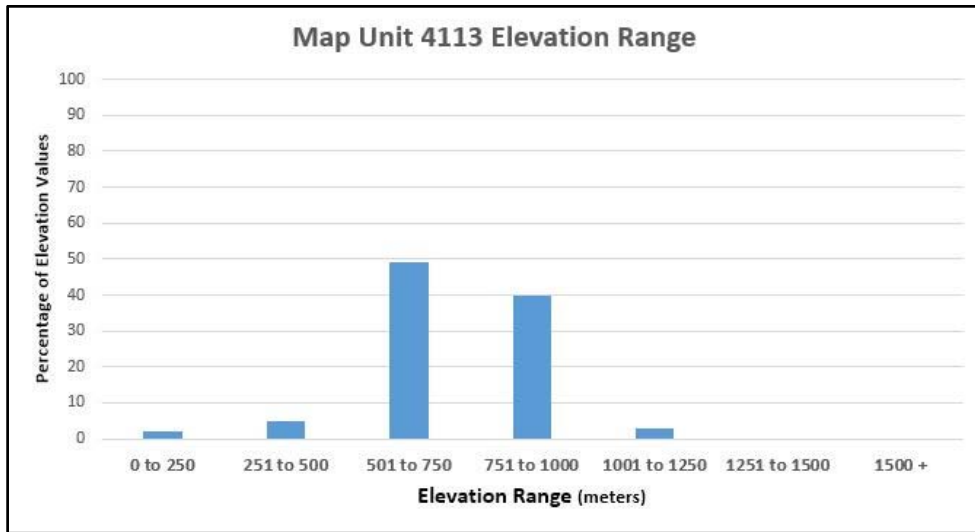


#### 4113 – *Atriplex polycarpa* Alliance



**DISTRIBUTION:** *Atriplex polycarpa* has the broadest ecological distribution and the highest shrub cover of any of the *Atriplex* species in the mapping area. This Alliance is distributed throughout much of the lower portions of the Western and Central Mojave Deserts where playa systems are frequent and extensive, and to a lesser extent along washes and disturbed sites. It is also found in small patches at the base of the bluffs adjacent to the Colorado River floodplain and on disturbed sites. Within the 2014-2016 mapping region, *Atriplex polycarpa* occurs in typical settings, lying between the upland desert scrub (*Larrea tridentata* – *Ambrosia dumosa*) and the more alkaline salt scrub vegetation closer to the margins of playas. It is also frequently found on old agricultural sites, including areas in the Mesquite Valley and west of Troy Lake. *A. polycarpa* is uncommon in the Salton Sea Trough, the Chuckwalla and Chocolate Mountains, and the Whipple Mountains zones.

4113 – *Atriplex polycarpa* Alliance



**4114 – *Encelia farinosa* Alliance**  
Brittle bush scrub Alliance



The *Encelia farinosa* Alliance occurs on hot, exposed, steep, rocky volcanic slopes and usually appears as small light colored shrubs. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The photo shows small, light-colored *Encelia farinosa* throughout this slope.

#### 4114 – *Encelia farinosa* Alliance

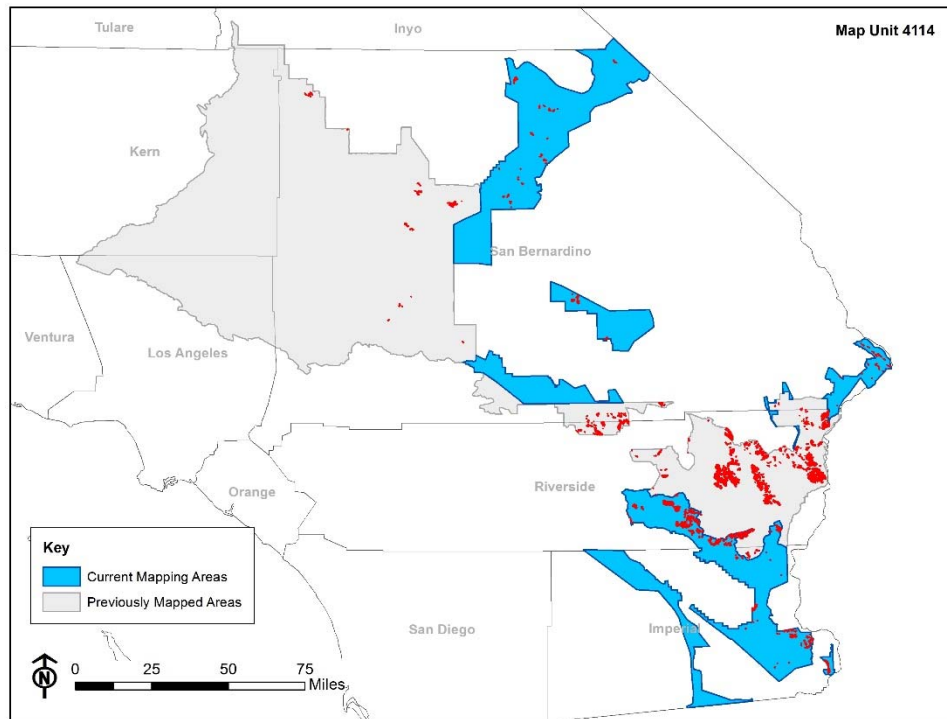
**DESCRIPTION:** *Encelia farinosa* is the dominant species, at greater than 1 percent cover, and with no other species having equal or higher cover. *Larrea tridentata* is largely absent. This Alliance occurs mainly on mid to upper (most exposed) south-facing slopes on hot and dark rocky substrate of the low-elevation interior desert mountains. Stands are usually bordered by the *Larrea tridentata* – *Encelia farinosa* Alliance on slightly less-exposed slopes (lower or less steep adjacent slopes) and giving way to *Larrea tridentata* – *Ambrosia dumosa* Alliance on more neutral slopes.

**PHOTOINTERPRETATION SIGNATURE:** Cover ranges from sparse to moderately dense and varies considerably as subtle characteristics of the topography change across the stand. Individual plants tend to be light gray and have a fairly well-defined crown. Darker substrate (volcanics and desert pavement) accentuate the light gray color of the shrubs. However, stands are difficult to discern when occurring on lighter-colored substrate. In the northern portions of its range, its distribution is limited by topographic features, and is found mainly on mid to upper steep exposed south-trending slopes below 2700 feet (820 meters). Further south, in the Colorado Desert, *Encelia farinosa* can be found on nearly all slope aspects, and distribution is more a factor of its preference for dark rock substrate and mountain terrain landforms.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Ambrosia dumosa* Alliance (4111) – In the Colorado Desert, *Ambrosia dumosa* is more likely found on lower fans and bajadas upslope from playa soils and below the darker-colored pavements adjacent to nearby mountains. It is less likely to dominate the small rills that dissect desert pavement. At times, it can be found on steep, lighter-colored exposed slopes over marble and limestone substrate. In the Western and Central Mojave Desert regions, it is much more likely to occur with *Larrea tridentata* except in the Pinto Mountains, where either species may co-dominate. *A. dumosa* tends to have a smaller, less distinct crown and a slightly darker color.
- *Atriplex polycarpa* Alliance (4113) – This Alliance is occasionally found in mountainous terrain on dark volcanic rock with alkaline-trending soils in the Mojave Desert. Signature color is similar to *Encelia farinosa*; however, crown sizes average somewhat larger. In these settings, stands more frequently follow small rivulets on steep slopes where cover is dense but restricted in extent.
- *Atriplex hymenelytra* Alliance (6111) – Signature differences between these two shrubs are difficult to discern. *A. hymenelytra* tends to remain consistent in cover across the stand, while *Encelia farinosa* varies based on soil development along the slopes. *E. farinosa* almost always occurs on higher slope positions and is less common on initial basalt formed volcanics.

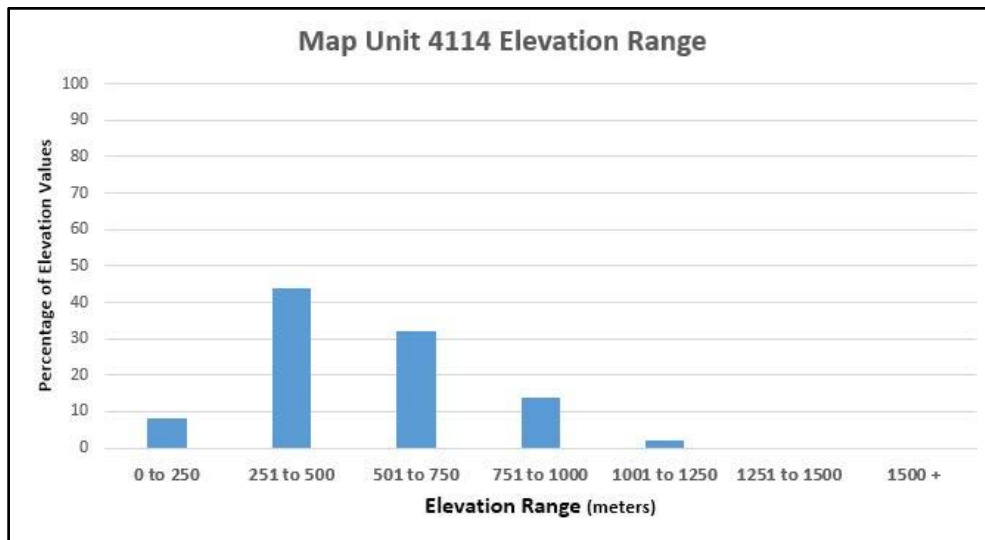
4114 – *Encelia farinosa* Alliance



**DISTRIBUTION:** The *Encelia farinosa* Alliance has its highest concentration of stands in the upper elevations of the Palen, McCoy, Big Maria, and Little Maria Mountains of the Colorado Desert as well as in the Pinto Mountains southeast of the Twentynine Palms area. Stands also occur on mid to upper (most exposed) south-facing slopes of the eastern and northern edge of the original study area (as far north as Trona and Spangler Hills, the south side of Alvord Mountains, Paradise Range, and the south side of Sidewinder Mountains near Lucerne). Within the 2014-2016 mapping region, *Encelia farinosa* occurs only on the hottest, most exposed mid and upper slopes in the Central Mojave region. In the Whipple Mountains zone, the shrub is found on nearly all slope positions in addition to the adjacent upper fan surfaces. *Encelia* is also widespread on mid and upper slopes in the Chuckwalla and Chocolate Mountains zone.



4114 – *Encelia farinosa* Alliance



**4115 – *Larrea tridentata* – *Ambrosia dumosa* Alliance**  
Creosote bush – white bursage scrub Alliance



The photo shows the larger, darker, evenly spaced shrubs of *Larrea tridentata* over smaller light gray *Ambrosia dumosa*. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The green, medium-height *Larrea tridentata*, seen here with yellow flowers, dominates the entire landscape of this image over a variable cover of smaller, light blue-gray *Ambrosia dumosa* shrubs. Understory annual grasses (mostly non-native) occur here as an inconsistent cover in this stand.

#### 4115 – *Larrea tridentata* – *Ambrosia dumosa* Alliance

**DESCRIPTION:** In this Alliance *Larrea tridentata* is broadly co-dominant with *Ambrosia dumosa*, and both species are evenly distributed across the stand. In combination, the two species (if their covers are added) clearly dominate. However, mapping of this Alliance takes into account areas of *Larrea* without *Ambrosia* or *Ambrosia* without *Larrea* if they occur as variable patches within broader *Larrea tridentata* – *Ambrosia dumosa* stands. *Ambrosia dumosa* is consistently present with at least 1 percent cover occurring between evenly spaced *L. tridentata*; however, it may have higher cover than *L. tridentata*. If *Encelia farinosa* is present, it is less than 1 percent cover. *Yucca schidigera* if present is less than 1 percent cover or is unevenly distributed. However, if *Y. schidigera* is higher cover and evenly distributed, the *Yucca schidigera* Alliance is mapped. *Atriplex polycarpa* can be co-dominant. The *Larrea tridentata* – *Ambrosia dumosa* Alliance is widespread on all but the hottest and rockiest areas of the middle and lower elevations. It is also unlikely to be found in sandy or alkaline settings. It is not expected on old alluvial surfaces, where *A. dumosa* tends not to grow. Older alluvial fans with interfluves are commonly mapped as the *Larrea tridentata* Alliance rather than *Larrea tridentata* – *Ambrosia dumosa*. In the lowest and hottest portions of the Mojave Desert mountains, *Larrea tridentata* – *Ambrosia dumosa* tends to occur on north-facing slopes, while *Larrea tridentata* – *Encelia farinosa* or *Encelia farinosa* Alliances favor south-facing exposures.

**PHOTOINTERPRETATION SIGNATURE:** Stand structure is two-tiered, made up of the medium height *Larrea tridentata* over the smaller subshrub *Ambrosia dumosa*. *L. tridentata* has a brown to green signature color with a diffuse crown edge, while *A. dumosa* has a light gray or brown signature color with a small rounded crown. Species cover may be sparse to moderately dense and can vary widely within a stand. This type occupies a broad range of desert settings. The most extensive stands occur on the broad bajadas and alluvial fans of both the Mojave and Colorado Desert portions of the study area. In the Mojave Desert, the upper elevation limits to this Alliance are climatically defined (winter cold) while lower limits are often governed by soil alkalinity. In the Colorado Desert, the upper limits to this Alliance are either defined by topography (steeper slopes) and/or substrate color (dark pavement or volcanic rock), while lower margins often are defined by high degrees of human disturbance.

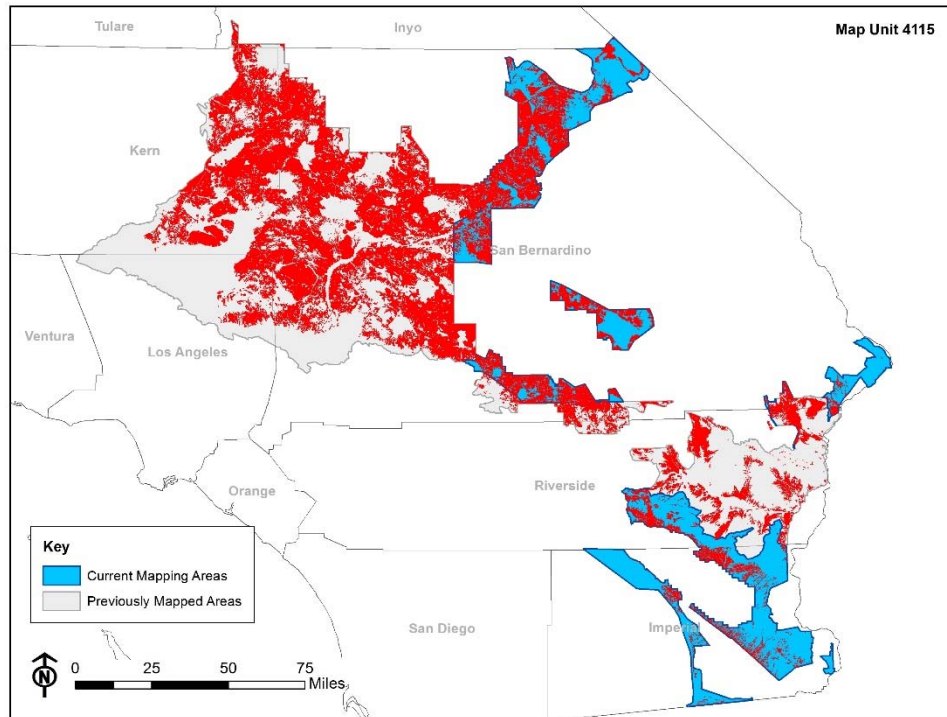
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Ambrosia dumosa* Alliance (4111) – On bajadas, this Alliance is generally associated with disturbed clearings where the *A. dumosa* recovers more quickly than the *L. tridentata*. The two types can become difficult to distinguish when *L. tridentata* is unevenly scattered throughout the stand.
- *Atriplex polycarpa* Alliance (4113) - Along the upper margins of playas, stands containing *L. tridentata*, *A. dumosa* and *A. polycarpa* are difficult to split between the two types. Generally, when viewing three distinct different shrub sizes, the *Larrea-Ambrosia* dual-species Alliance was mapped.

#### 4115 – *Larrea tridentata* – *Ambrosia dumosa* Alliance

- *Larrea tridentata* – *Encelia farinosa* Alliance (4118) – This dual-species Alliance is more common in the Colorado Desert on mountain slopes, especially on darker volcanic rock and on pavement surfaces close to the mountain slope interface. This type generally occurs farther upslope on hotter, more exposed settings. Understory shrubs (*Encelia farinosa*) are generally larger, have a more defined crown and are more distinct against a normally darker substrate than normally is found under *Ambrosia dumosa*.
- *Larrea tridentata* Alliance (4119) – This type is difficult to distinguish at higher elevations when understory shrub diversity is high and may not be dominated by *Ambrosia dumosa*. In these settings, photointerpreters generally define the stand as a *Larrea tridentata* – *Ambrosia dumosa* to the upward limits of the *Larrea* where smaller shrubs are still consistent in the stand. It is also difficult to discern low cover of *A. dumosa* at or near 1 percent in disturbance settings. In these situations, photointerpreters generally look for consistency of *A. dumosa* across the stand. On the alkaline margins of playa systems, *Larrea tridentata* – *Ambrosia dumosa* transitions to *L. tridentata*, then to the *Atriplex polycarpa* Alliance. In this transition zone *Atriplex polycarpa* gradually replaces *Ambrosia dumosa*. Since the zone is often very narrow and it is difficult to distinguish *Ambrosia dumosa* from young *Atriplex polycarpa*, the *Larrea tridentata* – *Ambrosia dumosa* Alliance was mapped to where it forms a boundary with the *Atriplex polycarpa* Alliance.

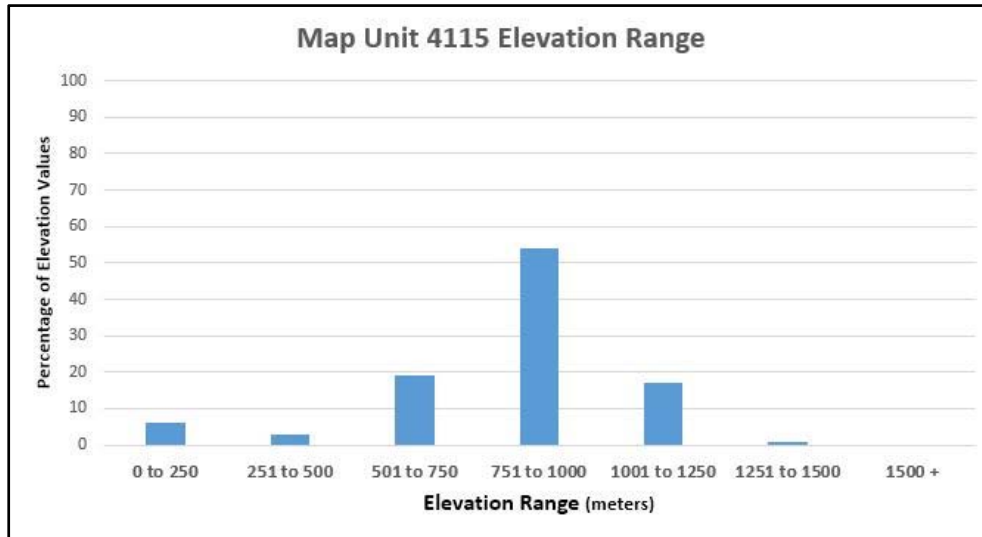
4115 – *Larrea tridentata* – *Ambrosia dumosa* Alliance



**DISTRIBUTION:** This is the most common type found across the study area and occurs on a wide variety of settings. Stands are absent from much of the western Antelope Valley as well as the foothills and adjacent alluvial fans between Lancaster and Hesperia. In the Colorado Desert, this Alliance is primarily found in the alluvial fans and flats but is replaced by the *Larrea tridentata* – *Encelia farinosa* Alliance on upper fans and adjacent mountain slopes. Within the 2014-2016 mapping region, stands co-dominated by these two shrubs are widespread, though their upslope occurrences are more frequently replaced with stands of *Larrea tridentata* and *Encelia farinosa*. Mid and upper fans and sometimes even lower bajadas are more frequently interspersed with *Encelia farinosa* as the co-dominating shrub, especially in the Whipple Mountain and Chuckwalla and Chocolate Mountain zones. On lower bajadas, *Larrea tridentata* – *Ambrosia dumosa* stands often transition to an *Atriplex polycarpa* Alliance where major playas are close by.



4115 – *Larrea tridentata* – *Ambrosia dumosa* Alliance



**4118 – *Larrea tridentata* – *Encelia farinosa* Alliance**  
Creosote bush – brittle bush scrub Alliance



In this image, *L. tridentata* co-dominates with *E. farinosa* in variable cover. The taller *Larrea* has a diffuse green crown that yields a small shadow. *E. farinosa* is the smaller, lighter-colored shrub with a more distinct crown. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



This example shows an open south-facing hill slope of *L. tridentata* and *E. farinosa* co-dominating on a gravelly substrate.

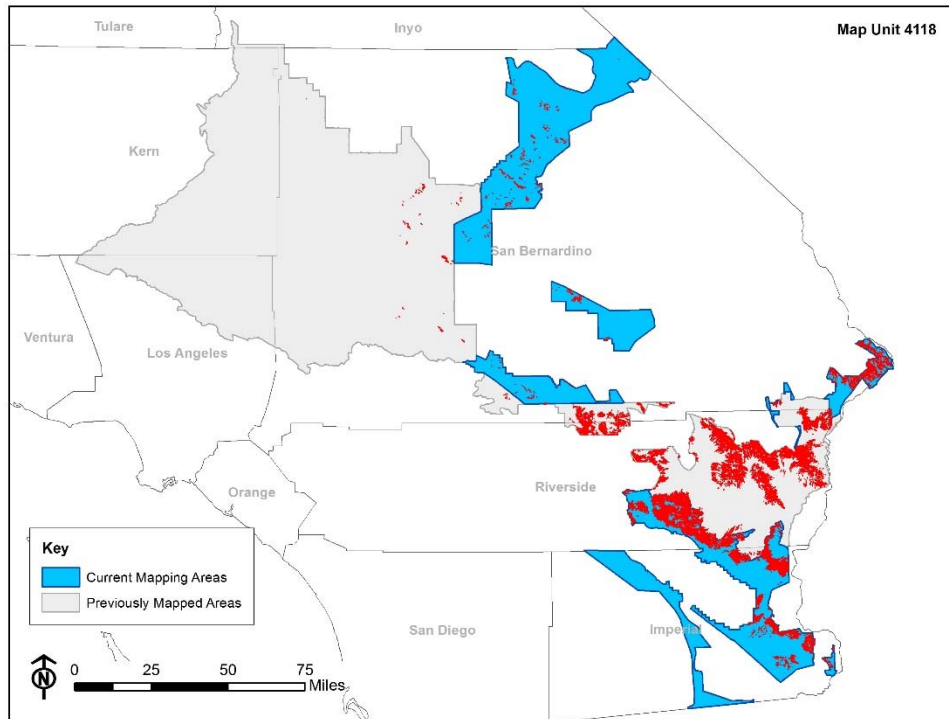
**DESCRIPTION:** In stands of this Alliance *Larrea tridentata* and *Encelia farinosa* are both present and in similar cover (broadly co-dominant). Occasionally, *E. farinosa* comprises less than 1 percent cover, but if so, *Ambrosia dumosa* is also in very low cover or absent. In rockier settings with thin soils, vegetative cover usually drops, and a number of small shrubs can co-dominate, including *Pleurocoronis pluriseta*, *Trixis californica*, *A. dumosa* and *Krameria grayi*. In rivulets between pavements, any number of species, including *Hyptis emoryi*, *A. dumosa*, and *K. grayi*, can co-dominate with *L. tridentata* and *E. farinosa*, often in high cover. Stands are usually found in rocky/bouldery uplands or on well-drained bajadas. In the Central Mojave region of the study area stands may be found on hot south-facing slopes and are commonly associated with dark volcanic metamorphosed rock. Further south, in the Pinto Mountains, this type becomes more widespread, occurring on a variety of slopes. This dual Alliance becomes even more common in the mountains of the Colorado Desert portion of the study area. Here the Alliance can be found on almost all topography, where it is most widespread on darker-colored volcanic substrate and adjacent pavement surfaces.

**PHOTOINTERPRETATION SIGNATURE:** Stands range from sparse to moderately dense in cover, with emergent medium-height *Larrea tridentata* consistently spaced over a subshrub layer of *Encelia farinosa*. *Larrea tridentata* appears green to brown in color with a diffuse crown edge. *E. farinosa* has a small round crown with a white or light gray color.

**TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

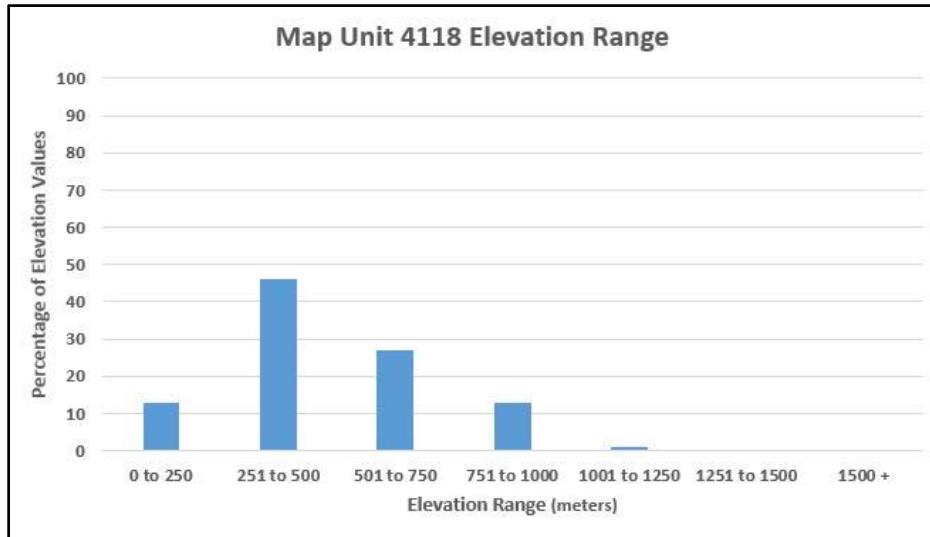
- *Encelia farinosa* Alliance (4114) – Stands strongly dominated by *Encelia farinosa* occur on even harsher settings, generally on steeper mid and upper mountain slopes with minimal soil development or in areas where recent fires have killed the former component of *Larrea tridentata*. Presence of *L. tridentata* on south-facing exposures is more readily discernible than on adjacent north-trending slopes where shadowing makes its presence more difficult to detect. Photointerpreters examine adjacent lower slopes and look for rockiness to infer the consistent presence of *Larrea* where it otherwise may be difficult to see.
- *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115) – In the Colorado Desert, stands are somewhat more common on older, mid and upper fans, generally downslope from mountain toe slopes. In the Central Mojave regions, the two Alliances overlap only on desert mountain terrain. In these settings, *Larrea tridentata* – *Ambrosia dumosa* occurs on adjacent, more mesic-trending northerly slopes and downslope from the hotter, mid and upper south-facing exposures. On these limited exposures, signature characteristics between the two Alliances are almost identical. The best method in determining the presence of *E. farinosa* in the Mojave Desert is elevation and regional distribution. With the exception of a few stands in the southern Searles Valley, nearly all stands are east of Barstow and below 3000 feet (920 meters) in elevation.
- *Cylindropuntia bigelovii* (4124) - Stands where this cactus species dominates contain only small amounts of *Larrea*. *C. bigelovii* signature is significantly darker than *Encelia* and crown size somewhat smaller. Stands are generally found on lower-positioned slopes. Patterning and stand distribution of the cactus appears swarm-like.

4118 – *Larrea tridentata* – *Encelia farinosa* Alliance



**DISTRIBUTION:** This type is highly concentrated in the northern half of the Colorado Desert region. These stands occur on most mid and upper-elevation mountain slopes and adjacent upper fans along all of the Colorado Desert’s mountain ranges. Smaller stands occur in the northern portion of the Pinto Mountains just south of Dale Dry Lake. Stands are limited in the Central Mojave region to areas east of Barstow, with the exception of isolated stands occurring on slopes above Searles Valley. Within the 2014-2016 mapping region, this Alliance is most restricted in its slope characteristics in the Eastern and Central Mojave regions, preferring mid and upper south- and west-trending exposures. In the Whipple Mountains and the Chuckwalla and Chocolate Mountains zones, it is found in settings that are more widespread. This Alliance is absent from the Salton Sea Trough zone.

4118 – *Larrea tridentata* – *Encelia farinosa* Alliance





**4119 – *Larrea tridentata* Alliance**  
Creosote bush scrub Alliance



The left side of the image displays a *Larrea tridentata*-dominated stand with a sparse, inconsistent subshrub cover over an open herbaceous understory. In contrast, the right side of the image reveals the two-tiered shrub layer of the *Larrea tridentata* – *Ambrosia dumosa* Alliance.



The photo depicts an upper fan dominated by *Larrea tridentata* over a moderately dense herbaceous understory. Understory herbaceous cover varies widely within this Alliance.

#### 4119 – *Larrea tridentata* Alliance

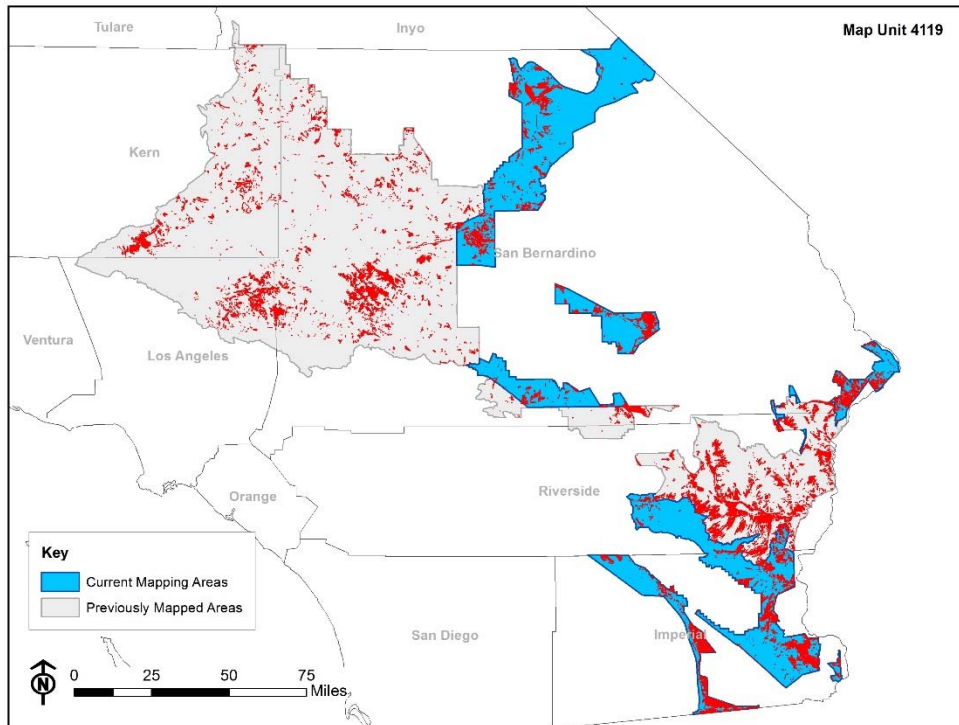
**DESCRIPTION:** In this Alliance *Larrea tridentata* is the dominant shrub with at least 2 percent cover and is evenly distributed in the stand. The following shrubs other than *Ambrosia dumosa* or *Encelia farinosa* may be present: *Krameria* spp., *Bebbia juncea*, *Ericameria teretifolia*, *Eriogonum fasciculatum*, *Atriplex polycarpa*, *Krascheninnikovia lanata*, *Acamptopappus sphaerocephalus*, *Ephedra nevadensis*, or *Opuntia acanthocarpa*. This species readily establishes on a wide variety of settings, including steep mountains slopes, more gradual alluvial fans, and in flats above the valley bottoms. Upper fans at higher elevations and transition zones moving away from playas tend to have greater diversity, with a variety of subshrub species mixing into the stand. Stands of this Alliance that are affected by fire, grazing, off-highway vehicle use or urban clearing frequently occur on lower bajadas and adjacent flats, where non-native annuals often dominate the herbaceous layer. In these settings, the understory shrub layer is discontinuous, and *Larrea tridentata* strongly dominates the shrub canopy. The presence of this Alliance can indicate a disturbance history where the more modal *Larrea tridentata* – *Ambrosia dumosa* Alliance stands have been degraded (Sawyer, Keeler-Wolf and Evens, 2009). On deeply incised upper fans with old impervious surfaces, especially in the Colorado Desert adjacent to the lower slopes of the Riverside, Palen, Big Maria, and Riverside Mountains, *L. tridentata* occurs in sparse cover generally between 2 and 5 percent. In these settings, *L. tridentata* is often the only shrub occurring in the stand.

**PHOTOINTERPRETATION SIGNATURE:** These widely varying sized shrubs appear dark brown to green (depending on water availability) with a diffuse crown edge. Stand cover may be sparse to moderately dense, with individuals spaced evenly apart and emergent over an herbaceous or subshrub understory. Stands with a dense herbaceous understory often have an extensive tan to yellow hue of varying brightness due to the high cover of the annual grasses.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

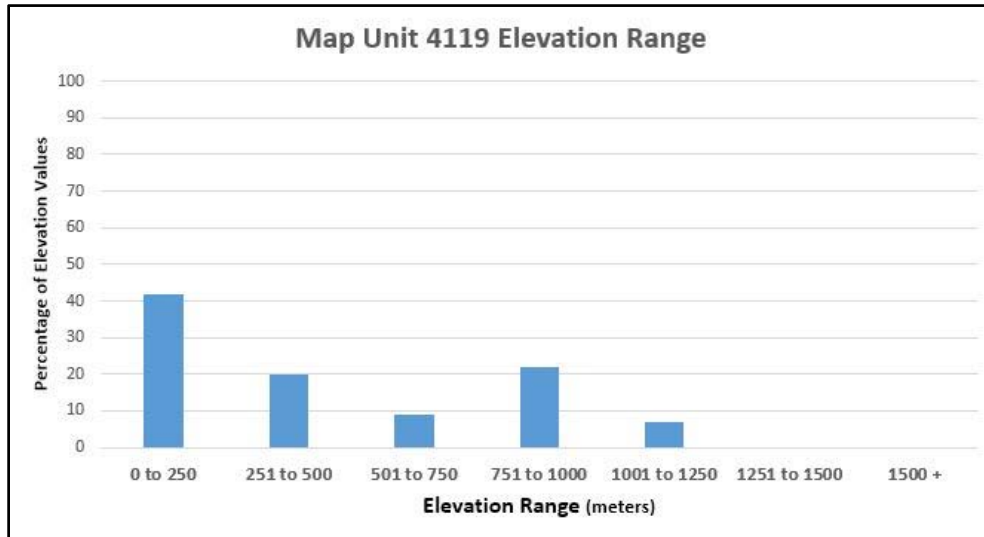
- *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115) – Stands within this Alliance can have a minimal cover of *Ambrosia dumosa*, at times as low as 1 percent. In these settings, *A. dumosa* is often poorly developed, making it is extremely difficult to discern the continuity of the understory shrub layer across the stand. Stands where *Larrea* occurs with a subshrub other than *A. dumosa* dominant, especially at higher elevations, are at times mistaken for this Alliance.
- *Larrea tridentata* – *Encelia farinosa* Alliance (4118) – At times, *Encelia farinosa* can be difficult to discern on steeper slopes where shadowing is extensive. In these settings, photointerpreters use environmental criteria and adjacent stand identification to aid in distinguishing this dual-species Alliance.

#### 4119 – *Larrea tridentata* Alliance



**DISTRIBUTION:** This Alliance is found throughout the Mojave and Colorado Desert portions of the study area. *Larrea tridentata* occurs on all but the highest elevations throughout the desert regions except on alkaline or wetland soils. Stands diminish west of Lancaster and Palmdale in the Antelope Valley and do not occur in the upper fans of the Tehachapi Mountains or the foothills and bajadas adjacent to the Transverse Ranges west of the Mojave River. Stands are frequently found on older impervious upper fans throughout the Central portions of the Mojave and Colorado Deserts. Within the 2014-2016 mapping region, this Alliance is widespread in all regions except the Eastern Mojave Desert. In this region, upper fans typically occur at elevations high enough to support stands of *Yucca brevifolia* or *Y. schidigera*.

4119 – *Larrea tridentata* Alliance





**4122 – *Pleuraphis rigida* Alliance**  
Big galleta shrub-steppe Alliance



The clonal signature of *P. rigida* depicted in this example (red polygon) displays a mottled pattern with indistinct crown and stand edges. *L. tridentata* and *A. dumosa* spill over slightly from adjacent stands to the north, contrasted by darker, more defined crowns. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The photo depicts a homogenous stand of *P. rigida* occurring on a sandy flat.



#### 4122 – *Pleuraphis rigida* Alliance

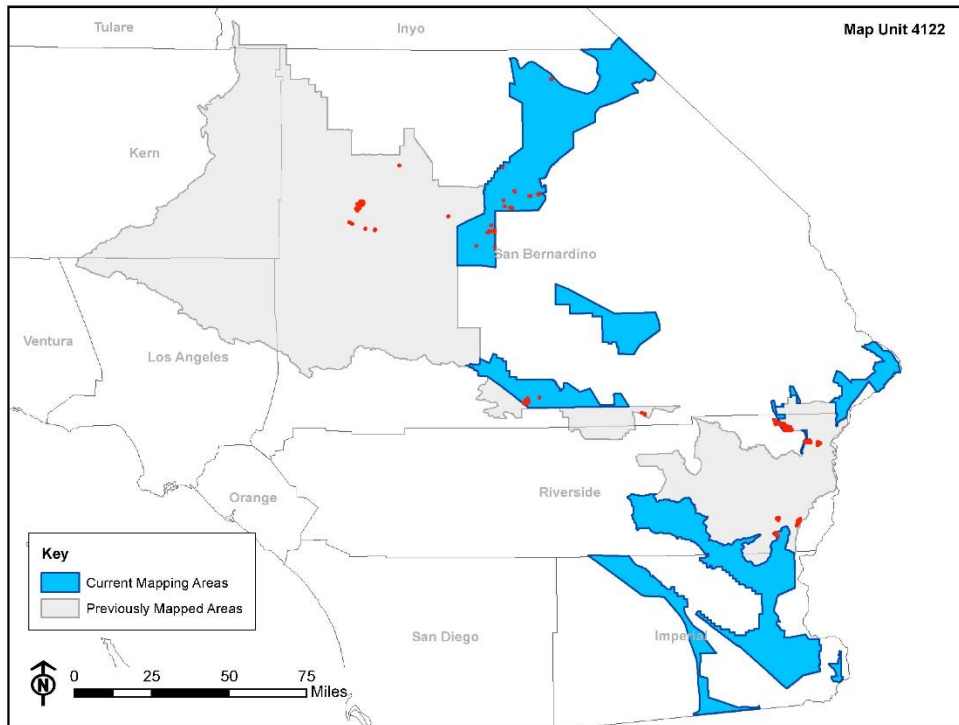
**DESCRIPTION:** In stands of this Alliance the shrubby bunch grass *Pleuraphis rigida* is the dominant perennial species. It may occur with scattered shrubs of *Larrea tridentata*, *Ambrosia dumosa*, *Ephedra trifurca*, or other shrub species at lower cover. Stands typically occur on sand ramps, dune aprons, stabilized dunes near playas, or wide washes adjacent to *Larrea tridentata* – *Ambrosia dumosa* stands. Sandy stands adjacent to freeways and disturbance often have a significant non-native component of *Brassica tournefortii*, *Schismus* spp., etc.

**PHOTOINTERPRETATION SIGNATURE:** This bunch grass has a mottled, dark brown signature, with cover often ranging widely within the stand. Color tone is generally darker with more indistinct crown margins in comparison to other subshrubs like *A. dumosa*, which may intermix at very low cover. *P. rigida* prefers sandier soils, which sometimes display a distinctly higher reflectance than surrounding soils. Sandy soils may be used as an indicator of *Pleuraphis* presence but not always.

**TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

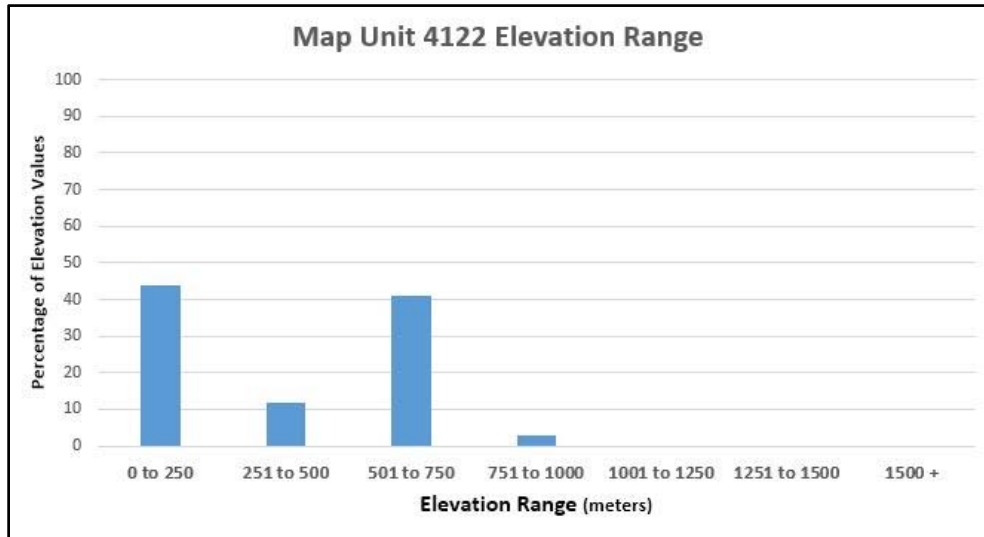
- *Ambrosia dumosa* Alliance (4111) – The signature of the plant has a lighter gray or brown hue with a slightly more defined crown. *Ambrosia dumosa* occurs on soils that are less sandy and do not yield as bright a signature tone. Unlike *Pleuraphis*, *A. dumosa* normally does not clone.

4122 – *Pleuraphis rigida* Alliance



**DISTRIBUTION:** Stands occur in isolated patches in all three subareas of the original study area. Some of the most extensive stands are found in the flats east of Harper Dry Lake. These are also the westernmost stands in the mapping area. A few stands were mapped on dunes east of Dale Dry Lake as well as on slopes and fans coming off of the north side of the Big Maria Mountains. Several larger stands also were mapped on the Palo Verde Mesa. Most stands occur in patches below the 10-acre MMU and are more common in the Colorado Desert. Within the 2014-2016 mapping region, *Pleuraphis rigida* is uncommon as a type. Most examples occur in the Central Mojave region in the vicinity of the Cady Mountains on sand ramps where sand collects at the base of the mountain chain. In these settings, the Alliance forms stands sometimes exceeding 50 acres in size. Several fairly large stands also occur in the Rice Valley in close proximity to the rare crucifixion thorn sites. Several mapped stands west of Coyote Lake in the Central Mojave region exceed 150 acres in size.

4122 – *Pleuraphis rigida* Alliance



**4124 – *Cylindropuntia bigelovii* Alliance**  
Teddy bear cholla patches Alliance



The example depicts a stand of *Cylindropuntia bigelovii* in the southern portions of the Chuckwalla Mountains near the Riverside and Imperial County lines. The *C. bigelovii* dominates but is mixing with patchy *Larrea tridentata*, *Fouquieria splendens*, *Encelia farinosa* and *Ambrosia dumosa*. *Oliveya tesota* is located in the wash. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The photo depicts a dense stand of *Cylindropuntia bigelovii* with small amounts of *Larrea tridentata* and *Fouquieria splendens*. The highly variable density typical of *Cylindropuntia bigelovii* is seen here.

#### 4124 – *Cylindropuntia bigelovii* Alliance

**DESCRIPTION:** *Cylindropuntia bigelovii* is a distinctive, jointed cholla with a vertical trunk; the plant grows to 1.5 meters in height. Stands dominate the shrub layer with at least 50% relative cover. The Alliance is found on alluvial fan deposits and gentle to moderate slopes of rocky highlands. Soils consist of coarse sands to loams (Sawyer et al., 2009). Polygons mapped to this Alliance tend to vary considerably in density across the stand. *Encelia farinosa* is present in low cover in addition to *Fouquieria splendens* and at times *Larrea tridentata*.

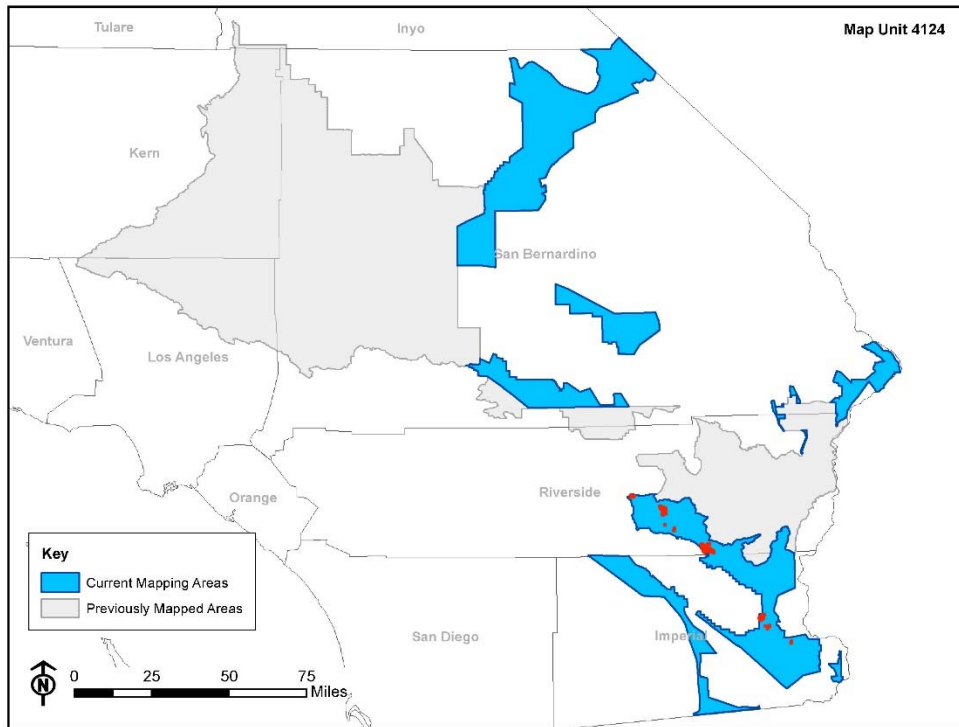
**PHOTOINTERPRETATION SIGNATURE:** Stands mapped to this Alliance closely resemble pavement surfaces containing large volcanic cobbles strewn about the landscape. However, reliable distinctions between the vegetated stands of *C. bigelovii* and unvegetated cobbly surfaces can be made based on the highly irregular cover variability of the cactus plants within a single stand. Individual plants yield a light tan to dark brown color (variable across the stand) and have a “swarm-like” distribution.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

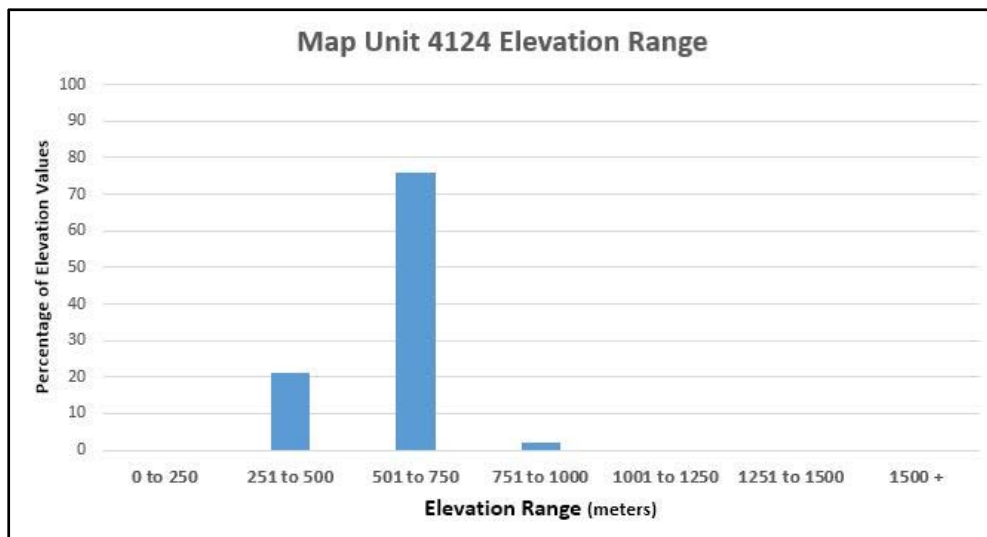
- *Encelia farinosa* Alliance (4114) – Both plants have small crowns, although *E. farinosa* averages slightly larger. Stands dominated by *E. farinosa* tend to occur on higher mountain slopes. Like *C. bigelovii*, cover is variable across the stand, but the patterning of *E. farinosa* is less ‘swarm-like’.
- *Chorizanthe rigida* – *Geraea canescens* Desert pavement Sparsely Vegetated Alliance (6117) – The sparse vegetation and numerous large cobbles tend to be more consistently distributed across the pavement surface. The color of the cobbles is less variable than that of the similar-looking *C. bigelovii*, and on close inspection tends to be darker.



4124 – *Cylindropuntia bigelovii* Alliance



**DISTRIBUTION:** Stands occur exclusively in the Chuckwalla and Chocolate Mountains zone, from Hayfield Dry Lake south to near Indian Pass. The best examples occur on upper fans and lower toe slopes on south-facing aspects in the Chuckwalla Mountains near the Chocolate Mountains Aerial Gunnery Range. Several stands span more than a thousand acres.



**4151 – *Viguiera parishii* Alliance**  
Parish's goldeneye scrub Alliance



In this example, *V. parishii* occurs on an extremely bouldery slope with plants widely scattered between rocks along a steep north face. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The photo depicts a typical setting where *V. parishii* and *Eriogonum fasciculatum* occur between the rocks and boulders, often co-occurring with a variety of other species including *Gutierrezia sarothrae*, *Ephedra nevadensis*, and *Stipa* spp. in very low cover.

#### 4151 – *Viguiera parishii* Alliance

**DESCRIPTION:** In stands of this Alliance *Viguiera parishii* is present with at least 1 percent cover. No other species has greater or equal cover, except for *Acacia greggii*, *Ambrosia dumosa*, *Simmondsia chinensis*, *Pleuraphis rigida*, *Lotus rigidus*, or *Encelia actoni*. Many stands are intermixed with other species such as *Ambrosia dumosa*, *Bebbia* spp., *Trixis californica*, *Ephedra nevadensis*, *Eriogonum fasciculatum*, and *Salazaria Mexicana*, but are lacking or have very low cover of *L. tridentata*. Stands are usually found on rocky slopes in areas with cobbles, boulders, and/or outcrops at low to mid elevations or, rarely, in washes. *V. parishii* is found on northerly slopes of the Mojave and Colorado Deserts in California. In the Central Mojave region the Alliance occurs at the higher edge of the *Larrea tridentata* – *Ambrosia dumosa* zone on bouldery, often granitic slopes in the Little San Bernardino Mountains. Within the mapping study area, stands frequently occur in settings co-dominating with *Eriogonum fasciculatum*.

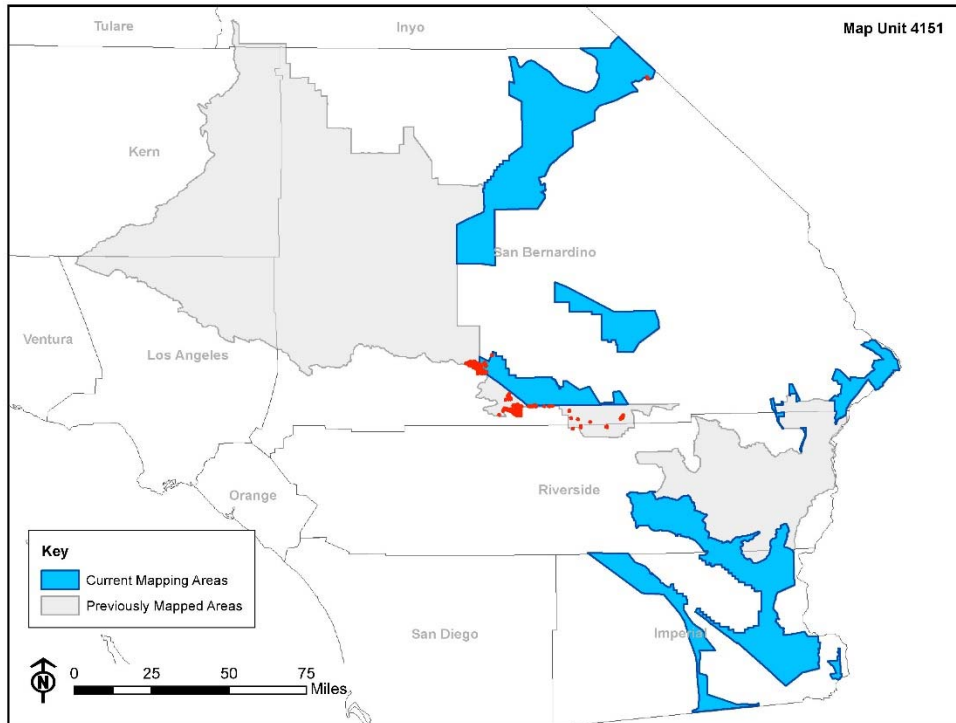
**PHOTOINTERPRETATION SIGNATURE:** Stands are restricted to ultra-rocky slopes where cover is open but may vary widely within the stand. These plants commonly occur on very bouldery slopes where higher densities of exposed rock limit the space for shrubs to establish. Individuals appear as small gray plants with indistinct edges and are tucked between large rock outcrops and boulders. The absence of *Larrea tridentata* and overall rockiness of the terrain, along with the limited regional distribution of this species, characterize the criteria for how this Alliance is identified. *Yucca schidigera* frequently occurs on the more gradual, less rocky toe slopes adjacent to these ultra-rocky areas.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

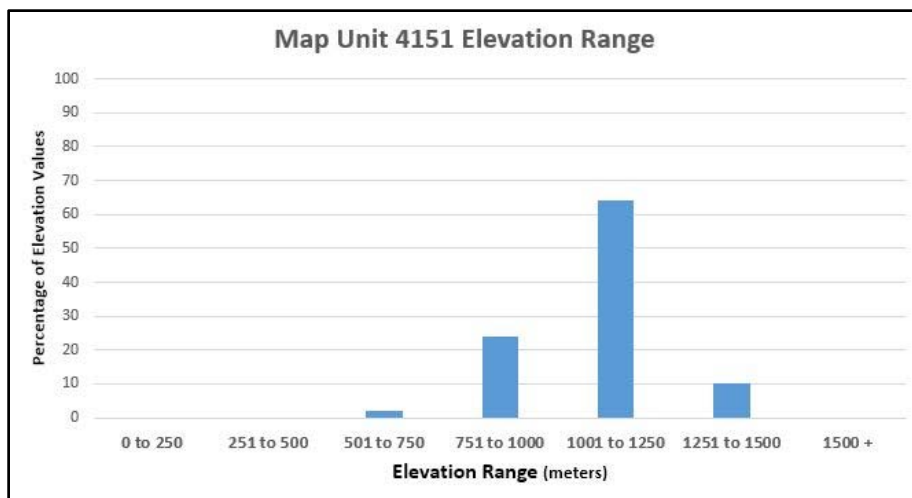
- *Ambrosia dumosa* Alliance (4111) – This type has a very similar signature to *V. parishii* but is not as successful establishing in areas of extreme rockiness.
- *Encelia farinosa* Alliance (4114) – Signature characteristics alone are not adequate to distinguish the two types, especially in rocky settings. Generally, *Encelia farinosa* occurs in lower elevation settings on south-trending exposed slopes. Overall shrub cover is usually higher.
- *Ephedra viridis* Alliance (5417) – Stands dominated by this plant occur in very similar bouldery settings at similar elevations. Both Alliances contain a sparse cover of vegetation. Some imagery may yield the brighter green signature of the *Ephedra* when cover is slightly higher than what typically occurs.
- *Coleogyne ramosissima* Alliance (5421) – Rockier upslope occurrences of this type are difficult to distinguish from *V. parishii*. Generally, they can be differentiated based on slope steepness and substrate characteristics. *Coleogyne ramosissima* frequently occurs on soils with a caliche layer that tends to yield a lighter substrate tone.



**4151 – *Viguiera parishii* Alliance**



**DISTRIBUTION:** In the original study area, stands are restricted to the northern fringe of Joshua Tree National Park. The largest stands in the study area occur east of Yucca Valley in the Little San Bernardino Mountains and extend eastward in widely scattered locations along the north slopes of the Pinto Mountains. Within the 2014-2016 mapping region, stands are mapped only in the westernmost portions of the Central Mojave region north of Yucca Valley. *V. parishii* occurs throughout the middle and higher elevations as a component to other Alliances mapped in the Eastern Mojave region.



**4152 – *Parkinsonia microphylla* Provisional Alliance**  
Foothill palo verde shrubland Provisional Alliance



In this example, *P. microphylla* co-dominates with *Encelia farinosa* on slopes in the Whipple Mountains. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The photo depicts a stand of low stature *P. microphylla* on dark slopes in the Whipple Mountains adjacent to Whipple Wash.



#### 4152 – *Parkinsonia microphylla* Provisional Alliance

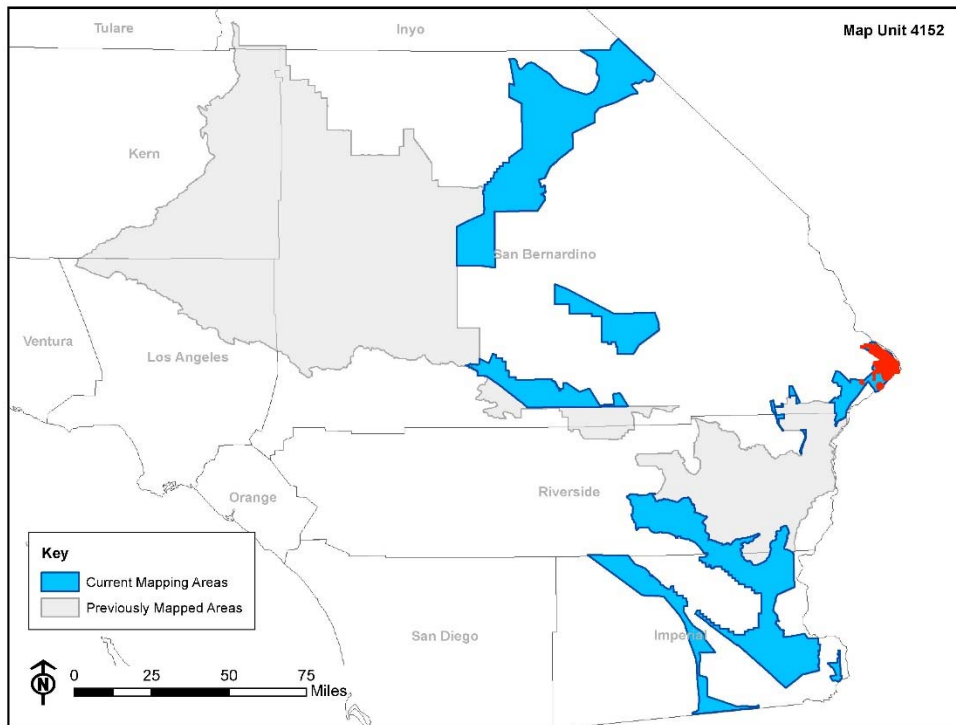
**DESCRIPTION:** *Parkinsonia microphylla* is a spiny shrub or small tree reaching 8 meters in height. *Parkinsonia microphylla* is a co-dominant in the shrub or low tree canopy. *Larrea tridentata* and *Encelia farinosa* frequently co-dominate the lower shrub canopy. Stands of this Provisional Alliance reach their westernmost limit in the Whipple Mountains, the easternmost part of California (Sawyer et al., 2009). In the mapping area, stands frequently occur on unconsolidated gently to moderately sloping foothill settings. Noteworthy to these stands are the widely scattered saguaro cactus (*Carnegiea gigantea*) that randomly dot the landscape. At least fifty individuals were noted in these stands during the mapping effort.

