2013 CALIFORNIA VEGETATION MAP IN SUPPORT OF THE DESERT RENEWABLE ENERGY CONSERVATION PLAN

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Aerial Information Systems, Inc.

Prepared for the

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ABSTRACT

Aerial Information Systems (AIS) and the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) with assistance from the California Native Plant Society (CNPS) created a fine-scale vegetation map of portions of the Mojave and Colorado Deserts in California. Approximately six million acres spanning desert portions of Inyo, Kern, Los Angeles, San Bernardino, Riverside, and Imperial Counties were mapped between 2011 and 2012. 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 true-color and color infrared 2010 one-meter National Agricultural Imagery Program (NAIP) imagery in conjunction with ancillary data and imagery sources. Map polygons were 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 one or five acre MMU) 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 46,803 map polygons representing 137 vegetation map classes were developed. The overall accuracy assessment rating for the final vegetation map was 84.59 percent.

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

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TABLE OF CONTENTS

	Page
Acknowledgements	iii
Abstract	iv
Figures	vi
Tables	vi
Chapter 1: Introduction	1
1.1 The Mapping Program	1
1.2 General Study Area	1
1.3 Microphyll Wooded Wash Mapping Effort	4
1.4 Ecological Regions	6
Chapter 2: Methodology	21
2.1 Overview	21
2.2 Project Materials	21
2.3 Mapping Classification	22
2.4 Field Reconnaissance	23
2.5 Photointerpretation Mapping Procedures	25
2.6 Accuracy Assessment	40
Chapter 3: Map Unit Descriptions	43
References	402
Glossary	406
List of Acronyms	410
Appendices	
Appendix A: Mapping Classification	
Appendix B: Summaries of Acreage & Polygon Count by Map Unit	
Appendix C: Vegetation Miscellaneous Classes Mapping Criteria	
Appendix D: Cover Classes	

FIGURES

	Page
Figure 1	2
Figure 2	5
Figure 3	6
Figure 4	9
Figure 5	11
Figure 6	12
Figure 7	14
Figure 8	16
Figure 9	18
Figure 10	20
Figure 11	25
Figure 12	37
Figure 13	38

TABLES

	Page
Table 1	5
Table 2	23
Table 3	29
Table 4	33
Table 5	34
Table 6	35
Table 7	36
Table 8	37
Table 9	38
Table 10	41

CHAPTER 1: Introduction

1.1 The Mapping Program

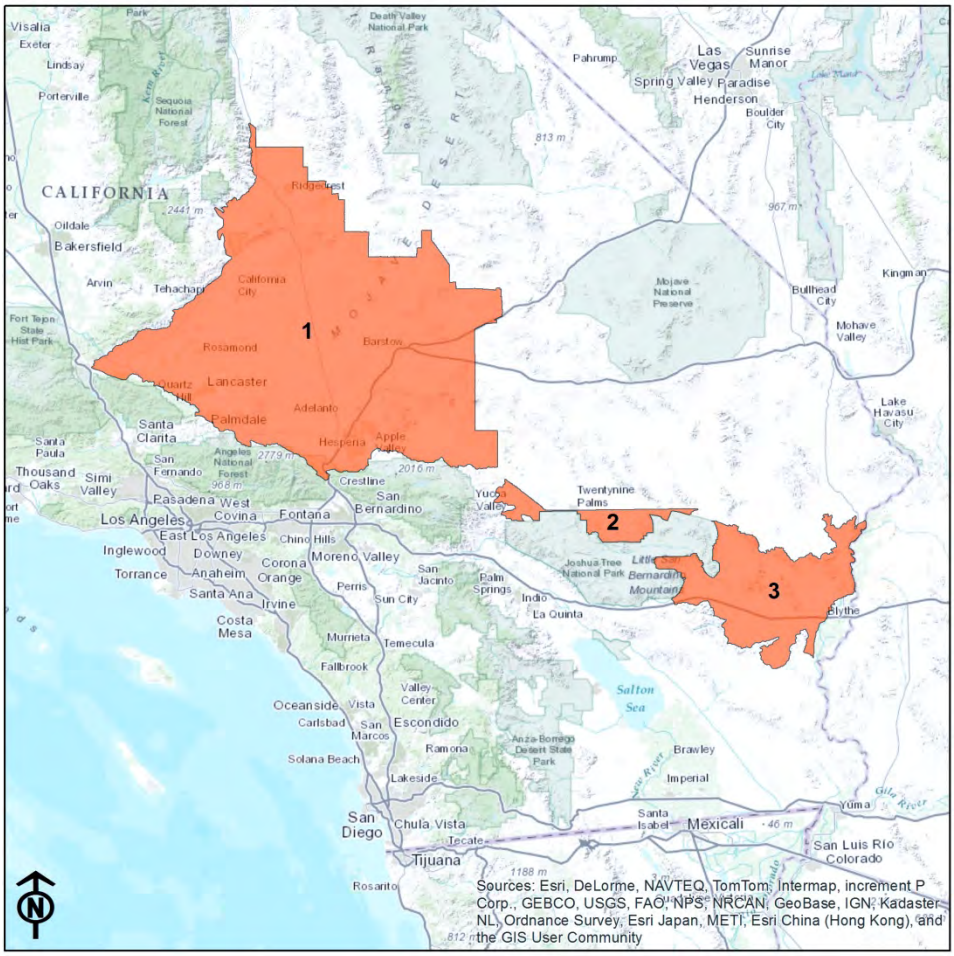
Aerial Information Systems (AIS) and the California Department of Fish and Wildlife (CDFW) Vegetation Classification and Mapping Program (VegCAMP) created a fine-scale vegetation map of parts of the Mojave and Colorado Deserts in southern California. Between 2011 and 2012 approximately six million acres of desert in Kern, Inyo, Los Angeles, San Bernardino, Imperial, and Riverside Counties were mapped. The primary purpose was to support the Desert Renewable Energy Conservation Plan (DRECP) in developing 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. This mapping effort was unique in that previous vegetation maps of the area were either large scale and generalized or they were detailed but covered a limited extent.

The vegetation classification for the DRECP follows Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS). It is based on previous surveys and classifications. Non-vegetative classes such as water bodies and land use are included. After field reconnaissance was conducted by staff from AIS, VegCAMP, and the California Native Plant Society (CNPS), photointerpreters created a map representing different vegetation Alliances and ranges of percent vegetation cover. Map polygons were assessed for exotics, development disturbance, and other attributes. The minimum mapping unit (MMU) for vegetation is ten acres; exceptions are made for wetlands and certain wash types, which are mapped to one or five acre MMUs. Land use polygons are mapped to a 2.5 acre MMU. The map geodatabase was produced using on-screen heads-up digitizing on a base of 2010 true-color and color infrared 1-meter National Agricultural Imagery Program (NAIP) imagery along with ancillary data and imagery sources. The geodatabase was subjected to quality control procedures before being finalized. Accuracy assessments were conducted by VegCAMP and CNPS staff.

1.2 General Study Area

The study area consists of three separate subareas that range from west to east, as shown in **Figure 1**. It covers a total of 5,969,650 acres, generally extending over the western portion of the Mojave Desert and the northern portion of the Colorado Desert. Aspen Environmental Group subcontracted AIS to map a total of 4,039,296 acres in all three subareas, and the California Energy Commission (CEC) contracted AIS to map an additional 1,151,022 acres in the western subarea. In addition to the areas mapped by AIS, VegCAMP mapped 779,332 acres in the western subarea.

Figure 1: Location of the Study Area



The mapping program's three distinct subareas are described below.

- **Subarea 1** – This, the largest of the subareas, falls entirely within the Mojave Desert except for a few foothill areas. The western boundary follows the lower fringes of the southern Sierra Nevada and Tehachapi Mountains, generally between the 2300-foot and 4600-foot level from Little Lake to the Quail Lake area.

  The southern edge falls within the foothill area of the Sierra Pelona, San Gabriel and San Bernardino Mountains. Here it follows the southern slope of the San Andreas Fault Rift Zone from Quail Lake to Pine Canyon, then follows the lower slope fringe of Portal Ridge to Ritter Ridge, where it continues along the lower toe slopes of the San Gabriel Mountains. Heading eastward, the boundary follows Cajon Canyon, which it crosses near Cajon Pass before continuing along the slopes north of Silverwood Lake. It follows the bottom toe slopes of the San Bernardino Mountains eastward to just north of Ruby Mountain/Homestead Valley.

  The eastern boundary does not follow any particular geographic or physiographic features and was defined based primarily on the limits of fine resolution aerial imagery

at the onset of the project. The boundary runs northward just east of Means Dry Lake, then westward through Upper Johnson Valley, and northward through the Rodman Mountains, west of Troy Dry Lake. The boundary continues northeast along Interstate 15 to the Midway railroad siding, then north around the Alvord Mountains.

The northern boundary trends northwest in a stairstep fashion from the Alvord Mountains to Little Lake on US Highway 395. This corresponds to the southern boundaries of the Fort Irwin Military Reservation and the Naval Air Weapons Station China Lake from just north of Interstate 15 to Trona Pinnacles Recreation Lands. The boundary goes westward north of the Alvord Mountains, then turns northwest up and around Goldstone Dry Lake. The boundary continues westward through the middle of the Superior Valley, then turns northward just west of Slocum Mountains, through Pilot Knob, then turns westward again through the north part of the Black Hills, then northward as it runs past the east side of the Lava Mountains. The boundary stairsteps northwest through the Trona Pinnacles Recreation Lands, the Salt Wells Valley, and the east end of China Lake. It continues westward south of the White Hills to US Highway 395, then northward to Little Lake.

- **Subarea 2** – This is the smallest subarea. It falls entirely within the Central Mojave Desert and generally follows Highway 62 from Yucca Valley at the west to just east of Clarks Pass at the eastern end. A narrow quarter-mile wide corridor, located north of the Joshua Tree National Park boundary, connects the western and eastern portions of the subarea.

  The western portion is comprised of Yucca Valley and a portion of the Homestead Valley, with Flamingo Heights at the north, Black Lava Butte-Flat Top-Black Hill at the west, and the Little San Bernardino Mountain foothills on the south. The southeast edge of this portion follows the Joshua Tree National Park boundary, above which is the town of Joshua Tree. From Panorama Heights, where this portion connects to the narrow corridor, the boundary is essentially a straight line extending northwestward to Flamingo Heights.

  On the eastern side of Subarea 2, the study area shares its southern boundary with Joshua Tree National Park. The shared boundary extends eastward from the Park's North Entrance Station, through the northern Pinto Mountain foothills, and ends east of Clarks Pass. The study area boundary then trends northeast until it joins the northern boundary, which is a straight line a quarter mile north of the San Bernardino Base Line. The boundary splits the southern part of the city of Twentynine Palms, where the eastern portion connects to the narrow corridor.

- **Subarea 3** – This is the easternmost part portion of the study area, and is almost entirely in the Colorado Desert. It extends west to east between the Eagle Mountains and the Colorado River. In the west, the boundary skirts the Coxcomb and Eagle Mountains before trending southeast along the base of the Chuckwalla Mountains. The southern boundary flanks the Little Chuckwalla Mountains, Black Hills, Palo Verde Mountains,

and Mule Mountains. The boundary then trends northeast, following the Palo Verde Mesa bluff. It continues northeast along the Colorado River before turning west at the base of the Riverside and Big Maria Mountains. On the north, the boundary skirts the northern sides of the Little Maria and Granite Mountains before returning to the vicinity of the Coxcomb Mountains.

1.3 Microphyll Wooded Wash Mapping Effort

As a separate task, AIS was contracted to produce a map of microphyll wooded washes. This entailed extracting four map unit types that are microphyll wooded wash Alliances from all of the vegetation types mapped within the study area. In addition, 234,000 acres in Riverside and Imperial Counties outside of the originally contracted study area were evaluated for microphyll wooded wash types only. The vegetation mapping methods and criteria employed in the larger project were applied to this extended area. Each stand of microphyll exceeding one acre in size and 90 feet in width was mapped and assigned one of four Alliance codes based on a combination of overstory dominance and indicator species significance. Although there was no field reconnaissance or accuracy assessment in the extended microphyll area, confidence in the mapping is high due to the distinct photo signatures of the microphyll wooded wash types, and due to field reconnaissance and accuracy assessment results for the same vegetation in Subarea 3. The resulting database assisted the US Fish and Wildlife Service and other stakeholders in identifying areas that merit preservation or conservation.

The areas assessed for microphyll are shown in **Figure 2**. Polygons containing microphyll vegetation in washes were extracted from the entirety of Subarea 3. Adjacent to the southeastern part of Subarea 3, the Mule Mountains and two smaller detached areas southeast of the Mule Mountains were also assessed for microphyll. The largest portion of the microphyll extension area is mainly southeast of Highway 78. The northern boundary of this area is roughly four miles south of Milpitas Wash. The boundary continues along Highway 78 until it veers west to approximate the boundary of the Chocolate Mountains Aerial Gunnery Range. The boundary then trends southeast above the railroad line near Glamis. It trends east a mile north of Interstate 8; then turns northeast one to four miles northwest of the All American Canal. It turns north through the Chocolate Mountains before stairstepping back to the top. Other smaller, detached pieces are between Interstate 8 and the border with Mexico; between Mission Wash and the Colorado River; south of Ferguson Lake; near Little Picacho Wash; north of Gavilan Wash; northeast of Draper Wash; north of Arrowweed Springs; and west of Ogilby Hills. **Table 1** presents the acreage results of this task.

Figure 2: Areas Mapped for Microphyll Wooded Washes

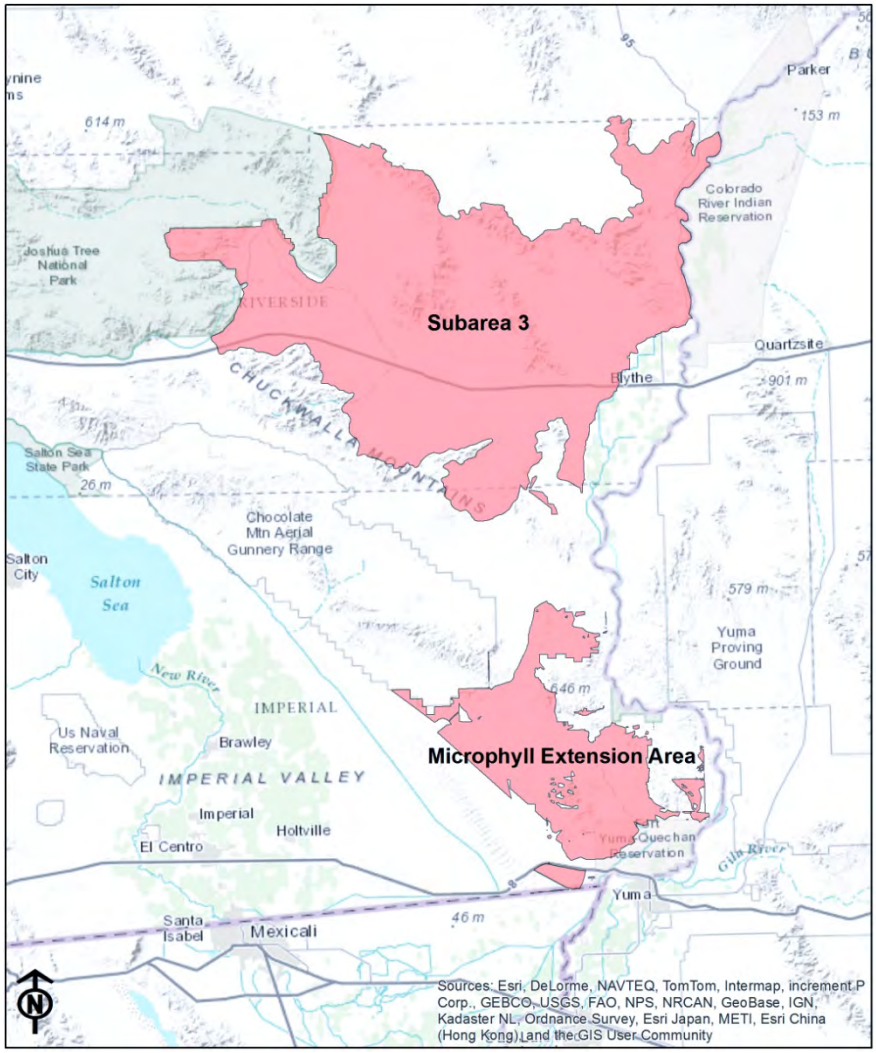


Table 1: Microphyll Wooded Wash Acreage Summary

Microphyll Wooded Wash Type	Acreage in Subarea 3	Acreage in Extended Area	Total Acreage
Chilopsis linearis Alliance	14	—	14
Parkinsonia florida – Olneya tesota Alliance	90,592	31,574	122,166
Prosopis glandulosa Alliance	4,821	—	4,821
Psorothamnus spinosus Alliance	164	—	164
Totals:	**95,591**	**31,574**	**127,165**

1.4 Ecological Regions

The study area covers portions of the Mojave and Colorado Deserts, which are shown in **Figure 3.** The following sections describe the two deserts and their zones found within the study area.

Figure 3: The Mojave and Colorado Deserts within Southern California

The Mojave Desert is represented by the yellow shading, and the Colorado Desert is shown in orange.

1.4.1 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.

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.

1.4.2 The Colorado Desert

Photo Credit: John Fulton

The Colorado Desert, encompassing about seven million acres almost exclusively in southeastern California, is a subsection of the larger Sonoran Desert which extends east throughout much of southern Arizona and down into portions of northwestern Mexico. The boundaries of the Colorado Desert are defined in the west by the northernmost portions of the Peninsula Ranges of southern and Baja California, to the south by the Gulf of California, to the north by the southern California Transverse Ranges, and to the east roughly by the Colorado River. (Note: in Miles and Goudey (1997) the orange portion of Figure 2 is divided into two sections called Sonoran Desert and Colorado Desert.)

The hottest and driest of the deserts of North America, the Colorado Desert on the whole receives less than four inches of precipitation annually. Characteristic of this desert is the presence of vast expanses of creosote bush *(Larrea tridentata)* and brittle bush *(Encelia farinosa)* on broad alluvial bajadas and adjacent mountain slopes interspersed with large washes containing several species of small microphyllous trees and shrubs. The scant precipitation occurs in a dual-season maximum as short brief isolated thunderstorms, mainly in the late summer, with occasional light but more widespread rain during the midwinter months.

1.4.3 Defined Regions of the Mojave Desert within the Study Area

1.4.3.1 The Western Mojave Desert

Photo Credit: Arin Glass

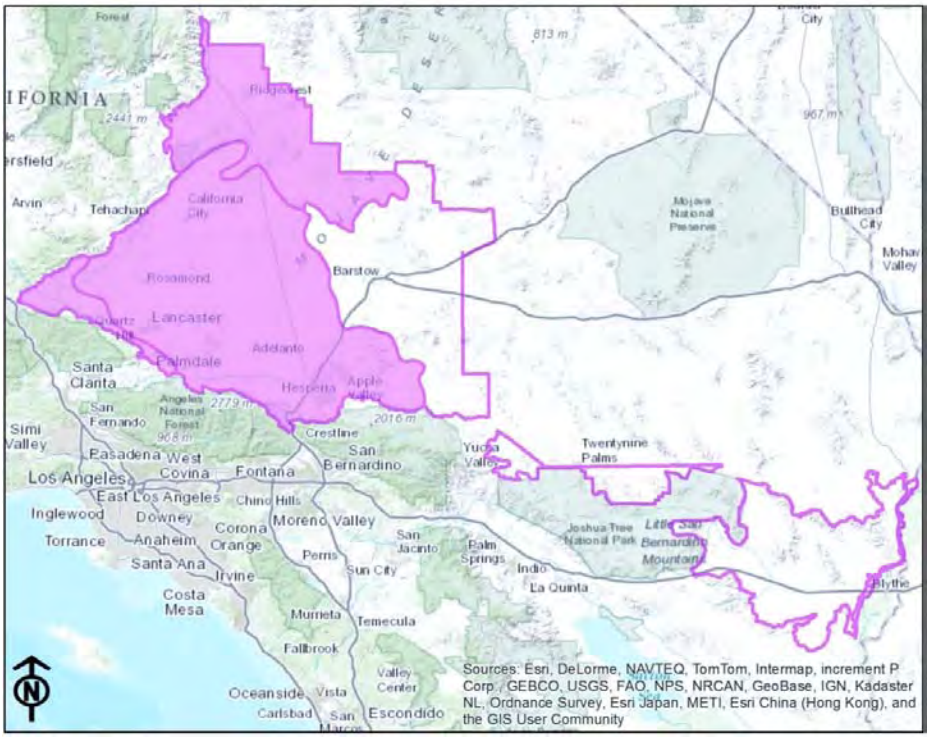
Encompassing over 3.5 million acres of land, the western portion of the Mojave Desert is located entirely within the project study area and is by far the largest region in the mapping area (**Figure 4**). In the north, its western margins conform with those of the greater Mojave Desert where the Indian Wells Valley is bounded along the eastern foothills of the southern Sierra Nevada at roughly the 3000-foot to 4000-foot elevation level, about a thousand feet below the tree line. The western margins of the Mojave Desert then bend southwestward along the southern foothills of the Tehachapi Mountains just upslope from Fremont Valley where the town of Mojave is located about 20 miles east of Tehachapi Pass. Further west, the westernmost margins of the Mojave ecoregion converge with four other major ecoregional zones within the state: the Sierra Nevada, Central Coastal Ranges, Central Valley, and the Southern California Transverse Ranges. To the south of the western portions of the Antelope Valley, the region's southern boundary gradually transitions into the low undulating Sierra Pelona along the western edge of the San Gabriel Mountains. Further east, the San Gabriel Mountains, which continue to form the southern boundary, increase in elevation and attain heights over 10,000 feet along the Mt. San Antonio crest. The eastern edges of the Western Mojave Desert are rather indistinct, initially trending northwestward, corresponding roughly with the eastern extent of the Lucerne and North Lucerne Valleys, and the southern base of Stoddard Ridge and Stoddard Mountain. The boundary then runs north, crossing the Mojave River near the town of Helendale and then extending northwest just east of the Iron Mountains and Harper Dry Lake where it again bends eastward to include the Gravel Hills and the Superior Valley in the northern section of the mapping region.

Within the region, precipitation generally decreases from west to east and to a lesser degree from south to north. The region experiences a strong winter rainfall maximum with most areas receiving over 80 percent of their annual precipitation during the winter month period from December through March. There is little or no precipitation during the hot summer months, making this area emulate the seasonality of the adjoining non-desert Mediterranean climates.

Elevations average at least a thousand feet higher than the adjoining Central Mojave Region, resulting in at least some seasonal snowfall in much of the region. Record minimum temperatures at or near zero have occurred in most of the cities within the Western Mojave Region and may in part be the cause of southward extensions of such species as big sagebrush *(Artemisia tridentata)*, rabbit brush (*Ericameria nauseosa*), shadscale *(Atriplex confertifolia)*, and spiny hop sage (*Grayia spinosa*). Growing seasons are reduced in the highest elevations to less than 200 days in some areas.

Of the three major regions within the mapping area, the Western Mojave is by far the most urbanized, including large population centers such as Lancaster-Palmdale and Victorville-Hesperia, and the smaller population center of Ridgecrest. Urban encroachment into Joshua tree woodlands and the chenopod scrub is substantially reducing total acreages of these types, and adjacent disturbance is impacting remaining stands.

Figure 4: Location of the Western Mojave Desert within the Study Area



The Western Mojave was further subdivided into three zones, which are described below.

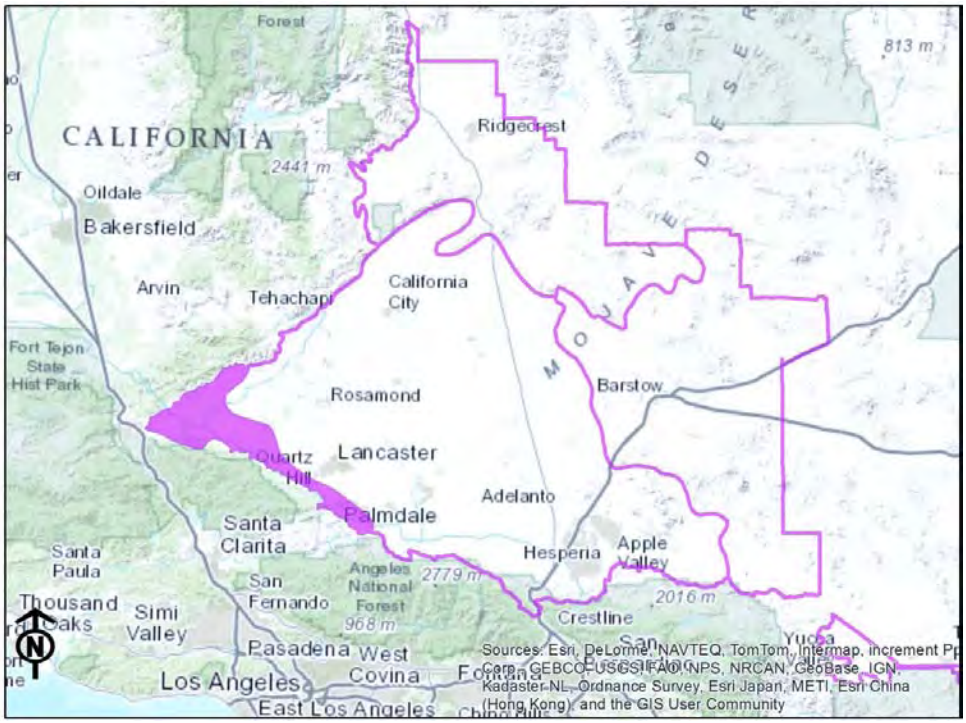
1.4.3.1.1 The Western Antelope Valley Zone

Photo Credit: John Fulton

The Western Antelope Valley (**Figure 5**) encompasses approximately 200,000 acres. Although physically contained within the Mojave Desert ecoregion, this subarea does not quite meet the true climatic definition of a desert. West of the city of Palmdale, the rain shadow effect becomes less pronounced due in part to the lower elevations of the adjacent Sierra Pelona, of which only several peaks attain elevations over 5000 feet. These lower elevations allow the storm path from the southwest to spill over and augment what would normally be a much lower precipitation regime. Rainfall totals in some areas exceed 10 inches annually. In fact, relatively high precipitation allows for small stands of blue oak *(Quercus douglasii)* and valley oak *(Q. lobata)* woodlands interspersed with emergent foothill pine *(Pinus sabiniana)* just north of Liebre Mountain near the site of Sandberg. These are the only areas in the Mojave Desert where significant increases in total rainfall over relatively short distances are not a result of increased elevations. Most areas of this zone are below 3000 feet in elevation.

In addition to the small oak woodland stands along the foothill margins, the adjacent lower slopes frequently offer a showy display of native flowers including California poppy *(Eschscholzia californica),* monolopia (*Monolopia* spp.), lupine (*Lupinus* spp.) and tidy tips (*Layia* spp.) especially after a generous late winter rainfall season. Small stands of creosote bush encroach into the eastern margins of this zone along with small patches of the clonal form of Joshua tree. Much of the region has been historically dry farmed where open stands of rabbit brush have since colonized the region in varying cover.

Figure 5: Location of the Western Antelope Valley Zone



1.4.3.1.2 <u>The Western Mojave Mountains and Valleys Zone</u>

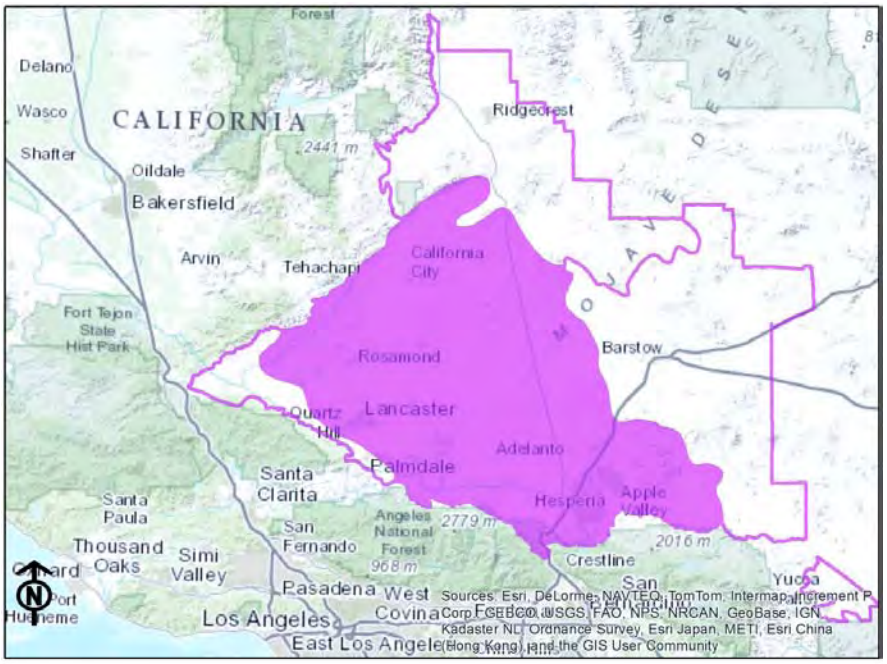
Photo Credit: Edward Reyes

The largest zone within the Western Mojave Desert, the Western Mojave Mountains and Valleys (**Figure 6**) encompasses nearly 2.5 million acres, ranging in elevations from slightly over 2000 feet at Rogers Dry Lake to over 4500 feet along the foothills of the San Gabriel Mountains.

Although creosote bush is widespread on the steeper alluvial fans and adjacent bajadas downslope, this portion of the Mojave Desert contains more saltbush (*Atriplex* spp.) and other chenopod scrub than any other region in the mapping area due in part to over 140,000 acres of playa systems that include Rosamond, Rogers and Buckhorn Dry Lakes. Within this playa complex, four species of *Atriplex* are common and widespread, each responding to subtle changes in edaphic and hydrologic conditions. Another lesser but still extensive playa system

covering about 15,000 acres occurs just south of the Granite Mountains and encompasses Lucerne and Rabbit Dry Lakes. Upslope from these endorheic basins, elevations are sufficiently high as to support a sparse emergent cover of Joshua tree over a fairly sparse understory of creosote bush, at times sharing dominance with white bursage *(Ambrosia dumosa)*. To the south and further upslope at elevations over 3000 feet, this isolated Joshua tree cover becomes a sparse woodland community with California juniper *(Juniperus californica)* co-dominating the tree canopy. Creosote bush is replaced in the understory with higher elevation species such as Nevada joint fir (*Ephedra nevadensis),* spiny hop sage, Cooper's goldenbush *(Ericameria cooperii)* and other small shrub species. Closer to the foothills of the San Gabriel Mountains, conifers become an important component to the overstory with stands of California juniper often over 20 percent cover mixing with singleleaf pinyon *(Pinus monophylla)* on the steeper side slopes of the lower foothills. The southeasternmost portion of this region actually spills over into the California chaparral communities where chamise *(Adenostoma fasciculatum)* and hoary leaf ceanothus *(Ceanothus crassifolius)* co-dominate in dense stands on steep slopes just south of Cajon Pass. Upslope from these chaparral communities, in protected northerly trending coves, small isolated stands of bigcone Douglas-fir *(Pseudotsuga macrocarpa)* remain in areas not recently burned that receive over 20 inches of precipitation annually. Also occurring within the southeastern portions of this region are some of the largest most continuous stands of Tucker oak *(Quercus john-tuckeri)* in the entire state. Tucker oak is a major component to the semi-desert chaparral found along the southern margins of this region and to the northwest along the inner coastal ranges. North and east of Rogers Dry Lake, extensive stands of spinescale *(Atriplex spinifera)* interface with white bursage on ancient Pleistocene lakebeds, often with extensive stands of California goldfields *(Lasthenia californica)* and tickseed (*Coreopsis* spp.) in the understory herbaceous layer.

Figure 6: Location of the Western Mojave Mountains and Valleys Zone



1.4.3.1.3 The Mojave Desert - Basin and Range Fringe Zone

Photo Credit: Edward Reyes

As its name implies, the Mojave Desert - Basin and Range Fringe Zone (**Figure 7**) is a transition between two major ecoregions. The zone is defined based on its physical proximity to the north-south trending ranges immediately adjacent to the north. As in much of the western Mojave, winter cold is an important factor in the presence of cooler climate Alliances more commonly found in the Great Basin. The Mojave Desert - Basin and Range Fringe typifies the species composition found further south in the Antelope Valley. However, rain shadow effects along the Sierra Nevada crest are more severe, precluding the development of any extensive stands of California juniper or dense Joshua tree woodlands commonly found along the foothill desert edges of the San Gabriel Mountains further south. The boundaries of this 900,000-acre portion of the Western Mojave are indistinct in places since they include mountains that share structural characteristics of both the Mojave Desert and the Great Basin. These ranges include the El Paso, Rand, Lava, and Summit Mountains, all of which trend southwest to northeast, eventually tying into the north-south running Argus Range and adjacent Panamint Valley to the north of the mapping area. The most prominent features within this portion of the Western Mojave are the El Paso Mountains, attaining elevations over 5000 feet, and the adjacent Indian Wells Valley to the north, just east of southern Sierra Nevada. Extensive stands of creosote bush occur within this valley just west of the Naval Air Weapons Station China Lake. The China Lake vicinity contains an extensive area of alkaline types including allscale *(Atriplex polycarpa)*, shadscale, iodine bush *(Allenrolfea occidentalis)*, and bush seepweed *(Suaeda moquinii)*. Upslope along the margins and lower slopes of the El Paso Mountains, spiny hop sage becomes a dominant understory species to a sparse overstory of Joshua tree. Further west, on moderately sloping pediment surfaces extending below the eastern Sierra foothills, black brush *(Coleogyne ramosissima)* dominates the shrub layer in cover ranging upwards of 25 to 30 percent. A small gap in the massive Sierra Nevada crest just outside the mapping region along the Walker Pass allows for an unusual combination of foothill pine (a species of the western Sierra Nevada Foothills and California Coastal Ranges) and Joshua tree to co-occur in small stands.

The elevation of a small portion of this zone drops below 2000 feet near the Trona Pinnacles, where shadscale, desert holly *(Atriplex hymenelytra)* and bush seepweed are found on alkali settings of the southern Searles Valley.

Figure 7: Location of the Mojave Desert – Basin and Range Fringe Zone

1.4.3.2 The Central Mojave Desert

Photo Credit: Edward Reyes

A noticeable drop in annual precipitation is the distinguishing characteristic of the central portions of the Mojave Desert (**Figure 8**), where most weather stations within the region receive less than five inches of rainfall annually. The area is transitional to both the eastern Mojave (outside the mapping area) and the Colorado Desert to the southeast in that most of the scant precipitation still falls in the cooler winter months; however, unlike the western Mojave, 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. Absent are stands of California juniper and singleleaf pinyon with the minor exception of several scattered areas in the southern portion of the region near Joshua Tree National Park. This is also where the only stands of Muller oak *(Quercus cornelius-mulleri)* are found within the entire study area.

Two distinct portions of the study area fall within the Central Mojave Desert Region. Although separated geographically, there are not sufficient differences between the portions to warrant unique zone descriptions. The larger portion, adjacent to the Western Mojave, encompasses over 1.2 million acres of land ranging north from the San Bernardino Mountain foothills to the Fort Irwin Military Reservation. This portion is bisected into two nearly equal pieces by the east-west trend of the Mojave River. South of the Mojave River, several significant mountain ranges rise from extensive fans and coalescing bajadas, including the Ord, Newberry, Stoddard, Sidewinder and Rodman Mountains. The Calico, Alvord, and Paradise Mountains occur in scattered locations to the north of the river. Most of the mountains are generally made up of Miocene volcanics or Mesozoic granite, and several have peaks exceeding 5000 feet.

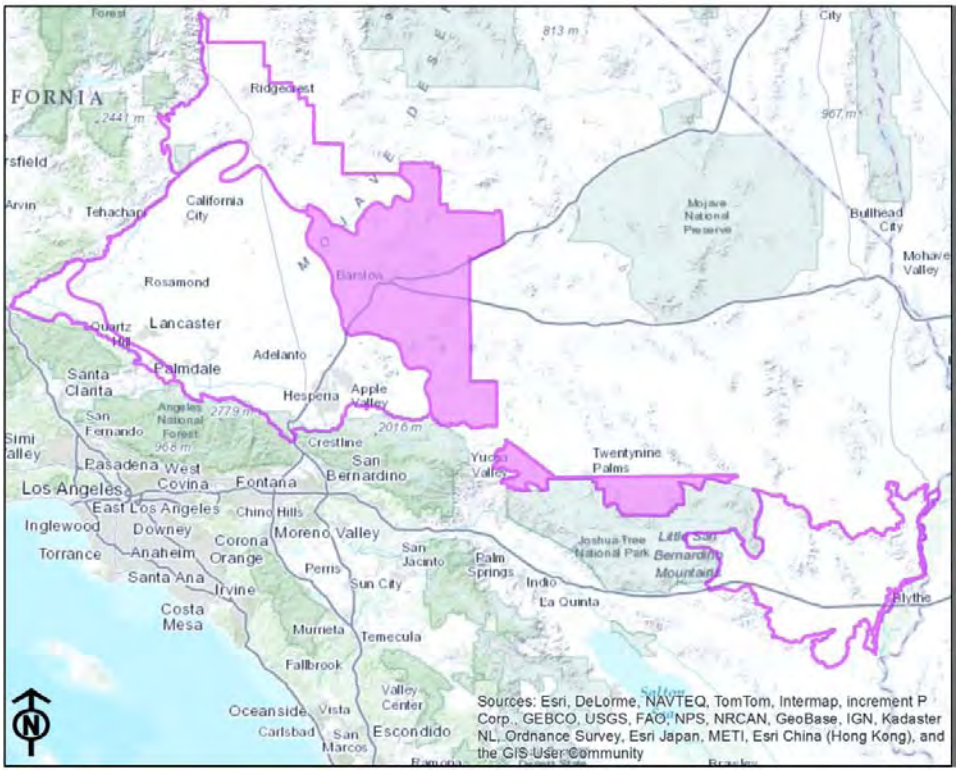
The smaller portion, containing about 250,000 acres, corresponds to Subarea 2. It lies southeast of Johnson Valley and falls partly within the northern reaches of the Little San Bernardino and Pinto Mountains. The more easterly Pinto Mountains separate the Twentynine Palms portion of the Central Mojave Desert from the Pinto Basin, a large east-west trending alluvial valley drained by the Pinto Wash southeastward into Palen Dry Lake in the Colorado Desert.

Unlike the southern foothill fringes of the Western Mojave Desert, the corresponding areas in this portion of the Central Mojave are in the lee of a "double-effect" rain shadow. Storm systems are sapped of their moisture as they cross the 10,000-foot to 11,000-foot crest of the San Bernardino Mountains, and they continue to lose moisture as clouds finally make it over the 7000-foot ridgelines north of Big Bear and Baldwin Lake. Elevations between 3500 feet and 4000 feet, which support blue and valley oak woodlands in the Western Antelope Valley near Tejon Pass, here yield a much drier community consisting of emergent Mojave yucca *(Yucca schidigera)* over a shrub layer where creosote bush and white bursage co-dominate.

As in the Western Mojave, the *Larrea tridentata – Ambrosia dumosa* Alliance is the most common vegetation community found within the Central Mojave. However, the Central Mojave also contains fairly extensive stands where creosote bush shares dominance with the warmer-loving brittle bush, a dual-species Alliance found throughout the Colorado Desert. With the exception of small patches occurring in the Searles Valley near Trona, brittle bush is for the most part not found west of the Calico Mountains and only becomes extensive to the south along the lower slopes of the Newberry Mountains below 2500 feet. Brittle bush is widespread in the Pinto Mountains as dominant stands on dark volcanics and as a dual-species Alliance with creosote bush on the adjacent foothills and upper fans.

Unlike the more populated Western Mojave, this region has only two small population centers: Barstow and Yucca Valley-Twentynine Palms. Disturbance is locally severe from off-road vehicle use in the 53,000 acre Stoddard Valley Off-Highway Vehicle Park (OHVP) and the smaller OHVP in Johnson Valley to the southeast. Much of the lower portions and adjacent slopes of the Stoddard, Sidewinder, and Fry Mountains have undergone intense burns, resulting in significant areas converting to early seral post fire stands of Virgin River brittle bush *(Encelia virginensis),* cheesebush *(Ambrosia salsola),* and bladder sage *(Salazaria mexicana).*

Figure 8: Location of the Central Mojave Desert Region within the Study Area



1.4.3.3 The Colorado Desert

Photo Credit: Edward Reyes

The Colorado Desert is located in the southeast corner of California. Approximately one million acres of the Colorado Desert is located within the study area (**Figure 9**). Although the region on average receives less than four inches of precipitation annually, it is the only area in California where nearly half the precipitation occurs in the summer and early fall months. Many areas have a growing season of over 300 days a year.

Several wash species, including *Olneya tesota,* which are less tolerant of winter freezes, are limited primarily to the Colorado Desert portion of the study area. Within the study area, the northernmost stands of the *Parkinsonia florida - Olneya tesota* Alliance occur on the bajadas just south of the Granite Mountains in the northern portion of Palen Valley.

The mapping study area (Subarea 3) targets primarily the northeastern portion of the Colorado Desert from the Eagle Mountains east to the Colorado River.

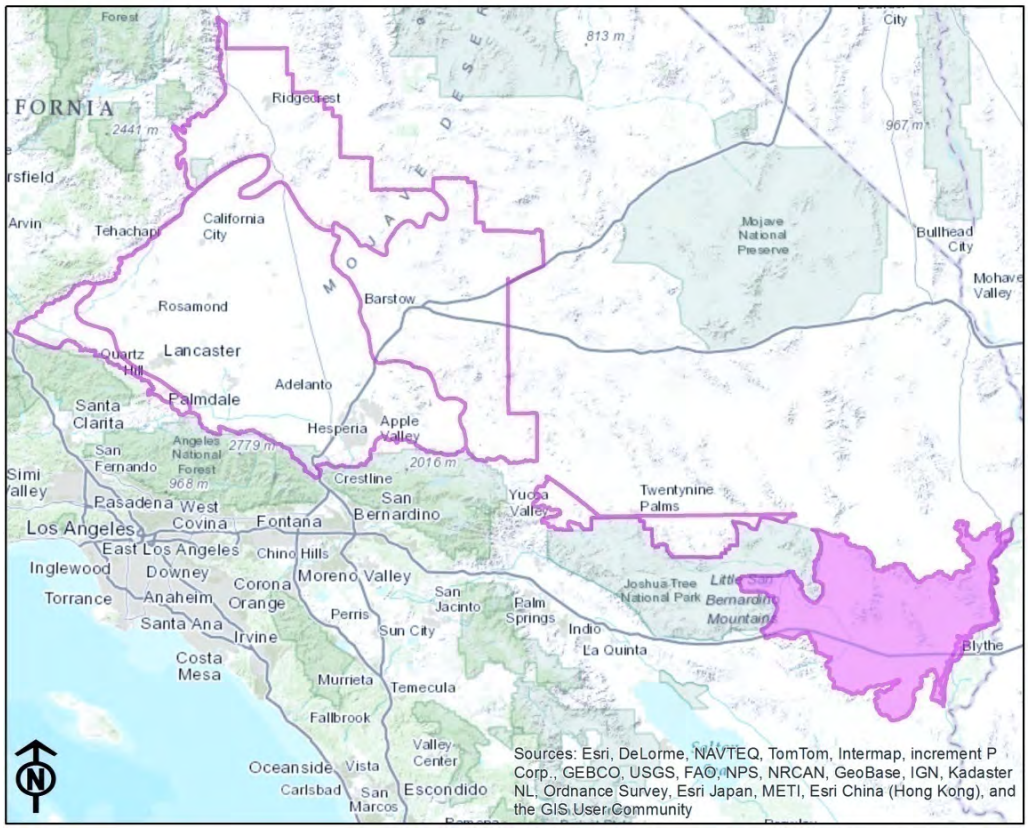
The western portions of the mapping area encompass approximately 340,000 acres of the Chuckwalla Valley, an extensive bajada-playa complex bounded by the Chuckwalla Mountains to the southeast and Palen Lake to the north. Within this region, two significant playa complexes, Palen and Ford Dry Lakes, are home to a number of significant vegetation communities. Fairly extensive dune complexes along the southern and eastern portions of Palen Lake support sparse stands of spectacle fruit *(Wislizenia refracta)* while a smaller body of much taller dunes along the northwest margins of the lake are home to about 3000 acres of mesquite *(Prosopis glandulosa).* On the Palen lakebed itself, some of the most extensive stands of iodine bush in the region co-dominate with bush seepweed in a sparse cover totaling nearly 1000 acres. The northwestern margins of the mapping area are drained by the Pinto Wash, which originates in the eastern sections of Joshua Tree National Park. This is an extensive wash complex containing large stands of microphyllous scrub including ironwood and blue palo verde *(Parkinsonia florida),* both of which often co-dominate in a variety of wash and active floodplain environments. The Chuckwalla Valley continues to drain southeast into Ford Dry Lake, where fairly extensive but sparse stands of bush seepweed are found in the most saline portions of the playa surface. North of Palen and Ford Dry Lakes, the Coxcomb, Palen and McCoy Mountains divide the three major watersheds draining the entire northern portions of the Colorado Desert Region. Within these isolated mountain systems, dark volcanic rock supports extensive, almost pure stands of brittle bush (*Encelia farinosa*) on nearly all slope settings below 3000 feet. Small washes draining these mountain chains contain narrow bands of blue palo verde and desert lavender *(Hyptis emoryi)* in the active channel adjacent to extensive bajadas covered by creosote bush and brittle bush. To the south of Interstate 10, the southwestern portion of the mapping area is bounded by the Chuckwalla Mountains, where some of largest ironwood trees and most undisturbed stands of ironwood woodlands occur on broad washes and adjacent floodplains. Several trees exceed 10 meters in height and have trunks approaching diameters of two feet.

Four mountain chains trending in a northwest to southeast direction are completely contained within and form the northern margins of the study area and in turn define roughly the boundary between the Colorado and Mojave Deserts. The Granite Mountains, which are the northwesternmost of the four, contain the least amount of brittle bush due in part to the lighter-colored granitic rock and higher overall elevation. Both the Big and Little Maria Mountains to the east are geologically more complex with large areas of darker-colored rock. They therefore contain extensive stands of brittle bush, especially on the middle and upper south-trending slopes. The smaller Riverside Mountains, located in the extreme northeastern corner of the mapping area, also contain extensive stands of brittle bush. Several fairly extensive dunes, containing longleaf joint fir *(Ephedra trifurca),* are found where sand has blown up against the

northern edges of the Big Maria Mountains along the eastern fringes of the Rice Valley. These stands generally share dominance with big galleta grass *(Pleuraphis rigida)*.

The eastern portions of the Colorado Desert Region are drained by the McCoy Wash in the north and encompass the Palo Verde Mesa and adjoining Colorado River Floodplain. Here the Colorado River defines the northeastern boundary of the study area. Further south, the bluffs along the western edge of the floodplain define the southeastern boundary. Agricultural and urban fringe disturbance is more characteristic of this portion of the Colorado Desert study area where unsuccessful jojoba farming efforts west of Blythe are being replaced with early seral stands of creosote bush, big galleta grass, and white bursage on sandy soils immediately adjacent to the floodplain bluffs. Disturbance over much of the eastern Chuckwalla Valley and Palo Verde Mesa have most likely reduced the cover and diversity of the bajadas, resulting in extensive stands of creosote bush with densities below 10 percent, often over a dense cover of Mediterranean grass (*Schismus* spp.) and other non-native forbs. Shrub diversity on these sites is uncharacteristically low.

Figure 9: Location of the Colorado Desert Region within the Study Area



1.4.3.3.1 The Colorado River Floodplain Zone

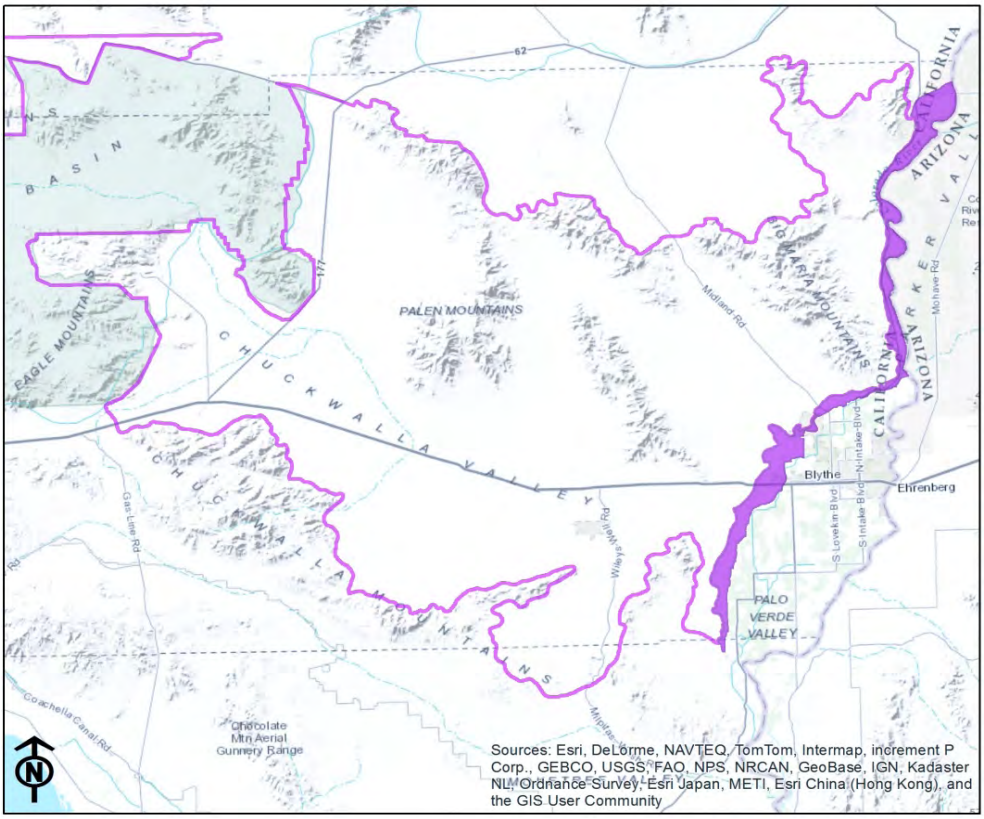
Photo Credit: Edward Reyes

One narrow zone (**Figure 10**) is defined within the Colorado Desert portion of the study area. 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.

The nearly 30,000-acre zone extends in a northerly direction from just south of the Riverside County line, primarily as older floodplain deposits on steep bluffs, and crosses Interstate 10 west of the city of Blythe about 14 miles to the north. From here it trends in a northeasterly direction, crossing old and active farmlands until it reaches the McCoy Wash just south of the base of the Big Maria Mountains. Here, the zone is "pinched" between the steeper alluvial fans and the active portions of the Colorado River floodplain, which in this locale is actively farmed. The zone extends northward and encompasses broader portions of the active floodplain, which has been formed by recent channel oxbows adjacent to the Colorado River. Although highly altered, most portions of the active floodplain in this area are currently not under any active agriculture. The study area's northern boundary lies just south of the San Bernardino County line to the east of the Riverside Mountains. Most of the study area north of the Palo Verde Dam lies within the boundaries of the Colorado River Indian Reservation.

Many of the desert's mesquite bosques occur within this region, occupying nearly 1800 acres primarily in extremely narrow stands along the breakpoint between the active floodplain and adjacent bluff. Extensive stands of tamarisk (*Tamarix* spp.) thickets have replaced native riparian vegetation throughout the active floodplain where current stands are estimated at nearly 5000 acres. Existing vegetation still defined as riparian, including arrow weed *(Pluchea sericea)* thickets along with mesquite and various chenopod scrubs, often contains a significant component of tamarisk also. 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 sparse patches, especially adjacent to US Highway 95 north of the Palo Verde Dam.

Figure 10: Location of the Colorado River Floodplain 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 monitors were helpful in viewing ancillary image sources and ground photos while the map was being created on the primary monitor. The maps were created using Esri's ArcGIS software. The final map was delivered in ArcGIS 10.0 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 2010.

A variety of supplemental digital image sources aided in the vegetation mapping effort. These included Bing Maps Aerial imagery and World imagery, both available from ArcGIS Online. CDFW provided access to download 1-foot GlobeXplorer Image Connect© imagery from the Internet. CDFW also provided 2010 imagery of Kern County. Natural color NAIP imagery from 2005 and 2009 was consulted for a historical perspective. The vegetation mappers were able to bring all of these georeferenced imagery sets directly into their ArcMap sessions.

The photointerpreters also referred to imagery available from the Internet, such as Google Earth, Google Maps, Bing Maps, and Yahoo Maps. The Google Maps street view option was sometimes used where available. The Bird's eye option in Bing Maps provided an angled aerial view that was sometimes helpful. Although these supplemental sources were used, all line work and cover values were based on the 2010 NAIP imagery as previously stated.

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 delineate 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, provided by CDFW or partnering agencies, were used regularly throughout the mapping effort:

- Fire data: wildfire and prescribed (Interagency Fire Perimeters. 2008. CalFIRE : http://frap.fire.ca.gov/data/frapgisdata/download.asp?rec=fire)
- Geology of California (USGS Surficial Geology, 2006 http://pubs.usgs.gov/of/2006/ publications 1165, 1090, 1265, 1276, 1035. Also see http://wrgis.wr.usgs.gov/open-file/of00-222)
- Roads (Bureau of Land Management, Kern Co., Inyo Co., San Bernardino Co., Riverside Co.)
- Vegetation of Edwards Air Force Base (AFB) (Ecosystem Classification and Relationships For Pleistocene Lake Thompson Bed, Mojave Desert, California. November 2004.)

Digital Elevation Model (DEM) data and topographic map Digital Raster Graphics (DRGs), created by the US Geological Survey (USGS), were downloaded from the Internet. In addition, the following soil surveys created by the Natural Resources Conservation Service of the US Department of Agriculture were downloaded for reference:

- Antelope Valley Area
- Edwards AFB
- Kern County, Southeastern Part
- Mojave Desert Area, Northwest Part
- Mojave Desert Area, West Central Part
- San Bernardino County, Mojave River Area
- San Bernardino National Forest Area

CNPS provided vegetation data from the field effort, conducted several years earlier, for the Bureau of Land Management's Northern & Eastern Colorado Desert (NECO) Coordinated Management Plan. CNPS also provided data collected around Palen Dry Lake and the Chuckwalla Mountains during workshops held in East Riverside County in 2011.

Finally, a digital file of the recently updated (2011) vegetation of Joshua Tree National Park was supplied by Park personnel.

2.3 Mapping Classification

The map classification 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 (unpublished draft 2012), and Vegetation Classification and Mapping at Lake

Mead National Recreation Area, Mojave National Preserve and Death Valley National Park (in progress, draft as of 2012). Vegetation information from these projects was compiled and placed within the NVCS hierarchy in existence as of March 2011.

Refinements to the 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 February 2011 and March 2012, AIS conducted eleven field reconnaissance trips dispersed throughout the mapping area with one or two crews per trip. The trips are summarized in **Table 2**.

Table 2: Summary of Field Reconnaissance Trips

Trip No.	Dates	Staff from:	Location
1	March 14-18, 2011	AIS/VegCAMP	Western Mojave Basin & Range Fringe, Western Mojave Mountains & Valleys
2	April 11-15, 2011	AIS/VegCAMP	Western Mojave Basin and Range Fringe, Western Mojave Mountains and Valleys, Western Antelope Valley
3	May 2-6, 2011	AIS/VegCAMP	Central Mojave
4	May 24-27, 2011	AIS/VegCAMP	Western Mojave Mountains & Valleys, Central Mojave
5	May 31-June 3, 2011	AIS/VegCAMP	Western Mojave Basin & Range Fringe, Western Mojave Mountains & Valleys, Central Mojave
6	July 25-27, 2011	AIS/VegCAMP	Western Mojave Mountains & Valleys
7	August 1-3, 2011	AIS/VegCAMP	Western Mojave Mountains & Valleys, Central Mojave

Trip No.	Dates	Staff from:	Location
8	September 19-22, 2011	AIS/VegCAMP	Central Mojave
9	October 5-6, 2011	AIS	Western Mojave Mountains & Valleys
10	December 11-16, 2011	AIS/VegCAMP/CNPS	Colorado Desert
11	February 26-March 2, 2012	AIS/VegCAMP/CNPS	Colorado Desert

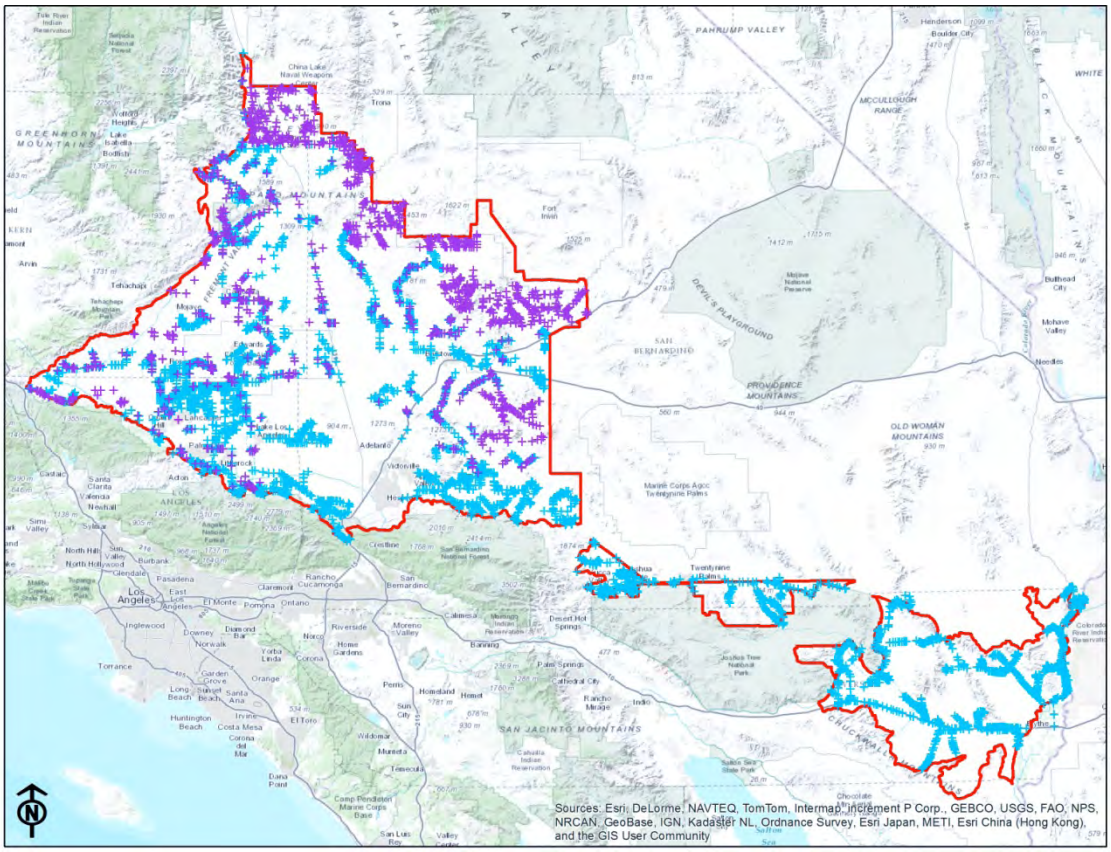
Prior to each trip, AIS staff reviewed imagery on-screen to identify and select potential reconnaissance sites in close proximity to roads. Sites were selected to represent different vegetation types and percent cover, as well as variations in geography, landform, and abiotic factors such as percent 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 ranged in scale from 1:26,000 to 1:35,000. 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 vehicles, stopping 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.

At many observation points, the crew took digital color ground photos. The frame number, direction the photographer was facing, and other information about the photo was recorded in the field and later input into computer files for easy reference. For 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 made approximately 6600 reconnaissance observations as shown in **Figure 11**, including points taken by AIS and by VegCAMP.

Figure 11: Location of Reconnaissance Observation Points



The blue points represent AIS reconnaissance observations, and the points in purple represent reconnaissance observations conducted by VegCAMP.

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. 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.

Prior to the delineation of vegetation map unit polygons, a team of photointerpreters specializing in land use reviewed each module one at a time in ArcMap sessions and drafted polygons corresponding to land use and water features. More detail about land use mapping can be found in Sections 2.5.3.1.2 and 2.5.3.9.

Each vegetation mapper then brought one of the modules completed for land use 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 1:4000. 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, and Land Use. 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. 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, large contiguous groups of adjacent completed modules were joined into seamless interim delivery database units. These database units were subject to further processing, edge-match checks, and review by a senior staff member before being delivered to VegCAMP or CNPS for AA. The accuracy assessment results for each set of delivered modules helped inform photointerpretation of subsequent areas and create more accurate maps as work continued. 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, appropriate tools and reference sources, photointerpretation training, and knowledge of vegetation communities 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 commonly occurring 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 118 Alliances and Alliance-level types such as Provisional Alliances, Semi-natural Stands, and Mapping Units, and 12 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 code. 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. A minimum mapping unit (MMU) is established to ensure the map contains polygons of a workable, meaningful size. The choice of an MMU is influenced by the clarity of the imagery, the detail of the mapping classification, the purpose of the data, and time and budget constraints. MMU can vary for different categories of features being mapped.

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 one acre MMU. The map classification presented in Appendix A indicates the MMU for each map unit class. Another exception to the upland vegetation MMU involved stands of *Atriplex polycarpa* and *Ambrosia salsola* occurring in washes, which were mapped with a five acre MMU. Where these two types occurred outside of washes, a 10 acre MMU was applied. Polygons representing land use were mapped with a 2.5 acre MMU.

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. To enable this desert mapping effort to blend with the Statewide vegetation map that will eventually surround it, the non-desert vegetation types in the foothills of the Transverse Ranges and Sierra Nevada (at the fringes of the study area) were mapped to an MMU of two acres.

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 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. In the foothill fringes of this project, the Statewide criterion of 8 to 10 percent cover was followed for non-desert vegetation types.

A summary of the minimum mapping units for this mapping effort is presented in **Table 3**.

Table 3: 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, California and Colorado River Aqueducts	1 acre
Non-desert vegetation types in the foothills of the Transverse Ranges and Sierra Nevada	2 acres
Land use: agriculture, built-up, water impoundment features	2.5 acres
Atriplex polycarpa and *Ambrosia salsola* 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 sq 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 minimum map unit size, guidelines were established for the minimum width of a map polygon. The rule of thumb was to make the minimum width roughly half the width of a square MMU box. The appropriate MMUs were still observed. 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 pertained to sparsely vegetated to nonvegetated areas. It was assumed that all vegetation polygons contained unvegetated or barren areas. On the

other hand, sparsely vegetated to nonvegetated areas were not coded in the database unless they met the minimum mapping resolution and could be mapped 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

As noted in Section 2.5.2, Miscellaneous Classes such as agriculture, land use and water features were mapped prior to the delineation of vegetation polygons. One reason for this approach was the relatively short timeframe available for completing the project. Having additional staff members delineate land use and water features maximized the amount of time that vegetation mappers could apply their specialized knowledge to focus on vegetation.

Another reason is the sometimes complicated relationship between vegetation and land use, which is reflected in the structure of this project's mapping classification. 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, in this project 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 Joshua trees or California juniper 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 California juniper woodland Alliance – a vegetation type – but in the Land Use layer, the same polygon can be flagged 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.

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 2005 to 2010. If the images 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, the California and Colorado River Aqueducts, 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.

In this project 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. A given vegetation polygon could 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 shrub vegetation type assigned but different cover categories for conifers (for example, >0-1% versus >5-15%).

The photointerpreters considered the coverage pattern of the 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 <u>Percent Cover Mapping Considerations</u>

It is important to note that the photointerpreters could only accurately quantify the vegetation that is visible on the aerial imagery. Therefore in this project, "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 foothill tree stands, riparian stands, and chaparral. 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 affect the percent cover seen during the on-site field visits.

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 red brome (*Bromus rubens*). Polygons were not created or split because of differences in the presence of exotics, but existing vegetation polygons were assigned an Exotics class. **Table 4**, 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.

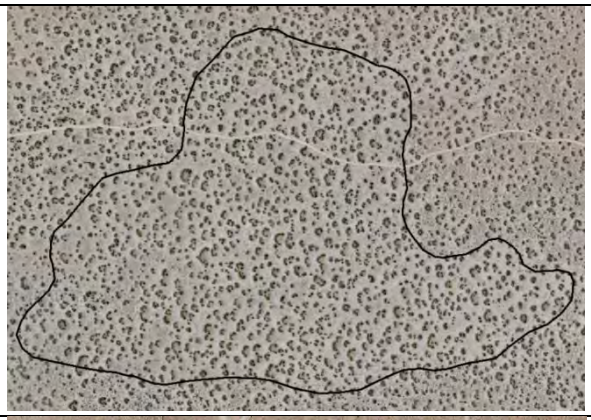
Table 4: Map Classes for Exotics

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 coarse rocky slopes, with no tawny or reddish *Schismus* spp. or *Bromus rubens* signature, desert pavement, very steep bouldery slopes, 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. *Larrea tridentata-Ambrosia dumosa* without high roadedness or degraded understory usually fall in this class. S*chismus* spp. or *Bromus rubens* 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, particularly herbaceous ones, are significant and cover may exceed the dominant vegetation strata. A "haze" *of Schismus* spp. (tawny) or *Bromus rubens* (reddish brown) is uniform in the understory of shrubby or treed overstory, as in degraded *Larrea tridentata* (lacking much *Ambrosia dumosa*); or an ochre "haze" of *Brassica* spp. is found in the sandy soil of *Larrea tridentata-Ambrosia dumosa*; or a brown to dark gray signature of *Salsola* spp. is associated with a native woody overstory (e.g., *Suaeda moquinii, Atriplex* spp.) in saline or alkaline soils.
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).
9	Not applicable/Not assigned	Exotics are not applicable when the MapUnit is 9210, 9220, 9300, 9310, 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, OHV trails, railroads, berms, and covered aqueduct. Impact is defined by the proportion of any polygon that is contiguously <u>without</u> these features, as shown in **Table 5**. The table is adapted from *2012 Vegetation Map in Support of the Desert Renewable Energy Conservation Plan, Interim Report 1.1* (VegCAMP, 2012). Roads following polygon boundaries were not included in the assessment. Polygons were not created or split because of differences in roadedness, but existing vegetation polygons were assigned a Roadedness Disturbance class.

Table 5: 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 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805, 9320 (non OHV).

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. However, a very large polygon with a "Moderate" Roadedness Disturbance code might still contain an extensive roadless area.

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 6**, 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 6: 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 widely spaced 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 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 7**, which was adapted from Appendix F of VegCAMP (2013).

Table 7: 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.

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.

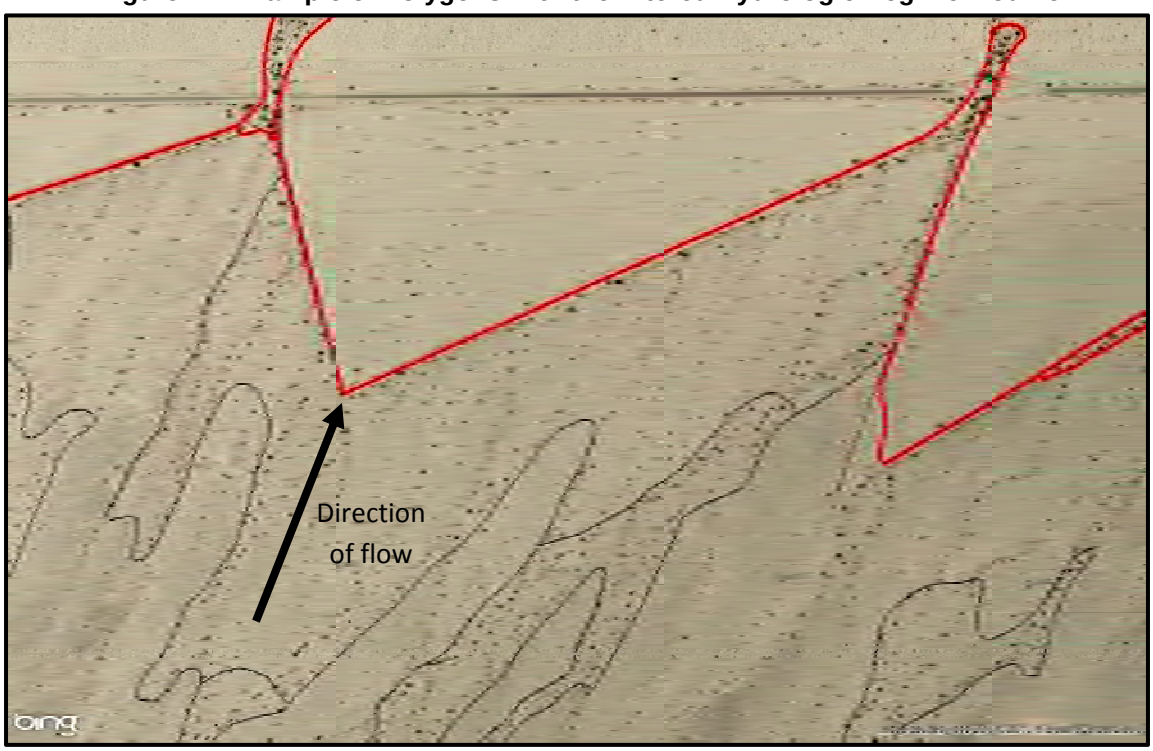
Since the Altered Hydrologic Regime Modifier was applied only where mappable changes in vegetation type or cover were observed across an impediment, an existing polygon was not split solely because part of it was subject to a diversion of surface flow. The map classes for Altered Hydrologic Regime Modifier are presented in **Table 8**.

Table 8: 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, 9320, 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).

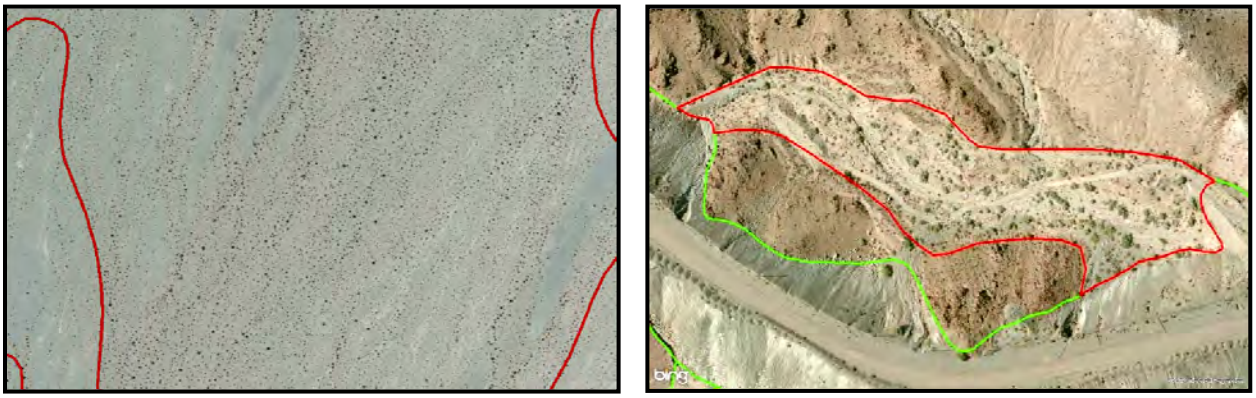
Ironwood – Blue Palo Verde Presence Modifier (OLTE_PAFL)

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 portion (Subarea 3). The modifier was added to accurately represent the vast expanses of sparse ironwood and/or blue palo verde emerging from the canopy of creosote, white bursage, and brittle bush shrub types on broad alluvial fans and bajadas, as well as in small rivulets dissecting sparsely vegetated desert pavement.

Polygons were assigned this attribute after completion of the mapping effort. Based on hardwood cover greater than 0 percent assigned to a given polygon, 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.

Figure 13 presents an example where the modifier was applied, and **Table 9** summarizes the map classes.

Figure 13: 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 9: Map Classes for OLTE_PAFL Modifier

Code	Definition	Discussion
0	Not present	Mapped polygons do not have *Olneya tesota* or *Parkinsonia florida* present consistently throughout the stand in at least trace amounts.
1	Present	Mapped polygons have *Olneya tesota* or *Parkinsonia florida* 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 (California and Colorado River Aqueducts only)
- 2000 = Agriculture (includes nurseries)
    - 2100 = Row and field crops
    - 2200 = Orchards and 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)

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 pine woodland type could not have a “None or Not observable” code in Percent Cover by Conifers. 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.

When all the modules in an interim delivery database 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 interim delivery database units.

At the end of the project, all of the individual database units were joined together into the final geodatabase. 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

From October 2011 through June 2012, VegCAMP staff made 2,014 accuracy assessments throughout Subareas 1 and 2. In Subarea 3, CNPS made 832 accuracy assessments between April and November 2012. Assessments were done as interim database deliveries were received. Conducting AA as the mapping progressed allowed the results of the earlier accuracy assessments to inform the ongoing photointerpretation effort.

Accuracy assessment begins with the allocation of polygons selected to be visited in the field. The allocations were 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.

In the office, data from the field AA forms were entered into an Access database and the vegetation type recorded by the photointerpreter was scored using the field surveys and accompanying ground photos. 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 10,** adapted from *2013 California Desert Vegetation Map and Accuracy Assessment in Support of the Desert Renewable Energy Conservation Plan,* (VegCAMP, 2013), shows how these points were assigned**.**

Table 10: 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 *Yucca brevifolia* Alliance for a stand with 1% evenly distributed *Yucca brevifolia* over *Larrea tridentata-Ambrosia dumosa* would get this score if the PI call was *Larrea tridentata-Ambrosia dumosa* Alliance with <1% *Yucca brevifolia*).	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 an interim delivery database unit 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. Once AA review was completed, the photointerpreters modified polygons based on AA results, whether in response to specific findings or in extrapolating AA results for trends that affected similar types throughout the database.

Overall, the database units received a user's accuracy of 84.4 percent and a producer's accuracy of 83.7 percent. 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 can be found in VegCAMP (2013).

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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 this project.

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 vegetaton 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.

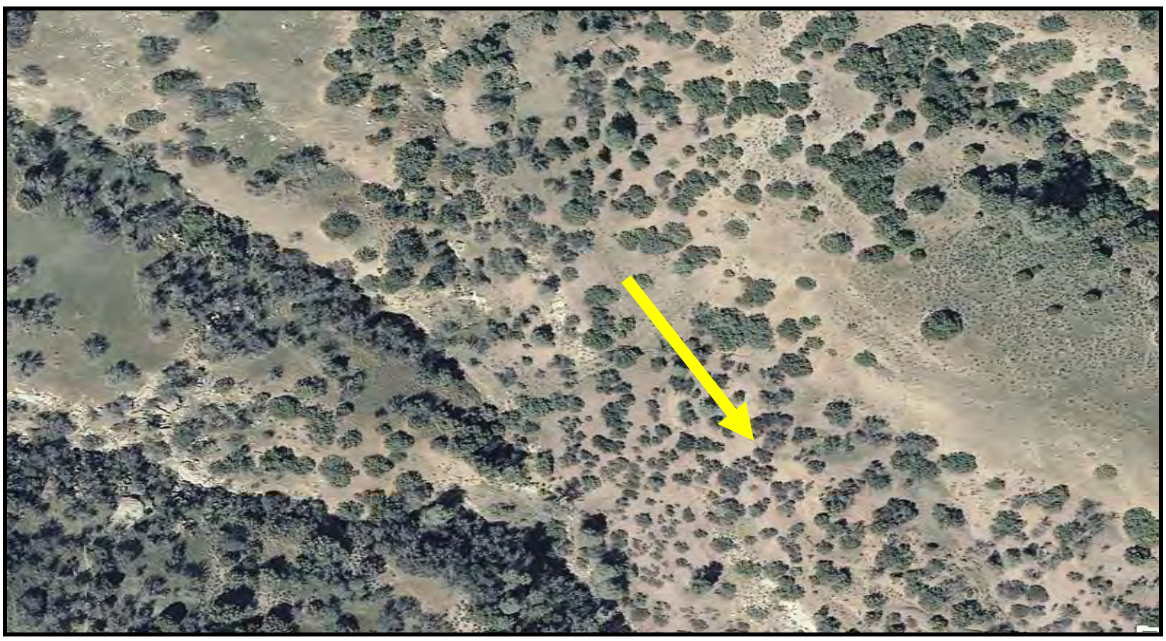
Following the distribution map discussion is an **elevation range** chart showing the frequency of elevation values for a given vegetation type within the study area. This was derived by extracting the elevation data (10 meter pixels) from the Digital Elevation Models (DEMs) in the National Elevation Dataset, available from the USGS, using the areal extent of the vegetation type. Along the vertical axis is the number of pixels occurring at a given elevation. Along the horizontal axis are the elevation values. The values on the axes of each chart are individualized based on the range of elevation values and pixel counts for each vegetation type. This chart is not an elevation profile of the vegetation type, nor does it represent the geographic distribution of its elevation range.

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.

1111 – *Quercus douglasii* Alliance

Blue oak woodland Alliance



In this image, stands of *Quercus douglasii* occur on variable slopes with *Pinus sabiniana* as a sparse emergent on more mesic north-trending slopes. This site is located in an area near Quail Lake. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.

This ground shot depicts a north-trending nearly pure stand of *Quercus douglasii* woodland at the base of Liebre Mountain.

1111 – *Quercus douglasii* Alliance

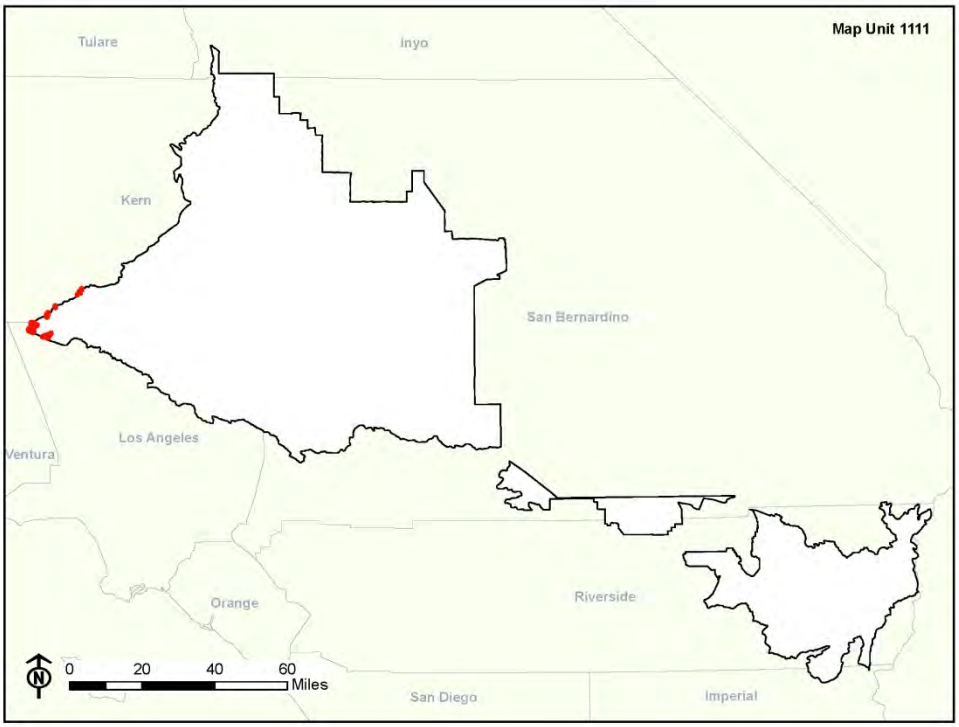
DESCRIPTION: In this Alliance *Quercus douglasii* is usually dominant to co-dominant in the tree layer. If mixed with *Q. lobata, Pinus sabiniana, Juniperus californica*, or *Q. chrysolepis*, *Q. douglasii* must be more than 60 percent relative cover. Generally the Alliance is only found at the base of Liebre Mountain and in the extreme westernmost portions of the study in the Tehachapi Mountains near Gorman. Stands occasionally mix with *Juniperus californica* and/or *Q. john-tuckeri* along with emergent *Pinus sabiniana,* at times with a mixture of transmontane and cismontane shrubs and herbs in the understory. Stands occur on a variety of slope features; denser woodlands with emergent *Pinus sabiniana* are more frequently found on more mesic north-trending slopes.

PHOTOINTERPRETATION SIGNATURE: Characteristic of the *Quercus douglasii* woodland is the presence of understory annual grasses in an open woodland setting. Canopy cover is generally below 30 percent, which characterizes this Alliance throughout the state. Individual crowns tend to be rather open, and fine-scale early season imagery allows the viewing of understory grasses and forbs. Crowns are medium sized and rounded to slightly irregular in shape. On late summer imagery, stands portray a characteristically blue-green to blue-gray color. Emergent *Pinus sabiniana* is visible in some stands as a smaller, somewhat light gray, more irregularly shaped crown contrasting in color with the adjacent blue oak.

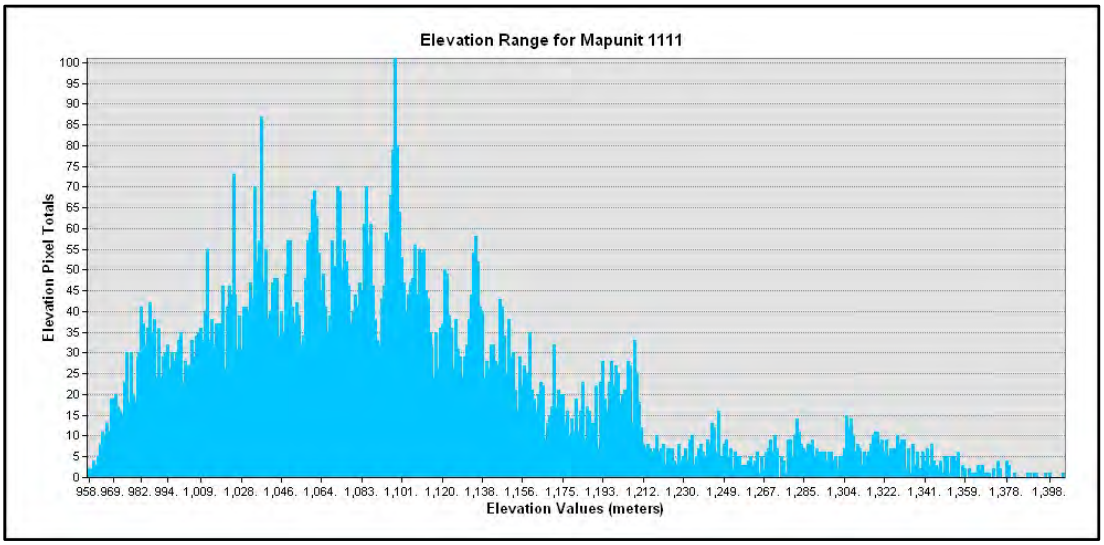
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus lobata* Alliance (1112) – This Alliance is generally found on deeper soils in valley bottoms and adjacent lower slopes. Crowns as a whole are significantly larger and more open, spreading broadly closer to the base with more clustering of branches throughout. Overall stand colors trend greener on late summer imagery, and decline of leaf vigor is less evident in the late dry season. Understory characteristics (primarily grasses and forbs) are similar to those of *Quercus douglasii* woodlands but tend to stay greener longer into the summer season.
- *Quercus wislizeni* Alliance (1114) – Stands generally occur on steeper, more protected lower to mid slopes, usually trending northerly with denser cover, often in post burn settings with other species of mesic chaparral. Crowns tend to be smaller, denser and have more distinct edges except in post burn settings where crowning becomes less distinct. Overall signature color is significantly greener. Image texture appearances across the stand are smoother, especially in post burn settings.
- *Quercus john-tuckeri* Alliance (3312) – Stands in the Sierra Pelona and Tehachapi Mountains tend to hybridize. For mapping purposes, the stand is assigned to the *Q. john-tuckeri* Alliance when the structural characteristics of the vegetation appear more shrub-like. Individual crowns are usually smaller, and branching within the crown is denser. Stands where the two species occur nearby can be distinguished by the usually denser cover (often over 40 percent) and lower stature of *Q. john-tuckeri* and lack of emergent *Pinus sabiniana*. Stands of *Q. john-tuckeri* often have a component of *Juniperus californica* showing up as a distinctly greener signature. *Q. john-tuckeri* tends to occur on steeper slopes.

1111 – *Quercus douglasii* Alliance

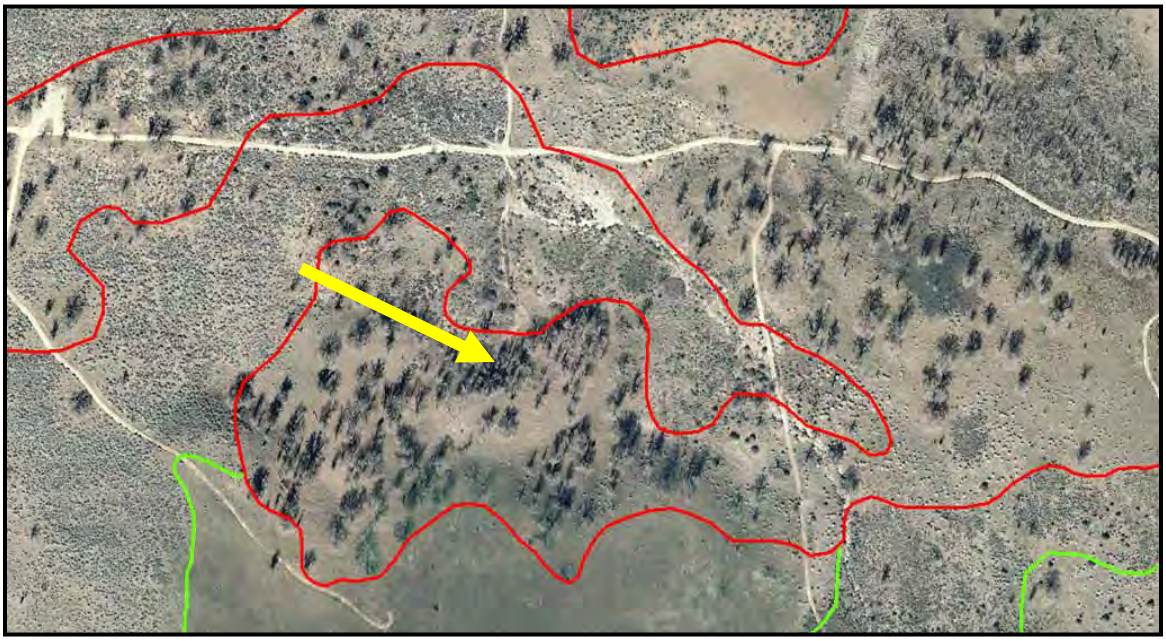


DISTRIBUTION: This Alliance is limited to the western portions of the Antelope Valley, primarily in three clusters: at the base of Liebre Mountain, along the foothills of the Tehachapi Mountains north and west of Quail Lake, and on a few slopes near the base of Sycamore Canyon close to the California Aqueduct. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1112 – *Quercus lobata* Alliance

Valley oak woodland Alliance



The example here depicts a stand of *Quercus lobata* in leaf-off conditions. This stand occurs in an open setting with a sparse shrub layer of *Ericameria nauseosa* over an understory of mixed grasses and forbs. The stand is located north of Liebre Mountain near Oakdale Canyon Road in the San Andreas Rift Zone.

Example photo depicts a small partially burned stand in cold-season leaf-off conditions on deep soil north of Liebre Mountain below Robinson Canyon.

1112 – *Quercus lobata* Alliance

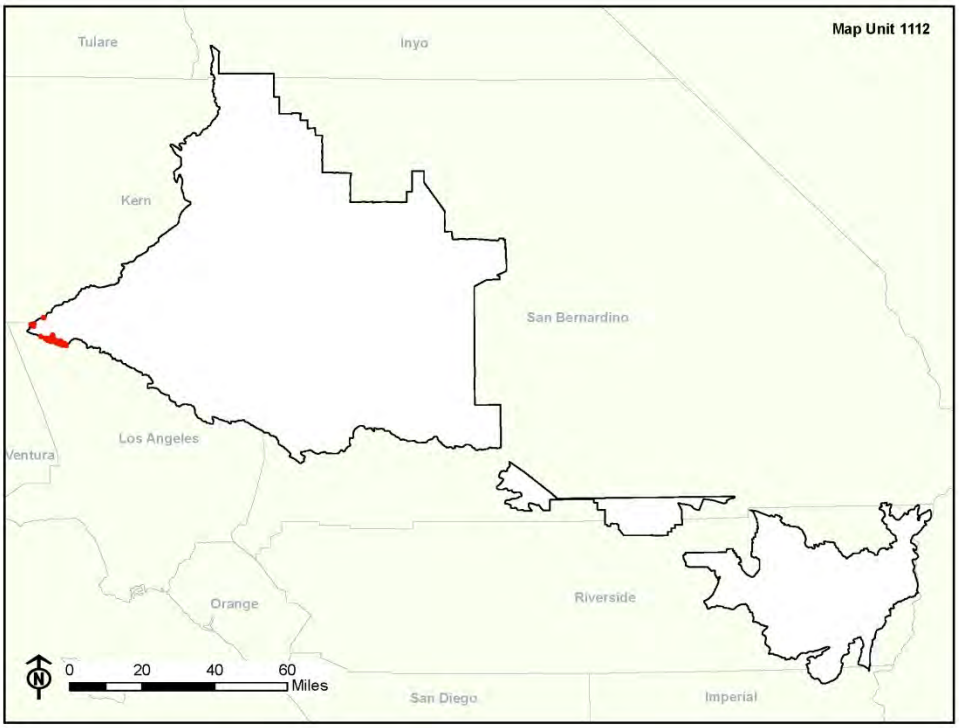
DESCRIPTION: *Quercus lobata* is dominant to co-dominant in this Alliance. *Q. lobata* may mix with *Q. douglasii*, *Q. chrysolepis*, or *Pinus sabiniana*, but must be least 30 percent relative cover in the canopy. The Alliance is only found at the base of Liebre Mountain and in the extreme westernmost Tehachapi Mountains near Gorman. Stands generally occur in deep, relatively mesic soils where they are scattered on rather level lower slopes and valley bottoms. The best examples of these stands in the study area occur in the Liebre Mountain area between Gorman and Pine Canyon Road.

PHOTOINTERPRETATION SIGNATURE: *Quercus lobata* occurs in open to very open woodland settings generally below 30 percent cover except in small protected coves, where cover can be quite dense. Individual crowns are very large and irregularly shaped. Branching from the main stem extends broadly and begins significantly closer to the base of the tree than in other oaks. Crown top branching tends to coalesce, forming small tight clusters within the upper reaches of the canopy. Cover across the stand tends to be highly variable in both distribution and tree size. Leaf-off imagery tends to depict tree crowning with indistinct edges and significant shadowing. Leaf vigor declines minimally in the summer months, yielding a fairly bright, green to light-green color across the stand when viewing leaf-on imagery.

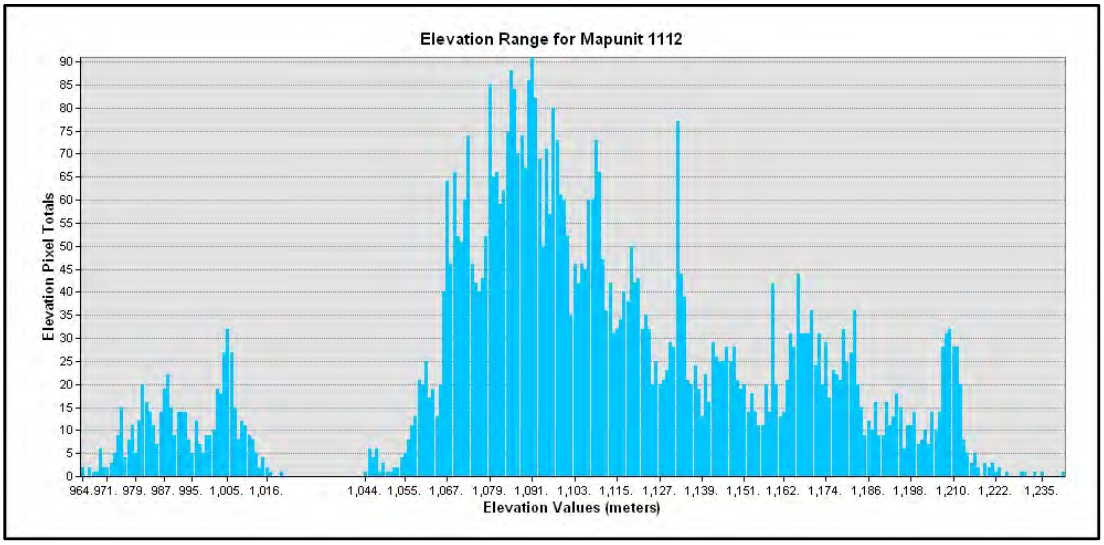
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus douglasii* Alliance (1111) – Stands are generally found on shallower soils in more xeric settings on somewhat steeper slopes. Crowns average smaller and slightly more rounded in shape, with more upward branching giving the overall tree a less complex shape. Early to mid-summer leaf-on imagery depicts *Q. douglasii* generally with more of a blue-green tint to the crown due to the onset of drought-related stress characteristics to the leaf.
- *Populus fremontii* Alliance (1411) – Small stands occurring near valley oak woodlands typically occur in a more linear riparian setting. Overall cover is more variable across the stand but generally trends higher. Leaf-off imagery usually depicts the main and larger auxiliary branches with a significantly lighter color. Crowns are similar in size but tend to vary more between individuals; larger trees often contain a significant dead component. Mid to late season leaf-on imagery tends to yield a lighter green color.

1112 – *Quercus lobata* Alliance

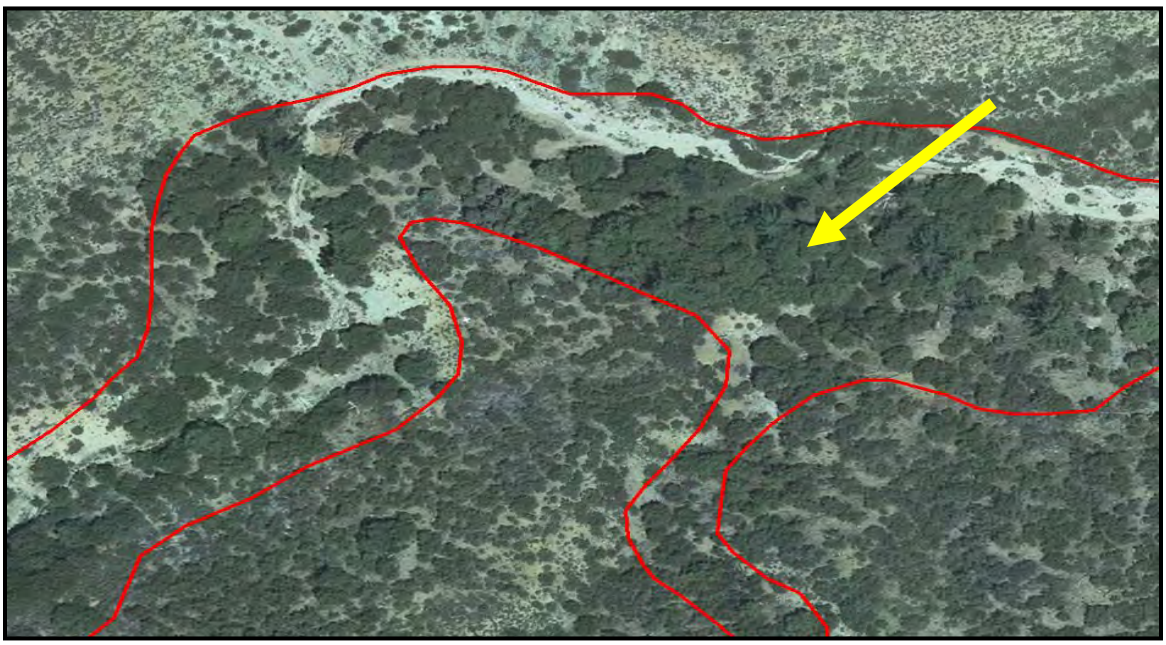


DISTRIBUTION: The range of this Alliance is similar to that of *Quercus douglasii* but is even more restricted to the valleys and lower slopes north of Liebre Mountain and in larger canyons below the Tehachapi Mountains northwest of Gorman. Several small stands in lower canyons east of Robinson Canyon are recovering from the 2004 Pine Fire. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1113 – *Quercus chrysolepis* Alliance

Canyon live oak forest Alliance



Quercus chrysolepis is depicted here in steep canyon terrain above 4500 feet (1370 meters) in moderate to dense cover with sparse emergent *Pseudotsuga macrocarpa*. This example is located south of Cajon Canyon in the lower foothills of the San Gabriel Mountains.

This photo depicts a stand on a steep and rocky north-trending slope where cover averages around 20 percent. Sparse *Pinus monophylla* is scattered throughout the stand and is especially noticeable on this photo along the upper ridgelines.

1113 – *Quercus chrysolepis* Alliance

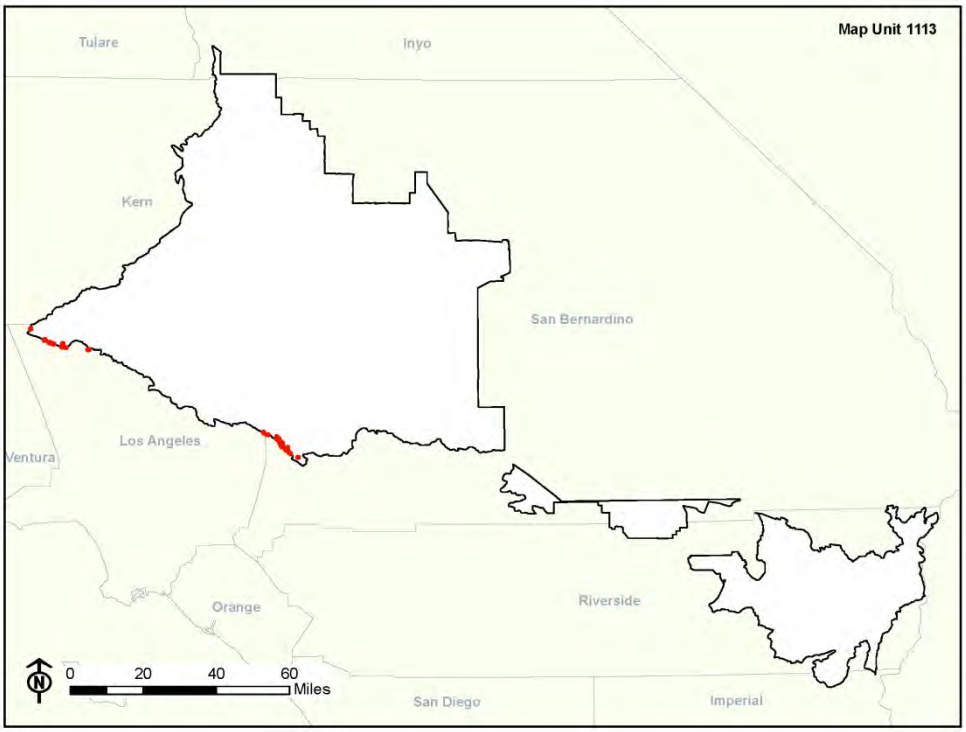
DESCRIPTION: In this Alliance *Quercus chrysolepis* is dominant to co-dominant in the tree overstory. Stands of this Alliance only occur along the Transverse Ranges, on generally steep north-facing or concave exposures. If co-occurring with other oaks (*Q. lobata* or *Q. wislizeni*), *Q. chrysolepis* must be at least 30 percent cover. If co-occurring with *Pinus monophylla, Q. chrysolepis* must be more than 60 percent relative cover. When *Pseudotsuga macrocarpa* is co-dominant to dominant, then *P. macrocarpa* is the Alliance type.

PHOTOINTERPRETATION SIGNATURE: *Quercus chrysolepis* can easily be recognized in that it is the only live oak restricted to canyons over 4000 feet (1220 meters) in elevation. Stands usually occur in cover well over 40 percent, and therefore understory shrub or herbaceous vegetation is normally not visible on the imagery. Individual crowns are medium to large and generally rounded in shape. The crowns are quite dense, a characteristic typical of all live oaks. Due to the dense stand cover, individual crowns normally are not very distinct; however, stand edges form a sharp boundary from adjacent more xeric types which are usually more open and lower in height. Stand configuration is generally fairly long and narrow due to settings found primarily in canyon bottoms and side slopes. Overall stand color during most of the year is a medium to dark green; higher elevation stands have sparse emergent *Pseudotsuga macrocarpa,* which have more blue-green star-like crowns.

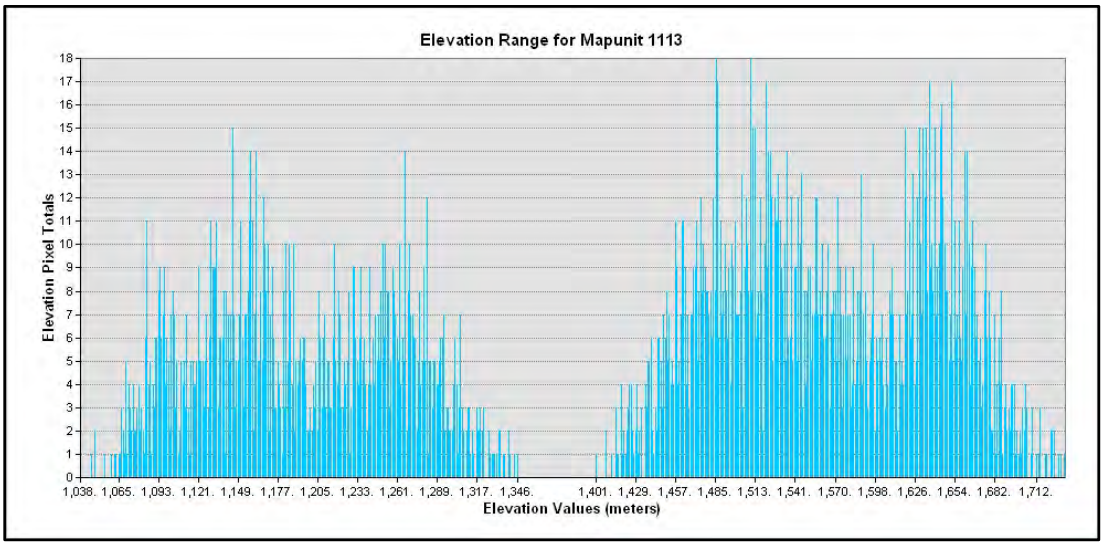
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus wislizeni* Alliance (1114) – This type is found at slightly lower elevations, and in the mapping area is considered more of a shrub than an actual tree. Most stands of *Q. wislizeni* in the mapping area have also been burned within the last decade. *Q. wislizeni* also occurs in a mixed setting with other premontane chaparral species such as *Ceanothus leucodermis.*
- *Pseudotsuga macrocarpa* Alliance (1211) – This species is quite distinct from *Q. chrysolepis* but determining relative density of the two species can be difficult on steep protected north slopes. Generally, when *Pseudotsuga macrocarpa* is consistent as an emergent conifer throughout the stand, it is mapped to that Alliance.

1113 – *Quercus chrysolepis* Alliance



DISTRIBUTION: Small stands occur in canyons and adjacent side slopes with seasonally or perennially flowing streams. Most stands are found above 4000 feet (1220 meters) in scattered locations only on the lower slopes of the San Gabriel Mountains from Ralston Peak north of Lone Pine Canyon west to near Bald Mountain in the Sierra Pelona. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1114 – *Quercus wislizeni* Alliance

Interior live oak woodland Alliance

In this stand, *Q. wislizeni* shares dominance with other premontane chaparral species including *Ceanothus leucodermis* and *Aesculus californica.* Much of the dense cover in this example occurs on steep terrain in a post burn setting near Oakdale Canyon. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.

This photo depicts a stand burned in the 2004 Pine Fire just upslope from Oakdale Canyon Road. Recovering species include *Quercus wislizeni, Ceanothus leucodermis* and *Aesculus californica.*

1114 – *Quercus wislizeni* Alliance

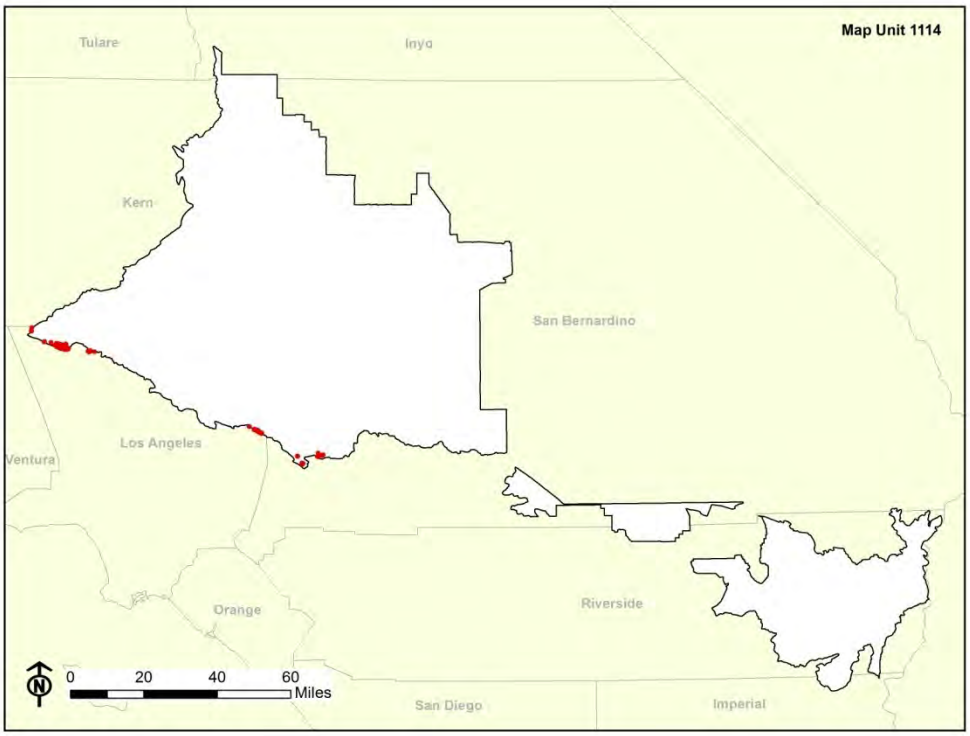
DESCRIPTION: In this Alliance *Quercus wislizeni* is dominant or co-dominant at more than 30 percent relative cover, with other tree species in the overstory. *Q. douglasii* and *Q. chrysolepis*, if present, occur at low cover (generally less than 30 percent relative canopy cover). Stands are limited to the north-facing base of Liebre Mountain and the San Gabriel Mountains as far east as Cajon Pass and Silverwood Lake**.** Some of the Silverwood Lake stands are in low valleys or on terraces adjacent to true riparian woodlands. Many have been recently burned and are scrubby. *Quercus wislizeni* ssp. *frutescens* Alliance (which would key in the premontane chaparral Group) has not been identified within in the study area.

PHOTOINTERPRETATION SIGNATURE: Stands are generally more shrub-like since most have undergone recent fire disturbance. Cover is usually very dense and recognizable by the dark green but variable color occurring throughout most of the stand. Stand color variability is due in part to other chaparral species co-dominating portions of the stand and the amount of dead vegetation present. Stand margins are often difficult to distinguish since they are often adjacent to other post burn chaparral types found in more xeric settings such as *Quercus john-tuckeri* and *Adenostoma fasciculatum.*

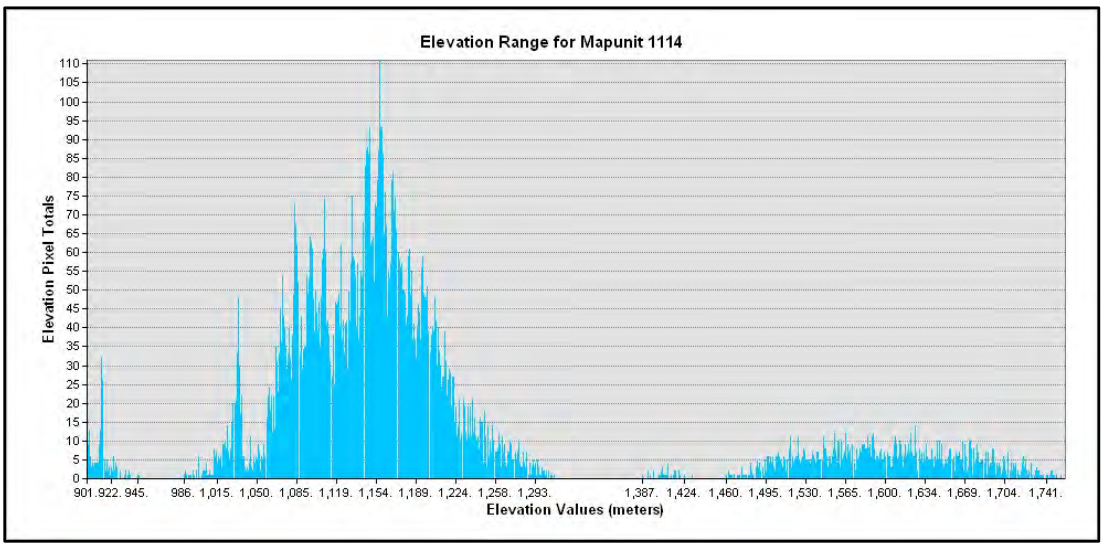
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus chrysolepis* Alliance (1113) – This species is more tree-like with a taller crown. Individual crowns are more distinct even in dense cover. Stands generally occur at higher elevations on more protected slopes.
- *Quercus berberidifolia* Alliance (2132) – This species also occurs as a dense cover and its photo signature is very similar. Overall color trends a duller green. *Q. berberidifolia* generally has a somewhat lumpy texture across the stand whereas *Q. wislizeni* is more even (possibly as a result of uniform shrub heights in post burn recovery). Stands of *Q. berberidifolia* can generally be distinguished by topographical settings where it occurs nearly exclusively on north-trending lower slopes and at somewhat lower elevations. Stands of *Q. berberidifolia* are also more closely associated with other species within the California Chaparral Group, especially *Adenostoma fasciculatum,* where it often co-dominates in the stand.
- *Quercus john-tuckeri* Alliance (3312) – This type is generally found in more of an open cover setting, often with a presence of *Juniperus californica* giving the stand a contrasting brighter green signature against a more brownish-green overall color. Stands generally occur closer to the desert margins and occasionally have *Yucca brevifolia* in the canopy.

1114 – *Quercus wislizeni* Alliance

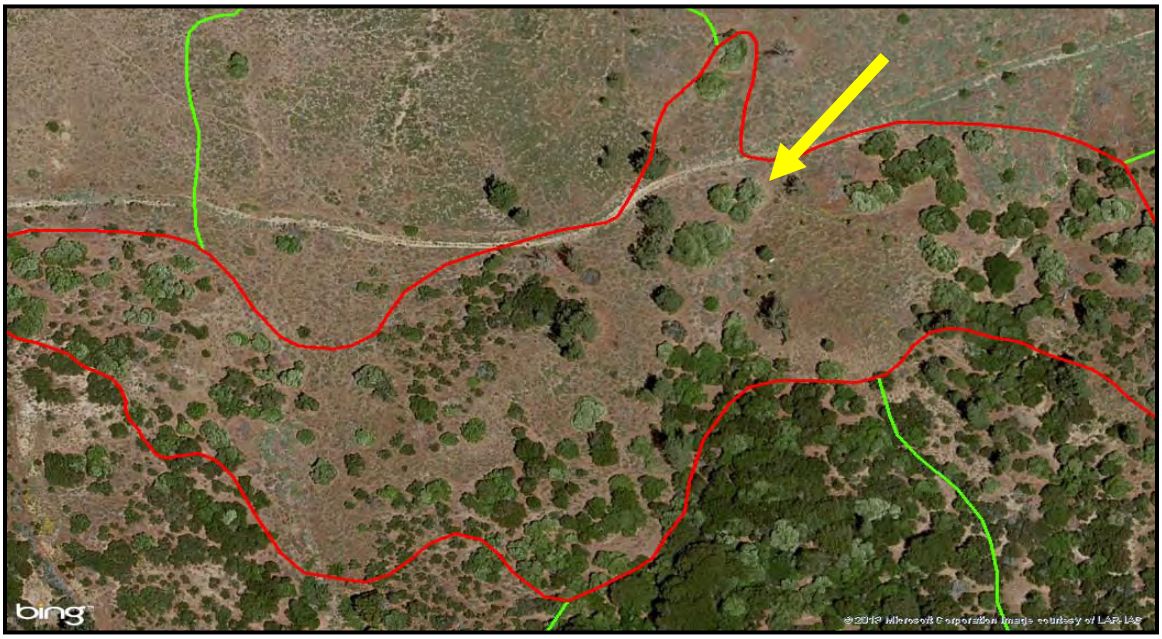


DISTRIBUTION: Scattered small stands occur from Liebre Mountain along the lower slopes of the San Gabriel Mountains east to Cajon Pass. Small patches also occur east of Cajon Pass in semi-desert settings in scattered locations within the Summit Valley. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1116 – *Aesculus californica* Alliance

California buckeye groves Alliance



This example depicts gray-green *Aesculus californica* dominating the stand with scattered *Pinus sabiniana* in an open setting with a rather dense understory cover of *Eriogonum fasciculatum.*

The above photo shows a small patch of *Aesculus californica* in an open grassy setting.

1116 – *Aesculus californica* Alliance

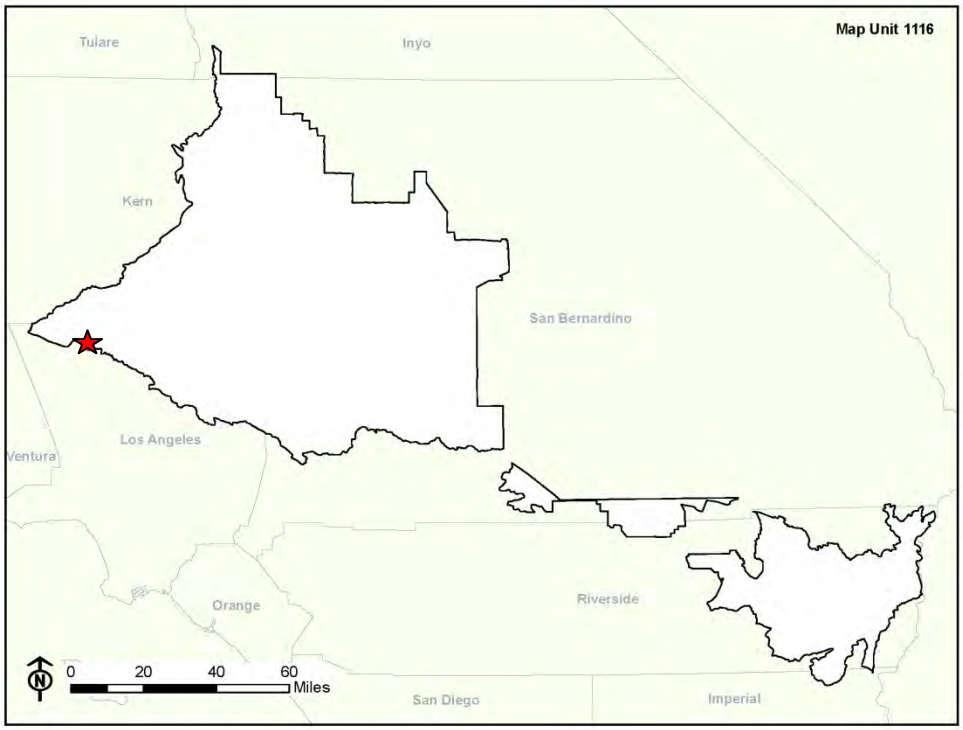
DESCRIPTION: In this Alliance *Aesculus californica* is strongly dominant (more than 60 percent relative cover) as a tree or tall shrub in the overstory. If *A. californica* is co-dominant with an oak species, the Alliance is generally mapped to the oak type. Several polygons mapped as other Alliances have *A. californica* co-dominating the stand on north-facing or concave slopes north of Liebre Mountain, adjacent to stands of chaparral or *Quercus wislizeni.* The only mapped stand of the *Aesculus californica* Alliance is found in the extreme western portion of the study, just north of Sawmill Mountain near Keeler Flats.

PHOTOINTERPRETATION SIGNATURE: Stands are easily recognizable due to early leaf loss in the late spring and early summer months as a result of the early onset of the dry season. With leaf-on imagery *A. californica* appears bright green to yellow-green. As the leaves senesce the color lightens to light green or yellow-green, then turns to light yellowish-brown to brown. Leaf-off imagery exposes light-colored branches. *Aesculus californica* is generally found as a co-dominant, usually with *Quercus chrysolepis,* in which case it is mapped to that Alliance.

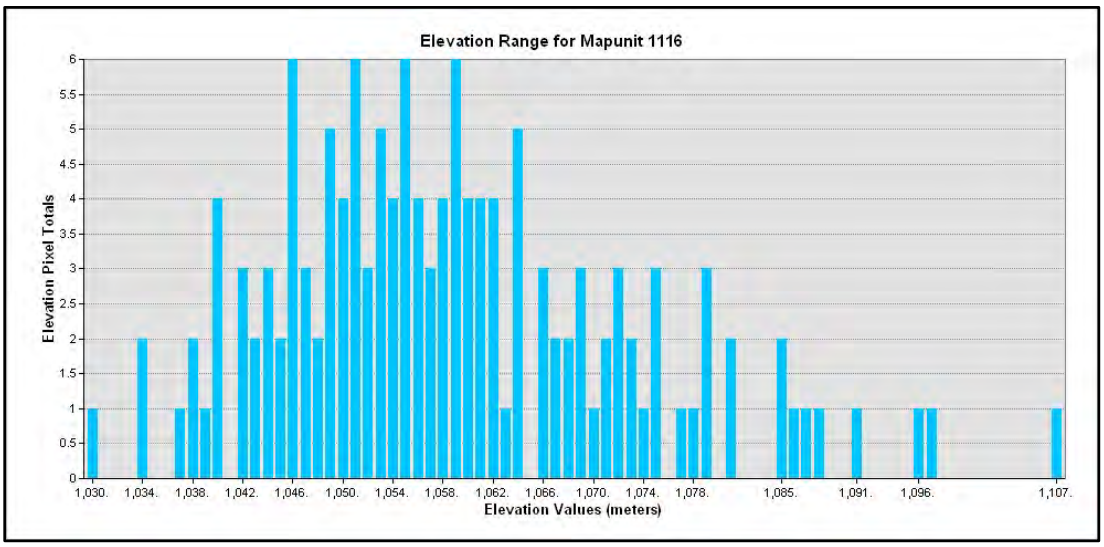
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus chrysolepis* Alliance (1113) – This species is easily distinguishable as a large evergreen oak co-dominating the stand with the summer leaf-off *Aesculus californica.* In settings where the two co-dominate, the stand is classified to the *Quercus chrysolepis* Alliance.

