

Vegetation and Flora of the Chocolate Mountain Aerial Gunnery Range, California

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Summary

The purpose of this Cooperative Agreement was to develop a comprehensive vegetation map and flora for the Chocolate Mountain Aerial Gunnery Range (CMAGR), under management by the Marine Corps Air Station Yuma (MCAS Yuma), Arizona. The vegetation map and flora will allow effective management of the vegetation communities on the CMAGR and provide a baseline for ecosystem management. The vegetation survey and flora are part the Integrated Natural Resources Management Plan (INRMP) prepared by MCAS Yuma under the Sikes Act Improvement Amendments of 1997.

Items delivered:

- Access database of species present and their abundance at 303 Rapid Assessment Plots
- Georeferenced digital photo(s) for each Rapid Assessment Plot
- Geodatabase of the vegetation associations/alliances for the CMAGR, the locations of Rapid Assessment Plots, and the routes taken by the authors
- Flora of 316 taxa documented on the CMAGR (Herbarium sheets housed at University of California, Riverside, with duplicates housed at Arizona Western College, Yuma)
- List and locations of invasive species

A total of 303 Rapid Assessment Plots were taken between 2015 and 2021. The resulting database holds quantitative and qualitative data – site description, canopy cover, prominence, and height – for perennial species across the CMAGR. From these data, and by inspection of aerial imagery, we mapped 34 units, including three units for (1) urban, (2) canal, and (3) other human disturbance, with the latter being largely lands disturbed by ordinance and the creation of targets. Of the 31 vegetated mapping units, 20 were mapped at the association level, 8 at the alliance level, and 3 as either “Group” or simply Mapping Unit. The Minimum Mapping Unit (MMU) was 1 hectare (2.5 acres) for most vegetation types, and 0.1 hectare (0.25 acres) for watercourses. All mapped vegetation units (vegetation types) were named (so far as possible) following the conventions of the National Vegetation Classification (NVC) and the Manual of California Vegetation (MCV), and to match the adjacent 2020 DRECP vegetation map surrounding the CMAGR and the 2007 NECO survey. A crosswalk is also provided to match the mapping units of the CMAGR with those of the Barry M. Goldwater Range – West, which is also managed by MCAS-Yuma.

Vegetation is classified in a hierarchy ranging from the very general '**class**' (e.g., "Desert") to very specific '**association**' (e.g., 'Creosotebush - Burrobush - Mojave Yucca Desert Shrubland'). **Macrogroup** fits in the middle of the hierarchy, between class and association. The majority of CMAGR vegetation is within either the **Mojave-Sonoran Semi-Desert Scrub Macrogroup** or the **North American Warm-Desert Xeric-Riparian Scrub Macrogroup**, with the latter including the ironwood/paloverde watercourses (xeric-riparian = dry river). At higher elevations (over 600 meters/2000 feet), typically on northern exposures and especially among granite boulders, there is an *Ambrosia-Ephedra* vegetation *may be* part of **Great Basin-**

Intermountain Dry Shrubland & Grassland Macrogroup but is provisionally placed within the Mojave-Sonoran Semi-Desert Scrub Macrogroup. Mesquite bosques and tamarisk thickets associated with the Coachella Canal are part of the **Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland Macrogroup**, while sea blite/saltbush vegetation is part of the **Warm & Cool Desert Alkali-Saline Marsh, Playa & Shrubland Macrogroup**. Finally, the NVC classifies barren rocky slopes and desert pavements as part of the **North American Warm Semi-Desert Cliff, Scree & Rock Vegetation**.

Collections for the flora include two perennial species that had previously never been documented in the United States. *Hoffmannseggia peninsularis*, a shrub in the pea family, was found near Salvation Wash, and previously only known from Baja California. *Fagonia densa*, a shrub related to the creosote bush, was discovered near the summit of the Chocolate Mountains, at 900 meters/3000 feet. It was also previously known only from Mexico.

Acknowledgements

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Introduction

The Chocolate Mountains Aerial Gunnery Range (CMAGR) covers 185,346 hectares (458,000 acres) of southeastern California. Because public access has been prohibited since its establishment circa 1942, the CMAGR is a relatively undisturbed element of our nation's biodiversity. There has never been a comprehensive survey of the vegetation. The range is mostly roadless, spotted with military targets and ordinance of all sorts.

As seen from state highway 111 along the Salton Sea, the CMAGR looks to be little more than an enormous rockpile skirted with alluvium washed out of the mountains during rare heavy rainfalls. Plant life appears scant, but this report shows that beyond Highway 111 a diverse desert ecosystem thrives.

As directed by the Integrated Natural Resources Management Plan (INRMP) prepared by Marine Corps Air Station – Yuma (MCAS-Yuma), we had two objectives. The first was to create a flora that documents every plant species discovered during our surveys. We collected enough material, at a minimum, from each species to create two archival herbarium sheets. One sheet is housed at the herbarium at University of California, Riverside, and the other is housed at the herbarium of Arizona Western College in Yuma, close to MCAS-Yuma.

The second effort was to map the vegetation. It is likely that most every animal species living on the CMAGR since its WWII establishment survives to this day, from badgers to less-noticed species such as red-spotted toads. All these creatures depend, ultimately, on the base of the food chain: the vegetation.

A vegetation map provides a visual representation, much like a geologic map, of what you or any other animal would encounter on the range, from thickets of cholla to patches of big galleta grass. We gathered vegetation data across the range and with the help of the California Native Plant Society, the UC Riverside Center for Conservation Biology, and the California Dept. of Fish and Wildlife, we then decided how and where to draw the lines on the map that separate the various vegetation communities. We also kept track of human-introduced species like Sahara mustard (*Brassica tournefortii*).

Field work spanned 2015 to 2021, taking advantage of range closures to make camps at various locations. We mapped vegetation to a minimum mapping unit (MMU) of 1 hectare (= 2.5 acres) for upland vegetation types, with greater detail (MMU of 0.1 ha) for watercourses. The CMAGR is prime habitat for the desert tortoise (Allison and McLuckie 2018), and according to Nafus et. al. (2017), watercourses are “used as foraging corridors by adult desert tortoises (Jennings & Berry 2015), can reduce adult dispersal away from translocation sites (Germano et al. 2012) and are selected for by juveniles (Todd et al. 2016).” In addition, we wished to accurately map the range/abundance of desert ironwood (*Olneya tesota*), a species important to wildlife, especially birds (England et al., 1984).

The Study Area

The Chocolate Mts Aerial Gunnery Range (CMAGR) is situated in the desert of southeastern California (Fig. 1). The Range is bounded to the southwest by the Salton Sea Basin, and to the northeast by the Chuckwalla and Palo Verde mountains. The northwest border is separated from the Orocopia Mountains by Salt Creek, while the northern border roughly follows the path of the historic Bradshaw Trail along the Chuckwalla Bench. The CMAGR is roughly 80 km (50 miles) long and 30 km (18 miles) wide. Elevations span from 14 meters (45 feet) below sea level to 933 meters (3060 feet) at an unnamed summit.

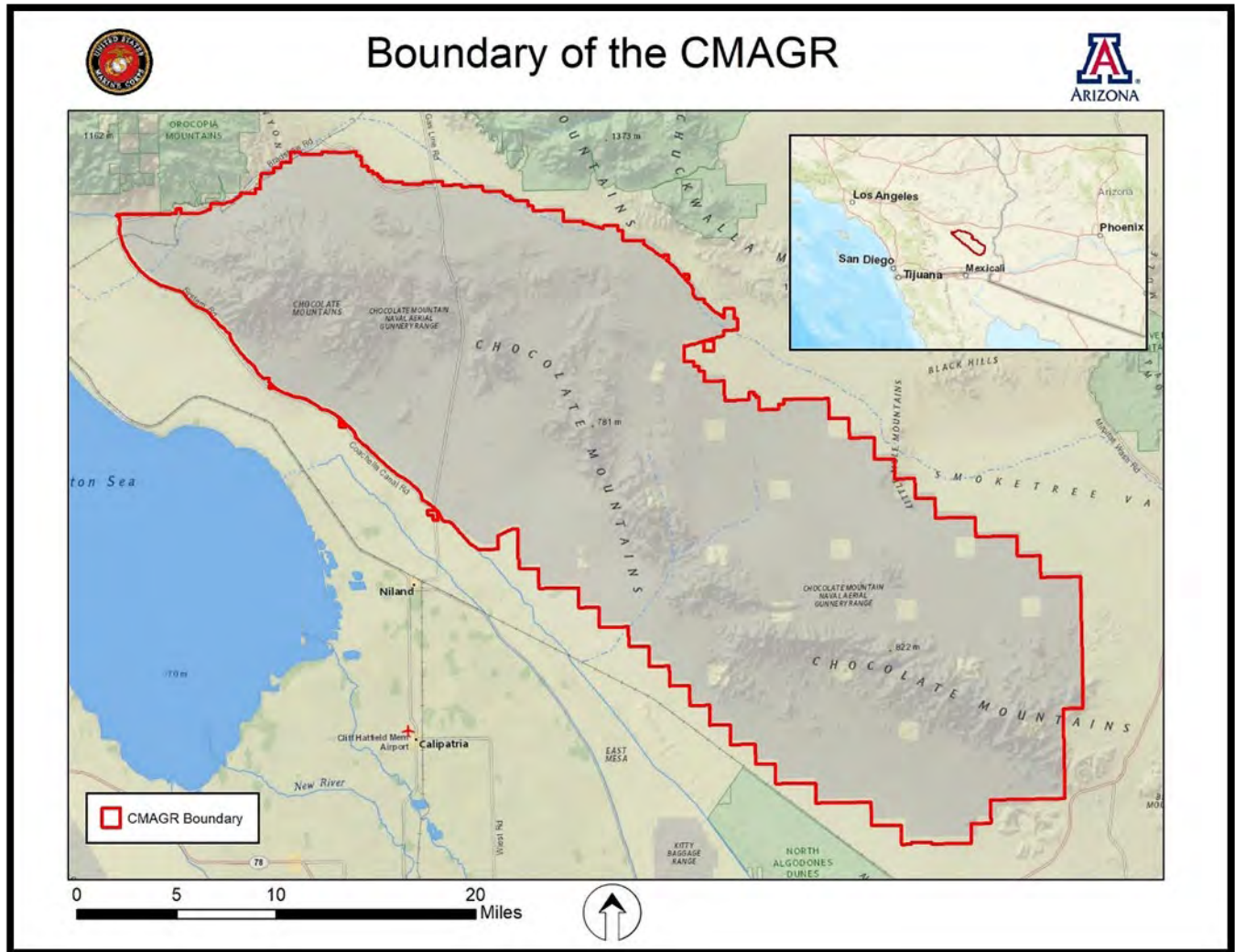


Figure 1. The boundary, in red, of the CMAGR in southeastern California, near the Salton Sea.

Climate

There are no weather stations on the range proper, but a fair indication of the temperature range can be seen in the 85 year record from the nearby Yuma Citrus Station: an average high of 41.2° C (106.1°F) in July to an average low of 3.9° C (39.1°F) in January, and an average annual precipitation of 87 m (3.4 in) (<http://www.wrcc.dri.edu/>; Yuma Citrus Station). These data are from 58 meters (190 feet), so we can expect cooler temperatures and more precipitation at the higher elevations within the range, and hotter temperatures below sea level. Rainfall gauges are lacking from the range, but PRISM climate data for 1991-2020 shows the range receiving from 65 to 140 mm/year (2.6 to 5.5 inches/year) (Fig. 2). The areas with the highest rainfall are in the northwest, where they receive a higher proportion of precipitation in the winter than the southeastern range (Fig. 2). (PRISM 2023).

A very brief history of CMAGR land acquisition

The following is lifted directly from the *Environmental Assessment: Withdrawal of the Chocolate Mountain Aerial Gunnery Range, Naval Air Facility, El Centro, California* (NAVFAC 1977)

“The Chocolate Mountain Aerial Gunnery Range, located in Imperial and Riverside Counties, contains approximately 460,000 acres and has been used for defense purposes continuously since World War II. The northerly portion of the gunnery range, consisting of approximately 208,388 acres, was acquired by fee acquisition of the private interests in 1942-43 by Decree on Declaration of Taking in Condemnation Action Case 2054-Y-CD Civil dated 12 February 1942...The southerly portion of the gunnery range, entirely in Imperial County, consists of approximately 252,000 acres. The privately owned property within the range consisted of 5,116 parcels comprising approximately 119,000 acres... All private interests have been acquired by the Government either through direct purchase or condemnation proceedings. The public domain lands in the southern portion of the range consisting of 133,000 acres were first occupied pursuant to the Wartime Powers Act (PL 507, 77th Congress) effective 18 July 1944.”

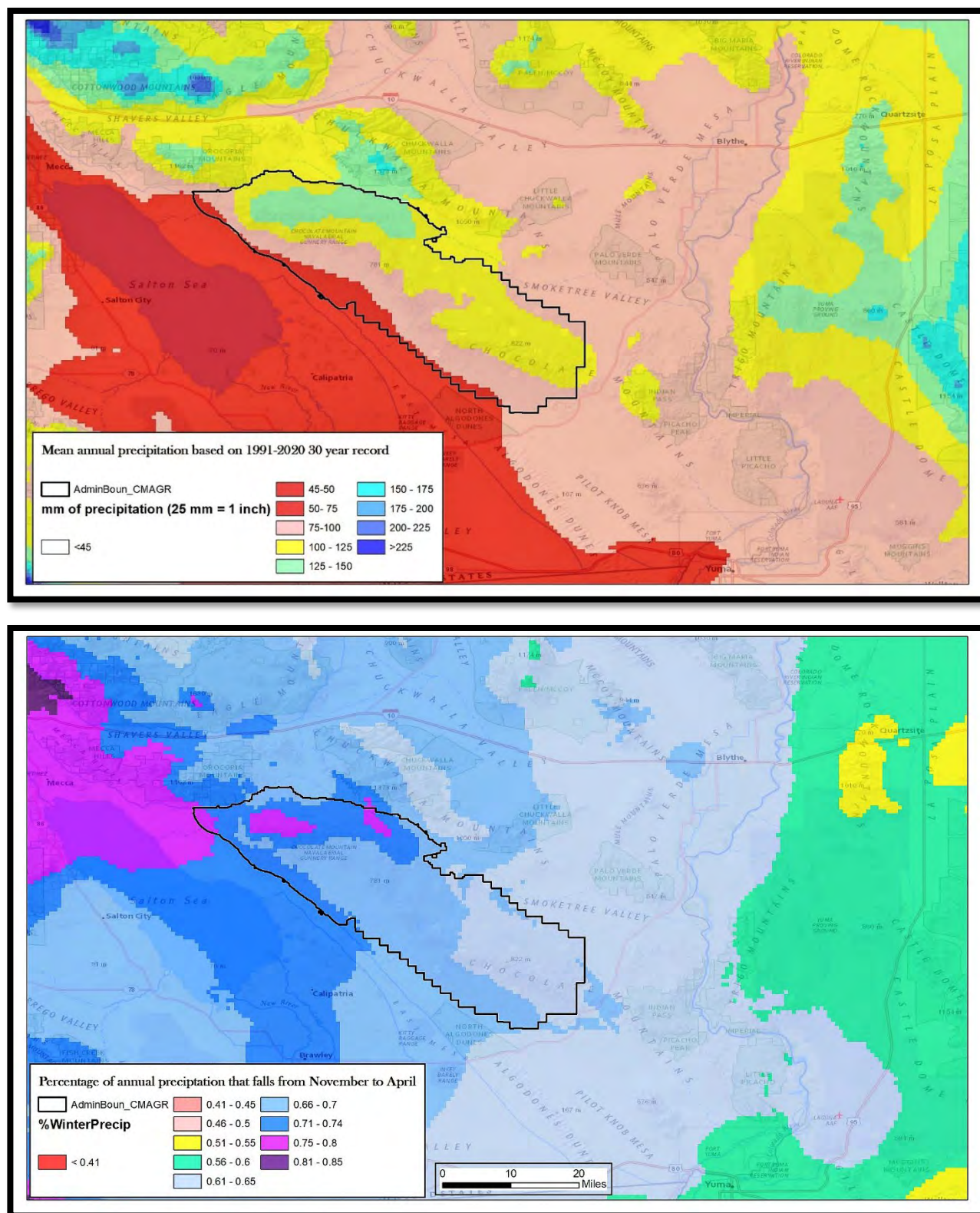


Fig 2. Amount and seasonality of precipitation, based on PRISM climate interpolations, 1991-2020.

FLORA AND VEGETATION OF THE CMAGR

Geology

The rocks making up the CMAGR vary tremendously in age, with volcanic basalts as young as 7 million years old to gneiss (= metamorphosed granite) over a billion years old (Powell et. al. 2018). Between these extremes are crystalline granites and pink volcanic rhyolites, as well as gleaming schists that were once mudstone (Fig. 2). The mountains are surrounded by a skirt of alluvium that varies from flat and smooth desert pavements in the southeast (e.g., FARPs Bull and Star) to steep alluvial fans of rubble in the northwest (the SWAT ranges) to a broad open valley between the Chocolate Mts and the Little Chuckwalla Mts to the north – the “Chuckwalla Bench”, the route of the historic Bradshaw Trail.

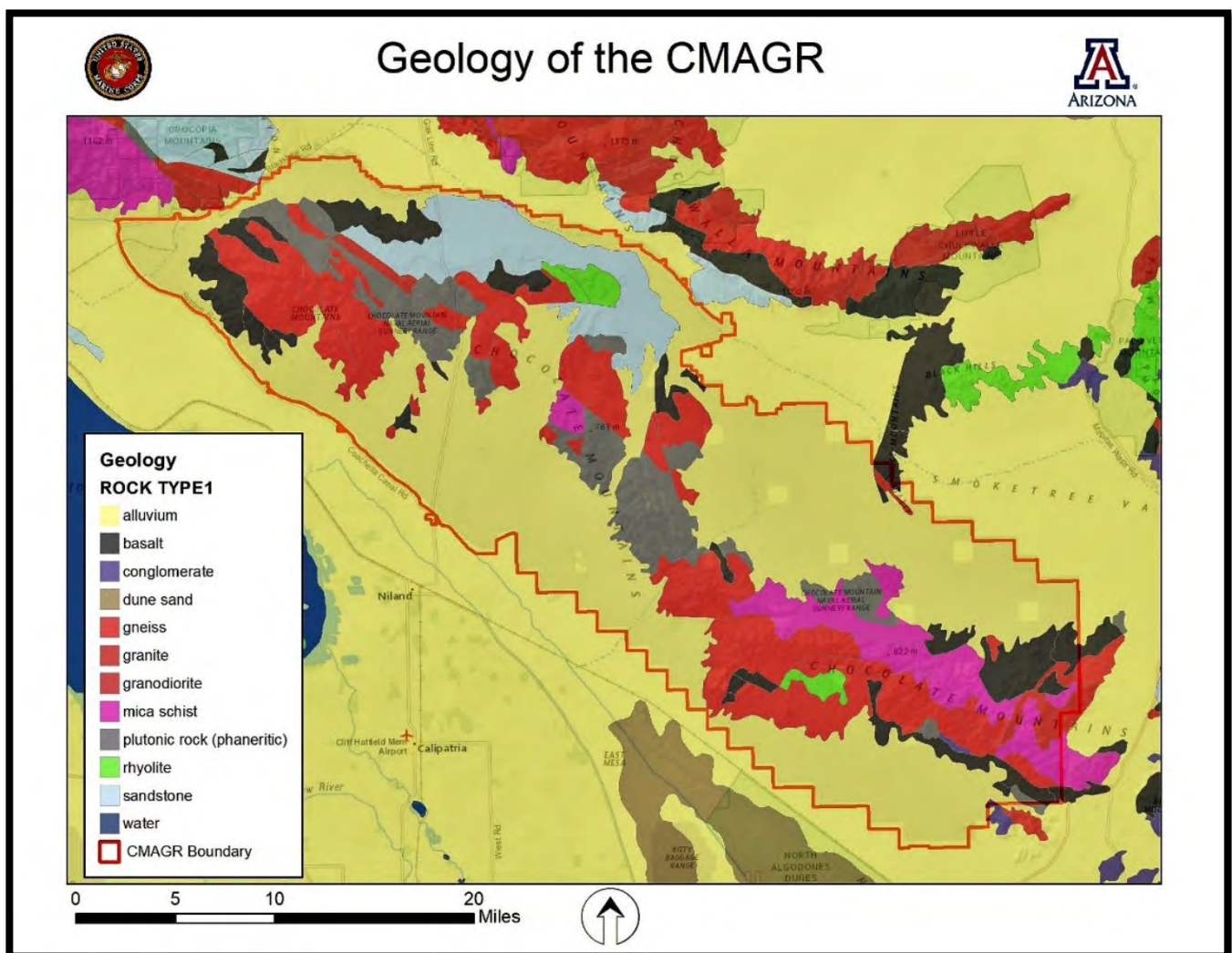


Figure 3. The geology of the CMAGR. “Plutonic rock” is a general term for igneous rocks with large crystals, including granite.

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The present topography began to form about 28 million years ago, motivated by 'extensional tectonism' – the stretching of the earth's crust (Powell et. al. 2018). This resulted in exhuming and tilting ancient rocks, and at the same time sparking the volcanism that created the basalts and rhyolites in the CMAGR. In addition, the San Andreas fault runs through the Salton Trough, adding earthquakes and lateral north-south displacement along the fault and making the Chocolate Mts very much a work in progress. The complexity of the resulting landscape is reflected in the vegetation map, particularly when different rocks are favored by different plants. For example, teddy bear cholla can be a dominant species on schist, and then vanish on granite boulders, despite similar elevations and exposures. These distinct landscapes are described below under A Tour of the CMAGR.

Previous Vegetation Maps

The vegetation of the CMAGR was mapped in the 1990s by the US Geological Survey's GAP mapping program (GAP 2008) (Fig. 4). Covering the entire continental United States, the GAP map was derived from summer 1990 Landsat Thematic Mapper (TM) satellite imagery and 1990 high altitude color infrared photography (Keeler-Wolf 2007) and field observations, with the latter being mostly absent from the CMAGR due to access restrictions. The vegetation was mapped at the level of ecological system, or ecosystem – for example, 'Sonora-Mojave Creosotebush (*Larrea tridentata*)-White Bursage (*Ambrosia dumosa*) Desert Scrub.' This ecosystem is found in both the Sonoran and Mohave deserts and is characterized by 'scrub' (=shrubs) of either/both creosote bush and white bursage. There are many variations within this ecosystem (e.g., the presence of big galleta grass [*Pleuraphis rigida*]), but they are not mapped at this level. The GAP map shows 11 ecosystems within the CMAGR, but only the six largest ecosystems are shown in Figure 4, with the others too small to be shown at this scale. While state-of-the-art for its time, the GAP map had numerous issues. For instance, it shows the alluvial fans (=bajadas) mapped as desert washes, but only sections of the fans are actually washes. This lack of detail was a consequence of the large 'minimum mapping unit' (MMU) of 100 hectares (=247 acres) (Keeler-Wolf 2007).

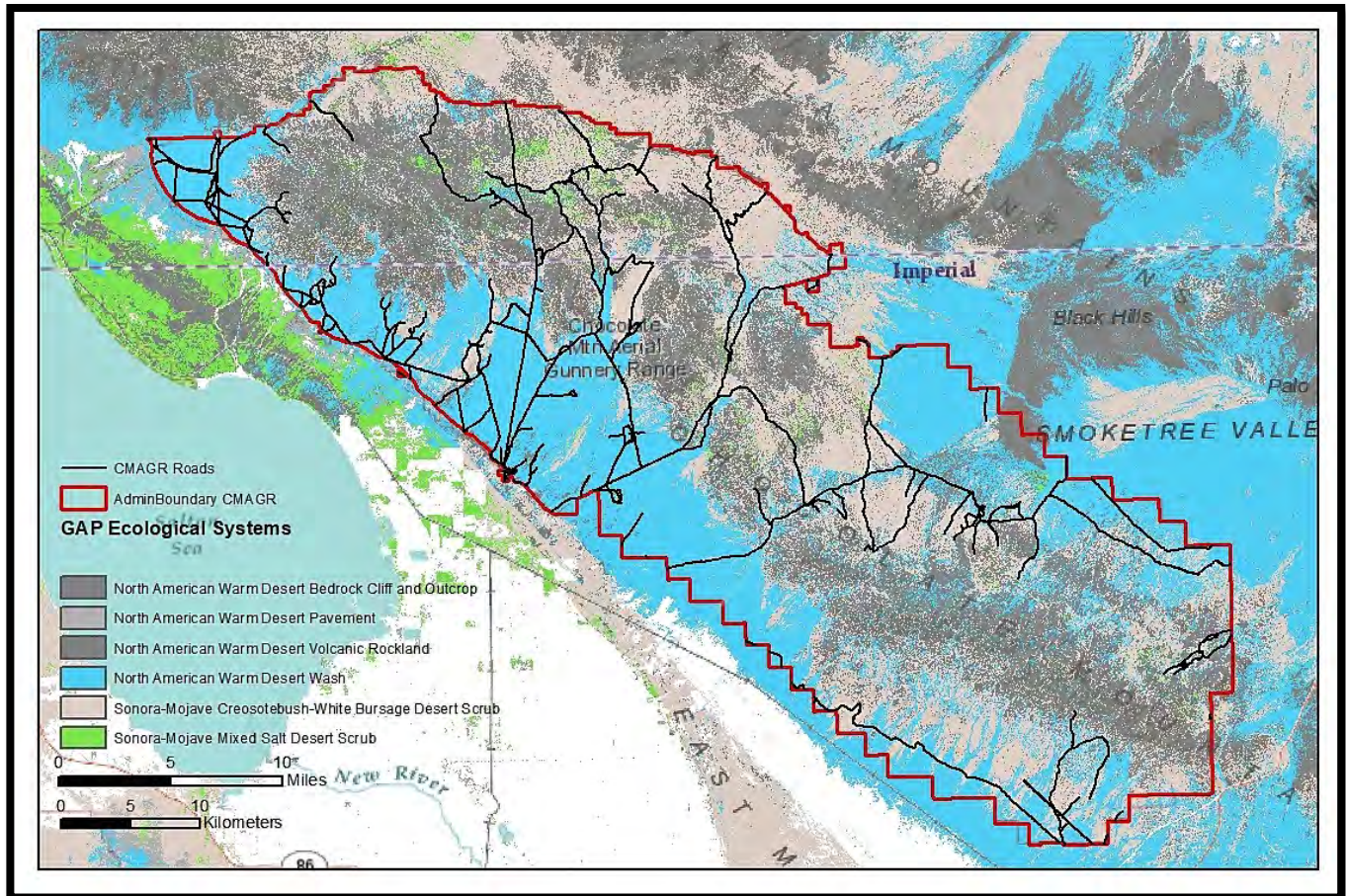


Figure 4. The GAP vegetation map of the CMAGR and surrounding lands.