**PHOTOINTERPRETATION SIGNATURE:** Stands are easily identifiable by the relatively high consistent cover of the tall *P. microphylla* shrub contrasting with the relative dark-colored substrate. This species of palo verde is similar in appearance to *P. florida* except that it is significantly smaller in size and is found on nearly all slope characteristics in low foothill settings. Overlap between the two species occurs only in larger wash settings that bisect the foothills. In these cases, the presence of *Olneya tesota* places it into the riparian *Parkinsonia florida* – *Olneya tesota* Alliance. *Encelia farinosa*, which frequently occurs in relatively high cover with this type, is easily recognizable against the darker-colored substrate.

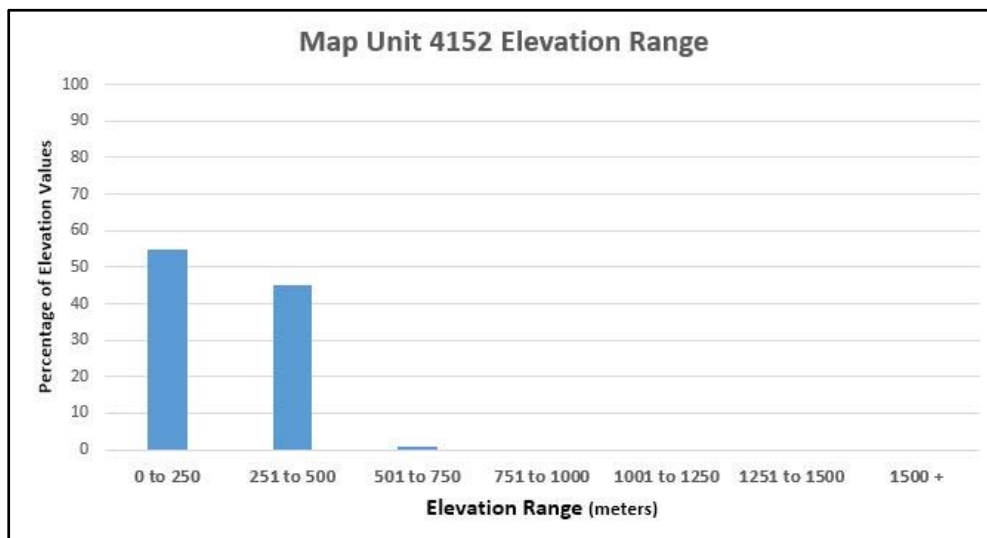
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Larrea tridentata* Alliance (4119) – Larger healthier (greener) *Larrea* shrubs can overlap slightly in size with *P. microphylla*. Spacing and shrub cover density in the upland terrain is not as consistent across the stand as that of *P. microphylla*. Stands dominated by *Larrea tridentata* also are more common on impervious upper fan surfaces. Stands of *Larrea* in the on toe slopes and foothills adjacent to *P. microphylla* and tend to have significantly smaller crowns.
- *Parkinsonia florida* – *Olneya tesota* Alliance (4227) – The two species of palo verde are for the most part inseparable based on image signature alone. However, of the two, only *P. microphylla* occupies an upland setting. When the two species overlap in medium to small washes, look for other riparian species, especially *Olneya tesota*, to aid in placing the stand in this riparian Alliance.

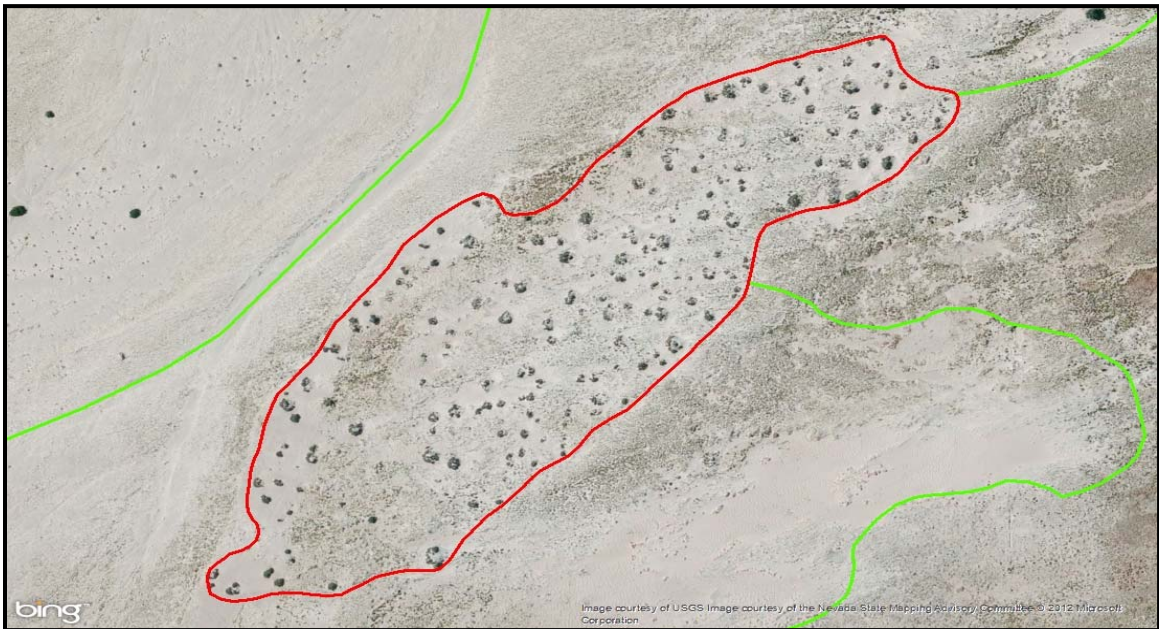
**4152 – *Parkinsonia microphylla* Provisional Alliance**



**DISTRIBUTION:** The distribution of this Provisional Alliance is limited to the foothills of the Whipple Mountains, just upslope from the Colorado River. These are most likely the only stands that occur in the state.



**4211 – *Ephedra californica* Alliance**  
California joint fir scrub Alliance



This image shows the dark green clonal rings of *Ephedra trifurca* growing adjacent to a wash on a very sandy substrate.



In the foreground *Ephedra trifurca* occupies a sandy dune with some tawny *Pleuraphis rigida* in the background.

#### 4211 – *Ephedra californica* Alliance

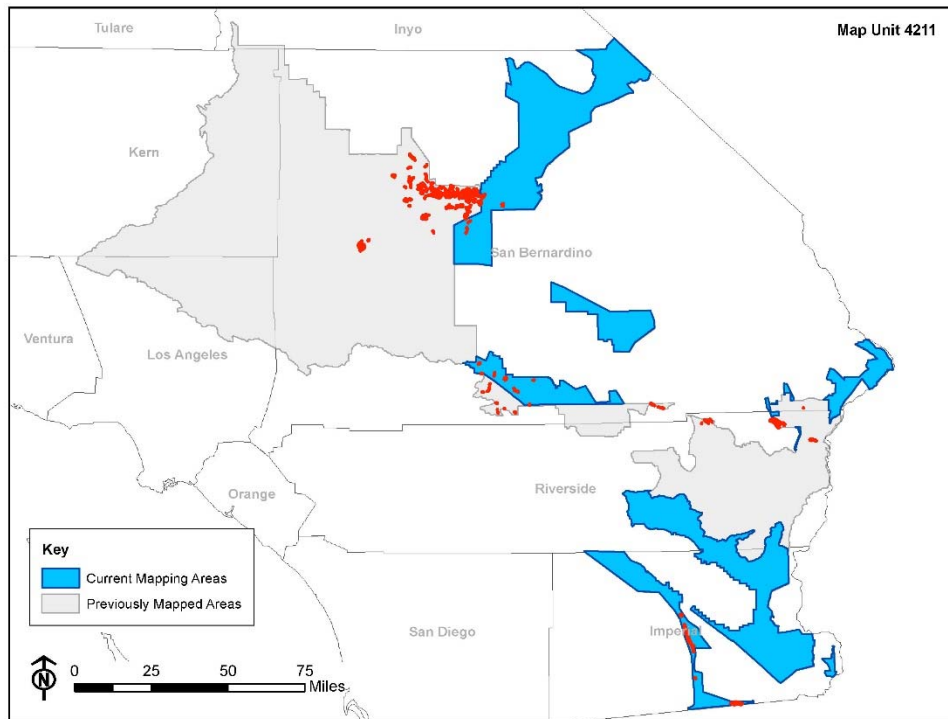
**DESCRIPTION:** In this Alliance *Ephedra californica* or *Ephedra trifurca* dominates or co-dominates with *Ambrosia salsola*, *Senna armata*, *Gutierrezia californica* or *Brickellia incana*. *Ephedra californica* is typically found on broad, active washes of mid to upper bajadas and fans. *E. californica* may be confused with the similar *Ephedra trifurca*, found on washes and sand dunes from Barstow eastward. *E. trifurca* is characteristic of low dunes and sand-sheets in the Colorado Desert but generally attains higher cover than vegetation types in the lithomorphic class that includes sparsely vegetated dunes. Due to similar ecology, both species are treated together and mapped under the *Ephedra californica* Alliance.

**PHOTOINTERPRETATION SIGNATURE:** The stands are typically open to moderately dense with a color variation from gray to green. Individuals have a dense crown with well-defined edges and grow in evenly spaced and/or clonal ring patterns. Shrubs tend to be medium to large and spreading with a very sparse herbaceous understory. The dark-colored shrubs contrast markedly with the white sandy substrate on which *Ephedra* frequently occurs. Stands tend to have a low diversity of shrubs, with *Atriplex canescens* at times co-dominating the stand, which typically creates minimal variability in the overall signature for this type.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Larrea tridentata* Alliance (4119) – *L. tridentata* tends to have more of an uneven, fuzzier-edged, more open crown and has a duller green color. When the two Alliances are nearby in similar settings, shrubs in both types are quite large. In these situations, the above-described crown features make distinguishing the two types fairly straightforward.
- *Ambrosia salsola* Alliance (4216) – These plants are not as large or rounded, and the edges of the crown are fuzzier and less defined.
- *Acacia greggii* Alliance (4226) – Crowns are not as dense and have less distinct edges. *A. greggii* tend to grow in small but dense inconsistent patches along wash margins.
- *Atriplex canescens* Alliance (5111) – This species can co-dominate a stand with *E. californica* in areas along the Mojave River. Crowns are less distinct, smaller, and not as dark colored. Nevertheless, when the two species co-occur, they are difficult to distinguish.

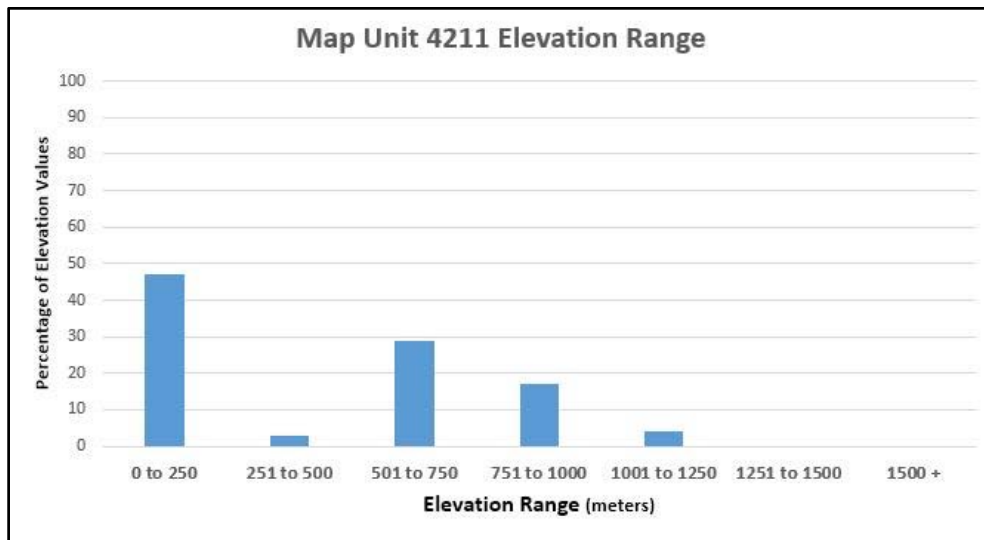
#### 4211 – *Ephedra californica* Alliance



**DISTRIBUTION:** The highest concentration of stands occurs in small washes surrounding Coyote Dry Lake and Alvord Mountain. This type also occurs south of Hinkley in sandy areas adjacent to the Mojave River, in washes of the Granite Mountains, and in portions of Pipes Wash. *Ephedra trifurca* (see description) is identified on dunes west of the Parker Valley portion of the Colorado River. Within the 2014-2016 mapping region, *Ephedra trifurca* and *E. californica* are uncommon but widely scattered in washes and sandy environments throughout most of the mapped region. Good examples of *E. californica* occur in the Mojave River and in small washes draining the easternmost slopes of the San Bernardino Mountains (Pipes Wash). Stands dominated by *E. trifurca* occur on several long, narrow sand sheets just west of the Algodones Dunes in the Salton Sea Trough zone.

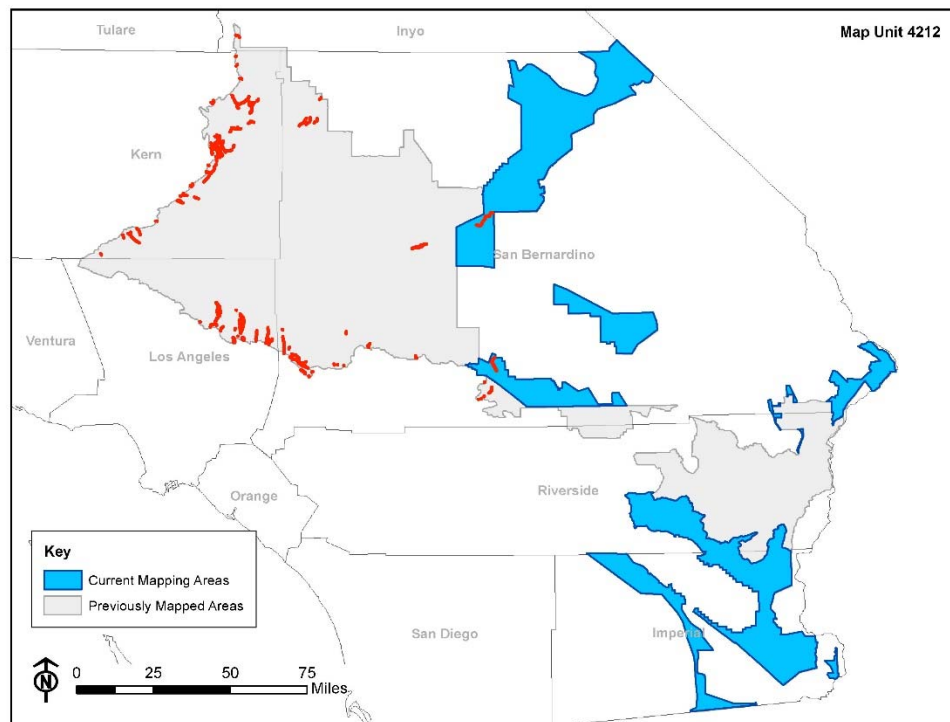


4211 – *Ephedra californica* Alliance



## 4212 – *Lepidospartum squamatum* Alliance

Scale broom scrub Alliance



**DISTRIBUTION:** Stands are concentrated along washes on the eastern base of the southern Sierra Nevada, San Bernardino and San Gabriel Mountains. The Alliance also occurs in wide, very active washes in the Fremont and Indian Wells Valleys, Sierran fans, the lower El Paso Mountains and the north side of the Lava Mountains, which is the easternmost limit of the species' regional distribution. Within the 2014-2016 mapping region, stands continue (from the west) in the more active portions of the Mojave River almost as far east as Afton Canyon and along Pipes Wash just west of Goat and Spy Mountains.

**4213 – *Ericameria paniculata* Alliance**  
Blackstem rabbitbrush Alliance



The image shows a narrow wash containing the dark green-colored *Ericameria paniculata* scattered intermittently along the main stream channel. Adjacent polygons to the north and south contain the brownish *Larrea tridentata* and the smaller gray *Ambrosia dumosa*.



The photo displays dense green *Ericameria paniculata* shrubs occupying a braided lower-energy wash.

#### 4213 – *Ericameria paniculata* Alliance

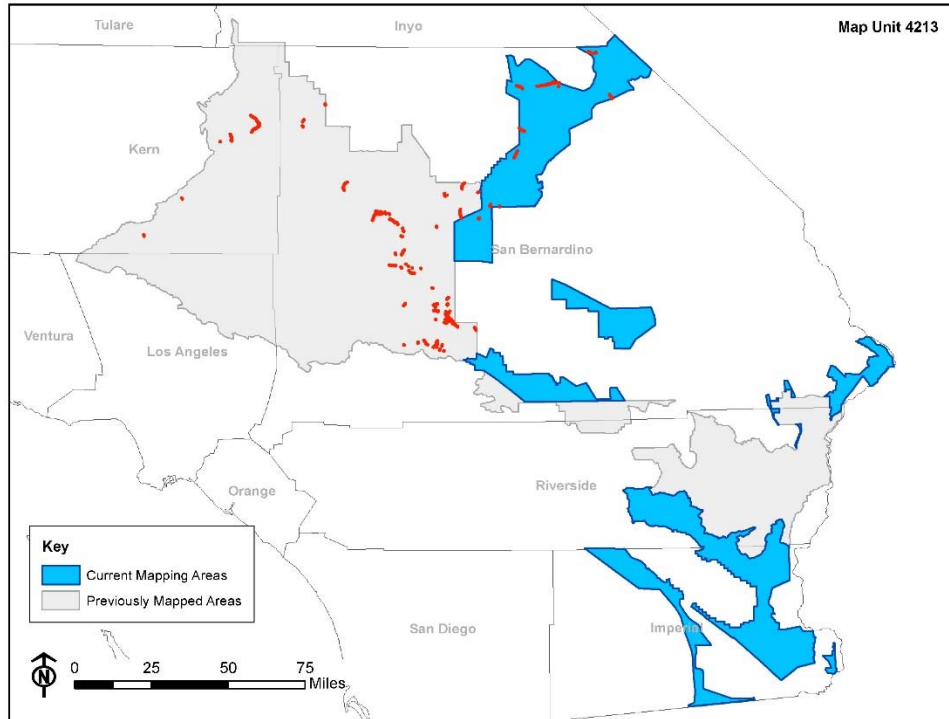
**DESCRIPTION:** This Alliance is mapped where *Ericameria paniculata* is dominant or co-dominant in the shrub canopy. *E. paniculata* comprises at least 2 percent of the absolute cover and at least 25 percent of relative cover. It is widespread throughout a broad elevation range in much of the mapping area on the edges and terraces of relatively large, recently active washes. If *E. paniculata* is mixed with *Lepidospartum squamatum*, it must be more than twice the cover of *L. squamatum* to be assigned to this Alliance.

**PHOTOINTERPRETATION SIGNATURE:** Stands are sparse to moderately dense in cover with larger mature shrubs appearing green to dark green in color with a dense rounded crown. Typically, shrubs are intermittently spaced in larger wash braids and relatively low-energy wash channels that contain a sparse herbaceous understory.

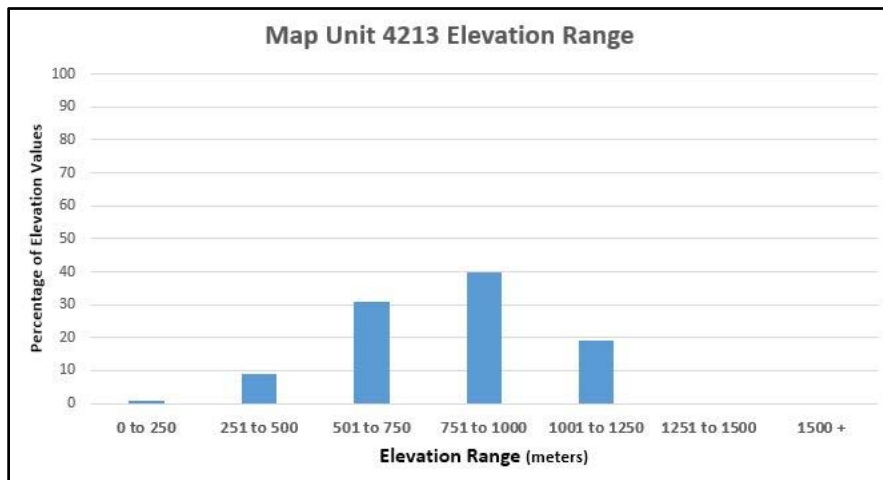
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Lepidospartum squamatum* Alliance (4212) – These shrubs are indistinguishable on aerial imagery and can be hard differentiating in the field. *Lepidospartum squamatum* generally prefers higher energy washes. Otherwise these plants are difficult to discern from *E. paniculata* due to their similar crown shape, texture and setting. Stands are more common in the western sections of the Mojave Desert.
- *Prunus fasciculata* Alliance (4214) – This plant is very similar in size and color but prefers gravelly canyons and washes on upper fans, usually in higher elevations.
- *Ambrosia salsola* Alliance (4216) – These shrubs are grayer in color and tend to dominate in less active parts of drainages (i.e. stream terraces, sheet wash areas).
- *Psoralea spinosa* Alliance (4225) – Plants are larger crowned, less rounded, and tend to have a lighter gray color. They occur in more active portions of the stream channel.
- *Ephedra californica* Alliance (4211) – Shrubs within this Alliance tend to average slightly greener, have a more irregularly shaped crown and occupy washes with a sandier substrate.

**4213 – *Ericameria paniculata* Alliance**

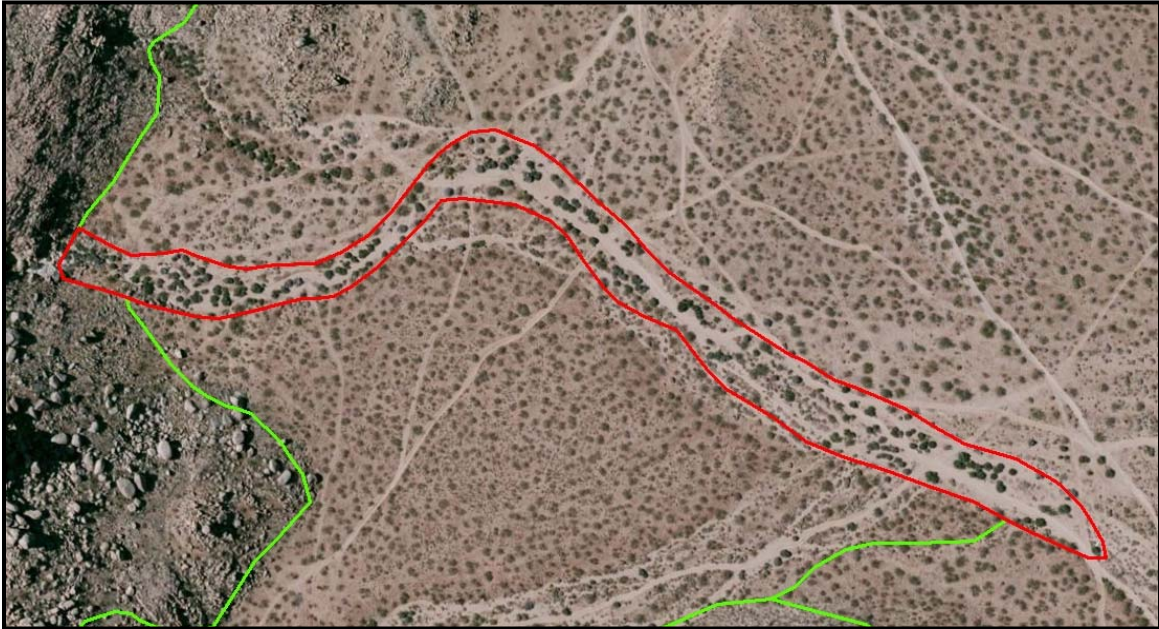


**DISTRIBUTION:** This Alliance has the highest concentration of stands in desert washes near Calico and Johnson Valley in the Central Mojave region. Fewer localized stands occur in narrow desert mountain arroyos near Koehn Dry Lake in the Mojave Desert – Basin and Range Fringe zone. There were no recorded stand occurrences in other portions of the original study area. The regional distribution of this type is centered in the Great Basin and Eastern Mojave regions outside this study area. Within the 2014-2016 mapping region, washes dominated by *Ericameria paniculata* occur sporadically only in the Central and Eastern Mojave regions. The most extensive stand occurs in the lower portions of the Kingston Wash, continuing along this channel for nearly 10 miles.





**4214 – *Prunus fasciculata* Alliance**  
Desert almond Alliance



This example shows a narrow run of *Prunus fasciculata* following a drainage at the base of rocky hills to the left.



The green shrub dominating this photo is *Prunus fasciculata* in a grassy, post disturbance setting.

#### 4214 – *Prunus fasciculata* Alliance

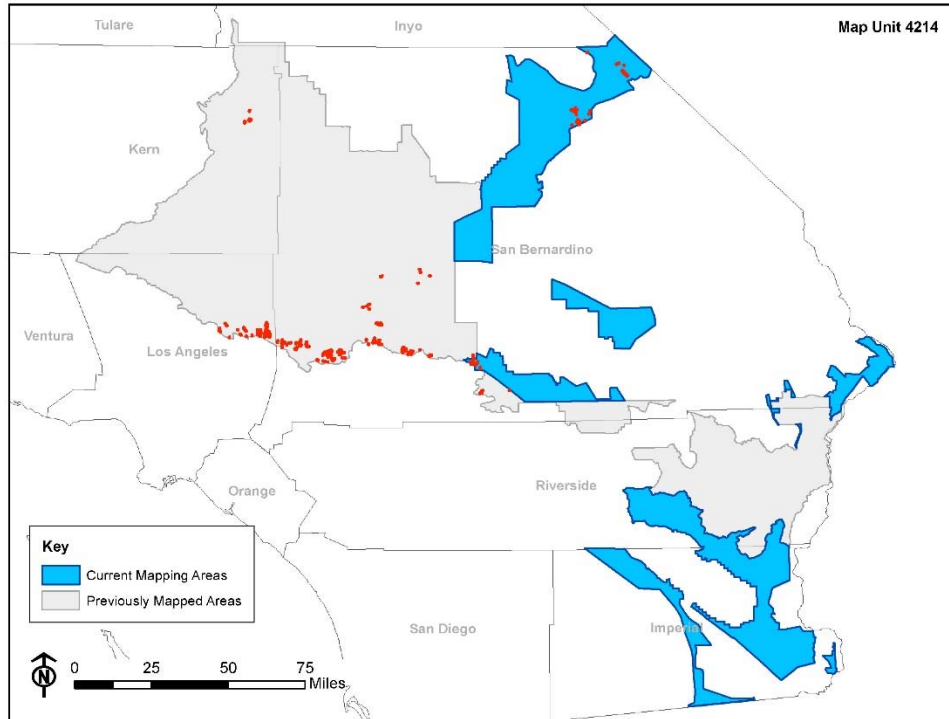
**DESCRIPTION:** This Alliance is mapped where *Prunus fasciculata* dominates or co-dominates the shrub layer and comprises at least 2 percent of the absolute cover and at least 25 percent of total relative cover. *Gutierrezia sarothrae* and *Lycium cooperi* may have up to twice the cover of *P. fasciculata*. If *Prunus fasciculata* co-occurs with other tall shrubs such as *Acacia greggii*, it must have twice the cover of other species to make the Alliance definition. Stands are usually found at upper elevations (above 1000 meters/3280 feet) and in well-defined mountain canyons or valley bottoms. Typically stands occur in washes and arroyos on upper fans, but they may occur on wash terraces or on concave rocky slopes. Cover may be high following resprouting from fire. The following species are common associates: *Salazaria mexicana*, *Ericameria teretifolia*, *Lycium cooperi*, *Yucca schidigera*, *Rhus trilobata*, and *Purshia tridentata*. This Alliance often occurs adjacent to stands of *Eriogonum fasciculatum*, *Grayia spinosa*, or *Salazaria mexicana*, and also occurs adjacent to *Artemisia tridentata* stands near the base of the San Gabriel Mountains.

**PHOTOINTERPRETATION SIGNATURE:** Stands range from sparse to moderately dense in cover with rounded, well-defined dark green to dark gray crowns. Plants form winding linear patterns following arroyos and canyon bottoms. In a post fire setting shrubs vary greatly in cover density, patterning, and texture, and tend to spread out beyond the immediate wash channel.

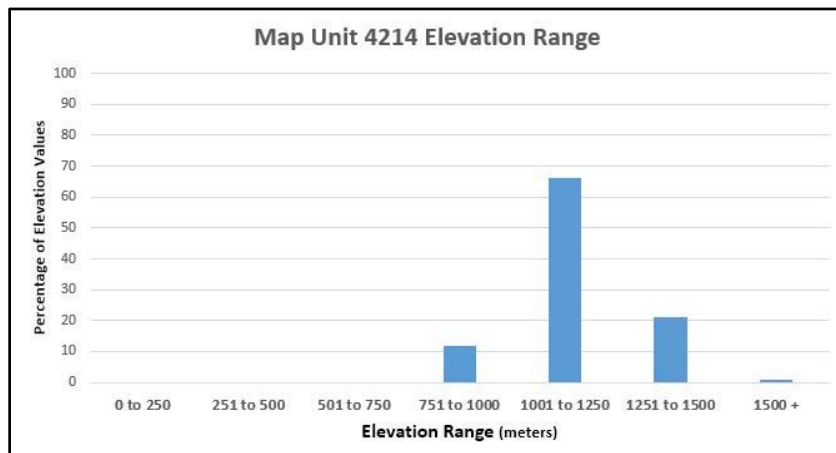
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Lepidospartum squamatum* Alliance (4212) – These shrubs are distinguished by having a lighter tone and browner color. They occur in more active portions of the wash.
- *Ericameria paniculata* Alliance (4213) – Shrubs tend to occur more frequently in broader washes downslope, often adjacent to broad fans and bajadas. Otherwise these plants are difficult to distinguish from *P. fasciculata* due to their similar crown shapes, texture, and setting.
- *Ambrosia salsola* Alliance (4216) – These shrubs are grayer in color and have a smaller, more diffuse crown.
- *Acacia greggii* Alliance (4226) – Higher elevation stands dominated by catclaw (*Acacia greggii*) overlap in elevation with the *Prunus fasciculata* Alliance. Color differences between the two species are minimal but separation is aided by differences in setting. *A. greggii* is more frequently limited to wash margins and tends to grow more often in long narrow bands. Distribution of *P. fasciculata* within the wash is more random.

**4214 – *Prunus fasciculata* Alliance**

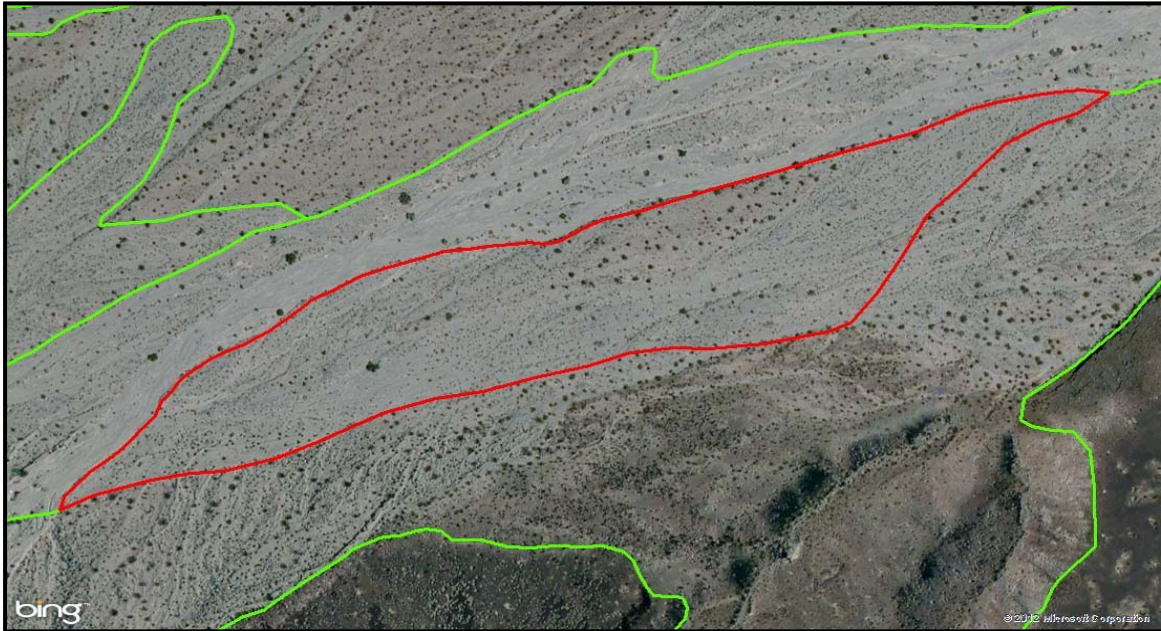


**DISTRIBUTION:** This Alliance is primarily found in upland washes and canyons in foothills of the San Bernardino and eastern San Gabriel Mountains. This species prefers higher precipitation and cooler temperatures than other wash vegetation types and is absent from the Colorado Desert and much of the lower elevation valleys of the Mojave Desert. A few localized stands do occur within cooler, protected canyons of the El Paso, Fairview, and Granite Mountain ranges. Within the 2014-2016 mapping region, the Alliance is noted more frequently in the higher elevation washes of the Eastern Mojave region near Turquoise Mountain and the Mesquite Mountains west of Mesquite Lake. Several occurrences of this type are also mapped in small washes draining the easternmost sections of the San Bernardino Mountains north of Yucca Valley.





**4216 – *Ambrosia salsola* Alliance**  
Cheesebush scrub Alliance



This image depicts *Ambrosia salsola* colonizing a typical wash terrace setting.



The scattered shrubs in the foreground of this photo are the two-tone light green and tawny colors of *Ambrosia salsola* occupying a sheet wash.

#### 4216 – *Ambrosia salsola* Alliance

**DESCRIPTION:** In this Alliance *Ambrosia salsola* is strongly dominant, comprising more than 60 percent relative cover in the dominant shrub layer. Stands occur in washes or on gently-sloping disturbed uplands. Upland stands are usually associated with fire, clearing, grazing, or other disturbance in former *Larrea tridentata*-*Ambrosia dumosa*, *Juniperus californica*, *Yucca schidigera*, *Coleogyne ramosissima* or other upland vegetation sites. Most non-fire-related stands of *A. salsola* are associated with washes in mid and lower elevations. *A. salsola* may mix with equal or somewhat higher amounts of *Senna armata* in washes and still be considered the *A. salsola* Alliance. Stands in washes were mapped if they were larger than five acres in size.

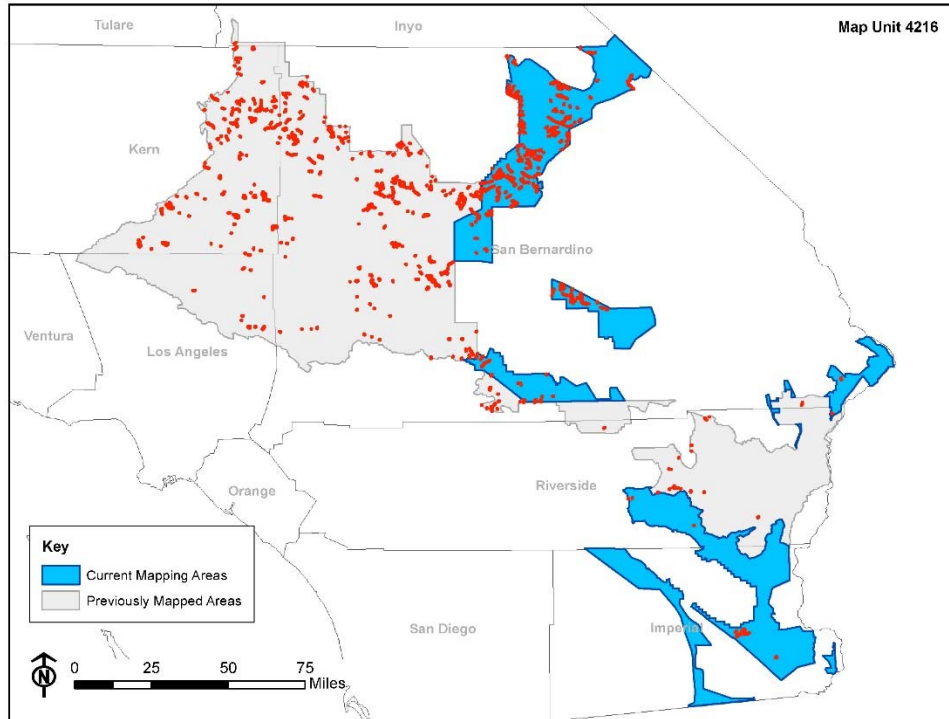
**PHOTOINTERPRETATION SIGNATURE:** Stands vary in cover from sparse to moderately dense. Individuals appear as small gray to gray-brown to yellow-brown shrubs with diffuse crowns. Stands occurring in wash settings rarely have dense cover and vary considerably along the weaker margins of the channel. On disturbed sites, shrub cover can be fairly high. In both settings, species diversity tends to be fairly low, resulting in minimal variability of the signature. Signature variability depends primarily on substrate and shrub cover.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

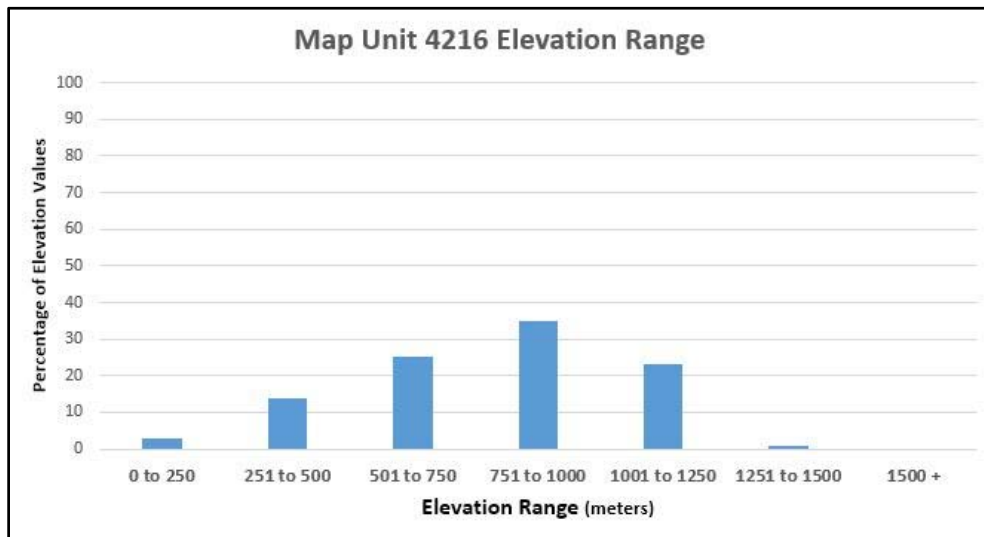
- *Ambrosia dumosa* Alliance (4111) – These shrubs have a similar signature but are found in less-disturbed sites and generally not in wash settings. *Ambrosia salsola* tends to grow in clumpier patches.
- *Atriplex polycarpa* Alliance (4113) - This species at times occurs as a dominant in washes near playa systems and in washes draining alkaline-trending volcanic mountain soils. In these settings, shrubs tend to be larger, lighter in color, and denser in cover. Cover varies considerably along the less-active channel margins, and overall distribution occurs in clumpier patterning.
- *Lepidospartum squamatum* Alliance (4212) – These shrubs are distinguished by having a browner color, usually with a larger crown. *Lepidospartum* tends to occupy higher-energy washes.
- *Ericameria paniculata* Alliance (4213) – These plants have a well-defined, greener, larger crown.



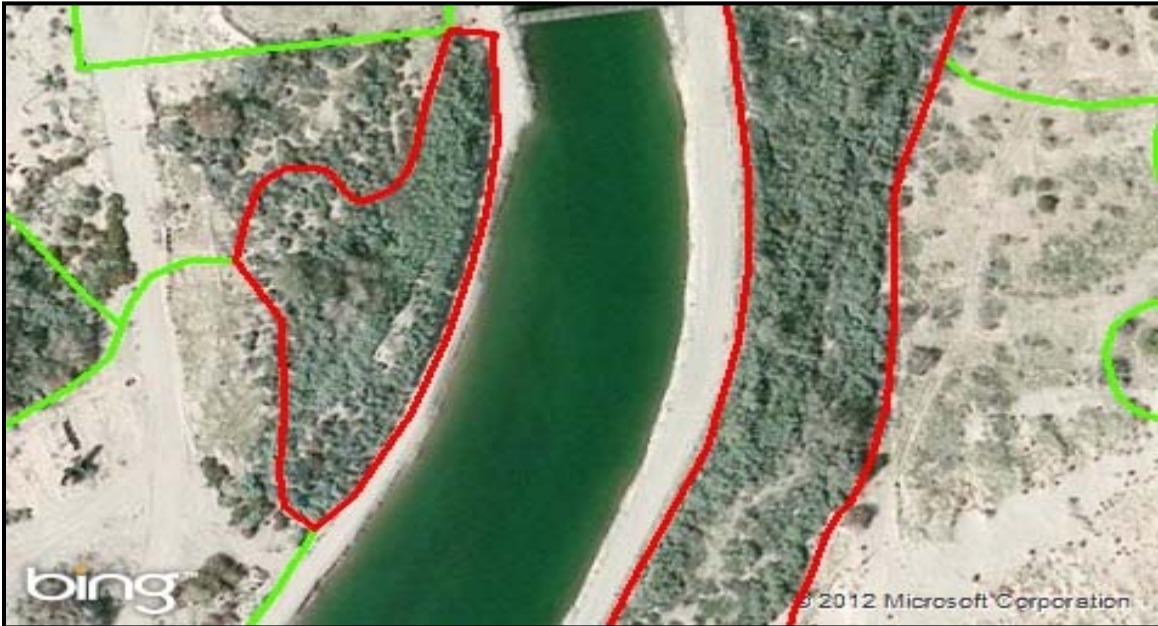
**4216 – *Ambrosia salsola* Alliance**



**DISTRIBUTION:** This Alliance is found throughout the Western Mojave and Central Mojave regions. Stands greatly diminish east of Yucca Valley and are mainly associated with human disturbance. Stands of this Alliance are mostly absent from the eastern portion of the Colorado Desert. Within the 2014-2016 mapping region, stands of *A. salsola* are commonly found in the Eastern Mojave and Central Mojave Desert regions. Elsewhere, stands of this Alliance are rare. Stands are best developed in weak minor wash settings in lower to moderate elevations.



**4221 – *Pluchea sericea* Alliance**  
Arrow weed thickets Alliance



In this example, *Pluchea sericea* grows in dense thickets hugging the edges of a channelized watercourse.



This photo portrays *Pluchea sericea* growing in a thicket at the low-lying base of a slope along the margins of the Colorado River Floodplain.

#### 4221 – *Pluchea sericea* Alliance

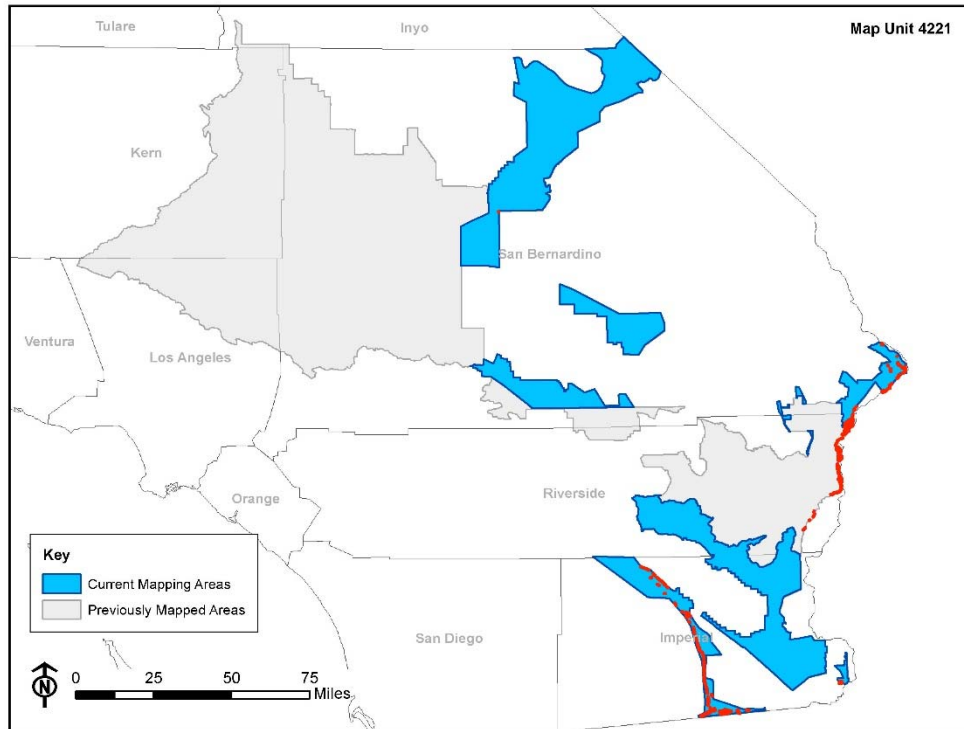
**DESCRIPTION:** In stands of this Alliance *Pluchea sericea* is present in the canopy with at least 2 percent absolute cover and no other shrub species having equal or greater cover. *Baccharis salicifolia*, *Atriplex* spp. *Tamarix* spp., and *Ericameria nauseosa* are among the other shrubs that may be present. Stands occur around springs, seeps, irrigation ditches, canyon bottoms, stream sides, and seasonally flooded washes. Stands are found abundantly on the Colorado River floodplain on alkaline terraces adjacent to *Prosopis glandulosa*, *Suaeda moquinii*, *Tamarix* spp., and occasionally freshwater marsh stands.

**PHOTOINTERPRETATION SIGNATURE:** Stand cover ranges from sparse to very dense. Dense stands may appear as a fine-textured thicket, varying minimally in height. Disturbance from clearings and flooding may lead to seasonal dieback. Mature individuals have narrow crowns. In dense, thicket-like settings, signature color is characteristically blue-green except in areas experiencing a high rate of plant senescence, where colors tend to be gray.

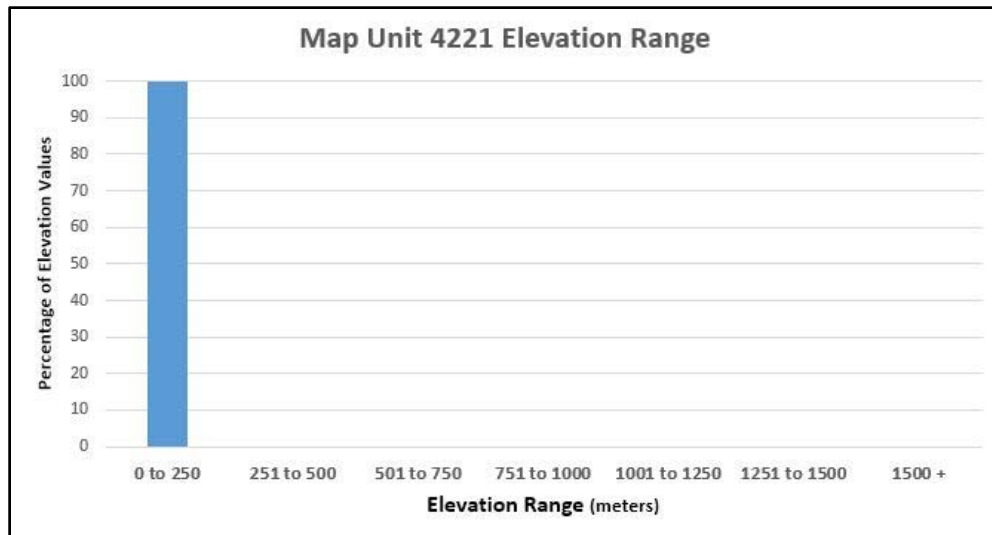
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Tamarix* spp. Semi-natural Stands (1432) – This type is primarily distinguished by their taller size and rusty brown tints in portions of the stand. Overall signature texture is not as smooth and is more variable across the stand. Stands of *Pluchea* are somewhat more restricted to perennial sources of water such as irrigation canals and stream margins.
- *Atriplex lentiformis* Alliance (3722) – These shrubs often occur in adjacent stands and prefer drier sites on alkaline soils, often in post disturbance clearings. Shrub cover is generally lower, with visible patches of bare ground.
- *Atriplex polycarpa* Alliance (4113) – Stands dominated by *A. polycarpa* occur in upland settings. Crowns are generally rounded with a more distinct edge. Cover densities between the two types overlap considerably; however, *A. polycarpa* is commonly open and is never found in thicket-like settings. Stands of *A. polycarpa* are more common near and on old agriculture fields on less active portions of the Colorado River floodplain.
- *Atriplex canescens* Alliance (5111) – In stands occurring nearby or adjacent to *Pluchea sericea*, this Alliance is found in settings and cover almost identical to *Atriplex lentiformis*.

4221 – *Pluchea sericea* Alliance



**DISTRIBUTION:** In the original study area stands are limited to Colorado River floodplain. Within the 2014-2016 mapping region, stands of *Pluchea sericea* continue along the Colorado River in the Whipple Mountains zone and are frequently mapped along narrow corridors adjacent to the East Highline and All American Canals in the Salton Sea Trough zone.





**4222 – *Prosopis glandulosa* Alliance**  
Mesquite bosque, mesquite thicket Alliance



*Prosopis glandulosa* occurs here (red polygons) along a dry lake in varying cover. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The photo displays a *Prosopis glandulosa* occupying a sandy fringe along the Mojave River.



#### 4222 – *Prosopis glandulosa* Alliance

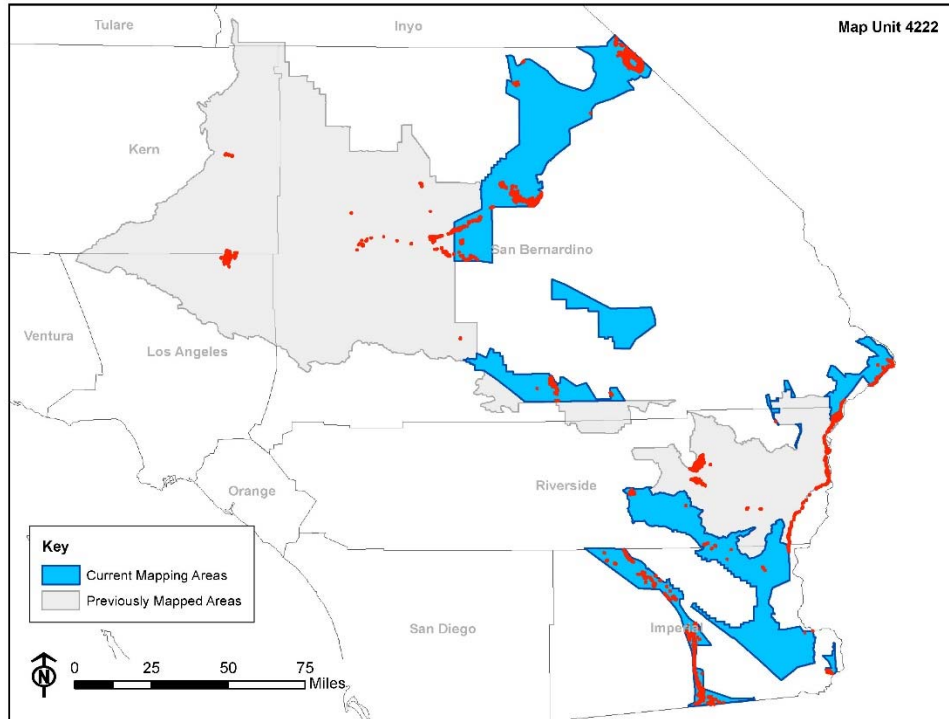
**DESCRIPTION:** In this Alliance *Prosopis glandulosa* comprises more than 3 percent of absolute cover as the dominant plant (including shrub and trees together), not exceeded in cover by any other species of microphyllous tall shrub or tree. In stands where *P. glandulosa* is consistent in the tall shrub/short tree layer with *Tamarix*, the stand is mapped to *P. glandulosa* even when *Tamarix* dominates the stand. The Alliance is usually associated with stabilized dunes or sand sheets adjacent to playas or basins. Stands were mapped even if there was very low cover, especially where there was evidence of recent die-off due to diminishing water supply from groundwater pumping, etc. Stands observed along the Mojave River near Daggett-Yermo are almost completely dead, but were mapped where possible.

**PHOTOINTERPRETATION SIGNATURE:** Stands range in cover from sparse to moderately dense, with the small trees appearing bluish gray to dark green in color. Some stands with heavy die-off can appear light gray to dark gray in color with very little green signature. The tree crown is rounded with a well-defined edge. These small trees typically occur on small sandy mounds, often giving them a hummocky appearance.

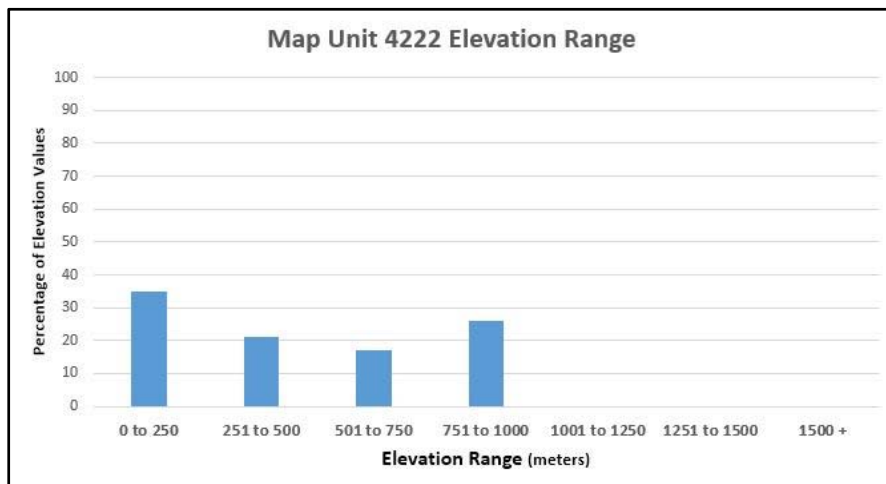
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Tamarix* spp. Semi-natural Stands (1432) – Shrubs from this Alliance have a less distinct crown and dense stands have a smoother, less hummocky texture. *Tamarix* often occurs in dense cover where it is a sole dominant. Signature, color, and tones are highly variable due to a frequent dead component across the stand.

**4222 – *Prosopis glandulosa* Alliance**



**DISTRIBUTION:** Stands of this Alliance are found along the margins of Koehn, Buckhorn, Rogers, and Palen Dry Lakes, along the Mojave River by Hinkley, and near Newberry Springs. Stands also occur near and along the Colorado River floodplain. Within the 2014-2016 mapping region, stands are common along Cronese and Troy Dry Lakes, and on dunes along the west side of Mesquite Dry Lake near Twentynine Palms. The larger Mesquite Dry Lake (in the northeasternmost section of the mapping region) is completely ringed by the Alliance. Stands are also common along the Mojave River and to the south in the Salton Sea Trough zone along the East Highline Canal, where *P. glandulosa* frequently shares dominance with *Tamarix*.



**4224 – *Chilopsis linearis* Alliance**  
Desert willow woodland Alliance



The large grayish-green crowns of *Chilopsis linearis* are seen in a wash in this photo.



The sprawling bright green short tree in the foreground is *Chilopsis linearis* occurring in a gravelly wash.

#### 4224 – *Chilopsis linearis* Alliance

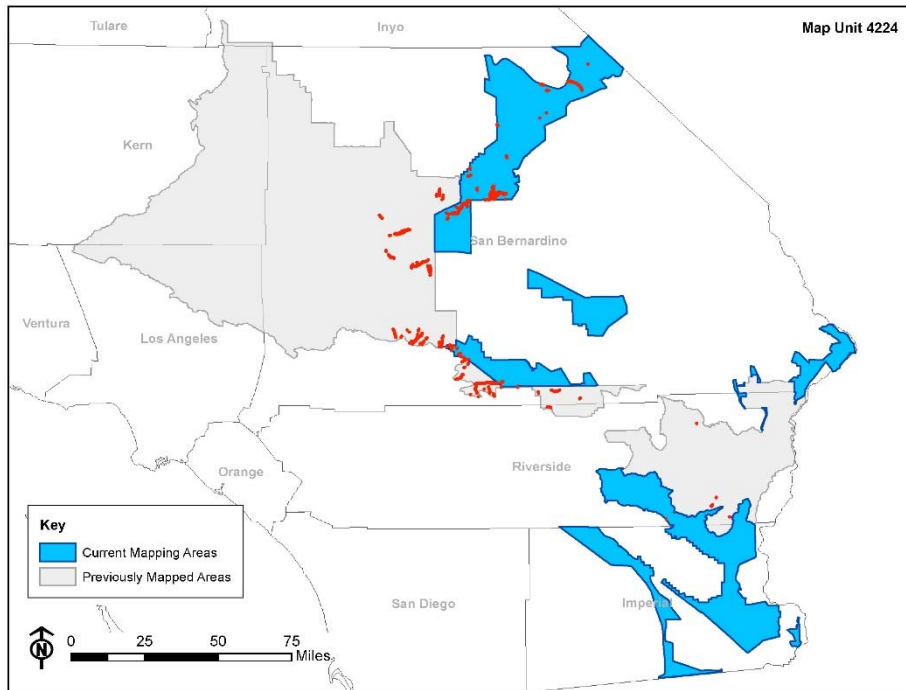
**DESCRIPTION:** Stands of this Alliance are dominated or co-dominated by *Chilopsis linearis*, which comprises at least 1 percent of the cover. *Chilopsis* is usually higher cover than any other tree, although stands may contain similar cover of *Acacia greggii* and/or *Prunus fasciculata*. The Alliance occurs in washes, intermittent channels, arroyos, or lower canyons that are intermittently flooded. Stands tend to occupy sandy or gravelly washes where wash energy is dissipated across a relatively wide flood path. *C. linearis* is also noted along washes where shallow bedrock or pediment forces underground water to flow up to or near the surface. Stands of the Alliance may be adjacent to *Ericameria paniculata*, *Ephedra californica*, *Ambrosia salsola*, *Atriplex polycarpa* or *A. canescens* in washes as far west as Daggett along the Mojave River. The Alliance does not range up into mountain valleys and narrow arroyos as much as the *Acacia greggii* or *Prunus fasciculata* shrublands do, and does not tend to occupy the most active wash centers where *Psoralea spinosus* more likely occurs. Stands are rarely found at permanent springs or seeps and are not usually associated with *Populus fremontii*, *Salix* spp., or other true riparian species.