1116 – *Aesculus californica* Alliance

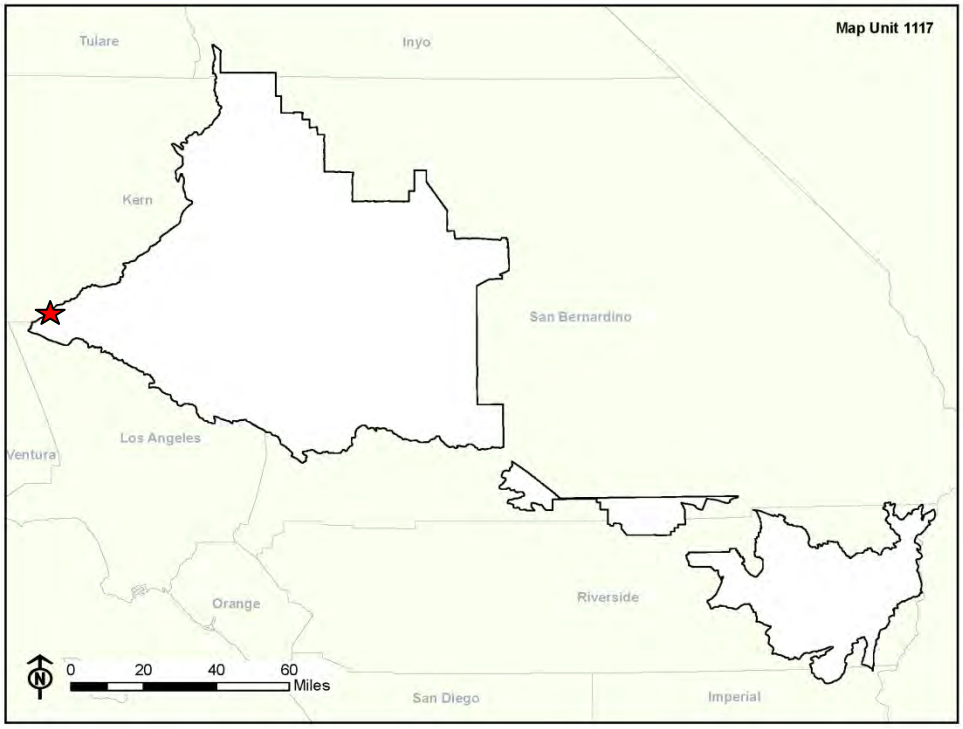


DISTRIBUTION: The only mapped example occurs north of Liebre Mountain. *Aesculus californica* is found in scattered sites as a co-dominant, mainly with *Quercus chrysolepis* in isolated locations on steep north-trending slopes along the western portions of the San Gabriel Mountains. Note: In the distribution map above, a star symbol has been placed on the polygon for display purposes.



1117 – *Quercus agrifolia* Alliance

Coast live oak woodland Alliance



DISTRIBUTION: Stands of this Alliance were infrequently mapped in the study area and are only mapped based on ground surveys or other field data. 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 on the polygon for display purposes.

1121 – *Pinus sabiniana* Alliance

Foothill pine woodland Alliance

This photo, along the lower foothills of Liebre Mountain, shows *Pinus sabiniana* scattered toward the center, adjacent to several small patches of *Adenostoma fasciculatum* and *Eriogonum fasciculatum*. In this example, polygon delineations are removed to accentuate the crown characteristics of the individual pines.

Pinus sabiniana occurs along the ridgeline above grassy slopes covered with *Eriogonum fasciculatum.*

1121 – *Pinus sabiniana* Alliance

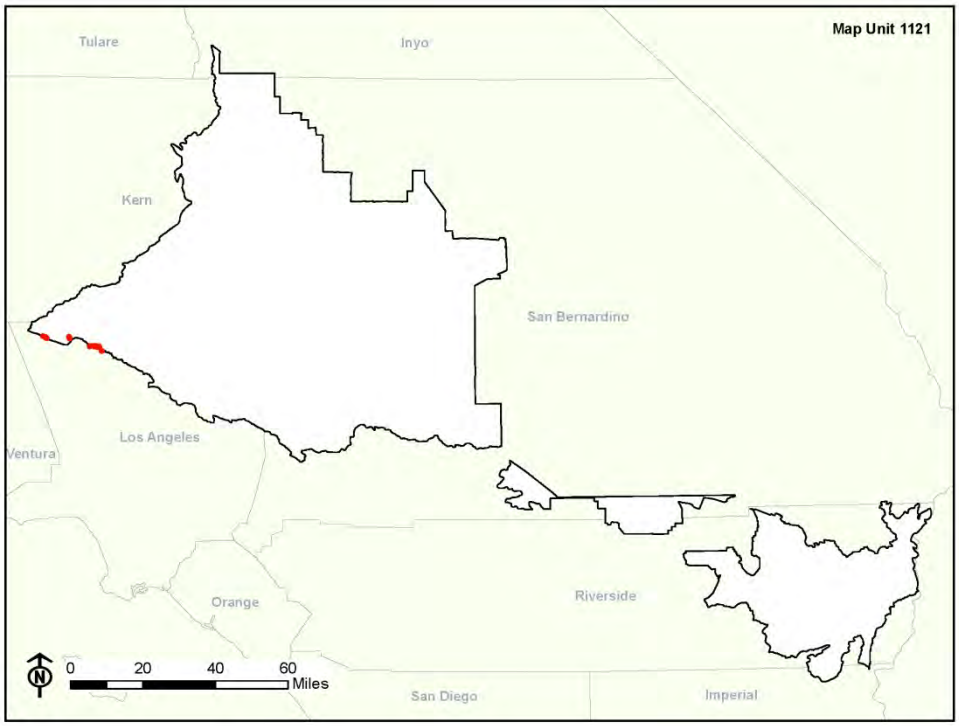
DESCRIPTION: In this Alliance *Pinus sabiniana* is the strongly dominant tree in the overstory, comprising more than 60 percent of the relative tree cover in a stand. Overall canopy cover is generally over 10 percent. Stands identifiable as the Alliance occur largely over herbaceous or mixed shrub/herb understories. Most stands occur on lower slopes along the northwest portion of the base of Liebre Mountain. Typically *P. sabiniana* is mapped to other tree Alliances since it rarely strongly dominates the stand.

PHOTOINTERPRETATION SIGNATURE: *Pinus sabiniana* can be identified by the irregularly shaped, multiple-branching crown and its characteristically blue-gray color. Unlike most stands throughout California's inner coastal ranges and Sierra Nevada Foothills, in the study area *Pinus sabiniana* does not usually co-dominate with oak. *Pinus sabiniana* can however be in close proximity to stands of *Quercus douglasii, Eriogonum fasciculatum* or open grasslands. Since most stands occur over a short shrub layer or in open grasslands, main stems are entirely visible and appear angular, typifying the growth patterns of this species of pine. These growth patterns and crown characteristics, especially visible with higher-resolution imagery, generally make the identification of this type fairly straightforward.

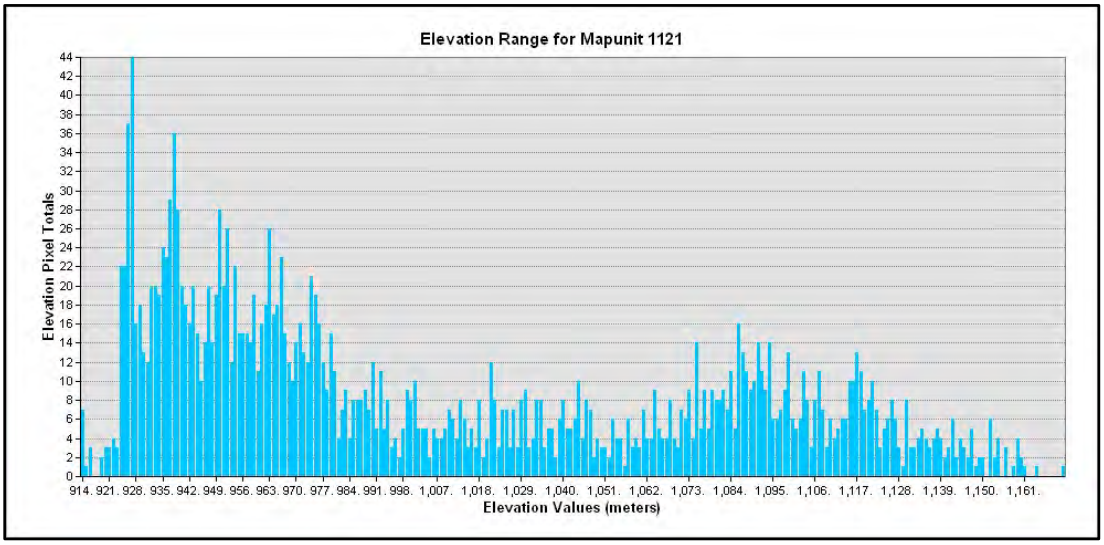
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus douglasii* Alliance (1111) – This species yields a similar blue-gray color but generally has a rounded, less irregularly shaped crown. When *Pinus sabiniana* is emergent to a dense oak canopy, the two species can be differentiated primarily by their height.

1121 – *Pinus sabiniana* Alliance



DISTRIBUTION: This Alliance occurs in isolated small stands in the western San Gabriel Mountains from Fairmont Reservoir, northwest along the foothill slopes to just east of Quail Lake. This Alliance was infrequently mapped in the study area. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1122 – *Juniperus californica* Alliance

California juniper woodland Alliance

In this example, *Juniperus californica* occurs in cover ranging from less than 3 percent to more than 20 percent over a moderately dense shrub understory of *Eriogonum fasciculatum*. This site is an urban fringe example with severe off-highway vehicle activity.

Juniperus californica dominates the overstory on the hills in the background over a fairly dense cover of *Eriogonum fasciculatum.* This site is located along the San Andreas Rift Zone just south of Palmdale.

1122 – *Juniperus californica* Alliance

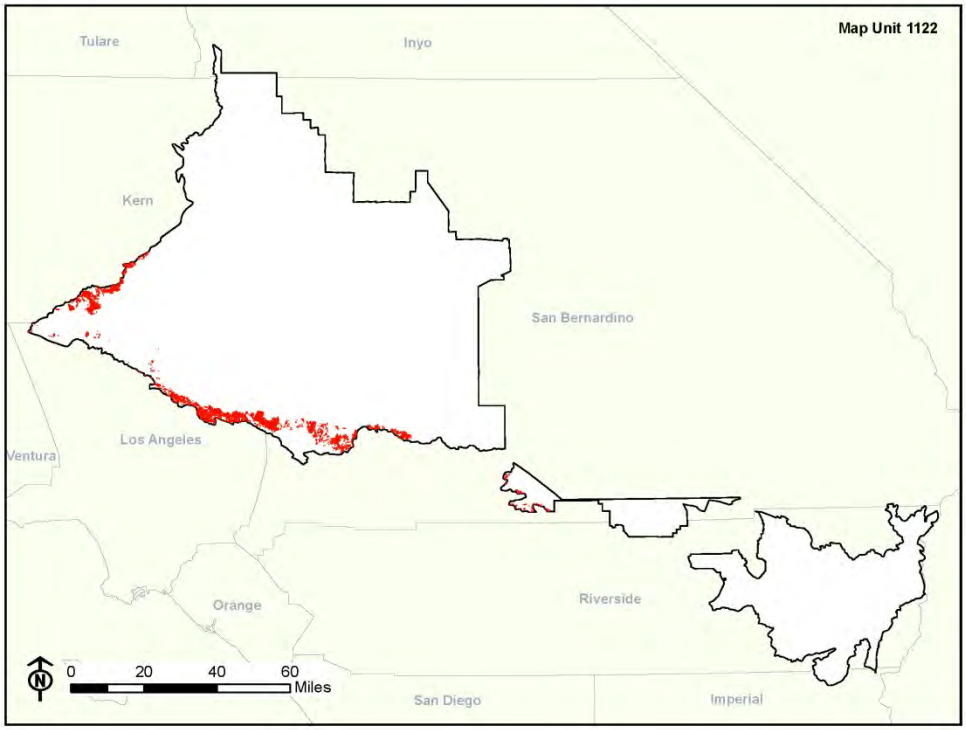
DESCRIPTION: In this Alliance *Juniperus californica* is the dominant species in the tree layer. Cover can vary considerably within the stand. Very sparse stands of *Juniperus californica* are mapped as a California juniper Alliance when *J. californica* is continuous throughout the stand and dominant in the tall shrub layer. *Yucca brevifolia* is often a component to the stand and when relative cover of Joshua tree reaches approximately a third of the canopy or greater, the Alliance is assigned to *Y. brevifolia* Alliance. Higher elevation juniper stands on slightly steeper slopes often have a component of *Pinus monophylla*. Stands occupying lower elevations away from the mountain foothills tend to have *Yucca brevifolia* in the canopy. *Quercus john-tuckeri* will often be a component to stands closer to Cajon Pass in areas that transition to semi-desert chaparral. Stands mapped as *J. californica* in the far west near Gorman will occasionally have *Quercus douglasii* as a co-dominant.

PHOTOINTERPRETATION SIGNATURE: One of the more conspicuous features of *Juniperus californica* is the crown shape, which is uniformly rounded regardless of the cover density. *Juniperus californica* is easily recognizable by other crown-related features including the green to dark green color visible on most image sets. (Midwinter imagery will accentuate these colors less, due to the low sun angle.) Crown margins are very distinct and overall heights are fairly uniform throughout the stand. Cover densities can vary considerably within the stand. *J. californica* can sometimes occur over a grassy herbaceous understory, but more often over a sparse to moderately dense shrub layer. Understory shrubs are for the most part facultatively deciduous and significantly smaller than the juniper. Isolated small patches of juniper on desert mountain ranges can be difficult to discern; imagery should be closely reviewed on north-trending slopes above 4500 feet (1370 meters) for these small stands.

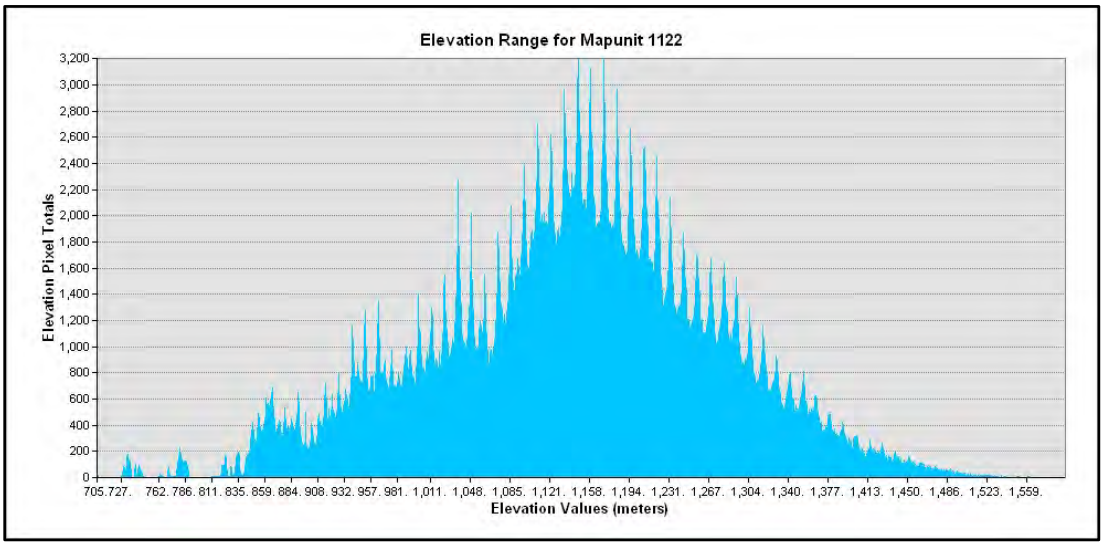
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Pinus monophylla* Alliance (1311) – This tree has a more irregularly shaped crown and displays a more blue-gray color. Higher elevation stands often contain both conifers, but when scattered consistently in the stand, *Pinus monophylla* is generally considered to be the Alliance. Due to their distinct crown characteristics, the two species are easily separable when co-occurring in the stand.
- *Quercus john-tuckeri* Alliance (3312) – This species can occur nearby or as a component to the *Juniperus californica* Alliance in stands west of Cajon Pass and can be distinguished primarily by the crown color, generally trending more toward the brown ranges of the color spectrum. Stands are usually found on somewhat steeper slopes located more within the semi-desert chaparral zone a little further from the desert margins. Stands of *Quercus john-tuckeri* usually contain less of a *Yucca brevifolia* component.

1122 – *Juniperus californica* Alliance

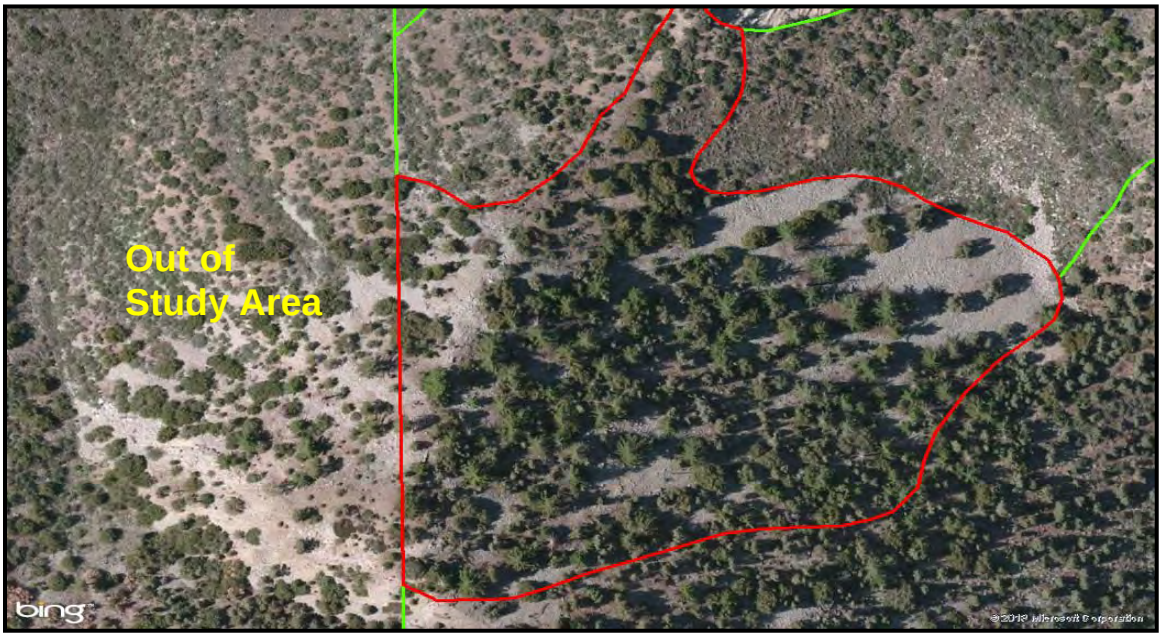


DISTRIBUTION: Within the study area, *Juniperus californica* occurs exclusively along the Foothills and adjacent fans of the Transverse Ranges from the Little San Bernardino Mountains west to the Sierra Pelona, and in similar settings in the Tehachapi Mountains. In the Western Mojave Desert, stands descend slightly on to lower slopes in the Antelope Valley at elevations down to 2500 feet (760 meters).

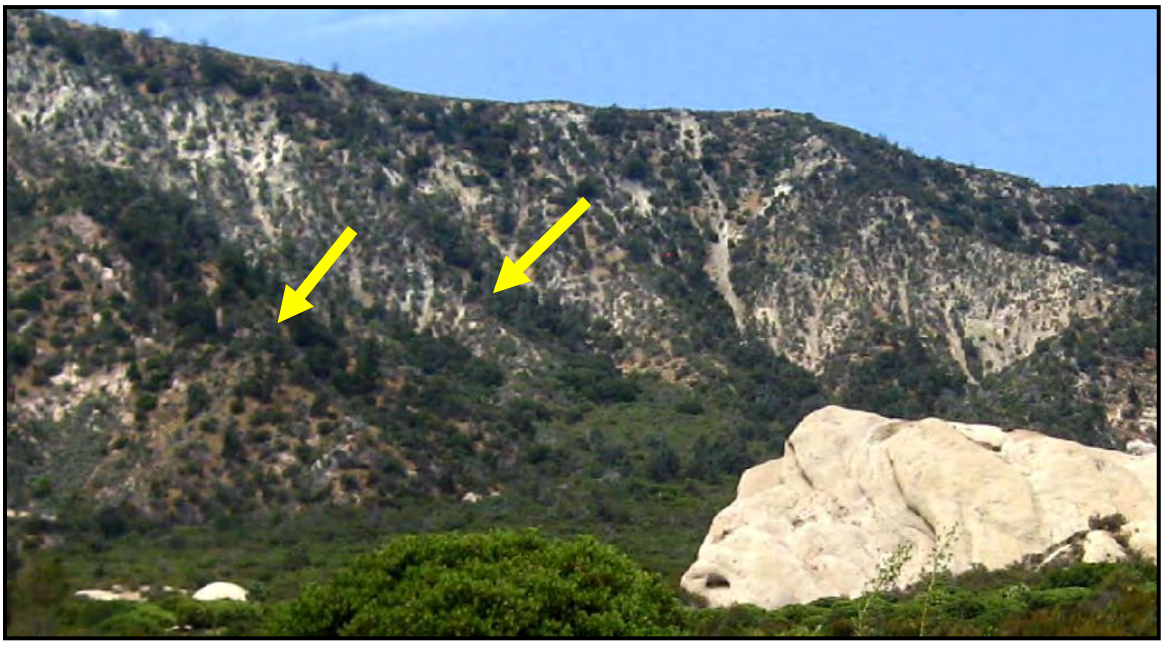


1211 – *Pseudotsuga macrocarpa* Alliance

Bigcone Douglas-fir Alliance



This example shows a stand of lighter green star-shaped *Pseudotsuga macrocarpa* dominating the tree canopy with a small component of darker green round-crowned *Quercus chrysolepis.* This stand is located in a small upper cove on steep gravelly terrain near the study area boundary.



In this example, small isolated stands are visible in protected coves on the mid and uppermost slopes.

1211 – *Pseudotsuga macrocarpa* Alliance

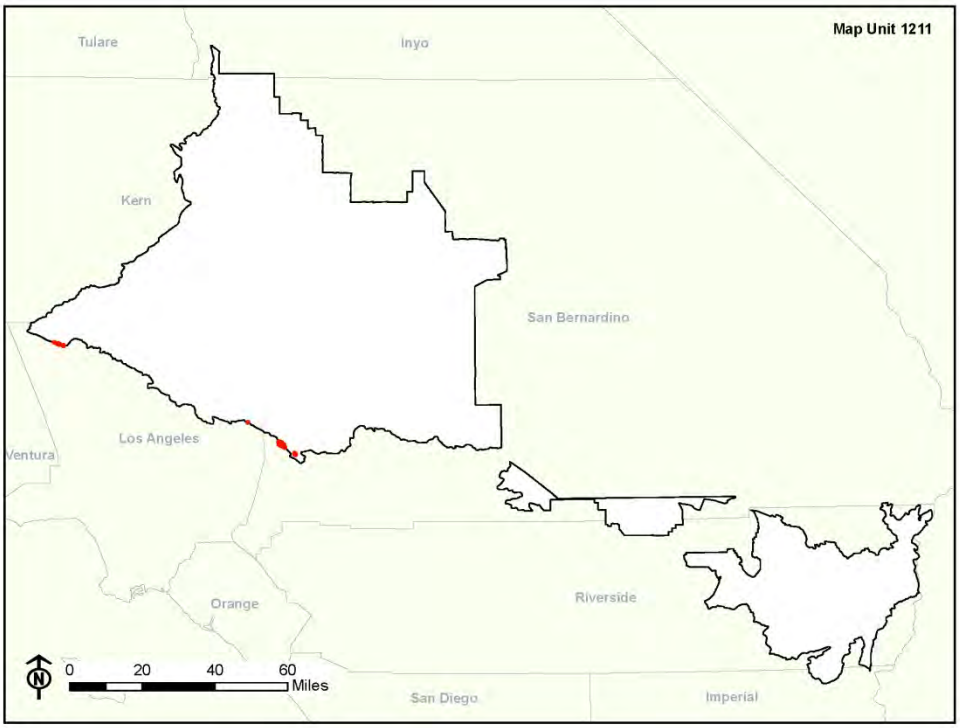
DESCRIPTION: In this Alliance stands are characterized by *Pseudotsuga macrocarpa* being evenly distributed in the canopy. *Quercus chrysolepis* is usually co-dominant, and may be up to three times the cover of *Pseudotsuga macrocarpa*. Stands of this Alliance are restricted to sheltered sites (sheltered from canopy fire on relatively steep and shady lower canyons and slopes) on Liebre Mountain and in the San Gabriel Mountains.

PHOTOINTERPRETATION SIGNATURE: Individuals are easily recognizable by the shapes of their crowns, which tend to be conical with radial branching from the main stem. Photo signature color is green to gray-green. Stands are small and several are partially burned, requiring close scrutiny of the image datasets. Most sites are also located on steep protected north slopes, making shadows a challenging factor in identifying smaller stands in this Alliance. All stands in the study area share dominance with *Quercus chrysolepis*, which is easily distinguishable by its dense and more rounded shaped crown. Stands are usually open, with a minimal understory of shrub or younger trees, which enables height recognition of these fairly tall conifers.

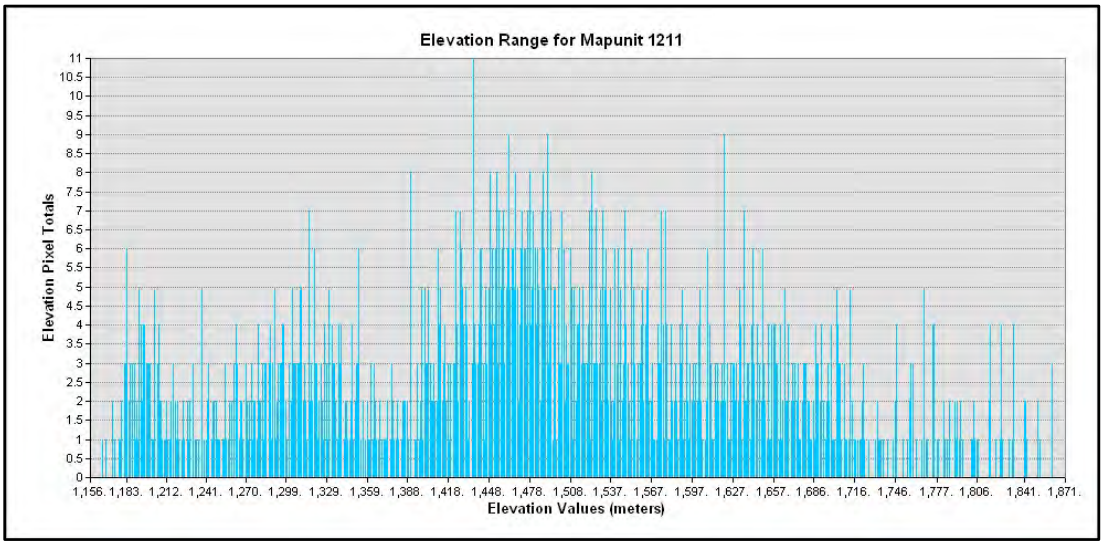
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus chrysolepis* Alliance (1113) – This type occurs nearby and within stands of *Pseudotsuga macrocarpa.* Although the two species are easily distinguishable, in such small stands it may be difficult to determine the overall relative cover densities of both. When *Pseudotsuga macrocarpa* occurs consistently within the stand, overall total canopy cover is in most cases below 30-40 percent, and therefore the conifer component is usually significant enough to assign to the *P. macrocarpa* Alliance.
- *Pinus monophylla* Alliance (1311) – This species is generally found in similar environments on steep slopes, but usually at lower elevations. Crowns are significantly smaller, less conical in shape and colors tend to be grayer. Stands are less likely to occur with *Quercus chrysolepis* and more often share dominance with *Juniperus californica*.

1211 – *Pseudotsuga macrocarpa* Alliance

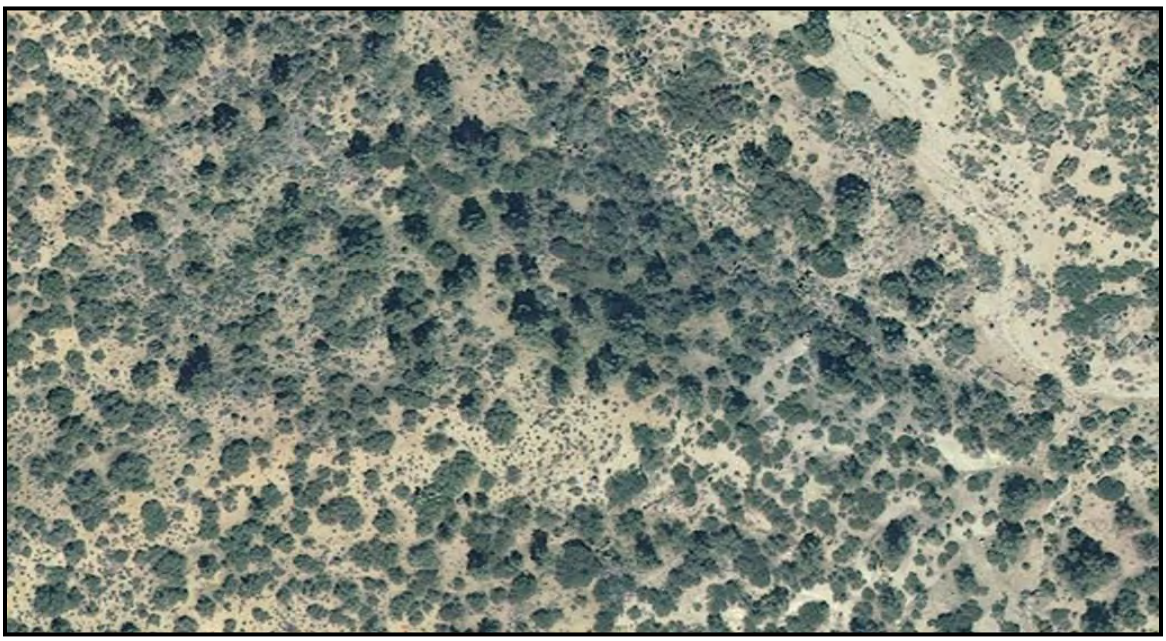


DISTRIBUTION: Small stands occur in only two areas: on Liebre Mountain in steep canyons south of Oakdale Canyon Road, and on steep north-facing slopes south of State Route 138 in Cajon Canyon. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1311 – *Pinus monophylla* Alliance

Singleleaf pinyon woodland Alliance



In this example, *Pinus monophylla* is a sparse emergent to an understory of tall shrubs including *Quercus john-tuckeri* and *Arctostaphylos glauca.* A secondary smaller shrub layer of *Eriogonum fasciculatum* is scattered throughout the stand. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.

This photo shows *Pinus monophylla* over a tall shrub layer of *Juniperus californica* and *Quercus john-tuckeri* on a steep, protected slope.

1311 – *Pinus monophylla* Alliance

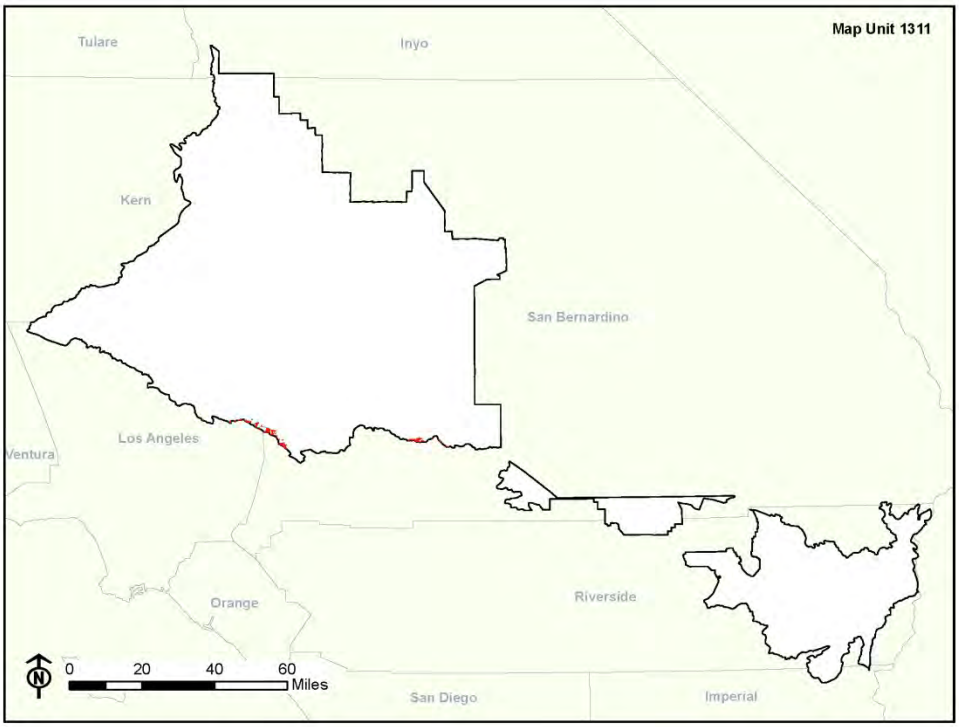
DESCRIPTION: In this Alliance *Pinus monophylla* has more than 1 percent absolute cover and is evenly distributed throughout the stand. Stands may have equal or higher cover of *Juniperus californica* and/or shrubs such as *Quercus john-tuckeri* and *Arctostaphylos glauca*. In desert and semi-desert chaparral settings *Pinus monophylla* cover can be as low as 1 percent and is usually the emergent cover where *Juniperus californica* and/or *Q. john-tuckeri* may dominate. When chaparral occurs in denser settings typically seen in less arid environments, the chaparral type normally gets assigned to the Alliance with an emergent component of pine. At lower elevations, *Juniperus californica* may be co-dominant, and sometimes may have greater cover than *P. monophylla*. *Yucca brevifolia* is often a component to lower elevation stands. At higher elevations, stands of *P. monophylla* increase in density and stands are generally larger. At higher elevations on steeper slopes, small amounts of *Quercus chrysolepis* can be a component to the stand.

PHOTOINTERPRETATION SIGNATURE: Typical stands in the *Pinus monophylla* Alliance do not often contain a strong conifer component, and therefore the pinyons in the stand are not representative of the overall signature of the mapped polygon. *P. monophylla* is detectable as an emergent to the understory tall shrub layer and is identified by the narrow irregularly shaped crown which generally is gray to blue-gray. When *P. monophylla* is a stronger component to the stand, the characteristic blue-gray signature becomes more evident. Stands can be difficult to delineate due in part to the sparse pine cover and the steep, protected, often north-trending settings in which they are found. When stands mix with *Juniperus californica,* the more rounded, brighter green juniper crowns contrast fairly well with the pines. Stands occurring over chaparral species such as *Arctostaphylos glauca* yield a greater height contrast with less of a distinction in colors.

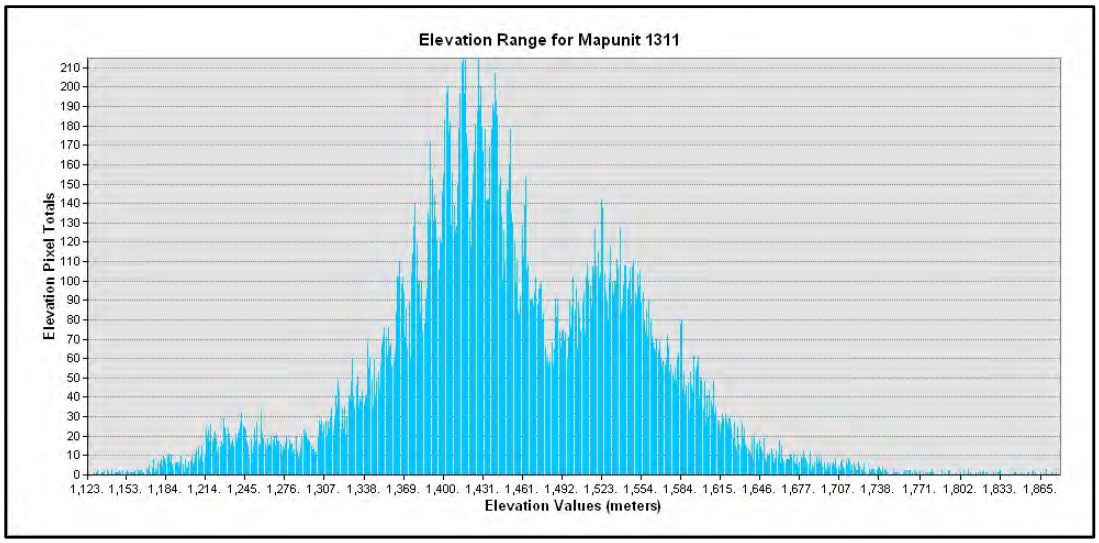
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus chrysolepis* Alliance (1113) – This type occurs at similar elevations but in more mesic settings in areas receiving higher precipitation. Stands are generally higher in tree cover. *Quercus chrysolepis* has a larger, denser crown and is more rounded with a distinct margin. Stands can have an emergent cover of *Pinus monophylla.*
- *Juniperus californica* Alliance (1122) – This species occurs at lower elevations on gentler slopes closer to the desert edge. Individuals have distinctly rounded crowns and tend usually to be brighter green. Individual crowns are denser and have more distinct margins.

1311 – *Pinus monophylla* Alliance

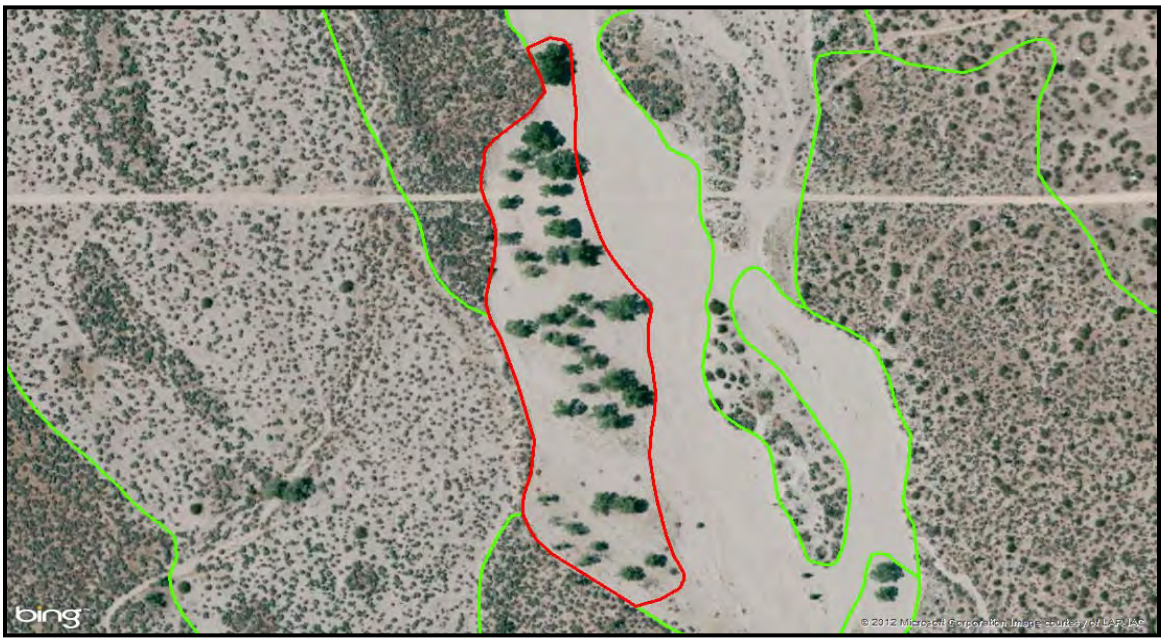


DISTRIBUTION: *Pinus monophylla* occurs in two disjunct stands in the study area: the drier eastern population near Cushenbury Canyon in the San Bernardino Mountains, and the more extensive western stands ranging from north of Lone Pine Canyon west to Pleasant View Ridge in the San Gabriel Mountains.



1411 – *Populus fremontii* Alliance

Fremont cottonwood forest Alliance



The photo depicts a “pure” stand of *P. fremontii* established in an active portion of Big Rock Wash.

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

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1411 – *Populus fremontii* Alliance

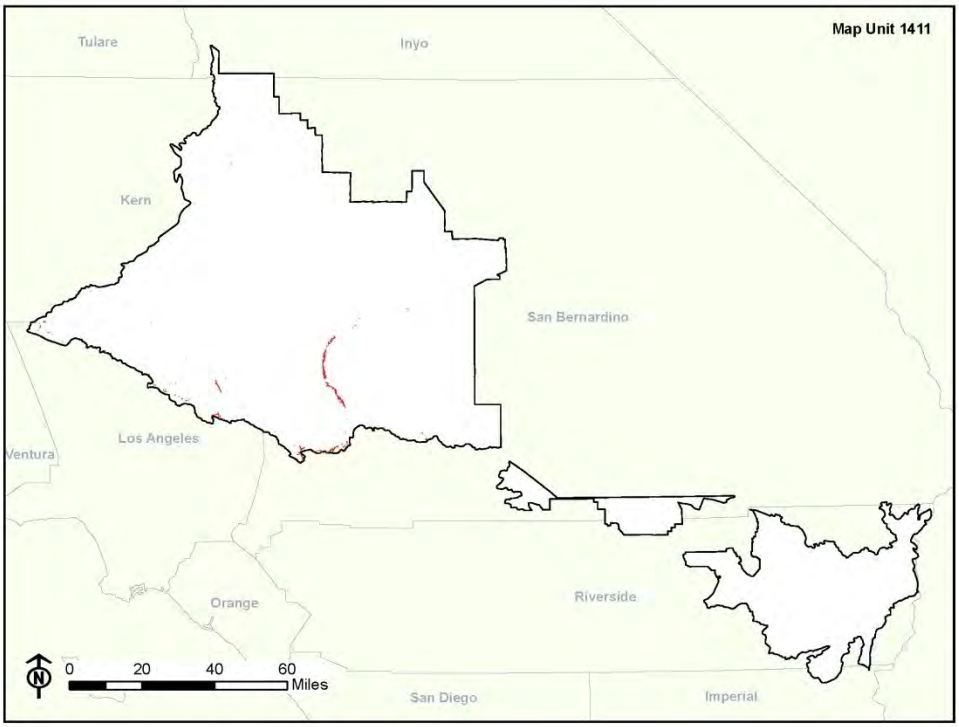
DESCRIPTION: In this Alliance *Populus fremontii* is dominant or co-dominant with over 5 percent absolute cover in the tree canopy. Stands occur along streams, springs, and valleys with a subsurface water supply. *P. fremontii* occurs with *Salix* spp., *Forestiera pubescens,* and *Baccharis* spp. among 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*, *S. exigua*, 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.

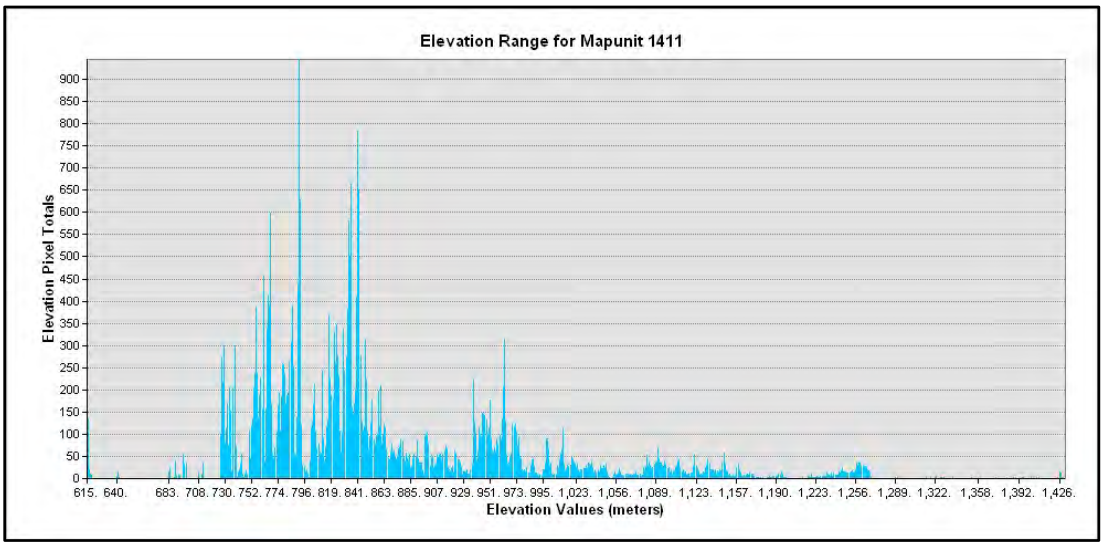
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *Platanus racemosa* Alliance (1414) – This species on average has a more irregularly shaped crown that is not as rounded as a mature cottonwood, lacking distinct crown margins. Stands of sycamore are much less common in the mapping area and tend to occur in slightly less flooded environments or in drier narrow canyons upslope from cottonwoods. Mapped sycamore polygons are usually extensions of stands that originate upstream in non-desert areas outside of the study area.

1411 – *Populus fremontii* Alliance

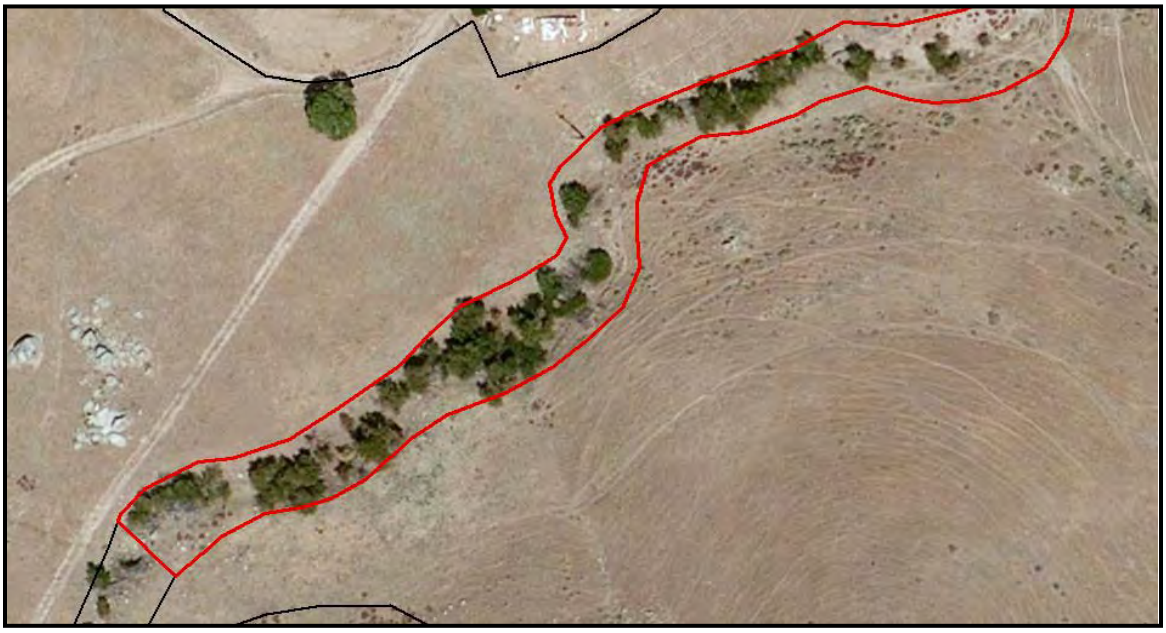


DISTRIBUTION: Stands are more well developed along the Mojave River from the Mojave Narrows Regional Park north to Helendale and along Horsethief Canyon to where it empties into the Mojave River Forks Reservoir. Isolated stands occur frequently along small washes draining the Transverse Ranges from Gorman 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.



1412 – *Salix laevigata* Alliance

Red willow thickets Alliance



This image depicts a *Salix laevigata*-dominated stand with a minor component of *Populus fremontii*.

Salix laevigata dominates the tree canopy in the foreground with some shrubby *Salix exigua.* Taller *Populus fremontii* occurs behind the stand toward the left side of the photo.

1412 – *Salix laevigata* Alliance

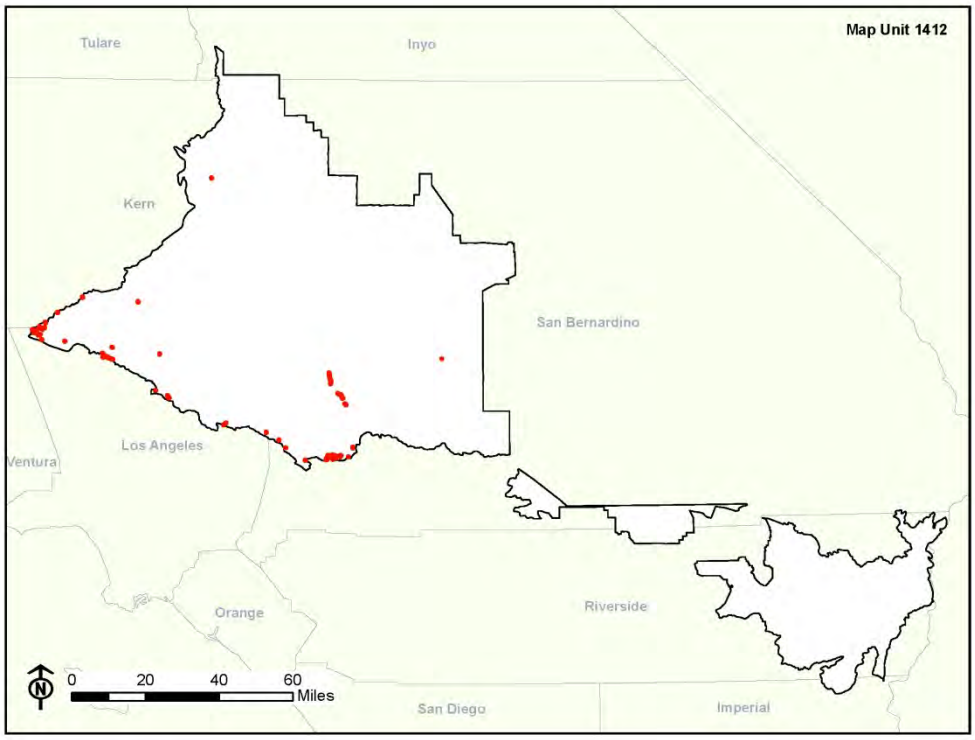
DESCRIPTION: In this Alliance *Salix laevigata* is the sole dominant species in the overstory layer with at least 10 percent cover. *Salix lasiolepis* may occur as a sub- or co-dominant in the shrub or low tree layer. Other willow species may occur in the canopy but in lower cover. Riparian trees such as *Populus fremontii* may occur in small amounts but do not co-dominate the stand. This Alliance usually occurs in small stands associated with isolated springs and seeps and locally along the Mojave River. Stands may be associated with *P. fremontii* or shrubby riparian stands of *Forestiera pubescens, S. exigua,* etc. Stands tend to colonize reservoir margins such as those associated with the California Aqueduct as at Quail Lake and Lake Palmdale.

PHOTOINTERPRETATION SIGNATURE: Stands occur in open to dense patches along riparian corridors, mainly in the non-desert portions of the study area. Trees in mature stands have multiple crowning from the main stem and tend to have a light to medium bright green color. Young stands may be much shorter and have more of an even, smoother texture.

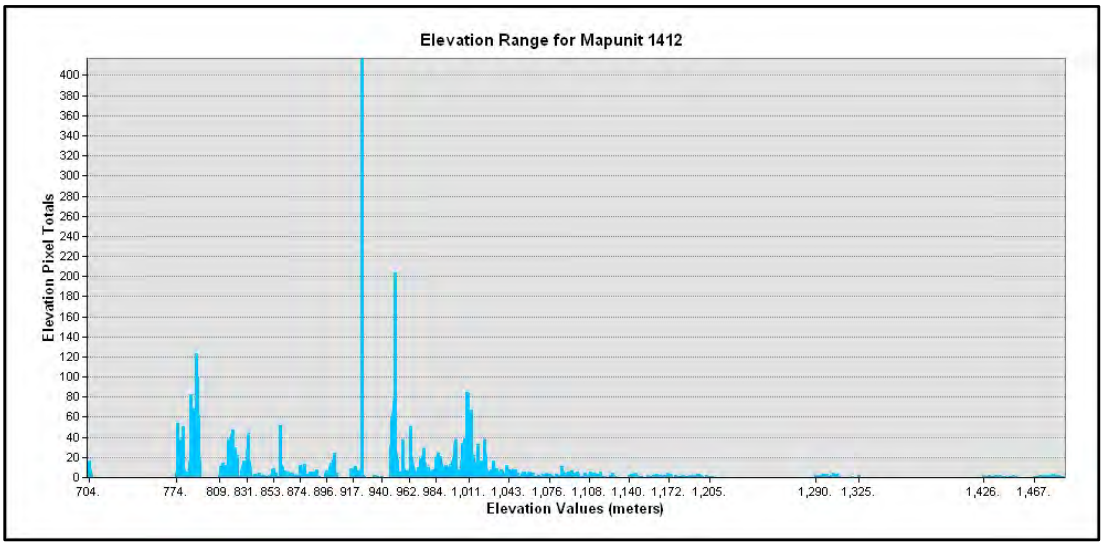
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Populus fremontii* Alliance (1411) – This species tends to have larger, more open crowns and overall has a darker green color. Both species often occur together in a stand; in these settings, photointerpreters mapped to the *Populus fremontii* Alliance. Stands are more likely to occur out of narrow canyons on broader floodplains. *Salix laevigata* associates with more permanent surface water than *Populus fremontii.*
- *Platanus racemosa* Alliance (1414) – Trees within stands dominated by *Platanus racemosa* tend to have a significantly less green appearance due to early-season leaf stress. Crowns are poorly defined and cover is generally lower. Stands tend to be isolated in very narrow canyons. Mapped sycamore polygons are usually extensions of stands that originate upstream in non-desert areas outside of the study area.
- *Salix lasiolepis* Alliance (1427) – Stands dominated by this willow species are generally not separable from immature stands of *Salix laevigata* because of structural unevenness due to vegetation age inconsistency within the stand. In older stands, overall height is generally more uniform throughout, resulting in a smoother texture to the signature.

1412 – *Salix laevigata* 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. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1414 – *Platanus racemosa* Alliance

California sycamore woodlands Alliance

In this example, *Platanus racemosa* intermixes with *Populus fremontii* on a broad stream terrace near the confluence of two creeks in Valyermo.

Platanus racemosa dominates the tree canopy in this narrow stand north of Cruthers Canyon.

1414 – *Platanus racemosa* Alliance

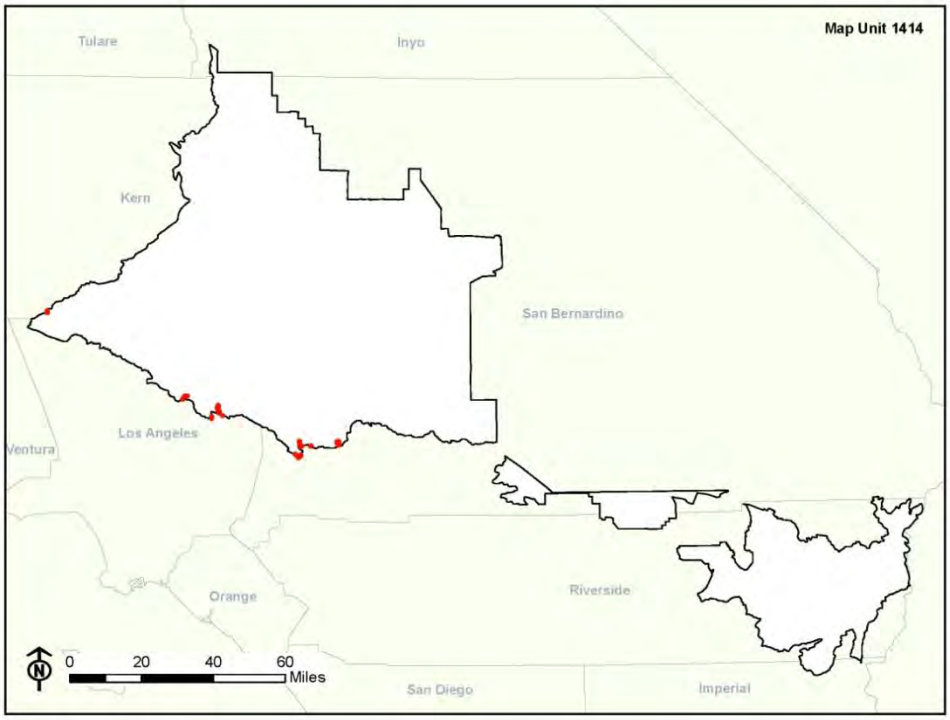
DESCRIPTION: *Platanus racemosa* dominates or co-dominates the riparian tree canopy with more than 8 to 10 percent cover. If present, *Populus fremontii* is less abundant than *Platanus racemosa*. Stands of this Alliance are found along seasonally flooded stream courses in the non-desert portions of the study area and are often associated with other stands of riparian trees or shrubs. Individuals of *Platanus racemosa* occur as far north as Victorville in the Mojave River floodplain, but stands are limited to within a few miles of the edge of the ecoregion. Stands are more common in the Cajon Pass area.

PHOTOINTERPRETATION SIGNATURE: *Platanus racemosa* has an open, irregularly shaped crown with the main stem (white color) visible on larger individuals. Crown color is usually medium green on healthy individuals; trees undergoing a leaf-stress phase tend to have a brownish tint. Understory vegetation can be grassy with a sparse shrub component but more often is sparsely vegetated with a cobble substrate.

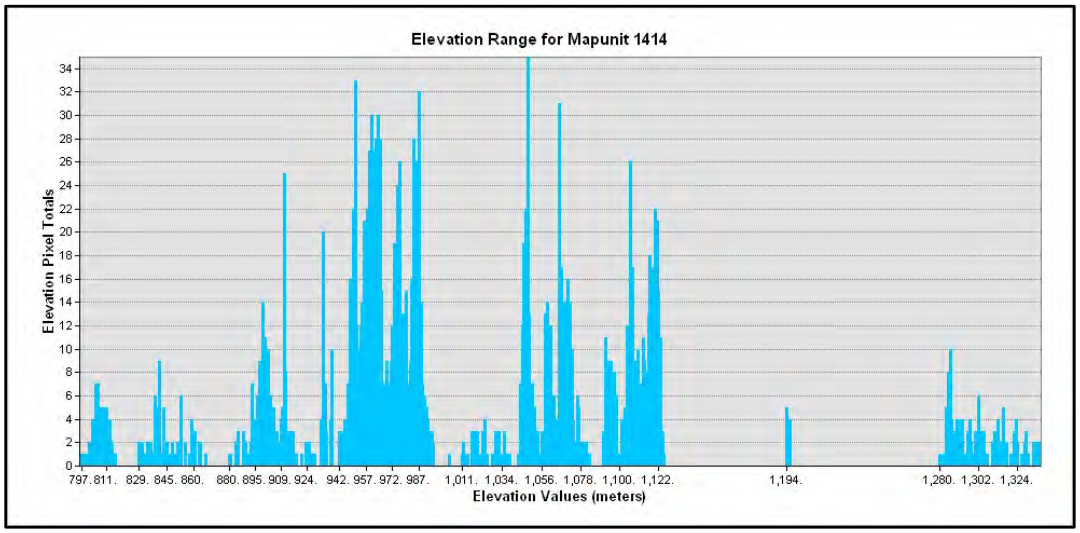
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Populus fremontii* Alliance (1411) – This species tends to have larger, more rounded crowns and overall has a darker green color. Both species can occur together in larger riparian woodlands and in narrow canyons fed by larger, seasonally flooded streams draining the Transverse Ranges.
- *Salix laevigata* Alliance (1412) – Both types can occur in narrow, seasonally flooded canyons; *Salix laevigata* is however more likely associated with small springs. Stands are denser but do not extend along the channel much below the water source and therefore are generally smaller. Crown colors vary less, and are almost always a fairly uniform green. Multiple crowning on larger individuals can at times be visible.

1414 – *Platanus racemosa* Alliance



DISTRIBUTION: Stands are very limited in the study area and predominantly occur in protected canyons along major drainages in the mountains and foothills of the San Bernardino and San Gabriel Mountains, with fairly large stands occurring in broad protected washes along Big and Little Rock Creeks. In the Summit Valley area below Silverwood Lake, there are a couple of large stands that occupy a broad grassy flat near the Mojave River. In the mountains near Cajon Pass, stands are found in Lone Pine Canyon and along smaller tributaries. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1422 – *Baccharis salicifolia* Alliance

Mulefat thickets Alliance

In this example, *Baccharis salicifolia* occupies a small channel braid with scattered individuals seen as dark green, small-crowned shrubs.

Baccharis salicifolia dominates the riparian shrub layer along the margins of the Mojave River near Helendale. Tall individuals of *Populus fremontii* occur in the background.

1422 – *Baccharis salicifolia* Alliance

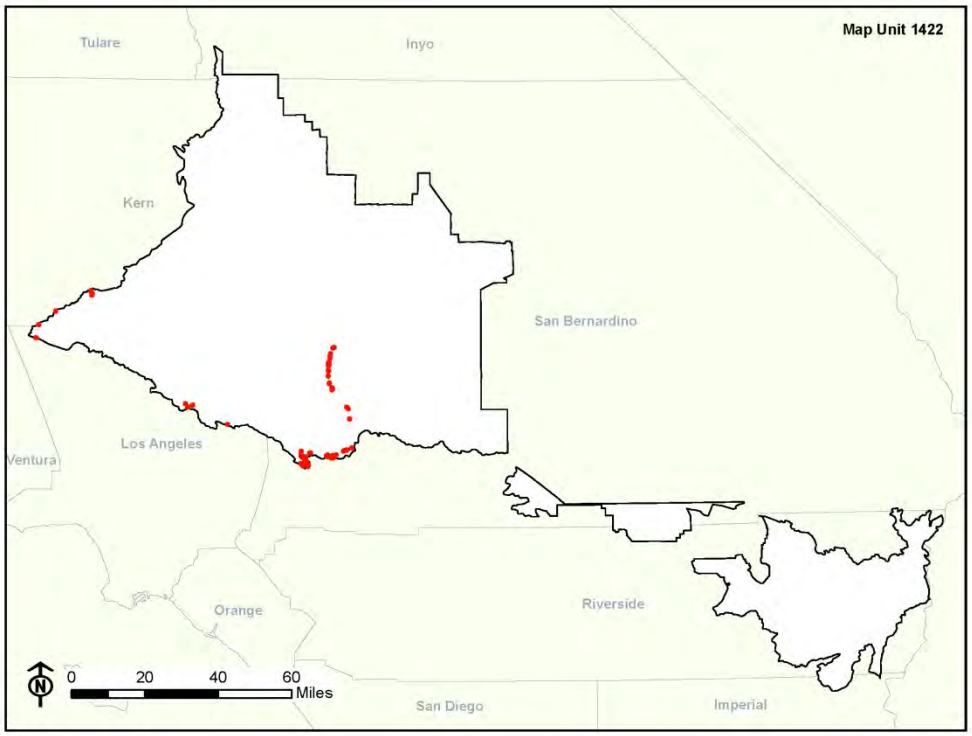
DESCRIPTION: The shrublands in this Alliance are characterized by the dominance of *Baccharis salicifolia,* which is usually more than 50 percent of the relative cover in the shrub layer. An emergent and sparse tree layer of willows or other species may also be present. The Alliance is found in upper arroyos on alluvial fans, where it is adjacent to *Populus fremontii, Salix gooddingii, Tamarix* spp., or other riparian stands.

PHOTOINTERPRETATION SIGNATURE: *Baccharis salicifolia* occurs in narrow bands in a wide range of cover along both the drier and more active portions of the stream channel. Stands with a dense cover tend to have a brownish to dark green color with a smooth texture. Sparser stands tend to have these same colors with a sparsely vegetated, very light-colored sandy to gravelly substrate. Individual crowns are small and poorly defined.

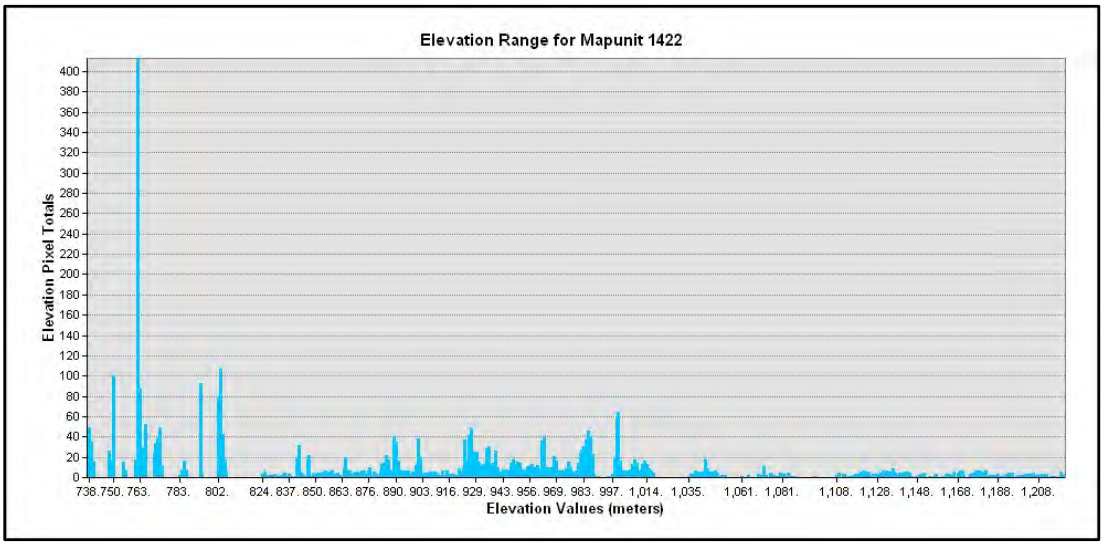
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salix exigua* Alliance (1424) – Riparian stands in mid- and late-season phases will almost always have a blue-gray to blue-green signature color. Only the youngest stands will lack any blue tint to the color. Both types occupy similar settings and cover height and density characteristics overlap considerably.
- *Salix lasiolepis* Alliance (1427) – This species also occurs in or immediately adjacent to the streambed. In general, cover tends to be denser, and overall canopy is taller. In stands where cover is similar, the signature tends to be brighter green, but texture generally remains smooth throughout.
- *Tamarix* spp. Semi-natural Stands (1432) – Stands of *Tamarix* can occur in similar settings to *Baccharis salicifolia,* but overall the setting is less restrictive than the above two types. Cover characteristics also overlap and range from sparse to thicket-like, where density often exceeds 60 percent. Young tamarisk generally displays a brighter green signature; as the stand matures, the color becomes highly variable within the stand, ranging from dark brown to blue-gray. Crown shapes in younger stands are very similar to *Baccharis*. Mature stands are easily separable from *Baccharis*-dominated thickets.

1422 – *Baccharis salicifolia* Alliance

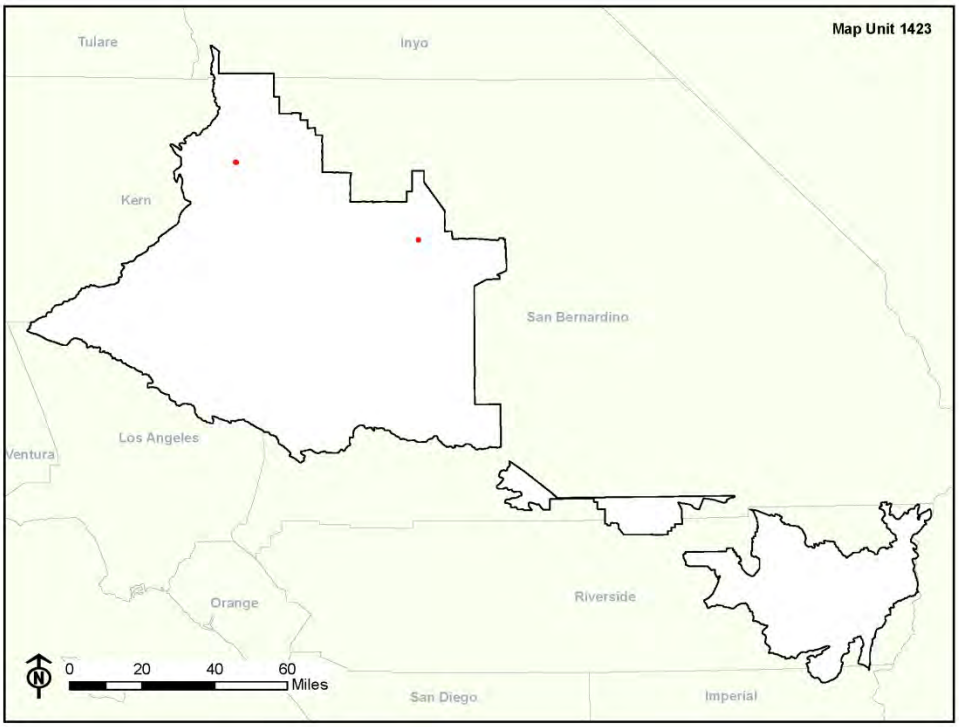


DISTRIBUTION: The Alliance is found in arroyos adjacent to upper alluvial fans which emerge from the San Gabriel, San Bernardino, and Tehachapi Mountains. Stands also establish along the Mojave River from the Mojave Narrows in Victorville northward and continue downstream to the town of Helendale. Note: In the distribution map above, the size of the polygons has been enhanced 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, the size of the polygons has been enhanced for display purposes.

1424 – *Salix exigua* Alliance

Sandbar willow thickets Alliance

The image shows the matted blue-gray clumps of *Salix exigua* occupying a broad wash. Dead shrubs and grasses from previous years appear as the shorter, dull gray signature seen mixing in the stand.

This photo gives a close-up view of a flowering *Salix exigua*. *Populus fremontii* is visible in the background on the right side of the photo.

1424 – *Salix exigua* Alliance

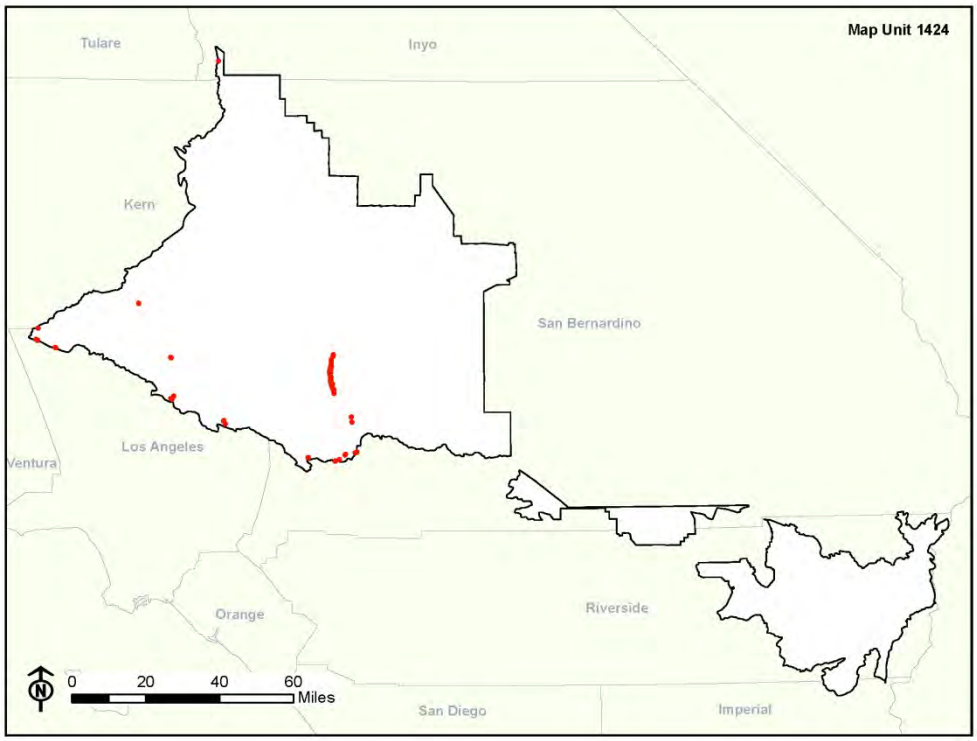
DESCRIPTION: *Salix exigua* is characteristically present as a dominant or co-dominant shrub with more than 5 percent absolute cover. *S. exigua* forms an open to continuous canopy along riparian corridors. Stands are often found in narrow strips along major creeks and rivers and along ditches and reservoir edges. Other willow species may be present as sub-dominants with low cover. *Salix exigua* dominates stands, with more than 50 percent relative cover in the shrub layer.

PHOTOINTERPRETATION SIGNATURE: Signature color in the mature growth phase is characteristically blue-green to blue-gray, with variability caused by differences in plant maturity and the dead component to the vegetation. Alternatively, young plants may yield a greener color tone. Stands are typically small in size, with individual crowns coalescing into smooth, continuous thickets. Dense patches are characteristically homogeneous, with other riparian species frequently occurring along the margins of the stand or clonal clumps. Stand cover may range from sparse to very dense but more often than not, cover is high.

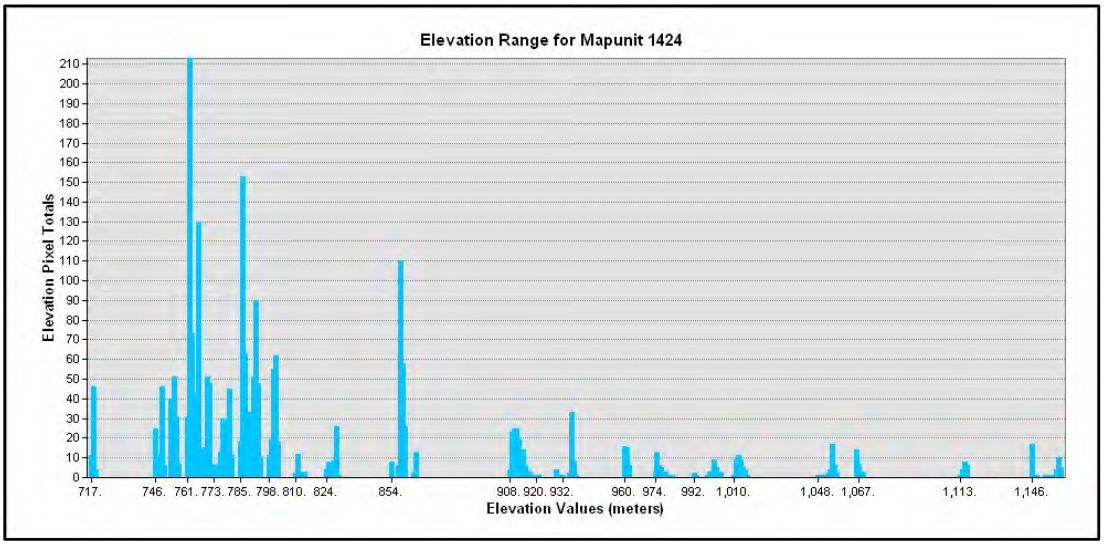
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salix laevigata* Alliance (1412) – Young stands forming thicket-like vegetation often contain a co-dominance of *Salix laevigata* along with other *Salix* species that are not distinguishable from one another. Mature trees are easily recognizable by their characteristic multiple crowning structure and lighter green color.
- *Baccharis salicifolia* Alliance (1422) – These shrubs grow in similar wash settings but generally have a dark green to dark brown signature color. Stands with sparse cover tend to have a more stippled appearance and are less clumpy and more consistent across the stand.
- *Salix lasiolepis* Alliance (1427) – This species also grows in dense cover along washes, but plants are distinguished by a slightly taller overall crown and dark green signature color.

1424 – *Salix exigua* Alliance



DISTRIBUTION: The majority of stands for this Alliance occur along the Mojave River corridor. A few stands are established in Big Rock Wash and around Lake Palmdale and Quail Lake. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1425 – *Forestiera pubescens* Alliance

Desert olive patches Alliance

The photo depicts a foothill stream terrace adjacent to Pallett Creek where *F. pubescens* is mixed with the shorter gray *Ericameria nauseosa*. Bordering to the north is a stand of *Populus fremontii* lining the streambed.

This example displays the dense highly branching crown of *F. pubescens* occurring in a small draw at the foot of a hill.

1425 – *Forestiera pubescens* Alliance

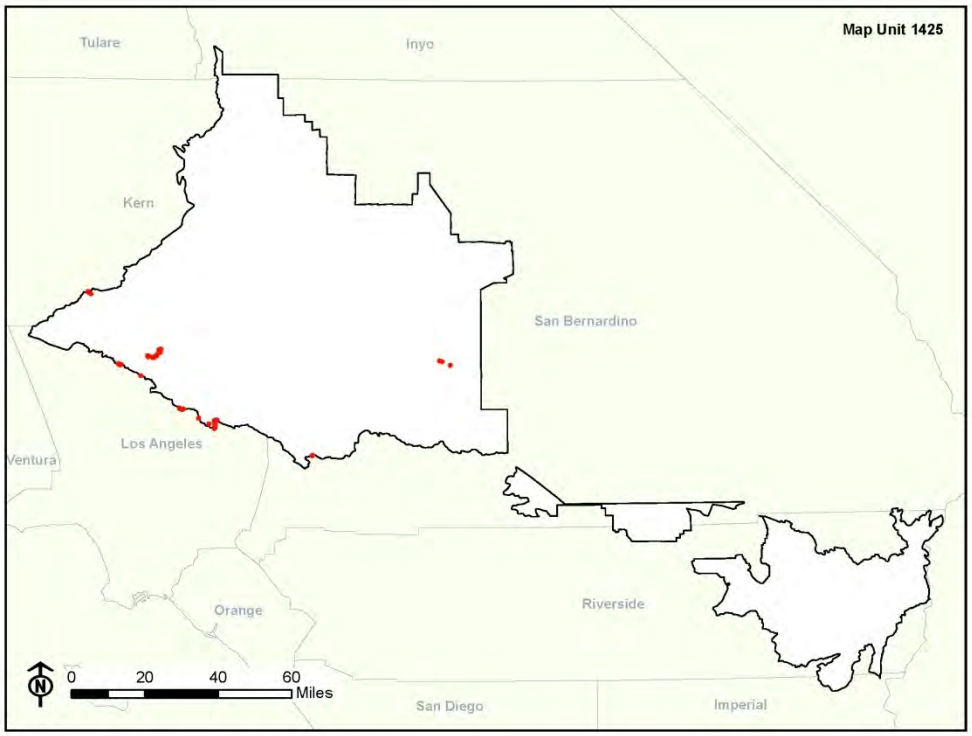
DESCRIPTION: *Forestiera pubescens* is the dominant shrub species in the canopy of this Alliance, which is usually found locally around permanent water or subsurface moisture. Stands occur in the western part of the mapping area adjacent to alkaline flats or on steeper slopes and along ravines in the Sierra Pelona. Isolated small patches also occur in mostly montane foothill areas around springs or in bottoms of narrow canyons in the foothills of the Ord and El Paso Mountains and the Sierra Nevada. Compared to the *Salix exigua* and *Populus fremontii* Alliances, the *Forestiera pubescens* Alliance seems to prefer slightly drier conditions upslope from flowing water. Stands are usually dense with a sparse understory.

PHOTOINTERPRETATION SIGNATURE: Stands may appear open to dense in cover, occupying areas adjacent to washes and small drainages. This medium-to-tall shrub appears bright green with rounded crowns, forming definitive edges along the margins of the stand. High resolution imagery depicts numerous branches radiating from the main stem of individual plants. Young or regenerating stands may coalesce into clonal thickets, forming a stippled dense mat of shrubs. Isolated stands in non-riparian settings are sparse in cover, and individual shrubs have rounded crowns.

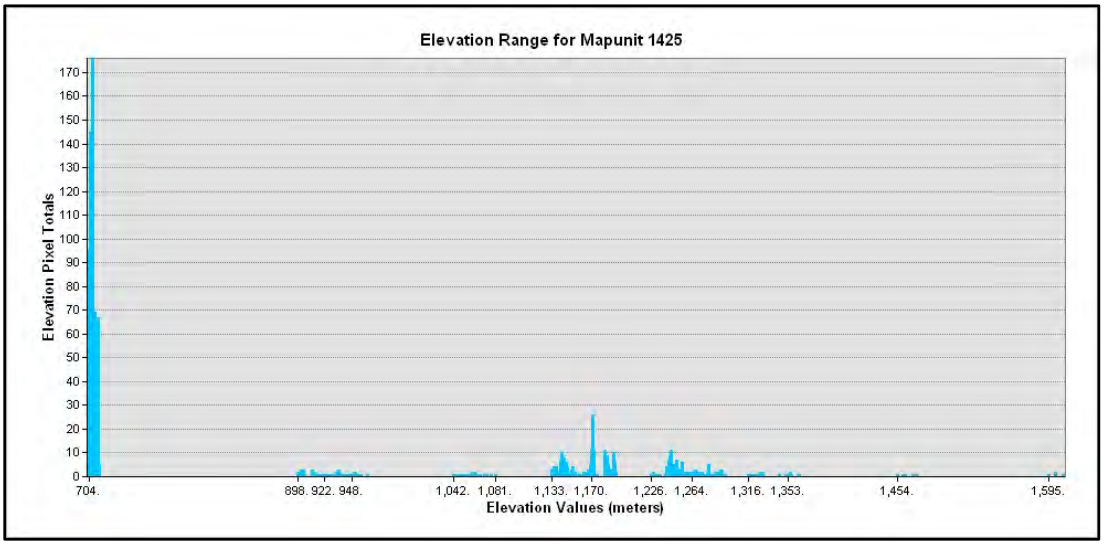
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salix lasiolepis* Alliance (1427) – This type typically occupies stream bottoms, whereas *Forestiera pubescens* tends to prefer slightly drier conditions upslope from streambeds but in close proximity to subsurface water. Crown branching is less visible, and therefore individual crown texture tends to be smooth rather than stippled.
- *Prosopis glandulosa* Alliance (4222) – Stands of *Forestiera pubescens* occurring in non-wash settings have cover characteristics and crown shapes similar to *P. glandulosa.* In these settings, (notably in more alkali environments north of Lancaster), *F. pubescens* tends to have rounded crowns but can be distinguished from *P. glandulosa* by the radial branching within the individual crowns. Stands of *P. glandulosa* tend to be on sandier substrate and although individuals may occur nearby, core populations do not overlap in range.

1425 – *Forestiera pubescens* 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. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1426 – *Sambucus nigra* Alliance

Blue elderberry stands Alliance

In this stand, *Sambucus nigra* (the larger light green shrub with a rounded crown) is widely scattered over a grassy understory. This stand is located in Summit Valley in a post fire setting. *Prunus fasciculata* increases in cover toward the eastern margins of the stand. A narrow band of *Ericameria cooperi* follows the northwest boundary of the polygon.

This photo shows an open *Sambucus nigra* stand over shrub and grass understory. The tall shrub in the background in flower is *Sambucus nigra*. *Artemisia tridentata* is seen in a linear band in the foreground. *Adenostoma fasciculatum* dominates the hills in the background.

1426 – *Sambucus nigra* Alliance

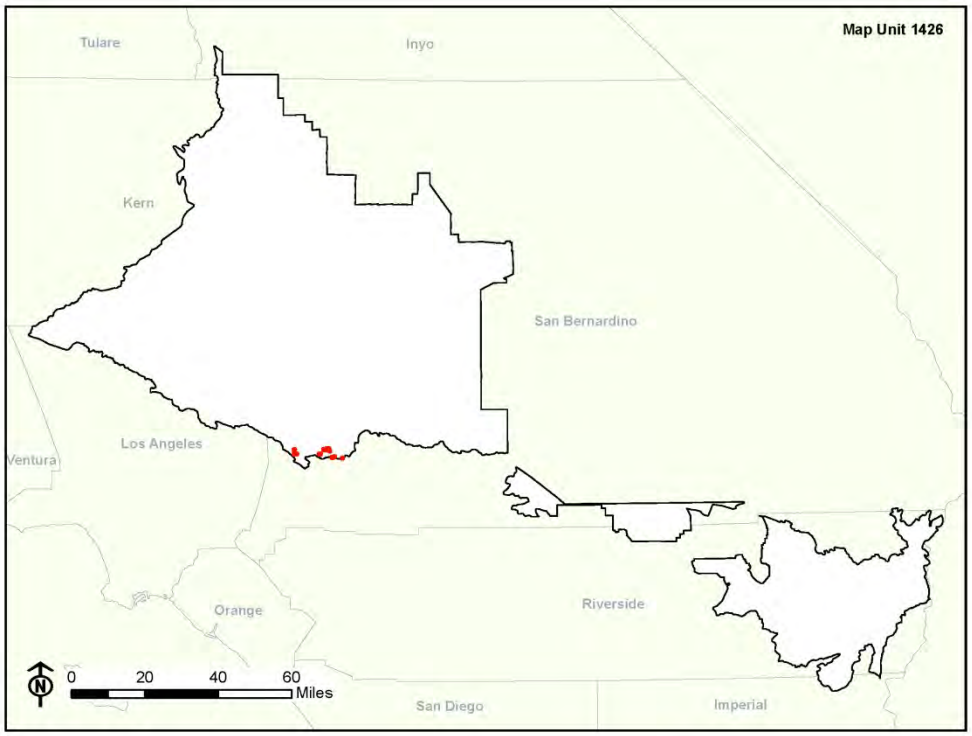
DESCRIPTION: In this Alliance *Sambucus nigra* is dominant in the overstory; however, other shorter shrubs such as *Artemisia tridentata* ssp. *tridentata* and *Eriodictyon* spp. may be equal or somewhat higher in cover. Although considered a shrub, *S. nigra* usually takes the form of a small tree, which forms open, well-spaced stands with a shorter shrub and herb understory. Mappable stands occur only in the margins of the study area, including moist bottomlands adjacent to the Mojave River near Hesperia, south to Mormon Rocks and Cajon Pass.

PHOTOINTERPRETATION SIGNATURE: In leaf-on conditions, *Sambucus nigra* appears as a large, bright green shrub with a rounded, well-defined crown. Stands are characterized by widely spaced shrubs with a highly variable cover. A normally dense herbaceous cover yields a tan to light gray signature to the understory. Shrub diversity is generally high, with other species including *Ericameria cooperi, Eriodictyon trichocalyx* and other early seral species adding to the variability of the signature. Most stands contain numerous individual shrubs that are highly stressed or dead, with crowns typically having a light to dark gray color.

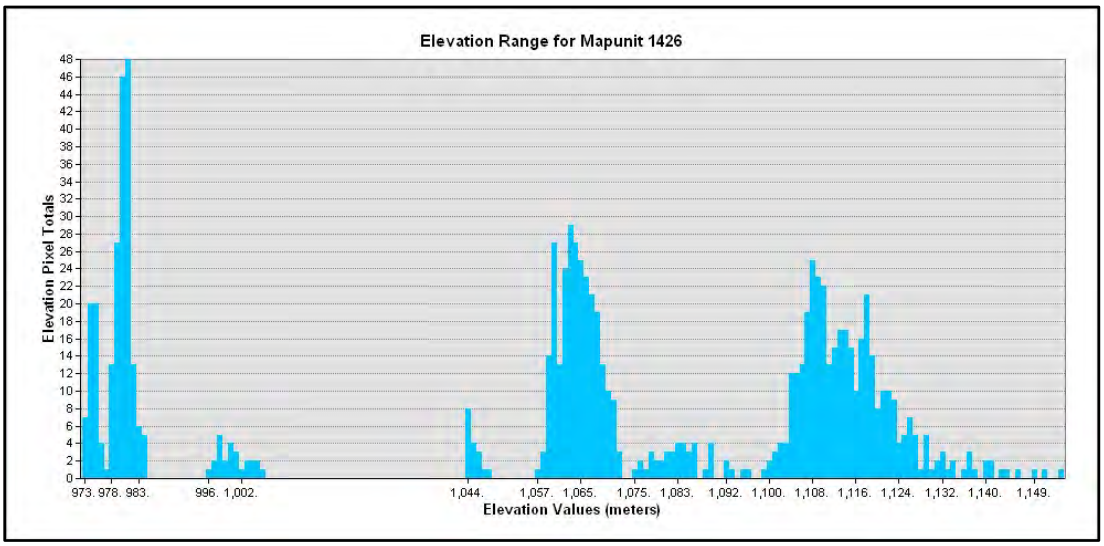
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Prunus ilicifolia* Alliance (2134) – Stands dominated by *Prunus ilicifolia* have similar cover characteristics and also occur over a dense herbaceous understory. Crowns also tend to be rounded but are more variable in size. Shrubs are generally darker green and stands tend to occur on steeper topography, often in small canyons and associated lower to middle slopes.
- *Prunus fasciculata* Alliance (4214) – Stands dominated by *Prunus fasciculata* occur in similar settings in Summit Valley. Crowns tend to be slightly smaller and darker green, and are generally very dense with no openings. Cover characteristics tend to yield a clumpier pattern, often occurring in small, widely scattered but dense patches.

1426 – *Sambucus nigra* Alliance



DISTRIBUTION: The *Sambucus nigra* Alliance is mapped only in the foothills of the San Bernardino Mountains, primarily in Cajon Canyon, Summit Valley, and the foothill canyon bottoms north of Summit Valley. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1427 – *Salix lasiolepis* Alliance

Arroyo willow thickets Alliance

In this example *S. lasiolepis* grows in dense cover, with mature plants attaining a fairly uniform height across the stand. Sparse patches of *Baccharis salicifolia* occur on drier areas of the floodplain along the eastern portion of this stand.

S. lasiolepis is seen in this photo growing in dense cover averaging about five meters in height.

1427 – *Salix lasiolepis* Alliance

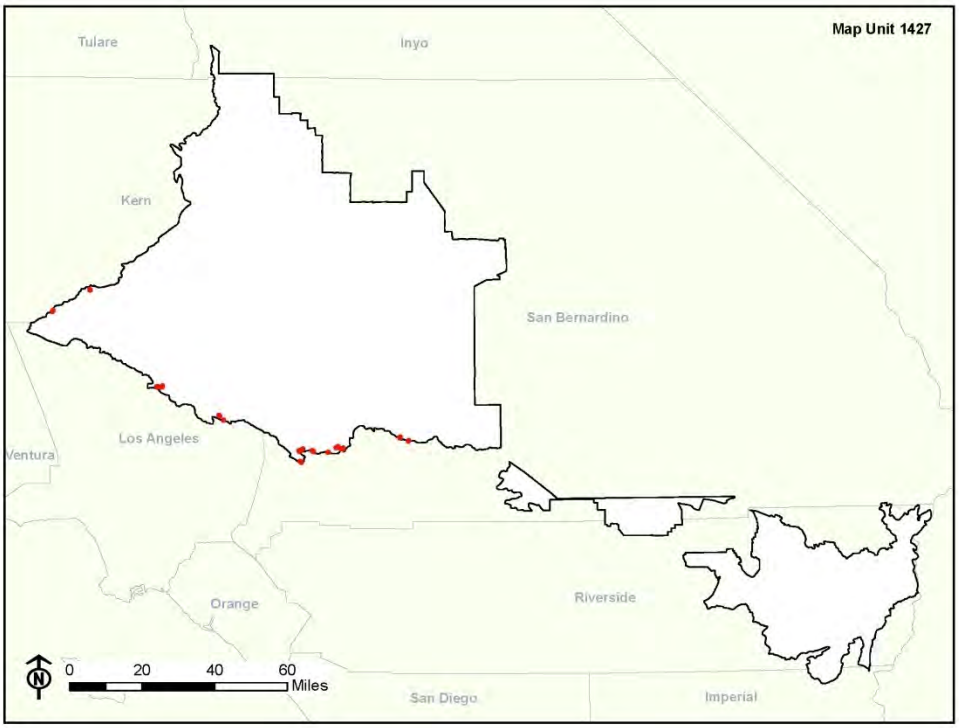
DESCRIPTION: In this Alliance the relative cover of *Salix lasiolepis* is over 50 percent, and no other willows are dominant or subdominant. Considered a shrub even though it may be taller than five meters, *Salix lasiolepis* may be accompanied by *Baccharis salicifolia* or other riparian shrubs. Small stands occur adjacent to freshwater streams and drainages in the western portion of the mapping area, usually at the margin of the desert ecoregion such as near Cajon Pass. If present, *S. laevigata* is less abundant than *S. lasiolepis,* and *Platanus racemosa, Populus* spp., and *S. gooddingii* all occur with very low cover.

PHOTOINTERPRETATION SIGNATURE: Stands characteristically attain a fairly uniform height when mature, usually averaging about five meters. Confusion occurs in thicket settings where several species of young willows may co-occur. In these settings, it is not possible to distinguish *S. lasiolepis* using even the highest-resolution imagery. Colors may be dark green to bright green to yellow during late-season leaf change. Most stands attain dense cover and yield a fairly smooth texture overall. Stand cover may vary due to natural flooding events.

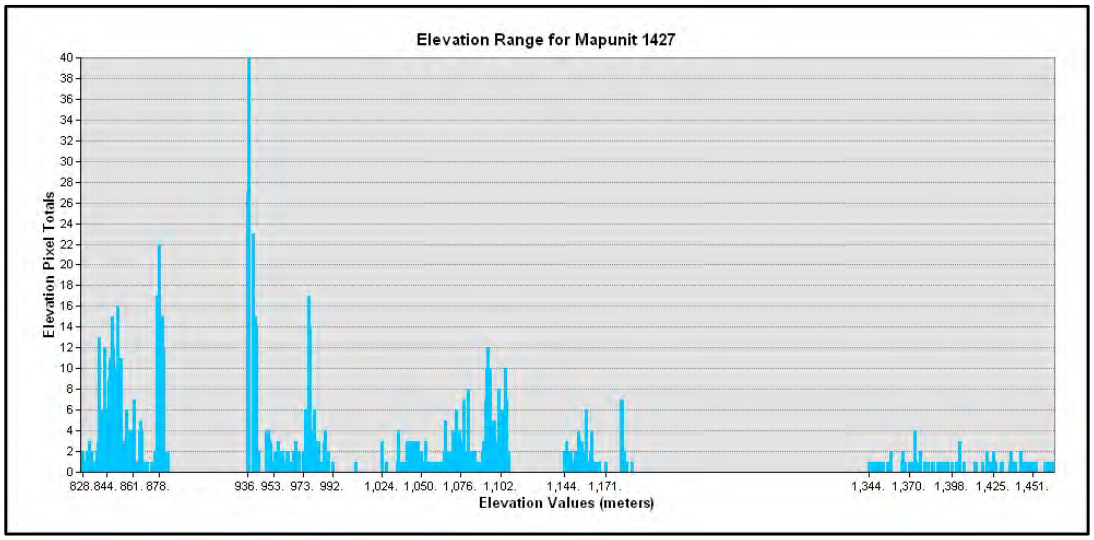
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES

- *Salix laevigata* Alliance (1412) – Typically these trees are significantly larger, with mature trees displaying multiple crowning. Younger stands are indistinguishable from other willow species. *Salix laevigata* is more likely to occur in spring-fed canyons, and cover is more variable along the stand.
- *Baccharis salicifolia* Alliance (1422) – These plants generally have a wider range of cover and sandy substrate is often visible in sparser stands. Overall signature color is darker green or trends to a greenish brown, and canopy height is significantly shorter.
- *Salix exigua* Alliance (1424) – *Salix exigua* can grow in similar cover characteristics but has a distinctive silvery blue or silvery green color.
- *Forestiera pubescens* Alliance (1425) – This type tends to occur in slightly drier conditions perched above the bottom of the wash along the terrace or in narrow upland concavities, whereas *S. lasiolepis* occurs directly adjacent to the wash or in stream bottoms. Crowns tend to have radial branching and more rounded margins.
- *Alnus rhombifolia* Alliance (1511) – This species grows in dense narrow bands in or immediately adjacent to perennial channels, but typically these trees are taller in size and are very rare within the study area.

1427 – *Salix lasiolepis* Alliance



DISTRIBUTION: This Alliance is uncommon in the desert and is restricted to larger drainages and protected canyon bottoms in the mountains and foothills. In the mountains, the highest concentration of stands occurs in drainages adjacent to Cajon Canyon. A handful of stands are found in the broad flat of Summit Valley where the Mojave River exits the San Bernardino Mountains. A few isolated stands are mapped along Big Rock Creek near the town of Valyermo, and along Anaverde Creek southeast of Palmdale. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1431 – *Arundo donax* Semi-natural Stands

Giant reed breaks Semi-natural Stands

This example of dense *Arundo donax* occurs along the margins of the Colorado River on the Colorado River Indian Reservation. The example depicts a larger than average stand, and *Arundo donax* is the sole dominant.

In this photo, *Arundo donax* is the taller green cane-like grass behind a dense post-growth phase of *Schoenoplectus* showing up as a light tan color adjacent to the river.

1431 – *Arundo donax* Semi-natural Stands

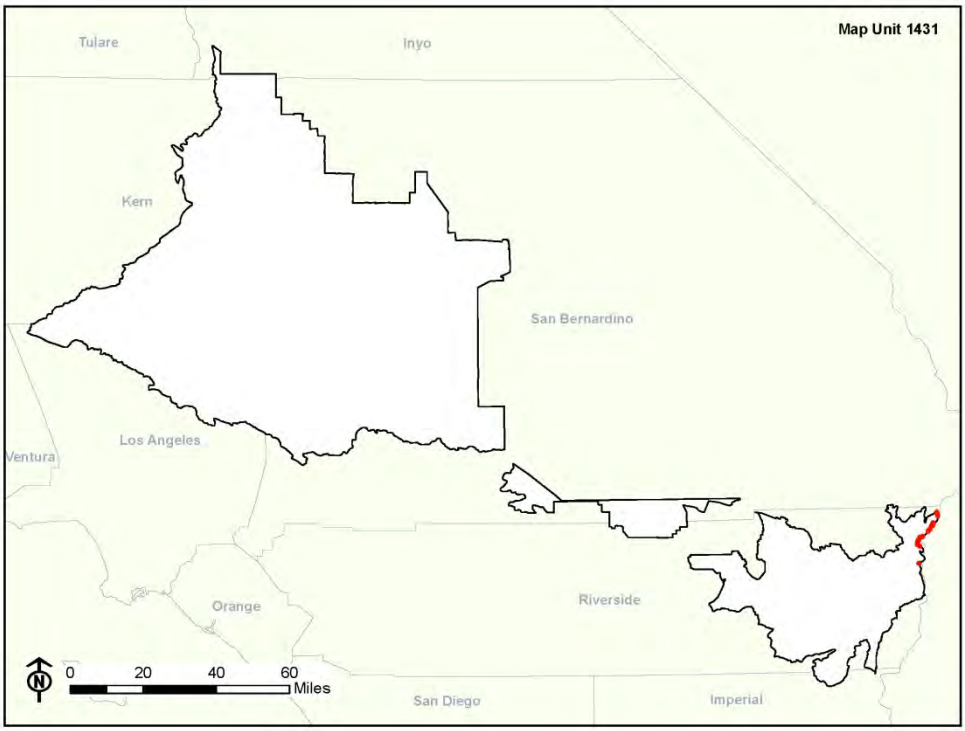
DESCRIPTION: *Arundo donax* dominates as clonal clumps in moist areas. A few small stands occur in moist areas along ditches or occasionally in lines along property boundaries or planted as windbreaks. It may not occur in the study area as true semi-natural stands. The characteristic signature of *Arundo* should be sufficient to pull out small planted stands (exotic plantings as part of development polygons), but the semi-natural *Arundo donax* type is reserved for areas that are not planted or are at least expanding.

PHOTOINTERPRETATION SIGNATURE: Mappable stands occur exclusively along the Colorado River and occur on the drier side of *Schoenoplectus* stands or along the water's edge. Small patches that are below the minimum mapping unit were noted on reconnaissance efforts throughout the study area. Stands typically yield a light green color, with tan components accounting for the previous season's dieback. Image texture has a characteristic stippled patterning from the numerous densely occurring individual tall canes. Stands often form distinct, well-defined margins.

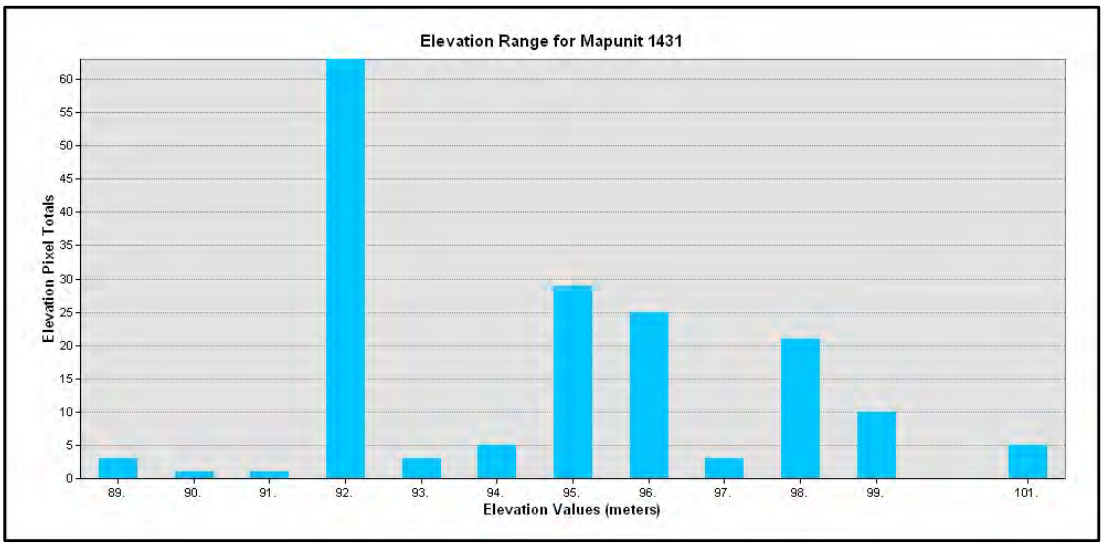
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Phragmites australis* Alliance (3411) – Although not observed as mappable stands in the study area, this species often yields a similar signature to *Arundo donax.* Field verification determined all of the tall cane species along the Colorado River to be *Arundo donax. Phragmites australis* stands do occur elsewhere along the Colorado River south of the mapping area.

1431 – *Arundo donax* Semi-natural Stands

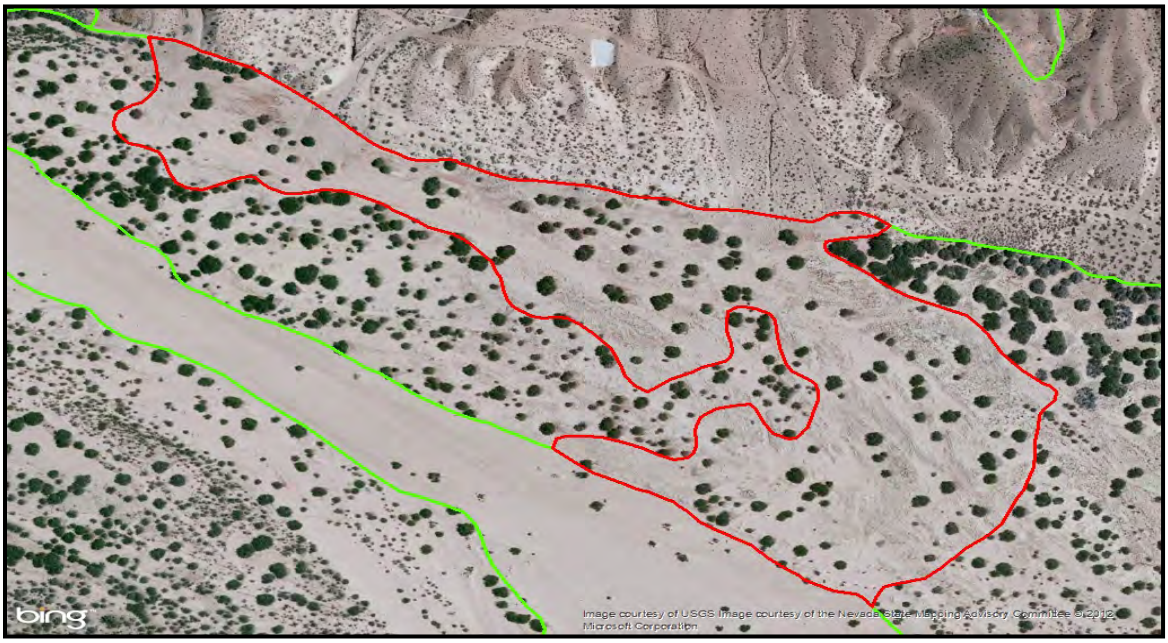


DISTRIBUTION: Mappable stands of *Arundo donax* Semi-natural Stands occur exclusively along the margins of the Colorado River in Subarea 3. Widely scattered isolated patches and individual canes occur in flooded sites throughout the remainder of the study area, especially along the Mojave River, where a removal program is currently underway. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



1432 – *Tamarix* spp. Semi-natural Stands

Tamarisk thickets Semi-natural Stands



This area on the Mojave River shows a sparse cover of *Tamarix* (red polygon) 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

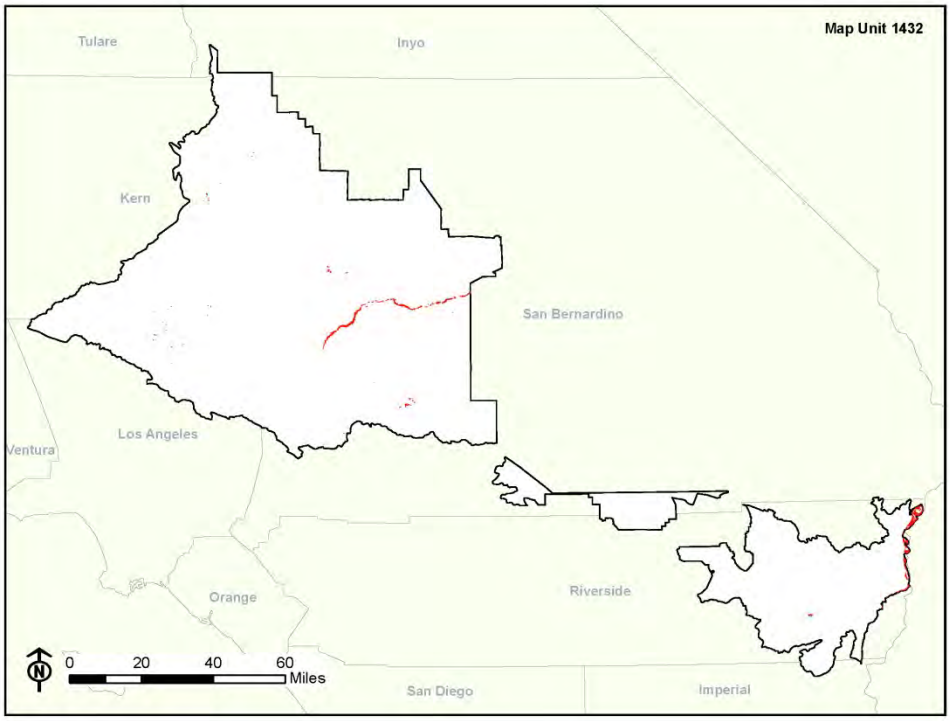
DESCRIPTION: In these semi-natural stands the vegetation is strongly dominated by tall shrubby invasive *Tamarix* spp., such as *T. ramosissima, T. chinensis*, or other similar species. *Tamarix* spp. constitutes more than 60 percent of the relative cover. These stands do not include the less invasive, 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 in riparian washes and 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, somewhat rounded to 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.

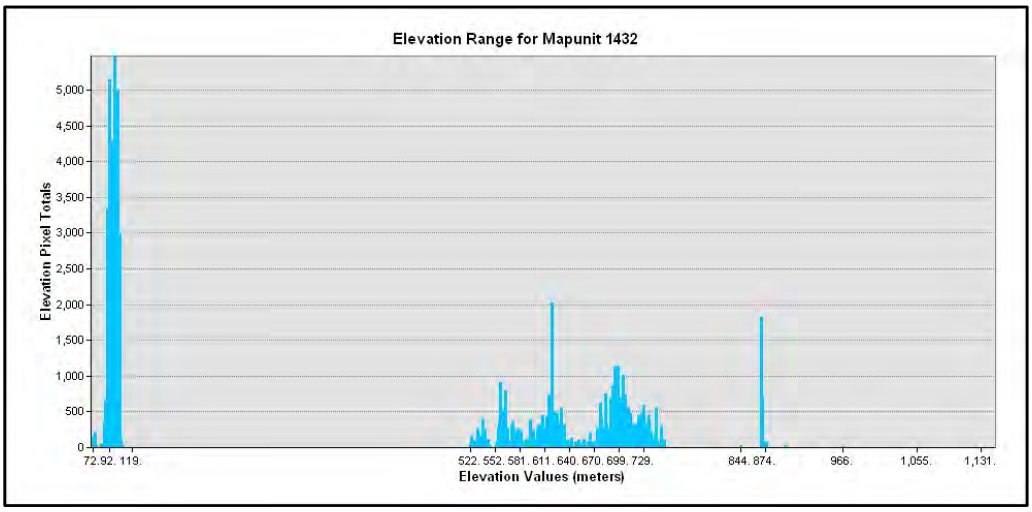
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 Alliance 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.



1511 – *Alnus rhombifolia* Forest Alliance

White alder groves Forest Alliance

The bright green linear stand of *Alnus rhombifolia* in this image occurs along the margins of this active perennially flowing stream channel.

This photo depicts a small perennial channel with a dense canopy dominated by *Alnus rhombifolia.*

1511 – *Alnus rhombifolia* Forest Alliance

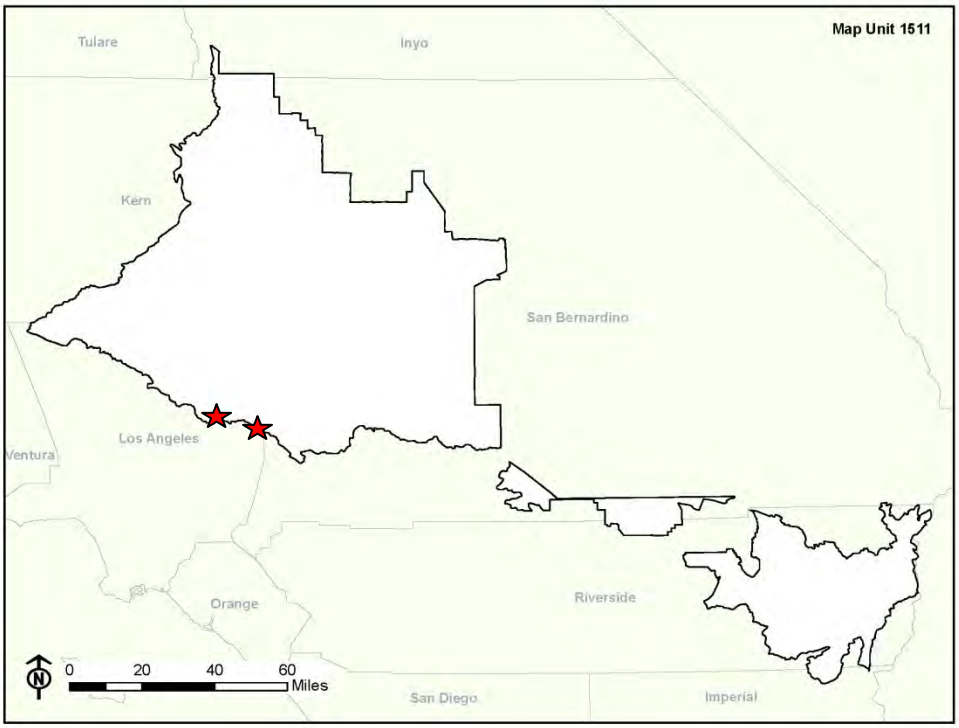
DESCRIPTION: In this Alliance, *Alnus rhombifolia* strongly dominates and is evenly distributed in the riparian tree layer. Stands of *A. rhombifolia* are found only in the non-desert margins of the study area along perennial steam channels. This Alliance occurs at the edge of the study area near Valyermo, and near Phelan.

PHOTOINTERPRETATION SIGNATURE: Stands are narrow, and cover is uniformly high. Individual crowns more or less tend to occur in a neat row of evenly spaced trees. Crown shapes are variable and their color is usually a fairly bright green.

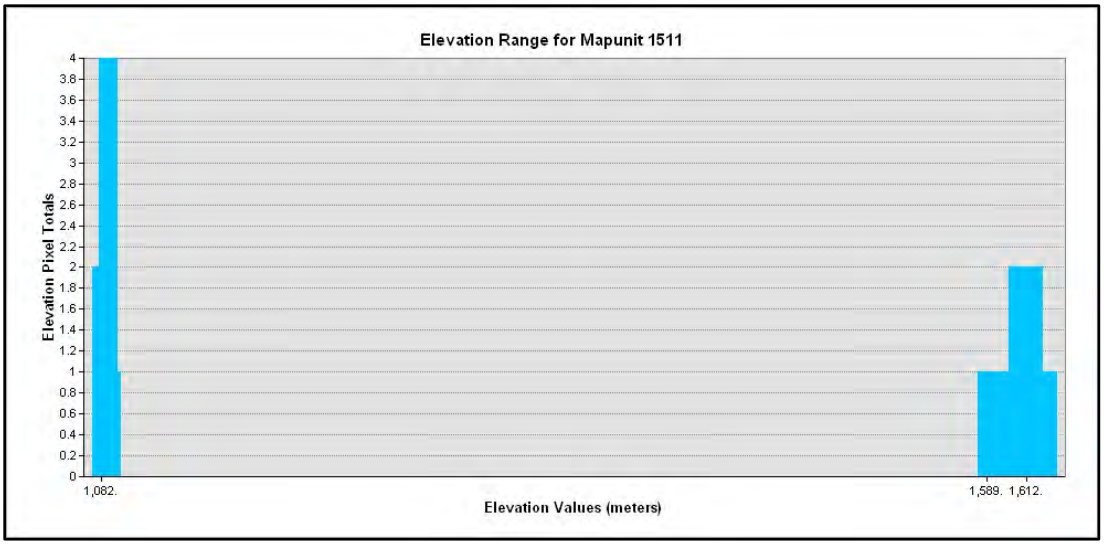
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Platanus racemosa* Alliance (1414) – Stands containing *Platanus racemosa* have more open crowns with a less-defined edge. Signature color tends to be a lighter green, with variable amounts of brown reflecting midseason leaf stress on individual trees. *Platanus racemosa* tends to occur on drier, rockier substrate, usually only in temporarily flooded settings. Overall cover of the stand is typically significantly lower. Unlike *Alnus rhombifolia, P. racemosa* rarely follows the margins of perennial streams.

1511 – *Alnus rhombifolia* Forest Alliance



DISTRIBUTION: Only two stands are mapped for this Alliance. One occurs near the confluence of Big Rock Creek and Pallett Creek, and the other on Le Montaine Creek just west of Phelan. Note: In the distribution map above, star symbols have been placed on the polygons for display purposes.



2111 – *Arctostaphylos glauca* Alliance

Bigberry manzanita chaparral Alliance

In the above image, *Arctostaphylos glauca* (darker shrubs with distinct margins) co-dominates the stand with *Adenostoma fasciculatum* (greener shrubs with a less distinct crown).

The bright green *Arctostaphylos glauca* co-dominates with *Adenostoma fasciculatum* in this example on gently undulating topography on the upper reaches of Baldy Mesa.

2111 – *Arctostaphylos glauca* Alliance

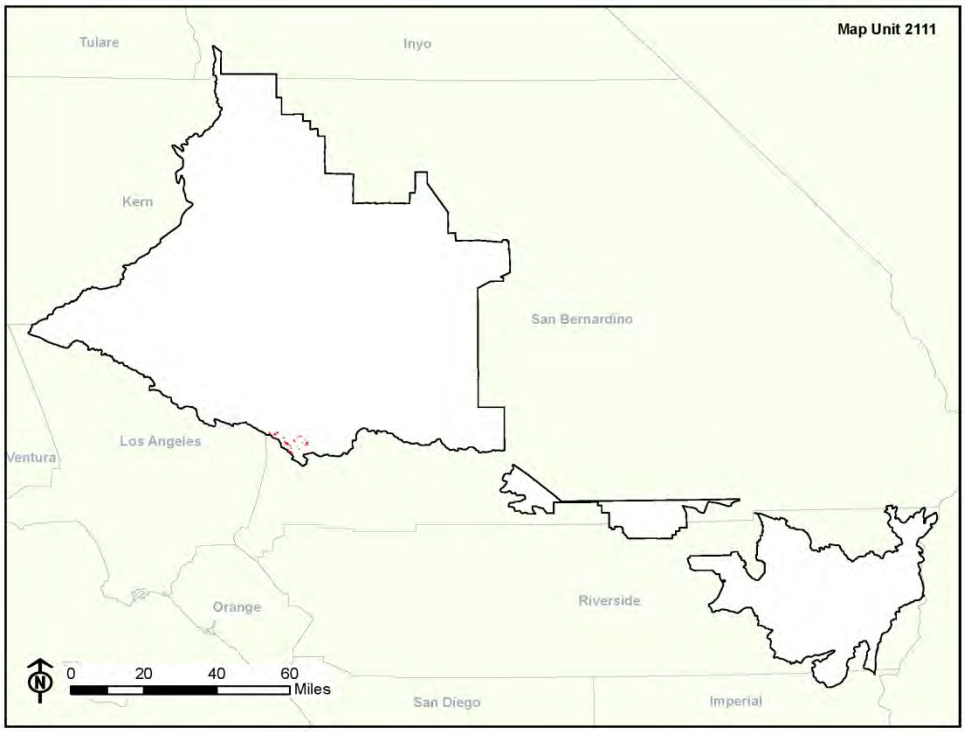
DESCRIPTION: In this Alliance *Arctostaphylos glauca* is the dominant or co-dominant overstory shrub, often occurring with a significant cover of *Adenostoma fasciculatum.* Conifers (*Pinus, Juniperus*) are absent or in very low cover. Stands of this Alliance are mapped only on the edges of the study area in the Transverse Ranges, usually adjacent to other chaparral stands such as A*denostoma fasciculatum, Fremontodendron californicum,* or *Quercus john-tuckeri.* Stands may occur adjacent to *Juniperus californica* or to *Pinus monophylla* types. Most stands are small, generally on upper slopes mixed with scattered *Yucca brevifolia.* The largest stands in the study area are near Cajon Pass and mix with *Adenostoma fasciculatum.*

PHOTOINTERPRETATION SIGNATURE: Stands frequently occur on gently sloping ridgelines and spurs, a characteristic feature of many of the manzanita species in the state. *Arctostaphylos glauca* generally occurs in cover sparse enough to evaluate individual crown characteristics without difficulty. Like most manzanita species, *A. glauca* has an irregularly shaped, dense crown with well-defined margins. Using the winter season high-resolution imagery, the modal stand appears dark gray and is often found in dense cover, with the overall appearance of the stand yielding a hummocky texture. Because of the structural growth patterns of individual plants, it can be difficult to discern the ratio of *A. glauca* to other chaparral species in a stand. Since this species is an important indicator, photointerpreters map to this Alliance when its presence is noted consistently in the stand.

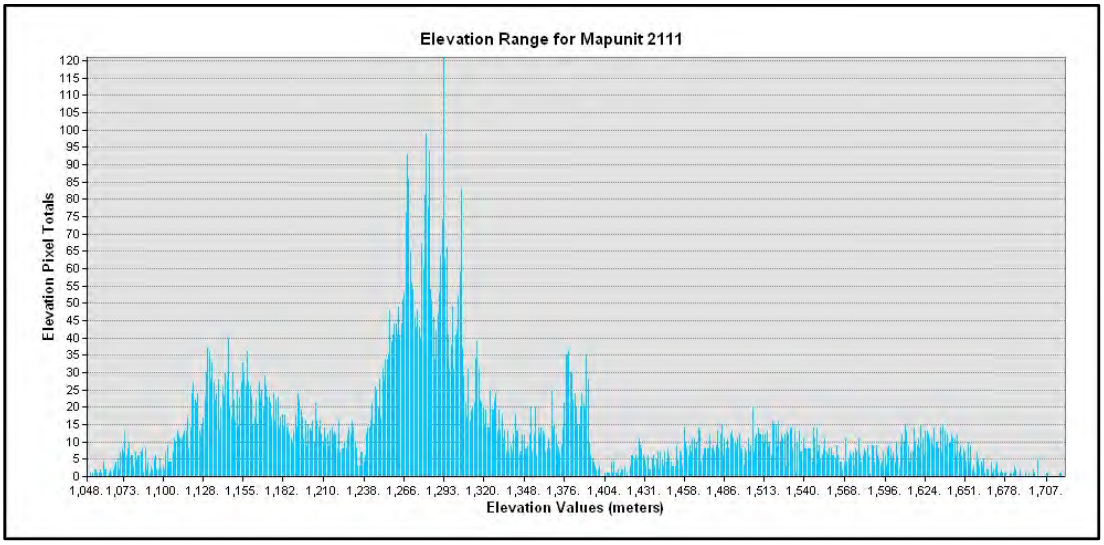
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – This species often occurs adjacent to and within stands of *Arctostaphylos glauca. Adenostoma fasciculatum* is more commonly found within the California xeric chaparral Group and normally does not extend as far into the desert margins of the study. When comparing dense cover characteristics of the two species, *Adenostoma fasciculatum* tends to have an overall less hummocky texture. Individual crowns are less distinct with fuzzier edges, and not as dense. Overall signature color is highly variable depending on imagery and the structural characteristics of the stand but tends to be lighter brown or lighter green.
- *Arctostaphylos glandulosa* Alliance (2121) – Stands occur in similar settings but generally at higher elevations and are more commonly found away from the desert margins. Overall, stands are smaller in size with denser cover and greener signature.
- *Quercus john-tuckeri* Alliance (3312) – In settings where *Quercus john-tuckeri* occurs nearby or adjacent to *A. glauca,* it is usually found on slightly steeper middle and lower slopes and broad ravine bottoms. Stands average slightly taller and tend to be more open. *Juniperus californica*, which has a rounded crown with a distinct green color, is often a component of this type and is rarely seen in stands of *A. glauca.*

2111 – *Arctostaphylos glauca* Alliance



DISTRIBUTION: This Alliance is almost exclusively limited to the vicinity around Cajon Pass and associated lower slopes of the San Gabriel Mountains to the west, especially near Cajon Canyon. Small isolated stands occur at the base of Liebre Mountain at the westernmost part of the study area.