A Tour of the CMAGR

The crest of the Chocolate Mts is oriented SE – NW, just like the Salton Sea and the Algodones Dunes. Consequently, much of the range faces SW towards the Salton Sea and the dunes, and to the NE towards the Little Chuckwalla Mts and the Bradshaw Trail. The SW slope drops to a much lower elevation than the NE slope (below sea level on the SW slope near Camp Billy Machen), while to the NE the saddle between the Chocolates and the Little Chuckwallas is at 2500 feet. The lower elevations make the SW slope hotter, and to turn up the heat a bit more it faces the afternoon sun.

These differences in elevation and aspect (e.g., facing SW) affect the vegetation and flora in ways that are plain to see to anyone circumambulating the Chocolate Mts. For an on-the-ground reveal of the differences between the two sides of the mountains, take the Gas Line Road from Camp Billy Machen to the Bradshaw Trail and you'll climb 2300 feet in about 13 miles.

The section below is an introduction to the various landforms and associated vegetation that are familiar to Range Management. Although we mentioned above the difference between NE and SW slopes of the CMAGR, when it comes to more local differences in the flora and vegetation, we refer simply to the 'north' and 'south' sides of the mountain, with the north-side being higher and cooler.

See Appendix B for images of the vegetation maps corresponding to each of the areas highlighted below.

South of Mount Barrow: Imperial Gables, Mesquite Gold Mine



The vegetation of the southeastern end of the CMAGR holds the largest populations of jumping cholla (*Cylindropuntia bigelovii*), on the CMAGR, including one covering nearly 3 square miles (1,806 acres). The cholla is most common on schist, the same dark rock that supports the range's largest populations of barrel cactus, *Ferocactus cylindraceus*. Access is through either the Imperial Gables Road off of highway 78 or the range road heading NW from Bull FARP.

The Mesquite Mine sits on the range boundary near the sand-buggy capital of Glamis, California. The mine has produced more than four million ounces of gold since it began operating in 1986, with average annual gold production of approximately 130,000 ounces/year over the last 10 years. Surrounding vegetation is typical of the SW slope of the CMAGR, dominated by creosote, white bursage, and ironwood.



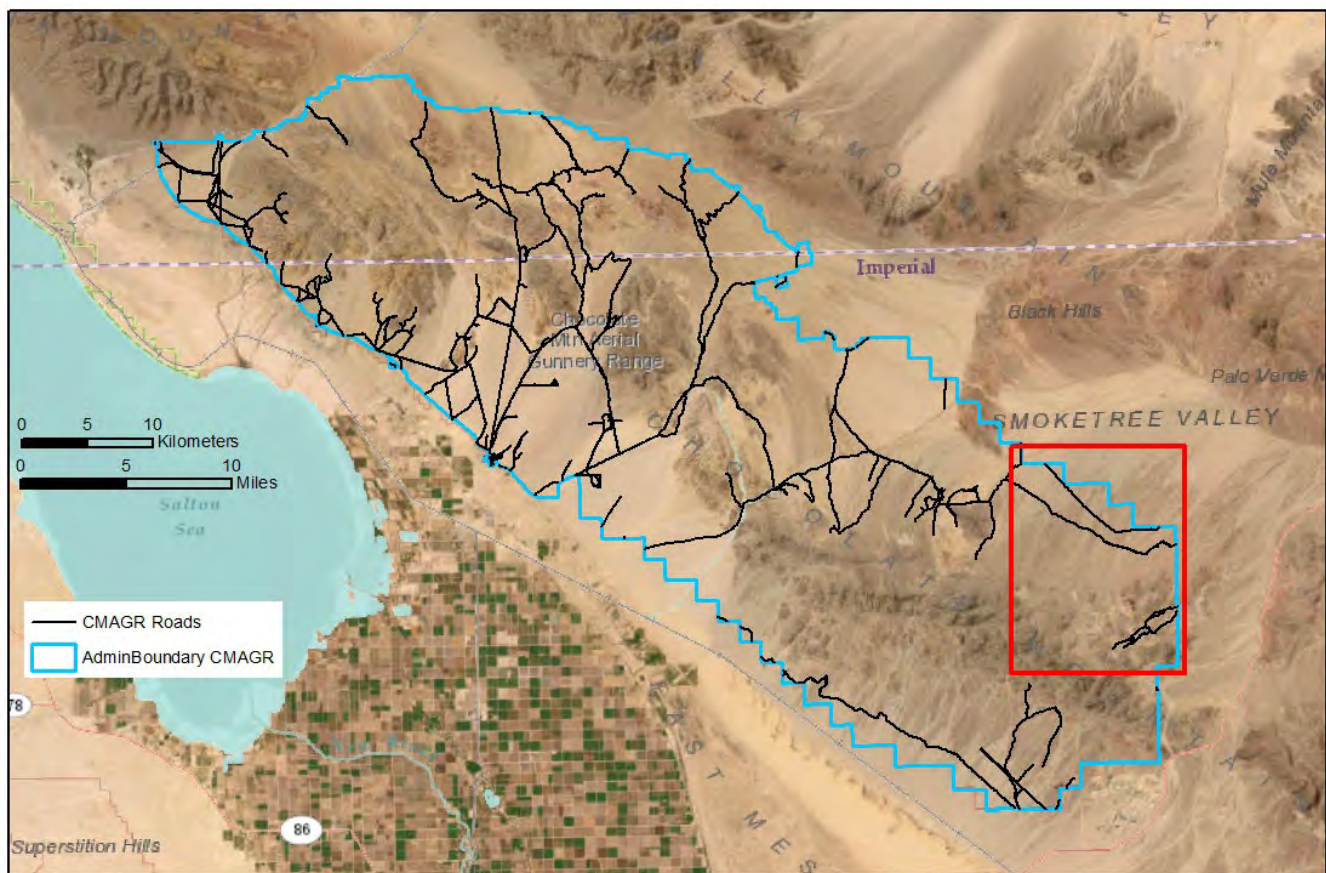
Above: The population of *Cylindropuntia bigelovii* near Imperial Gables.



Above: The view southwest towards the Algodones Dunes from 2560 feet (762 m), with ocotillo and barrel cactus (*Ferocactus cylindraceus*).

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North of Mount Barrow: Sawtooth Mountain



This corner of the CMAGR receives apparently receives a bit more summer rain than the rest of the CMAGR, as evidenced by the former presence of the summer-rain dependent saguaro along the range boundary photographed by Jim Malusa in 1991. Sawtooth Mountain is the tallest of a collection of volcanic peaks north of Mt Barrow. These peaks exceed 2000 feet in elevation, and likely hold unusual plants on their northern slopes, but were too steep for us to tackle and await better climbers to investigate. The surrounding alluvial plains typically hold the fairy duster (*Calliandra eriophylla*) along the watercourses, an important browse species for mule deer (Carrera et al., 2015).

Mt. Barrow is almost 2500 feet high, and the north slopes of this and other granitic mountains hold vegetation very different from the hotter and more arid slopes on the south side of Mt. Barrow.

Access is through either the Mt. Barrow Corridor via Midway Well or along Dietz Road. The 'CMAGR Roads' shapefile obtained from MCAS-Yuma Range Management shows two long E-W roads near the north border (see figure above), but these roads no longer exist.



Above: Malusa photographed a saguaro off Dietz Rd. on the range boundary in 1991 (above), but subsequent searches in 2020 could not relocate the specimen. It was a large mature (10 m) saguaro with two arms and has likely died in the intervening 3 decades. It was the westernmost saguaro in North America. The cactus at its base is *Echinocactus polycephalus*.



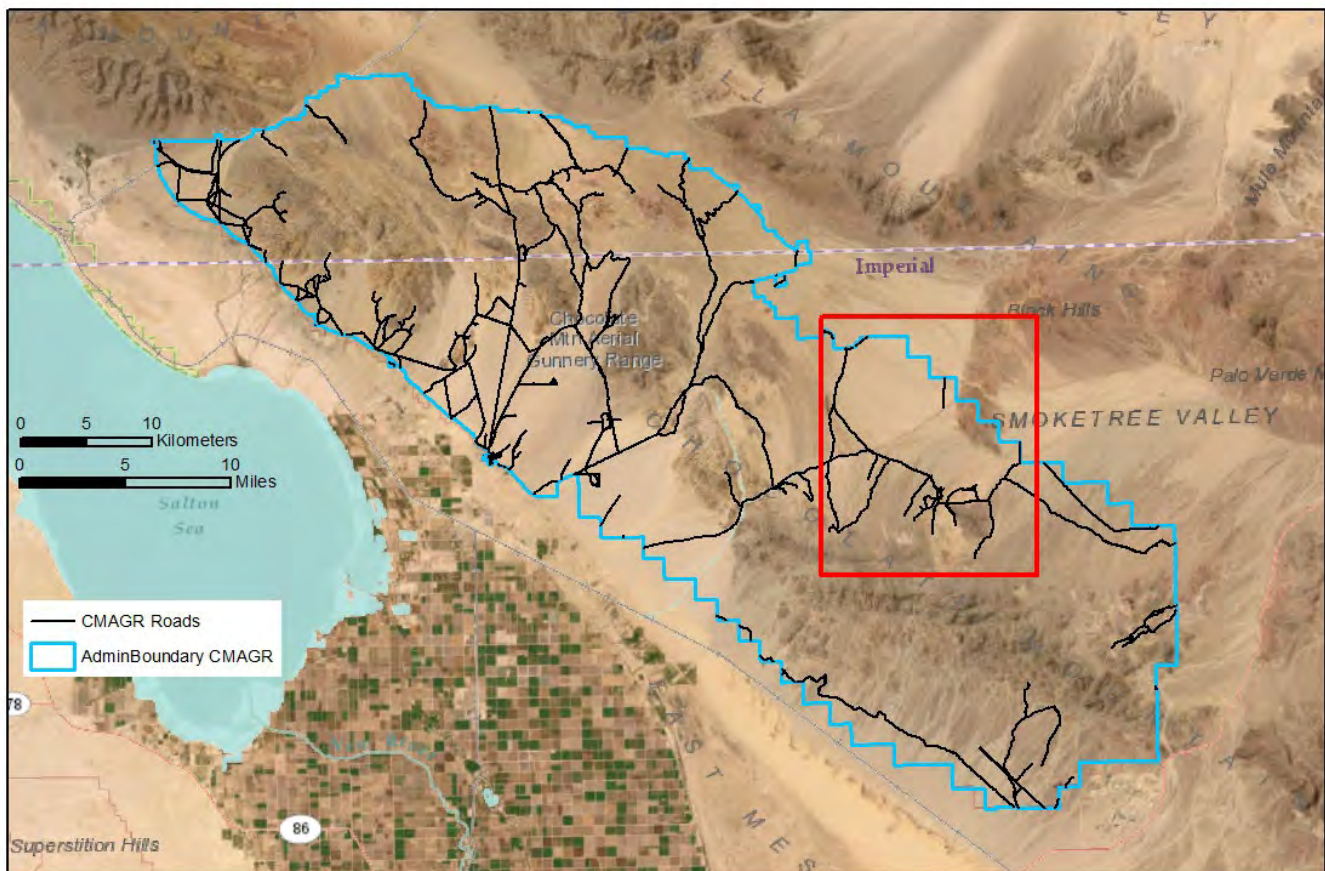
Above: Mt. Barrow reaches 754 meters (2473 ft) in the SE corner of the CMAGR. The north facing slope is a jumble of granodiorite boulders, with vegetation dominated by white bursage and Mormon tea.



Above: The view north and east to Sawtooth Mt (center) and associated peaks on November 2, 2016. The cactus is teddy bear cholla, aka jumping cholla (*Cylindropuntia bigelovii*).

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Camp Burt, Blue Mountain, and the Little Mule Mountains



On the north side of the CMAGR at an elevation of around 1100 feet, Camp Burt and nearby associated targets hold vegetation typical of the bajadas (alluvial slopes), with a mix of creosote, white bursage, and ironwood, either dispersed relatively evenly or with the vegetation confined to narrow watercourses on desert pavements. A species rare in California, *Koeberlinia spinosa* or crown of thorns, is found only in this region of the CMAGR.

The Little Mule Mts are little, barely exceeding 1400 feet, relatively barren, and notable mainly for the easternmost extent of Munz's cholla, a species largely restricted to the CMAGR and previous to this study believed to be rare. The area west of Camp Burt and near Blue Mountain holds many targets that show significant Human Disturbance.

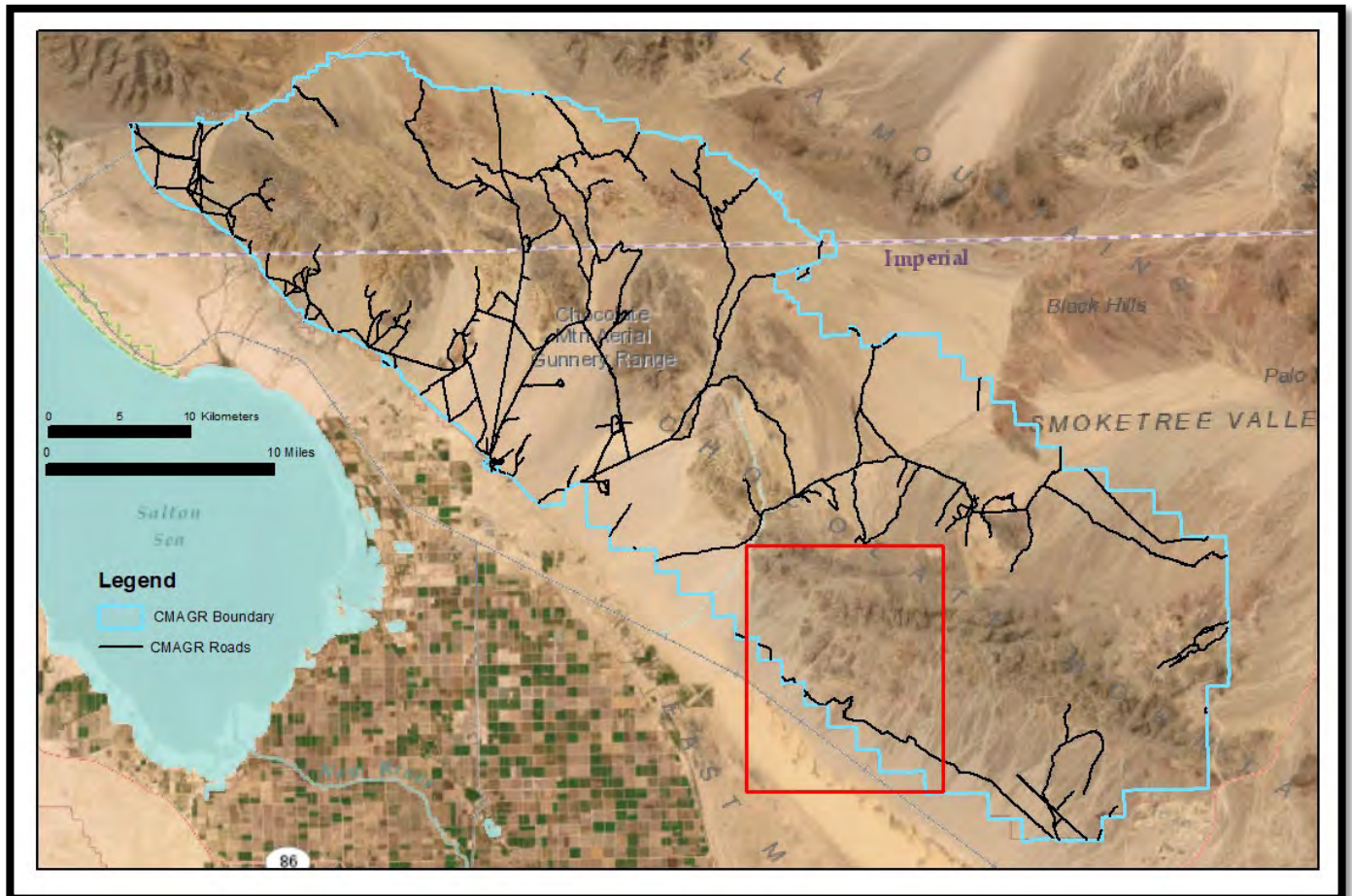
Access is through either Salvation Pass or along Dietz Road.



Top: *Koeberlinia spinosa*, at left, along a wash near Camp Burt. **Bottom:** Munz's cholla cactus along a small arroyo in the Little Mule Mts.

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Mammoth Wash



Mammoth Wash is on the south side of the CMAGR and is frequently and illegally visited by folks from the Imperial Valley. Although the 'CMAGR Roads' shapefile obtained from MCAS-Yuma Range Management shows no road into Mammoth Wash, there is a well-established track that leaves the Ted Kipf Road and heads NNE for Hayden Well. Beyond the well, the route continues up Mammoth Wash to 'the narrows', where ATVs squeeze through and proceed further via a badly eroded wildcat track out of the wash (see below).

STAR FARP is also in this area, along with extensive desert pavements and the most barren mountains on the CMAGR. It's tough country for a plant.



Above, just above The Narrows of Mammoth Wash, an illegal road made by recreational motorists from the Imperial Valley. **Below**, the barren mountains north of STAR FARP.

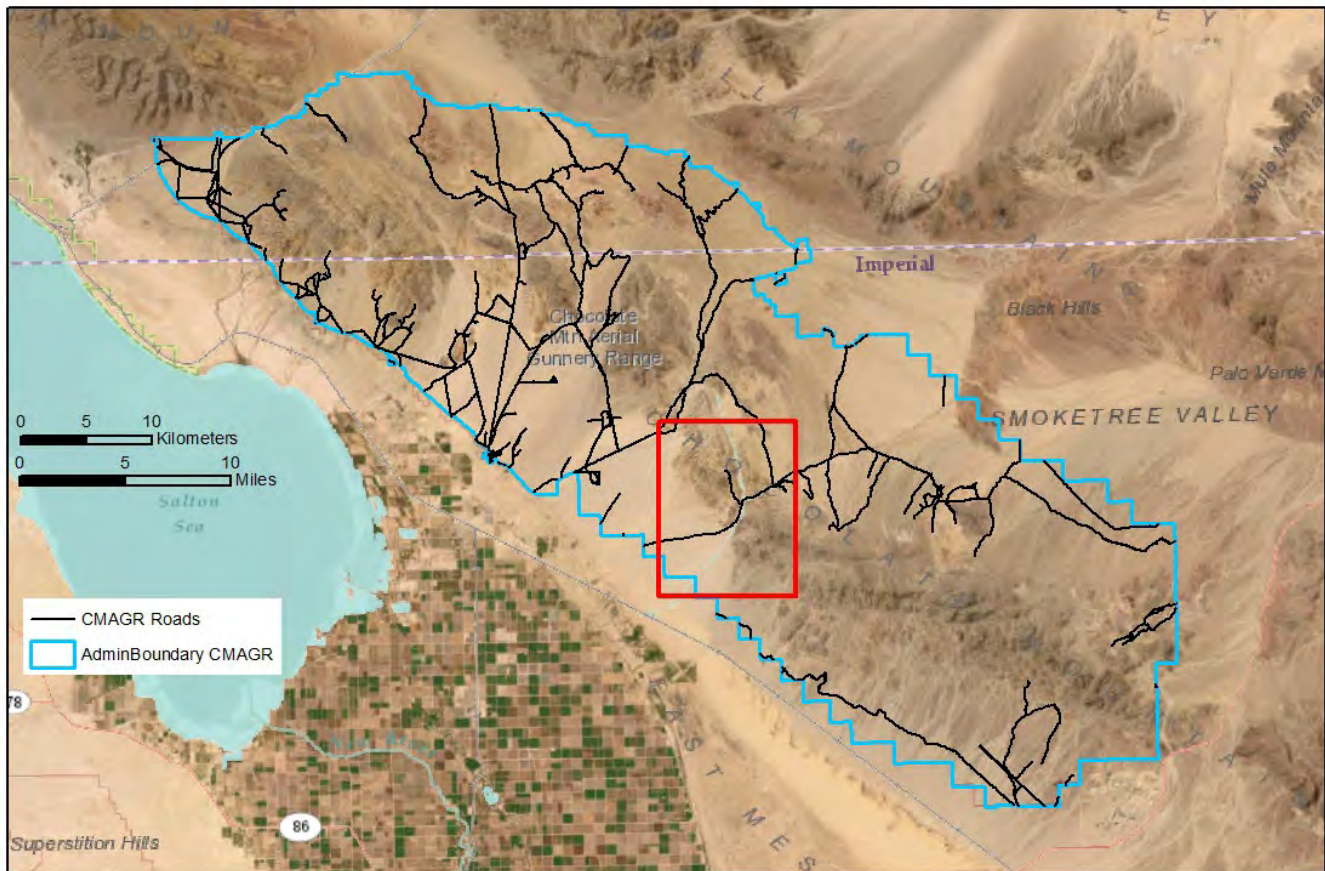


FLORA AND VEGETATION OF THE CMAGR



Above, typical desert pavements east of STAR FARP, with scattered *Larrea tridentata*, *Olneya tesota*, *Encelia farinosa*, and *Fouquieria splendens*.

Salvation Pass



Accessed via the Niland – Pegleg Well Road, Salvation Pass is one of three vehicle routes across the Chocolate Mountains. The route is mostly along Salvation Wash, past stands of ironwood, desert willow, and smoketree. The bedrock geology is largely granitic, and the narrow canyons on the north side of the pass hold thriving populations of Bigelow's nolina (*Nolina bigelovii*) and hollyleaf bursage (*Ambrosia illicifolia*), with the latter species only found in this area. *Larrea tridentata* is rare or uncommon on the mountain slopes, which are instead dominated by *Encelia farinosa*, *Ambrosia dumosa*, and at higher elevations, *Ephedra aspera*.



Above, smoketree in Salvation Wash.

Below, *Nolina* and *Ephedra* in a canyon above Salvation Wash.



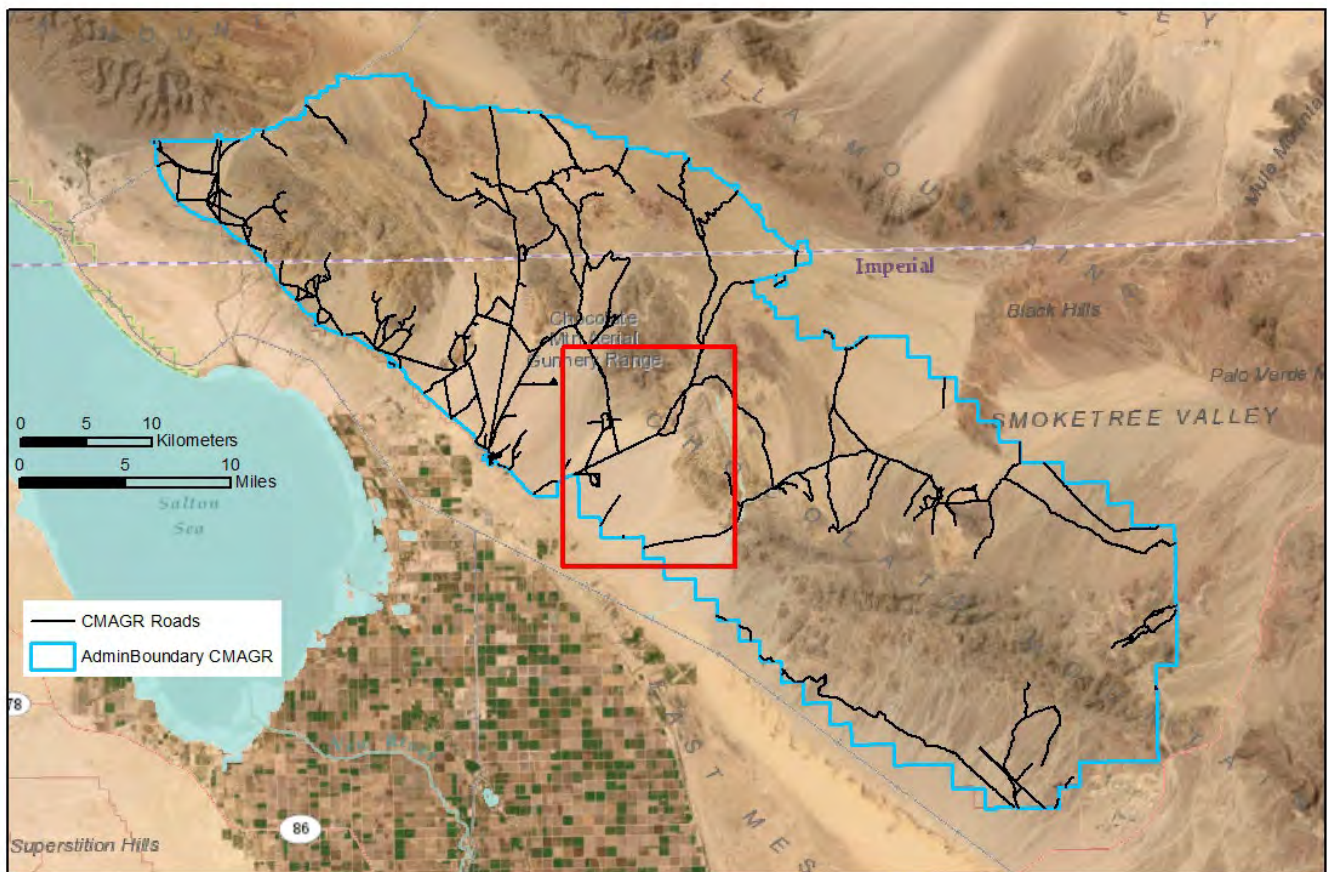


Above, *Olneya tesota* and *Parkinsonia florida* line a rocky tributary of Salvation Wash, north of Salvation Pass.