**PHOTOINTERPRETATION SIGNATURE:** Stands may be sparse to moderately dense in cover with individuals exhibiting a gray to grayish green, diffuse, irregularly shaped crown with a coarse texture. Individual plants can be quite large, at times measuring over 5 meters across. Plants appear scattered apart and follow the edges of large high-energy washes, creating stands that are linear in shape with a white sandy substrate.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Tamarix* spp. Semi-natural Stands (1432) – Typically this plant has a darker green color and is not restricted to washes and adjacent terraces.
- *Ericameria paniculata* Alliance (4213) – Shrubs are smaller in size and occupy lower energy, less well-defined wash channels.
- *Psoralea spinosus* Alliance (4225) – Smaller, lighter-colored crowns are not as dense and also tend to have a poorly defined margin. The irregular branching and upright growth patterns of this species many times displays shadows within or along the edge of the crown. This type is also found more in the center of active high energy channels; however, unlike *C. linearis*, they are not limited to large wash systems.
- *Acacia greggii* Alliance (4226) – These shrubs typically have a smaller crown and tend to occur higher upstream into mountain valleys and narrow arroyos.
- *Parkinsonia florida* – *Olneya tesota* Alliance (4227) – This dual-species Alliance occurs much more frequently in the mapping area and is limited to the Colorado Desert. Where the two Alliances co-occur, *Chilopsis* will occupy the most channelized portion of the largest wash systems, generally over a very small area. *Chilopsis* has a larger, denser and brighter green crown.

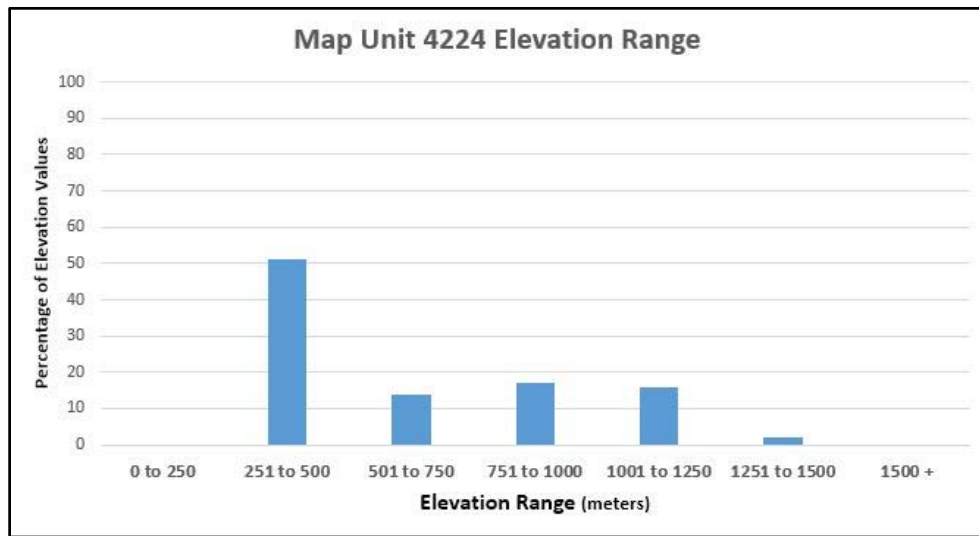
4224 – *Chilopsis linearis* Alliance



**DISTRIBUTION:** The highest concentration of stands occurs in the lower washes coming out of the eastern San Bernardino and Bighorn Mountains. Stands are found in large washes draining into the Mojave River in the Alvord, Daggett, Ord, and Rodman Mountains, and in drainages on the north side of Joshua Tree National Park. A large stand is found in the bottom drainage running through the town of Joshua Tree. Stands also occur in some of the tributaries (Chaparrosa Wash) that feed into Pipes Wash. Stands were rarely found in the Colorado Desert portion of the original study area, but a few localized patches occur in washes near the Little Chuckwalla and Mule Mountains. Within the 2014-2016 mapping region, *Chilopsis linearis* is found only in the Central and Eastern Mojave Desert regions. Small stands occur in isolated locations in washes coming out of the eastern foothills of the San Bernardino Mountains. Stands are widespread and common along more active portions of the Mojave River from Manix Wash east to where it empties into East Cronese and Soda Dry Lakes. Several large stands are also found in the Shadow Valley, in the upper reaches of Kingston Wash.



4224 – *Chilopsis linearis* Alliance



**4225 – *Psorothamnus spinosus* Alliance**  
Smoke tree woodland Alliance



The photo shows the irregularly shaped gray crown of *Psorothamnus spinosus* dominating a wash channel with a few *Parkinsonia florida* seen in the lower end of the stand as the larger, green crown.



In this example *Psorothamnus spinosus* dominates a wash, and displays its characteristic grayish-blue crown and upright sprawling branches.

#### 4225 – *Psorothamnus spinosus* Alliance

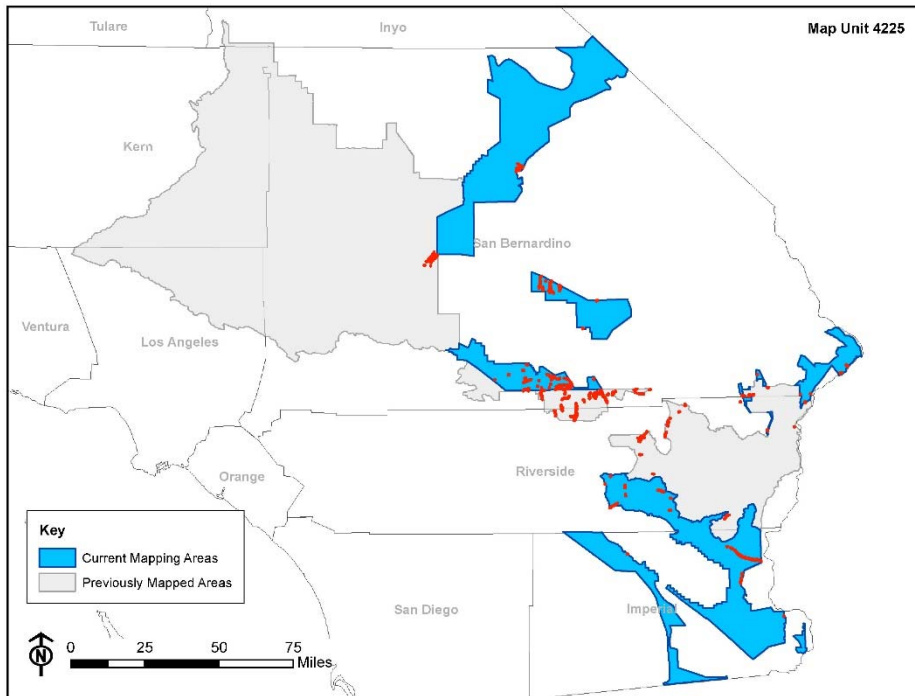
**DESCRIPTION:** In this Alliance, *Psorothamnus spinosus* is dominant or co-dominant in the tree canopy. *Psorothamnus spinosus* is consistently distributed in low-energy washes, normally at greater than 1 percent cover. *Chilopsis linearis* may occur in some stands at equal cover. *Larrea tridentata* or *Ambrosia salsola* may be similar in cover. *P. spinosus* is more commonly found in the Colorado Desert, often in the most active portion of the wash adjacent to *Parkinsonia florida* or *Olneya tesota*. It is often associated with *Ericameria paniculata* or *Ambrosia salsola* washes, and occasionally with *Ephedra californica* stands.

**PHOTOINTERPRETATION SIGNATURE:** Stands can be sparse to moderately dense in cover with a diffuse, irregularly shaped crown edge. The trees appear gray to grayish blue in color with irregular and upright branching that casts shadows within or along the edge of the crown. The shrubs typically occur in the active channel of the wash and many times form meandering linear stands. Stands containing a sparse cover are often so lightly colored that they cannot be distinguished from the similarly colored wash substrate.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

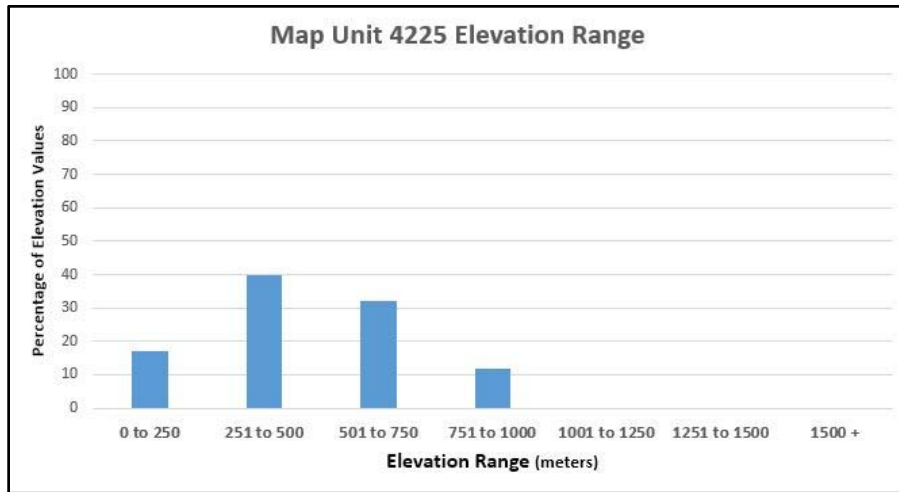
- *Ericameria paniculata* Alliance (4213) – Shrubs have a green to dark green color with a dense rounded crown.
- *Prunus fasciculata* Alliance (4214) – Plants are rounded with well-defined dark green crowns.
- *Chilopsis linearis* Alliance (4224) – These trees are typically larger in size and have rounded to irregularly shaped crowns with a coarse texture. Colors range from gray to grayish green.
- Unvegetated wash and river bottom Mapping Unit (6114) – In stands where *Psorothamnus spinosus* individuals are small and widely scattered, they may be difficult to detect, and the area may be mistaken for this Mapping Unit. Shadows cast by *P. spinosus* individuals may be visible on finer-resolution imagery to help make the distinction.”

4225 – *Psorothamnus spinosus* Alliance



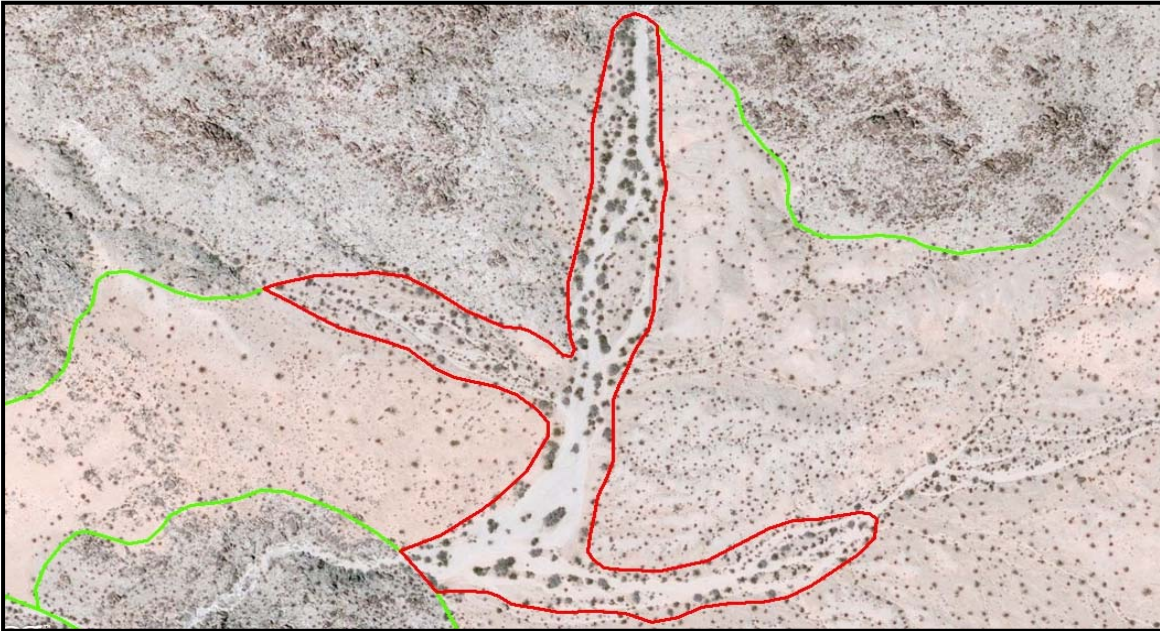
**DISTRIBUTION:** The highest concentration of stands occurs in drainages coming out of the Pinto Mountains between Twentynine Palms and Dale Dry Lake. There are some localized stands along Kane Wash between the Newberry and Rodman Mountains, representing the westernmost limit of this species' range. Stands are found east of the Coxcomb Mountains in the flats of Palen Valley and in drainages east of the Eagle Mountains in Chuckwalla Valley, and along the Colorado River floodplain. Within the 2014-2016 mapping efforts, this Alliance occurs in weak wash systems near the Lava Hills. Stands are more common in washes draining the northern portions of Joshua Tree National Park. Further south, stands occur in the Chuckwalla and Chocolate Mountains zone, where significant portions of Milpitas Wash contain broad swaths of *P. spinosus*, especially in the more active portions of the channel.

4225 – *Psorothamnus spinosus* Alliance





**4226 – *Acacia greggii* Alliance**  
Catclaw acacia thorn scrub Alliance



In this narrow wash channel, the larger rounded gray *Acacia greggii* dominates the shrub layer.



The wash in this photo is dominated by the wispy green *Acacia greggii* in the foreground mixed with the smaller tawny *Ambrosia salsola* in the background.

#### 4226 – *Acacia greggii* Alliance

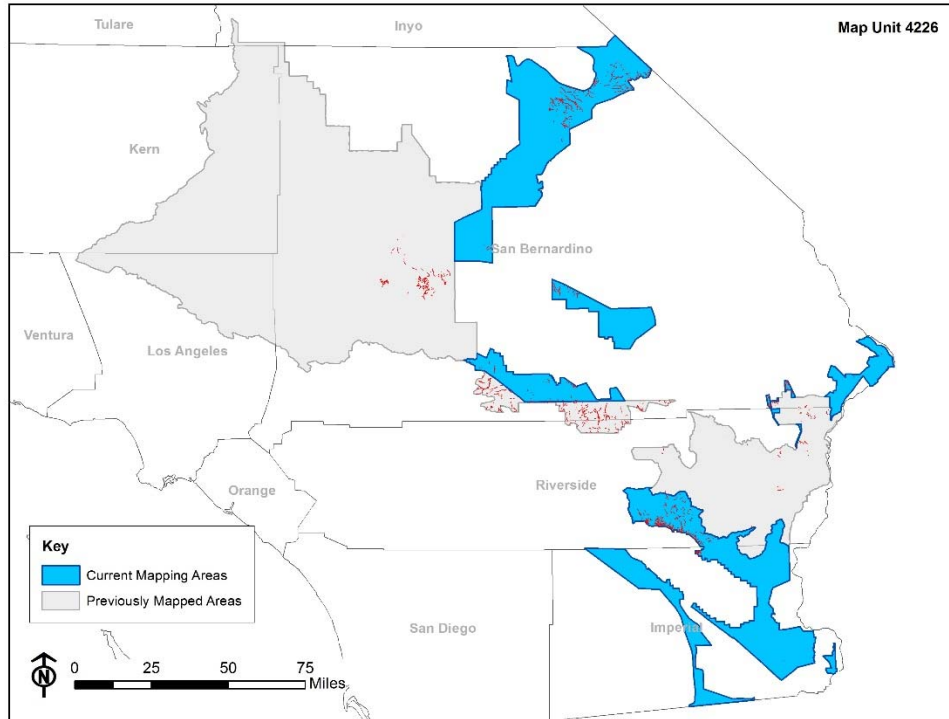
**DESCRIPTION:** In this Alliance *Acacia greggii* is dominant, co-dominant, or subdominant in the shrub canopy and comprises more than 2 percent of the cover. *Prunus fasciculata* or *Hyptis emoryi* may be of equal or slightly greater cover than that of *Acacia*. Smaller shrubs such as *Ericameria paniculata* or *Ambrosia salsola* can have higher cover but no more than twice the cover of *Acacia greggii*. Stands of this Alliance occur in washes and arroyos, as well as in upland valleys and on bouldery slopes. *Acacia greggii* proliferates after disturbances such as flood and fire.

**PHOTOINTERPRETATION SIGNATURE:** This is a taller shrub species often forming irregularly shaped, small but distinct patches along the margins of active channels. Crowns tend to be dense with a dark gray or dark brown color, sometimes with a green tint. Stands can range from sparse to moderately dense in cover and follow linear stream patterns, many times flowing out of mountain canyons and along the base of hills.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

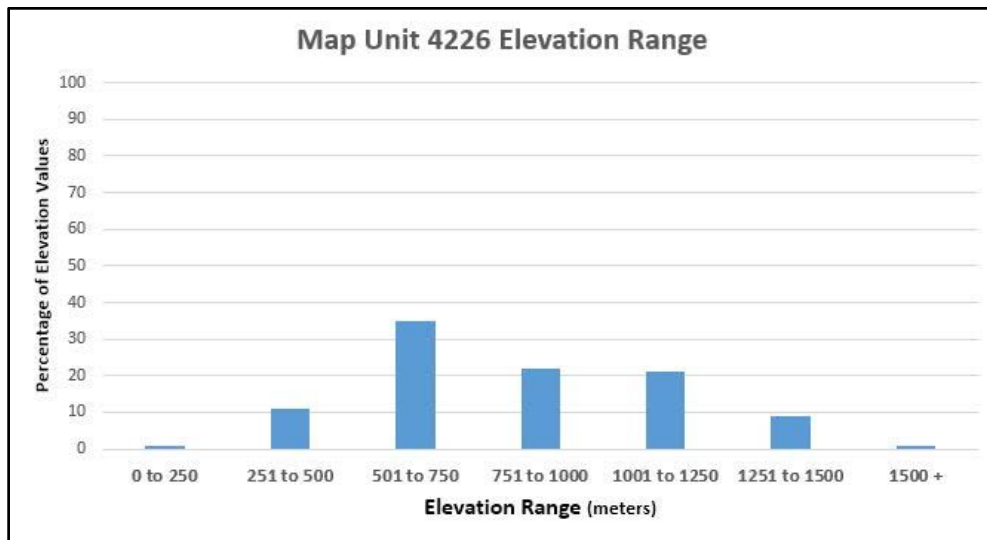
- *Larrea tridentata* Alliance (4119) – Large individuals of this species can occupy all portions of weaker washes and can be confused with *Acacia greggii*. *L. tridentata* generally has a rounder crown and is less likely to clump with other individuals, whereas this is a common occurrence in the *A. greggii* Alliance. Wash substrate where *L. tridentata* dominates has a less scoured appearance, and is therefore more likely to contain a higher weedy herbaceous component.
- *Ericameria paniculata* Alliance (4213) – Shrubs are green to dark green color with a dense rounded crown and tend to occur in less active broader washes.
- *Prunus fasciculata* Alliance (4214) – This species appears greener in color with more of a well-defined crown margin.
- *Psoralea spinosus* Alliance (4225) – Stands of *P. spinosus* tend to occur in higher-energy washes in the most active portion of the channel. Signature characteristics are similar; however, *Psoralea* generally has a larger crown. Stands tend to occur in sparser cover.
- *Hyptis emoryi* Alliance (4228) – These plants have a similar signature with a slightly grayer, more diffuse crown. This species rarely forms dense patches and is more common in very narrow rivulets, often between pavement surfaces.

4226 – *Acacia greggii* Alliance



**DISTRIBUTION:** In the original study area, stands of *Acacia greggii* are concentrated within two areas. The area of highest concentration is along the northern boundary of Joshua Tree National Park from Pioneertown eastward to past the Sheephole Mountains. The other is southeast of Barstow from Stoddard Ridge east to Rodman Mountains down to the edge of Lucerne and Johnson Valleys. A few disjunct stands occur adjacent to Little Chuckwalla Mountains, in drainages within the Big Maria Mountains, and in washes along the northern fringe of Riverside Mountains. Within the 2014-2016 mapping region, stands are widespread and common in the Eastern Mojave Desert region; less common but widespread in the Central Mojave Desert region; and fairly common at higher elevations in the Chuckwalla and Chocolate Mountains zone. Stands are absent further south and in the Salton Sea Trough zone.

4226 – *Acacia greggii* Alliance





**4227 – *Parkinsonia florida* – *Olneya tesota* Alliance**  
Blue palo verde – ironwood woodland Alliance



This image depicts a *Parkinsonia florida* – *Olneya tesota* wash. The light green *P. florida* contrasts with the gray crown of the *Olneya* trees.



The photo shows the taller *Olneya tesota* scattered along the gravelly wash. *Larrea tridentata* is scattered along the margins of the wash in the foreground.



#### 4227 – *Parkinsonia florida* – *Olneya tesota* Alliance

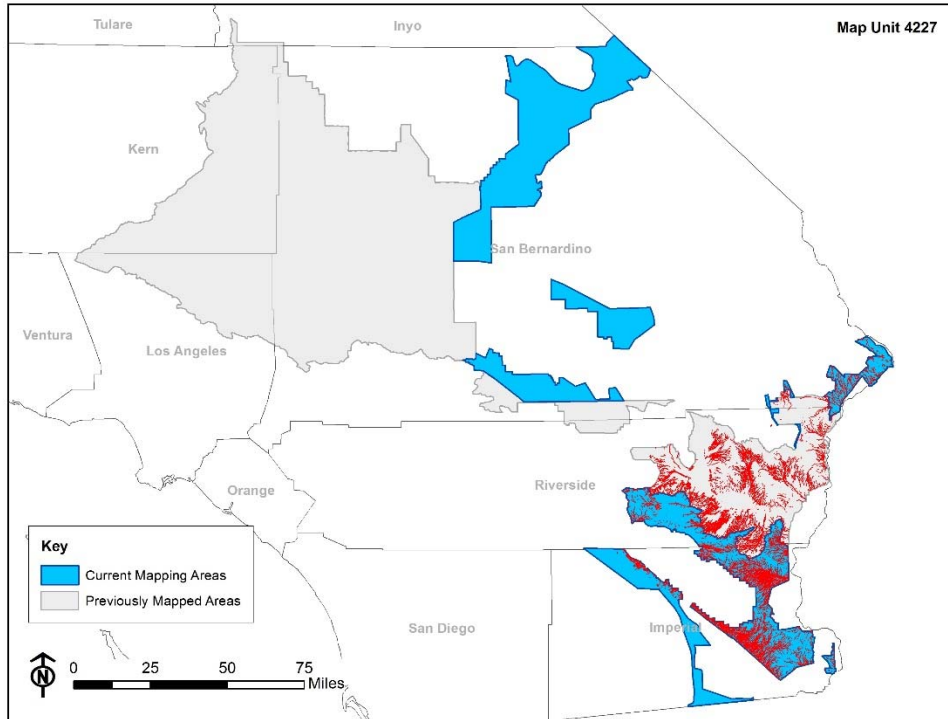
**DESCRIPTION:** In this Alliance either *Olneya tesota* or *Parkinsonia florida* is dominant, or they co-dominate the tree canopy. They can occur together or on their own at usually greater than 2 percent cover. Associated species may include *Larrea tridentata* and *Ambrosia salsola*, which may be similar in cover to *Olneya tesota* and/or *Parkinsonia florida*. Stands occur east and south of Joshua Tree National Park. They are usually found in washes but occasionally are spread out over the middle portions of large alluvial fan systems.

**PHOTOINTERPRETATION SIGNATURE:** *Parkinsonia florida* has a dense light green crown with a coarse texture and roughly defined crown margin. *Olneya tesota* has a grayish to gray-brown color with an irregularly shaped crown. Individuals of both species vary greatly in size within stands and can range from open to moderately dense in cover.

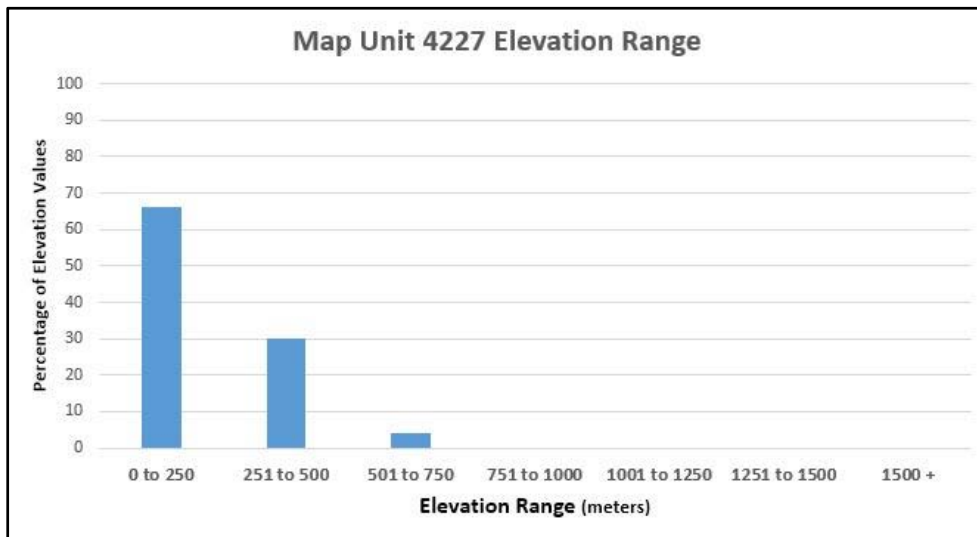
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115) – Stands in the Colorado Desert often contain a small emergent cover of *Olneya tesota* occupying small rivulets incised within broad, extensive alluvial deposits. Determining sparse cover values around the 3 percent threshold, which defines the *Parkinsonia* – *Olneya* Alliance, is often quite difficult especially when the trees are small.
- *Parkinsonia microphylla* Alliance (4152) – Stands dominated by the appropriately named Foothill palo verde are separated by their setting; they grow in the gentle to moderately sloping foothills of the Whipple Mountains. They generally maintain a consistent cover across the stand, usually in low to moderate cover. Large washes bisecting the foothills containing *Olneya tesota* are mapped to *Parkinsonia florida* – *Olneya tesota* Alliance.
- *Chilopsis linearis* Alliance (4224) – Stands are infrequent within the range of the *Parkinsonia florida* – *Olneya tesota* Alliance. However, when present, they generally occur only along the margins of very large active wash systems adjacent to *Olneya* or *Parkinsonia*. Crowns are large and tend to be a brighter green. Small clusters of *Chilopsis* are dense and form irregular shapes.

**4227 – *Parkinsonia florida*-*Olneya tesota* Alliance**

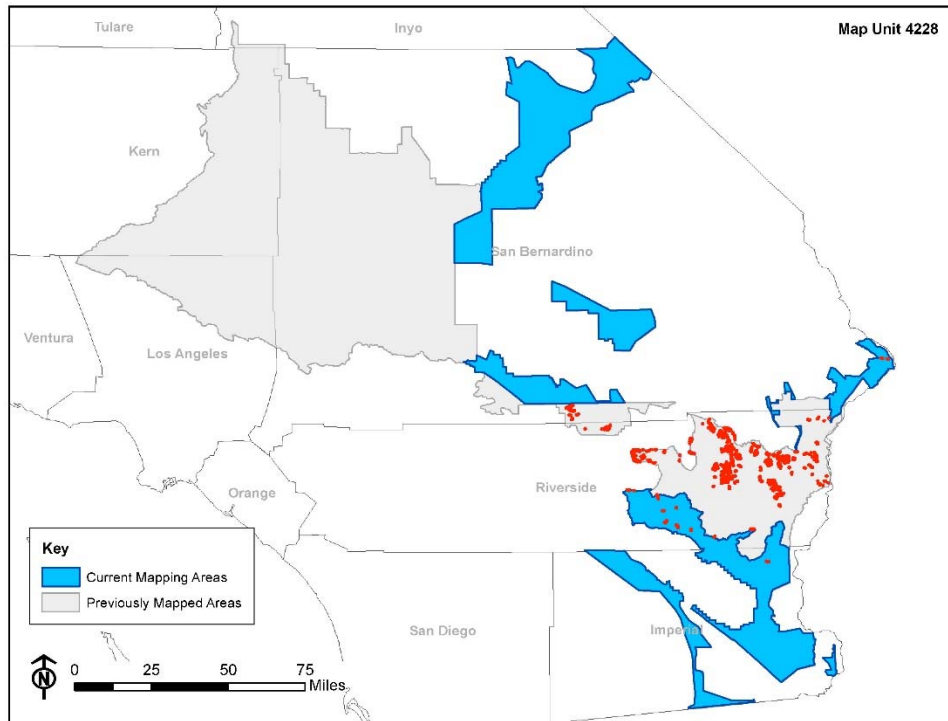


**DISTRIBUTION:** *Parkinsonia florida*-*Olneya tesota* Alliance occurs exclusively in the Colorado Desert region of the study area. These woodland stands are prevalent in lowland washes, active alluvial fans, and higher gradient canyon washes throughout this region. Almost all stands occur below 800 meters in elevation. Within the 2014-2016 mapping region, this Alliance is found only in the Chuckwalla and Chocolate Mountains zone, the northern half of the Salton Sea Trough zone, and in the Whipple Mountains zone and the Rice and Vidal Valleys zone.



## 4228 – *Hyptis emoryi* Alliance

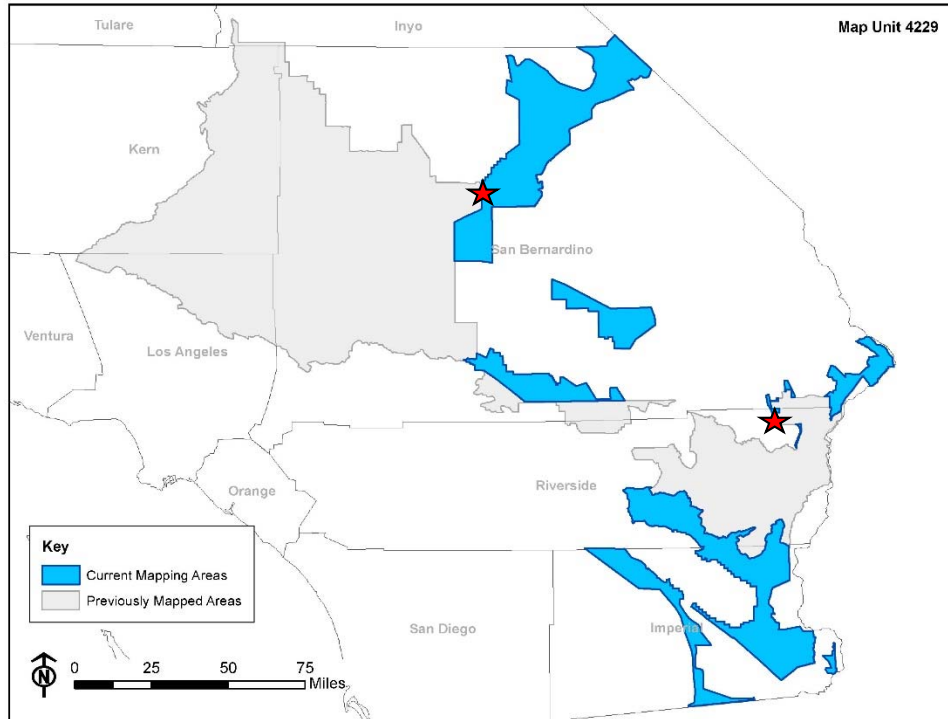
Desert lavender scrub Alliance



**DISTRIBUTION:** Stands of the *Hyptis emoryi* Alliance occur in narrow upland canyons and alluvial fans east of Twentynine Palms along the northeastern fringe of Joshua Tree National Park. Stands are common in the Colorado Desert in small mountain washes and rivulets between desert pavement. Within the 2014-2016 mapping region, washes dominated by this Alliance are fairly common in similar settings. However, since most stands are significantly less than 10 meters wide, they are generally too narrow to map for this effort. Several larger washes containing this Alliance are found in narrow south-trending canyons on the mid and lower slopes of the Chuckwalla Mountains.

## 4229 – *Castela emoryi* Special Stands

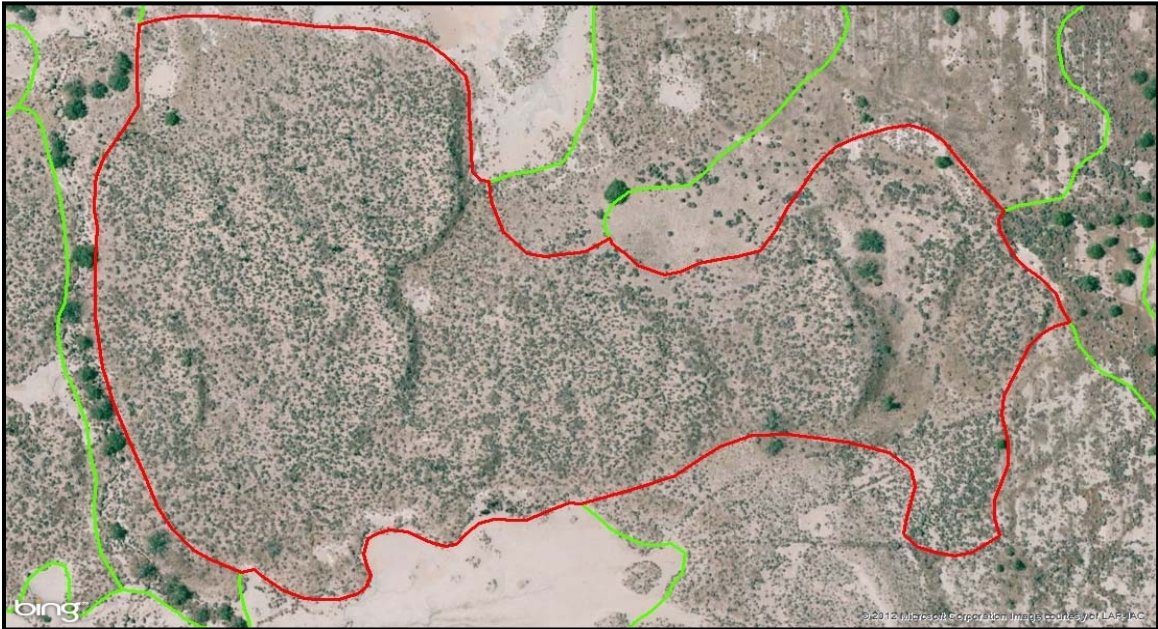
### Crucifixion thorn Special Stands



**DISTRIBUTION:** Stands of the rare crucifixion thorn plant are mapped in two locations within the DRECP mapped area. One, a stand containing less than 50 individuals occurs on the southern edge of a small silty playa about 3 miles north of Interstate 15 off a power line road. A much larger stand described in Bell and Herskovits (2013) is mapped in a series of small playas adjacent to sand formations in the Rice Valley about 5 miles south of town of Rice. This stand is approximately 200 acres in size and locally co-dominates with *Larrea tridentata*. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



**5111 – *Atriplex canescens* Alliance**  
Fourwing saltbush scrub Alliance



*Atriplex canescens* occurs as grayish blue clumps on sandy hills mixing here with a sparse emergent cover of *Yucca brevifolia*. White scalds of sparse *Suaeda moquinii* border to the north and south.



*Atriplex canescens* appears in the foreground, and is mixed with emergent *Yucca brevifolia* and *Larrea tridentata* in the background.



## 5111 – *Atriplex canescens* Alliance

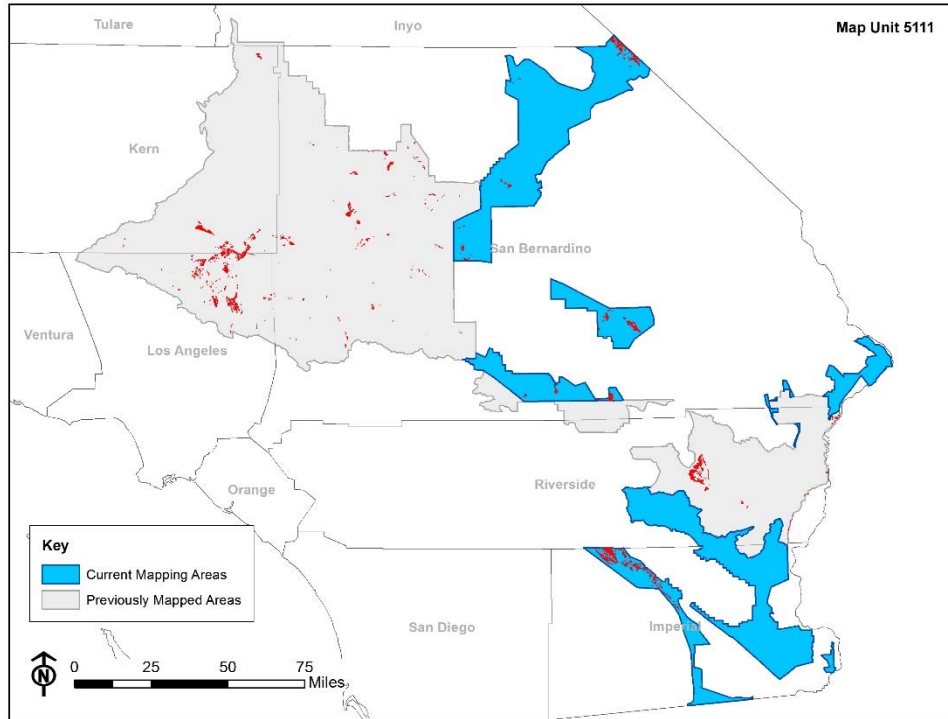
**DESCRIPTION:** This Alliance is mapped where *Atriplex canescens* characterizes stands, typically with the highest cover, though *Ambrosia dumosa* or *Atriplex polycarpa* may have similar cover. Some stands have emergent *Yucca brevifolia*. This species prefers sandy substrates, usually stabilized dunes or sand ridges, and also sandy washes surrounded by *Larrea tridentata* – *Ambrosia dumosa*, *Yucca brevifolia* or *Yucca schidigera* Alliances. Stands with co-dominant *Ephedra californica* or *E. trifurca* are mapped as the *Ephedra californica* Alliance. The *Atriplex canescens* Alliance may occur above 1000 meters (3280 foot) elevation in sandy washes in granitic mountains (such as the Sidewinder Mountains). The subspecies *linearis* prefers saltier or more alkaline sand at the edges of Coyote Dry Lake, adjacent to *Suaeda moquinii* (downslope) or *Atriplex polycarpa* (upslope). A different but ecologically similar subspecies, *A. canescens* var. *laciniata*, occurs around the low dunes and playa margin at Palen Dry Lake. This variety also appears to be more salt-tolerant and can occur in low numbers adjacent to *Allenrolfea occidentalis* on the playa. If *A. canescens* and *Allenrolfea occidentalis* co-dominate, the Alliance is the latter.

**PHOTOINTERPRETATION SIGNATURE:** Except in washes, cover is usually highly variable within the stand because of variability in the sand content of the substrate. This type rarely forms dense or extensive stands. The signature most commonly appears brown to tan, less commonly gray to grayish blue. *Atriplex canescens* often has a darker tone and slightly larger crown than most other *Atriplex* species. They occur on mounded hummocks or small sandy hills, in or adjacent to sandy washes and in disturbance areas such as road corridors or cleared land. They also are mapped close to playa margins in similar sandy settings.

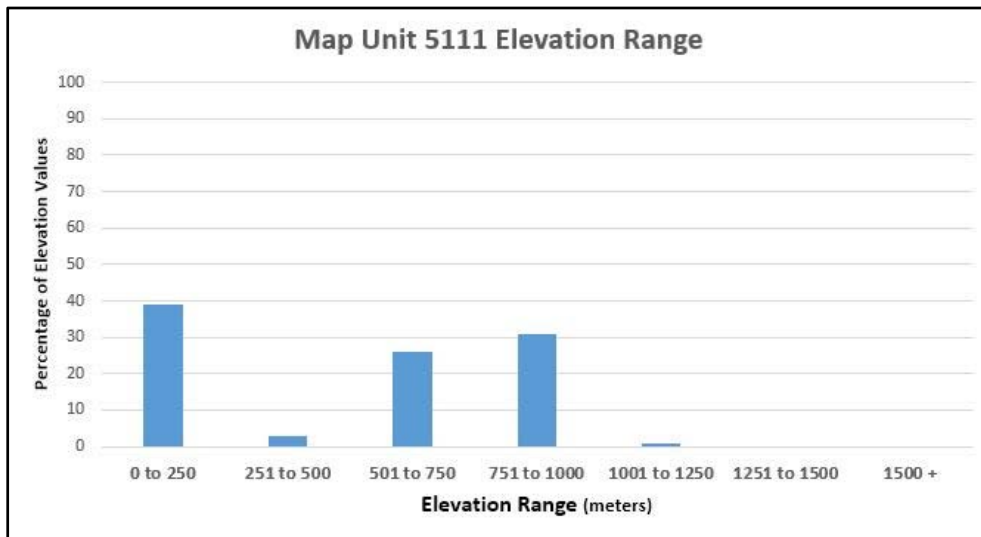
### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Allenrolfea occidentalis* Alliance (3721) – In playa margins, salt-tolerant varieties of this *Atriplex* at times co-occur with *A. occidentalis*. In these situations, the comma-shaped patterns that often result when *A. occidentalis* clones form a distinctive photo signature.
- *Suaeda moquinii* Alliance (3725) – In sandy, alkaline settings, it is almost impossible to distinguish the two shrubs. *S. moquinii* has on the whole a slightly more brownish-deep red color. Adjacent linear dunes may be indicators of *A. canescens* presence.
- *Atriplex polycarpa* Alliance (4113) – These shrubs more commonly occur in denser, more continuous stands along stream and wash corridors and upslope in less alkaline portions of the salt scrub communities surrounding larger playas.
- *Ambrosia salsola* Alliance (4216) – Shrubs are more directly related to disturbance (such as fire, clearings, washes) and typically have a smaller, gray crown.

**5111 – *Atriplex canescens* Alliance**



**DISTRIBUTION:** *Atriplex canescens* is found in every region of the study area and can occur in a variety of sandy settings including washes, edges of dunes, sandy hills and playa margins. There are very few stands in the northwest portion of the Northern Mojave region west of Cuddeback Dry Lake. Within the 2014-2016 mapping region, this Alliance occurs in the Central Mojave and Eastern Mojave Desert regions, and further south in the Salton Sea Trough zone. Within these areas, *A. canescens* is found in all the settings described above.



**5112 – *Atriplex confertifolia* Alliance**  
Shadscale scrub Alliance



This large-scale image of *Atriplex confertifolia* shows the variation in shrub density and scalding within a single stand. The white, highly reflective scalding is a typical patterning for this type. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.



*Atriplex confertifolia* occurs in this photo as evenly spaced individuals over a grassy understory interspersed with some exposed scalding as shown in the upper left portion of the image.

## 5112 – *Atriplex confertifolia* Alliance

**DESCRIPTION:** This Alliance is mapped where *Atriplex confertifolia* dominates or co-dominates the shrub layer, typically with at least 2 percent absolute cover. Stands may occur in alkaline/saline valleys or playas but also occur in the upper mid-elevation Mojave Desert on rolling hills and slopes with higher pH substrates. Stands are particularly common in the northern portion of the mapping area on rhyolite, upland carbonate soils or in silty badlands. According to Charlton (in Lichvar et al., (2004)), at Edwards Air Force Base *Atriplex confertifolia* tolerates more saline and finer soils than *A. spinifera* (in areas that have high salt and clay concentrations from hydrological activity at lower elevations). When *Atriplex confertifolia* is co-dominant with *Suaeda moquinii* on playas, the Alliance is *S. moquinii*. If *A. confertifolia* and *Allenrolfea occidentalis* co-dominate, the Alliance is the latter. When *Atriplex confertifolia* is mixed with *Stanleya pinnata*, *Lepidium fremontii*, and *Atriplex lentiformis* var. *parryi*, the Alliance is *Atriplex confertifolia*. The Alliance is also called out as *Atriplex confertifolia* when *Atriplex confertifolia* is associated with pool and swale topography and *Lasthenia* spp. in the Antelope Valley, and when *Atriplex spinifera* and/or *Artemisia spinescens* are co-dominant with *A. confertifolia* on playa edges (as at Edwards Air Force Base).

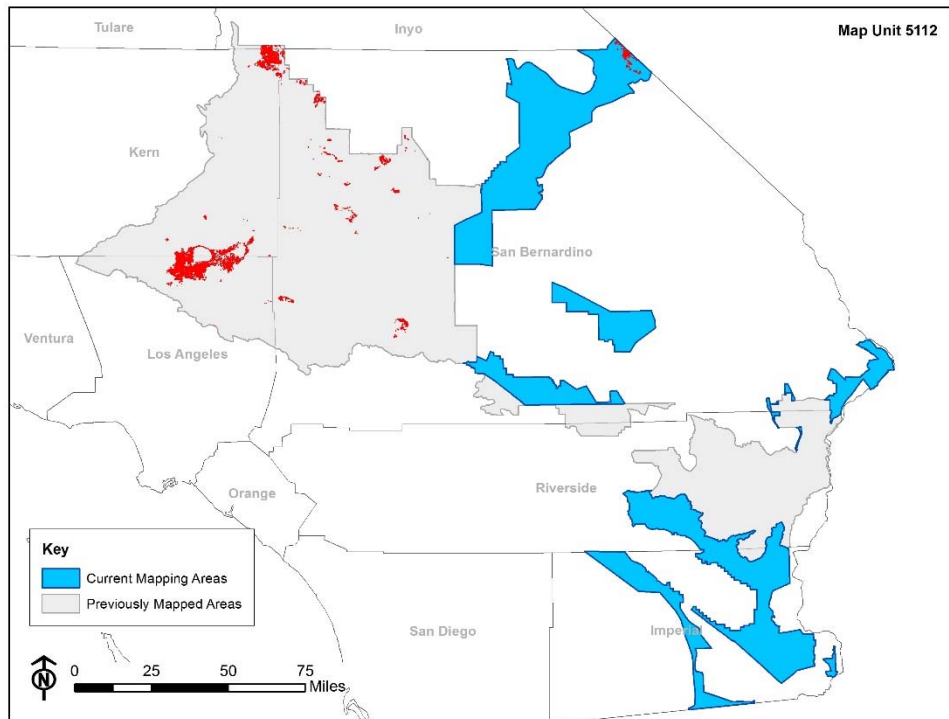
**PHOTOINTERPRETATION SIGNATURE:** Stand cover ranges from sparse to moderately dense with plants typically appearing as small rounded gray to gray-brown shrubs. Stands along playa margins and scalds often have variable shrub and herbaceous cover densities as well as a high diversity of shrub species. However, where disturbance occurs, species diversity is reduced and a denser grassy understory is more common. Examples of this setting are found in the Lancaster area, where *Yucca brevifolia* often occurs as a sparse, widely scattered emergent. *A. confertifolia* also occurs in very sparse stands on hills whose geologic substrate is composed of ancient alkaline lake deposits.

### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Allenrolfea occidentalis* Alliance (3721) – These plants do not form extensive stands and occur in closest proximity to the most alkaline and saturated portions of the playa and salt pannes.
- *Atriplex lentiformis* Alliance (3722) – These shrubs rarely form dominant stands and occupy more alkaline and saturated portions of playa margins or highly disturbed cleared sites.
- *Suaeda moquinii* Alliance (3725) – Shrub color typically has a darker, browner appearance.
- *Atriplex polycarpa* Alliance (4113) – Shrubs have a slightly larger crown size, appear bluish gray, and can form much denser stands.
- *Atriplex canescens* Alliance (5111) – Near Mesquite Lake (in the northeastern portion of the mapping area) both of these Alliances frequently occur nearby in adjacent stands. Separating the two Alliances in this area is extremely difficult because both occur in similar edaphic settings, making the signatures of each species alike. However, stands containing *A. canescens* in this region will often transition to sandier settings.



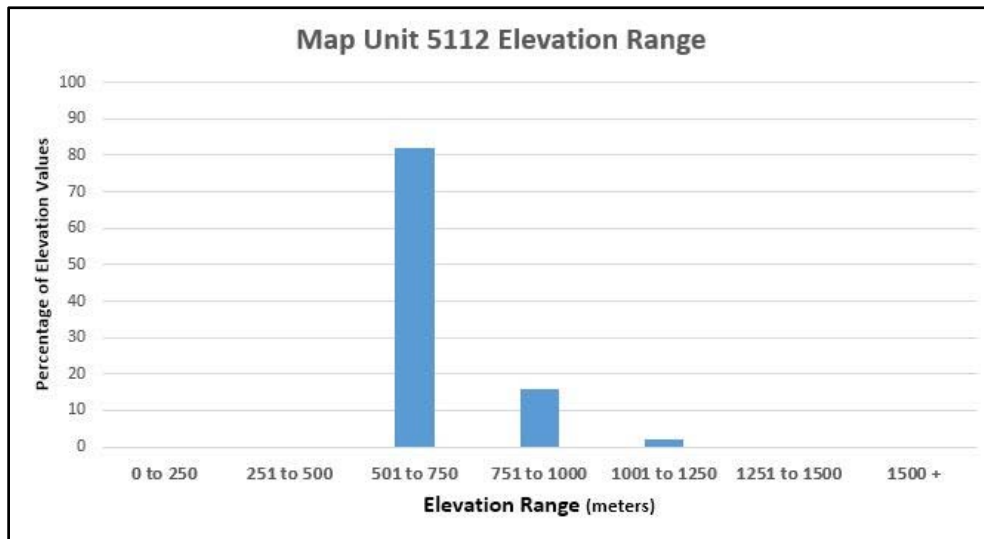
5112 – *Atriplex confertifolia* Alliance



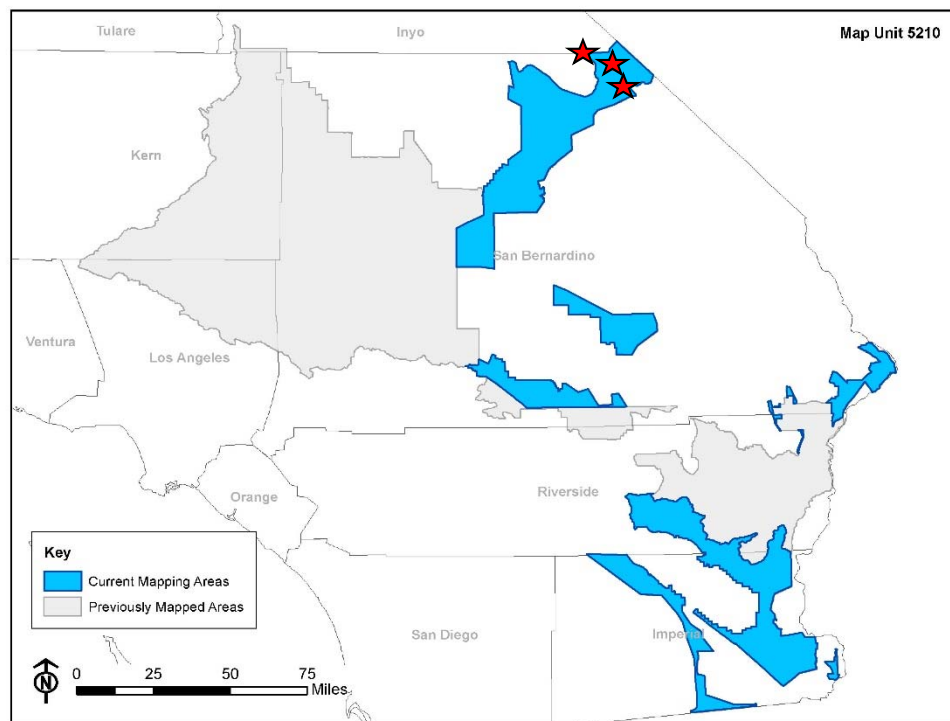
**DISTRIBUTION:** In the original study area this Alliance is restricted to the Antelope Valley, Northern Mojave, and the westernmost portion of the Central Mojave region. The mapping study area represents the southernmost extent of this type, which extends northeast into the cooler, wetter climates of the Great Basin and the San Joaquin Valley. *Atriplex confertifolia* is absent in the eastern portion of the Central Mojave Desert region and the Colorado Desert region due most likely to lower precipitation and higher average temperatures. Within the 2014-2016 mapping region, *Atriplex confertifolia* is mapped only in the Eastern Mojave Desert region north of Mesquite Lake. Several individual plants were noted elsewhere (especially near Troy Lake), but never attained sufficient cover to define as a stand.



5112 – *Atriplex confertifolia* Alliance



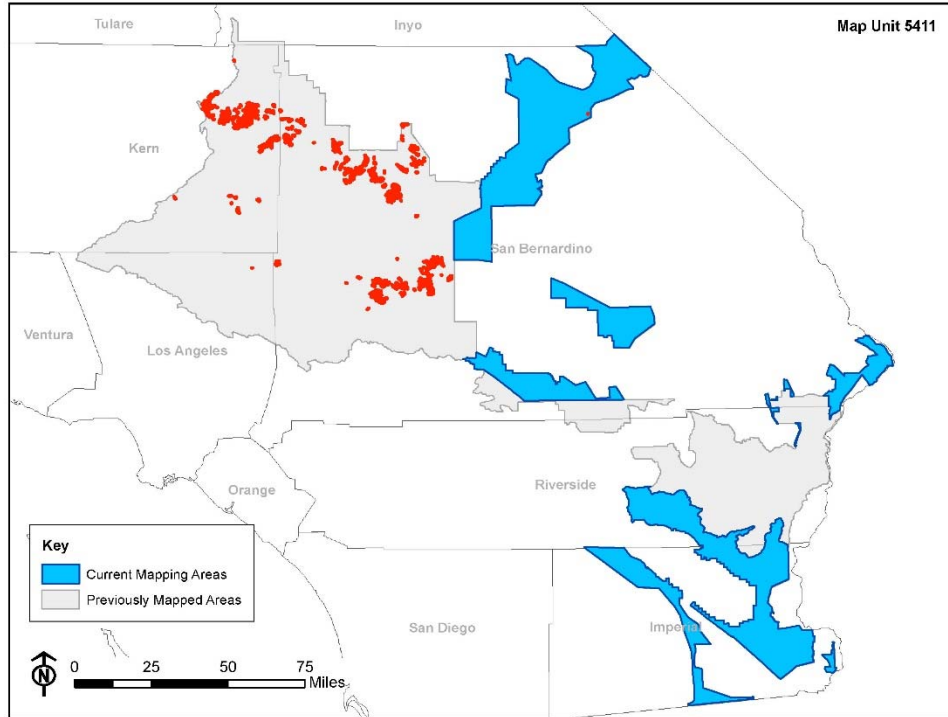
## 5210 – Intermontane seral shrubland Group



**DISTRIBUTION:** Few polygons were mapped at the Group level. The Group level is assigned to the vegetation type only when the photo signature and ecological characteristics make photointerpretation and modeling/extrapolation inconclusive for a specific Alliance call. Most of the polygons mapped involved recent disturbance, which creates a fine-scale matrix of several related vegetation types within this broader Group. Within the 2014-2016 mapping region, only a few sites comprising 740 acres are mapped in higher elevations near the Kingston and Mesquite Mountains. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.

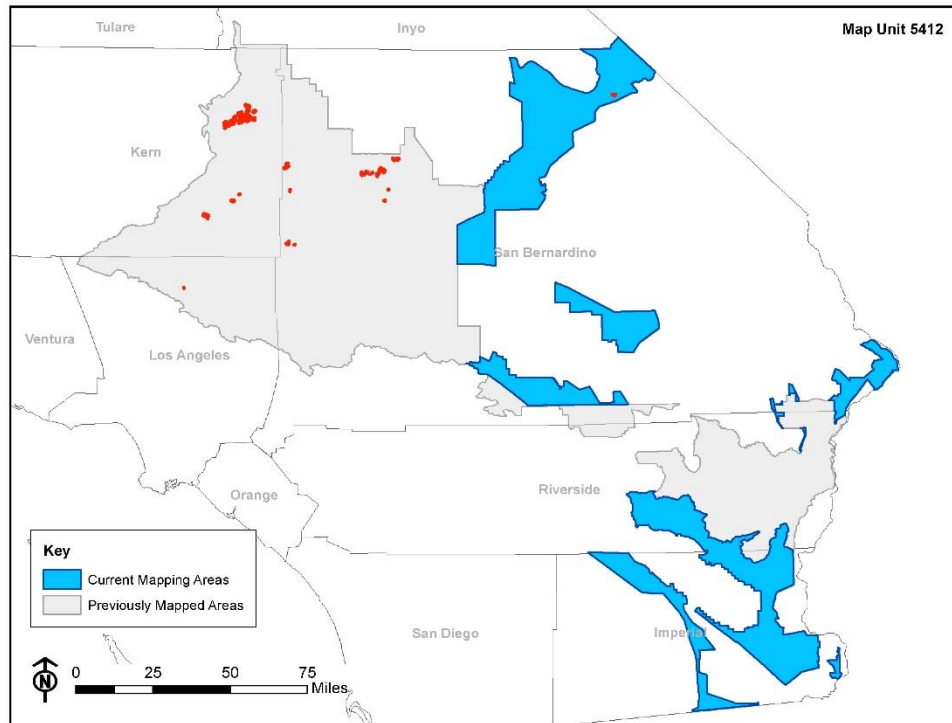
## 5411 – *Grayia spinosa* Alliance

Spiny hop sage scrub Alliance



**DISTRIBUTION:** *Grayia's* distribution is centered in the Great Basin Desert, but stands do occur commonly in the higher portions of the northern and western Mojave Desert. The largest concentration of stands occurs along the northern fringe of the Western and Central Regions of the Mojave Desert. Areas include valleys and mountains adjacent to Superior Dry Lake, extending to the northwest into the Rand, Lava and El Paso Mountains, and across the flats and high elevation fans of the Indian Wells Valley. Another concentration of stands is located in protected canyons of the Newberry, Ord, Rodman, Sidewinder, and Stoddard Mountain ranges. No *Grayia* stands have been mapped in the study area south and east of the Ord Mountains. Only one 9-acre stand is identified and mapped in the 2014-2016 mapping region east of Squaw Mountain in a silty area of deep soils at 1250 meters (4100 feet) in elevation.

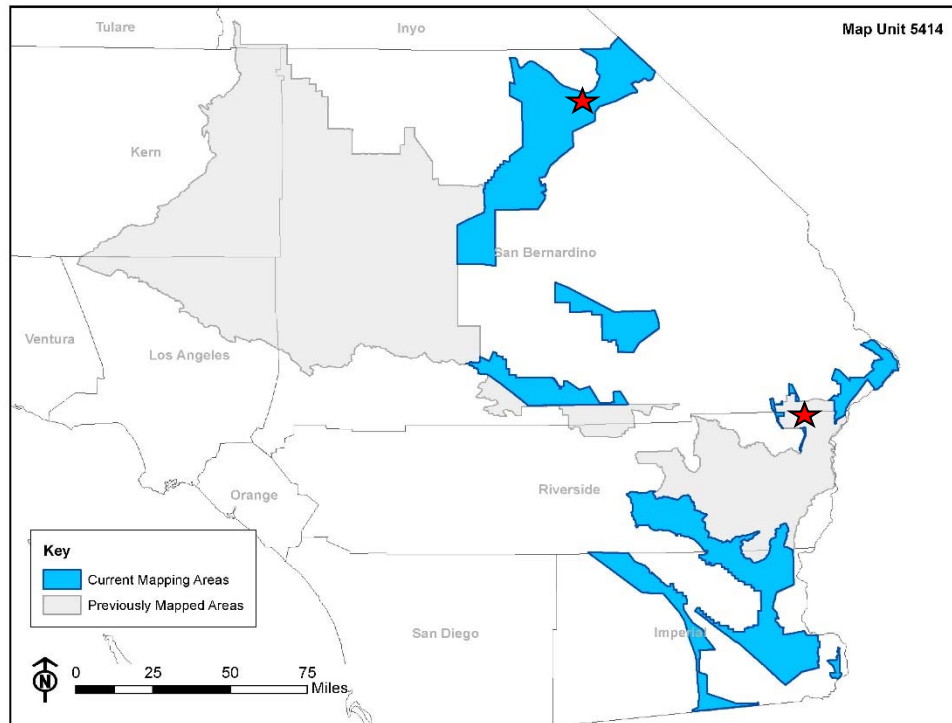
**5412 – *Krascheninnikovia lanata* Alliance**  
Winterfat scrubland Alliance



**DISTRIBUTION:** Stands were mapped along the base and toe slopes of the El Paso Mountains and on flats in the Superior Valley. Isolated stands are widely scattered in basins north of Edwards AFB and near Kramer Junction. Within the 2014-2016 mapping region, only one stand of 162 acres is mapped along Kingston Road in a disturbance setting at approximately 1000 meters (3300 feet) in elevation.