2112 – *Adenostoma fasciculatum* Alliance

Chamise Alliance

In the above image, *Adenostoma fasciculatum* dominates the shrub canopy on moderately steep south-trending slopes in a variety of cover densities.

The photo depicts an example in Cajon Pass of a dense, strongly dominant stand of *Adenostoma fasciculatum* in a late bloom phase with inflorescences giving a yellow cast to the upper portions of the shrubs.

2112 – *Adenostoma fasciculatum* Alliance

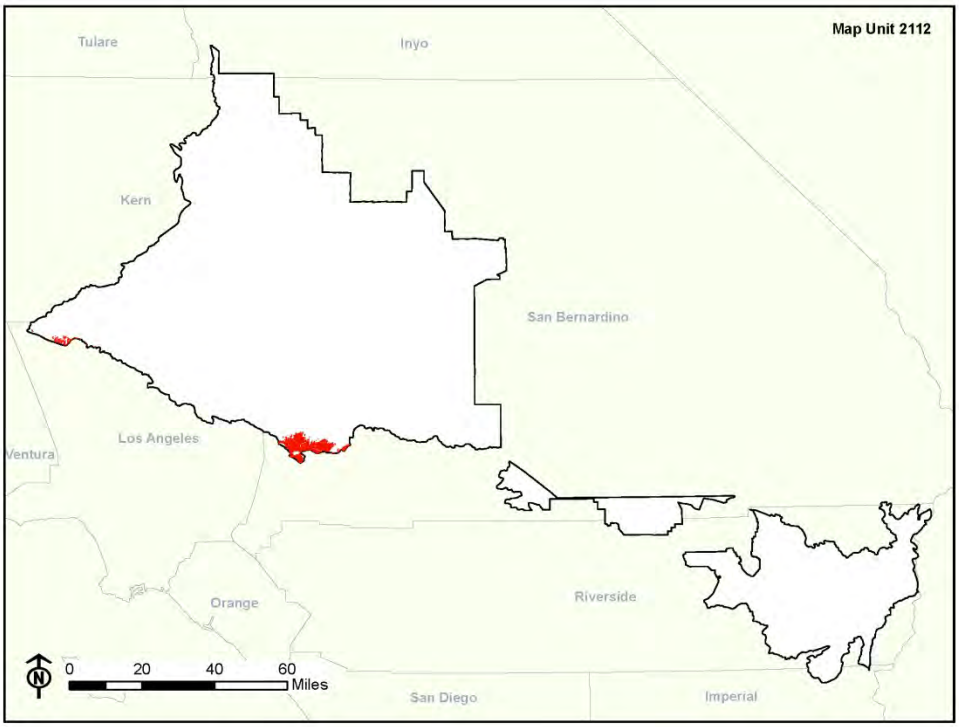
DESCRIPTION: In this Alliance *Adenostoma fasciculatum* occurs as a dominant, or as a co-dominant with *Eriogonum fasciculatum* or other shrubs such as *Eriodictyon crassifolium* or *Eriodictyon trichocalyx*. If *Adenostoma fasciculatum* is co-dominant with *Arctostaphylos glauca,* then *Arctostaphylos glauca* is the Alliance type. *A. fasciculatum* occurs above stands of *Quercus john-tuckeri, Artemisia tridentata, Salazaria mexicana,* and *Eriogonum fasciculatum* on slopes ranging from the desert edge to south of the Cajon Pass summit. Stands are generally found on neutral to convex slopes.

PHOTOINTERPRETATION SIGNATURE: Signature is highly variable depending on a number of factors including stand age, density, and species composition, in addition to image specifications including the season and year in which the imagery was flown. Because individual plants do not have a well-defined crown edge, dense and monotypic stands of this Alliance tend to show a smooth texture on most imagery. The plant's profuse flowering determines the overall image signature in the middle and late growing season, especially in higher than normal rainfall years. Early summer imagery tends to yield a yellow-green color. As the many flowered inflorescences gradually die off later in the season, the color deepens to a rusty brown.

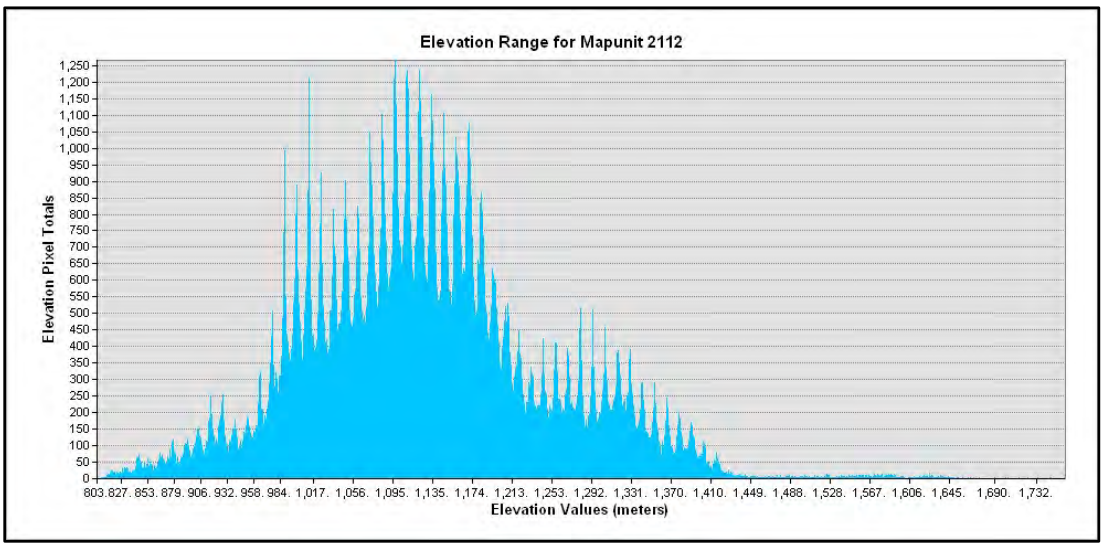
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Arctostaphylos glauca* Alliance (2111) – This Alliance usually occurs on gentle upper slopes, ridges and spurs, generally above stands of *Adenostoma fasciculatum.* Individual crowns are denser, somewhat larger, and have a well-defined edge. Dense stands tend to have a hummocky texture.
- *Eriodictyon (crassifolium, trichocalyx)* Alliance (2215) – Early seral stands of *Adenostoma fasciculatum* are difficult to separate out from this post fire Alliance. *E. (crassifolium, trichocalyx)* stands are patchy and inconsistent across the landscape, often containing other seral scrub species including *Adenostoma fasciculatum.*
- *Quercus john-tuckeri* Alliance (3312) – Stands are found adjacent to *Adenostoma fasciculatum* in several locations, most extensively near Cajon Pass. In these circumstances, *Q. john-tuckeri* tends to occur on slightly more mesic settings downslope in shallow ravines and lower sideslopes. Individual shrubs are significantly taller with well-defined crowns, and occur in more open cover.

2112 – *Adenostoma fasciculatum* Alliance



DISTRIBUTION: This type is found in two major regions along the Transverse Ranges, the larger of the two in the vicinity of Cajon Pass from Cajon Canyon east to Summit Valley. *Adenostoma fasciculatum* is also found in a smaller area to the northwest in the foothills of Liebre Mountain.



2113 – *Ceanothus crassifolius* Alliance

Hoary leaf ceanothus chaparral Alliance

On the example above, *Ceanothus crassifolius* forms a dense cover co-dominating with *Adenostoma fasciculatum* in a stand south of Cajon Pass.

This photo shows a dense stand of *Ceanothus crassifolius* with emergent *Prunus ilicifolia* on a gently sloping southwesterly aspect just upslope from Cajon Canyon.

2113 – *Ceanothus crassifolius* Alliance

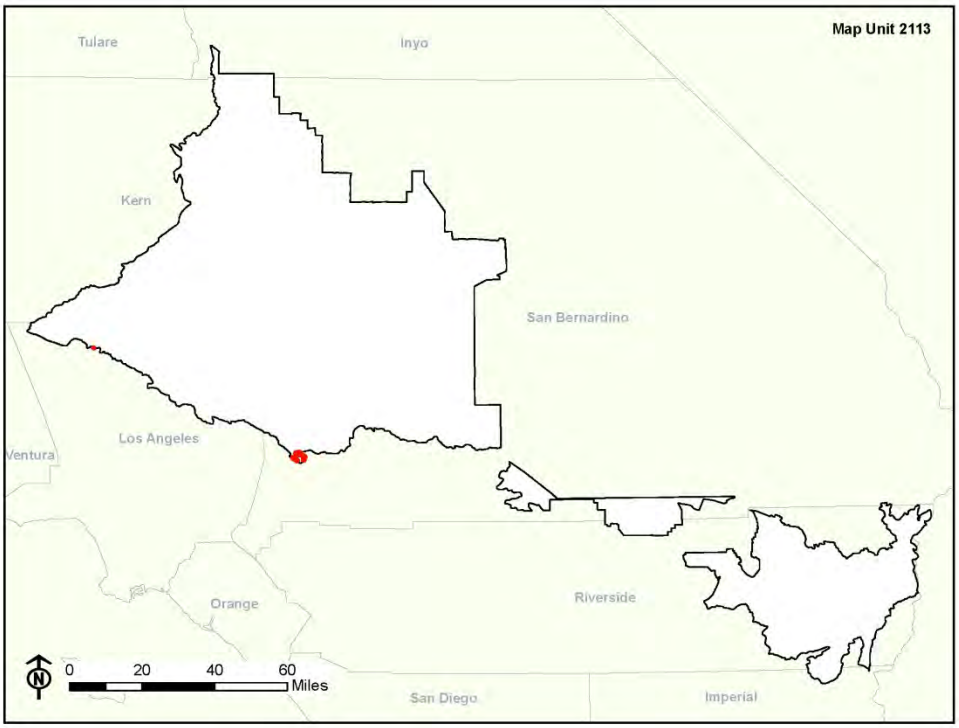
DESCRIPTION: In this Alliance *Ceanothus crassifolius* usually occurs as a dominant, or as a co-dominant with other chaparral shrubs at lower cover, such as *Adenostoma fasciculatum, Heteromeles arbutifolia* and *Cercocarpus montanus*. Stands of this Alliance are only mapped in the southern portion of the study area southwest of Cajon Pass, and on the north foothills of Portal Ridge.

PHOTOINTERPRETATION SIGNATURE: Stands typically occur in dense cover and often co-dominate with *Adenostoma fasciculatum.* Individual shrubs tend to have fairly distinct crowns except in younger post fire stands. Signature color trends slightly blue-gray and texture is smooth to slightly hummocky. Signature characteristics vary considerably across the stand due to uneven or patchy burn patterns, and also because of the relative location and cover characteristics of other chaparral species.

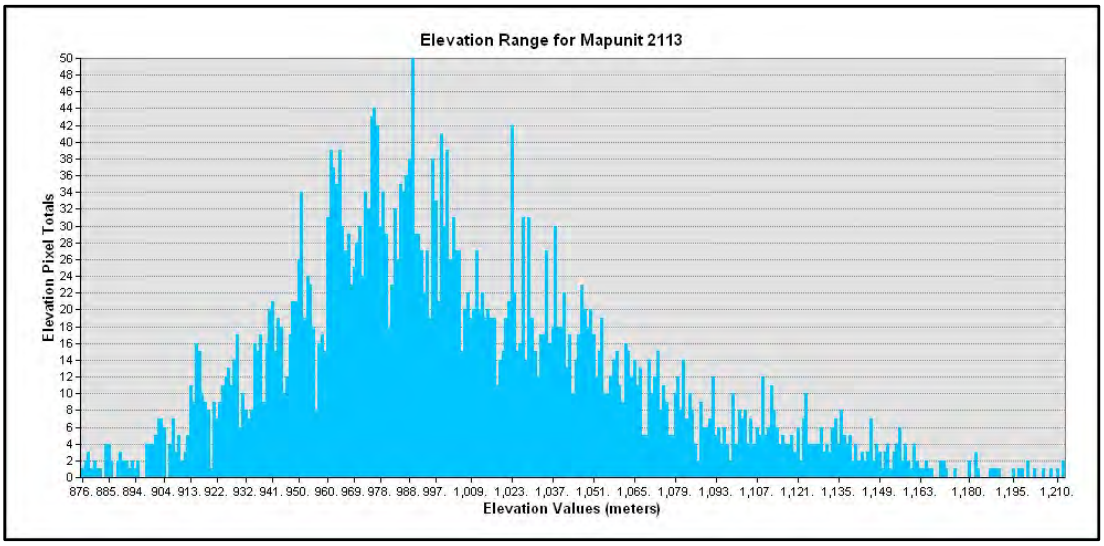
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – This Alliance is found in slightly more xeric settings and more frequently in monotypic stands. The two Alliances can be extremely difficult to differentiate, especially since *A. fasciculatum* often co-dominates stands of *Ceanothus.* Chamise inflorescences often characterize the signature color late in the season and will produce a rusty brown color which contrasts somewhat with the bluish gray *Ceanothus crassifolius* shrubs adjacent. These contrasts are best defined when individuals of either species will strongly dominate over small distinct patches within the stand.
- *Cercocarpus montanus* Alliance (2131) – Stands within this Alliance (in areas where *C. crassifolius* occurs nearby) are extremely rare and are found on much steeper, middle to middle-upper north-trending slopes. Cover tends to be lower and exposed rock is often present. Stands tend to occur in areas with significant shadowing due to their topographic setting.
- *Quercus berberidifolia* Alliance (2132) and *Quercus berberidifolia – Adenostoma fasciculatum* Alliance (2133) – Both of these Alliances are almost exclusively found on lower to lower-middle north-trending slopes and for the most part are limited in size. Overall texture is more hummocky and signature color is darker green.

2113 – *Ceanothus crassifolius* Alliance



DISTRIBUTION: Small stands of this Alliance are limited to areas south of Cajon Pass in the southernmost portions of Subarea 1 on slopes above Lone Pine and Cajon Canyons. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



2114 – *Fremontodendron californicum* Alliance

Flannelbush scrub Alliance

In this image, *Fremontodendron californicum* is a tall emergent shrub over a relatively dense cover of *Eriogonum fasciculatum.* Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

In this example, *Fremontodendron californicum* is the tall emergent shrub widely scattered here on a broad, fairly rocky sheet wash just below the San Gabriel Mountains. *Eriogonum fasciculatum, Encelia actoni,* and *Hesperoyucca whipplei* are visible in the lower right portions of the photo over a fairly dense grassy herbaceous layer.

2114 – *Fremontodendron californicum* Alliance

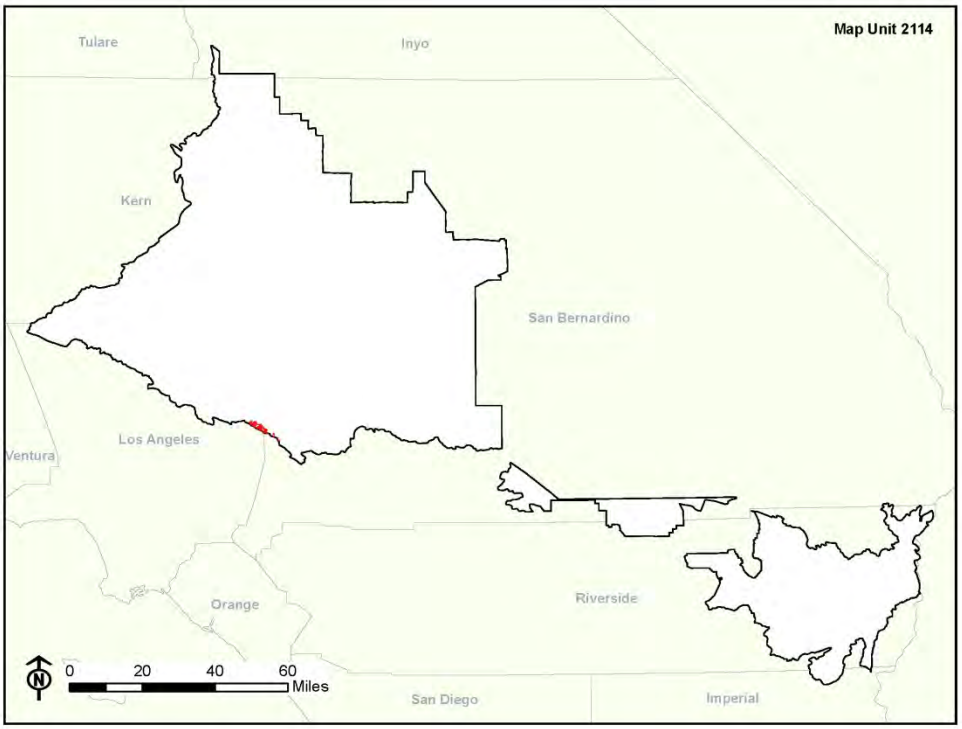
DESCRIPTION: In this Alliance stands are dominated by the tall shrub *Fremontodendron californicum,* with a mixture of desert chaparral and shorter shrubs including *Purshia tridentata, Hesperoyucca whipplei, Eriodictyon trichocalyx, Eriogonum fasciculatum, Cercocarpus montanus, Ceanothus leucodermis, Ericameria linearifolia, Salvia dorrii, Artemisia tridentata* ssp. *tridentata,* and scattered emergent *Yucca brevifolia.* Stands occur on coarse alluvium including edges of arroyos and washes of upper valleys or lower steep slopes of mountains. They are often adjacent to *Quercus john-tuckeri, Adenostoma fasciculatum, Pinus monophylla* and *Yucca brevifolia* stands, or recent burns with *Encelia actoni* and *Eriogonum fasciculatum*.

PHOTOINTERPRETATION SIGNATURE: Stands are often found in older post fire settings and always have a multiple canopy of taller shrubs over a fairly dense understory shrub layer averaging less than a meter in height. Overall cover of emergent *Fremontodendron californicum* varies considerably across the stand. However, signature characteristics of the individual shrubs tend to remain constant throughout the stand and generally have a well-defined, rounded, dark green crown.

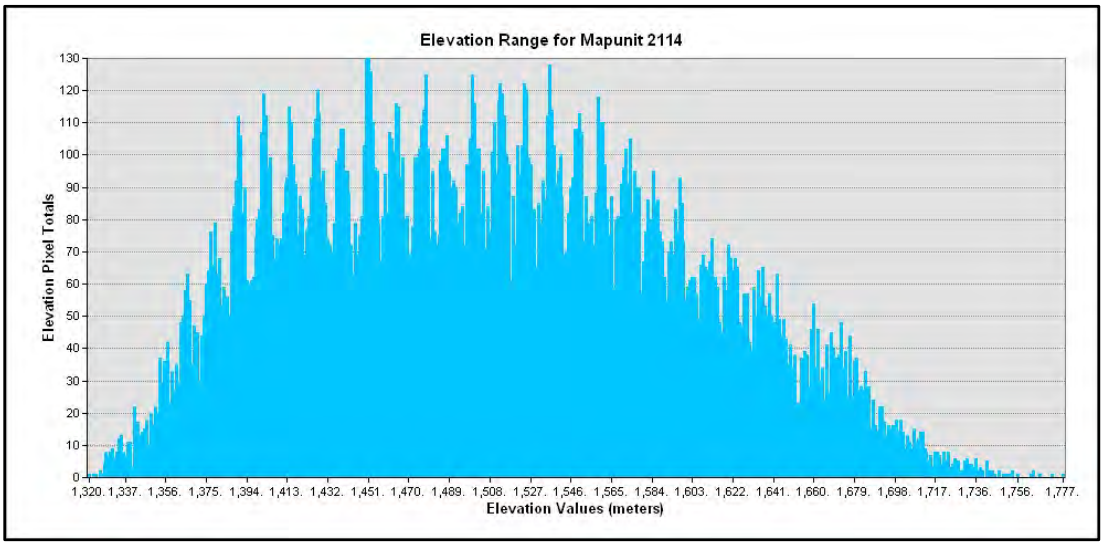
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum fasciculatum* Alliance (2221) – *Eriogonum fasciculatum* is often found adjacent to and as an understory component to *Fremontodendron californicum.* Individual shrubs are significantly smaller and difficulties in separating the two Alliances are based on relative cover of the two species. When *E. fasciculatum* is more than about two times the relative cover of the emergent *F. californicum*, the stand is mapped as the *Eriogonum fasciculatum* Alliance.
- *Purshia tridentata* Alliance (5422) – This Alliance can be found in similar settings, frequently establishing after older burns. Overall, stands of this Alliance are a bit closer to the desert margins on similar topographic settings to *F. californicum.* Shrubs tend to be smaller and overall are a lighter green. Cover characteristics are similar to those of *F. californicum* with a wide range of variability across the stand. Like *Fremontodendron,* stands of *Purshia tridentata* also tend to have a dense low shrub understory layer.

2114 – *Fremontodendron californicum* Alliance

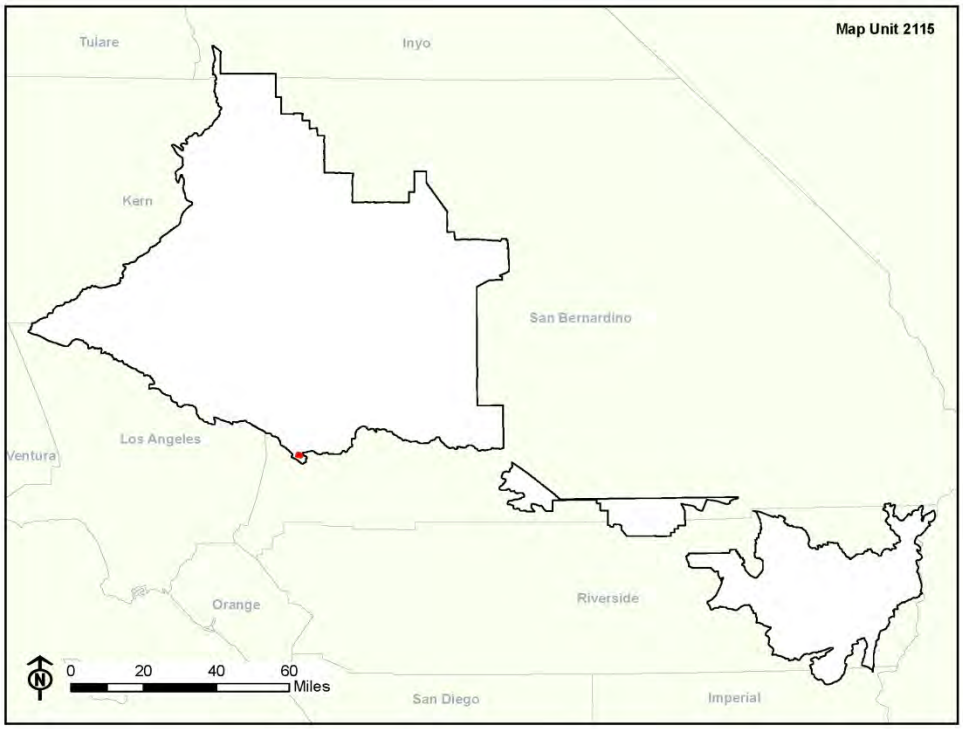


DISTRIBUTION: This Alliance is found exclusively along a continuous swath of landscape from Mescal Canyon south and east to Horse Canyon. Most stands occur on the lower mountain toe slopes and continue northward (downslope) to the uppermost fans and coarse alluvial washes immediately adjacent.



2115 – *Adenostoma fasciculatum – Salvia mellifera* Alliance

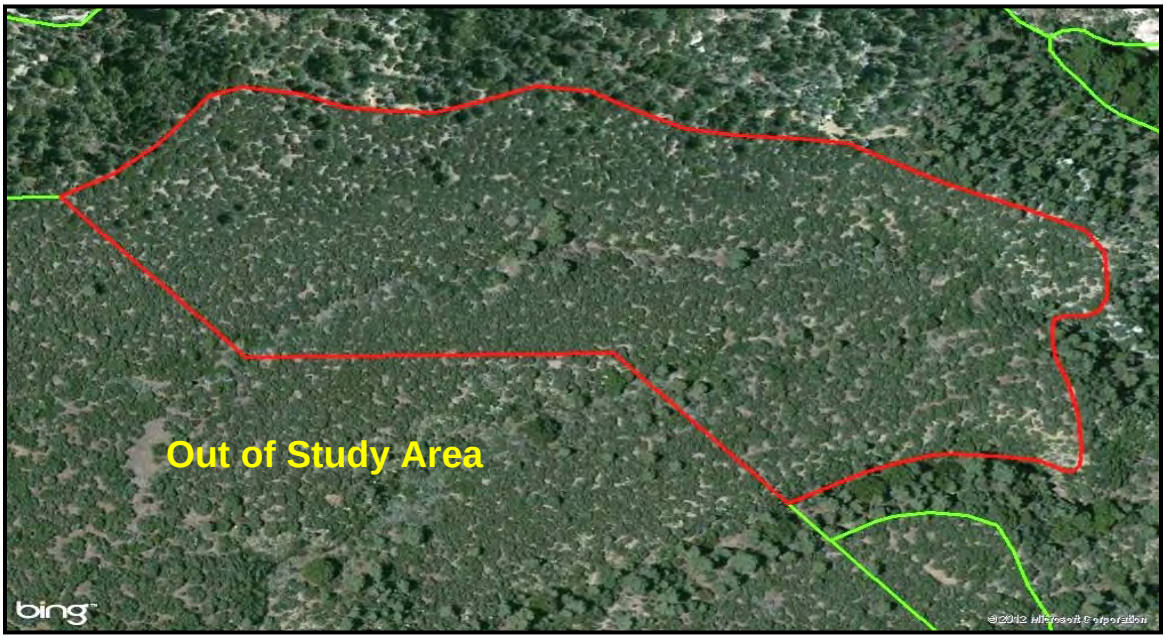
Chamise – black sage chaparral Alliance



DISTRIBUTION: Stands of this Alliance were infrequently mapped in the study area. As with several other chaparral Alliances, this Alliance is much more common in the foothills and lower montane slopes of the Transverse Ranges, and is only marginally present in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, the size of the polygon has been enhanced for display purposes.

2121 – *Arctostaphylos glandulosa* Alliance

Eastwood manzanita Alliance



The above example at the edge of the study area shows a dense, strongly dominant stand of *Arctostaphylos glandulosa* with some emergent *Pinus monophylla* at about the 5000-foot (1525-meter) level near the summit of Circle Mountain in the San Gabriel Mountains.

The photo depicts a stand of *Arctostaphylos glandulosa* strongly dominating the shrub canopy with *Adenostoma fasciculatum* scattered throughout as the taller grayer shrub.

2121 – *Arctostaphylos glandulosa* Alliance

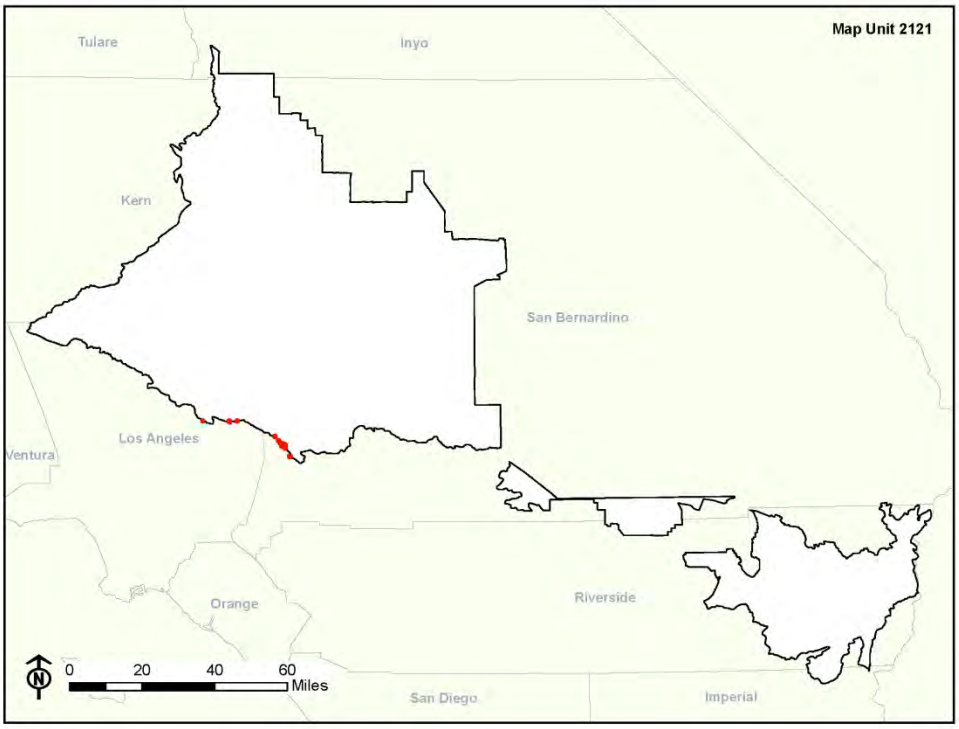
DESCRIPTION: In this Alliance *Arctostaphylos glandulosa* usually occurs as a dominant or co-dominant in the shrub overstory. Stands are found on north-facing slopes, outcrops, and ridges on shallow soils, only on the desert-facing slopes of the San Gabriel Mountains. The Alliance is common on open ridges and convex slopes surrounded by other chaparral stands, such as *Adenostoma fasciculatum* or *Quercus berberidifolia* south of Mormon Rocks.

PHOTOINTERPRETATION SIGNATURE: Stands are recognized and mapped primarily by their structural characteristics and ecological setting. Separation of *A. glauca* and *A. glandulosa* is difficult, and even in the field often requires close examination for burl presence. The *A. glandulosa* Alliance occurs in cooler more mesic settings at higher elevations and therefore the characteristic leaf signature has fewer seasonal drought-related traits such as a strong glaucous tint to the leaf. Overall signature color trends a medium to medium-bright green and texture is smooth to slightly mottled. Stands are dense and often contain a strong dominance of *A. glandulosa.*

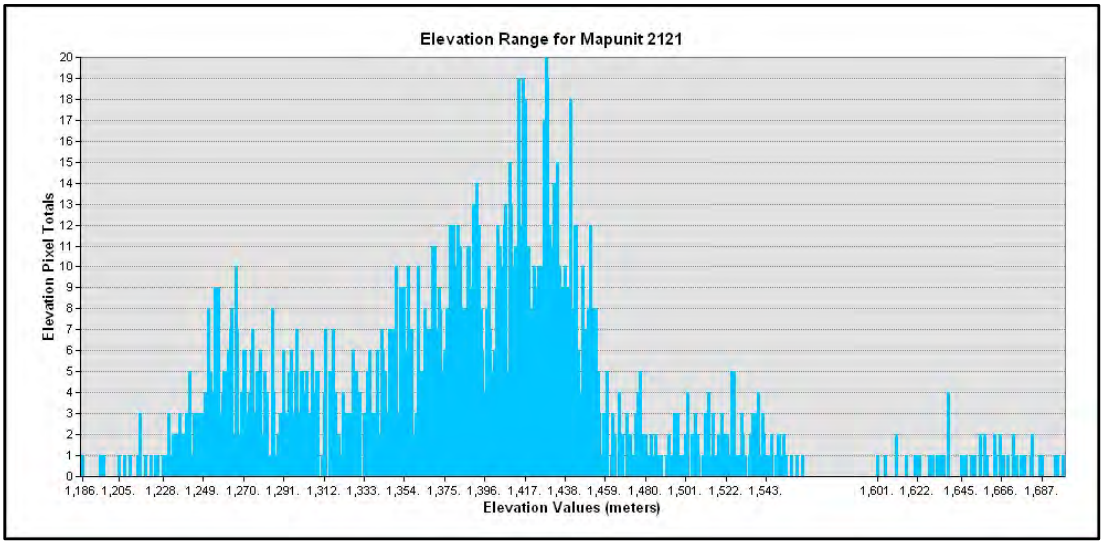
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Arctostaphylos glauca* Alliance (2111) – This Alliance tends to occur at lower elevations in similar topographic settings. The more xeric settings in which this type occurs tend to produce a glaucous, less shiny blue-gray leaf color. Viewed on imagery, stands are slightly more hummocky and tend to be not as bright green. Polygons defined as the *Arctostaphylos glauca* Alliance often have a co-dominance of *Adenostoma fasciculatum,* yielding a more variable signature across the stand.
- *Adenostoma fasciculatum* Alliance (2112) – Stands characterized by this Alliance tend to have a darker brown signature and generally occur on more xeric settings. Overall shrub cover in both Alliances is usually quite dense; however, post burn open stands are more common in *A. fasciculatum.*

2121 – *Arctostaphylos glandulosa* Alliance



DISTRIBUTION: This Alliance is limited to the southern edge of Subarea 1 at elevations generally over 4000 feet (1220 meters). Nearly all of the small stands mapped occur on slopes above Lone Pine Canyon on the Upper Lytle Creek Ridge and adjacent ridgelines to the north. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



2122 – *Ceanothus leucodermis* Alliance

Chaparral whitethorn Alliance

In this example at the edge of the study area, *Ceanothus leucodermis* strongly dominates the shrub layer in a dense post burn setting immediately adjacent to stands of older, more decadent *Adenostoma fasciculatum.*

The stand depicted on this photo is strongly dominated by *Ceanothus leucodermis* with the dead remains of *Quercus wislizeni* in a post burn setting as a result of the 2004 Pine Fire.

2122 – *Ceanothus leucodermis* Alliance

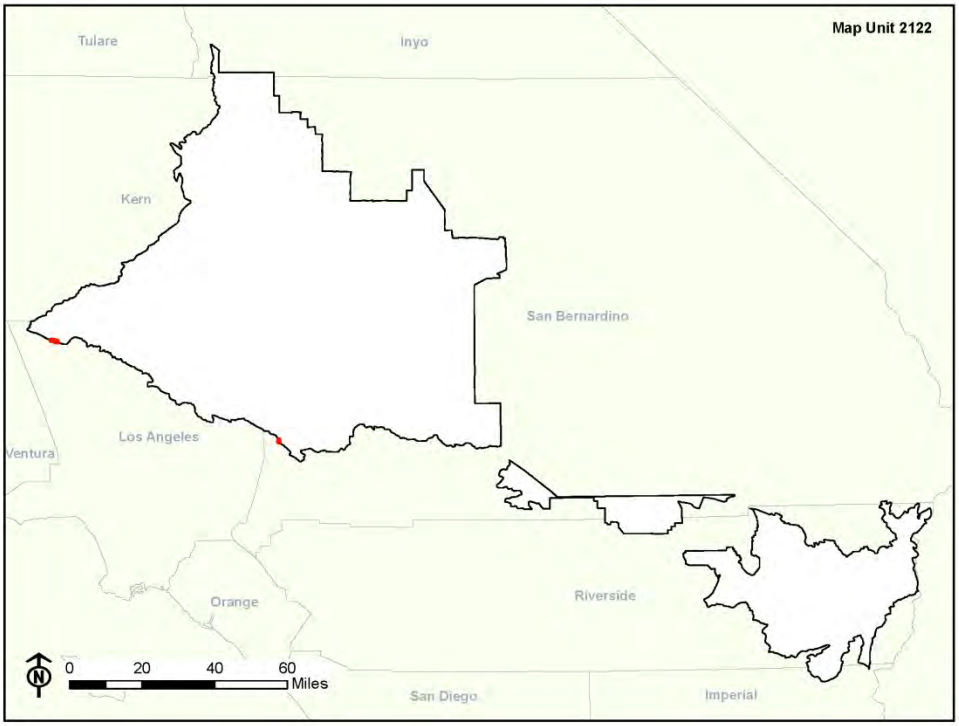
DESCRIPTION: In this Alliance *Ceanothus leucodermis* characterizes the shrub canopy as a dominant or co-dominant. There is no consistent canopy tree overstory, but top-killed stems of short resprouts of *Quercus wislizeni* may be present. Stands are found primarily on north-facing slopes only in recently burned areas of Liebre Mountain. It is a common post fire regeneration type in former *Quercus wislizeni* stands. Stands also are found adjacent to *Quercus lobata* north of Liebre Mountain.

PHOTOINTERPRETATION SIGNATURE: Stands dominated by *Ceanothus leucodermis* tend to have a dense shrub cover with an overall monotypic signature. Young post fire stands in the Liebre Mountain area tend to be a fairly bright green while older stands are a more glaucous-like blue-green. Individual crowns are not well defined and blend together, creating a smooth texture across the landscape. In stands where *Quercus wislizeni* have been killed from fire, the signature becomes mottled with the light gray remains of the individual trees scattered throughout as an emergent to the shrub layer.

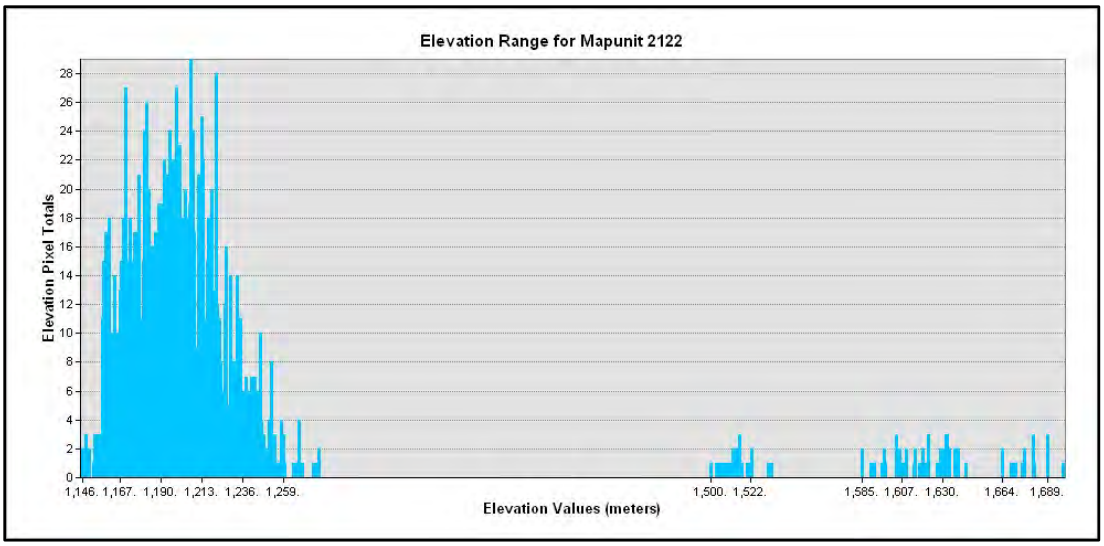
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – This Alliance tends to occur in lower elevations on steeper terrain. *C. leucodermis* is almost exclusively found in post burn environments. Dense shrub cover is characteristic of both Alliances; however, species variability is generally higher in the *A. fasciculatum* Alliance and will therefore yield a more uneven signature across the stand.
- *Arctostaphylos glandulosa* Alliance (2121) – Premontane chaparral stands dominated by *A. glandulosa* are less likely to occur in recent post burn settings. Overall, the signature tends to be a bit more hummocky and individual shrubs are generally more recognizable within the stand. *A. glandulosa* is more likely to be adjacent to conifer types such as *Pinus monophylla.*

2122 – *Ceanothus leucodermis* Alliance



DISTRIBUTION: The few stands mapped were in post burn settings of the 2004 Pine Fire, occurring north of Liebre Mountain. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



2131 – *Cercocarpus montanus* Alliance

Birchleaf mountain mahogany Alliance

In this desert edge setting, *Cercocarpus montanus* is found in a post burn regeneration area on slightly steeper north-trending slopes adjacent to open stands of *Adenostoma fasciculatum.*

This stand is located in a California mesic chaparral setting south of Cajon Pass on a steep north-facing slope. *Cercocarpus* co-dominates here with *Ceanothus crassifolius* and some *Prunus ilicifolia.* Along the ridgeline, the shrubland changes to a more xeric community dominated by *Adenostoma fasciculatum.*

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2131 – *Cercocarpus montanus* Alliance

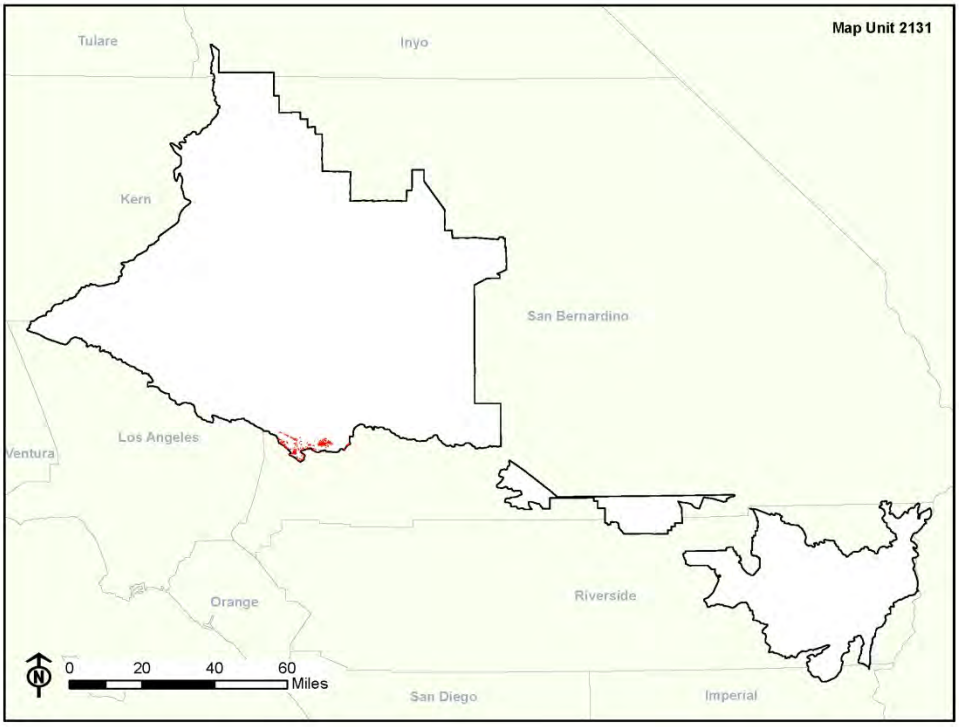
DESCRIPTION: In this Alliance *Cercocarpus montanus* has more than 30 percent relative cover with no other shrub species exceeding it in cover, or *C. montanus* and *Arctostaphylos glauca* have equal relative cover (Keeler-Wolf *et al*. 1998). *C. montanus* and *Eriogonum fasciculatum* may co-dominate, each having between 30 percent and 60 percent relative cover in the shrub canopy. Stands are found on the north side of Portal Ridge in the extreme west of the study area, or on north slopes of the San Gabriel Mountains in the vicinity of Lone Pine Canyon, and north of Cleghorn Ridge and Silverwood Lake.

PHOTOINTERPRETATION SIGNATURE: Within the study area, *Cercocarpus montanus* is found in two distinct settings: (1) Toward the desert margins on north slopes, frequently in a post fire setting where tall shrubs are emergent over a dense annual grass cover. In this environment, *C. montanus* individuals are significantly darker brown than adjacent slopes of *Adenostoma fasciculatum.* Less than one mile to the north, high desert stands of *Yucca brevifolia* over desert shrubs such as *Salazaria mexicana* dominate the landscape. (2) South of Cajon Pass in a more typical mesic chaparral environment on steep northerly protected slopes. Shrub cover on these examples is dense except in the steepest, rockiest area, and *C. montanus* often shares dominance with other mesic chaparral species such as *Prunus ilicifolia, Ceanothus crassifolius* and *Quercus berberidifolia.* In this setting, overall signature color is a dark green, texture is variable, and shadowing occurs over the steeper portions of the stand.

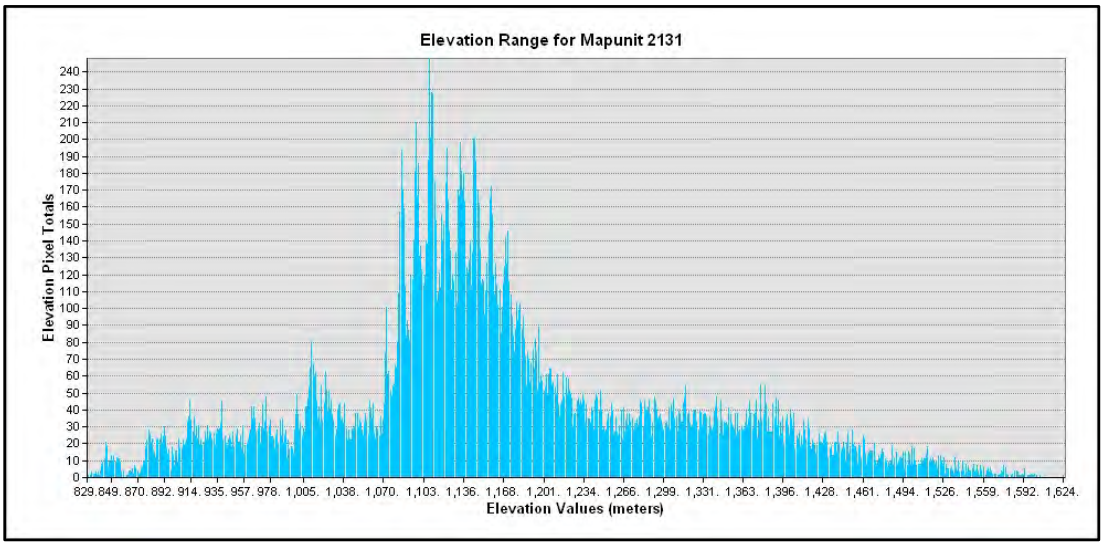
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – Open grassy stands on steeper slopes can be difficult to separate out from xeric stands of *Cercocarpus montanus.* Individual shrubs generally have less well-defined crowns and are not as dark a brown.
- *Quercus berberidifolia* Alliance (2132) and *Quercus berberidifolia – Adenostoma fasciculata* Alliance (2133) – These two Alliances generally occur immediately downslope in less steep environments. Texture across the stand is hummocky, and crown margins of individual tall shrubs, even in dense cover, are fairly distinct. Stands tend to be narrow and maintain their slope position by following the topography fairly closely.
- *Prunus ilicifolia* Alliance (2134) – This Alliance mimics the overall distribution of *Cercocarpus montanus* in that it is also found in two distinct settings. In its drier, desert edge environment, *P. ilicifolia* tends to have a larger more rounded crown and generally occurs more frequently on lower slopes and valley bottoms. When occurring in mesic chaparral, *P. ilicifolia* is almost always a component to the *Cercocarpus montanus* Alliance and also has a larger crown.

2131 – *Cercocarpus montanus* Alliance



DISTRIBUTION: This Alliance is found almost exclusively on slopes from just west of Cajon Pass to the highly dissected hills just north of Summit Valley near Hesperia.



2132 – *Quercus berberidifolia* Alliance

Scrub oak chaparral Alliance

In this example, *Quercus berberidifolia* has a large, well-defined dark green crown and is found in a typical setting, toward the bottom of a protected north-facing slope.

The example here shows *Quercus berberidifolia* (dark green) in a post burn setting on steep north-trending slopes mixing with *Cercocarpus montanus* and other mesic chaparral species.

2132 – *Quercus berberidifolia* Alliance

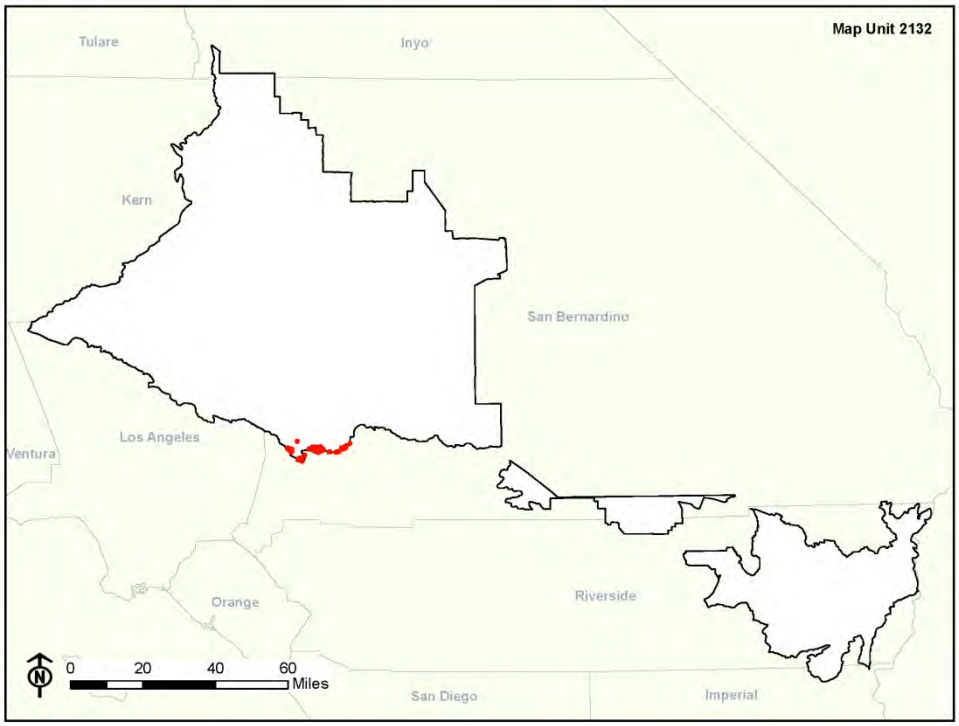
DESCRIPTION: In this Alliance *Quercus berberidifolia* usually occurs as a dominant to strongly dominant shrub. However, if it co-dominates with *Adenostoma fasciculatum,* then it is mapped as the *Quercus berberidifolia – Adenostoma fasciculatum* Alliance. If it co-dominates with *Cercocarpus montanus,* it is mapped as the *Cercocarpus montanus* Alliance. Individuals of *Q. berberidifolia* occur with *Q. john-tuckeri* near Cajon Pass, making stands difficult to differentiate from the *Q. john-tuckeri* Alliance. Therefore, in these situations, when stands are surrounded by mixed desert species, they were mapped as the *Q. john-tuckeri* Alliance. When stands were surrounded mostly by other California chaparral species, they were mapped as the *Quercus berberidifolia* Alliance.

PHOTOINTERPRETATION SIGNATURE: *Quercus berberidifolia* can be recognized by the sharply defined crowns which distinguish it from other chaparral species normally found within its range. This species has a significantly greener signature color and the crown is much denser than nearby chaparral in more xeric settings. In the narrow range where the species overlaps with *Q. john-tuckeri,* they are indistinguishable. Near the eastern portion of its range where it overlaps with *Q. wislizeni,* the two species are also indistinguishable. Mapped stands of *Q. berberidifolia* tend to be relatively narrow in shape. The stands are generally limited in their upslope extent, maintaining their slope position by closely following the topography.

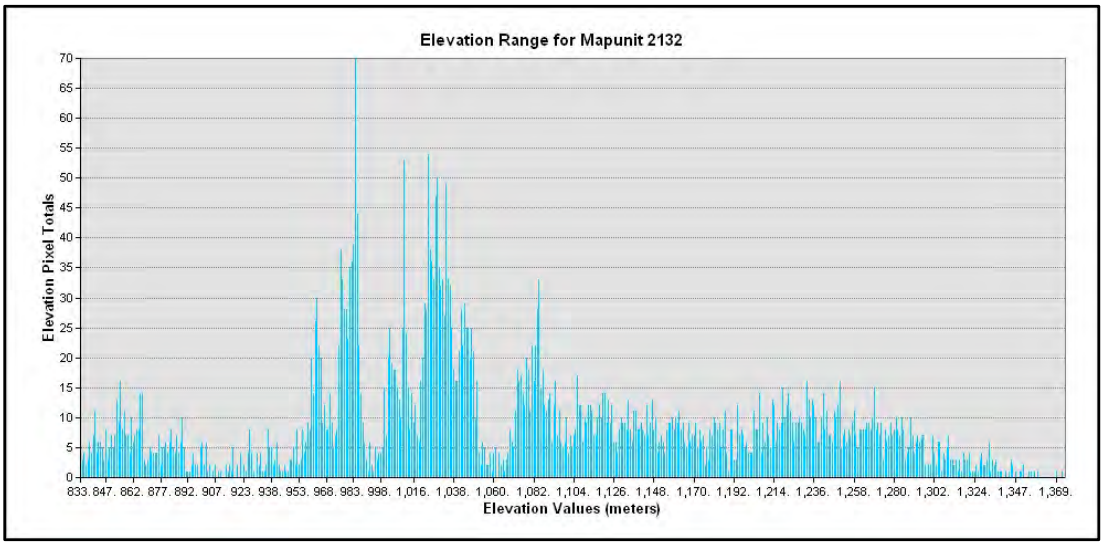
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Quercus wislizeni* Alliance (1114) – This Alliance is indistinguishable from *Q. berberidifolia.* In the mapping area, there is some overlap, especially in Summit Valley near Silverwood Lake. Generally, *Q. wislizeni* occurs in higher elevations and is considered a premontane species. In Summit Valley, a severe cold-air basin, stands of *Q. wislizeni* average around 3400 feet (1035 meters) in elevation and are typically adjacent to small stands of *Artemisia tridentata.*
- *Quercus berberidifolia – Adenostoma fasciculatum* Alliance (2133) – This Alliance is found in slightly more xeric settings and is generally flanked by the *Quercus berberidifolia* Alliance downslope and by the *Adenostoma fasciculatum* Alliance upslope. It has the characteristic signatures of the two diagnostic species, *Q. berberidifolia* and *A. fasciculatum.* The two species are a constant co-dominant throughout and should not represent a gradient where one or the other strongly dominates a major portion of the stand.
- *Quercus john-tuckeri* Alliance (3312) – Although there is a narrow zone of overlap where the two species occur nearby, *Q. john-tuckeri* is a semi-desert chaparral species found in different topographical settings, characteristically on gentler slopes on the upper alluvial fans below the San Gabriel Mountains. *Q. john-tuckeri* often shares the canopy with desert species such as *Yucca brevifolia* and *Juniperus californica,* whereas *Q. berberidifolia* is normally found with other chaparral species in the California mesic Group. The signature characteristics of the two species are almost identical; however, *Q. john-tuckeri* is not quite as deep a green.

2132 – *Quercus berberidifolia* Alliance



DISTRIBUTION: This Alliance is found in a narrow band along the southern margins of the study area from Cajon and Lone Pine Canyons east to Summit Valley near State Route 173. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



2133 – *Quercus berberidifolia – Adenostoma fasciculatum* Alliance

Scrub oak – chamise chaparral Alliance

This example shows a mixing of the two diagnostic species, *Quercus berberidifolia* and *Adenostoma fasciculatum* on the lower slopes adjacent to a small stream channel. *Q. berberidifolia* is recognized by its dark green color and well-defined crown.

Adenostoma fasciculatum shares dominance with *Quercus berberidifolia* on this gentle to moderately steep north-facing slope.

2133 – *Quercus berberidifolia – Adenostoma fasciculatum* Alliance

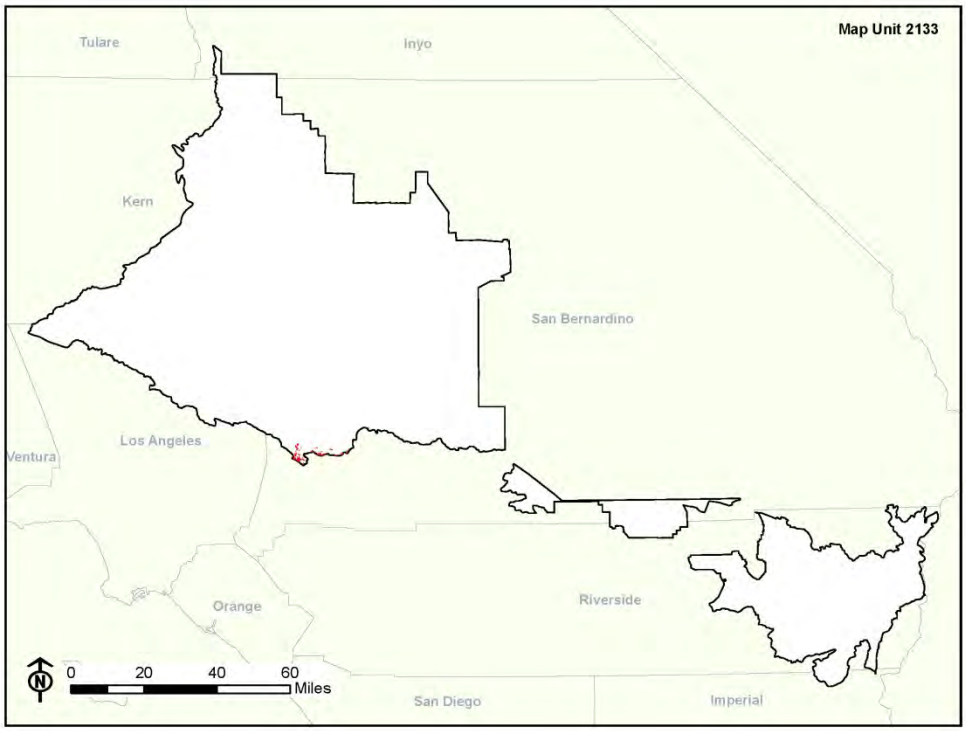
DESCRIPTION: In this Alliance *Quercus berberidifolia* co-dominates with *Adenostoma fasciculatum. A. fasciculatum* and *Q. berberidifolia* each have greater than 15 percent relative cover in the shrub layer, while other shrubs in the stands have significantly less cover. Within the study area this Alliance is only found in the Cajon Pass and Summit Valley area.

PHOTOINTERPRETATION SIGNATURE: This Alliance has characteristic signature qualities of both the *Adenostoma fasciculatum* and *Quercus berberidifolia* Alliance. The two species are a constant co-dominant throughout and should not represent a gradient where one or the other strongly dominates a major portion of the stand. The distinct dark green crown of the scrub oak contrasts notably with the smaller diffuse crown features found in the chamise. Stands are nearly always found upslope and adjacent to the *Quercus berberidifolia* Alliance.

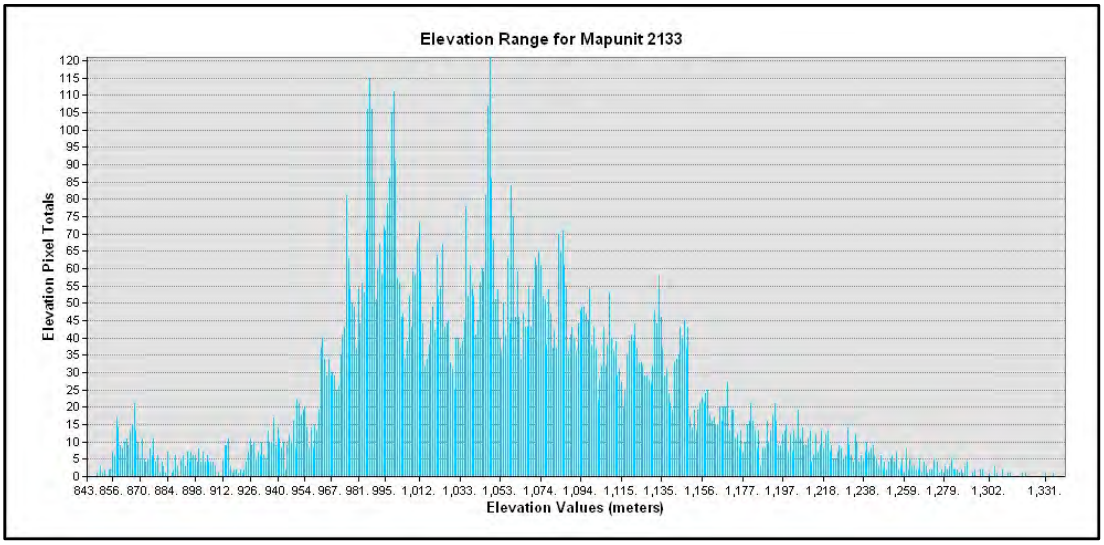
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – This Alliance is found in more xeric settings and shares only the common signature characteristics of the chamise. *Adenostoma fasciculatum* has a smaller, less distinct crown and has a light green to dark rusty brown signature color, depending on the season in which the imagery was acquired. Stands where *A. fasciculatum* is a major component can be found upslope from stands of the *Quercus berberidifolia – Adenostoma fasciculatum* Alliance.
- *Cercocarpus montanus* Alliance (2131) – Depending on the environmental setting, *C. montanus* can have signature qualities similar to that of *A. fasciculatum.* The crowns of both species are poorly defined and are similar in size and color. *C. montanus* is generally a darker brown and varies less from season to season. This type lacks the distinct signature attributes of *Q. berberidifolia.*
- *Quercus berberidifolia* Alliance (2132) – This Alliance is found in more mesic settings and shares only the common signature characteristics of *Q. berberidifolia*. Stands where *Q. berberidifolia* is a major component can be found downslope from stands of the *Quercus berberidifolia – Adenostoma fasciculatum* Alliance.

2133 – *Quercus berberidifolia – Adenostoma fasciculatum* Alliance



DISTRIBUTION: The range of this Alliance is similar to that of *Q. berberidifolia* and is found south of Cajon Pass east to Summit Valley.



2134 – *Prunus ilicifolia* Alliance

Holly leaf cherry chaparral Alliance

In this scene, *Prunus ilicifolia* occupies slopes immediately adjacent to a narrow wash downslope from *Adenostoma fasciculatum* in a post fire regeneration area.

Prunus ilicifolia co-dominates with other shrubs on the lower to uppermost portions of this rocky slope.

2134 – *Prunus ilicifolia* Alliance

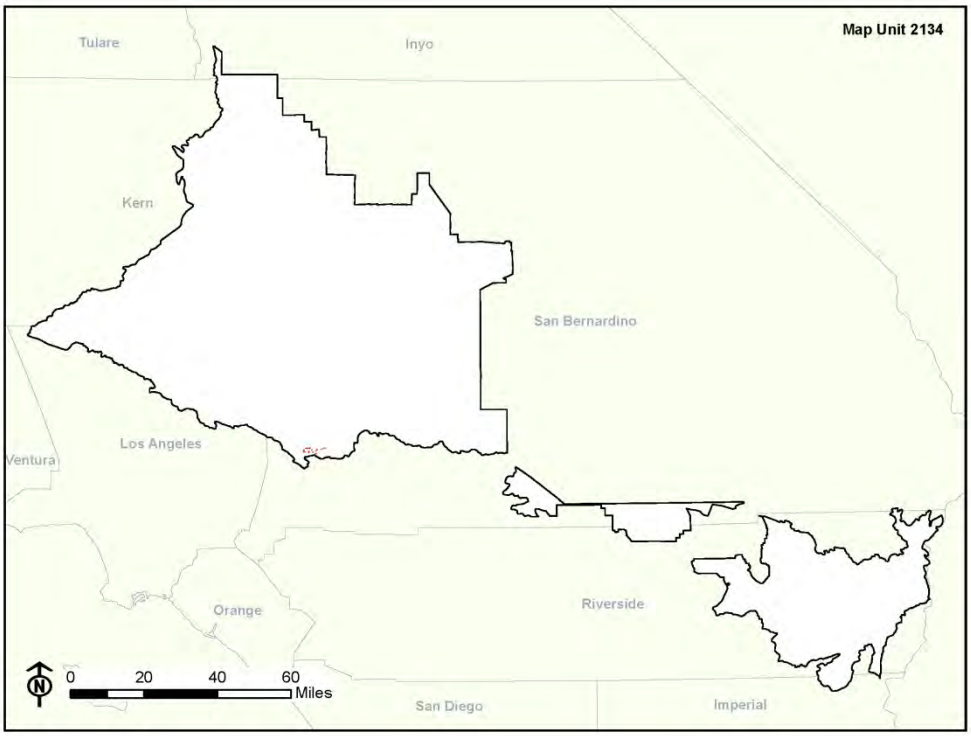
DESCRIPTION: Stands in this Alliance are dominated or co-dominated by *Prunus ilicifolia*. *Heteromeles arbutifolia* may be co-dominant. If *Quercus john-tuckeri* co-dominates, *Q. john-tuckeri* is the Alliance type. The *Prunus ilicifolia* Alliance is rare in the study area. Stands usually are found on either south- or east-facing steep slopes near Cajon Pass in both post burn regeneration and mesic chaparral settings.

PHOTOINTERPRETATION SIGNATURE: Stands are mapped almost exclusively in post fire settings with multiple overlapping burn histories. Most stands occur with an open grassy understory on lower slopes adjacent to small ravines. Crowns of *P. ilicifolia* are rounded and fairly large with a signature color trending toward a medium to dark green. Crown shapes tend to be more consistent than other taller shrubs occurring in similar environments.

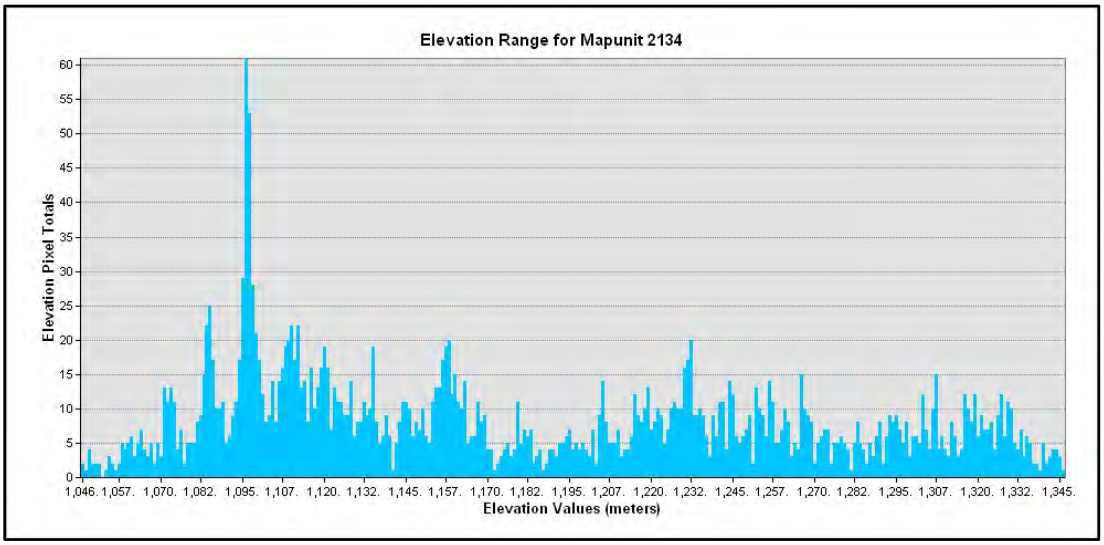
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Cercocarpus montanus* Alliance (2131) – This Alliance is frequently found nearby on similar topography and can be very difficult to distinguish. *C. montanus* usually occupies slightly steeper slopes, and its crowns tend to be smaller and darker brown.
- *Quercus berberidifolia* Alliance (2132) – Stands within the *Q. berberidifolia* Alliance are not as commonly found in post burn settings and occur on lower portions of north-trending slopes. Shrubs within this Alliance have less rounded, more irregularly shaped crowns which tend to have a darker green signature color.

2134 – *Prunus ilicifolia* Alliance



DISTRIBUTION: The *Prunus ilicifolia* Alliance has a very narrow range, occurring from Cajon Pass east to the western portions of Summit Valley and northward.



2214 – *Ericameria linearifolia – Isomeris arborea* Alliance

Narrowleaf goldenbush – bladderpod scrub Alliance

In this example, *Ericameria linearifolia* occurs on a steep hillside west of Quail Lake in the far western portion of the study area.

Ericameria linearifolia dominates the shrub layer just downslope from a stand of *Pinus sabiniana*. Stands of this type often have an understory of annual grasses and native flowers including *Monolopia, Layia* and *Lasthenia.*

2214 – *Ericameria linearifolia – Isomeris arborea* Alliance

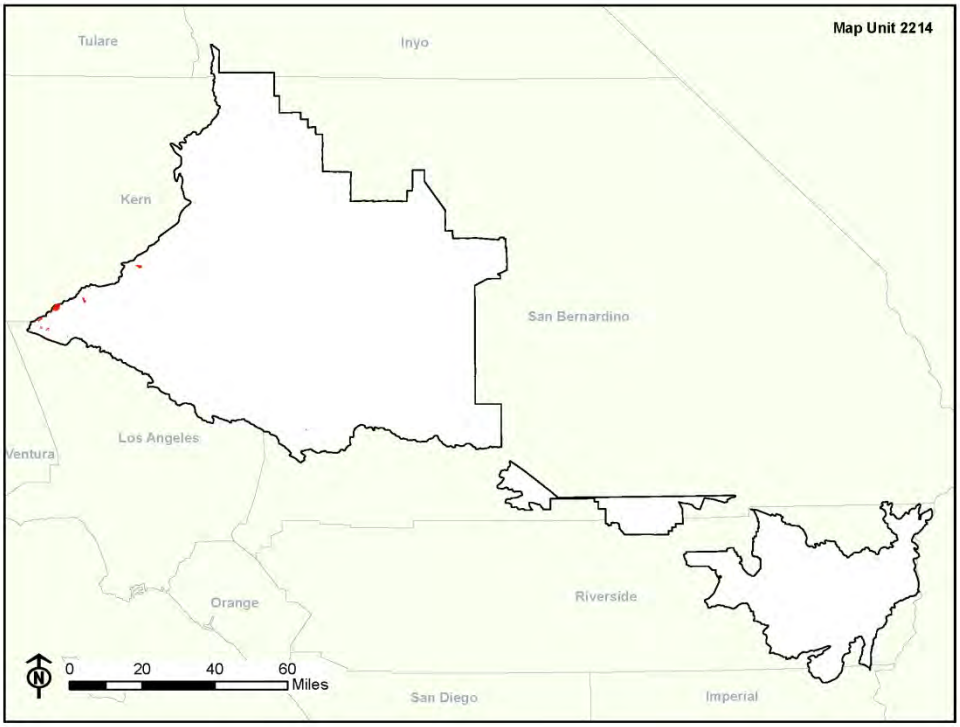
DESCRIPTION: In this Alliance *Ericameria linearifolia* is dominant to co-dominant in the shrub canopy with *Isomeris arborea* and/or *Gutierrezia californica, Eriophyllum confertiflorum, Eriogonum fasciculatum* and others. The herb layer can be well-developed, and *Poa secunda* is characteristically present.

PHOTOINTERPRETATION SIGNATURE: In undisturbed settings, *Ericameria linearifolia* occurs on fairly steep slopes on low hills with significant patches of bare ground. In these settings, their range is restricted to the westernmost portions of the study area. The signature-related characteristics are fairly indistinct; shrubs are small, gray, and lack a well-defined crown. Cover characteristics tend to be patchy and vary considerably along the slope. Stands are generally small in size. On cleared disturbance-related sites, *E. linearifolia* is difficult to differentiate from other early seral shrub types.

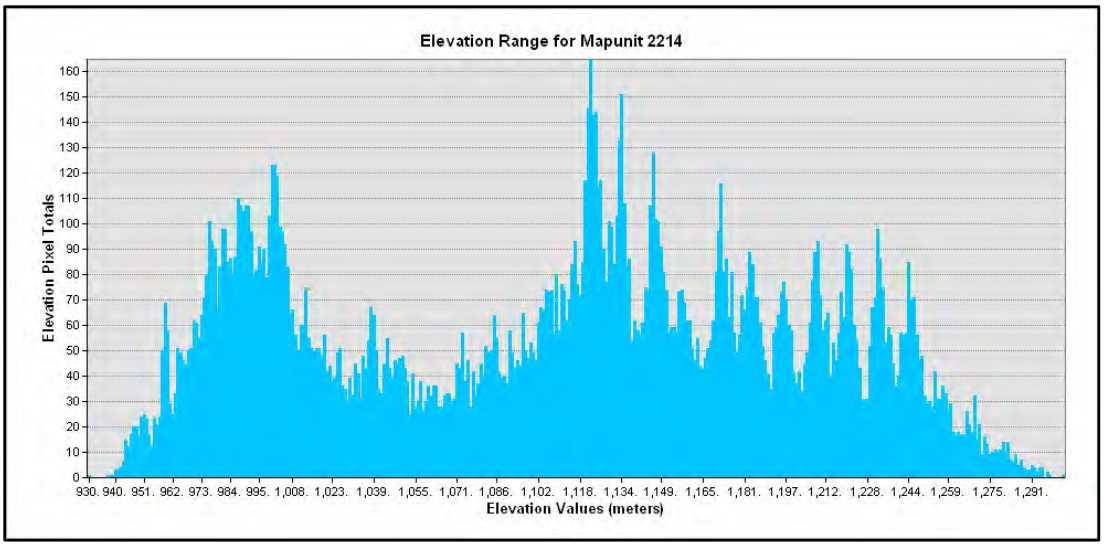
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum fasciculatum* Alliance (2221) – *Eriogonum fasciculatum* can be a component to the *Ericameria linearifolia* Provisional Alliance. In these settings, *Eriogonum fasciculatum* has a slightly larger, more distinct crown and has a darker gray signature with a trace of a brown hue. Also, *Eriogonum fasciculatum* will be found in dense patches on nearly level disturbed terrain immediately downslope from steeper hillsides of *Ericameria linearifolia* stands.
- *Ericameria nauseosa* Alliance (5212) – Stands generally occur on the valley floor adjacent to hillsides containing *E. linearifolia* in the westernmost portion of the study area. *E. nauseosa* has a larger crown, and stands have a denser herbaceous understory associated with them.
- *Ericameria cooperi* Alliance (5215) – This Alliance is more likely found on post disturbance clearings and is generally found further to the east on desert bajadas north of Cajon Pass. In these disturbance situations, the two species are extremely difficult to distinguish.

2214 – *Ericameria linearifolia – Isomeris arborea* Alliance



DISTRIBUTION: Most mapped stands are found in the westernmost portions of the Antelope Valley. To the east, small patches occur on cleared disturbances in a matrix with early seral shrub types.



2215 – *Eriodictyon (crassifolium, trichocalyx)* Provisional Alliance

Thick leaf and hairy yerba santa scrub Provisional Alliance

Eriodictyon trichocalyx occurs above in a typical setting in a matrix of several other small shrub patches. In this example, *E. trichocalyx* dominates or co-dominates on most of the image; smaller assemblages of *Artemisia tridentata* (blue green patch – center lower portion) and *Prunus fasciculata* occur along the margins.

Eriodictyon trichocalyx dominates the foreground with some *Artemisia tridentata* occurring as the taller light blue shrub behind. The stand occurs in a post cleared disturbance in Summit Valley along State Route 138.

2215 – *Eriodictyon (crassifolium, trichocalyx)* Provisional Alliance

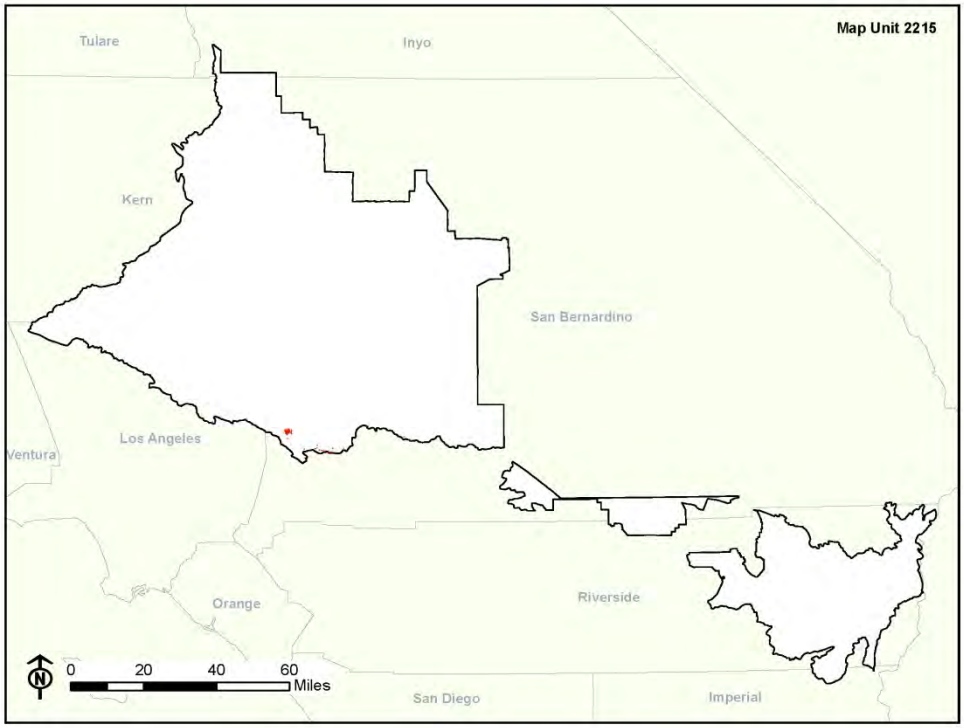
DESCRIPTION: In this Provisional Alliance an *Eriodictyon* species dominates. Within the study area, stands are dominated by *E. trichocalyx*. Typically, stands are *E. crassifolium* on the north side of Liebre Mountain (outside of the study area) and *E. trichocalyx* on the north side of the San Gabriel and San Bernardino Mountains and in the Cajon Pass region.

PHOTOINTERPRETATION SIGNATURE: Stands of *Eriodictyon trichocalyx* occur in small patches, usually in post disturbance clearings as an early returning shrub. Texture is generally smooth across the small, bright green patches where it dominates, but patterning across the stand tends to be mottled and haphazard. *E. trichocalyx* stands out conspicuously against other distinct patches of *Artemisia tridentata* and *Prunus fasciculata*. When occurring in clearings which were formerly dominated by *Adenostoma fasciculatum*, stands are more difficult to distinguish.

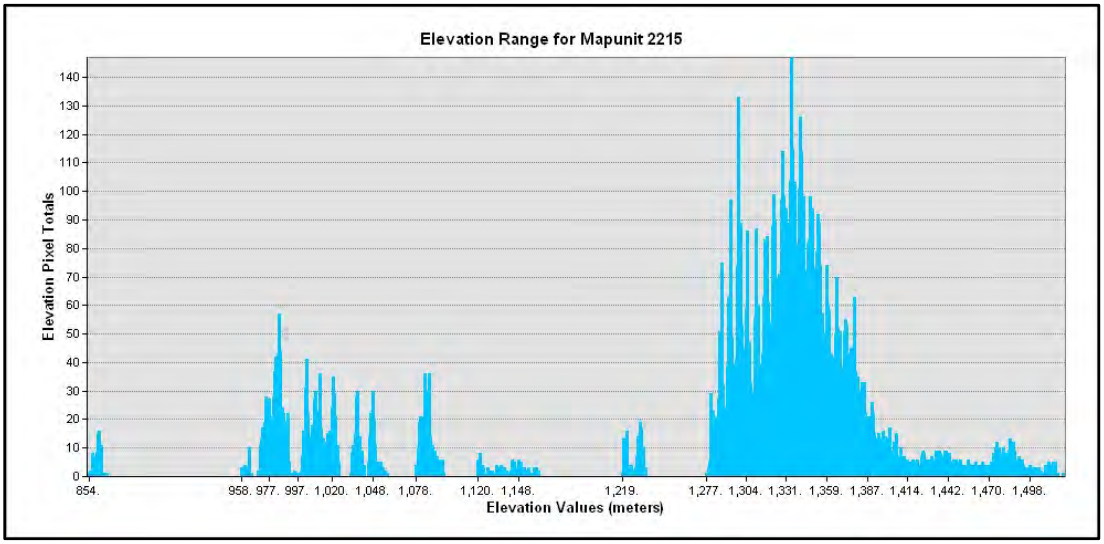
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Adenostoma fasciculatum* Alliance (2112) – Post fire disturbance stands of *Adenostoma fasciculatum* tend to yield a signature color similar to *Eriodictyon trichocalyx;* however, stand size is generally much larger and less patchy. Post fire stands of *A. fasciculatum* can be replaced with areas of *E. trichocalyx*, which can be difficult to distinguish in these settings. Where mature stands of *Adenostoma* are adjacent to *E. trichocalyx*, the overall color is darker green, often with a rusty brown component from the numerous remnant inflorescences covering the plants.
- *Ericameria cooperi* Alliance (5215) – Stands mapped as *Ericameria cooperi* occur in similar regions slightly to the north of most of the *Eriodictyon* mapped in the study area. Both types occur in areas disturbed by recent vegetation removal due to urban expansion or agriculture. *Ericameria cooperi* tends to occur in a pattern that is not as patchy as *Eriodictyon* stands, yielding less of a mottled texture to the signature. Signature color is similar, trending to a medium-intensity green. On higher-resolution imagery, individual crowns of *Ericameria cooperi* are very small but fairly well defined.

2215 – *Eriodictyon (crassifolium, trichocalyx)* Provisional Alliance

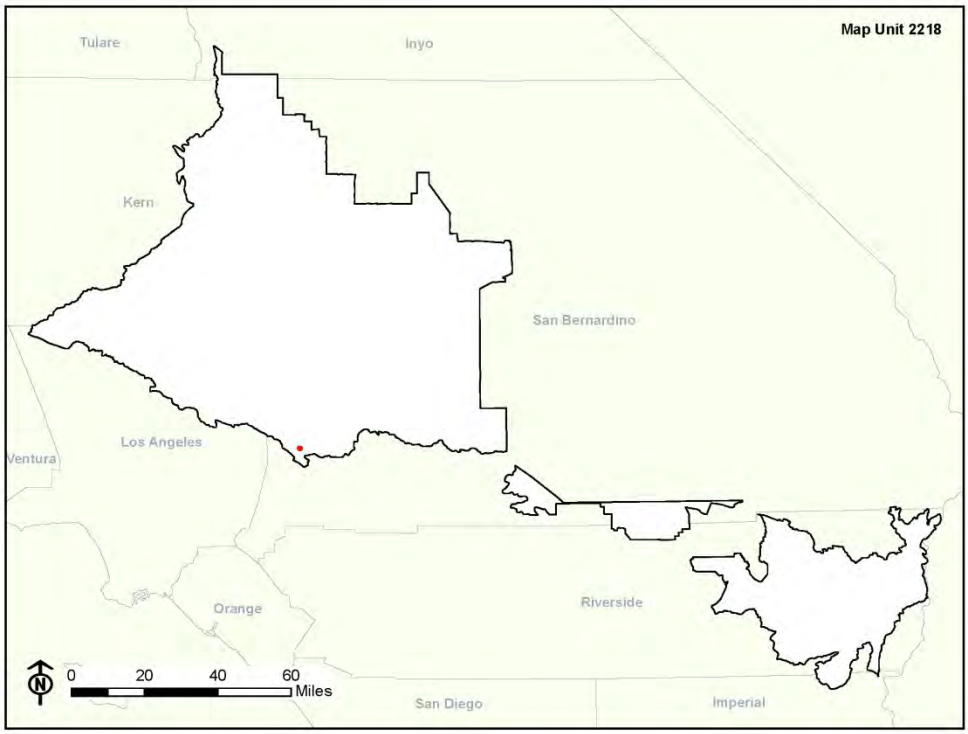


DISTRIBUTION: Nearly all stands are mapped east of Cajon Pass in Horsethief Canyon and Summit Valley. Small areas are also mapped to the northwest on the uppermost fans north of Cajon Canyon. *Eriodictyon* is a component to other disturbance-related types over broader areas of the western Mojave Desert adjacent to the Transverse Ranges.



2218 – *Corethrogyne filaginifolia* Alliance

Common sand-aster scrub 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. The field assessed stands were viewed inside and outside of the DRECP boundary in the vicinity of Cajon Pass, in cleared areas, surrounded by chaparral. Note: In the distribution map above, the size of the polygon has been enhanced for display purposes.

2221 – *Eriogonum fasciculatum* Alliance

California buckwheat scrub Alliance

This example depicts *Eriogonum fasciculatum* in a dense cover (over 20 percent) in a post clearance disturbance along a transportation corridor in Cajon Pass. Note: this screenshot is a portion of a larger polygon whose boundaries are not shown.

The above photo depicts *Eriogonum fasciculatum* in flower, mixing with the brighter green *Ericameria* spp. The stand represents a returning shrub layer from a cleared field near Palmdale.

2221 – *Eriogonum fasciculatum* Alliance

DESCRIPTION: In this Alliance *Eriogonum fasciculatum* comprises at least 2 percent absolute cover or more than 50 percent relative cover in the shrub canopy. Other shrubs, if present, comprise less than half its cover, but *Hyptis emoryi* or *Salvia dorrii* may be higher (Thomas et al. 2004). In the desert hills and mountains above 1000 meters (3280 feet) elevation, *Eriogonum fasciculatum* co-occurs with many other semi-desert shrubs; if *Encelia actoni, Ericameria teretifolia, Purshia tridentata,* or *Ericameria linearifolia* are of equal or higher cover, the stands were mapped as those Alliances. Mixed stands containing *Ephedra nevadensis, Ambrosia salsola, Ericameria cooperi,* or *Grayia spinosa* only require *Eriogonum fasciculatum* to be higher cover and more evenly distributed than any of the other shrubs for the stands to be mapped as the *E. fasciculatum* Alliance. Generally, *E. fasciculatum* occurs on steeper, more protected, cooler slopes above the *Larrea tridentata – Ambrosia dumosa* zone. Most pure stands occur along the east face of the Tehachapi and Scodie Mountains. These stands, and those in the Cajon Pass area surrounded by chaparral, tend to have substantially higher shrub cover and usually do not co-dominate with many species. Instead, they are often single dominant stands. *E. fasciculatum* also may co-dominate with *Viguiera parishii* and other mid-elevation desert shrubs on rocky granitic northerly facing between Lucerne Valley and Twentynine Palms; however, most of these stands were mapped as the *Viguiera parishii* Alliance (4151).

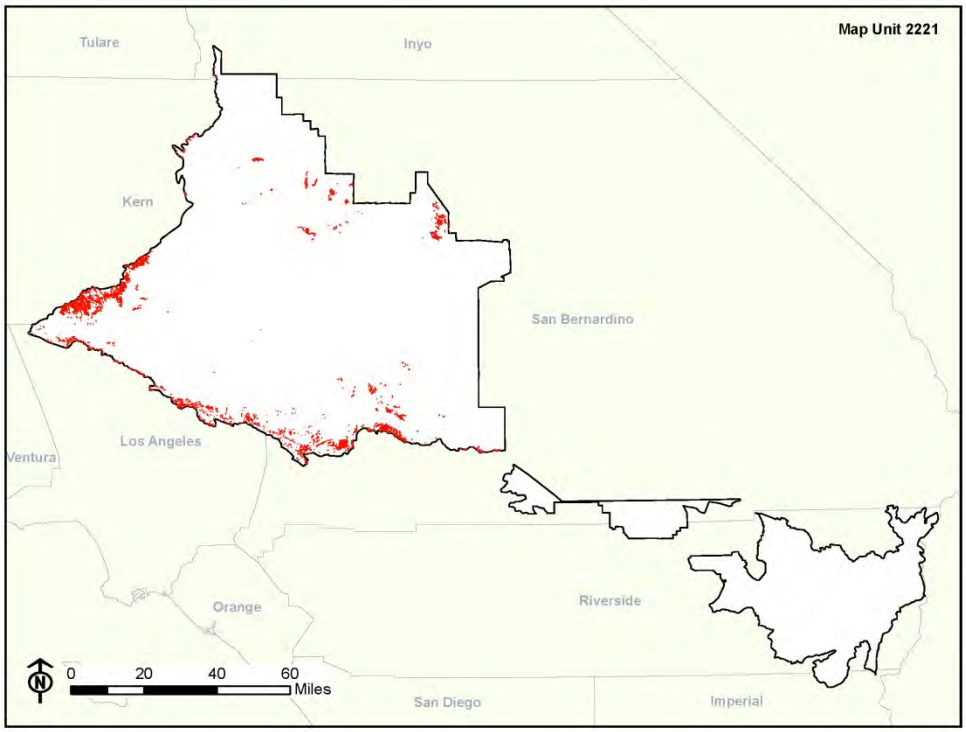
PHOTOINTERPRETATION SIGNATURE: *Eriogonum fasciculatum* occurs over wide areas of the western Mojave and adjacent desert margins. Throughout much of its range, *E. fasciculatum* maintains a medium to dark brown signature color with a distinct crown. In the intermontane ranges of the western Mojave, *E. fasciculatum* often occurs at less than 10 percent cover, making the signature color difficult to discern. In post clearance disturbance settings, it often occurs as fairly distinct patches with relatively high cover. Signature variability across its range is lower than most seral types due to its strong dominance in many of the mapped stands. Stands along the desert margins south of Cajon Pass are generally associated with transportation corridor clearings and are easily recognizable.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

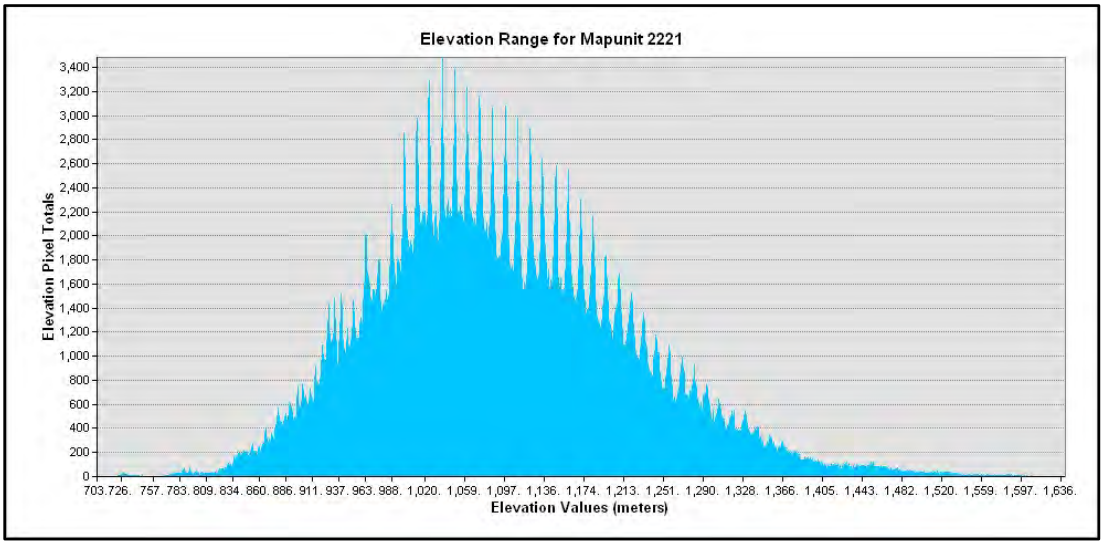
- *Adenostoma fasciculatum* Alliance (2112) – Stands near Cajon Pass often occur adjacent to *Eriogonum fasciculatum*. In these areas, *Adenostoma* occurs immediately adjacent to the recently cleared sites where *Eriogonum* is found. *Adenostoma* tends to have a higher variability in cover due to a matrix of post fire related disturbance history. North of Cajon Pass, stands of *Adenostoma* occur adjacent to *Eriogonum* on upper dissected fans just north of the San Andreas Rift Zone. In these circumstances, *Eriogonum* is found on the steeper side slopes along small washes incised in the fan. *Adenostoma* generally has a more diffuse and slightly larger crown than *Eriogonum* in all settings.
- *Ericameria linearifolia – Isomeris arborea* Alliance (2214) – Where the two species overlap, *Ericameria linearifolia* is found on steeper hill slopes, upslope and adjacent to post clearance stands of *Eriogonum fasciculatum*.

- *Eriodictyon (crassifolium, trichocalyx)* Alliance (2215) – This Alliance overlaps with *Eriogonum fasciculatum* in and around the Cajon Pass region and generally has a more complex and mottled patterning with numerous other patches of shrubs occurring well below the minimum mapping unit. *E. trichocalyx* has a medium green signature, and individual crowns are rarely visible since they form discrete but very dense small patches.
- *Ambrosia dumosa* Alliance (4111) – On middle and upper slopes of the intermontane desert ranges and eastern Sierra foothills, *Ambrosia dumosa* may occur near or adjacent to stands of *Eriogonum fasciculatum.* In these settings, although distinguishing the two types can be difficult due to the sparse cover, *A. dumosa* has a lighter gray crown. *E. fasciculatum* occurs on steeper, more protected, cooler slopes at higher elevations.
- *Viguiera parishii* Alliance (4151) – *V. parishii* may co-dominate with *Eriogonum fasciculatum* on rocky, northerly trending slopes of the Little San Bernardino and Pinto Mountains from Lucerne Valley to Twentynine Palms. When the species do co-dominate, photointerpreters map to the *V. parishii* Alliance. Because *V. parishii* generally occurs in rockier settings and in sparser cover, it is difficult to determine relative dominance between the different species of shrubs occurring in the stand. Within the study area, the relatively restricted distribution and narrowly defined setting of *V. parishii* are important guidelines in mapping this type.
- *Ericameria cooperi* Alliance (5215) – This Alliance also overlaps with *Eriogonum fasciculatum* in and around the Cajon Pass area. Both Alliances occur in post clearance disturbance settings; however, *Ericameria cooperi* usually has a smaller crown that tends to be a medium green rather than brown. *Ericameria cooperi* typically occurs in less steep settings and not on cleared areas related to transportation corridors.
- *Salazaria mexicana* Alliance (5415) – In intermontane desert ranges, *Salazaria mexicana* may occur near or adjacent to *Eriogonum fasciculatum* in post burn settings. The sparse nature of the cover makes distinguishing the two types extremely difficult, especially on steep rocky slopes. In these settings, photointerpreters generally model the location of *S. mexicana* to very rocky areas in and adjacent to small washes in the lower portions of the mountains. Where cover increases, *S. mexicana* tends to be patchier and overall has a lighter gray signature with distinct crown edges along the margins of the vegetation patch.

2221 – *Eriogonum fasciculatum* Alliance

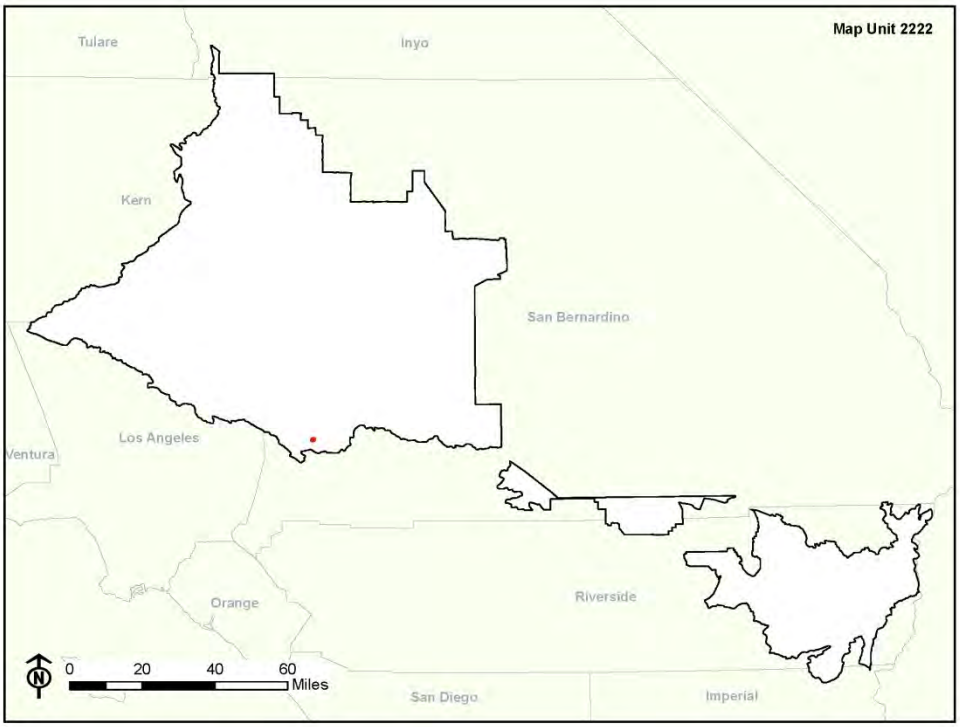


DISTRIBUTION: This type is common and widespread along the desert margins north of the Transverse Ranges from the Bighorn Mountains to Gorman. Stands are also common along the southeastern fringe of the Tehachapi Mountains from Gorman to State Route 58. Stands become sporadic along the eastern Sierra foothills from State Route 58 to the northern boundary of the study area. Scattered localized stands occur in the Granite, Fairview and El Paso Mountains in addition to small isolated hills near Goldstone and Cuddeback Dry Lakes.



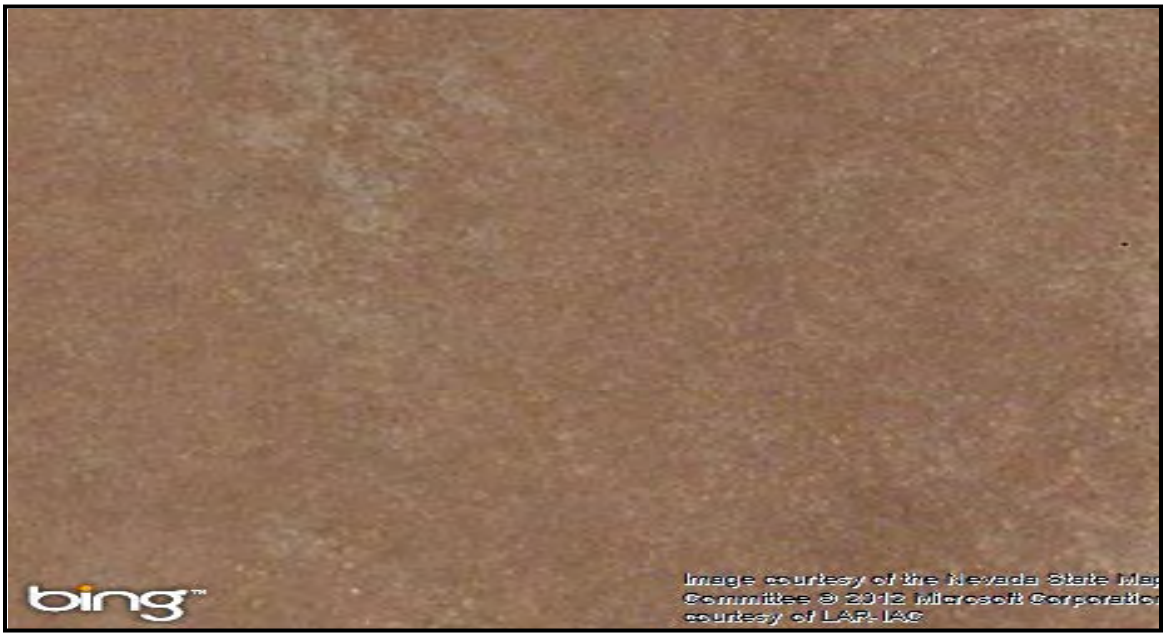
2222 – *Eriogonum wrightii* Alliance

Wright's buckwheat patches 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. Although only one stand of mappable size occurred in the study area, a few stands (below MMU) were observed very close to the DRECP boundary near the transition of the Mojave Desert and Transverse Ranges. Some occurred in successional shrubland in the interface areas between *Yucca brevifolia, Juniperus californica*, and *Quercus john-tuckeri* Alliance stands. Note: In the distribution map above, the size of the polygon has been enhanced for display purposes.

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



This example occurs in the western Antelope Valley where non-native annuals (mostly *Bromus rubens)* share dominance with smaller components of *Nassella pulchra, Poa secunda,* and an even smaller component of *Eschscholzia californica.* Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

In this photo, *Bromus rubens* co-dominates the stand with native grasses including *Nassella pulchra*. Note scattered *Eschscholzia californica* in a small patch toward the middle of the photo.

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

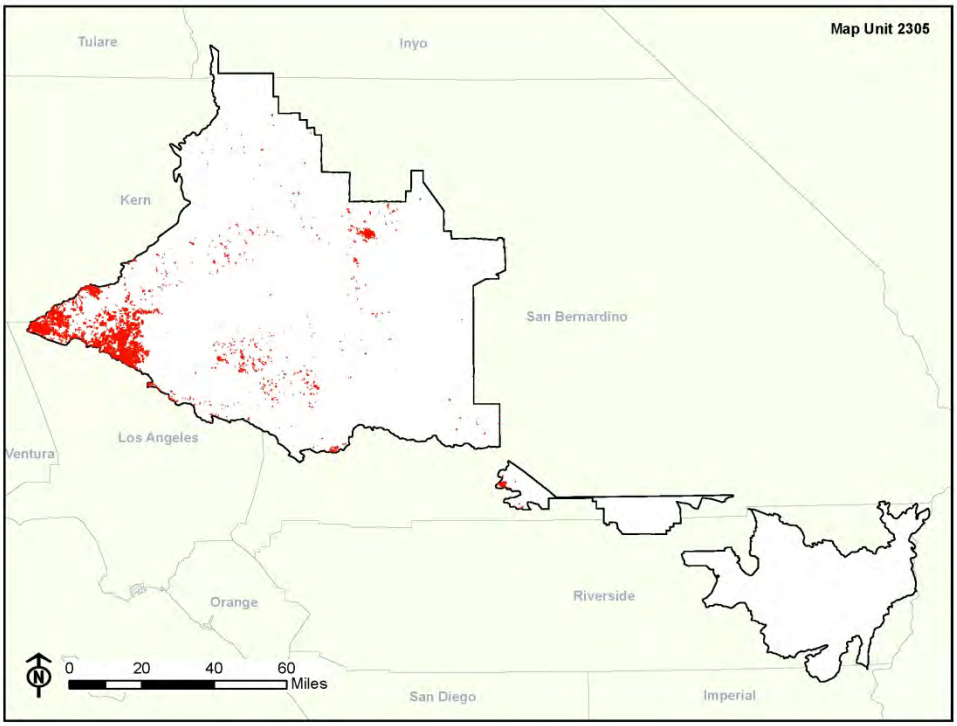
DESCRIPTION: These stands are presumed to contain native grass and herb species especially without wildflower color signature. Stands within this mapping unit can occur in both natural and highly disturbed settings, such as vacant lots in urban locations and on old agricultural fields. In the western Mojave Desert, these grasslands tend to maintain a native component even though cover may be dominated by non-native species such as *Bromus rubens*, *Bromus berteroanus*, *Erodium* spp., or *Schismus* spp. Stands occur throughout the western Mojave, but are more apt to shift from higher grass cover with several native species (*Achnatherum speciosum, Nassella cernua, Poa secunda)*, to less grass cover and more forb cover to the east. Stands near Superior Dry Lake in the northeast portion of the map area are co-dominated with *Amsinckia* spp., *Coreopsis calliopsidea*, and non-native grasses. Patches of California annual forb/grass Group (2310) may occur interspersed with this mapping unit, especially in the western Antelope Valley.

PHOTOINTERPRETATION SIGNATURE: Stands generally have a monotypic signature with little variability. Texture is generally very smooth except in disturbance settings where there is a history of vegetative clearing, or in alkaline areas that have scattered small scalds within the stand.

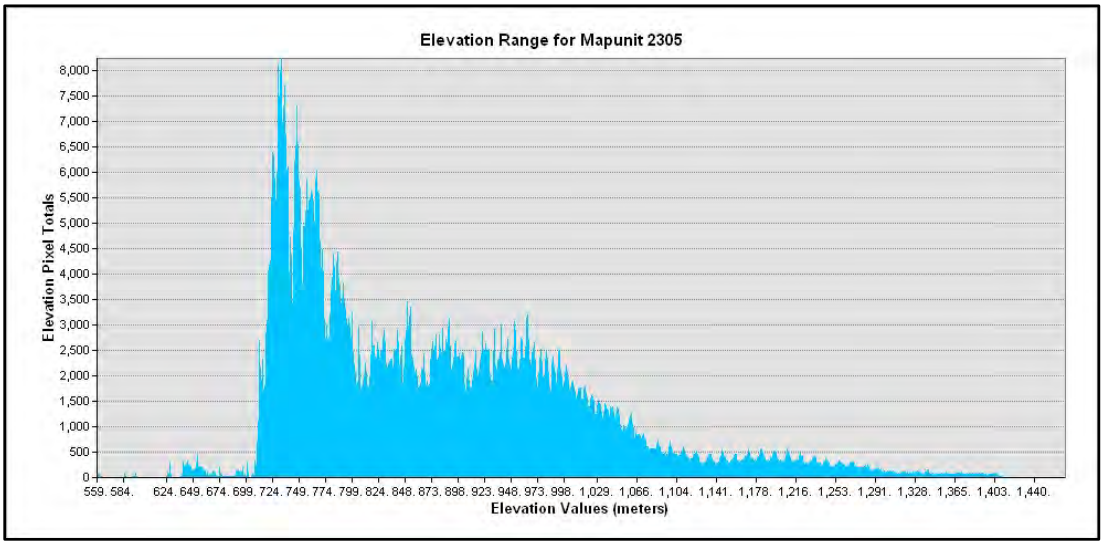
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- California annual forb/grass vegetation Group (Flower Fields) (2310) – Stands containing a component of showy flowers (*Eschscholzia californica, Lasthenia californica, Monolopia* spp., *Amsinckia* spp.) will exhibit color on at least one set of imagery. When the color is consistent over an area larger than 10 acres, the stand should be mapped to this type. These colorful signatures stand out on the 2010 NAIP imagery flown after an especially high late-season rainfall year in portions of the western Antelope Valley.
- Mediterranean California naturalized annual and perennial grasslands Group (Weedy) (2330) – This type cannot reliably be separated out based on photo signature alone. Texture overall is generally more mottled, but signature overlap between the two types is considerable because both mapping units can have a significant matrix of grass and forb species within a stand. In general, most stands that are highly disturbed will contain less of a native component. If the disturbance is occurring in a large urban or agricultural region, the stand is less likely to have a native component. Small disturbances such as recent clearings away from urban or agricultural lands can however return with a high component of native species such as *Achnatherum speciosum* or *Nasella.*

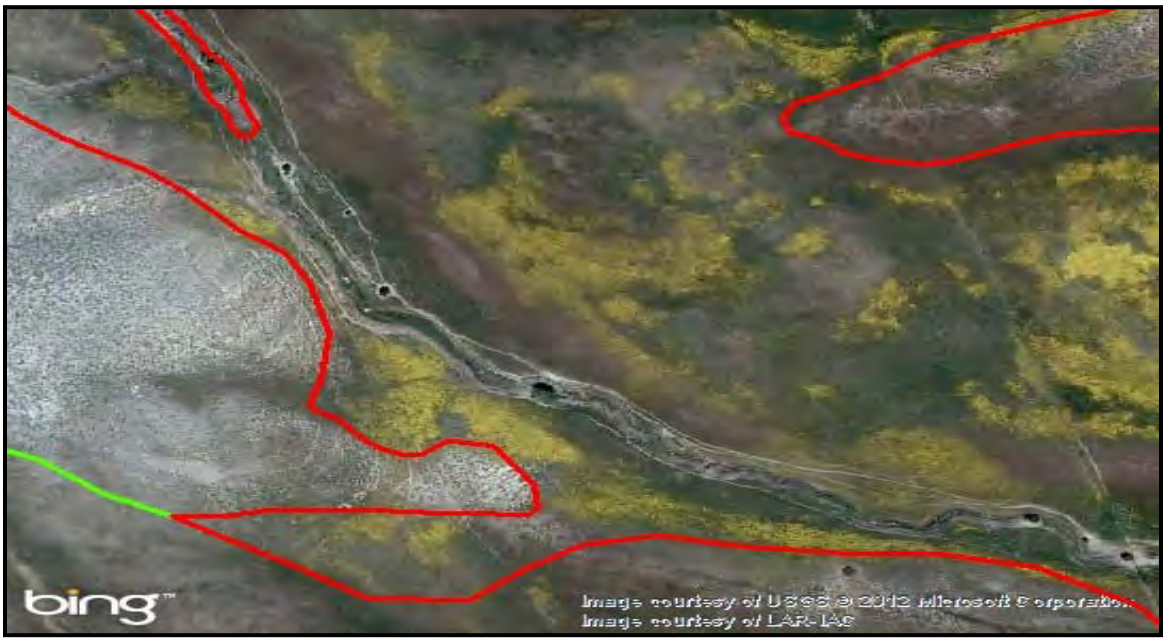
2305 – California annual and perennial grassland Mapping Unit (Native component)



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.



2310 – California annual forb/grass vegetation Group



The above image depicts *Monolopia, Layia platyglossa,* and/or *Lasthenia* after a higher than average late season rain in the western Antelope Valley near Gorman.

Lasthenia californica is depicted here under a stand of *Larrea tridentata* in the El Paso Mountains north of Koehn Dry Lake. In general, stands containing yellow flowers cannot be distinguished or environmentally modeled and must be designated to a Group level.

2310 – California annual forb/grass vegetation Group

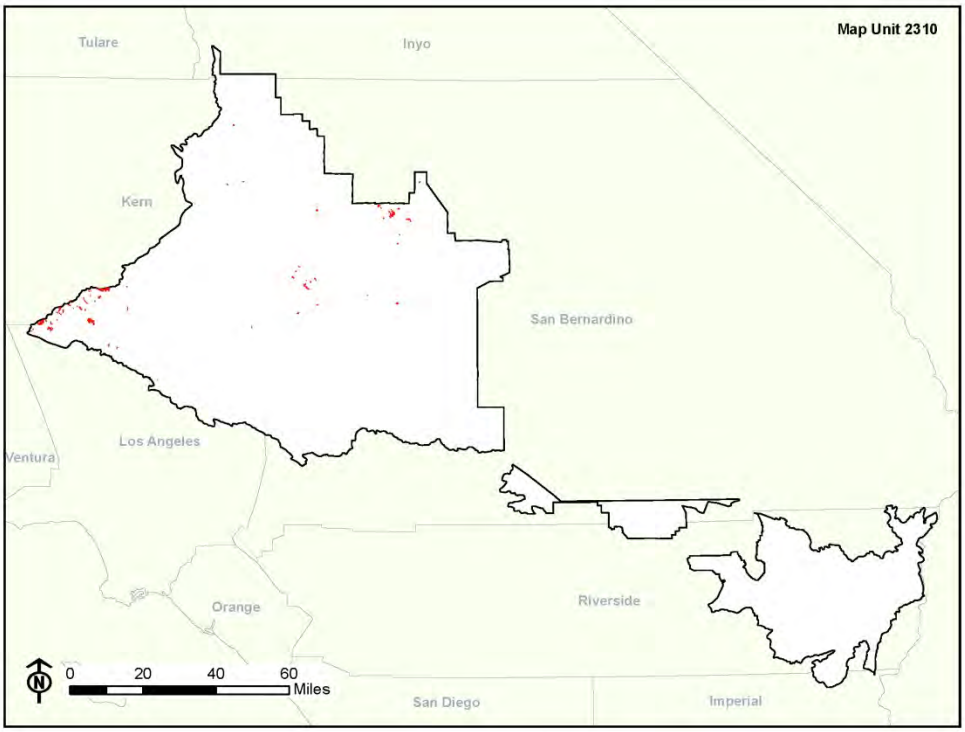
DESCRIPTION: Stands of this Group are dominated or characterized by mostly annual grasses and forbs. Native herbs are characteristic and evenly distributed across the herbaceous layer, though non-native forbs and grasses may be dominant. Cover and composition vary year to year, but indicators are usually present in sufficient amounts to differentiate these stands from non-native stands. Diagnostic species include *Amsinckia* spp., *Eschscholzia* spp., *Lasthenia* spp., *Monolopia* spp., *Layia* spp., *Coreopsis* spp., *Plantago erecta* and *Vulpia microstachys*.

PHOTOINTERPRETATION SIGNATURE: Stands designated with this vegetation Group have a showy color display on at least one set of imagery. In most cases, these flower displays are seen on the 2010 NAIP late spring – early summer imagery. When the color(s) is/are consistent over an area larger than 10 acres, the stand should be mapped to this type. Texture is smooth as in most herbaceous types but patterning is mottled, often with a patchwork of colors intermixing with the typical signatures of the annual Mediterranean grasses. No one color dominates the stand except yellow.

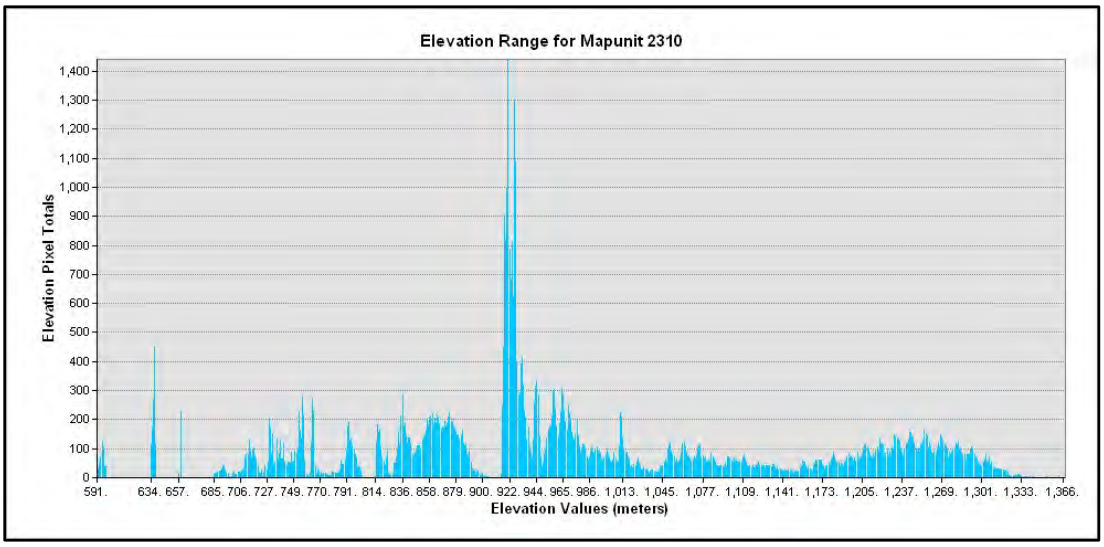
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- California annual and perennial grassland Mapping Unit (Native component) (2305) – Stands designated with this mapping unit lack the consistent showy color reflected in the native flower fields. Although both types are represented throughout the study area west of the Mojave River, this mapping unit is significantly more common and widespread. Stands mapped to this type are less likely to occur in alkaline settings where *Lasthenia* will often bloom adjacent to scalds with *Atriplex spinifera.*
- Mediterranean California naturalized annual and perennial grassland Group (Weedy) (2330) – These are weedy areas that contain little or no native forbs. Difficulty separating out these two categories occurs in disturbance sites which are returning as weedy fields but with a significant component of *Amsinckia* spp. In these situations, *Amsinckia* that is consistent in the herbaceous layer cannot be detected on the photo, and mapped stands may be incorrectly designated with this type.

2310 – California annual forb/grass vegetation Group

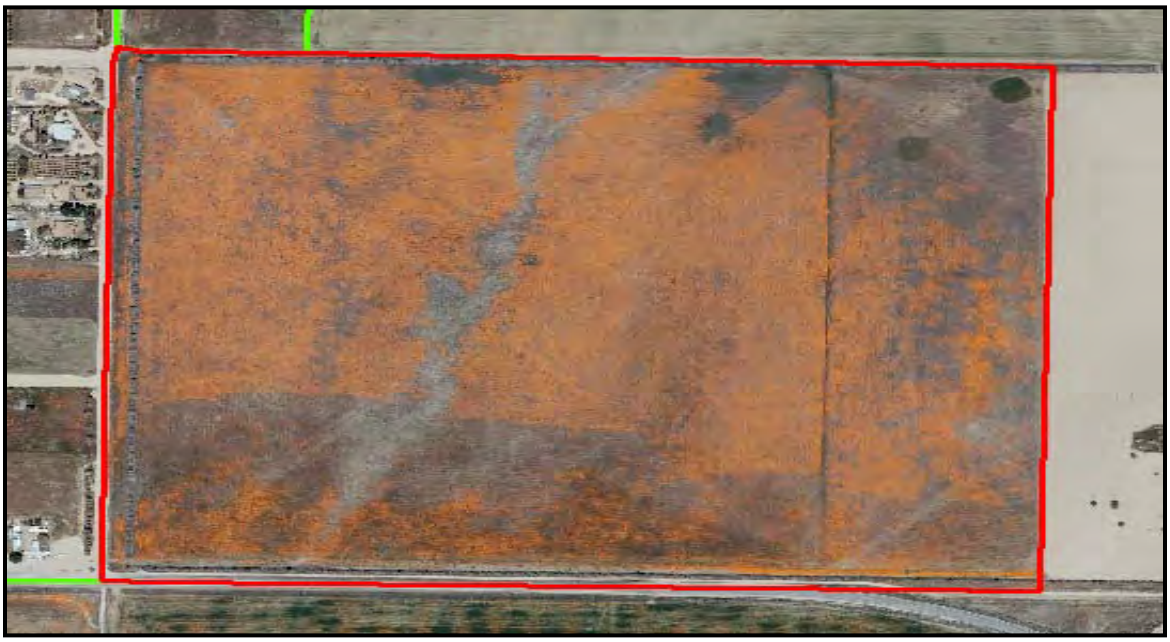


DISTRIBUTION: Stands are scattered in locations throughout the western Mojave Desert and are more common in the western Antelope Valley. Scattered stands occur in alkaline settings in Edwards AFB and Superior Valley.



2311 – *Eschscholzia (californica)* Alliance

California poppy fields Alliance



The above image shows *Eschscholzia* in an old plowed field just north of the Antelope Valley California Poppy State Reserve.

This is a typical setting where *Eschscholzia* cover varies considerably across short distances, creating a patchy signature on the image and on the ground.

2311 – *Eschscholzia (californica)* Alliance

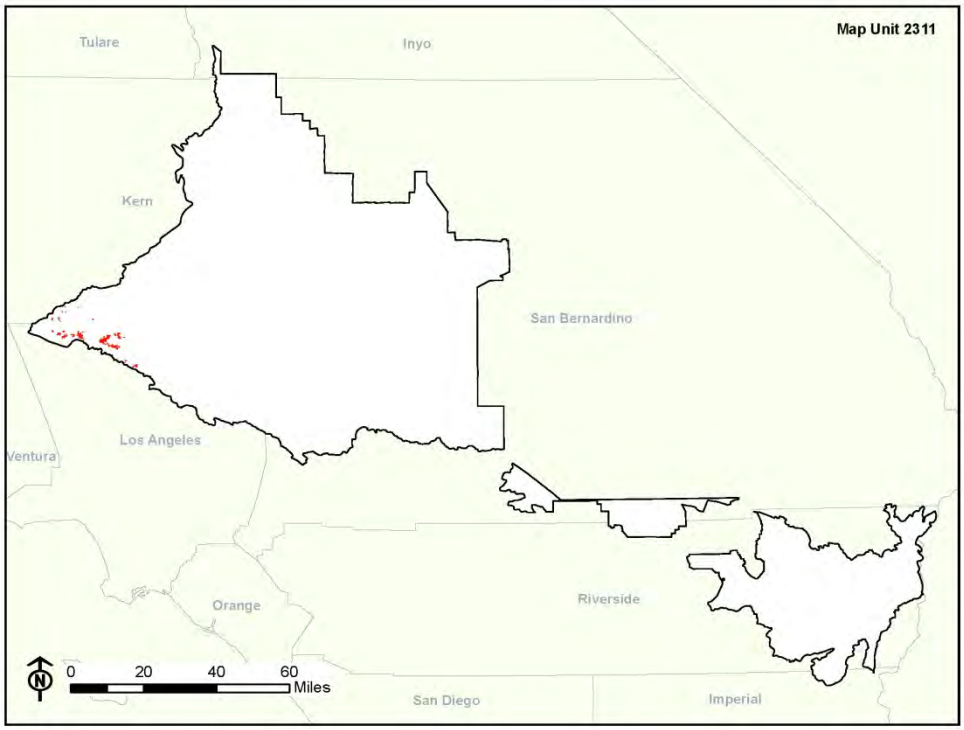
DESCRIPTION: In this Alliance *Eschscholzia californica* is seasonally dominant on upland slopes or flats with well-drained sandy to loamy soils. *Amsinckia, Avena, Bromus, Castilleja exserta, Erodium cicutarium, Gilia* spp., *Lupinus bicolor, Lupinus microcarpus, Uropappus lindleyi* and a variety of other native and non-native forbs and grasses may be present. Known from famous wildflower fields in Antelope Valley on non-alkaline soils from west of Lancaster and Palmdale to Gorman, *Eschscholzia californica* is associated with *Poa secunda, Achnatherum speciosum, Gutierrezia* spp., *Eriogonum fasciculatum, Ericameria linearifolia,* and *Ericameria nauseosa* Alliance stands. The plants tolerate disturbance such as regular spring grazing and past agricultural tilling.