Below, *Ambrosia dumosa*, *Encelia farinosa*, and *Ephedra aspera* above a side canyon of Salvation Wash. Note lack of creosote and cactus.



Lower Surveyors Pass



Accessed via the Niland-Blythe Road, Surveyors Pass follows an historic path pioneered in the mid-1800's. The route climbs from around 100 ft above sea level at the south CMAGR boundary, to 2186 ft at the summit of the pass near the CMAGR north boundary, mostly following the route of a power line, and passing a windmill at Beal Well. From south to north, the route passes holly-leaf saltbush, the densest populations of *Cylindropuntia munzii* on the CMAGR, and eventually rises into the land of *Yucca schidigera*. Between Surveyors Pass and Salvation Pass (to the southeast) is a complex of granite mountains reaching 2200 ft that are unusual in their diversity, with species like elephant tree (a single specimen of *Bursera microphylla*) and Hall's shrubby spurge (*Tetracoccus hallii*).



Top, *Atriplex hymenelytra*, desert holly saltbush, with creosote below Surveyors Pass at 660 feet. **Bottom,** *Bursera microphylla*, the elephant tree, with Surveyors Pass in background.

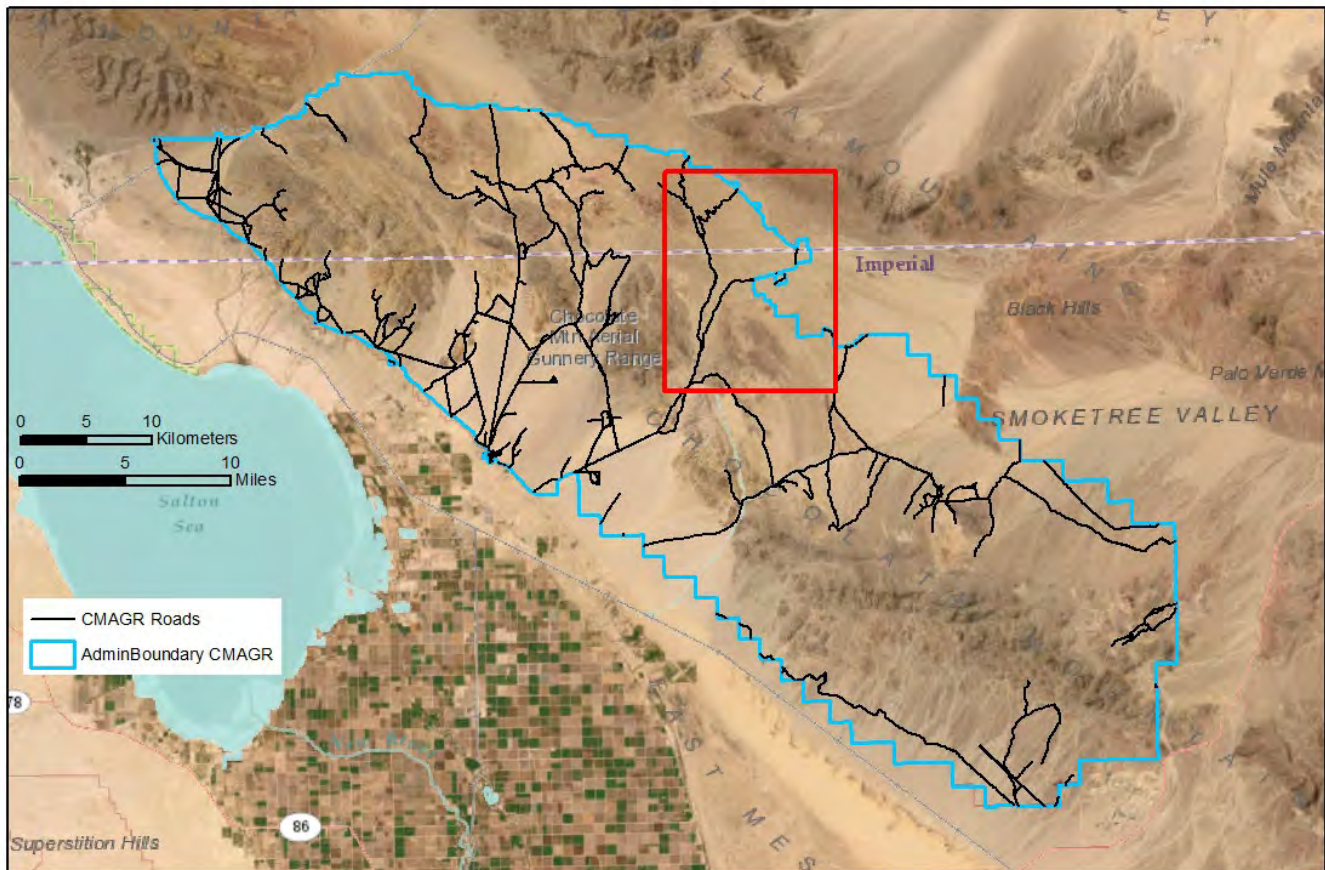
FLORA AND VEGETATION OF THE CMAGR



Top, on alluvium near the head of Surveyors Pass at 1950 ft, Andy Sanders passes an 8-foot tall *Cylindropuntia munzii*. **Bottom**, at 1775 ft on granite, *Ambrosia dumosa* and *Tetradlopus hallii* are co-dominant, with common *Senna armata*, *Yucca schidigera*, *Simmondsia chinensis*, and *Psoralea schottii*.

FLORA AND VEGETATION OF THE CMAGR

Upper Surveyors Pass to Bradshaw Trail

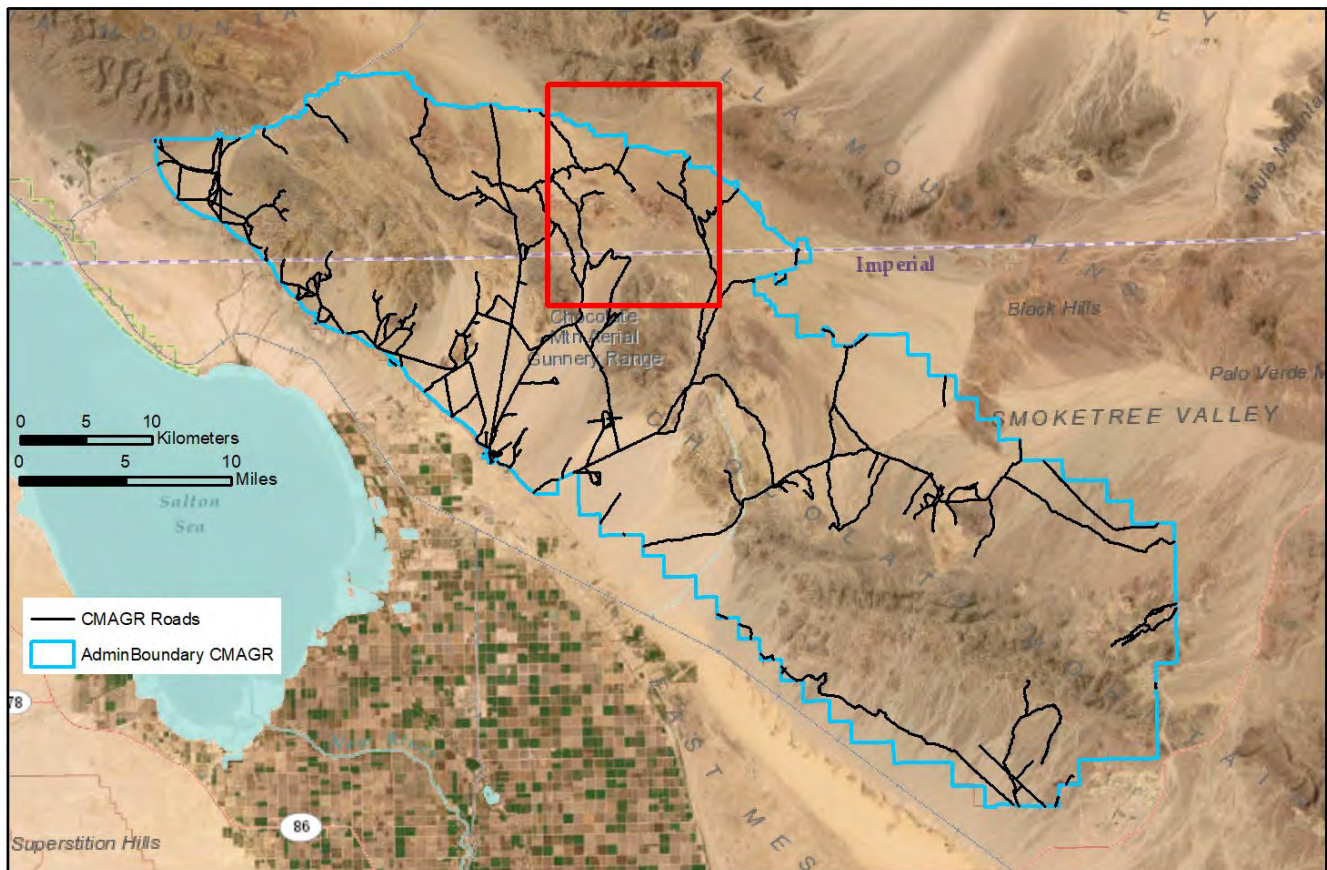


This area includes the transition zone from *Larrea tridentata* – *Ambrosia dumosa* – *Cylindropuntia munzii* to *Larrea tridentata* – *Ambrosia dumosa* – *Yucca schidigera*, which loosely coincides with the transition from *Parkinsonia florida* – *Olneya tesota* watercourses to *Senegalia greggii* – *Hyptis emoryi* watercourses. Elevations range from 1600 to 2800 ft. Access is via the Bradshaw Trail or the Niland- Blythe Road.



Top, north of Invader Butte at 1600 ft, *Cylindropuntia munzii* is a common associate of *Larrea tridentata* and *Ambrosia dumosa*, but **(bottom)** about seven miles north at 2150 feet, *Yucca schidigera* has become the more common associate, as has jojoba.

Bradshaw Trail and Iris Pass



Between the Bradshaw Trail and Iris Pass are some of the highest elevations on the CMAGR, ranging up to 2845 ft, with highest points composed of extrusive volcanics such as basalt and rhyolite. The latter highlands have vegetation more closely related to Mojave Desert, including the 'winding Mariposa Lily' (*Calochortus flexuosus*) and Nevada indigobush (*Psoralea polydenia*), near badlands holding desert holly salt bush. Elsewhere, this area is dominated by *Larrea tridentata* – *Ambrosia dumosa* – *Yucca schidigera* vegetation, with *Cylindropuntia munzii* only at the lower elevations in Iris Pass. Access is via the Bradshaw Trail.



Top, the winding Mariposa Lily (*Calochortus flexuosus*) near the head of Iris Pass at 2600 feet. **Bottom**, typical *Larrea tridentata* – *Ambrosia dumosa* – *Yucca schidigera* vegetation between the Bradshaw Trail and Iris Pass around 2400 ft.

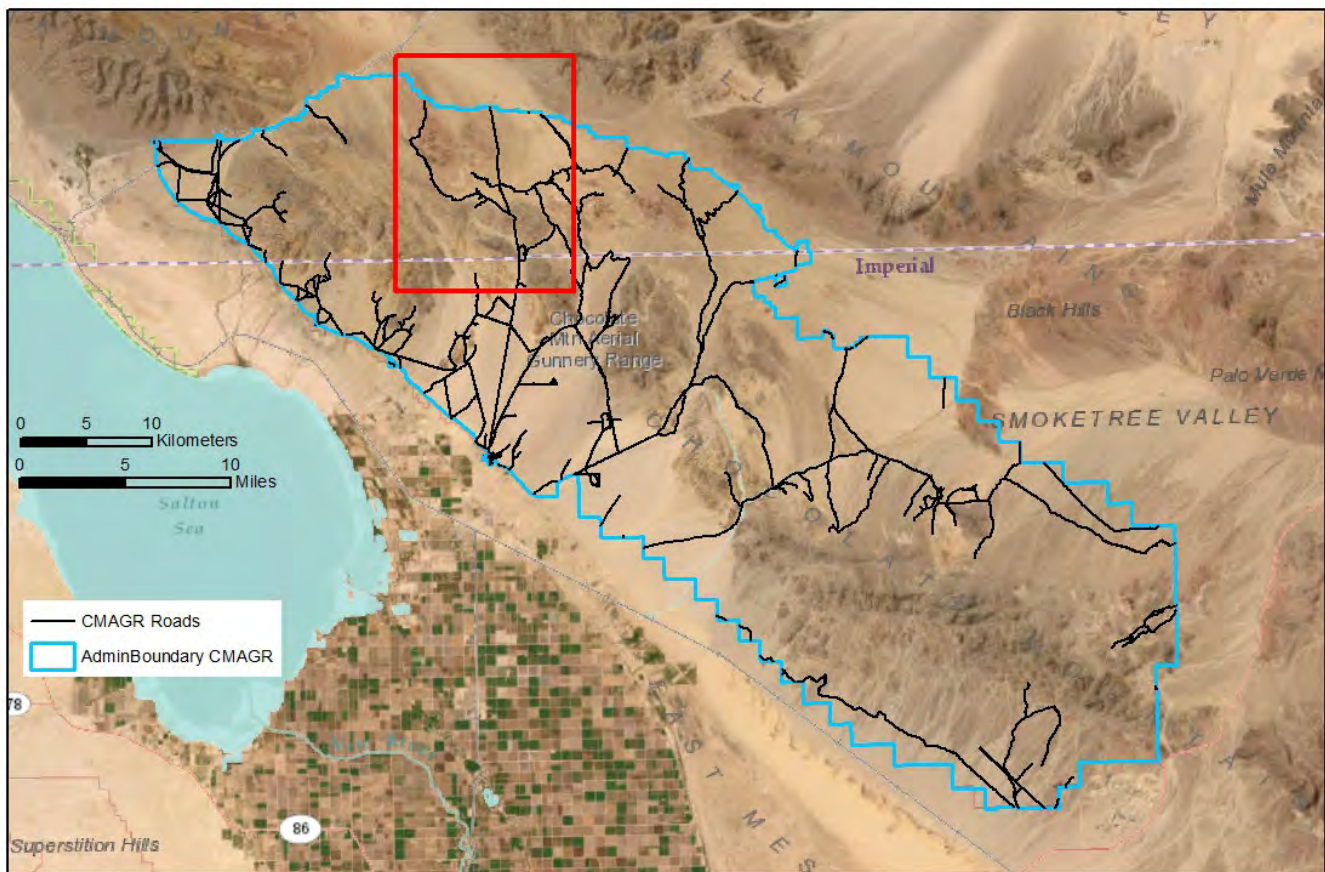
FLORA AND VEGETATION OF THE CMAGR



Top, at the 2500 ft saddle separating the Salt Creek and Arroyo Seco watersheds, a floodplain is dense with big galleta grass (*Pleuraphis rigida*). **Bottom**, smoketree and desert willow along Upper Salt Creek at 2360 ft.

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Upper Gas Line Road and Bradshaw Trail



Vegetation between the upper Gas Line Road (above 1300 ft) and the Bradshaw Trail is similar to that between Iris Pass and the Bradshaw Trail. The Tabeseca Hills are built of extrusive volcanics, reach 2800 ft, and have patches of desert holly saltbush amid north slopes of *Ambrosia dumosa*, *Ephedra aspera*, and *Lycium andersonii*. The surrounding ridges are dominated by *Larrea tridentata* – *Ambrosia dumosa* – *Yucca schidigera* at elevations above 2300 ft. Watercourses above 1800 ft are lined with *Senegalia greggii* and *Hyptis emoryi*, and those below 1800 are typically *Parkinsonia florida* and *Olneya tesota* and with swaths of smoketree, *Psoralea spinosa*.



Top, the view north to the Tabaseca Hills from 2300 ft. **Bottom**, typical scene of *Yucca schidigera* scattered among *Larrea tridentata* and *Ambrosia dumosa*, near the upper Gas Line Road at 2185 ft.

FLORA AND VEGETATION OF THE CMAGR



Top, a braided watercourse at 2000 feet, with *Senegalia greggii*, *Ambrosia salsola*, and *Simmondsia chinensis*. **Bottom**, north slope at 2500 ft on extrusive rocks in the Tabaseca Hills, dominated by *Ambrosia dumosa*, with associated *Ephedra aspera* and the mallow *Sphaeralcea ambigua*.

FLORA AND VEGETATION OF THE CMAGR

Lower Gas Line Road



The CMAGR boundary runs 25 miles along the Coachella Canal from the Niland – Blythe Road (Surveyors Pass) northwest to Salt Creek. Along the way are numerous hydrologically altered vegetation types, including *Prosopis glandulosa*, *Tamarix*, and *Suaeda nigra* – *Atriplex canescens*. Old lake sediments form badlands near Camp Billy Machen. Further upslope are steep alluvial fans that blur the boundary between watercourse and uplands vegetation. Access to Gas Line Road is through Camp Billy Machen. Access to SWAT ranges further west must be coordinated with Leg Iron and Camp Billy Machen.



Top, a *Parkinsonia florida* – *Olneya tesota* watercourse at 1300 feet on a side canyon off of the Gas Line Road. **Bottom**, Tamarix dominates where water collects along the berm protecting the Coachella Canal. Elevation 100 ft.

FLORA AND VEGETATION OF THE CMAGR



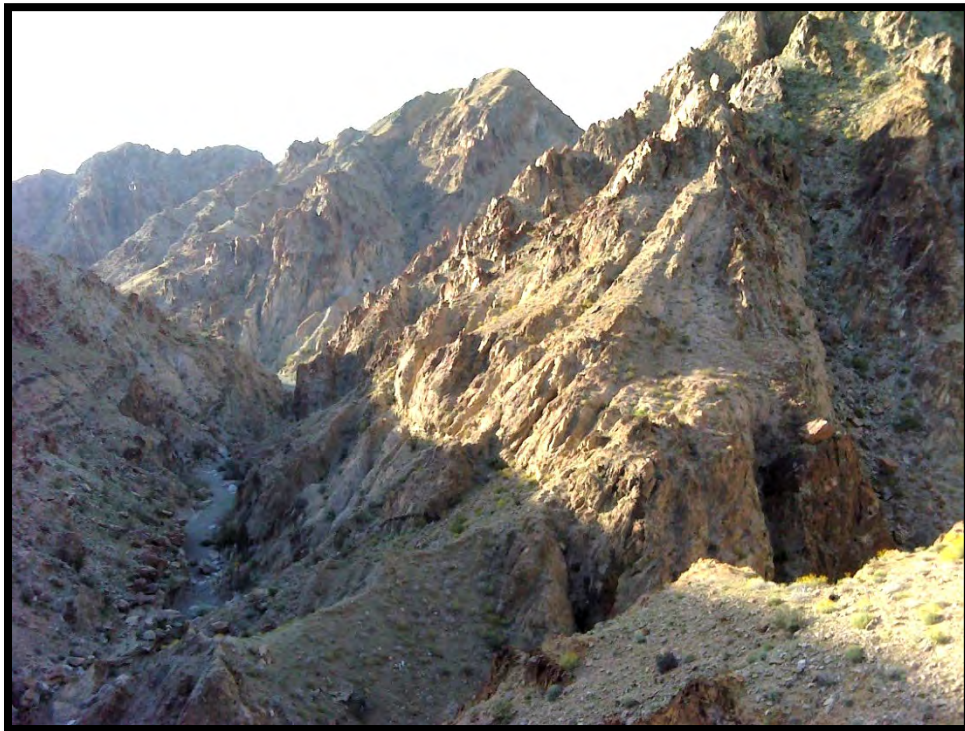
Top, *Ambrosia salsola* dominates this steep alluvial fan at 800 ft, two miles west of the Gas Line Road. **Bottom**, old lake sediments make up the mud hills 1.5 miles NW of Camp Billy Machen, at 110 ft.

FLORA AND VEGETATION OF THE CMAGR

Lower Salt Creek



This is the steepest terrain on the CMAGR, where the highest elevation on the range (3060 ft) is close to the Salton Sea trough (shoreline at minus 230 ft). The Salt Creek watershed is 269 square miles, with the majority upstream of the CMAGR. Floods have created an enormous fan of braided channels below the Eagle Mt railway trestle. On the slopes above these channels, bajadas descending from both the Chocolate and the Orocopia mountains are home to two uncommon vegetation mapping units, the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association and the *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association. Access is via the Summit Road or the SWAT ranges.



Top, this steep alluvial fan (5 degrees slope) above Siphon 18 lacks *Ambrosia dumosa* and *Olneya tesota* and is instead characterized by *Encelia farinosa* and *Psoralea schottii*. Elevation 400 ft. **Bottom**, very steep terrain, at 1600 ft, within the *Larrea tridentata* – *Encelia farinosa* alliance.

FLORA AND VEGETATION OF THE CMAGR



Top, alluvium from the Orocopa Mts is dominated by *Psoralea schottii* and *Larrea tridentata* in this view at 400 ft looking east across lower Salt Creek to the Chocolate Mts. **Bottom**, *Salvia greatae*, *Larrea tridentata*, *Parkinsonia florida*, and *Encelia farinosa* each have 2 to 3% cover on this dissected fan above the Eagle Mountain railway trestle (back right). View southwest to the Salton Sea. 960 ft.

FLORA AND VEGETATION OF THE CMAGR

Upper Salt Creek



Above the Eagle Mt railway trestle, Salt Creek is relatively narrow, and frequent flooding has favored smoketree and desert willow communities alongside the more typical *Parkinsonia florida* – *Olneya tesota*. The steep rocky slopes above are mostly *Larrea tridentata* – *Encelia farinosa* alliance, while the bajadas are either a *Larrea tridentata* - *Ambrosia dumosa* vegetation, or *Larrea tridentata* – *Ambrosia dumosa* – *Yucca schidigera*.



Top, mostly leafless in February, desert willow (*Chilopsis linearis*) lines Salt Creek at 900 ft elevation. Further upcanyon (**Bottom**), smoketree is the dominant species along Salt Creek, at 1430 ft elevation.





Top, at 1600 feet, *Ambrosia salsola* dominates the 'islands' between braided *Parkinsonia florida* watercourses above Salt Creek on the east side. **Bottom**, phaneritic igneous bedrock at 2100 feet, with a view south to the highlands of the CMAGR, largely dominated by the *Larrea tridentata* – *Encelia farinosa* Alliance.



FLORA AND VEGETATION OF THE CMAGR

METHODS

The Flora

In our effort to collect every plant species we visited every sort of habitat except for those prohibited by Range Management due to dangerous ordinance, e.g., cluster munitions in the “ICM Box.” Most collecting was from January to March, with two trips in September to collect species responding to summer rains. Collecting was mostly done by Andrew Sanders within three miles of a road, while more remote locales were collected by Jim Malusa. Extra attention was given to locations where historic collections had been made (such as Beal Well in Surveyor’s Pass) and for special status species listed in the CMAGR INRMP (2023) such as Orocopia sage (*Salvia greatae*) and Munz’s cholla (*Cylindropuntia munzii*).

Specimens collected in the field were pressed in the field, and later mounted and catalogued by the staff at the UC Riverside herbarium. Duplicates of specimens were mailed to Arizona Western College in Yuma, where they are curated by Jacob Gibson, Professor of Environmental Science (928) 344-7610 (Jacob.Gibson@azwestern.edu) and Joann Chang, Associate Dean of Science, Mathematics, Engineering, Physical Education, and Wellness (928) 344-7665 (Joann.Chang@azwestern.edu).



Above: Andrew Sanders pressing plants after a day of collecting in the CMAGR.

Vegetation Mapping

Field Sampling

Vegetation field sampling and mapping followed, so far as possible, protocols established by the Survey of California Vegetation, Classification, and Mapping Standards developed by the California Department of Fish and Wildlife's (CDFW) Vegetation, Classification, and Mapping Program (SCV 2022), as well as protocols used for lands on Barry M. Goldwater Range – West in SW Arizona (Malusa and Sundt 2015). The first step was compiling vegetation maps from lands surrounding the CMAGR (Fig. 5). Most of this was accomplished by the DRECP, or Desert Renewable Energy Conservation Plan (Reyes et. al., 2020), with an additional effort covering Dos Palmas Conservation Area (Sweet et. al., 2019) (Fig. 5). Neither of these efforts were complete when this project began, but Rosalie Yacoub of CDFW and Lynn Sweet of UC Riverside kindly provided access to all available data, and we adapted as our work proceeded.