## 5414 – *Lycium andersonii* Alliance

Anderson's boxthorn scrub Alliance

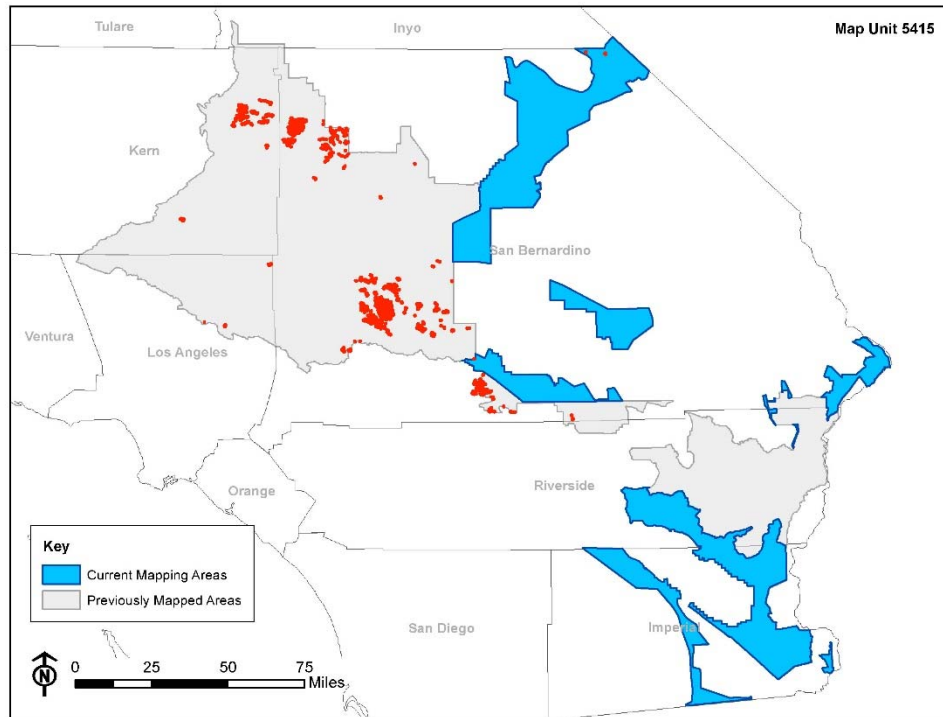


**DISTRIBUTION:** Only a few stands were mapped throughout the entire mapping region based on Accuracy Assessment field observations. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



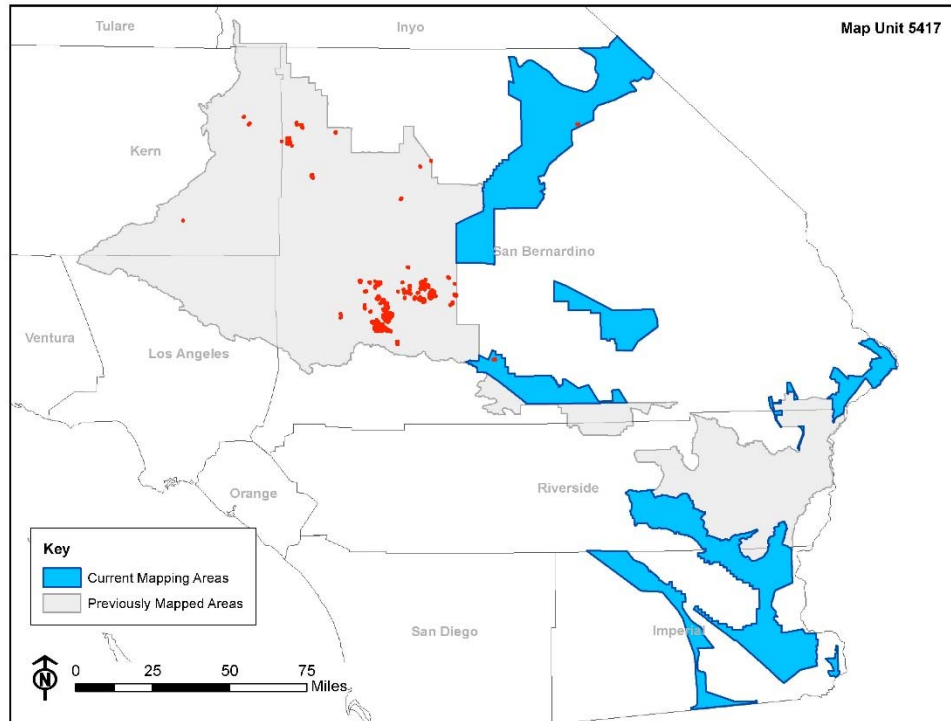
## 5415 – *Salazaria mexicana* Alliance

Bladder sage scrub Alliance



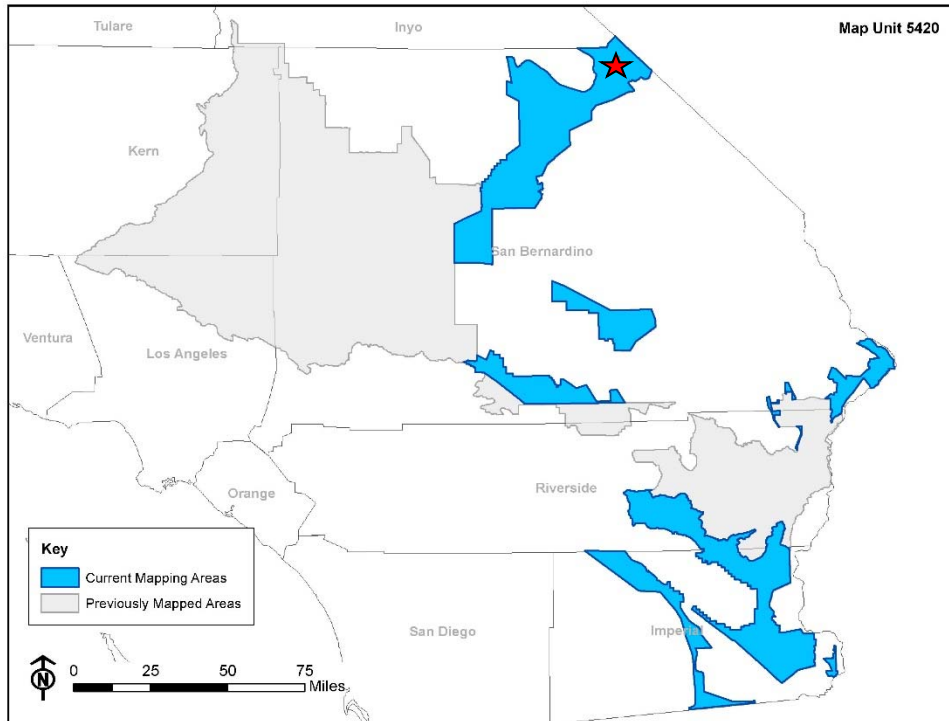
**DISTRIBUTION:** This Alliance occurs along washes and arroyos on alluvial fans surrounding the Black Hills northeast of Cuddeback Dry Lake and along steep north-facing slopes and protected canyons of the Lava Mountains. Extensive stands are also found in post burn settings on mountains adjacent to Lucerne Valley including the Fairview, Granite and Sidewinder Mountains. Stands, which are correlated with recent fire disturbance, are established in areas north of Pioneertown and along the south edge of Yucca Valley adjacent to Joshua Tree National Park. Within the 2014-2016 mapping region, only 52 acres are mapped on isolated hills between the Kingston Range and Mesquite Valley.

**5417 – *Ephedra viridis* Alliance**  
Mormon tea scrub Alliance



**DISTRIBUTION:** Most of the mapped stands are in the mountains and low hills of the Stoddard, Granite and Ord Mountains. Other stands are found on the upper slopes of the Lava Mountains and near the summit of Red Mountain. Within the 2014-2016 mapping region, only two sites totally 156 acres are mapped based on reconnaissance efforts; one on a rocky north trending-slope on Spy Mountain, and another in a similar setting on Turquoise Mountain to the north.

## 5420 - Mojave and Great Basin upper bajada and toeslope Group



**DISTRIBUTION:** Few polygons were mapped at the Group level. The Group level is assigned to the vegetation type only when the photo signature and ecological characteristics make photointerpretation and modeling/extrapolation inconclusive for a specific Alliance call difficult. Only two stands totally 434 acres are mapped to this Group level category, both in the northern portion of the Mesquite Mountains and both based on field observations. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



**5421 – *Coleogyne ramosissima* Alliance**  
Black brush scrub Alliance



This image depicts a stand strongly dominated by *Coleogyne ramosissima*, with several emergent *Yucca brevifolia* individuals widely scattered throughout. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



*Coleogyne ramosissima* is seen in the foreground here as the gray-colored short shrub. *Larrea tridentata*, sparse *Yucca schidigera*, and trace amounts of *Yucca brevifolia* are also mixing in this stand. Herbaceous understory, as depicted on this photo, is typically sparse.

## 5421 – *Coleogyne ramosissima* Alliance

**DESCRIPTION:** In stands of this Alliance *Coleogyne ramosissima* is the dominant or co-dominant shrub, typically with no species of taller shrub greater than 33 percent of the total relative cover of *Coleogyne*, though other smaller shrubs such as *Ephedra nevadensis* may be of equal or greater cover. Although *Coleogyne* typically dominates stands, its cover may be exceeded by disturbance-related species such as *Ambrosia salsola*, *Salazaria mexicana*, *Ericameria* spp. or *Eriogonum fasciculatum*. If *Yucca schidigera* is present with *C. ramosissima*, the *Coleogyne* needs to be more than three times the cover of *Y. schidigera* for the stand to be in the *Coleogyne ramosissima* Alliance. *C. ramosissima* is generally upslope from *Larrea tridentata* – *Ambrosia dumosa* on shallow rocky soils of upper bajadas, pediments, and hill slopes. It does not prefer steep colluvial deposits with larger rocks and boulders. Because *C. ramosissima* is extremely susceptible to fire (even low-intensity), many thousands of acres of it have now converted to *Grayia*, *Salazaria*, *Ericameria*, and *Ambrosia* types throughout the mapping area. Particularly impacted are the Stoddard Wells, Fairview Valley, and Ord Mountain areas.

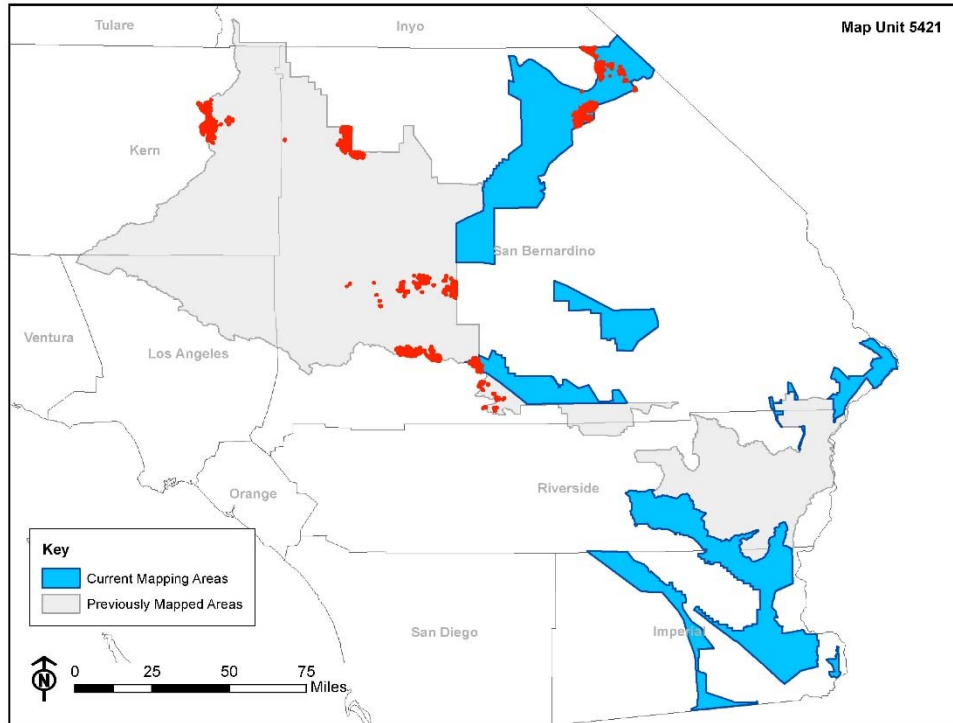
**PHOTOINTERPRETATION SIGNATURE:** The most characteristic quality of the *Coleogyne ramosissima* Alliance is the very dark shrub layer contrasting vividly with the much lighter pediment-like substrate. Cover density is usually consistent across the stand with very little clumping, and shrubs vary minimally in size. Individual shrubs have a well-defined, generally rounded crown. Larger stands tend to have a fairly low diversity of shrub species, and therefore overall signature is consistent across much of the stand.

### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

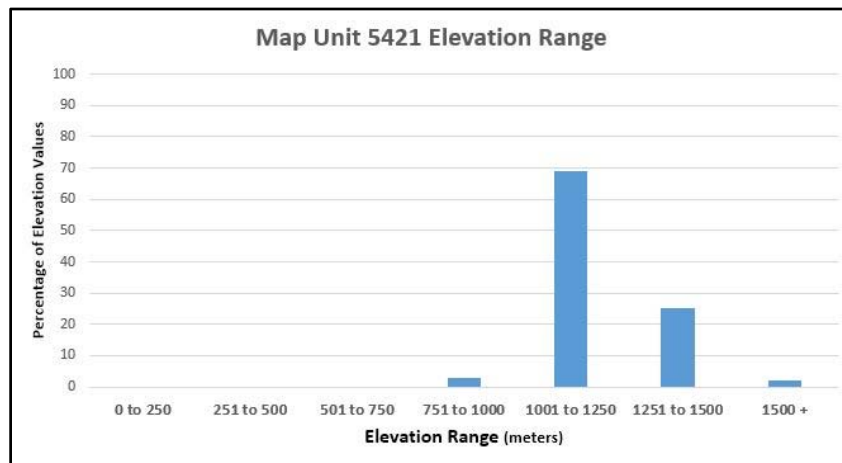
- *Ambrosia dumosa* Alliance (4111) – Stands where *Ambrosia dumosa* dominate the shrub layer tend to have a significantly lighter gray color to the vegetative component. Conversely, the substrate is not as vivid a white, making the distinction between vegetative and nonvegetative layers less apparent. Individual shrubs are slightly smaller and crowns less distinct. This type is less likely to be found on pediment surfaces and is more common at lower elevations.
- *Grayia spinosa* Alliance (5411) – This Alliance can also occur on fairly light-colored substrate but does not often occur on thin-soiled pediment, and therefore usually has a much higher herbaceous layer. This herbaceous layer generally makes the understory signature tone not as vivid a white. Individual shrubs are slightly larger; crowns are not as well defined, and not quite as dark a color. Both Alliances are often mapped in near to completely dormant phases and yield little in the way of green hues.
- *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115) – Higher elevation stands often mix with a high diversity of understory shrubs including *C. ramosissima*. Substrate characteristics help to separate out areas where *C. ramosissima* dominates. As mentioned above, *Coleogyne* tends to occur on lighter caliche-layered substrate.



**5421 – *Coleogyne ramosissima* Alliance**



**DISTRIBUTION:** *Coleogyne ramosissima* is extensively mapped in five regions of the original study: (1) along the base of the Sierra Nevada on sparse pediments in the southern Indian Wells Valley; (2) along the base of the San Bernardino Mountains above Lucerne Valley; (3) in the Ord Mountains; (4) adjacent to Naval Air Weapons Station China Lake, and (5) along a small region of the Little San Bernardino Mountains near the town of Yucca Valley. Within the 2014-2016 mapping region, this Alliance occurs in the Eastern Mojave Desert region throughout Shadow Valley and to the south in the Central Mojave Desert region on upper fans and lower slopes of the eastern edge of the San Bernardino Mountains.



**5423 – *Yucca brevifolia* Alliance**  
Joshua tree woodland Alliance



In this example *Yucca brevifolia* occurs in cover between 5 and 15 percent over a shrub layer comprised mostly of *Coleogyne ramosissima*. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



Emergent large multiple-crowned individuals of *Yucca brevifolia* are seen here over a shrub cover containing large *Yucca schidigera*, *Larrea tridentata* and *Ambrosia dumosa*.

## 5423 – *Yucca brevifolia* Alliance

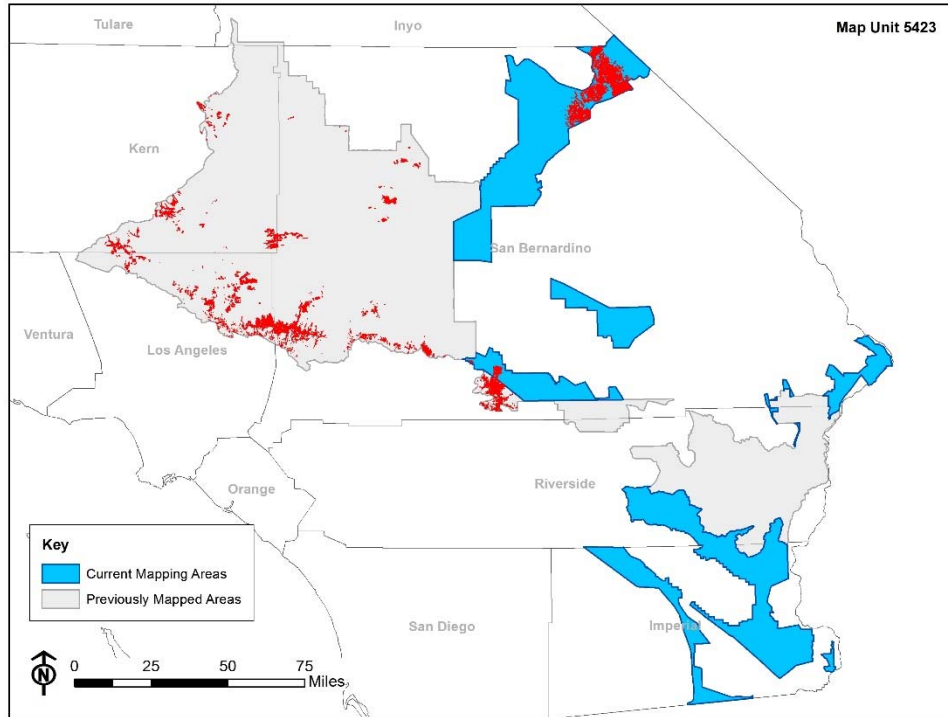
**DESCRIPTION:** *Yucca brevifolia* must be evenly distributed, not scattered and clumped, and must be at least 1 percent absolute cover to map a stand as this Alliance. Although they usually only comprise between 1 and 5 percent cover, the highest cover of *Y. brevifolia* may reach 10 percent in clonal stands in the western part of the mapping area. Often, shorter shrubs or perennial grasses have substantially higher cover beneath the well-spaced emergent trees. Where *Y. brevifolia* and *Pinus monophylla* occur together, and *P. monophylla* is more than 1 percent absolute cover and evenly distributed, the stand is mapped as the *Pinus monophylla* Alliance. Where *Y. brevifolia* and *Juniperus californica* occur together, and *J. californica* is more than three times the cover of *Y. brevifolia*, the stand is mapped as the *Juniperus californica* Alliance.

**PHOTOINTERPRETATION SIGNATURE:** Stands are typically sparse in cover and can be comprised of individuals with single or multiple crowns. Crown shape, size and age may vary widely within a stand. The dull greenish gray individuals often produce shadowing that may appear linear from the base of the tree and is apparent on the image as a result of its single upright trunk and thick forking branches. Single-stem individuals below 3 meters tall are difficult to interpret even using high-resolution imagery.

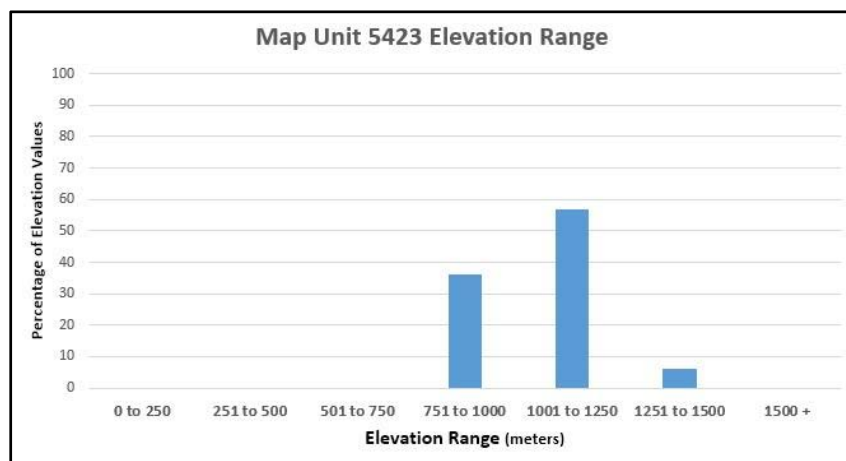
### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Yucca schidigera* Alliance (5424) – Individuals are on average smaller in stature, with a single shadow accompanying its shorter main stem. *Y. schidigera* almost always occurs in areas where *Larrea tridentata* is present in the shrub layer. There is an approximate elevation overlap zone, roughly between 2700 - 3700 feet (820 – 1130 meters), where both *Yucca* species may co-occur. In these settings, *Y. brevifolia* is generally not as well developed, having shorter than normal stature and smaller crowns, making the distinction between the two types difficult. *Yucca schidigera* individuals are generally not found west of the Mojave River and north of Interstate 40.

**5423 – *Yucca brevifolia* Alliance**



**DISTRIBUTION:** Stands are established along higher elevation fans and bajadas adjacent to the Scodie, Tehachapi, San Gabriel and San Bernardino Mountains and as far east as the Little San Bernardino Mountains near Yucca Valley. Near Edwards Air Force Base, they extend into lower elevation areas that are associated with cold-air basins. Small outlier populations also occur on higher elevation fans such as in Superior Valley. Within the 2014-2016 mapping region, stands of *Yucca brevifolia* occur in the Eastern Mojave and Central Mojave regions. Stands are extensive in the Shadow Valley and higher portions of Mesquite Valley above 3000 feet (900 meters). To the south, *Y. brevifolia* is found near Landers above 2800 feet (850 meters) in the Central Mojave region.





## 5424 – *Yucca schidigera* Alliance

Mojave yucca scrub Alliance



The image depicts *Yucca schidigera* scattered mainly in the central and western portions of the imagery. The most visible feature of this species of *Yucca* is the fairly conspicuous shadow on the larger individuals. *Coleogyne ramosissima* is the dominant understory shrub with highest cover in the northeastern portion of the image. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



In this example, the *Yucca schidigera* individuals are large. Also found in this example are *Krameria erecta*, *Acacia greggii*, *Ambrosia salsola*, *Ferocactus cylindraceus*, *Cylindropuntia acanthocarpa* and trace amounts of *Yucca brevifolia*.



## 5424 – *Yucca schidigera* Alliance

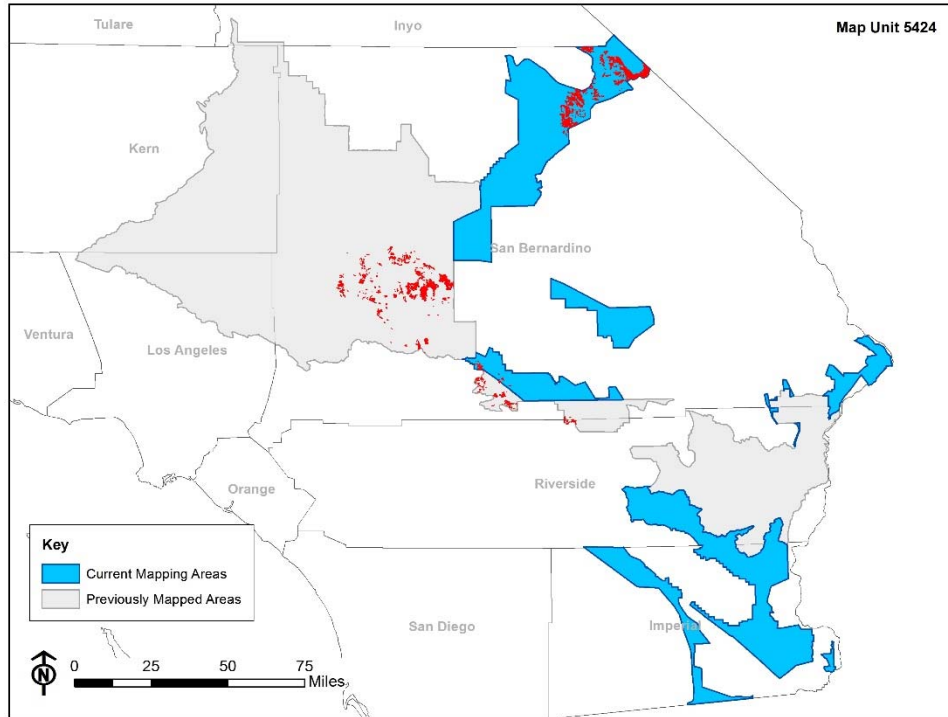
**DESCRIPTION:** In stands of this Alliance *Yucca schidigera* is conspicuous, evenly distributed and generally comprises at least 1 percent absolute cover. At lower elevations, stands may have *Larrea tridentata*, *Ambrosia dumosa*, and other shrubs at equal or even higher cover. At upper elevations *Yucca brevifolia* is often scattered in the tree layer with less than 1 percent cover, and *Juniperus californica* may be present with less than 2 percent cover. If *Juniperus* is at least twice the cover of *Y. schidigera*, then the stand is mapped as the *Juniperus californica* Alliance. Where *Coleogyne ramosissima* and *Y. schidigera* occur together, *Coleogyne* has to be at least three times the cover of *Y. schidigera* to be mapped as the *Coleogyne ramosissima* Alliance. Near the upper-elevation range of the *Yucca schidigera* Alliance, stands are found on pediments and upper fans adjacent to the foothills of the San Bernardino and Little San Bernardino Mountains. At lower and middle elevations, stands are common on upper bajadas, adjacent toeslopes, and low hills of some of the interior desert mountain ranges.

**PHOTOINTERPRETATION SIGNATURE:** Because other shrubs can be of equal or greater cover, the photo signature of a stand mapped as the *Yucca schidigera* Alliance will have the characteristics of the more conspicuous plants (i.e. *Larrea tridentata* at lower elevations and *Coleogyne ramosissima* at higher elevations). *Y. schidigera* almost always occurs in areas where *L. tridentata* is present with a higher cover in the shrub layer. Characteristic to the signature of *Y. schidigera* is the noticeable short shadow created by multi-stemmed individuals that crown within a meter of the ground. Where *Y. schidigera* occurs on pediment substrate, the individual plants can be easily distinguished against the light-colored surface.

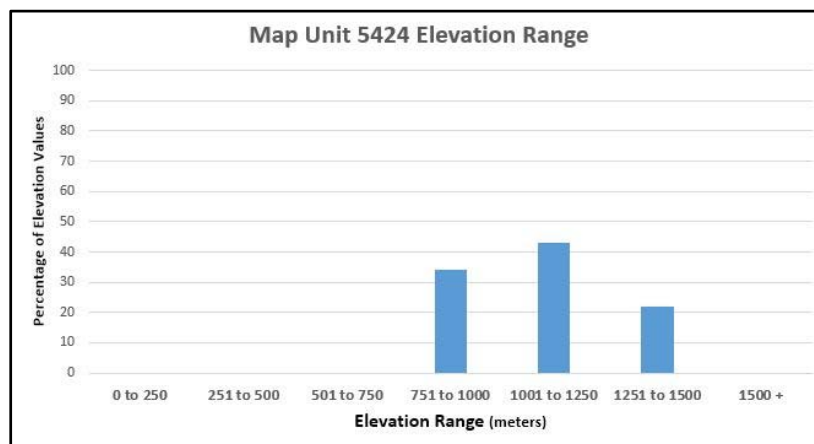
### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus californica* Alliance (1122), *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115), *Coleogyne ramosissima* Alliance (5421) – The *Yucca schidigera* Alliance can be easily confused with these Alliances because the presence and cover of *Yucca* can be difficult to determine. It is easy for photointerpreters to overestimate the cover of the more conspicuous plants when they are scattered in the shrub layer; conversely, it becomes more difficult to recognize a higher cover of smaller single-stemmed *Yucca* plants. The most difficult aspect to mapping the *Yucca schidigera* Alliance is determining the minimum cover from the imagery. The most reliable criteria in accurately mapping this Alliance is the presence of a consistent perceptible cover of *Y. schidigera* across the stand.
- *Yucca brevifolia* Alliance (5423) – *Yucca brevifolia* can be separated out in most cases based on its taller stature and growth characteristics. Shadowing features of *Y. brevifolia* often contain a taller single stem below a multiple crown, whereas larger individuals of *Y. schidigera* will crown closer to the ground. Where stands mix, the two species are extremely difficult to separate.

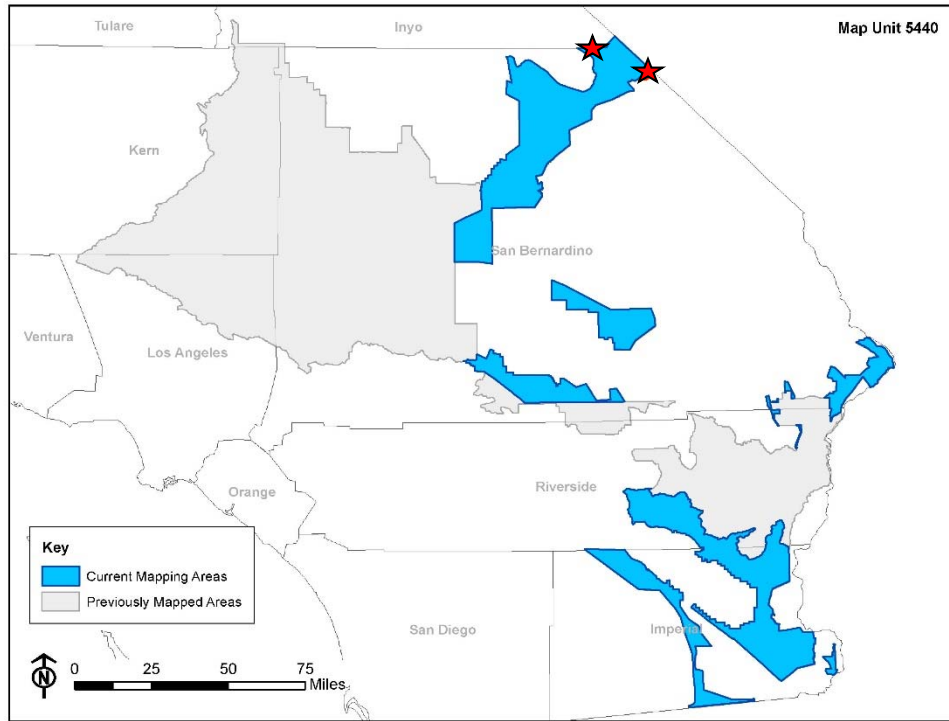
5424 – *Yucca schidigera* Alliance



**DISTRIBUTION:** In the original study area almost all mapped stands of this Alliance occur east of the Mojave River and south of Interstate 40, with the highest concentration of polygons and largest stands occurring on lower slopes of the Ord Mountains and on the alluvial fans surrounding them. Smaller stands occur in higher elevations toward the eastern end of Lucerne Valley and on fans near the towns of Yucca Valley and Joshua Tree. Within the 2014-2016 mapping region, this Alliance significantly overlaps *Yucca brevifolia*. In most examples, stands are mapped an average of approximately 1000 feet lower in elevation, except for a unique area at the base of the Kingston range where *Y. schidigera* locally occurs as the sole yucca species at higher elevations near 4000 feet (1200 meters).



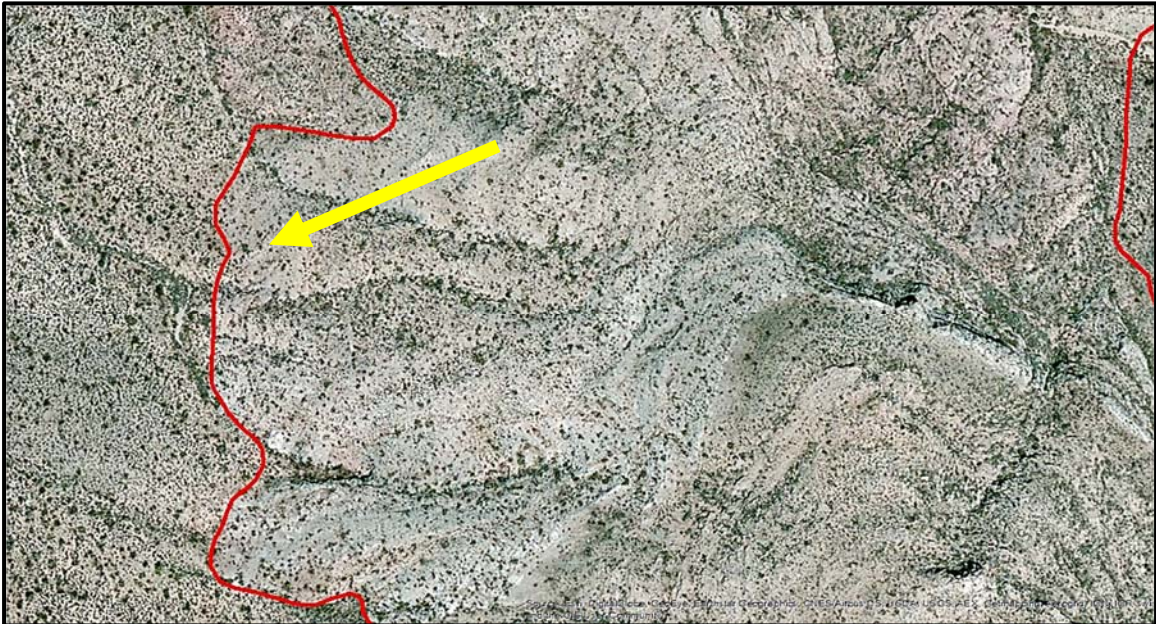
## 5440 – Intermountain shallow/calcareous soil scrub Group



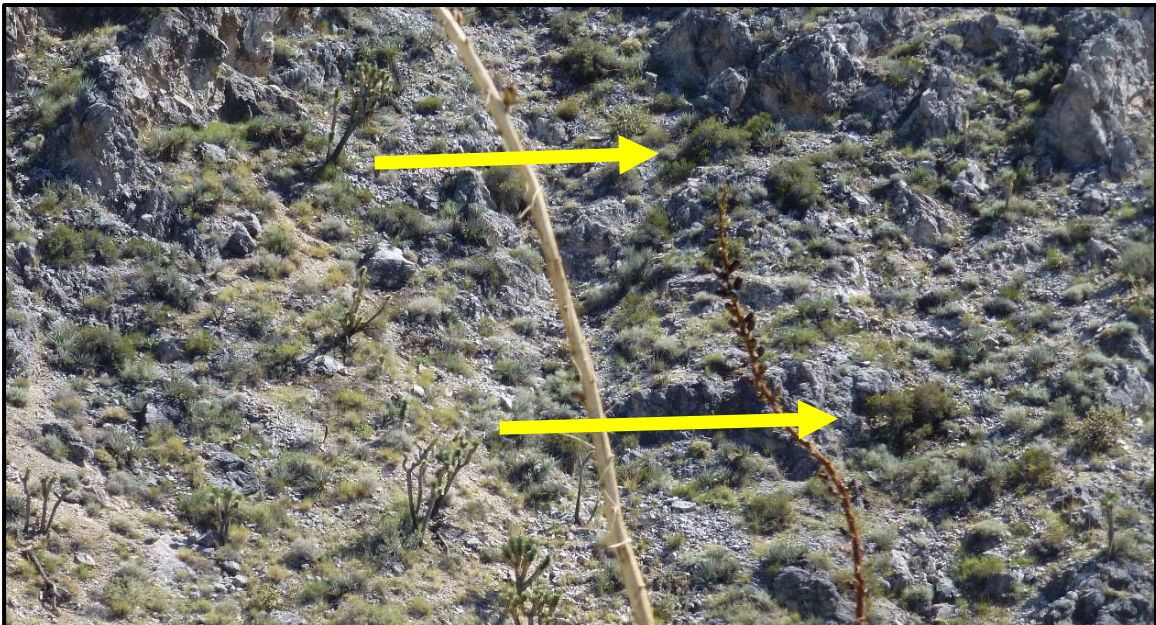
**DISTRIBUTION:** Few polygons were mapped at the Group level. The Group level is assigned to the vegetation type only when the photo signature and ecological characteristics make photointerpretation and modeling/extrapolation inconclusive for a specific Alliance call difficult. Most of the polygons mapped to this particular Group were found on dolomite or related substrate that contained plants that were often found on this soil. Plants mapped on this type of substrate included *Purshia stansburiana* and *Ephedra funerea*, but also include components of *Buddleja utahensis* and *Artemisia nova*. All polygons mapped occur in the northeasternmost portion of the mapping area in the Eastern Mojave Desert region. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



**5442 – *Purshia stansburiana* Alliance**  
Stansbury cliff rose scrub Alliance



Contained within the polygon in the center of the image, *Purshia stansburiana* appears as the smaller rounded green individuals in the diverse stand (yellow arrow points to example *Purshia* individuals). The *Yucca brevifolia* Alliance is located to the west.



Shown in the photo on the right is a *Purshia stansburiana* stand on a rocky, dark dolomite slope. The stand consists of large dark green *P. stansburiana* shrubs occurring with *Ephedra funerea*, *Cylindropuntia acanthocarpa*, and *Ferocactus cylindraceus*, along with small amounts of *Yucca schidigera* and *Agave utahensis*. In the left section of the photo, *Yucca brevifolia* presence increases and the stand becomes a *Y. brevifolia* Alliance.

#### 5442 – *Purshia stansburiana* Alliance

**DESCRIPTION:** *Purshia stansburiana* is dominant or co-dominant in the shrub layer. Cover is at least 2% in the shrub canopy; no other single species has greater cover. Stands are found along the edges of intermittent watercourses, canyons, hills, steep slopes and cliffs. Soils are well drained, shallow, rocky, rapidly permeable, and usually calcareous (Sawyer et al., 2009). In the mapping area, stands are often associated with ridgeline occurrences of *Agave utahensis* or *Nolina* spp. Lower, less rocky slopes frequently transition into *Yucca brevifolia* woodlands or *Coleogyne ramosissima* shrublands. Several stands were noted as contain containing *Prunus fasciculata* co-dominating the shrub canopy.

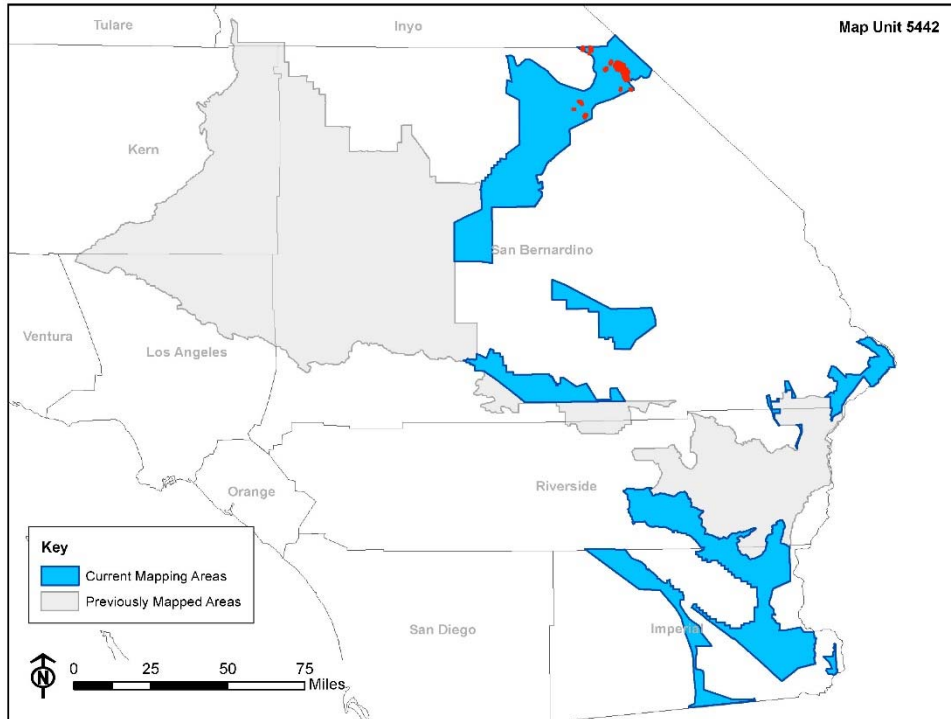
**PHOTOINTERPRETATION SIGNATURE:** *Purshia stansburiana* is a medium to large shrub that is fairly recognizable in its setting as a component to much smaller shrub species frequently found within the stand. Individuals are dark green to dark gray with a dense well-defined irregularly shaped crown. The dolomite substrate, diagnostic to this species, tends to be massively rocky with variable color ranging from light gray or tan to dark gray. Shrub distinction is easiest on lighter expressions of the dolomite.

#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

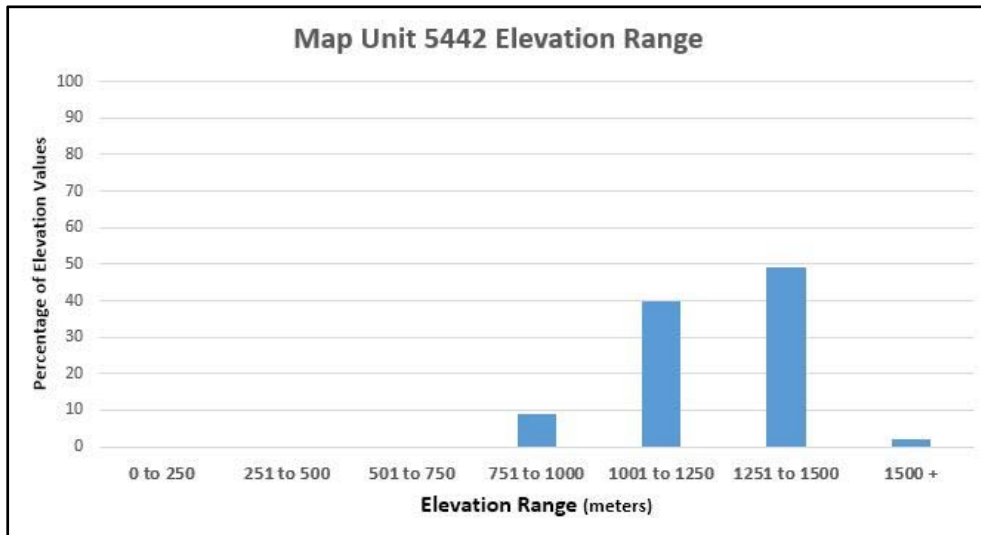
- *Prunus fasciculata* Alliance (4214) – Vegetation dominated by this species is somewhat more restricted to lower slopes and riparian settings. In the mapping area, the two species overlap and are difficult to distinguish.
- *Nolina (bigelovii, parryi)* Alliance (Not Mapped) – Stands were observed from a distance during reconnaissance efforts. Subsequent image analysis noted stands were too small to map; however, the signature of the individual plants were similar to *P. stansburiana*. *Nolina* tends to follow uppermost slopes and ridgelines.



**5442 – *Purshia stansburiana* Alliance**



**DISTRIBUTION:** Stands dominated by *Purshia stansburiana* occur on dolomite substrate in the Eastern Mojave Desert region generally above 3000 feet (900 meter) elevation. Stands are mapped on dark colored substrate in the Mesquite Mountains and on lighter colored substrate in the Kingston Range.



## 6110 – North American warm desert bedrock cliff and outcrop Group



The image shows areas of sparsely vegetated rocky slopes with minimal amounts of unconsolidated surfaces in the Cargo Muchacho Mountains. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.



The photo shows rocky outcroppings interfacing with small areas of some soil development in the Cargo Muchacho Mountains.

## **6110 – North American warm desert bedrock cliff and outcrop Group**

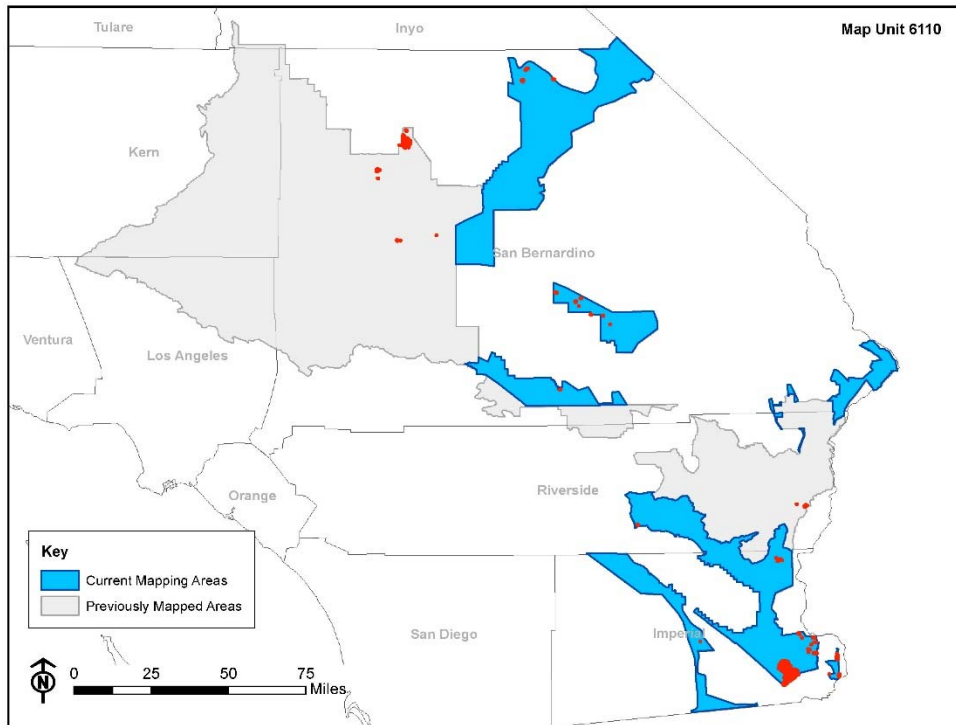
**DESCRIPTION:** This is a Group-level category consisting of rock outcroppings, sparsely vegetated Alliances (*Ephedra funerea* or *Atriplex hymenelytra*), alkaline lacustrine derived hills (mud hills), pavement surfaces with diagnostic plants, playas, washes and riverine flats, and complexes of two or more of any of the above. Stands are mapped to this level when it is difficult to discern to any of the abovementioned map units. Also, stands are mapped to this level or finer levels in this Group when vegetation falls below 2 percent absolute cover.

**PHOTOINTERPRETATION SIGNATURE:** Image signature varies considerably depending on the substrate origin, post weathering dynamics, and subsequent tectonic events. The substrate is more influential than floristics in determining the signature. Image signature plays a minor role based on floristic dominance.

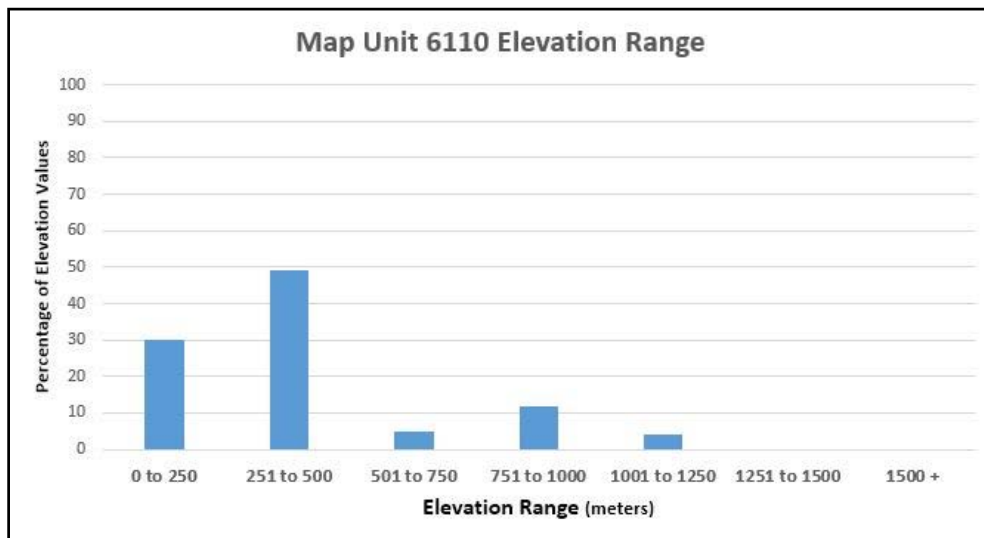
### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- Low cover floristically defined stands of vegetation where the substrate is the primary signature on the imagery.

**6110 – North American warm desert bedrock cliff and outcrop Group**



**DISTRIBUTION:** Group-level designations are mapped primarily where photointerpreters cannot determine whether mountainous surfaces are massive enough (containing little or no unconsolidated material) to make a reliable decision to a finer level. Stands are infrequent in most regions of the mapping area and are concentrated for the most part in steep, rocky terrain.





**6111 – *Atriplex hymenelytra* Alliance**  
Desert holly scrub Alliance



The image shows *Atriplex hymenelytra* Alliance on light-colored alkaline soils. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The photo shows sparse light-colored *Atriplex hymenelytra* on rocky volcanic substrate.



## 6111 – *Atriplex hymenelytra* Alliance

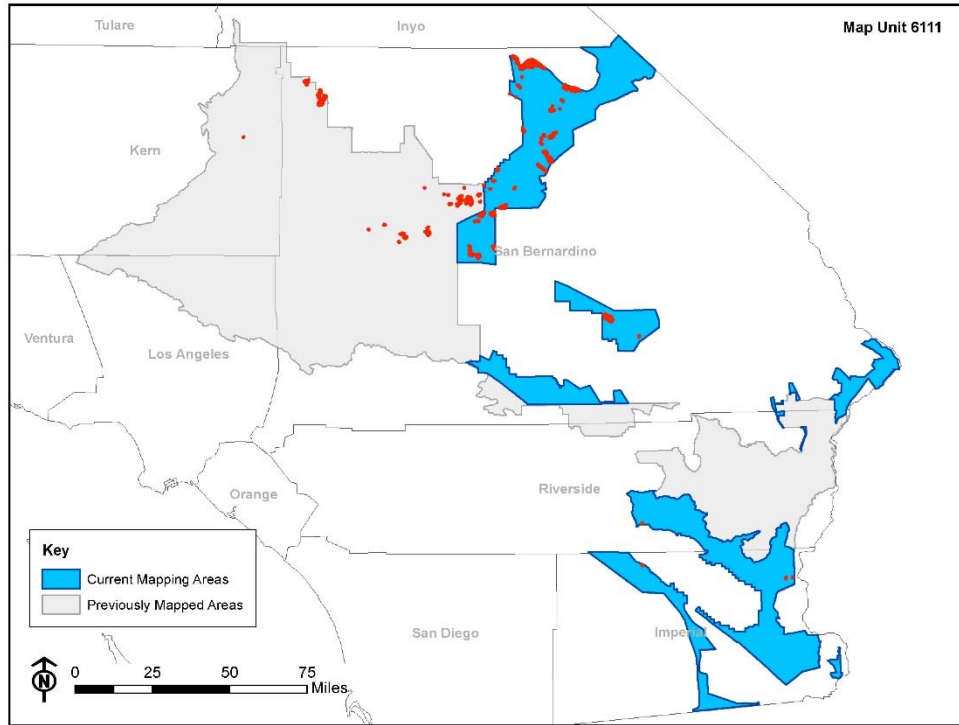
**DESCRIPTION:** *Atriplex hymenelytra* comprises more than 1 percent of the cover and no other woody species has equal or higher cover. This Alliance may occur on hot rocky slopes, dry bajadas, or alkaline badlands and playa edges. Stands are local in the extreme north of the mapped area near Ridgecrest and Trona on alkaline basin sediments, and are more extensive in the Calico and Alvord Mountains on volcanic ash and flows emanating from the southern and eastern sides of these ranges. Stands are also known from the altered volcanic hills southeast of Barstow and west of Daggett. Stands are generally considered “sparsely vegetated” (mostly less than 2 percent shrub cover). However, some stands can have up to 10 percent shrub cover under certain circumstances. Stands that are co-dominated by *Atriplex confertifolia* are mapped as the *Atriplex confertifolia* Alliance.

**PHOTOINTERPRETATION SIGNATURE:** *Atriplex hymenelytra* occurs in a very sparse cover of shrubs, usually on the lower slopes of dark volcanic hills. It is also mapped on steep fan/pediment surfaces and washes downslope of alkaline rocky hills. *A. hymenelytra* is also scattered on some pavement surfaces and some eroding old fans with pavement surface. Darker surfaces tend to accentuate the sparse cover of very pale shrubs.

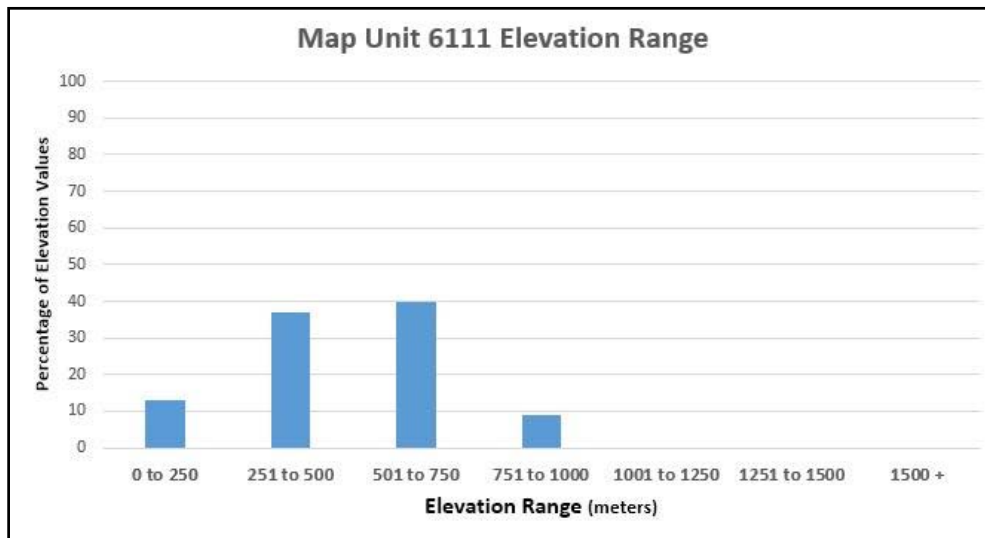
### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia dumosa* (4111) – At times, a sparse cover of this species can occur on substrate similar to that of *A. hymenelytra*, making it difficult to discern the two species.
- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – The Mud Hills type is very sparsely vegetated, usually associated with a highly eroded fine-textured sedimentary substrate. The overall topography is highly variable, often resulting in complex badland landscapes. Substrate color is patchy and highly variable due to the often changing soil chemistry and geology over small areas.
- Massive sparsely vegetated rock outcrop Mapping Unit (6115) – Areas mapped to rock outcrops are very sparsely vegetated with rough hard-surface terrain and are often very steep, creating frequent shadowing.
- *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance (6117) – Stands mapped to this mapping unit often have a medium to dark gray substrate. This makes shrubs dominated by the light-colored *A. hymenelytra* easily visible even in sparse cover. If the cover is inconsistent across the pavement surface and below 2 percent, photointerpreters map to this type.

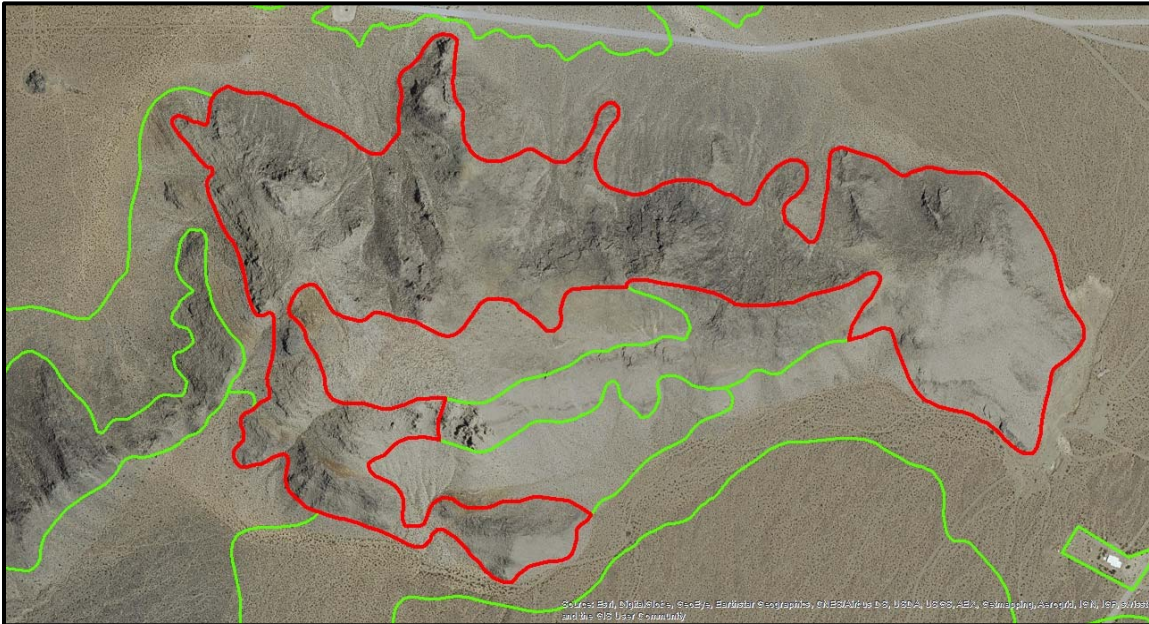
**6111 – *Atriplex hymenelytra* Alliance**



**DISTRIBUTION:** The *Atriplex hymenelytra* Alliance is mapped in three areas within the original study area: the southern portion of Searles Valley in the vicinity of Teagle Wash, the Alvord Mountains, and the Calico Mountains and hills north of Barstow. Within the 2014-2016 mapping region, this Alliance is mapped almost exclusively in the Central Mojave and Eastern Mojave regions. It occurs frequently from hills above the Dumont Dunes south and west at lower elevations to Troy Dry Lake.



**6112 – *Ephedra funerea* Alliance**  
Death Valley joint fir scrub Alliance



The image depicts a stand of *Ephedra funerea* in the Mesquite Mountains.



The photo shows an *Ephedra funerea*-dominant stand with a diverse shrub cover that includes *Ambrosia dumosa*, *Krascheninnikovia lanata*, *Coleogyne ramosissima* and *Lycium* spp. on dolomite substrate.

## 6112 – *Ephedra funerea* Alliance

**DESCRIPTION:** *Ephedra funerea* is dominant or co-dominant in the shrub canopy on rocky slopes and ridges. Soils are shallow, skeletal, and calcareous. *Ephedra funerea* is endemic to the northern Mojave Desert and southern Great Basin (Sawyer et al., 2009). In the mapping area, this Alliance was noted where *E. funerea* dominates the shrub layer, at times with *Agave utahensis*, *Yucca schidigera*, *Ambrosia dumosa*, *Larrea tridentata*, *Ephedra nevadensis*, *Salazaria mexicana*, *Viguiera parishii*, and occasionally, emergent *Yucca brevifolia*. Stands are mapped in cover ranging from about 2 to 10 percent. Substrate is calcareous, and often very steep and rocky.