PHOTOINTERPRETATION SIGNATURE: The signature color is orange, which is scattered to dominant but consistent throughout the stand without any other co-dominance of flower color. Most stands are mapped from the 2010 NAIP imagery, which shows conditions after a late-season, high-rainfall year. *Eschscholzia californica* is mapped when its orange signature dominates the stand of mixed-color showy flower fields (generally mixed with yellow but occasionally with purple flowers). Co-dominance of showy flower field colors is mapped to the generic Group category (2310). Signature patterning is often mottled but in portions of the western Antelope Valley, extensive fields of *Eschscholzia* dominate large areas.

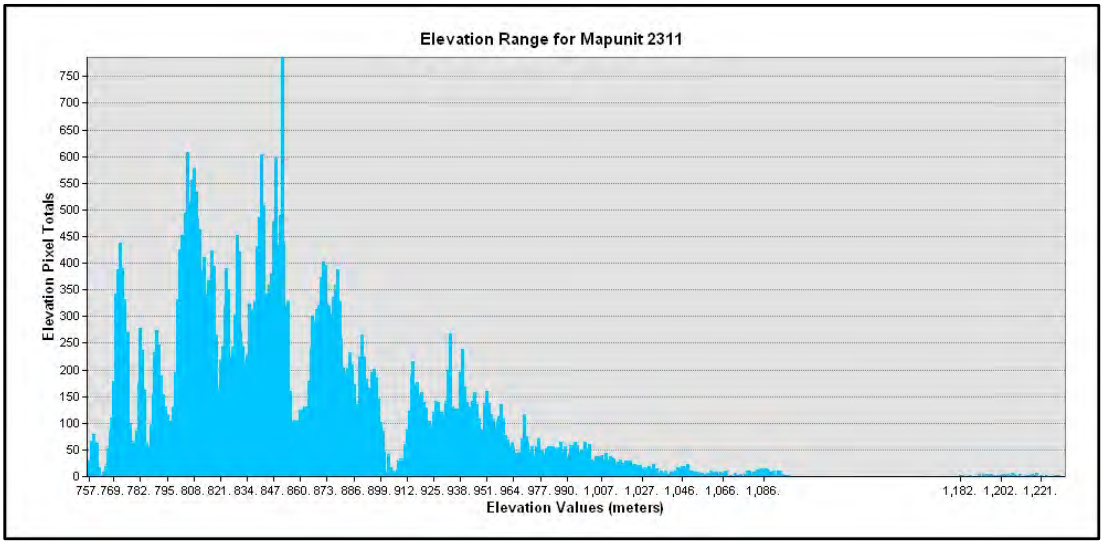
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- California annual forb/grass vegetation Group (Flower fields) (2310) – Signature colors in this Group have more than one showy flower color (usually yellow and orange) occurring in a patchwork less than 10 acres in size. Stands mapped to this category have no one color dominating the stand except in flower fields which show yellow. Species yielding yellow colors in most cases cannot be distinguished or modeled in the study area.

2311 – *Eschscholzia (californica)* Alliance

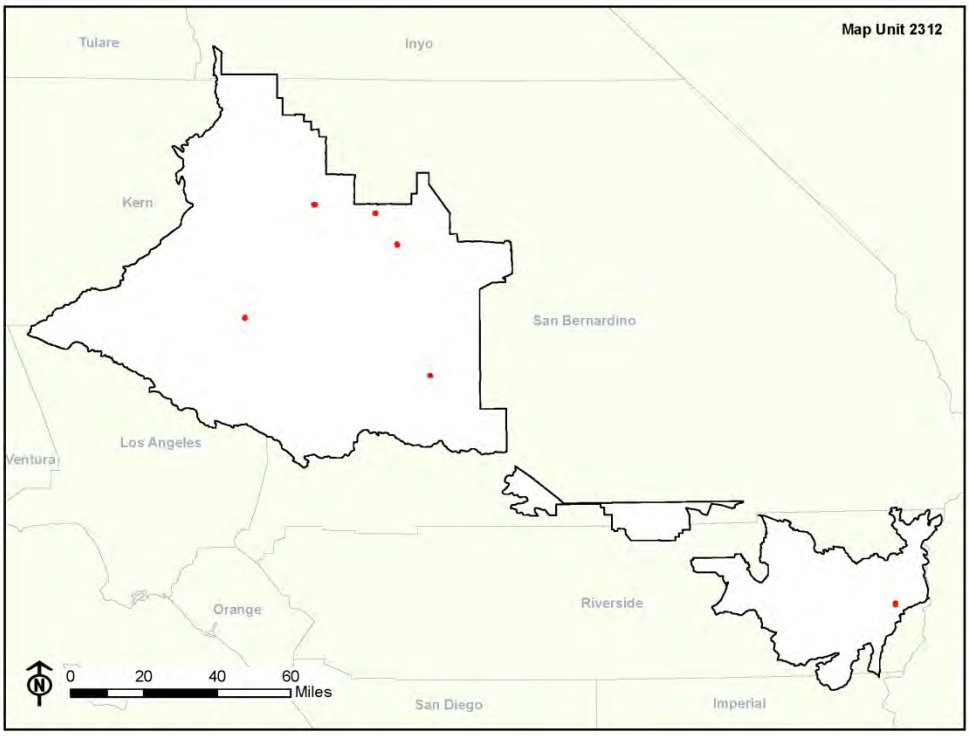


DISTRIBUTION: Stands of *Eschscholzia* are located exclusively in the western portion of the Antelope Valley north of the lower foothills of the Sierra Pelona. The best examples are found near and immediately north of the Antelope Valley California State Poppy Preserve.



2312 – *Amsinckia (menziesii, tessellata)* Alliance

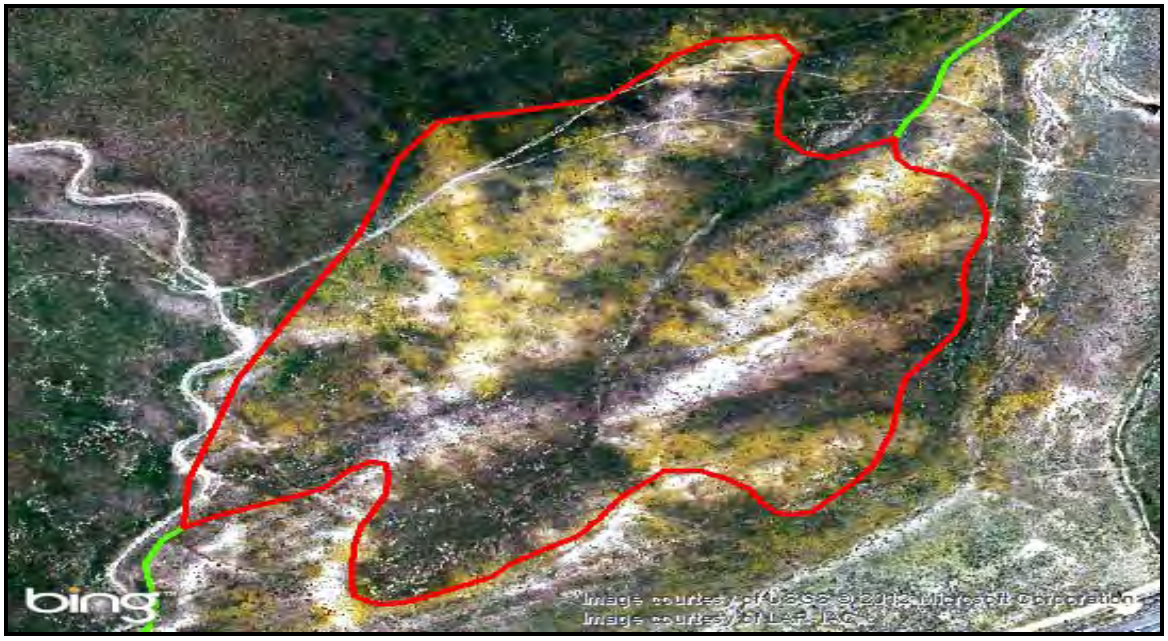
Fiddleneck fields Alliance



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). Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

2313 – *Lasthenia californica – Plantago erecta – Vulpia microstachys* Alliance

California goldfields – Dwarf plantain – Six-weeks fescue flower fields Alliance



The above example depicts a stand in the western Antelope Valley north of State Route 138, where *Lasthenia gracilis* co-dominates the herbaceous layer with annual grasses and other herbs.

Lasthenia gracilis tends to occur as an understory in somewhat alkaline settings such as this one, where *Atriplex spinifera* is seen as the overstory at between 5 and 10 percent shrub cover.

2313 – *Lasthenia californica – Plantago erecta – Vulpia microstachys* Alliance

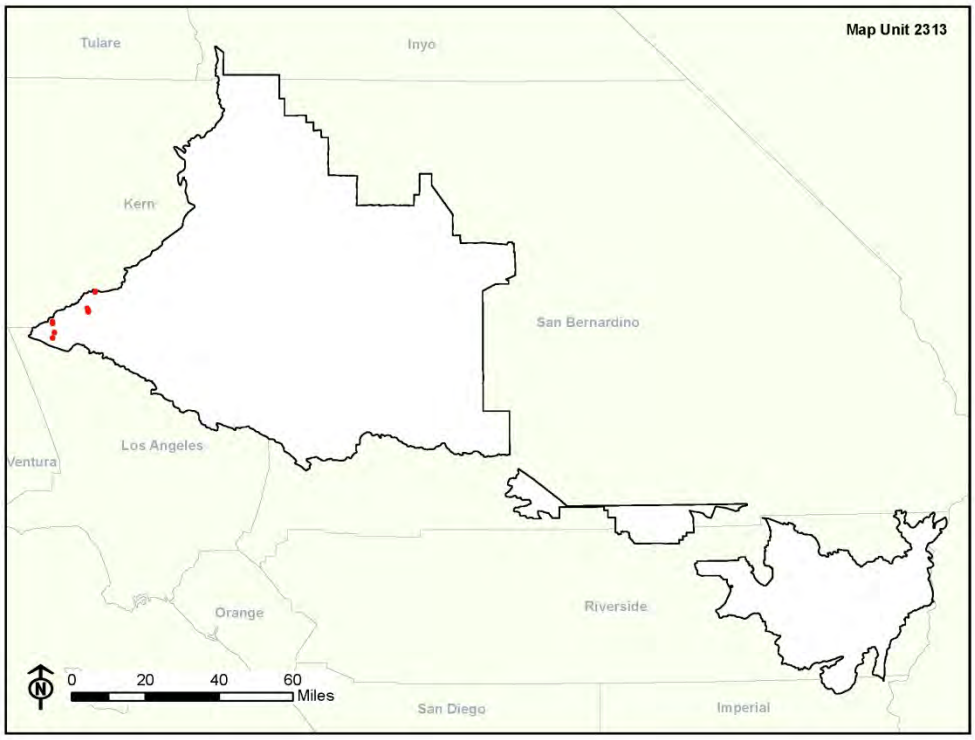
DESCRIPTION: In this Alliance native annual species *Vulpia microstachys*, *Plantago erecta* and/or *Lasthenia californica* (or *L. gracilis)* are characteristically present in stands and usually at least 10 percent relative in cover to other herbs. *L. gracilis* completely replaces *L. californica* in the western Mojave Desert. Other native species such as *Castilleja exserta, Crassula connata, Lepidium nitidum, Lupinus,* and *Trifolium* are often well-represented (and sometimes co-dominant to dominant) as well as a variety of herbs. Soils may be clayey, wet to moist in spring and dry by summer. Stands of the Alliance are mapped mainly in the Antelope Valley west of Lancaster and Palmdale, but may also occur as a component of *Larrea tridentata* or related Alliances in clearings as far east as the Granite and Sidewinder Mountains. Stands with an even distribution of *Larrea* or other desert shrubs with more than 2 percent cover were mapped as a shrub Alliance.

PHOTOINTERPRETATION SIGNATURE: Stands occur as an understory herbaceous layer to *Larrea tridentata* or *Atriplex spinifera* north and east of Edwards AFB. Late spring imagery depicts these areas, none of which were mapped to this Alliance due to the high cover of shrubs. Several stands which are mapped in the Antelope Valley based on site visits depict the yellow signature of *Lasthenia* flowers that are strongly dominant on the 2010 NAIP imagery. As with all flower signatures, texture is very smooth but patterning is patchy across the stand.

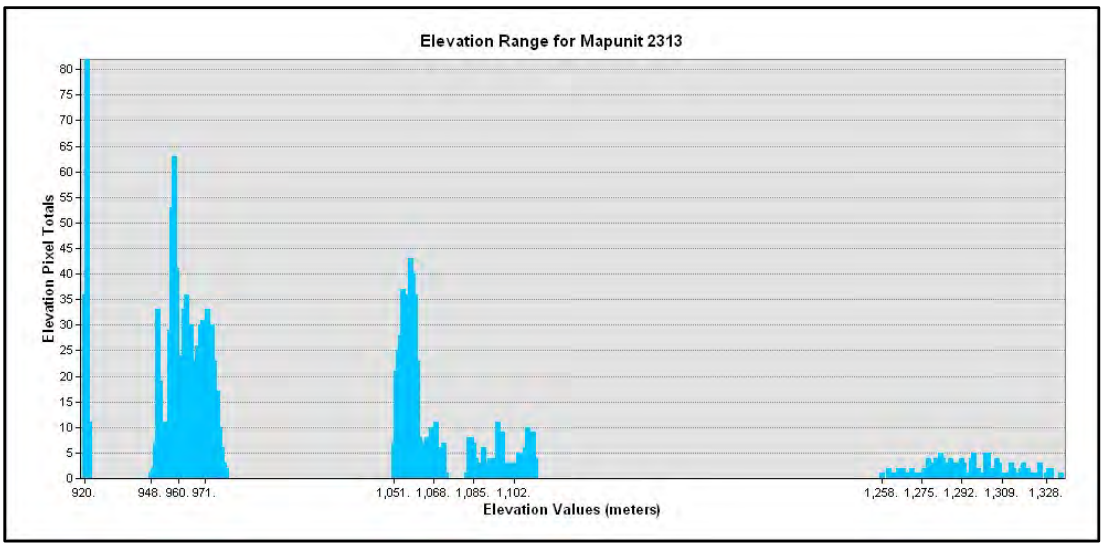
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- California annual forb/grass vegetation Group (Flower Fields) (2310) – Signature colors in this Group generally have more than one showy flower color (usually yellow and orange) occurring in a patchwork less than 10 acres in size. No one color (other than yellow, occasionally) dominates the stand. In situations where yellow dominates the color, photointerpreters cannot determine which species of flower is present and the stand is therefore mapped to the Group level.
- *Larrea tridentata* Alliance (4119) and *Atriplex spinifera* Alliance (3723) - In the western Mojave near Kramer Junction, these two Alliances often have a dense cover of *Lasthenia* under a fairly sparse shrub cover. However, stands in this area have shrub cover over 2 percent, and no patches of *Lasthenia* above 10 acres were observed.

2313 – *Lasthenia californica – Plantago erecta – Vulpia microstachys* Alliance

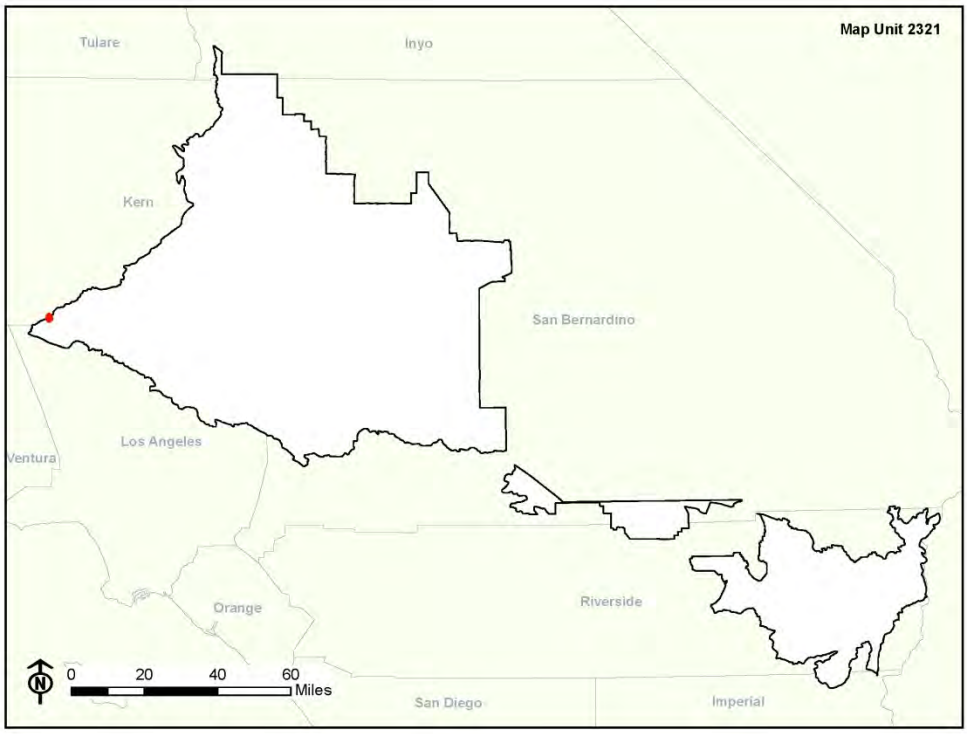


DISTRIBUTION: Only a few stands were mapped, all in the western Antelope Valley. This combination of species is however common as an understory in late spring beneath creosote and spinescale shrublands throughout much of the western Mojave Desert. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



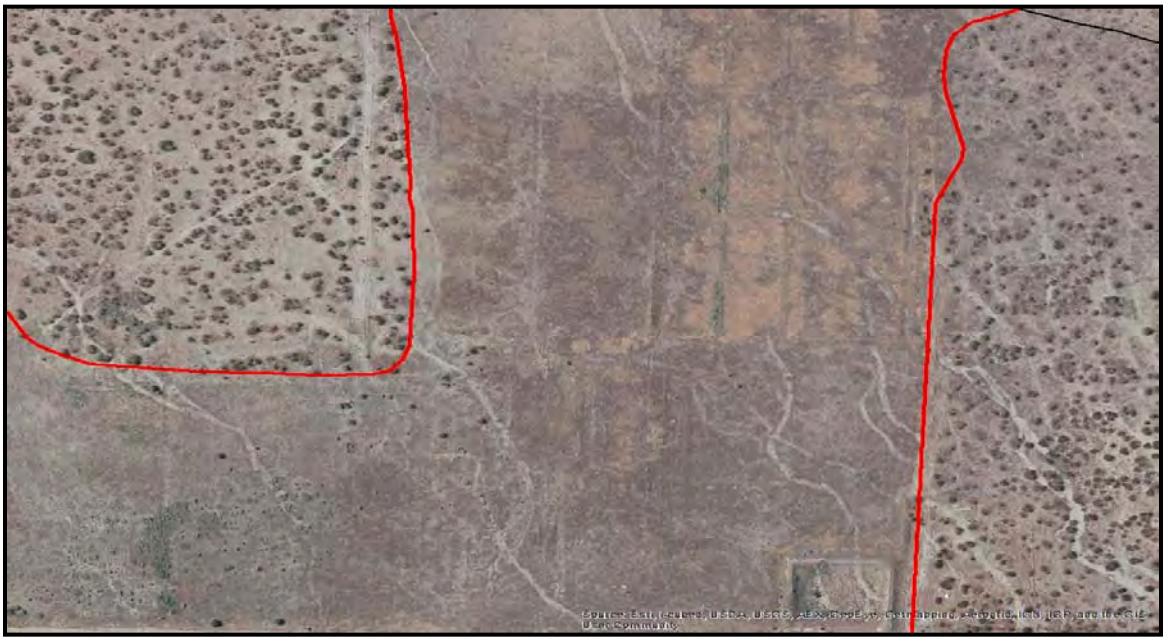
2321 – *Nassella cernua* Provisional Alliance

Nodding needle grass grassland Provisional Alliance



DISTRIBUTION: Stands of this Provisional Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, the size of the polygon has been enhanced for display purposes.

2330 – Mediterranean California naturalized annual and perennial grassland Group



The above image depicts a portion of annual grassland dominated by a mix of *Bromus rubens* and other non-native forbs with an inconsistent scattering of *Larrea tridentata* and other shrubs below 1 percent cover. The above example is an old agricultural field located in the Antelope Valley.

Bromus rubens, along with other annual grasses and forbs, strongly dominates this example of Mediterranean annuals in cover over 15 percent. *Larrea tridentata* increases in the background toward the middle and upper portions of the photo.

2330 – Mediterranean California naturalized annual and perennial grassland Group

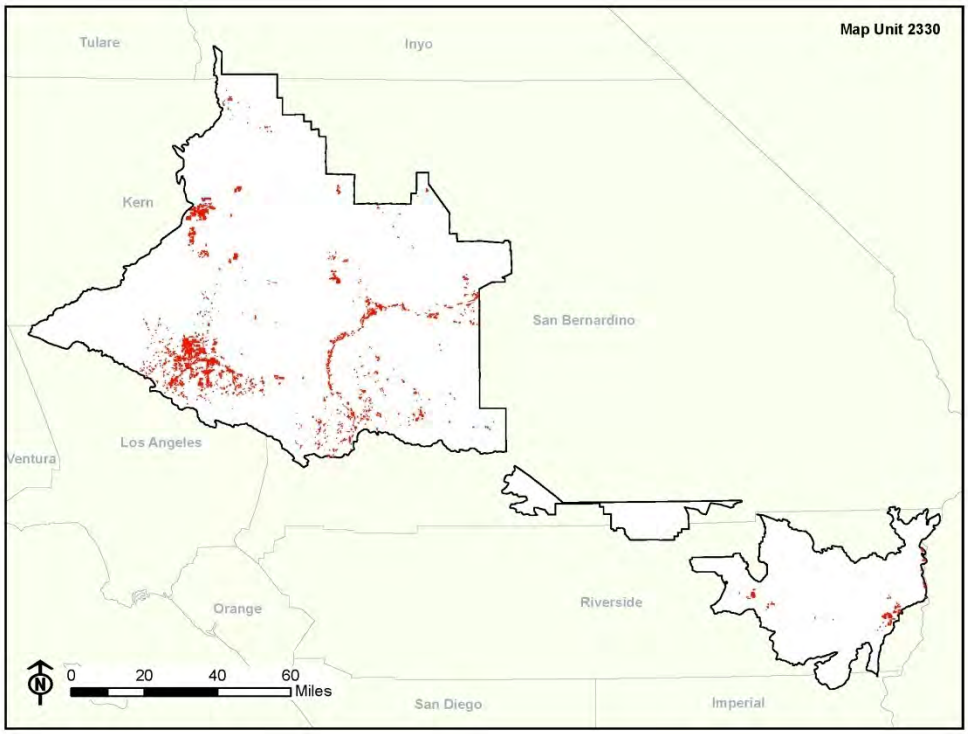
DESCRIPTION: Stands are strongly dominated by non-native herbaceous species, lacking evenly distributed diagnostic native plants (which usually constitute less than 5 percent of relative cover). Annual *Bromus, Schismus, Avena, Brassica* and other non-natives are strongly dominant, with little regular 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 higher 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 tends 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 its annual growth cycle.

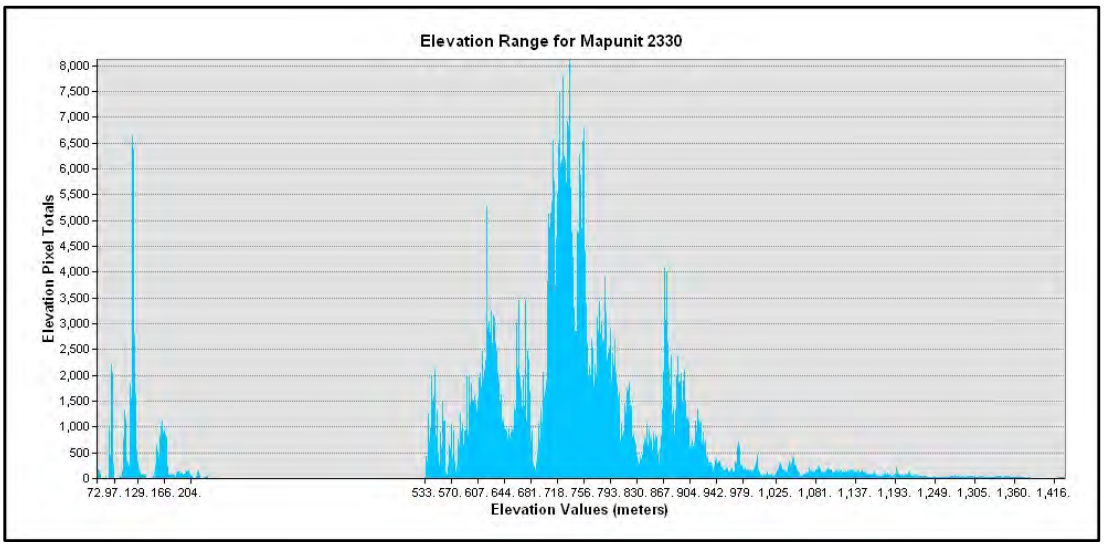
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- 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,* to mention a few. This cover may vary considerably between image datasets created in different years and also between the baseline imagery date of 2010 and when subsequent field verification was undertaken.

2330 – Mediterranean California naturalized annual and perennial grassland Group

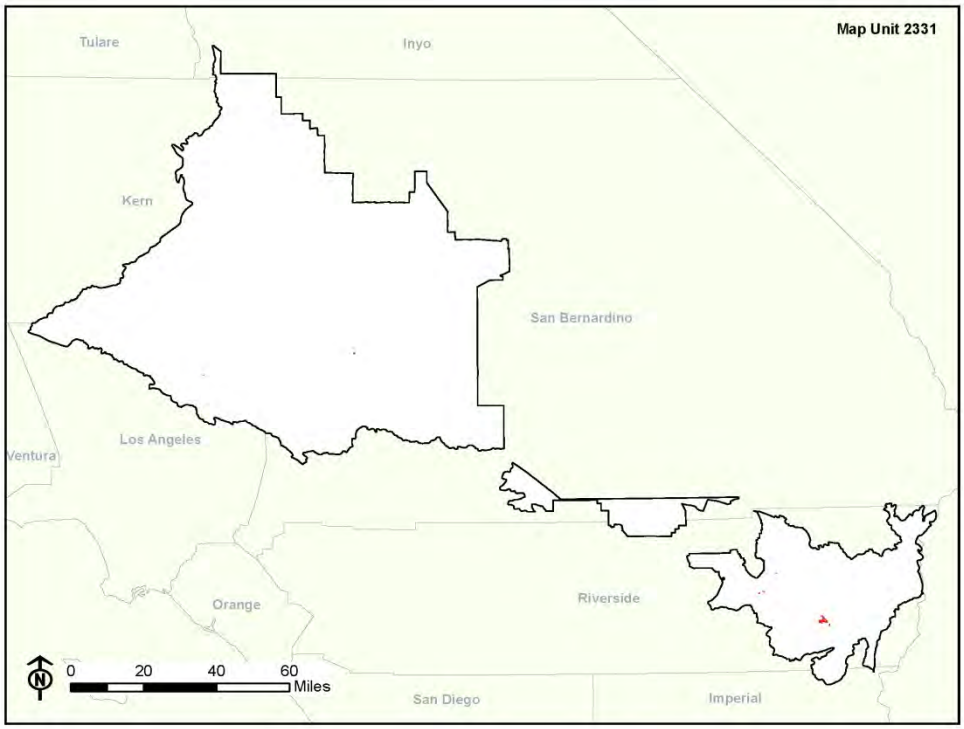


DISTRIBUTION: This mapping unit is found throughout most of the study area with the exception of portions of the Colorado Desert, Yucca Valley and western Antelope Valley. Highest concentrations occur in and around the heavily urbanized areas of Lancaster, Palmdale, Victorville, and Hesperia, and also along the Mojave River.



2331 – *Brassica nigra* and other mustards Semi-natural Stands

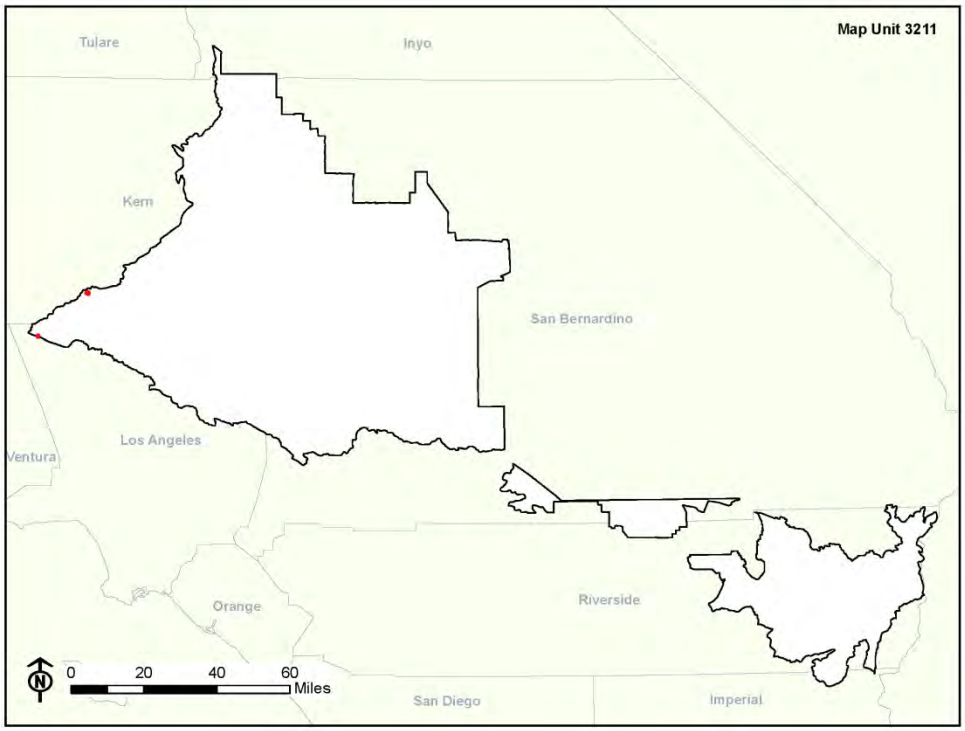
Upland mustards Semi-natural Stands



DISTRIBUTION: Although a common component to numerous stands of weedy herbaceous vegetation, this type was infrequently mapped in the study area. Especially in Subarea 3, there were several cases where polygons mapped as Mediterranean California naturalized annual and perennial grassland Group (2330) were in fact likely to be stands strongly dominated by *Brassica* sp. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project.

3211 – *Ribes quercetorum* Provisional Alliance

Oak gooseberry thickets Provisional Alliance



DISTRIBUTION: Stands of this Provisional Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Stands are more common outside of the study area, immediately to the west and the south of the western portion of Subarea 1. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

3312 – *Quercus john-tuckeri* Alliance

Tucker oak chaparral Alliance

In this image, stands of *Quercus john-tuckeri* form an emergent canopy over an understory of *Eriogonum fasciculatum. Q. john-tuckeri* increases in cover in protected settings, especially toward the right side of the image. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

The darker green *Quercus john-tuckeri* dominates the tall shrub and low tree canopy with minor amounts of *Juniperus californica* (bright green) over a discontinuous small shrub layer on an undulating upper alluvial fan.

3312 – *Quercus john-tuckeri* Alliance

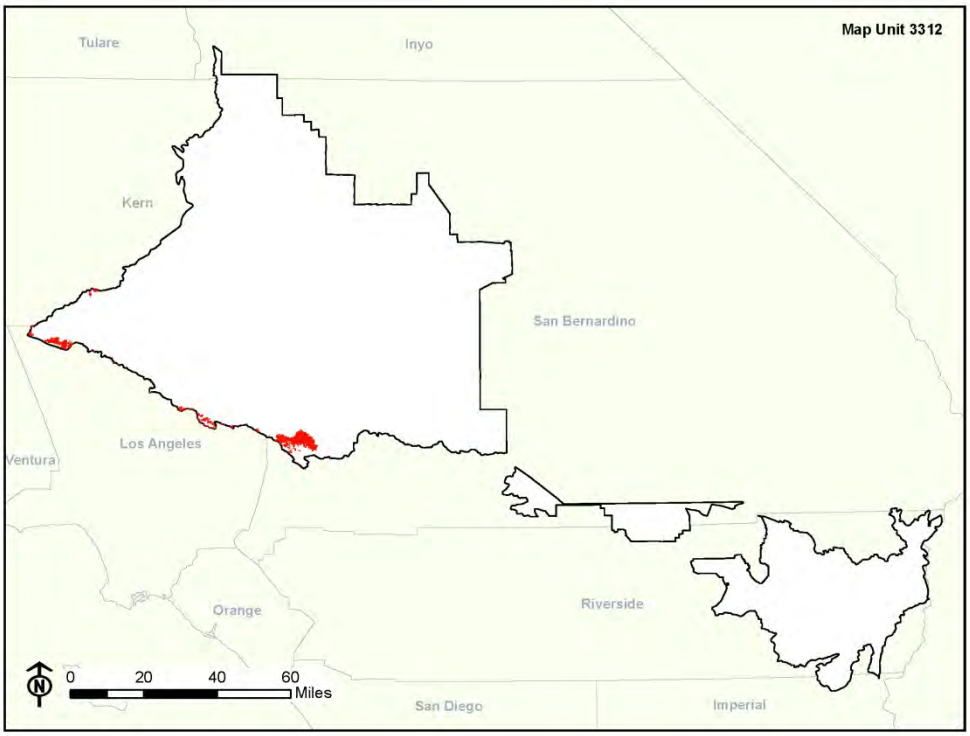
DESCRIPTION: In this Alliance *Quercus john-tuckeri* is dominant, or is co-dominant and evenly distributed across the stand. It can intermix with *Juniperus californica* at similar or higher cover. *Q. john-tuckeri* tends to occur on drier mesic settings in shallow ravines and lower side slopes. In these settings, a variety of shrubs, such as *Arctostaphylos glauca, Garrya flavescens, Ericameria linearifolia, Ericameria cooperi, Adenostoma fasciculatum,* and *Eriogonum fasciculatum*, may be present at low cover in the shrub layer. Stands are found along the northern fringe of the Sierra Pelona and San Gabriel Mountains. Stands in the Sierra Pelona and Tehachapi Mountains tend to hybridize with *Quercus douglasii*. For mapping purposes, the stand is assigned to the *Quercus john-tuckeri* Alliance when the structural characteristics of the vegetation appear more shrub-like.

PHOTOINTERPRETATION SIGNATURE: *Quercus john-tuckeri* is a medium to large shrub with a well-defined crown. Crowns vary in size and height, and tend to have a dark gray color with a brownish or slightly green tint. *Q. john-tuckeri* cover varies considerably across the stand and among other *Q. john-tuckeri* stands in locations nearby. There is almost always a small shrub layer, making the overall vegetative cover of this Alliance quite high. In many stands, there is a component of *Juniperus californica,* which can be identified by the more consistently rounded crown and brighter green signature. More open stands at lower elevations can have a component of *Yucca brevifolia,* which readily separates this type from other scrub oak Alliances.

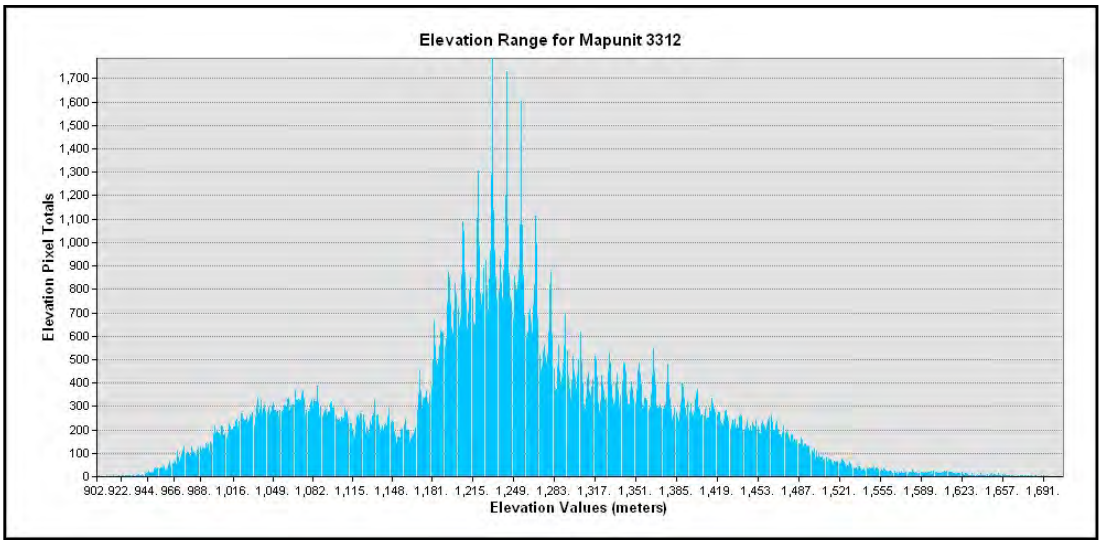
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus californica* Alliance (1122) – Mixing of these two species is fairly common and occurs over a significant portion of their range, generally on more level and less undulating topography. Overall, *J. californica* is found at slightly lower elevations. *Juniperus californica* has a fairly regular rounded crown in both smaller and large individuals; crown shape is more irregular in *Q. john-tuckeri*. Signature color overlap between the two species is minimal with *J. californica* being almost always a brighter green.
- *Quercus berberidifolia* Alliance (2132) – Overlap between these two Alliances is minimal and occurs along a narrow band near and just west of Cajon Summit. Where they overlap, the two species are indistinguishable on aerial imagery. Within their narrow overlap zone, *Q. berberidifolia* may co-dominate over small areas with *Q. john-tuckeri* in a typical semi-desert chaparral setting where only *Q. john-tuckeri* would be expected. Unlike *Q. berberidifolia*, *Q. john-tuckeri* is not expected to occur in a California mesic chaparral setting with species such as *Prunus ilicifolia, Ceanothus crassifolius* or *Cercocarpus montanus.*

3312 – *Quercus john-tuckeri* Alliance



DISTRIBUTION: *Quercus john-tuckeri* is found in a narrow swath along the Transverse Ranges from just east of Cajon Summit to Gorman. Stands are extensive near Cajon Summit with over 15,000 acres (almost 25 square miles) of nearly continuous cover. Stands near Gorman are smaller and tend to hybridize with *Quercus douglasii.*



3314 – *Quercus cornelius-mulleri* Alliance

Muller oak chaparral Alliance

This image depicts an example of *Quercus cornelius-mulleri* on steep rocky terrain on the lower slopes of the Little San Bernardino Mountains. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

In this photo, *Quercus cornelius-mulleri* occurs with *Yucca brevifolia* on a steep north slope with a moderately dense smaller shrub understory.

3314 – *Quercus cornelius-mulleri* Alliance

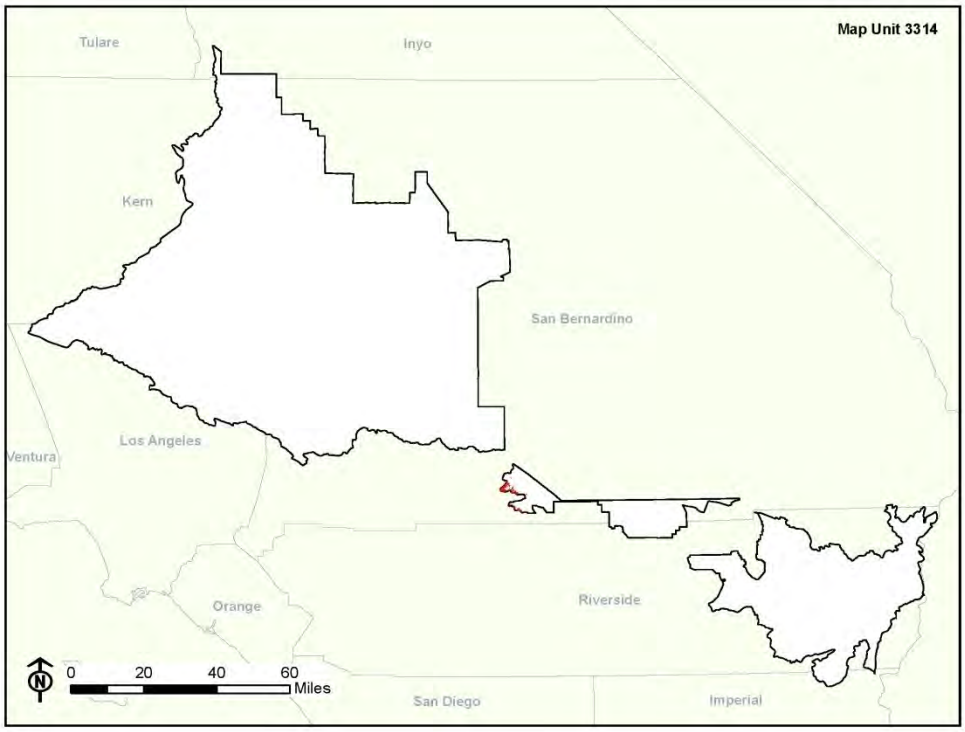
DESCRIPTION: In this Alliance *Quercus cornelius-mulleri* is dominant, or is co-dominant and evenly distributed across the stand. It occurs with a mixture of shrubs including *Eriogonum fasciculatum, Ericameria linearifolia, Ericameria teretifolia,* and *Yucca schidigera.* Stands are limited to the vicinity of Morongo Valley and the town of Yucca Valley. These stands are on north-facing slopes and often mix with stands of *Juniperus californica* or *Coleogyne ramosissima*. If *J. californica* and *Q. cornelius-mulleri* are co-dominant, then *J. californica* is the Alliance type, especially where stands contain some *C. ramosissima* and *Achnatherum speciosum*.

PHOTOINTERPRETATION SIGNATURE: Individual crowns within the *Quercus cornelius-mulleri* Alliance are typically significantly smaller than in other scrub oak Alliances in the study area. Individuals of both *Q. Cornelius-mulleri* and *Q. john-tuckeri* are difficult to distinguish, and both are known from the Little San Bernardino Mountains in Joshua Tree National Park, adjacent to the mapping area. However, there is no known identifiable range of overlap of the two scrub oak Alliances in the mapping area. Although crown sizes of *Q. cornelius-mulleri* individuals are rather small, they are significantly larger than the other associated desert shrubs commonly found within this Alliance. *Q. cornelius-mulleri* stands tend to be open, and occur primarily on steep northerly slopes in rocky terrain, which make the oak cover in this type stand out quite vividly against the light-colored granites associated with this Alliance.

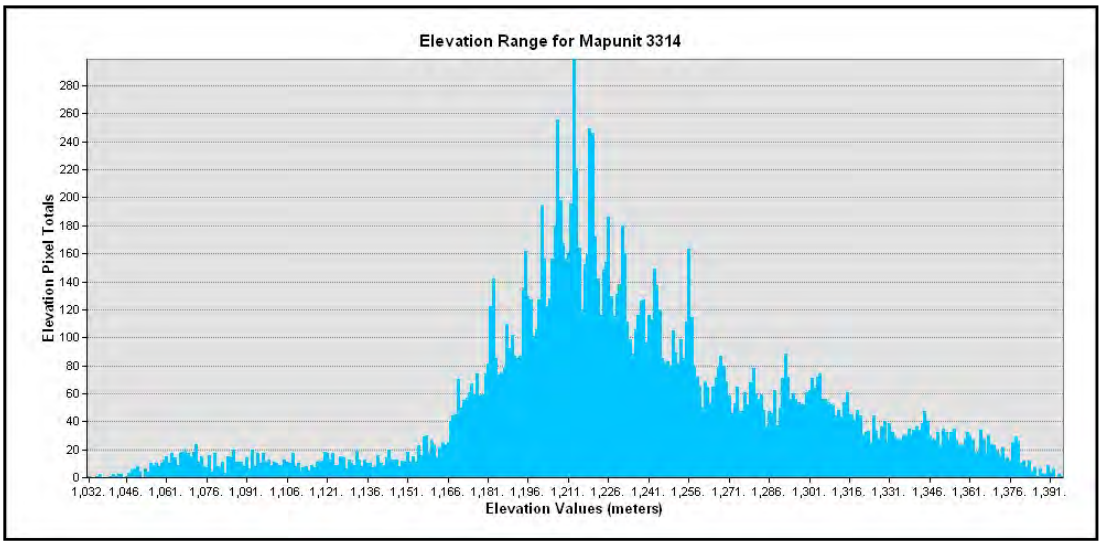
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus californica* Alliance (1122) – This Alliance can occur adjacent to or near stands of *Quercus cornelius-mulleri*. Junipers generally have a larger more rounded crown and are slightly taller. When seen next to *Q. cornelius-mulleri*, the juniper is distinguishable by having a brighter green color. The *Juniperus californica* Alliance is usually found on less steep and less rocky settings than *Q. cornelius-mulleri.*

3314 – *Quercus cornelius-mulleri* Alliance



DISTRIBUTION: This Alliance is limited to the lower foothills north of Pioneertown and the Little San Bernardino Mountains south of Yucca Valley.



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

Hardstem bulrush, California bulrush Mapping Unit

The above stand is located along a small oxbow off the Colorado River. The vegetation is strongly dominated by *Schoenoplectus.* Emergent light-colored tufts toward the center of the stand are *Arundo donax* canes.

This photo depicts *Schoenoplectus* in varying stages of growth surrounding a small pond adjacent to the Colorado River.

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

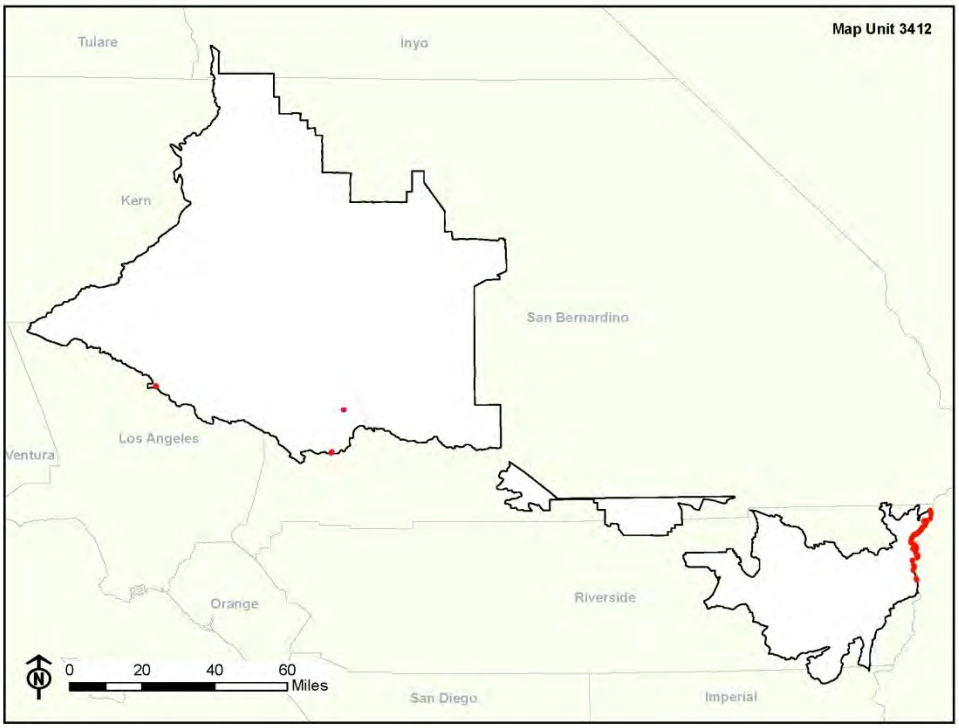
DESCRIPTION: *Schoenoplectus acutus* or *S. californicus*, tall bulrushes, dominate the stand. Small stands occur in all areas of the study where ponds and sluggish permanently flowing freshwater exist. Note: two Alliances are combined within this mapping unit. It is not possible to map these bulrushes to the species level without substantiating them in the field; however, when field information was available, the stand was assigned to its corresponding Alliance. Both species within this mapping unit have similar ecologies in the study area. *S. acutus* occurs in fresh or brackish water; *S. californicus* appears more regularly at edges of open water.

PHOTOINTERPRETATION SIGNATURE: Signature is highly dependent on the amount of senesced vegetation in the stand along with the presence of open areas of standing water. New annual growth generally is not widely represented on image datasets which are flown early in the summer before the young stems emerge. For both Alliances within this mapping unit, signature texture is smooth to finely stippled, and patterning ranges from fairly uniform to highly mottled. Patterning is determined primarily by the irregular distribution of the new growth and the previous year's growth within a stand. The color of senesced growth ranges from a tan to dark gray and is highly variable within the stand.

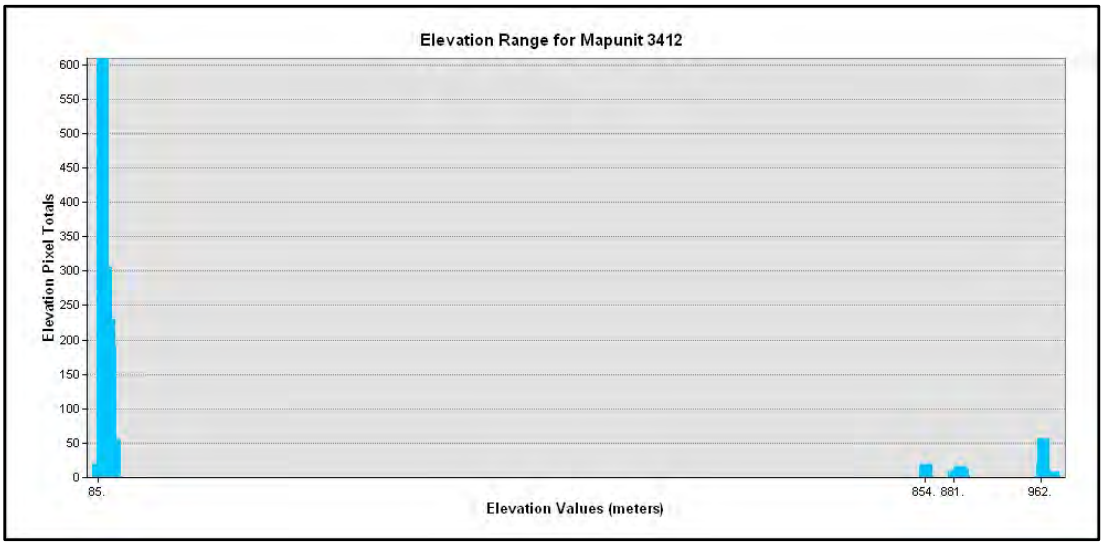
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Typha (angustifolia, domingensis, latifolia)* Cattail marsh (3415) – Marshes dominated by *Typha* are distinguished based on photo signature only. No apparent environmental distinctions from *Schoenoplectus* were observed during reconnaissance or later noted on the imagery during the mapping effort. However, mapped stands do occur less frequently along the Colorado River and are more often mapped along the edges of small farm ponds and reservoirs. In most settings, *Typha* has a lighter tan signature color when observing previous year's growth, which was the typical growth cycle on all image datasets.

3412 – *Schoenoplectus acutus, californicus* Mapping Unit

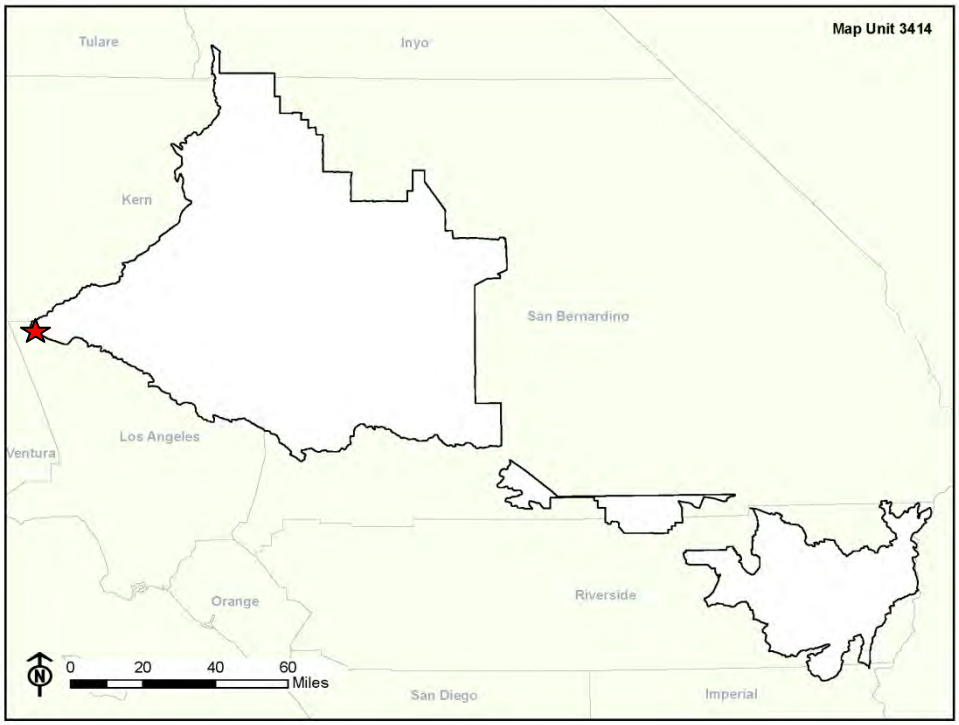


DISTRIBUTION: Stands are mapped in isolated locations throughout the study area, with over 90 percent occurring along the Colorado River. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



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. 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 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

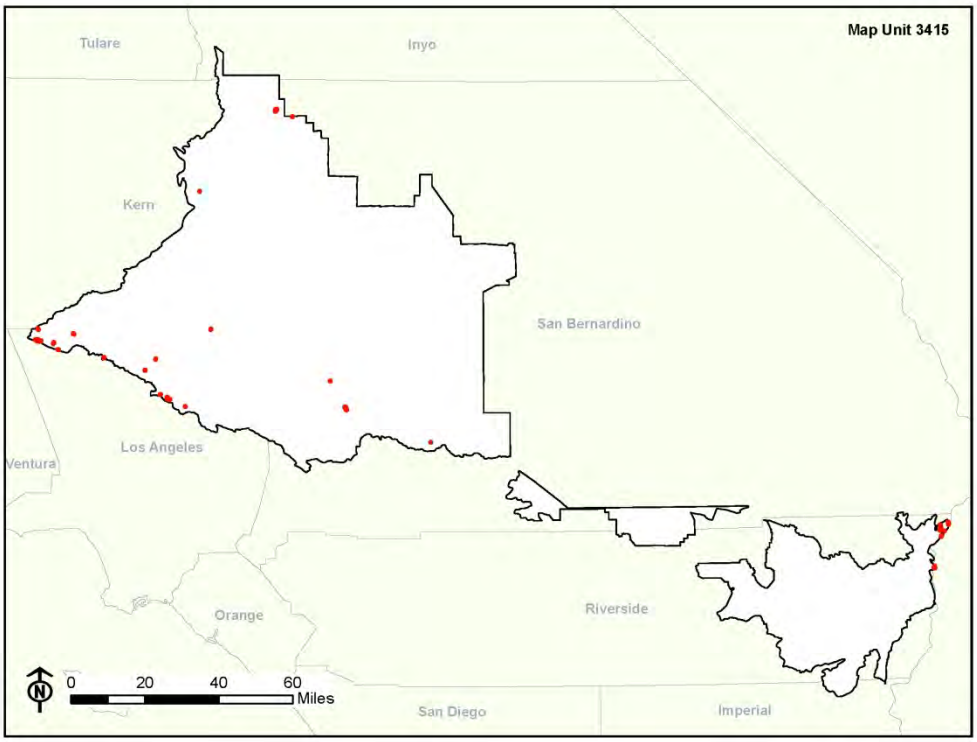
DESCRIPTION: *Typha* spp. dominate the stands of this Alliance. Most stands growing within water with slightly alkaline or saline chemistry are *T. domingensis*. Stands of *T. latifolia* have only been inventoried in fresh water at Lost Lake in the Cajon Pass region.

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. Post season growth in senesced conditions tends to yield a light tan signature. Full mature growth often has a stippled texture.

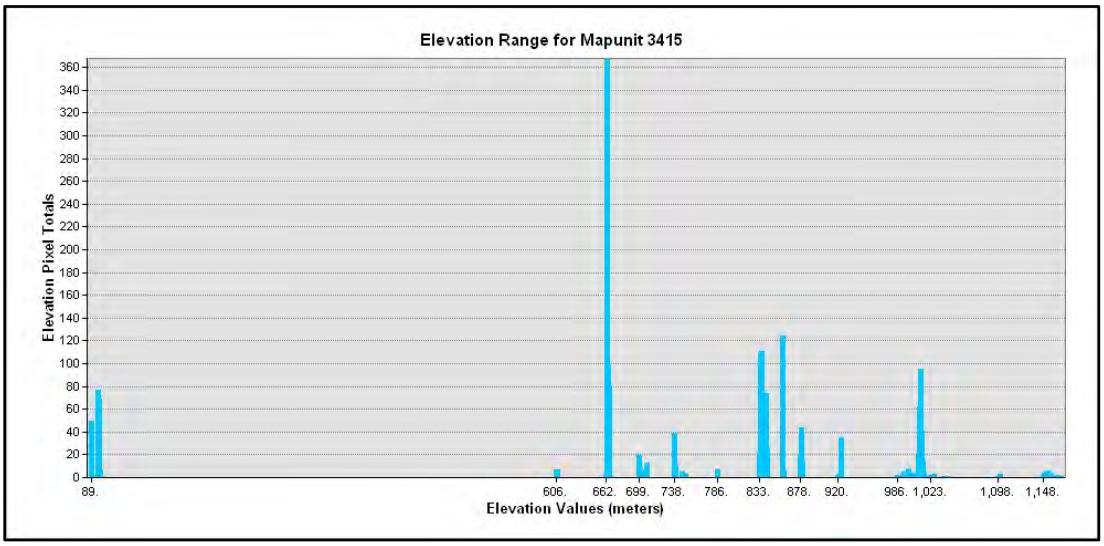
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 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.

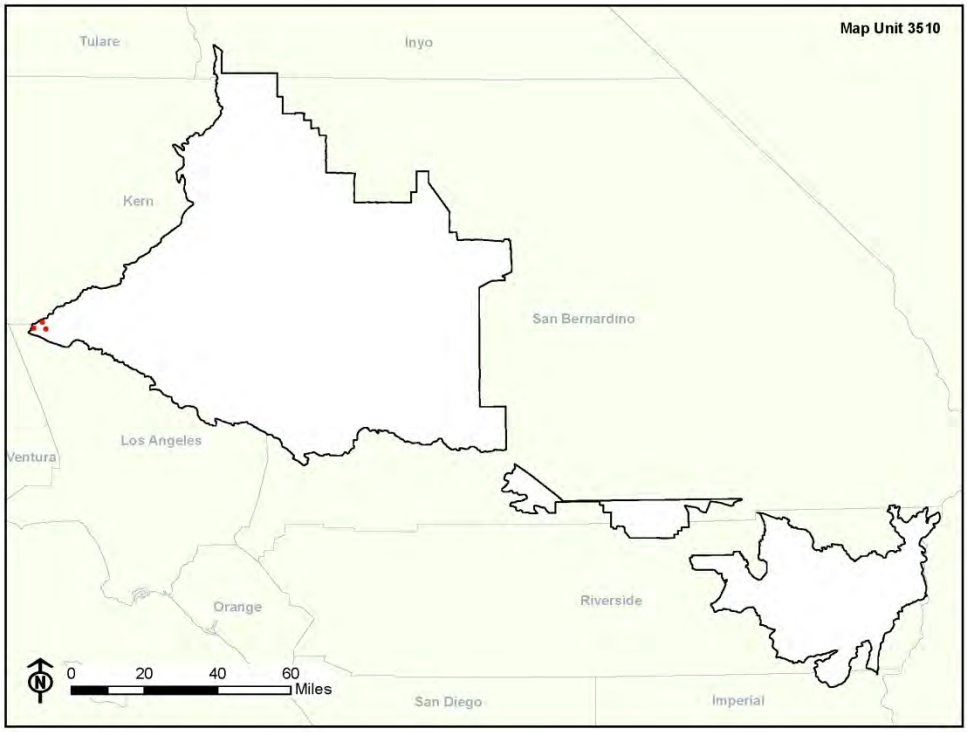
3415 – *Typha (angustifolia, domingensis, latifolia)* Alliance



DISTRIBUTION: Over half of the mapped stands occur in perennial water settings in the western portions of the Antelope Valley along the base of the San Gabriel Mountains and Sierra Pelona. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3510 – Californian mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group



DISTRIBUTION: Stands of this Group were infrequently mapped in the study area. These stands were mapped at the Group level because the Alliance was not discernible from the imagery. Three polygons were mapped, none of which were verified or visited in the field. All of them occur in the westernmost portion of the Antelope Valley in the transitional zone between the desert and Mediterranean climate of coastal California. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

3611 – *Juncus arcticus (*var*. balticus, mexicanus)* Alliance

Baltic and Mexican rush marshes Alliance

This example occurs along the San Andreas Rift Zone just east of Lake Palmdale along Barrel Springs Road. The stand is strongly dominated by *Juncus arcticus.*

In this example, *Juncus arcticus* dominates the herbaceous cover along the San Andreas Rift Zone south of Palmdale.

3611 – *Juncus arcticus* (var. *balticus*, *mexicanus)* Alliance

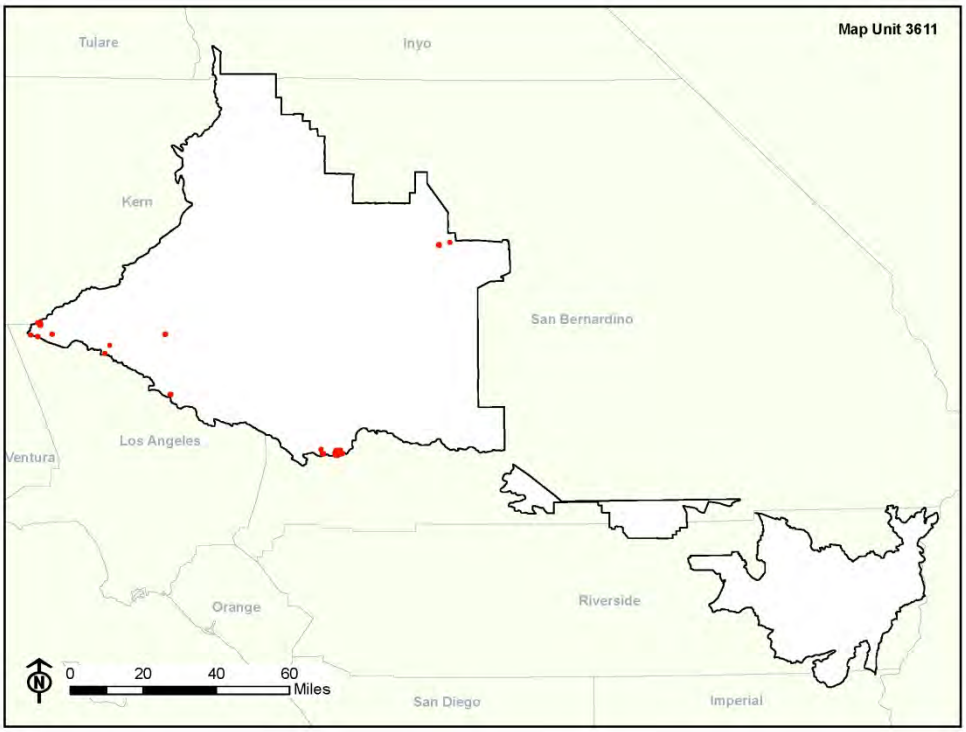
DESCRIPTION: In this Alliance, *Juncus arcticus* is the dominant rhizomatous rush species that occurs in temporarily to seasonally flooded meadow environments. Stands may include similar to lower cover of other native and non-native herbs, but *J. arcticus* is prevalent throughout. The largest mappable stands occur in Summit Valley and around seeps and springs such as on the west side of Coyote Dry Lake and Paradise Springs.

PHOTOINTERPRETATION SIGNATURE: Stands are found in low swales with little or no stream channel noted. Growing season signature color is a medium to dark green with a fairly bright hue. Late in the growing season, meadow signatures are more distinct against annual grasses; however, many of the more mesic forbs remain green and can be mistaken for *Juncus* spp. Stands along meadow edges tend to be better defined and have a slight brownish tone in mature growth phases.

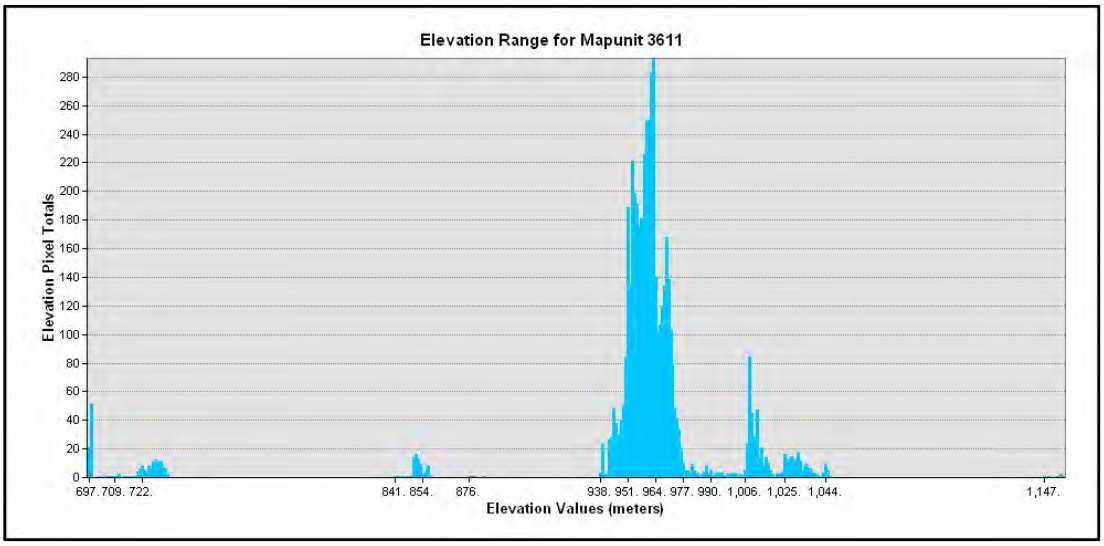
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- California annual and perennial grassland Mapping Unit (Native component) (2305) – Early growing season stands of this herbaceous type tend to yield a bright green signature very similar to *Juncus arcticus* meadows. As the annuals die out, mesic swales tend to remain green and often form shapes that emulate wetland meadows. Seasonally flooded wetland meadows usually form a more distinct color gradient than a mesic forb to drier grassland community.
- Mediterranean California naturalized annual and perennial grassland Group (2330) – Herbaceous cover within this Group tends to form smooth but very patchy patterning in the landscape. Wetland gradients are largely absent. Unlike herbaceous cover dominated by *Juncus* spp. and other wetland grasses, low mesic swales containing weedy forbs tend to have a small but clearly defined stream channel bisecting the herbaceous cover. These stream channel characteristics are more likely to occur in the mapping area rather than meadows found in more humid climates.

3611 – *Juncus arcticus* (var. *balticus, mexicanus)* Alliance

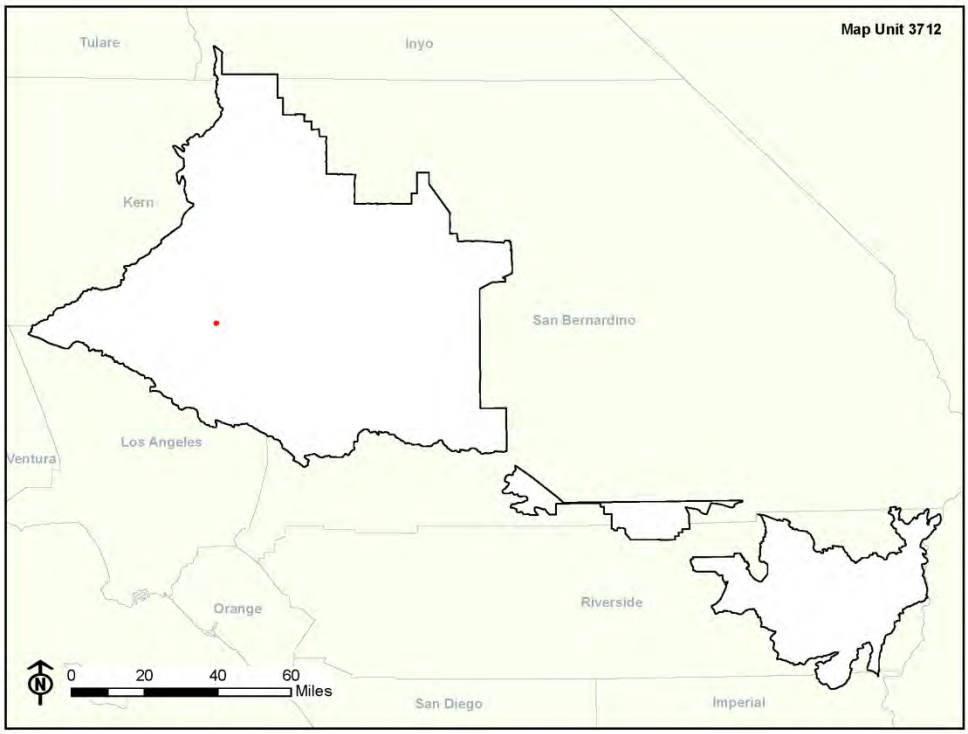


DISTRIBUTION: Stands were found in scattered locations along the desert margins in the western Antelope Valley and at the Mojave River Forks Reservoir. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3712 – *Sporobolus airoides* Alliance

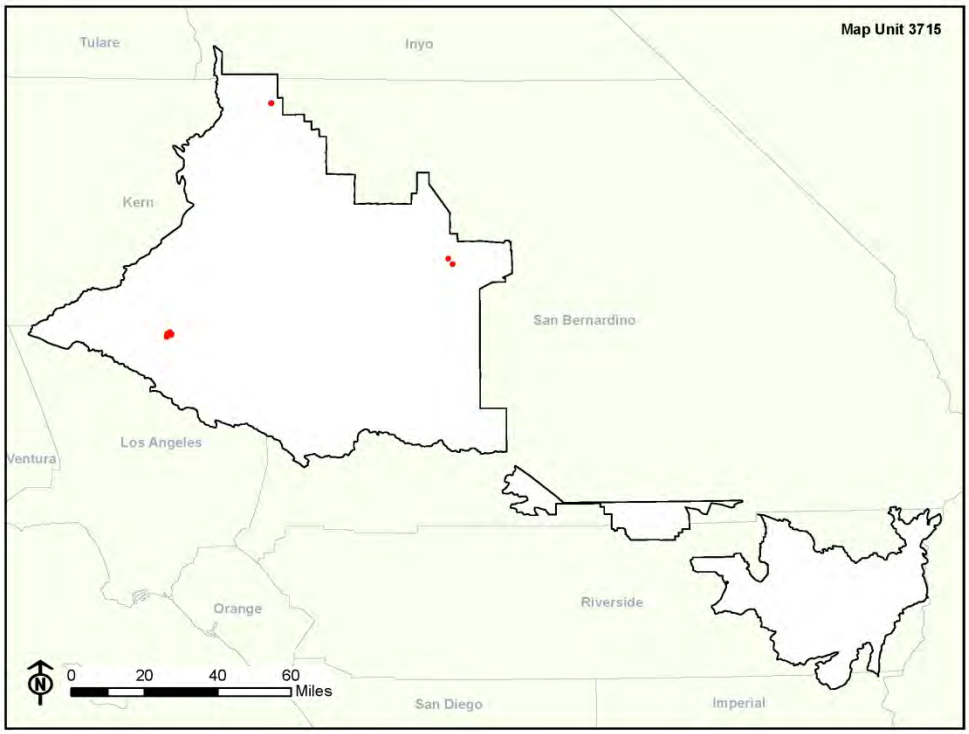
Alkali sacaton grassland Alliance



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. Note: In the distribution map above, the size of the polygon has been enhanced for display purposes.

3715 – *Bolboschoenus maritimus*, *Schoenoplectus americanus* Mapping Unit

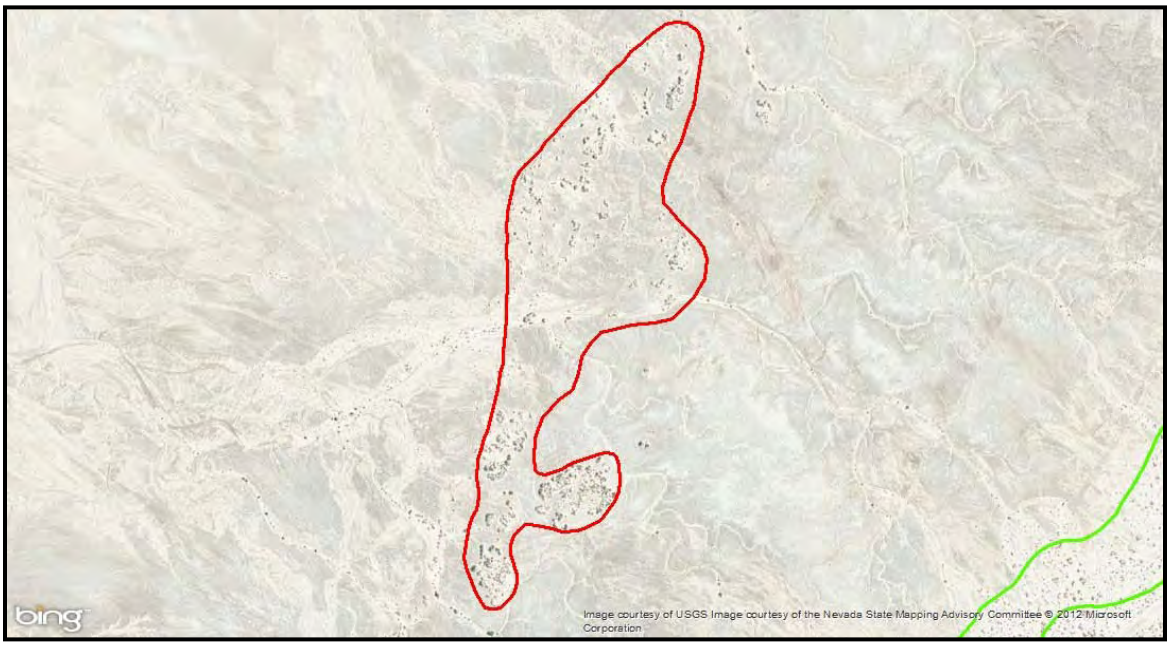
Salt marsh bulrush, American bulrush Mapping Unit



DISTRIBUTION: Stands of this Alliance were infrequently mapped in the study area and are only mapped based on ground surveys or verification. All stands are associated with alkaline or saline, saturated or flooded wetland settings. Most of these are adjacent to or within playas having water tables near the surface. However, environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

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

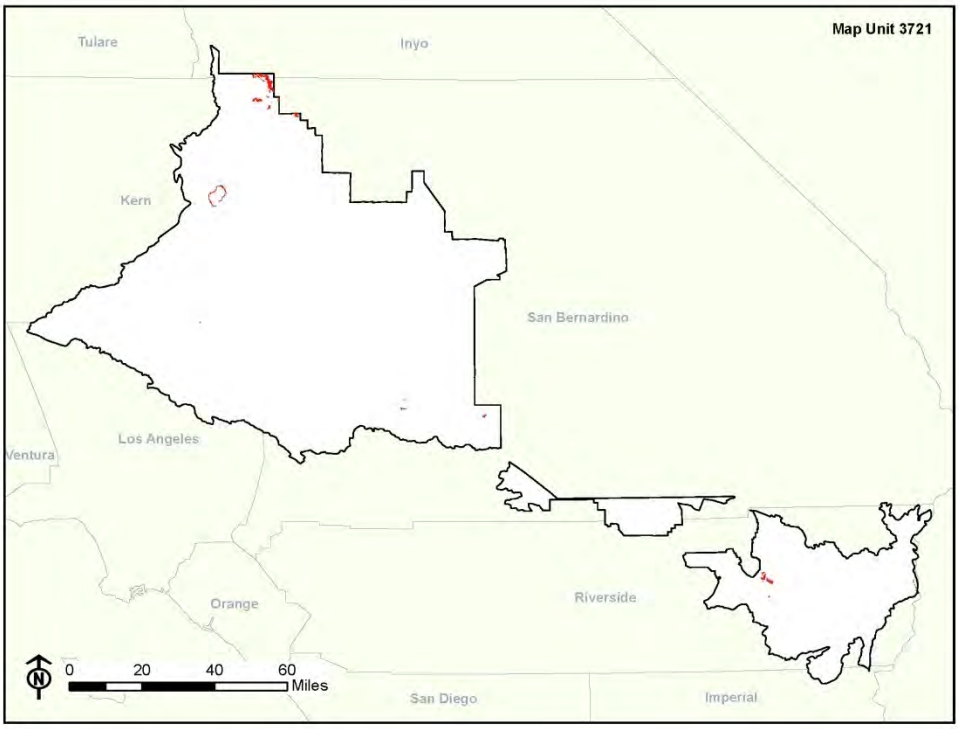
DESCRIPTION: Polygons mapped as this Alliance typically have *Allenrolfea occidentalis* comprising more than 2 percent absolute cover in the shrub canopy and no other species with greater or equal cover, except *Suaeda moquinii*, *Atriplex confertifolia*, or *A. canescens* (Keeler-Wolf *et al.* 1998, 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 Dry Lake. 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.

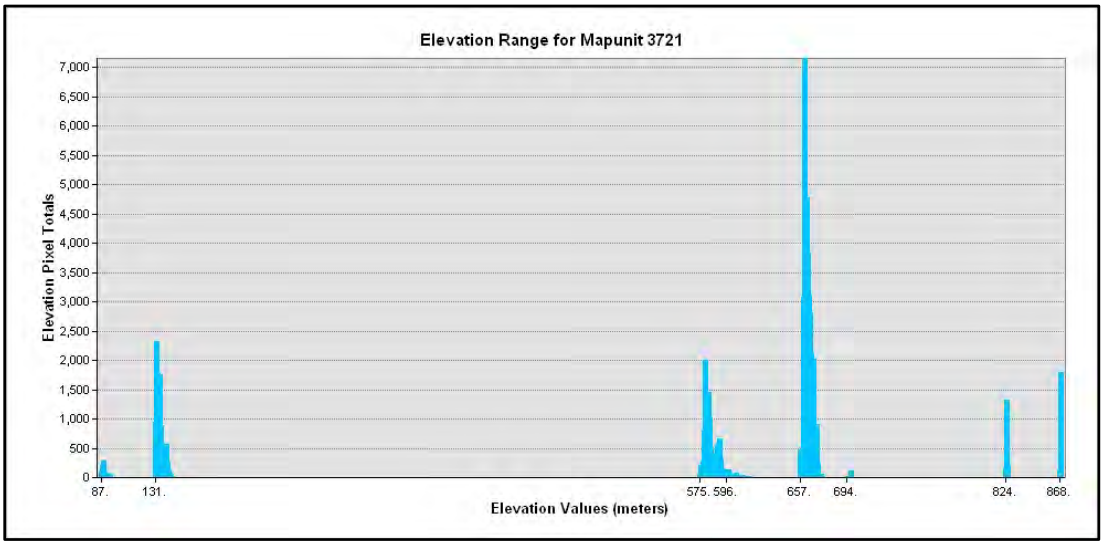
TYPES WITH SIMILAR PHOTO INTERPRETATION SIGNATURES:

- *Atriplex lentiformis* Alliance (3722) – *S*hrubs may have a tawny, puffier crown. Stands of *A. lentiformis* generally are below the Minimum Mapping Unit size and are treated as an inclusion within the Alliances of other alkali species.
- *Suaeda moquinii* Alliance (3725) – Shrubs can sometimes mix with *Allenrolfea occidentalis* but in low cover and may have a browner color.
- *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

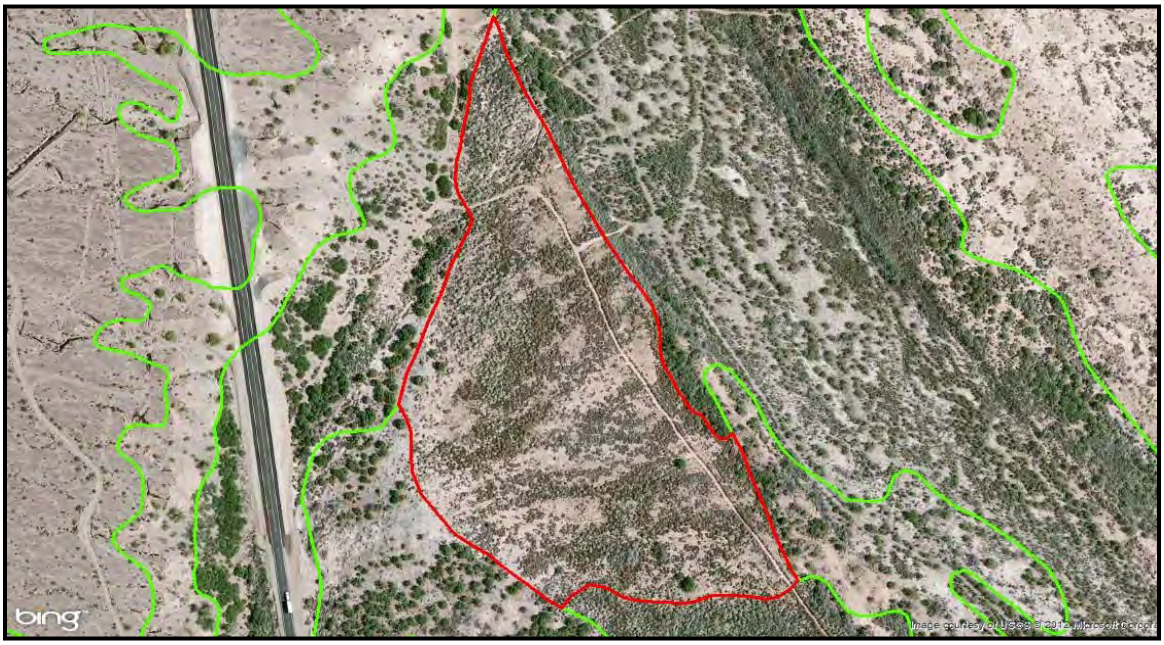


DISTRIBUTION: Stands are found along dry lakes throughout the study area, including Buckhorn, China, Koehn, Lucerne, Melville, Palen, Salt Wells Valley, and Rosamond Dry Lakes. This species also occurs along margins of the Colorado River.



3722 – *Atriplex lentiformis* Alliance

Quailbush scrub Alliance



In this image *Atriplex lentiformis* (larger, blue-gray shrubs) are mixed with *Suaeda moquinii* (smaller, rust-colored shrubs) in a disturbed setting near the Colorado River.

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

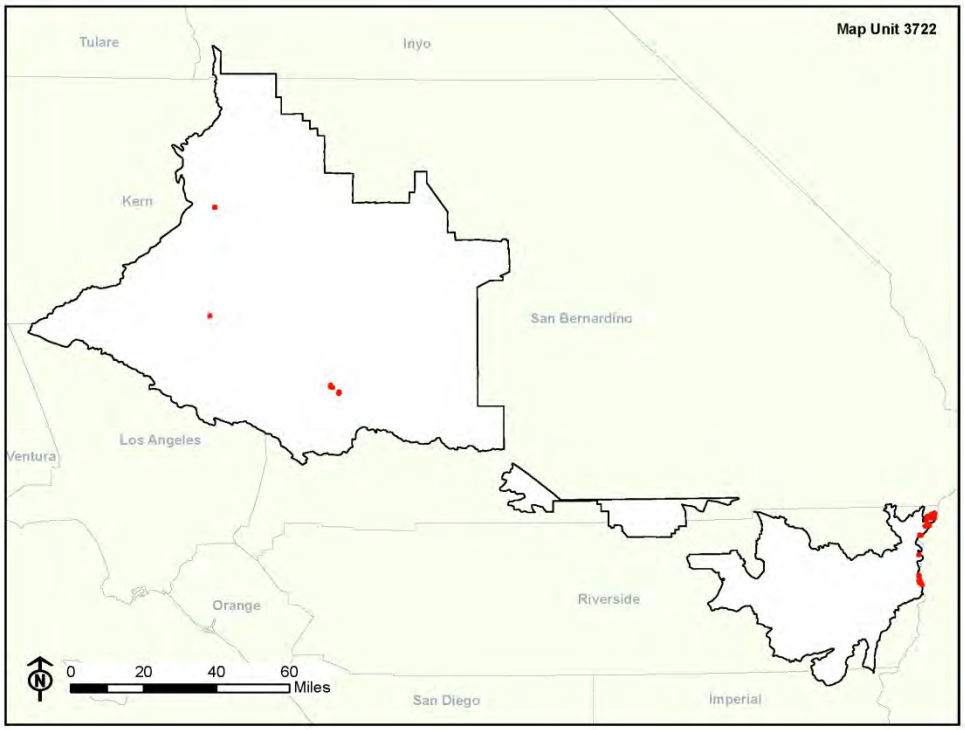
DESCRIPTION: Stands of this Alliance are strongly dominated (typically more than 60 percent relative cover) by *A. lentiformis*. Stands are uncommon and are of two kinds. The tall, broad, bushy form of *A. lentiformis* ssp. *lentiformis* occurs on river terraces adjacent to *Populus fremontii* stands 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 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.

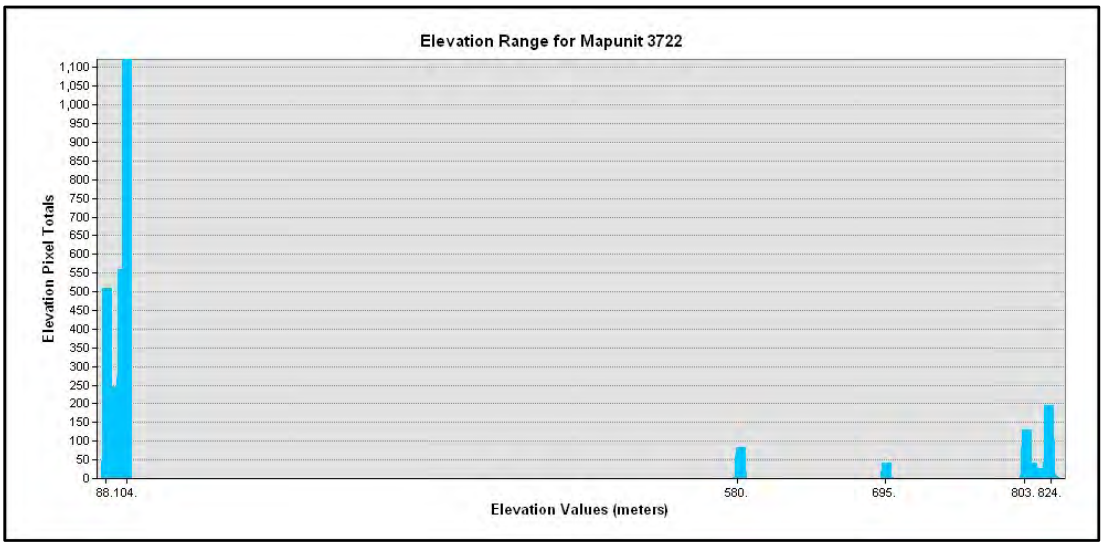
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.

3722 – *Atriplex lentiformis* Alliance

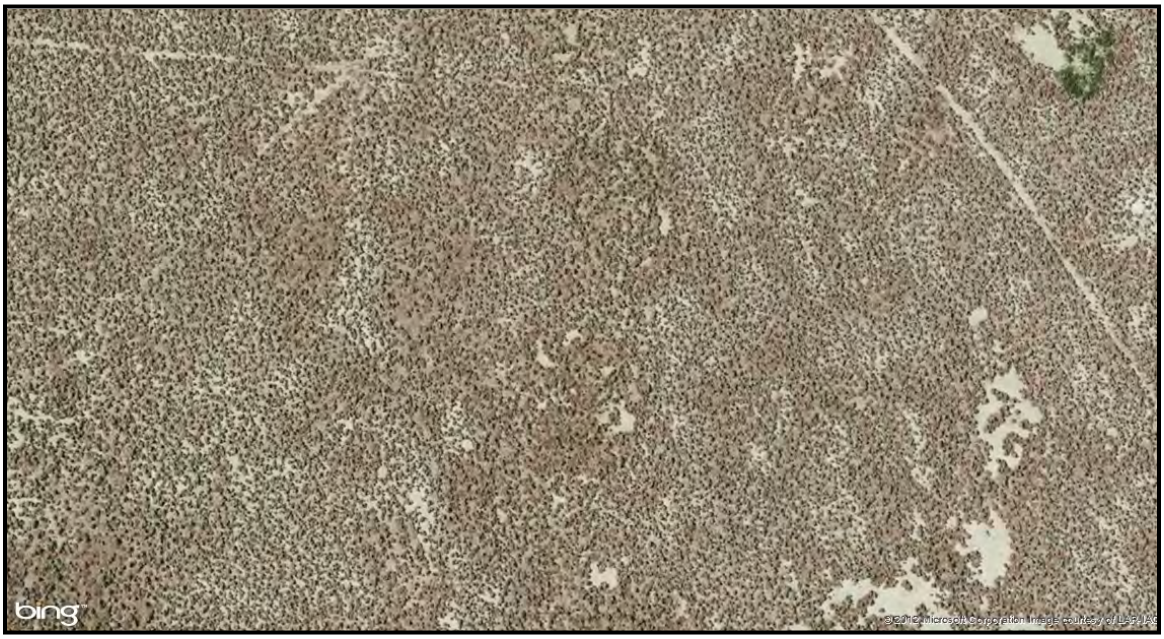


DISTRIBUTION: Stands are found in disturbed fluvial settings with alkaline soils along the Mojave and Colorado Rivers. They are also found in small populations on the margins of Koehn and Lucerne Dry Lakes. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3723 – *Atriplex spinifera* Alliance

Spinescale scrub Alliance



This image depicts a commonly occurring setting where *A. spinifera* occurs in a consistent cover throughout the stand occasionally interrupted with small clayey scalds with little or no vegetative cover. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

The photo shows *Atriplex spinifera* dominant over annuals including *Lasthenia gracilis*.

3723 – *Atriplex spinifera* Alliance

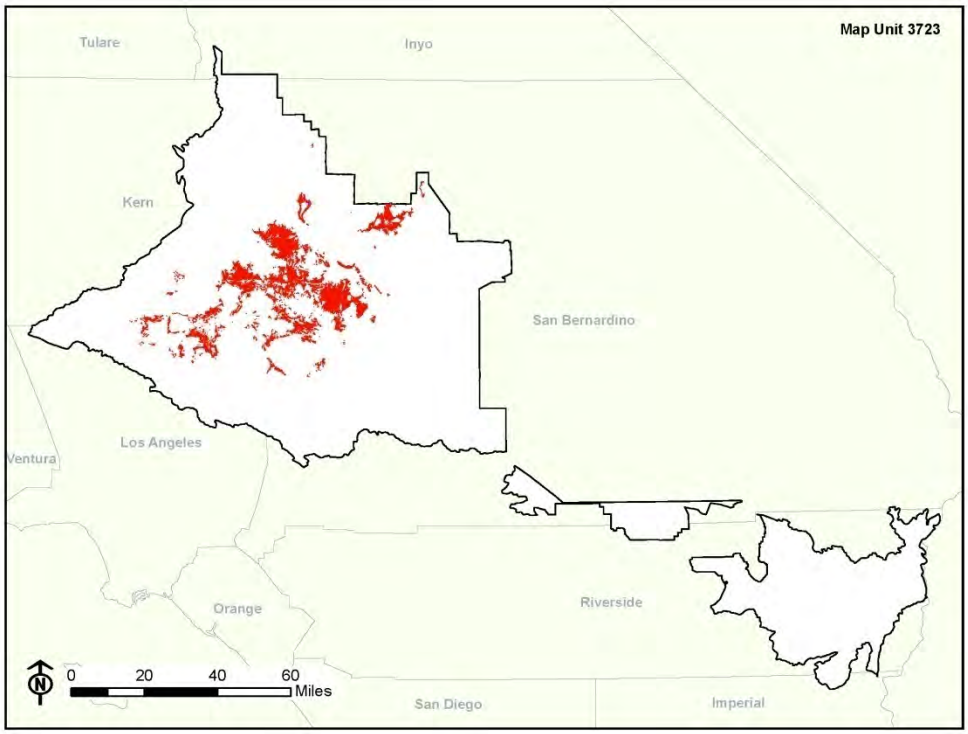
DESCRIPTION: In this Alliance *Atriplex spinifera* frequently is a strong dominant or sole component to the stand, occasionally co-dominating with *Atriplex polycarpa*, *Larrea tridentata*, or *Ambrosia dumosa* in less severe settings along the upland margins of the stand. When *Atriplex confertifolia* is co-dominant with *A. spinifera*, then *A. confertifolia* is the Alliance type. The herb layer has open to intermittent cover including *Bromus rubens*, *Erodium cicutarium* and *Lasthenia* spp. *Atriplex spinifera* prefers fine textured silty or clay soils that aren't strongly alkaline or salty. Stands tend to have evenly spaced moderate-sized shrubs with small gray clay lenses scattered throughout, and not highly reflective whitish pannes. *A. spinifera* occurs with *Artemisia spinescens* and *Lepidium fremontii* near playa lakebeds, where either of these additional species may co-dominate. Occasionally, stands may occur in less silty and sandier soils as near Hinkley and Helendale (west of Barstow) where one would normally predict *A. polycarpa*. Stands may be extensive or can occur in a fine matrix with *Ambrosia dumosa* (present or co-dominant), *Atriplex polycarpa*, and *Krascheninnikovia lanata* (for example in Kramer Junction area north to Cuddeback Dry Lake). *Lasthenia gracilis* or *Coreopsis calliopsidea* are often the dominant annual species associated with *A. spinifera*. *Atriplex spinifera* often occurs on hydrophobic soils that saturate to only a few centimeters during the rainy season. The soil surface remains moist throughout spring. These conditions favor the development of the blacktop form of cryptobiotic crust. Sensitive species observed in this community include Mojave spineflower *(Chorizanthe spinosa)* and crowned onion *(Muilla coronata)*.

PHOTOINTERPRETATION SIGNATURE: Stands are typically sparse to moderately dense in cover, consistent across much of the stand with the plants appearing as medium sized rounded gray to silver-gray shrubs. Shrubs can occur in small clumps or as sparse individuals in and adjacent to larger playas. When occurring in areas that are not strongly alkali they often interface with adjacent creosote bush scrub, forming sharp boundaries that are noticeable especially in the herbaceous understory and shrub density.

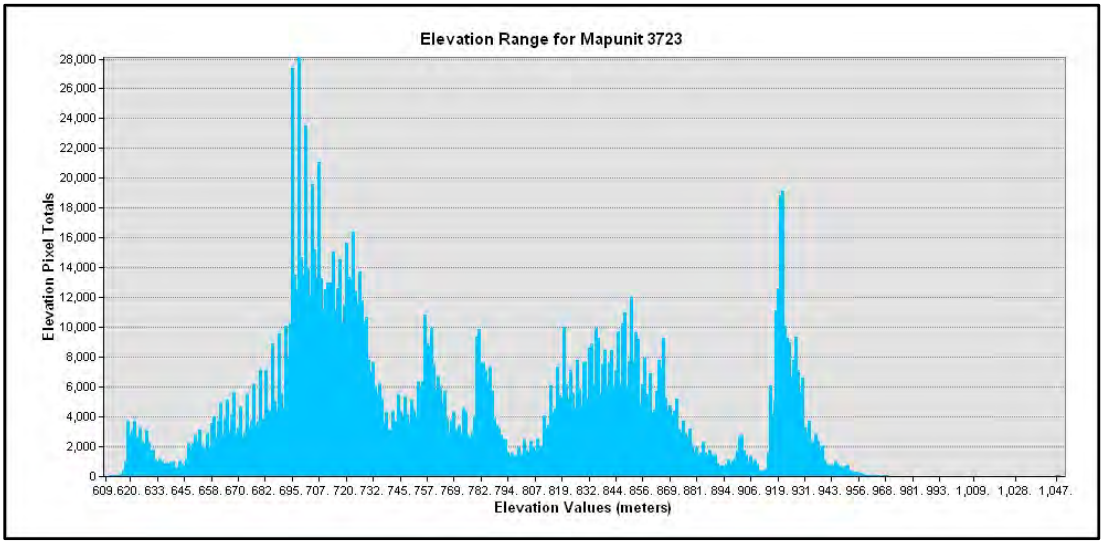
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* Alliance (4113) – Shrubs occur in drainage bottoms, along edges of larger washes, and in disturbed areas. They also have a clumpier growth pattern and more of a bluish-gray color.
- *Atriplex confertifolia* Alliance (5112) – Shrubs occupy more severe scalds with a higher soil reflectance and stands may have greater diversity of shrubs. These plants also tend to establish in disturbed areas.

3723 – *Atriplex spinifera* Alliance



DISTRIBUTION: This Alliance ranges from the Antelope Valley to the Northern Mojave region and east to the Barstow area. This type is especially concentrated around Buckhorn, Cuddeback, El Mirage, Harper, Rogers, Rosamond, and Superior Dry Lakes and the area surrounding Kramer Junction.



3724 – *Frankenia salina* Alliance

Alkali heath marsh Alliance

This image shows a portion of a *Frankenia salina* stand north of China Dry Lake.

The photo shows a stand of *Frankenia salina* (left) on edge of a salt panne, with *Distichlis spicata* in the foreground.

3724 – *Frankenia salina* Alliance

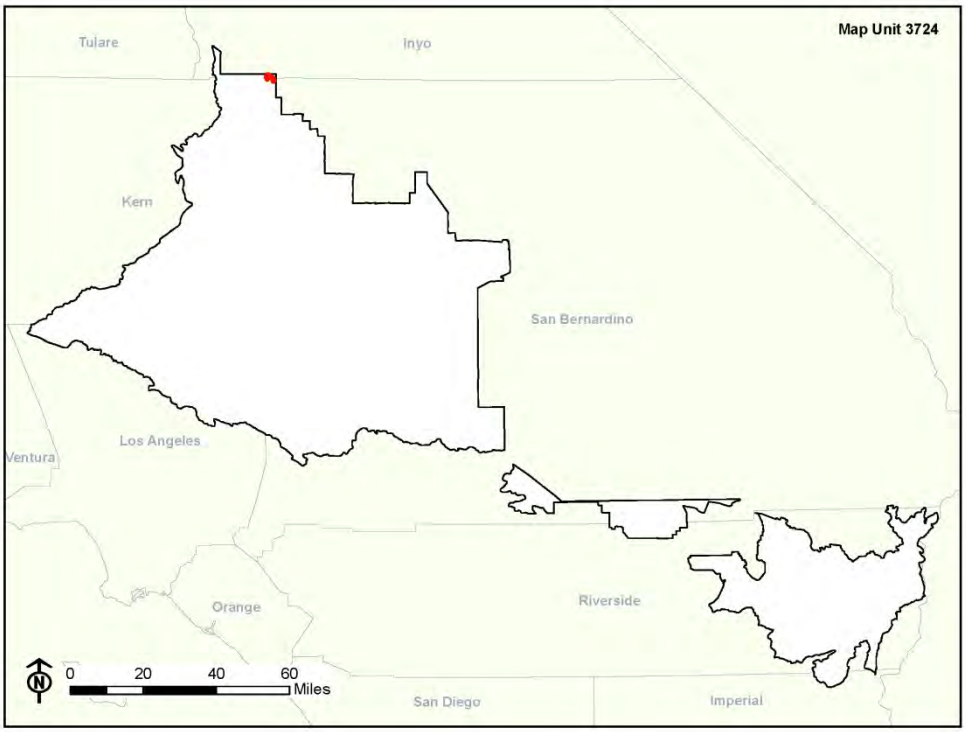
DESCRIPTION: Polygons mapped as this Alliance are dominated or co-dominated by *Frankenia salina,* typically comprising more than 30 percent relative cover in the shrub layer. *Atriplex* spp., *Cressa truxillensis* and other species may be present. *Frankenia salina* is a low, matted subshrub with small, narrow leaves. Within the study area, stands tend to occur on alkaline flats and are often intermixed with *Bassia, Salsola*, or other alkali-tolerant weeds.

PHOTOINTERPRETATION SIGNATURE: The stands of *Frankenia salina* can be open and patchy to continuous in cover. Individuals are not distinguishable; rather, the stands have a low, hazy, gray-green to taupe signature. Stands occur at the edges of and in patches on salty alkaline flats, and bare openings within the stand often appear white from the reflective salt on the soil surface. Stands are mapped in local areas where there were field observations of the type.

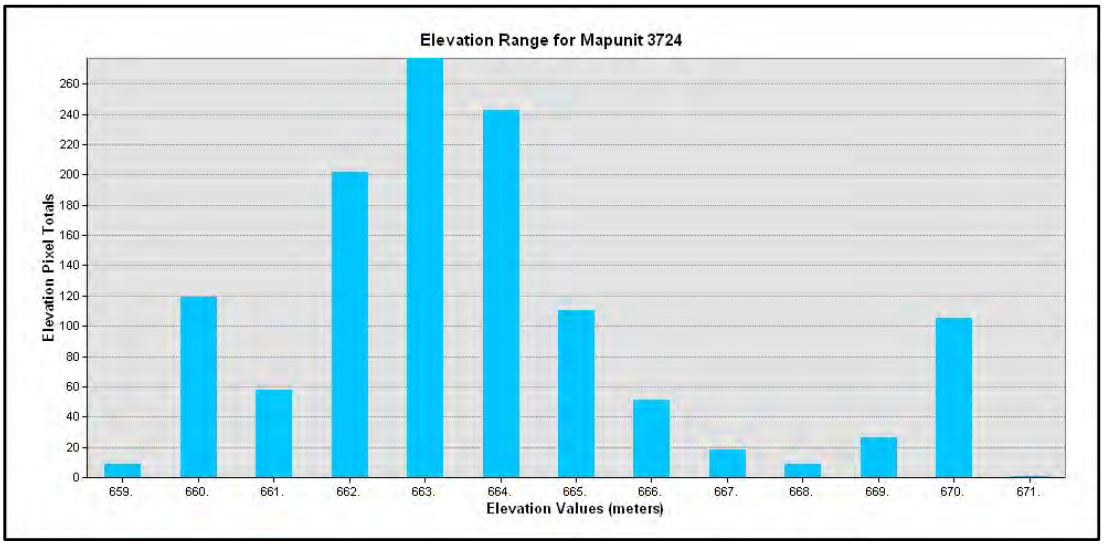
TYPES WITH SIMILAR PHOTO INTERPRETATION SIGNATURES:

- *Distichlis spicata* Alliance (3726) – Stands of *D. spicata* within this study area are very difficult to distinguish from stands of *Frankenia salina*. They often co-dominate and occur in the same habitat and are a similar height and texture. Homogeneous stands of *D. spicata* tend to be more blue-green in color.

3724 – *Frankenia salina* Alliance



DISTRIBUTION: Mappable stands are unusual in the study area but occur at China Dry Lake. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3725 – *Suaeda moquinii* Alliance

Bush seepweed scrub Alliance

In this example, *Suaeda moquinii* dominates the stand and appears as a dense brownish red color mixed with *Prosopis glandulosa*, *Atriplex polycarpa* and *Pluchea sericea.*

In this example *Suaeda moquinii* co-dominates with *Atriplex spinifera*; *S. moquinii* is reddish brown.

3725 – *Suaeda moquinii* Alliance

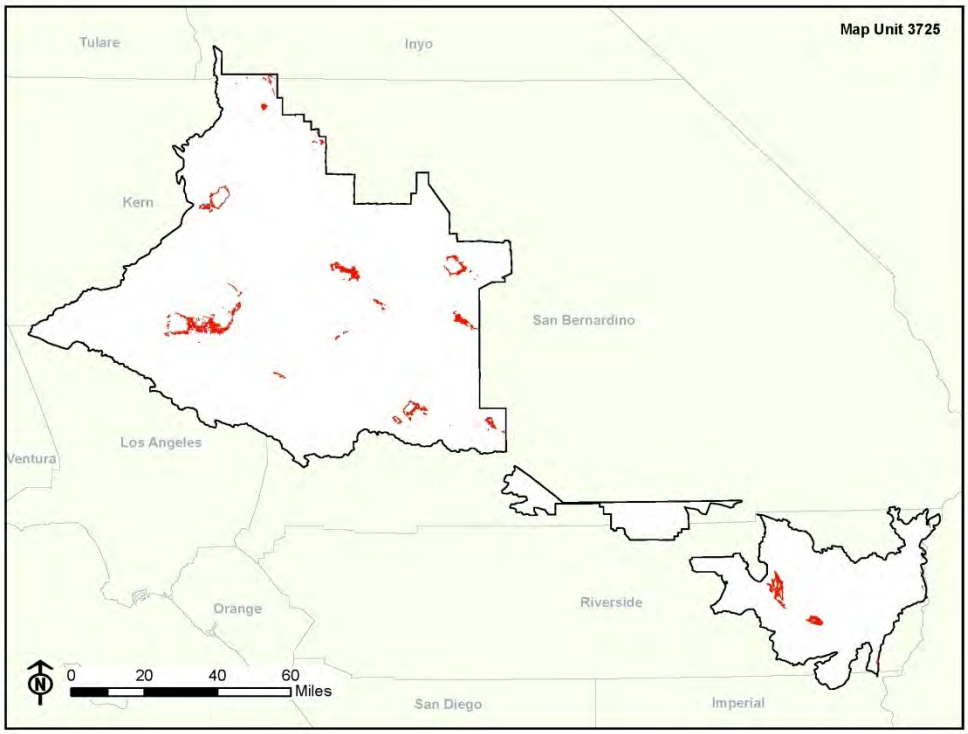
DESCRIPTION: This Alliance is mapped where *Suaeda moquinii* dominates or co-dominates the shrub layer, typically with at least 2 percent absolute shrub cover (however, it may have lower cover in shrub stands with a sparse canopy). Stands typically occupy strongly saline or alkaline playas, usually with 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 is typically 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.

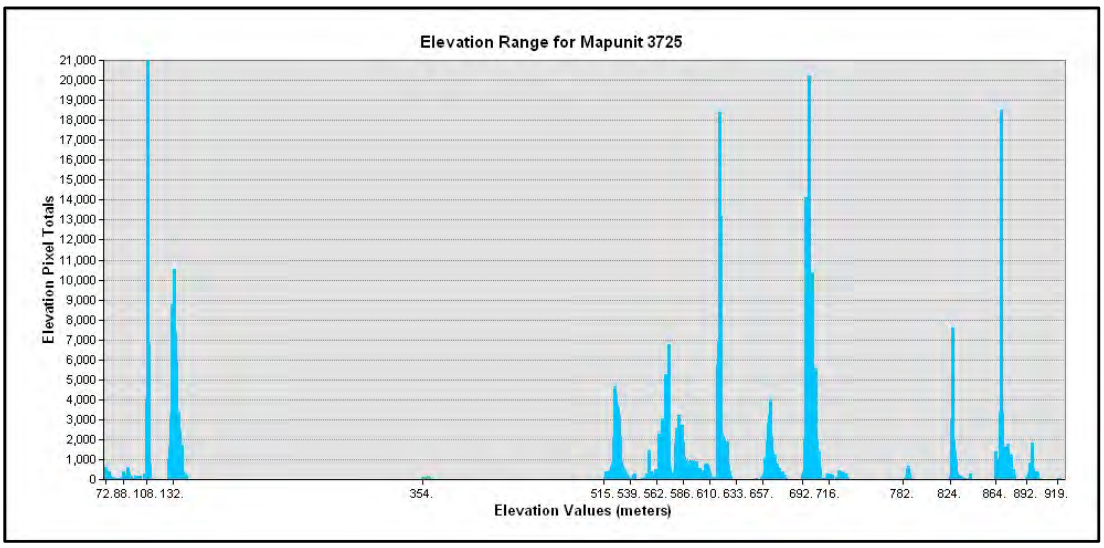
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 spinifera* Alliance (3723) – Shrubs occupy areas of lesser alkalinity or salinity, trending towards lower soil reflectance and saturation levels.
- *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 appear as a bluish gray color.
- *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 on almost every major dry lake throughout the study area and forms pockets of stands along the Mojave River north of Helendale to Newberry Springs. Stands are also common along the margins of the Colorado River floodplain.



3726 – *Distichlis spicata* Alliance

Salt grass flats Alliance

This stand of *Distichlis spicata* is mapped along the western margins of Harper Dry Lake. The area receives water from small ditches draining agricultural runoff to the south and west of the stand.

This photo depicts a band of dense *Distichlis spicata* along the margins of Harper Dry Lake in post season growth phase.

3726 – *Distichlis spicata* Alliance

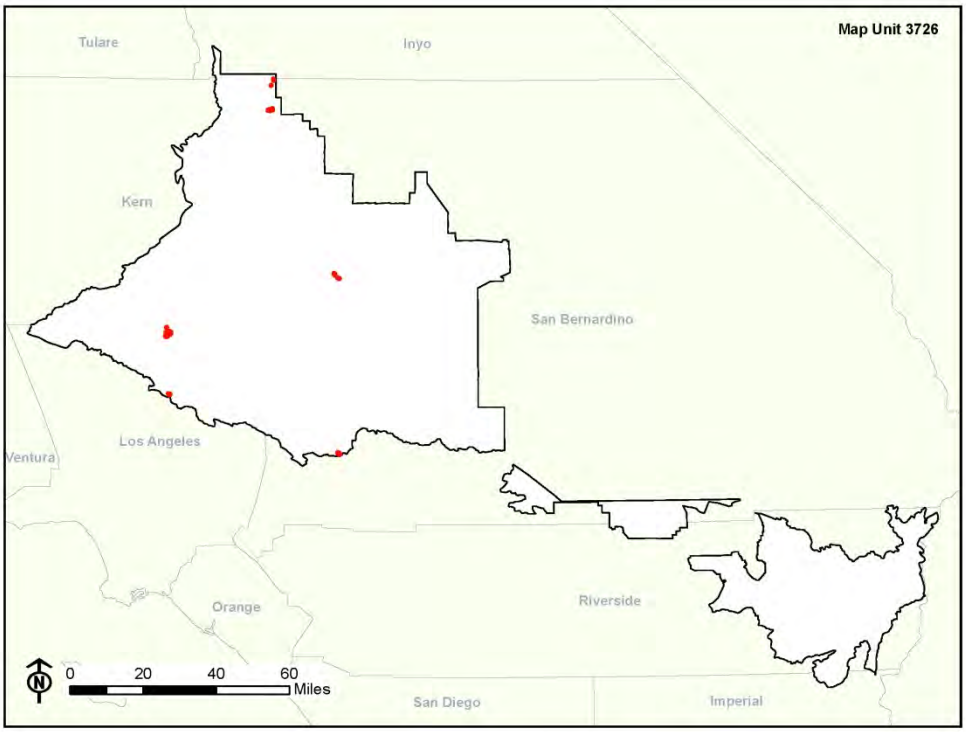
DESCRIPTION: Although often a component of tidal salt and brackish marshes, *Distichlis spicata* occurs widely in Southwestern North American salt basins. *D. spicata* is a short rhizomatous salt grass likely to be seen adjacent to episodically flooded basins, springs, playas, and salt marshes, sometimes without visible salt deposits on the surface. Mappable stands occur at Harper Dry Lake and several other sites in the study area.

PHOTOINTERPRETATION SIGNATURE: Stands are mapped in several locations adjacent to salt flats along the margins of lakebeds in the western Mojave Desert. Signature color is variable, ranging from tan to light gray depending on how recently the herbaceous layer senesced. Texture is smooth but patterning is somewhat mottled. Herbaceous cover adjacent to more recent agricultural activity has some greenness to the signature color.

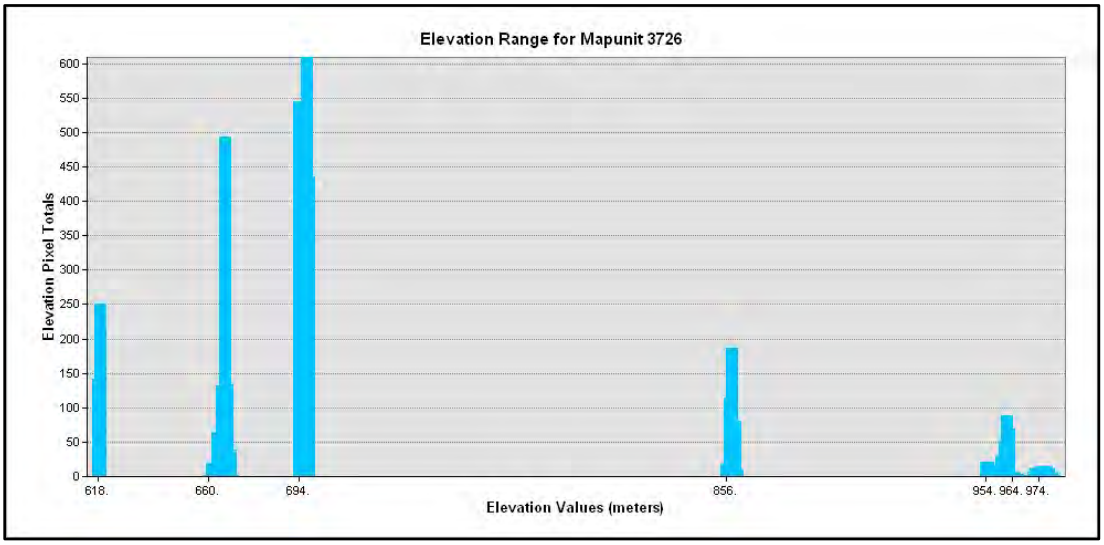
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Mediterranean California naturalized annual and perennial grasslands Group (2330) – Stands containing *Bassia scoparia* were noted in similar settings to *D. spicata.* Signature characteristics are currently not understood in post season phases of this species.
- Alliances within the Warm Semi-Desert/Mediterranean Alkali-Saline Wetland Macrogroup (3711 - 3729) – Typically, signature characteristics of herbaceous types within this Group are poorly understood due to their similar environmental settings and limited distribution within the study area.

3726 – *Distichlis spicata* Alliance

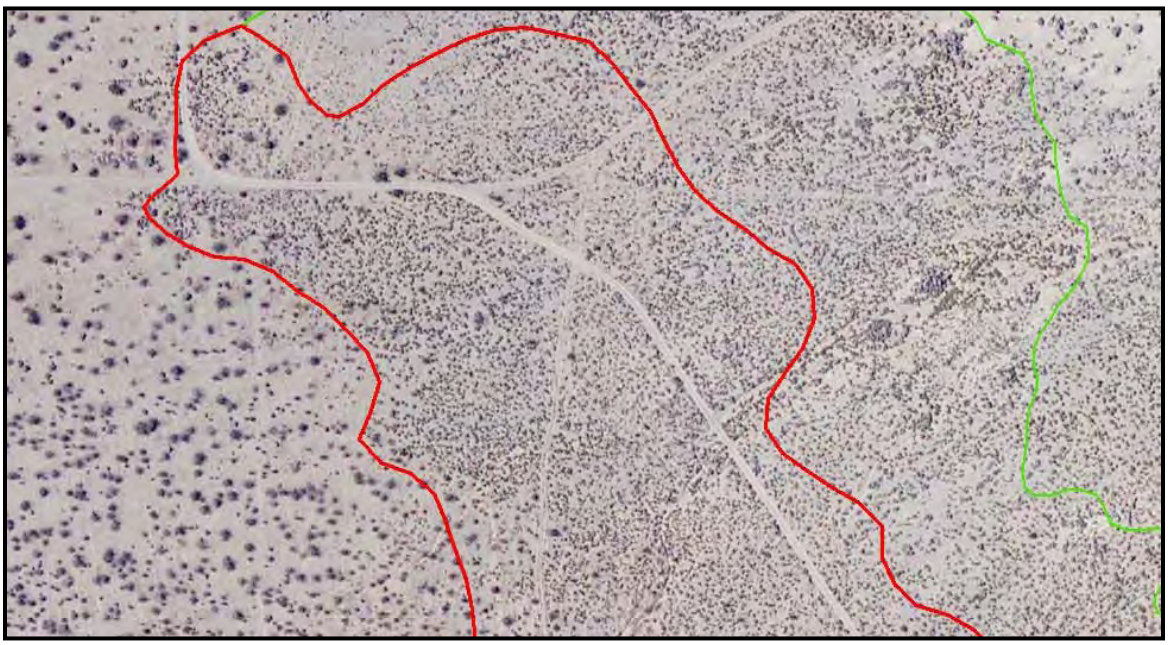


DISTRIBUTION: This type occurs infrequently over widely scattered locations in the western Mojave Desert, principally along the margins of Harper and Rosamond Dry Lakes. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3728 – *Isocoma acradenia* Alliance

Alkali goldenbush Alliance



This image shows a stand of *Isocoma acradenia* between a stand of *Suaeda moquinii* (downslope to the east) and *Larrea tridentata* (upslope to the west) near a dry lakebed.

The photo shows an *Isocoma acradenia* stand with an annual grass understory and scattered *Larrea tridentata*. This stand grades into a *Suaeda moquinii* stand on the edge of a dry lakebed.

3728 – *Isocoma acradenia* Alliance

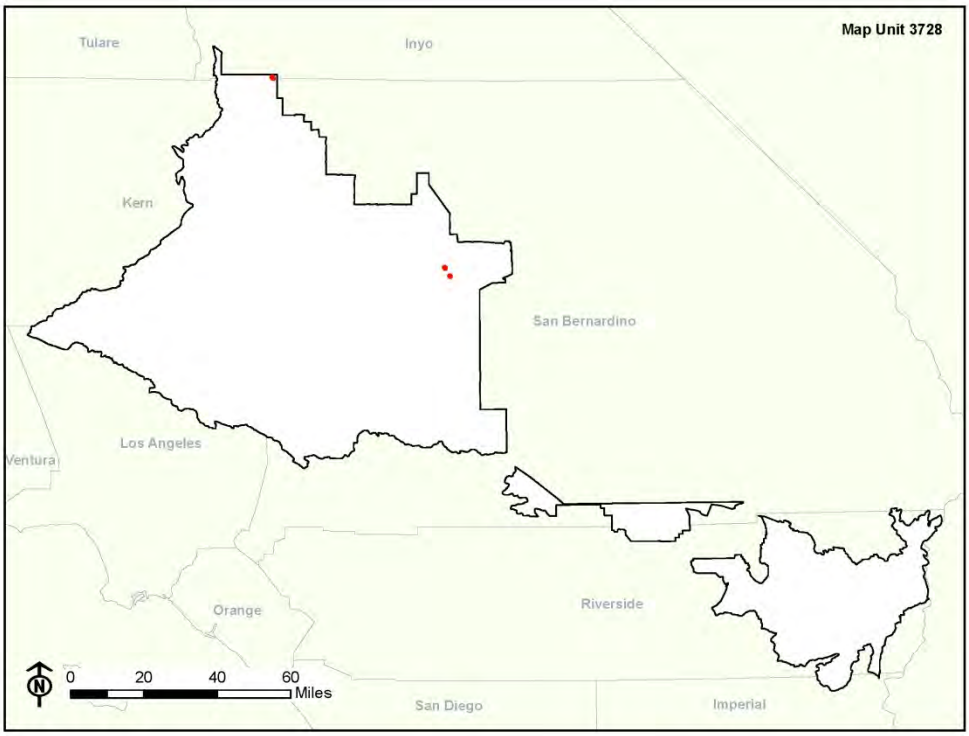
DESCRIPTION: Polygons mapped as this Alliance are dominated by *Isocoma acradenia* in the shrub layer. Stands occur on flat to gentle slopes near salty margins of dry lakes and playas or on episodic alkaline outwash deposits from springs and seeps. Stands at China and Lucerne Dry Lakes are not always 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.