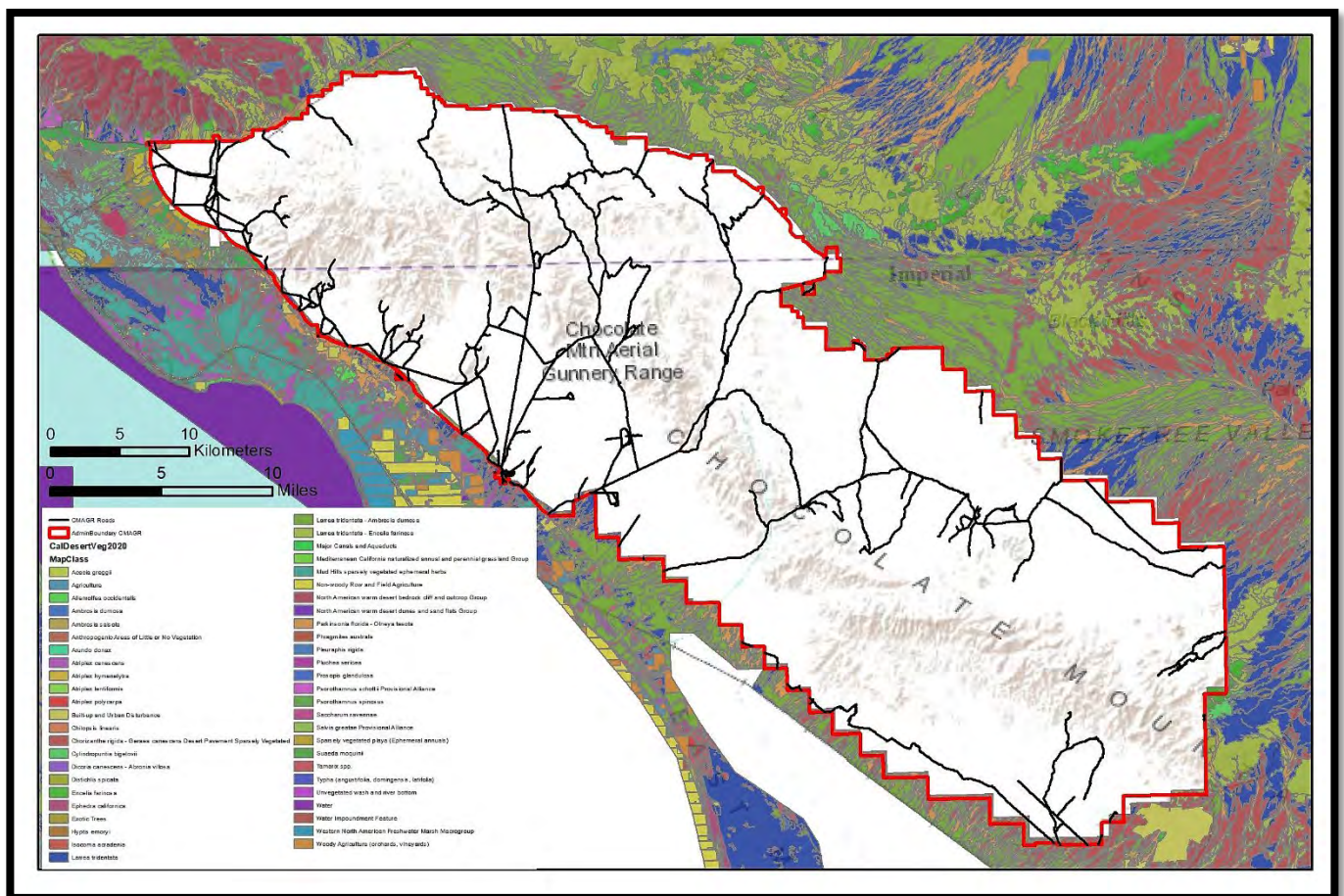


Figure 5. The CMAGR is surrounded by the DRECP and Dos Palmas vegetation maps.

Field sampling took place during 19 trips of up to 8 days each, between January 2015 and February 2021, at times and places permitted by MCAS-Yuma Range Operations and by activities on the SWAT ranges

(US Navy). Within permissible areas, selection of sample sites began with the visual analysis of aerial imagery. We used both Google Earth imagery as well as 2015 color imagery of the entire range created for MCAS-Yuma by Valley Air. The imagery guided us to obvious landscape features such as desert pavements or watercourses, as well as more subtle variations in, say, the color of an alluvial fan due to a different parent rock in the sediment source. The Valley Air imagery was then printed at a 1:10,000 scale (1 mm = 10 m), with four maps created to cover each 7.5 minute USGS quadrangle. Each map was 27" by 34" with a 500 by 500 m UTM grid overlain (NAD 1983), making it possible to pinpoint our position with the use of a GPS. Paper maps don't need batteries and can be appended in the field with a simple pen, a durable method for multi-day trips in remote locations that occasionally required overnight backpacks.

In the field we chose an area based on a visual assessment of whether that location constituted a relatively homogenous stand representing a vegetation mapping unit. When possible we chose sample sites that appeared representative of the vegetation mapping units previously described in surrounding lands (Fig. 5), but we also sampled vegetation that did not fit any of these units. For example, at over 2000 feet elevation we encountered a novel Mormon tea (*Ephedra aspera*) association.

Finally, sample site selection was influenced by a need to distinguish associations within the very widespread creosote-burrobush (*Larrea tridentata* – *Ambrosia dumosa*) alliance, to produce a final product most useful to range managers and biologists. For example, Linda Allison (US Fish and Wildlife Service) communicated that tortoises use several species of plants for shelter, or they build burrows in the more stable area near the roots, e.g., *Yucca schidigera*. Similarly, we sampled locations near those used by the small mammal and herpetofauna study sites (CMAGR, MCAS Yuma 2022). These study sites encircled the range boundary, and also penetrated the range at Salvation Pass, Gasline Road, BullFARP, and in several canyons on the NW side of the range near Salt Creek. Also for wildlife reasons, we GPSed the location of 5 natural seasonal waterholes discovered in remote canyons, as well as the well-known Tabaseca Tank.

Vegetation was sampled at 303 locations using a modified CNPS-CDFW Combined Rapid Assessment and Relevé Field Form (Appendix A), with the exception of the first 36 locations visited and recorded using a similar data sheet created for the Barry M. Goldwater Range (Malusa and Sundt 2015). Each survey location was photographed and marked using a Garmin 550T GPS device that also tracked our route to reach the various locations to produce a GIS map of the surveyed data points and routes (Fig. 6). For most sample sites, an additional photo was taken at the end of the transect (described below). Physical site features recorded included elevation, slope, aspect, macro-topography (e.g., bajada), substrate (e.g., schist), and the approximate percentage of substrate attributable to each of seven classes: bedrock, boulder, stones, cobbles, gravels, sands, and silt/clay. Soil samples were not taken. Vegetation data included all perennial plant species and annuals if conspicuously abundant. For each species we recorded its canopy cover by either ocular estimate or 'step-point method' (Evans and Love, 1957; Mitchell and Hughes, 1995), its 'prominence' (5 = dominant, 4 = codominant, 3 = common, 2 = uncommon, 1 = rare), and, if a common, codominant, or dominant species, the height of 10 individuals.

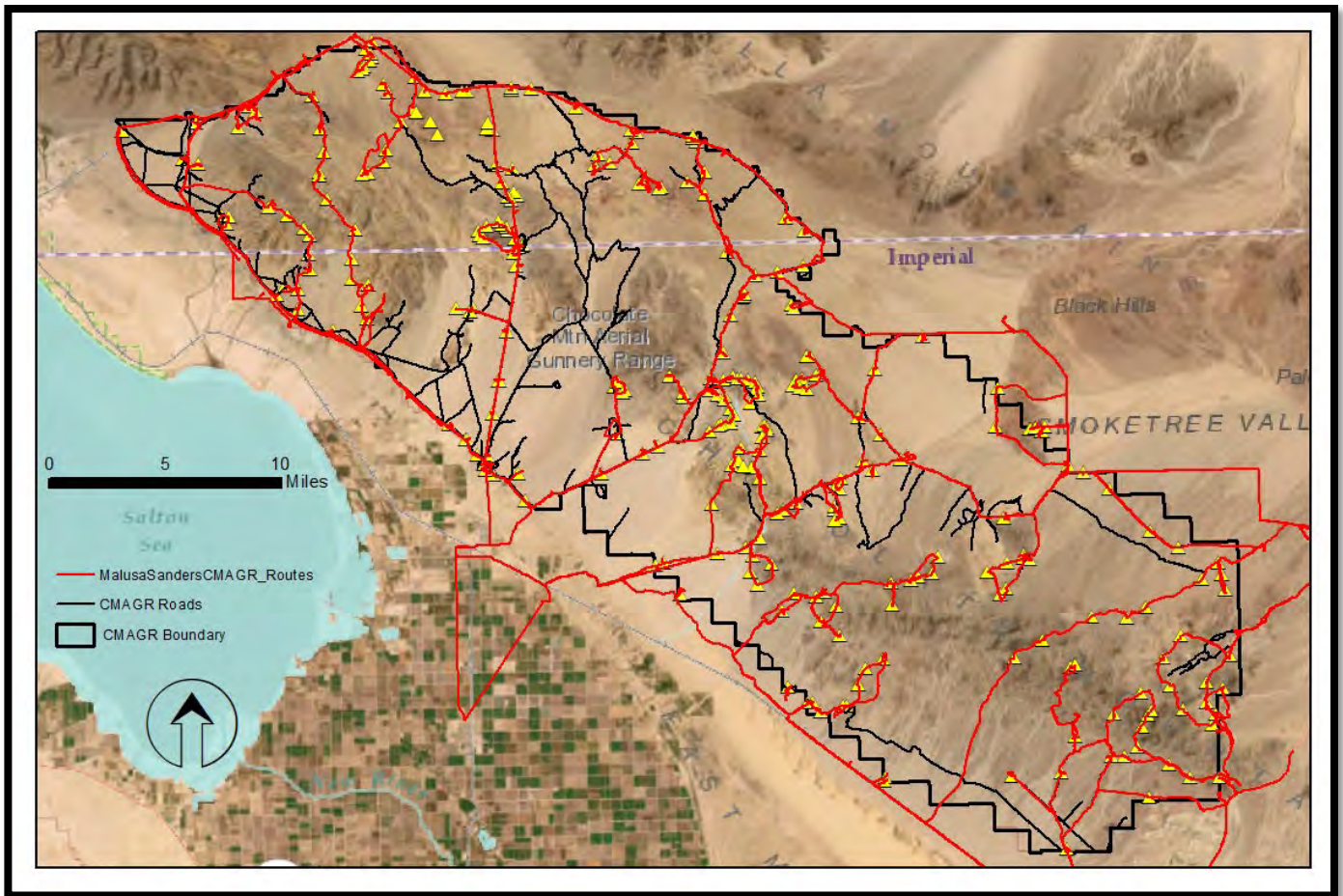


Figure 6. Location of the 303 sample sites and the routes traveled in the CMAGR by Malusa and Sanders.

Below is an example of the field sampling method when using the step-point method, which was used in 225 of the 303 samples. The remaining 78 of 303 samples used ocular estimates of cover, because they were on very steep slopes or in dense vegetation such as a *Tamarix* thicket. Ocular estimates were to the nearest whole number for cover values $\geq 1\%$. For cover values $< 1\%$, see data entry below.

Let's say we wish to sample the *Larrea tridentata* – *Ambrosia dumosa* alliance with the step-point method. Malusa begins by placing himself squarely within a place where both species are estimated to have at least one percent cover, and brittlebush has less than one percent cover, because this is the basic criteria for distinguishing this unit. After picking a prominent point on the horizon, he then tosses his walking stick over his shoulder. Wherever it lands is the random starting point from which he walks towards the point on the horizon picked moments before. On the data sheet Sanders names the sample site with the first letters of the name of the 7.5-minute USGS quad sheet that contains that point (Fig.8). All samples from that quad are sequentially numbered, e.g., the first sample from the Mammoth Wash quad is MW-1. We record the location with a GPS and take a geo-tagged photo oriented along the path to be taken toward the point on the horizon. The photo is later given the same name as the sample site.

As mentioned above, a brief environmental description is recorded: aspect, geomorphology, lithology, dominant surface texture, and slope.

Then Malusa walks toward the point on the horizon chosen earlier, keeping track of the number of paces with a hand clicker. An average step was 0.7 meters (2.3 feet). Each time a line on the tip of his boot falls atop or under a plant canopy (including branches that may/may not be alive), Sanders records a 'hit' for that species on the data sheet. More than one species can occupy the space above the point, especially in the case of a paloverde or ironwood, which often sheltered other species. For places Malusa can't reach along the transect – under a large and terrible cholla, for instance – he uses his walking stick to determine the next point. It's marked off in decimeters, so it's a big ruler as well as a walking stick.

Such transects ranged from 100 to 1000 step-points (about 70 to 700 meters), depending on the terrain and plant cover, with the longer transects in areas of sparse vegetation. Concluding the transect, we'll tally up the number of 'hits' to figure out the canopy cover and the prominence of each perennial species. If a species had 15 hits in 500 paces, that's 3% canopy cover.

To fully document the vegetation, a list of *all* perennial species in the sample site is gathered as I walk, whether it receives a 'hit' or not. Because many species can have less than 1% cover and yet be common (you would note them without searching), we also recorded prominence, a proxy for relative cover, based on Warren et. al. (1981) methods. The species with the highest cover value is the **dominant** species for that relevé, so long as it is at least double the cover of the second-place species. If two are more species are close in cover values, and are the most common species, they are considered **co-dominant**. If a species is neither dominant nor co-dominant, yet plain to see, they are **common**, even though they may have less than 1% cover. **Uncommon** species are those you must search for unless they are tall and obvious. In other words, a rapid assessment plot sample with 4 ocotillos over a hectare (2.5 acres) would rank them as uncommon, though it was no trouble to find them. Finally, **rare** species are those with only one or two individuals discovered in the sample. This does not mean one or two individuals that received 'hits' from the point transect, but instead only one or two seen anywhere in the sample.

Time permitting, we also measure the height of ten individuals of each perennial species that ranks as common, co-dominant, or dominant. Height was estimated to the nearest 10 cm using my walking stick/ruler, while trees and ocotillos over two meters tall were estimated using a Nikon laser hypsometer. Individuals for measurements were chosen haphazardly, as encountered along the transect. We did not measure individuals that were less than 1/10 the estimated height of adult plants. For instance, if a typical ironwood looked to be four meters tall, we didn't measure juveniles 40 cm or less. Finally, the height measurement included the flower stalks of species like brittle bush, whether flowering or not. An exception was made for the large monocots like *Yucca* and *Nolina*, where the height measurement did not include the flowering stalks.

The presence and abundance of the invasive Sahara mustard were always noted, but other annuals were recorded only if time permitted. Annual species may or may not be characteristic of a vegetation type –

the seed banks of annuals can ‘migrate’ as conditions change. For this reason, annual species are not recorded as dominant or co-dominant, regardless of their cover at the time of the survey.

The step-point transect has the advantage of compelling the observer to walk slowly over a long distance and is doubly good for somebody aiming to cover miles of territory on any given day. However, a significant drawback is that it underestimates the canopy cover of less abundant species by failing to detect them as a hit (Elzinga et. al., 1998). A species with 1% cover might be hit once in 100 steps, twice, or not at all. We sought to minimize this error by making transects up to 1000 steps long. Still, these cover values are not statistically robust, and should not be used to detect change through time if transects are revisited. They are only meant to better describe the samples with relatively easy access. Keep in mind, too, that we used ocular estimates for 78 of the 303 samples.

If a transect intersects an obviously different vegetation – say, a watercourse cutting across the creosote\bursage transect in the example above – then I stop counting the steps while crossing the watercourse and resume on the other side.

Watercourses and desert pavements had special protocols for sampling. Care was taken on **desert pavements** to walk perpendicular to the small narrow runnels that characterize pavements; otherwise, you can easily end up paralleling either the pavement or the runnel, each of which differs dramatically from the other.

Watercourses such as the *Parkinsonia florida* – *Olneya tesota* alliance (paloverde-ironwood) with an open bed at least one-meter wide were sampled along a single bank for 100 paces (about 70 meters). While walking in the watercourse, I paused with each step and made an imaginary line with my walking stick extending 2 meters back from the bank. Every species that fell along, above, or below that line was included as a ‘hit’. This method was chosen because it was very difficult to run a point transect anywhere near the bank, which was often a dense tangle of wolfberry and catclaw. (It also compelled me to look closely at the understory.) The cover values generated from the watercourse samples cannot be compared to those from other vegetation types. Instead, these cover values were solely to establish which species are dominant/co-dominant within the sample, and to provide a picture for the reader of what the typical vegetation resembled along the bank of a watercourse. As with other rapid-assessment samples, species that were not ‘hit’ during a transect are nonetheless recorded during the sampling.

Finally, when samples are near a road, the transect begins at least 5 meters from the road and extends away from the road.

Data Entry

The Database

All data were entered into a Microsoft Access database supplied in 2015 by Rosie Yacoub, GIS Specialist for California Dept of Fish and Wildlife. Rosie named it Standalone_RA-Releve_Database_forJMalusa, and it was subsequently renamed Chocolate_Mountains_JimMalusa. This database had numerous pre-populated tables, including a list of species names from the USDA NRCS PLANTS database (<https://plants.usda.gov/home>). NOTE: with regard to the “% surface cover” data entries, the datasheet had a place to record ‘Silt/Clay’ but the database had a column (field) for ‘Bare Fines’. All other surface types (e.g., cobble, gravel) matched, so the estimated % for Silt/Clay on the data sheet was entered under Bare Fines in the database.

Data entry followed the *Protocol for RA/Relevé Database Entry (August 2015)*. We began with the table named RA Projects, using Chocolate Mountains for both the Project Name and Project Description, and CHOC for Project Code. All field data was entered into the tables RA Plots and RA Plants. In most cases the data entry for RA Plots is self-explanatory, with the exception of the field called Photos_other. Here we input the original jpeg number, and the compass direction of the photo(s). For example: [5243,315] refers to jpeg 5244, taken at 315 degrees. For the project deliverables, photos were subsequently renamed with the plot name, e.g., RCC-1. Plots were named sequentially for their location in respective USGS quadrangle, with RCC-1 being the first plot taken in the Red Cloud Canyon 7.5” quadrangle (Fig. 7).

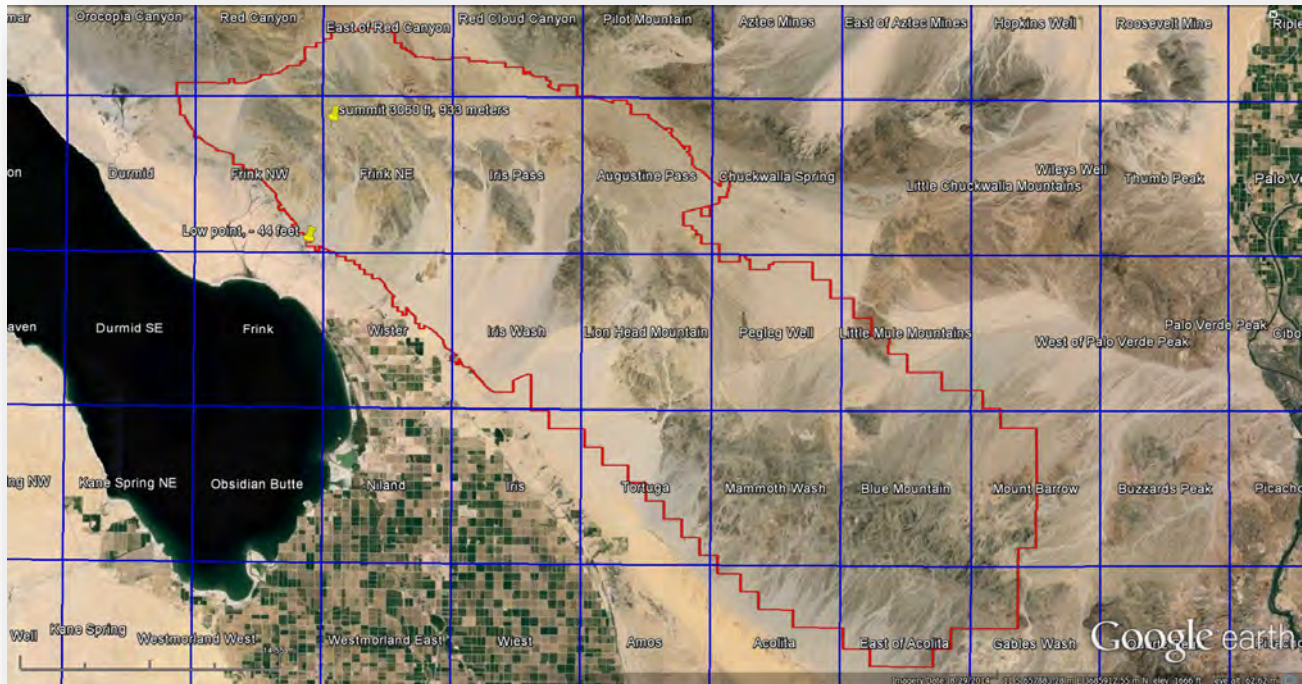


Figure 7. USGS 7.5 quadrangle names, with the CMAGR boundary in red.

For the table RA Plants, cover data for each species was entered to the nearest 0.1 for all values $\geq 1\%$. For species with $<1\%$ cover at a plot, yet recorded with a prominence of **common**, 0.2% was entered. For species with $<1\%$ cover at a plot, and recorded as **uncommon or rare**, 0.11% was entered. We also added two fields to the table RA Plants: Height (meters) and Rank (Prominence). Height is the mean of ten measurements (see field data, above) for the species. Prominence is ranked as in Table 1 below. Because annual plants are ephemeral, they are never ranked as dominant or co-dominant at any plot, even if they have the highest cover value at the time of sampling. In the latter case, they would be ranked as a 3, common.

Table 1: Prominence Codes

Prominence Codes
5 = dominant
4 = co-dominant
3 = common
2 = uncommon
1 = rare

Classification

So far as possible we used existing classifications created by the DRECP (Reyes et. al., 2020; Menke et al, 2013), the Vegetation Survey and Classification for the Northern & Eastern Colorado Desert Coordinated Management Plan (NECO) (Evens and Hartman, 2007), the Dos Palmas Conservation Area 2013 & 2018 Vegetation Map Report (Sweet et. al., 2019), the Mecca Hills and Orocopia Mountains Vegetation Map Report (Sweet et. al., 2015), and the Vegetation Association Descriptions for Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument (Evens et. al., 2020). The DRECP classification was largely iterative. Regarding the lands surrounding the CMAGR, the 2020 DRECP states on pages 33-34:

It was determined that the Salton Sea South and Picacho subareas were similar enough to the existing DRECP classification that no additional floristic classification work was needed. The map classification was based on the original DRECP mapping project (Menke et al., 2013, and Menke et al., 2016), which was provided by VegCAMP, and is based largely on work done in the area for previous and ongoing projects: Vegetation Mapping of Anza-Borrego Desert State Park and Environs (Keeler-Wolf et al., 1998), the Mojave Desert Ecosystem Program's Vegetation Database (Thomas et al., 2004), Vegetation of Joshua Tree National Park (2013), and Vegetation Classification at Lake Mead National Recreation Area, Mojave National Preserve, Castle Mountain National Monument, and Death Valley National Park (Evens et al., 2020). Refinements to the mapping classification were made as mapping proceeded.

Similarly, the Dos Palmas effort (Sweet et. al., 2019) states on page 15:

Classification of the vegetation was done based on prior vegetation Mapping of Anza-Borrego Desert State Park and Environs (Keeler-Wolf et al. 1998), the Western Riverside County MSHCP Vegetation Map (2004), Vegetation of Joshua Tree National Park (La Doux et al., 2013), and the Vegetation Map in support of the Desert Renewable Energy Conservation Plan (Menke et al., 2013) and by the UCR Center for Conservation Biology in previous maps (most recently Sweet et al. 2017).

Of the above mapping efforts, only NECO surveyed lands within the CMAGR. Based on 855 samples that included 140 from within the CMAGR, the NECO effort (Evens and Hartman, 2007) created a classification using methods described on page 5:

A summary of the analysis process is provided in the following steps:

- 1. Run presence-absence Cluster Analysis to determine general arrangement of plots.*
- 2. Run cover category Cluster Analysis to display a more specific arrangement of plots based on species abundance as well as presence.*
- 3. Break up the dataset into smaller, sizeable units for subsequent Cluster Analysis runs.*
- 4. Run Indicator Species Analysis (ISA) at each of the successive group levels for each of the Cluster Analysis dendrograms from 2 groups up to the maximum number of groups (all groups have at least 2 samples).*
- 5. Settle on the final representative grouping level of each Cluster Analysis to use in the preliminary labeling.*
- 6. Preliminarily label alliance and association for each of the samples, and denote indicator species from the ISA.*
- 7. Develop decision rules for each association and alliance based on most conservative group membership possibilities based on review of species cover on a sample-by-sample basis.*
- 8. Re-label final alliance labels for each sample and arrange in table of database.*
- 9. Use decision rules developed in the new data to assign alliance and association names to all analyzed data and all outlier samples removed from dataset.*

The herculean effort behind the Vegetation Classification at Lake Mead National Recreation Area, Mojave National Preserve, Castle Mountains National Monument, and Death Valley National Park (Evens et. al., 2020) was the result of an equally extensive classification process that is described at length on pages 18-21. In sum:

“...we employed cluster analysis with a hierarchical agglomerative technique, typically using Sørensen distance and flexible beta group linkage method at -0.25 in PC-ORD (McCune and Mefford 2006). Though Two Way Indicator Species Analysis’s (TWINSpan’s) divisive technique is sometimes employed for this type of analysis when one main underlying environmental determinant is evident in a dataset, we chose an agglomerative clustering technique with Sørensen distance...”