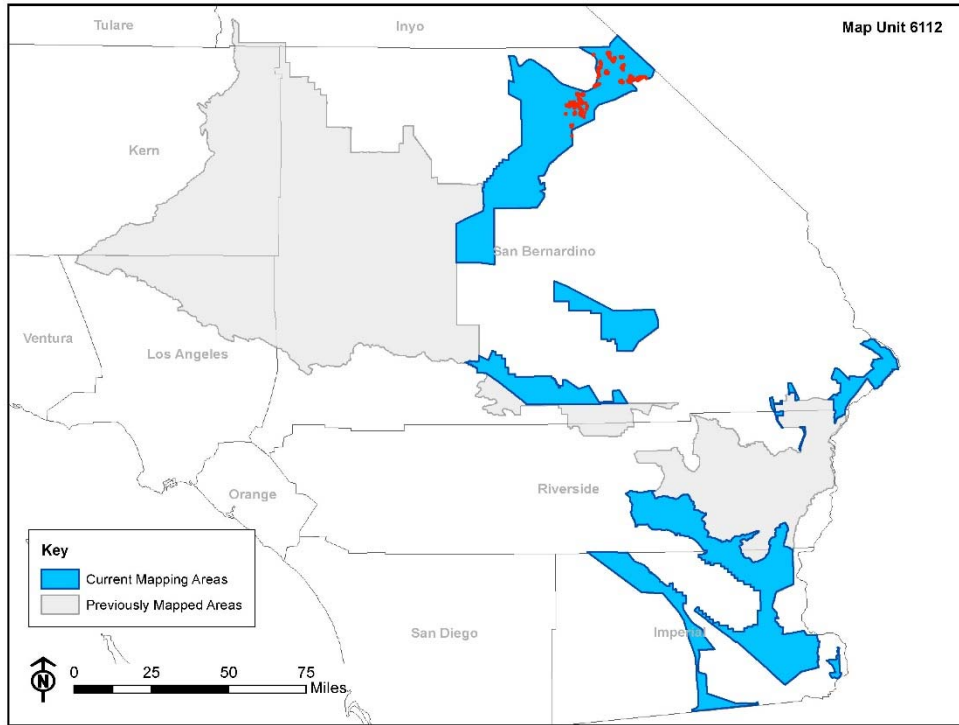
**PHOTOINTERPRETATION SIGNATURE:** *Ephedra funerea* has no distinct signature characteristics except for its small size and low cover. It is often mapped where a number of other small shrubs are also present in the stand. Photo signature is heavily dependent on the characteristics of a calcareous substrate. These surfaces are typically rocky and undulating, ranging in color from light to dark gray.

### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

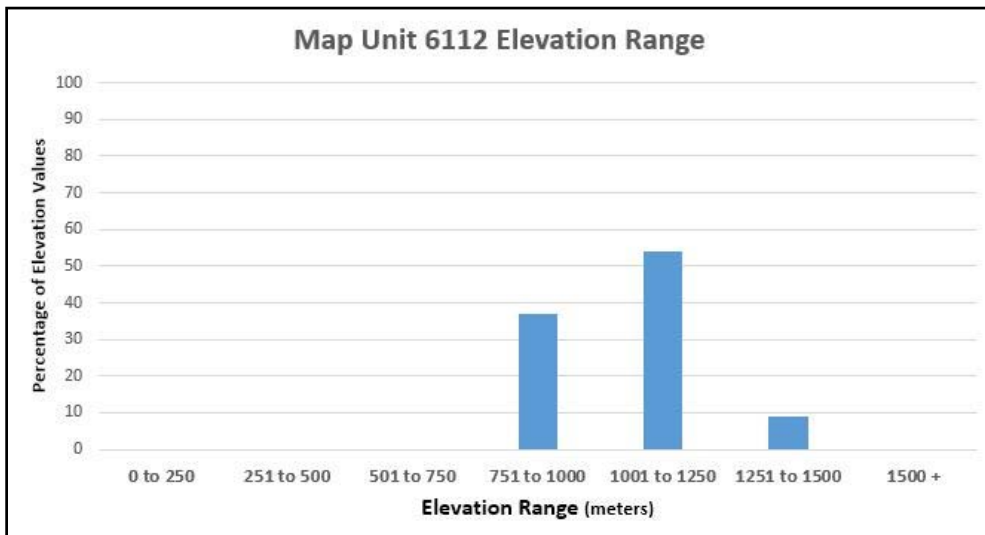
- *Coleogyne ramosissima* Alliance (5421) – Stands are frequently mapped downslope from this Alliance on similar substrate. Cover is generally higher, shrub color is darker and crowns edges are more distinct.
- Other rare shrub communities not mapped in this effort, including *Buddleja utahensis*, *Artemisia nova*, and *Agave utahensis*, may be similar in setting and signature to this uncommonly mapped Alliance.



6112 – *Ephedra funerea* Alliance



**DISTRIBUTION:** The *Ephedra funerea* Alliance is mapped exclusively in the Eastern Mojave Desert region in the Shadow, Turquoise, and Mesquite Mountains on calcareous soils.

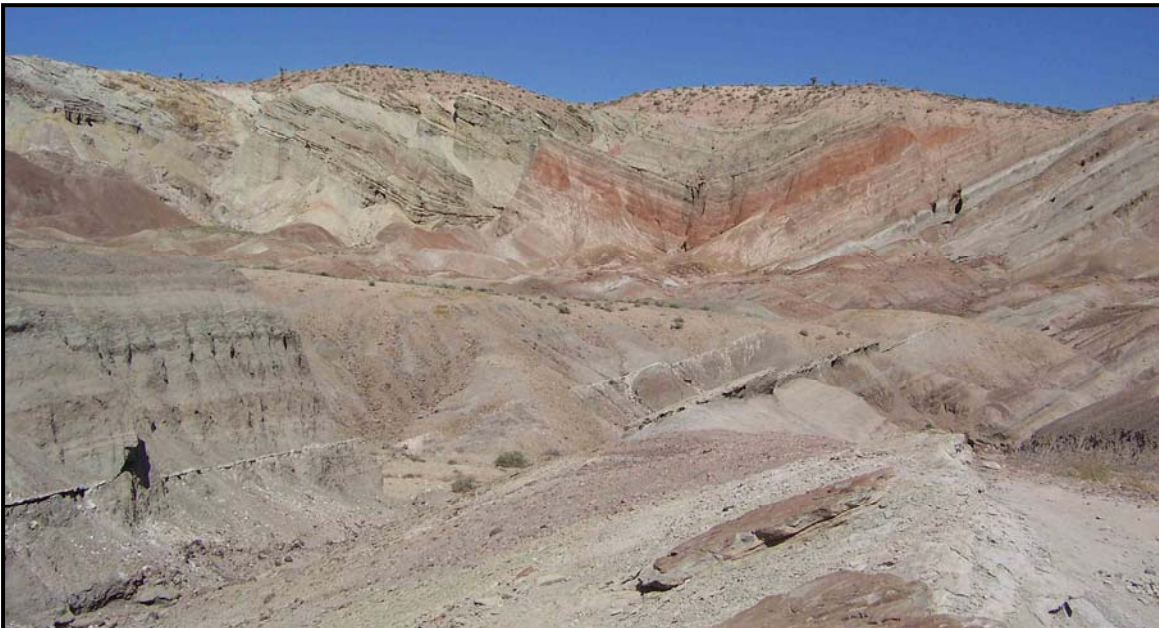




## 6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit



This image shows the mottled pastels ranging from white to tan color of extensively eroded badlands with smooth interfluves that characterizes the Mud Hills sparsely vegetated ephemeral herbs Mapping Unit. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.



This ground photo shows very sparse vegetation over the folded and distorted alkaline lacustrine-derived substrate.

## 6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit

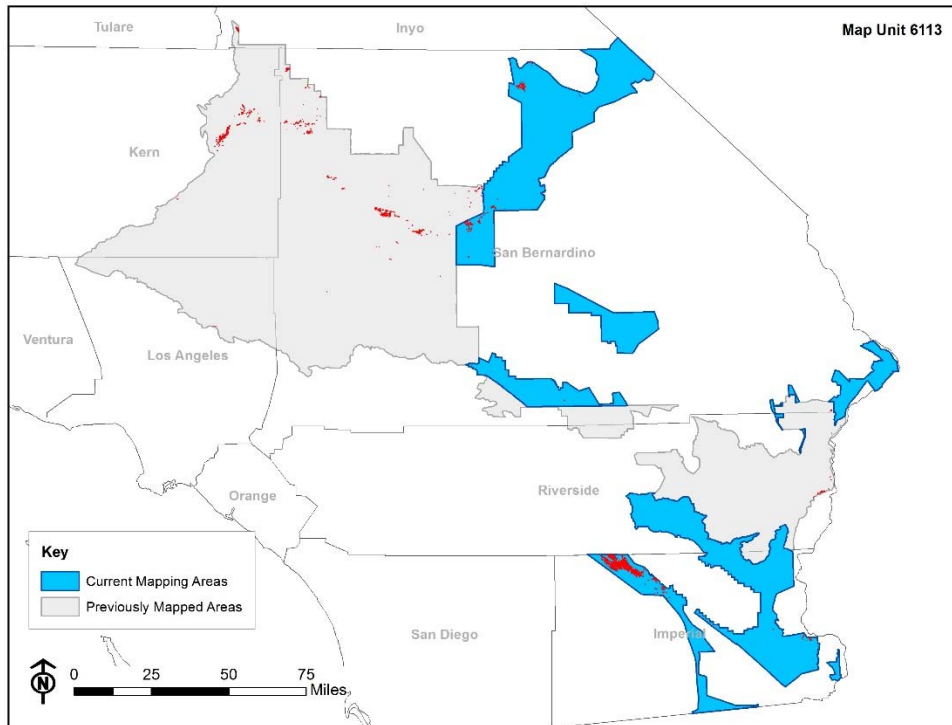
**DESCRIPTION:** This mapping unit is usually sparsely vegetated with less than 2 percent shrub or herb cover. Substrate is composed of unconsolidated and uncemented fine, sometimes alkaline, sediments. These substrate variations result in highly diverse but typically sparsely vegetated slopes. The landscape can be made up of a matrix of small patches of shrubs or herbs (below 10 acres) at 2 percent cover interspersed with larger areas of little or no measurable cover of herbs or shrubs. Topography is often rugged and eroded (“badlands”). In many years these areas are largely unvegetated. Some species that may occur are *Atriplex hymenelytra*, *Atriplex confertifolia*, *Stanleya pinnata* and other woody species. In El Niño years clay slopes are heavily covered with annual *Eriogonum* species, probably most commonly *E. inflatum* (many sizes and morphs of this plant). This and other species of *Eriogonum*, along with *Plantago ovata*, *Chorizanthe* spp., and sometimes *Lepidium flavum*, *Coreopsis calliopsidea*, and other species, can lend noticeable color to these exposures.

**PHOTOINTERPRETATION SIGNATURE:** The photo signature shows very little to no vegetation. Typically, this mapping unit occurs on badland topography or eroded hills with an unpredictable mosaic of white, tan, pink and gray colors, and a smooth texture in the interfluves.

### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

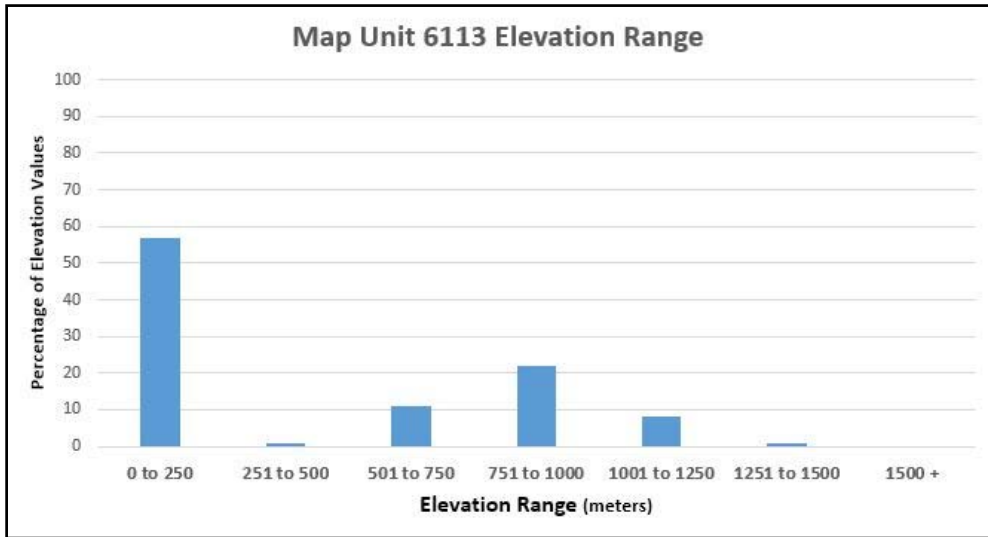
- North American warm desert bedrock cliff and outcrop Group (6110) – Sparsely vegetated landscapes should be mapped to this Group when it is difficult to discern the Mud Hills mapping unit from any of the other types in this Group.
- *Atriplex hymenelytra* Alliance (6111) – Small light-colored *A. hymenelytra* shrubs are consistently scattered with low cover. This species often is a component to mud hills topography. If shrubs are visible, cover is most likely at least 2 percent, and therefore should be mapped to this Alliance.
- Massive sparsely vegetated rock outcrop Mapping Unit (6115) – Signature usually shows extensive rough hard-surface terrain, usually not in an eroded badland pattern. Colors on massive rock substrate are not pastel-like in tone.
- *Chorizanthe rigida* - *Geraea canescens* desert pavement sparsely vegetated Alliance (6117) – Topography on this landform is less complex; surface color, which ranges in color from light gray to dark gray, is more uniform across the stand. There are generally no pastel pinks, oranges, browns or light purple colors. Dissection in mud hills topography is more complex; even in more recently developed mud hill topography the dendritic pattern is apparent.

## 6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit



**DISTRIBUTION:** The Mud Hills sparsely vegetated ephemeral herbs Mapping Unit is concentrated in the northern part of the study area. In the Western Mojave region it is found in the El Paso Mountains, Summit Range, and Lava Mountains. In the Central Mojave region it forms an arc from the Gravel Hills to the Mud Hills then to the Calico Mountains. It is also found along the bluffs of the Colorado River floodplain north and west of Blythe. Within the 2014-2016 mapping region, the Mud Hills Mapping Unit is found along old terraces north of the Mojave River, on the western edge of the Silurian Valley in the Salt Springs Hills, and further south in isolated foothill regions of the Chocolate Mountains near the Picacho State Recreation Area. Younger, less well developed examples of this landform occur east of the Salton Sea along State Route 111.

6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit





## 6114 – Unvegetated wash and river bottom Mapping Unit



This mainly unvegetated sandy portion of the Mojave River bottom is flanked by stands of *Tamarix* spp. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



This photo depicts an unvegetated section of the Mojave River looking upstream. Recent or frequent flooding generally hinders the development of woody and perennial vegetative growth.



## 6114 – Unvegetated wash and river bottom Mapping Unit

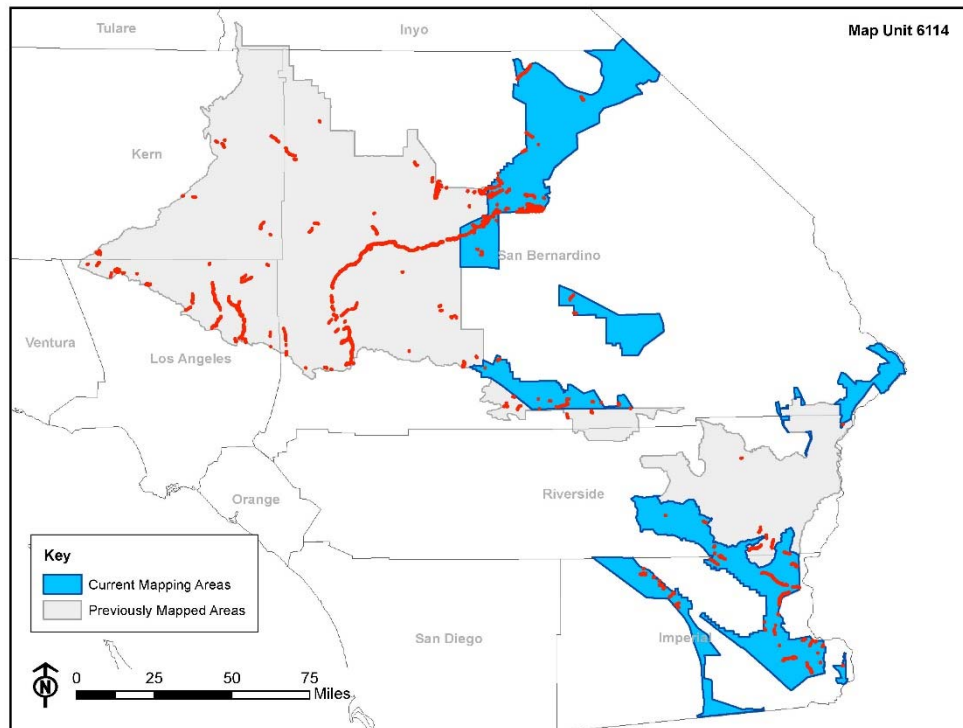
**DESCRIPTION:** This mapping unit is distinguished by largely unvegetated sands and gravels in the active centers of washes throughout the study area. Recent or frequent flooding generally hinders the development of woody and perennial vegetative growth. Due to varying flooding frequencies and intensities, “river-wash” channels can change rapidly and regularly, alternating from unvegetated to being vegetated by annual natives and then back to unvegetated. Photointerpreters map to this category when scattered shrubs and herbs are inconsistent in the stand and make up less than 2 percent average cover.

**PHOTOINTERPRETATION SIGNATURE:** Signature variability within unvegetated and sparsely vegetated washes is determined primarily by the intensity and frequency of fluvial events and by the geology of the parent substrate upstream. The signature is light, with the color ranging from white to tan, and increases in lightness and brightness in higher energy wash systems where fluvial activity is more frequent and intense. Fluvial dynamics within washes fluctuate considerably year to year, resulting in a high temporal variability of vegetative cover. Photointerpreters used the base imagery as for determining vegetative cover. For washes larger than the MMU, every attempt was made to maintain representative connectivity of the drainage by continuing the main stem of the wash even where the channel narrowed considerably below the minimum mapping width. As a rule, smaller braids and rivulets were not grouped together to form a polygon.

### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

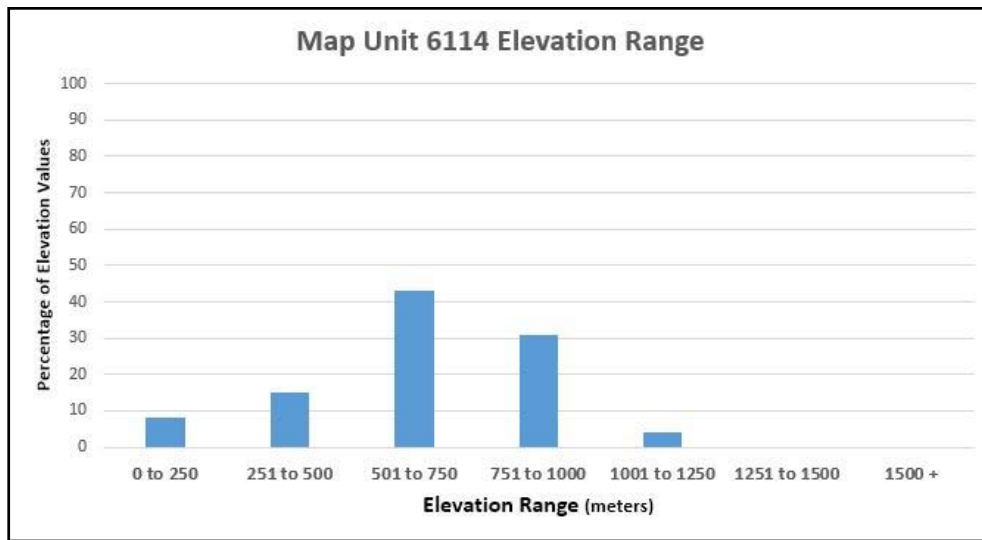
- Low cover wash types: Washes consisting of less than 5 percent cover can frequently be coded to the Unvegetated wash and river bottom Mapping Unit. This is especially true when wash features are dominated by a low cover of light colored vegetation such as *Psoralea argophylla*, *Bebbia juncea*, or *Hyptis emoryi*. On some image datasets, shadowing of the larger plants can aid in cover estimates of these hard-to-see types.
- Sparsely vegetated playa Mapping Unit (6116): Where wash features broaden into a small basin, portions of the wash tends to pool and evaporate, collecting salts and creating localized scalding. Fluvial activity may pick up further downstream where these small scalds no longer occur. Wash polygons in these settings generally are continued through the scald areas to emphasize connectivity and flow.

## 6114 – Unvegetated wash and river bottom Mapping Unit



**DISTRIBUTION:** Mappable features within this type are found scattered throughout the Western and Central Mojave regions of the original study area, especially at the base of mountains and on upper elevation fans/bajadas. Some of the best examples of this type occur along the Mojave River in the form of riverine washes, flats and bars. Unvegetated wash and river bottom features are significantly smaller in the Colorado Desert, and are often too narrow to map. Larger wash systems in this region are generally vegetated by a significant cover of *Parkinsonia florida* and *Olneya tesota*. Within the 2014–2016 mapping region, many of these features are mapped frequently in the Central Mojave region, and the Chuckwalla and Chocolate Mountains, and the Salton Sea Trough zones.

6114 – Unvegetated wash and river bottom Mapping Unit



## 6115 – Massive sparsely vegetated rock outcrop Mapping Unit



The above image depicts a sparsely vegetated Mesozoic granitic outcrop. Vegetative cover is below 2 percent, a vivid contrast with the nearly 15 percent cover of *Larrea tridentata* to the southeast.



This photo depicts a steep south-facing slope composed of gravels, cobbles and boulders. Vegetative cover is extremely low on numerous slopes in this range with cover here averaging well below 2 percent.

## 6115 – Massive sparsely vegetated rock outcrop Mapping Unit

**DESCRIPTION:** This mapping unit is defined by extensive solid blocks of resistant rock of any type. In the study area these may be volcanic extrusives such as basalt or rhyolite; igneous intrusives such as granodiorite, gabbro, or quartz monzonite; or sedimentary sandstones or limestones, etc. Large unfractured bedrock or boulders are typical, with narrow crevices in different densities. Overall shrub and herb cover tends to be under 2-3 percent, making it difficult to distinguish any particularly dominant species. Mapping units of this type may include small (less than 10 acres) stands of *Ephedra viridis*, *Atriplex polycarpa*, *Encelia farinosa*, *Ericameria cuneatus*, *Ericameria teretifolia*, *Salazaria mexicana*, *Eriogonum fasciculatum*, *Atriplex hymenelytra*, *Peucephyllum schottii*, and other Alliances with extremely low cover. This mapping unit is differentiated from Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) by erosional patterns. Individual rock outcrops, boulders, etc. will be seen in this unit but not in the Mud Hills type.

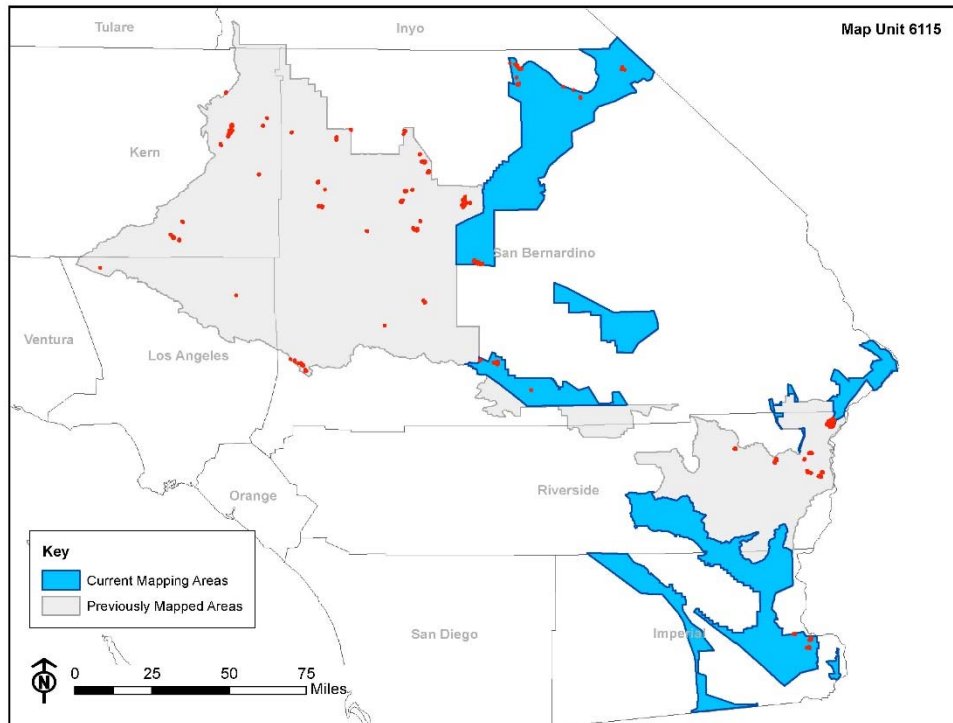
**PHOTOINTERPRETATION SIGNATURE:** Signature is variable depending on the base rock type. Color can be white, gray, brownish tan, reddish tan, or dark gray to black. Vegetative cover is very sparse. Throughout much of the desert mountain ranges, isolated areas containing less than 2 percent cover fall into this category but are often below the MMU. The signature usually shows extensive rough hard-surface terrain. Highly dissected badland features generally contain over 2 percent vegetative cover or fall into the sparsely vegetated Mud Hills Mapping Unit.

### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

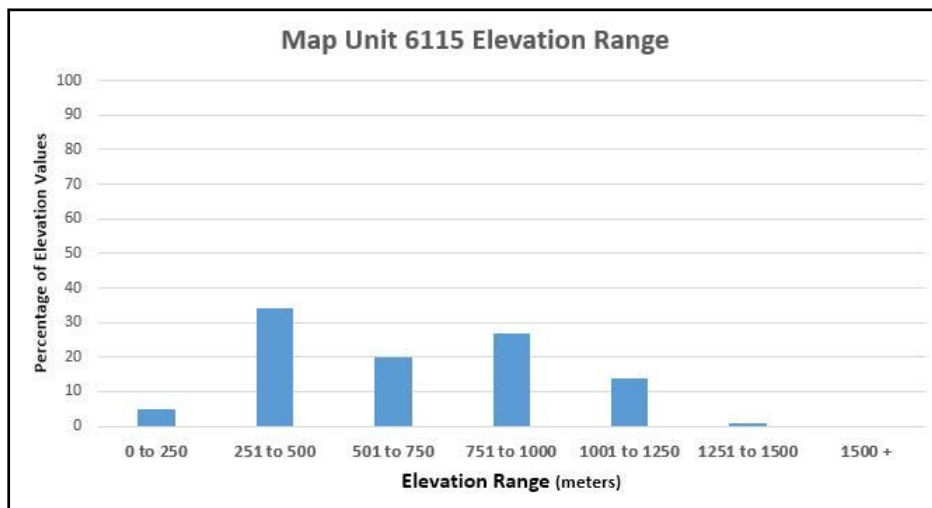
- *Encelia farinosa* Alliance (4114) – This type has greater than 2 percent cover of light gray individual shrubs on dark volcanic rock.
- North American warm desert bedrock cliff and outcrop Group (6110) – Sparsely vegetated terrain features are mapped to the Group level when massive bedrock outcroppings are not discernable on the imagery over areas greater than 10 acres in size.
- *Atriplex hymenelytra* Alliance (6111) – This sparsely vegetated Alliance is generally mapped on pavement surfaces, basalts, or on the Mud Hills sparsely vegetated ephemeral herbs Mapping Unit. When occurring on light-colored rock of any substrate, the sparse cover is generally not discernible even on high-resolution imagery.
- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – Topography is typically complex, extensively eroded in nature, with smooth-textured interfluves. Terrain does not have a massive, broken-up, or rough-surface character.



**6115 – Massive sparsely vegetated rock outcrop Mapping Unit**



**DISTRIBUTION:** This sparsely vegetated type occurs on bedrock over widely scattered areas of both the Mojave and Colorado Desert portions of the original study area. Concentrations of this mapping unit occur in the El Paso, Calico, Lava, and Riverside Mountains. However, the majority of occurrences of these features were below the 10 acre MMU, which therefore were not mapped. Within the 2014–2016 mapping region, this feature is uncommon but is widely distributed in isolated areas of the Chocolate Mountains, Silurian Hills, and other small ranges in addition to lava flows east of Troy Dry Lake.



## 6116 – Sparsely vegetated playa (Ephemeral annuals) Mapping Unit



This image shows a playa almost totally devoid of shrubs surrounded by a patchwork of scalds.



A sparsely vegetated playa is seen here with its lack of shrubs and grasses on a dry, cracked alkaline substrate.

## 6116 – Sparsely vegetated playa (Ephemeral annuals) Mapping Unit

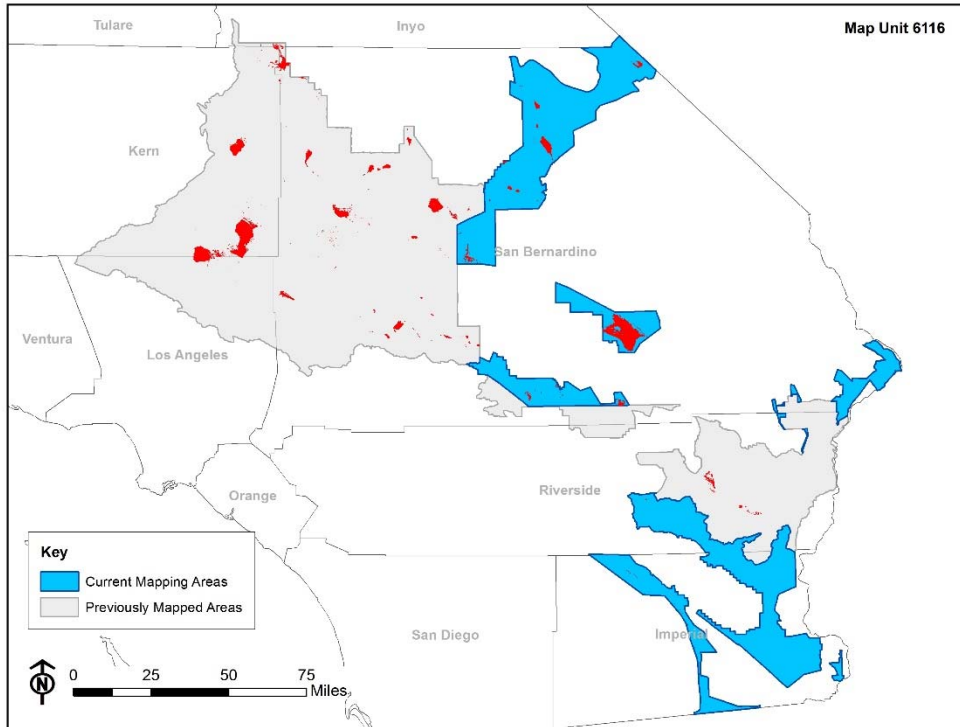
**DESCRIPTION:** This mapping unit defines silty, clay, or salt crust playa (dry lake) surfaces throughout the study area. Characteristics include moderate to highly reflective cracked substrate with no obvious slope. Most of the time playas, whether they are salty, silty, or clay, have less than 2 percent vegetative cover. However, annuals such as *Monolepis nuttalliana*, *Atriplex elegans*, *A. phyllostegia*, and others may occur in relatively high cover during good El Niño years. Even with this temporal growth, these sites are still identified as playas.

**PHOTOINTERPRETATION SIGNATURE:** Areas are mostly devoid of shrubs and herbaceous plants, reflecting a gray to white to tan color depending on alkalinity and moisture content of the soil. They occur in the lowest portions of watersheds and drainages. Shrubs can occur in isolated low-gradient rills or cracks within the surface.

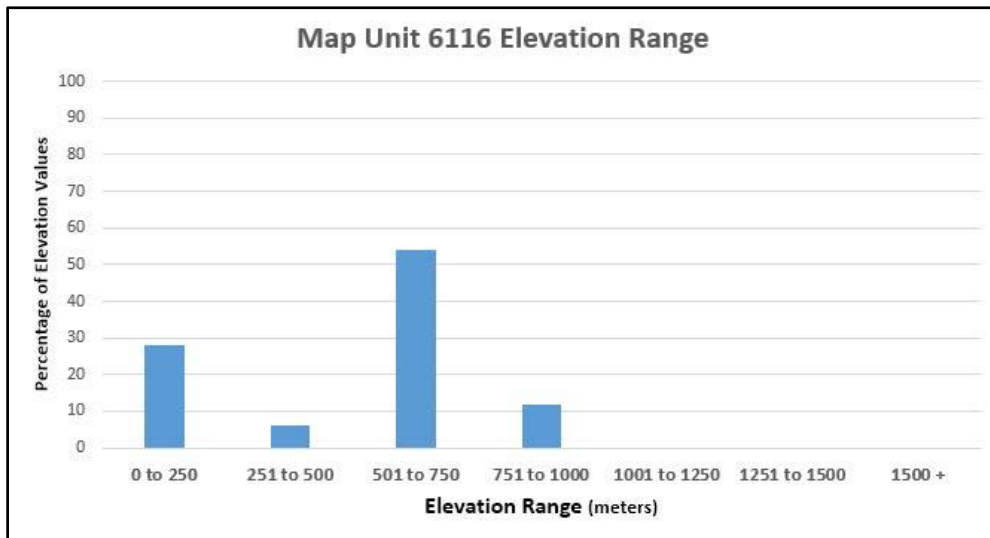
### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Types within the California Annual and Perennial Grassland Macrogroup (2300) – In most cases herbaceous cover appears light brown and does not have a high reflectance. Many times scattered shrubs or herbaceous patterns occupy portions of the stand. Confusion mainly occurs when these stands are very sparse and patchy in cover, especially on imagery taken during a dry year.
- Very sparse alkaline shrub types – In general, very sparse stands of *Allenrolfea occidentalis* (3721), *Atriplex confertifolia* (5112), *Atriplex lentiformis* (3722), or *Suaeda moquinii* (3725) along the playa margin may be difficult to discern for cover of live vegetation depending on the year and season of the imagery, and on how the shrubs respond to the corresponding climatic conditions.
- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – In settings with minimal topographic variability, this mapping unit can at times be similar to older playa surfaces. In these situations, the Mud Hills Mapping Unit generally has a higher color variability across the surface, usually with subtle pink, orange, and/or gray hues to the signature in addition to at least minimal amounts of surface dissection.
- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance (6117) – This type typically occurs adjacent to the mountains, forming alluvial fans that are usually darker in color. This Alliance is also distinguished by dissecting rills that many times are vegetated and run throughout the pavement surface.
- North American warm desert dunes and sand flats Group (6120) – In several locations, most noteworthy in the Dumont Dunes, large sand sheets occur adjacent to or nearby smaller playas, both of which are occurring on minimal slope. It is possible to differentiate these features by looking at in-stand and adjacent vegetation in addition to surface drainage patterns.

**6116 – Sparsely vegetated playa (Ephemeral annuals) Mapping Unit**



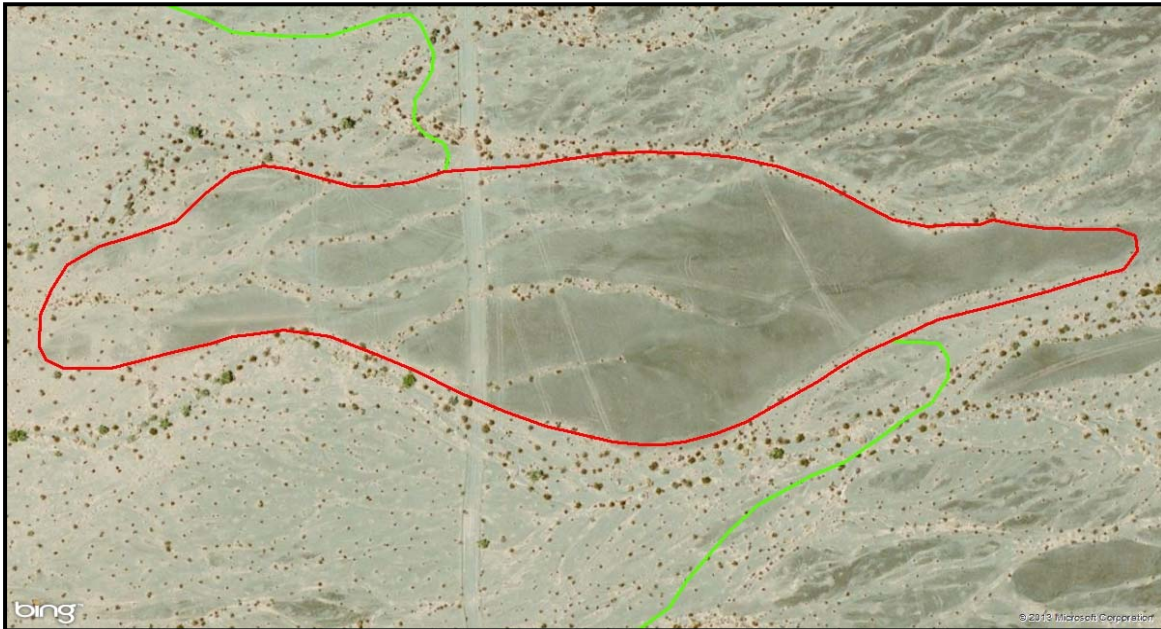
**DISTRIBUTION:** The Sparsely vegetated playa (Ephemeral annuals) Mapping Unit is found in every region of the study area. This type is comprised of larger endorheic basins such as Rogers and Palen Dry Lakes as well as smaller alkali sink complexes that occur southeast of Kramer Junction. Within the 2014–2016 mapping region, playa surfaces are common and vary considerably in size. The sparsely vegetated playa portion of Bristol Lake is over 43,000 acres in size.





**6117 – *Chorizanthe rigida* - *Geraea canescens* Desert Pavement  
Sparsely Vegetated Alliance**

Spiny herb – Desert Gold Desert Pavement Sparsely Vegetated Alliance



This Desert Pavement example contains narrow rills with concentrations of *Larrea tridentata* dissecting the interfluves of nearly unvegetated darker pavement.



Desert pavement surfaces can range from a very dark to light tone. Here the pavement surface itself is devoid of shrubs, while the rill edge at the right contains *Larrea tridentata*.



#### 6117 *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance

**DESCRIPTION:** This mapping unit is extremely sparse, dark, and unvegetated to a large degree even in good rainfall years. Photo signature is usually distinctive and often looks like asphalt pavement. No evenly spaced shrubs are present. Vegetative cover is less than 2 to 4 percent, mainly from the narrow rills that are less than the MMU and whose distribution is not representative of the polygon. The mapping unit is often characterized by old dark alluvial surfaces with no shrub cover on gradual to moderate slopes. The best examples of this mapping unit are in the eastern part of the study area where these features are an extensive and diagnostic part of the Colorado Desert. Farther west the rainfall average is higher and the quality and extent of this landform are less pronounced. Good examples occur adjacent to Pinto Basin and in the Dale Dry Lake basin.

**PHOTOINTERPRETATION SIGNATURE:** This type is a sparsely vegetated landform, often dissected by narrow rills containing a sparse to rather dense cover of shrubs and at times a low-growing *Parkinsonia florida* - *Olneya tesota* (microphyll) wash component. Overall vegetative cover is less than 2 to 4 percent, almost entirely occurring in the narrow rills that are less than the MMU and whose distribution is not representative of the polygon. The pavement surface itself is for the most part entirely devoid of woody vegetation. The image signature depicts a smooth texture with a dark brown-black or dark gray color that can occasionally vary to lighter tones. The color tone may change across the surface.

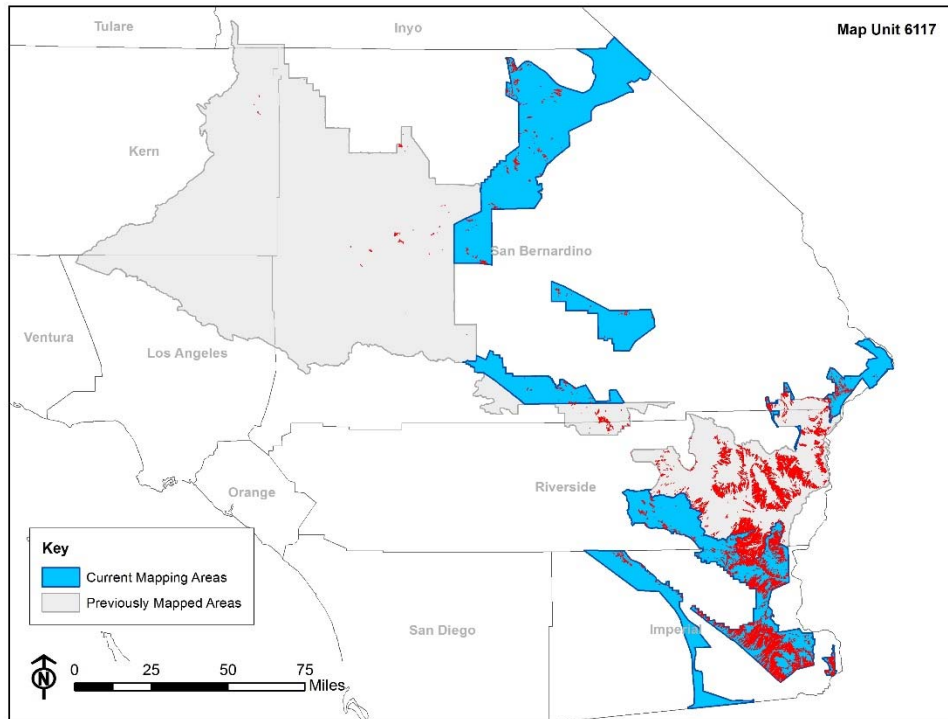
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Larrea tridentata* - *Ambrosia dumosa* (4115), *Larrea tridentata* - *Encelia farinosa* (4118), and *Larrea tridentata* (4119) Alliances – These types are mapped on pavement areas where shrubs are present on the pavement surface, and/or where the vegetated rills of the pavement area are evenly distributed across the pavement polygon. Total cover of the pavement polygon is above 3 to 4 percent. If a vegetative type is assigned to the pavement, it reflects the surrounding vegetation type.
- *Parkinsonia florida* - *Olneya tesota* Alliance (4227) – This type is mapped on pavement areas where trees are present on the pavement surface, and/or where the tree-vegetated rills of the pavement area are evenly distributed (representative) across the pavement polygon. Total cover of the pavement polygon is above 2 to 4 percent.
- North American warm desert bedrock cliff and outcrop Group (6110) – Pavement surfaces can be tectonically altered to where they may be difficult to distinguish from other darker colored slopes that occur on typically higher, more complex terrain. In these settings, it may be necessary to map to the more generalized Group-level category.
- *Atriplex hymenelytra* Alliance (6111) – The *A. hymenelytra* Alliance on desert pavement landforms has small light-colored shrubs scattered on the pavement surface. This type is mapped from field data and locally extrapolated.

**6117 *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance**

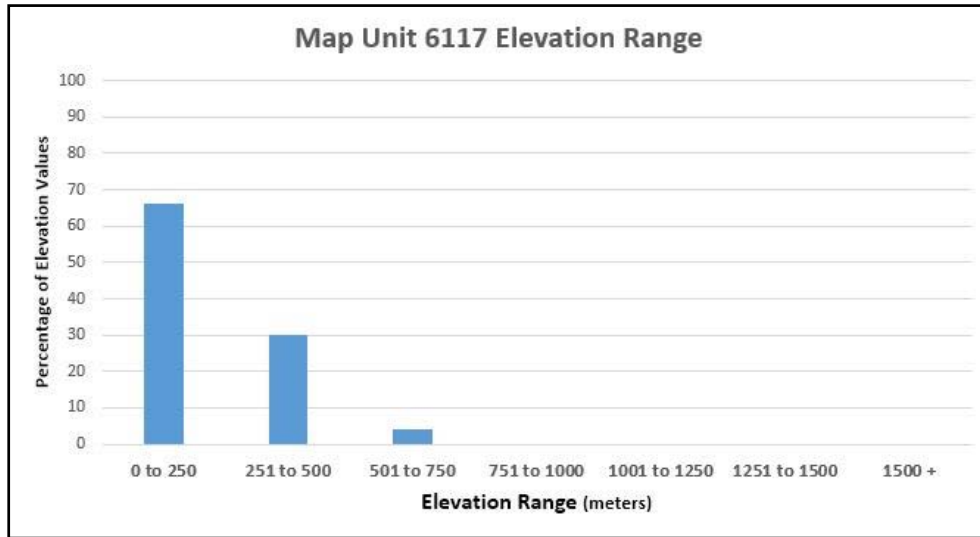
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – In certain settings, particularly around the eastern and southern edges of Ford Dry Lake, pavement surfaces come in close contact with the edges of the playa. In these situations, pavement color is significantly lighter than average and can be confused with the drier margins of the playa. Overall herbaceous cover is slightly higher along the playa margins than on the pavement and can be detected on the NAIP color infrared (CIR) imagery.

**6117 *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance**

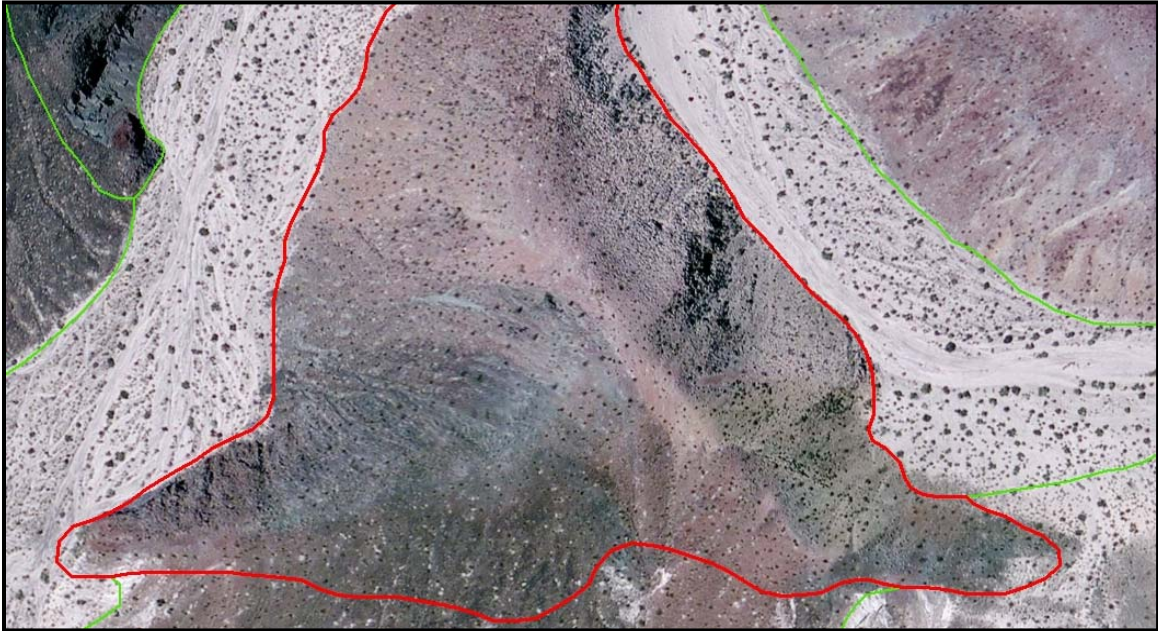


**DISTRIBUTION:** Most of the polygons mapped to the *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance occur in the Colorado Desert on middle to upper bajadas flanking all the mountains in that region. In the Central Mojave Desert region they are primarily mapped on bajadas nearby and adjacent to the Pinto Mountains, and at the base of the Calico and Alvord Mountains. In the Western Mojave Desert region they are on bajadas adjacent to the El Paso Mountains. Within the 2014-2016 mapping region, these land features are frequent and widespread, especially in the Chuckwalla and Chocolate Mountains zone, where they make up nearly 20 percent of the total area mapped. They are much less common in the Eastern Mojave Desert region and are absent in all but the northeastern corner of the Salton Sea Trough zone.

6117 *Chorizanthe rigida* - *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance



**6118 – *Peucephyllum schottii* Alliance**  
Desert fir Alliance



This image shows a *Peucephyllum schottii* stand with low cover on a steep, rocky slope. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.



The photo shows *Peucephyllum schottii* on the talus slopes above the wash in the foreground.



#### 6118 – *Peucephyllum schottii* Alliance

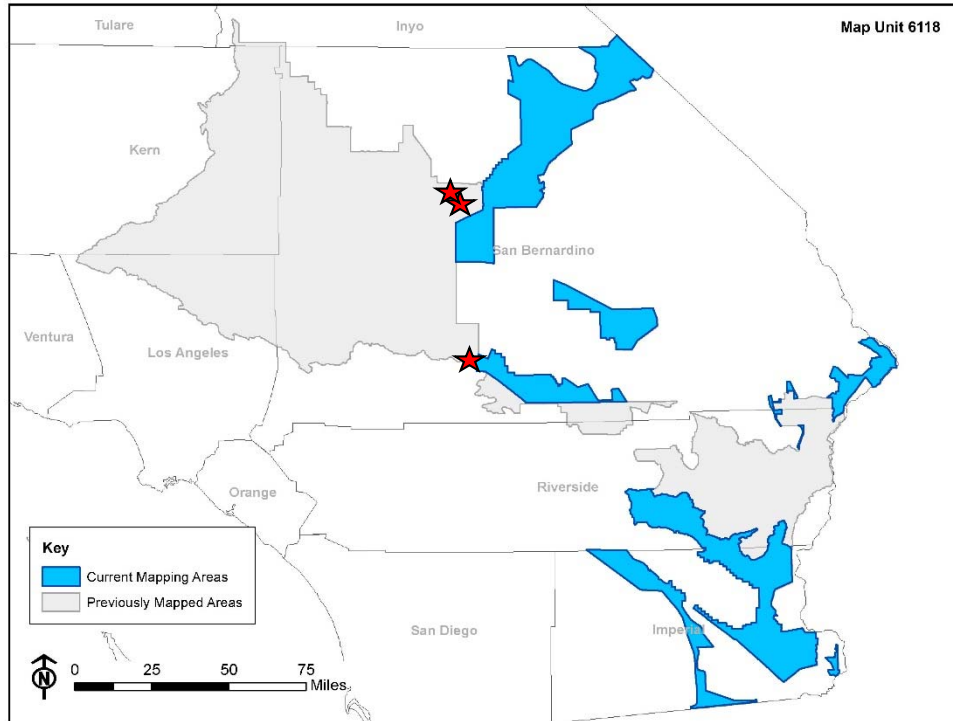
**DESCRIPTION:** Polygons mapped as this Alliance are dominated or characterized by *Peucephyllum schottii*, often at low (1 to 5 percent) cover. No other indicator shrubs are present in greater cover or dispersion. This arborescent shrub is vivid green and densely leafy, with narrow, almost needlelike leaves. Stands are typically on steep massive outcrops of basalt or calcareous rocks (cliffs and scree) at lower elevations in the study area. Stands are mapped in local areas in which there were field observations of the type.

**PHOTOINTERPRETATION SIGNATURE:** The stands are generally very open on steep, rocky substrates of varying aspects. Individual shrubs are irregularly shaped and appear dark green to black. There is generally very little herbaceous understory associated with this sparsely vegetated Alliance.

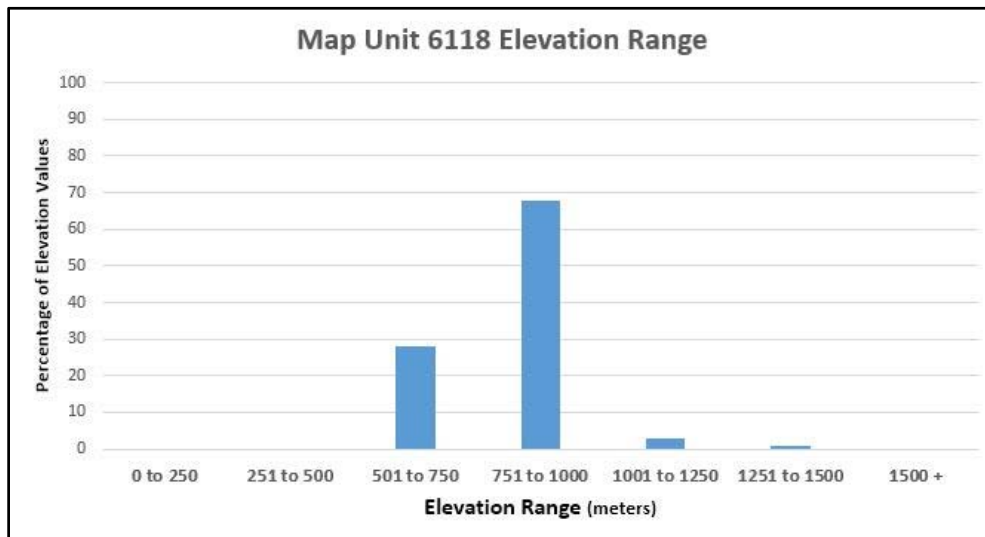
#### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Larrea tridentata* – *Encelia farinosa* Alliance (4118) – This Alliance occurs in very similar settings but generally shows the gray, mounded signature of *Encelia farinosa* (which can sometimes be confused with talus rocks).
- *Larrea tridentata* Alliance (4119) – *Larrea tridentata* may also occur at low cover on steep slopes but is less irregularly shaped and is lighter in color due to a less dense crown.

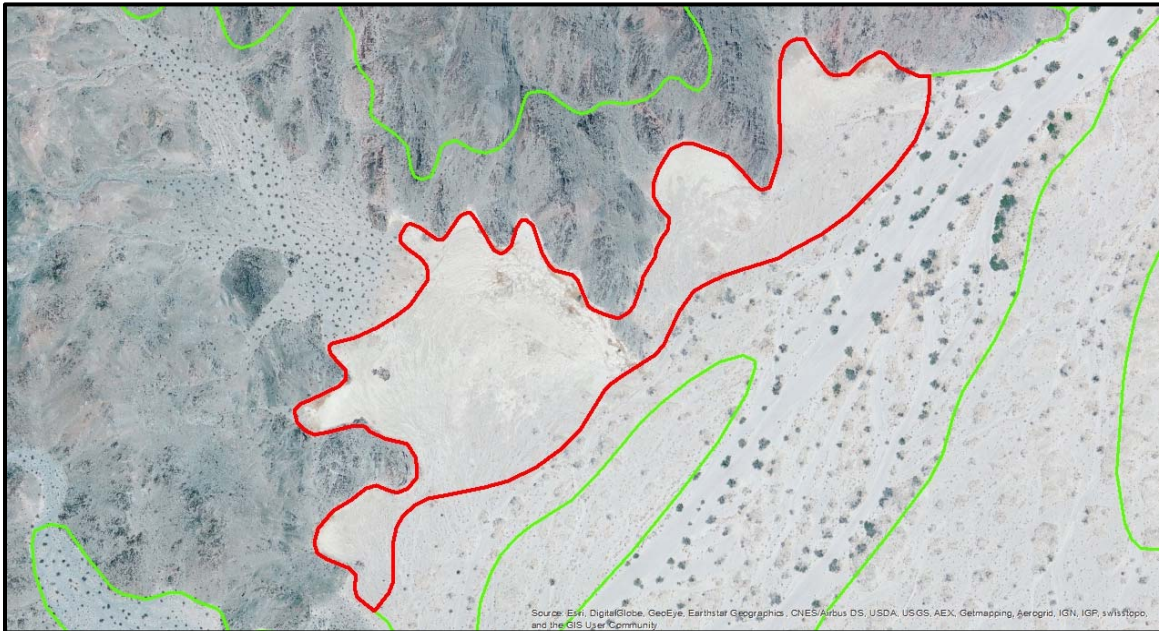
6118 – *Peucephyllum schottii* Alliance



**DISTRIBUTION:** Most mapped occurrences are in the Alvord Mountains, although smaller, below-MMU stands were noted elsewhere, such as Red Rock Canyon. Although *Peucephyllum schottii* was observed in the field as a component to numerous stands of vegetation, especially in the *Larrea tridentata* – *Encelia farinosa* Alliance, this type was mapped only once within the 2014–2016 mapping region based on a field observation near the town of Landers. Note: In the distribution map above, a star symbol has been placed over the polygons for display purposes.



## 6120 – North American warm desert dunes and sand flats Group



Located at the base of Cave Mountain, the image shows the typical white signature of a sandy flat (in red polygon). Stands of *Larrea tridentata* - *Ambrosia dumosa* and *Larrea tridentata* - *Encelia farinosa* cover the mountain the west and north of the polygon; a stand of *Chilopsis linearis* is in the wash to the south and east of the polygon.



Low dunes and sand flats with very sparse vegetation are exhibited in this ground photo.

## 6120 – North American warm desert dunes and sand flats Group

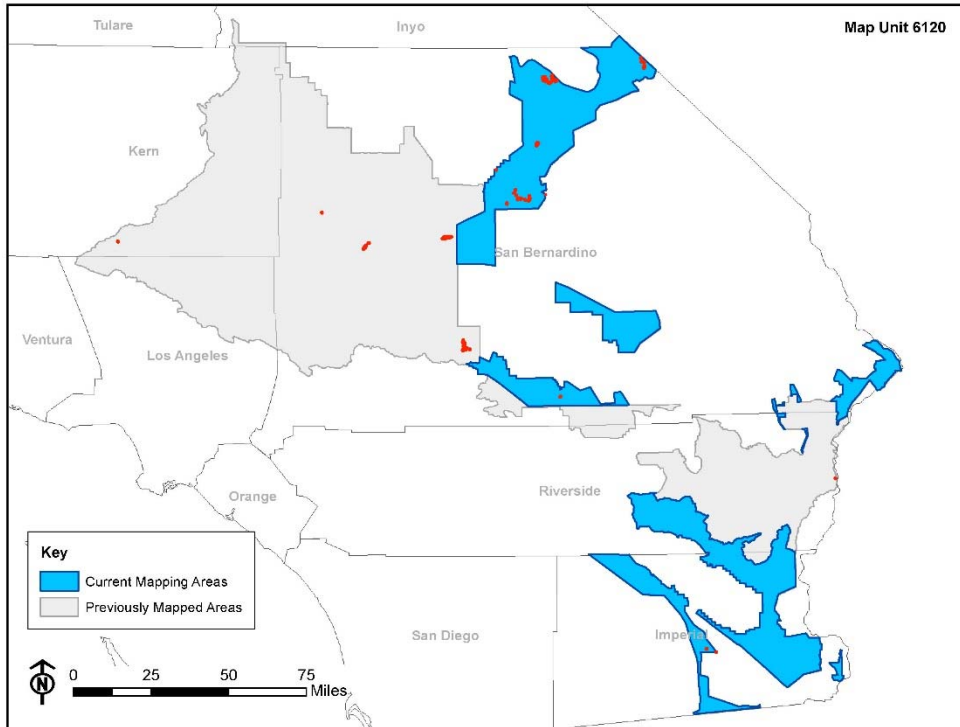
**DESCRIPTION:** This category was used for sparsely vegetated to unvegetated sand dunes and sandy flats. The vegetation type was assigned to the Group level when signature and ecological characteristics were inconclusive, making photointerpretation and modeling/extrapolation for specific Alliance calls difficult. In the study area, this was used mostly when field work did not substantiate a more detailed call such as the *Dicorea canescens* – *Abronia villosa* Alliance.

**PHOTOINTERPRETATION SIGNATURE:** Sandy areas typically have a white to light tan or light gray signature. Dunes tend to have a hummocky appearance whose topography is highlighted by vegetative edges in low relief areas or by shadows. Specific dune Alliances within this Group are mapped from field data and locally extrapolated.