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. Stands are mapped in local areas where there were field observations of the type.

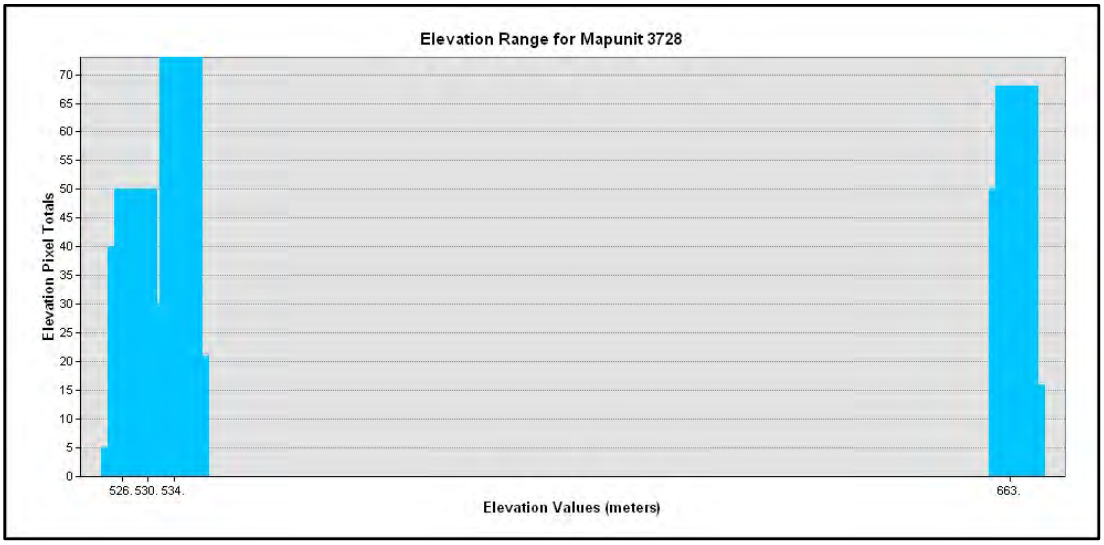
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex parryi* Alliance (3722) – *Atriplex parryi* occurs in similar conditions at China Dry Lake but is denser and has a grayer appearance.
- *Suaeda moquinii* Alliance (3725) – Shrubs can sometimes mix with *Isocoma acradenia* but appear less brown.

3728 – *Isocoma acradenia* Alliance



DISTRIBUTION: There are three mappable stands in the study area, one on China Dry Lake and two near Coyote Dry Lake. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



3729 – *Atriplex parryi* Provisional Alliance

Parry's saltbush scrub Provisional Alliance

This image shows an *Atriplex parryi* photo signature with an *Atriplex confertifolia* stand to the west and a sparsely vegetated playa to the east.

The photo shows a sparse *Atriplex parryi* stand with some *Distichlis spicata* in the herbaceous layer.

3729 – *Atriplex parryi* Provisional Alliance

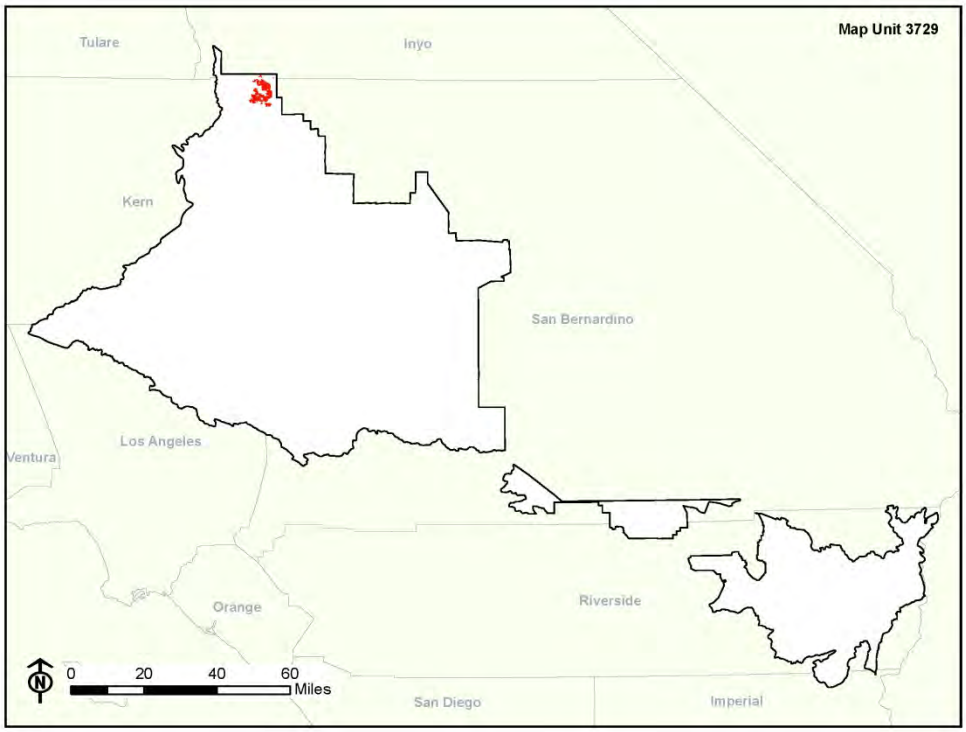
DESCRIPTION: Polygons mapped as this Provisional Alliance are strongly dominated by *Atriplex parryi,* typically comprising more than 2 percent absolute cover in the shrub canopy and no other species having greater or equal cover. Shrubs are rounded and leaves are white, scaly, and generally elliptic to heart-shaped. Stands occur in alkaline basins on fine-textured soils just upslope from *Allenrolfea occidentalis* stands or downslope from the *Atriplex confertifolia* stands on China Dry Lake. Stands below MMU have been noted within larger *Atriplex confertifolia* stands at Coyote Dry Lake, and with *Atriplex spinifera* near California City. Stands are not known south or east of Coyote Dry Lake.

PHOTOINTERPRETATION SIGNATURE: The stands are very open to sometimes moderately dense in cover, occurring as small light gray rounded shrubs. These shrubs establish in the terrace just slightly higher than the most saturated and saline areas of the playa. Stands often contain patches of *Atriplex confertifolia* and *Allenrolfea occidentalis.* The herbaceous layer is sparse, and saline characteristics of the soil yield a highly reflective signature adjacent to the plants. Stands are mapped in local areas where there were field observations of the type.

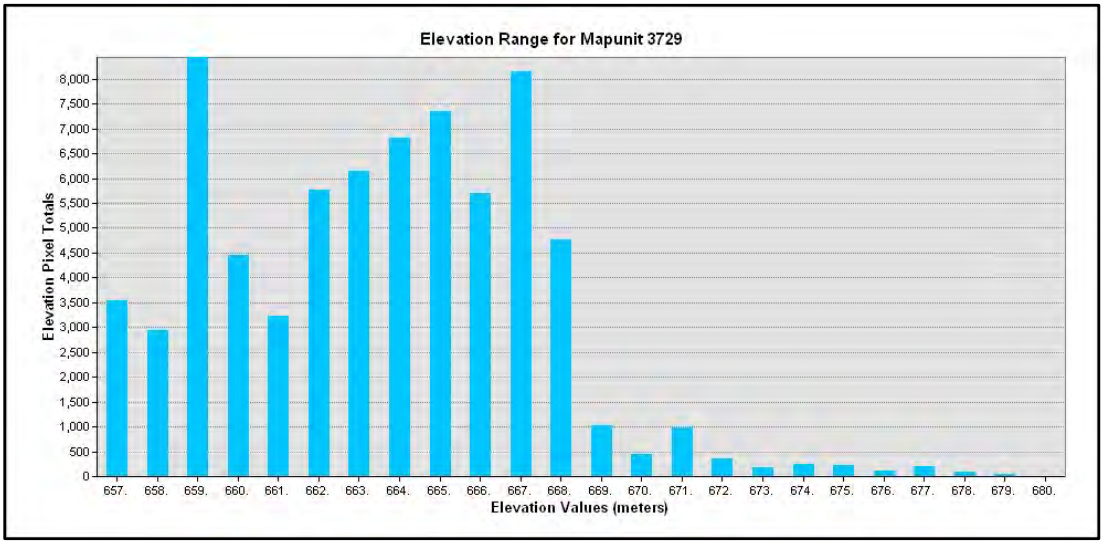
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Allenrolfea occidentalis* Alliance (3721) – Shrubs can sometimes mix with *Atriplex parryi* but shrubs are darker and slightly larger, causing this signature to appear darker overall. Non-mappable stands of *Allenrolfea occidentalis* can occur in below-MMU swales within larger *Atriplex parryi* stands.
- *Atriplex confertifolia* Alliance (5112) – The size of these shrubs is very similar to that of *Atriplex parryi* but *Atriplex confertifolia* appears darker in color, prefers slightly less saturated margins of lakes, occurs with a higher diversity and cover of shrubs, and is more common. *A. confertifolia* can occur as non-mappable stands on hummocks within larger *A. parryi* stands or as a subdominant component.

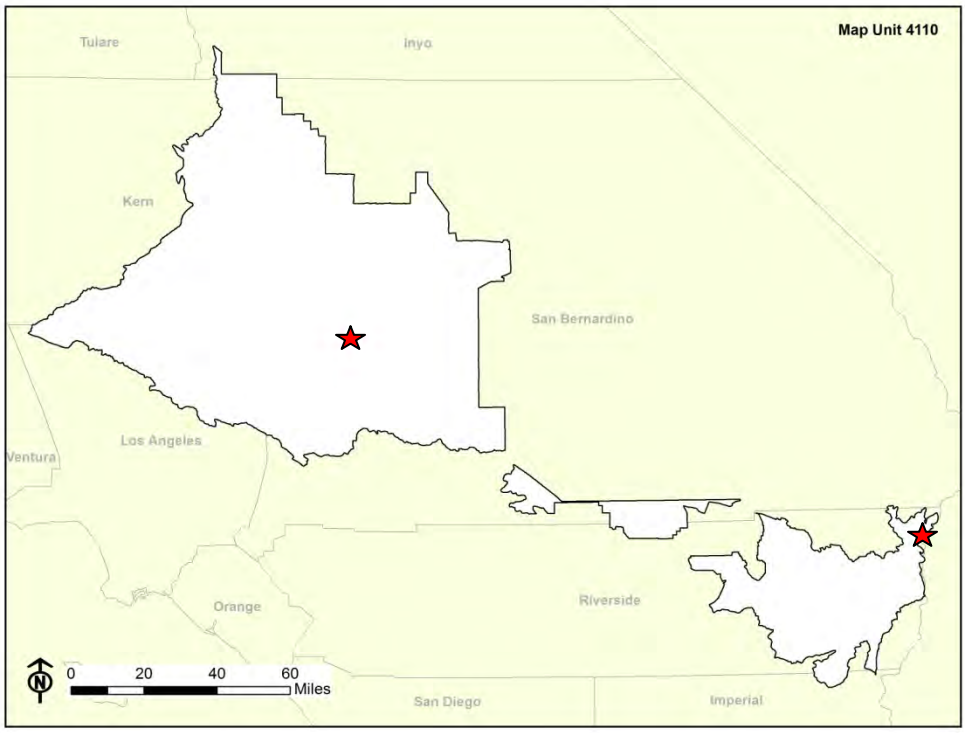
3729 – *Atriplex parryi* Provisional Alliance



DISTRIBUTION: Mappable stands occur at China Dry Lake and below-MMU stands have been noted at Coyote Dry Lake and near California City.



4110 – Lower Bajada and Fan Mojavean-Sonoran desert scrub Group



DISTRIBUTION: Stands are mapped to the Group level because a definitive signature is not discernible from the imagery at finer levels in the hierarchy. This may be due to the successional or fragmented nature of the stands encompassed within a minimum mappable area. Polygons are mapped to this Group based on field data. Note: In the distribution map above, star symbols have been placed on the polygons for display purposes.

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.

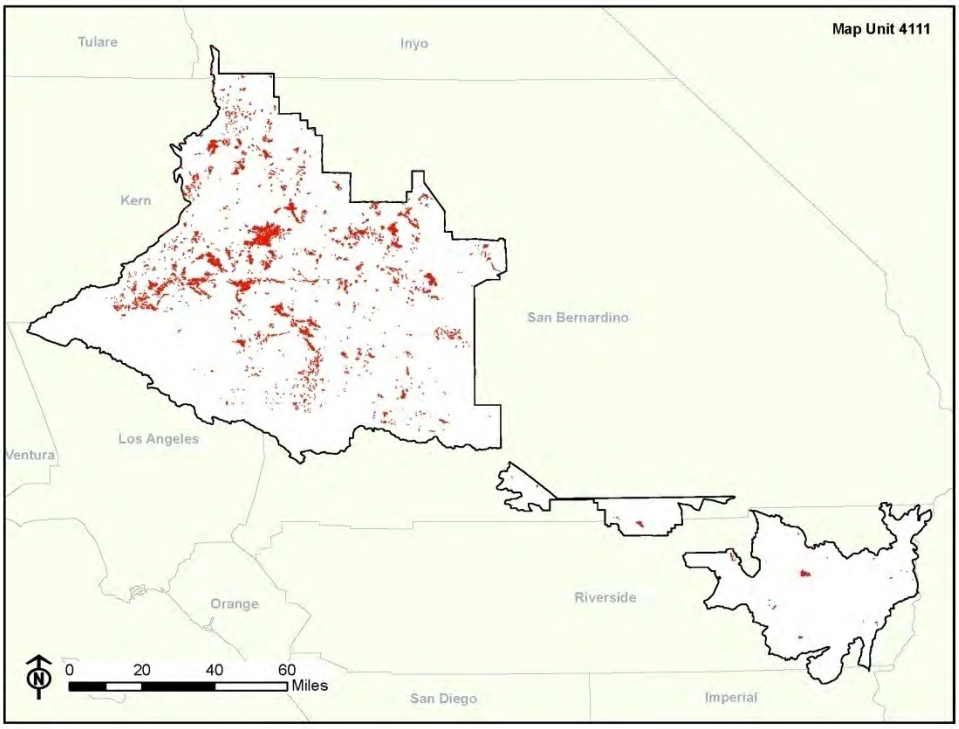
PHOTOINTERPRETATION SIGNATURE: Stands are typically open to moderately dense with evenly spaced small shrubs and very few if any taller shrubs. The crowns are gray to brown in color with a rounded, fairly well-defined edge.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

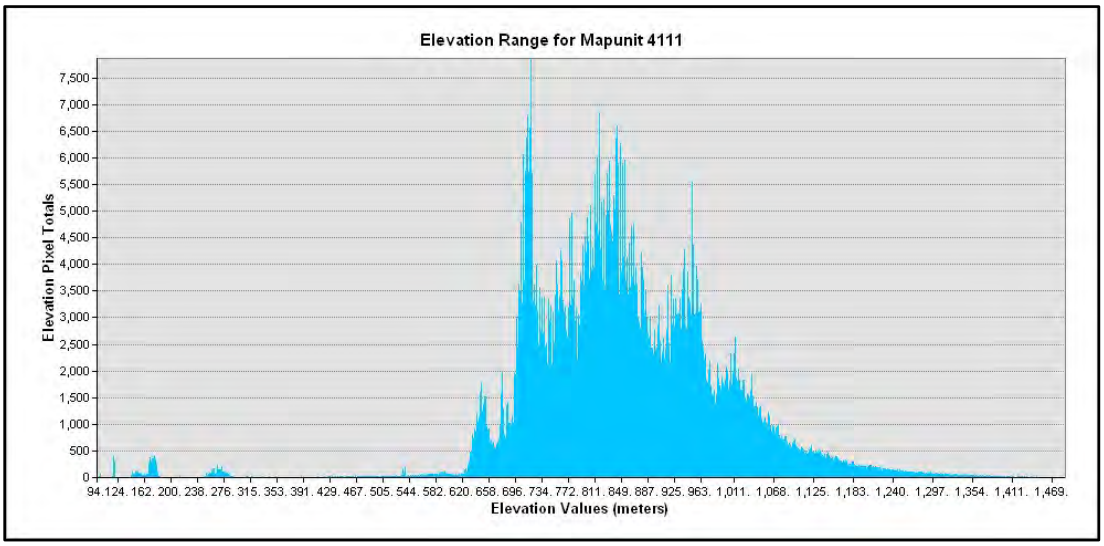
- *Atriplex polycarpa* Alliance (4113) – These plants are found in slightly more alkaline settings and are more likely to occur in agricultural-related disturbance near dry lake beds. Crowns are larger and signature color variability is lower, generally a light to medium gray. In natural settings, they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

- *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.
- *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.
- *Encelia virginensis* Alliance (5211) – This type colonizes on steep slopes of the desert mountain ranges shortly after a burn. Cover tends to be sparser in these settings and very difficult to discriminate on medium- to light-colored substrate. This species also ranges out of the desert and occurs in similar post fire settings in the San Andreas Rift Zone.
- *Ericameria nauseosa* Alliance (5212) – *E. nauseosa* tends to have a high variability of cover across the stand, and individual shrubs also vary considerably in size. Signature color is usually gray to blue-green. The ranges of the two species overlap primarily in the eastern portions of the Antelope Valley; *E. nauseosa* does not generally have *Larrea tridentata* adjacent or nearby.
- *Ericameria cooperi* Alliance (5215) – This Alliance is generally found in cooler, moister environments. In disturbance settings, where most stands are mapped, signature color tends to be slightly greener and species diversity within the stand is higher.
- *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.

4111 – *Ambrosia dumosa* Alliance

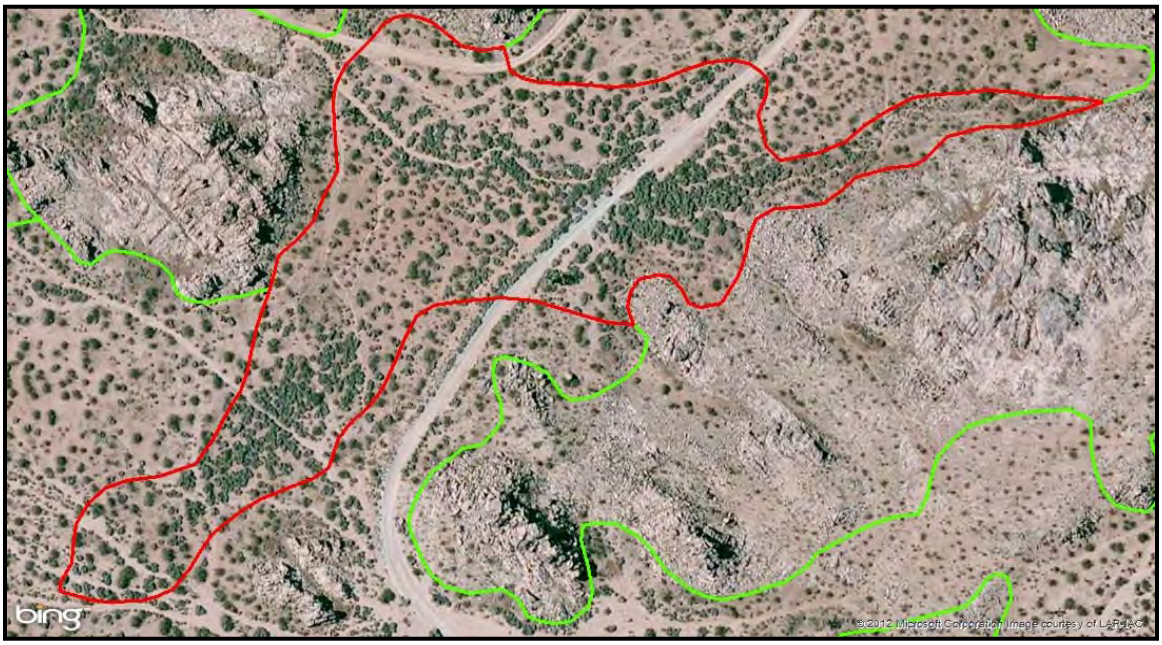


DISTRIBUTION: This Alliance is found throughout the study area, but primarily in the Western and Central Mojave Regions. The Alliance does not occur in the Western Antelope Valley or in the foothills of the Sierra Pelona, Tehachapi, San Gabriel, or San Bernardino Mountains. *Ambrosia dumosa* is less common in the Colorado Desert but does occur frequently as a co-dominant with *Larrea tridentata* on lower fans and bajadas.



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

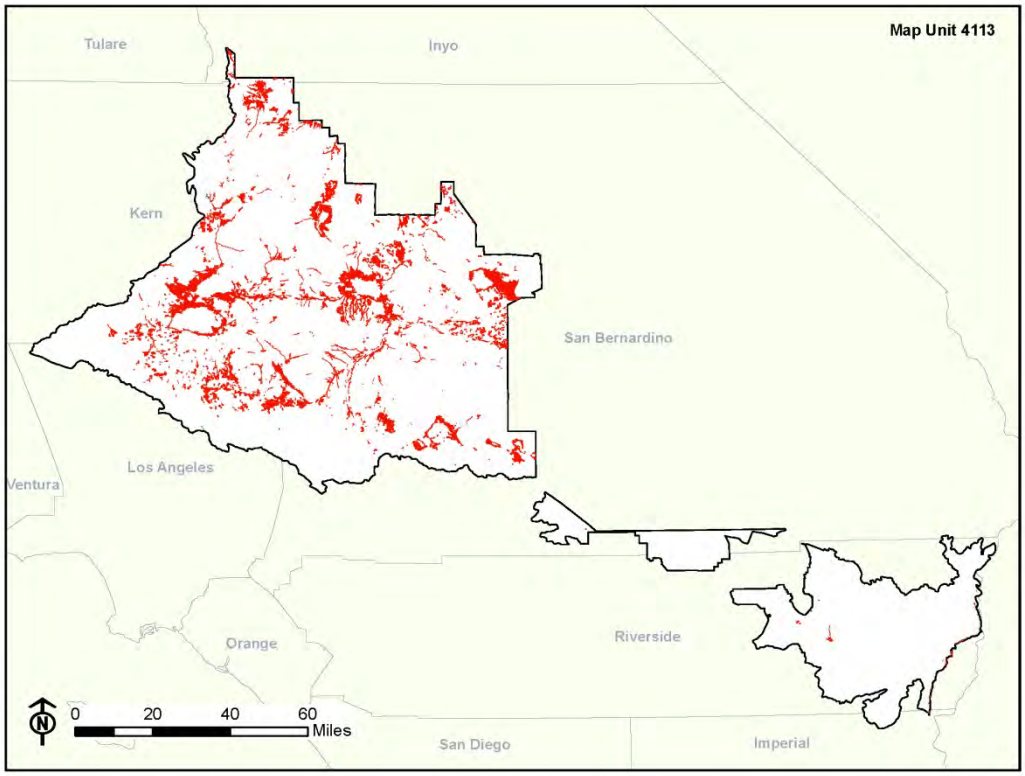
DESCRIPTION: This Alliance is mapped where *A. polycarpa* dominates the shrub layer, usually with at least 2 percent absolute cover of a single stand and more than 50 percent of the relative shrub cover. Stands can occur on broad flats, in washes, on steep volcanic ravines and slopes, and as disturbance 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.

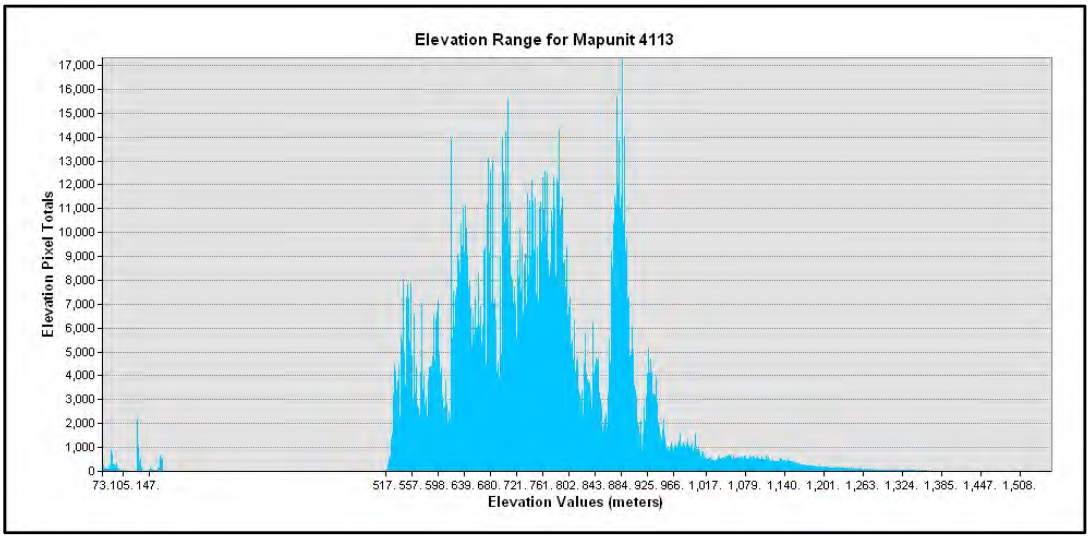
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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. These stands are more often associated with *Yucca brevifolia*.
- *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.
- *Ericameria nauseosa* Alliance (5212) – These shrubs are primarily related to human disturbance and occupy roadside clearings and fallow agriculture fields in less salty or alkaline settings. This Alliance is more likely found in the western Antelope Valley and foothills of the San Gabriel Mountains.

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 also found in small patches at the base of the bluffs adjacent to the Colorado River floodplain and on disturbed sites.



4114 – *Encelia farinosa* Alliance

Brittle bush scrub Alliance

The *Encelia farinosa* Alliance occurs on hot, exposed, steep, rocky volcanic slopes. The small light-colored shrubs in this image are located in the Palen Mountains. 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 in the southern Palen Mountains.

4114 – *Encelia farinosa* Alliance

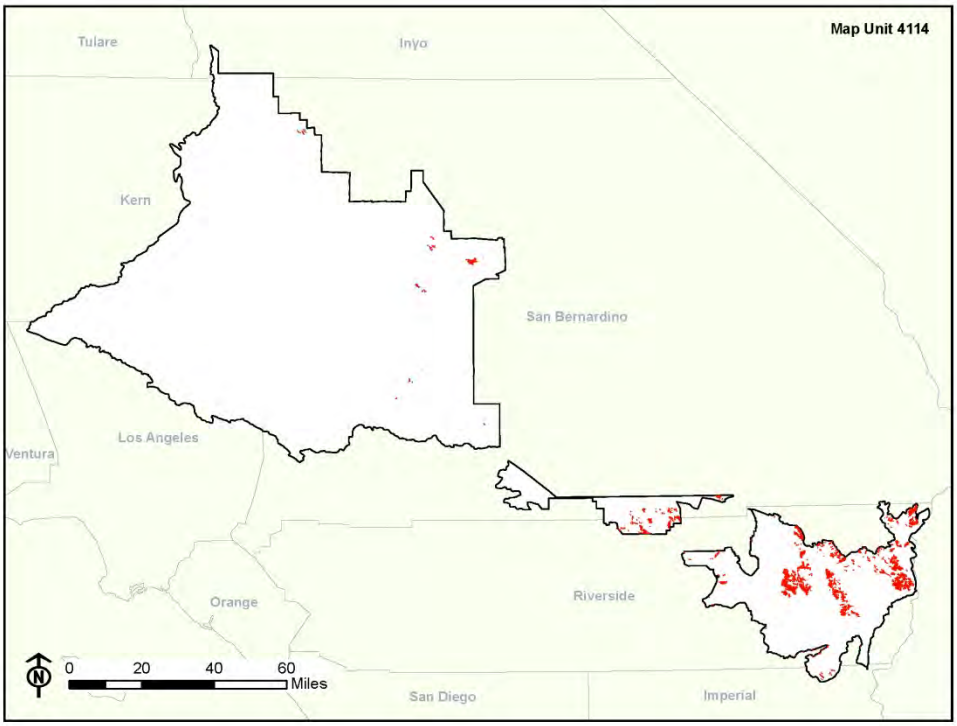
DESCRIPTION: *Encelia farinosa* is the dominant species, at greater than 1 percent cover, and with no other species having equal or higher cover. *Larrea tridentata* is largely absent. This Alliance occurs mainly on mid to upper (most exposed) south-facing slopes on hot and dark rocky substrate of the 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.

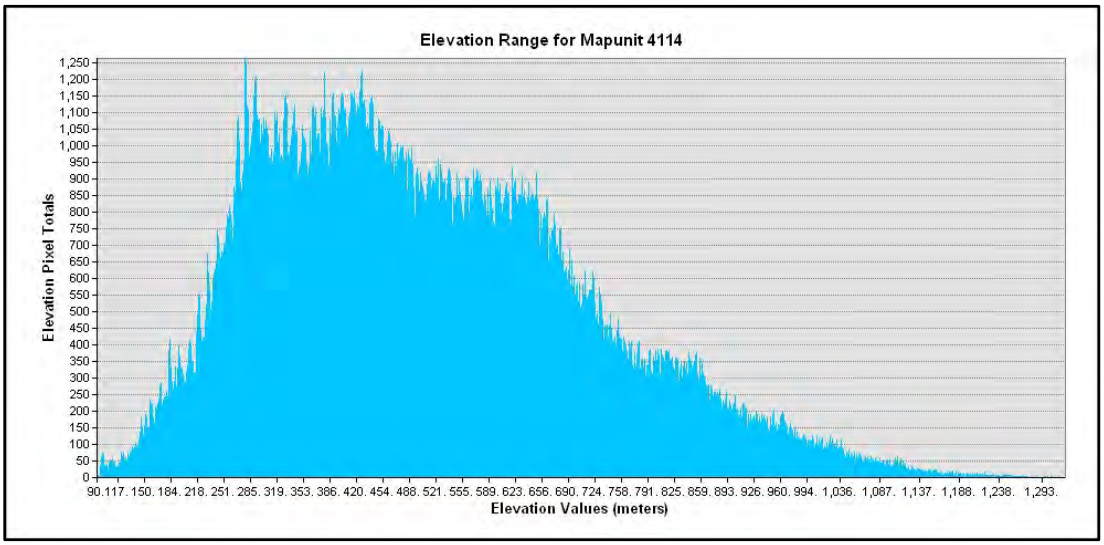
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 Subareas 1 and 2, 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.
- *Ephedra nevadensis* Alliance (5413) – In the Colorado Desert, this species may replace *Encelia farinosa* as a component in the higher elevations of the Granite Mountains and possibly elsewhere on lighter-colored substrate.

4114 – *Encelia farinosa* Alliance

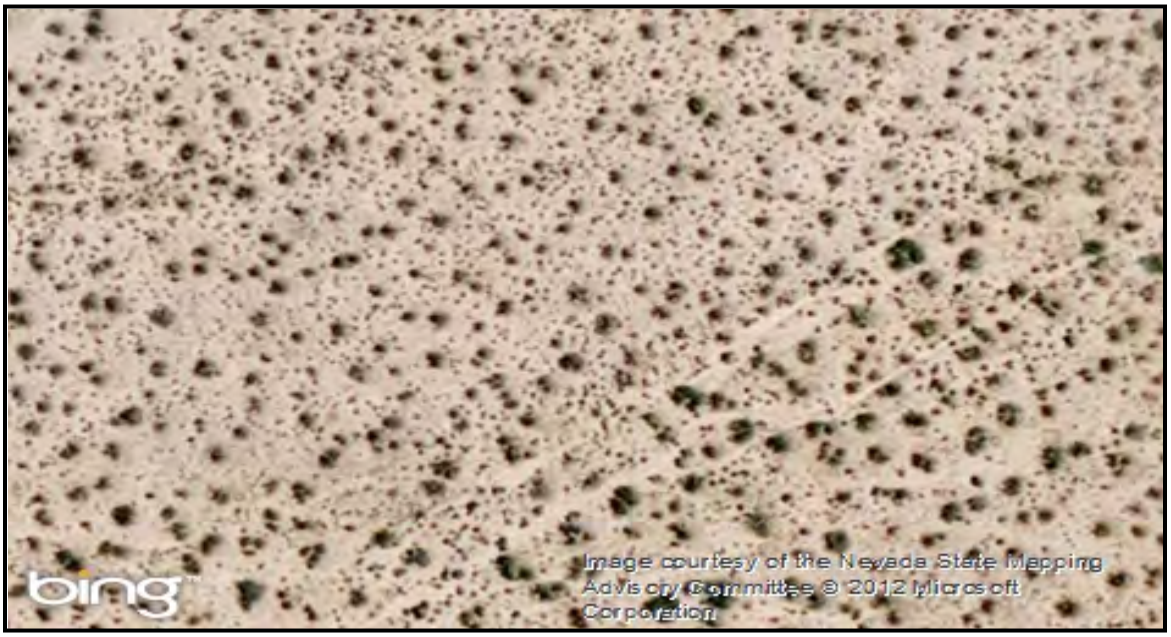


DISTRIBUTION: The *Encelia farinosa* Alliance has its highest concentration of stands in the upper elevations of the Palen, McCoy, Big Maria, and Little Maria Mountains of the Colorado Desert as well as in the Pinto Mountains of Subarea 2. Stands also occur on mid to upper (most exposed) south-facing slopes of the eastern and northern edge of Subarea 1 (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).



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.

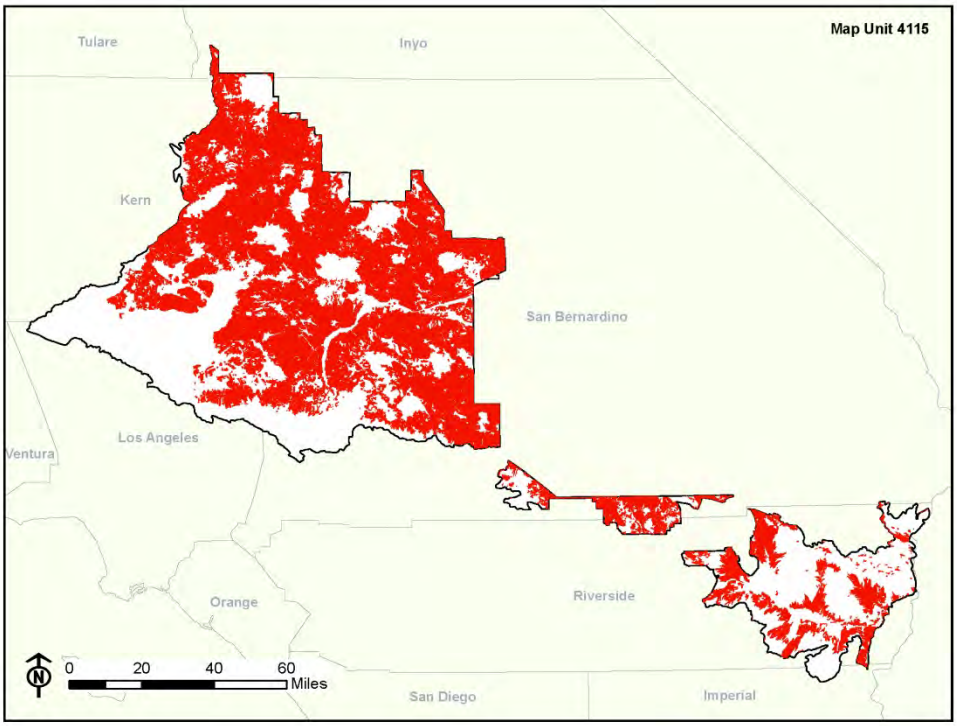
PHOTOINTERPRETATION SIGNATURE: Stands structure is two-tiered, made up of the medium height *Larrea tridentata* over the smaller subshrub *Ambrosia dumosa*. *L. tridentata* has a brown to green signature color with a diffuse crown edge, while *A. dumosa* has a light gray or brown signature color with 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:

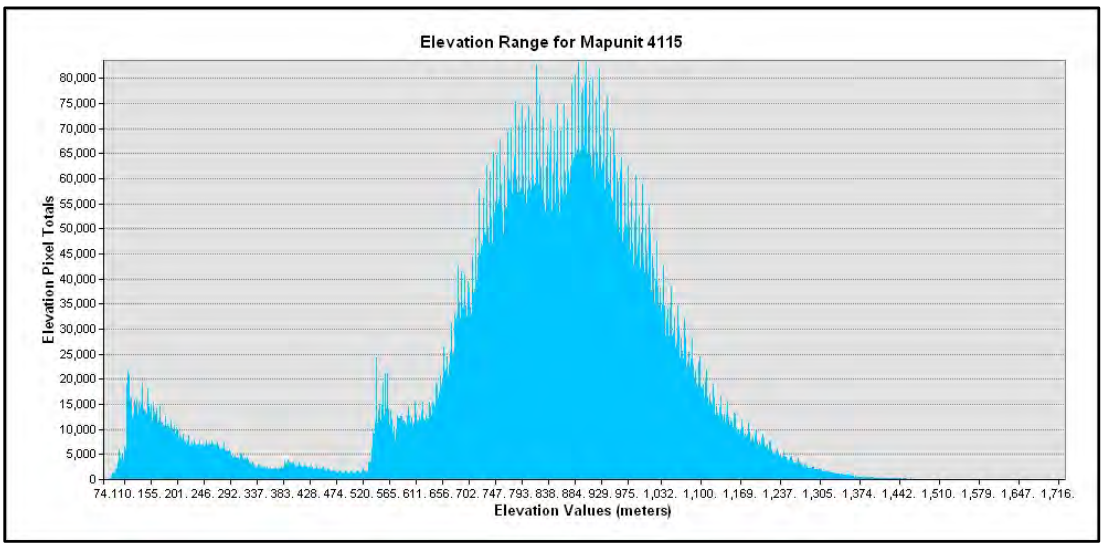
- *Ambrosia dumosa* Alliance (4111) – On bajadas, this Alliance is generally associated with disturbed clearings where the *A. dumosa* recovers more quickly than the *L. tridentata*. The two types can become difficult to distinguish when *L. tridentata* is unevenly scattered throughout the stand.
- *Larrea 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.

- *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.



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.

4118 – *Larrea tridentata – Encelia farinosa* Alliance

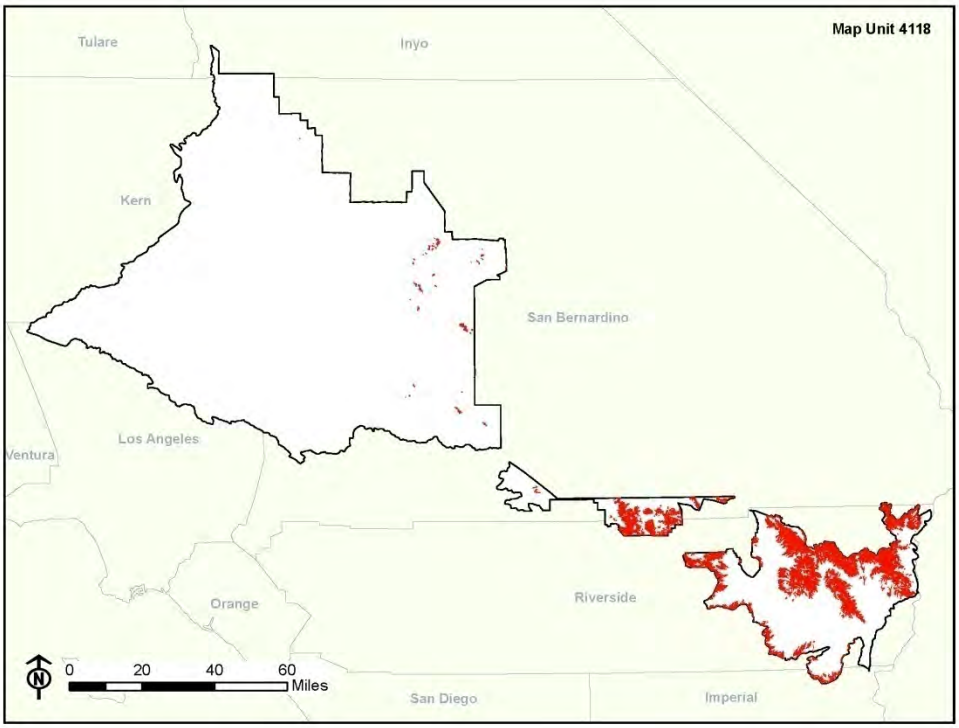
DESCRIPTION: In stands of this Alliance *Larrea tridentata* and *Encelia farinosa* are both present and in similar cover (broadly co-dominant). Occasionally, *E. farinosa* comprises less than 1 percent cover, but if so, *Ambrosia dumosa* is also in very low cover or absent. In rockier settings with thin 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 portion of Subarea 1, stands may be found on hot south-facing slopes and are commonly associated with dark volcanic rock. Further east, 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*. *L. 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.

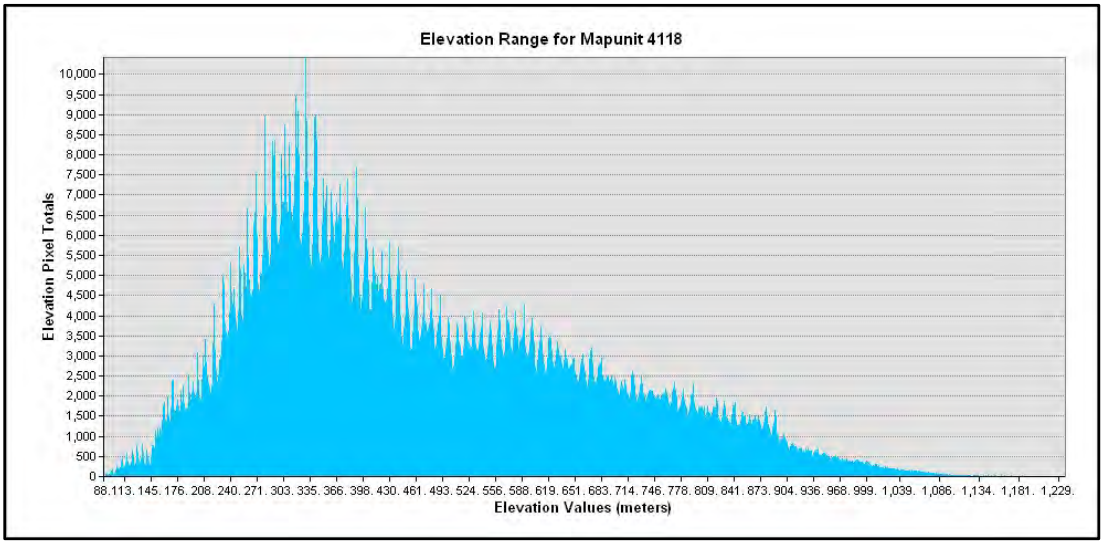
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 occur on broad alluvial fans and bajadas generally downslope from mountain toe slopes and older highly dissected fans and pavement surfaces. In Subareas 1 and 2 of the Mojave Desert, 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.

4118 – *Larrea tridentata – Encelia farinosa* Alliance



DISTRIBUTION: This type is highly concentrated in the northern third of the Colorado Desert (Subarea 3) and along the southern fringes of that same Subarea. 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 Subarea 1 to areas east of Barstow, with the exception of isolated stands occurring on slopes above Searles Valley.



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.

4119 – *Larrea tridentata* Alliance

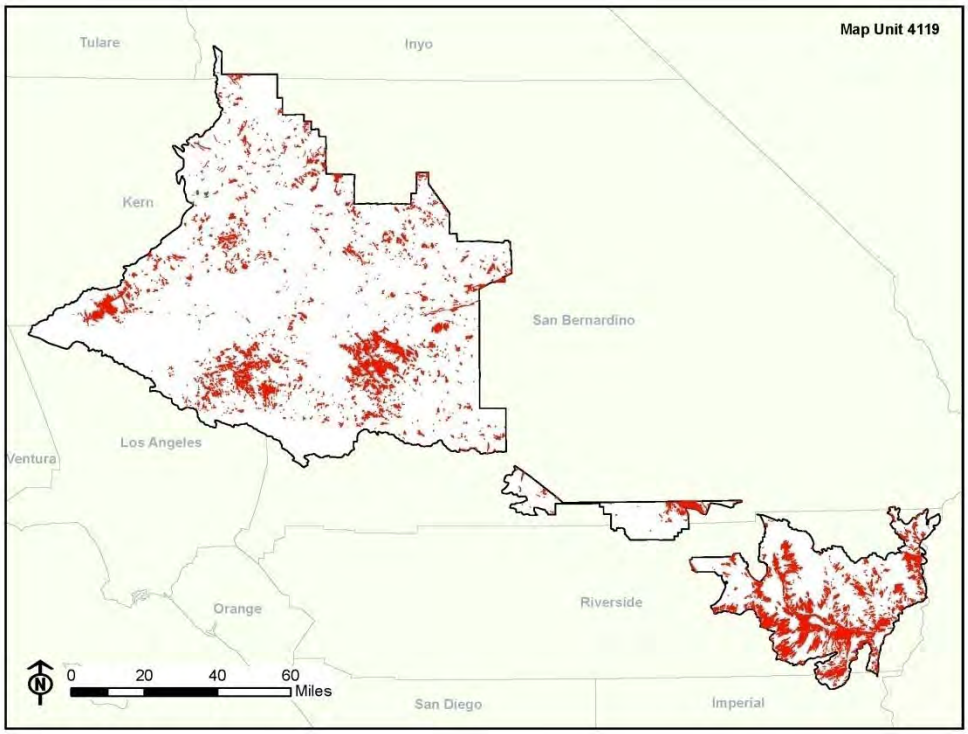
DESCRIPTION: In this Alliance *Larrea tridentata* is the dominant shrub with at least 2 percent cover and is evenly distributed in the stand. The following shrubs other than *Ambrosia dumosa* or *Encelia farinosa* may be present: *Krameria* spp., *Bebbia juncea*, *Ericameria teretifolia*, *Eriogonum 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 medium-sized shrubs appear dark brown to green 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. These stands often have an extensive tan to yellow hue of varying brightness due to the high cover of the annual grasses.

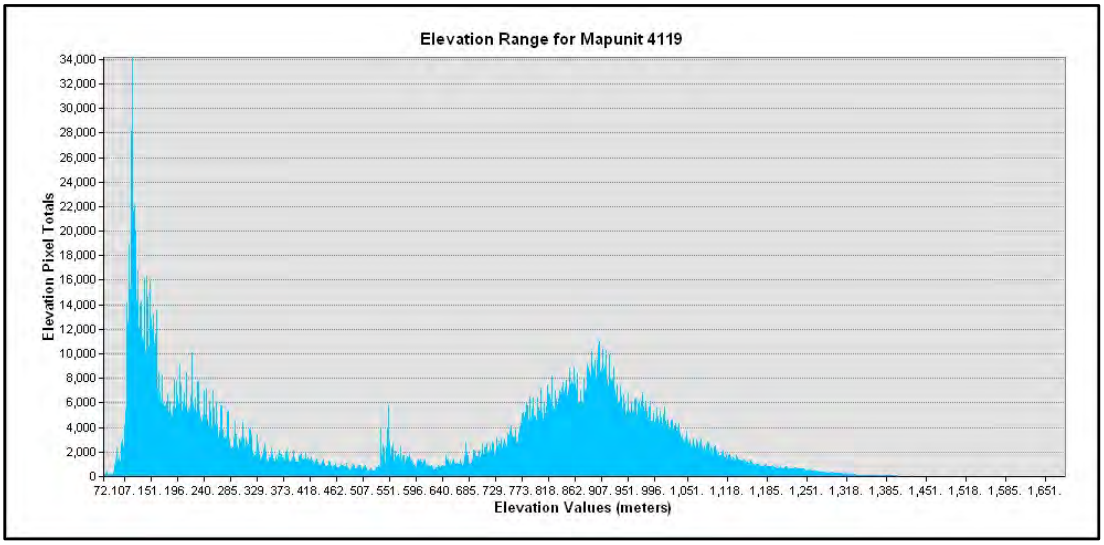
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *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 east of the Mojave River. Stands are limited on the active portions of the Colorado River Floodplain.



4122 – *Pleuraphis rigida* Alliance

Big galleta shrub-steppe Alliance

The clonal signature of *P. rigida* depicted in this example displays a mottled pattern with indistinct crown and stand edges. *L. tridentata* and *A. dumosa* spill over in adjacent stands from the north, contrasted by darker, more defined crowns.

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

4122 – *Pleuraphis rigida* Alliance

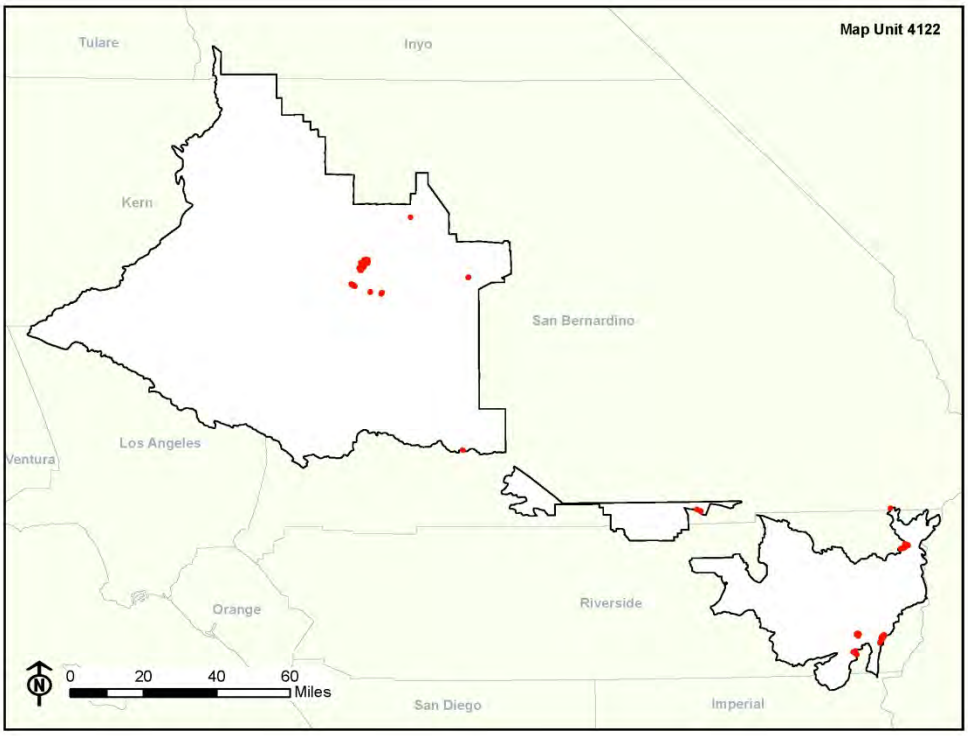
DESCRIPTION: In stands of this Alliance the shrubby bunch grass *Pleuraphis rigida* is the dominant perennial species. It may occur with scattered shrubs of *Larrea tridentata, Ambrosia dumosa, Ephedra trifurca,* or other shrub species at lower cover. Stands typically occur on sand ramps, dune aprons, 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. The westernmost occurrence of this Alliance in the study area is near Harper Dry Lake.

PHOTOINTERPRETATION SIGNATURE: This bunch grass has a mottled, light gray signature, with cover ranging widely within a stand. Color tone may be lighter 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 additional indicator of *Pleuraphis* presence.

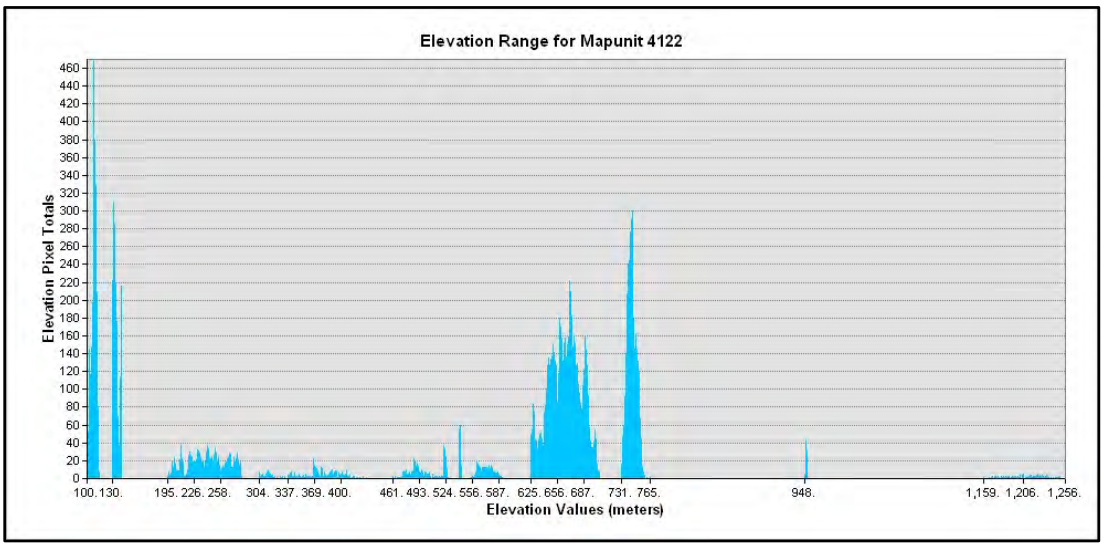
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia dumosa* Alliance (4111) – The signature of the plant has a darker 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* will not have a hummocky texture.

4122 – *Pleuraphis rigida* Alliance



DISTRIBUTION: Stands occur in isolated patches in all three subareas. Some of the most extensive stands are found in the flats east of Harper Dry Lake. These are also the westernmost stands in the map 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. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



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 near Joshua Tree National Park. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

The photo depicts a typical setting where *V. parishii* (pale, straw-colored, diffusely-branching shrubs) colonizes between the rocks and boulders, often co-occurring with a variety of other species including *Pleurocoronis pluriseta*, *Bebbia juncea, Simmondsia chinensis, Trixis californica,* and *Ambrosia dumosa* in very low cover.

4151 – *Viguiera parishii* Alliance

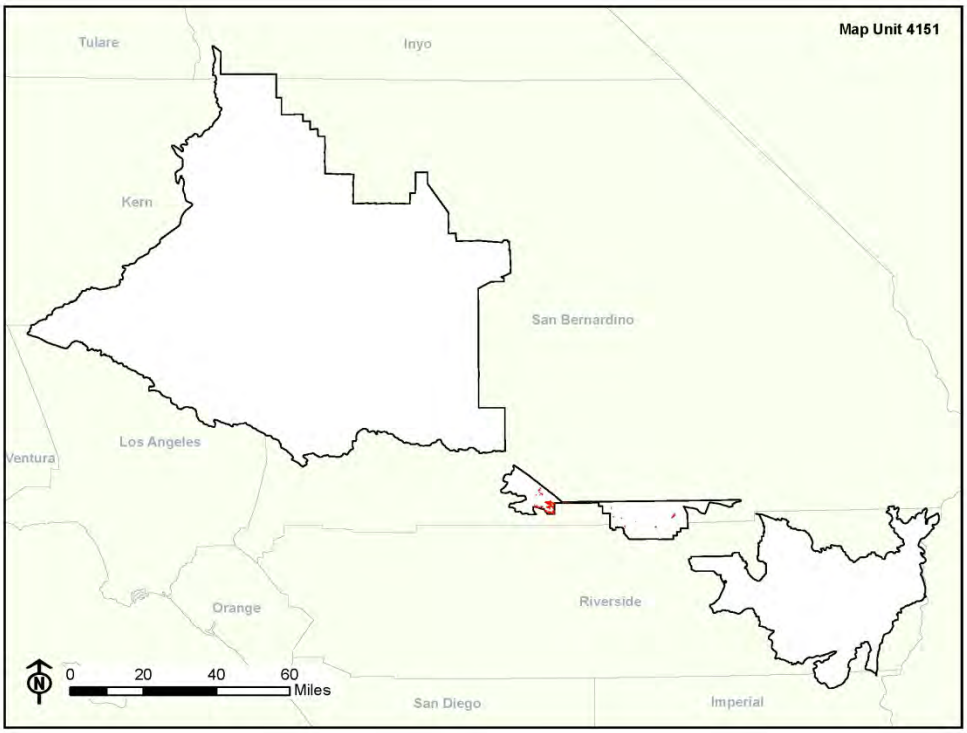
DESCRIPTION: In stands of this Alliance *Viguiera parishii* is present with at least 1 percent cover. No other species has greater or equal cover, except for *Acacia greggii, Ambrosia dumosa, Simmondsia chinensis, Pleuraphis rigida, Lotus rigidus,* or *Encelia actoni.* Many stands are intermixed with 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 Sonoran Deserts in California. In Subarea 2, 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.

PHOTOINTERPRETATION SIGNATURE: Stands are restricted to ultra-rocky, north-facing 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 the severity of slope and rockiness along with the limited regional distribution of this species, characterize the criteria for how this Alliance is identified. Many times *Yucca schidigera* stands occur on the more gradual, less rocky toe slopes adjacent to these ultra-rocky areas.

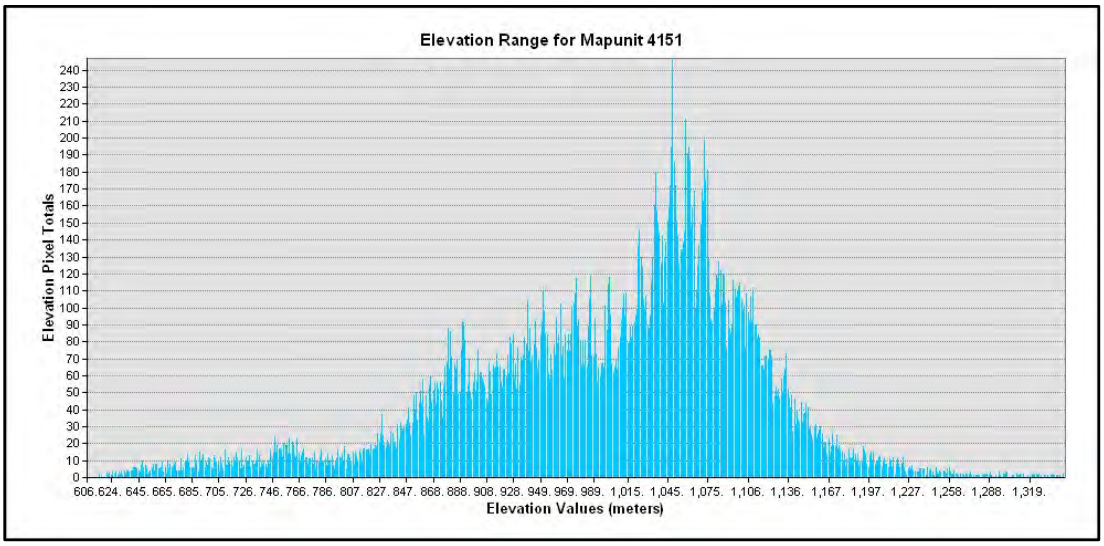
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.

4151 – *Viguiera parishii* Alliance

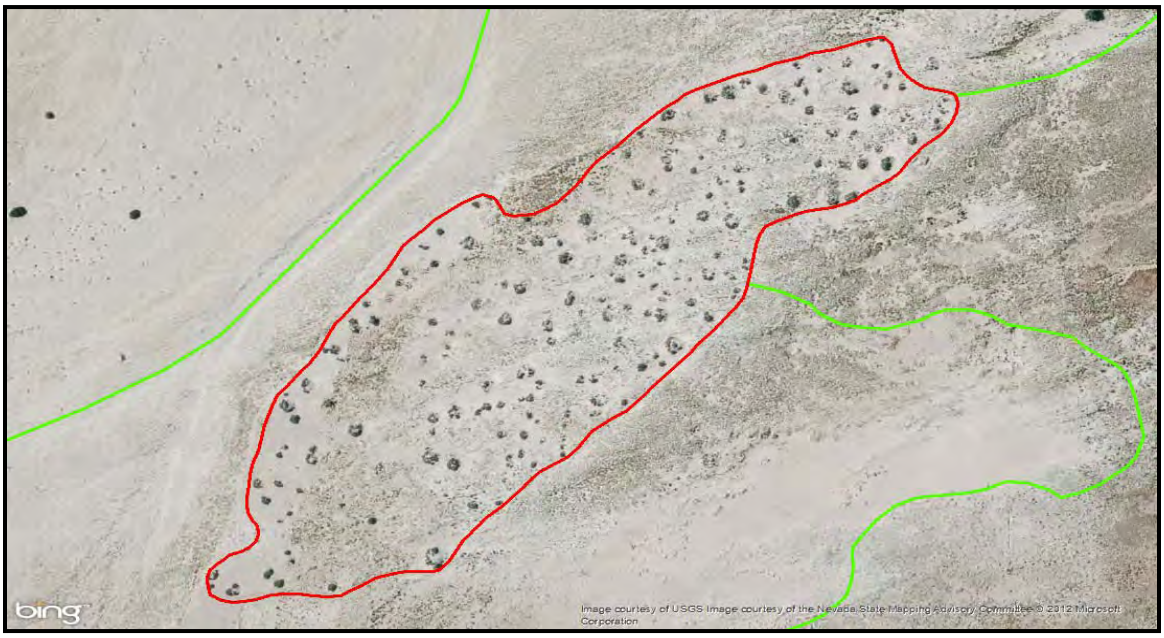


DISTRIBUTION: Stands are restricted to the northern fringe of Joshua Tree National Park in Subarea 2. The largest stands in the study area occur east of Yucca Valley in the Little San Bernardino Mountains and extend eastward in widely scattered locations along the north slopes of the Pinto Mountains.



4211 – *Ephedra californica* Alliance

California joint fir scrub Alliance



This image shows the dark green clonal rings of *Ephedra californica* 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

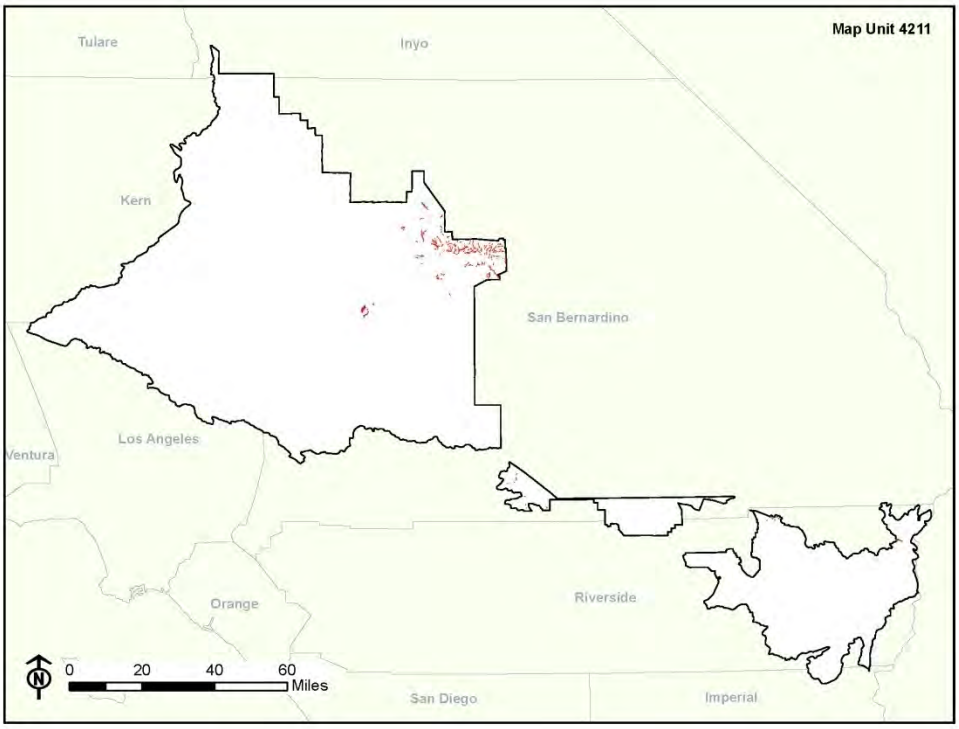
DESCRIPTION: In this Alliance *Ephedra californica* or *Ephedra trifurca* dominates or co-dominates with *Ambrosia salsola, Senna armata, Gutierrezia californica* or *Brickellia incana. Ephedra californica* is typically found on broad, active washes of mid to upper bajadas and fans. *E. californica* 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. This setting produces a marked contrast with the white sandy substrate and the dark-colored shrubs dominating the stand. Stands tend to have a low diversity of shrubs, with *Atriplex canescens* at times co-dominating the stand; a setting which typically creates minimal variability in the overall signature for this type.

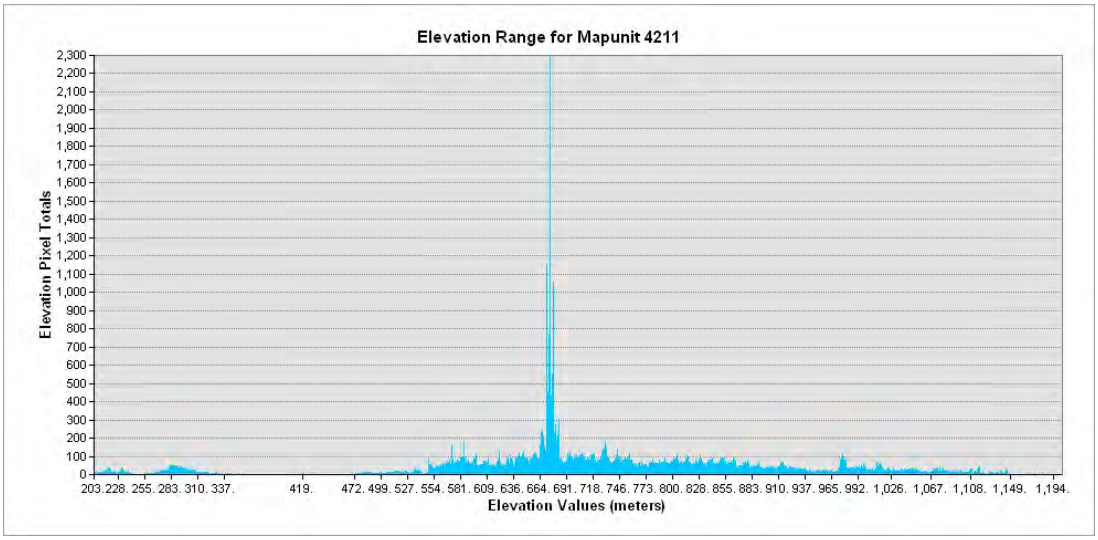
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 settings, 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* (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.



4212 – *Lepidospartum squamatum* Alliance

Scale broom scrub Alliance

The image shows brownish *Lepidospartum squamatum* shrubs occurring in a typical wash setting with emergent *Populus fremontii*.

In the foreground of the photo is a *Lepidospartum squamatum* shrub occupying a low-energy wash, although it prefers high-energy washes.

4212 – *Lepidospartum squamatum* Alliance

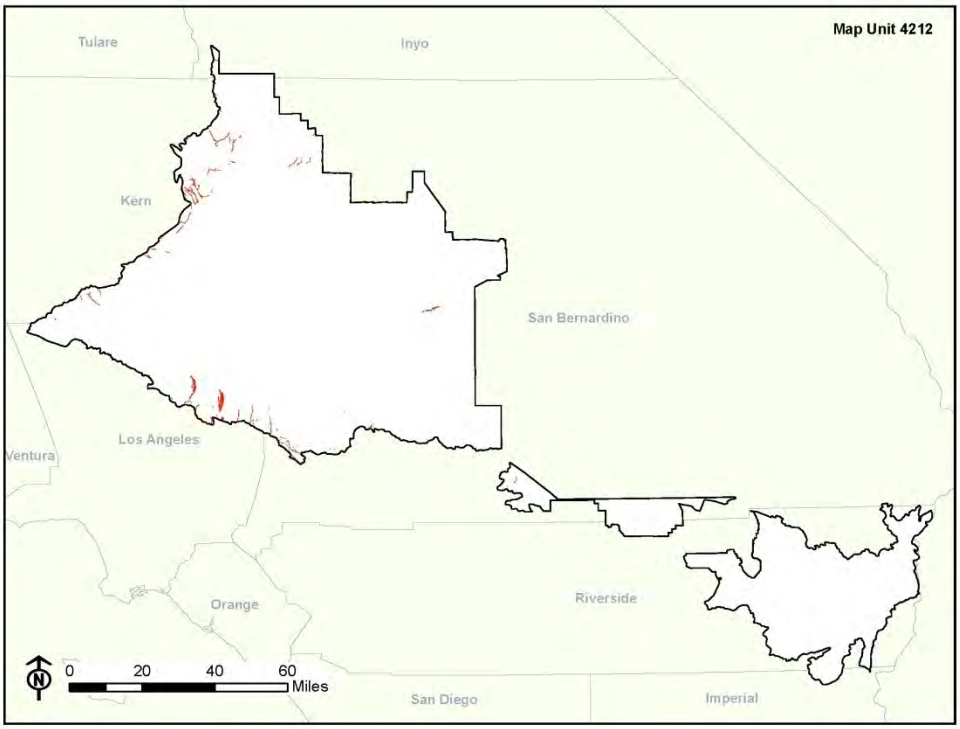
DESCRIPTION: This Alliance is mapped where *Lepidospartum squamatum* dominates, co-dominates, or even subdominates within the shrub layer due to its status as an indicator species of the Alliance. These plants usually occur in larger washes with regular flooding where the substrate texture is coarse sand to small cobbles to gravel. *Lepidospartum squamatum* drops out upstream as watershed area decreases. Downstream, where the channel thins or becomes less dynamic, *L. squamatum* may transition to *Ericameria paniculata*. Stands for the most part are limited to arroyos and upper fans at the bases of the Transverse Ranges and the Sierra Nevada, and are also found along the Mojave River near Barstow.

PHOTOINTERPRETATION SIGNATURE: Stands range from sparse to moderately dense in cover, with a color variation from brown to brownish green to gray. *L. squamatum* is a small to medium-sized shrub with a rounded to irregular crown shape and rough, uneven texture. It consistently occurs in the most active portions of stream channels.

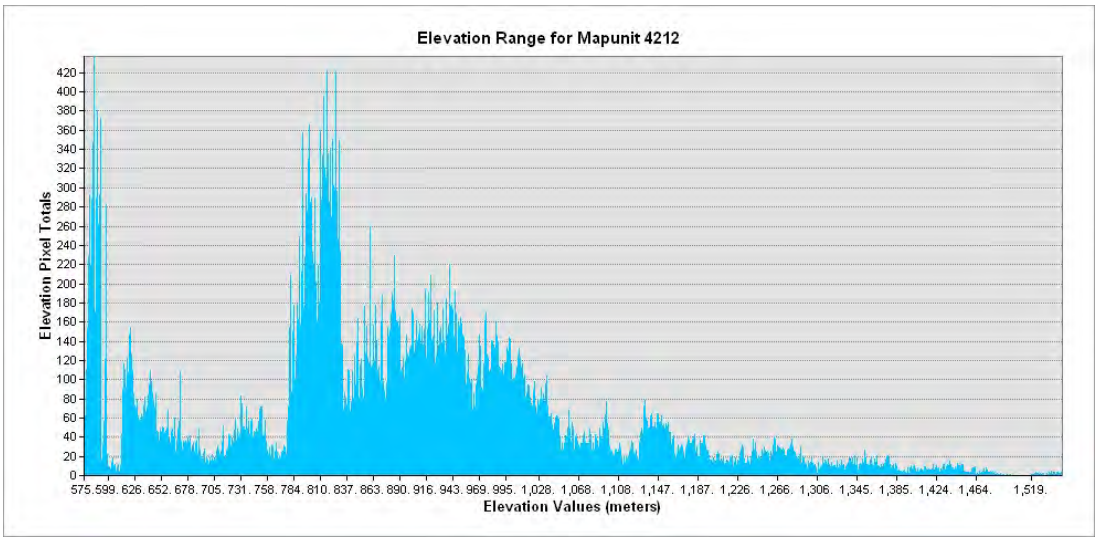
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ericameria paniculata* Alliance (4213) – Mature, larger shrubs are distinguished by having a greener color. Otherwise these plants are difficult to discern from *L. squamatum* due to their similar crown shape, texture, and setting. This species tends to occur in lower-energy washes with smaller watersheds.
- *Prunus fasciculata* Alliance (4214) – This plant has a consistent greener color, typically mixes with a variety of other shrubs, and prefers less active parts of drainages (i.e. stream terraces or sheet wash areas).
- *Ambrosia salsola* Alliance (4216) – These shrubs are significantly smaller in size, have a lighter gray color, and occupy stream terraces and lower energy washes.

4212 – *Lepidospartum squamatum* Alliance

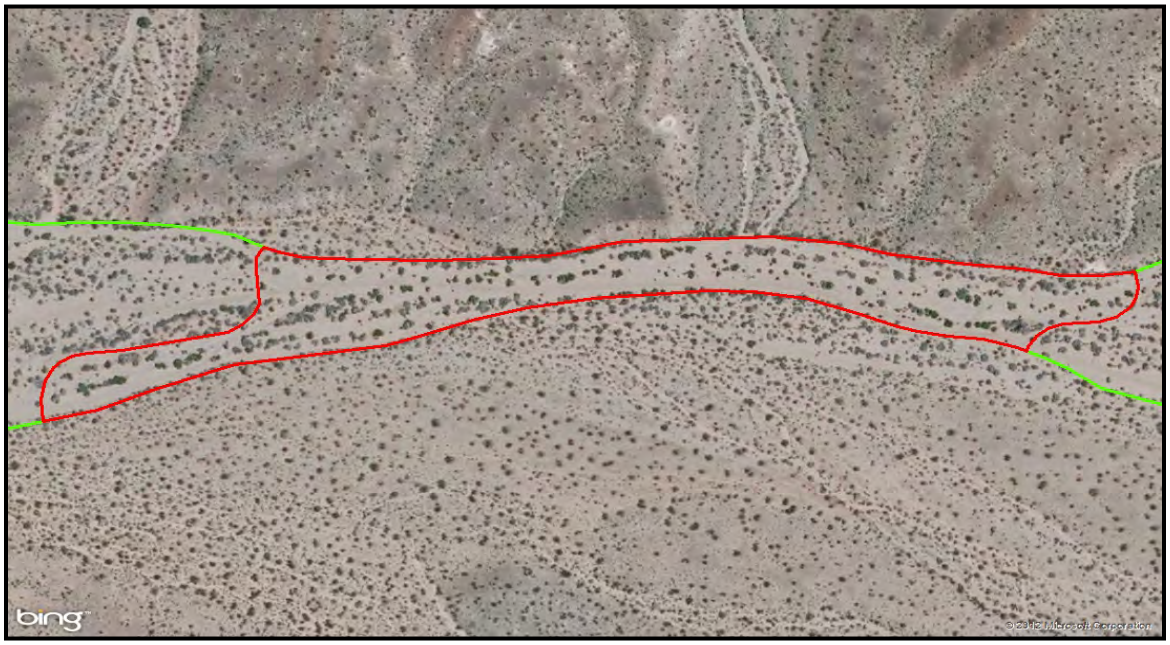


DISTRIBUTION: Stands are concentrated along washes on the eastern base of the southern Sierra Nevada, San Bernardino and San Gabriel Mountains. It also occurs in wide, very active washes in Fremont and Indian Wells Valleys, Sierran fans, lower El Paso Mountains and the north side of the Lava Mountains, which is the easternmost limit of the species' regional distribution.



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

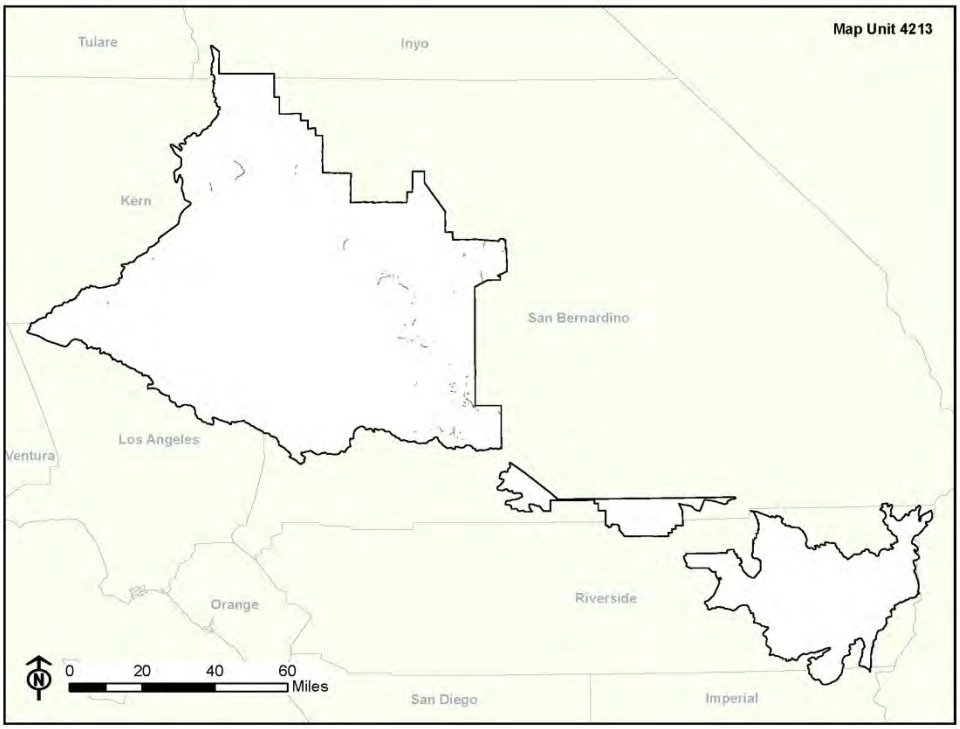
DESCRIPTION: This Alliance is mapped where *Ericameria paniculata* is dominant or co-dominant in the shrub canopy. *E. paniculata* comprises at least 2 percent of the absolute cover and at least 25 percent of relative cover. It is widespread throughout a broad elevation range in much of the mapping area 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.

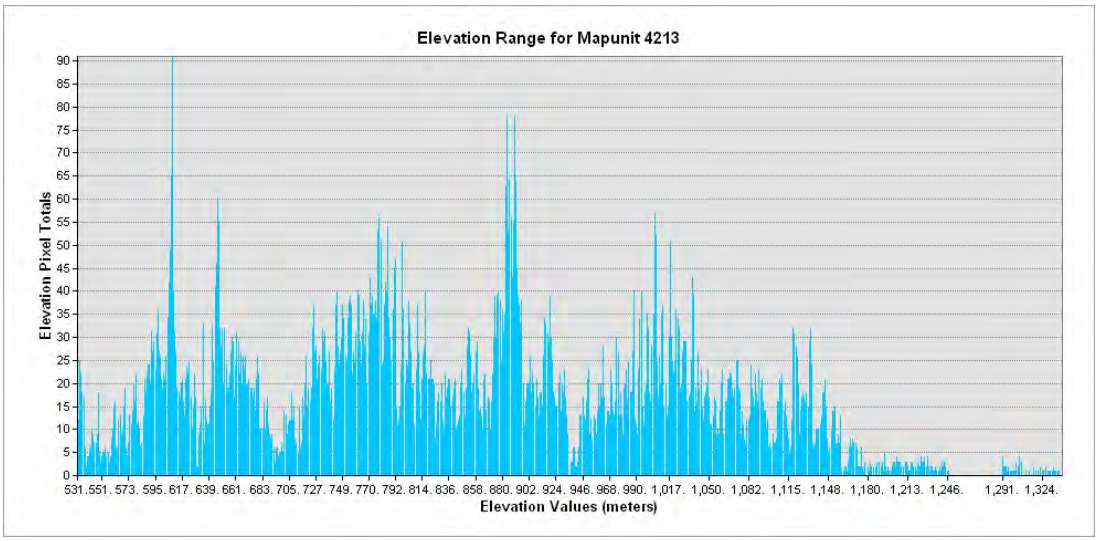
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Lepidospartum squamatum* Alliance (4212) – These shrubs are distinguished by having a lighter tone and browner color, and prefer higher energy washes. Otherwise these plants are difficult to discern from *E. paniculata* due to their similar crown shape, texture and setting.
- *Prunus fasciculata* Alliance (4214) – This plant is very similar in size and color but prefers gravelly canyons and washes on upper fans.
- *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).
- *Psorothamnus 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.

4213 – *Ericameria paniculata* Alliance

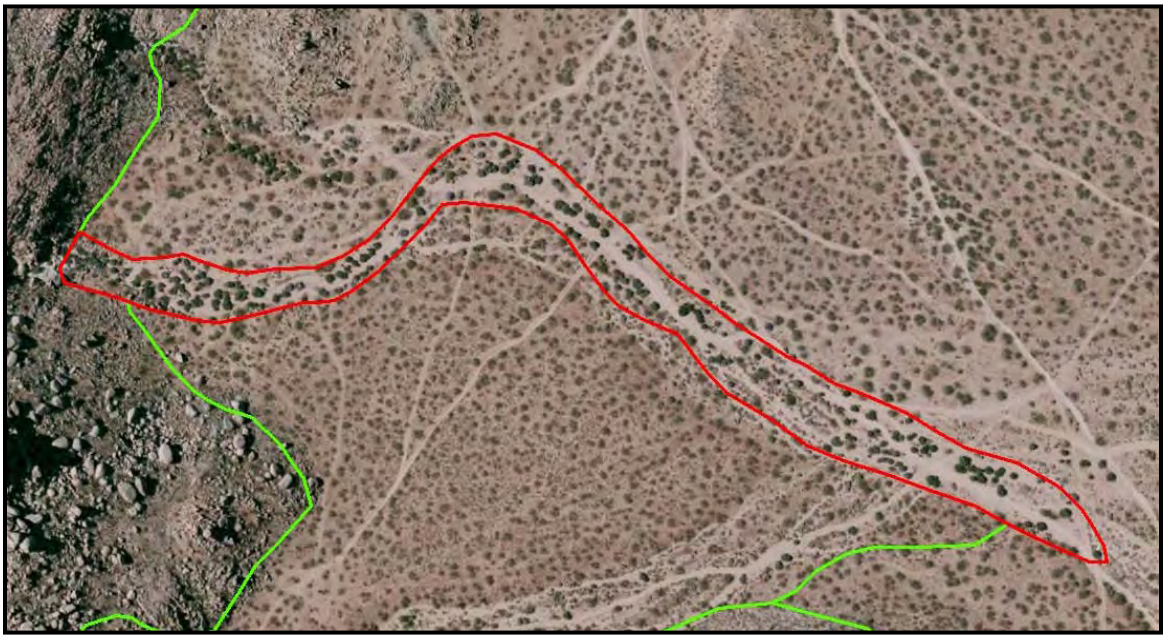


DISTRIBUTION: This Alliance has the highest concentration of stands in desert washes near Calico and Johnson Valley in the Central Mojave region. Fewer localized stands occur in narrow desert mountain arroyos near Koehn Dry Lake in the Mojave – Basin and Range Fringe zone. There were no recorded stand occurrences in Subareas 2 and 3. The regional distribution of this type is centered in the Great Basin and Eastern Mojave regions outside this study area.



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

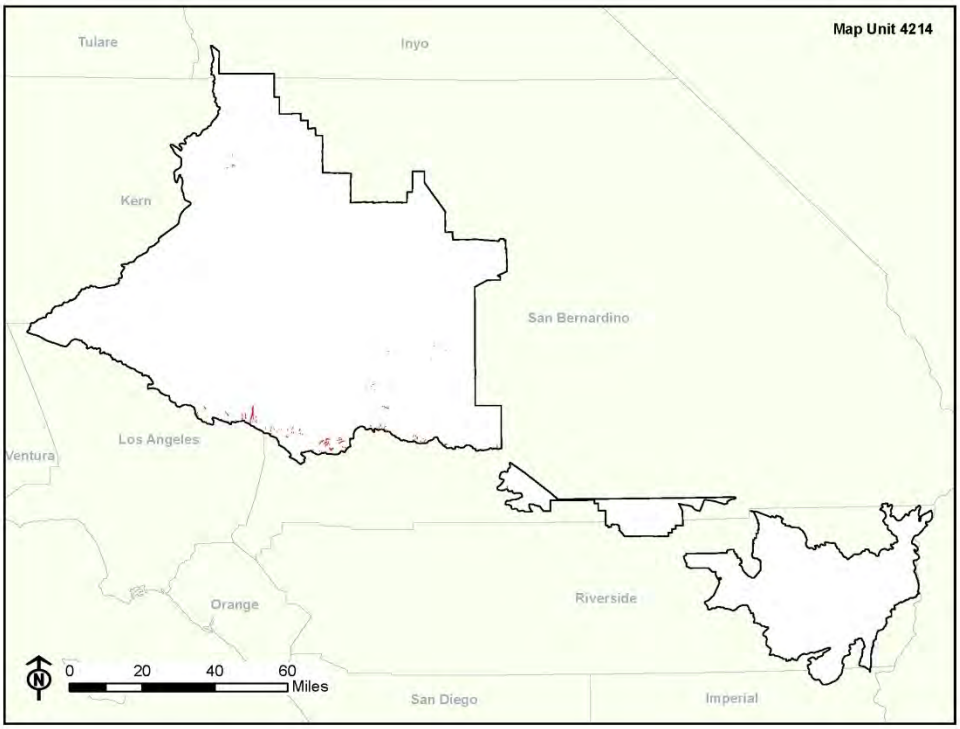
DESCRIPTION: This Alliance is mapped where *Prunus fasciculata* dominates or co-dominates the shrub layer and comprises at least 2 percent of the absolute cover and at least 25 percent of total relative cover. *Gutierrezia sarothrae* and *Lycium cooperi* may have up to twice the cover of *P. fasciculata.* 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.

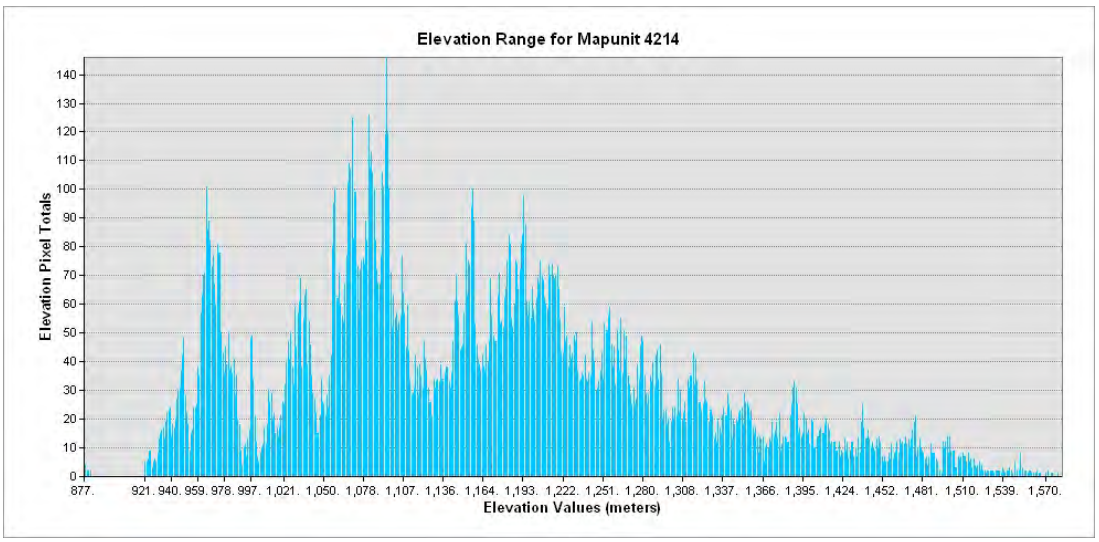
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.

4214 – *Prunus fasciculata* Alliance

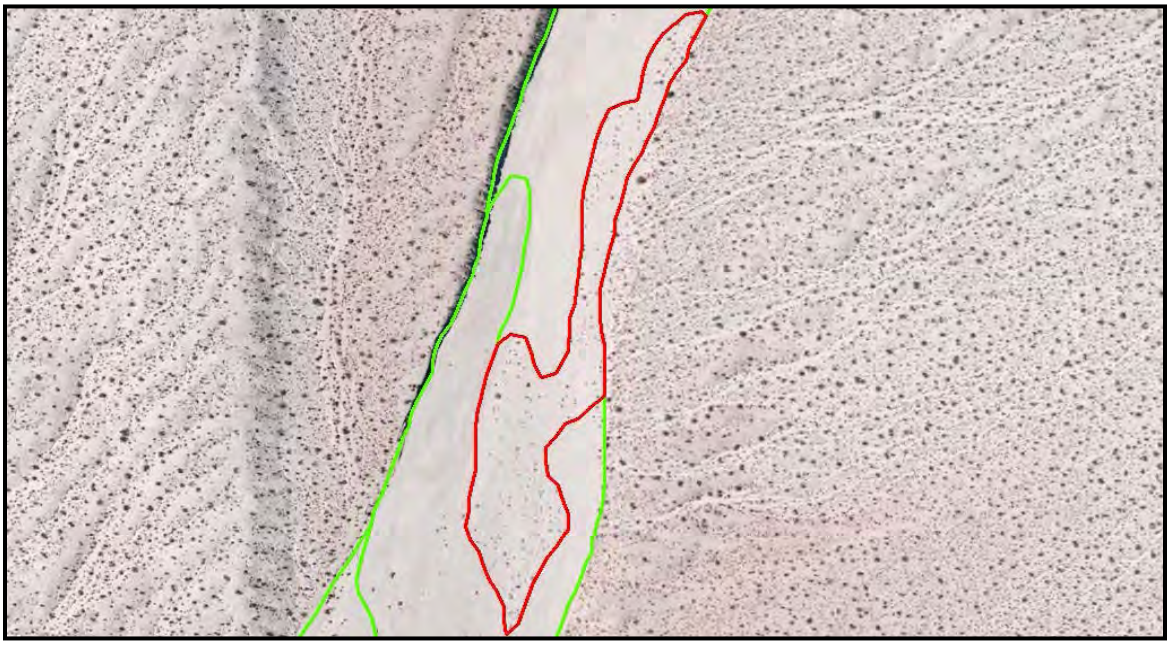


DISTRIBUTION: This Alliance is primarily found in upland washes and canyons in foothills of the San Bernardino and eastern San Gabriel Mountains. This species prefers higher precipitation and cooler temperatures than other wash vegetation types and is absent from the Colorado Desert and much of the interior valleys of the Mojave Desert. A few localized stands do occur within cooler, protected canyons of the El Paso, Fairview, and Granite Mountain ranges.



4215 – *Brickellia incana* Provisional Alliance

Woolly brickellia wash scrub Provisional Alliance



This image shows the light gray *Brickellia incana* occurring in the active channel of a stream.

The grayish green *Brickellia incana* dominates this wash with a few flowering *Ephedra californica* mixed in the stand.

4215 – *Brickellia incana* Provisional Alliance

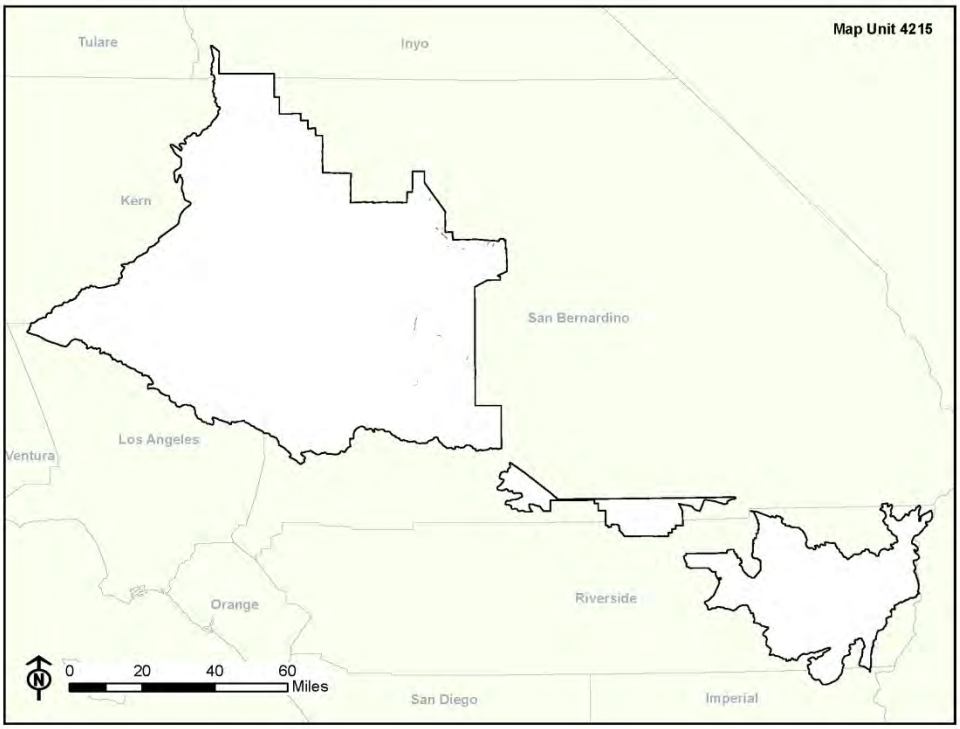
DESCRIPTION: Rarely strongly dominant, *Brickellia incana* usually occurs with *Ephedra californica*, and may be a part of the *Ephedra californic*a Alliance. It occurs in sandy washes in the Central Mojave, usually at mid to lower elevations as around Coyote Dry Lake, and south of Barstow. Some large stands strongly dominated by *B. incana* occur in areas without *E. californica,* as in hills northwest of the Hodge Road exit off of Interstate 15 between Victorville and Barstow.

PHOTOINTERPRETATION SIGNATURE: Stands generally contain a sparse and widely variable cover, with shrub color trending white to light gray. Crowns are small and tend to be rounded in shape. Plants establish in the most active portions of the channel, and cover can vary from year to year due to flooding events. Stands rarely cover large areas and are not commonly mapped. The small light-colored shrubs in sparse settings against a white sandy wash substrate make interpreting this Alliance extremely difficult.

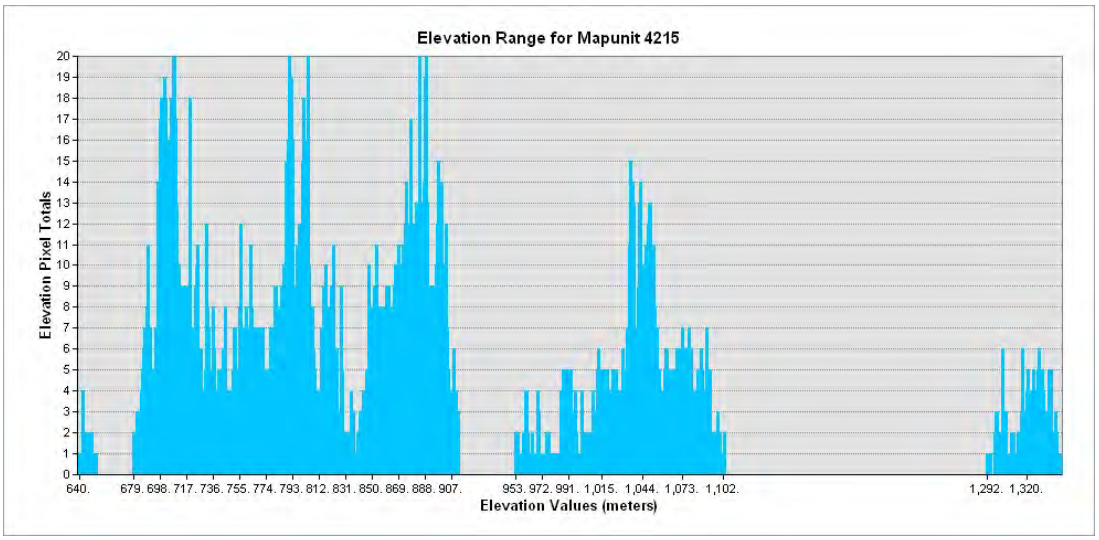
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Lepidospartum squamatum* Alliance (4212) – These shrubs are distinguished by having a larger crown and a browner color.
- *Ericameria paniculata* Alliance (4213) – These plants are larger in size and have a greener color than *B. incana*.
- *Ambrosia salsola* Alliance (4216) – These shrubs appear darker gray in color, have a diffuse crown and do not prefer the most active portions of the channel.

4215 – *Brickellia incana* Provisional Alliance

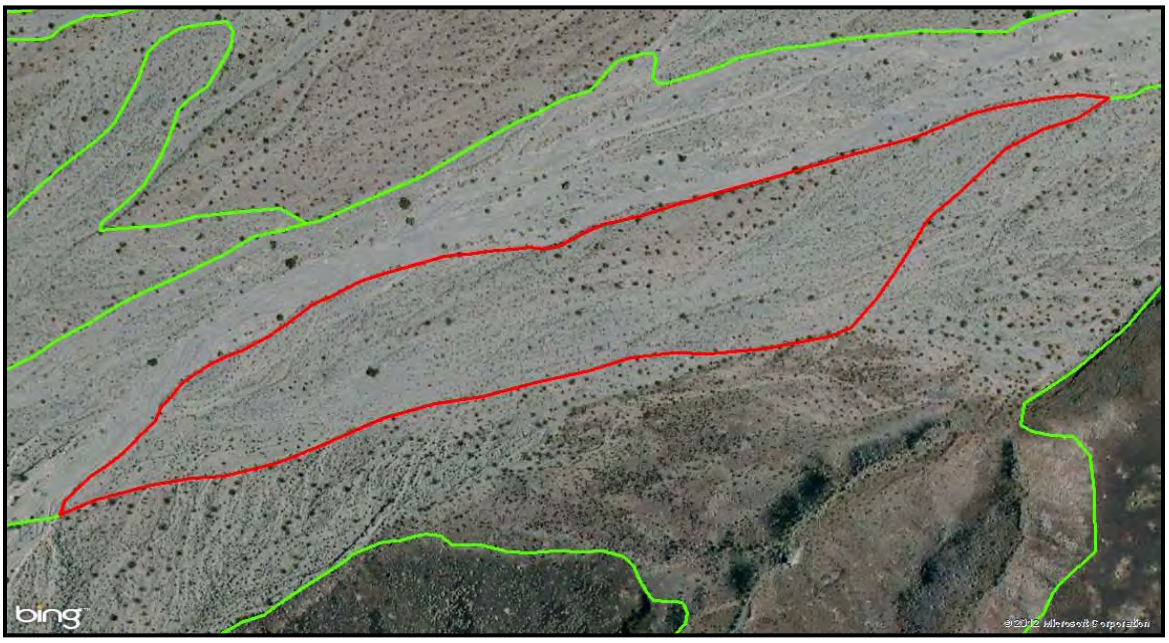


DISTRIBUTION: Very few localized stands are found within wash channels in the Central Mojave Desert Region south from Goldstone Dry Lake down to the northern edge of Lucerne Valley.



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

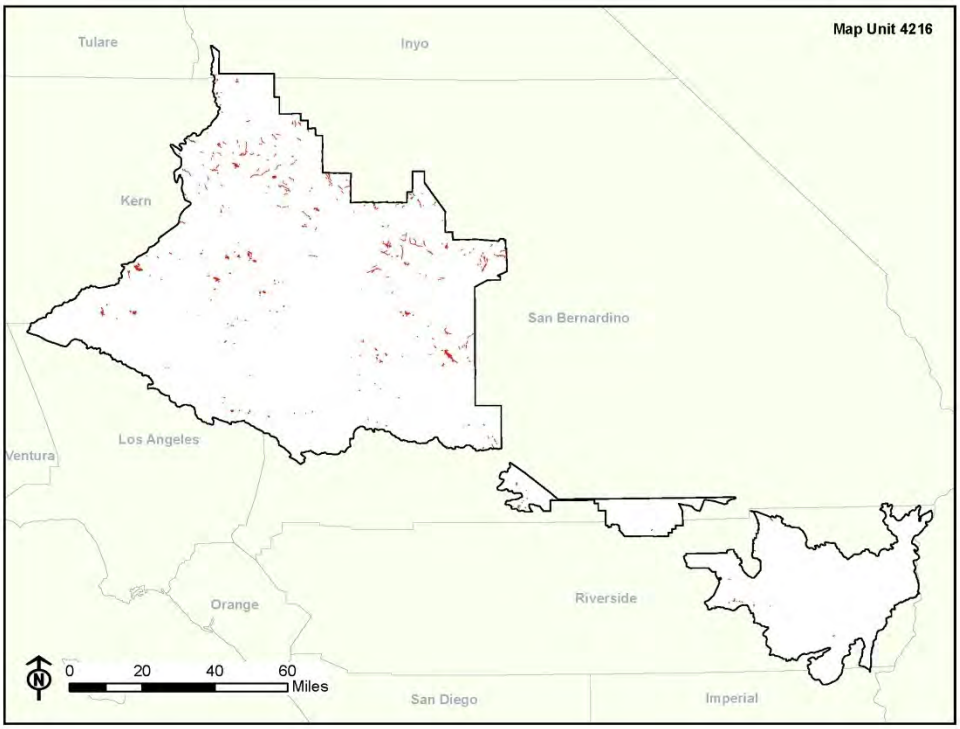
DESCRIPTION: In this Alliance *Ambrosia salsola* is strongly dominant, comprising more than 60 percent relative cover in the dominant shrub layer. Stands occur in washes or on gently-sloping disturbed uplands. Upland stands are usually associated with fire, clearing, grazing, or other disturbance in former *Larrea tridentata-Ambrosia dumosa*, *Juniperus californica, Yucca schidigera, Coleogyne ramosissima* or other upland vegetation. 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 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.

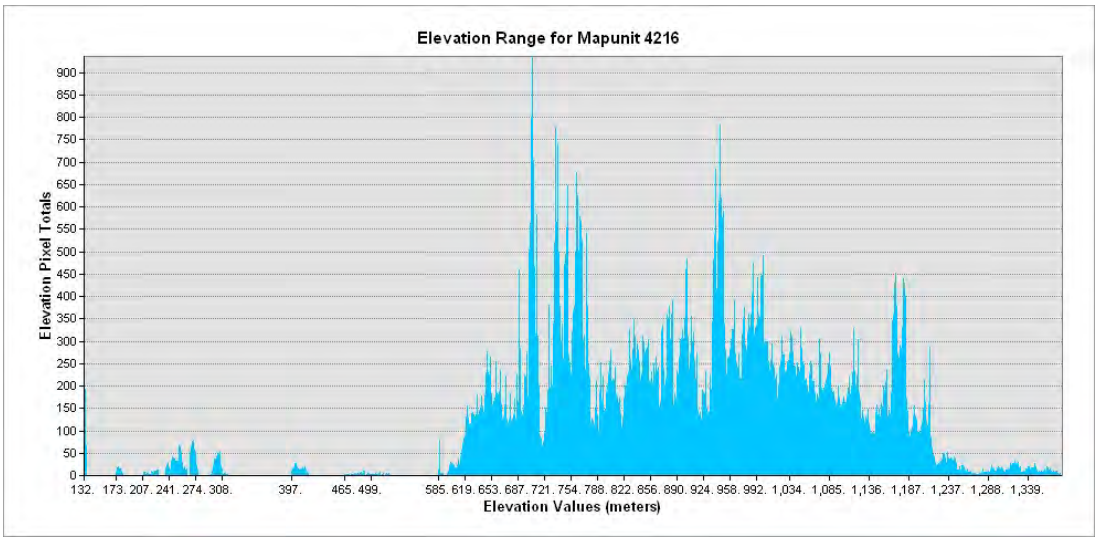
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *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.
- *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.

4216 – *Ambrosia salsola* Alliance

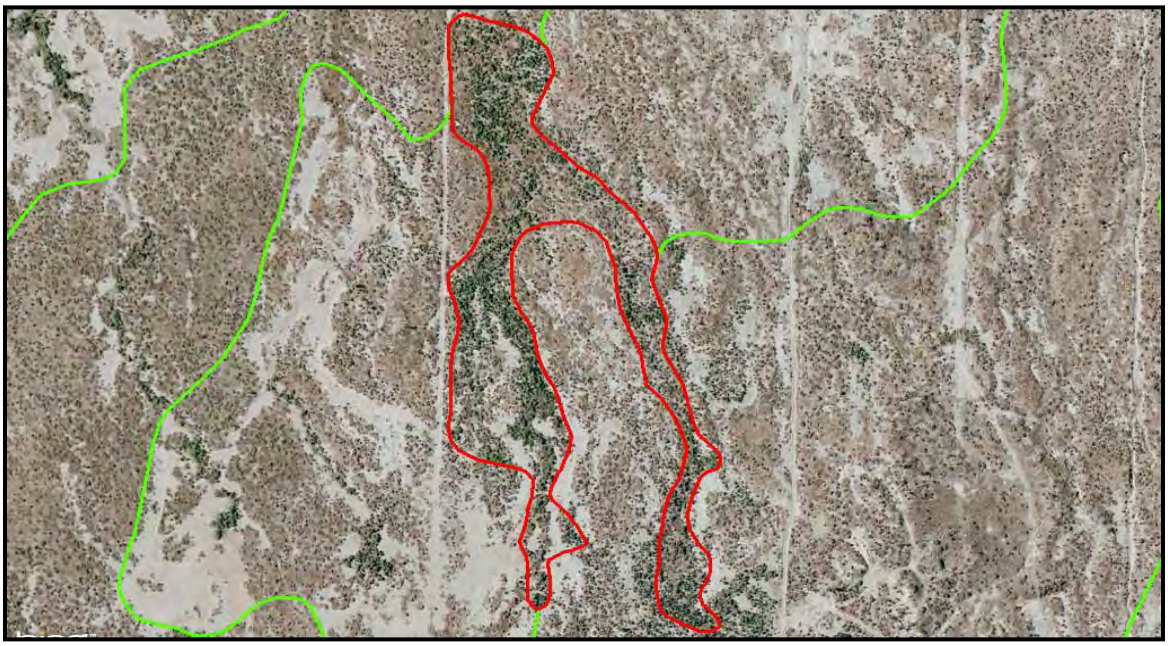


DISTRIBUTION: This Alliance is found throughout the Western Mojave and Central Mojave Regions. Stands greatly diminish east of Yucca Valley and are mainly associated with human disturbance. Stands of this Alliance are mostly absent from the eastern portion of the Colorado Desert.



4217 – *Artemisia tridentata* ssp. *parishii* Provisional Alliance

Parish's sagebrush Provisional Alliance



This image displays a stand of the darker gray *Artemisia tridentata* ssp*. parishii* colonizing a wash terrace.

The photo shows a stand of grayish green *Artemisia tridentata* ssp. *parishii* on a terrace adjacent to Anaverde Creek in south Palmdale.

4217 – *Artemisia tridentata* ssp. *parishii* Provisional Alliance

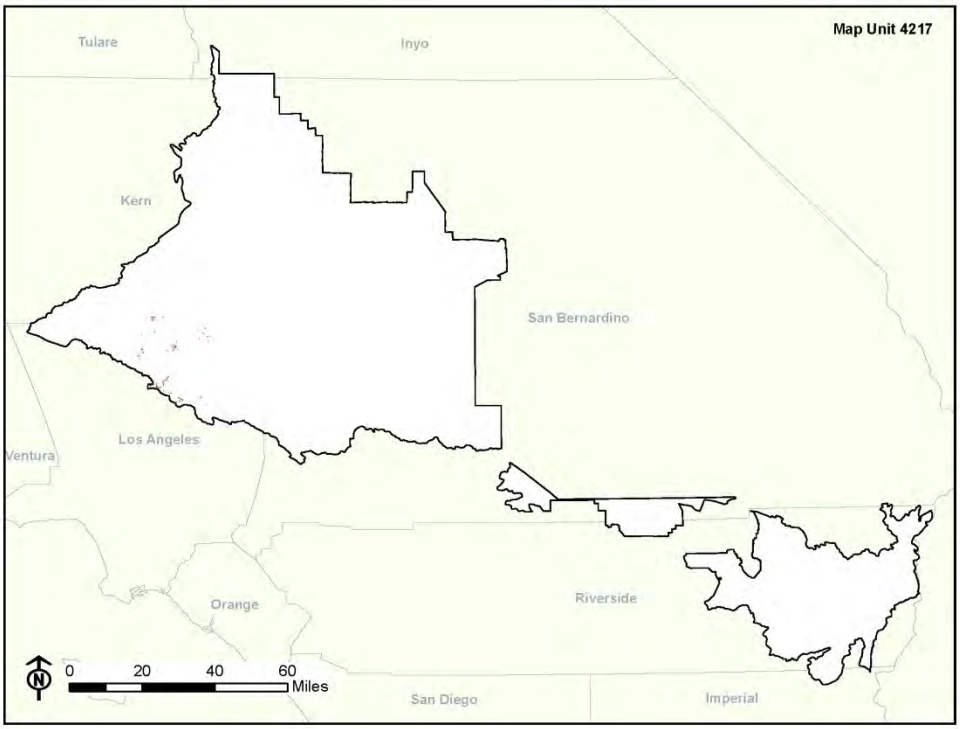
DESCRIPTION: *Artemisia tridentata* ssp. *parishii* is the dominant shrub in stands of this Provisional Alliance. Stands may have *Atriplex polycarpa, Ericameria nauseosa,* or *Atriplex confertifolia*, and may have emergent *Forestiera pubescens* or *Prosopis glandulosa* at low cover or widely scattered. Small, usually linear stands associated with low-gradient channels and washes are found in the Lancaster-Palmdale area. *Artemisia tridentata* ssp. *parishii* is associated with *Prosopis glandulosa* on Edwards AFB, and with *Forestiera pubescens* and *Atriplex polycarpa* on finer soils west and north of Lancaster. This vegetation is often habitat for the rare species *Calochortus striatus* (alkali mariposa lily).

PHOTOINTERPRETATION SIGNATURE: Stands vary in cover from sparse to dense with gray to blue-green irregularly shaped crowns. Shrubs many times follow linear drainage patterns and denser patches have a coarse, uneven texture. Stands often follow small meanders and road margins where water collects. In these settings, *A. tridentata* ssp. *parishii* tends to form numerous small stands which are adjacent to *Atriplex* communities along the margins of playa systems. Good examples of these stands occur southwest of Rosamond Dry Lake.

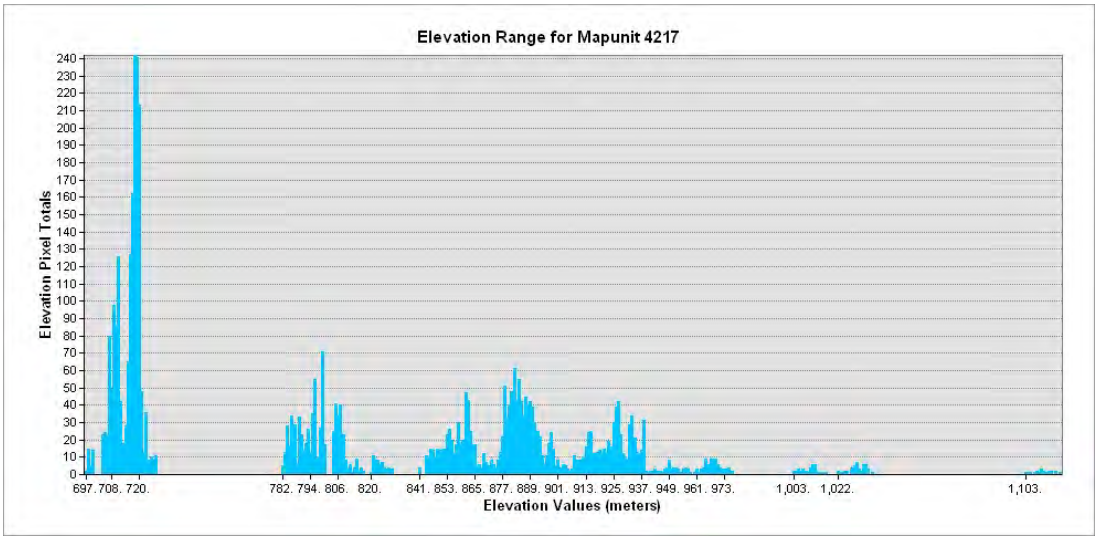
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* Alliance (4113) – Shrubs within this Alliance occur adjacent to *A. tridentata* ssp. *parishii* in the Antelope Valley but on slightly more alkaline settings adjacent to agriculture in more disturbed locations.
- *Ericameria nauseosa* Alliance (5212) – Shrubs of this Alliance tend to have a lighter crown color, and cover density varies considerably across the stand. Stands are found in disturbance settings, especially recent agricultural areas, and rarely occur in wash settings.
- *Artemisia tridentata* Alliance (5311) – Stands have a similar signature but occur in different settings: generally on uplands away from washes or wash terraces and closer to the foothills of the San Gabriel and San Bernardino Mountains.

4217 – *Artemisia tridentata* ssp. *parishii* Provisional Alliance

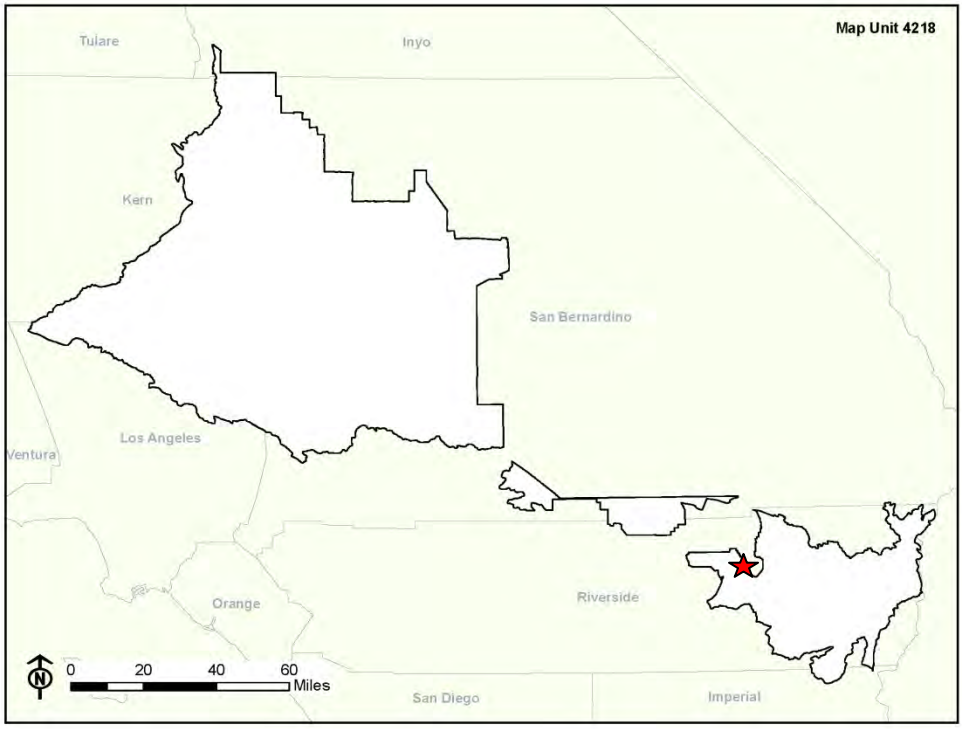


DISTRIBUTION: This Provisional Alliance is found in drainages on Edwards Air Force Base surrounding Rosamond and Rogers Dry Lakes, as well as in areas around Lancaster and Palmdale.



4218 – *Bebbia juncea* Provisional Alliance

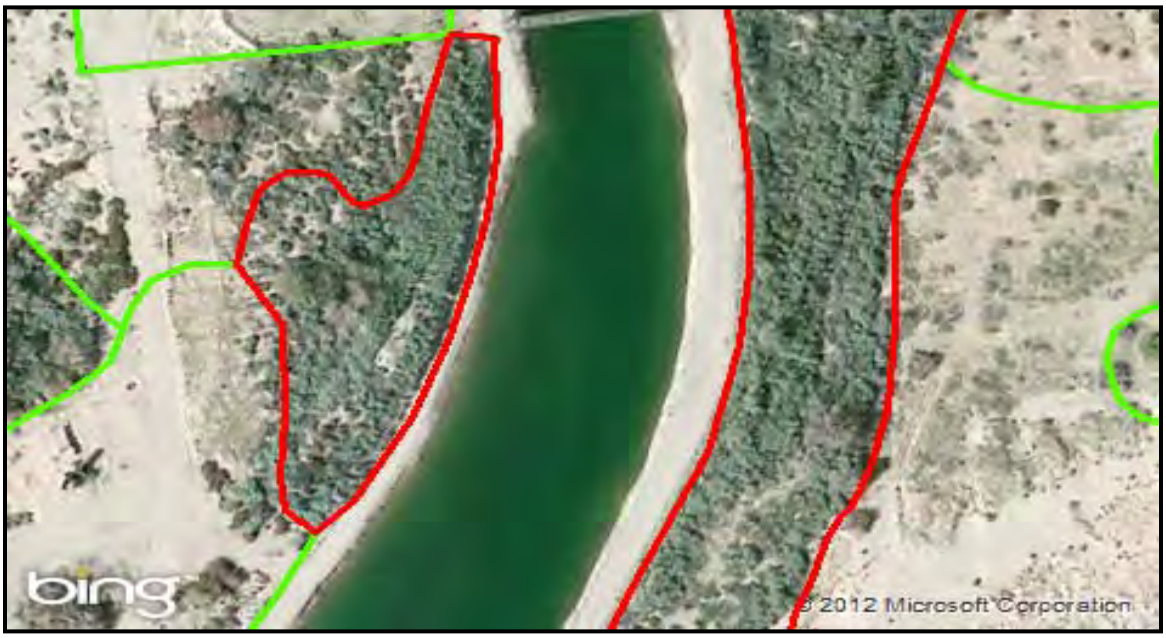
Sweet-bush scrub Provisional Alliance



DISTRIBUTION: Stands of this Provisional Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. The few stands encountered, mostly below MMU, were in rocky washes or on steep eroded rocky slopes. Note: In the distribution map above, a star symbol has been placed on the polygon for display purposes.

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

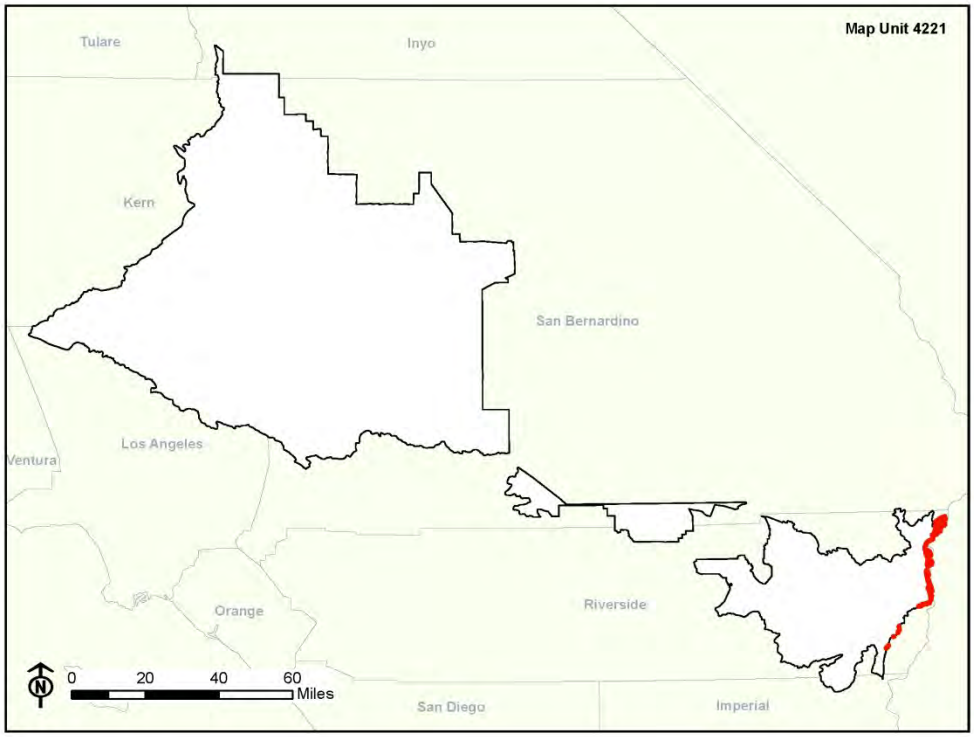
DESCRIPTION: In stands of this Alliance *Pluchea sericea* is present in the canopy with at least 2 percent absolute cover and no other shrub species having equal or greater cover. *Baccharis salicifolia, Atriplex* spp. *Tamarix* spp., and *Ericameria nauseosa* are among the other shrubs that may be present. 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.