Within the CMAGR, we classified 34 mapping units. Of these, 31 generally fit well within these existing classifications (Table 3, Results), based on inclusion rules in various sources including the California Manual of Vegetation. We also described and mapped three new (provisional) associations. The ***Larrea***

***tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association** is meant to capture the range of Munz's cholla and the ***Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association** maps the Orocopia sage. Both are BLM sensitive species with a CNPS rare plant ranking of 1B.3, meaning rare, threatened, or endangered in California. The ***Hyptis emoryi* - *Nolina bigelovii* Association** is part of the widespread *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance, and differentiates the narrow rocky canyons characterized by *Hyptis* (desert lavender) and *Nolina bigelovii* from the more widespread *Senegalia* (catclaw) watercourse.

Three of the 34 mapping units were 'cultural': Human Disturbance, Major Canals, and Urban.

As described below under Accuracy Assessment (AA), the first draft of the classification included 12 additional provisional associations, some established and some novel, but these were deemed unmappable after the results of the first AA and wrapped into existing alliances.

Vegetation Key

Each of the 303 sample sites in the Access database was assigned a vegetation unit based primarily on descriptions and membership rules in the prior studies cited above (e.g., NECO (Evens and Hartman 2007) and DRECP (Reyes et. al. 2020)) and on the California Manual of Vegetation (CNPS 2023). Rules unique to the CMAGR were created for provisional units. For example, *Salvia greatae* with $\geq 1\%$ cover leads to the *Salvia greatae* Association.

No prior key was appropriate for the CMAGR, prompting us to create our own. The key features alternative 'routes' to the same vegetation unit to account for variation documented in the field samples. For example, the *Larrea tridentata* – *Ambrosia dumosa* – *Calliandra eriophylla* association had 8 samples. *Larrea tridentata* was greater than 1% cover in 7 of 8 sample plots, and less than 1% cover in 1 of 8 samples. Because the key has a couplet based on *Larrea tridentata* cover being either $<1\%$ or $\geq 1\%$, the *Larrea tridentata* – *Ambrosia dumosa* – *Calliandra eriophylla* association can be reached by either choice: *Larrea tridentata* $<1\%$ or $\geq 1\%$.

The key also recognizes the difficulty in distinguishing between watercourse and upland vegetation. Watercourses in the CMAGR typically exit the mountains and fan out over the bajada (= coalesced alluvial fans), and in such settings it's a matter of making clear rules for distinguishing when a watercourse becomes upland vegetation. This is of particular importance in the CMAGR, where there are vast areas holding ironwood (*Olneya tesota*) that are not in xero-riparian watercourses.

Finally, so far as possible the key uses species that are visible on imagery because much of the CMAGR was not visited during this study.

Describing Vegetation Units

Each of 31 vegetation mapping units is provided with a description in the results that includes photos, a distribution map, a summary table, and a description of how the unit was distinguished from similar mapping units in the field and on imagery. The photos are from RA sites, and an interested viewer can use the Access database to find a full description of that site. The photo selection aims to show the range of variation within that mapping unit, not simply the ideal representation. The summary table for each mapping unit includes **all perennial species that had at least 1% cover in at least one of the Rapid Assessment Sites** for that vegetation type. For each of the species that had at least 1% cover in at least one site, the table shows the number of Rapid Assessment Sites in which it was found, regardless of its cover value, and the median and range of its prominence values (proxy for relative cover) and absolute canopy cover values across all sites for that vegetation type. The summary table also shows the mean height of common, co-dominant, and dominant species for that vegetation type. Species were not segregated into herbaceous, shrub and tree categories.

Mapping

The final GIS platform was ArcMap 10.8.2. All digitization was by Jim Malusa, drawn with a Wacom Cintiq 22D pen display, over 2015 color imagery created for MCAS-Yuma by Valley Air, with interpretation supplemented by (1) Google Earth imagery from several dates, (2) a geologic map of California (Jennings et. al. 2000), (3) sample site data from 140 NECO sites (Evens and Hartman 2007) and the 303 sites from this study, and (4) several thousand georeferenced photos taken by the authors and by 2019 and 2020 tortoise surveys. The latter was kindly supplied by Linda Allison of US Fish and Wildlife.

A template geodatabase named DesertGeodatabaseFall2019.gdb was supplied by Rosie Yacoub, GIS Specialist, California Dept of Fish and Wildlife. This template was similar to that used by the DRECP and was subsequently renamed ChocolateMtsAerialGunneryRange.gbd. A topology was created for the vegetation feature class with two rules: Must Not Overlap and Must Not Have Gaps. Polygons drawn along the perimeter of the CMAGR were snapped to the boundaries of the DRECP (Reyes et. al. 2020) and the Dos Palmas (Sweet et. al. 2019) vegetation maps to provide seamless coverage, with the exception of approximately 140 hectares (346 acres) of private lands outside the CMAGR boundary near Siphon 22. We had not visited these lands.

The Minimum Mapping Unit (MMU) was 1 hectare (2.5 acres) for most vegetation types. Because watercourses are important avenues of animal movements, the watercourse MMU was reduced to 0.1 hectare (0.25 acres). A total of 13,912 polygons were drawn.

The attribute table contains a field named HydroModifier. Areas that were downslope of the levees diverting runoff to the Coachella Canal siphons were attributed as “Affected” if they were within a kilometer of the levee.

Accuracy Assessment

The COVID virus frustrated the accuracy assessment (AA) in 2020. We had planned on the team of Lynn Sweet and Cam Barrows from UC Riverside’s Center for Conservation Biology, but by the time the CMAGR became accessible they were already overbooked. Instead, we recruited a NPS botanist, Joe Black, to do the AA in 2021 in areas deemed accessible by Range Management. A total of 235 sample sites (Fig. 8) were randomly generated on ArcMap 10.8.2 as follows:

Create primary points

1. Use Dissolve tool (Data Management > Generalization toolset) to create a new feature class where each association is combined to a single feature (polygon)
 - a. Input: VegPoly; Dissolve attribute: Association
 - b. Output: VegPoly_DissolvebyAssoc
2. Open the attribute table and select all features that belong to “watercourse” types (i.e. those with long skinny polygons)
 - a. Right click on VegPoly_DissolvebyAssoc, then click selection > Create new layer from selection
 - b. Right click on selection layer > Data > Export to save layer as new feature class
 - i. Output: VegPoly_5m
3. Repeat for larger polygons that will need 50 m buffers. This can be done by reversing the previous selection. At this point, also deselect “Human Disturbance”
 - a. Right click on VegPoly_DissolvebyAssoc, then click selection > Create new layer from selection
 - b. Right click on selection layer > Data > Export to save layer as new feature class
 - i. Output: VegPoly_50m
4. Create buffers with buffer tool (under geoprocessing tab)
 - a. Enter “-50” for 50m buffer and “-5” for 10m buffer
5. Merge two buffer layers to create a single buffer layer using Merge tool in geoprocessing tab
6. Use Create Random Points tool (Data Management > Sampling toolset) to generate one random point per association
 - a. Constraining feature class should be merged buffer feature class, the output from the previous step
 - b. Number of points = 1
7. Use dissolve tool (under Geoprocessing tab) to create one feature containing all buffered polygons
 - a. Input = output from step 5, dissolve field = none

8. Use Create Random Points tool to generate the rest of the random points, distributed randomly through entire area (minus buffers). This will result in +/- proportionally distributed points by association total area.
 - a. Constraining Feature Class = output from step 7
 - b. Number of points = 150 – number of points generated in step 6
9. Merge outputs from steps 8 and 6 to create a final feature class of primary random sample points.
10. Assign each point an ID

Create Alternate points

1. Repeat step 6 above but create 2 points per association to be used as alternate points in case some of the original points cannot be sampled.
2. Assign each point an ID

An additional constraint: all points had to be within 5 km of a road.

The surveyor was provided a provisional version of the key, a laser rangefinder/hypsometer, and the same data sheets we used. For each AA site, he did not attempt to sample all of the mapped polygon, which ranged in size all the way up to 8,821 hectares (34 square miles), but instead a 1-hectare area surrounding the sample point (a circle of 56 m radius). In the case of narrow watercourses, and their smaller MMU, he also brought a digital map of georeferenced PDFs on his phone, showing the polygon boundaries. He made an ocular estimate of the % cover of perennial species, then used the key to identify the polygon.

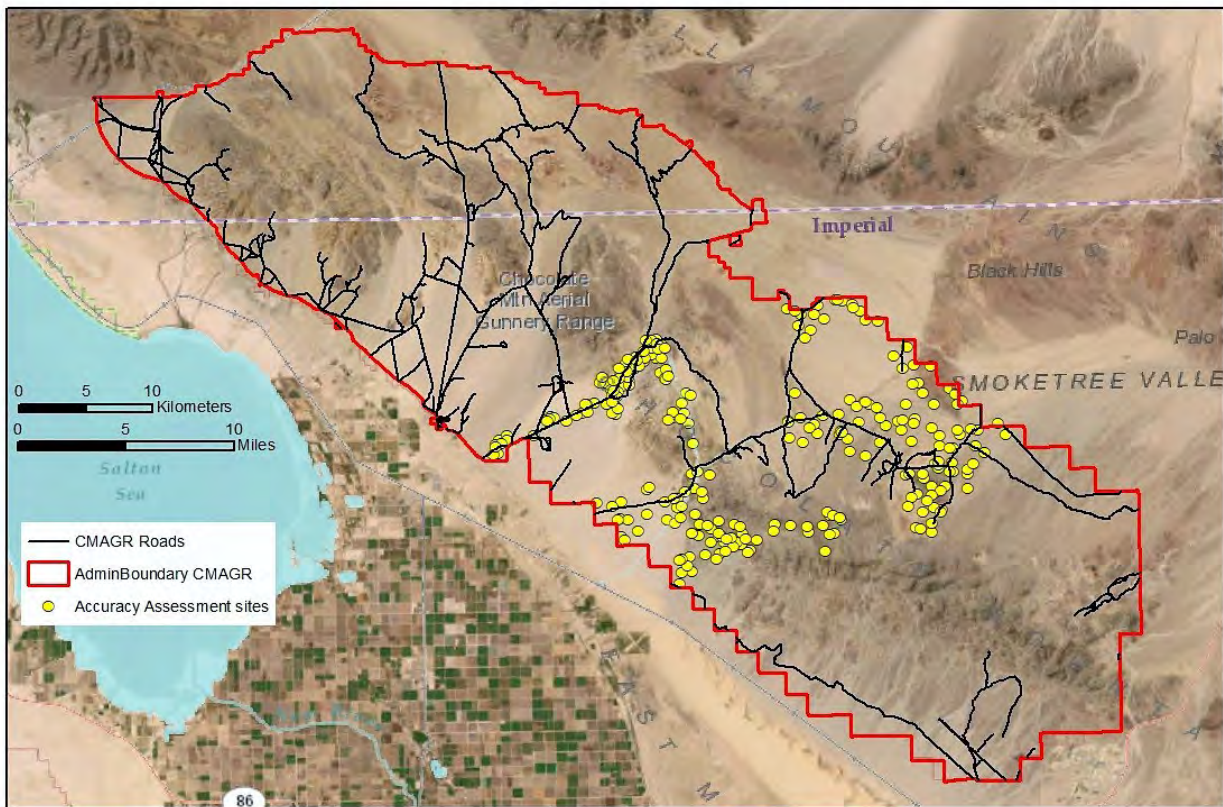


Figure 8. Accuracy Assessment sites in 2021.

The results of the 2021 Accuracy Assessment were discouraging: producer and user agreed on only 147 of the 235 sample locations, or an overall accuracy of 62.6%. (No fuzzy logic was employed). Producer and user errors indicated which associations could not be mapped accurately and would have to be wrapped into a higher-level alliance. For example, the *Larrea tridentata* – *Ambrosia dumosa* – *Pleuraphis rigida* Association could not reliably be distinguished on the Canyon Air imagery, and so became part of the larger *Larrea tridentata* – *Ambrosia dumosa* Alliance. Similarly, the *Senegalia greggii* – *Hyptis emoryi* – *Tetradloccus hallii* Association had to be wrapped into the more inclusive *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance, because *Tetradloccus hallii* could not reliably be distinguished on imagery, nor inferred from landform or geology. In this way the total number of vegetated mapping units was reduced from 43 to 33, and surveyor Joe Black was again sent into the field in 2022 with a revised key and new sample points (Fig. 9). As with the previous effort, most of the CMAGR was not accessible due to operations, and some associations could not be sampled at all, so the sample size is woefully inadequate.

The results were encouraging – producer and user agreed on 98 of 127 sites (see Appendix C for contingency table), or an overall accuracy of 77.2%. Most of the errors involved two similar mapping units and helped refine the key. Two associations performed poorly: *Larrea tridentata* – *Ambrosia dumosa* – *Fouquieria splendens* Association (users score, 3 of 6 correct, producers, 3 of 4) and

Parkinsonia florida - *Olneya tesota* / *Hyptis emoryi* Association (users, 1 of 4, producers 1/1). These associations were subsequently wrapped into their corresponding alliances. If the 2022 accuracy assessment were repeated with the updated key, and the surveyor made the same judgements on cover values, the overall accuracy would be improved. For instance, the mapped *Parkinsonia florida* - *Olneya tesota* / *Hyptis emoryi* Association that was identified in the field as the *Parkinsonia florida* - *Olneya tesota* Alliance in 3 out of 4 samples would now be correctly identified, raising the overall accuracy of the map to 101 of 127 sites, or 79.5%. But, as mentioned above, the CMAGR is poorly suited to a proper accuracy assessment, with narrow windows of accessibility to only parts of the range. Our mapping/flora effort spanned years in order to be able to reach most of the CMAGR.

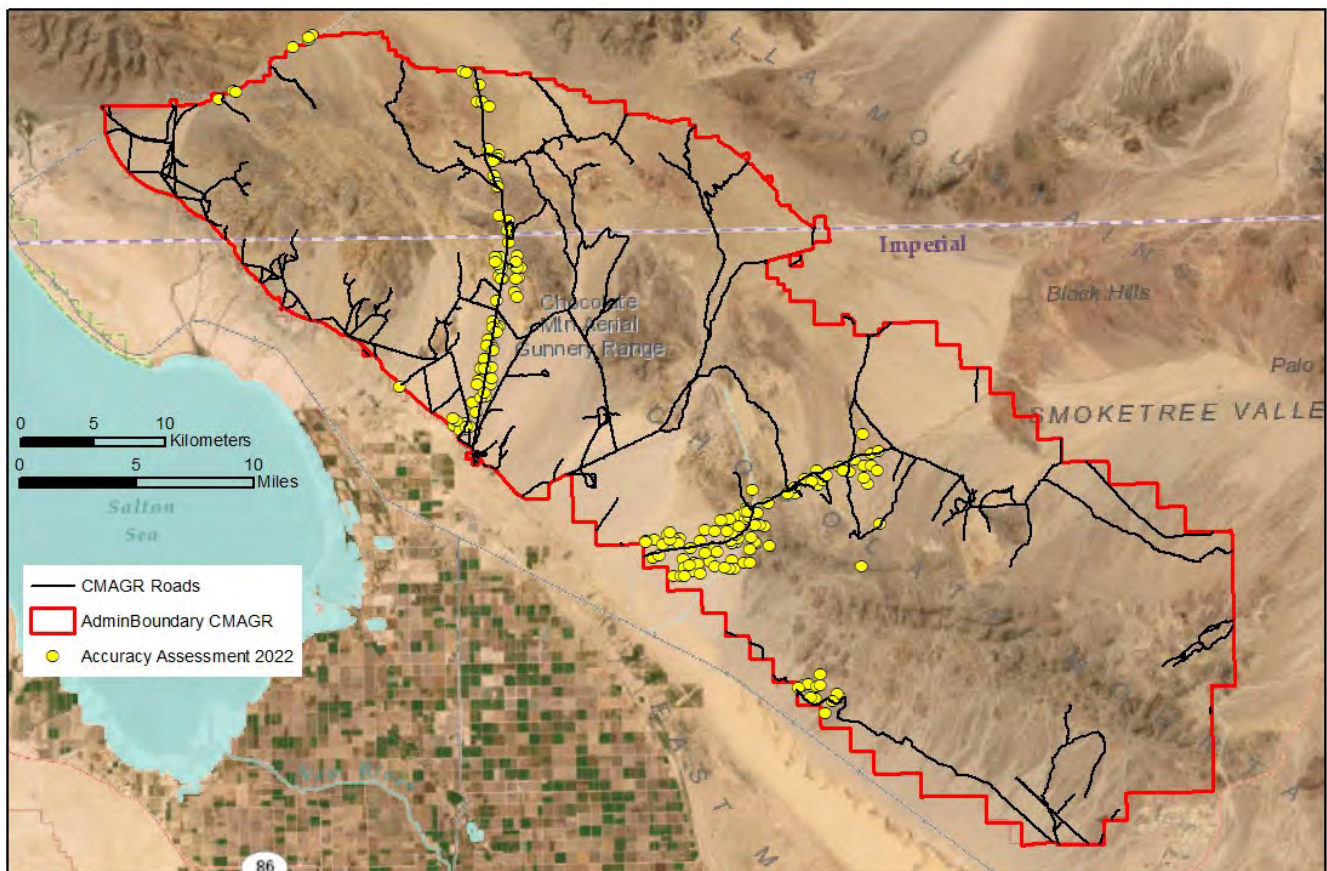


Figure 9. Accuracy Assessment sites in 2022.

RESULTS

Flora

A total of 316 taxa were documented on the CMAGR, with an additional 3 taxa collected within a few miles of the range boundary and likely on the CMAGR. A species list is below (Table 2), while the complete flora is in Appendix E.

Collections for the flora include two species that were previously undocumented in the United States. *Hoffmannseggia peninsularis*, a shrub in the pea family, was found near Salvation Wash, and previously only known from Baja California. *Fagonia densa*, a shrub related to the creosote bush, was discovered near the summit of the Chocolate Mountains, at 900 meters/3000 feet. It was also previously known only from Mexico. Also notable was the discovery of a fine specimen of the elephant tree, *Bursera microphylla*, a species previously documented in Anza-Borrego State Park, but never before on the east side of the Salton Basin in California.

Special status species listed in the CMAGR INRMP (2023) include the **Orocopia Sage** and **Sand Evening Primrose**. As stated in the INRMP, Orocopia Sage (*Salvia greatae*) is “designated by CNPS as a List 1B.3 and a BLM sensitive species...is considered to be rare, threatened, or endangered in California and elsewhere, but not very threatened in California (low degree/immediacy of threats or no threats known).” In this study we found it to be a locally common on alluvial slopes and hillsides at the northwest end of the CMAGR. We observed it on the slopes leading down to Salt Creek, as well as in mountain canyons on deeply cut alluvium and colluvium fringing arroyos as high as 620 m (2030 ft). The CMAGR population of Orocopia sage numbers in the thousands.

Regarding the sand evening primrose, it is now more commonly known as the Fortuna Range Suncup (*Chylismia arenaria*). As stated in the INRMP, the CNPS considers this “... a List 2.2 species, meaning it is rare, threatened, or endangered in California but more common elsewhere and, specifically, fairly threatened in California (moderate degree/immediacy of threat).” We found the species to be a very scarce and localized perennial, primarily an inhabitant of rocky crests and steep mountain sides, but also found along washes, where perhaps it is a waif. The largest populations we found were in steep places that the numerous burro mule deer (*Odocoileus hemionus eremicus*) of the alluvial slopes cannot easily reach. It was collected from a canyon along the Gas Line Rd, at 366 m (1200 ft).

The CMAGR INRMP (2023) includes a list of other special status plant species, shown in Table 3 below, which was appended to show updates to species status. Most notable are two species formerly listed as ‘potential’ that were documented in this study: Emory’s crucifixion-thorn (*Castela emoryi*) and Pink fairy-duster (*Calliandra eriophylla*). The former is rare, the latter abundant. Also notable was *Cylindropuntia munzii*, a very large cholla previously believed to be rare (CNPS rank 1B.3), and found to be widespread

and very common, occurring in 76 of our 303 sample sites (Fig. 10). There are many thousands of *Cylindropuntia munzii* on the CMAGR, which apparently is its favored habitat.

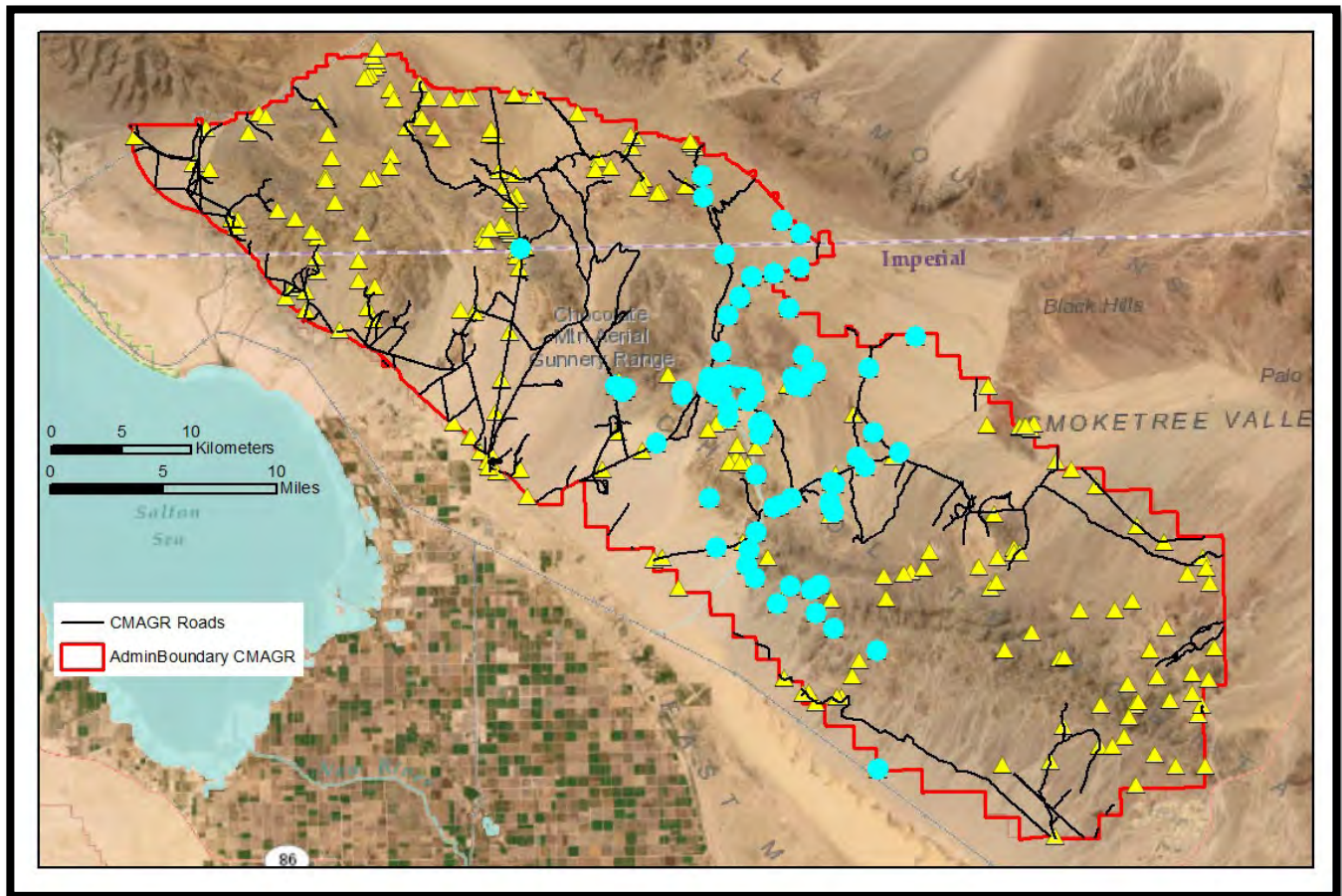


Figure 10. Blue dots represent Rapid Assessment sites recording the presence of Munz's cholla, *Cylindropuntia munzii*. The species is abundant on the central CMAGR, especially in Salvation Pass and Surveyor's Pass. Imagery also shows the species abundant in Iris Pass, between the Gas Line Road and Surveyor's Pass, which was off limits to this study due to munitions.