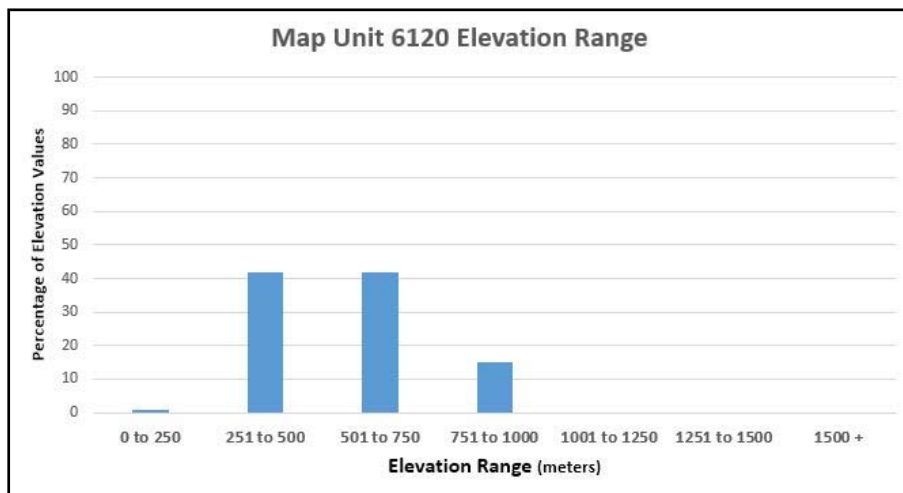
### TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pleuraphis rigida* Alliance (4122) – Stands have greater than 2 percent cover of vegetation. This bunch grass has a mottled, light gray signature, with cover ranging widely within a stand.
- *Ephedra californica* Alliance (4211) – The *E. trifurca* version of this type occurs on sand dune areas. The stands are vegetated at greater than 2 percent cover. They appear as large gray to green individuals with a dense crown, well-defined edges, and grow in evenly-spaced and/or clonal ring patterns.
- *Atriplex canescens* Alliance (5111) – Stands have greater than 2 percent cover of vegetation. The shrub signature most commonly appears brown to tan, less commonly gray to grayish blue. Stands dominated by this species of *Atriplex* are commonly found on dunes, especially in areas close to larger playas.
- Unvegetated wash and river bottom Mapping Unit (6114) – This type occupies the active channel portion of dry washes and rivers. Substrate may be sand, cobble, or rock. No dune-like forms are present.
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – The similarities between these two land features are addressed in the sparsely vegetated playa section of this report.
- *Dicorea canescens* - *Abronia villosa* Alliance (6121) – This type was mapped in the Colorado Desert portion of the study area from field survey data and locally extrapolated. Where field data does not exist, stands are mapped only on larger dune complexes such as the Dumont Dunes in the Eastern Mojave Subregion.
- *Panicum urvilleanum* Alliance (6122) – This type occurs in broad river washes within the study area. Signature shows vegetation in the form of gray dots of plants at individual small sand mounds where the plants capture blowing sand at their base. The *P. urvilleanum* Alliance is mapped and extrapolated locally from field survey sites.

**6120 – North American warm desert dunes and sand flats Group**



**DISTRIBUTION:** The few Group-level sand dunes and flats in the Central Mojave Region were mapped on the east side of Lower Johnson Valley south of Melville Dry Lake, southeast of the Mojave River just west of Lenwood, and in the Mojave River floodplain north of Newberry Springs. One polygon was mapped on the Colorado River floodplain at the southeast end of the Big Maria Mountains. Within the 2014–2016 mapping region, most polygons were mapped in sparsely vegetated sandy areas with minimal topography east of Mesquite Lake, adjacent to the Dumont Dunes, and on sand ramps at the base of Cave and Cronese Mountain.





**6121 – *Dicoria canescens* – *Abronia villosa* Alliance**  
Desert dunes Alliance



This is an example of a very sparsely vegetated *Dicoria canescens* - *Abronia villosa* Alliance desert dune. Note the east-west linear dune pattern.



The dunes depicted on this photo show the Rice Valley Sand Dunes. *Oenothera deltoides* (dune primrose) pictured in the inset may be encountered in this environment.

## 6121 – *Dicoria canescens* – *Abronia villosa* Alliance

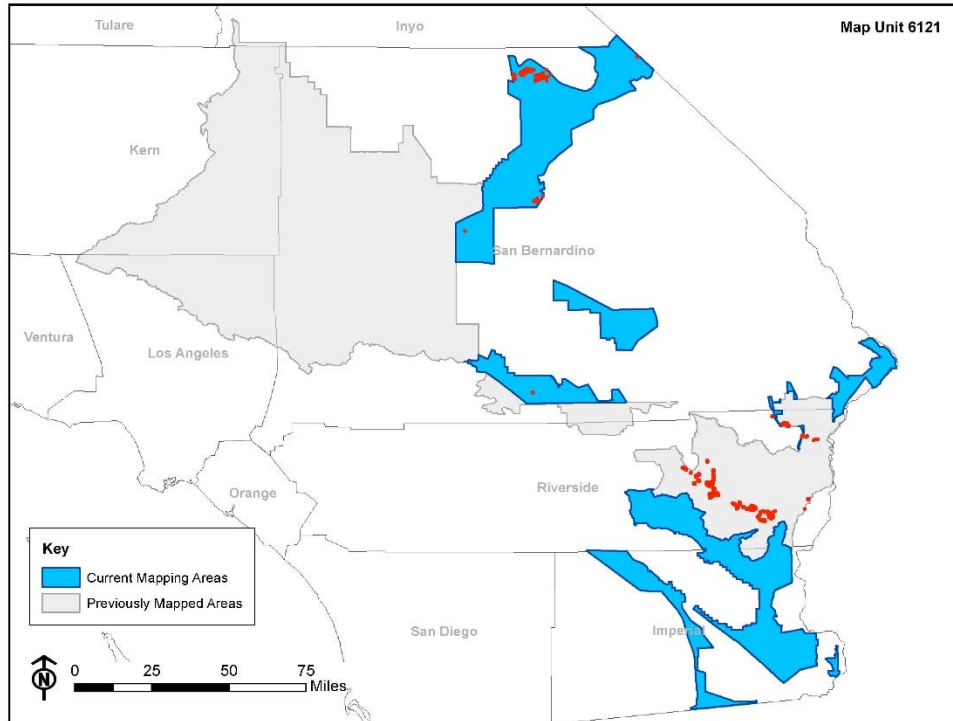
**DESCRIPTION:** *Dicoria canescens* or *Abronia villosa* are characteristically present in stands, but are not necessarily dominants, depending upon the year and the phenology of these annual plants. Skeletons of *Dicoria*, *Oenothera deltoides*, *Abronia villosa* and other psammophytic annuals are usually present and uniform woody plant cover is less than 2 percent absolute cover.

**PHOTOINTERPRETATION SIGNATURE:** Photo signature shows little or no vegetation on a substrate composed primarily of white to tan sands. Crescent or wavy linear patterns of dunes are visible, sometimes with a gray tone. Sparse vegetation may assemble in the interdunal spaces or may be scattered throughout the stand in cover below 2 percent when occurring on sand sheets.

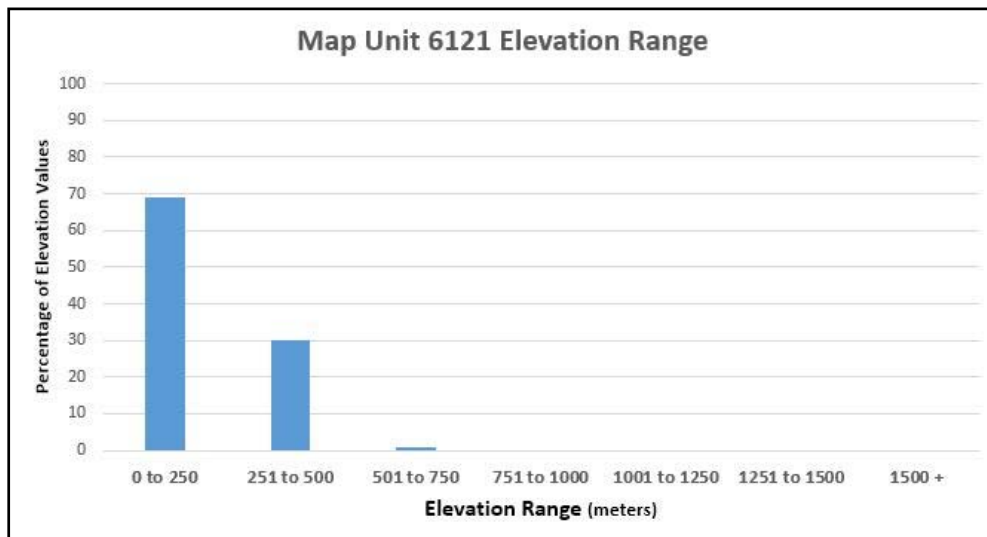
### **TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:**

- *Ephedra californica* Alliance (4211) – The *E. trifurca* version of this type occurs on sand dune areas. The stands are vegetated at greater than 2 percent cover. They appear as large gray to green individuals with a dense crown and well-defined edges, and grow in evenly-spaced and/or clonal ring patterns.
- *Atriplex canescens* Alliance (5111) – Stands have greater than 2 percent cover of vegetation. The shrub signature most commonly appears brown to tan, less commonly gray to grayish blue.
- North American warm desert dunes and sand flats Group (6120) – This is the default type for sparsely vegetated sand dunes and sand flats that do not appear to have any vertical relief or contain vegetation that may not be as diagnostic as that which may occur on a classic dune.

6121 – *Dicoria canescens* – *Abronia villosa* Alliance



**DISTRIBUTION:** The only stands of *Dicoria canescens* - *Abronia villosa* Alliance mapped in the original study area occur in the Colorado Desert Region all along the Chuckwalla Valley from Palen Dry Lake and just south of the Coxcomb Mountains to just east of Wileys Well Road. A few isolated stands also occur on the eastern edge of Palo Verde Mesa. Within the 2014-2016 mapping region, dunes and field-verified sand sheets are mapped to this Alliance primarily in the Dumont Dunes area in the Eastern Mojave Subregion.



## 9200 – Agriculture



The above image is of a nursery, one type of agriculture mapped as 9200. Note the variation in pattern.

**DESCRIPTION:** The Agriculture map unit includes land used primarily for the production of food, fiber, and livestock. For this project, agricultural practices are broken down into two categories: woody orchards and vineyards (9210) and non-woody row and field crops (9220). Agriculture is further defined as planted and maintained, and not fallow for longer than a five-year period. However, this more generalized map unit is mainly applied to miscellaneous agricultural uses such as nursery, poultry, and dairy operations. The map unit may also be applied to lands where specific agricultural use cannot be determined with existing imagery (e.g. plots of land in an agricultural area that were previously used as orchard or citrus but have been cleared with no obvious land use on 2014 imagery). It is also used to describe field plantings where it is not evident that the site is a nursery but is covered with linear patterns of plastic.

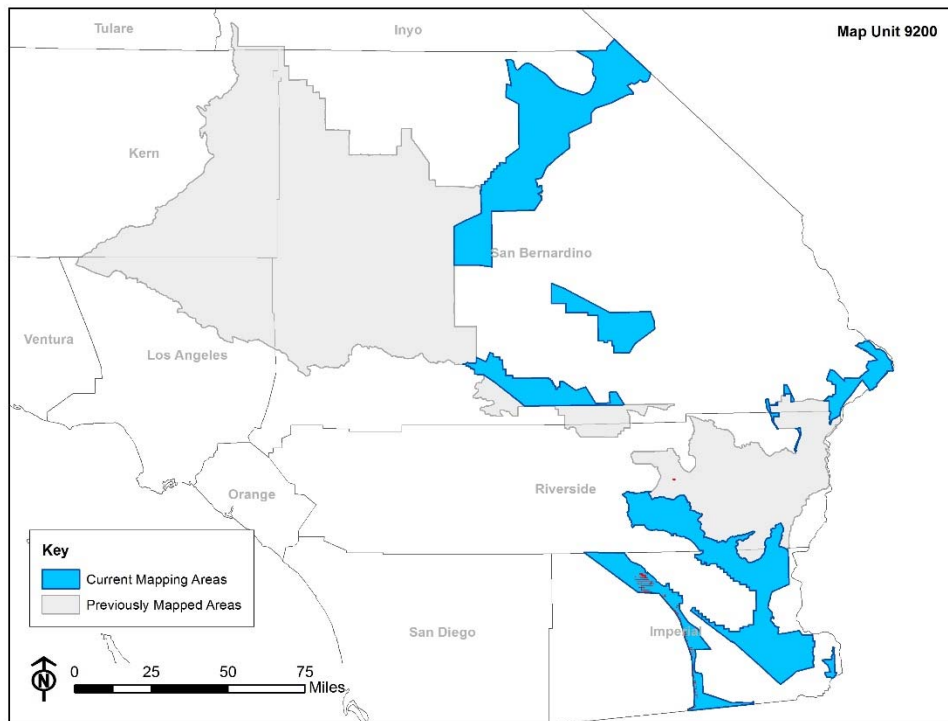
In addition, the Agriculture map unit is used to describe corridors of agricultural drains in the agricultural area near the Salton Sea. These small agricultural channels are referred to as “lateral drains” on the USGS topographic map. They run perpendicular to major canals, typically containing two small agricultural channels, although some might have only one. The corridors may also include a road and/or a staging area for agricultural practices. (See Appendix C.)

## 9200 – Agriculture

**PHOTOINTERPRETATION SIGNATURE:** Nurseries appear similar to row crops in configuration, but the rows are often not uniform due to the numerous types of plants grown there. They may contain staging areas that can include equipment and supplies. Greenhouse structures may be present. Impounded water sources may also be located in or near the nurseries. Other signatures for the Agriculture mapping unit include areas that were previously a citrus or orchard area that are now cleared on the project base imagery. These areas appear to be smooth with no obvious land use intent and most likely recently cleared. The other common photo signature for this type is of corridors containing small agricultural drains that are often located adjacent to agricultural fields, and contain either two channels, one channel that appears to carry water consistently, or one or two channels and a road.



## 9200 – Agriculture



**DISTRIBUTION:** In the original study area the Agriculture map unit was mapped in the Desert Center area. Within the 2014–2016 mapping region, land use features mapped to this broad category occur in the Imperial Valley (Salton Sea Trough zone) primarily along the East Highline Canal. Most features mapped as this category are the corridors of approximately 40 laterals west of this canal. To the north, another set of these corridors of small channels bisect the numerous managed wetland ponds within the Imperial State Wildlife Refuge.

## 9210 – Woody Agriculture (orchards, vineyards)

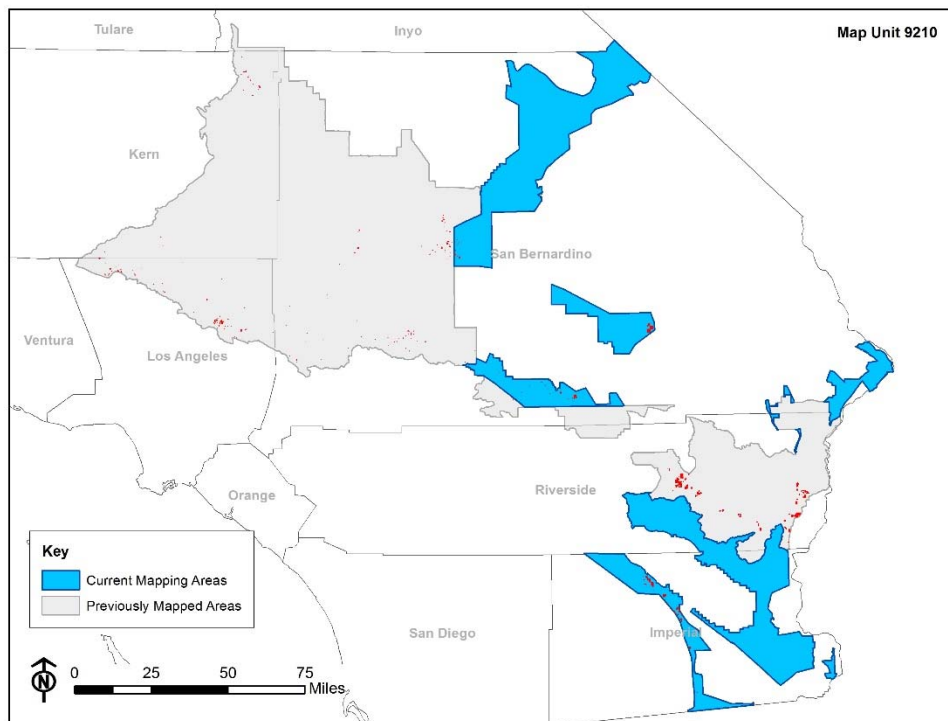


The above image is an example of an orchard. The rows at the lower part of the image are newly planted and appear as brown dots. The more mature trees above show a dark green signature. Often times, houses are located in the middle of orchards.

**DESCRIPTION:** Woody agriculture consists of commercially productive tree, bush, and vine crops. This class includes orchards, vineyards, jojoba farms, etc. active within the five-year set of imagery prior to the 2010 base imagery for the previously mapped Subareas 1, 2, and 3; and prior to the 2014 base imagery for the current mapping effort of Subareas 4, 5, and 6. Examples include frost-sensitive citrus groves, such as grapefruit and oranges, grown in the Colorado River floodplain and Imperial Valley, and cold season deciduous crops in the Antelope Valley including pears, apples, cherries and various nut crops. This class remains valid for abandoned orchards until the trees are removed.

**PHOTOINTERPRETATION SIGNATURE:** Most image datasets evaluated in the mapping effort depict woody agriculture in leaf-on conditions and therefore contrast considerably from the adjacent non-irrigated natural vegetation. Younger stands require closer scrutiny to differentiate them from annual field and row crops. Orchard trees are typically aligned in a grid pattern, with crowns appearing to abut each other. Bush crops are similar to orchards, but may be configured in rows rather than a grid, and appear to be much shorter in height. The orchard and vineyard areas tend to be neat and uniform. Vineyards usually are aligned in evenly spaced rows about five to ten feet apart. With the exception of vineyards, which rarely occur within the mapping area, linear patterning is not accentuated in woody agriculture as significantly as in annual row crops.

## 9210 – Woody Agriculture (orchards, vineyards)



**DISTRIBUTION:** Woody agriculture is concentrated in two major regions of the original study area. Cold-season deciduous crops parallel the foothills of the Transverse Ranges adjacent to and near small communities such as Pearblossom, Littlerock, Phelan, Palmdale, and Lucerne Valley. Isolated occurrences are also found in the Indian Wells, Mojave, and Hinkley Valley areas. Frost-sensitive citrus crops are exclusive to the Colorado Desert, growing primarily in the Colorado River floodplain and western portions of the Chuckwalla Valley. Within the 2014-2016 mapping region, cold-season deciduous crops continue to parallel the eastern portions of the Transverse Ranges north of the communities of Joshua Tree and Twentynine Palms. Citrus crops are common in the Imperial Valley along the East Highline Canal in the Salton Sea Trough zone.

## 9220 – Non-woody Row and Field Agriculture



The above image is an example of an irrigated agricultural field mapped as the “Non-woody Row and Field Agriculture” type in the Imperial Valley near Niland, CA. The tilling pattern of this field crop is extremely fine, a characteristic which helps differentiate this from orchards and vineyards.

**DESCRIPTION:** This class of agriculture consists of annual non-woody row and field crops. Croplands include cultivated, in crop, harvested, fallow, or temporarily idle land. Within the mapping area, almost all field and row crops are irrigated, with the exception of occasional dry farming of grain crops in the western Antelope Valley. Fields lay fallow for at least one season within the year. In the Antelope Valley *Atriplex polycarpa* or *Ericameria nauseosa*, both of which are rapid colonizers, may be present in recently cleared or farmed land. In the Imperial Valley fallow fields which have remained inactive for over two years may contain a sparse shrub cover, including such species as *Suaeda moquinii*, *Tamarix* spp., *Atriplex canescens*, and *Atriplex lentiformis*. Croplands idle for more than five years are designated with a natural vegetation class.

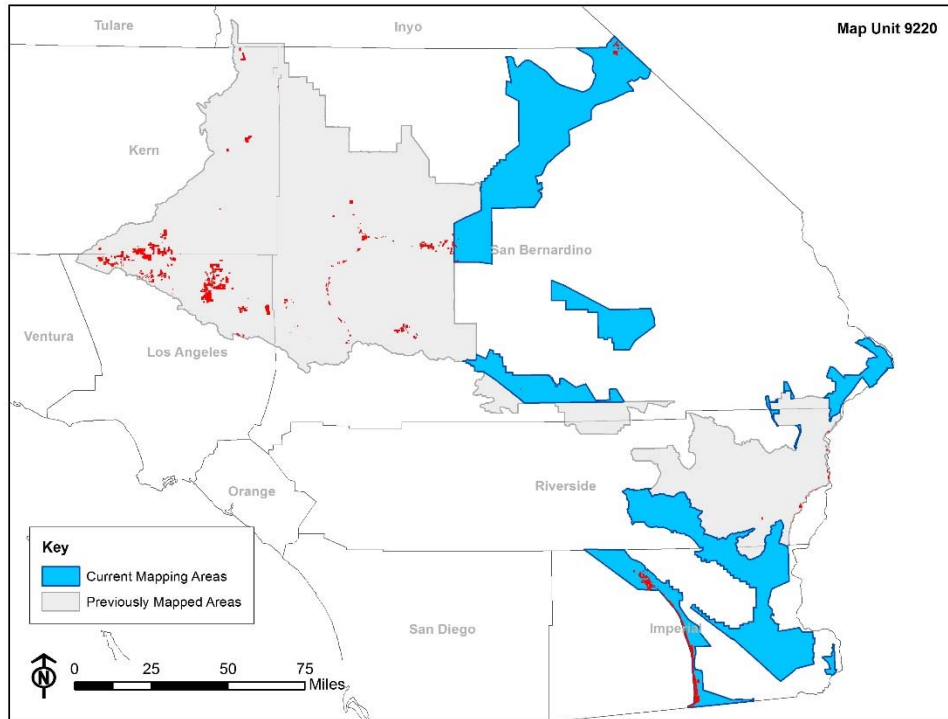
**PHOTOINTERPRETATION SIGNATURE:** Field and row crops have a highly variable color patterning depending on a number of factors including the planting techniques, type of harvest, and growth cycle of the particular crop. Irrigated field crops will appear as a uniform, smooth-textured area, with a green color. Row crops will appear similar, except the individual rows can be distinguished. Irrigation equipment such as sprinklers are sometimes visible. Tilling patterns in fruit and vegetable crops appear more evident and breaks in the patterning are more regular, their arrangement depending primarily on differing irrigation techniques. Non-irrigated field crops will show a dull green to mottled brown color with smooth, uniform texture. Dry farmed areas will appear very similar to natural grass vegetation.

## **9220 – Non-woody Row and Field Agriculture**

Tilled fields will appear smooth in texture with a white to tan color. Typically, dry fields have a homogeneous tone. Depending on the moisture content of the field, its appearance can become mottled, with moister areas appearing darker. Fallow fields will have a variable cover of seral native and non-native herbaceous vegetation. The signature color and texture can vary from homogeneous to mottled with shades of green and brown.



## 9220 – Non-woody Row and Field Agriculture



**DISTRIBUTION:** The largest concentration of row and field crops occurs in the Antelope Valley, yielding both vegetables and grains. Smaller tracts of land devoted to row and field crops follow most of the length of the Mojave River, producing primarily feed and hay. Small portions of the intensively farmed Colorado River floodplain (nearly a quarter of a million acres on the Arizona side of the Colorado River) cross over into the study area along the eastern margins of the Colorado Desert. Within the 2014-2016 mapping region, circular-irrigated row and field crops occur in the Mesquite Valley north of Mesquite Lake. To the south, in the Salton Sea Trough zone, extensive areas of feed crops parallel the western side of the East Highline Canal, representing the eastern edge of the Imperial Valley agricultural area. This agricultural region extends westward, mostly uninterrupted, for nearly 20 miles.

## 9300 – Built-up & Urban Disturbance



The above image is an example of a built-up area comprising several types of urbanization. To the west (left) of the road is a school; adjacent to the east are several small homes. Along the northeast fringe of the polygon, portions of natural vegetation stands are included in the urban polygon. Photointerpreters often must take minimum mapping unit criteria and ownership (fenceline) boundaries into consideration when delineating polygons.

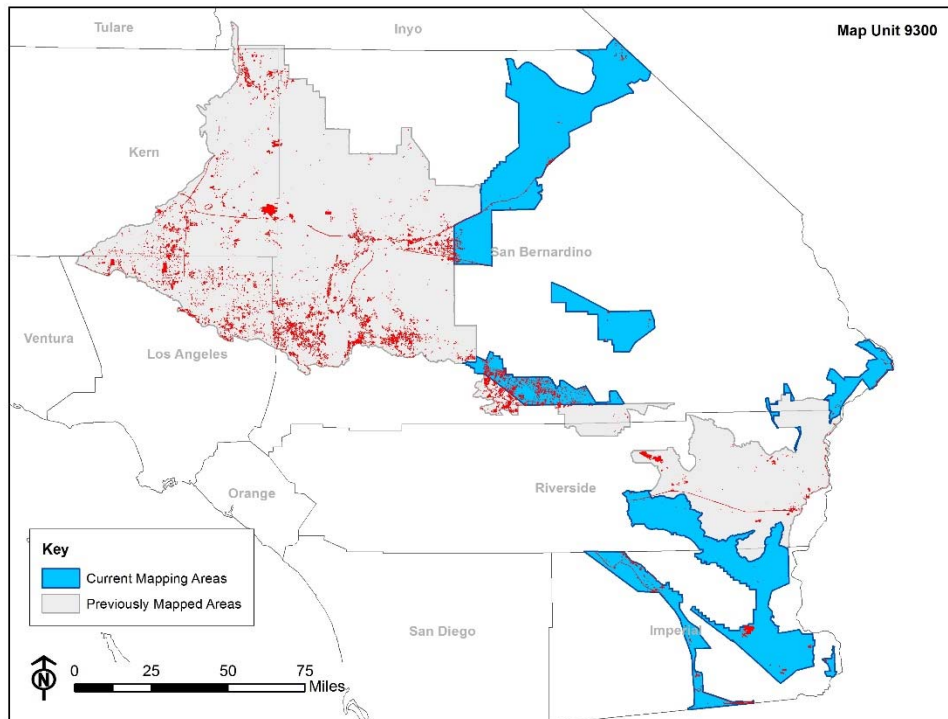
**DESCRIPTION:** Built-up areas include permanent and semi-permanent structures that are occupied/used or abandoned. Built-up areas can include residential, commercial and services, industrial, and transportation uses, as well as their associated disturbed lands. Areas under construction are also included. Associated impervious surfaces such as parking lots and playgrounds are normally included in the built-up area. Small areas of naturally occurring vegetation may be included in the built-up area following the guidelines of the land use criteria (See Appendix C).

Major four-lane divided highways and freeways are included in this mapping type and are delineated to the fenced right-of-way. Near the Salton Sea, the railroad and State Route 111 run parallel and are mapped as one polygon coded as the “Built-Up & Urban Disturbance” map unit. North of the town of Frink where the railroad and State Route 111 complex is mapped, berms adjacent to the railroad have been recently scraped and devoid of vegetation. These recently disturbed berms are included in this polygon with the railroad and State Route 111. However, berms adjacent to the railroad south of Frink have not been recently altered and are vegetated. Instead of being included within the “Built-Up & Urban Disturbance” polygon, they are mapped to the appropriate vegetation type. (See Appendix C.)

### **9300 – Built-up & Urban Disturbance**

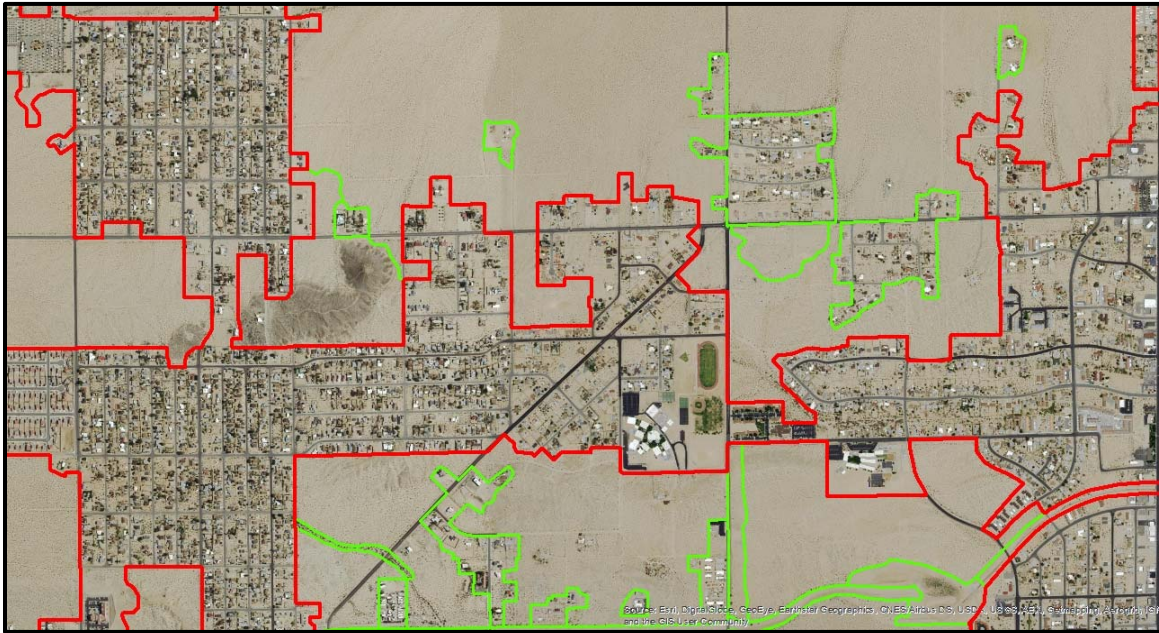
**PHOTOINTERPRETATION SIGNATURE:** Built-up areas consist of structures and the surrounding associated cleared and/or impervious surface. The boundaries often follow road centerlines and/or fence property lines. Vegetation within the polygon is limited to small naturally occurring components of adjacent stands crossing into the built-up area, and exotic plantings associated with the land use such as lawns, gardens, hedgerows and trees.

## 9300 – Built-up & Urban Disturbance



**DISTRIBUTION:** Built-up areas occur throughout the study area. They are centered within the major developments of Barstow, Ridgecrest, Lancaster-Palmdale, Victorville-Hesperia-Apple Valley, Yucca Valley and Blythe. Concentrations are highest in the southern and western portions of the Western Mojave Desert region along the foothills of the Transverse Ranges from Cajon Pass to the Antelope Valley. Within the 2014-2016 study area, built-up land occurs in all major subregions. The area with the most built-up land in current mapping area lies along the corridor between Yucca Valley and Twentynine Palms, where it covers almost 12,000 acres of land.

## 9310 – Urban Window



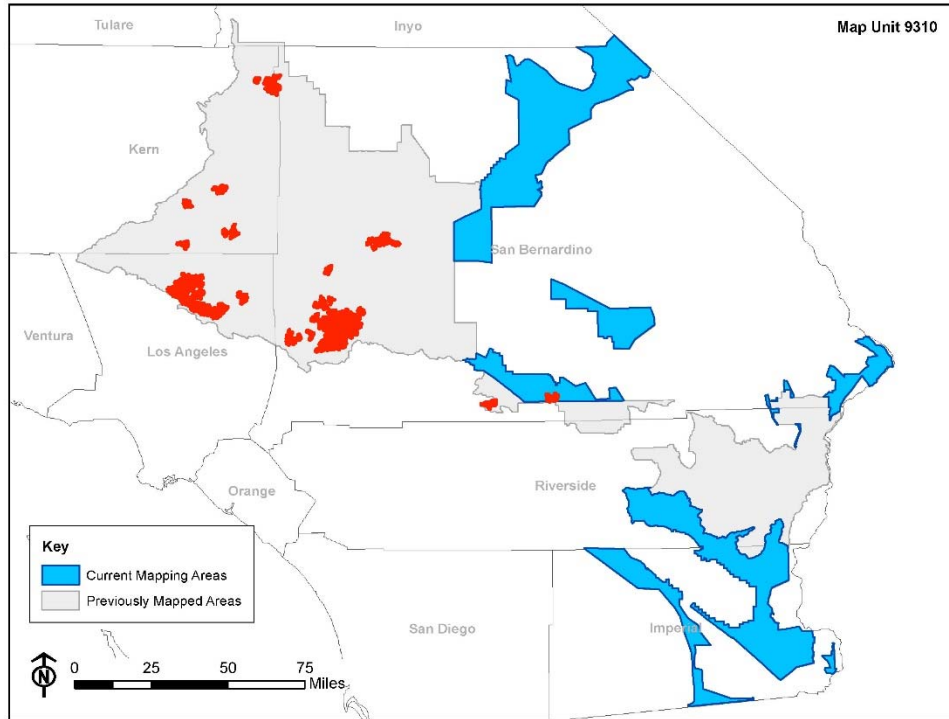
The red polygon in the above image is an example of an urban window, which includes a portion of the city of Twentynine Palms. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.

**DESCRIPTION:** An urban window is a developed contiguous area of built-up and disturbed lands greater than one square mile in size. Agricultural and vacant areas of natural vegetation within an urban window are not mapped unless they are greater than 10 acres in size. Flood control basins within an urban window are mapped separately if larger than ten acres in size.

**PHOTOINTERPRETATION SIGNATURE:** The photo signature is characteristic of built-up areas, in that urban windows are contiguous areas of built-up and disturbed lands originating from an intensely developed urban core. Urban windows are comprised of a number of different uses, generally including residential, commercial, industrial, and transportation.



**9310 – Urban Window**



**DISTRIBUTION:** Urban windows are found in large population areas. The original study area has urban windows in such areas as Lancaster-Palmdale, Ridgecrest, Barstow, Apple Valley-Hesperia, and Yucca Valley. Within the 2014-2016 mapping region, only the town of Twentynine Palms meets the size requirements for this designation.

## 9320 – Anthropogenic Areas of Little or No Vegetation

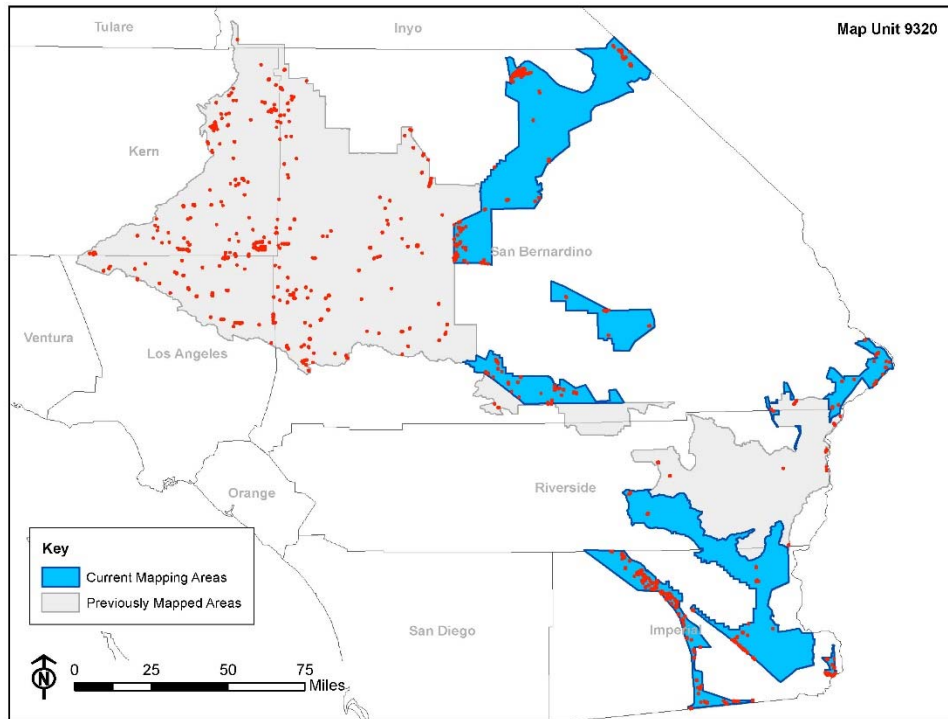


The above image is an example of an anthropogenically cleared area adjacent to a housing development.

**DESCRIPTION:** Anthropogenically cleared areas contain less than 2 percent vegetative cover and have been cleared by human impact. These areas can be temporal in nature and are based on the project base imagery timeframe. Surfaces are generally permeable and can either be covered by fill dirt from another source or contain the original soil and/or substrate layer. Small remnant impervious pavement surfaces can make up a portion of the site. Examples include areas which have recently been cleared for construction, demolition sites which have most of their impervious surface removed, and Off-Highway Vehicle “staging areas” used as rendezvous sites and for camping.

**PHOTOINTERPRETATION SIGNATURE:** Anthropogenic Areas of Little or No Vegetation appear as cleared land. They normally have a smooth texture and generally reflect the color of the substrate surface formed by its parent material. There is usually a distinct boundary where the vegetation ends and the clearing begins. Cleared edges follow angular or straight lines which do not normally occur along the boundaries between vegetation types. Anthropogenic areas are difficult to distinguish when adjacent natural vegetation is under 5 percent cover.

## 9320 – Anthropogenic Areas of Little or No Vegetation



**DISTRIBUTION:** In the original study area, anthropogenically cleared areas are consistently scattered throughout the Western Mojave Desert region. These areas are less common and occur only sporadically in the Central Mojave Desert and the Colorado Desert regions. Within the 2014-2016 mapping region, these cleared areas are less frequent but still widespread except in the Salton Sea Trough zone, where they are prevalent.

## 9500 – Exotic Trees

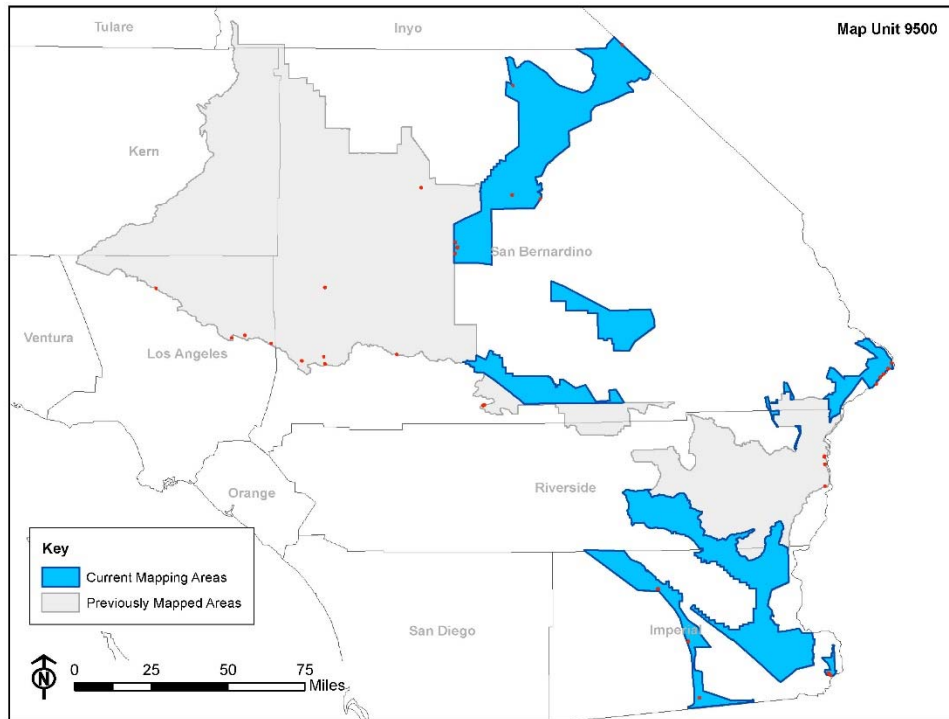


The above image is an example of exotic trees dominated by *Tamarix aphylla* adjacent to the Colorado River south of Parker Dam.

**DESCRIPTION:** Exotic trees are non-native to the area and are associated with human habitation. This category is reserved for generally nonaggressive, invasive, exotic tree species within the mapping area. Included in the exotic trees category are planted trees that remain on old home sites such as pines, non-native palms, evergreen salt cedars (*Tamarix aphylla*), and *Eucalyptus* spp. The vegetation is confined to aesthetic horticultural plantings of trees not grown for harvest, food, or other products. Note: aggressive non-tree exotics such as *Tamarix ramosissima* or *T. chinensis*, *Arundo donax*, Mediterranean naturalized annuals, etc., if discernible on the imagery, were mapped to their own vegetation map unit class.

**PHOTOINTERPRETATION SIGNATURE:** Exotic trees appear purposefully planted, generally not blending into the surrounding landscape. They usually form rows or follow along highways and other human-related features such as aqueducts or flood control features, or they may occur on abandoned sites where the structures have been removed. However, they are often below the project minimum mapping unit size.

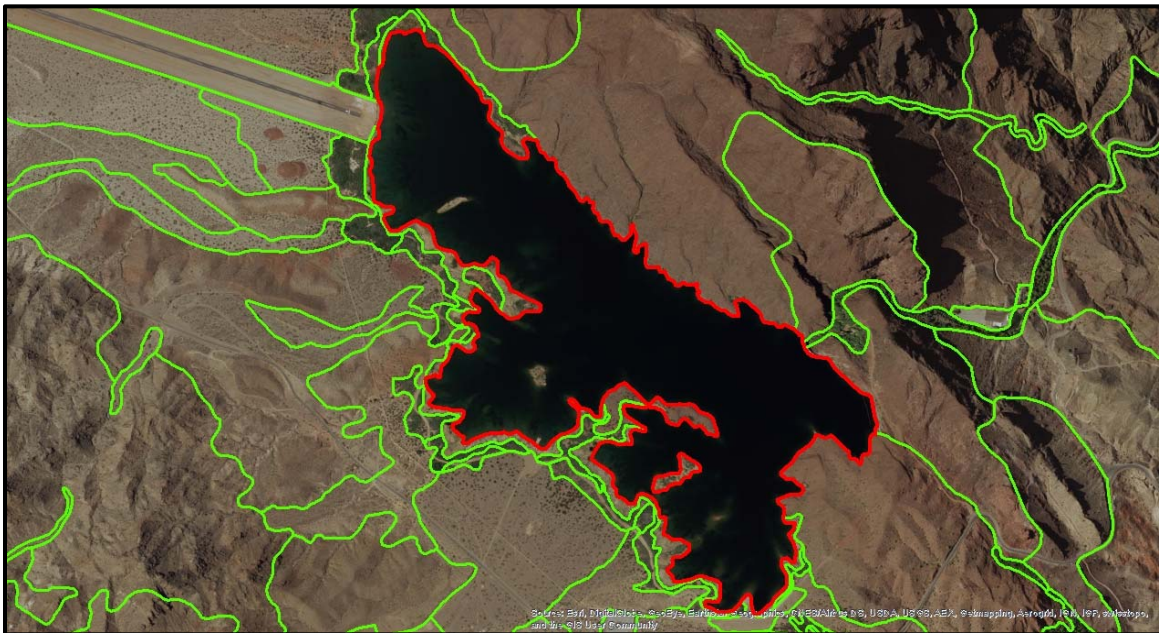
## 9500 – Exotic Trees



**DISTRIBUTION:** Mappable exotic trees are scattered in small patches along the base of the San Gabriel and San Bernardino Mountains. A few are also mapped near the California-Arizona border, mainly *Tamarix aphylla*. Within the 2014-2016 mapping region, exotic trees are mapped in only a handful of localities.



## 9800 – Water

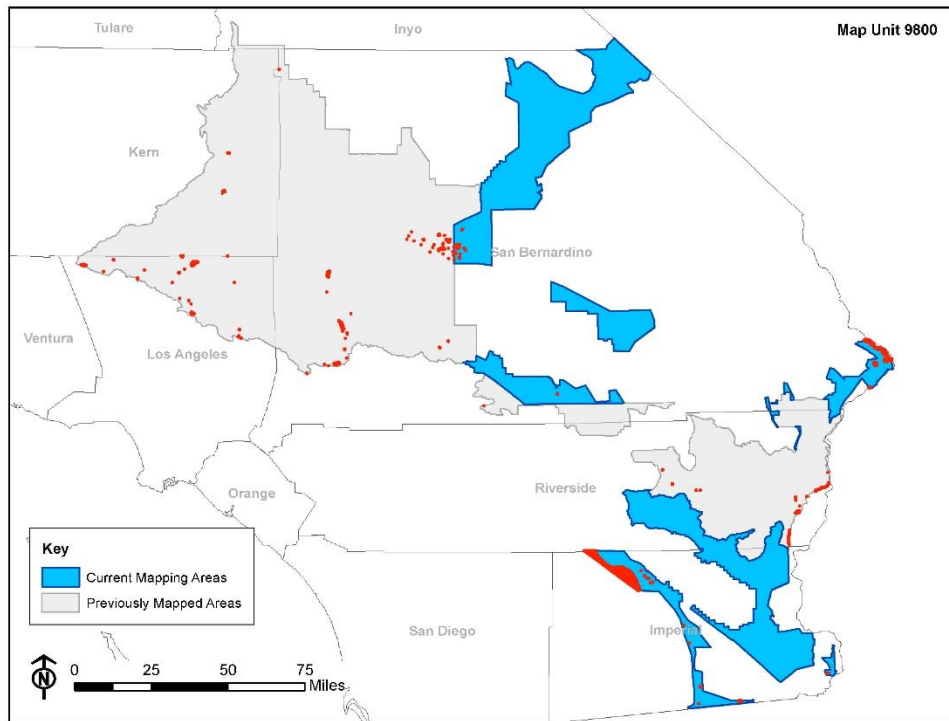


The above image is an example of a man-made reservoir (Gene Wash Reservoir) in the Whipple Mountains near Parker Dam.

**DESCRIPTION:** The Water map unit includes open water bodies, either natural or artificially created, that may or may not contain water at the time of the project base imagery. For this project, water was further broken down into four categories: perennial stream channels (9801), small earthen-dammed and naturally occurring lakes (9803), major canals and aqueducts (9804), and water impoundment features (9805). However, in this project the more generalized 9800 code is applied to artificially created water bodies containing water supplied from sources other than the watershed upslope from the mapped feature. Some examples would include park ponds, recreational lakes within a residential development, cement-lined agricultural ponds, and reservoirs.

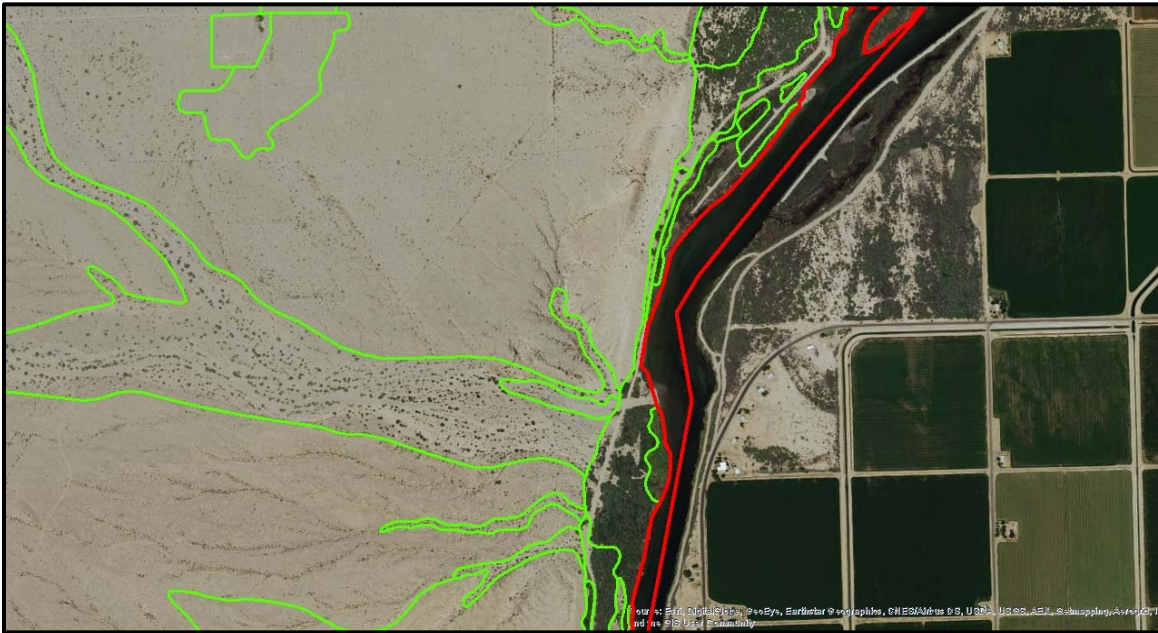
**PHOTOINTERPRETATION SIGNATURE:** Many times these man-made water bodies are within an urban setting. The water will often appear as various shades of blue to black. Sun reflectance can be seen on the water surface at times. The water is mapped to the high water line. Water must be present at the time the project base imagery was flown. Water is mapped to the visible high water mark normally incurred during high rainfall years. In drier years, a “bathtub ring” signature surrounds the existing waterline.

9800 – Water



**DISTRIBUTION:** Most of these non-naturally occurring water bodies in the study area are found in agricultural and urban areas, many of which occur in Western Mojave and Central Mojave regions, and along the Colorado River floodplain. Within the 2014-2016 mapping region, the eastern edge of the Salton Sea in the Salton Sea Trough zone, along with Lake Havasu on the Colorado River, represent the largest examples of these water features.

## 9801 – Perennial Stream Channel (open water)

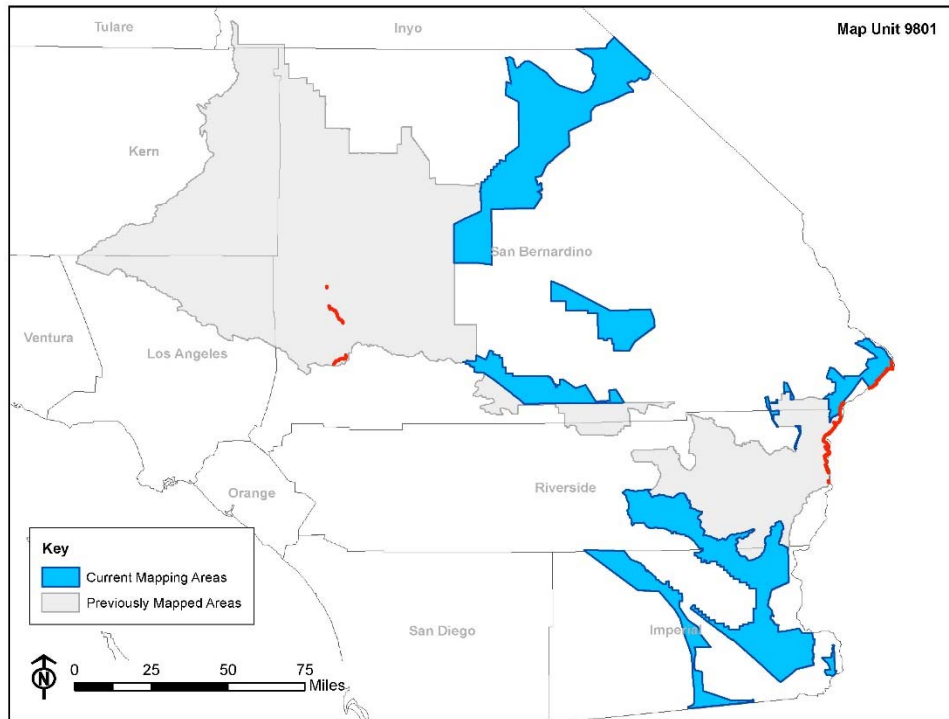


A portion of the Colorado River, a perennial stream channel, is shown above in the red polygon. Although the Colorado River extends past the eastern boundary of the perennial stream channel polygon, the study area terminates at the state boundary between California and Arizona. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.

**DESCRIPTION:** The Perennial Stream Channel map unit consists of stream channels in which water is present during all or most of the year. This category may also include temporarily exposed flats adjacent to the main channel. This sparsely vegetated category is mapped when riparian vegetation comprises less than 8 to 10 percent cover. Water must be present over most of the polygon on all image datasets. Temporarily exposed flats and channels can be visible during several weeks of the year or during longer periods in seasons with below-average rainfall.

**PHOTOINTERPRETATION SIGNATURE:** A water signature is visible over most of the channel. Shallow water reveals a semi-opaque view of the underlying substrate and will yield a lighter color than deep water. Adjacent flats and exposed portions of the channel will show an intense light gray to white signature similar to that of a typical dry wash. Occasionally, floating aquatics and small patches of immature marsh vegetation (*Typha* spp., *Schoenoplectus* spp.) will produce a light to medium dark-green color over less active portions of the channel, especially along small side channels.

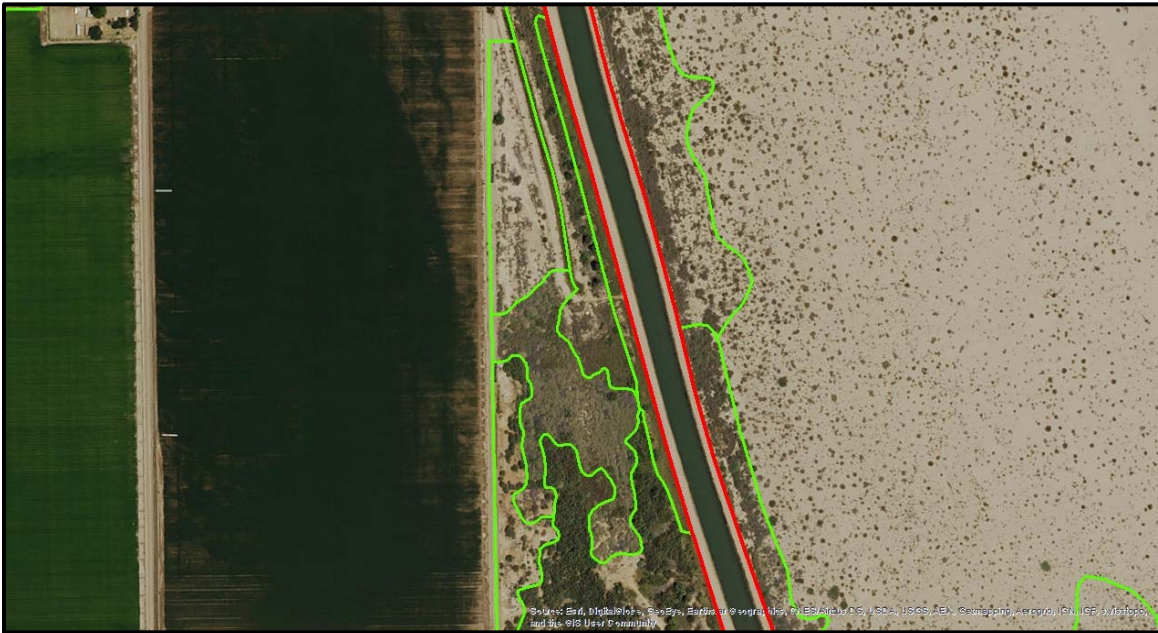
**9801 = Perennial Stream Channel (open water)**



**DISTRIBUTION:** Perennial stream channels are restricted to a few isolated locations along the Mojave River including the Mojave River Narrows and in the Summit Valley. The largest example includes the naturally flowing portions of the Colorado River south of the Parker Dam. This includes a 13-mile stretch of the river forming the eastern boundary of the Whipple Mountains zone, and a 32-mile stretch along the Colorado River Floodplain.



## 9804 – Major Canals and Aqueducts



The above image shows a portion of the East Highline Canal (red polygon) located northeast of Brawley. Note: This screenshot is a portion of a larger polygon whose entire boundary is not shown.

**DESCRIPTION:** The California Aqueduct carries water collected from the rivers and streams draining the southern portion of the Cascade Range and most of the Sierra Nevada, and transports it into Southern California. The water is pumped through the Tehachapi Mountains, enters the study area and resumes its above-ground path at South Portal in the western portion of the Antelope Valley. The Colorado River Aqueduct begins at Lake Havasu on the California-Arizona border and terminates at Lake Mathews in Riverside County. The All American Canal transfers water from the Imperial Reservoir of the Colorado River into the Imperial Valley. It feeds the Coachella Canal and the East Highline Canal. The Coachella Canal conveys water northwest to the Coachella Valley. The East Highline Canal transports water northwest and terminates northeast of the town of Wister. The aqueducts and canals are mapped only where open water is visible above ground. Pumping stations associated with the aqueducts and canals are mapped as Built-up & Urban Disturbance (9300). The levees (landward sides, levee roads and exposed portions above the waterline) that parallel both sides of the water feature are included in the delineation.

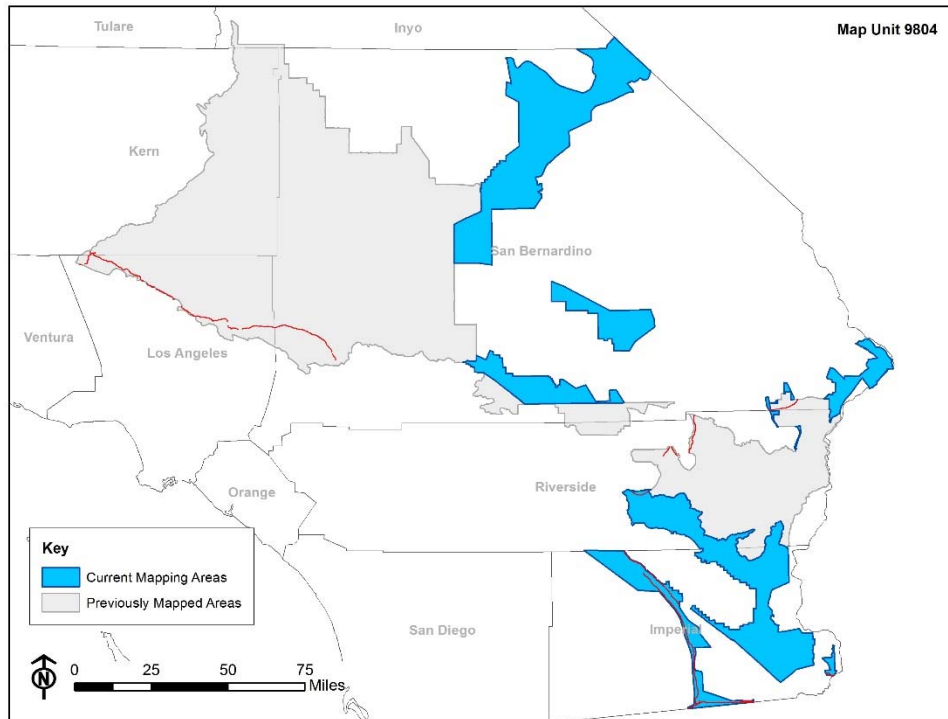
**PHOTOINTERPRETATION SIGNATURE:** These water features are recognized by their straight and angular linear configuration and, for the most part, visible concrete lining and extensive levees paralleling both sides of the channel. The open water channel width varies minimally across the



## **9804 – Major Canals and Aqueducts**

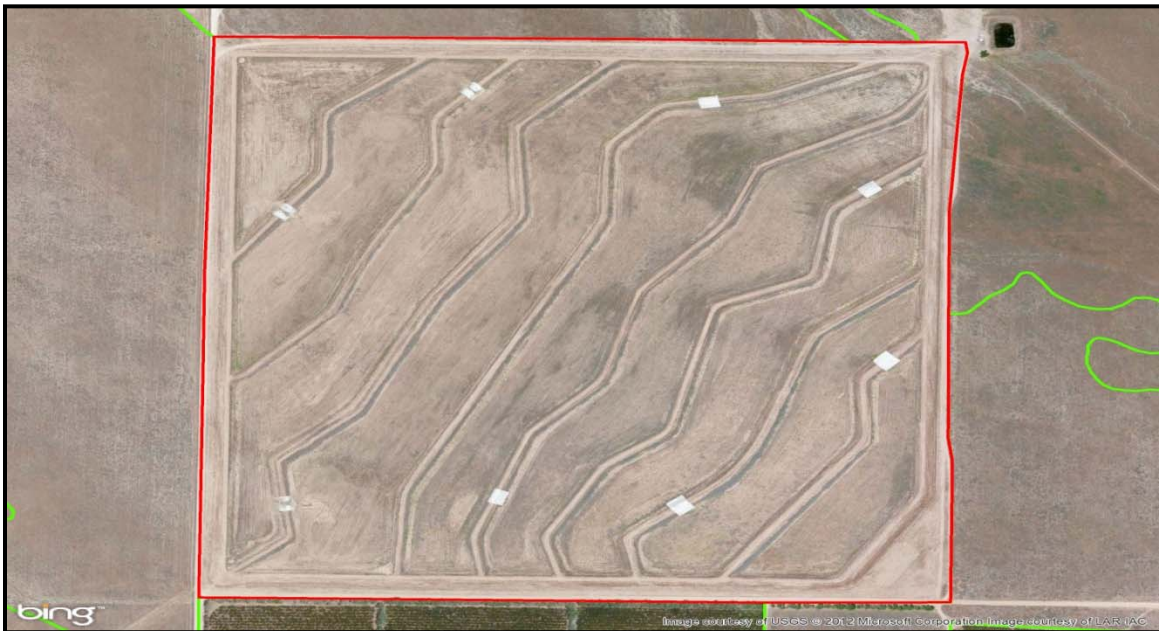
distance of the aqueduct. The water flowing through the aqueduct appears dark, with a green, black, or blue color depending on sun reflectance on some image sources. Because of the highly fractured and disturbance characteristics of the wetland and riparian vegetation associated with (nearby and adjacent to) the East Highline Canal and the All American Canal, the vegetation there was mapped to a 15 meter minimum mapping width (MMW), which is half the DRECP project standard width for riparian and wetland vegetation.