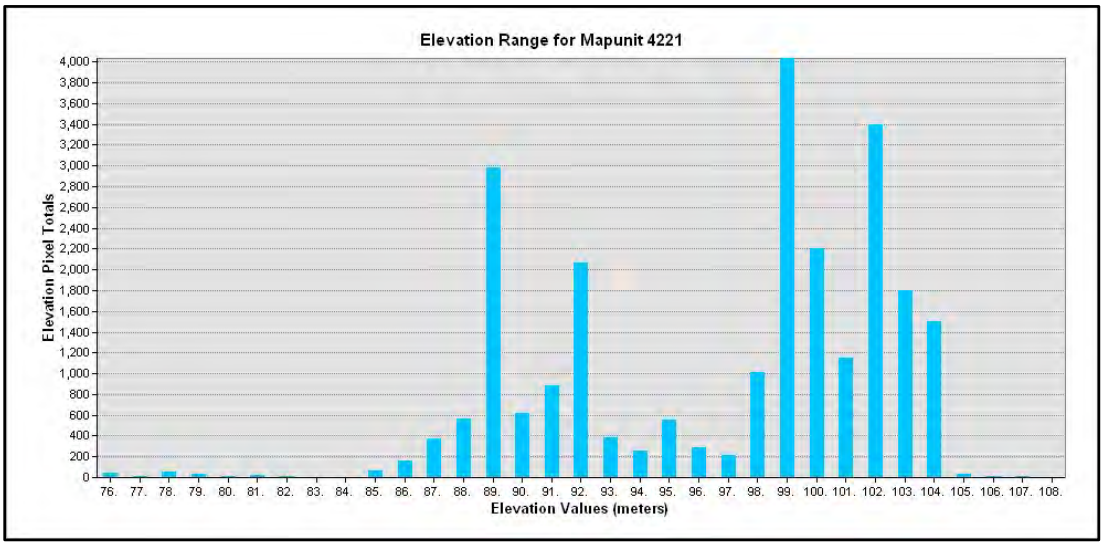
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Alliance (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

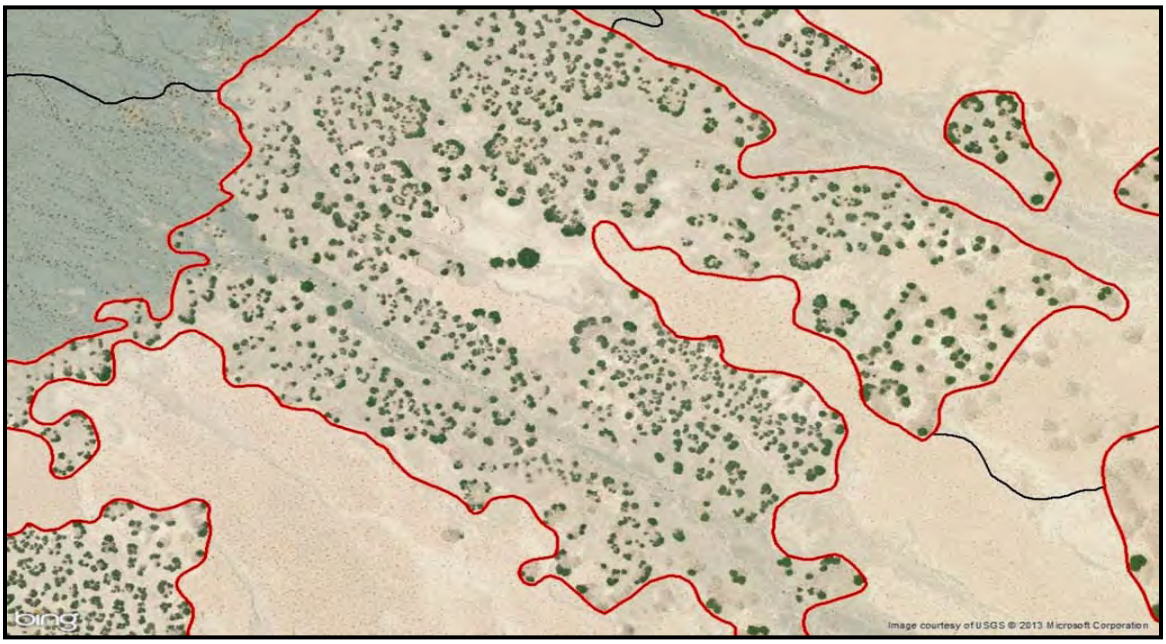


DISTRIBUTION: Mapped stands are limited to Colorado River floodplain. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



4222 – *Prosopis glandulosa* Alliance

Mesquite bosque, mesquite thicket Alliance



Prosopis glandulosa occurs here along the northern edges of Palen Dry Lake in varying cover.

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

4222 – *Prosopis glandulosa* Alliance

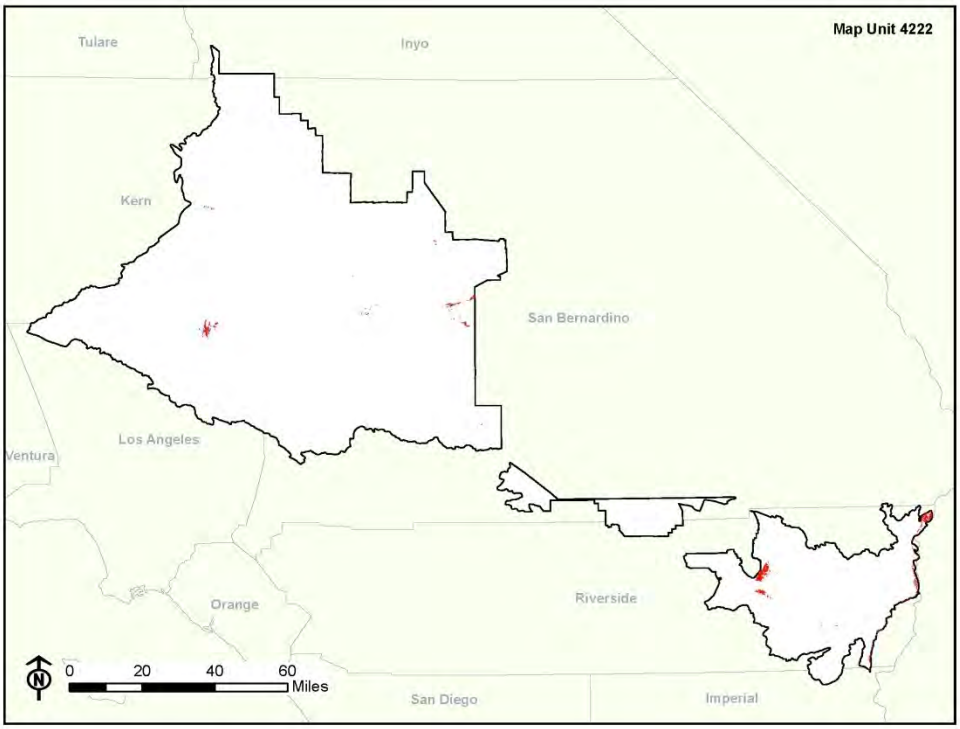
DESCRIPTION: In this Alliance *Prosopis glandulosa* comprises more than 3 percent of absolute cover as the dominant plant (including shrub and trees together), not exceeded in cover by any other species of microphyllous tall shrub or tree. In stands were *P. glandulosa* is consistent in the tall shrub/short 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.

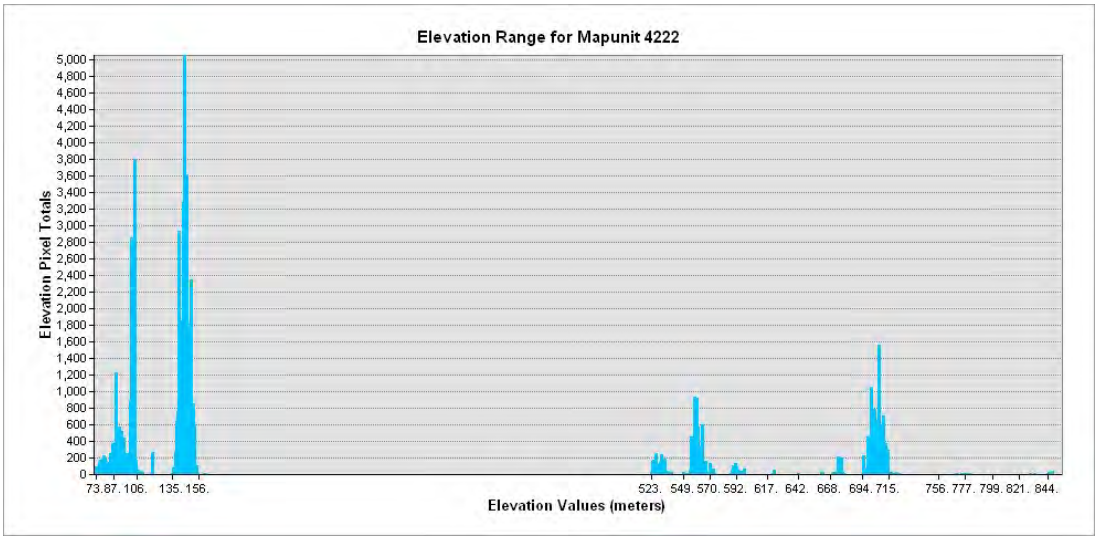
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Alliance (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

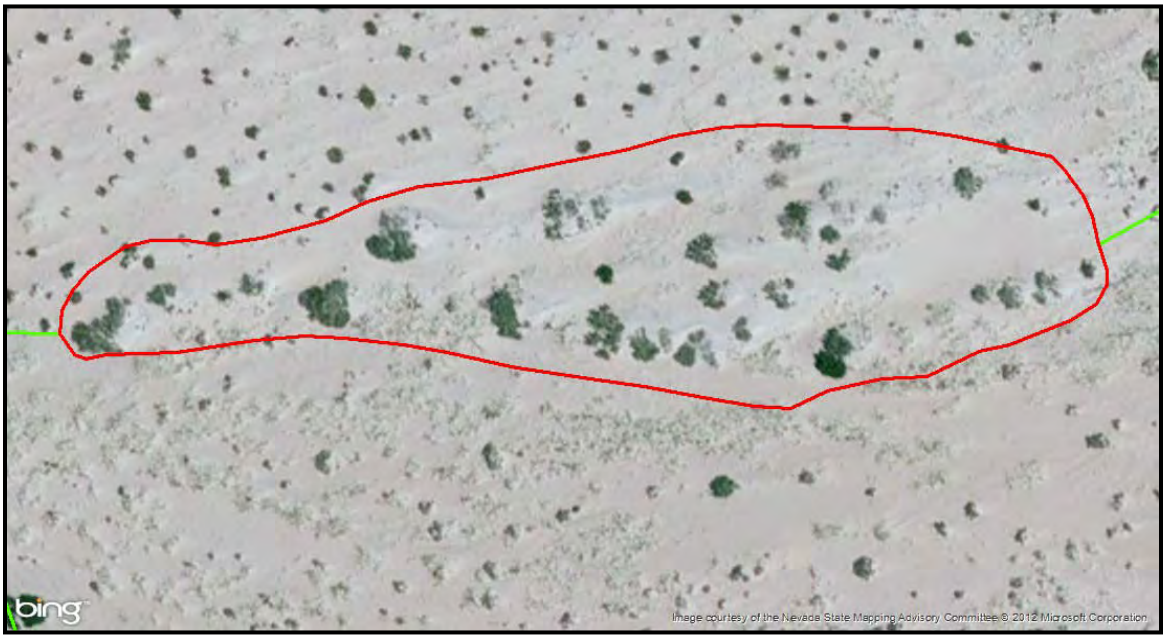


DISTRIBUTION: Stands of this Alliance are found along the margins of Koehn, Buckhorn, Rogers, and Palen Dry Lakes, along the Mojave River by Hinkley, and near Newberry Springs. Stands also occur near and along the Colorado River floodplain.



4224 – *Chilopsis linearis* Alliance

Desert willow woodland Alliance



The grayish-green crowns of *Chilopsis linearis* are seen on sandy hummocks in this photo.

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

4224 – *Chilopsis linearis* Alliance

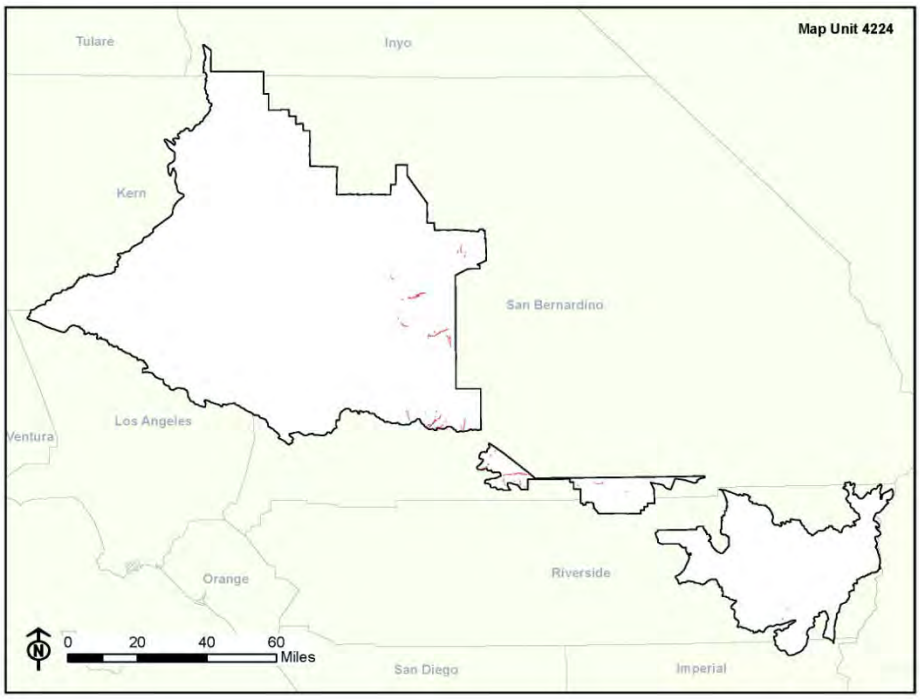
DESCRIPTION: Stands of this Alliance are dominated or co-dominated by *Chilopsis linearis,* which comprises at least 1 percent of the cover. *Chilopsis* is usually higher cover than any other tree, although stands may contain similar cover of *Acacia greggii* and/or *Prunus fasciculata.* The Alliance 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 as do *Psorothamnus spinosus, Ericameria paniculata,* or *Ambrosia salsola* shrublands. 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. 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.

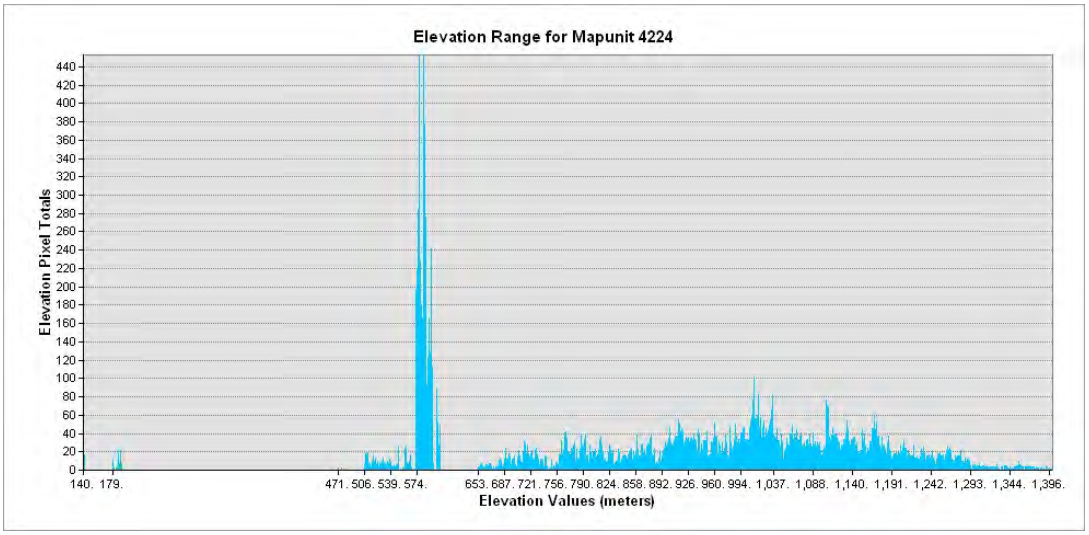
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Alliance (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.
- *Psorothamnus 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 exclusively 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 study, but a few localized patches occur in washes near Little Chuckwalla and Mule Mountains.



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

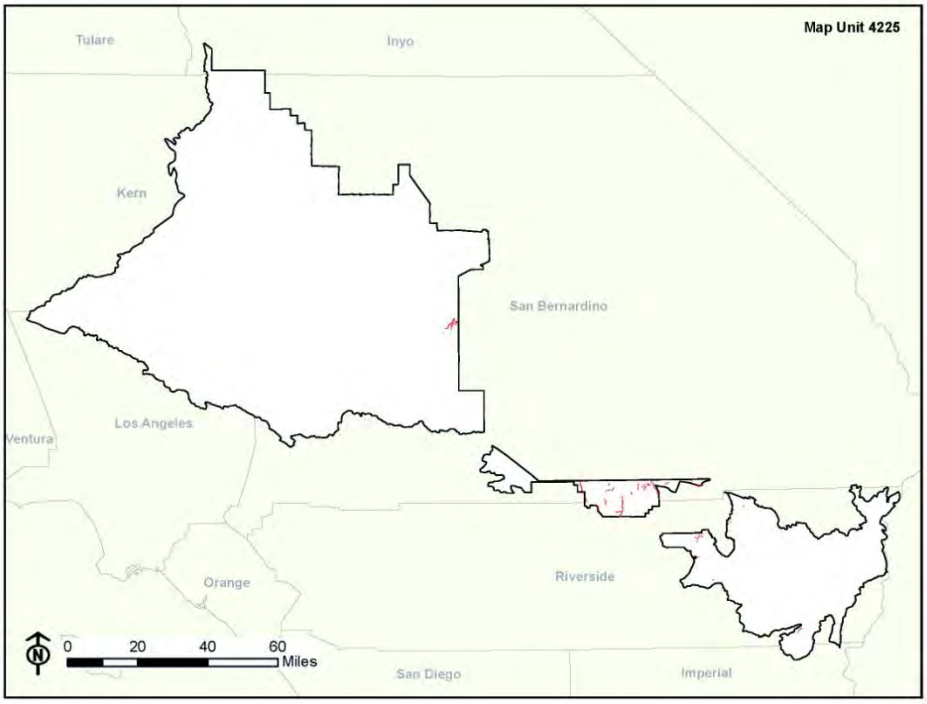
DESCRIPTION: In this Alliance, *Psorothamnus spinosus* is dominant or co-dominant in the tree canopy**.** *Psorothamnus spinosus* is consistently distributed in low-energy washes, normally at greater than 1 percent cover. *Chilopsis linearis* may occur in some stands at equal cover. *Larrea tridentata* or *Ambrosia salsola* may be similar in cover. *Psorothamnus spinosus* only occurs in the Central Mojave Desert portion of the study area on lower or mid fan wash systems out of Newberry Mountains or the Twentynine Palms area. *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.

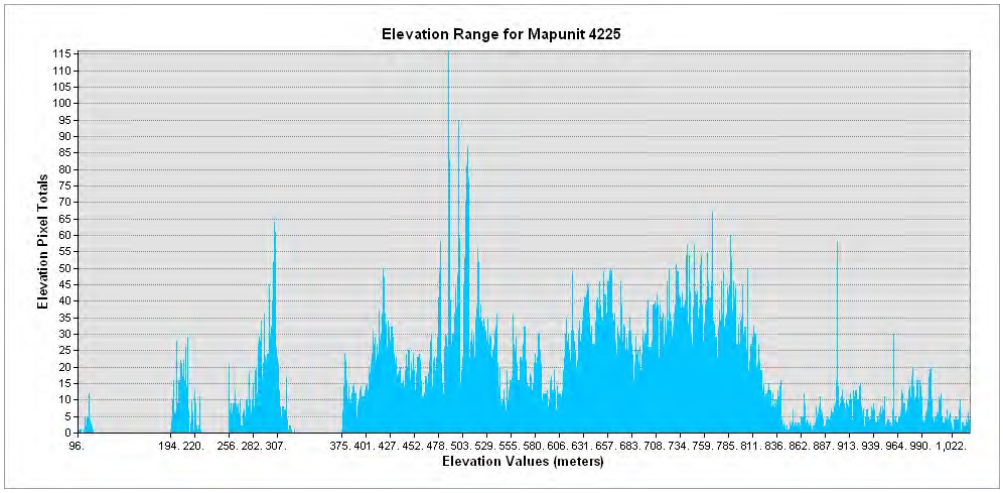
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.

4225 – *Psorothamnus spinosus* Alliance



DISTRIBUTION: The highest concentration of stands occurs in drainages coming out of 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. No other stands were mapped within the Mojave Desert portion of the study area. Although *P. spinosus* prefers the hotter Colorado Desert, few stands of mappable size were present in that portion of the study area. Exceptions are found east of the Coxcomb Mountains in the flats of Palen Valley, in drainages east of the Eagle Mountains in Chuckwalla Valley, and along the Colorado River floodplain.



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

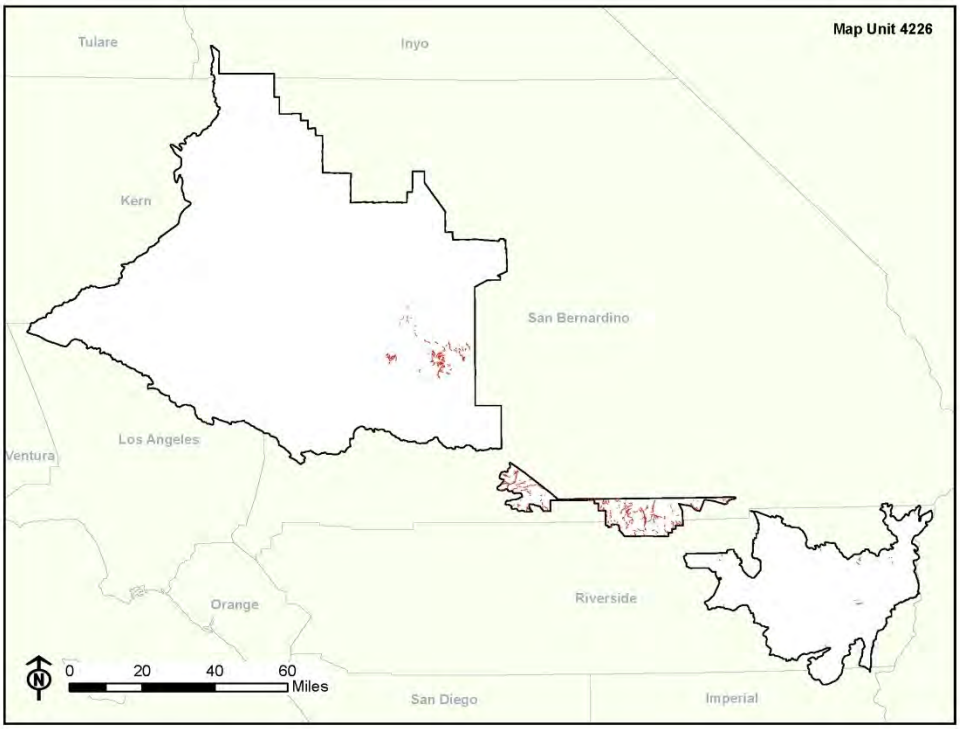
DESCRIPTION: In this Alliance *Acacia greggii* is dominant, co-dominant, or subdominant in the shrub canopy and comprises more than 2 percent of the cover. *Prunus fasciculata* or *Hyptis emoryi* may be of equal or slightly greater cover than that of *Acacia.* Smaller shrubs such as *Ericameria paniculata* 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. The Alliance is found in the Ord Mountains, as far west as the north slope of Sidewinder Mountain, in the eastern portions of the study near Twentynine Palms, and throughout the Colorado Desert.

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.

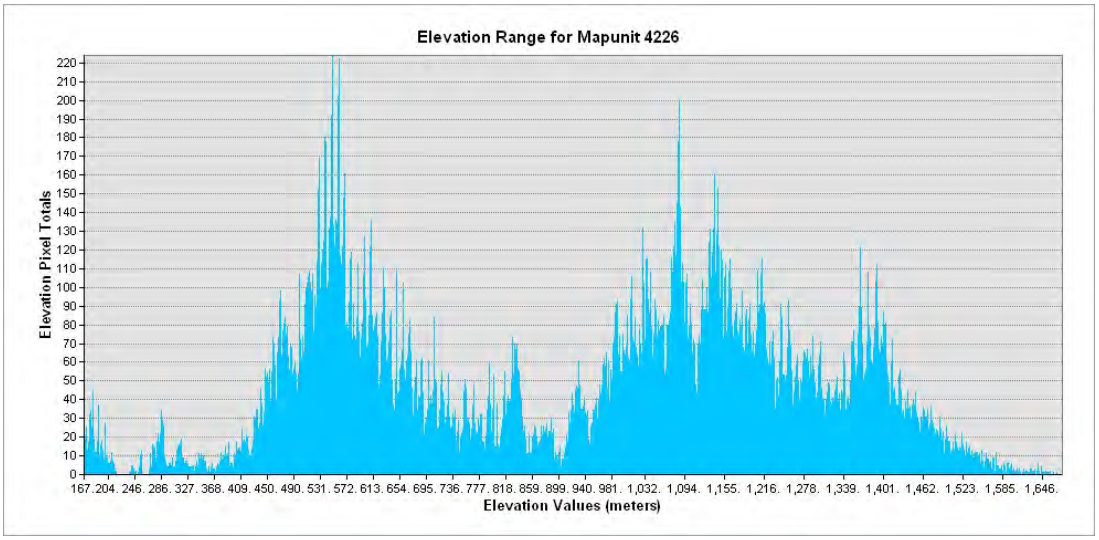
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *Psorothamnus 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, *Psorothamnus* 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

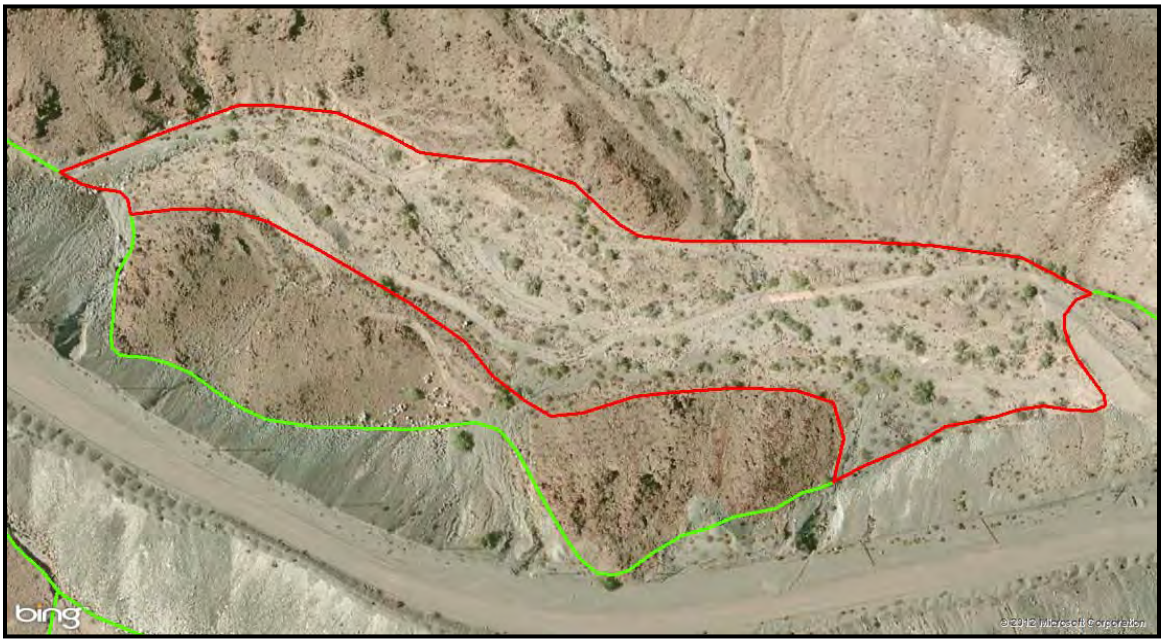


DISTRIBUTION: Stands of *Acacia greggii* are concentrated within two areas. The area of highest concentration is along the northern boundary of Joshua Tree National Park from Pioneertown to the eastern edge of Subarea 2. The other is southeast of Barstow from Stoddard Ridge east to Rodman Mountains down 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.



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.

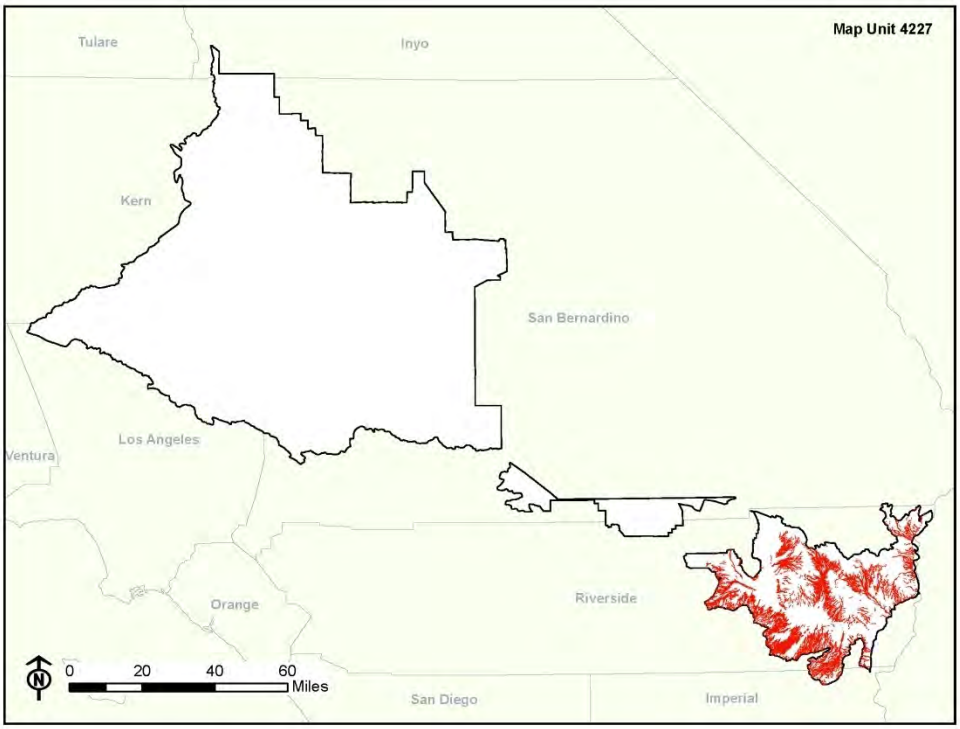
DESCRIPTION: In this Alliance either *Olneya tesota* or *Parkinsonia florida* is dominant, or they co-dominate the tree canopy. They can occur together or on their own at usually greater than 2 percent cover. Associated species may include *Larrea tridentata* and *Ambrosia salsola*, which may be similar 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.

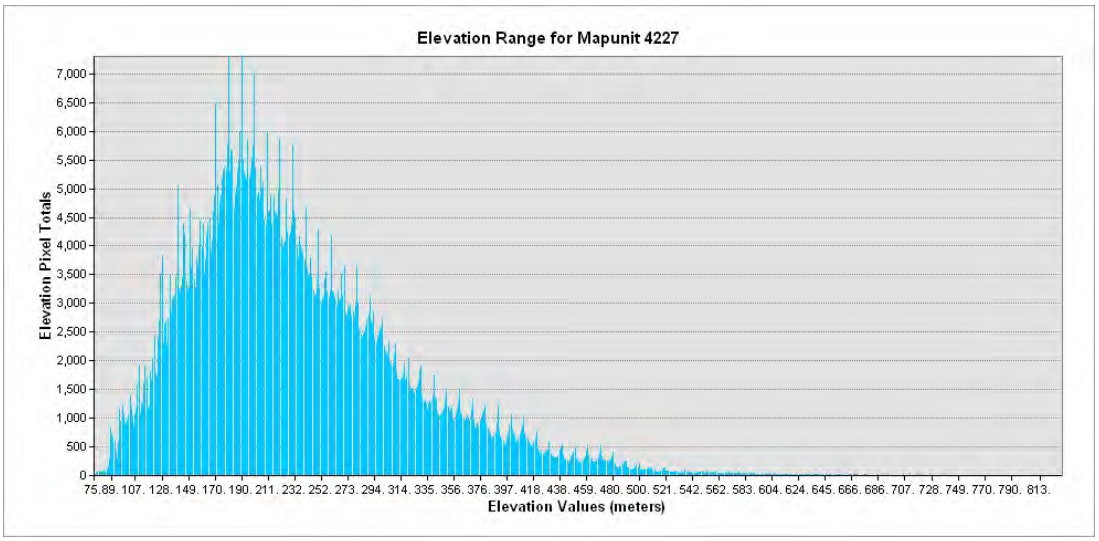
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *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

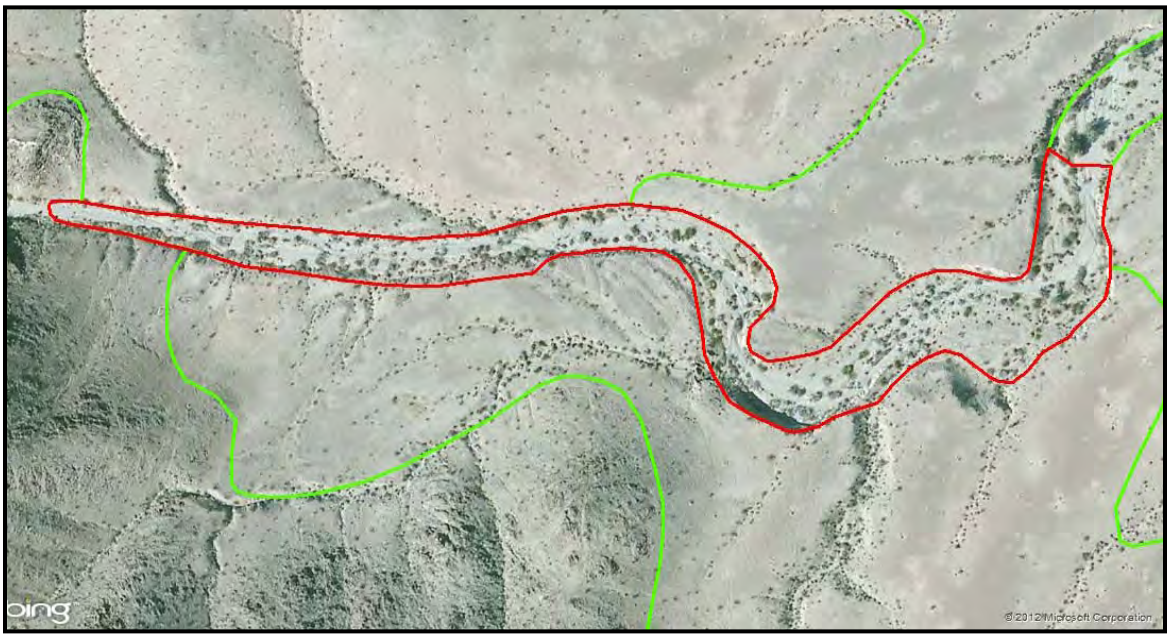


DISTRIBUTION: *Parkinsonia florida-Olneya tesota* Alliance occurs exclusively in the Colorado Desert Region of the study area. These woodland stands are prevalent in lowland washes, active alluvial fans, and higher gradient canyon washes throughout this region. Almost all stands are below 600 meters (1970 feet) in elevation.



4228 – *Hyptis emoryi* Alliance

Desert lavender scrub Alliance



This image depicts *Hyptis emoryi* dominating a narrow drainage running through an old alluvial fan with light-colored patches of pavement.

In the center of the photo, a *Hyptis emoryi* occupies the margin of a wash. The yellow-green *Ambrosia salsola* on the left occurs commonly within these stands.

4228 – *Hyptis emoryi* Alliance

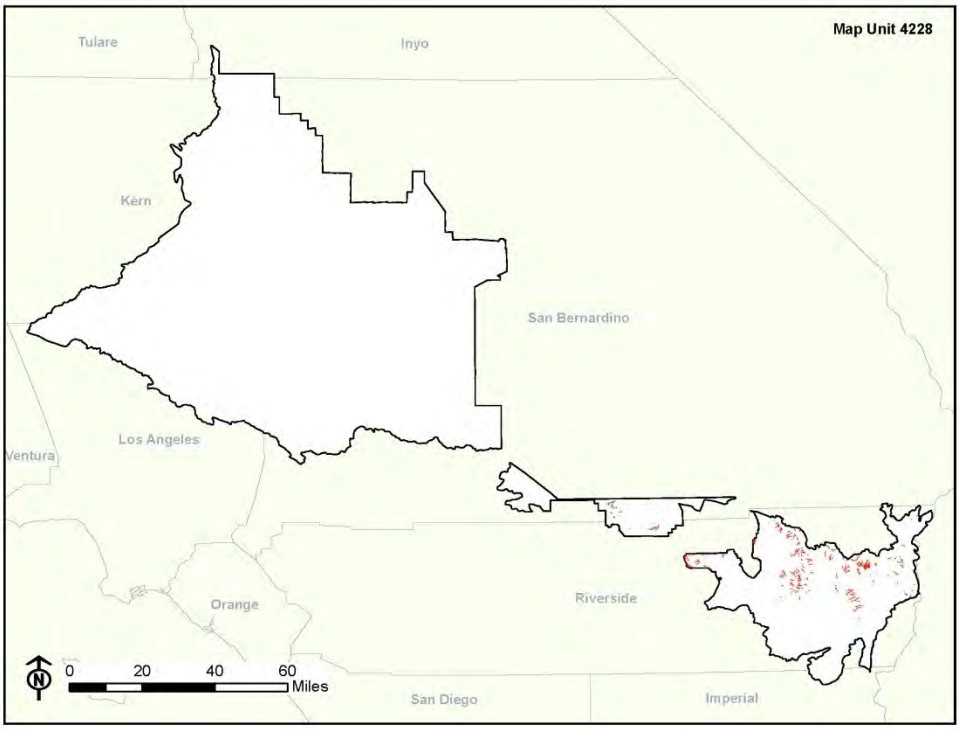
DESCRIPTION: *Hyptis emoryi* is the dominant or co-dominant plant in the shrub canopy with cover of at least 2 percent. Other shrub species not in high cover within the stand may include *Acacia greggii, Larrea tridentata*, and *Sarcostemma hirtellum.* Stands of this Alliance are found in rocky washes of upper bajadas and low-elevation canyons in the eastern portion of Subarea 2 north of Joshua Tree National Park, and throughout the Colorado Desert.

PHOTOINTERPRETATION SIGNATURE: Stands are open to moderately dense in cover and typically occur in the middle or along the margin of the wash channel and in small rivulets between desert pavement settings. Dense stands are narrow and appear a dark green to brownish green with a fairly uniform texture.

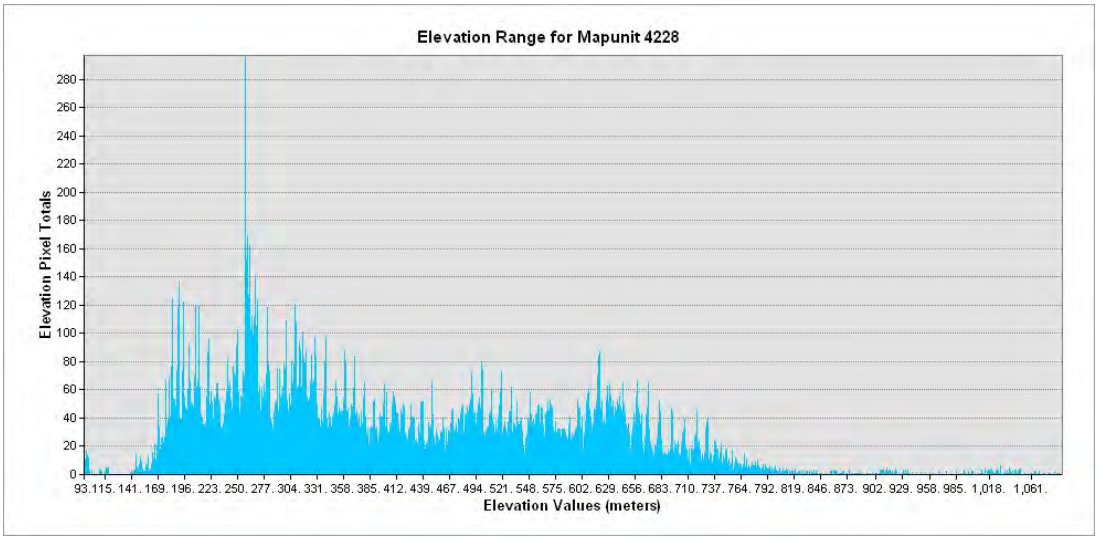
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Psorothamnus spinosus* Alliance (4225) – This species has a similar gray color but is differentiated by having more of an irregularly shaped and upright crown. Many times the spreading upper branches of the small tree cast jagged shadows around the tree crown.
- *Acacia greggii* Alliance (4226) – Overall individuals of this species are almost indistinguishable from *Hyptis emoryi*, other than its slightly larger crown. *A. greggii* often forms small, distinct, irregularly shaped patches of several individual shrubs along wash margins, whereas *Hyptis* individuals are somewhat smaller, and more regular in shape and spacing.

4228 – *Hyptis emoryi* Alliance



DISTRIBUTION: Stands of the *Hyptis emoryi* Alliance occurs 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.



5111 – *Atriplex canescens* Alliance

Fourwing saltbrush scrub Alliance

Atriplex canescens occurs as grayish blue clumps on sandy hills mixed with *Yucca brevifolia* and a few *Prosopis glandulosa* in the lows. 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* in the background.

5111 – *Atriplex canescens* Alliance

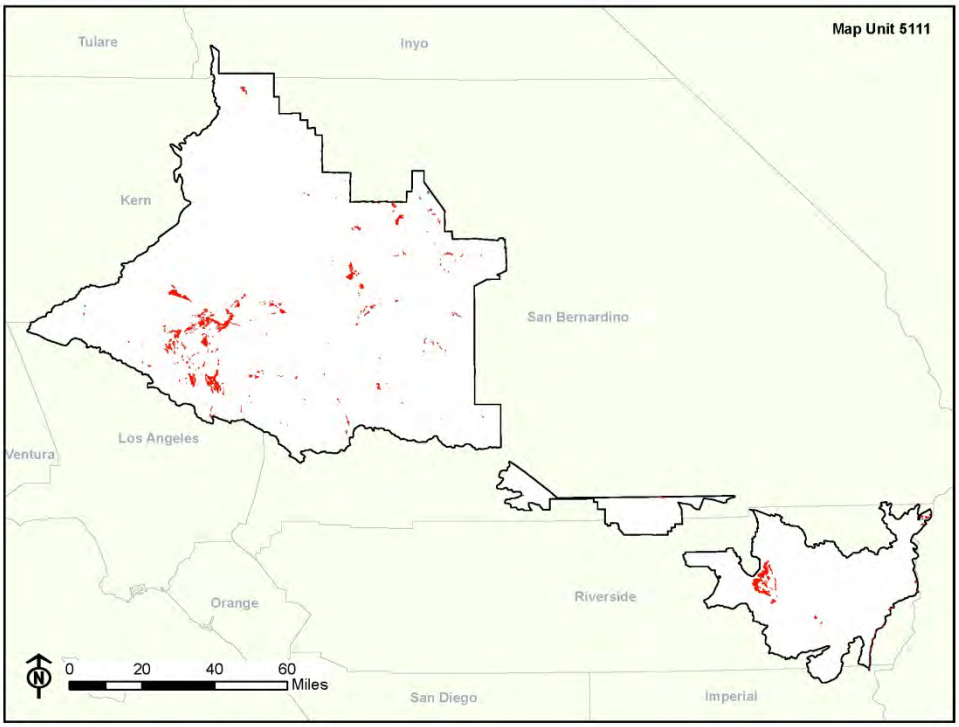
DESCRIPTION: This Alliance is mapped where *Atriplex canescens* characterizes stands, typically with the highest cover, though *Ambrosia dumosa* or *Atriplex polycarpa* may have similar cover. Some stands have emergent *Yucca brevifolia*. This species prefers sandy substrates, usually stabilized dunes 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 due to the often very sandy 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.

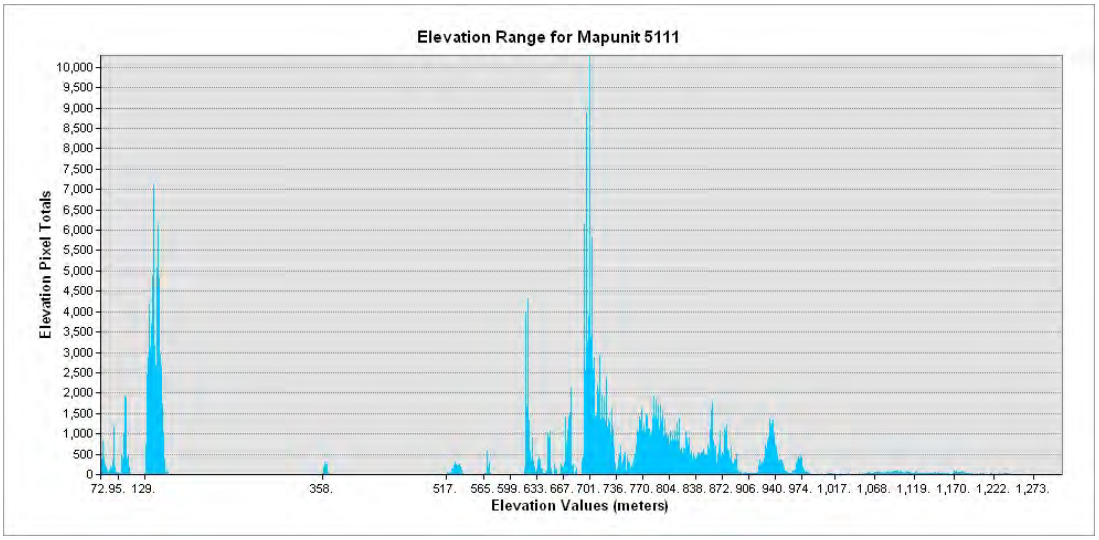
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* Alliance (4113) – These shrubs more commonly occur in denser, more continuous stands along stream and wash corridors.
- *Ambrosia salsola* Alliance (4216) – Shrubs are more directly related to disturbance (such as fire, clearings, washes) and typically have a smaller, gray crown.
- *Ericameria nauseosa* Alliance (5212) – These shrubs predominantly occur in the cold-air basins of Antelope Valley and primarily are related to human disturbance such as road corridors, clearings, agricultural fringes and fallow agricultural fields.

5111 – *Atriplex canescens* Alliance

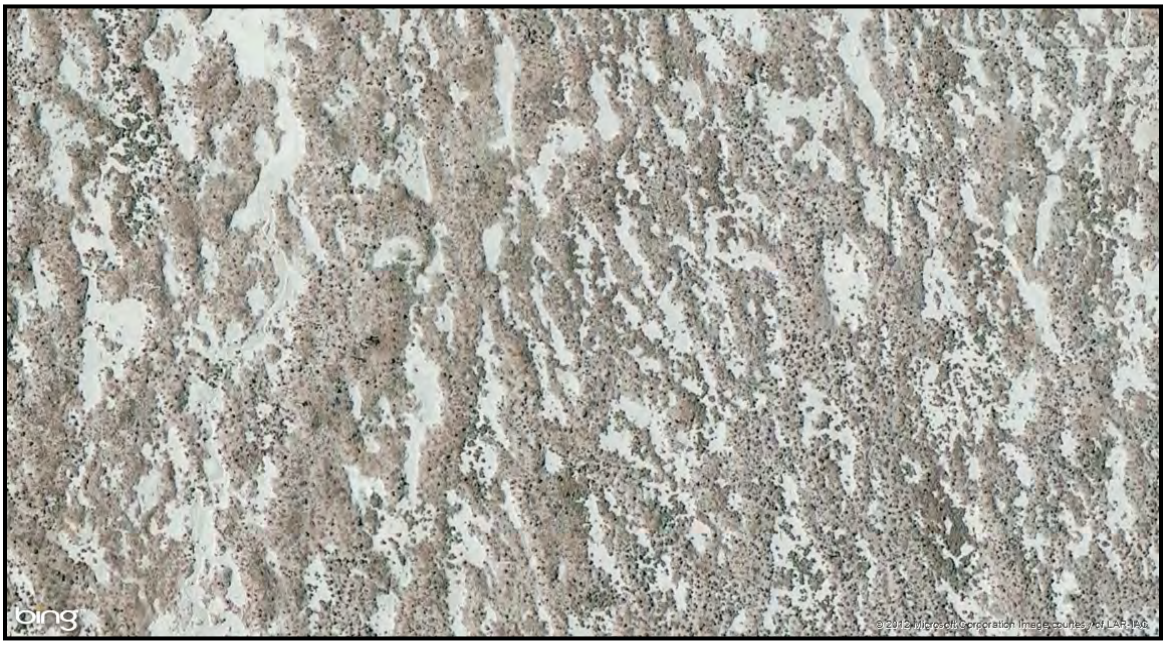


DISTRIBUTION: *Atriplex canescens* is found in every region of the study area and can occur in a variety of sandy settings including washes, edges of dunes, sandy hills and playa margins. There are very few stands in the northwest portion of the Northern Mojave region west of Cuddeback Dry Lake.



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

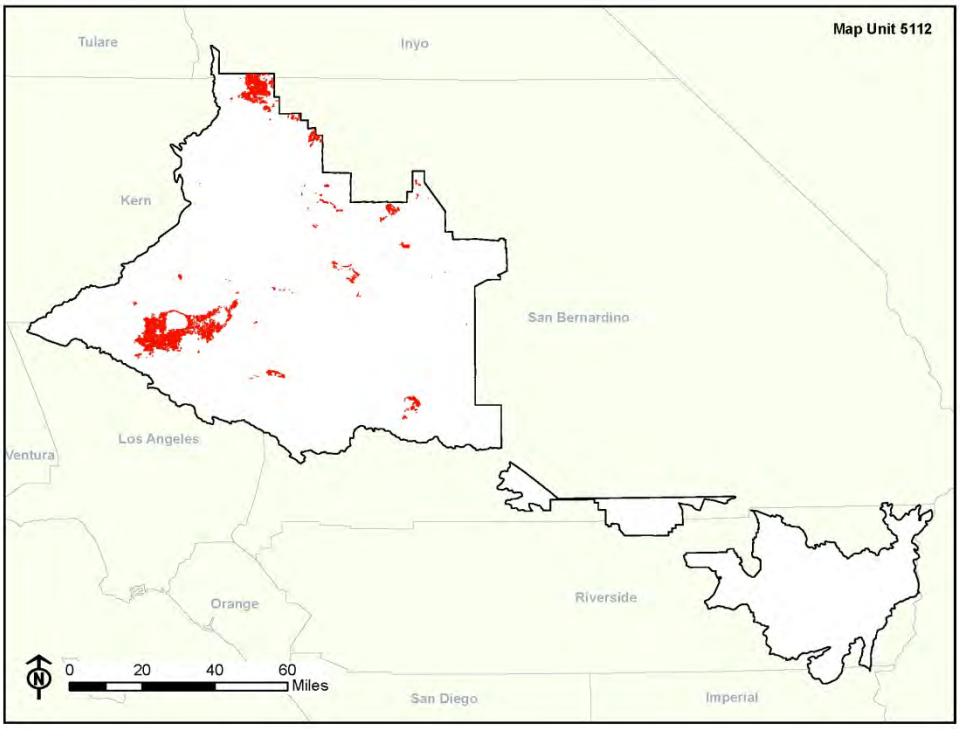
DESCRIPTION: This Alliance is mapped where *Atriplex confertifolia* dominates or co-dominates the shrub layer, typically with at least 2 percent absolute cover. Stands may occur in alkaline/saline valleys or playas but also occur in the upper mid-elevation Mojave Desert on rolling hills and slopes with 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. Example occurrences 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.

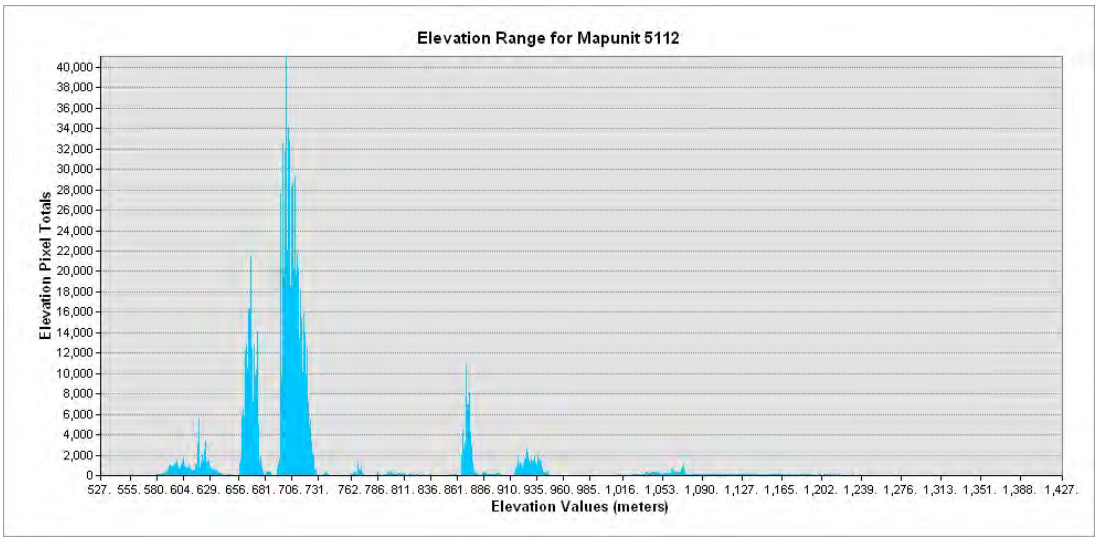
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 on highly disturbed cleared sites.
- *Atriplex spinifera* Alliance (3723) – Shrub composition is often less diverse and cover density is more consistent within the stand. Stands also occupy slightly less alkaline settings with lower soil reflectance. These shrubs tend not to tolerate disturbance as well.
- *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.

5112 – *Atriplex confertifolia* Alliance

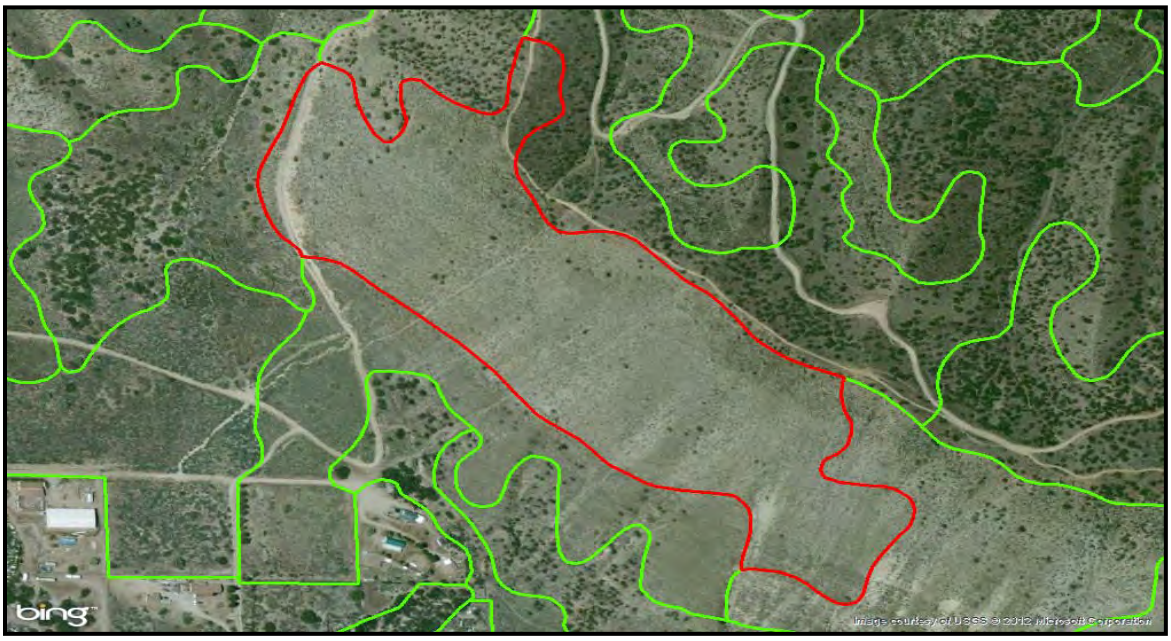


DISTRIBUTION: This Alliance is restricted to the Antelope Valley, Northern Mojave, and the westernmost portion of the Central Mojave region. The DRECP Study represents the southernmost extent of this type, which extends northeast into the cooler, wetter climes of the Great Basin and the San Joaquin Valley. *Atriplex confertifolia* is absent in the eastern portion of the Central Mojave, Yucca Valley-Twentynine Palms, and Eastern Colorado Desert regions due most likely to lower precipitation and higher average temperatures.



5211 – *Encelia (actoni, virginensis)* Alliance

Acton's encelia & Virgin River brittle brush scrub Alliance



In this example, *Encelia* occurs on a steep southwest-facing slope north of State Route 138 in Cajon Canyon along the San Andreas Rift Zone. This stand has been recently burned and is in an early successional stage of revegetation.

Encelia, the shrub with the light gray/white colored leaf in the foreground, is seen here in a mixed stand with emergent *Yucca brevifolia* scattered in the background.

5211 – *Encelia (actoni, virginensis)* Alliance

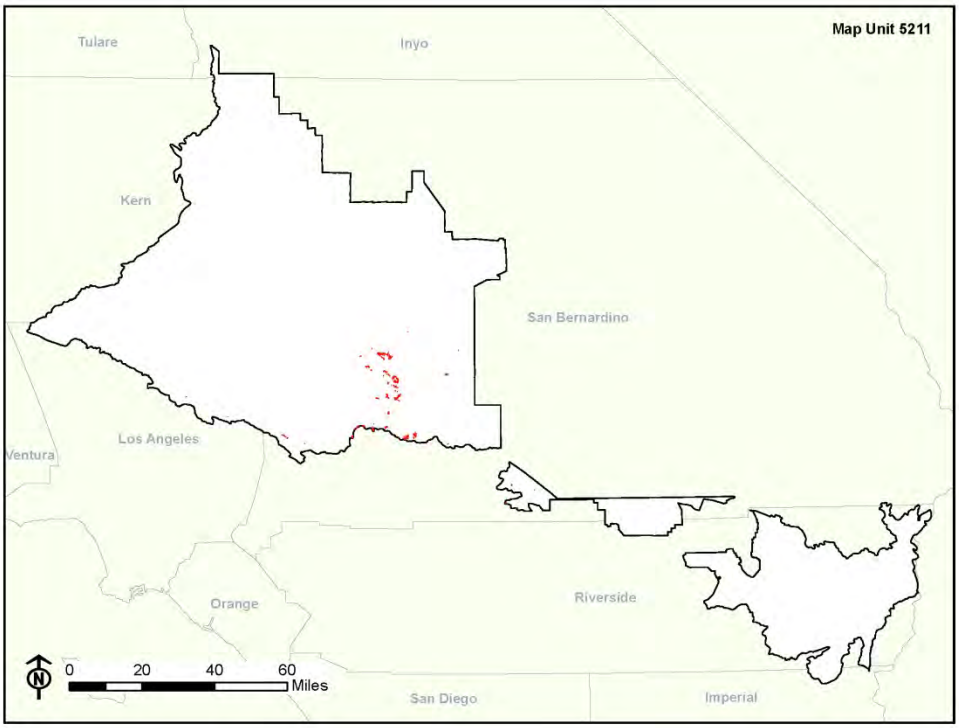
DESCRIPTION: In stands of this Alliance, the closely and ecologically related *Encelia actoni* and *E. virginensis* are dominant or co-dominant and comprise at least 2 percent of the cover, with no other shrub species having greater or equal cover. *Encelia actoni* was previously considered a subspecies of *Encelia virginensis.* The two share very similar ecological traits. *E. actoni* is the taxon most common in the study area. This Alliance typically occurs in washes or other disturbed areas (such as recently burned mid-elevation desert slopes) throughout the Mojave Desert. Where the Western Mojave borders the Transverse and Tehachapi Ranges, stands often occur on steep south-facing slopes associated with *Hesperoyucca whipplei* or *Eriogonum fasciculatum*. Stands may also have relatively high cover of *Achnatherum speciosum* and *Salazaria mexicana.*

PHOTOINTERPRETATION SIGNATURE: Stands range from sparse to moderately dense in cover. These small shrubs have a dull light gray to dark gray color with indistinct crown edges. The plants appear as small individuals varying in size and shape depending on their phase of post disturbance recovery. Recently burned slopes appear very open and sparse, with smaller regenerating crowns barely visible on imagery. In these situations, stand composition is typically mixed with a variety of other successional shrubs, and it may be difficult to identify *Encelia* from among the other shrubs at low cover.

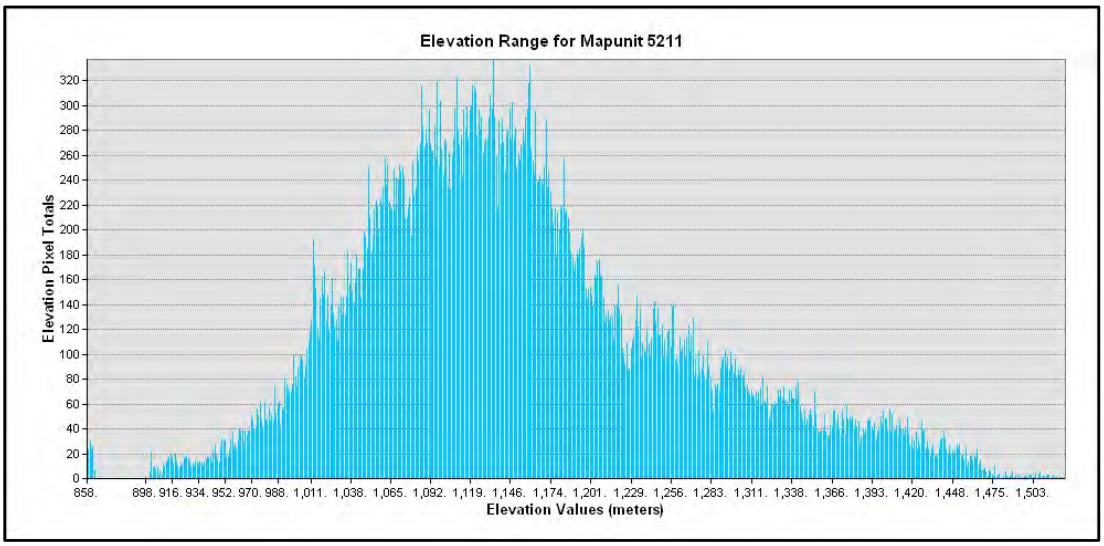
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum fasciculatum* Alliance (2221) – In the higher elevation desert hills and mountains (above 3000 feet/920 meters), *Eriogonum fasciculatum* and *Encelia* can co-occur. *E. fasciculatum* tends to be a little darker in color. Although both of these species are early seral colonizers, in areas of recent burns *Encelia* is more likely to occur, especially on the fans along the San Bernardino Mountains south of Lucerne Valley. *E. fasciculatum,* however, tends to occur in disturbances where the soil is disrupted, as with scrapes and road cuts.
- *Ambrosia dumosa* Alliance (4111) – *A. dumosa* tends to be closely associated with the presence of *Larrea tridentata* on lower elevation fans (below 3000 feet/920 meters). At higher elevations, the fans lack the presence of *L. tridentata* and will have more potential for *Encelia* or *Eriogonum fasciculatum* to occur.
- *Ambrosia salsola* Alliance (4216) – The ranges of both species overlap on post burn fans and bajadas within the foothill zone, but *A. salsola* will be more restricted to the nearby washes.
- *Salazaria mexicana* Alliance (5415) – On desert mountain ranges in Subarea 1, stands dominated by *S. mexicana* were observed in post burn settings generally downslope from *Encelia* or upslope on rockier terrain. Plants can have more of a greenish blue color, and crowns may coalesce together into clumps within a stand. Individual crowns are generally somewhat larger.

5211 – *Encelia (actoni, virginensis)* Alliance



DISTRIBUTION: The largest stands occur on recently burned upper elevation steep slopes in the Sidewinder, Stoddard, and Granite Mountains. There are also scattered stands along burned slopes and fans coming off of the San Bernardino Mountains and further west along the San Andreas Rift Zone on steep south-facing escarpments.



5212 – *Ericameria nauseosa* Alliance

Rubber rabbitbrush scrub Alliance

This image shows a previously cleared setting where *Ericameria nauseosa* is one of the first recolonizers following the cessation of active agriculture. Crowns vary considerably in size and shape across the stand and may appear as individuals or coalesce into clonal clumps.

The photo depicts a stand in the western Antelope Valley dominated by the grayish green *Ericameria nauseosa* over a dense herbaceous layer.

5212 – *Ericameria nauseosa* Alliance

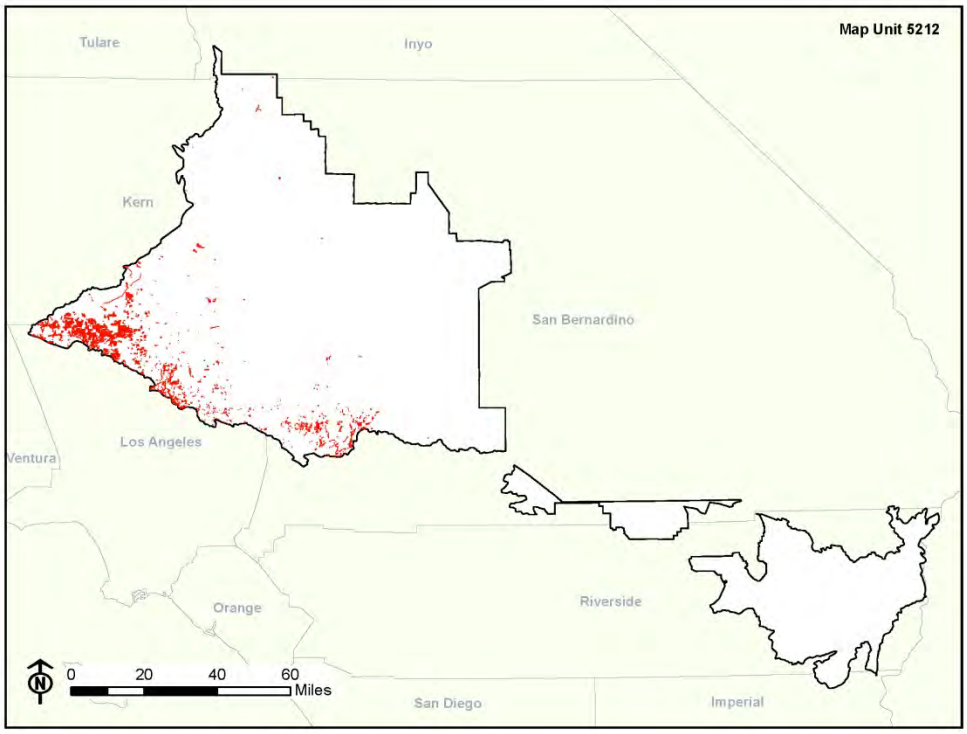
DESCRIPTION: This Alliance is mapped where *Ericameria nauseosa* has at least 2 percent absolute and at least 25 percent relative cover. Stands are found in middle and upper elevations, usually in disturbed areas with agricultural, fire, or grazing history. Broadly, *E. nauseosa* extends into the desert study area from its extensive range in the Great Basin and northern Great Plains. However, this species is divided into at least nine varieties in California alone. Variety *mohavensis* is the most common stand-former in the study area. This broad and variable species is typically a "cold desert" rather than a "warm desert" species, and its presence in the western Mojave Desert is due to the cooler temperatures and higher rainfall associated with the Antelope Valley and the upper fans adjacent to the Tehachapi and San Gabriel Mountains.

PHOTOINTERPRETATION SIGNATURE: Stands can have a sparse to very dense cover of shrubs. Cover may vary considerably across a stand, appearing as individuals and/or coalescing to form clonal clumps. Shrubs have a gray or bluish green color with a small rounded crown. Disturbance is a common indicator of this Alliance. In stands in the Antelope Valley, mapping of this type is facilitated by the evident remnant row scarring from old agriculture, and scarring from other related activities.

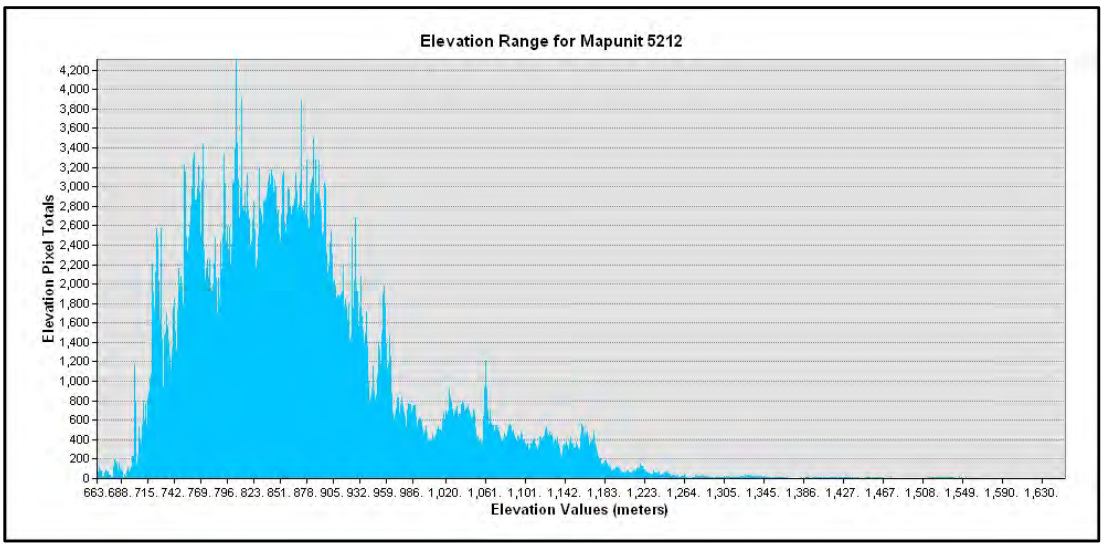
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* Alliance (4113) – Stands of this Alliance occur farther into the interior of the desert regions. *A. polycarpa* tends to favor a slightly more alkaline setting and is therefore more likely to be found closer to dry lake beds and their associated clay-like soils. Overlap between the ranges of the two species is significant; however, within these areas *A. polycarpa* tends to have more of a consistent cover across the stand.
- *Artemisia tridentata* ssp. *parishii* Alliance (4217) – This type is confined more to the bottom or immediate edges of small drainages, where cover may be dense. *E. nauseosa,* however, tends to be slightly higher up on the adjacent flat. *A. tridentata* has a darker grayish tone and a larger crown with a coarse texture.
- *Atriplex canescens* Alliance (5111) – Although *Atriplex canescens* can establish in anthropogenically disturbed areas, *E. nauseosa* is more closely associated with recent clearings and fallow agricultural fields. *A. canescens* establishes more commonly along sandier flats adjacent to drainages. The ranges of these two species narrowly overlap, mainly between the area south of Rosamond and Rogers Dry Lakes and the flats adjacent to Big Rock Wash.
- *Ephedra nevadensis* Alliance (5413) – Overall, these stands tend to be denser and have more consistent shrub cover. *Ephedra nevadensis* stands typically are more diverse in species composition, often occurring with emergent *Yucca brevifolia*. Stands with a dense shrub cover tend to yield subtle green hues.

5212 – *Ericameria nauseosa* Alliance

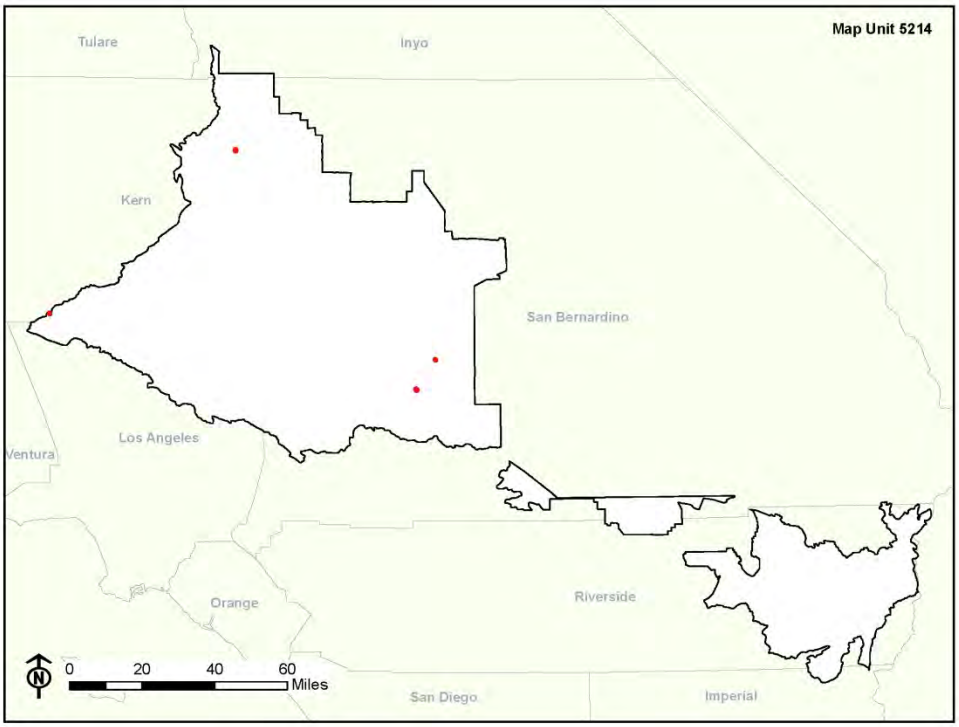


DISTRIBUTION: The highest concentration of stands occurs in western Antelope Valley and the foothills of the San Gabriel and San Bernardino Mountains. They are primarily related to human disturbances such as roadside clearings and fallow agricultural fields. This Alliance does not occur east of Hesperia or in the Colorado Desert.



5214 – *Gutierrezia sarothrae* Provisional Alliance

Broom snake weed scrub Provisional Alliance



DISTRIBUTION: Stands of this Provisional Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. The few stands assessed were in successional areas of moderate elevation. Stands of this Provisional Alliance can include both *Gutierrezia sarothrae* and/or the similar *G. microcephala*. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

5215 – *Ericameria cooperi* Provisional Alliance

Cooper's goldenbush Provisional Alliance

Contained within the polygon in the center of the image, *Ericameria cooperi* appears as the smaller rounded green individuals mixed in the lower half with some bluish green *Artemisia* and clumpier dark green *Prunus fasciculata* inclusions.

Shown in the photo is a moderately dense stand of *Ericameria cooperi* with the tawny remains of the spring-season inflorescences characteristic of several of the *Ericameria* species in the study.

5215 – *Ericameria cooperi* Provisional Alliance

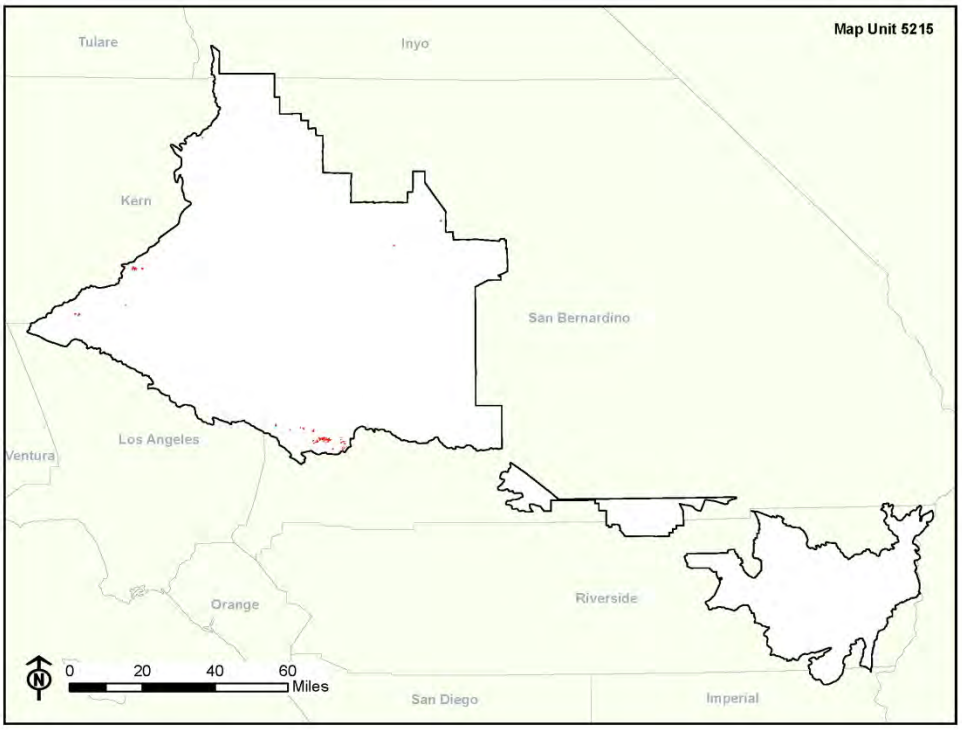
DESCRIPTION: This Provisional Alliance is based on a strong dominance (generally more than 60 percent relative cover) of *E. cooperi,* which is evenly distributed across the stand. If *E. cooperi* co-dominates with *E. nauseosa* or *E. teretifolia,* the stands would be classified as those Alliances respectively. Stands show evidence of recent disturbance (typically fire) and are usually adjacent to stands with larger and longer-lived shrubs such as *Grayia spinosa, E. teretifolia, Coleogyne ramosissima,* or *Larrea tridentata – Ambrosia dumosa*. Stands of dense cover are unusual, and most stands containing *E. cooperi,* even if it is co-dominant, can be better placed in the *Ambrosia dumosa*, *Grayia spinosa*, or *Ambrosia salsola* Alliances. The species occurs as a component to other types common in all parts of the Western Mojave. It is spring flowering, shorter-lived, and more directly responds to disturbance than *Ericameria teretifolia.*

PHOTOINTERPRETATION SIGNATURE: Stand cover ranges from sparse to dense. Individual shrubs are generally small, rounded, and have a medium green color. Stands with higher cover tend to have a more recognizable green signature, which distinguishes *E. cooperi* from other seral shrub types. This species often occurs in small patches intermixing with other species close by, such as *Eriogonum fasciculatum, Artemisia tridentata,* and/or *Prunus fasciculata.*

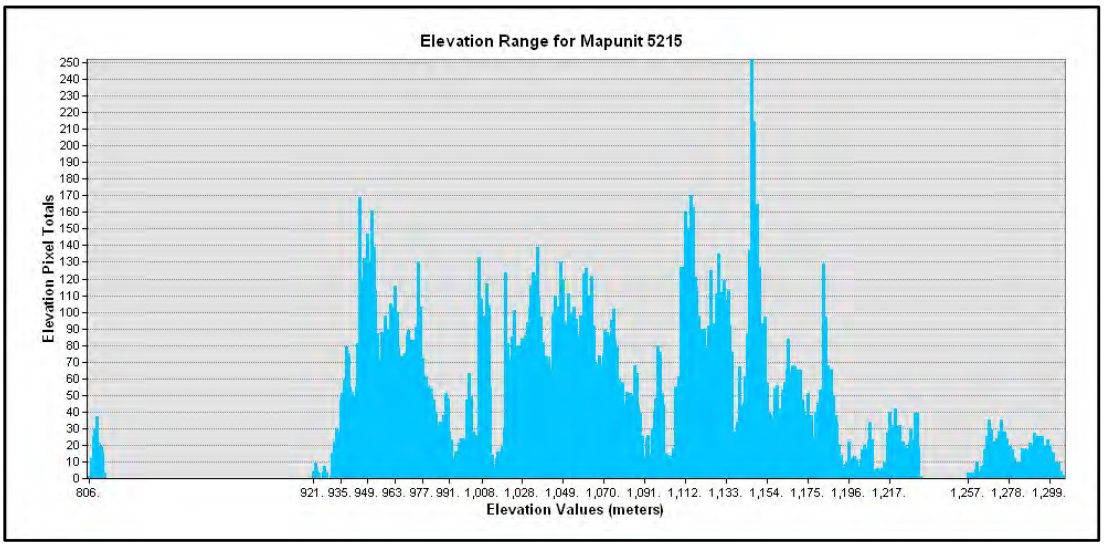
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriodictyon (crassifolium, trichocalyx)* Alliance (2215) – Stands are associated with disturbance (anthropogenic, fire) and are usually found in more open, highly variable cover settings. This species grows in clumpier patches, often with a denser herbaceous understory due to disturbance.
- *Eriogonum fasciculatum* Alliance (2221) – Overall these shrubs have a consistent gray or brown color, with somewhat larger crowns. Stands dominated by *E. fasciculatum* are usually significantly larger.
- *Prunus fasciculata* Alliance (4214) – Mature individuals are larger in size with a dark green to dark gray color. Individual crowns may coalesce into clonal clumps in denser stands.
- *Artemisia tridentata* Alliance (5311) – This species has an overall bluish green or bluish gray color, with mature plants having a larger crown. Individuals may appear in clumps or spread evenly throughout the stand. Stands are more likely to occur near well-drained wash settings.

5215 – *Ericameria cooperi* Provisional Alliance

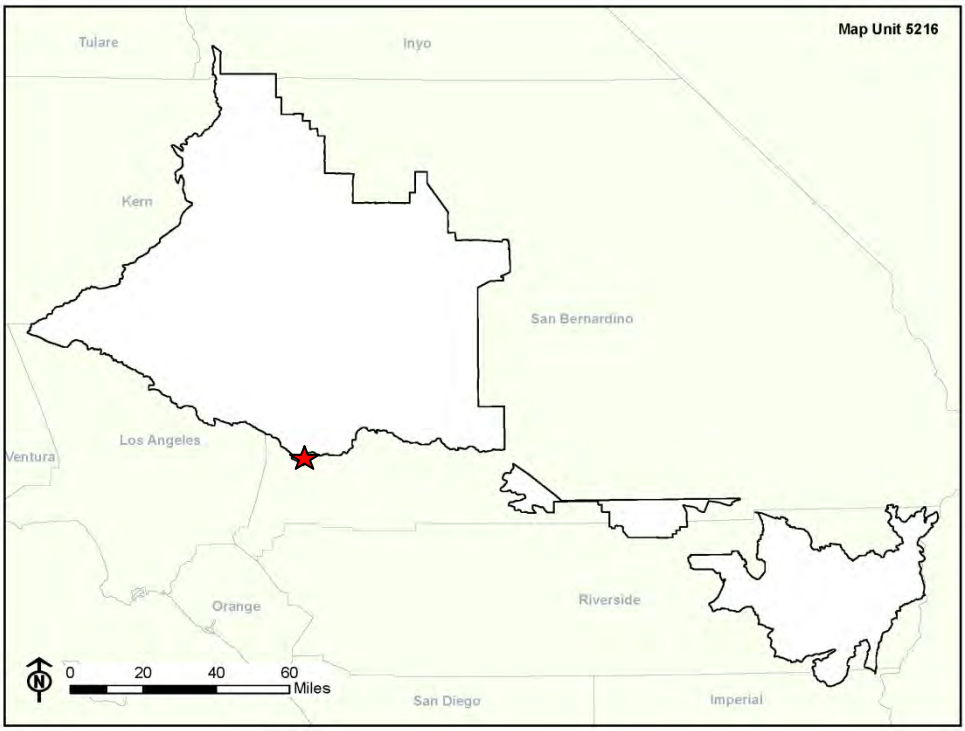


DISTRIBUTION: The highest concentration of mapped stands occurs between Summit Valley and Hesperia. There are also a few scattered stands at the foot of the Tehachapi Mountains along the upper elevation fans.



5216 – *Dendromecon rigida* Alliance

Bush poppy scrub 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 occur in recently burned chaparral vegetation and are technically not part of the desert vegetation. Note: In the distribution map above, a star symbol has been placed on the polygon for display purposes.

5311 – *Artemisia tridentata* Alliance

Big sagebrush Alliance

In this example, *Artemisia tridentata* occurs as a dense clumpy mat on a floodplain adjacent to riparian stands of *Populus fremontii*.

The photo shows a young stand of *Artemisia tridentata* growing in a disturbance setting on deep soils associated with floodplain deposits.

5311 – *Artemisia tridentata* Alliance

DESCRIPTION: In stands of this Alliance *Artemisia tridentata* ssp. *tridentata* is dominant or co-dominant. No other single shrub species has greater cover except *Ericameria nauseosa, Eriogonum fasciculatum*, or *Eriodictyon trichocalyx.* Where *Prunus fasciculata* co-dominates, the *P. fasciculata* Alliance is mapped. Stands having more than 2 percent cover of *Juniperus californica* or *Yucca brevifolia* (regardless of height) were mapped as the *Juniperus* or *Yucca* Alliances, respectively. *A. tridentata* Alliance occurs on coarse alluvium (granitic sands and gravels) in valleys on the north side of the San Gabriel and Sierra Pelona Ranges and in Summit Valley north of Silverwood Lake.

PHOTOINTERPRETATION SIGNATURE: *Artemisia tridentata* occurs in a wide range of cover, often as a co-dominant with other shrubs of similar height. In some post disturbance settings, where species diversity is low, the Alliance tends to display a more uniform bluish green signature color. In these settings, cover is more consistent across the stand, yielding a smoother texture overall. In early seral settings, species diversity can often be high, and patterning therefore tends to be clumpier with a high variability of color. As the stand matures, individual plants take on more of a bluish gray color and tend to vary more in size and height, resulting in a hummocky texture to the signature.

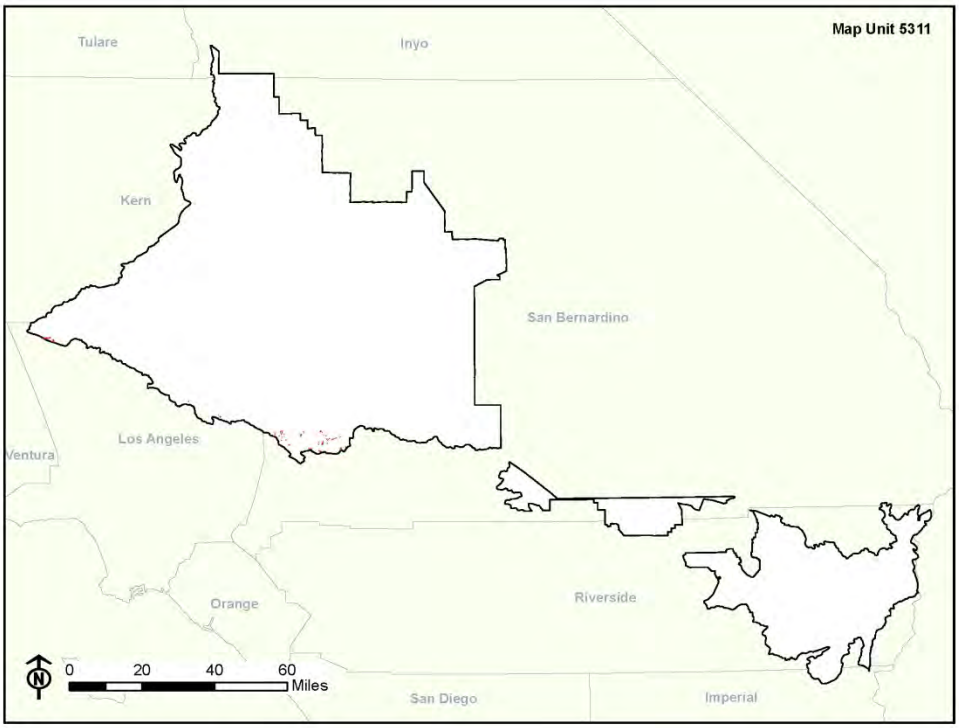
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriodictyon* (*crassifolium, trichocalyx*) Provisional Alliance (2215) – Stands of *Eriodictyon* often form a complex patchwork in early seral settings with *Artemisia tridentata.* Within each patch, species composition is quite uniform, making separation based on signature characteristics fairly straightforward. However, the overall arrangement of the patches within each stand is highly complex, making it difficult to ascertain dominance over an area greater than the minimum mapping unit. *Eriodictyon trichocalyx* generally has a greener color without any of the glaucous tint commonly found in *Artemisia tridentata.*
- *Prunus fasciculata* Alliance (4214) – When occurring in an early seral patchwork, *Prunus fasciculata* is often found adjacent to stands of *Artemisia tridentata*. Shrubs are larger, with a more distinct crown that overall is a darker green. Like *A. tridentata*, shrub cover within this Alliance varies considerably across the stand, especially in early seral settings.
- *Artemisia tridentata* ssp. *parishii* Provisional Alliance (4217) – Stands have a similar signature but occur in low-gradient channels and washes in the Lancaster-Palmdale area, in more alkaline settings downslope from *Artemisia tridentata* ssp. *tridentata*. They are also found along roadside ditches where water collects.
- *Ericameria nauseosa* Alliance (5212) – Both *Ericameria nauseosa* and *Artemisia tridentata* have a bluish gray to bluish green color depending on maturity of the stand. In early seral settings, *A. tridentata* tends to occur in denser cover and have larger crowns. In more mature stands, *A. tridentata* is less likely to be found in disturbed settings and more often will occur on lower slopes and gravelly floodplains. Older stands of *E. nauseosa* are more associated with post disturbance cleared sites.

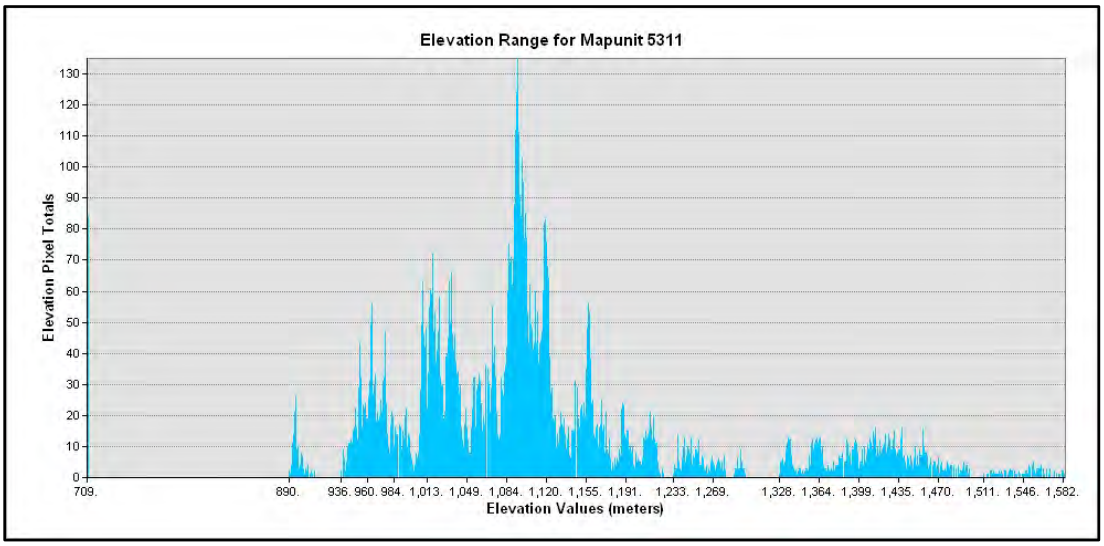
5311 – *Artemisia tridentata* Alliance

- *Ericameria cooperi* Alliance (5215) – Stands where *Ericameria cooperi* dominate tend to have a stippled texture due to the small size coupled with fairly dense shrub cover. Shrubs tend to be more uniform in height and the overall signature color is greener without the glaucous tint.

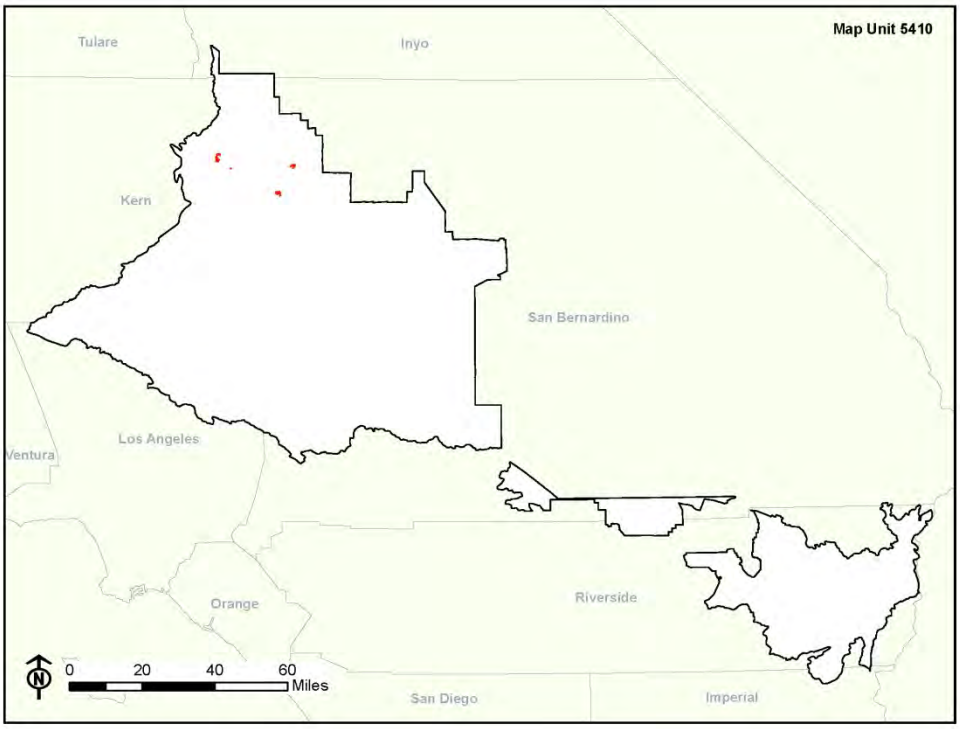
5311 – *Artemisia tridentata* Alliance



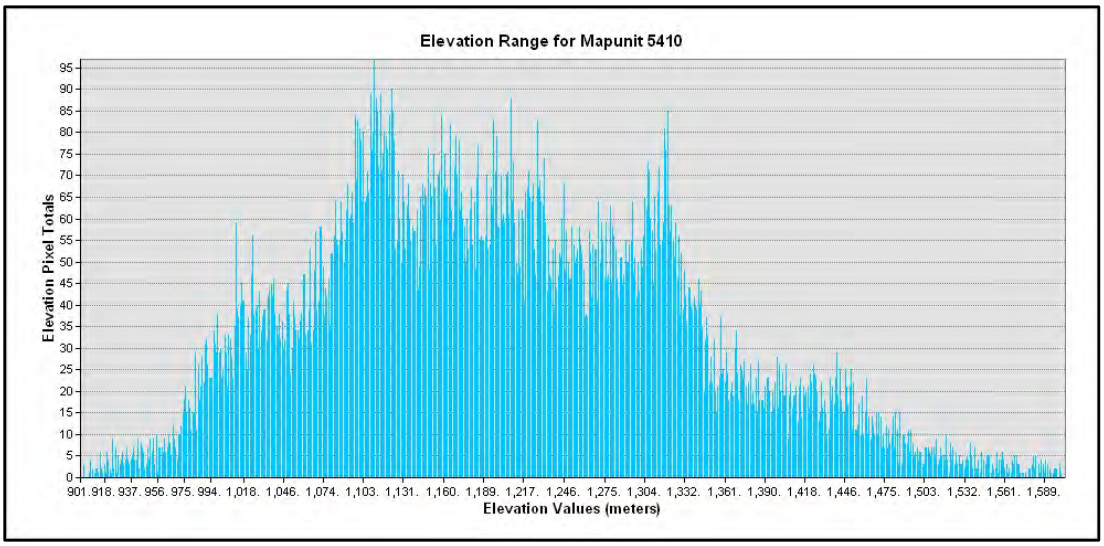
DISTRIBUTION: The highest concentration of stands for this Alliance occurs in the area along the northern foothills of the San Gabriel and San Bernardino Mountains between Cajon Canyon and Mojave River Forks Regional Park. A few isolated stands are scattered further west along the foothills of the San Gabriel Mountains and the base of Liebre Mountain.



5410 – Intermontane deep or well-drained 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 involved recent disturbance, which creates a fine-scale matrix of several related vegetation types within this broader Group.



5411 – *Grayia spinosa* Alliance

Spiny hop sage scrub Alliance

This is a typical signature of *Grayia spinosa* on a higher elevation fan. In this example, *Grayia spinosa* dominates with a characteristic light gray color. Emergent *Yucca brevifolia* occurs in scattered locations, shown here with a larger, darker crown. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

The photo depicts an open stand of *Grayia spinosa* with a few smaller *Krascheninnikovia lanata* on a broad, gently sloping bajada. Emergent *Yucca brevifolia* is widely scattered in the stand.

5411 – *Grayia spinosa* Alliance

DESCRIPTION: *Grayia spinosa* comprises at least 2 percent of the cover in stands of this Alliance and is dominant or co-dominant in the shrub canopy. *G. spinosa* is evenly distributed in the stands, and no other species has substantially greater cover. The large majority of *G. spinosa* stands feature co-dominant species. Thus, careful assessment of shrub distribution is important for proper identification. In many cases stands have been affected by fire, clearing, grazing, or other disturbances. Where this has occurred, seral shrubs such as *Tetradymia stenolepis*, *Ericameria cooperi, Lycium cooperi, Lepidium fremontii, Senna armata*, or *Lycium andersonii* can have similar cover. *G. spinosa* Alliance stands occupy the transition between warm desert and cool desert vegetation in much of the study area. *G. spinosa* does resprout after fire, and along with *Salazaria mexicana, Encelia actoni,* and *Lycium andersonii* may replace *Coleogyne ramosissima* stands as a result. There are many post fire seral stands that have strong mixtures of multiple species, but if *G. spinosa* is evenly distributed in such stands, the *G. spinosa* Alliance is mapped. If *Ephedra viridis* comprises at least 2 percent cover and is evenly distributed, the *E. viridis* Alliance is mapped.

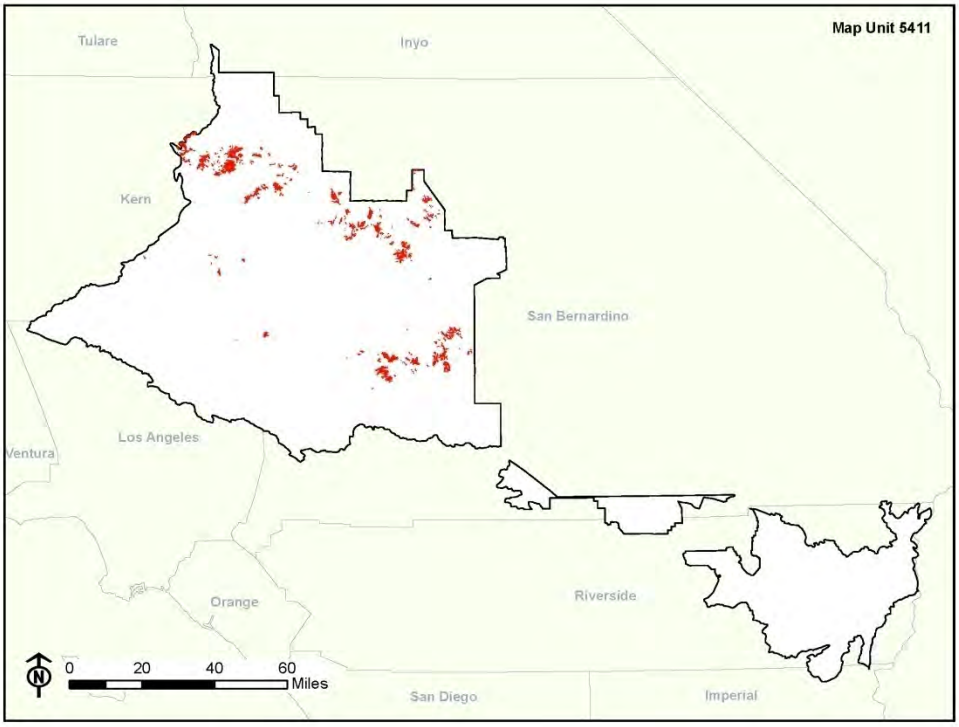
At lower elevations *Grayia spinosa* stands usually occur on north-facing slopes in regions dominated by *Larrea tridentata – Ambrosia dumosa*, and in lower basins and cold-air drainages on relatively well-drained medium-textured soils. Larger stands occur on moderate to gentle middle and upper slopes above approximately 1000 meters (3280 feet) or on basin margins as a "bathtub ring" effect above *Atriplex polycarpa* or *Atriplex spinifera* stands. At elevations similar to *Coleogyne ramosissima*, *Grayia spinosa* stands are on relatively less rocky and less exposed sites (mid slope, not convex upper slope) and often have evidence of more recent fire. Stands transition to *Ambrosia dumosa* adjacent to *Larrea tridentata – Ambrosia dumosa* on lower slopes. They transition to *Ericameria teretifolia* or *Ephedra nevadensis* on convex rocky slopes, or to *Salazaria mexicana* on concave (often burned) rocky slopes. On higher elevation rocky crags or slopes, stands transition to *Ephedra viridis*. Abrupt shifts in soil texture in flats and basins cause *G. spinosa* stands to give way to *Atriplex spinifera* or *Atriplex polycarpa* on fine-textured soils, or *Krascheninnikovia lanata* on calcareous soils; transitioning to *Ambrosia dumosa* or *Larrea tridentata – Ambrosia dumosa* on well-drained slopes above cold-air pockets.

PHOTOINTERPRETATION SIGNATURE: Stands range from open to very dense in cover. Individuals are light gray in color with a diffuse crown. In healthy, relatively undisturbed stands, shrub cover is fairly consistent throughout and individual crown size varies little. Signature variability increases in disturbance settings due to the higher diversity of shrub species present and greater inconsistency in woody vegetative cover density across the stand. Stands on broad alluvial fans often have a component of *Yucca brevifolia,* which contrasts sharply with the overall light gray color of the understory shrub layer.

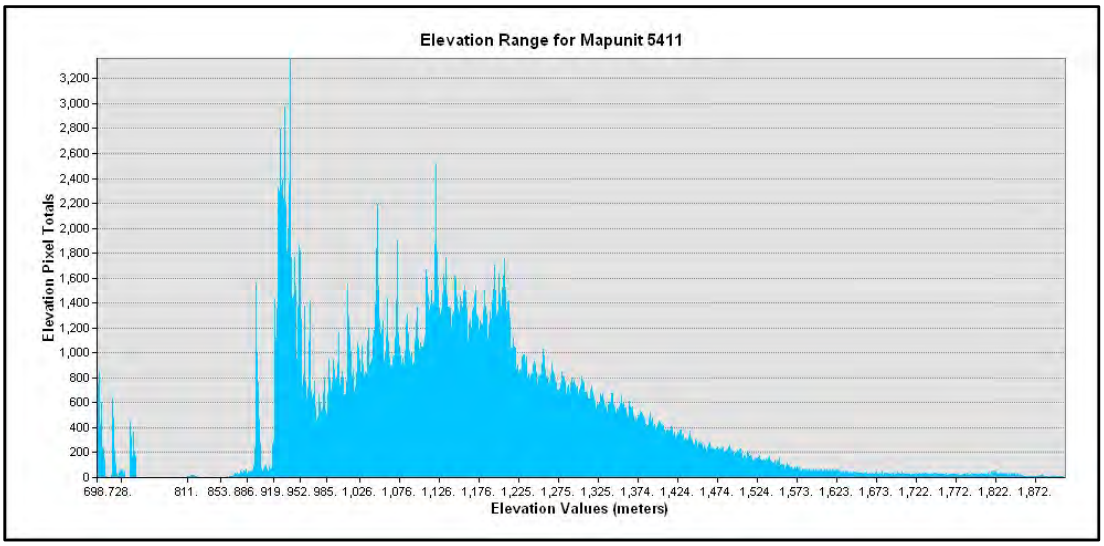
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia dumosa* Alliance (4111) – The signature of this type is very similar to *Grayia spinosa,* and differences between stands are especially difficult to discern where the two species co-occur. *Ambrosia dumosa* tends to have a smaller crown. Both Alliances can have a minor component of *Larrea tridentata*; however, hill slopes occurring adjacent to the *Grayia spinosa* Alliance will most likely lack *Larrea* in the stand. If *Larrea tridentata* drops out of a stand along the margins of a well-defined cold-air basin, it is more likely that the stand will be *Grayia spinosa. Grayia spinosa* tends to occur on north faces at higher elevations, whereas *Ambrosia dumosa* may tend to be found on the south-facing slopes.
- *Krascheninnikovia lanata* Alliance (5412) – Stands where this species dominates are difficult to distinguish from other light-colored shrubs, including *Grayia spinosa.* This Alliance is generally mapped from field data and subsequent extrapolation based on the presence of light-colored calcium-rich soils, often containing a whitish caliche layer at the surface.
- *Salazaria mexicana* Alliance (5415) – Denser, more mature stands of this type have a blue-green color, while stands on ultra-steep, rocky or burned settings appear faint with a light gray crown and a reduced size. Plants within this Alliance often form small dense patches along lower slopes adjacent to small washes. *Salazaria mexicana* is less likely to occur as a mapping type on minimally dissected broad alluvial fans containing fine silty soils.
- *Coleogyne ramosissima* Alliance (5421) – Shrubs have a darker gray to grayish brown color with a well-defined crown. Stands of *Coleogyne ramosissima* are easily recognizable against the light-colored rocky pediments with shallower soil where they are likely to occur. Like *Grayia spinosa, Coleogyne* tends to have consistent cover and shrub size across the stand; however, the understory herbaceous cover is generally very sparse.

5411 – *Grayia spinosa* Alliance

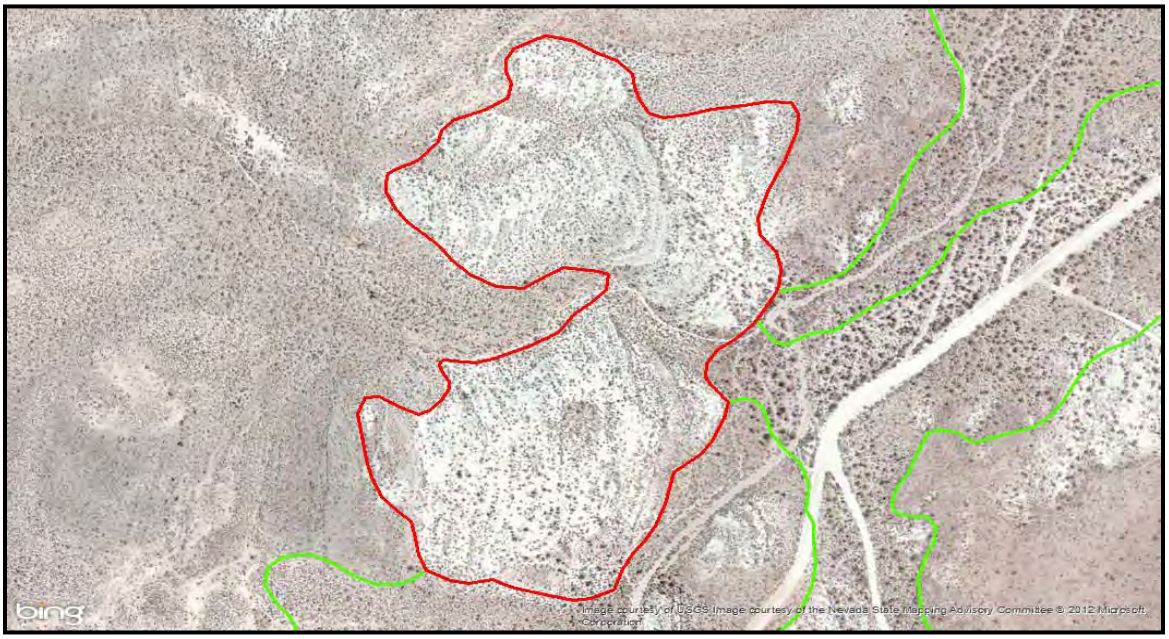


DISTRIBUTION: *Grayia*'s distribution is centered in the cool Great Basin Desert, but stands do occur commonly in the higher portions of the northern and western Mojave Desert. The largest concentration of stands occurs along the northern fringe of the Western and Central Regions of the Mojave Desert. 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.



5412 – *Krascheninnikovia lanata* Alliance

Winterfat scrubland Alliance



The image depicts a stand of *Krascheninnikovia lanata* occurring on a white calcareous substrate northwest of the El Paso Mountains.

This photo shows a stand of *Krascheninnikovia lanata* on a white calcareous substrate over a sparse cover of *Nasella* spp.

5412 – *Krascheninnikovia lanata* Alliance

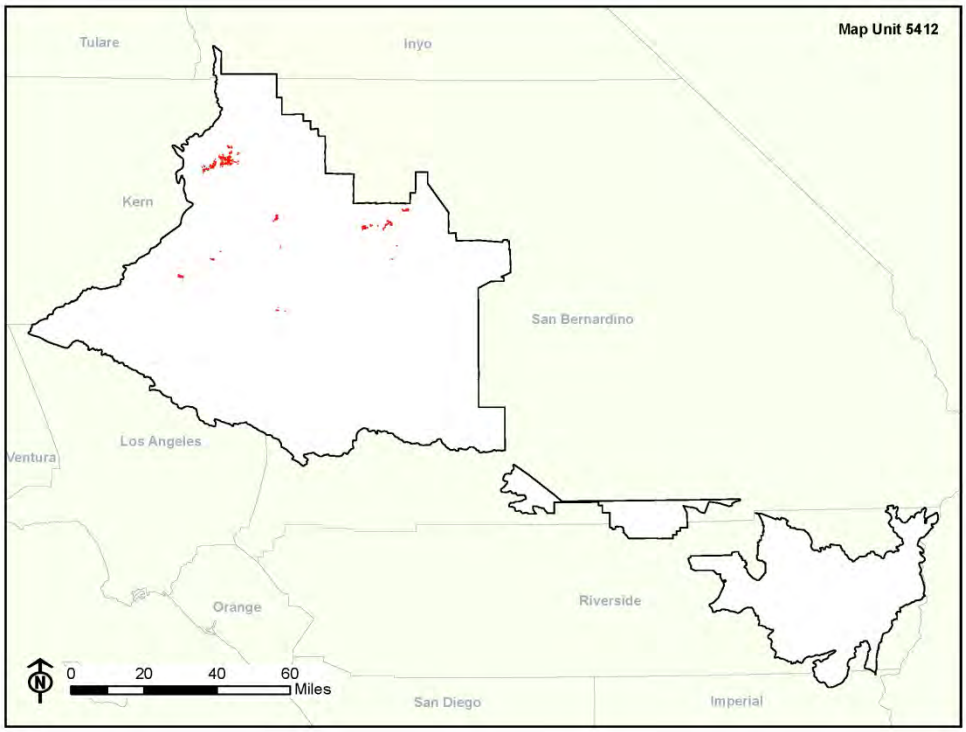
DESCRIPTION: Stands of this Alliance are strongly dominated by the low shrub *Krascheninnikovia lanata*, without any other species in higher cover. Stands are found in mid- to upper-elevation flats and small basins. Southeast of California City, where *Atriplex spinifera* is not dominant, stands of *K. lanata* occur in small basins with silty but not strongly alkaline soil. These stands give way to *Grayia spinosa*, then *Ambrosia dumosa*, and then *Larrea tridentata – Ambrosia dumosa* in sequence upslope. The largest stands of *K. lanata* occur in Superior Valley, in a matrix adjacent to *Atriplex spinifera* on calcium-rich soils (whitish caliche layer at surface), or *Atriplex confertifolia* on saltier basin soils, or *Ambrosia dumosa* on slightly higher slopes with better-drained soils. *Krascheninnikovia lanata* also occurs on shallow caliche or dolomite adjacent to volcanics on northwest and eastern slopes of the El Paso Mountains, where stands tend to co-dominate with *Grayia spinosa* and *Tetradymia fasciculatum.* Stands were assumed rare throughout the California deserts, but some extensive stands have been mapped in this study. These include the largest ones now known in California.

PHOTOINTERPRETATION SIGNATURE: Stands in and near the El Paso Mountains are associated with light-colored calcareous soils and can be identified by the signature of these soil characteristics. *K. lanata* tends to have small rounded crowns and a light gray color on the imagery. Stands in low-lying areas south and east of California City and near Edwards AFB are found on darker-colored substrate and are extremely difficult to distinguish from other shrubs in the area such as *Ambrosia dumosa* and *Grayia spinosa.*

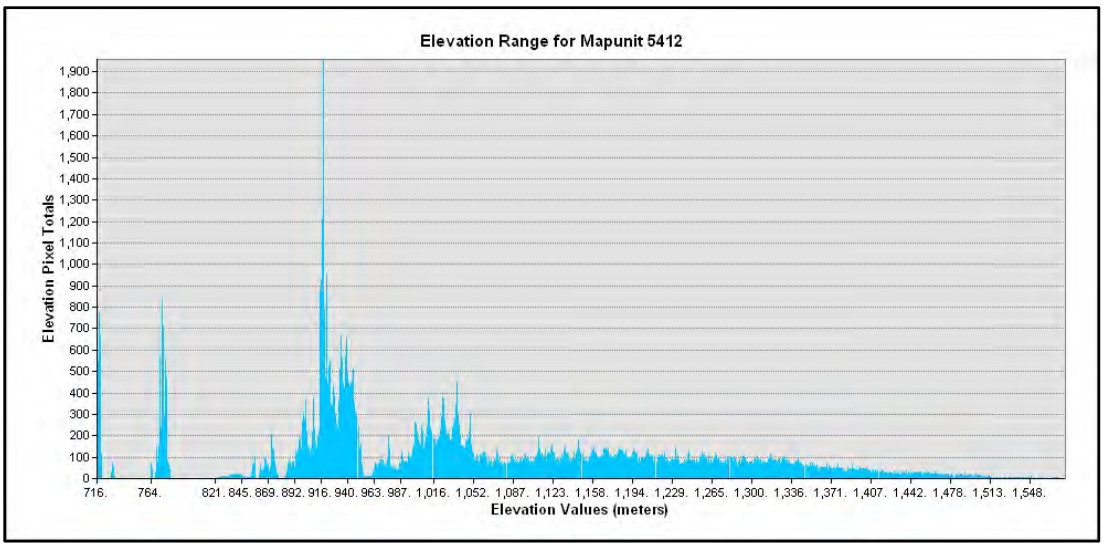
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia dumosa* Alliance (4111) – Shrubs in this Alliance have a nearly identical signature to *K. lanata* and must be separated out by differences based on their unique edaphic and ecological settings. *A. dumosa* rarely dominates in stands located in cold-air basins or on sites with light-colored calcareous substrate.
- *Grayia spinosa* Alliance (5411) – Stands containing *Grayia spinosa* tend to have a higher shrub cover along with a fairly dense herbaceous layer that is discernible on the imagery. *G. spinosa* also does not generally occur on such a light-colored substrate. Individual shrubs are slightly larger and have a more consistent cover across the stand.
- *Coleogyne ramosissima* Alliance (5421) – Both Alliances tend to occur on light-colored substrate, but the contrasting darker *Coleogyne ramosissima* makes separating these two Alliances fairly straightforward. Unlike *K. lanata,* plants in this Alliance occur in cover that remains fairly consistent across the stand. *C. ramosissima* also tends to occur more often on pediment-like surfaces at the base of mountains and their associated toe slopes.

5412 – *Krascheninnikovia lanata* 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.



5413 – *Ephedra nevadensis* Alliance

Nevada jointfir Alliance

Shown above is a representative example of a dense stand of *Ephedra nevadensis* on a middle to upper bajada with a sparse cover of *Yucca brevifolia.* Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

Stands of *Ephedra nevadensis*, like the example in this photo, occur frequently on middle to upper fans in the Antelope Valley near Palmdale and Littlerock. Emergent *Yucca brevifolia* is present here in sparse cover over a dense layer of annual grasses.

DESCRIPTION: *Ephedra nevadensis* comprises more than 2 percent cover in stands of this Alliance. No other species has greater cover, with the exceptions of *Acamptopappus sphaerocephalus* or *Chrysothamnus viscidiflorus*. If *Eriogonum fasciculatum* is co-dominant with *Ephedra nevadensis,* the stand would be mapped as the *Eriogonum fasciculatum* Alliance (desert version). Stands within the mapping area occur primarily in two settings: (1) on cooler middle or upper slopes of mountains where *Ephedra nevadensis* is co-dominant with *Salazaria mexicana, Encelia actoni* and/or *Ericameria cooperi*, often replacing *Grayia spinosa* or *Coleogyne ramosissima* following repeated fire; or (2) on broad terraces adjacent to large washes between Pearblossom and Palmdale (e.g., Little Rock Wash, Big Rock Wash), where *Ephedra nevadensis* is often co-dominant with *Encelia actoni* with emergent *Yucca brevifolia.* Both expressions are often adjacent to *Larrea tridentata – Ambrosia dumosa* stands (upper elevation associations of *Larrea tridentata – Ambrosia dumosa* often contain *Ephedra nevadensis*). Fire stimulates resprouting of *Ephedra nevadensis,* as does occasional fluvial disturbance. Because of their dependence upon these disturbances, the locations of *Ephedra nevadensis* stands are difficult to model. Rocky substrates (either cobble-alluvium or shallow broken colluviums) on slopes are usually important. Stands are not found on extensive sandy or fine-textured soils.

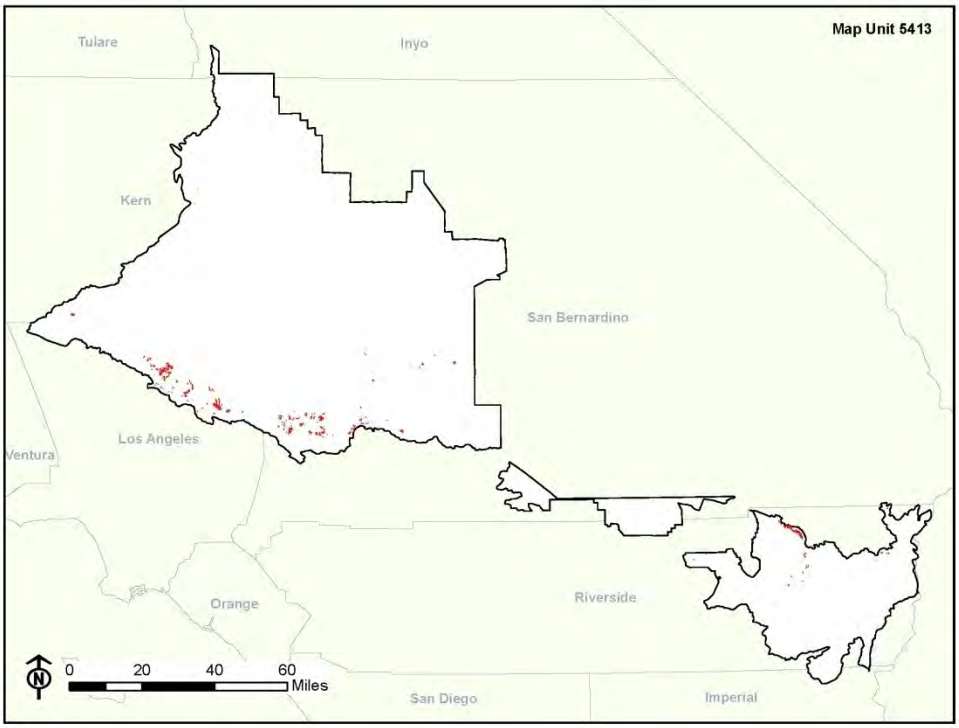
Stands often mix with other mid-elevation scrub species such as *Grayia spinosa*, *Salazaria mexicana, Tetradymia* spp., *Ericameria cooperi, Eriogonum fasciculatum,* or (near Twentynine Palms) *Viguiera parishii* and *Simmondsia chinensis. Achnatherum speciosum* is common in many stands. *Coleogyne ramosissima* and *Ephedra nevadensis* often occur in similar situations and exposures, but *Coleogyne* is killed outright by fire, while *Ephedra nevadensis* is stimulated by it. Thus, *Ephedra nevadensis* may in some cases be a type conversion from *Coleogyne* in many burned areas of the desert mountains.