Table 2 – Species list for the CMAGR flora

CRYPTOGAMS**PTERIDACEAE***Cheilanthes parryi* (D.C. Eat.) Domin*Notholaena californica* D. C. Eat.**GYMNOSPERMS****EPHEDRACEAE***Ephedra aspera* Engelm. ex S. Wats.*Ephedra californica* S. Wats.*Ephedra nevadensis* S. Wats.*Ephedra trifurca* Torr. ex S. Wats.**ANGIOSPERMS
EUDICOTYLEDONS****ACANTHACEAE***Justicia californica* (Benth.) D. Gibson**AIZOACEAE***Mesembryanthemum crystallinum* L.*Mesembryanthemum nodiflorum* L.*Sesuvium verrucosum* Raf.**AMARANTHACEAE***Amaranthus fimbriatus* (Torr.) Benth. ex S. Wats.*Tidestromia suffruticosa* (Torr.) Standl. var. *oblongifolia* (S. Watson) Sánch. Pino & Flores Olv.**APOCYNACEAE***Amsonia tomentosa* Torr. & Frem.*Asclepias albicans* S. Wats.*Asclepias erosa* Torr.*Asclepias subulata* Decne.*Funastrum cynanchoides* (Decne.) Schltr.*Funastrum hirtellum* (A. Gray) Schltr.*Funastrum utahense* (Engelm.) Liede & Meve*Matelea parvifolia* (Torr.) Woodson**ASTERACEAE***Acamptopappus sphaerocephalus* (Harv. & A. Gray) A. Gray*Adenophyllum porophylloides* (A. Gray) Strother*Ambrosia dumosa* (A. Gray) Payne*Ambrosia ilicifolia* (A. Gray) W. Payne*Ambrosia salsola* (T & G) Strother & Baldwin*Atrichoseris platyphylla* (A. Gray) A. Gray*Baccharis brachyphylla* A. Gray*Baccharis sarothroides* A. Gray*Bahiopsis parishii* (Greene) E.E. Schill. & Panero*Baileya pauciradiata* Harvey & A. Gray ex A. Gray

Baileya pleniradiata Harvey & A. Gray ex A. Gray
Bebbia juncea (Benth.) Greene var. *aspera* Greene
Brickellia desertorum Coville
Brickellia incana A. Gray
Calycoseris wrightii A. Gray
Chaenactis carphoclinia A. Gray var. *carphoclinia*
Chaenactis fremontii A. Gray
Chaenactis stevioides Hook. & Arn.
Encelia farinosa A. Gray ex Torr. var. *farinosa*
Encelia farinosa var. *phenicodonta* (Blake) Jtn.
Encelia frutescens (A. Gray) A. Gray
Ericameria paniculata (A. Gray) Rydb.
Erigeron canadensis L.
Eriophyllum lanosum (A. Gray) A. Gray
Geraea canescens Torr. & A. Gray
Gutierrezia microcephala (DC.) A. Gray
Isocoma acradenia (Greene) Greene
Lactuca serriola L.
Logfia depressa (A. Gray) Holub.
Malacothrix coulteri A. Gray
Malacothrix glabrata A. Gray
Malacothrix stebbinsii W.S. Davis & Raven
Microseris lindleyi (DC.) A. Gray
Monoptilon bellioides (A. Gray) H.M. Hall
Palafoxia arida B.L. Turner & M. Morris var. *arida*
Pectis papposa Harvey & A. Gray var. *papposa*
Perityle emoryi Torr.
Perityle sp. (yellow-rayed form)
Peucephyllum schottii A. Gray
Pleurocoronis pluriseta (A. Gray) King & H.E. Robins.
Pluchea odorata (L.) Cass. var. *odorata*
Pluchea sericea (Nutt.) Cov.
Porophyllum gracile Benth.
Prenanthes exiguus (A. Gray) Rydb.
Psathyrotes ramosissima (Torr.) A. Gray
Psilostrophe cooperi (A. Gray) Greene
Rafinesquia neomexicana A. Gray
Senecio mohavensis A. Gray
Sonchus asper (L.) Hill ssp. *asper*
Sonchus oleraceus L.
Stephanomeria pauciflora (Torr.) Nutt.
Stylocline micropoides A. Gray
Trichoptilium incisum A. Gray
Trixis californica Kellogg
Xylorhiza tortifolia (T. & G) Greene var. *tortifolia*

BIGNONIACEAE

Chilopsis linearis (Cav.) Sweet ssp. *arcuata* (Fosberg) Henrickson

BORAGINACEAE

Amsinckia intermedia Fisch. & C.A. Mey.
Amsinckia tessellata A. Gray var. *tessellata*
Cryptantha angustifolia (Torr.) Greene
Cryptantha barbiger (A. Gray) Greene var. *barbiger*
Cryptantha decipiens (M.E. Jones) Heller
Cryptantha dumetorum (Greene ex A. Gray) Greene
Cryptantha holoptera (A. Gray) Macbr.
Cryptantha maritima (Greene) Greene var. *maritima*
Cryptantha maritima (Greene) Greene var. *pilosa* I.M. Johnston
Cryptantha micrantha (Torr.) Jtn. var. *micrantha*
Cryptantha nevadensis A. Nels. & Kennedy var. *nevadensis*
Cryptantha pterocarya var. *cycloptera* (Greene) J.F. Macbr.
Cryptantha racemosa (S. Wats.) Greene
Cryptantha utahensis (A. Gray) Greene
Pectocarya anisocarpa Veno
Pectocarya heterocarpa (Jtn.) Jtn.
Pectocarya penicillina (H. & A.) A. DC.
Pectocarya peninsularis I.M. Johnst.
Pectocarya platycarpa (Munz & Jtn.) Munz & Jtn.
Pectocarya recurvata Jtn.
Plagiobothrys jonesii A. Gray
Tiquilia canescens var. *pulchella* (I.M. Johnston) A. Richards.
Tiquilia plicata (Torr.) A. Richardson

BRASSICACEAE

Brassica geniculata (Desf.) Benth.
Brassica tournefortii Gouan
Caulanthus cooperi (S. Wats.) Payson
Caulanthus lasiophyllus (Hook. & Arn.) Payson
Descurainia pinnata (Walt.) Britt.
Dithyrea californica Harv.
Draba cuneifolia Nutt. ex T. & G.
Lepidium fremontii S. Wats.
Lepidium lasiocarpum Nutt. ex Torr & A. Gray ssp. *lasiocarpum*
Physaria tenella (A. Nelson) O'Kane & Al-Shehbaz
Sisymbrium irio L.
Streptanthella longirostris (S. Wats.) Rydb.

BURSERACEAE

Bursera microphylla A. Gray

CACTACEAE

Carnegiea gigantea (Engelm.) Britton & Rose
Cylindropuntia acanthocarpa (Engelm. & J. M. Bigelow) F. M. Knuth var. *acanthocarpa*
Cylindropuntia bigelovii (Engelm.) F.M. Knuth
Cylindropuntia chuckwallensis M.A. Baker & M.A. Cloud-Hughes
Cylindropuntia echinocarpa (Engelm. & J. M. Bigelow) F. M. Knuth

Cylindropuntia munzii (C.B. Wolf) Backeb.
Cylindropuntia ramosissima (Engelm.) F.M. Kunth
Echinocactus polycephalus Engelm. & Bigelow
Echinocereus engelmannii (Parry ex Engelm.) Lem. var. *engelmannii*
Ferocactus cylindraceus (Engelm.) Orcutt
Mammillaria tetrancistra Engelm.
Opuntia basilaris Engelm. & Bigel.

CAMPANULACEAE

Nemacladus glanduliferus Jeps.
Nemacladus orientalis (McVaugh) Morin
Nemacladus ramosissimus Nutt.
Nemacladus rubescens E.L. Greene
Nemacladus tenuis (McVaugh) Morin var. *aliformis* Morin

CAPPARIDACEAE

Cleomella arborea (Nutt.) Roalson & J.C.Hall

CARYOPHYLLACEAE

Achyronychia cooperi T. & G.
Spergularia marina (L.) Griseb.

CHENOPODIACEAE

Allenrolfea occidentalis (S. Wats.) Kuntze
Atriplex sp.
Atriplex canescens (Pursh) Nutt. ssp. *canescens*
Atriplex canescens (Pursh) Nutt. var. *macilenta* Jepson
Atriplex elegans (Moq.) D. Dietr.
Atriplex hymenelytra (Torr.) S. Wats.
Atriplex lentiformis (Torr.) S. Wats.
Atriplex polycarpa (Torr.) S. Wats.
Chenopodium murale L.
Salsola tragus L.
Suaeda nigra (Raf.) J.F. Macbr.

CUCURBITACEAE

Brandegea bigelovii (S. Wats.) Cogn.
Cucurbita palmata S. Wats.

EUPHORBIACEAE

Ditaxis lanceolata (Benth.) Pax & Hoffm.
Ditaxis serrata (Torrey) Müll. Arg.
Euphorbia abramsiana L.C. Wheeler
Euphorbia eriantha Benth.
Euphorbia micromera Boiss. ex Engelm.
Euphorbia pediculifera Engelm.
Euphorbia polycarpa Benth. var. *hirtella* Boiss.
Euphorbia setiloba Engelm. ex Torr.
Stillingia linearifolia S. Wats.

Stillingia spinulosa Torr.

FABACEAE

Acmispon maritimus (Torr. & A. Gray) D.D. Sokoloff var. *brevivexillus* (Ottley) Brouillet

Acmispon strigosus (Nutt.) Brouillet

Astragalus crotalariae (Benth.) A. Gray

Astragalus insularis var. *harwoodii* Munz & McBurney ex Munz

Astragalus lentiginosus Dougl. ex Hook.

Astragalus nuttallianus DC.

Calliandra eriophylla Benth.

Dalea mollis Benth.

Dalea mollissima (Rydb.) Munz

Hoffmannseggia microphylla Torr.

Hoffmannseggia peninsularis Wiggins

Leucaena leucocephala (Lam.) DeWit

Lupinus arizonicus (S. Wats.) S. Wats.

Lupinus sparsiflorus Benth.

Marina parryi (T. & G.) Barneby

Olneya tesota A. Gray

Parkinsonia florida (Benth. ex A. Gray) S. Wats.

Prosopis glandulosa Torr. ssp. *torreyana* (L. Benson) E. Murray

Prosopis juliflora (Sw.) DC.

Psoralea arborescens var. *simplicifolia* (Parish) Barneby

Psoralea emoryi (A. Gray) Rydb.

Psoralea polydenius (Torr. ex S. Wats.) Rydb.

Psoralea schottii (Torr.) Barneby

Psoralea spinosus (A. Gray) Barneby

Senegalia greggii (A. Gray) Britton & Rose

Senna armata (S. Wats.) Irwin & Barneby

Senna covesii (A. Gray) I. & B.

FOUQUIERIACEAE

Fouquieria splendens Engelm. ssp. *splendens*

GERANIACEAE

Erodium cicutarium (L.) L'Her. ex Ait.

Erodium texanum A. Gray

HYDROPHYLLACEAE [included in Boraginaceae in some recent treatments]

Eucrypta micrantha (Torr.) Heller

Nama demissa A. Gray var. *demissa*

Nama hispida A. Gray var. *spathulata* (Torr.) C. Hitchc.

Phacelia crenulata Torr. ex S. Wats. var. *ambigua* (M. Jones) Macbr.

Phacelia distans Benth.

Phacelia minutiflora J. Voss

Phacelia neglecta M.E. Jones

Phacelia pedicellata A. Gray

KOEBERLINIACEAE

Koeberlinia spinosa ssp. *tenuispina* (K. & P.) E. Murray

KRAMERIACEAE

Krameria bicolor S. Watson

Krameria erecta Willd. ex Schult.

LAMIACEAE

Hyptis emoryi Torr.

Salvia columbariae Benth.

Salvia greatae Brandeg.

Scutellaria mexicana Torr.) A.J. Paton

LOASACEAE

Mentzelia desertorum (Davidson) H. Thompson & J. Roberts

Mentzelia involucrata S. Wats.

Mentzelia involucrata S. Wats. var. *involucrata*

Mentzelia involucrata var. *megalantha* I.M. Johnston

Mentzelia longiloba Darl.

Mentzelia puberula J. Darl.

Petalonyx linearis Greene

Petalonyx thurberi A. Gray

MALVACEAE

Eremalche exilis (A. Gray) Greene

Eremalche rotundifolia (A. Gray) Greene

Hibiscus denudatus Benth.

Horsfordia newberryi (S. Wats.) A. Gray

Sphaeralcea ambigua A. Gray

Sphaeralcea coulteri (S. Wats.) A. Gray

Sphaeralcea emoryi Torr. ex A. Gray

MARTYNIACEAE

Proboscidea althaeifolia (Benth.) Dcne.

MOLLUGINACEAE

Mollugo cerviana (L.) Ser.

MONTIACEAE

Calandrinia ambigua (S. Wats.) Howell

NYCTAGINACEAE

Abronia villosa S. Wats. var. *villosa*

Allionia incarnata L.

Boerhavia coccinea P. Mill.

Boerhavia coulteri (Hook.f.) S.Wats. var. *palmeri* (S. Wats.) Spellenberg

Boerhavia triquetra S. Wats var. *intermedia* (M.E. Jones) Spellenberg.

Boerhavia wrightii A. Gray
Mirabilis laevis (Benth.) Curran var. *retrorsa* (Heller) Jepson
Mirabilis laevis (Benth.) Curran var. *villosa* (Kell.) Spellenb.

ONAGRACEAE

Chylismia arenaria A. Nelson
Chylismia brevipes (A. Gray) Small ssp. *arizonica* (P.H. Raven) W.L. Wagner & Hoch
Chylismia brevipes (A. Gray) Small ssp. *brevipes*
Chylismia cardiophylla (Torr.) Small
Chylismia claviformis (Torr. & Frem.) A. Heller ssp. *aurantiaca* (Munz) W.L. Wagner & Hoch
Chylismia claviformis (Torr. & Frem.) A. Heller ssp. *yumae* (P.H. Raven) W.L. Wagner & Hoch
Eremothera boothii (Dougl.) W.L. Wagner & Hoch ssp. *condensata* (Munz) W.L. Wagner & Hoch
Eremothera chamaenerioides (A. Gray) W.L. Wagner & Hoch
Eremothera refracta (S. Watson) W.L. Wagner & Hoch

OROBANCHACEAE

Orobanche cooperi (A. Gray) Heller

PAPAVERACEAE

Argemone munita Dur. & Hilg. ssp. *argentea* G.B. Ownbey
Eschscholzia glyptosperma Greene
Eschscholzia minutiflora S. Wats.
Eschscholzia papastillii Shannon Still
Eschscholzia parishii Greene

PHRYMACEAE

Diplacus bigelovii (A.Gray) G.L.Nesom

PICODENDRACEAE

Tetracoccus hallii Brandegee

PLANTAGINACEAE

Antirrhinum filipes A. Gray
Mohavea confertiflora (Benth.) Heller
Plantago ovata Forsskal
Stemodia durantifolia (L.) Sw.

POLEMONIACEAE

Aliciella latifolia (S. Wats.) J.M. Porter ssp. *latifolia*
Eriastrum eremicum (Jeps.) H. Mason
Gilia scopulorum M.E. Jones
Gilia stellata A. Heller
Langloisia setosissima (T. & G.) Greene ssp. *setosissima*
Loeseliastrum schottii (Torr.) Timbrook
Linanthus jonesii (A. Gray) Greene

POLYGONACEAE

Chorizanthe brevicornu Torr. var. *brevicornu*

Chorizanthe corrugata (Torr.) Torr. & A. Gray
Chorizanthe rigida (Torr.) Torr. & A. Gray
Eriogonum deflexum Torr.
Eriogonum inflatum Torr. & Frem.
Eriogonum nidularium Cov.
Eriogonum reniforme Torr. & Frem.
Eriogonum thomasi Torr.
Eriogonum trichopes Torr. var. *trichopes*
Eriogonum viridescens Heller
Eriogonum wrightii Torr. ex Benth. var. *nodosum* (Small) Reveal
Pterostegia drymarioides F. & M.

RESEDACEAE

Oligomeris linifolia (Vahl) J.F. Macbr.

RHAMNACEAE

Condalia globosa var. *pubescens* I.M. Johnston
Ziziphus obtusifolia (T. & G.) A. Gray

ROSACEAE

Prunus fasciculata (Torr.) A. Gray

RUBIACEAE

Galium stellatum Kellogg

RUTACEAE

Thamnosma montana Torr. & Frem.

SIMAROUBACEAE

Castela emoryi (A. Gray) Moran & Felger

SIMMONDSIACEAE

Simmondsia chinensis (Link) C. Schneider

SOLANACEAE

Datura discolor Bernh.
Datura wrightii Regel
Lycium andersonii A. Gray
Lycium brevipes Benth.
Nicotiana obtusifolia Mart. & Gal.
Physalis crassifolia Benth.

TAMARICACEAE

Tamarix aphylla (L.) Karsten
Tamarix ramosissima Ledeb.

URTIQUILA CANESCENSCEAE

Parietaria hespera Hinton var. *hespera*

VISACEAE

Phoradendron californicum Nutt.

ZYGOPHYLLACEAE

Fagonia densa Johnston

Fagonia laevis Standl.

Fagonia pachyacantha Rydb.

Kallstroemia californica (S. Wats.) Vail

Larrea tridentata (Sesse & Moc. ex DC.) Cov.

ANGIOSPERMS
MONOCOTYLEDONS

ARECACEAE

Phoenix dactylifera L.

Washingtonia filifera (Lindl.) Wendl.

ASPARAGACEAE

Hesperocallis undulata A. Gray

Nolina bigelovii (Torr.) S. Wats.

Yucca schidigera Roezl ex Ortega

LILIACEAE

Calochortus flexuosus S. Wats.

POACEAE

Aristida adscensionis L.

Aristida purpurea Nutt.

Bouteloua aristidoides (HBK) Griseb.

Bouteloua barbata Lag. var. *barbata*

Bromus arizonicus (Shear) Stebbins

Bromus berterioanus Colla

Bromus rubens L.

Cynodon dactylon (L.) Pers.

Dasyochloa pulchella (Kunth) Willd. ex Rydb.

Festuca octoflora Walt.

Hilaria rigida (Thurb.) Scribn.

Hordeum murinum L.

Muhlenbergia microsperma (DC.) Kunth.

Muhlenbergia porteri Scribn. ex Beal

Phalaris minor Retz.

Phragmites australis (Cav.) Steud.

Polypogon monspeliensis (L.) Desf.

Saccharum ravennae (L.) Murr.

Schismus arabicus Nees

Sorghum bicolor (L.) Moench

Sporobolus airoides (Torr.) Torr.

Stipa speciosa Trin. & Rupr.

Tridens muticus (Torr.) Nash

Table 3. Special Status plant species in the CMAGR INRMP (2023), in addition to the Orocopia sage and Fortuna Range suncup, discussed in text. Large “X” indicates updates to table regarding Present or Potential.

Common Name Scientific Name	Federal Status	BLM Status	State Status	Species or Habitat			Results from Malusa and Sanders 2023
				Present	Potential	Absent	
Plants							
Harwood’s rattleweed (<i>Astragalus insularis</i> var. <i>harwoodii</i>)	None	None	CNPS 2.2, SH S2.2		x		A scarce native spring annual which we did not find but which has been collected near the CMAGR twice, once each on the north and west edges of the range.
Peirson’s milk-vetch (<i>Astragalus magdalenae</i> var. <i>peirsonii</i>)	T	None	E		x		Not found
Triple-ribbed milk-vetch (<i>Astragalus tricarinatus</i>)	E	None	SH S1.2		x		Not found
California ayenia (<i>Ayenia compacta</i>)	None	None	CNPS 2.3, SH S3?1 ²		x		Not found
Pink fairy-duster (<i>Calliandra</i> <i>eriophylla</i>)	None	None	CNPS 2.3, SH S2S3	X			Common on the northeastern section of the CMAGR, usually along watercourses.
Saguaro (<i>Carnegiea gigantea</i>)	None	None	CNPS 2.2, SH 1.2		x		Large specimen, 10 m tall with two arms, previously documented by Malusa in 1990 along Dietz Road, but unable to relocate the plant during this study.
Emory’s crucifixion-thorn (<i>Castela emoryi</i>)	None	None	CNPS 2.3, SH S2S3	X			Found only once on this survey, a single plant at the upper end of the Salvation Pass Road at 410 m (1345 ft.)
Las Animas colubrine (<i>Colubrina californica</i>)	None	None	CNPS 2.3, SH S2S3.3		X		Not found. Contrary to the INRMP, this species has not been documented in the CMAGR.

FLORA AND VEGETATION OF THE CMAGR

Wiggins' croton (<i>Croton wigginsii</i>)	None	S	CNPS 2.2, SH S1.2, RCNPPA		x		Not found
Munz's cholla (<i>Cylindropuntia munzii</i>)	None	S	CNPS 1B.3, SH S1.2	x			Abundant cactus, documented at 76 of 303 sample sites.
Desert silver bush (<i>Argythamnia claryana</i> or <i>Ditaxis claryana</i>)	None	None	CNPS 2.2, SH S1		x		Not found
Crown-of-thorns (<i>Koeberlinia spinosa</i> var. <i>tenuispina</i>)	None	None	CNPS 2.2, SH S2.2	x			Rare shrub, only a few individuals. Collected from 0.15 km NNW of the well near Salvation Pass at 356 m (1167 ft).
Algodones sunflower (<i>Helianthus niveus</i> var. <i>tephrodes</i>)	None	S	CNPS 1B.2, SH S1.2		x		Not found
Spear-leaf matelea (<i>Matelea parvifolia</i>)	None	None	CNPS 2.3, SH S2.2	x			Very infrequent perennial vine with milky latex, usually found growing up through shrubs on the sides of small washes, notably on <i>Tetracoccus</i> along the Bradshaw Trail on the Chuckwalla Bench. Also at Tabaseca Tank.
Darlington's blazing star (<i>Mentzelia puberula</i> [<i>oreophila</i>])	None	None	CNPS 2.2, SH S2		x		Scarce perennial in rocky places. We did not find this plant during our work, but it has been collected on the edge of the range in 2011 at the end of Imperial Gables Road.
Slender cottonheads (<i>Nemacaulis denudata</i> var. <i>gracilis</i>)	None	None	CNPS 2.2, SH S2		x		Not found
Giant Spanish-needle (<i>Palafoxia arida</i> var. <i>gigantea</i>)	None	S	CNPS 1B.3, SH S2		x		Not found
Sand food (<i>Pholisma sonora</i>)	None	S	CNPS 1B.2, SH S2		x		Not found

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Cove's cassia (<i>Senna covesii</i>)	None	None	CNPS 2.2, SH S1	x			We only found it once, on a berm along the side of the Bradshaw Trail.
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Vegetation Mapping

Classification

Within the CMAGR we classified 34 mapping units (Table 4) that are fully described under Map Unit Descriptions. Three CMAGR units were cultural disturbances: Urban, Major Canals, and Human Disturbance. Three CMAGR units were natural areas with little vegetation: (1) Unvegetated wash and river bottom Mapping Unit, (2) Mud Hills sparsely vegetated ephemeral herbs Mapping Unit, and (3) North American warm desert bedrock cliff and outcrop Group. Of remaining 28 units, 19 were mapped at the association level, 9 at the alliance level. All 28 map units fell under 15 previously described NVC alliances, with the possible exception of the vegetation of the higher elevations of the CMAGR range (1700-3000 feet). On cooler aspects and especially on granitic rocks, the vegetation is characterized by Mormon tea, *Ephedra aspera*, also known as rough joint-fir, along with *Ambrosia dumosa* and *Encelia farinosa*. The most similar previously described mapping unit characterized by *Ephedra* is the *Ephedra nevadensis*- *Lycium andersonii* - *Bicolora spinosa* alliance, but this unit is characteristic of the Mojave, not the Sonoran, with only *Lycium andersonii* present in the CMAGR. A provisional unit, the ***Ambrosia dumosa* – *Ephedra aspera* Association**, within the NVC *Ambrosia dumosa* alliance, is described more fully under Map Unit Descriptions. See Appendix D for a crosswalk between the CMAGR and the Barry M Goldwater Range vegetation mapping units.

Mapping

The total mapped area is 455,869 acres, or 184,484 hectares, or 1,760 square miles. This is slightly less than the area within the administrative boundary of approximately 458,000 acres because the present map was drawn to seamlessly match the borders of vegetation maps of adjoining lands (DRECP and Dos Palmas). These maps did not precisely follow the border of the range.

A total of 13,913 polygons were drawn and each attributed with a 'map unit'. The total area represented by each map unit in acres, hectares, and square miles is shown in Figs. 11-13. A polygon mapped as an alliance means it was not attributed at the more-detailed association level for that polygon. A polygon mapped as an association also belongs to a higher-level alliance. For example, the **most widespread alliance** was creosote – white bursage (*Larrea tridentata* - *Ambrosia dumosa*) alliance, whose 152,951 acres included 97,086 acres representing six associations within the alliance, as well as 55,865 acres within the alliance but not mapped at the association level. The total area represented by each alliance in acres, hectares, and square miles is shown in Figs. 14-15.

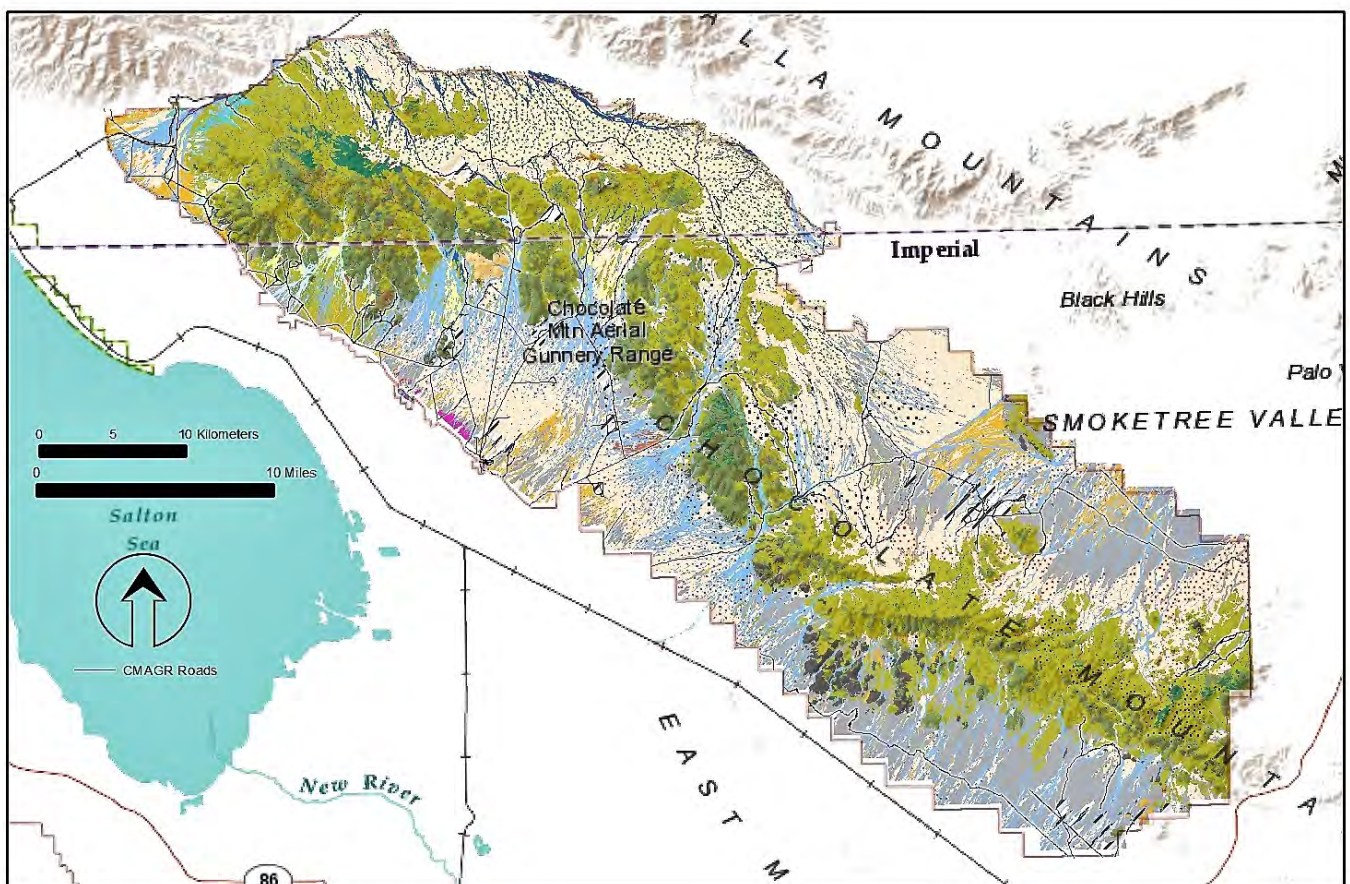
The creosote-brittlebush (*Larrea tridentata* - *Encelia farinosa*) alliance was the **most widespread mapping unit**, covering 97,520 acres. This figure does not include several associations within the alliance. The **most widespread association** was desert pavements (*Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota*), covering 47,195 acres.