## 9804 – Major Canals and Aqueducts



**DISTRIBUTION:** The aboveground portion of the California Aqueduct enters the original study area at South Portal in the western Antelope Valley. From there it divides into two channels, one flowing south to where it exits the study area at Quail Lake and another flowing east along the lower slopes of the San Gabriel Mountains to Summit Valley, where it goes underground to be pumped through the San Bernardino Mountains. The Colorado River Aqueduct is mostly underground but surfaces just north of the study area just east of Chambers Well Road. From there it flows west then south, following the eastern slopes of the Coxcomb Mountains where it is pumped through that range into the northern portion of the Chuckwalla Valley. From there it surfaces and flows eight miles, then goes underground, exiting the study area at the base of Eagle Mountains. Within the 2014-2016 mapping region the All American Canal flows west from the Imperial Reservoir on the Colorado River to the Imperial Valley. The Coachella and the East Highline Canals each flow north from the All American Canal along the eastern side of the Imperial Valley.

## 9805 – Water Impoundment Feature

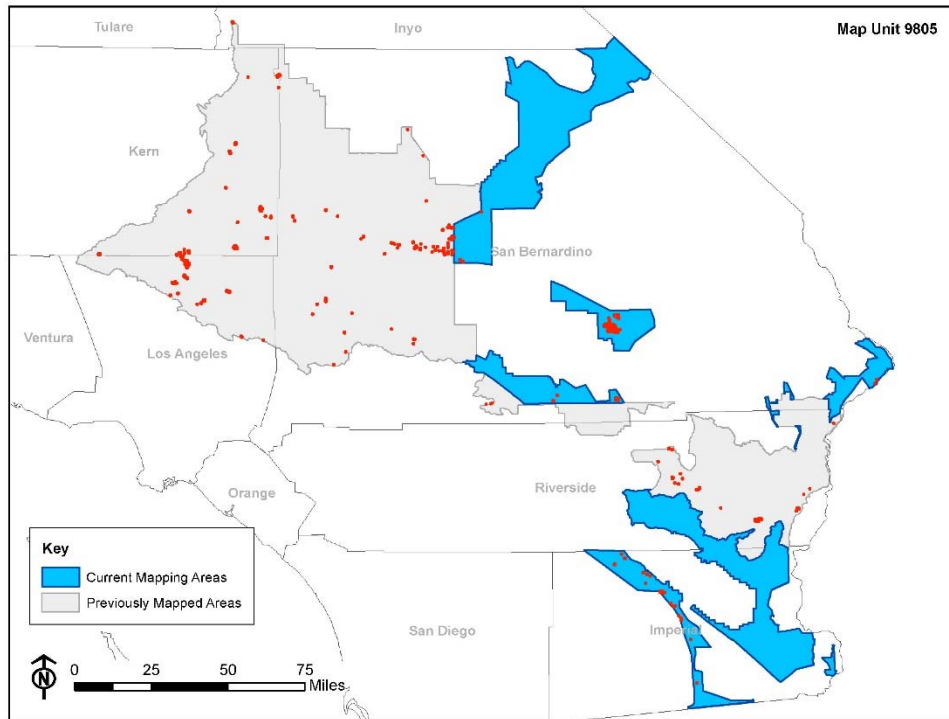


The above image shows a water impoundment feature in the form of a duck pond (empty in this image).

**DESCRIPTION:** This category is composed primarily of straight-edged water bodies impounded by berms and that are at least 2.5 acres in size. Examples include settling ponds, sewage treatment ponds, salt evaporators, duck ponds, and agricultural ponds. Flood control basins are mapped as Water Impoundment Features when they are greater than ten acres in size.

**PHOTOINTERPRETATION SIGNATURE:** These features are bermed on all sides and may or may not contain water at the time the imagery was flown. Several sets of imagery along with topographic maps were used to help identify some of these features if water was not present at the time the project base imagery was flown.

## 9805 – Water Impoundment Feature



**DISTRIBUTION:** Clusters of these water features occur within or near agricultural or developed areas throughout the Western Mojave Desert region, in portions of the Central Mojave Desert region, and in the Colorado Desert region in the Chuckwalla Valley and Colorado River Floodplain. Within the 2014-2016 mapping region, these features occur primarily in the Salton Sea Trough zone, mainly in agricultural areas.

## References

- Anderson, J.R., E.E. Hardy, and J.T. Roach. 1972. A land-use classification system for use with remote-sensor data. US Geological Survey Circular 671, 16 p.
- Bedford, D.R., D.M. Miller, and G.A. Phelps. 2006. Preliminary surficial geologic map database of the Amboy 30 x 60 minute quadrangle, California. Open-File Report 2006-1165. U.S. Geological Survey, Reston, VA.  
Available from: <http://pubs.usgs.gov/of/2006/1165>
- Bell, Duncan S. and Herskovits, Tasya. 2013. "A Newly Discovered Large and Significant Population of *Castela emoryi* (Emory's Crucifixion Thorn, Simaroubaceae) in California," *Aliso: A Journal of Systematic and Evolutionary Botany*: Vol. 31: Iss. 1, Article 7. Available from: <http://scholarship.claremont.edu/aliso/vol31/iss1/7>
- Bureau of Land Management. 2008. National Forest Service Lands – Wilderness Areas. US Dept. of the Interior, Bureau of Land Management, Washington DC. Accessed from: [http://www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal\\_nationwide/Documents/GIS\\_Data.html](http://www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide/Documents/GIS_Data.html)
- California Department of Finance. 2012. New report: California added more than a quarter-million in 2011; total state population nearly 37.7 million. E-1 2012 press release. Accessed 2012 from: <http://www.dof.ca.gov/research/demographic/reports/estimates/e-1/view.php>
- Dibblee, T.W., 2008. Geologic Map of the Alvord Mountain & Cave Mountain 15 Minute Quadrangles, San Bernardino County, California. 1:62,500. Dibblee Geology Center Map Series, map DF-398. Santa Barbara, CA. Santa Barbara Museum of Natural History. Accessed 2012 from: [http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Dibblee, T.W., A.M. Bassett. 1966. Geologic Map of the Cady Mountains Quadrangle, San Bernardino County, California. 1:62,500. Miscellaneous Geologic Investigations Series, map I-467. Washington, DC. U.S. Geological Survey. Accessed 2012 from: [http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Dibblee, T.W., A.M. Bassett. 1966. Geologic Map of the Newberry Quadrangle, San Bernardino County, California. 1:62,500. Miscellaneous Geologic Investigations Series, map I-461. Washington, DC. U.S. Geological Survey. Accessed 2012 from: [http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Evens, J.M., K. Sikes, and D. Stout. 2011. Vegetation classification and mapping at Lake Mead National Recreation Area, Mojave National Preserve and Death Valley National Park, Annual Report. Natural Resource Data Series NPS/MOJN/NRDS—2011/XXX. National Park Service, Fort Collins, Colorado.



- Federal Geographic Data Committee (FGDC). 2008. National Vegetation Classification Standard, Version 2 FGDC-STD-005-2008 (version 2). Vegetation Subcommittee, FGDC Secretariat, U.S. Geological Survey. Reston, VA.  
Available from: <http://usnvc.org/data-standard/>
- Felton, E. 1968. California's many climates. Pacific Book Publishers, Palo Alto, CA.
- Fire and Resource Assessment Program (FRAP). 2008. Fire perimeters statewide interagency personal geodatabase. California Department of Forestry and Fire Protection.  
Available from: <http://frap.fire.ca.gov/data/frapgisdata/download.asp?rec=fire>
- Hewett, D.F. 1931. Geologic Map of the Goodspings Quadrangle, in Geology and ore deposits of the Goodspings Quadrangle, Nevada. 1:62,500. Professional Paper 162, plate 1. Washington, DC. U.S. Geological Survey. Accessed 2012 from:  
[http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Hewett, D.F. 1956. Geologic Map and Sections of the Ivanpah Quadrangle, California-Nevada, in Geology and Mineral Resources of the Ivanpah Quadrangle, California and Nevada. 1:125,500. Professional Paper 275, plate 1. Washington, DC. U.S. Geological Survey.  
Accessed 2012 from: [http://ngmdb.usgs.gov/ngmdb/ngmdb\\_home.html](http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)
- Hillinger, C. (1991, January 31). Bagdad Fades Into the Desert—in California. *The Los Angeles Times*. Accessed from: [http://articles.latimes.com/1991-01-31/news/mn-422\\_1\\_bagdad-cafe](http://articles.latimes.com/1991-01-31/news/mn-422_1_bagdad-cafe)
- Jennings, M.D., D. Faber-Langendoen, R.K. Peet, O.L. Loucks, D.C. Glenn-Lewin, A. Damman, M.G. Barbour, R. Pfister, D.H. Grossman, D. Roberts, D. Tart, M. Walker, S.S. Talbot, J. Walker, G.S Hartshorn, G. Waggoner, M.D. Abrams, A. Hill, M. Rejmanek. 2006. Description, documentation, and evaluation of associations and alliances within the U.S. National Vegetation Classification, Version 4.5. Ecological Society of America, Vegetation Classification Panel. Washington DC.
- Jennings, M.D., D. Faber-Langendoen, O.L. Loucks, R.K. Peet, and D. Roberts. 2009. Standards for associations and alliances of the U.S. National Vegetation Classification. *Ecological Monographs* 79: 173-199.
- Johnson (Limon), D. and E. Reyes. 1990 (rev. 1993, 2000, 2005). Southern California Land Use Consortium (SCALUC)/Southern California Association of Governments (SCAG) aerial land use study – land use code descriptions and key signatures, Level III/IV. Aerial Information Systems, Redlands, California. Unpublished.
- Kauffman, E. Climate and topography. *In Atlas of the biodiversity of California*. California Department of Fish and Game, Sacramento, CA. Accessed 2012 from:  
[www.dfg.ca.gov/biogeodata/atlas/pdf/Clim\\_12b\\_web.pdf](http://www.dfg.ca.gov/biogeodata/atlas/pdf/Clim_12b_web.pdf)

- Keeler-Wolf, T., K. Lewis, and C. Roye. 1998. Vegetation mapping of Anza-Borrego Desert State Park and environs. California Department of Fish and Game, Sacramento, CA.  
Available from: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18246>
- La Doux, T., C. Lea, and E. Babich. 2013. A summary of the Joshua Tree National Park Vegetation Mapping Project: NPS Vegetation Inventory Program. Natural Resource Technical Report NPS/JOTR/NRTR—2013/723. National Park Service, Fort Collins, Colorado.
- Lichvar, R., S. Sprecher, D. Charlton, G. Gustina, M. Ericsson, and J. Campbell. 2004. Ecosystem classification and relationships for Pleistocene Lake Thompson bed, Mojave Desert, California. US Army Corps of Engineers®, Engineer Research and Development Center, ERDC/CRREL TR-04-21. Prepared for Edwards Air Force Base, California.
- Menke, J., E. Reyes, A. Glass, D. Johnson, and J. Reyes. 2013. 2013 California Vegetation Map in Support of the Desert Renewable Energy Conservation Plan. Final Report. Prepared for the California Department of Fish and Wildlife Renewable Energy Program and the California Energy Commission. Aerial Information Systems, Inc., Redlands, CA.
- Menke, J., E. Reyes, D. Johnson, J. Evens, K. Sikes, T. Keeler-Wolf, and R. Yacoub. 2011. Northern Sierra Nevada Foothills Vegetation Project: vegetation mapping report. California Department of Fish and Game, Sacramento, CA.  
Available from: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=31346>
- Miles, S.R. and C.B. Goudey. 1997. Ecological subregions of California. Technical Report R5-EM-TP-005. USDA Forest Service, Pacific Southwest Research Station, San Francisco, CA.
- National Atlas of the United States. 2005a. Federal lands of the United States. National Atlas of the United States, Reston, VA. Accessed from: <http://nationalatlas.gov/atlasftp.html>
- National Atlas of the United States. 2005b. Indian lands of the United States. National Atlas of the United States, Reston, VA. Accessed from: <http://nationalatlas.gov/atlasftp.html>
- National Park Service – Land Resources Division. 2013. Administrative Boundaries of National Park System Units 4/22/2013. National Geospatial Data Asset (NGDA) NPS National Parks Dataset. Accessed from: <http://irma.nps.gov>
- Pignatti, S., E. Oberdorfer, J.H.J. Schaminee, and V. Westhoff. 1994. On the concept of vegetation class in phytosociology. *Journal of Vegetation Science* 6:143-152.
- Sawyer, J.O., T. Keeler-Wolf, and J. Evens. 2009. A manual of California vegetation, second edition. California Native Plant Society, Sacramento, CA.

- Schmidt, K.M. and M. McMackin. 2006. Preliminary surficial geologic map of the Mesquite Lake 30' x 60' quadrangle, California and Nevada. Open-File Report 2006-1035. U.S. Geological Survey, Reston, VA.  
Available from: <http://pubs.usgs.gov/of/2006/1035>
- Sonoran Desert. (n.d.). *In* Encyclopedia of the Earth. Accessed from:  
<http://www.eoearth.org/view/article/51cbeef77896bb431f69b7f5/>
- Specht, R.L. and A. Specht. 2001. Australia, ecosystems of. Pp. 307 - 324, In S.A. Levin (ed.). Encyclopedia of Biodiversity, Vol. 1. Academic Press, New York.
- Thomas, K., T. Keeler-Wolf, J. Franklin, and P. Stine. 2004. Mojave Desert Ecosystem Program: Central Mojave vegetation database. Final Report , U.S. Geological Survey, Western Ecological Research Center and Southwest Biological Science Center, Sacramento, CA. Colorado Plateau Field Station, Flagstaff, AZ.  
Available from: <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=13890>
- University of California Cooperative Extension, Los Angeles County. High desert climate. Accessed 2012 from: [http://celosangeles.ucanr.edu/Agriculture/High\\_Desert\\_Climate/](http://celosangeles.ucanr.edu/Agriculture/High_Desert_Climate/)
- US Fish and Wildlife Service. 2013. California wetlands. National Wetlands Inventory, Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, Washington DC. Accessed from: <http://www.fws.gov/wetlands/Data/State-Downloads.html>
- US Geological Survey – USGS Mineral Resources. 2005. State geologic maps. Accessed from: <http://datagateway.nrcs.usda.gov>
- Vegetation Classification and Mapping Program (VegCAMP). 2012. 2012 vegetation map in support of the Desert Renewable Energy Conservation Plan. Interim Report 1.1. Prepared for the Desert Renewable Energy Conservation Planning Program and California Energy Commission. California Department of Fish and Game, Sacramento, CA.
- Vegetation Classification and Mapping Program (VegCAMP). 2013. 2013 California desert vegetation map and accuracy assessment in support of the Desert Renewable Energy Conservation Plan. Final Report. Prepared for the California Department of Fish and Wildlife Renewable Energy Program and the California Energy Commission. California Department of Fish and Wildlife, Sacramento, CA.
- Vegetation Classification and Mapping Program (VegCAMP). 2016. Addendum to the 2013 California desert vegetation map and accuracy assessment in support of the Desert Renewable Energy Conservation Plan. Final Report. Prepared for the California Department of Fish and Wildlife Renewable Energy Program and the California Energy Commission. California Department of Fish and Wildlife, Sacramento, CA.

## Glossary

<b>Agromorphic</b>	agricultural vegetation, such as corn or hay. The term is used in the US National Vegetation Classification (NVC). See also “ <b>hortomorphic.</b> ”
<b>Alliance</b>	a vegetation classification unit of low rank (7th level) containing one or more associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation (Jennings et al., 2006). Alliances reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.
<b>Bajada</b>	an alluvial plain formed at the base of a mountain by the coalescing of several alluvial fans.
<b>Bosque</b>	in arid climates, an oasis-like ribbon of canopied vegetation that only exists near rivers, streams, or other water courses.
<b>Chenopod</b>	any plant of the goosefoot family; common in deserts and especially in saline or alkaline soils. Examples include <i>Allenrolfea</i> , <i>Atriplex</i> , <i>Grayia</i> , <i>Krascheninnikovia</i> , <i>Salicornia</i> , <i>Salsola</i> , <i>Sarcobatus</i> , and <i>Suaeda</i> .
<b>Colluvial</b>	referring to loose earth material that has accumulated at the base of a hill through the action of gravity.
<b>Desiccation</b>	the state of being thoroughly dried up.
<b>Endorheic</b>	of or pertaining to interior drainage basins (basins that don't drain to the ocean).
<b>Edaphic</b>	related to or caused by particular soil conditions, as of texture or drainage, rather than by physiographic or climatic factors.
<b>Fluvial</b>	of or pertaining to a river; produced by or found in a river.
<b>Geodatabase</b>	a database designed to store, query, and manipulate geographic information and spatial data.

<b>Group</b>	a vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (cf. Pignatti et al., 1994, Specht and Specht, 2001).
<b>Hortomorphic</b>	developed vegetation, such as lawns or golf courses. The term is used in the US National Vegetation Classification (NVC). See also <b>“agromorphic.”</b>
<b>Hummocky</b>	relating to any topographic surface characterized by rounded or conical mounds.
<b>Intermontane</b>	a feature between mountains, such as a plateau or a basin.
<b>Lithomorphic</b>	pertaining to a soil with a shallow profile, with organic soil horizons directly overlying bedrock.
<b>Macrogroup</b>	a vegetation classification unit of intermediate rank (5th level) defined by combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes (cf. Pignatti et al., 1994).
<b>Mesic</b>	of, pertaining to, or adapted to an environment having a balanced supply of moisture.
<b>Microphyll</b>	a type of small leaved tree/community adapted to arid deserts.
<b>Panne</b>	a shallow depression or flat that is often unvegetated and can have encrustations of salt left by evaporation.
<b>Phenology</b>	the science dealing with the influence of climate on the recurrence of such annual phenomena of plant life as budding and other growth phases.
<b>Playa</b>	the sandy, salty, or mud-caked flat floor of a desert basin having interior drainage, usually occupied by a shallow lake during or after prolonged, heavy rains.
<b>Pool and swale topography</b>	landscape characterized by shallow depressions where water can collect seasonally (pools), and long, narrow, shallow, troughs or depressions that may slope downward (swales).
<b>Psammophytic</b>	a plant that grows in sand or sandy soil.



<b>Refugia</b>	areas where environmental circumstances enabled a species or community to survive after becoming extinct in surrounding areas.
<b>Scald</b>	a hard impermeable surface on saline or sodic soils as a result of wind or sheet erosion (dry scald) or by surface sealing through deposition of salts and clays following evaporation of surface water (wet scald).
<b>Seral</b>	referring to a community that is an intermediate stage in ecological succession, preceding the climax community.
<b>Signature</b>	the visual characteristics of objects on an aerial photograph that allow one to differentiate them. The characteristics include tone, shape, size, pattern, texture, and shadow.
<b>Stoloniferous</b>	producing or bearing stolons, which are prostrate stems, at or just below the ground surface, that produce new plants from buds at their tips or nodes.

## List of Acronyms

<b>4WD</b>	Four Wheel Drive
<b>AA</b>	Accuracy Assessment
<b>AFB</b>	Air Force Base
<b>AIS</b>	Aerial Information Systems, Inc.
<b>BLM</b>	Bureau of Land Management
<b>CMAGR</b>	Chocolate Mountain Aerial Gunnery Range
<b>CDFW</b>	California Department of Fish and Wildlife
<b>CEC</b>	California Energy Commission
<b>CMAGR</b>	Chocolate Mountain Aerial Gunnery Range
<b>CNPS</b>	California Native Plant Society
<b>DRECP</b>	Desert Renewable Energy Conservation Plan
<b>DEM</b>	Digital Elevation Model
<b>DRG</b>	Digital Raster Graphics
<b>FGDC</b>	Federal Geographic Data Committee
<b>GIS</b>	Geographic Information System
<b>GPS</b>	Global Positioning System
<b>MCAGCC</b>	Twentynine Palms Marine Corps Air Ground Combat Center
<b>MMU</b>	Minimum Mapping Unit
<b>MMW</b>	Minimum Mapping Width
<b>NAIP</b>	National Agricultural Imagery Program
<b>NVCS</b>	National Vegetation Classification Standards
<b>OHV</b>	Off-Highway Vehicle
<b>PI</b>	Photointerpretation, photointerpreter
<b>ROW</b>	Right-of-way
<b>USGS</b>	US Geological Survey
<b>VegCAMP</b>	Vegetation Classification and Mapping Program

# APPENDIX A

## MAPPING CLASSIFICATION

### Vegetation Type (Map Unit attribute in geodatabase)

**NOTE:** \*indicates an Alliance or Mapping Unit level code value that was not in the final DRECP 2011-2016 geodatabase  
# indicates a Macrogroup or Group level code value that was assigned as a broader code for a given polygon in the final DRECP 2011-2016 geodatabase

#### **1000 = TEMPERATE FOREST SUBCLASS**

##### **1100 = California Forest and Woodland Macrogroup MG009**

- 1110 = Californian broadleaf forest and woodland Group
  - 1111 = *Quercus douglasii* (Blue oak woodland) Alliance
  - 1112 = *Quercus lobata* (Valley oak woodland) Alliance
  - 1113 = *Quercus chrysolepis* (Canyon live oak forest) Alliance
  - 1114 = *Quercus wislizeni* (Interior live oak woodland) Alliance
  - \*1115 = *Juglans californica* (California walnut groves) Alliance
  - 1116 = *Aesculus californica* (California buckeye groves) Alliance
  - 1117 = *Quercus agrifolia* (Coast live oak woodland) Alliance
- 1120 = Californian evergreen coniferous forest and woodland Group
  - 1121 = *Pinus sabiniana* (Foothill pine woodland) Alliance
  - 1122 = *Juniperus californica* (California juniper woodland) Alliance

##### **1200 = Californian-Vancouverian Montane and Foothill Forest Macrogroup MG023**

- 1210 = Californian montane conifer forest Group
  - 1211 = *Pseudotsuga macrocarpa* (Bigcone Douglas-fir) Alliance

##### **1300 = Intermountain Basins Pinyon-Juniper Woodland Macrogroup MG026**

- 1310 = Western Great Basin montane conifer woodland Group
  - 1311 = *Pinus monophylla* (Singleleaf pinyon woodland) Alliance

##### **1400 = Southwestern North American Riparian, Flooded and Swamp Forest Macrogroup MG036**

- 1410 = Southwestern North American riparian evergreen and deciduous woodland Group
  - 1411 = *Populus fremontii* (Fremont cottonwood forest) Alliance
  - 1412 = *Salix laevigata* (Red willow thickets) Alliance
  - 1413 = *Salix gooddingii* (Black willow thickets) Alliance
  - 1414 = *Platanus racemosa* (California sycamore woodlands) Alliance
  - 1415 = *Washingtonia filifera* (California fan palm oasis) Alliance
- 1420 = Southwestern North American riparian/wash scrub Group
  - \*1421 = *Baccharis emoryi* (Emory's baccharis thickets) Provisional Alliance
  - 1422 = *Baccharis salicifolia* (Mulefat thickets) Alliance
  - 1423 = *Baccharis sergiloides* (Broom baccharis thickets) Alliance
  - 1424 = *Salix exigua* (Sandbar willow thickets) Alliance
  - 1425 = *Forestiera pubescens* (Desert olive patches) Alliance
  - 1426 = *Sambucus nigra* (Blue elderberry stands) Alliance
  - 1427 = *Salix lasiolepis* (Arroyo willow thickets) Alliance

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.

- 1430 = Southwestern North American introduced riparian scrub Group
- 1431 = *Arundo donax* (Giant reed breaks) Semi-natural Stands
- 1432 = *Tamarix* spp. (Tamarisk thickets) Semi-natural Stands
- 1433 = *Saccharum ravennae* (Ravennagrass) Mapping Unit

**1500 = Western Cordilleran Montane-Boreal Riparian Scrub and Forest Macrogroup MG034**

- 1510 = Vancouverian riparian deciduous forest Group
- 1511 = *Alnus rhombifolia* (White alder groves) Forest Alliance

**2000 = MESOMORPHIC SHRUB AND HERB CLASS**

**2100 = California Chaparral Macrogroup MG043**

- 2110 = Californian xeric chaparral Group
  - 2111 = *Arctostaphylos glauca* (Bigberry manzanita chaparral) Alliance
  - 2112 = *Adenostoma fasciculatum* (Chamise) Alliance
  - 2113 = *Ceanothus crassifolius* (Hoary leaf ceanothus chaparral) Alliance
  - 2114 = *Fremontodendron californicum* (Flannelbush scrub) Alliance
  - 2115 = *Adenostoma fasciculatum* – *Salvia mellifera* (Chamise – black sage chaparral) Alliance
- 2120 = Californian pre-montane chaparral Group
  - 2121 = *Arctostaphylos glandulosa* (Eastwood manzanita) Alliance
  - 2122 = *Ceanothus leucodermis* (Chaparral whitethorn) Alliance
- 2130 = Californian mesic chaparral Group
  - 2131 = *Cercocarpus montanus* (Birchleaf mountain mahogany) Alliance
  - 2132 = *Quercus berberidifolia* (Scrub oak chaparral) Alliance
  - 2133 = *Quercus berberidifolia* – *Adenostoma fasciculatum* (Scrub oak – chamise chaparral) Alliance
  - 2134 = *Prunus ilicifolia* (Holly leaf cherry chaparral) Alliance

**2200 = California Coastal Scrub Macrogroup MG044**

- 2210 = Central and south coastal California seral scrub Group
  - \*2211 = *Gutierrezia californica* (California match weed patches) Provisional Alliance
  - \*2212 = *Lotus scoparius* (Deer weed scrub) Alliance
  - \*2213 = *Lupinus albifrons* (Silver bush lupine scrub) Alliance
  - 2214 = *Ericameria linearifolia* – *Isomeris arborea* (Narrowleaf goldenbush – bladderpod scrub) Alliance
  - 2215 = *Eriodictyon* (*crassifolium*, *trichocalyx*) (Thick leaf and hairy yerba santa scrub) Provisional Alliance
  - \*2216 = *Malacothamnus fasciculatus* (Bush mallow scrub) Alliance
  - \*2217 = *Eriogonum* (*elongatum*, *nudum*) (Longstem buckwheat) Provisional Alliance
  - 2218 = *Corethrogyne filaginifolia* (Common sand-aster scrub) Alliance
- 2220 = Central and South Coastal Californian coastal sage scrub Group
  - 2221 = *Eriogonum fasciculatum* (California buckwheat scrub) Alliance
  - 2222 = *Eriogonum wrightii* (Wright's buckwheat patches) Alliance
  - \*2223 = *Salvia mellifera* (Black sage scrub) Alliance

**#2300 = California Annual and Perennial Grassland Macrogroup MG045**

- 2305 = California annual and perennial grassland Mapping Unit (Native component)
- #2310 = California annual forb/grass vegetation Group
  - 2311 = *Eschscholzia californica* (California poppy fields) Alliance
  - 2312 = *Amsinckia* (*menziesii*, *tessellata*) (Fiddleneck fields) Alliance

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.

- 2313 = *Lasthenia californica* – *Plantago erecta* – *Vulpia microstachys* (California goldfields - Dwarf plantain - Six-weeks fescue flower fields) Alliance
- \*2314 = *Monolopia (lanceolata)* – *Coreopsis (calliopsidea)* (*Monolopia* and *Tickseed*) Alliance
- \*2315 = *Plagiobothrys nothofulvus* (*Popcorn flower fields*) Alliance
- 2320 = California perennial grassland Group
  - 2321 = *Nassella cernua* (*Nodding needle grass grassland*) Provisional Alliance
  - \*2322 = *Nassella pulchra* (*Purple needle grass grassland*) Alliance
- #2330 = Mediterranean California naturalized annual and perennial grassland Group
  - 2331= *Brassica nigra* and other mustards (*Upland mustards*) Semi-natural Stands
  - \*2332= *Bromus rubens* – *Schismus (arabicus, barbatus)* (*Red brome or Mediterranean grass grasslands*) Semi-natural Stands
  - \*2333 = *Lolium perenne* (*Perennial rye grass fields*) Semi-natural Stands
  - \*2334 = *Pennisetum setaceum* (*Fountain grass swards*) Semi-natural Stands

### **3000 = TEMPERATE AND BOREAL SHRUBLAND AND GRASSLAND SUBCLASS (3000)**

#### **3100 = Western North American Temperate Grassland and Meadow Macrogroup MG048**

- 3110 = Vancouverian and Rocky Mountain naturalized annual grassland Group
  - \*3111 = *Bromus tectorum* (*Cheatgrass grassland*) Semi-natural Stands
- 3120 = Western dry upland perennial grassland Group
  - \*3121= *Elymus multisetus* (*Big squirreltail patches*) Provisional Alliance
  - \*3122 = *Poa secunda* (*Curly or one-sided blue grass grassland*) Alliance

#### **3200 = Western Cordilleran Montane Shrubland and Grassland Macrogroup MG049**

- 3210= Western Cordilleran montane deciduous scrub Group
  - 3211 = *Ribes quercetorum* (*Oak gooseberry thickets*) Provisional Alliance
- 3220 = Western Cordilleran montane moist graminoid meadow Group
  - \*3221 = *Muhlenbergia richardsonis* (*Mat muhly meadows*) Provisional Alliance

#### **3300 = Warm Interior Chaparral Macrogroup MG051**

- 3310 = Western Mojave and Western Sonoran Desert borderland chaparral Group
  - \*3311 = *Ceanothus greggii* (*Cup leaf ceanothus chaparral*) Alliance
  - 3312 = *Quercus john-tuckeri* (*Tucker oak chaparral*) Alliance
  - \*3313 = *Quercus palmeri* (*Palmer oak*) Alliance
  - 3314 = *Quercus cornelius-mulleri* (*Muller oak chaparral*) Alliance

#### **#3400 = Western North American Freshwater Marsh Macrogroup MG073**

- 3410 = Arid West freshwater emergent marsh Group
  - 3411 = *Phragmites australis* (*Common reed marshes*) Alliance
  - 3412 = *Schoenoplectus (acutus, californicus)* (*Hardstem bulrush, California bulrush*) Mapping Unit
  - \*3413 = *Schoenoplectus acutus* (*Hardstem bulrush marsh*) Alliance
  - 3414= *Schoenoplectus californicus* (*California bulrush marsh*) Alliance
  - 3415 = *Typha (angustifolia, domingensis, latifolia)* (*Cattail marshes*) Alliance

#### **3500 = Western North America Vernal Pool Macrogroup MG074**

- #3510 = Californian mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group
  - \*3511 = *Deinandra fasciculata* (*Clustered tarweed fields*) Alliance
  - \*3512 = *Cressa truxillensis* – *Distichlis spicata* (*Spreading alkaliweed – Saltgrass*) Mapping Unit

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.



**#3600 = Western North America Wet Meadow and Low Shrub Carr Macrogroup MG075**

- 3610 = Californian warm temperate marsh/seep Group
- 3611 = *Juncus arcticus* (var. *balticus*, *mexicanus*) (Baltic and Mexican rush marshes) Alliance
- \*3612 = *Leymus triticoides* (Creeping rye grass turfs) Alliance
- \*3613 = *Muhlenbergia rigens* (Deer grass beds) Alliance

**#3700 = Warm Semi-Desert/Mediterranean Alkali-Saline Wetland Macrogroup MG083**

- 3710 = Southwestern North American alkali marsh/seep vegetation Group
- \*3711 = *Spartina gracilis* (Alkali cordgrass marsh) Alliance
- 3712 = *Sporobolus airoides* (Alkali sacaton grassland) Alliance
- \*3713 = *Anemopsis californica* (Yerba mansa meadows) Alliance
- 3714 = *Juncus cooperi* (Cooper's rush marsh) Alliance
- 3715 = *Bolboschoenus maritimus*, *Schoenoplectus americanus* (Salt marsh bulrush, American bulrush) Mapping Unit
- \*3716 = *Crypsis schoenoides* (Swamp Timothy) Mapping Unit
- 3720 = Southwestern North American salt basin and high marsh Group
- 3721 = *Allenrolfea occidentalis* (Iodine bush scrub) Alliance
- 3722 = *Atriplex lentiformis* (Quailbush scrub) Alliance
- 3723 = *Atriplex spinifera* (Spinescale scrub) Alliance
- 3724 = *Frankenia salina* (Alkali heath marsh) Alliance
- 3725 = *Suaeda moquinii* (Bush seepweed scrub) Alliance
- 3726 = *Distichlis spicata* (Salt grass flats) Alliance
- \*3727 = *Salicornia depressa* (Pickleweed flats) Herbaceous Alliance
- 3728 = *Isocoma acradenia* (Alkali goldenbush) Alliance
- 3729 = *Atriplex parryi* (Parry's saltbush) Provisional Alliance

**4000 = WARMSEMI-DESERT SCRUB AND GRASSLAND SUBCLASS**

**4100 = Mojavean-Sonoran Desert Scrub Macrogroup MG088**

- #4110 = Lower bajada and fan Mojavean-Sonoran desert scrub Group
- 4111 = *Ambrosia dumosa* (White bursage scrub) Alliance
- 4113 = *Atriplex polycarpa* (Allscale scrub) Alliance
- 4114 = *Encelia farinosa* (Brittle bush scrub) Alliance
- 4115 = *Larrea tridentata* – *Ambrosia dumosa* (Creosote bush – white bursage scrub) Alliance
- 4118 = *Larrea tridentata* – *Encelia farinosa* (Creosote bush – brittle bush scrub) Alliance
- 4119 = *Larrea tridentata* (Creosote bush scrub) Alliance
- \*4121 = *Tidestromia oblongifolia* (Arizona honey sweet sparse scrub) Provisional Alliance
- 4122 = *Pleuraphis rigida* (Big galleta shrub-steppe) Alliance
- \*4123 = *Brickellia desertorum* (Desert brickellbush scrub) Alliance
- 4124 = *Cylindropuntia bigelovii* (Teddy bear cholla patches) Alliance
- 4150 = Arizonan upland Sonoran desert scrub Group
- 4151 = *Viguiera parishii* (Parish's goldeneye scrub) Alliance
- 4152 = *Parkinsonia microphylla* (Foothill palo verde shrubland) Provisional Alliance

**4200 = Madrean Warm Semi-Desert Wash Woodland/Scrub Macrogroup MG092**

- 4210 = Mojavean semi-desert wash scrub Group
- 4211 = *Ephedra californica* (California joint fir scrub) Alliance
- 4212 = *Lepidospartum squamatum* (Scale broom scrub) Alliance
- 4213 = *Ericameria paniculata* (Blackstem rabbitbrush) Alliance

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.

- 4214 = *Prunus fasciculata* (Desert almond) Alliance
- 4215 = *Brickellia incana* (Woolly brickellia wash scrub) Provisional Alliance
- 4216 = *Ambrosia salsola* (Cheesebush scrub) Alliance
- 4217 = *Artemisia tridentata* ssp. *parishii* (Parish's sagebrush) Provisional Alliance
- 4218 = *Bebbia juncea* (Sweet-bush scrub) Provisional Alliance
- 4220 = Sonoran-Coloradan semi-desert wash woodland/scrub Group
- 4221 = *Pluchea sericea* (Arrow weed thickets) Alliance
- 4222 = *Prosopis glandulosa* (Mesquite bosque, mesquite thicket) Alliance
- 4224 = *Chilopsis linearis* (Desert willow woodland) Alliance
- 4225 = *Psoralea argophylla* (Smoketree woodland) Alliance
- 4226 = *Acacia greggii* (Catclaw acacia thorn scrub) Alliance
- 4227 = *Parkinsonia florida* – *Olneya tesota* (Blue palo verde – ironwood woodland) Alliance
- 4228 = *Hyptis emoryi* (Desert lavender scrub) Alliance
- 4229 = *Castela emoryi* (Crucifixion thorn) Special Stands

## **5000 = COOL SEMI-DESERT SCRUB AND GRASSLAND SUBCLASS**

### **5100 = Cool Semi-Desert Alkali-Saline Flats Macrogroup MG093**

- 5110 = Shadscale-saltbush cool semi-desert scrub Group
- 5111 = *Atriplex canescens* (Fourwing saltbush scrub) Alliance
- 5112 = *Atriplex confertifolia* (Shadscale scrub) Alliance

### **5200 = Cool Semi-Desert Wash and Disturbance Scrub Macrogroup MG095**

- #5210 = Intermontane seral shrubland Group
- 5211 = *Encelia (actoni, virginensis)* (Acton's encelia & Virgin River brittle brush scrub) Alliance
- 5212 = *Ericameria nauseosa* (Rubber rabbitbrush scrub) Alliance
- 5214 = *Gutierrezia sarothrae* (Broom snake weed scrub) Provisional Alliance
- 5215 = *Ericameria cooperi* (Cooper's goldenbush) Provisional Alliance
- 5216 = *Dendromecon rigida* (Bush poppy scrub) Alliance

### **5300 = Western North America Tall Sage Shrubland and Steppe Macrogroup MG096**

- 5310 = Inter-Mountain West mesic tall sagebrush shrubland and steppe Group
- 5311 = *Artemisia tridentata* (Big sagebrush) Alliance

### **5400 = Inter-Mountain Dry Shrubland and Grassland Macrogroup MG098**

- #5410 = Intermontane deep or well-drained soil scrub Group
- 5411 = *Grayia spinosa* (Spiny hop sage scrub) Alliance
- 5412 = *Krascheninnikovia lanata* (Winterfat scrubland) Alliance
- 5413 = *Ephedra nevadensis* (Nevada joint fir) Alliance
- 5414 = *Lycium andersonii* (Anderson's boxthorn scrub) Alliance
- 5415 = *Salazaria mexicana* (Bladder sage scrub) Alliance
- 5416 = *Ericameria teretifolia* (Needleleaf rabbitbrush scrub) Alliance
- 5417 = *Ephedra viridis* (Mormon tea scrub) Alliance
- 5418 = *Lycium cooperi* (Cooper's boxthorn scrub) Provisional Alliance
- #5420 = Mojave and Great Basin upper bajada and toeslope Group
- 5421 = *Coleogyne ramosissima* (Black brush scrub) Alliance
- 5422 = *Purshia tridentata* (Bitter brush scrub) Alliance
- 5423 = *Yucca brevifolia* (Joshua tree woodland) Alliance
- 5424 = *Yucca schidigera* (Mojave yucca scrub) Alliance
- 5425 = *Menodora spinescens* (Greenfire scrub) Alliance
- 5430 = Southern Great Basin semi-desert grassland Group
- 5431 = *Achnatherum speciosum* (Desert needlegrass grassland) Alliance

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.

- \*5432 = *Pleuraphis jamesii* (James' galleta shrub-steppe) Alliance
- 5433 = *Achnatherum hymenoides* (Indian rice grass grassland) Alliance
- #5440 = Intermountain shallow/calcareous soil scrub Group
- 5441 = *Cercocarpus ledifolius* (Curl leaf mountain mahogany scrub) Alliance
- 5442 = *Purshia stansburiana* (Stansbury cliff rose scrub) Alliance

**5500 = Cool Semi-Desert Alkali-Saline Wetlands Macrogroup MG082**

- 5510 = Great Basin cool semi-desert alkali basin Group
- 5511 = *Sarcobatus vermiculatus* (Greasewood scrub) Alliance

**6000 = NORTH AMERICAN WARM SEMI-DESERT CLIFF, SCREE AND ROCK VEGETATION DIVISION**

**6100 = North American Warm Semi-Desert Cliff, Scree, and Other Rock Vegetation Macrogroup MG117**

- #6110 = North American warm desert bedrock cliff and outcrop Group
  - 6111 = *Atriplex hymenelytra* (Desert holly scrub) Alliance
  - 6112 = *Ephedra funerea* (Death Valley joint fir scrub) Alliance
  - 6113 = Mud Hills sparsely vegetated ephemeral herbs Mapping Unit
  - 6114 = Unvegetated wash and river bottom Mapping Unit
  - 6115 = Massive sparsely vegetated rock outcrop Mapping Unit
  - 6116 = Sparsely vegetated playa (Ephemeral annuals) Mapping Unit
  - 6117 = *Chorizanthe rigida* – *Geraea canescens* (Spiny herb-Desert gold) Desert Pavement Sparsely Vegetated Alliance
  - 6118 = *Peucephyllum schottii* (Desert fir) Alliance
- #6120 = North American warm desert dunes and sand flats Group
  - 6121 = *Dicoria canescens* – *Abronia villosa* (Desert dunes) Alliance
  - 6122 = *Panicum unvilleanum* (Desert panic grass patches) Alliance
  - 6123 = *Wislizenia refracta* (Spectacle fruit) Special Stands

**9000 = MISCELLANEOUS CLASSES**

#9200 = Agriculture

- 9210 = Woody Agriculture (orchards, vineyards)
- 9220 = Non-woody Row and Field Agriculture

#9300 = Built-up & Urban Disturbance

- 9310 = Urban Window
- 9320 = Anthropogenic Areas of Little or No Vegetation

#9500 = Exotic Trees

- \*9501 = Eucalyptus

#9800 = Water

- 9801 = Perennial Stream Channel (open water)
- 9803 = Small Earthen-dammed Ponds and Naturally Occurring Lakes
- 9804 = Major Canals and Aqueducts
- 9805 = Water Impoundment Feature

XXXX = 1acre MMU XXXX = 2.5acre MMU

All other classes were mapped to 10 acre MMU, unless the polygon was located in the foothills of the Transverse Ranges. MMU was 2 acres in those situations.

## **Percent of Cover by Conifers**

- 0 = None, Not observable
- 1 = >0-1%
- 2 = >1-5%
- 3 = >5-15%
- 4 = >15-25%
- 5 = >25-50%
- 6 = >50-75%
- 7 = >75-100%
- 9 = Not applicable/Not assigned

## **Percent of Cover by Hardwoods**

- 0 = None, Not observable
- 1 = >0-1%
- 2 = >1-5%
- 3 = >5-15%
- 4 = >15-25%
- 5 = >25-50%
- 6 = >50-75%
- 7 = >75-100%
- 9 = Not applicable/Not assigned

## **Percent of Cover by Joshua Tree**

- 0 = None, Not observable
- 1 = >0-1%
- 2 = >1-5%
- 3 = >5%
- 9 = Not applicable/Not assigned

## **Percent of Cover by Trees**

- 0 = None, Not observable
- 1 = >0-1%
- 2 = >1-5%
- 3 = >5-15%
- 4 = >15-25%
- 5 = >25-50%
- 6 = >50-75%
- 7 = >75-100%
- 9 = Not applicable/Not assigned

## **Percent of Cover by Shrub**

- 0 = None, Not observable
- 1 = >0-1%
- 2 = >1-5%
- 3 = >5-15%
- 4 = >15-25%
- 5 = >25-50%
- 6 = >50-75%
- 7 = >75-100%
- 9 = Not applicable/Not assigned

## **Percent of Cover by Herbaceous**

- 1 = None, Not observable, 0-2%
- 2 = >2-15%
- 3 = >15-40%
- 4 = >40-100%
- 9 = Not applicable/Not assigned

## **Exotics**

- 0 = None, Not observable
- 1 = Low
- 2 = Moderate
- 3 = High
- 9 = Not applicable/Not assigned

## **Roadedness Disturbance**

- 0 = None, Not observable
- 1 = Low (>2/3 contiguous area roadless)
- 2 = Moderate (1/3 - 2/3 contiguous area roadless)
- 3 = High (<1/3 contiguous area roadless)
- 9 = Not applicable/Not assigned

## **Development Disturbance**

- 0 = None, Not observable
- 1 = Low (>0 - 2% of polygon affected)
- 2 = Moderate (>2% - 5% of polygon affected)
- 3 = High (>5% of polygon affected)
- 9 = Not applicable/Not evaluated

## **Anthropogenically Altered Disturbance**

- 0 = None, Not observable
- 1 = Low (>0% – 33% of polygon affected)
- 2 = Moderate (>33% – 66% of polygon affected)
- 3 = High (>66% of polygon affected)
- 9 = Not applicable/Not evaluated

## **Altered Hydrologic Regime Modifier**

- 0 = Not affected
- 1 = Affected
- 9 = Not applicable/Not assigned



## Land Use

0000 = Not Assigned/Not Assessed

1000 = Urban

1436 = Water Transfer (major canals, aqueducts and agricultural channels)

1850 = Wildlife Preserves & Sanctuaries

2000 = Agriculture (includes nurseries)

2100 = Non-woody Row & Field Crops

2200 = Orchards & Vineyards

9800 = Undifferentiated Water

9810 = Water Impoundment Feature

## Method ID

1 = Rapid Assessment (current project)

2 = Relevé

3 = Field Verification

4 = Photo Interpretation

5 = Adjacent Stand Information or Ground Photo

6 = Reconnaissance (current project)

7 = Other Information

8 = Older Plot Data

9 = Older Recon Data

10 = Accuracy Assessment

60 = Additional Recon Information

## OITe-PaFI (Ironwood – Blue Palo Verde Presence Modifier)

0 = *Olneya tesota* and/or *Parkinsonia florida* not visible or not consistent in stand

1 = *Olneya tesota* and/or *Parkinsonia florida* present in at least trace amounts and consistent throughout most of the stand

# APPENDIX B

## SUMMARIES OF ACREAGE AND POLYGON COUNT BY MAP UNIT

Three tables are presented on the following pages. The first table lists each of the map units occurring in the final database, combining the areas previously mapped and the current project, in numerical order by code value. The number of polygons is presented, followed by four columns relating to area: the total area covered by the map unit in the study area expressed in hectares; total area in acres; the percent of the total study area mapped as the given map unit; and the map unit's average polygon size in acres. The second table is identical to the first, except the map units are presented in alphabetical order.

The third table lists the map units in order by total area. Only the map units that constituted more than 1 percent of the total study area are presented in this table. The acreage of these 18 map units comprise almost 88 percent of the entire study area.

**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
1111	<i>Quercus douglasii</i> Alliance	39	390.9	965.8	0.0%	24.8
1112	<i>Quercus lobata</i> Alliance	28	239.9	592.9	0.0%	21.2
1113	<i>Quercus chrysolepis</i> Alliance	37	138.5	342.3	0.0%	9.3
1114	<i>Quercus wislizeni</i> Alliance	44	426.8	1,054.5	0.0%	24.0
1116	<i>Aesculus californica</i> Alliance	1	5.6	13.7	0.0%	13.7
1117	<i>Quercus agrifolia</i> Alliance	1	6.6	16.3	0.0%	16.3
1121	<i>Pinus sabiniana</i> Alliance	18	85.9	212.3	0.0%	11.8
1122	<i>Juniperus californica</i> Alliance	1,708	26,862.8	66,379.5	0.8%	38.9
1211	<i>Pseudotsuga macrocarpa</i> Alliance	15	65.3	161.4	0.0%	10.8
1311	<i>Pinus monophylla</i> Alliance	181	1,264.0	3,123.5	0.0%	17.3
1411	<i>Populus fremontii</i> Alliance	327	1,604.7	3,965.4	0.0%	12.1
1412	<i>Salix laevigata</i> Alliance	70	176.5	436.0	0.0%	6.2
1413	<i>Salix gooddingii</i> Alliance	4	9.3	23.1	0.0%	5.8
1414	<i>Platanus racemosa</i> Alliance	28	79.8	197.1	0.0%	7.0
1415	<i>Washingtonia filifera</i> Alliance	16	25.8	63.7	0.0%	4.0
1422	<i>Baccharis salicifolia</i> Alliance	55	149.7	370.0	0.0%	6.7
1423	<i>Baccharis sergiloides</i> Alliance	3	2.2	5.4	0.0%	1.8
1424	<i>Salix exigua</i> Alliance	42	105.2	260.0	0.0%	6.2
1425	<i>Forestiera pubescens</i> Alliance	43	47.8	118.0	0.0%	2.7
1426	<i>Sambucus nigra</i> Alliance	11	37.2	92.0	0.0%	8.4
1427	<i>Salix lasiolepis</i> Alliance	20	35.0	86.5	0.0%	4.3
1431	<i>Arundo donax</i> Semi-natural Stands	40	13.4	33.0	0.0%	0.8
1432	<i>Tamarix</i> spp. Semi-natural Stands	1,106	8,952.7	22,122.6	0.3%	20.0
1433	<i>Saccharum ravennae</i> Mapping Unit	23	47.5	117.5	0.0%	5.1
1511	<i>Alnus rhombifolia</i> Forest Alliance	2	1.4	3.4	0.0%	1.7
2111	<i>Arctostaphylos glauca</i> Alliance	45	374.3	924.8	0.0%	20.6
2112	<i>Adenostoma fasciculatum</i> Alliance	433	8,837.3	21,837.4	0.3%	50.4

**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
2113	<i>Ceanothus crassifolius</i> Alliance	13	155.0	383.0	0.0%	29.5
2114	<i>Fremontodendron californicum</i> Alliance	81	1,028.4	2,541.3	0.0%	31.4
2115	<i>Adenostoma fasciculatum</i> - <i>Salvia mellifera</i> Alliance	1	37.4	92.4	0.0%	92.4
2121	<i>Arctostaphylos glandulosa</i> Alliance	13	62.2	153.8	0.0%	11.8
2122	<i>Ceanothus leucodermis</i> Alliance	4	59.4	146.7	0.0%	36.7
2131	<i>Cercocarpus montanus</i> Alliance	206	1,257.0	3,106.2	0.0%	15.1
2132	<i>Quercus berberidifolia</i> Alliance	44	194.1	479.7	0.0%	10.9
2133	<i>Quercus berberidifolia</i> - <i>Adenostoma fasciculatum</i> Alliance	78	452.6	1,118.4	0.0%	14.3
2134	<i>Prunus ilicifolia</i> Alliance	29	98.2	242.6	0.0%	8.4
2214	<i>Ericameria linearifolia</i> - <i>Isomeris arborea</i> Alliance	37	785.5	1,941.0	0.0%	52.5
2215	<i>Eriodictyon (crassifolium, trichocalyx)</i> Provisional Alliance	41	377.1	931.8	0.0%	22.7
2218	<i>Corethrogyne filaginifolia</i> Alliance	1	6.7	16.5	0.0%	16.5
2221	<i>Eriogonum fasciculatum</i> Alliance	1,274	28,325.2	69,993.2	0.8%	54.9
2222	<i>Eriogonum wrightii</i> Alliance	1	5.5	13.7	0.0%	13.7
2300	California Annual and Perennial Grassland Macrogroup	2	8.5	21.1	0.0%	10.6
2305	CA annual and perennial grassland Mapping Unit (Native component)	1,025	43,317.5	107,039.9	1.3%	104.4
2310	California annual forb/grass vegetation Group	90	4,649.2	11,488.5	0.1%	127.6
2311	<i>Eschscholzia (californica)</i> Alliance	50	1,959.9	4,842.9	0.1%	96.9
2312	<i>Amsinckia (menziesii, tessellata)</i> Alliance	16	217.8	538.2	0.0%	33.6
2313	<i>Lasthenia californica</i> - <i>Plantago erecta</i> - <i>Vulpia microstachys</i> Alliance	7	92.0	227.3	0.0%	32.5
2321	<i>Nassella cernua</i> Provisional Alliance	1	131.4	324.8	0.0%	324.8
2330	Mediterranean CA naturalized annual and perennial grassland Group	1,152	36,096.6	89,196.6	1.1%	77.4
2331	<i>Brassica nigra</i> and other mustards Semi-natural Stands	12	493.7	1,220.0	0.0%	101.7
3211	<i>Ribes quercetorum</i> Provisional Alliance	3	5.0	12.3	0.0%	4.1
3312	<i>Quercus john-tuckeri</i> Alliance	544	8,115.6	20,054.1	0.2%	36.9
3314	<i>Quercus cornelius-mulleri</i> Alliance	43	720.1	1,779.4	0.0%	41.4
3400	Western North American Freshwater Marsh Macrogroup	23	2,265.7	5,598.8	0.1%	243.4

**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
3411	<i>Phragmites australis</i> Alliance	32	30.9	76.3	0.0%	2.4
3412	<i>Schoenoplectus (acutus, californicus)</i> Mapping Unit	57	82.8	204.7	0.0%	3.6
3414	<i>Schoenoplectus californicus</i> Alliance	7	5.7	14.0	0.0%	2.0
3415	<i>Typha (angustifolia, domingensis, latifolia)</i> Alliance	136	277.4	685.4	0.0%	5.0
3510	CA mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group	3	2.6	6.4	0.0%	2.1
3611	<i>Juncus arcticus</i> (var. <i>balticus, mexicanus</i> ) Alliance	32	208.9	516.1	0.0%	16.1
3700	Warm Semi-Desert/Mediterranean Alkali-Saline Wetland Macrogroup	1	7.5	18.4	0.0%	18.4
3712	<i>Sporobolus airoides</i> Alliance	14	24.7	61.1	0.0%	4.4
3714	<i>Juncus cooperi</i> Alliance	2	3.3	8.1	0.0%	4.0
3715	<i>Bolboschoenus maritimus, Schoenoplectus americanus</i> Mapping Unit	6	118.2	292.1	0.0%	48.7
3721	<i>Allenrolfea occidentalis</i> Alliance	241	4,829.8	11,934.8	0.1%	49.5
3722	<i>Atriplex lentiformis</i> Alliance	65	622.8	1,539.0	0.0%	23.7
3723	<i>Atriplex spinifera</i> Alliance	1,568	71,645.4	177,039.7	2.1%	112.9
3724	<i>Frankenia salina</i> Alliance	7	48.6	120.2	0.0%	17.2
3725	<i>Suaeda moquinii</i> Alliance	1,138	24,769.3	61,206.2	0.7%	53.8
3726	<i>Distichlis spicata</i> Alliance	31	185.9	459.3	0.0%	14.8
3728	<i>Isocoma acradenia</i> Alliance	78	811.0	2,004.0	0.0%	25.7
3729	<i>Atriplex parryi</i> Provisional Alliance	33	2,841.8	7,022.3	0.1%	212.8
4110	Lower bajada and fan Mojavean-Sonoran desert scrub Group	2	15.7	38.8	0.0%	19.4
4111	<i>Ambrosia dumosa</i> Alliance	2,249	59,852.7	147,899.3	1.8%	65.8
4113	<i>Atriplex polycarpa</i> Alliance	2,590	126,149.2	311,721.5	3.8%	120.4
4114	<i>Encelia farinosa</i> Alliance	643	33,198.1	82,034.4	1.0%	127.6
4115	<i>Larrea tridentata - Ambrosia dumosa</i> Alliance	8,298	1,462,543.2	3,614,023.3	43.8%	435.5
4118	<i>Larrea tridentata - Encelia farinosa</i> Alliance	2,624	197,298.0	487,534.0	5.9%	185.8
4119	<i>Larrea tridentata</i> Alliance	6,483	288,786.7	713,607.5	8.6%	110.1
4122	<i>Pleuraphis rigida</i> Alliance	66	1,870.2	4,621.3	0.1%	70.0
4124	<i>Cylindropuntia bigelovii</i> Alliance	34	1,372.3	3,391.1	0.0%	99.7



**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4151	<i>Viguiera parishii</i> Alliance	88	2,071.4	5,118.5	0.1%	58.2
4152	<i>Parkinsonia microphylla</i> Provisional Alliance	74	6,558.0	16,205.3	0.2%	219.0
4211	<i>Ephedra californica</i> Alliance	214	3,547.6	8,766.2	0.1%	41.0
4212	<i>Lepidospartum squamatum</i> Alliance	179	2,637.8	6,518.0	0.1%	36.4
4213	<i>Ericameria paniculata</i> Alliance	103	625.5	1,545.6	0.0%	15.0
4214	<i>Prunus fasciculata</i> Alliance	178	927.6	2,292.2	0.0%	12.9
4215	<i>Brickellia incana</i> Provisional Alliance	16	108.0	266.8	0.0%	16.7
4216	<i>Ambrosia salsola</i> Alliance	695	8,892.3	21,973.2	0.3%	31.6
4217	<i>Artemisia tridentata</i> ssp. <i>parishii</i> Provisional Alliance	96	182.8	451.7	0.0%	4.7
4218	<i>Bebbia juncea</i> Provisional Alliance	1	2.3	5.8	0.0%	5.8
4221	<i>Pluchea sericea</i> Alliance	374	2,114.7	5,225.6	0.1%	14.0
4222	<i>Prosopis glandulosa</i> Alliance	1,252	8,089.8	19,990.4	0.2%	16.0
4224	<i>Chilopsis linearis</i> Alliance	186	1,962.3	4,849.0	0.1%	26.1
4225	<i>Psoralea argophylla</i> Alliance	214	1,274.9	3,150.3	0.0%	14.7
4226	<i>Acacia greggii</i> Alliance	776	5,443.3	13,450.6	0.2%	17.3
4227	<i>Parkinsonia florida</i> - <i>Olneya tesota</i> Alliance	2,632	73,309.7	181,152.2	2.2%	68.8
4228	<i>Hyptis emoryi</i> Alliance	257	1,126.8	2,784.5	0.0%	10.8
4229	<i>Castela emoryi</i> Special Stands	2	82.4	203.7	0.0%	101.8
5111	<i>Atriplex canescens</i> Alliance	995	24,654.1	60,921.6	0.7%	61.2
5112	<i>Atriplex confertifolia</i> Alliance	1,114	41,754.7	103,178.1	1.2%	92.6
5210	Intermontane seral shrubland Group	5	299.4	739.9	0.0%	148.0
5211	<i>Encelia (actoni, virginensis)</i> Alliance	86	2,669.4	6,596.2	0.1%	76.7
5212	<i>Ericameria nauseosa</i> Alliance	1,185	28,090.9	69,414.0	0.8%	58.6
5214	<i>Gutierrezia sarothrae</i> Provisional Alliance	4	38.2	94.4	0.0%	23.6
5215	<i>Ericameria cooperi</i> Provisional Alliance	51	1,122.7	2,774.2	0.0%	54.4
5216	<i>Dendromecon rigida</i> Alliance	1	1.1	2.7	0.0%	2.7
5311	<i>Artemisia tridentata</i> Alliance	57	395.5	977.4	0.0%	17.1