PHOTOINTERPRETATION SIGNATURE: *Ephedra nevadensis* has a wide range of signature characteristics depending on the settings in which they occur. In post fire disturbance, *E. nevadensis* forms a dense cover, often with a variable component of other shrubs. In these situations the modal signature is due to the high cover of *E. nevadensis,* which has a slight green tint to an otherwise very dark gray color. This species also has a fairly distinct, irregularly shaped spreading crown, rarely over one meter high. Stands on high mountain slopes are generally sparse in cover and yield little vegetative signature. These stands are difficult to differentiate from other shrubs within the Intermontane scrub Group and are best separated out by their distinguishing topographical characteristics (higher elevation, north-trending aspects).

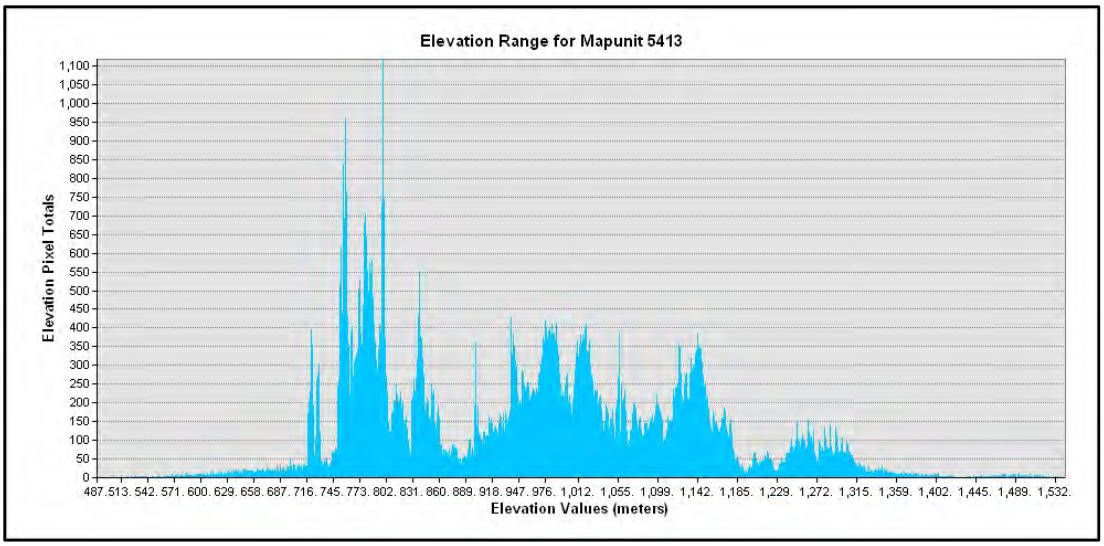
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum fasciculatum* Alliance (2221) – When the *Ephedra nevadensis* Alliance occurs in post fire settings, *Eriogonum fasciculatum* often co-dominates or occurs immediately adjacent to the stand. In adjacent stands, *Eriogonum fasciculatum* will tend to have a lower shrub cover and individual shrubs are smaller in size. Shrub cover is less consistent across the stand and the overall signature color can have a minor brown tint to an otherwise dark gray color. Stands of *Eriogonum* tend not to form clonal patterns as much as *Ephedra. Eriogonum fasciculatum* will also occur on steeper slopes such as the side slopes to a larger ravine or the steeper dissected portions of alluvial fans. On steeper slopes in the desert mountain ranges, *Eriogonum fasciculatum* is one of the few shrubs that form a dense enough cover to be recognized on the imagery. Shrubs in these settings tend to also be a dark brown, and overall size is small.
- *Ericameria cooperi* Provisional Alliance (5215) – In post fire regeneration, *Ericameria cooperi* has a significantly smaller crown, and shrub cover is notably sparser. When shrubs form fairly large stands, this Alliance tends to present a rather stippled texture, unlike the clonal patchy texture found in stands of *Ephedra nevadensis.*
- *Salazaria mexicana* Alliance (5415) – Stands dominated by *Salazaria mexicana* are often smaller and limited more to wash margins and associated older floodplains. Stand cover is less consistent, forming small, widely scattered dense clonal-looking patches. Individual shrubs tend to be a lighter gray color, at times with a slight tint of green.
- *Ephedra viridis* Alliance (5417) – Small stands occur in very rocky steep and protected settings, especially in the desert mountain ranges. Differentiating the two *Ephedra* species on the imagery is very difficult, and subtle differences in ecological and topographical setting are not always reliable. On a broad scale, *E. viridis* is more common in the northernmost portions of the Mojave Desert.

5413 – *Ephedra nevadensis* Alliance



DISTRIBUTION: This Alliance is found on the higher alluvial and colluvial fans from the eastern portions of the Antelope Valley to the upper elevations of the Lucerne Valley. Isolated small stands are found throughout the desert mountain ranges, including several small areas in the Granite Mountains north of Palen Dry Lake in the Colorado Desert. Stands are more common in the northern and eastern Mojave and the adjacent Great Basin outside of the study area.



5415 – *Salazaria mexicana* Alliance

Bladder sage scrub Alliance

The above image depicts *Salazaria mexicana* in a post fire setting where cover is greater than 15 percent. Crowns vary considerably in size across the stand. Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

In this example, the gray-green *Salazaria mexicana* forms a sparse cover on rocky slopes over annual grasses in a post fire setting.

5415 – *Salazaria mexicana* Alliance

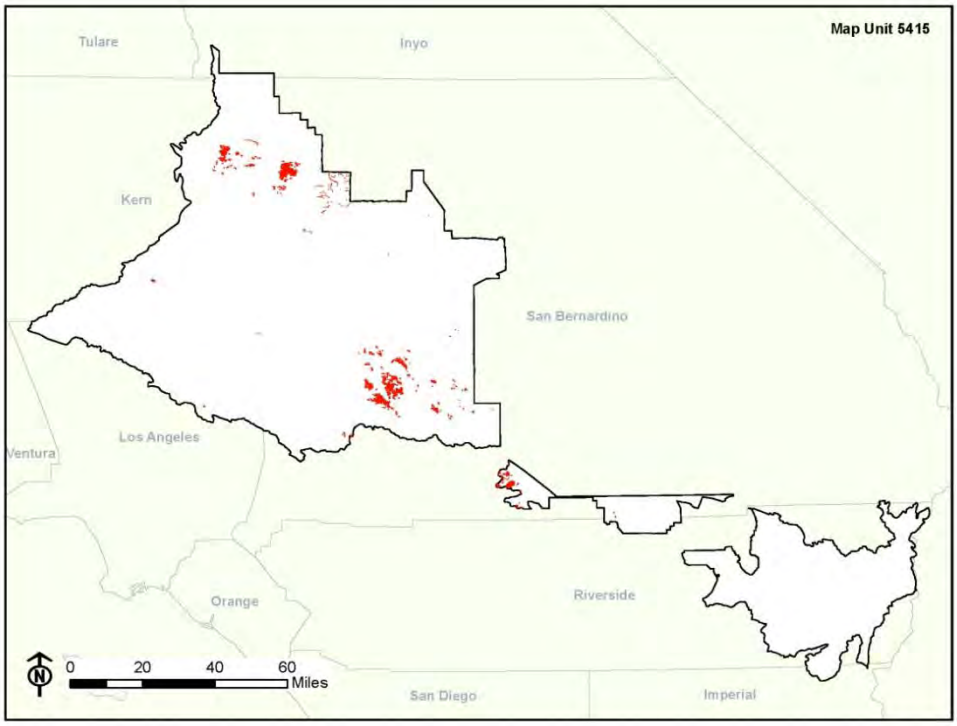
DESCRIPTION: *Salazaria mexicana* comprises more than 2 percent cover in stands of this Alliance and is dominant or co-dominant in the shrub canopy. Other shrubs, if present, each comprise less than half of the cover of *S. mexicana,* with the exceptions of *Hyptis emoryi, Senna armata or Salvia dorrii,* which may have higher or equal cover. *Salazaria* stands are mostly restricted to sandy or gravelly washes in terrain where fire has been minimal, but may occur on post burn or in other disturbed steep and rocky uplands. In washes, *Salazaria mexicana* often occurs with *Ambrosia salsola, Bebbia juncea, Eriogonum fasciculatum* or *Senna armata.* On rocky slopes *Salazaria mexicana* tends to occupy bases of larger outcrops or narrow concave defiles, or ravines where water is channeled during run-off. Depending upon the site topography, many upland stands of this Alliance may contain a fine-scale matrix of several vegetation Alliances including *Encelia actoni, Ephedra nevadensis, Eriogonum fasciculatum, Ambrosia salsola* or *Ericameria teretifolia.* The substrate for all expressions of this Alliance is frequently granitic or crystalline non-calcareous metamorphic material (gneiss, schist, phyllite). Stands of *Salazaria mexicana* Alliance are largely limited to the Mojave Desert Ecoregion and the adjacent southern Great Basin. They are not known from the Colorado Desert, although the species ranges south to Texas and New Mexico**.**

PHOTOINTERPRETATION SIGNATURE: Shrubs tend to have a rounded crown, often coalescing into small clonal patches. Signature color trends gray to bluish green. In sparser settings, especially on rocky slopes, it is difficult to separate out from other shrubs in the stand. Geographic and environmental factors are generally the most reliable way to identify stands within this Alliance. On burned, rocky, lower to middle slopes dissected by small ravines containing concentrations of vegetation, *S. mexicana* is expected to have significant cover, even though other small stands may be present.

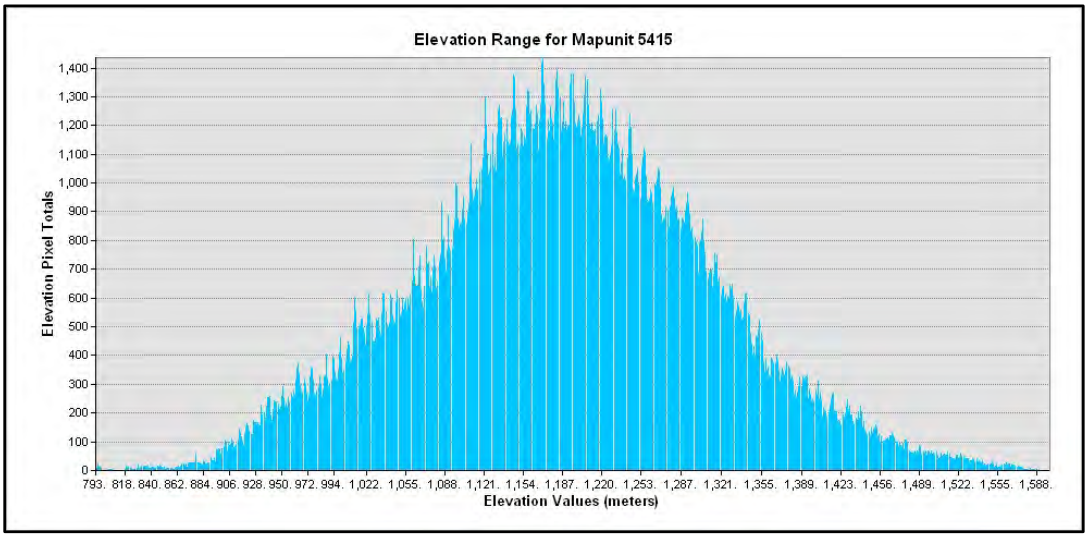
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia salsola* Alliance (4216) – Stands of vegetation within this Alliance may occur in similar settings in broad, low energy washes. *Ambrosia salsola* generally is found in less rocky settings and more commonly occurs after land has been scraped or cleared. *A. salsola* has a smaller crown and trends a darker brown; *Salazaria mexicana* generally has a bluish green color.
- *Encelia (actoni, virginensis)* Alliance (5211) – Stands dominated by *E. virginensis* were observed in post burn settings generally upslope from *Salazaria mexicana* on steeper terrain. This model did not always replicate from one desert mountain range to the next, and separating out this type remains extremely difficult. Cover is generally very sparse, and overall sparseness is accentuated in the signature by the extremely small and light gray-colored crown of *E. virginensis.*
- *Ephedra nevadensis* Alliance (5413) – In post disturbance environments, both *Ephedra nevadensis* and *Salazaria mexicana* can form dense cover. However, the cover characteristics of *S. mexicana* are generally less consistent across large areas, and plants are more confined to low-energy washes and the adjacent floodplain.

5415 – *Salazaria mexicana* Alliance

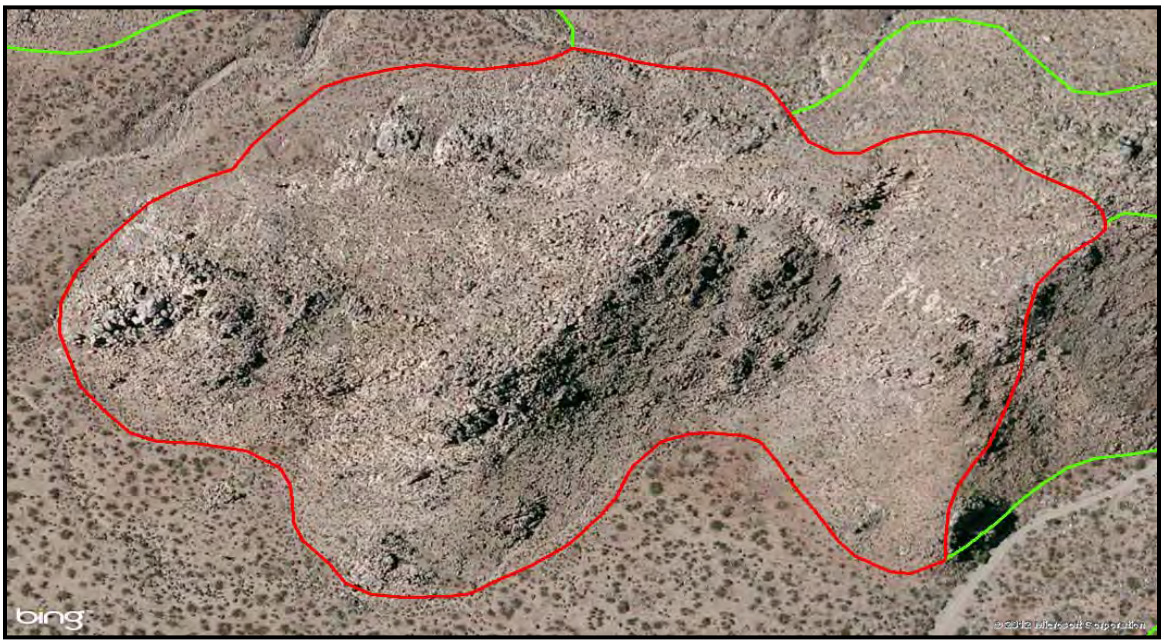


DISTRIBUTION: This Alliance occurs along washes and arroyos on alluvial fans surrounding the Black Hills northeast of Cuddeback Dry Lake and along steep north-facing slopes and protected canyons of the Lava Mountains. Extensive stands are also found in post burn settings on mountains adjacent to Lucerne 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.



5416 – *Ericameria teretifolia* Alliance

Needleleaf rabbitbrush scrub Alliance



This image shows a rocky, steep setting where *E. teretifolia* appears as small, dark, rounded individuals widely scattered on the uppermost slopes.

In this picture, *E. teretifolia* plants are the lighter green shrubs in the upper portion of the rocky slope mixing with the grayer *Brickellia desertorum.*

5416 – *Ericameria teretifolia* Alliance

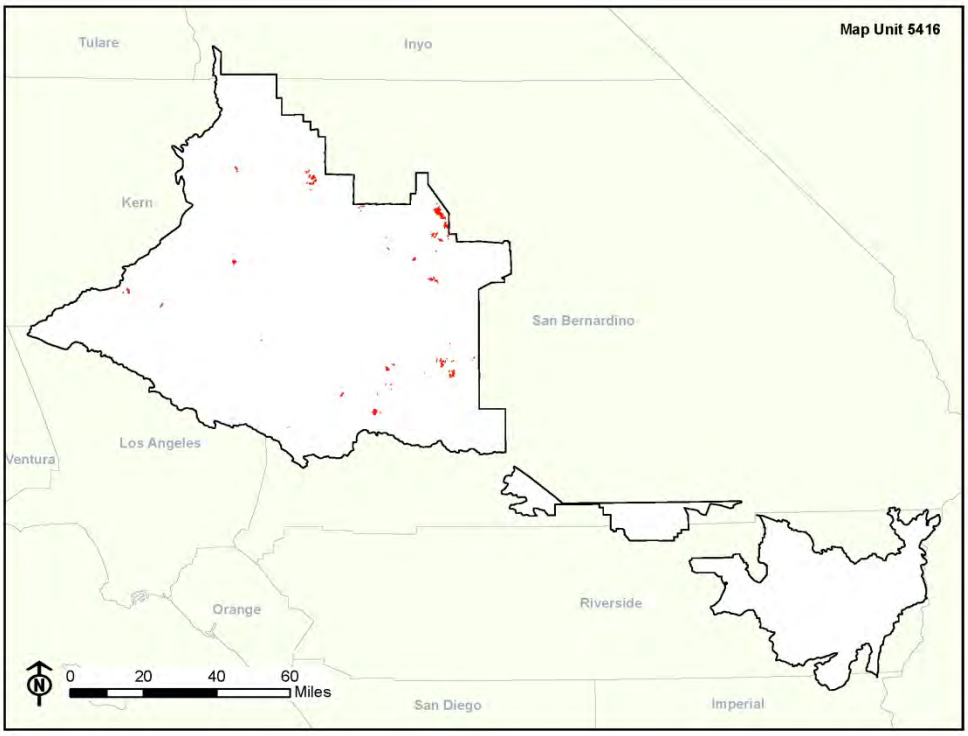
DESCRIPTION: *Ericameria teretifolia* comprises at least 2 percent cover in stands of this Alliance. No other species has greater cover, but *Ericameria teretifolia* can share dominance with *Eriogonum fasciculatum, Gutierrezia sarothrae*, or *Opuntia chlorotica*. When *Ericameria teretifolia* is co-dominant with *Grayia spinosa, Ephedra viridis, Coleogyne ramosissima,* or *Salazaria mexicana*, those other Alliances are mapped. In the study area it is usually found as low-cover shrubland in granitic or other rocky uplands on south- or north-facing steep, bouldery slopes. Stands are found in disturbed uplands in the mid-elevation Mojave or Colorado Desert, but also occur in undisturbed stands on shallow granitic pediments and rock outcrops. *Ericameria teretifolia* may occupy shallow, rocky, post fire stands associated with *Juniperus californica* or other upland Alliances. *Ericameria teretifolia* tolerates high temperatures better than *Ephedra viridis,* which is a species more commonly found in the Great Basin.

PHOTOINTERPRETATION SIGNATURE: Stand cover is typically very sparse and occurs on steep rocky upper slopes. Shrubs appear as scattered, dark, rounded individuals, generally with distinct well-defined crowns. Separating out this Alliance from other intermontane types is extremely difficult due to its generally sparse cover and small stand size.

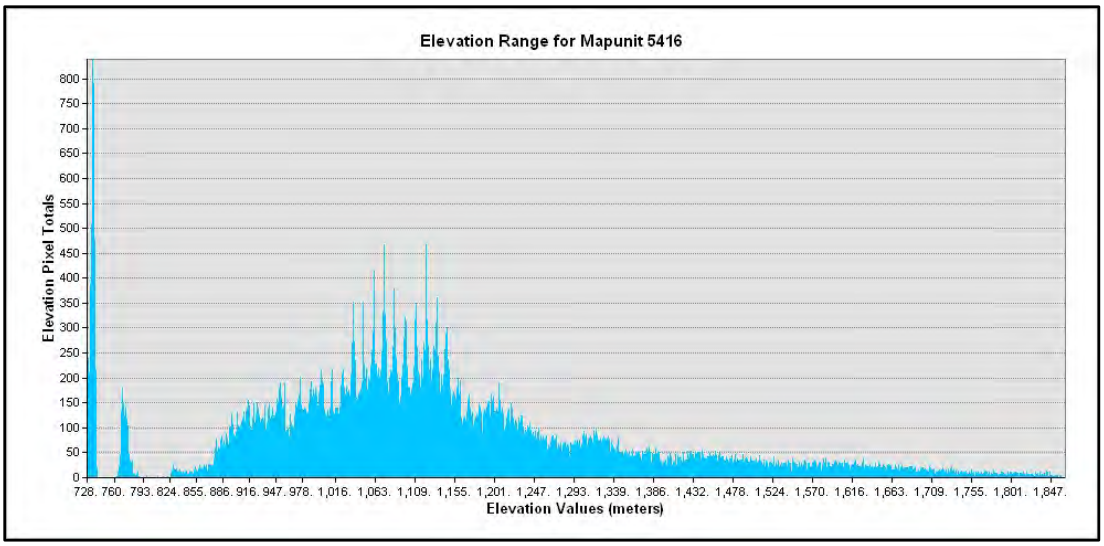
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salazaria mexicana* Alliance (5415) – This Alliance also occurs on intermontane desert ranges, but generally is found on lower slopes and along ravines. Sparse cover of both Alliances in these settings makes vegetative distinctions extremely difficult. *Salazaria mexicana* is generally more associated with recent fire history even in these settings.
- *Ephedra viridis* Alliance (5417) – Separating out these two Alliances is problematic at best due to their similar vegetative signatures and environmental constraints. The overall distribution of *Ephedra viridis* tends to be significantly outside the study area to the north, but this distribution is not reflected in the small amount of mapped polygons of both types.
- Massive sparsely vegetated rock outcrop Mapping Unit (6115) – This sparsely vegetated type may contain a number of intermontane species, including *Ericameria teretifolia.* It is extremely difficult to discern subtle differences of cover at or below 2 percent in these rocky settings.

5416 – *Ericameria teretifolia* Alliance

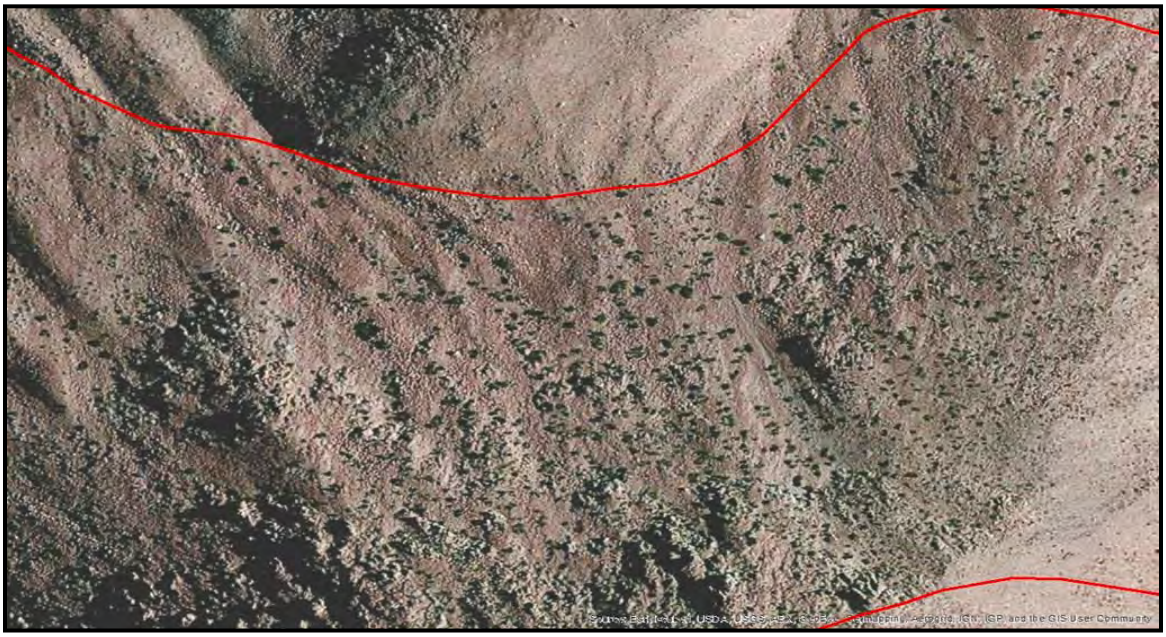


DISTRIBUTION: Stands occupy the middle and upper slopes of the Ord, Sidewinder, Stoddard, Granite, and Fairview Mountains adjacent to Lucerne Valley. Isolated stands also occur in disturbance settings near the base of the southern Sierra Nevada foothills along the Los Angeles Aqueduct. Isolated stands were also mapped in the El Paso Mountains, and southeast of the Lava Mountains.



5417 – *Ephedra viridis* Alliance

Mormon tea scrub Alliance



In the above image, *Ephedra viridis* is seen as a dark, medium-sized shrub co-dominating with smaller shrubs including *Grayia spinosa.*

Ephedra viridis is seen here as the bright green shrubs mixed between the rocky boulders.

5417 – *Ephedra viridis* Alliance

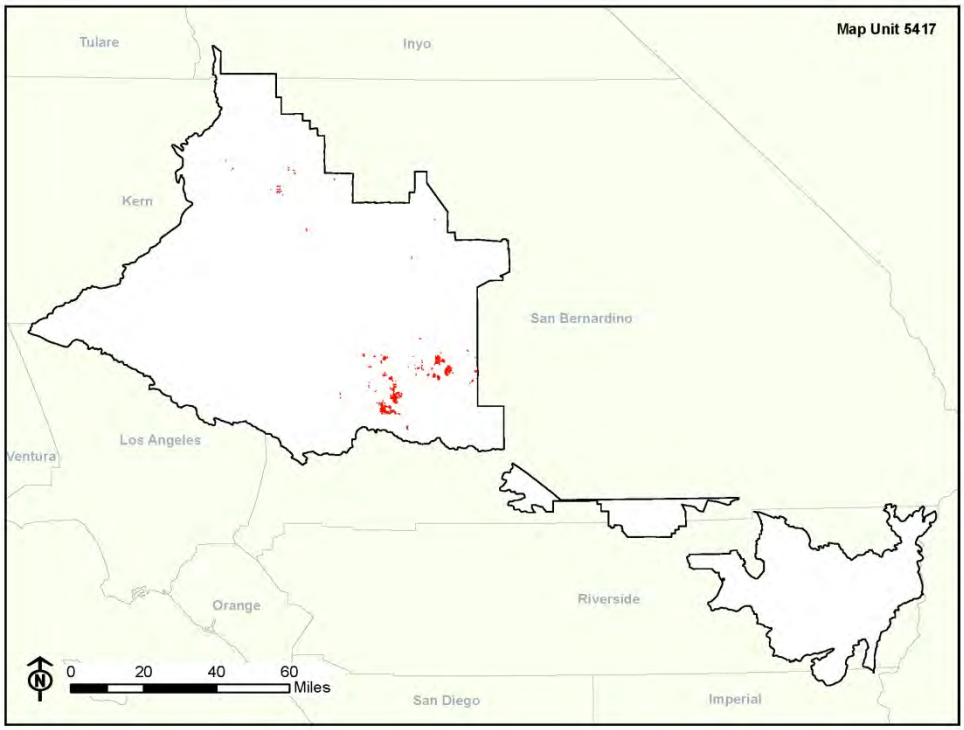
DESCRIPTION: In stands of this Alliance *Ephedra viridis* comprises at least 2 percent of the cover and is dominant or co-dominant with *Ericameria teretifolia, Grayia spinosa, Salazaria mexicana, Krascheninnikovia lanata, Ericameria cuneatus*, or *Eriogonum fasciculatum*. Stands are found on steep, boulder-covered slopes of middle to higher elevation mountains, from the Scodie Mountains west of the Los Angeles Aqueduct to the highest points of the Ord Mountains (above 1800 meters, or 5900 feet). *Ephedra viridis* is associated with steep talus or rock outcrops except at highest elevations, where it can occur on more moderate slopes. Stands tend to mix with *Grayia spinosa*, *Salazaria mexicana* or with *Ericameria teretifolia* at slightly lower and warmer rocky settings. Stands may also mix with *Brickellia desertorum* on slopes of the Sidewinder or Granite Mountains (near Apple Valley).

PHOTOINTERPRETATION SIGNATURE: Stand cover is typically sparse and is generally found on very rocky slopes, with individuals appearing as small rounded shrubs with a variable green to dark green color. Separating out this Alliance from other intermontane types is extremely difficult due to its generally sparse cover and small stand size.

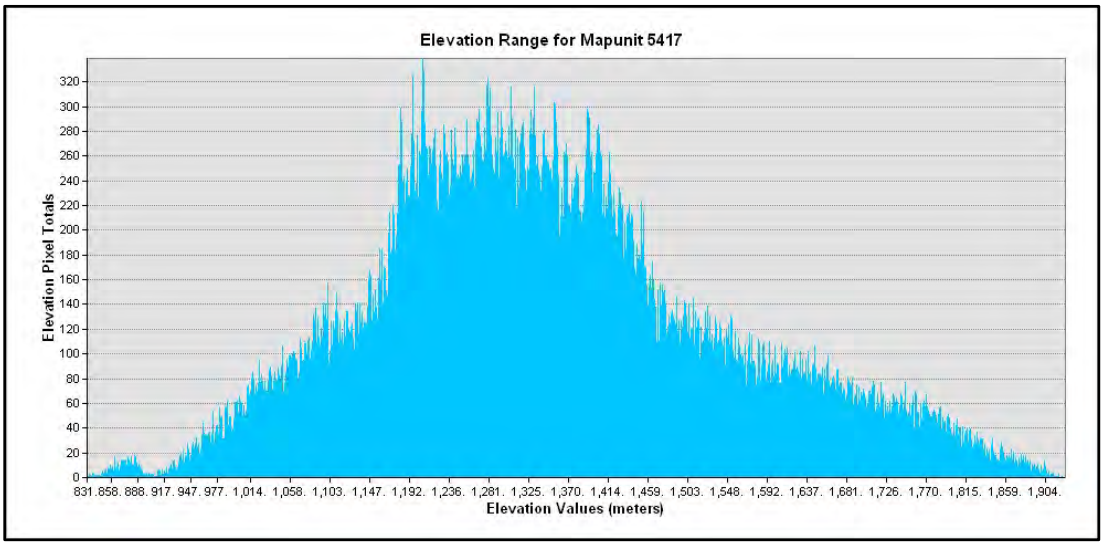
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Salazaria mexicana* Alliance (5415) – In rocky intermontane settings, *Salazaria mexicana* generally occurs in somewhat denser cover forming scattered clonal patches, usually on slopes closer to small ravines and washes. Crowns are generally lighter green and not as rounded. Difficulty separating out the two Alliances is due primarily to their sparse cover and small stand size.
- *Ericameria teretifolia* Alliance (5416) – Distinguishing these two Alliances is often extremely difficult in intermontane settings. Both Alliances occupy rocky middle and upper slopes, and both types generally occur in sparse cover. *Ericameria teretifolia* is more commonly found in concentrations in mountains near Lucerne Valley, and typically has a lighter green signature with smaller and more evenly spaced shrubs.
- Massive sparsely vegetated rock outcrop Mapping Unit (6115) – This sparsely vegetated type may contain a number of intermontane species including *Ephedra viridis.* It is extremely difficult to discern subtle differences of cover at or below 2 percent in these rocky settings.

5417 – *Ephedra viridis* Alliance

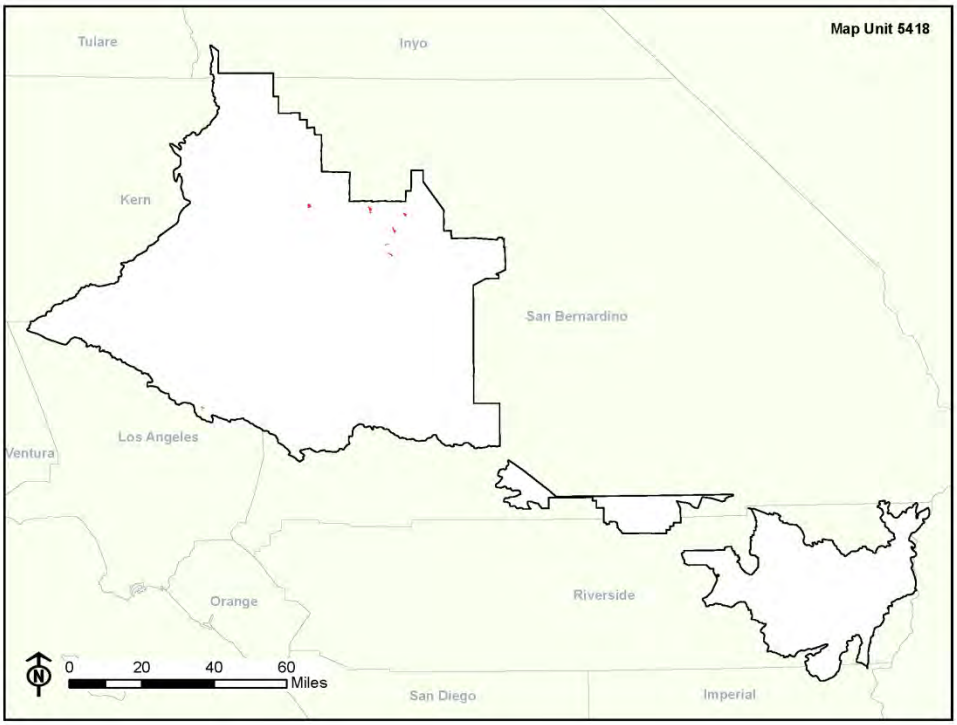


DISTRIBUTION: Most of the mapped stands are in the mountains and low hills of the Stoddard, Granite and Ord Mountains. Other stands are found on the upper slopes of the Lava Mountains and near the summit of Red Mountain.

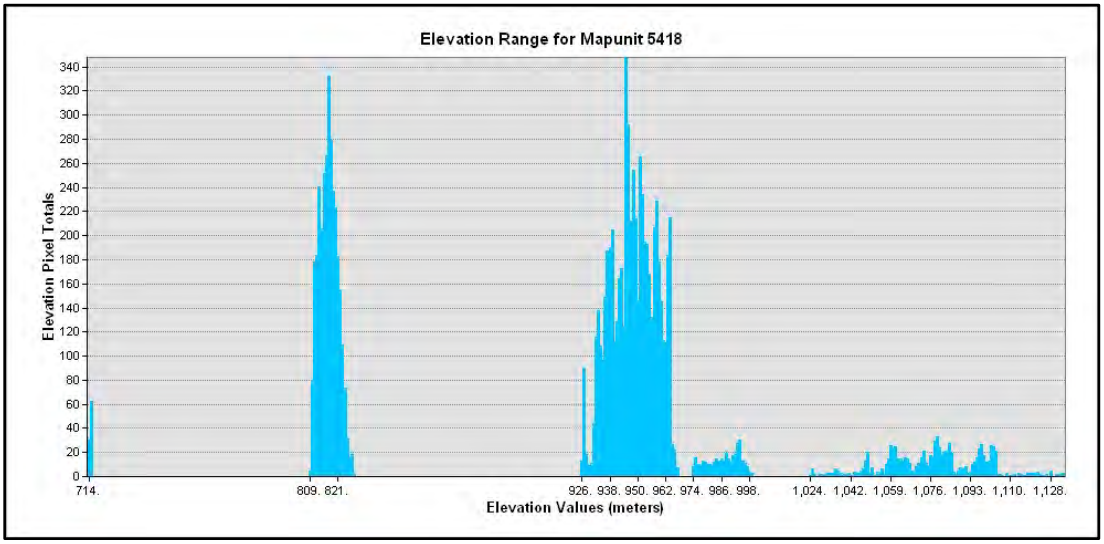


5418 – *Lycium cooperi* Provisional Alliance

Cooper's boxthorn scrub Provisional Alliance



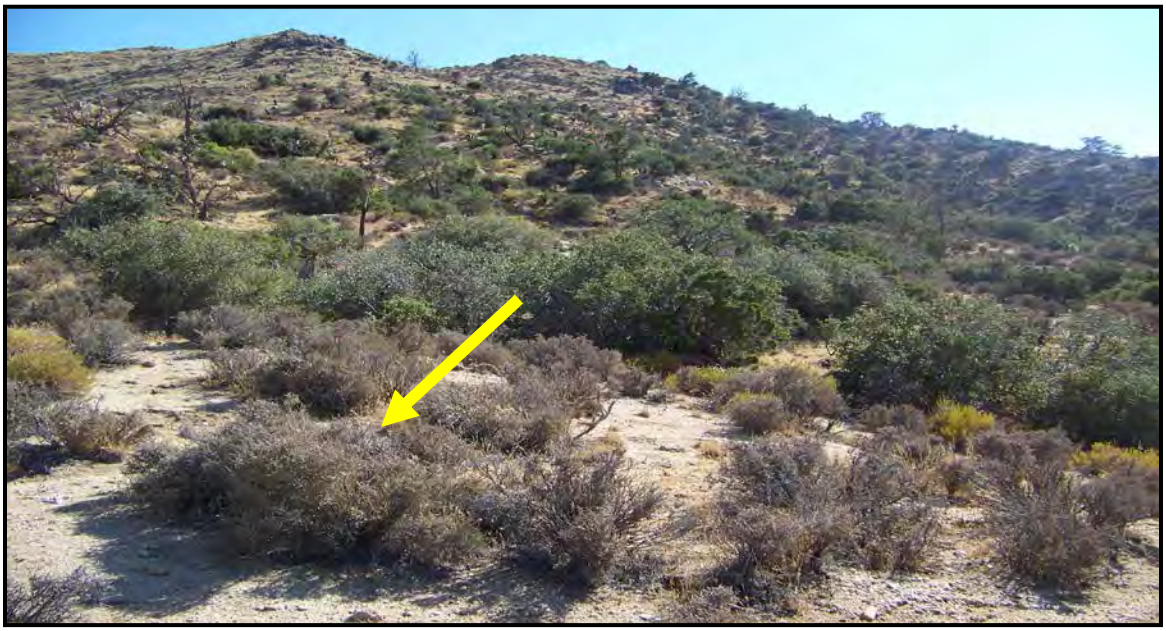
DISTRIBUTION: Stands of this Alliance were infrequently mapped in the study area. Environmental correlates and/or photointerpretation signature attributes cannot reliably be established for this project. The few verified stands tend to occupy settings similar to *Grayia spinosa* on deeper alluvial soils. *Lycium cooperi* resprouts and persists following fire and other disturbance.



5421 – *Coleogyne ramosissima* Alliance

Black brush scrub Alliance

This image depicts a stand strongly dominated by *Coleogyne ramosissima,* with several emergent *Juniperus californica* and *Yucca brevifolia* individuals widely scattered throughout.



Coleogyne ramosissima is seen in the foreground here as the darker-colored short shrub. The darker appearance is indicative of its common name, black brush scrub. Herbaceous understory, as depicted on this photo, is typically sparse.

5421 – *Coleogyne ramosissima* Alliance

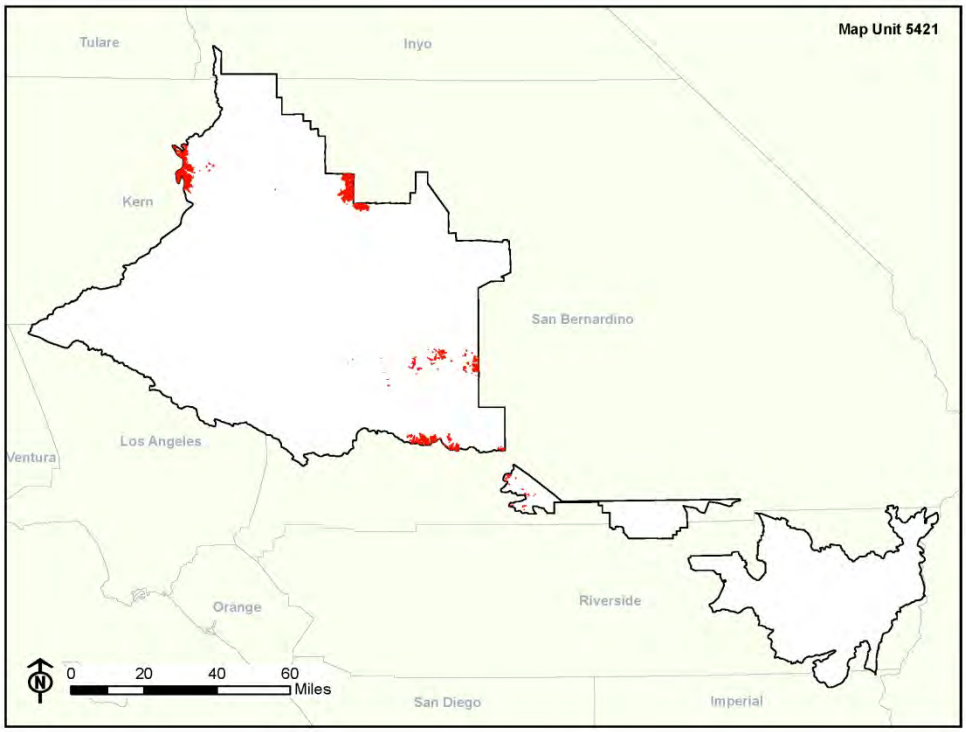
DESCRIPTION: In stands of this Alliance *Coleogyne ramosissima* is the dominant or co-dominant shrub, typically with no species of taller shrub greater than 33 percent of the total relative cover of *Coleogyne*, though other smaller shrubs such as *Ephedra nevadensis* may be of equal or greater cover. 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.

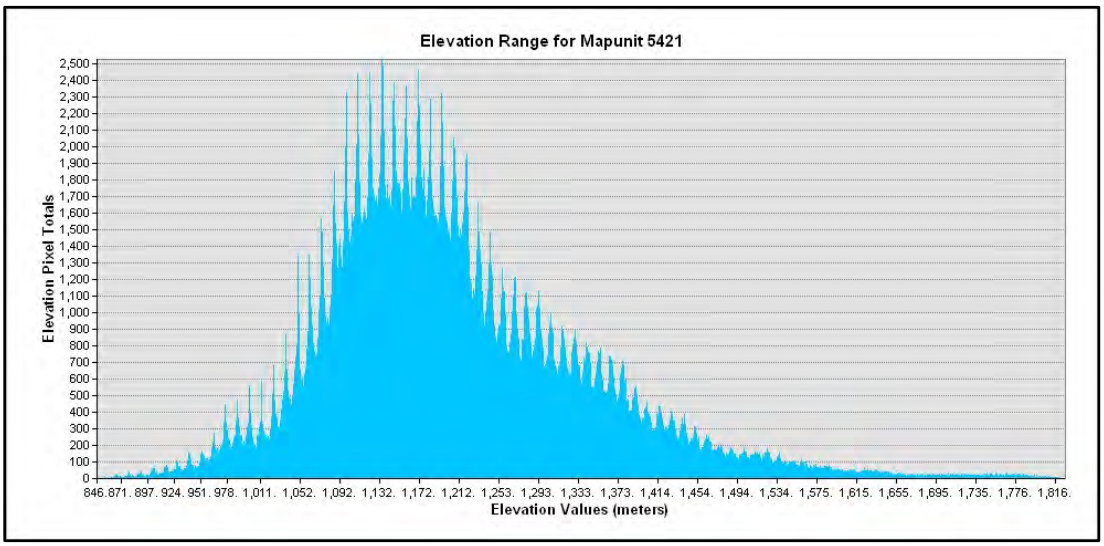
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum fasciculatum* Alliance (2221) – Overlap between these two Alliances is infrequent but may occur along the southern Sierra Nevada foothills and slopes of intermontane desert ranges. In the southern Sierra foothills, *E. fasciculatum* generally will occur adjacent to stands of *Coleogyne ramosissima* upslope on steeper terrain. Shrubs are typically smaller and tend to be lighter brown.
- *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.

5421 – *Coleogyne ramosissima* Alliance



DISTRIBUTION: *Coleogyne ramosissima* is extensively mapped in five regions of the 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.



5422 – *Purshia tridentata* Alliance

Bitter brush scrub Alliance

Purshia tridentata dominates the emergent shrub layer in this example over a shorter understory of *Eriogonum fasciculatum.* Note: This screenshot is a portion of a larger polygon whose boundaries are not shown.

In this example, *Purshia tridentata* occurs on a higher elevation fan with a sparse emergent cover of *Yucca brevifolia.* A rather dense cover of annual grasses is established in this post fire stand.

5422 – *Purshia tridentata* Alliance

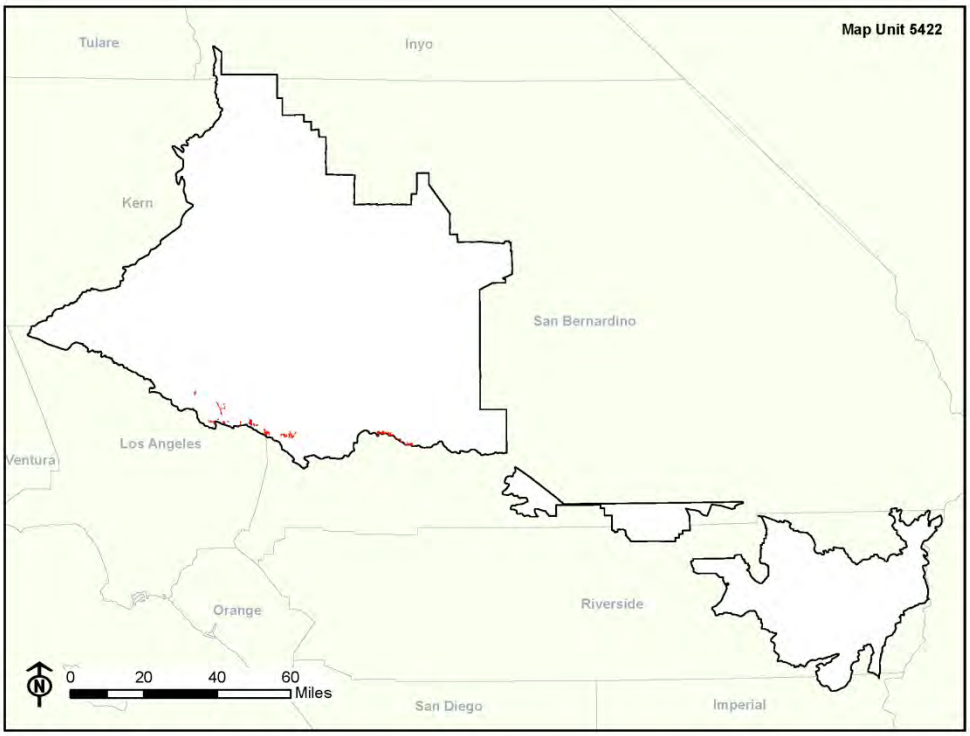
DESCRIPTION: In stands of this Alliance *Purshia tridentata* constitutes at least 2 percent absolute cover and in most cases comprises higher relative cover than any other single shrub. If *Artemisia tridentata* or *Ephedra viridis* are present, they have less than 1 percent cover. When *Purshia tridentata* co-dominates with smaller early seral shrubs such as *Eriogonum fasciculatum, Encelia actoni,* and *Ericameria linearifolia* in the understory shrub layer, the Alliance is mapped to *P. tridentata.* There are two common settings where *P. tridentata* occurs in the study area: (1) post fire type conversions from *Juniperus californica* to resprouting *Purshia*, and (2) established stands. Examples of established stands are on steep rocky slopes near Cushionberry Grade and on steep incised faces of old alluvial surfaces at the base of the San Gabriel Mountains near Valyermo, where *Purshia* is co-dominant with *Eriogonum fasciculatum*, *Encelia actoni*, and *Hesperoyucca whipplei*. Small, linear, lower-elevation stands occur on rocky terraces and irregularly flooding episodic stream channels north of State Route 18 between Pearblossom and Piñon Hills.

PHOTOINTERPRETATION SIGNATURE: *Purshia tridentata* is a medium-sized shrub with a rounded to irregularly shaped crown that has a signature color similar to that of the California juniper. In most stands, the cover of *P. tridentata* varies considerably and always contains a low shrub understory layer, usually of *Eriogonum fasciculatum*. The signature color of the emergent *Purshia* shrubs contrasts dramatically with the brown hues of the smaller *Eriogonum* shrub layer. Most stands were mapped in post fire settings, where understory annual grasses yielded a typical yellow-tan color, which contrasted with the brighter, sparsely vegetated substrate of the adjacent unburned vegetation.

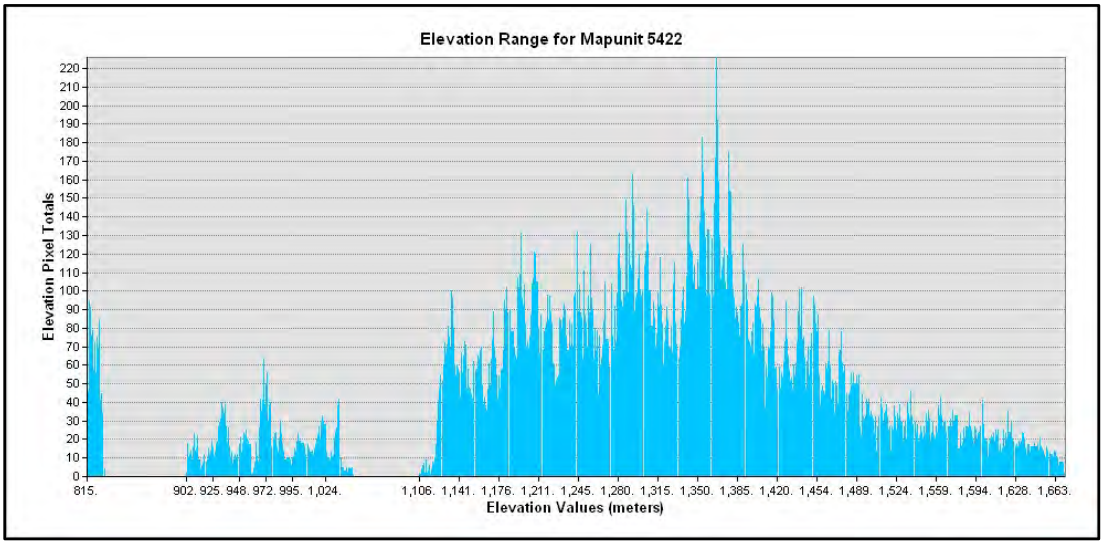
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Juniperus californica* Alliance (1122) – *Juniperus californica* typically has a much larger crown and is more consistently rounded. Individual trees are significantly taller and yield definitive shadowing. Unlike stands within the *Purshia tridentata* Alliance, most juniper stands are not found in post fire settings, and therefore generally do not have an early recovery shrub layer. The contrasting understory layers in both of these types are an important factor in helping differentiate their typical disturbance-related settings and thus aid in discriminating between the two Alliances.
- *Prunus fasciculata* Alliance (4214) – Although *Prunus fasciculata* is not exclusive to wash environments, where the two types occur in proximity to each other, *Prunus* is more likely to be found in the washes. *Prunus fasciculata* has a darker signature with less of a green hue. Shrubs are generally larger and less rounded.

5422 – *Purshia tridentata* Alliance

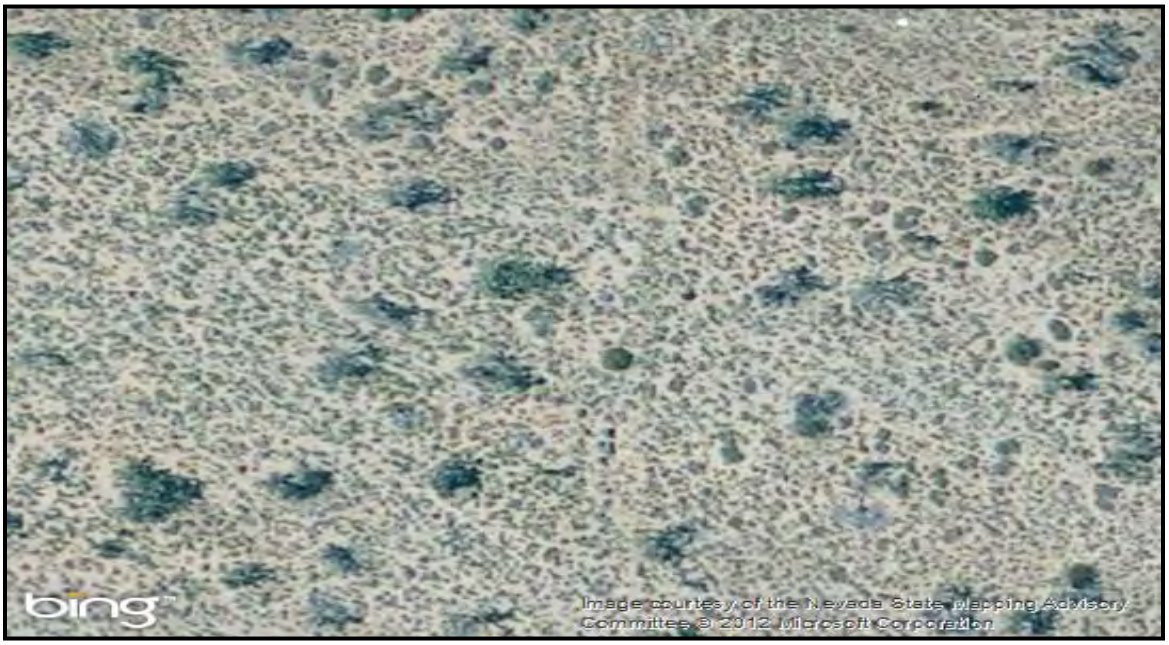


DISTRIBUTION: *Purshia tridentata* occurs in two distinct areas of the study: in the San Gabriel Mountain toe slopes near the Piñon Hills and Phelan area, and along the toe slopes of the San Bernardino Mountains south of Fifteenmile Valley.



5423 – *Yucca brevifolia* Alliance

Joshua tree woodland Alliance



In this example *Yucca brevifolia* occurs as multiple-crowning individuals in cover between 3 and 5 percent over a mixed shrub layer comprised mostly of *Eriogonum fasciculatum.* 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 an inconsistent shrub cover of *Atriplex polycarpa.* Dense annuals (mainly *Bromus rubens*) form a distinct herbaceous layer in the foreground.

5423 – *Yucca brevifolia* Alliance

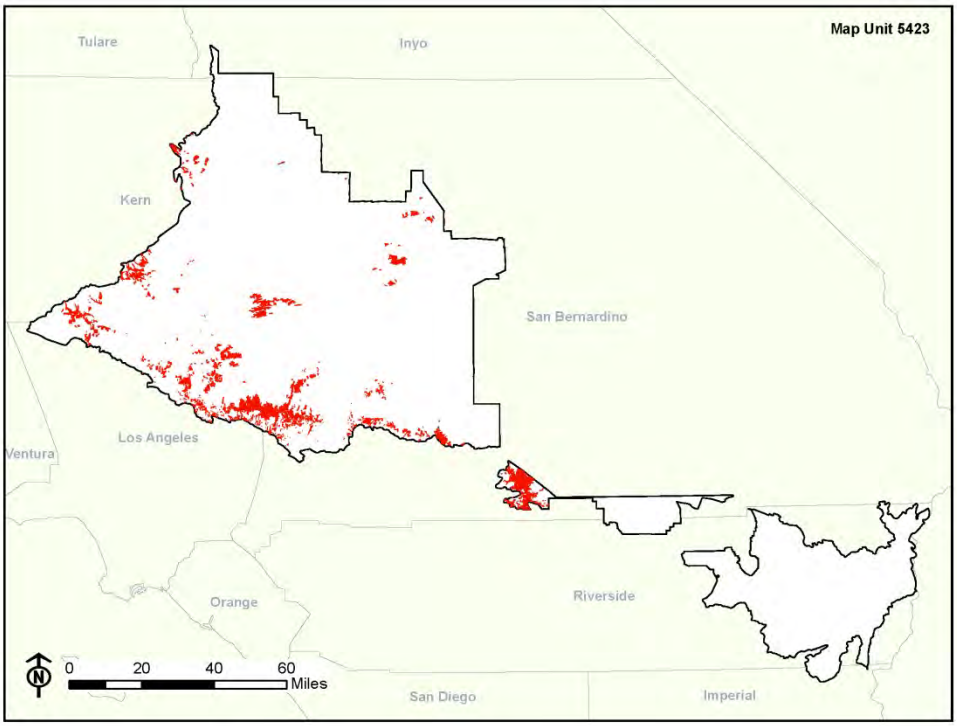
DESCRIPTION: *Yucca brevifolia* must be evenly distributed, not scattered and clumped, and must be at least 1 percent absolute cover to map a stand as this Alliance. Although they usually only comprise between 1 and 5 percent cover, the highest cover of *Y. brevifolia* may reach 10 percent in clonal 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 are 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.

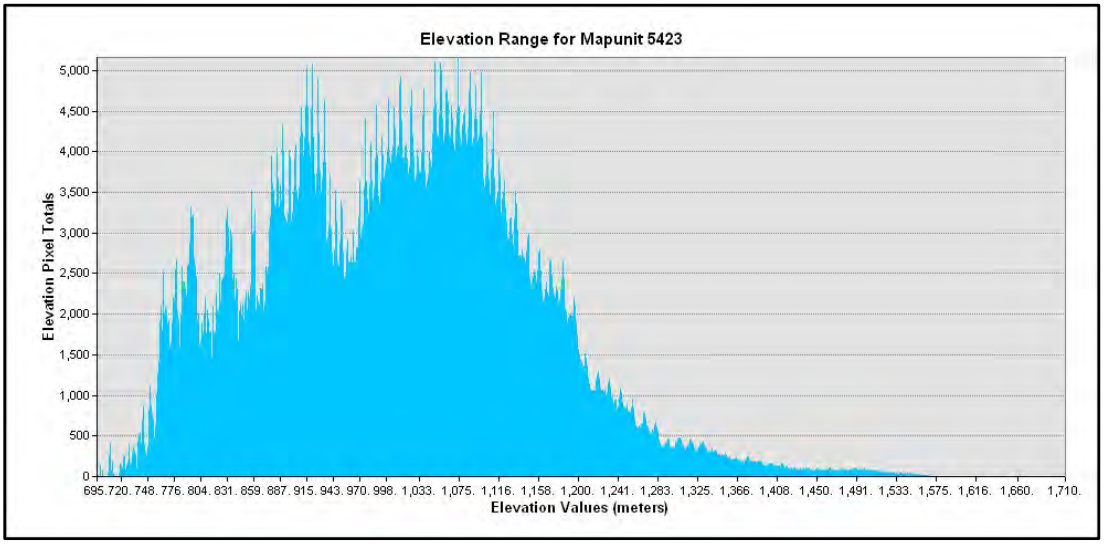
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 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.



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, *Yucca schidigera* appears as the widely scattered succulent shrub that forms a component to a variable cover of *Larrea tridentata.* Dense annual bromes characterize the herbaceous layer.

5424 – *Yucca schidigera* Alliance

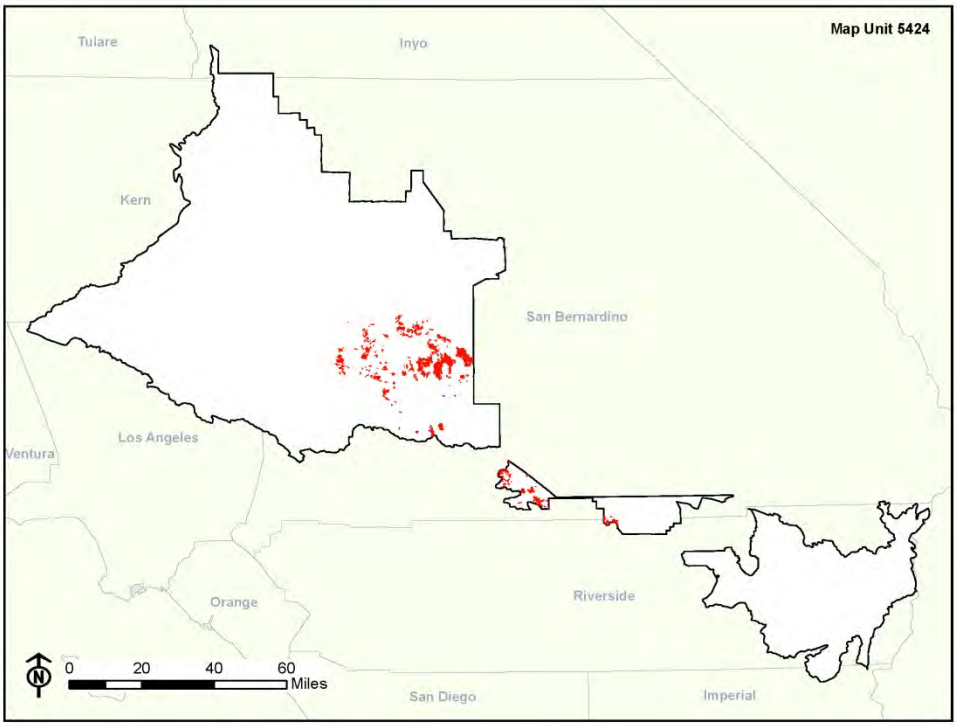
DESCRIPTION: In stands of this Alliance *Yucca schidigera* is conspicuous, evenly distributed and generally comprises at least 1 percent absolute cover. At lower elevations, stands may have *Larrea tridentata, Ambrosia dumosa*, and other shrubs at equal or even higher cover. At upper elevations *Yucca 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 toe slopes, 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.

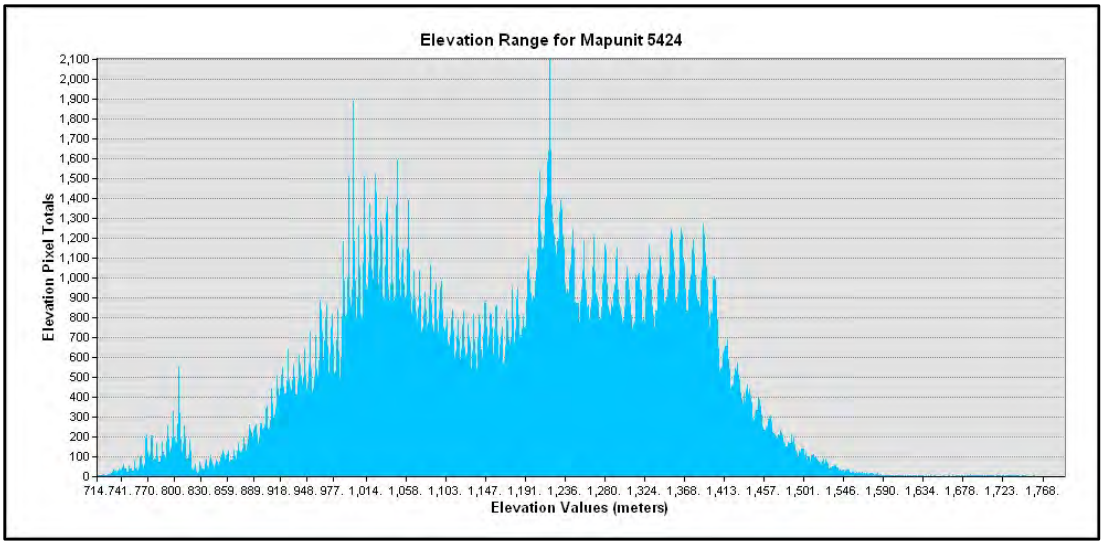
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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

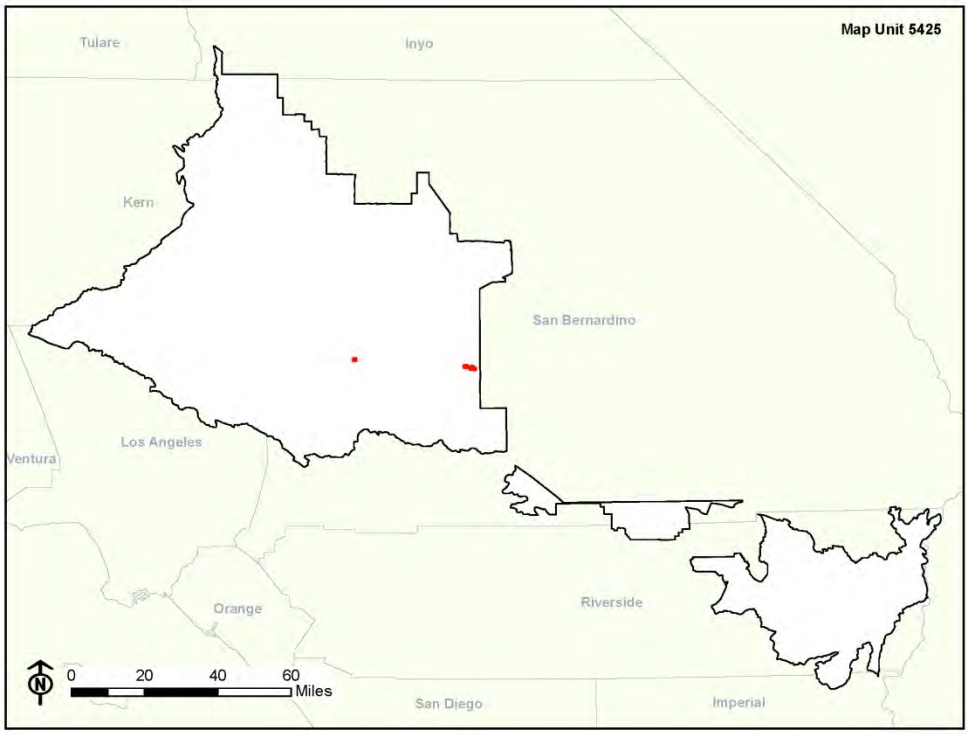


DISTRIBUTION: Almost all mapped stands of this Alliance occur east of the Mojave River and south of Interstate 40, with the highest concentration of polygons and largest stands occurring on lower slopes of the Ord Mountains and on the alluvial fans surrounding them. Smaller stands occur in higher elevations toward the eastern end of Lucerne Valley and on fans near the towns of Yucca Valley and Joshua Tree.



5425 – *Menodora spinescens* Alliance

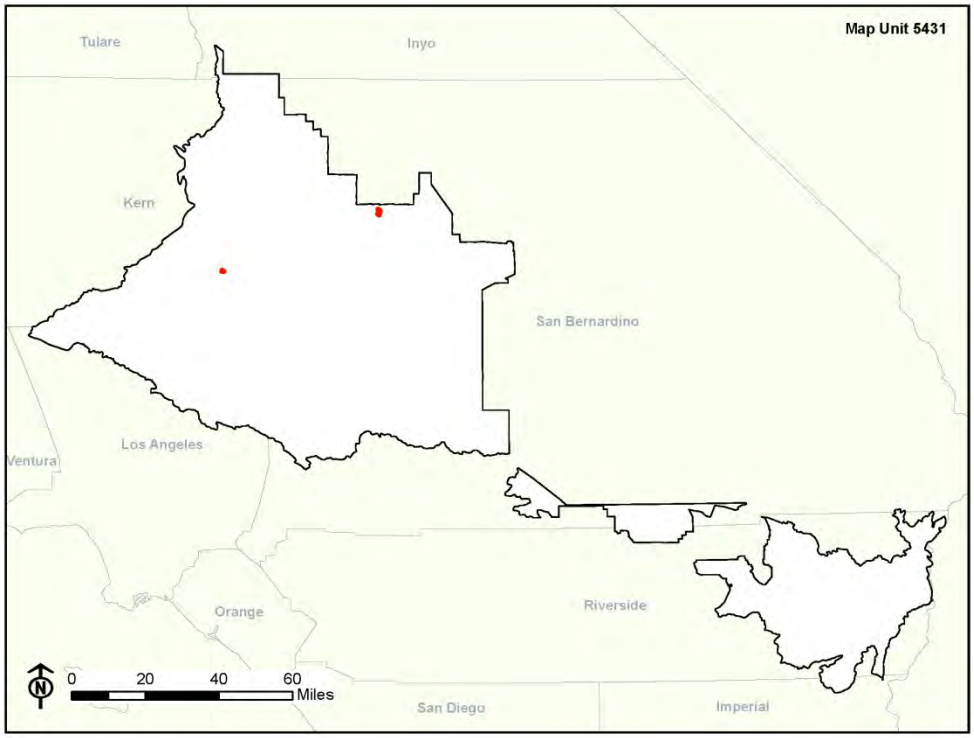
Greenfire scrub Alliance



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. The majority of the stands of this Alliance occur to the northeast of the mapping area in the central and northeastern Mojave Desert. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

5431 – *Achnatherum speciosum* Alliance

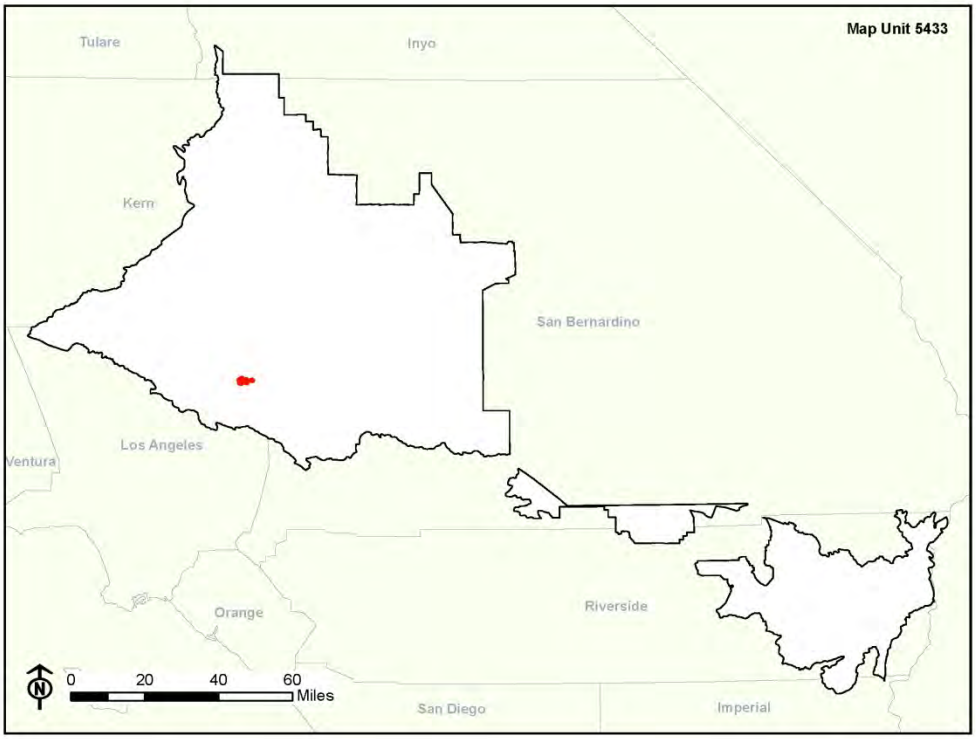
Desert needlegrass grassland Alliance



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 associated with recent fires in mid-elevation zones of the desert often adjacent to *Grayia spinosa*, *Atriplex canescens*, or *Krascheninnikovia lanata* Alliance stands. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

5433 – *Achnatherum hymenoides* Alliance

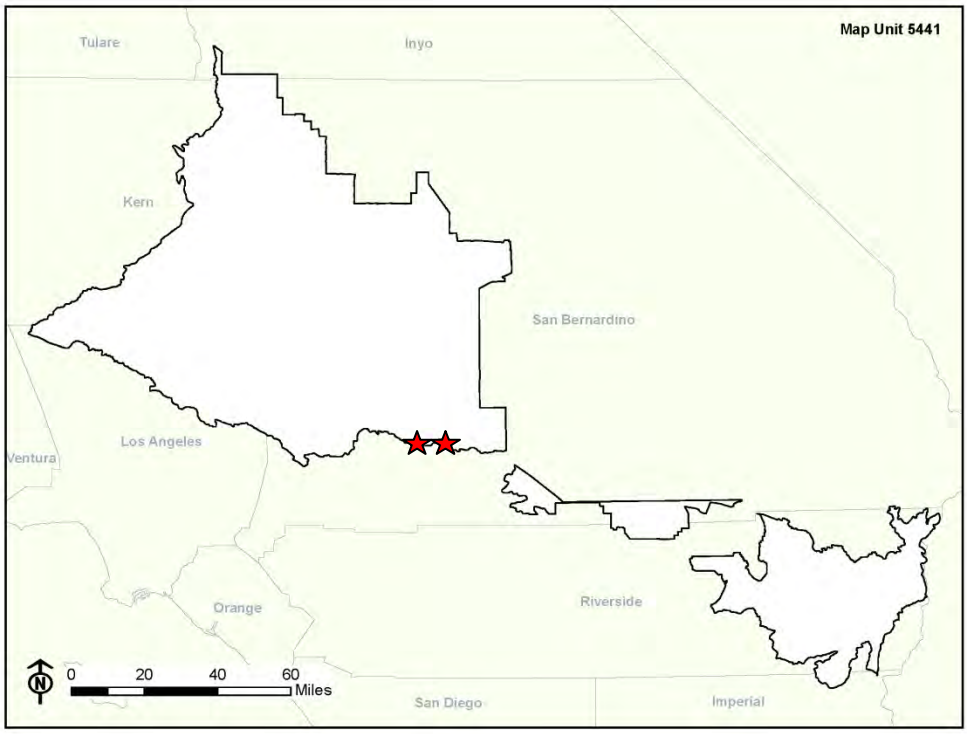
Indian rice grass grassland Alliance



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. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

5441 – *Cercocarpus ledifolius* Alliance

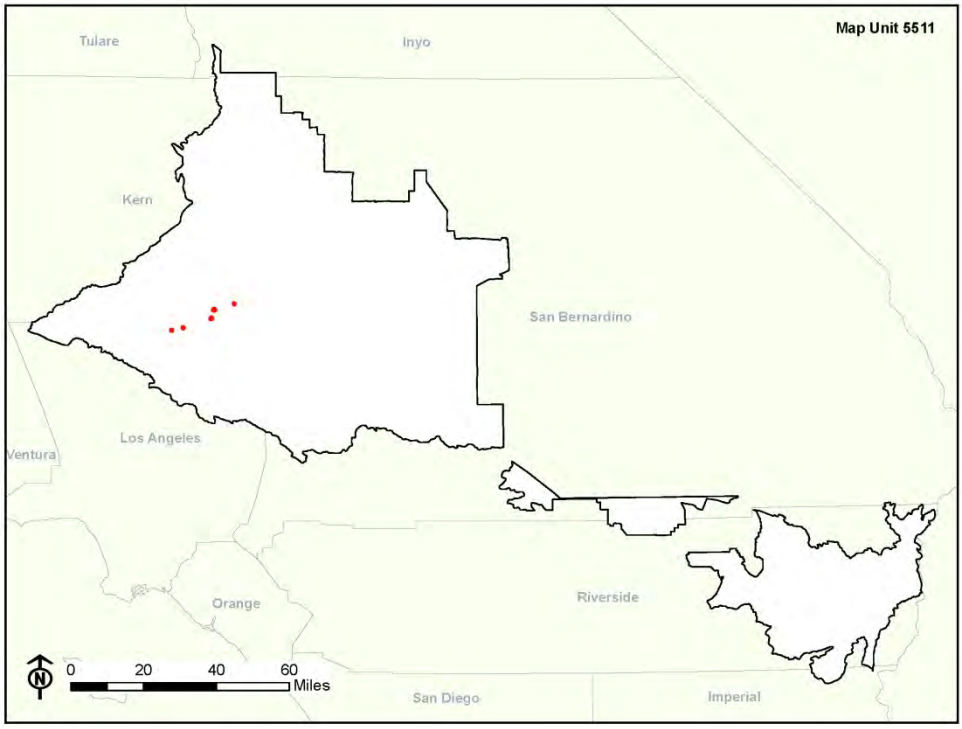
Curl leaf mountain mahogany scrub Alliance



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. Two small stands occur on limestone very near the edge of the study area at the north base of the San Bernardino Mountains near Cushenbury Canyon. Note: In the distribution map above, star symbols have been placed on the polygons for display purposes.

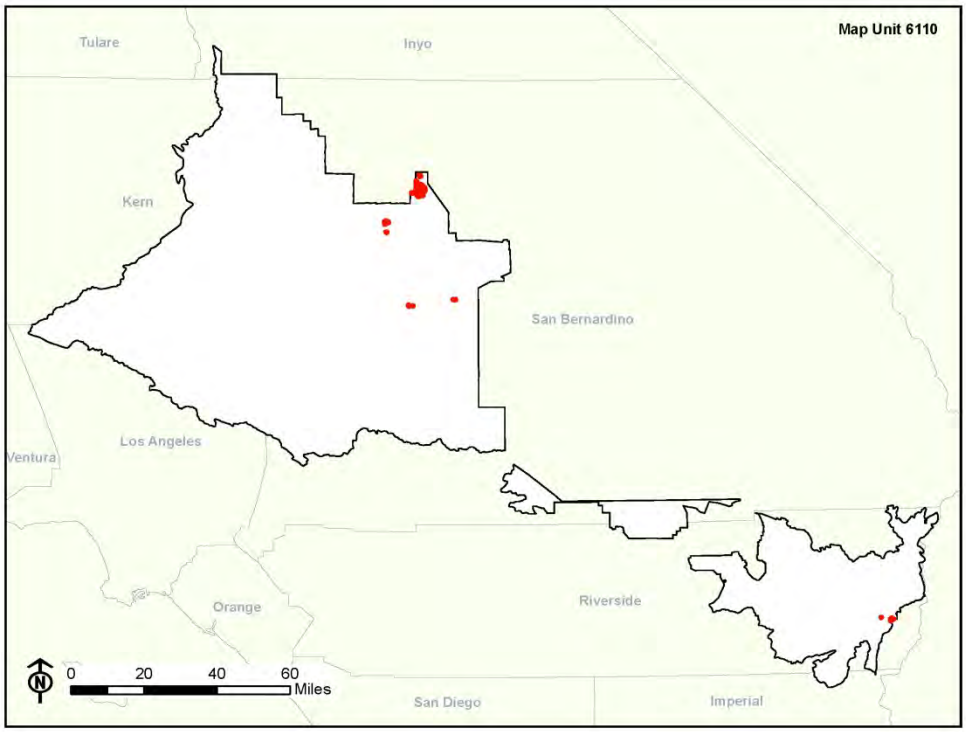
5511 – *Sarcobatus vermiculatus* Alliance

Greasewood scrub 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. The stands in and immediately west of Edwards Air Force Base are presumed to be the westernmost occurrence of this Alliance in the Mojave ecoregion. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

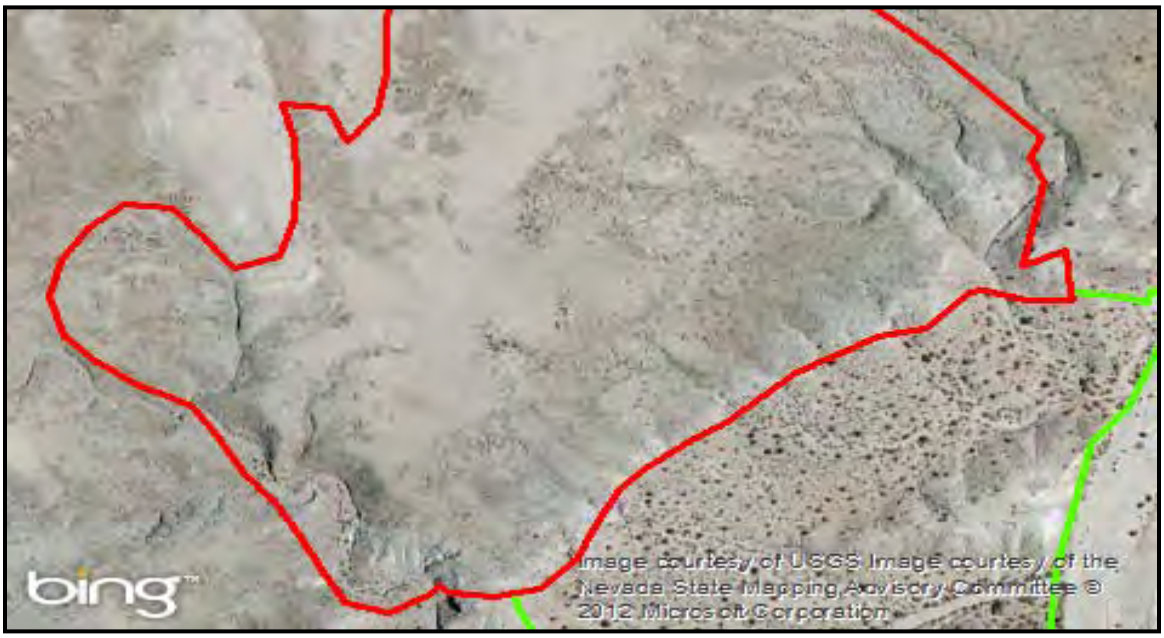
6110 – North American warm desert bedrock cliff and outcrop Group



DISTRIBUTION: These stands are mapped at the Group 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. Although all desert rock outcrops have some associated vegetation, it is difficult to differentiate and define. This Group encompasses a different suite of species than found in other sparsely vegetated desert vegetation types such as playas, dunes, and desert pavements. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

6111 – *Atriplex hymenelytra* Alliance

Desert holly scrub Alliance



The image shows *Atriplex hymenelytra* Alliance on light-colored alkaline soils in the southern Searles Valley.

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

6111 – *Atriplex hymenelytra* Alliance

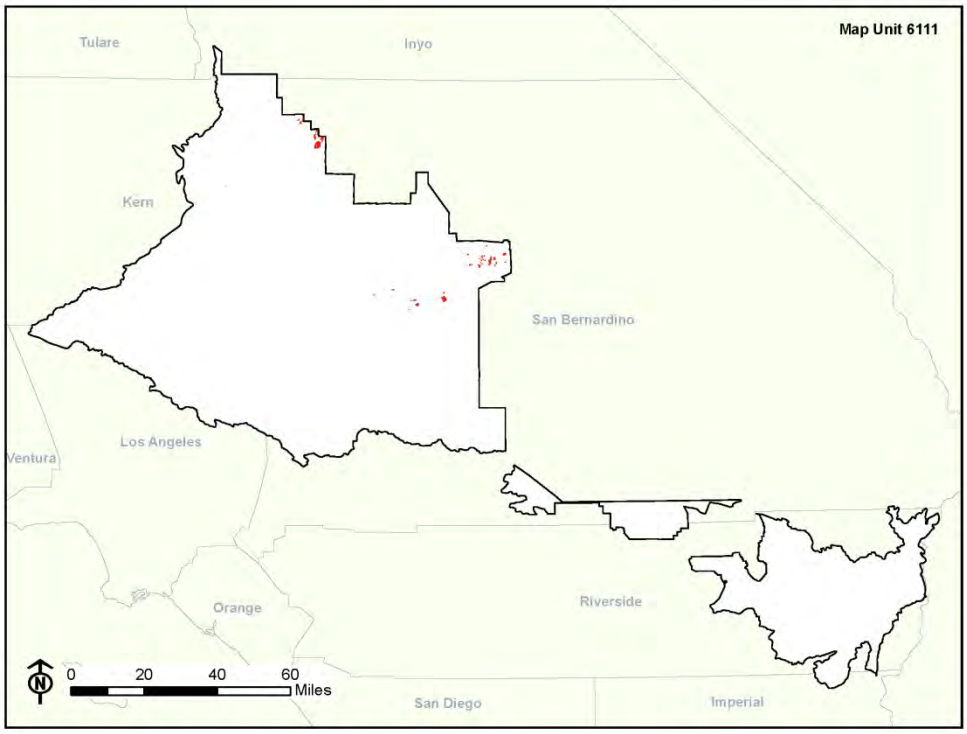
DESCRIPTION: *Atriplex hymenelytra* comprises more than 1 percent of the cover and no other woody species has equal or higher cover. This Alliance may occur on hot rocky slopes, dry bajadas, or alkaline badlands and playa edges. Stands are local in the extreme north of the mapped area near Ridgecrest 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* Alliance is mapped from ground assessed points, then extrapolated locally. The signature shows a very sparse cover of shrubs with a white to light tan rocky substrate, similar to the Mud Hills Mapping Unit (6113). 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.

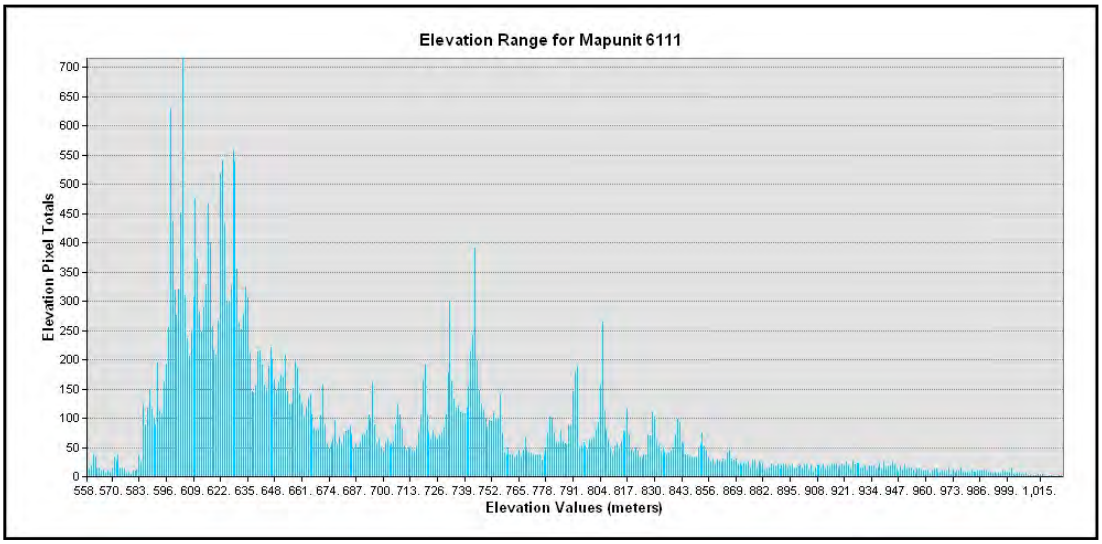
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- 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 *S*parsely 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 mapped to this type.

6111 – *Atriplex hymenelytra* Alliance



DISTRIBUTION: The *Atriplex hymenelytra* Alliance is mapped in three areas within the 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.



6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit

This image in the Mud Hills area shows the mottled 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 rocky substrate at the Rainbow Basin Natural Area in the Mud Hills northwest of Barstow.

6113 – Mud Hills sparsely vegetated ephemeral herbs Mapping Unit

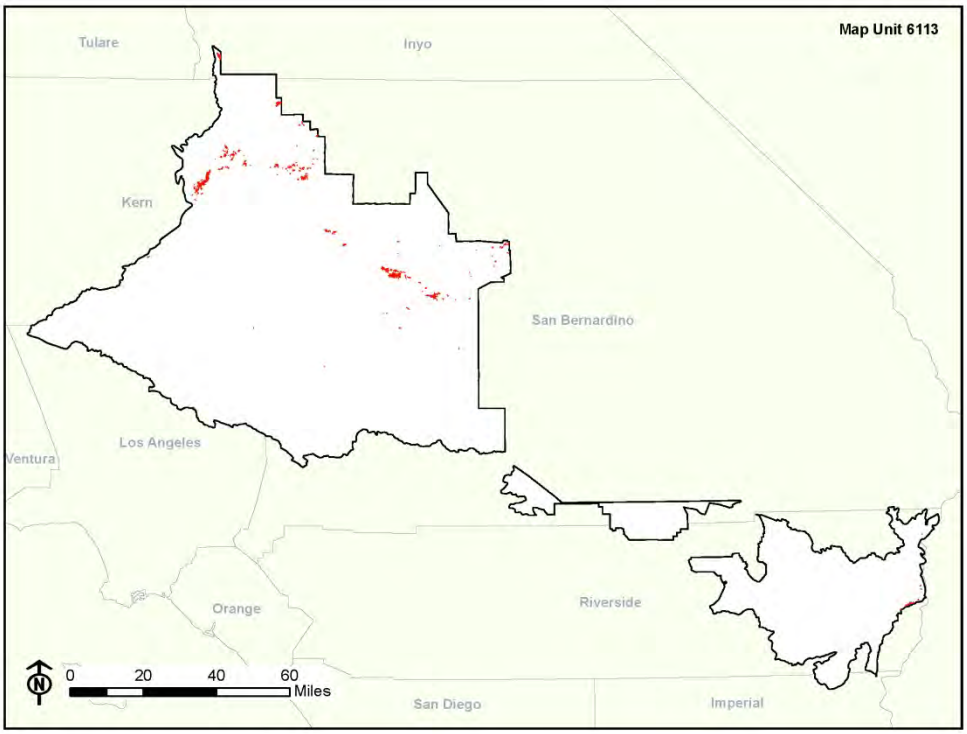
DESCRIPTION: This mapping unit is usually sparsely vegetated with less than 2 percent shrub or herb cover. Substrate is composed of unconsolidated and uncemented fine, sometimes alkaline, sediments. These substrate variations result in highly diverse but typically sparsely vegetated slopes. The landscape 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.

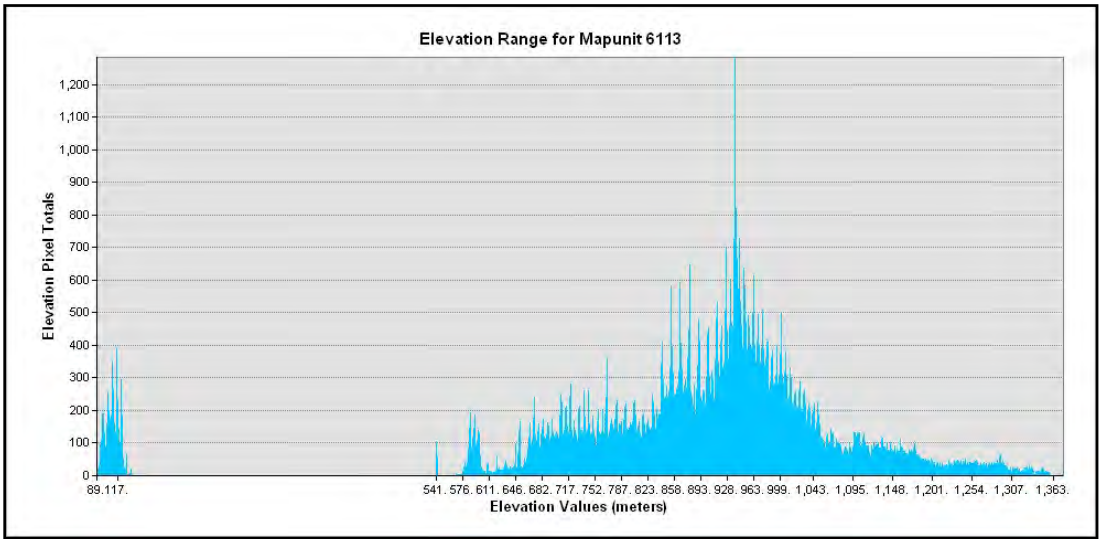
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex hymenelytra* Alliance (6111) – Small light-colored *A. hymenelytra* shrubs are consistently scattered with over 2 percent cover. This type is generally mapped from field data and locally extrapolated.
- Massive sparsely vegetated rock outcrop Mapping Unit (6115) – Signature usually shows extensive rough hard-surface terrain, usually not in an eroded badland pattern.

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.



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.

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

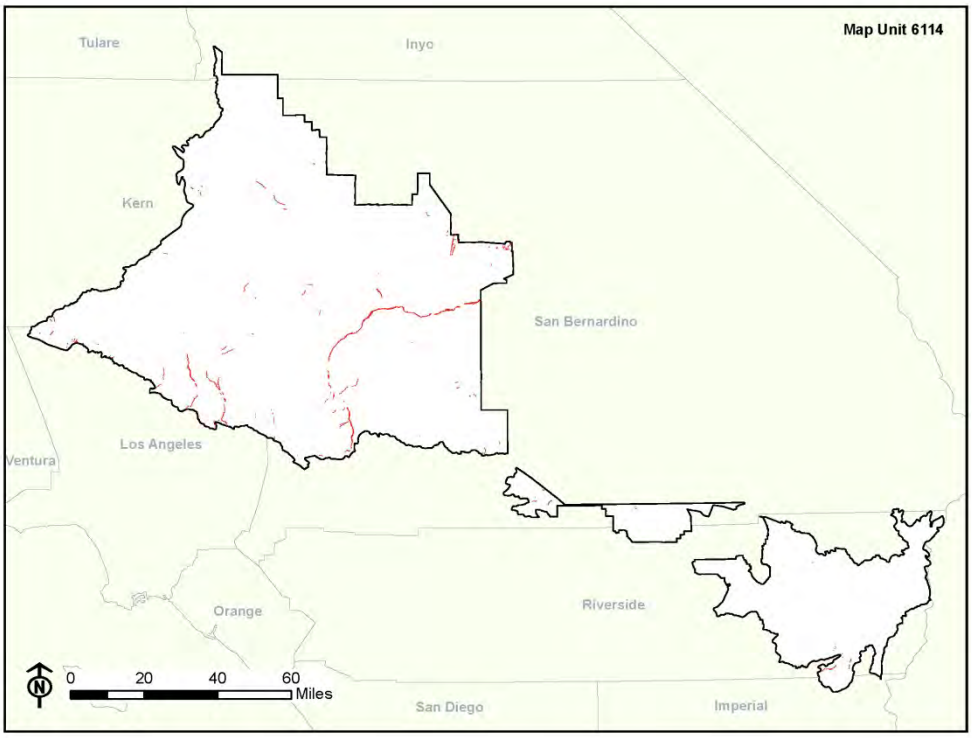
DESCRIPTION: This mapping unit is distinguished by largely unvegetated sands and gravels in the active centers of washes throughout the study area. Recent or frequent flooding generally hinders the development of woody and perennial vegetative growth. Due to varying flooding frequencies and intensities, "river-wash" channels can change rapidly and regularly, alternating from unvegetated to vegetated by annual natives and 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 2010 NAIP 1-meter imagery as a base 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.

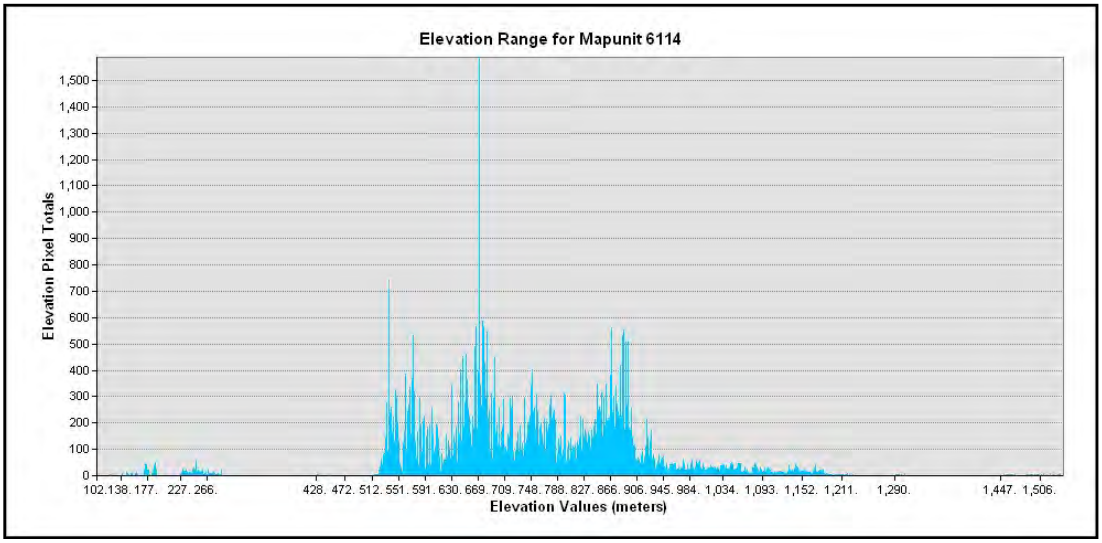
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Panicum urvilleanum* Alliance (6122) – This type occurs in broad river washes, or on low sand dunes. The signature shows gray dots representing 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.

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 study area, especially at the base of mountains and on upper elevation fan/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 far less common in the Colorado Desert portion of the study area.



6115 – Massive sparsely vegetated rock outcrop Mapping Unit

The above image depicts a sparsely vegetated Mesozoic granitic outcrop near Fremont Peak. 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 in the Big Maria Mountains 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

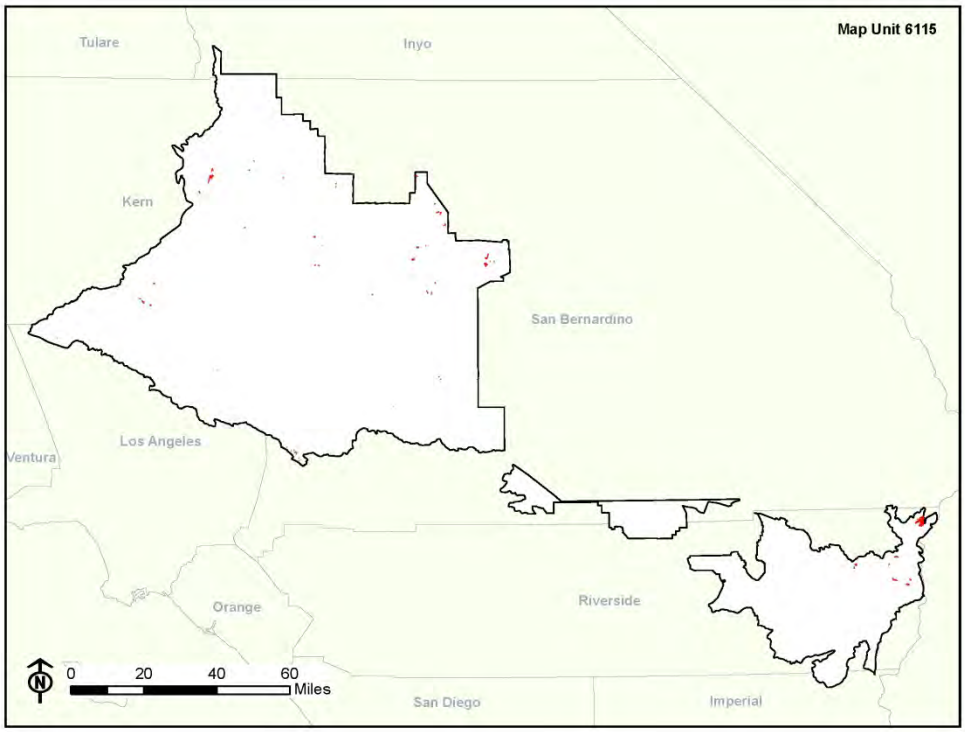
DESCRIPTION: This mapping unit is defined by extensive solid blocks of resistant rock of any type. In the study area these may be volcanic extrusives such as basalt or rhyolite; igneous intrusives such as granodiorite, gabbro, or quartz monzonite; or sedimentary sandstones or limestones, etc. Large unfractured bedrock or boulders are typical, with narrow crevices in different densities. Overall shrub and herb cover tends to be under 5 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,* and other Alliances. 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. The constant variation of positive and negative surfaces results in shadowing throughout the area.

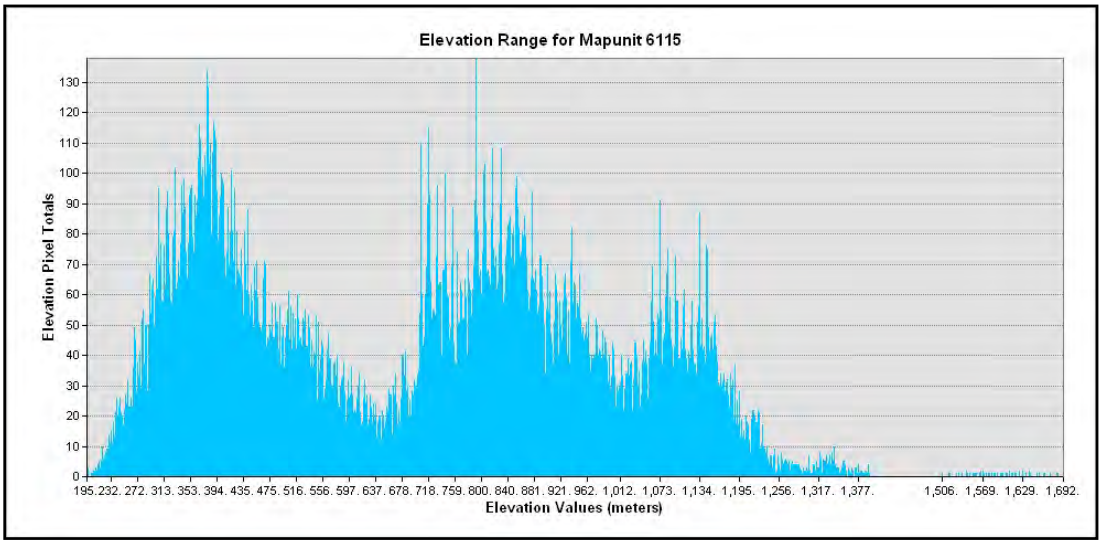
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Encelia farinosa* Alliance (4114) – This type has greater than 2 percent cover of shrubs as light gray individual shrubs on dark volcanic rock.
- *Atriplex hymenelytra* Alliance (6111) – This sparsely vegetated Alliance is generally mapped on pavement surfaces or on the Mud Hills sparsely vegetated ephemeral 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 badland in nature, with smooth-textured interfluves. Terrain does not have a hard, broken-up, rough-surface character.

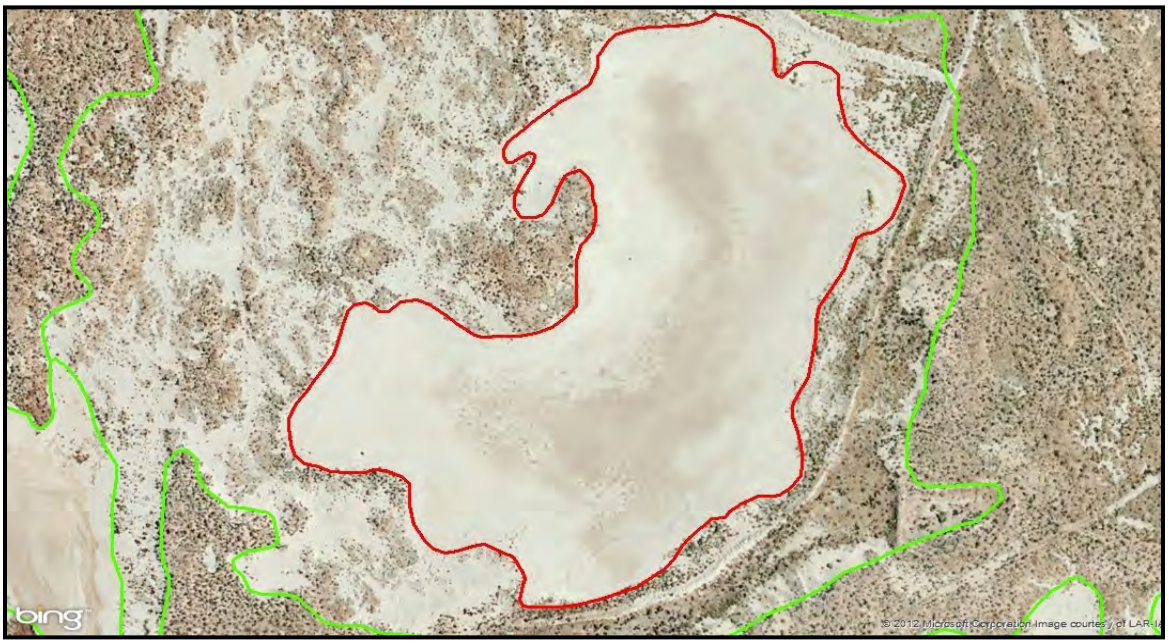
6115 – Massive sparsely vegetated rock outcrop Mapping Unit



DISTRIBUTION: This sparsely vegetated type occurs on bedrock over widely scattered areas of both the Mojave and Colorado Desert portions of the 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.



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

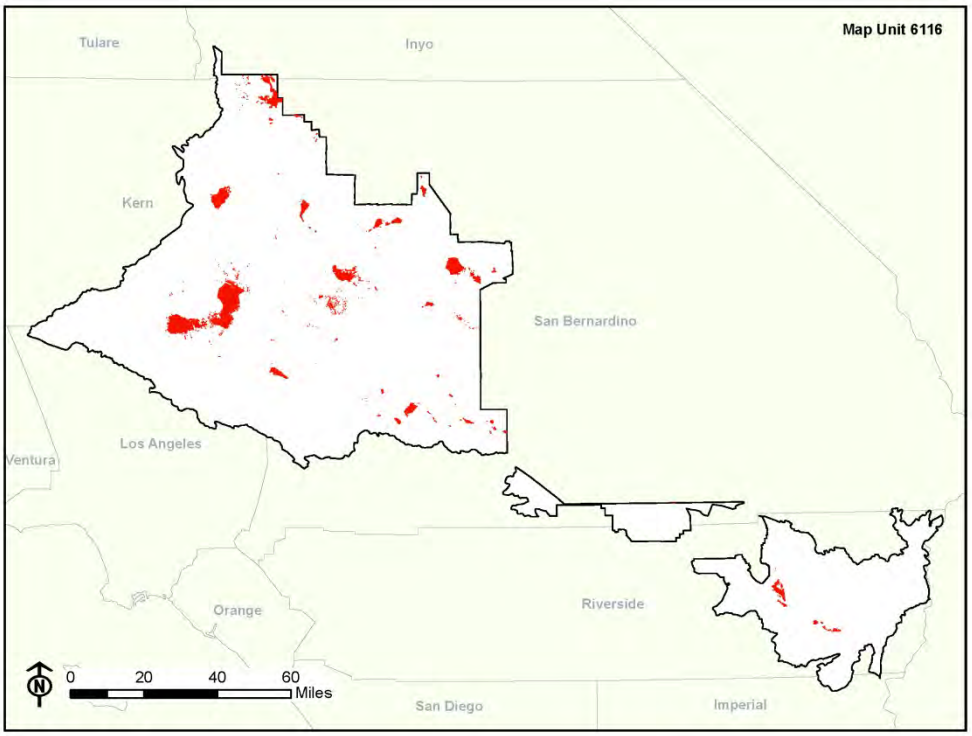
DESCRIPTION: This mapping unit defines silty, clay, or salt crust playa (dry lake) surfaces throughout the study area. Characteristics include moderate to highly reflective cracked substrate with no obvious slope. Most of the time playas, whether they are salty, silty, or clay, have less than 2 percent 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.

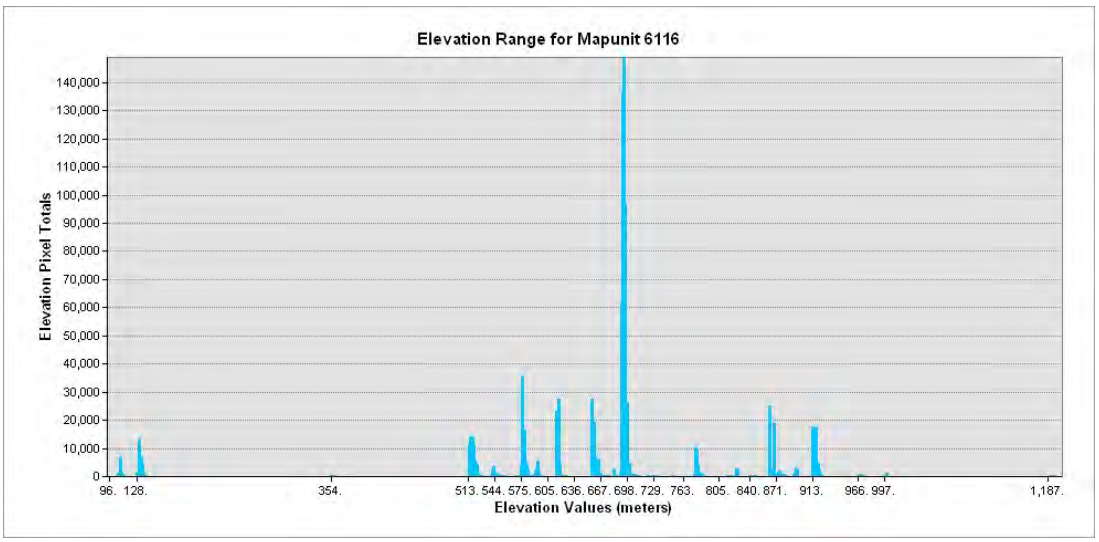
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Types within the California Annual and Perennial Grassland Macrogroup (2300) – Most of the time 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.
- *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 mapping unit is also distinguished by dissecting rills that many times are vegetated and run throughout the pavement surface.

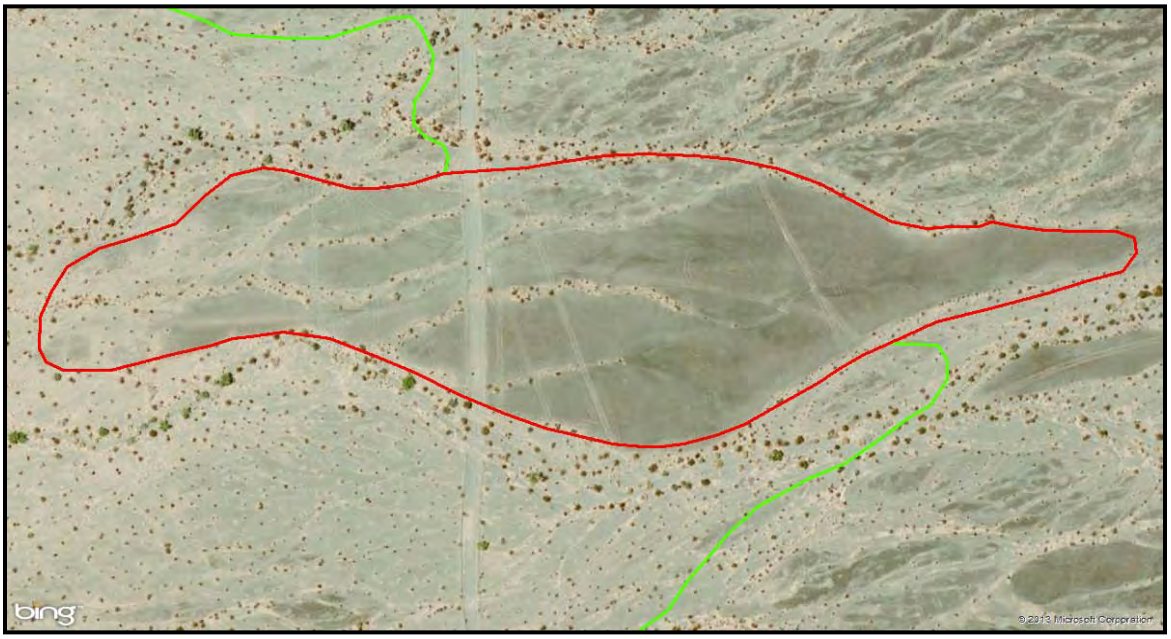
6116 – Sparsely vegetated playa (Ephemeral annuals) Mapping Unit



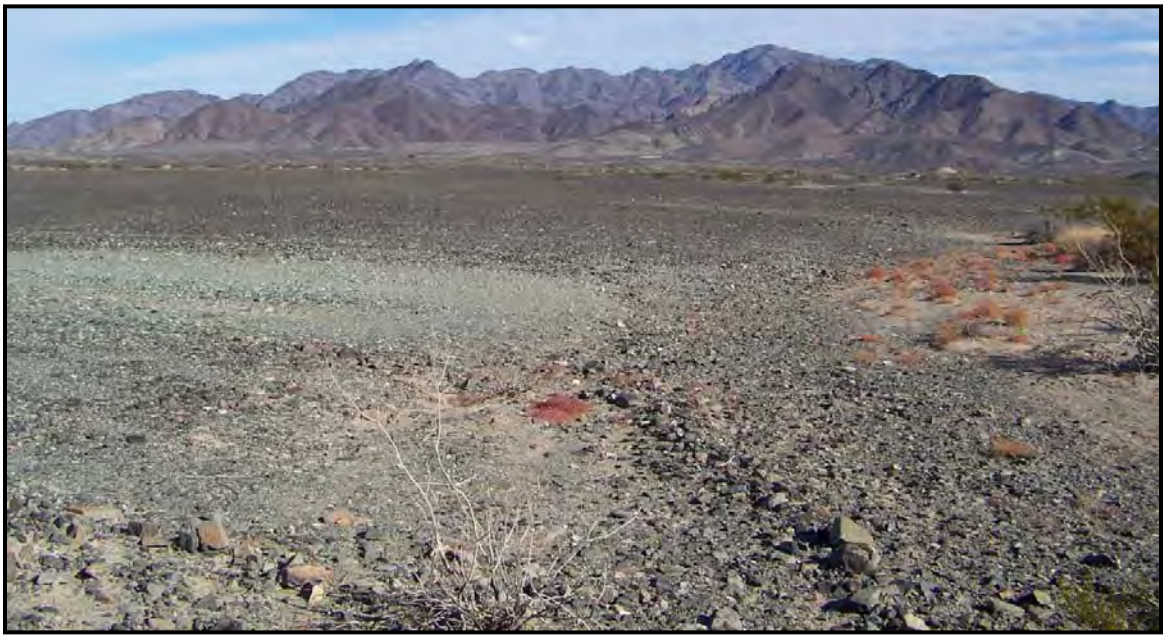
DISTRIBUTION: The Sparsely Vegetated Playa (Ephemeral annuals) Mapping Unit is found in every region of the study area. This type is comprised of larger endorheic basins such as Rogers and Palen Dry Lakes as well as smaller alkali sink complexes that occur southeast of Kramer Junction.



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



This Desert Pavement example is on the upper bajada on the west flank of the Palen Mountains. Note the 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*. This example is at the base of the west side of the Palen Mountains.

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

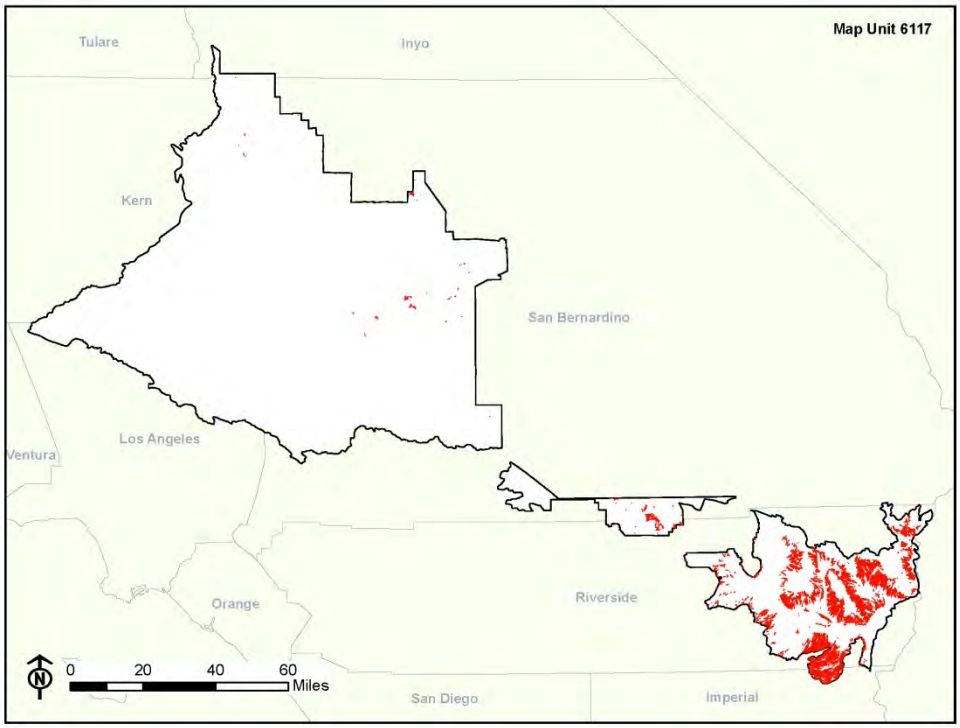
DESCRIPTION: This mapping unit is extremely sparse, dark, and unvegetated to a large degree even in good rainfall years. Photo signature is usually distinctive and often looks like asphalt pavement. No evenly spaced shrubs are present. Vegetative cover is less than 2 to 4 percent, mainly from the narrow 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 some also occur 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.

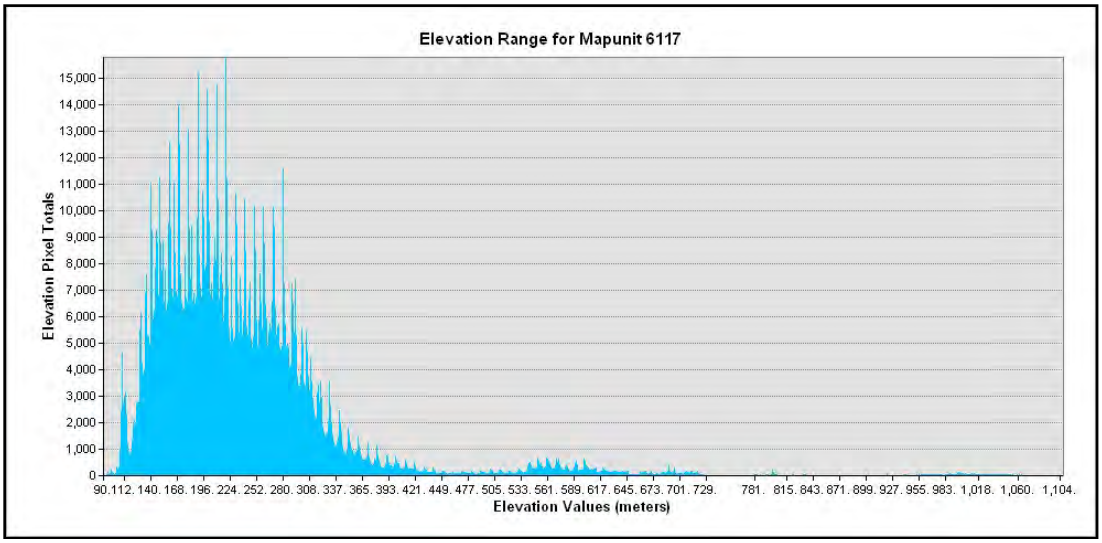
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- *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.
- 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

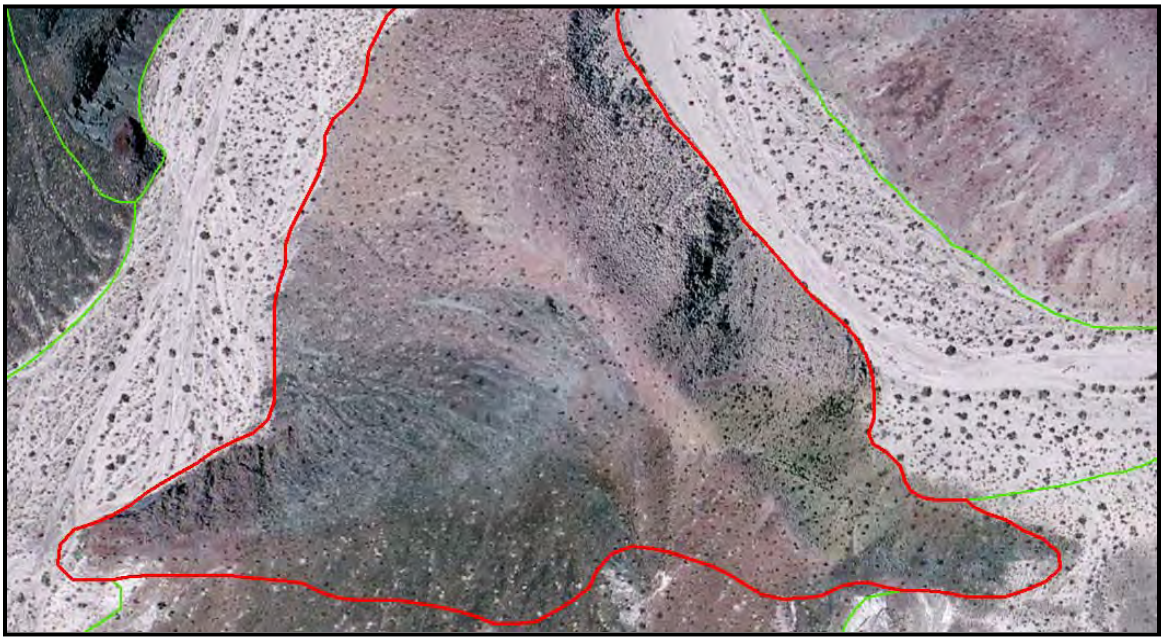


DISTRIBUTION: Most of the polygons mapped to the *Chorizanthe rigida - Geraea canescens* Desert Pavement Sparsely Vegetated Alliance occur in the Colorado Desert on middle to upper bajadas flanking all the mountains in that region. In the Central Mojave Region they are primarily mapped on bajadas nearby and adjacent to the Pinto Mountains, and at the base of the Calico and Alvord Mountains. In the Western Mojave they are on bajadas adjacent to the El Paso Mountains.