Fourteen of the 34 mapping units were under 1000 acres each. Six of these were less than 100 acres and included all the mapping units associated with the Coachella Canal – *Tamarix* Alliance, *Sueda moquinii*-*Atriplex canescens* Association, and *Prosopis glandulosa* Association.

Overall, creosote (*Larrea tridentata*) is king of the CMAGR, found at every elevation. Map units with a median creosote cover of at least 1% encompassed 318,742 acres out of the 455,869 acres total, or 70%.

Ironwood (*Olneya tesota*) was also very common on the CMAGR, despite its range limited to below 2300 ft (701 m). Map units with a median ironwood cover of at least 1% encompassed 133,304 acres out of the 455,869 acres total, or 29%.

To pinpoint the location of any other species, you can use the Access database included with this report. For instance, narrowleaf silverbush (*Ditaxis lanceolata*) is an important browse species for wildlife. It's not characteristically common within any map unit, but the species can be very common at certain locations. Forty-five Rapid Assessment plots held the silverbush, and 8 of those had cover values from 1 to 8%. Where are they? To find these plots you can use the database that is included with the study, searching the table called "RAPplants" for *Ditaxis lanceolata*.



Above: Snapshot view of the vegetation of the CMAGR. Detailed maps of various areas are in Appendix B.

Table 4 – CMAGR mapping units crosswalked to NVC, DRECP, California Dept. of Fish and Wildlife, and other sources.
Associations lacking an NVC association code are provisional associations.

CMAGR Map Class	NVC alliance code	NVC association code	DRECP Map Unit	Most similar or equivalent mapping unit (source)	California Dept Fish Wildlife 'natural community'
Ambrosia dumosa Alliance	A3279		4111	Ambrosia dumosa alliance (DRECP)	Ambrosia dumosa alliance
Ambrosia dumosa - Ephedra aspera association	A3279		none	New provisional association for CMAGR	A provisional association within the Ambrosia dumosa alliance
Ambrosia salsola - Psorothamnus schottii Association	A4188		7211	Ambrosia salsola - Psorothamnus schottii Association (NECO)	Ambrosia salsola - Bebbia juncea Alliance
Chilopsis linearis Association	A1044	CEGL001164	4224	Chilopsis linearis Association (DRECP)	Chilopsis linearis - Psorothamnus spinosus Alliance
Chorizanthe rigida - Geraea canescens - Olneya tesota Association	A4024		6117	Chorizanthe rigida - Geraea canescens Alliance (DRECP)	Chorizanthe rigida - Geraea canescens Alliance
Cylindropuntia bigelovii Alliance	A3146		4124	Cylindropuntia bigelovii Alliance (DRECP)	Cylindropuntia bigelovii Alliance
Encelia farinosa - Larrea tridentata - Psorothamnus schottii Association	A3278		4118	Larrea tridentata--Encelia farinosa--Psorothamnus schottii-- Association (Dos Palmas) OR Encelia farinosa--Psorothamnus schottii / Parkinsonia florida Association (Mecca/Orocopia)	Larrea tridentata - Encelia farinosa Alliance
Encelia farinosa Alliance	A4215		4114	Encelia farinosa Alliance (DRECP)	Encelia farinosa Alliance
Human disturbance			9320	Anthropogenic areas of little or no vegetation (DRECP)	
Hyptis emoryi - Nolana bigelovii Association	A4187		4226	New provisional association for CMAGR	Senegalia greggii - Hyptis emoryi - Justicia californica Alliance
Larrea tridentata - Ambrosia dumosa- Atriplex hymenelytra Association	A3277	CEGL001264	4115	Larrea tridentata -Ambrosia dumosa-Atriplex hymenelytra Association (Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument)	Larrea tridentata – Ambrosia dumosa alliance

Larrea tridentata - Ambrosia dumosa - Calliandra eriophylla Association	A3277		4115	Ambrosia dumosa - Olneya tesota - Calliandra eriophylla (NECO)	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Ambrosia dumosa - Cylindropuntia munzii Association	A3277		4115	New provisional association for CMAGR	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Ambrosia dumosa - Olneya tesota Association	A3277		4115	Larrea tridentata - Ambrosia dumosa - Olneya tesota Association (NECO)	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Ambrosia dumosa - Psoralea schottii Association	A3277		4115	Larrea tridentata--Ambrosia salsola--Psoralea schottii Association (Dos Palmas)	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Ambrosia dumosa - Yucca schidigera Association	A3277	CEGL005762	4115	Larrea tridentata - Ambrosia dumosa - Yucca schidigera Association (Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument)	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Ambrosia dumosa Alliance	A3277		4115	Larrea tridentata - Ambrosia dumosa Alliance (DRECP)	Larrea tridentata – Ambrosia dumosa alliance
Larrea tridentata - Encelia farinosa Alliance	A3278	CEGL005766	4118	Larrea tridentata - Encelia farinosa Alliance (DRECP)	Larrea tridentata - Encelia farinosa Alliance
Larrea tridentata - Encelia farinosa - Salvia greatae association	A3278		4118	Encelia farinosa - Ambrosia dumosa - Salvia greatae association (NECO) OR Larrea tridentata - Salvia greatae association (Mecca/Orocopia) OR Encelia farinosa - Salvia greatae association (Mecca/Orocopia)	A provisional association within the Larrea tridentata - Encelia farinosa Alliance
Larrea tridentata Association	A3277	CEGL001261	4119	Larrea tridentata Association (NECO)	Larrea tridentata – Ambrosia dumosa alliance
Major canals			9804	Major canals (DRECP)	
Mud Hills sparsely vegetated ephemeral herbs Mapping Unit			6113	Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (DRECP)	Barren = Sparsely Vegetated

FLORA AND VEGETATION OF THE CMAGR

North American warm desert bedrock cliff and outcrop Group			6110	North American warm desert bedrock cliff and outcrop Group (DRECP)	
Parkinsonia florida - Olneya tesota - Cylindropuntia munzii Association	A0588		4227	Parkinsonia florida - Olneya tesota - Cylindropuntia munzii Association (NECO)	Parkinsonia florida - Olneya tesota Alliance
Parkinsonia florida - Olneya tesota Alliance	A0588		4227	Parkinsonia florida - Olneya tesota Alliance (DRECP)	Parkinsonia florida - Olneya tesota Alliance
Parkinsonia florida Association	A0588		4227	Parkinsonia florida Association (NECO)	Parkinsonia florida - Olneya tesota Alliance
Pleuraphis rigida Alliance	A3170		4122	Pleuraphis rigida Alliance (DRECP)	Pleuraphis rigida Alliance
Prosopis glandulosa Association	A3877	CEGL001381	4222	Prosopis glandulosa Association (NECO)	Prosopis glandulosa – Prosopis velutina – Prosopis pubescens Alliance (4222)
Psorothamnus spinosus Association	A1044	CEPP006744	4225	Psorothamnus spinosus Association (DRECP)	Chilopsis linearis - Psorothamnus spinosus Alliance
Senegalia greggii - Hyptis emoryi - Justicia californica Alliance	A4187		4226	Senegalia greggii - Hyptis emoryi - Justicia californica Alliance (DRECP)	Senegalia greggii - Hyptis emoryi - Justicia californica Alliance
Suaeda nigra - Atriplex canescens Association	A3880	CEPP006758	5111	Suaeda moquinii – Atriplex canescens Association (Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument)	Suaeda nigra Alliance
Tamarix spp. Alliance	A0842		1432	Tamarix spp. Alliance (DRECP)	Tamarix spp. Alliance
Unvegetated wash and river bottom Mapping Unit			6114	Unvegetated wash and river bottom Mapping Unit (DRECP)	
Urban			9300	Urban (DRECP)	

FLORA AND VEGETATION OF THE CMAGR

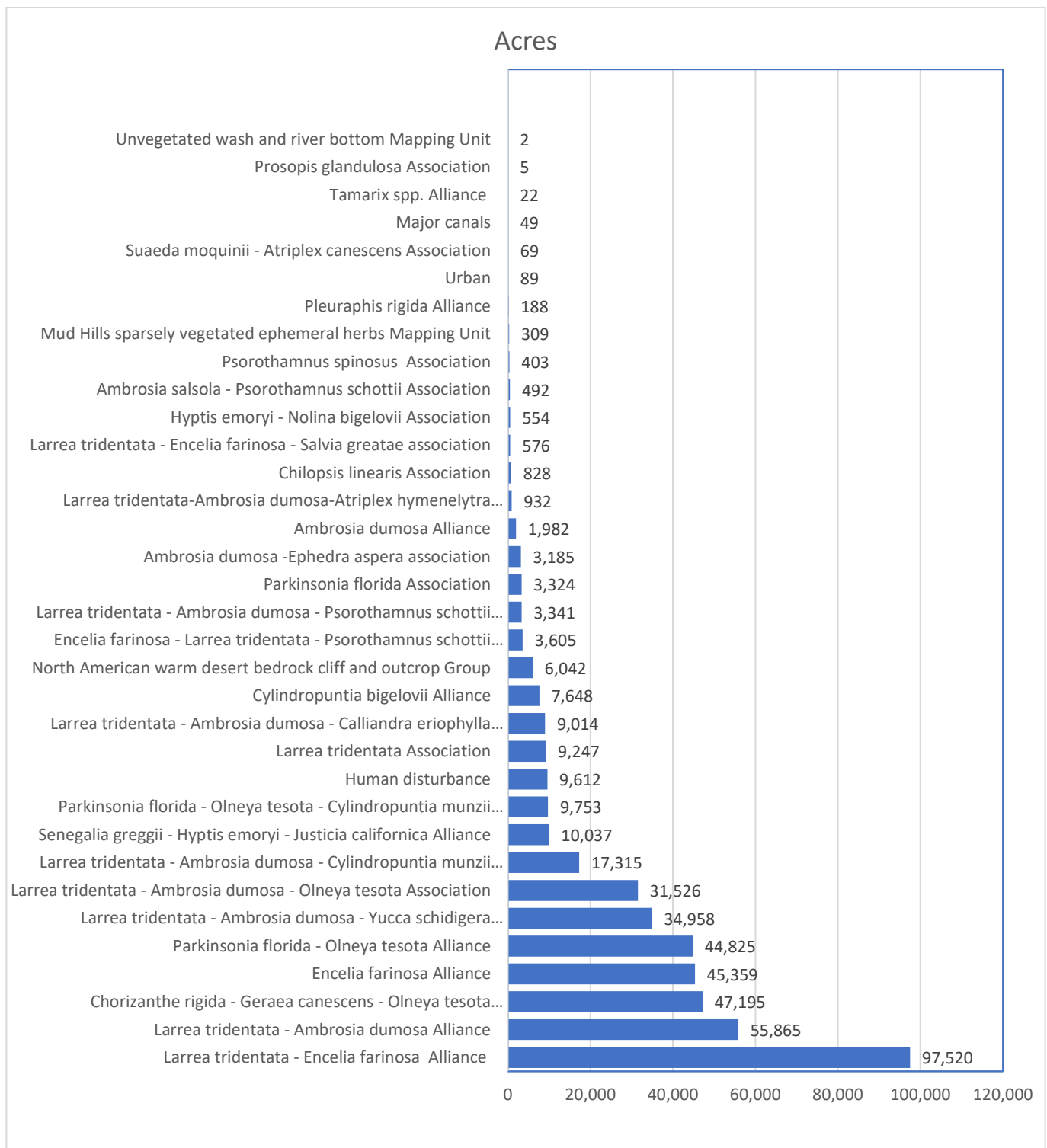


Figure 11. Number of acres mapped for each **map unit**. Total mapped area = 455,869 acres.

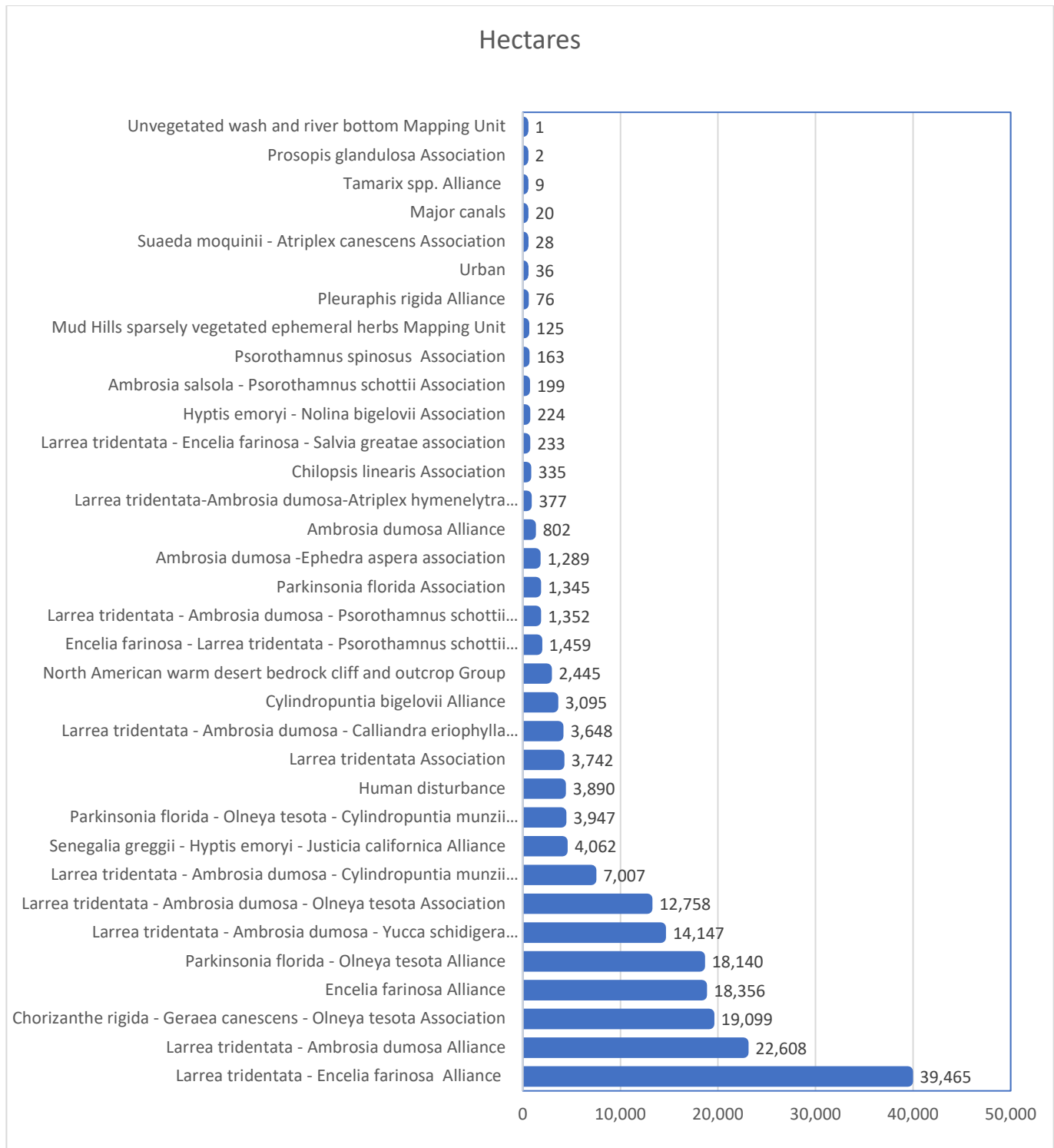


Figure 12. Number of hectares mapped for each **map unit**. Total mapped area = 184,484 hectares

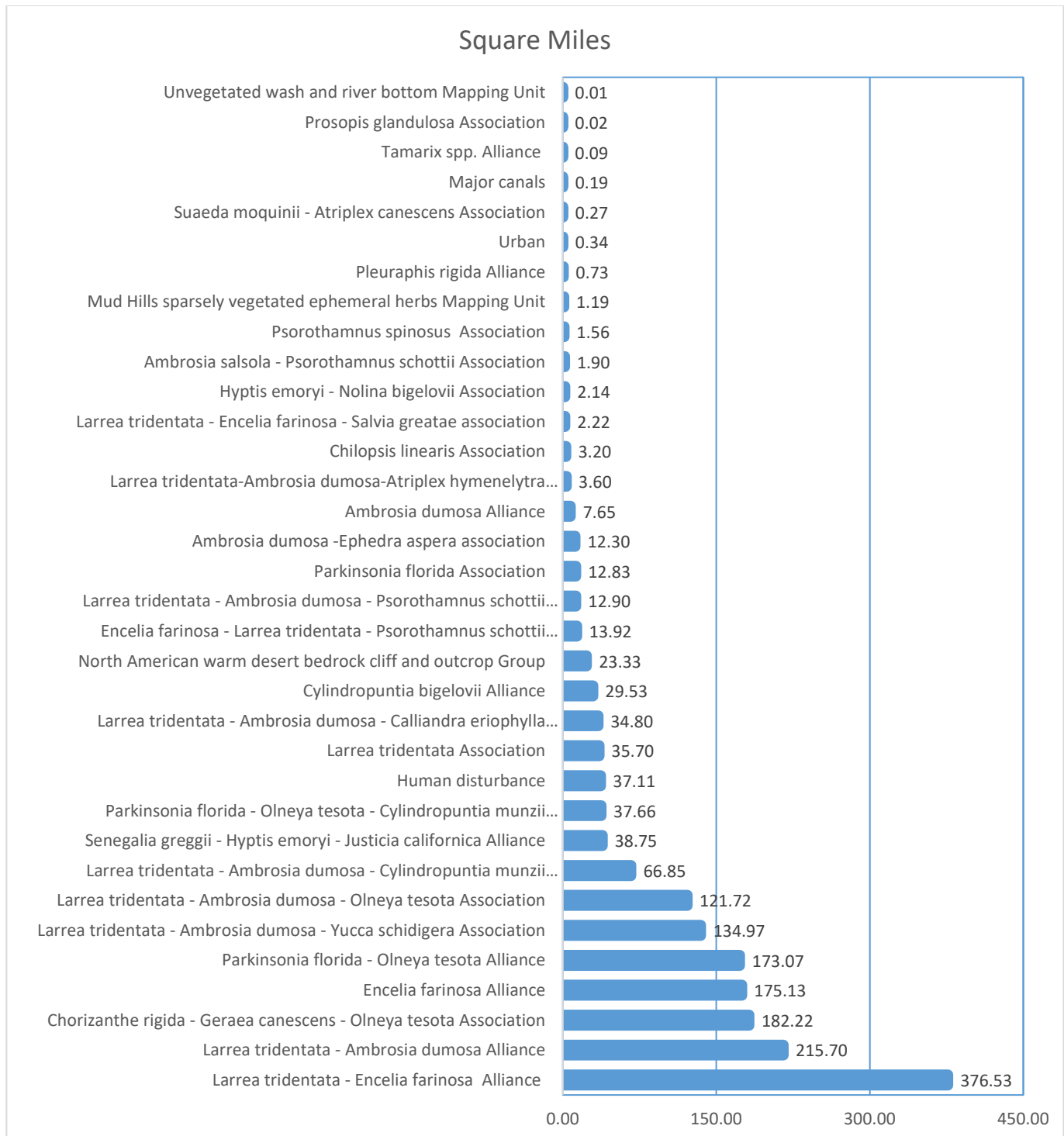


Figure 13. Number of square miles mapped for each **map unit**. Total mapped area = 1,760 square miles.

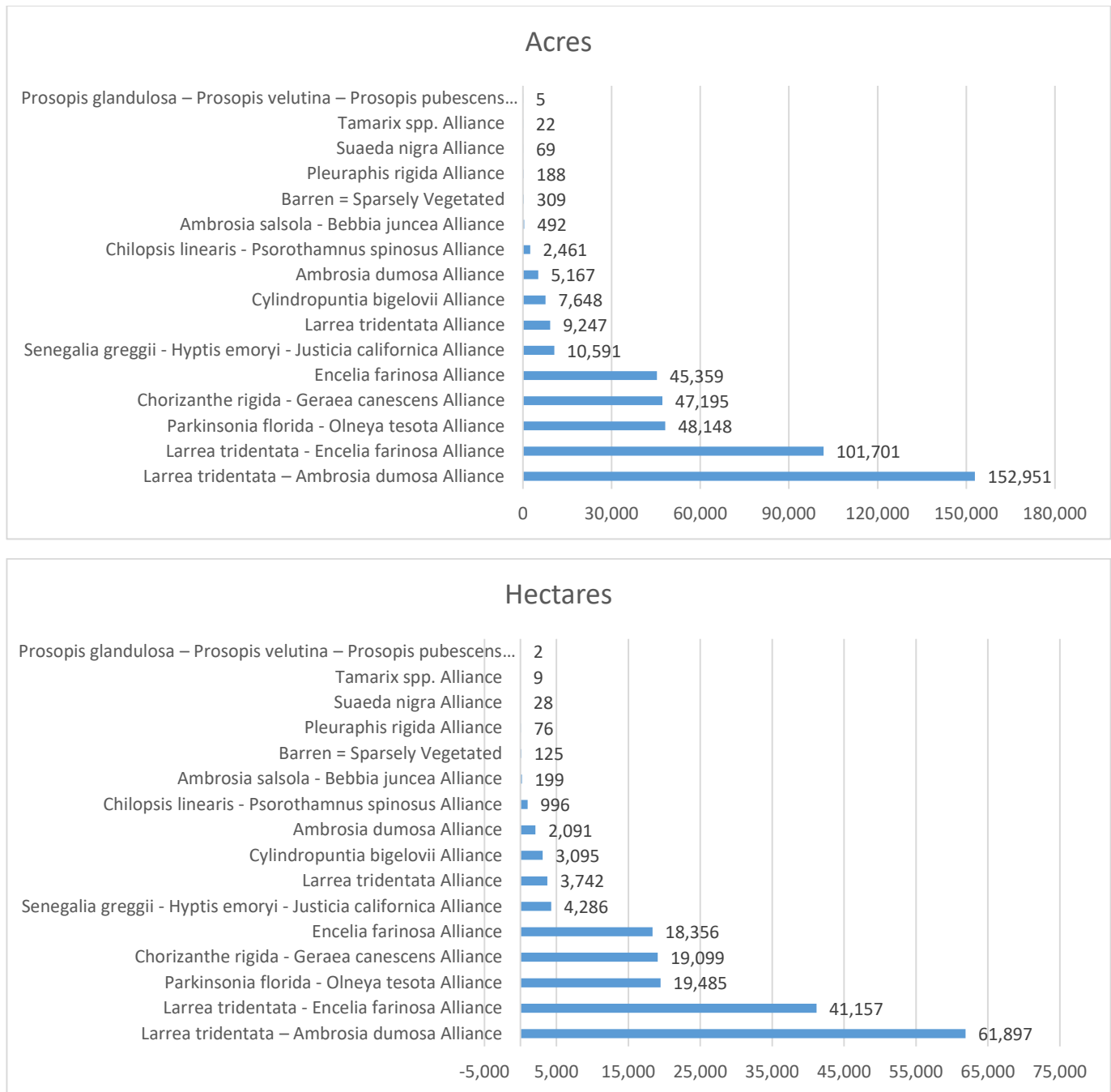


Figure 14. Number of acres and hectares mapped for each **alliance**. Total mapped area = 455,869 acres = 184,484 hectares