**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
5410	Intermontane deep or well-drained soil scrub Group	6	926.5	2,289.4	0.0%	381.6
5411	<i>Grayia spinosa</i> Alliance	401	22,266.3	55,021.1	0.7%	137.2
5412	<i>Krascheninnikovia lanata</i> Alliance	68	3,224.5	7,968.0	0.1%	117.2
5413	<i>Ephedra nevadensis</i> Alliance	222	4,780.4	11,812.6	0.1%	53.2
5414	<i>Lycium andersonii</i> Alliance	4	15.7	38.8	0.0%	9.7
5415	<i>Salazaria mexicana</i> Alliance	329	14,859.7	36,719.1	0.4%	111.6
5416	<i>Ericameria teretifolia</i> Alliance	127	3,517.4	8,691.7	0.1%	68.4
5417	<i>Ephedra viridis</i> Alliance	144	5,089.3	12,575.8	0.2%	87.3
5418	<i>Lycium cooperi</i> Provisional Alliance	14	422.7	1,044.6	0.0%	74.6
5420	Mojave and Great Basin upper bajada and toeslope Group	2	175.7	434.1	0.0%	217.1
5421	<i>Coleogyne ramosissima</i> Alliance	355	25,993.2	64,230.5	0.8%	180.9
5422	<i>Purshia tridentata</i> Alliance	84	1,547.8	3,824.6	0.0%	45.5
5423	<i>Yucca brevifolia</i> Alliance	1,697	97,659.0	241,320.6	2.9%	142.2
5424	<i>Yucca schidigera</i> Alliance	613	38,743.5	95,737.3	1.2%	156.2
5425	<i>Menodora spinescens</i> Alliance	3	43.4	107.2	0.0%	35.7
5431	<i>Achnatherum speciosum</i> Alliance	2	116.3	287.4	0.0%	143.7
5433	<i>Achnatherum hymenoides</i> Alliance	5	249.7	617.1	0.0%	123.4
5440	Intermountain shallow/calcareous soil scrub Group	10	153.4	379.0	0.0%	37.9
5441	<i>Cercocarpus ledifolius</i> Alliance	2	1.9	4.6	0.0%	2.3
5442	<i>Purshia stansburiana</i> Alliance	36	2,165.8	5,351.9	0.1%	148.7
5511	<i>Sarcobatus vermiculatus</i> Alliance	6	10.3	25.6	0.0%	4.3
6110	North American warm desert bedrock cliff and outcrop Group	83	5,963.1	14,735.1	0.2%	177.5
6111	<i>Atriplex hymenelytra</i> Alliance	202	5,843.9	14,440.7	0.2%	71.5
6112	<i>Ephedra funerea</i> Alliance	86	1,402.6	3,465.9	0.0%	40.3
6113	Mud Hills sparsely vegetated ephemeral herbs Mapping Unit	482	13,706.7	33,870.1	0.4%	70.3
6114	Unvegetated wash and river bottom Mapping Unit	382	4,318.0	10,669.9	0.1%	27.9
6115	Massive sparsely vegetated rock outcrop Mapping Unit	134	2,579.0	6,372.9	0.1%	47.6

**Table B-1: Map Unit Acreage, Listed Numerically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	1,798	71,665.1	177,088.4	2.1%	98.5
6117	<i>Chorizanthe rigida</i> - <i>Geraea canescens</i> Desert Pavement Sparsely Vegetated Alliance	3,701	120,916.7	298,791.6	3.6%	80.7
6118	<i>Peucephyllum schottii</i> Alliance	9	70.1	173.3	0.0%	19.3
6120	North American warm desert dunes and sand flats Group	55	971.9	2,401.5	0.0%	43.7
6121	<i>Dicoria canescens</i> - <i>Abronia villosa</i> Alliance	87	4,209.5	10,401.9	0.1%	119.6
6122	<i>Panicum urvilleanum</i> Alliance	9	294.8	728.5	0.0%	80.9
6123	<i>Wislizenia refracta</i> Special Stands	10	1,228.6	3,035.9	0.0%	303.6
9200	Agriculture	78	1,409.1	3,481.9	0.0%	44.6
9210	Woody Agriculture (orchards, vineyards)	321	8,292.0	20,489.9	0.2%	63.8
9220	Non-woody Row and Field Agriculture	391	36,738.4	90,782.5	1.1%	232.2
9300	Built-up & Urban Disturbance	9,484	72,655.6	179,535.9	2.2%	18.9
9310	Urban Window	58	68,435.0	169,106.5	2.0%	2,915.6
9320	Anthropogenic Areas of Little or No Vegetation	563	4,563.3	11,276.2	0.1%	20.0
9500	Exotic Trees	34	79.2	195.7	0.0%	5.8
9800	Water	188	12,390.6	30,617.7	0.4%	162.9
9801	Perennial Stream Channel (open water)	14	691.8	1,709.5	0.0%	122.1
9803	Small Earthen-dammed Ponds and Naturally Occurring Lakes	10	6.5	16.1	0.0%	1.6
9804	Major Canals and Aqueducts	95	2,029.5	5,015.0	0.1%	52.8
9805	Water Impoundment Feature	182	3,528.9	8,720.0	0.1%	47.9
<b>Totals</b>		<b>68,992</b>	<b>3,342,441.6</b>	<b>8,259,353.6</b>	<b>100.0%</b>	<b>119.7</b>

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4226	<i>Acacia greggii</i> Alliance	776	5,443.3	13,450.6	0.2%	17.3
5433	<i>Achnatherum hymenoides</i> Alliance	5	249.7	617.1	0.0%	123.4
5431	<i>Achnatherum speciosum</i> Alliance	2	116.3	287.4	0.0%	143.7
2115	<i>Adenostoma fasciculatum</i> - <i>Salvia mellifera</i> Alliance	1	37.4	92.4	0.0%	92.4
2112	<i>Adenostoma fasciculatum</i> Alliance	433	8,837.3	21,837.4	0.3%	50.4
1116	<i>Aesculus californica</i> Alliance	1	5.6	13.7	0.0%	13.7
9200	Agriculture	78	1,409.1	3,481.9	0.0%	44.6
3721	<i>Allenrolfea occidentalis</i> Alliance	241	4,829.8	11,934.8	0.1%	49.5
1511	<i>Alnus rhombifolia</i> Forest Alliance	2	1.4	3.4	0.0%	1.7
4111	<i>Ambrosia dumosa</i> Alliance	2,249	59,852.7	147,899.3	1.8%	65.8
4216	<i>Ambrosia salsola</i> Alliance	695	8,892.3	21,973.2	0.3%	31.6
2312	<i>Amsinckia (menziesii, tessellata)</i> Alliance	16	217.8	538.2	0.0%	33.6
9320	Anthropogenic Areas of Little or No Vegetation	563	4,563.3	11,276.2	0.1%	20.0
2121	<i>Arctostaphylos glandulosa</i> Alliance	13	62.2	153.8	0.0%	11.8
2111	<i>Arctostaphylos glauca</i> Alliance	45	374.3	924.8	0.0%	20.6
5311	<i>Artemisia tridentata</i> Alliance	57	395.5	977.4	0.0%	17.1
4217	<i>Artemisia tridentata</i> ssp. <i>parishii</i> Provisional Alliance	96	182.8	451.7	0.0%	4.7
1431	<i>Arundo donax</i> Semi-natural Stands	40	13.4	33.0	0.0%	0.8
5111	<i>Atriplex canescens</i> Alliance	995	24,654.1	60,921.6	0.7%	61.2
5112	<i>Atriplex confertifolia</i> Alliance	1,114	41,754.7	103,178.1	1.2%	92.6
6111	<i>Atriplex hymenelytra</i> Alliance	202	5,843.9	14,440.7	0.2%	71.5
3722	<i>Atriplex lentiformis</i> Alliance	65	622.8	1,539.0	0.0%	23.7
3729	<i>Atriplex parryi</i> Provisional Alliance	33	2,841.8	7,022.3	0.1%	212.8

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4113	<i>Atriplex polycarpa</i> Alliance	2,590	126,149.2	311,721.5	3.8%	120.4
3723	<i>Atriplex spinifera</i> Alliance	1,568	71,645.4	177,039.7	2.1%	112.9
1422	<i>Baccharis salicifolia</i> Alliance	55	149.7	370.0	0.0%	6.7
1423	<i>Baccharis sergiloides</i> Alliance	3	2.2	5.4	0.0%	1.8
4218	<i>Bebbia juncea</i> Provisional Alliance	1	2.3	5.8	0.0%	5.8
3715	<i>Bolboschoenus maritimus</i> , <i>Schoenoplectus americanus</i> Mapping Unit	6	118.2	292.1	0.0%	48.7
2331	<i>Brassica nigra</i> and other mustards Semi-natural Stands	12	493.7	1,220.0	0.0%	101.7
4215	<i>Brickellia incana</i> Provisional Alliance	16	108.0	266.8	0.0%	16.7
9300	Built-up & Urban Disturbance	9,484	72,655.6	179,535.9	2.2%	18.9
2305	CA annual and perennial grassland Mapping Unit (native component)	1,025	43,317.5	107,039.9	1.3%	104.4
2310	California annual forb/grass vegetation Group	90	4,649.2	11,488.5	0.1%	127.6
3510	CA mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group	3	2.6	6.4	0.0%	2.1
2300	California Annual and Perennial Grassland Macrogroup	2	8.5	21.1	0.0%	10.6
4229	<i>Castela emoryi</i> Special Stands	2	82.4	203.7	0.0%	101.8
2113	<i>Ceanothus crassifolius</i> Alliance	13	155.0	383.0	0.0%	29.5
2122	<i>Ceanothus leucodermis</i> Alliance	4	59.4	146.7	0.0%	36.7
5441	<i>Cercocarpus ledifolius</i> Alliance	2	1.9	4.6	0.0%	2.3
2131	<i>Cercocarpus montanus</i> Alliance	206	1,257.0	3,106.2	0.0%	15.1
4224	<i>Chilopsis linearis</i> Alliance	186	1,962.3	4,849.0	0.1%	26.1
6117	<i>Chorizanthe rigida</i> - <i>Geraea canescens</i> Desert Pavement Sparsely Vegetated Alliance	3,701	120,916.7	298,791.6	3.6%	80.7
5421	<i>Coleogyne ramosissima</i> Alliance	355	25,993.2	64,230.5	0.8%	180.9
2218	<i>Corethrogyne filaginifolia</i> Alliance	1	6.7	16.5	0.0%	16.5



**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4124	<i>Cylindropuntia bigelovii</i> Alliance	34	1,372.3	3,391.1	0.0%	99.7
5216	<i>Dendromecon rigida</i> Alliance	1	1.1	2.7	0.0%	2.7
6121	<i>Dicoria canescens</i> - <i>Abronia villosa</i> Alliance	87	4,209.5	10,401.9	0.1%	119.6
3726	<i>Distichlis spicata</i> Alliance	31	185.9	459.3	0.0%	14.8
5211	<i>Encelia (actoni, virginensis)</i> Alliance	86	2,669.4	6,596.2	0.1%	76.7
4114	<i>Encelia farinosa</i> Alliance	643	33,198.1	82,034.4	1.0%	127.6
4211	<i>Ephedra californica</i> Alliance	214	3,547.6	8,766.2	0.1%	41.0
6112	<i>Ephedra funerea</i> Alliance	86	1,402.6	3,465.9	0.0%	40.3
5413	<i>Ephedra nevadensis</i> Alliance	222	4,780.4	11,812.6	0.1%	53.2
5417	<i>Ephedra viridis</i> Alliance	144	5,089.3	12,575.8	0.2%	87.3
5215	<i>Ericameria cooperi</i> Provisional Alliance	51	1,122.7	2,774.2	0.0%	54.4
2214	<i>Ericameria linearifolia</i> - <i>Isomeris arborea</i> Alliance	37	785.5	1,941.0	0.0%	52.5
5212	<i>Ericameria nauseosa</i> Alliance	1,185	28,090.9	69,414.0	0.8%	58.6
4213	<i>Ericameria paniculata</i> Alliance	103	625.5	1,545.6	0.0%	15.0
5416	<i>Ericameria teretifolia</i> Alliance	127	3,517.4	8,691.7	0.1%	68.4
2215	<i>Eriodictyon (crassifolium, trichocalyx)</i> Provisional Alliance	41	377.1	931.8	0.0%	22.7
2221	<i>Eriogonum fasciculatum</i> Alliance	1,274	28,325.2	69,993.2	0.8%	54.9
2222	<i>Eriogonum wrightii</i> Alliance	1	5.5	13.7	0.0%	13.7
2311	<i>Eschscholzia (californica)</i> Alliance	50	1,959.9	4,842.9	0.1%	96.9
9500	Exotic Trees	34	79.2	195.7	0.0%	5.8
1425	<i>Forestiera pubescens</i> Alliance	43	47.8	118.0	0.0%	2.7
3724	<i>Frankenia salina</i> Alliance	7	48.6	120.2	0.0%	17.2
2114	<i>Fremontodendron californicum</i> Alliance	81	1,028.4	2,541.3	0.0%	31.4

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
5411	<i>Grayia spinosa</i> Alliance	401	22,266.3	55,021.1	0.7%	137.2
5214	<i>Gutierrezia sarothrae</i> Provisional Alliance	4	38.2	94.4	0.0%	23.6
4228	<i>Hyptis emoryi</i> Alliance	257	1,126.8	2,784.5	0.0%	10.8
5410	Intermontane deep or well-drained soil scrub Group	6	926.5	2,289.4	0.0%	381.6
5210	Intermontane seral shrubland Group	5	299.4	739.9	0.0%	148.0
5440	Intermountain shallow/calcareous soil scrub Group	10	153.4	379.0	0.0%	37.9
3728	<i>Isocoma acradenia</i> Alliance	78	811.0	2,004.0	0.0%	25.7
3611	<i>Juncus arcticus</i> (var. <i>balticus</i> , <i>mexicanus</i> ) Alliance	32	208.9	516.1	0.0%	16.1
3714	<i>Juncus cooperi</i> Alliance	2	3.3	8.1	0.0%	4.0
1122	<i>Juniperus californica</i> Alliance	1,708	26,862.8	66,379.5	0.8%	38.9
5412	<i>Krascheninnikovia lanata</i> Alliance	68	3,224.5	7,968.0	0.1%	117.2
4115	<i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> Alliance	8,298	1,462,543.2	3,614,023.3	43.8%	435.5
4118	<i>Larrea tridentata</i> - <i>Encelia farinosa</i> Alliance	2,624	197,298.0	487,534.0	5.9%	185.8
4119	<i>Larrea tridentata</i> Alliance	6,483	288,786.7	713,607.5	8.6%	110.1
2313	<i>Lasthenia californica</i> - <i>Plantago erecta</i> - <i>Vulpia microstachys</i> Alliance	7	92.0	227.3	0.0%	32.5
4212	<i>Lepidospartum squamatum</i> Alliance	179	2,637.8	6,518.0	0.1%	36.4
4110	Lower bajada and fan Mojavean–Sonoran desert scrub Group	2	15.7	38.8	0.0%	19.4
5414	<i>Lycium andersonii</i> Alliance	4	15.7	38.8	0.0%	9.7
5418	<i>Lycium cooperi</i> Provisional Alliance	14	422.7	1,044.6	0.0%	74.6
9804	Major Canals and Aqueducts	95	2,029.5	5,015.0	0.1%	52.8
6115	Massive sparsely vegetated rock outcrop Mapping Unit	134	2,579.0	6,372.9	0.1%	47.6
2330	Mediterranean CA naturalized annual and perennial grassland Group	1,152	36,096.6	89,196.6	1.1%	77.4
5425	<i>Menodora spinescens</i> Alliance	3	43.4	107.2	0.0%	35.7

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
5420	Mojave and Great Basin upper bajada and toeslope Group	2	175.7	434.1	0.0%	217.1
6113	Mud Hills sparsely vegetated ephemeral herbs Mapping Unit	482	13,706.7	33,870.1	0.4%	70.3
2321	<i>Nassella cernua</i> Provisional Alliance	1	131.4	324.8	0.0%	324.8
9220	Non-woody Row and Field Agriculture	391	36,738.4	90,782.5	1.1%	232.2
6110	North American warm desert bedrock cliff and outcrop Group	83	5,963.1	14,735.1	0.2%	177.5
6120	North American warm desert dunes and sand flats Group	55	971.9	2,401.5	0.0%	43.7
6122	<i>Panicum urvilleanum</i> Alliance	9	294.8	728.5	0.0%	80.9
4227	<i>Parkinsonia florida</i> - <i>Olneya tesota</i> Alliance	2,632	73,309.7	181,152.2	2.2%	68.8
4152	<i>Parkinsonia microphylla</i> Provisional Alliance	74	6,558.0	16,205.3	0.2%	219.0
9801	Perennial Stream Channel (open water)	14	691.8	1,709.5	0.0%	122.1
6118	<i>Peucephyllum schottii</i> Alliance	9	70.1	173.3	0.0%	19.3
3411	<i>Phragmites australis</i> Alliance	32	30.9	76.3	0.0%	2.4
1311	<i>Pinus monophylla</i> Alliance	181	1,264.0	3,123.5	0.0%	17.3
1121	<i>Pinus sabiniana</i> Alliance	18	85.9	212.3	0.0%	11.8
1414	<i>Platanus racemosa</i> Alliance	28	79.8	197.1	0.0%	7.0
4122	<i>Pleuraphis rigida</i> Alliance	66	1,870.2	4,621.3	0.1%	70.0
4221	<i>Pluchea sericea</i> Alliance	374	2,114.7	5,225.6	0.1%	14.0
1411	<i>Populus fremontii</i> Alliance	327	1,604.7	3,965.4	0.0%	12.1
4222	<i>Prosopis glandulosa</i> Alliance	1,252	8,089.8	19,990.4	0.2%	16.0
4214	<i>Prunus fasciculata</i> Alliance	178	927.6	2,292.2	0.0%	12.9
2134	<i>Prunus ilicifolia</i> Alliance	29	98.2	242.6	0.0%	8.4
1211	<i>Pseudotsuga macrocarpa</i> Alliance	15	65.3	161.4	0.0%	10.8
4225	<i>Psoralea argophylla</i> Alliance	214	1,274.9	3,150.3	0.0%	14.7

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
5442	<i>Purshia stansburiana</i> Alliance	36	2,165.8	5,351.9	0.1%	148.7
5422	<i>Purshia tridentata</i> Alliance	84	1,547.8	3,824.6	0.0%	45.5
1117	<i>Quercus agrifolia</i> Alliance	1	6.6	16.3	0.0%	16.3
2133	<i>Quercus berberidifolia</i> - <i>Adenostoma fasciculatum</i> Alliance	78	452.6	1,118.4	0.0%	14.3
2132	<i>Quercus berberidifolia</i> Alliance	44	194.1	479.7	0.0%	10.9
1113	<i>Quercus chrysolepis</i> Alliance	37	138.5	342.3	0.0%	9.3
3314	<i>Quercus cornelius-mulleri</i> Alliance	43	720.1	1,779.4	0.0%	41.4
1111	<i>Quercus douglasii</i> Alliance	39	390.9	965.8	0.0%	24.8
3312	<i>Quercus john-tuckeri</i> Alliance	544	8,115.6	20,054.1	0.2%	36.9
1112	<i>Quercus lobata</i> Alliance	28	239.9	592.9	0.0%	21.2
1114	<i>Quercus wislizeni</i> Alliance	44	426.8	1,054.5	0.0%	24.0
3211	<i>Ribes quercetorum</i> Provisional Alliance	3	5.0	12.3	0.0%	4.1
1433	<i>Saccharum ravennae</i> Mapping Unit	23	47.5	117.5	0.0%	5.1
5415	<i>Salazaria mexicana</i> Alliance	329	14,859.7	36,719.1	0.4%	111.6
1424	<i>Salix exigua</i> Alliance	42	105.2	260.0	0.0%	6.2
1413	<i>Salix gooddingii</i> Alliance	4	9.3	23.1	0.0%	5.8
1412	<i>Salix laevigata</i> Alliance	70	176.5	436.0	0.0%	6.2
1427	<i>Salix lasiolepis</i> Alliance	20	35.0	86.5	0.0%	4.3
1426	<i>Sambucus nigra</i> Alliance	11	37.2	92.0	0.0%	8.4
5511	<i>Sarcobatus vermiculatus</i> Alliance	6	10.3	25.6	0.0%	4.3
3412	<i>Schoenoplectus (acutus, californicus)</i> Mapping Unit	57	82.8	204.7	0.0%	3.6
3414	<i>Schoenoplectus californicus</i> Alliance	7	5.7	14.0	0.0%	2.0
9803	Small Earthen-dammed Ponds and Naturally Occurring Lakes	10	6.5	16.1	0.0%	1.6

**Table B-2: Map Unit Acreage, Listed Alphabetically**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	1,798	71,665.1	177,088.4	2.1%	98.5
3712	<i>Sporobolus airoides</i> Alliance	14	24.7	61.1	0.0%	4.4
3725	<i>Suaeda moquinii</i> Alliance	1,138	24,769.3	61,206.2	0.7%	53.8
1432	<i>Tamarix</i> spp. Semi-natural Stands	1,106	8,952.7	22,122.6	0.3%	20.0
3415	<i>Typha (angustifolia, domingensis, latifolia)</i> Alliance	136	277.4	685.4	0.0%	5.0
6114	Unvegetated wash and river bottom Mapping Unit	382	4,318.0	10,669.9	0.1%	27.9
9310	Urban Window	58	68,435.0	169,106.5	2.0%	2,915.6
4151	<i>Viguiera parishii</i> Alliance	88	2,071.4	5,118.5	0.1%	58.2
3700	Warm Semi-Desert/Mediterranean Alkali-Saline Wetland Macrogroup	1	7.5	18.4	0.0%	18.4
1415	<i>Washingtonia filifera</i> Alliance	16	25.8	63.7	0.0%	4.0
9800	Water	188	12,390.6	30,617.7	0.4%	162.9
9805	Water Impoundment Feature	182	3,528.9	8,720.0	0.1%	47.9
3400	Western North American Freshwater Marsh Macrogroup	23	2,265.7	5,598.8	0.1%	243.4
6123	<i>Wislizenia refracta</i> Special Stands	10	1,228.6	3,035.9	0.0%	303.6
9210	Woody Agriculture (orchards, vineyards)	321	8,292.0	20,489.9	0.2%	63.8
5423	<i>Yucca brevifolia</i> Alliance	1,697	97,659.0	241,320.6	2.9%	142.2
5424	<i>Yucca schidigera</i> Alliance	613	38,743.5	95,737.3	1.2%	156.2
<b>Totals</b>		68,992	3,342,441.6	8,259,353.6	100.0%	119.7



**Table B-3: Map Units That Comprise Greater Than 1 Percent of the Study Area**

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4115	<i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> Alliance	8,298	1,462,543.2	3,614,023.3	43.8%	435.5
4119	<i>Larrea tridentata</i> Alliance	6,483	288,786.7	713,607.5	8.6%	110.1
4118	<i>Larrea tridentata</i> - <i>Encelia farinosa</i> Alliance	2,624	197,298.0	487,534.0	5.9%	185.8
4113	<i>Atriplex polycarpa</i> Alliance	2,590	126,149.2	311,721.5	3.8%	120.4
6117	<i>Chorizanthe rigida</i> - <i>Geraea canescens</i> Desert Pavement Sparsely Vegetated Alliance	3,701	120,916.7	298,791.6	3.6%	80.7
5423	<i>Yucca brevifolia</i> Alliance	1,697	97,659.0	241,320.6	2.9%	142.2
4227	<i>Parkinsonia florida</i> - <i>Olneya tesota</i> Alliance	2,632	73,309.7	181,152.2	2.2%	68.8
9300	Built-up & Urban Disturbance	9,484	72,655.6	179,535.9	2.2%	18.9
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	1,798	71,665.1	177,088.4	2.1%	98.5
3723	<i>Atriplex spinifera</i> Alliance	1,568	71,645.4	177,039.7	2.1%	112.9
9310	Urban Window	58	68,435.0	169,106.5	2.0%	2,915.6
4111	<i>Ambrosia dumosa</i> Alliance	2,249	59,852.7	147,899.3	1.8%	65.8
2305	CA annual and perennial grassland Mapping Unit (native component)	1,025	43,317.5	107,039.9	1.3%	104.4
5112	<i>Atriplex confertifolia</i> Alliance	1,114	41,754.7	103,178.1	1.2%	92.6
5424	<i>Yucca schidigera</i> Alliance	613	38,743.5	95,737.3	1.2%	156.2
9220	Non-woody Row and Field Agriculture	391	36,738.4	90,782.5	1.1%	232.2
2330	Mediterranean CA naturalized annual and perennial grassland Group	1,152	36,096.6	89,196.6	1.1%	77.4
4114	<i>Encelia farinosa</i> Alliance	643	33,198.1	82,034.4	1.0%	127.6

# APPENDIX C

## VEGETATION MISCELLANEOUS CLASSES AND LAND USE MAPPING CRITERIA

Miscellaneous Classes are Vegetation Type (Map Unit) categories reserved for land use types such as agriculture, urban disturbance, and water features, which are attributes of vegetation polygons. A two-tiered coding system (Vegetation Type and Land Use) was used to allow for the coding of a given polygon as both a natural vegetation type and a land use type if the situation warranted it. A polygon that had been assigned a Miscellaneous Class land use code value in the Vegetation Type (Map Unit) Attribute was automatically populated with a corresponding land use code value in the Land Use Attribute.

### Minimum Mapping Unit

The minimum mapping unit (MMU) for Miscellaneous Class types 9200, 9210, 9220, 9300, 9320, and 9805 is 2.5 acres. Water types 9800, 9801, 9803, and 9804 have a 1 acre MMU. The minimum size of an Urban Window (9310) polygon is one square mile. Any other specific MMU considerations are given under each map type discussion below. The minimum mapping width (MMW) of a linear-shaped feature is half the width of its appropriate MMU square. These figures served as guidelines rather than strict rules.

### Vegetation Type (Map Unit) Attribute:

#### **9000 = MISCELLANEOUS CLASSES**

- 9200 = Agriculture
  - 9210 = Woody Agriculture (orchards, vineyards)
  - 9220 = Non-woody Row and Field Agriculture
- 9300 = Built-up & Urban Disturbance
  - 9310 = Urban Window
  - 9320 = Anthropogenic Areas of Little or No Vegetation
- 9500 = Exotic Trees
  - 9501 = Eucalyptus
- 9800 = Water
  - 9801 = Perennial Stream Channel (Open Water)
  - 9803 = Small Earthen-dammed Ponds and Naturally Occurring Lakes
  - 9804 = Major Canals and Aqueducts
  - 9805 = Water Impoundment Feature

## **9200 = Agriculture**

Corresponding Land Use Attribute Code is 2000 or 1436

For this project, agriculture was broken down into two categories: orchards and vineyards (9210), and non-woody row and field agriculture (9220). In general, agriculture polygons, such as nurseries, were coded with the generic 9200 code if they were not defined to the 9210 or 9220 subclasses, or were classified as agricultural irrigation channels that met MMU (see below).

Criteria specific to mapping the 9200 vegetation type is listed below:

- a. Nurseries were coded to a vegetation type of Agriculture (9200) with a land use value of Agriculture (2000). This included ambiguous areas where it was unclear if the field was row crop or nursery, and the field was covered with linear patterns of plastic. In these situations we erred towards calling the polygon nursery.
- b. Citrus or orchard removal within 5 years prior to the project base imagery, and appearing as cleared land on the imagery (e.g. Imperial Valley area) were also coded as vegetation type of Agriculture (9200) with a land use value of Agriculture (2000).
- c. In the agricultural areas of the Imperial Valley, minor irrigation channels were not considered as water features (9804 = Major Canals and Aqueducts) but rather part of the agricultural practice, therefore the MMW for these minor irrigation channels had to meet the MMW for land use (one-half of a 2.5 acre MMU box or ~150 feet). Usually these irrigation channels were oriented perpendicular to major canals such as the East Highline Canal or the All American Canal. These small agricultural channels were referred to as “lateral drains” on the USGS topographic map. Often these irrigation channels formed corridors that typically contained one to two small agricultural channels and sometimes included a road and/or a staging area for agricultural practices. These minor irrigation corridors were mapped when they met the MMW of ~150 feet and one of the following criteria:
  - contained two channels
  - contained one channel which appeared to carry water consistently
  - contained one or two channels and a road

The resulting polygon was then coded as vegetation type of 9200 (Agriculture) with a land use value of 1436 (Water Transfer).

Additional criteria related to agriculture areas:

- a. Structures associated with agriculture and their adjacent cleared areas were mapped as Built-up & Urban Disturbance (9300) as long as they met the 2.5-acre MMU.
- b. Agricultural areas within an urban window (9310) were mapped if they were greater than 10 acres in size.

The criteria that are more specific to the 9210 and 9220 categories are described in the appropriate sections below.

**9210 = Woody Agriculture (orchards, vineyards)**

Corresponding Land Use Attribute code is 2200

Woody agriculture (as depicted on the project base imagery) is defined in this study as orchards, vineyards, or jojoba farms. Abandoned orchards remain as 9210 until the trees/shrubs have been removed.

**Example 1 – Abandoned Jojoba Plantation**



The example above shows a portion of an area west of the small irrigation channel that is an inactive jojoba plantation. Abandoned orchards and vineyards were mapped as Agriculture if the plants were still visible on the imagery. To the east is a citrus grove that is still in production.

Once an orchard/vineyard has been completely removed the area is mapped as the condition depicted on the base imagery and coded with an appropriate vegetation and/or land use type. If the vegetation was removed and the area was not revegetated, or if it was not evident on the project imagery that the land was taken out of agriculture, then it was coded as vegetation type of Agriculture (9200) with a land use value of Agriculture (2000).

### **9220 = Non-woody Row and Field Agriculture**

Corresponding Land Use Attribute code is 2100

Agriculture in the desert may be difficult to map, especially in areas that have historically been farmed. When mapping an area of agriculture, the question becomes, “when should an area no longer be considered agriculture?” Old plow and irrigation marks on land that has not been cultivated in the past 10 to 20 years or longer may still be visible on the current imagery sources, giving the impression that the area may be agriculture.

To account for the ambiguity of agricultural signatures due to land rotating in and out of agricultural activity, land that had been in crop production at any time within 5 years of the current base imagery is mapped as agriculture for the project. The agriculture polygon boundary was drawn to the largest actively farmed area seen on any of the 5-year set of NAIP imagery. Using the multiple image sets as a guide to code the agricultural areas may have resulted in polygons coded as 9220 that are not photomorphic to the signature on the base imagery. For example, in the 2014-2016 mapping effort, if an area was last actively farmed in 2009, but had been inactive since then, the agriculture polygon extent and attribution was based on the 2009 NAIP image, however, the delineation was based on 2014 image (e.g. following roads, fence lines, etc. that usually appear on all sets of imagery).

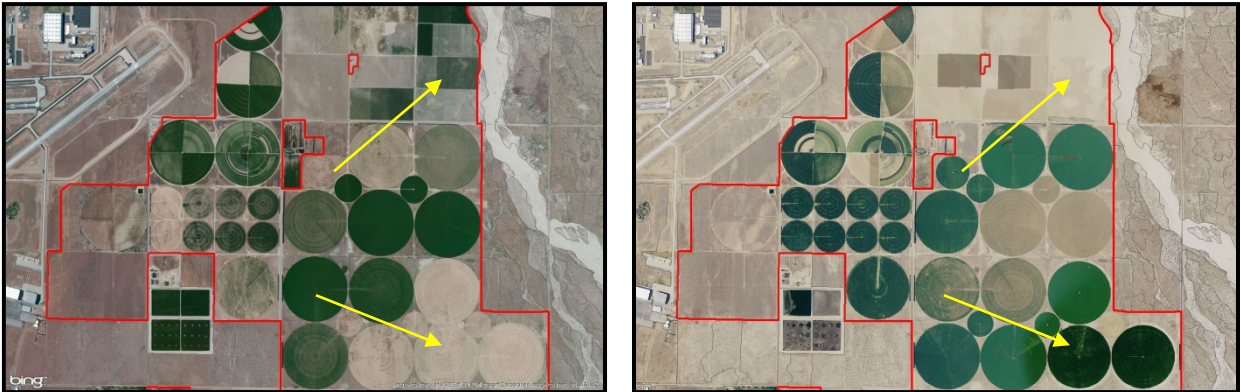
The following criteria were set for non-woody Row and Field Agriculture:

- a. Land that has been actively farmed within ~5 years was considered agriculture (9220 in the Vegetation Type (Map Unit) Attribute, and 2100 in the Land Use Attribute).
  - If the area in question showed signs of **active** agricultural use (e.g., crop irrigation patterns, or other signs of actively managed crops) on the project base image source, the area was called agriculture (9220).
  - If an area was shown on the project base imagery as fallow, weedy, or abandoned, but earlier sources within the prior 5 years showed active agriculture (crops, plowed dirt, etc.) then the area was still mapped as agriculture.

Below is an example of agriculture in different phases.



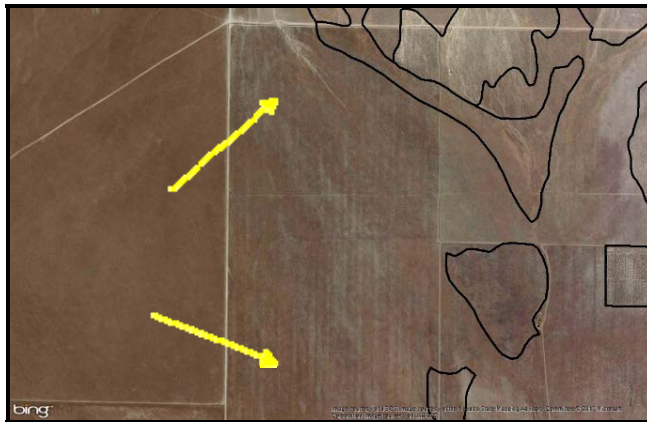
## Example 2 – Annual and Bi-annual Crop Rotation



The above imagery compares a two-year crop cycle. All fallow areas shown on the imagery have been productive at least once within the previous five years. Note the alternating cycles of croplands in and out of rotation.

- b. If the area appeared to be **inactive** agriculture (based on the –imagery set going back 5 years from the project imagery) and remained unchanged from image source to image source, then the mapper made the assumption the area was no longer being used for agricultural purposes even though old plow and/or irrigation marks were still visible. Usually the imagery showed a mottled grass or herbaceous signature. Shrubs may have been present in varying amounts and distribution.

## Example 3 – Former Agriculture



This example shows former agriculture out of the 5-year timespan returning to natural vegetation. Note the till patterning (eastern 2/3 of the image) that is at least 15 years old.

However, sometimes it was difficult to distinguish an older inactive agricultural field from an active one. Species found in the inactive agriculture

fields vary, depending on the location within the study area. The inactive fields usually appeared as a homogeneous, smooth tan grassy signature. These areas were mapped as non-native annual grass (2330) unless the field data noted otherwise. In these situations, an Anthropogenically Altered Disturbance Attribute of 3 was assigned.

- c. Cleared and vegetated areas between and at the outer corners of circular pivot-irrigated agricultural fields (crop circles) were evaluated and mapped according to the following criteria:
  - In areas where vegetation (trees, shrubs and grasses) abutted the crop circle, the crop circle was tightly delineated and the vegetation was mapped next to the crop circle if the appropriate MMU was met.
  - The areas between multiple crop circles were often vacant or grassy. If the adjacent area (between or adjacent to crop circles) looked to be cleared or vacant and actively used to aid in the farming operation, then it was coded as part of the 9220 vegetation type.
  - Any buildings with 2.5-acre MMU were coded as the Built-up & Urban Disturbance vegetation type (9300).

### **9300 = Built-up & Urban Disturbance**

Corresponding Land Use Attribute code is 1000

Built-up & Urban Disturbance represents isolated built-up areas as well as settlements and suburban areas less than 1 square mile in size.

Isolated built-up areas are typically more rural in character, and can range from one isolated homestead to a group of houses on large lots mixed with vacant lots, small agricultural plots, and pods of natural vegetation. Settlements and suburban areas are larger areas of urban development that are below the 1-square-mile MMU for Urban Window (9310).

There are situations where natural vegetation occurs on the same plot of land as the built-up disturbance. In these settings, it was important to represent the urban disturbance as well as show the continuity of the natural vegetation community by using the two-tiered coding system (Vegetation Type and Land Use Attributes).

- If the natural vegetation met the mapping criteria for an Alliance, the entire area was coded as a natural vegetation type in the Vegetation Map Unit Attribute, and was assigned a Land Use Attribute value of 1000. An example of this is the vegetated campgrounds (Hot Spring Long Term Visitor Area) found in Imperial County.
- If the natural vegetation did not meet the mapping criteria for an Alliance, the entire area was coded as a 9300. This polygon was assigned a Land Use Attribute value of 1000.

The following are mapping considerations for 9300:

- a. Photointerpreters were instructed to keep the polygon boundary tight to the land use and associated land use disturbance signature by delineating land use with as little natural vegetation as possible.
- b. Natural vegetation that came into the settlement from the outside was continued into the Urban area as a natural vegetation type if the natural area within the Urban area met the 10-acre MMU. When the natural vegetation was riparian, the MMU was lowered to 1 acre to maintain continuity.
- c. If a mappable settlement or other developed area polygon (9300) was directly adjacent to an Urban Window (9310) polygon, then the 9300 was incorporated into the 9310.
- d. Vacant areas that have “natural” vegetation and are fully contained within a settlement or rural residential area were mapped using the following criteria:
  - A vegetation polygon was created if it was at least 10 acres of contiguous vegetation not split or disrupted by roads or other man-made features. This rule applies to areas that are “more built-up” (settlements) and does not apply to “more natural,” undeveloped areas that are just split by multiple roads.
  - If the vegetated area met the “10-acre contiguous not split by roads” criteria, then other smaller, similarly vegetated areas adjacent to this “main” unit but separated from it by roads were added to the vegetation polygon.
- e. Scraped lots and any urban built-up areas that were less than 1 acre and adjacent to urban areas were usually included in the Urban polygon. Context was used for this guideline: for example, scraped areas may not always have been included with the land use, especially if the scrapings were linear along a roadway or fence.
- f. Non built-up “holes” within a settlement that are scraped or otherwise disturbed were left as part of the Urban (9300) polygon.
- g. An area under construction (including buildings or cleared land with an urban development footprint) was coded as 9300. This includes under-construction areas that were adjacent to existing land uses, such as residential developments, as well as areas that were isolated.

- h. If there was a large (at least 2.5 acres) isolated area of disturbance (scraped land) with very little to no development, it was assigned a Vegetation Map Unit code of 9320.
- i. On horse-related property, cleared areas were coded as 9300.
- j. Flood control basins were included in the 9300 polygon. However, a basin was mapped separately as a 9805 if it was larger than 10 acres.
- k. Major four-lane divided highways and freeways, such as Interstates 8, 15, and 40, were usually delineated to the fenced right-of-way (ROW) as a 9300 polygon. Vegetation within the ROW was normally not mapped. In most cases the vegetation within the ROW is a disturbance type of vegetation and is different from the natural type of vegetation outside of the ROW.
  - If the ROW fell below the 2.5 acre MMU width (1/2 the width of a 2.5 acre box), that portion of the highway was not mapped unless it was for a very short span, thus keeping the roadway connectivity intact.
  - When the ROW extended beyond 90 feet past the pavement edge, the disturbance corridor was re-evaluated for natural vegetation, and the ROW boundary was not necessarily used as the road/urban boundary. Where possible, the vegetation was kept together in one polygon, and the road and its associated disturbance was captured in a different polygon.
- l. Near the Salton Sea, the railroad and California Highway 111 run parallel and were mapped as one polygon coded as "Built-up & Urban Disturbance". North of the town of Frink where the railroad and Highway 111 complex was mapped, there were man-made berms adjacent to the railroad that were recently scraped. These disturbed berms were included in the 9300 polygon with the railroad and Highway 111. However, south of Frink, berms paralleling the railroad that were not obviously altered were not included with the "Built Up & Urban Disturbance" polygon, and were therefore mapped to the appropriate vegetation type instead.
- m. Surface areas with associated underground mines were mapped as natural vegetation with no land use coding. The Anthropogenically Altered Disturbance Attribute was coded as 1, 2 or 3 depending on surficial disturbance visible on images.
- n. Inactive quarries, usually where vegetation has been re-established, were assigned a natural Vegetation Type (Map Unit) code, an Anthropogenically Altered Disturbance Attribute of 1, 2, or 3, and a Land Use Attribute value of 1000.

- o. A rural portion of the Mojave Desert near Twentynine Palms contained numerous patchy built-up sections that were under 2.5 acres in size. This region includes built-up areas near the towns of Landers, Sunfair, and in discontinuous locales east to Dale Lake. In these circumstances, the criteria was modified to ensure that the land use was mapped. The specific criteria modifications are listed below:
  - The MMU for active residential was lowered from 2.5 acres to 1.5 acres (i.e. residential areas currently in use).
  - Land use polygons were delineated around active land use including the structures, any exotic plants, and disturbance surrounding the active built-up structures. Photointerpreters excluded as much vegetation from the land use polygon as possible.

**9310 = Urban Window**

Corresponding Land Use Attribute Code is 1000

Contiguous areas of built-up and disturbed lands greater than 1 square mile in size are considered an Urban Window.

Urban Windows were mapped using the following criteria:

- a. If an urban area was smaller than 1 square mile, it was mapped as a 9300.
- b. Urban/disturbed polygons (9300) next to an Urban Window were not mapped separately, but were incorporated into the Urban Window.
- c. If an area was within or adjacent to the Urban Window and under construction at the time of the imagery (including buildings or cleared land with an urban development footprint), it was coded as part of the 9310.
- d. Only agricultural areas greater than 10 acres were mapped separately within an Urban Window. However, agricultural areas along the edge of an Urban Window were mapped adhering to the 2.5 acre MMU rule.
- e. Natural vegetation was not mapped in an Urban Window unless it met the following criteria:
  - Vacant areas within an Urban Window that were “natural” vegetation were assigned a natural vegetation type if they were at least 10 acres of contiguous area and not split or disrupted by roads or other man-made features. However, adjacent, smaller, similarly vegetated areas were added to the “main” unit even if separated by roads.



- Natural vegetation that came into the settlement from the outside was continued into the Urban Window area as a natural vegetation type if the natural area met the 10 acre MMU and MMW criteria. When the natural vegetation was riparian, the MMU was lowered to 1 acre to maintain continuity.
- f. Flood control basins were included in the 9310 polygon but were mapped separately as a 9805 if they were larger than 10 acres.

**9320 = Anthropogenic Areas of Little or No Vegetation**

Corresponding Land Use Attribute Code is 0000

Isolated scrapes that were larger than 2.5 acres with no apparent built-up uses associated with them were mapped as 9320 with an Anthropogenically Altered Disturbance Attribute code of 3.

Intensely used OHV areas, where the vegetation may have been sparse due to high vehicle traffic, were not considered a 9320. Such areas were assigned an appropriate Vegetation Type code and a Roadedness Disturbance Attribute value of 2 or 3. However, cleared or scraped OHV staging areas used for camping or rendezvous were considered 9320. For these situations, a Roadedness Disturbance Attribute value of 3 and an Anthropogenically Altered Disturbance Attribute value of 9 were assigned.

Situations in which scraped land was not coded as 9320 include the following:

- a. Isolated scraped land and urban built-up areas less than 2.5 acres were ignored. These visible patterns, when less than 2.5 acres, were treated within the vegetation polygon by using the Anthropogenically Altered Disturbance or the Development Disturbance Attribute codes (both of which had scales ranging from 0 to 3).
- b. When scraped land abutted an urban polygon (9300 or 9310) and was greater than 2.5 acres, it was mapped as part of the 9300/ 9310 polygon.
- c. When scraped land abutted an urban polygon (9300 or 9310) and was less than 2.5 acres, it was left to the mapper's discretion about how it was mapped.

**9500 = Exotic Trees**

Corresponding Land Use Attribute Code is 0000

The non-native tree plantings that are mapped under this class are usually associated with former human habitation sites and disturbed areas near the Colorado River as well

as near the East Highline Canal. These trees meet the appropriate MMU and are not mapped as part of a 9300 or 9310 polygon. These are considered “hortomorphic” as opposed to “agromorphic” classes in the National Vegetation Classification. The MMU for upland exotic trees is 10 acres and the MMU for wetland exotic trees is 1 acre. (Note: The aggressive non-tree exotics that have their own map unit are *Arundo donax* (1431), *Tamarix* spp. (1432), and Mediterranean naturalized annuals (2330)).

### **9800 = Water**

Corresponding Land Use Attribute Code is 9800

The Water map unit includes open water bodies, either natural or artificially created, that may or may not contain water at the time of the project base imagery. For this project, water was further broken down into four categories: perennial stream channels (9801), small earthen-dammed and naturally occurring lakes (9803), major canals and aqueducts (9804), and water impoundment features (9805). (No polygons coded 9803 were mapped in the 2014-2016 mapping effort.) However, in this project the more generalized 9800 code was applied to artificial perennial water bodies containing water supplied from sources other than the watershed upslope from the mapped feature.

The following are considerations for mapping polygons that were coded as 9800 in this project:

- Artificial water bodies were mapped as 9800. Examples include:
  - Park ponds
  - Recreational lakes within a residential development
  - Reservoirs
  - Curvilinear-shaped duck ponds with water
  - Bermed agricultural ponds with water
- The MMU was 1 acre. However, in an Urban Window (9310) the MMU was 10 acres.
- The water body contained perennial water.
- All the available imagery and topographic references were reviewed.
- The high water line served as the boundary.
- Water in a playa was mapped as part of the playa (Vegetation Type Attribute code = 6116)

### **9801 = Perennial Stream Channel (Open Water)**

Corresponding Land Use Attribute Code is 9800

This type is restricted to a few locations along the Colorado River where water flows throughout most average rainfall years. This type has an MMU of 1 acre and an MMW of half the width of a 1-acre square.

**9803 = Small Earthen-dammed Ponds and Naturally Occurring Lakes**

Corresponding Land Use Attribute Code is 9800

This class includes perennial or seasonally flooded water bodies, either occurring naturally in the landscape or impounded by earthen dams, which receive their water completely from the upstream watershed. They have an MMU of 1acre.

The following are considerations for mapping polygons that were coded as 9803:

- The MMU was 1 acre.
- Small dammed ponds on creeks contain ephemeral water from natural seasonal flow.
- Some dammed ponds are found on drainages in the San Gabriel Mountain foothills.
- Bermed ponds in agricultural fields are not included.

These may include naturally ponded water in the Mojave River and Colorado River floodplain.

**9804 = Major Canals and Aqueducts**

Corresponding Land Use Attribute Code is 1436

Aqueducts and major canals are coded separately because of their unique characteristics as a water conveyance system. Only open water aqueducts and major canals that meet the 1-acre MMU are mapped. In the 2014-2016 mapping region, the Colorado Aqueduct, East Highline Canal, All American Canal and Coachella Canal are mapped as this type.

**9805 = Water Impoundment Feature**

Corresponding Land Use Attribute Code is 9810

These are typically utility or other straight-edged water bodies impounded by berms and may or may not contain water at time of imagery exposure. The MMU is 2.5 acres. Examples are settling ponds, sewage treatment ponds, salt evaporators, non-curvilinear duck ponds (with and without water), curvilinear duck ponds (without water) and bermed agricultural ponds (without water).

Water impoundment features were coded with a Development Disturbance Attribute code of 3 and Anthropogenically Altered Disturbance Attribute code of 3.

The following criteria are provided to give additional clarification for specific situations regarding Water Impoundment Features:

- **Flood Control Basins** – are not mapped as a 9805 unless they are greater than 10 acres in size. Flood control basins less than 10 acres in size are mapped as part of a 9300 or 9310 polygon.
- **Duck Ponds** – In situations where there is a mix of duck ponds (curvilinear, non-curvilinear, with and/or without water) that are determined to be in current use, these were, as a whole, mapped as 9805, and not separated into individual 9800 and 9805 polygons. Inactive duck pond areas with shrubs growing in them are mapped as natural vegetation.

## Land Use Attribute:

The land use types are taken from the Southern California Land Use Consortium/Southern California Association of Government's Land Use Classification developed by AIS (Johnson and Reyes, 1990), which was based on the Anderson, et al. (1972) land use classification system.

## Land Use

0000 = Not Assigned/Not Assessed

1000 = Urban

1436 = Water Transfer (major canals, aqueducts and agricultural channels)

1850 = Wildlife Preserves & Sanctuaries

2000 = Agriculture (includes nurseries)

2100 = Non-woody Row & Field Crops

2200 = Orchards & Vineyards

9800 = Undifferentiated Water

9810 = Water Impoundment Feature

### **0000 = Not Assigned/Not Assessed**

Corresponding Vegetation Type is variable

This value is assigned to areas that are not evaluated for land use.

### **1000 = Urban**

Corresponding Vegetation Type is variable

The Level I Urban or Built-up Land category is characterized by intensive land use where the landscape has been altered by human activities. Although structures are usually present, this category is not restricted to traditional urban areas. Urban or Built-up Land Level II categories include Residential; Commercial and Service; Industrial; Transportation, Communication and Utilities; Industrial and Commercial Complexes; Mixed Urban or Built-up; Other Urban or Build-up and Recreational. Included with each

of the above land uses are associated lands, buildings, parking lots, access roads, and other appurtenances, unless these are specifically excluded. Utility features such as settling ponds, sewage treatment ponds, and salt evaporators were mapped as Water Impoundment Feature (9810).

### **1436 = Water Transfer (major canals, aqueducts and agricultural channels)**

Corresponding Vegetation Type Code is 9200 and 9804

This Level IV category typically includes major aboveground water distribution channels, aqueducts, water treatment, filtration (non-sewage), reclamation (non-sewage), and pumping facilities. However, for the DRECP mapping project, only aboveground open water transfer conveyance features were mapped as this class. Other facilities, such as treatment, reclamation and pumping facilities, were mapped as the general Level I Urban category (1000).

Examples of water transfer conveyance features are the California and Colorado River Aqueducts for domestic water; and the Coachella, All American, and East Highline Canals for agricultural irrigation water. These appear on the aerial photos as a linear, open water, concrete lined or unlined canal. Also included are small irrigation channels/ditches if they met the mapping MMU/MMW criteria. This category does not include improved flood channels and structures which are included in the Urban category (1000) or Water Impoundment Feature (9810).

### **1850 = Wildlife Preserves & Sanctuaries**

Corresponding Vegetation Type is variable

This Level III category typically includes public and private facilities, and developed areas devoted to the preservation of wildlife species and habitats. For the DRECP mapping project only non-built-up undeveloped managed wetland areas were mapped as this class.

### **2000 = Agriculture (includes nurseries)**

Corresponding Vegetation Type code is 9200

This Level I category typically includes all lands used primarily for the production of food and fiber, poultry, and livestock, as well as structures associated with these activities. For the DRECP project, Agriculture was broken down into two more specific categories: Orchards and Vineyards (2100), and Non-woody Row and Field Agriculture (2200). In general, agriculture uses, such as nurseries, were coded with the generic Level I Agriculture (2000) category if they were not defined to the 2100 or 2200 subclasses. Citrus or orchard removal within 5 years prior to the project base imagery, and appearing as cleared land on the imagery (e.g. Imperial Valley area), were also coded as the Level I Agriculture category.



## **2100 = Non-woody Row & Field crops**

Corresponding Vegetation Type code is 9220

This Level II category was used with areas of Non-woody Row and Field Agriculture.

Included here are active field and row cropland areas and improved pasture lands. The croplands include cultivated, in-crop, harvested, fallow or temporarily idle land. The improved pasture land may be in pasture year-around or may be in the cropland seasonal rotation. Improved pasture land does not include rangeland.

## **2200 = Orchards & Vineyards**

Corresponding Vegetation Type code is 9210

This Level II category includes commercially productive tree, bush, and vine crops.

Orchards include fruit and nut trees, and bush crops. Nut and other fruit trees are similar; however, the color will be a lighter shade of green. The trees are aligned in a matrix form, with crowns abutting each other. Bush crops are similar to orchards; however, they may be configured in rows rather than a matrix, and are much shorter in height. The photo signature for vineyards will appear as dark green, coarse-textured, thin linear rows that, when measured, will be approximately five to ten feet apart. The height of vineyards is shorter than orchards. The orchard and vineyard areas will be neat and uniform.

Orchards in the study area are typically citrus, fruit, and nut crops. Bush crops tend to be jojoba. Vine crops are rare.

## **9800 = Undifferentiated Water**

Corresponding Vegetation Type codes are 9800, 9801, 9803

The Level I Undifferentiated Water category typically includes open water bodies, either natural or artificially created, that may or may not contain water at the time of the project base imagery. For this project perennial stream channels and small earthen-dammed and naturally occurring lakes are included. Major canals and aqueducts are mapped as Water Transfer (1436); water impoundment features (settling ponds, sewage treatment ponds, salt evaporators, non-curvilinear duck ponds that may or may not contain water, curvilinear duck ponds without water, and bermed agricultural ponds without water) are mapped as Water Impoundment Feature (9810).

**9810 = Water Impoundment Feature**

Corresponding Vegetation Type codes are primarily 9805

The Level II Water Impoundment Features are typically utility or other straight-edged water bodies impounded by berms and may or may not contain water at time of imagery exposure. The MMU is 2.5 acres. Examples are settling ponds, sewage treatment ponds, salt evaporators, non-curvilinear duck ponds (with and without water), curvilinear duck ponds (without water) and bermed agricultural ponds (without water).

# APPENDIX D

## COVER CLASSES

Table D-1: Map Classes for Total Cover by Conifers

Code	Range	Discussion
0	None, Not observable	There are no conifers in this stand.
1	>0-1%	This cover class is rare in the study area. Conifers are widely scattered as emergent. <i>Juniperus californica</i> and <i>Pinus monophylla</i> are found in sparse cover on the in the foothills of the San Bernardino Mountains near Highway 247 and adjoins previously mapped areas.
2	>1-5%	This cover class is rare in the study area. Conifers are sparse and unevenly scattered to dispersed and evenly distributed. An area of <i>Juniperus californica</i> was mapped on the western edge of the study in the foothills of the San Bernardino Mountains near Highway 247 and adjoins previously mapped areas.
3	>5-15%	This cover class is rare in the study area, only being mapped in a <i>Pinus monophylla</i> type. It is located on the western edge of the study area and adjoins previously mapped areas.
4	>15-25%	This cover class was not used in the database.
5	>25-50%	This cover class was not used in the database.
6	>50-75%	This cover class was not used in the database.
7	>75-100%	This cover class was not used in the database.
9	Not applicable/Not assigned	Conifer cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

**Table D-2: Map Classes for Total Cover by Hardwoods**

Code	Range	Discussion
0	None, Not observable	There are no hardwoods in this stand.
1	>0-1%	This cover class is indicative of a sparse cover of hardwoods in stand.
2	>1-5%	A low cover of evenly distributed riparian trees is indicated. This cover is characteristic of stands of <i>Prosopis glandulosa</i> , <i>Psoralea argemone</i> , <i>Chilopsis linearis</i> , and washes with <i>Parkinsonia florida</i> and <i>Olneya tesota</i> .
3	>5-15%	This class is typical of open stands of <i>Prosopis glandulosa</i> , <i>Psoralea argemone</i> , <i>Parkinsonia florida</i> and <i>Olneya tesota</i> washes and open riparian woodlands with <i>Populus fremontii</i> , etc.
4	>15-25%	This class is uncommon in the study area, mostly used with <i>Prosopis glandulosa</i> stands and washes dominated by <i>Parkinsonia florida</i> and <i>Olneya tesota</i> .
5	>25-50%	This class is uncommon in the study area.
6	>50-75%	This is rare in the study area.
7	>75-100%	This cover class is rare in the study area.
9	Not applicable/Not assigned	Hardwood cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

**Table D-3: Map Classes for Total Cover by Joshua Trees**

Code	Range	Discussion
0	None, Not observable	There are no visible <i>Yucca brevifolia</i> in the stand, although widely scattered juveniles <3 m tall may be included.
1	>0-1%	This is common in desert shrublands of <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> , <i>Coleogyne ramosissima</i> , <i>Yucca schidigera</i> , etc. <i>Yucca brevifolia</i> tree signature may be visible, but individuals are not evenly distributed and are widely dispersed.
2	>1-5%	This class commonly denotes an open, tree-size <i>Yucca brevifolia</i> woodland, usually evenly distributed with higher shrub cover.
3	>5%	This density is rare and only found at higher or wetter sites in the Eastern Mojave portion of the study area.
9	Not applicable/Not assigned	Joshua tree cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

**Table D-4: Map Classes for Total Cover by Trees**

<b>Code</b>	<b>Range</b>	<b>Discussion</b>
0	None, Not observable	There are no visible trees (including <i>Yucca brevifolia</i> ) in the stand, although widely scattered juveniles <3 m tall may be included.
1	>0-1%	Emergent <i>Yucca brevifolia</i> , <i>Olneya tesota</i> , <i>Parkinsonia florida</i> , and <i>Prosopis glandulosa</i> are examples of this class.
2	>1-5%	Most <i>Yucca brevifolia</i> woodlands over a well-developed shrub cover are included. Stands of <i>Prosopis glandulosa</i> and desert washes with scattered <i>Chilopsis linearis</i> , <i>Psoralea argemone</i> , and <i>Olneya tesota</i> with <i>Parkinsonia florida</i> are other types commonly found with this cover class.
3	>5-15%	The highest density <i>Yucca brevifolia</i> (rarely occurring in the eastern portion of the study area in the Eastern Mojave Desert), open stands of <i>Prosopis glandulosa</i> , and well-developed washes containing <i>Olneya tesota</i> and <i>Parkinsonia florida</i> fall in this class.
4	>15-25%	<i>Prosopis glandulosa</i> is the most common example with this cover class.
5	>25-50%	<i>Prosopis glandulosa</i> is the most common example with this cover class.
6	>50-75%	This is rare in the study area.
7	>75-100%	This cover class is rare in the study area.
9	Not applicable/Not assigned	Total tree cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.



**Table D-5: Map Classes for Total Cover by Shrub**

Code	Range	Discussion
0	None, Not observable	There is no visible perennial shrub signature, such as on extensive cliffs and outcrops, extensive dunes or sand sheets, current agriculture, urban areas, etc.
1	>0-1%	This code value should not be assigned to shrub types. Shrubs are not evenly distributed.
2	>1-5%	Shrubs are widely distributed on harsh substrates, for example <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> or <i>Encelia farinosa</i> on steep rocky slopes, or old inactive alluvial surfaces.
3	>5-15%	Upland vegetation (modal <i>Larrea tridentata</i> - <i>Ambrosia dumosa</i> , <i>Atriplex</i> spp.) and active vegetated washes (e.g. <i>Ambrosia salsola</i> ) fall in this range.
4	>15-25%	Well-developed <i>Coleogyne ramosissima</i> on moderate rocky slopes, <i>Isocoma acradenia</i> in sandy substrates, <i>Pluchea sericea</i> in wet areas, and <i>Tamarix</i> are examples with this cover class.
5	>25-50%	This cover class is uncommon in the study area. Examples are high cover stands of <i>Tamarix</i> , and <i>Pluchea sericea</i> , found in the Salton Sea section of the study area.
6	>50-75%	This cover class is uncommon in the study area. Examples are high cover stands of <i>Tamarix</i> and <i>Pluchea sericea</i> , found in the Salton Sea section of the study area.
7	>75-100%	This class is rare in the study area.
9	Not applicable/Not assigned	Shrub cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

**Table D-6: Map Classes for Total Cover by Herbaceous**

Code	Range	Discussion
1	0-2%	In general, includes areas with very low rainfall on older alluvial fans and pavement surfaces with impervious substrate, and steep massive bedrock sideslopes.
2	>2-15%	This cover class applies to areas with more rainfall, better soil development, and substrate that is at least somewhat permeable. This is typical of <i>Coleogyne ramosissima</i> , <i>Yucca schidigera</i> , and <i>Atriplex</i> spp. stands. In addition, dry washes with <i>Parkinsonia</i> and <i>Olneya tesota</i> , <i>Ephedra californica</i> , or <i>Chilopsis linearis</i> are expected to have herb covers in this class.
3	>15-40%	This is rare in the study area.
4	>40%	This is uncommon in this study area. Herbaceous cover in this range is only found in dense wetlands, such as local stands of <i>Typha</i> , <i>Phragmites australis</i> , etc.
9	Not applicable/Not assigned	Herbaceous cover is not applicable when the MapUnit is 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.