6118 – *Peucephyllum schottii* Alliance

Desert fir Alliance



This image shows a *Peucephyllum schottii* stand with low cover on a steep, rocky slope.

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

6118 – *Peucephyllum schottii* Alliance

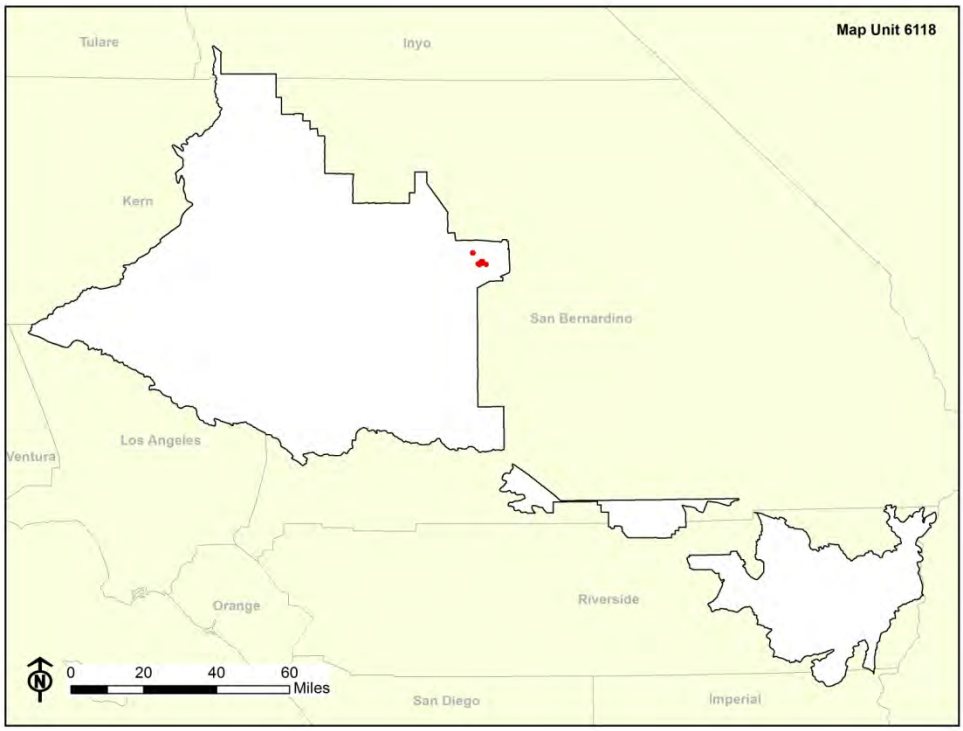
DESCRIPTION: Polygons mapped as this Alliance are dominated or characterized by *Peucephyllum schottii*, often at low (1 to 5 percent) cover. No other indicator shrubs are present in greater cover or dispersion. This arborescent shrub is vivid green and densely leafy, with narrow, almost needle-like 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.

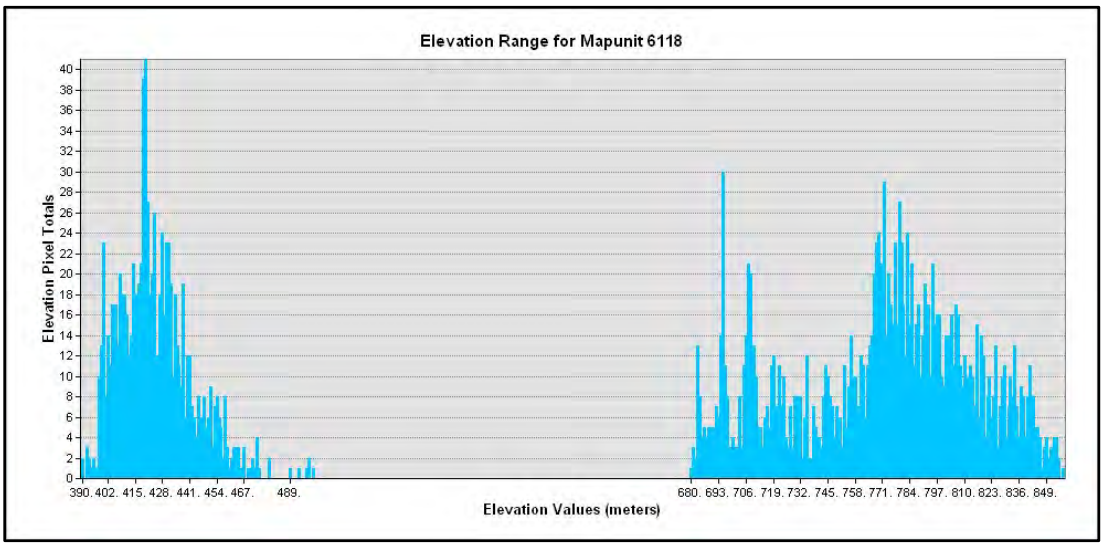
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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 shadow.

6118 – *Peucephyllum schottii* Alliance



DISTRIBUTION: All mapped occurrences are in the Alvord Mountains, although smaller, below-MMU stands were noted elsewhere, such as Red Rock Canyon. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



6120 – North American warm desert dunes and sand flats Group

The image shows a typical white signature of a sandy flat with minor small dunes within the Mojave River floodplain east of Yermo.

Low dunes and sand flats with very sparse vegetation is exhibited in this ground shot of the Mojave River east of Yermo.

6120 – North American warm desert dunes and sand flats Group

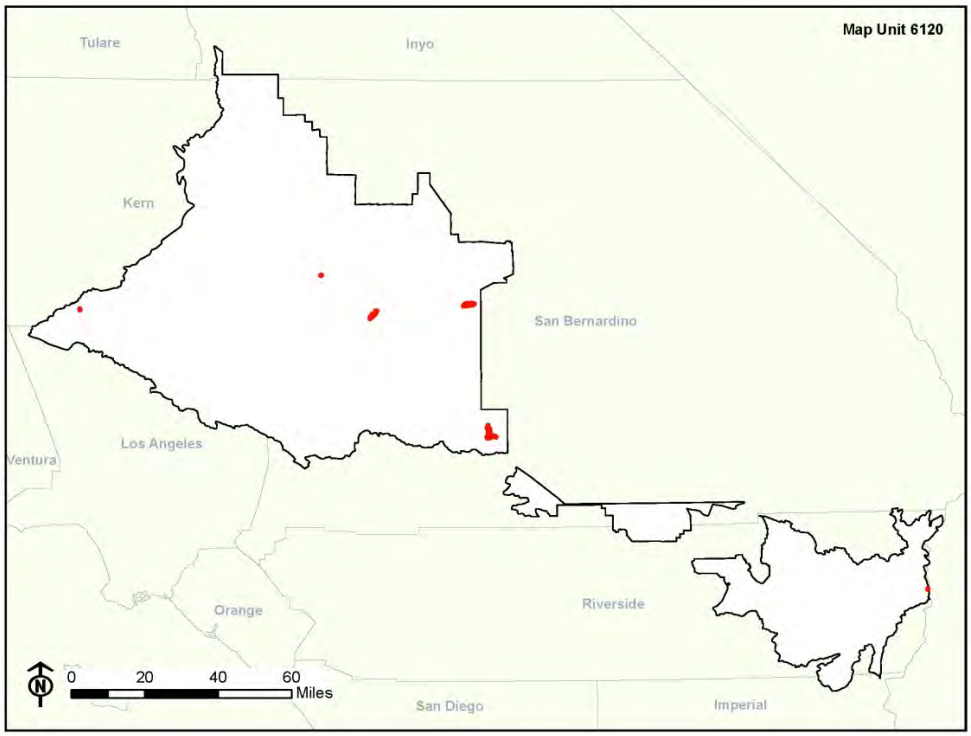
DESCRIPTION: This category was used for sparsely vegetated to unvegetated sand dunes and sandy flats. The vegetation type was assigned to the Group level when signature and ecological characteristics were inconclusive, making photointerpretation and modeling/extrapolation for specific Alliance calls difficult. In our 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 are mapped from field data and locally extrapolated.

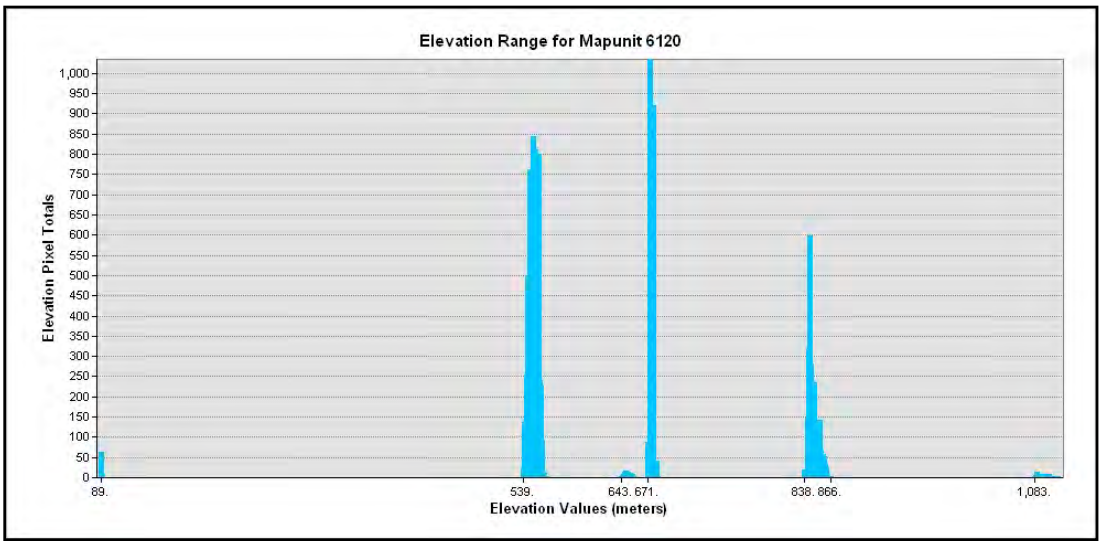
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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.
- 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.
- *Dicoria 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.
- *Panicum urvilleanum* Alliance (6122) – This type occurs in broad river washes within our 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.
- *Wislizenia refracta* Special Stands (6123) – The dune is a complex of high and low areas. The perennial herbs have small crowns and stand as individuals or are gathered in clumps and patches throughout the lower relief areas. Mapped stands are limited to the margins of Palen Dry Lake.

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. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.



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 between Palen Dry Lake and the Palen Mountains. Note the east-west linear dune pattern.

The dunes depicted on this photo represent the eastern edge of the Rice Valley Sand Dunes, located in the BLM's Rice Valley Wilderness. The *Oenothera deltoides* (dune primrose) pictured in the inset may be encountered in this environment.

6121 – *Dicoria canescens – Abronia villosa* Alliance

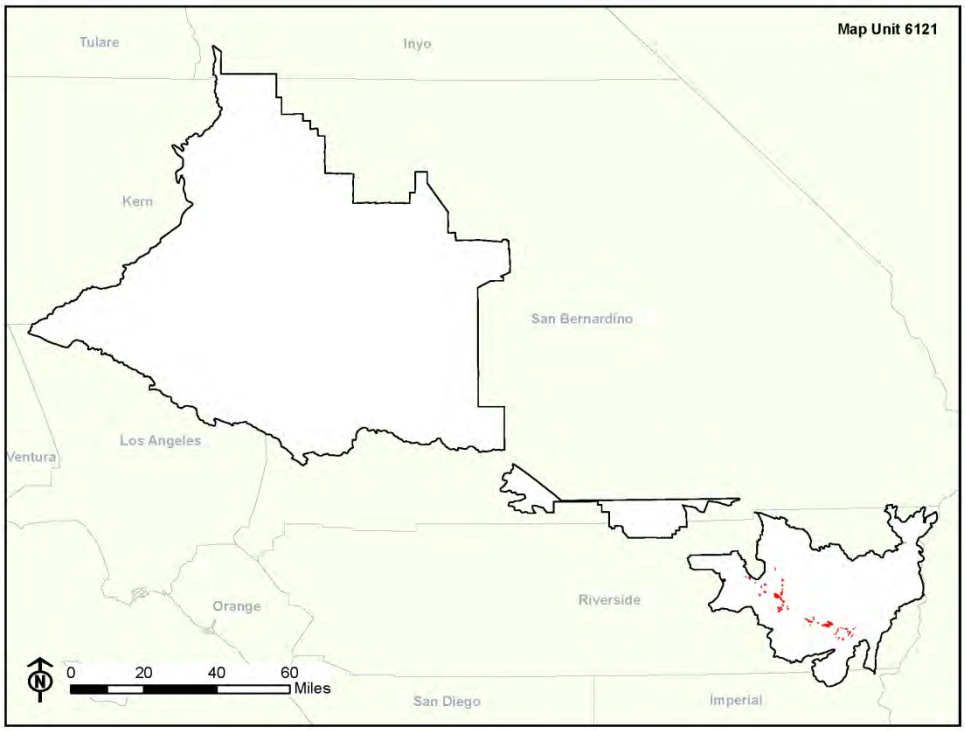
DESCRIPTION: *Dicoria canescens* or *Abronia villosa* are characteristically present in stands, but are not necessarily dominants, depending upon the year and the phenology of these annual plants. Skeletons of *Dicoria, Oenothera deltoides, Abronia villosa* and other psammophytic annuals are usually 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.

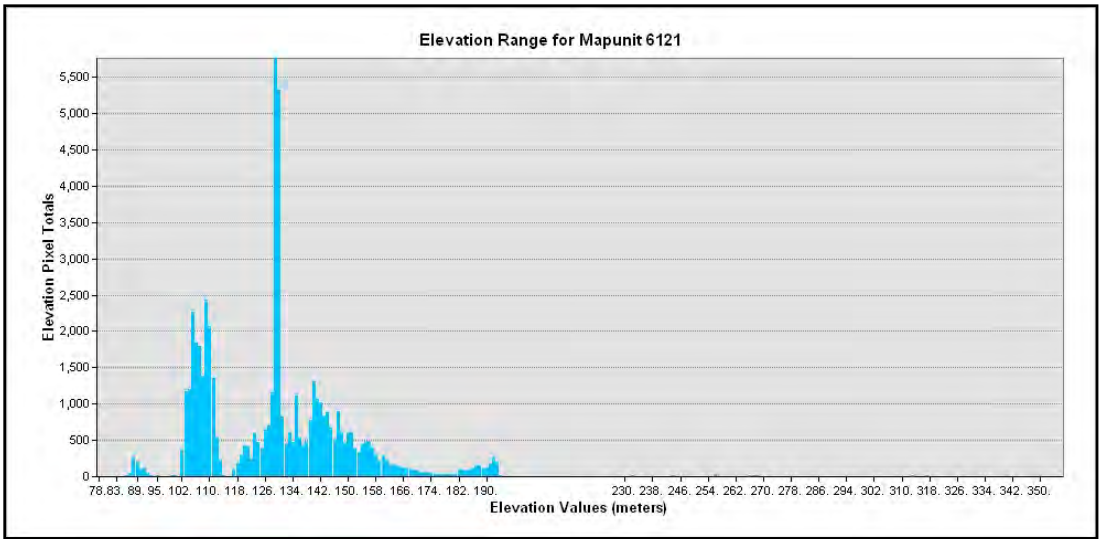
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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, 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 in the Western and Central Mojave Regions.
- *Wislizenia refracta* Special Stands (6123) – The dune is a complex of high and low areas. The perennial herbs have small crowns and stand as individuals or are gathered in clumps and patches throughout the lower relief areas.

6121 – *Dicoria canescens – Abronia villosa* Alliance



DISTRIBUTION: The only stands of *Dicoria canescens - Abronia villosa* Alliance mapped 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 in the eastern portion of Subarea 3. None are mapped in the Western and Central Mojave Regions of the study area.



6122 – *Panicum urvilleanum* Alliance

Desert panic grass patches Alliance

Here is an example of *Panicum urvilleanum* along the sandy Mojave River bottom near Yermo. Larger plants are scattered *Tamarix* spp.

This photo shows a *Panicum urvilleanum* Alliance stand on loose sandy substrate in the Mojave River bottom near Yermo.

6122 – *Panicum urvilleanum* Alliance

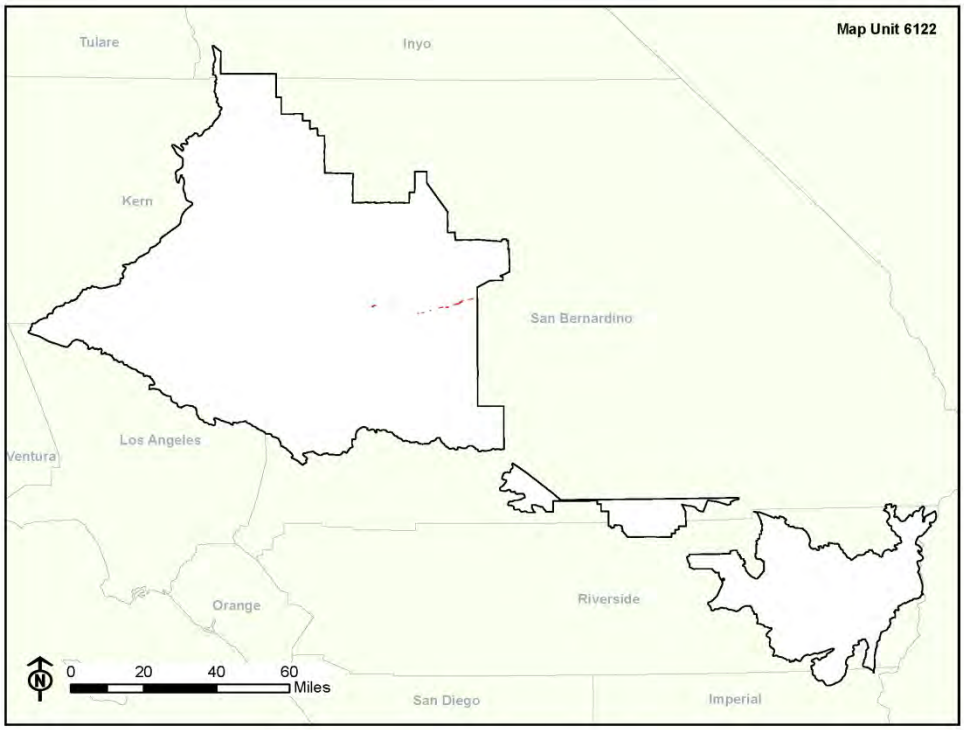
DESCRIPTION: Stands are characterized by even, sparse distribution of the stoloniferous dune panic grass (*Panicum urvilleanum*). The Alliance is restricted locally to broad sandy riverbeds and adjacent low dunes of the Mojave River from Hinkley to Camp Cady.

PHOTOINTERPRETATION SIGNATURE: This sparsely vegetated Alliance yields a photo signature primarily from the sandy substrate occurring in a wash environment. The sparse grasses appear to have a clumpy texture with the plants themselves appearing a light gray. Individual grass clumps create a small sand mound where they capture blowing sand at their base. Individual mounds are scattered throughout the stand. *P. urvilleanum* is mapped and extrapolated locally from field survey sites exclusively on the Mojave River.

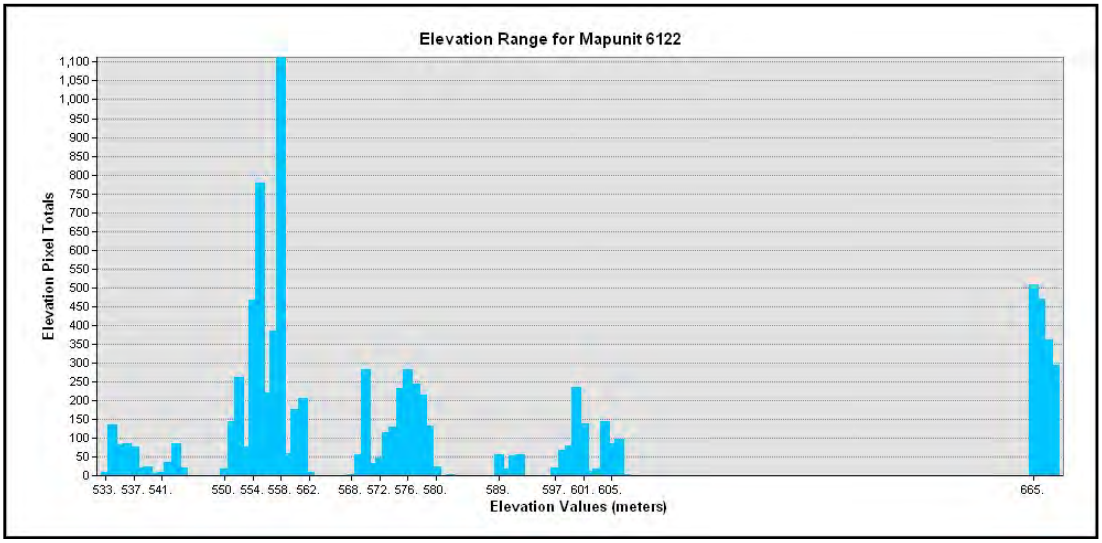
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- 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. No vegetative herbaceous signature is evident.
- North American warm desert dunes and sand flats Group (6120) – This is the default type for sparsely vegetated sand dunes and sand flats in the Western and Central Mojave Regions.
- *Dicoria canescens - Abronia villosa* Alliance (6121) – This type was mapped on sand dunes in the Colorado Desert portion of the study area from field survey data and locally extrapolated. It is not mapped in a sandy wash setting.

6122 – *Panicum urvilleanum* Alliance



DISTRIBUTION: The *Panicum urvilleanum* Alliance is mapped only along the Mojave River in the Barstow area from Lenwood to Harvard Hill.



6123 – *Wislizenia refracta* Special Stands

Spectacle fruit Special Stands

This example shows a sparse cover of *Wislizenia refracta* occurring mainly in the interdunal lows in a complex of hummocky dunes south of Palen Dry Lake.

Wislizenia refracta forms open sparse stands and is the only plant of consequence. This photo shows the plants situated mainly in the interdunal flats, where they are adjacent to the partially exposed bed of Palen Dry Lake, a playa.

6123 – *Wislizenia refracta* Special Stands

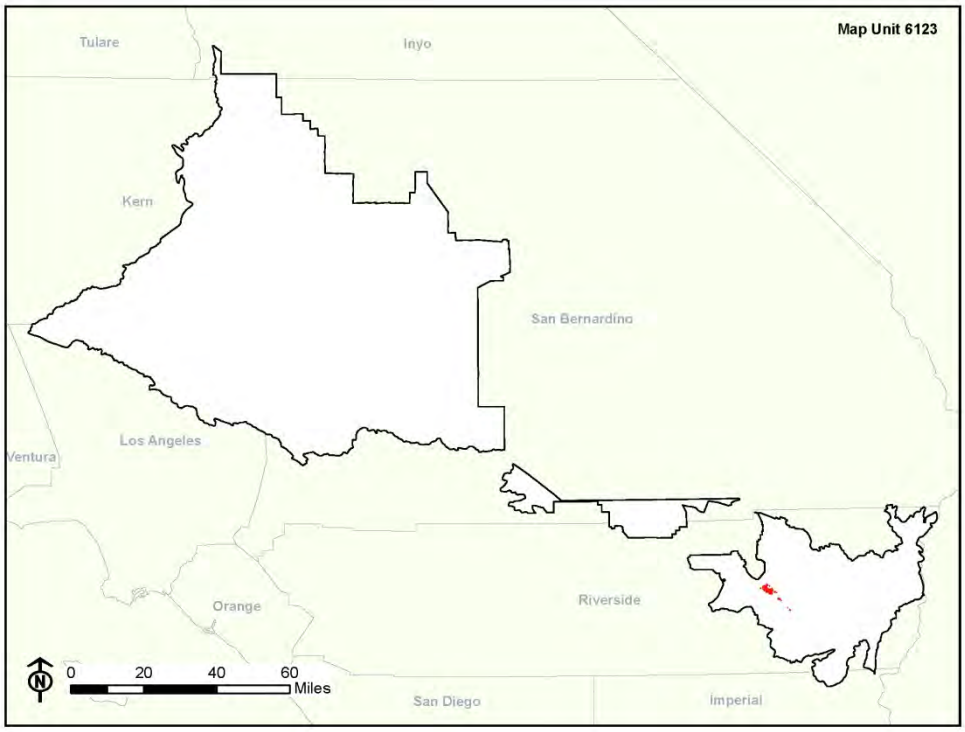
DESCRIPTION: Stands are dominated by the tall perennial herb *Wislizenia refracta*. They are found associated with low dunes adjacent to Palen Dry Lake, often adjacent to open stands of *Atriplex canescens* or *Suaeda moquinii* scrubland.

PHOTOINTERPRETATION SIGNATURE: Signature shows a concentrated complex of crescent-shaped dunes and interdunal flats. The dune area is white to light tan with vegetation concentrated at the southeast edge of each dune hill. The perennial herbs have small crowns and stand as individuals or are gathered in clumps and patches throughout the lower relief areas.

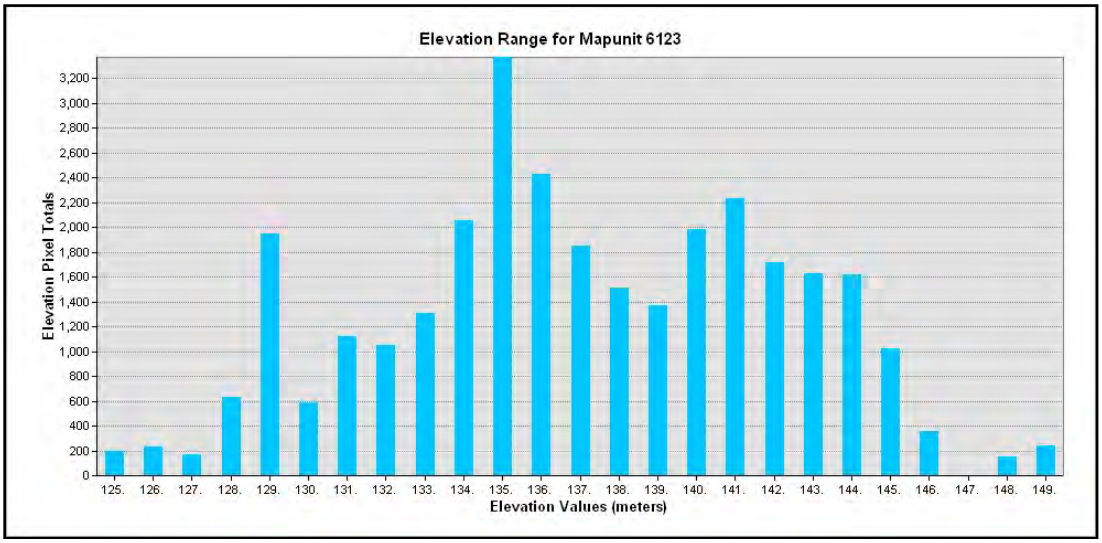
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *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, 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 in the Western and Central Mojave Regions.
- *Dicoria canescens - Abronia villosa* Alliance (6121) – This type was mapped on sand dunes and sand sheets in the Colorado Desert portion of the study area from field survey data and locally extrapolated.

6123 – *Wislizenia refracta* Special Stands



DISTRIBUTION: This was mapped exclusively on the sand dunes south and west of Palen Dry Lake playa in the Colorado Desert.



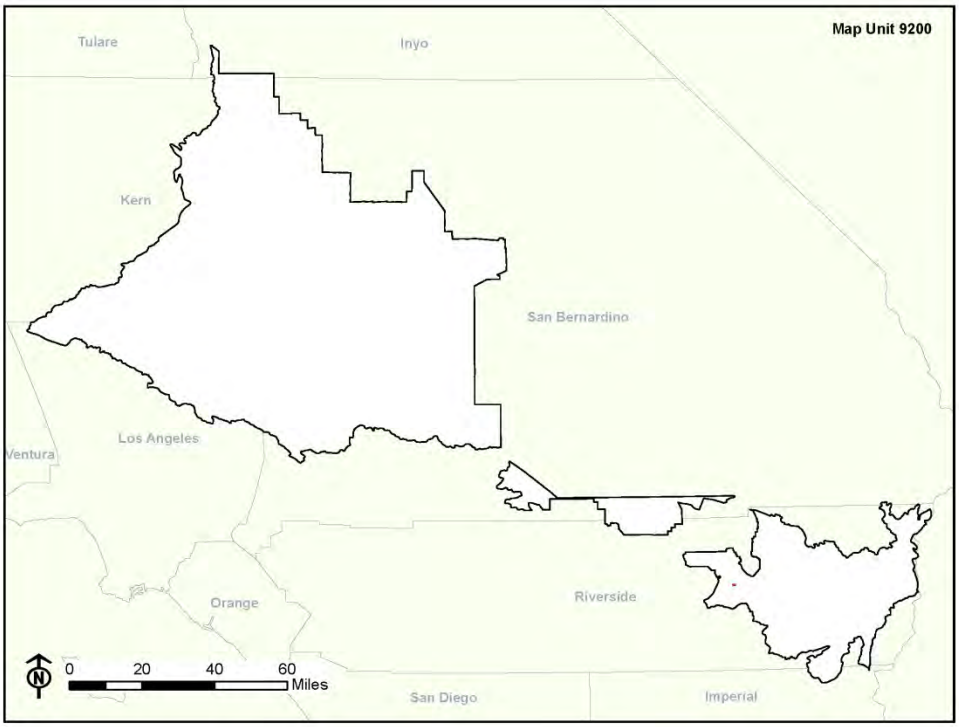
9200 – Agriculture

The above image is of a nursery, the only 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 9200 code is applied to miscellaneous agricultural uses such as nursery, poultry, and dairy operations. The code may also be applied to lands where specific agricultural use cannot be determined with existing imagery. Nurseries are the only type of agriculture mapped as this class in the study area, and are therefore described here.

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. There may also be impounded water sources in or near them.

9200 – Agriculture



DISTRIBUTION: The only polygon mapped as this class in the study area is located north of State Route 177 in Desert Center.

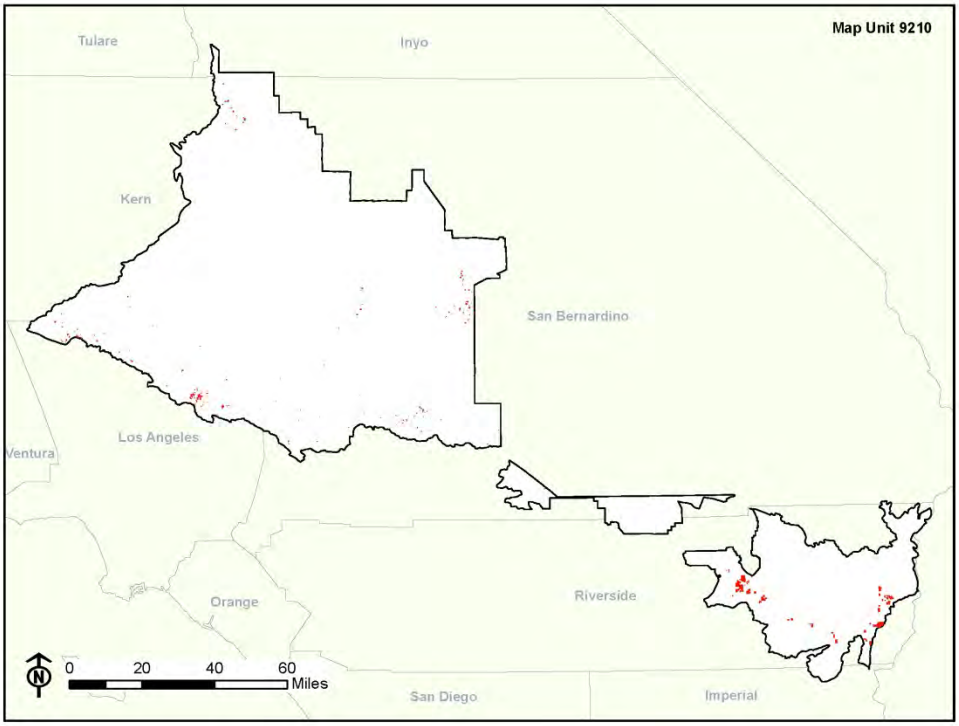
9210 – Woody Agriculture (orchards, vineyards)

The above image is an example of an orchard. The rows at the bottom 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 between 2005 and 2010. Examples include frost-sensitive citrus groves grown in the Colorado River floodplain such as grapefruit and oranges, 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 matrix form, with crowns appearing to abut each other. Bush crops are similar to orchards, but may be configured in rows rather than a matrix, and appear to be much shorter in height. The orchard and vineyard areas will 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 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 Subarea 3, growing primarily in the Colorado River floodplain and western portions of the Chuckwalla Valley.

9220 – Non-woody Row and Field Agriculture

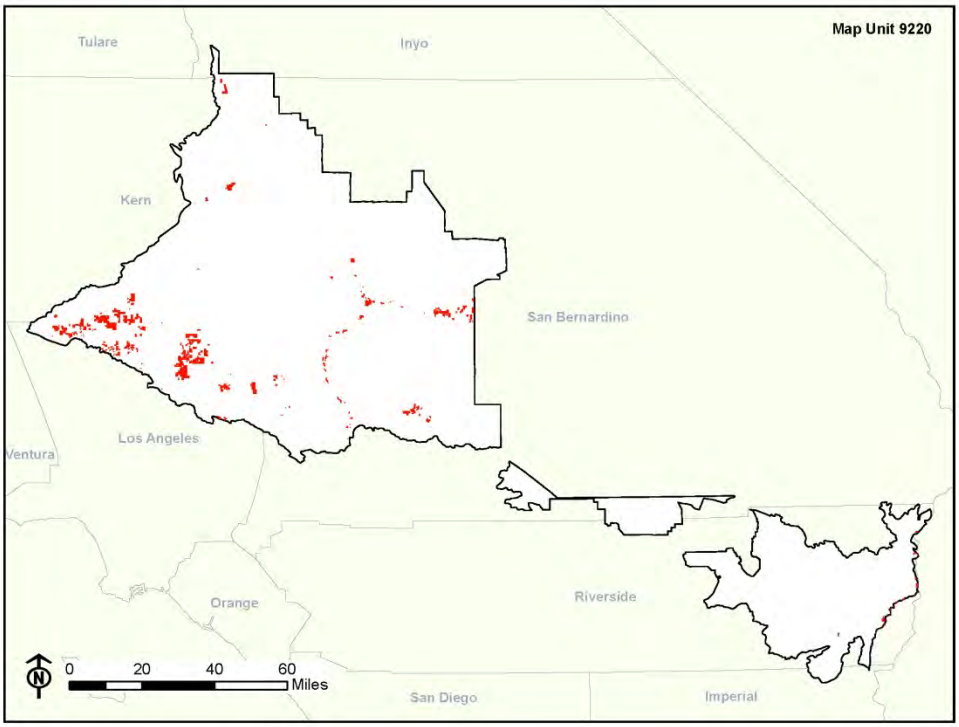
The above image is an example of an irrigated alfalfa field in the western Antelope Valley. The tilling pattern of this field crop is extremely fine, a characteristic which helps differentiate this from orchards and vineyards.

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. Fallow fields which have remained inactive for over two years may contain a sparse shrub cover, including such species as *Atriplex polycarpa* or *Ericameria nauseosa*, both of which are rapid colonizers in recently cleared or farmed land. 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 is 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.

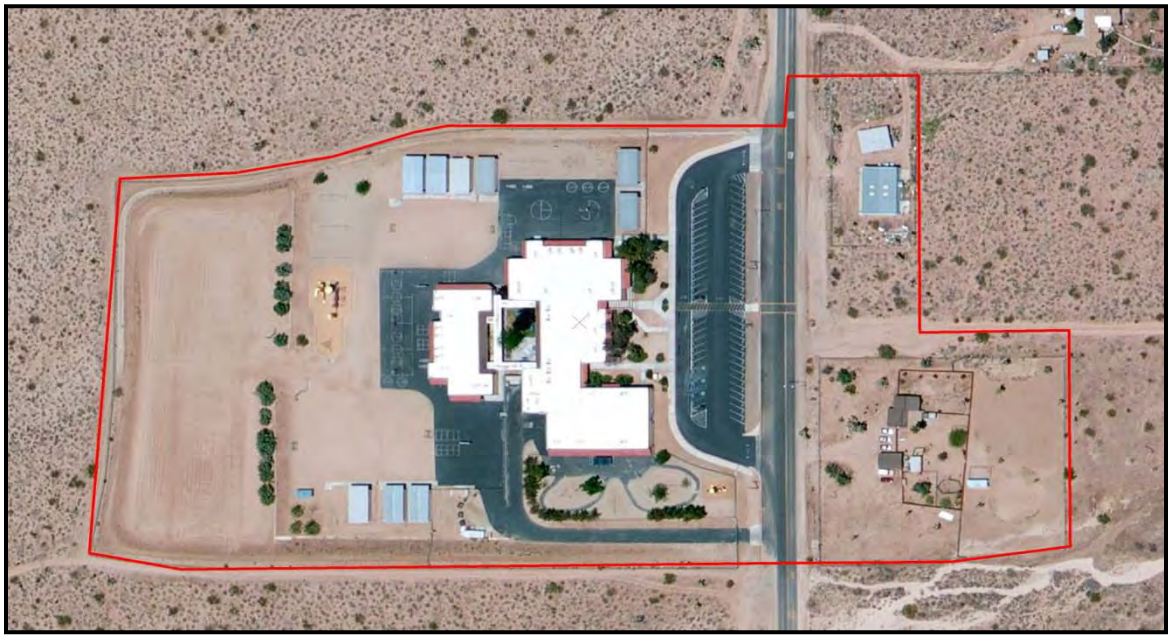
Tilled fields will appear smooth in texture with a white to tan color. Typically, dry fields have a homogeneous tone. Depending on the moisture content of the field, its appearance can become mottled, with moister areas appearing darker. Fallow fields will have a variable cover of seral native and non-native 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 Subarea 3.

9300 – Built-up & Urban Disturbance

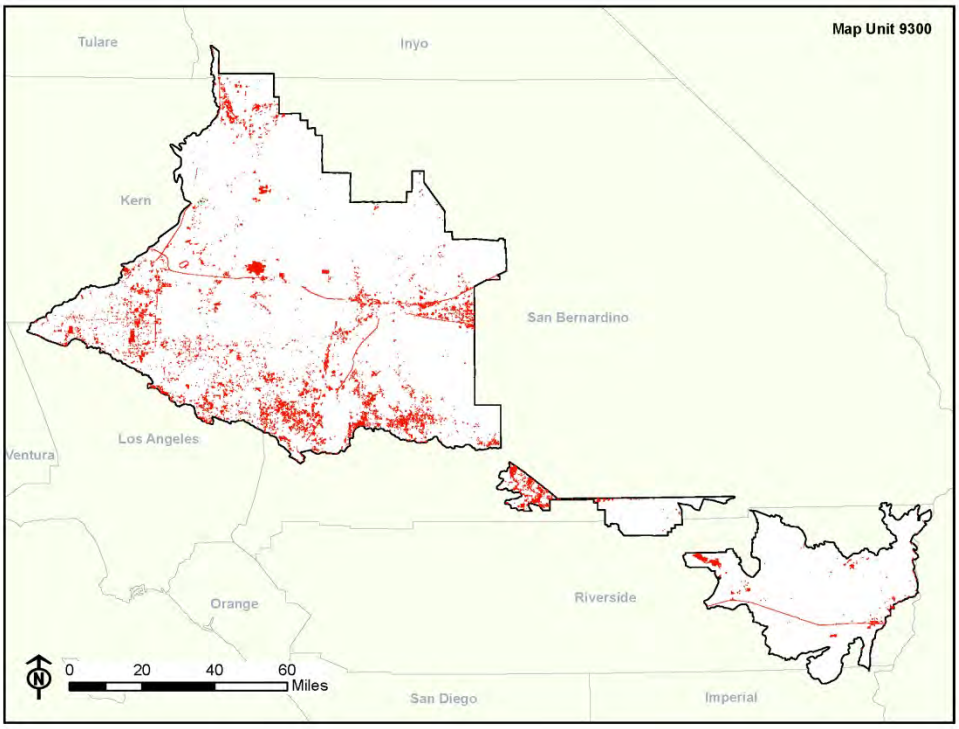


The above image is an example of a built-up area comprising several types of urbanization. To the west (left) of the road is a school; adjacent to the east are several small homes. Along the northeast fringe of the polygon, portions of natural vegetation stands are included in the urban polygon. Photointerpreters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

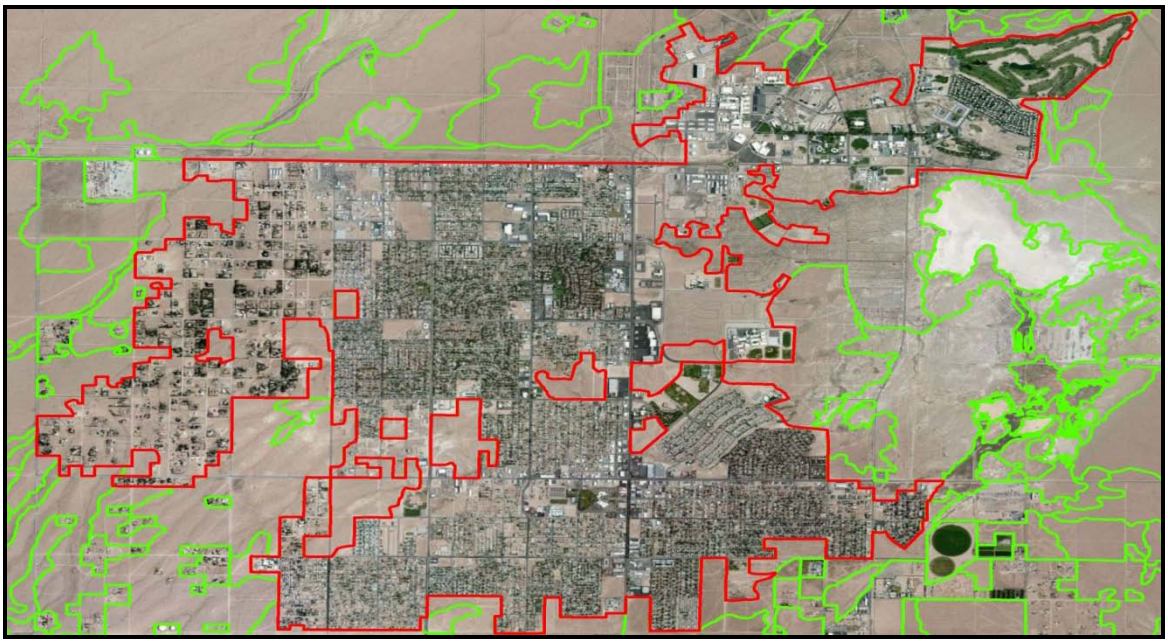
PHOTOINTERPRETATION SIGNATURE: Built-up areas consist of structures and the surrounding associated cleared and/or impervious surface. The boundaries often follow road centerlines and/or fence property lines. Vegetation within the polygon is limited to small naturally occurring components of adjacent 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, Yucca Valley and Blythe. Concentrations are highest in the southern and western portions of Subarea 1 along the foothills of the Transverse Ranges from Cajon Pass to the Antelope Valley.

9310 – Urban Window

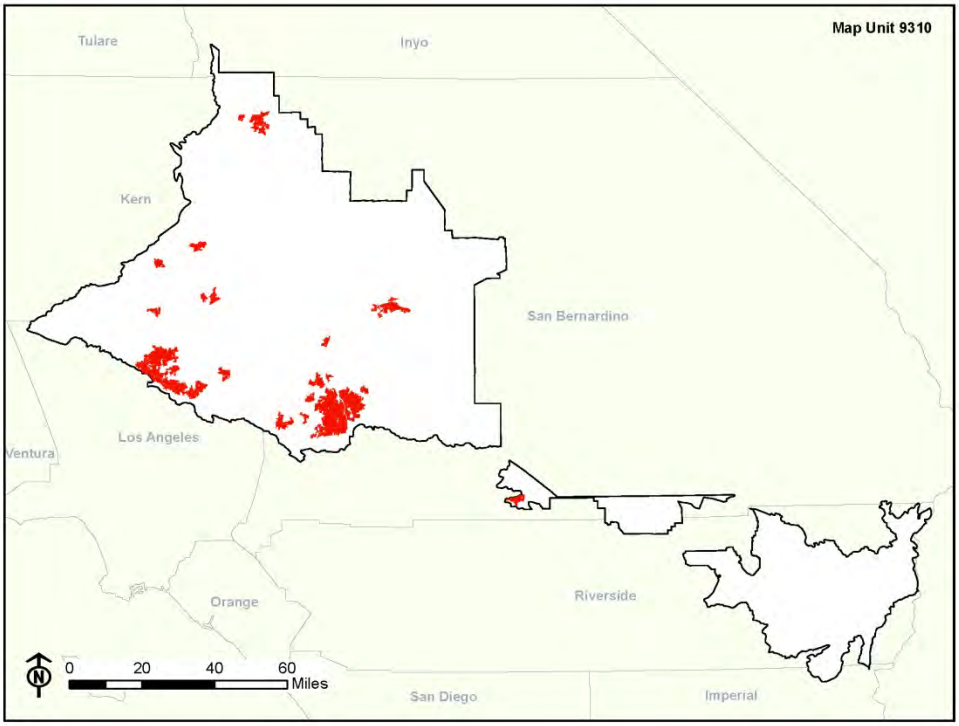


The above image is an example of an urban window, which includes Ridgecrest and the facilities at Naval Air Weapons Station China Lake in the eastern portion of Indian Wells Valley. Individual larger undeveloped polygons show up as “islands” of non-urban vegetation.

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-related uses.

9310 – Urban Window



DISTRIBUTION: Urban windows are found in large population areas. Subareas 1 and 2 have urban windows in such areas as Lancaster-Palmdale, Ridgecrest, Barstow, Apple Valley-Hesperia, and Yucca Valley. There are no urban windows located in Subarea 3.

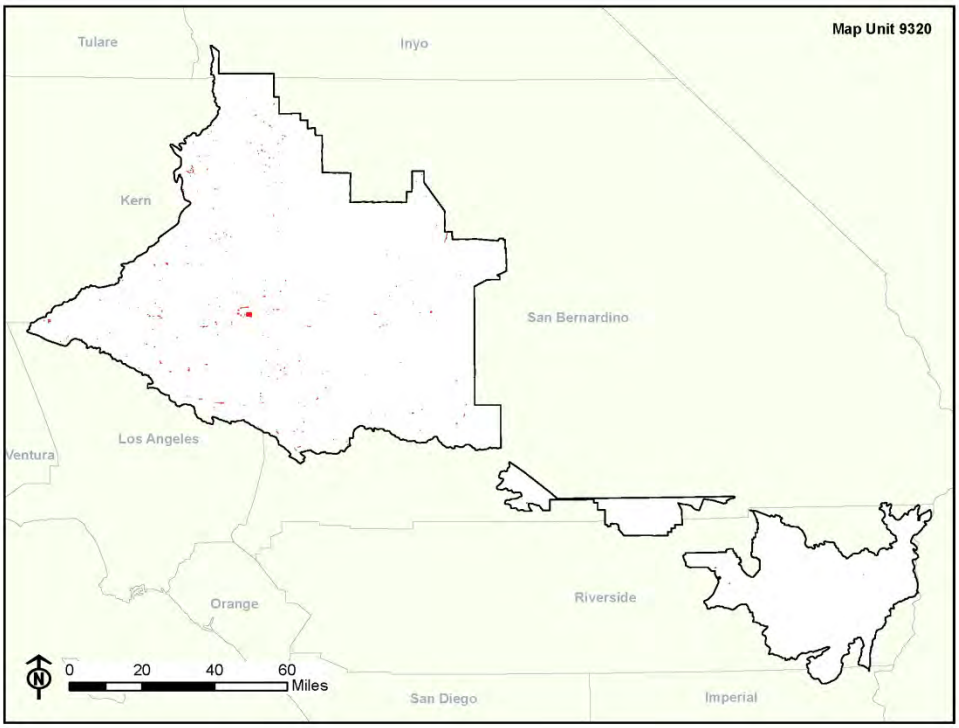
9320 – Anthropogenic areas of little or no vegetation

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 NAIP 2010 baseline 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: Anthropogenically cleared areas are fairly evenly scattered throughout Subarea 1. These areas are less common and occur only sporadically in Subareas 2 and 3.

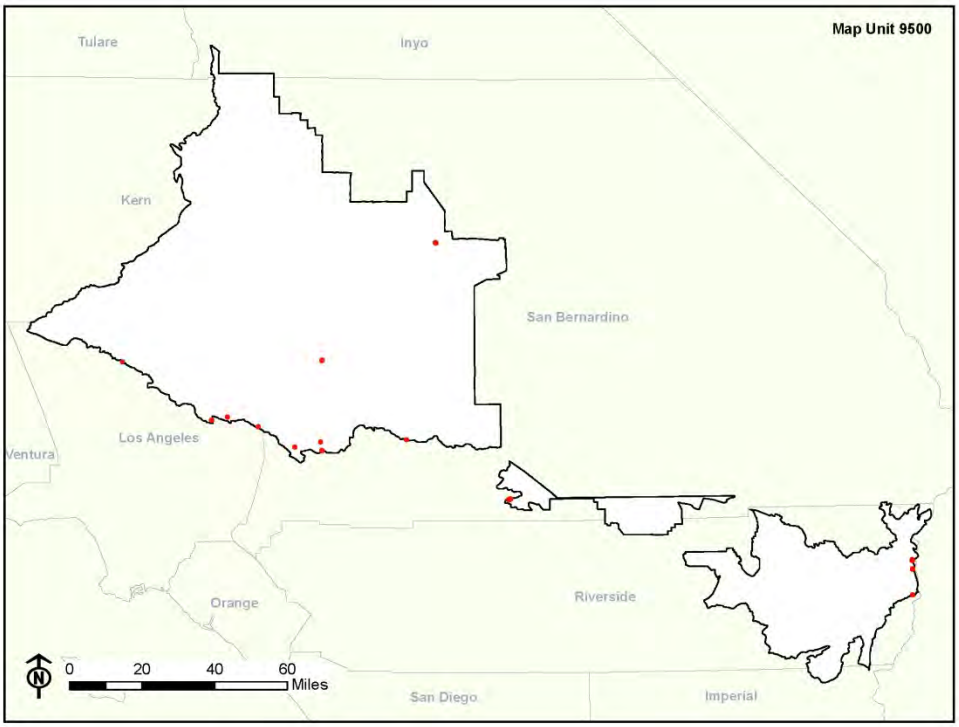
9500 – Exotic Trees

The above image is an example of exotic trees (*Pinus* spp.) in an old home site along Bob's Gap Road near Valyermo.

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, 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* spp., *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: Most 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.* Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

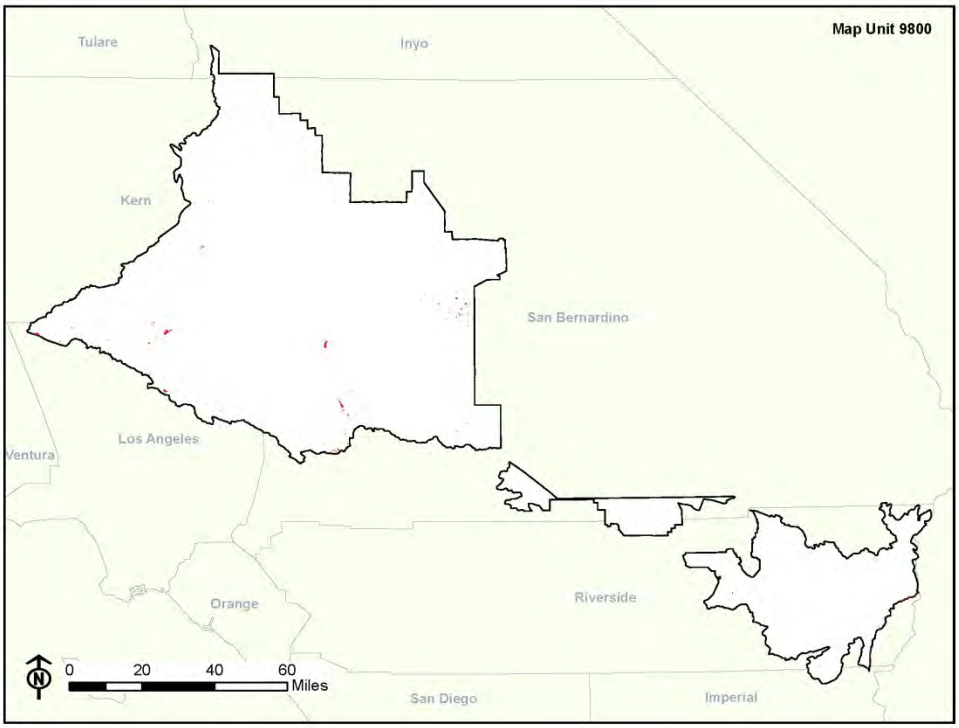
9800 – Water

The above image is an example of a man-made pond adjacent to a golf course in California City.

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 2010 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), the California and Colorado River 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 base line 2010 NAIP 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 Subarea 1 and along the Colorado River floodplain in Subarea 3.

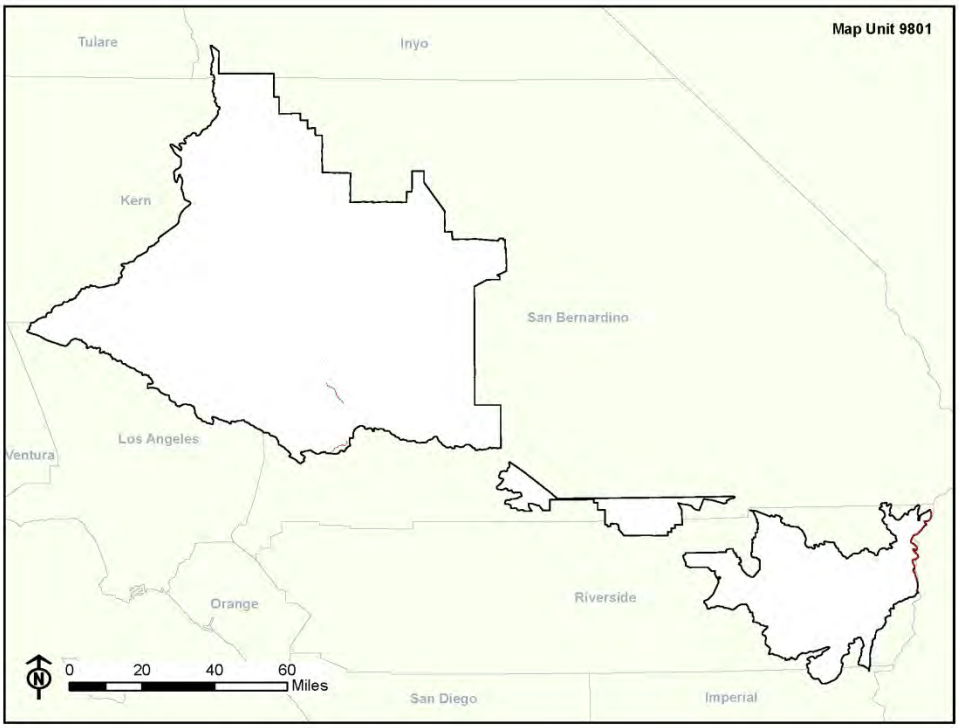
9801 – Perennial Stream Channel (Open Water)

The above image is an example of a perennial stream channel. This is the Mojave River north of Lake Silverwood. Small sparsely vegetated exposed riverine flats included in this mapping unit are depicted in this example adjacent to the channel.

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 such as in the Mojave River Narrows and Summit Valley. The largest example, the Colorado River, forms the eastern boundary of Subarea 3 in the Colorado Desert.

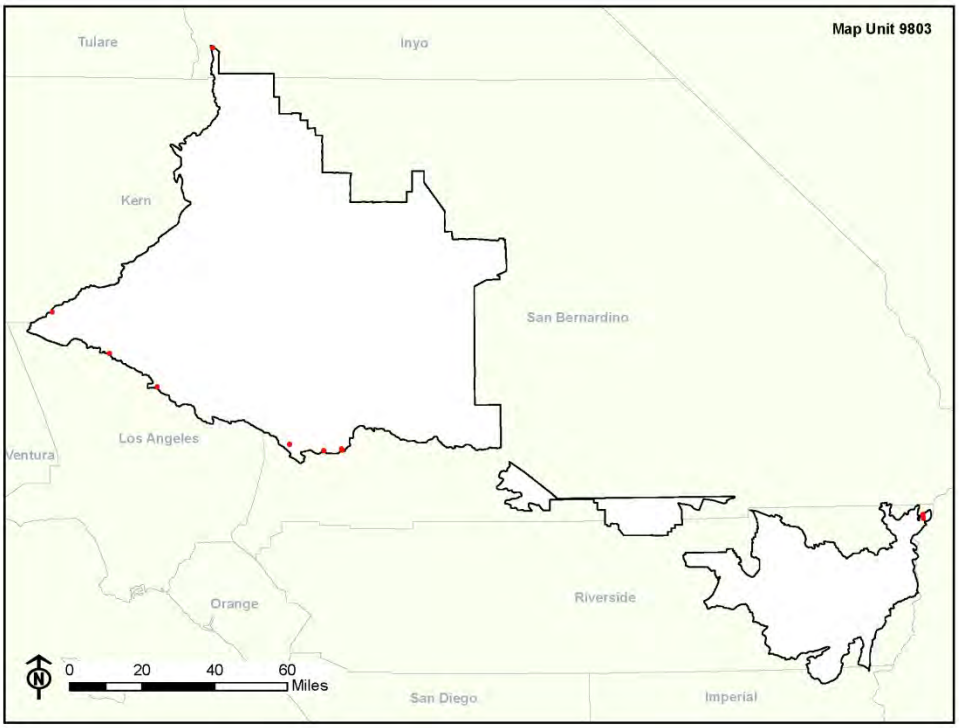
9803 – Small Earthen-dammed Ponds and Naturally Occurring Lakes

The above image is an example of a small earthen-dammed pond on the lower slopes of the San Bernardino Mountains above Summit Valley. The majority of the polygon boundary follows the high-water line established in high rainfall years.

DESCRIPTION: This class includes perennial or seasonally flooded water bodies, either occurring naturally in the landscape or impounded by earthen dams, that receive their water completely from the upstream watershed. Most of these features are seasonal and become completely dry usually in the late summer to early fall. Other features, such as Lost Lake, a small oxbow lake of the Colorado River, retain water throughout most of the year. Bermed ponds in agricultural areas are not included.

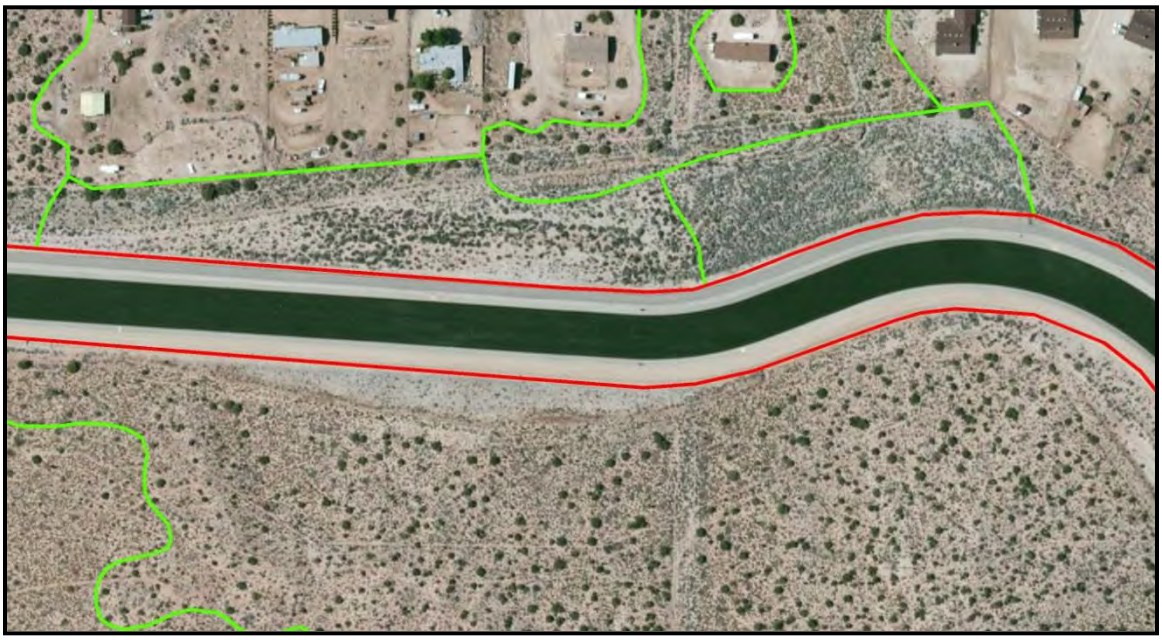
PHOTOINTERPRETATION SIGNATURE: Most of the features mapped in this category occur as small earthen-dammed ponds. Their characteristic signature is defined by the dark signature of deep water, lighter shades of shallower water along the margins, and varying greens and browns depicting young vegetative growth and wet mud just upslope from the recent water line. The shape of the feature is defined upslope by the topographic characteristics of the local landscape. Downslope, the shape of the feature is defined by a typically straight-lined small earthen dam.

9803 – Small Earthen-dammed Ponds and Naturally Occurring Lakes



DISTRIBUTION: Most earthen dammed ponds occur along the lower foothills of the Transverse Ranges from Summit Valley to Gorman. Several small naturally occurring oxbow lakes are mapped along the Colorado River in the northeastern corner of Subarea 3. Note: In the distribution map above, the size of the polygons has been enhanced for display purposes.

9804 – California Aqueduct, Colorado River Aqueduct (Open Water)

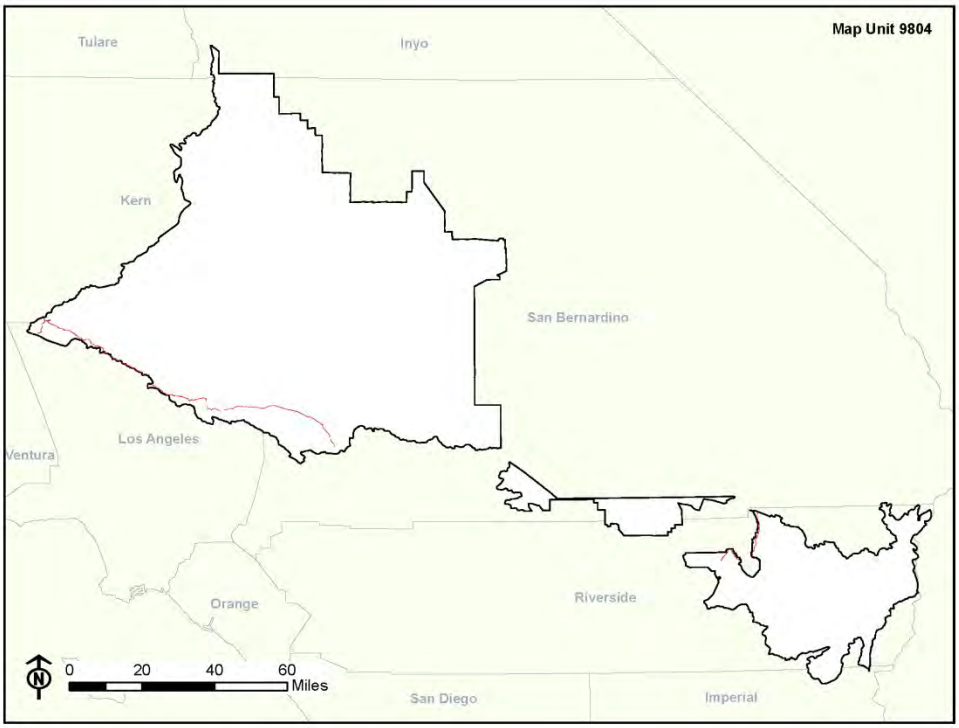


The above image shows a portion of the California Aqueduct south of Littlerock.

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 and 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 two aqueducts are mapped only where open water is visible above ground. Pumping stations associated with the aqueducts are mapped as Built-up & Urban Disturbance (9300). The entire levee (landward sides, levee roads and exposed portions above the waterline) that parallels 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 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.

9804 – California Aqueduct, Colorado River Aqueduct



DISTRIBUTION: The above-ground portion of the California Aqueduct enters the study area in Subarea 1 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 at West Iron Portal. From there it flows 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.

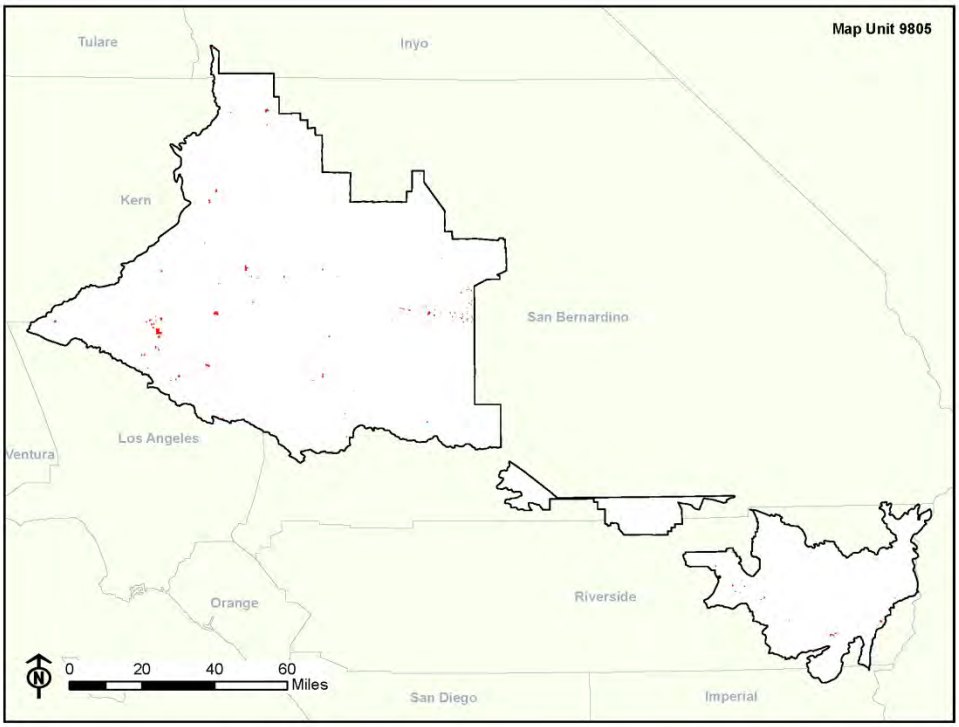
9805 – Water Impoundment Feature

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

DESCRIPTION: This category is composed primarily of straight-edged water bodies impounded by berms and 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 NAIP 2010 imagery was flown.

9805 – Water Impoundment Feature



DISTRIBUTION: Clusters of these water features occur within or near agricultural or developed areas throughout Subarea 1 and in portions of Subarea 3 in the Chuckwalla Valley and Colorado River floodplain.

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Glossary

Alliance 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.

Bajada an alluvial plain formed at the base of a mountain by the coalescing of several alluvial fans.

Bosque in arid climates, an oasis-like ribbon of canopied vegetation that only exists near rivers, streams, or other water courses.

Chenopod any plant of the goosefoot family; common in deserts and especially in saline or alkaline soils. Examples include *Allenrolfea, Atriplex, Grayia, Krascheninnikovia, Salicornia, Salsola, Sarcobatus*, and *Suaeda.*

Cismontane refers to the portion of Southern California on the coastal side of the Transverse and Peninsular mountain ranges. The term "Southern California" often refers to this region specifically. See also **"transmontane".**

Colluvial referring to loose earth material that has accumulated at the base of a hill through the action of gravity.

Cove (on a hillside) a hollow or recess in a mountain; a narrow pass or sheltered area between woods or hills.

Cryptobiotic crust a layer on the surface of desert soils composed of biotic organisms such as blue-green algae, lichens, mosses, green algae, microfungi, and bacteria.

Decadent (botany) a plant that is dead or dying.

Defile a narrow passage, especially between mountains.

Desiccation the state of being thoroughly dried up.

Endorheic of or pertaining to interior drainage basins (basins that don't drain to the ocean).

Edaphic related to or caused by particular soil conditions, as of texture or drainage, rather than by physiographic or climatic factors.

Facultative having the capacity to live under more than one specific set of environmental conditions - as opposed to "obligate".

Fluvial of or pertaining to a river; produced by or found in a river.

Geodatabase a database designed to store, query, and manipulate geographic information and spatial data.

Group 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).

Hummocky relating to any topographic surface characterized by rounded or conical mounds.

Hydrophobic (soil) a condition in which water collects on the soil surface rather than infiltrating into the ground. Wildfires generally cause soils to be hydrophobic temporarily.

Intermontane a feature between mountains, such as a plateau or a basin.

Lens a body of rock or ore that is thick in the middle and thinner toward the edges, similar in shape to a biconvex lens.

Lithomorphic pertaining to a soil with a shallow profile, with organic soil horizons directly overlying bedrock.

Macrogroup 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).

Mesic of, pertaining to, or adapted to an environment having a balanced supply of moisture.

Microphyll a type of small leaved tree/community adapted to arid deserts.

Panne a shallow depression or flat that is often unvegetated and can have encrustations of salt left by evaporation.

Phenology the science dealing with the influence of climate on the recurrence of such annual phenomena of plant life as budding and other growth phases.

Playa 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.

Pool and swale topography landscape characterized by shallow depressions where water can collect seasonally (pools), and long, narrow, shallow, troughs or depressions that may slope downward (swales).

Premontane pertaining to an elevation zone corresponding to foothills or lower mountain slopes.

Psammophytic a plant that grows in sand or sandy soil.

Rhizomatous a plant producing rhizomes, which are root-like subterranean stems, commonly horizontal in position, that usually produce roots below and send up shoots progressively from the upper surface.

Scald 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).

Sclerophyllous typically scrub, but also forest, in which the leaves of the trees and shrubs are evergreen, hard, thick, leathery, and usually small. A dominant plant form in hot dry areas, especially Mediterranean-type climates.

Seral referring to a community that is an intermediate stage in ecological succession, preceding the climax community.

Signature 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.

Stoloniferous 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.

Transmontane refers to the largely desert areas of Southern California, on the noncoastal side of the Transverse and Peninsular mountain ranges. See also "**cismontane**".

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List of Acronyms

AA	Accuracy Assessment
AFB	Air Force Base
AIS	Aerial Information Systems, Inc.
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife (name changed 1/1/13)
CEC	California Energy Commission
DRECP	Desert Renewable Energy Conservation Plan
DEM	Digital Elevation Model
DRG	Digital Raster Graphics
FGDC	Federal Geographic Data Committee
GIS	Geographic Information System
GPS	Global Positioning System
MMU	Minimum Mapping Unit
MMW	Minimum Mapping Width
NAIP	National Agricultural Imagery Program
NAWS	Naval Air Weapons Station
NVCS	National Vegetation Classification Standards
OHV	Off-Highway Vehicle
OHVP	Off-Highway Vehicle Park
PI	Photointerpretation, photointerpreter
ROW	Right-of-way
USGS	US Geological Survey
VegCAMP	Vegetation Classification and Mapping Program

2013 CALIFORNIA VEGETATION MAP IN SUPPORT OF THE DESERT RENEWABLE ENERGY CONSERVATION PLAN

Appendices A - D

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Prepared for the

California Department of Fish and Wildlife Renewable Energy Program
and the
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APPENDIX A

MAPPING CLASSIFICATION

Vegetation Type (Map Unit)

NOTE: * indicates a map unit that was not in the final geodatabase
# indicates a Group level code value that was assigned as a broader code for a given polygon in the final 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 was2 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

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
2313 = Lasthenia californica - Plantago erecta - Vulpia microstachys (California goldfields - Dwarf plantain - Six-weeks fescue flower 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 was2 acres in those situations.

**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*

3600 = Western North America Wet Meadow and Low Shrub Carr Macrogoup 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*

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 was2 acres in those situations.

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

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 = WARM SEMI-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*

4150 = Arizonan upland Sonoran desert scrub Group

4151 = Viguiera parishii (Parish's goldeneye scrub) 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
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 = Psorothamnus spinosus (Smoke tree 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

5000 = COOL SEMI-DESERT SCRUB AND GRASS 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
**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

5500 = Cool Semi-Desert Alkali-Saline Wetlands Macrogroup MG082
5510 = Great Basin cool semi-desert alkali basin Group
5511 = Sarcobatus vermiculatus (Greasewood scrub) 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 was2 acres in those situations.

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 = California Aqueduct, Colorado River Aqueduct (Open Water)

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 was2 acres in those situations.

Percent of Cover by Conifers

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

Percent of Cover by Hardwoods

0 = None or 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 or 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

Percent of Cover by Trees

0 = None or 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

Exotics

0 = None visible
1 = Low
2 = Moderate
3 = High
9 = Not applicable/Not assigned

Roadedness Disturbance

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

Development Disturbance

0 = None visible
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 visible
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 (Calif. and Colo. River Aqueducts only)
2000 = Agriculture (includes nurseries)
2100 = Non-woody row & field crops
2200 = Orchards & vineyards
9800 = Undifferentiated water
9810 = Water impoundment feature

OlTe-PaFl (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

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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 database 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 19 map units comprise almost 90 percent of the entire study area.

Table B-1: Map Unit Acreage, Listed Numerically by Code Value

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
1111	*Quercus douglasii* Alliance	39	390.9	965.8	0.0%	24.8
1112	*Quercus lobata* Alliance	28	239.9	592.9	0.0%	21.2
1113	*Quercus chrysolepis* Alliance	37	138.5	342.3	0.0%	9.3
1114	*Quercus wislizeni* Alliance	44	426.8	1,054.5	0.0%	24.0
1116	*Aesculus californica* Alliance	1	5.6	13.7	0.0%	13.7
1117	*Quercus agrifolia* Alliance	1	6.6	16.3	0.0%	16.3
1121	*Pinus sabiniana* Alliance	18	85.9	212.3	0.0%	11.8
1122	*Juniperus californica* Alliance	1,707	26,830.8	66,300.3	1.1%	38.8
1211	*Pseudotsuga macrocarpa* Alliance	15	65.3	161.4	0.0%	10.8
1311	*Pinus monophylla* Alliance	180	1,263.6	3,122.5	0.1%	17.3
1411	*Populus fremontii* Alliance	305	1,560.0	3,854.9	0.1%	12.6
1412	*Salix laevigata* Alliance	68	174.9	432.1	0.0%	6.4
1414	*Platanus racemosa* Alliance	28	79.8	197.1	0.0%	7.0
1422	*Baccharis salicifolia* Alliance	55	149.7	370.0	0.0%	6.7
1423	*Baccharis sergiloides* Alliance	2	1.8	4.4	0.0%	2.2
1424	*Salix exigua* Alliance	42	105.2	260.0	0.0%	6.2
1425	*Forestiera pubescens* Alliance	39	46.1	113.8	0.0%	2.9
1426	*Sambucus nigra* Alliance	11	37.2	92.0	0.0%	8.4
1427	*Salix lasiolepis* Alliance	20	35.0	86.5	0.0%	4.3
1431	*Arundo donax* Semi-natural Stands	25	6.0	14.8	0.0%	0.6
1432	*Tamarix* spp. Semi-natural Stands	378	4,172.1	10,309.4	0.2%	27.3
1511	*Alnus rhombifolia* Forest Alliance	2	1.4	3.4	0.0%	1.7
2111	*Arctostaphylos glauca* Alliance	45	374.3	924.8	0.0%	20.6
2112	*Adenostoma fasciculatum* Alliance	433	8,837.3	21,837.4	0.4%	50.4
2113	*Ceanothus crassifolius* Alliance	13	155.0	383.0	0.0%	29.5
2114	*Fremontodendron californicum* Alliance	81	1,028.4	2,541.3	0.0%	31.4
2115	*Adenostoma fasciculatum - Salvia mellifera* Alliance	1	37.4	92.4	0.0%	92.4
2121	*Arctostaphylos glandulosa* Alliance	13	62.2	153.8	0.0%	11.8

Table B-1: Map Unit Acreage, Listed Numerically by Code Value

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
2122	*Ceanothus leucodermis* Alliance	4	59.4	146.7	0.0%	36.7
2131	*Cercocarpus montanus* Alliance	206	1,257.0	3,106.2	0.1%	15.1
2132	*Quercus berberidifolia* Alliance	44	194.1	479.7	0.0%	10.9
2133	*Quercus berberidifolia - Adenostoma fasciculatum* Alliance	78	452.6	1,118.4	0.0%	14.3
2134	*Prunus ilicifolia* Alliance	29	98.2	242.6	0.0%	8.4
2214	*Ericameria linearifolia - Isomeris arborea* Alliance	37	785.5	1,941.0	0.0%	52.5
2215	*Eriodictyon (crassifolium, trichocalyx)* Provisional Alliance	41	377.1	931.8	0.0%	22.7
2218	*Corethrogyne filaginifolia* Alliance	1	6.7	16.5	0.0%	16.5
2221	*Eriogonum fasciculatum* Alliance	1,278	28,425.2	70,240.1	1.2%	55.0
2222	*Eriogonum wrightii* Alliance	1	5.5	13.7	0.0%	13.7
2305	CA Annual & Perennial Grassland Mapping Unit (native component)	1,019	42,978.1	106,201.0	1.8%	104.2
2310	CA annual forb/grass vegetation Group	82	2,605.0	6,437.2	0.1%	78.5
2311	*Eschscholzia (californica)* Alliance	50	1,959.9	4,842.9	0.1%	96.9
2312	*Amsinckia (menziesii, tessellata)* Alliance	12	165.8	409.7	0.0%	34.1
2313	*Lasthenia californica - Plantago erecta - Vulpia microstachys* Alliance	7	92.0	227.3	0.0%	32.5
2321	*Nassella cernua* Provisional Alliance	1	131.4	324.8	0.0%	324.8
2330	Medit. CA naturalized annual & perennial grassland Group	1,107	35,089.4	86,707.7	1.5%	78.3
2331	*Brassica nigra* & other mustards Semi-natural Stands	12	493.7	1,220.0	0.0%	101.7
3211	*Ribes quercetorum* Provisional Alliance	3	5.0	12.3	0.0%	4.1
3312	*Quercus john-tuckeri* Alliance	544	8,115.6	20,054.1	0.3%	36.9
3314	*Quercus cornelius-mulleri* Alliance	43	720.1	1,779.4	0.0%	41.4
3412	*Schoenoplectus (acutus, californicus)* Mapping Unit	55	72.0	177.8	0.0%	3.2
3414	*Schoenoplectus californicus* Alliance	2	0.9	2.3	0.0%	1.1
3415	*Typha (angustifolia, domingensis, latifolia)* Alliance	44	75.8	187.2	0.0%	4.3
3510	CA mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group	3	2.6	6.4	0.0%	2.1
3611	*Juncus arcticus* (var. *balticus, mexicanus*) Alliance	32	208.9	516.1	0.0%	16.1
3712	*Sporobolus airoides* Alliance	1	0.6	1.5	0.0%	1.5
3715	*Bolboschoenus maritimus, Schoenoplectus americanus* Mapping Unit	6	118.2	292.1	0.0%	48.7

Table B-1: Map Unit Acreage, Listed Numerically by Code Value

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
3721	*Allenrolfea occidentalis* Alliance	76	2,579.2	6,373.4	0.1%	83.9
3722	*Atriplex lentiformis* Alliance	24	218.9	540.8	0.0%	22.5
3723	*Atriplex spinifera* Alliance	1,568	71,645.5	177,039.7	3.0%	112.9
3724	*Frankenia salina* Alliance	7	48.6	120.2	0.0%	17.2
3725	*Suaeda moquinii* Alliance	658	17,490.8	43,220.6	0.7%	65.7
3726	*Distichlis spicata* Alliance	26	169.2	418.1	0.0%	16.1
3728	*Isocoma acradenia* Alliance	3	14.6	36.1	0.0%	12.0
3729	*Atriplex parryi* Provisional Alliance	33	2,841.8	7,022.3	0.1%	212.8
4110	Lower Bajada & Fan Mojavean–Sonoran desert scrub Group	2	15.7	38.8	0.0%	19.4
4111	*Ambrosia dumosa* Alliance	1,896	51,016.0	126,063.0	2.1%	66.5
4113	*Atriplex polycarpa* Alliance	2,179	112,049.3	276,879.6	4.6%	127.1
4114	*Encelia farinosa* Alliance	391	22,408.4	55,372.2	0.9%	141.6
4115	*Larrea tridentata - Ambrosia dumosa* Alliance	4,044	1,092,981.6	2,700,814.0	45.2%	667.9
4118	*Larrea tridentata - Encelia farinosa* Alliance	1,395	106,382.0	262,875.5	4.4%	188.4
4119	*Larrea tridentata* Alliance	3,941	168,774.6	417,050.7	7.0%	105.8
4122	*Pleuraphis rigida* Alliance	26	790.0	1,952.0	0.0%	75.1
4151	*Viguiera parishii* Alliance	50	1,193.2	2,948.4	0.0%	59.0
4211	*Ephedra californica* Alliance	170	1,753.6	4,333.2	0.1%	25.5
4212	*Lepidospartum squamatum* Alliance	167	2,488.3	6,148.7	0.1%	36.8
4213	*Ericameria paniculata* Alliance	83	526.5	1,301.0	0.0%	15.7
4214	*Prunus fasciculata* Alliance	146	842.9	2,083.0	0.0%	14.3
4215	*Brickellia incana* Provisional Alliance	16	108.0	266.8	0.0%	16.7
4216	*Ambrosia salsola* Alliance	413	6,289.3	15,541.1	0.3%	37.6
4217	*Artemisia tridentata* ssp. *parishii* Provisional Alliance	96	182.8	451.7	0.0%	4.7
4218	*Bebbia juncea* Provisional Alliance	1	2.3	5.8	0.0%	5.8
4221	*Pluchea sericea* Alliance	142	986.2	2,437.0	0.0%	17.2
4222	*Prosopis glandulosa* Alliance	338	2,741.5	6,774.3	0.1%	20.0
4224	*Chilopsis linearis* Alliance	100	829.9	2,050.8	0.0%	20.5

Table B-1: Map Unit Acreage, Listed Numerically by Code Value

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
4225	*Psorothamnus spinosus* Alliance	65	628.0	1,551.8	0.0%	23.9
4226	*Acacia greggii* Alliance	331	2,653.9	6,557.8	0.1%	19.8
4227	*Parkinsonia florida - Olneya tesota* Alliance	837	36,590.1	90,416.1	1.5%	108.0
4228	*Hyptis emoryi* Alliance	244	1,089.9	2,693.1	0.0%	11.0
5111	*Atriplex canescens* Alliance	662	15,282.1	37,762.9	0.6%	57.0
5112	*Atriplex confertifolia* Alliance	1,059	39,585.3	97,817.4	1.6%	92.4
5211	*Encelia (actoni, virginensis)* Alliance	86	2,669.4	6,596.2	0.1%	76.7
5212	*Ericameria nauseosa* Alliance	1,185	28,090.9	69,414.0	1.2%	58.6
5214	*Gutierrezia sarothrae* Provisional Alliance	4	38.2	94.4	0.0%	23.6
5215	*Ericameria cooperi* Provisional Alliance	51	1,122.7	2,774.2	0.0%	54.4
5216	*Dendromecon rigida* Alliance	1	1.1	2.7	0.0%	2.7
5311	*Artemisia tridentata* Alliance	57	395.5	977.4	0.0%	17.1
5410	Intermontane deep or well-drained soil scrub Group	6	926.5	2,289.4	0.0%	381.6
5411	*Grayia spinosa* Alliance	400	22,262.6	55,012.1	0.9%	137.5
5412	*Krascheninnikovia lanata* Alliance	67	3,159.1	7,806.2	0.1%	116.5
5413	*Ephedra nevadensis* Alliance	222	4,780.4	11,812.6	0.2%	53.2
5415	*Salazaria mexicana* Alliance	327	14,838.7	36,667.3	0.6%	112.1
5416	*Ericameria teretifolia* Alliance	126	3,489.8	8,623.5	0.1%	68.4
5417	*Ephedra viridis* Alliance	142	5,026.1	12,419.8	0.2%	87.5
5418	*Lycium cooperi* Provisional Alliance	14	422.7	1,044.6	0.0%	74.6
5421	*Coleogyne ramosissima* Alliance	249	19,930.1	49,248.4	0.8%	197.8
5422	*Purshia tridentata* Alliance	84	1,547.8	3,824.6	0.1%	45.5
5423	*Yucca brevifolia* Alliance	1,482	61,731.6	152,542.1	2.6%	102.9
5424	*Yucca schidigera* Alliance	323	19,796.2	48,917.5	0.8%	151.4
5425	*Menodora spinescens* Alliance	3	43.4	107.2	0.0%	35.7
5431	*Achnatherum speciosum* Alliance	2	116.3	287.4	0.0%	143.7
5433	*Achnatherum hymenoides* Alliance	5	249.7	617.1	0.0%	123.4
5441	*Cercocarpus ledifolius* Alliance	2	1.9	4.6	0.0%	2.3

Table B-1: Map Unit Acreage, Listed Numerically by Code Value

Map Unit	Map Unit Description	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
5511	*Sarcobatus vermiculatus* Alliance	6	10.3	25.6	0.0%	4.3
6110	North American warm desert bedrock cliff and outcrop Group	20	988.7	2,443.2	0.0%	122.2
6111	*Atriplex hymenelytra* Alliance	50	1,528.1	3,775.9	0.1%	75.5
6113	Mud hills sparsely vegetated ephemeral herbs Mapping Unit	229	5,073.2	12,536.2	0.2%	54.7
6114	Unvegetated wash and river bottom Mapping Unit	191	3,210.7	7,933.7	0.1%	41.5
6115	Massive sparsely vegetated rock outcrop Mapping Unit	98	2,001.4	4,945.6	0.1%	50.5
6116	Sparsely vegetated playa (ephemeral annuals) Mapping Unit	1,499	45,905.5	113,434.8	1.9%	75.7
6117	*Chorizanthe rigida - Geraea canescens* Desert Pavement Sparsely Vegetated Alliance	1,433	60,417.7	149,295.2	2.5%	104.2
6118	*Peucephyllum schottii* Alliance	8	67.4	166.6	0.0%	20.8
6120	North American warm desert dunes and sand flats Group	21	515.3	1,273.4	0.0%	60.6
6121	*Dicoria canescens - Abronia villosa* Alliance	49	2,249.2	5,558.0	0.1%	113.4
6122	*Panicum urvilleanum* Alliance	9	294.8	728.5	0.0%	80.9
6123	*Wislizenia refracta* Special Stands	10	1,228.6	3,035.9	0.1%	303.6
9200	Agriculture	1	111.3	275.1	0.0%	275.1
9210	Woody Agriculture (orchards, vineyards)	249	5,889.2	14,552.4	0.2%	58.4
9220	Non-woody Row and Field Agriculture	277	27,520.5	68,004.6	1.1%	245.5
9300	Built-up & Urban Disturbance	7,527	60,133.8	148,593.7	2.5%	19.7
9310	Urban Window	54	67,399.5	166,547.8	2.8%	3,084.2
9320	Anthropogenic areas of little or no vegetation	299	2,103.0	5,196.6	0.1%	17.4
9500	Exotic Trees	14	44.0	108.7	0.0%	7.8
9800	Water	139	847.7	2,094.8	0.0%	15.1
9801	Perennial Stream Channel (open water)	12	437.3	1,080.5	0.0%	90.0
9803	Small Earthen-dammed Ponds and Naturally Occurring Lakes	10	6.5	16.1	0.0%	1.6
9804	California Aqueduct, Colorado River Aqueduct (Open Water)	49	970.6	2,398.3	0.0%	48.9
9805	Water Impoundment Feature	149	2,224.8	5,497.7	0.1%	36.9
Totals		46,803	2,415,833.9	5,969,650.3	100.0%	127.5

Table B-2: Map Unit Acreage, Listed Alphabetically

Map Unit Description	Map Unit	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
Acacia greggii Alliance	4226	331	2,653.9	6,557.8	0.1%	19.8
Achnatherum hymenoides Alliance	5433	5	249.7	617.1	0.0%	123.4
Achnatherum speciosum Alliance	5431	2	116.3	287.4	0.0%	143.7
Adenostoma fasciculatum Alliance	2112	433	8,837.3	21,837.4	0.4%	50.4
Adenostoma fasciculatum - Salvia mellifera Alliance	2115	1	37.4	92.4	0.0%	92.4
Aesculus californica Alliance	1116	1	5.6	13.7	0.0%	13.7
Agriculture	9200	1	111.3	275.1	0.0%	275.1
Allenrolfea occidentalis Alliance	3721	76	2,579.2	6,373.4	0.1%	83.9
Alnus rhombifolia Forest Alliance	1511	2	1.4	3.4	0.0%	1.7
Ambrosia dumosa Alliance	4111	1,896	51,016.0	126,063.0	2.1%	66.5
Ambrosia salsola Alliance	4216	413	6,289.3	15,541.1	0.3%	37.6
Amsinckia (menziesii, tessellata) Alliance	2312	12	165.8	409.7	0.0%	34.1
Anthropogenic areas of little or no vegetation	9320	299	2,103.0	5,196.6	0.1%	17.4
Arctostaphylos glandulosa Alliance	2121	13	62.2	153.8	0.0%	11.8
Arctostaphylos glauca Alliance	2111	45	374.3	924.8	0.0%	20.6
Artemisia tridentata Alliance	5311	57	395.5	977.4	0.0%	17.1
Artemisia tridentata spp. *parishii* Provisional Alliance	4217	96	182.8	451.7	0.0%	4.7
Arundo donax Semi-natural Stands	1431	25	6.0	14.8	0.0%	0.6
Atriplex canescens Alliance	5111	662	15,282.1	37,762.9	0.6%	57.0
Atriplex confertifolia Alliance	5112	1,059	39,585.3	97,817.4	1.6%	92.4
Atriplex hymenelytra Alliance	6111	50	1,528.1	3,775.9	0.1%	75.5
Atriplex lentiformis Alliance	3722	24	218.9	540.8	0.0%	22.5
Atriplex parryi Provisional Alliance	3729	33	2,841.8	7,022.3	0.1%	212.8
Atriplex polycarpa Alliance	4113	2,179	112,049.3	276,879.6	4.6%	127.1
Atriplex spinifera Alliance	3723	1,568	71,645.5	177,039.7	3.0%	112.9
Baccharis salicifolia Alliance	1422	55	149.7	370.0	0.0%	6.7
Baccharis sergiloides Alliance	1423	2	1.8	4.4	0.0%	2.2
Bebbia juncea Provisional Alliance	4218	1	2.3	5.8	0.0%	5.8

Table B-2: Map Unit Acreage, Listed Alphabetically

Map Unit Description	Map Unit	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
Bolboschoenus maritimus, Schoenoplectus americanus Mapping Unit	3715	6	118.2	292.1	0.0%	48.7
Brassica nigra & other mustards Semi-natural Stands	2331	12	493.7	1,220.0	0.0%	101.7
Brickellia incana Provisional Alliance	4215	16	108.0	266.8	0.0%	16.7
Built-up & Urban Disturbance	9300	7,527	60,133.8	148,593.7	2.5%	19.7
CA Annual & Perennial Grassland (native component) Mapping Unit	2305	1,019	42,978.1	106,201.0	1.8%	104.2
CA annual forb/grass vegetation Group	2310	82	2,605.0	6,437.2	0.1%	78.5
CA mixed annual/perennial freshwater vernal pool/swale/plain bottomland Group	3510	3	2.6	6.4	0.0%	2.1
California Aqueduct, Colorado River Aqueduct (Open Water)	9804	49	970.6	2,398.3	0.0%	48.9
Ceanothus crassifolius Alliance	2113	13	155.0	383.0	0.0%	29.5
Ceanothus leucodermis Alliance	2122	4	59.4	146.7	0.0%	36.7
Cercocarpus ledifolius Alliance	5441	2	1.9	4.6	0.0%	2.3
Cercocarpus montanus Alliance	2131	206	1,257.0	3,106.2	0.1%	15.1
Chilopsis linearis Alliance	4224	100	829.9	2,050.8	0.0%	20.5
Chorizanthe rigida - Geraea canescens Desert Pavement Sparsely Vegetated Alliance	6117	1,433	60,417.7	149,295.2	2.5%	104.2
Coleogyne ramosissima Alliance	5421	249	19,930.1	49,248.4	0.8%	197.8
Corethrogyne filaginifolia Alliance	2218	1	6.7	16.5	0.0%	16.5
Dendromecon rigida Alliance	5216	1	1.1	2.7	0.0%	2.7
Dicoria canescens - Abronia villosa Alliance	6121	49	2,249.2	5,558.0	0.1%	113.4
Distichlis spicata Alliance	3726	26	169.2	418.1	0.0%	16.1
Encelia (actoni, virginensis) Alliance	5211	86	2,669.4	6,596.2	0.1%	76.7
Encelia farinosa Alliance	4114	391	22,408.4	55,372.2	0.9%	141.6
Ephedra californica Alliance	4211	170	1,753.6	4,333.2	0.1%	25.5
Ephedra nevadensis Alliance	5413	222	4,780.4	11,812.6	0.2%	53.2
Ephedra viridis Alliance	5417	142	5,026.1	12,419.8	0.2%	87.5
Ericameria cooperi Provisional Alliance	5215	51	1,122.7	2,774.2	0.0%	54.4
Ericameria linearifolia – Isomeris arborea Alliance	2214	37	785.5	1,941.0	0.0%	52.5
Ericameria nauseosa Alliance	5212	1,185	28,090.9	69,414.0	1.2%	58.6

Table B-2: Map Unit Acreage, Listed Alphabetically

Map Unit Description	Map Unit	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
Ericameria paniculata Alliance	4213	83	526.5	1,301.0	0.0%	15.7
Ericameria teretifolia Alliance	5416	126	3,489.8	8,623.5	0.1%	68.4
Eriodictyon (crassifolium, trichocalyx) Provisional Alliance	2215	41	377.1	931.8	0.0%	22.7
Eriogonum fasciculatum Alliance	2221	1,278	28,425.2	70,240.1	1.2%	55.0
Eriogonum wrightii Alliance	2222	1	5.5	13.7	0.0%	13.7
Eschscholzia (californica) Alliance	2311	50	1,959.9	4,842.9	0.1%	96.9
Exotic Trees	9500	14	44.0	108.7	0.0%	7.8
Forestiera pubescens Alliance	1425	39	46.1	113.8	0.0%	2.9
Frankenia salina Alliance	3724	7	48.6	120.2	0.0%	17.2
Fremontodendron californicum Alliance	2114	81	1,028.4	2,541.3	0.0%	31.4
Grayia spinosa Alliance	5411	400	22,262.6	55,012.1	0.9%	137.5
Gutierrezia sarothrae Provisional Alliance	5214	4	38.2	94.4	0.0%	23.6
Hyptis emoryi Alliance	4228	244	1,089.9	2,693.1	0.0%	11.0
Intermontane deep or well-drained soil scrub Group	5410	6	926.5	2,289.4	0.0%	381.6
Isocoma acradenia Alliance	3728	3	14.6	36.1	0.0%	12.0
Juncus arcticus (var. *balticus, mexicanus*) Alliance	3611	32	208.9	516.1	0.0%	16.1
Juniperus californica Alliance	1122	1,707	26,830.8	66,300.3	1.1%	38.8
Krascheninnikovia lanata Alliance	5412	67	3,159.1	7,806.2	0.1%	116.5
Larrea tridentata Alliance	4119	3,941	168,774.6	417,050.7	7.0%	105.8
Larrea tridentata - Ambrosia dumosa Alliance	4115	4,044	1,092,981.6	2,700,814.0	45.2%	667.9
Larrea tridentata - Encelia farinosa Alliance	4118	1,395	106,382.0	262,875.5	4.4%	188.4
Lasthenia californica - Plantago erecta - Vulpia microstachys Alliance	2313	7	92.0	227.3	0.0%	32.5
Lepidospartum squamatum Alliance	4212	167	2,488.3	6,148.7	0.1%	36.8
Lower Bajada & Fan Mojavean–Sonoran desert scrub Group	4110	2	15.7	38.8	0.0%	19.4
Lycium cooperi Alliance	5418	14	422.7	1,044.6	0.0%	74.6
Massive sparsely vegetated rock outcrop Mapping Unit	6115	98	2,001.4	4,945.6	0.1%	50.5
Medit. CA naturalized annual & perennial grassland Group	2330	1,107	35,089.4	86,707.7	1.5%	78.3
Menodora spinescens Alliance	5425	3	43.4	107.2	0.0%	35.7

Table B-2: Map Unit Acreage, Listed Alphabetically

Map Unit Description	Map Unit	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
Mud hills sparsely vegetated ephemeral herbs Mapping Unit	6113	229	5,073.2	12,536.2	0.2%	54.7
Nassella cernua Provisional Alliance	2321	1	131.4	324.8	0.0%	324.8
Non-woody Row and Field Agriculture	9220	277	27,520.5	68,004.6	1.1%	245.5
North American warm desert bedrock cliff and outcrop Group	6110	20	988.7	2,443.2	0.0%	122.2
North American warm desert dunes and sand flats Group	6120	21	515.3	1,273.4	0.0%	60.6
Panicum urvilleanum Alliance	6122	9	294.8	728.5	0.0%	80.9
Parkinsonia florida-Olneya tesota Alliance	4227	837	36,590.1	90,416.1	1.5%	108.0
Perennial Stream Channel (Open Water)	9801	12	437.3	1,080.5	0.0%	90.0
Peucephyllum schottii Alliance	6118	8	67.4	166.6	0.0%	20.8
Pinus monophylla Alliance	1311	180	1,263.6	3,122.5	0.1%	17.3
Pinus sabiniana Alliance	1121	18	85.9	212.3	0.0%	11.8
Platanus racemosa Alliance	1414	28	79.8	197.1	0.0%	7.0
Pleuraphis rigida Alliance	4122	26	790.0	1,952.0	0.0%	75.1
Pluchea sericea Alliance	4221	142	986.2	2,437.0	0.0%	17.2
Populus fremontii Alliance	1411	305	1,560.0	3,854.9	0.1%	12.6
Prosopis glandulosa Alliance	4222	338	2,741.5	6,774.3	0.1%	20.0
Prunus fasciculata Alliance	4214	146	842.9	2,083.0	0.0%	14.3
Prunus ilicifolia Alliance	2134	29	98.2	242.6	0.0%	8.4
Pseudotsuga macrocarpa Alliance	1211	15	65.3	161.4	0.0%	10.8
Psorothamnus spinosus Alliance	4225	65	628.0	1,551.8	0.0%	23.9
Purshia tridentata Alliance	5422	84	1,547.8	3,824.6	0.1%	45.5
Quercus agrifolia Alliance	1117	1	6.6	16.3	0.0%	16.3
Quercus berberidifolia Alliance	2132	44	194.1	479.7	0.0%	10.9
Quercus berberidifolia - Adenostoma fasciculatum Alliance	2133	78	452.6	1,118.4	0.0%	14.3
Quercus chrysolepis Alliance	1113	37	138.5	342.3	0.0%	9.3
Quercus cornelius-mulleri Alliance	3314	43	720.1	1,779.4	0.0%	41.4
Quercus douglasii Alliance	1111	39	390.9	965.8	0.0%	24.8
Quercus john-tuckeri Alliance	3312	544	8,115.6	20,054.1	0.3%	36.9

Table B-2: Map Unit Acreage, Listed Alphabetically

Map Unit Description	Map Unit	# of Polygons	Total Area (hectares)	Total Area (acres)	% of Total Area	Average Polygon Size (ac.)
Quercus lobata Alliance	1112	28	239.9	592.9	0.0%	21.2
Quercus wislizeni Alliance	1114	44	426.8	1,054.5	0.0%	24.0
Ribes quercetorum Provisional Alliance	3211	3	5.0	12.3	0.0%	4.1
Salazaria mexicana Alliance	5415	327	14,838.7	36,667.3	0.6%	112.1
Salix exigua Alliance	1424	42	105.2	260.0	0.0%	6.2
Salix laevigata Alliance	1412	68	174.9	432.1	0.0%	6.4
Salix lasiolepis Alliance	1427	20	35.0	86.5	0.0%	4.3
Sambucus nigra Alliance	1426	11	37.2	92.0	0.0%	8.4
Sarcobatus vermiculatus Alliance	5511	6	10.3	25.6	0.0%	4.3
Schoenoplectus californicus Alliance	3414	2	0.9	2.3	0.0%	1.1
Schoenoplectus spp. Mapping Unit	3412	55	72.0	177.8	0.0%	3.2
Small Earthen-dammed Ponds and Naturally Occurring Lakes	9803	10	6.5	16.1	0.0%	1.6
Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	6116	1,499	45,905.5	113,434.8	1.9%	75.7
Sporobolus airoides Alliance	3712	1	0.6	1.5	0.0%	1.5
Suaeda moquinii Alliance	3725	658	17,490.8	43,220.6	0.7%	65.7
Tamarix spp. Semi-natural Stands	1432	378	4,172.1	10,309.4	0.2%	27.3
Typha (angustifolia, domingensis, latifolia) Alliance	3415	44	75.8	187.2	0.0%	4.3
Unvegetated wash and river bottom Mapping Unit	6114	191	3,210.7	7,933.7	0.1%	41.5
Urban Window	9310	54	67,399.5	166,547.8	2.8%	3,084.2
Viguiera parishii Alliance	4151	50	1,193.2	2,948.4	0.0%	59.0
Water	9800	139	847.7	2,094.8	0.0%	15.1
Water Impoundment Feature	9805	149	2,224.8	5,497.7	0.1%	36.9
Wislizenia refracta Special Stands	6123	10	1,228.6	3,035.9	0.1%	303.6
Woody Agriculture (orchards, vineyards)	9210	249	5,889.2	14,552.4	0.2%	58.4
Yucca brevifolia Alliance	5423	1,482	61,731.6	152,542.1	2.6%	102.9
Yucca schidigera Alliance	5424	323	19,796.2	48,917.5	0.8%	151.4
Totals		46,803	2,415,833.9	5,969,650.3	100.0%	127.5

Table B-3: Map Units That Comprise More 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	*Larrea tridentata - Ambrosia dumosa* Alliance	4,044	1,092,981.6	2,700,814.0	45.2%	667.9
4119	*Larrea tridentata* Alliance	3,941	168,774.6	417,050.7	7.0%	105.8
4113	*Atriplex polycarpa* Alliance	2,179	112,049.3	276,879.6	4.6%	127.1
4118	*Larrea tridentata - Encelia farinosa* Alliance	1,395	106,382.0	262,875.5	4.4%	188.4
3723	*Atriplex spinifera* Alliance	1,568	71,645.5	177,039.7	3.0%	112.9
9310	Urban Window	54	67,399.5	166,547.8	2.8%	3,084.2
5423	*Yucca brevifolia* Alliance	1,482	61,731.6	152,542.1	2.6%	102.9
6117	*Chorizanthe rigida - Geraea canescens* Desert Pavement Sparsely Vegetated Alliance	1,433	60,417.7	149,295.2	2.5%	104.2
9300	Built-up & Urban Disturbance	7,527	60,133.8	148,593.7	2.5%	19.7
4111	*Ambrosia dumosa* Alliance	1,896	51,016.0	126,063.0	2.1%	66.5
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	1,499	45,905.5	113,434.8	1.9%	75.7
2305	CA Annual & Perennial Grassland Mapping Unit (Native component)	1,019	42,978.1	106,201.0	1.8%	104.2
5112	*Atriplex confertifolia* Alliance	1,059	39,585.3	97,817.4	1.6%	92.4
4227	*Parkinsonia florida - Olneya tesota* Alliance	837	36,590.1	90,416.1	1.5%	108.0
2330	Medit. CA naturalized annual & perennial grassland Group	1,107	35,089.4	86,707.7	1.5%	78.3
2221	*Eriogonum fasciculatum* Alliance	1,278	28,425.2	70,240.1	1.2%	55.0
5212	*Ericameria nauseosa* Alliance	1,185	28,090.9	69,414.0	1.2%	58.6
9220	Non-woody Row and Field Agriculture	277	27,520.5	68,004.6	1.1%	245.5
1122	*Juniperus californica* Alliance	1,707	26,830.8	66,300.3	1.1%	38.8

APPENDIX C

VEGETATION MISCELLANEOUS CLASSES (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.

9000 = MISCELLANEOUS CLASSES (part of the Vegetation Type mapping classification)

- 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 = California Aqueduct, Colorado River Aqueduct (Open Water)
  - 9805 = Water Impoundment Feature

Land Use

0000 = Not Assigned/Not assessed
1000 = Urban
1436 = Water transfer (Calif. and Colo. River Aqueducts only)
2000 = Agriculture (includes nurseries)
2100 = Non-woody row & field crops
2200 = Orchards & vineyards
9800 = Undifferentiated water
9810 = Water impoundment feature

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 one-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
Corresponding Land Use Attribute Code is 2000

For this project, agriculture was broken down into two categories: orchards and vineyards (9210) and non-woody row and field agriculture (9220). In general, polygons were not coded with the generic 9200 code unless they did not meet the criteria of the 9210 or 9220 subclasses. An example of this would be nurseries.

Criteria regarding agriculture in general were as follows:

- Structures related to agriculture and their associated disturbed areas were mapped as Built-up & Urban Disturbance (9300) as long as they met the 2.5-acre MMU.
- Agricultural areas within an urban window were mapped if they were greater than 10 acres in size.

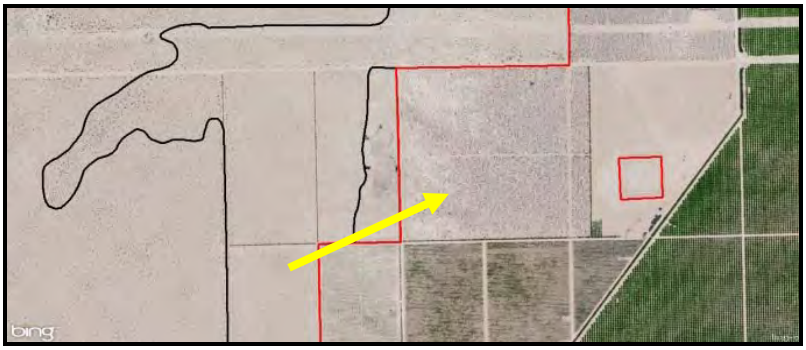
The criteria that are more specific to the 9210 and 9220 categories are described in the appropriate sections below.

9210 = Woody Agriculture (orchards, vineyards)
Corresponding Land Use Attribute code is 2200

Woody agriculture is defined as orchards, vineyards, jojoba farms, etc. shown on the early summer 2010 NAIP imagery.

- Abandoned orchards remain as 9210 until the trees have actually 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 abandoned 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.

- If an orchard/vineyard was completely removed based on the 2010 imagery, then the area was mapped as its current (2010) vegetation and/or land use type.

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.

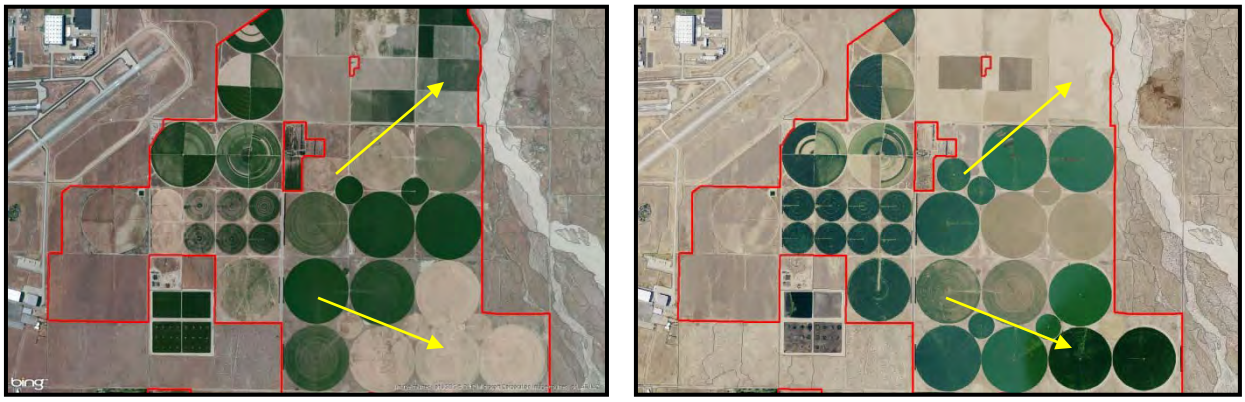
To account for the ambiguity of agricultural signatures due to land rotating in and out of activity, land that had been in crop production at any time between 2005 and 2010 is mapped as agriculture for this project. The agriculture polygon boundary was drawn to the largest actively farmed area seen on any of the 5-year set of NAIP imagery from the early summer 2005 – early summer 2010 timespan. 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 2010 base imagery. For example, if an area was last actively farmed in 2005, but had been inactive since then, the agriculture polygon was delineated and coded based on the 2005 image. However, the agriculture delineation was still registered to the 2010 image base (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 2010 image source, the area was called agriculture.
    - If an area was shown on the 2010 imagery as fallow, weedy, or abandoned, but earlier sources (2005-2010) 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 in the Antelope Valley. All fallow areas shown on the imagery have been productive at least once within the previous five years. In this example, alfalfa and other feed crops are growing in soils with alkaline-trending chemistry near Rosamond Dry Lake. Note the alternating cycles of croplands in and out of rotation.

b. If the area appeared to be **inactive** agriculture (based on the 2005-2010 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 in the Western Antelope Valley

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. Polygons along the eastern portion of the image depict sparse stands of *Ericameria nauseosa* returning over a cover of annual grasses.

However, sometimes it was extremely difficult to distinguish an older inactive agricultural field from an active one. An example is *Hordeum* spp. plantings (or another single grass/grain crop) that have been inactive since 2005. In this case, although not actively maintained, these fields are still monotypic with *Hordeum* growing from old seed. They appear 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. Vacant vegetated areas between and at the outer corners of circular pivot-irrigated agricultural fields were included in the delineation of the agricultural area, regardless of the 10-acre natural vegetation MMU. The resulting polygons were therefore mapped with straight-lined boundaries, following fence lines or roads where possible.

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 many 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.
- 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 mapping 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 (e.g. California City).
    - 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 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. Areas that are identified on the DRG as "target" were assigned a Map Unit code of 9300. These areas may be cleared or scraped, or have an herbaceous cover. These have been mapped on Edwards AFB. Additionally, areas within a military facility that are maintained as cleared for other purposes were also coded as 9300.

l. Major four-lane divided highways and freeways, such as State Routes 14 and 58, and Interstates 15 and 40, were usually delineated to the fenced right-of-way (ROW) as 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.

m. Active quarries were mapped as 9300, and the Land Use Attribute was coded as Urban = 1000. Vegetated areas within an active mine operation were included.

n. Underground mines were mapped as natural vegetation with no land use coding. The Anthropogenically Altered Disturbance Attribute may have been coded as 1, 2 or 3 depending on surficial disturbance visible on images.

o. 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.

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. An exception to the Urban Window criteria "e." discussed above occurs in the Piñon Hills region, where there is a contiguous area of built-up and disturbed land greater than 1 square mile that would have normally been mapped as a 9310 in the Vegetation Type (Map Unit) Attribute. In this situation, the natural vegetation is composed of a fairly large, dense and continuous (non-disjunct) cover of California juniper, Joshua trees, and pinyon pine overlapping the "Urban Window" polygon. It was decided instead to map this area as a *Juniperus californica* Alliance in order not to lose this continuous overstory of natural vegetation. The area still retained its urban designation (code = 1000) in the Land Use Attribute.

g. 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 0 were assigned.

Typically, the corresponding Land Use Attribute code of 0000 is assigned to a Vegetation Type (Map Unit) polygon coded as a 9320. However, there were situations where the Land Use Attribute was coded 1000 (Urban). This included the land within the fenced area for a vehicle test track facility.

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 therefore 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. (Note: The aggressive non-tree exotics that have their own map unit are 1431 (*Arundo donax*), 1432 (*Tamarix* spp.), 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 2010 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), the California and Colorado River Aqueducts (9804), and water impoundment features (9805). However, in this project the more generalized 9800 code was applied to artificially created 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:

- Artificially created water bodies were mapped as 9800. Examples include:
    - Park ponds
    - Residential development with recreational lakes
    - Reservoirs
    - Curvilinear-shaped duck ponds <u>with</u> water
    - Bermed agricultural ponds <u>with</u> water
- The MMU was 1 acre. However, in an Urban Window 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 Mojave and Colorado Rivers where water flows throughout most average rainfall years. These have an MMU of one acre and an MMW of half the width of a one-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, that receive their water completely from the upstream watershed. They have an MMU of one acre.

The following are considerations for mapping polygons that were coded as 9803:

- The MMU was one 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 = California Aqueduct, Colorado River Aqueduct (Open Water)
Corresponding Land Use Attribute Code is 1436

Aqueducts are coded separately because of their unique characteristics as a water conveyance system. Only open water aqueducts are mapped. The MMU was one acre for 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** – were 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 were mapped as natural vegetation.

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APPENDIX D:

COVER CLASSES

Table D-1: Map Classes for Total Cover by Conifers

Code	Range	Discussion
0	None or Not observable	There are no visible conifers in this stand.
1	>0-1%	*Juniperus californica, Pinus monophylla, P. sabiniana* are widely scattered as emergents.
2	>1-5%	Conifers are sparse and unevenly scattered to dispersed and evenly distributed.
3	>5-15%	This is a common cover class for *Juniperus californica* in the western Mojave Desert, and an occasional cover class for *Pinus monophylla* or *Pseudotsuga macrocarpa* in and near the Transverse Ranges.
4	>15-25%	This is an occasional cover class for *Juniperus californica*, *Pinus monophylla*, and *Pseudotsuga macrocarpa.*
5	>25-50%	This class is unusual, except perhaps in the most shaded/mesic setting of lower canyons in the Transverse Range.
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 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

Table D-2: Map Classes for Total Cover by Hardwoods

Code	Range	Discussion
0	None or Not observable	This class is typical for most desert uplands away from the Transverse or Tehachapi Ranges.
1	>0-1%	The stand may include isolated *Platanus racemosa, Populus fremontii*, *Salix gooddingii*, or *Salix laevigata* in riparian scrub.
2	>1-5%	A low cover of evenly distributed riparian trees is indicated.
3	>5-15%	This class is typical of open *Quercus douglasii* or *Quercus lobata* stands in the Transverse or Tehachapi Ranges, or of riparian woodlands with *Populus fremontii*, *Salix gooddingii*, etc.
4	>15-25%	This class would be an uncommonly high density for upland oak types or riparian woodlands in the study area.
5	>25-50%	This class would be an unusually high cover of upland oak or riparian woodlands dominated by hardwoods.
6	>50-75%	This would indicate a quite uncommon, locally dense riparian stand of trees.
7	>75-100%	This cover class was not used in the database.
9	Not applicable/Not assigned	Hardwood cover is not applicable when the MapUnit is 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 or Not observable	There are no visible *Yucca brevifolia* in the stand, although widely scattered juveniles <3 m tall may be included.
1	>0-1%	This is common in desert shrublands of *Larrea tridentata-Ambrosia dumosa, Atriplex polycarpa, Atriplex canescens, Coleogyne ramosissima,* etc. *Yucca brevifolia* 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 *Yucca brevifolia* woodland, usually evenly distributed with higher shrub cover.
3	>5%	This density is usually only found at higher or wetter sites within the study area, where clonal stands occur. It can occasionally involve non-clonal stands of spreading tree morphs at highest density, as near the southwest side of Ft Irwin.
9	Not applicable/Not assigned	Joshua tree cover is not applicable when the MapUnit is 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

Table D-4: Map Classes for Total Cover by Trees

Code	Range	Discussion
0	None or Not observable	There are no visible trees (including *Yucca brevifolia*) in the stand, although widely scattered juveniles <3 m tall may be included.
1	>0-1%	Emergent tree-size *Juniperus californica, Pinus monophylla, and Yucca brevifolia* are examples of this class, as well as wetlands with isolated tree *Salix* spp. or *Populus fremontii*.
2	>1-5%	Most *Yucca brevifolia* or open *Juniperus californica* woodlands over a well-developed shrub cover are included. Desert washes with scattered *Chilopsis linearis* or *Psorothamnus spinosus* are other examples.
3	>5-15%	The highest density *Yucca brevifolia* (usually the short clonal type in west Mojave), well-developed *Juniperus californica* woodland, and open *Quercus lobata* or *Q. douglasii* woodland in the Transverse and Tehachapi Ranges fall in this class.
4	>15-25%	*Quercus lobata, Q. douglasii*, or *Q. chrysolepis* woodlands in concavities in the Transverse and Tehachapi ranges are examples.
5	>25-50%	High-cover *Pseudotsuga macrocarpa* (with *Quercus chrysolepis*) stands in concavities in the Transverse Range on the edge of the ecoregion, or locally dense stands of *Populus fremontii* or other riparian trees, are examples.
6	>50-75%	This class is rare in the study area.
7	>75-100%	This cover class was not used in the database.
9	Not applicable/Not assigned	Total tree cover is not applicable when the MapUnit is 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

Table D-5: Map Classes for Total Cover by Shrub

Code	Range	Discussion
0	None or 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 *Larrea tridentata-Ambrosia dumosa* or *Encelia farinosa* on steep rocky slopes, or old inactive alluvial surfaces.
3	>5-15%	Upland vegetation (modal *Larrea tridentata-Ambrosia dumosa, Atriplex* spp.) and active vegetated washes (for example *Ephedra californica*, *Ericameria paniculata, Ambrosia salsola*) fall in this range.
4	>15-25%	High cover *Larrea tridentata-Ambrosia dumosa* (as in west Mojave near Inyokern with high density *Ambrosia dumosa*), well-developed *Coleogyne ramosissima* on moderate rocky slopes, well-defined *Atriplex polycarpa* in washes and swales in the western portion of the study area are examples.
5	>25-50%	Examples are high cover chaparral or coastal sage scrub types found in the foothills of the Sierra Nevada, the Transverse or Tehachapi Ranges. Small stands of *Salix* or *Prosopis* associated with springs, stable reservoirs or other water bodies are in this range. This cover class is rare in the study area.
6	>50-75%	This class is extremely rare in the study area.
7	>75-100%	This cover class was not used in the database
9	Not applicable/Not assigned	Shrub cover is not applicable when the MapUnit is 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%	Examples include ancient nonactive alluvial fans and steep slopes, both having low shrub cover (shrub cover class 2) and little to no herbaceous signature.
2	>2-15%	Typical *Larrea tridentata-Ambrosia dumosa* stands, and dry washes with *Ambrosia salsola*, *Ephedra californica,* or *Chilopsis linearis* are expected to have herb covers in this class.
3	>15-40%	Examples include most wetland woody and herbaceous polygons, and also degraded *Larrea tridentata* or *Larrea tridentata-Ambrosia dumosa* stands having visible and evenly dispersed largely non-native herb cover.
4	>40%	Herbaceous cover in this range is only found in dense wetlands, such as local stands of *Typha, Juncus, Schoenoplectus*, etc.
9	Not applicable/Not assigned	Herbaceous cover is not applicable when the MapUnit is 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.