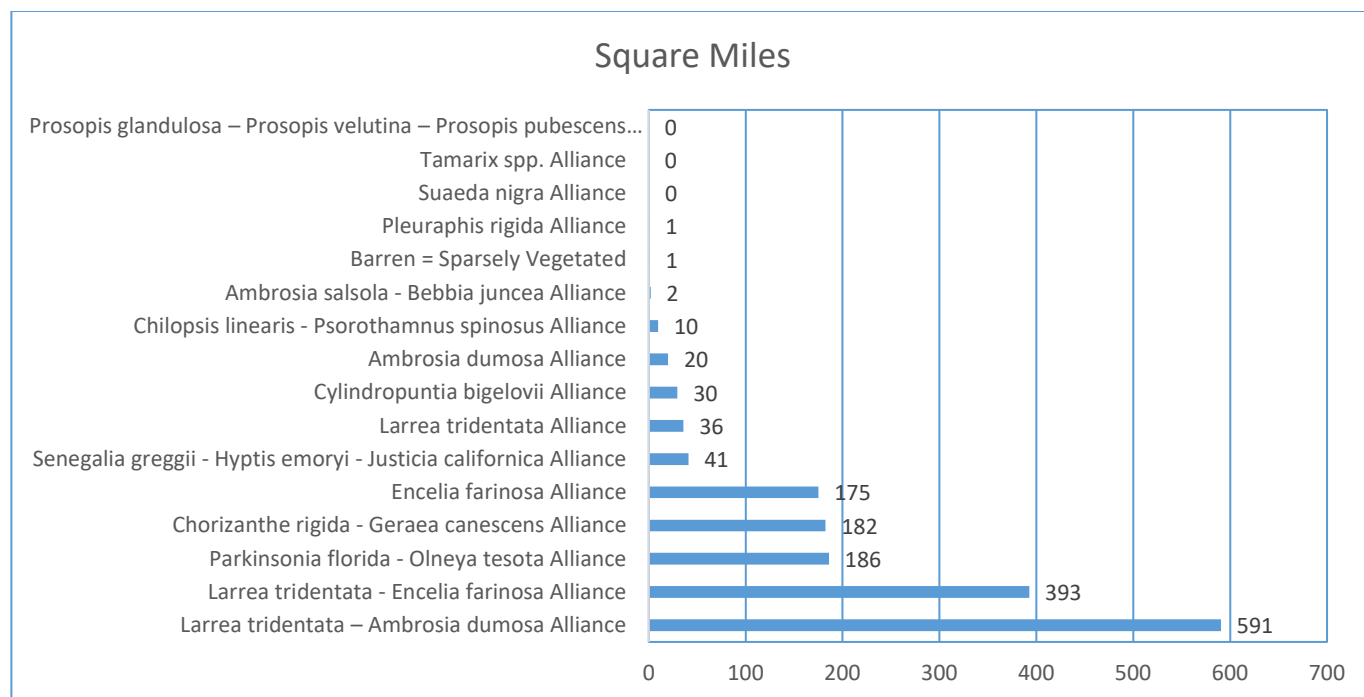


Figure 15. Number of square miles mapped for each **alliance**. Total mapped area = 1,760 square miles

Map Unit Descriptions

This section gives full descriptions for each of the 34 Map Units represented in the geodatabase, listed below:

Ambrosia dumosa Alliance
Ambrosia dumosa - *Ephedra aspera* Association
Ambrosia salsola - *Psoralea schottii* Association
Chilopsis linearis Association
Chorizanthe rigida - *Geraea canescens* - *Olneya tesota* Association
Cylindropuntia bigelovii Alliance
Encelia farinosa - *Larrea tridentata* - *Psoralea schottii* Association
Encelia farinosa Alliance
 Human disturbance
Hyptis emoryi - *Nolina bigelovii* Association
Larrea tridentata Association
Larrea tridentata - *Ambrosia dumosa* Alliance
Larrea tridentata – *Ambrosia dumosa* - *Atriplex hymenelytra* Association
Larrea tridentata - *Ambrosia dumosa* - *Calliandra eriophylla* Association
Larrea tridentata - *Ambrosia dumosa* - *Cylindropuntia munzii* Association
Larrea tridentata - *Ambrosia dumosa* - *Olneya tesota* Association
Larrea tridentata - *Ambrosia dumosa* - *Psoralea schottii* Association
Larrea tridentata - *Ambrosia dumosa* - *Yucca schidigera* Association
Larrea tridentata - *Encelia farinosa* Alliance
Larrea tridentata - *Encelia farinosa* - *Salvia greatae* Association
 Major canals
 Mud Hills sparsely vegetated ephemeral herbs Mapping Unit
 North American warm desert bedrock cliff and outcrop Group
Parkinsonia florida - *Olneya tesota* Alliance
Parkinsonia florida - *Olneya tesota* - *Cylindropuntia munzii* Association
Parkinsonia florida Association
Pleuraphis rigida Alliance
Prosopis glandulosa Association
Psoralea spinosus Association
Senegalia greggii - *Hyptis emoryi* - *Justicia californica* Alliance
Suaeda moquinii - *Atriplex canescens* Association
Tamarix spp. Alliance
 Unvegetated wash and river bottom Mapping Unit
 Urban

***Ambrosia dumosa* Alliance**

Common name: White bursage alliance

Most similar or equivalent mapping unit on adjacent lands: *Ambrosia dumosa* Alliance DRECP 4111

Most similar or equivalent NVC alliance: *Ambrosia dumosa* Alliance A3279

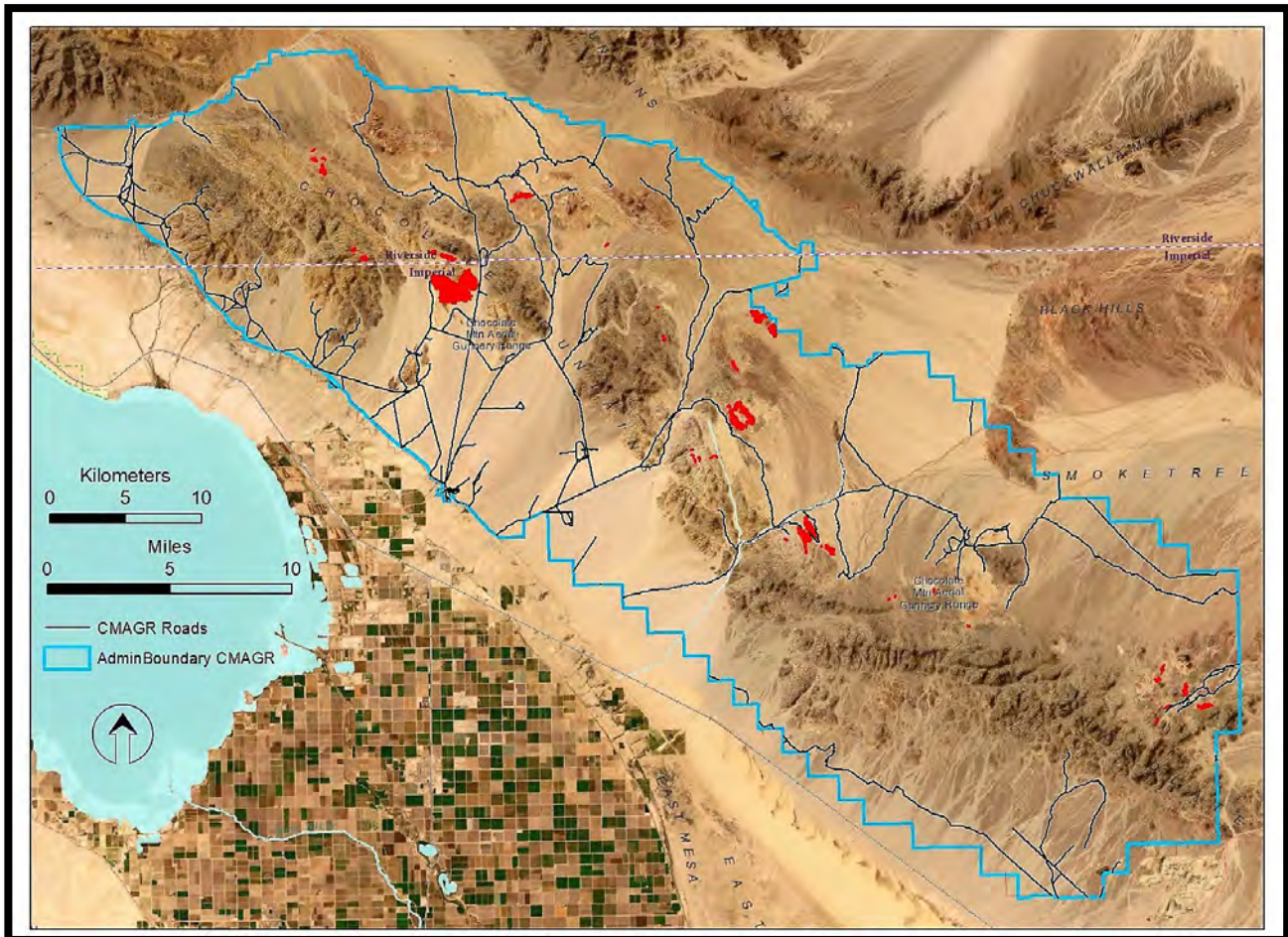
Acres (hectares) mapped on CMAGR: 1,982 (802)



Above: *Ambrosia dumosa* is dominant on this northeast-facing granite slope at 1950 ft. (594 m) near Lion Head Mt. (RA plot LHM-51). Common associates at this site include *Atriplex hymenelytra*, *Eriogonum inflatum*, and *Xylorhiza tortifolia*.



Above: *Ambrosia dumosa* dominant, with common associates *Fagonia pachyacantha* and *Krameria erecta* at 2035 ft. (620 m) on rhyolite near Surveyor's Pass (RA plot AP-18). Red hill in background was mapped as *Larrea tridentata*-*Ambrosia dumosa* alliance.



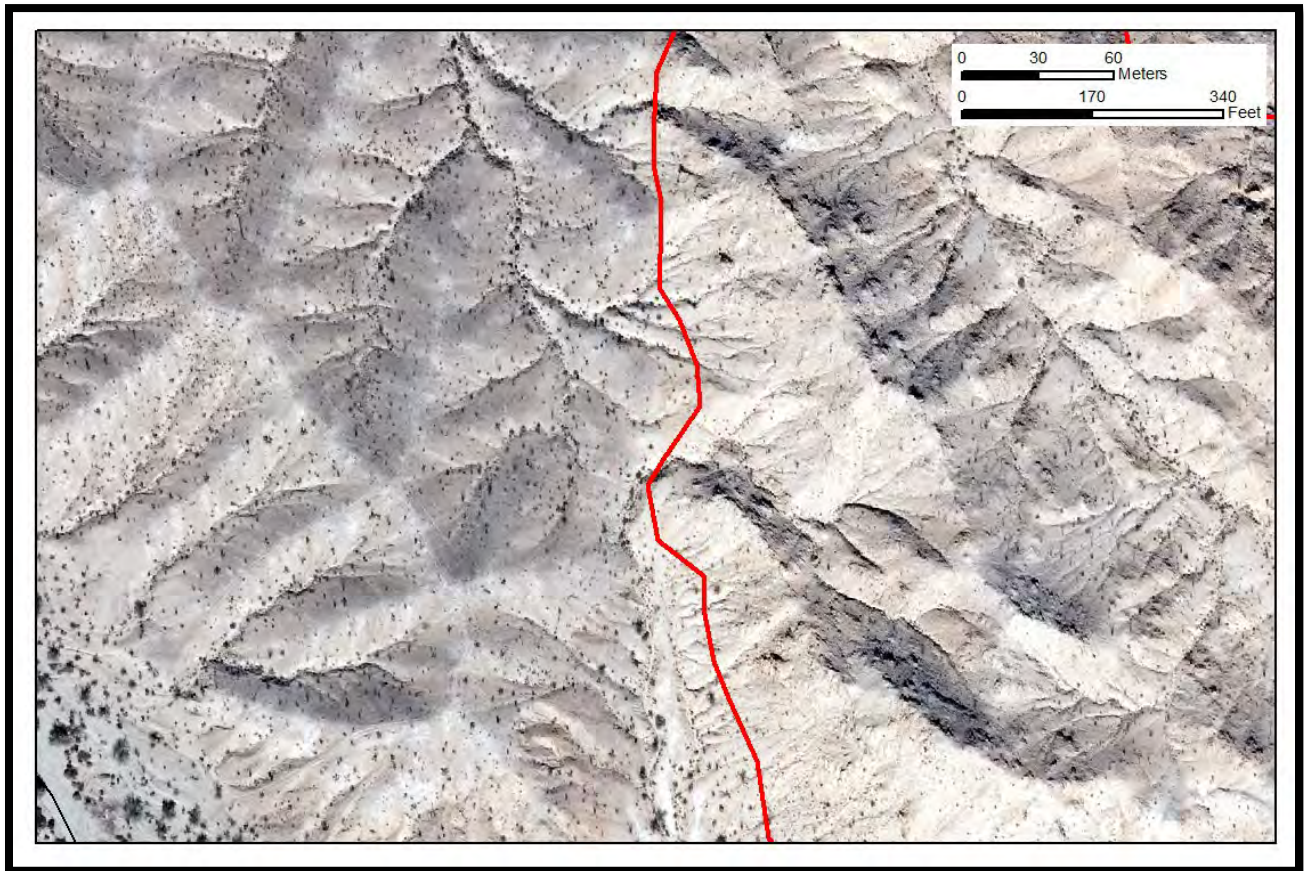
Above: Distribution of *Ambrosia dumosa* Alliance in red. Extent of vegetation polygons exaggerated for visibility.

Description: *Ambrosia dumosa* is dominant, with at least twice the cover of other perennials, and *Larrea tridentata* has less than 1% cover. *Fouquieria splendens* and *Encelia farinosa* were present at all six samples, occasionally common but with <1% median cover. *Tiquilia canescens*, *Eriogonum inflatum* and *Krameria erecta* were also occasionally common, and found in five of the six samples.

Setting: This alliance can be an early seral stage in disturbed *Larrea tridentata*-*Ambrosia dumosa* alliance, but that did not appear to be the case in the CMAGR except on targets (which were mapped as ‘Human Disturbance’). Otherwise, the *Ambrosia dumosa* alliance was always on slopes exceeding 5 degrees, on all aspects, on both extrusive volcanics and phaneritic igneous rocks (e.g., gabbro, diorite, and granite), and mapped at elevations ranging from 1350 to 2700 ft (411 – 823 m)

Image identification: *Larrea tridentata* is typically visible on imagery, making it possible to map areas with <1% cover. However, estimating *Encelia farinosa* cover to be less than half of *Ambrosia dumosa* cover is very difficult, especially on steep light-colored substrates. Mapped areas were based mainly on

field visits by the authors, NECO sample plots, and photos from tortoise surveys. If said areas were judged to be the *Ambrosia dumosa* alliance (*Ambrosia dumosa* dominant, *Larrea tridentata* <1% cover), the polygon would be drawn to include areas that appeared similar in the image, but only if they were nearby (the largest polygon for this mapping unit is about one square mile). More distant areas without field data yet visibly lacking *Larrea tridentata* > 1% cover were attributed as the *Encelia farinosa* alliance (which may or may not have *Ambrosia dumosa*) or the *Ambrosia dumosa* – *Ephedra aspera* alliance, depending on the elevation, aspect, and substrate.



Above, the *Ambrosia dumosa* alliance is on the right, and apparent by the lack of creosote. Image from near Pegleg Well, above Salvation Pass.

Mapping Units with a similar appearance on imagery: According to the California Manual of Vegetation, the *Encelia farinosa* alliance includes *Ambrosia dumosa* as a common associate. Because it is difficult to separate *Ambrosia dumosa* from *Encelia farinosa* on imagery, the ***Encelia farinosa* alliance** is easy to confuse with the *Ambrosia dumosa* alliance, especially on light colored substrates. On dark substrates on steep slopes with rubble chutes, *Larrea tridentata* can also be difficult to see, so it is possible to misattribute the *Ambrosia dumosa* alliance to places that are actually the ***Larrea tridentata* – *Encelia farinosa* alliance**, which also includes *Ambrosia dumosa* as an associate in descriptions. Users accuracy for the *Ambrosia dumosa* alliance was 2/2, but producers was 2/4, indicating that this alliance is likely underrepresented on the map.

Table of all taxa that had at least 1% cover in at least one sample site for:
***Ambrosia dumosa* Alliance**

Number of Rapid Assessment Sites: 6

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Ambrosia dumosa</i> White bursage	6	5 (5)	10 (7-15)	0.3
<i>Fouquieria splendens</i> Ocotillo	6	2.5 (1-3)	<1 (0.11-5)	-
<i>Encelia farinosa</i> Brittlebush	6	2.5 (2-3)	<1 (0.2-2.5)	0.5
<i>Tiquilia canescens</i> Woody crinklemat	5	2.5 (0-3)	<1 (0-2)	0.2
<i>Krameria erecta</i> Littleleaf ratany	5	2.5 (0-3)	1 (0-2)	0.3
<i>Eriogonum inflatum</i> Desert trumpet	5	3 (0-3)	<1 (0-1)	-
<i>Fagonia laevis</i> California fagonbush	4	3 (0-3)	1 (0-3.5)	0.1
<i>Fagonia pachyacantha</i> Sticky fagonbush	3	1.5 (0-3)	<1 (0-2)	0.1
<i>Senna armata</i> Desert senna	3	0.5 (0-3)	<1 (0-3)	-
<i>Pleuraphis rigida</i> Big galleta	3	0 (0-3)	<1 (0-1)	-
<i>Acamptopappus sphaerocephalus</i> Rayless goldenhead	2	1 (0-3)	<1 (0-5)	0.3
<i>Adenophyllum porophylloides</i> San Felipe dogweed	2	1.5 (0-3)	<1 (0-1)	0.5
<i>Simmondsia chinensis</i> Jojoba	2	1 (0-3)	<1 (0-1)	1.1
<i>Xylorhiza tortifolia</i> Mojave-woolyaster	3	0 (0-3)	<1 (0-1.5)	-
<i>Ephedra aspera</i> Boundary ephedra	2	0 (0-3)	<1 (0-1)	0.5
<i>Echinocactus polycephalus</i> Cottontop cactus	2	0.5 (0-3)	<1 (0-1)	-

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Atriplex hymenelytra</i> Desertholly saltbush	1	0 (0-3)	<1 (0-2)	-
<i>Psorothamnus schottii</i> Schott's dalea	1	0 (0-3)	<1 (0-2)	-

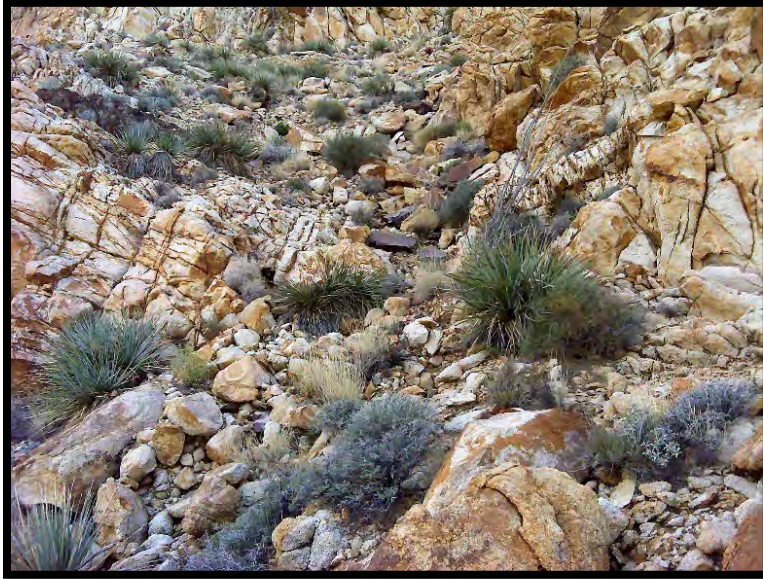
***Ambrosia dumosa* - *Ephedra aspera* Association (provisional)**

Common name: White bursage – rough jointfir association

Most similar or equivalent mapping unit on adjacent lands: *Ambrosia dumosa* Alliance DRECP 4111

Most similar or equivalent NVC alliance: *Ambrosia dumosa* Alliance A3279

Acres (hectares) mapped on CMAGR: 3,185 (1,289)



Above: *Ambrosia dumosa*, *Ephedra aspera*, *Nolina bigelovii*, and *Pleuraphis rigida* co-dominate, with common associates *Fagonia laevis*, *Pleurocoronis pluriseta*, *Tiquila canescens* and *Gallium stellatum*, at 2100 ft. (640 m) on a NE facing granitic slope about 2.5 miles SE of Lion Head Mountain. (RA plot LHM-15)



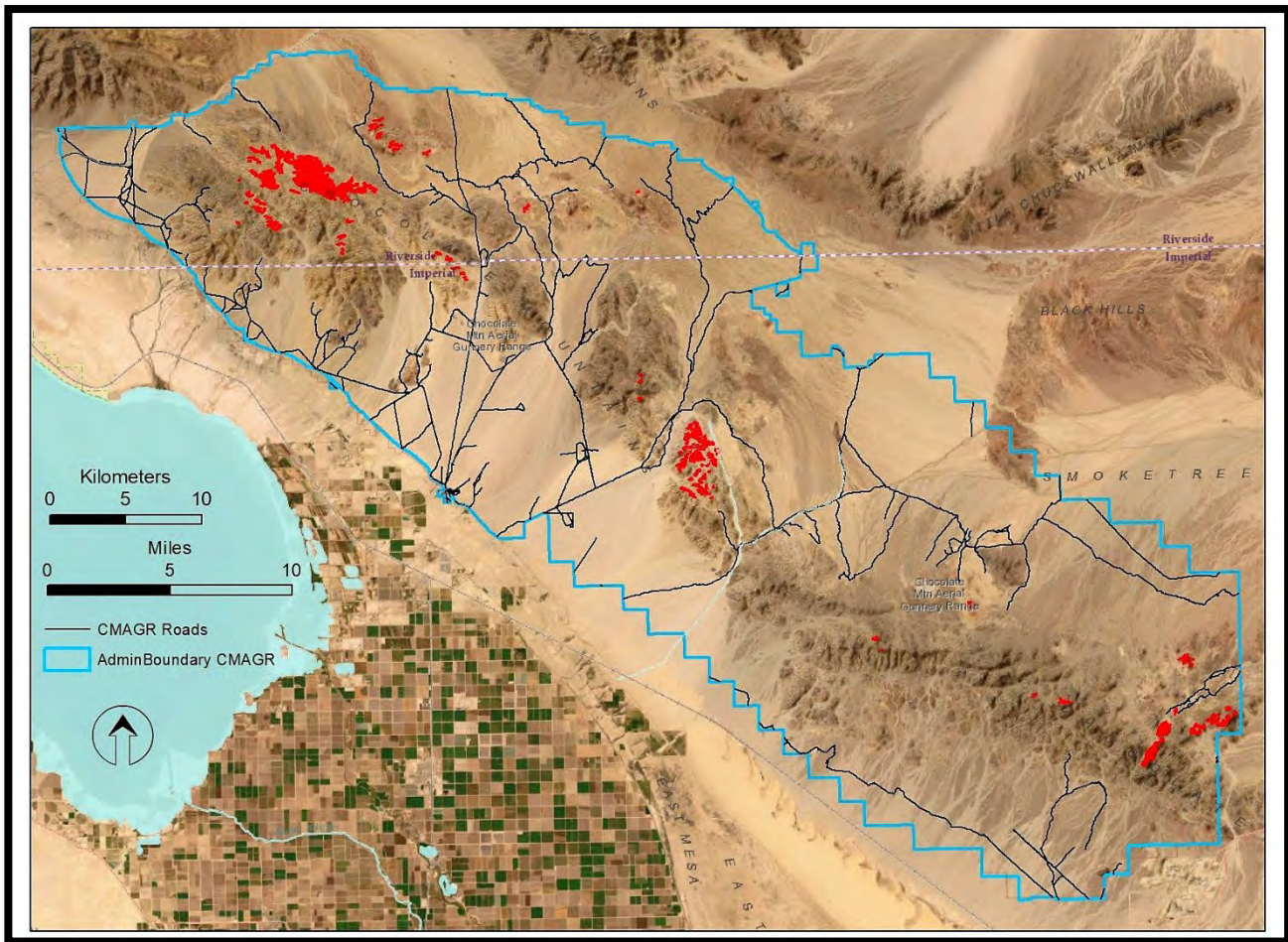
Above: *Ambrosia dumosa* and *Pleuraphis rigida* co-dominate on this west-facing granite slope at 1685 ft. (514 m) about 4 miles SW of Mount Barrow. (RA plot BM-4). Common associates at this site include *Ephedra aspera*, *Encelia farinosa*, and *Hyptis emoryi*, each with about 3% cover.



Above: The most xeric expression of this mapping unit. *Encelia farinosa* is dominant on this south facing slope at 2800 ft, on gneiss, about 13 miles north of Camp Billy Machen. *Ephedra aspera* has only 1% cover, but *Nolina bigelovii*, *Ambrosia dumosa*, and *Bahiopsis parishii* each have 3% cover. (RA plot FNE-15) Just over the ridgeline at top, the unseen north-facing slope holds *Ambrosia dumosa* as the dominant species, with *Ephedra aspera*, *Bahiopsis parishii*, *Gallium stellatum*, and *Encelia farinosa* each with 3 to 4% cover.



Above: Clockwise from bottom left, the four large shrubs are *Senna armata*, *Psoralea schottii*, *Nolina bigelovii*, and *Tetracoccus hallii*, set among granite boulders 2.5 miles NE of Lion Head Mountains, at 1775 ft (541 m). At this sample site (RA plot LHM-48), *Ambrosia dumosa* and *Tetracoccus hallii* are co-dominant, with common associates *Ephedra aspera*, *Encelia farinosa*, *Simmondsia chinensis* and *Krameria erecta* each with 2 to 3% cover.



Above: Distribution of *Ambrosia dumosa*-*Ephedra aspera* Association in red. Extent of vegetation polygons exaggerated for visibility.

Description: Sites are typically dominated or co-dominated by either *Ambrosia dumosa* or *Ephedra aspera* on cooler aspects and by *Encelia farinosa* on hotter aspects, with a host of other species that may co-dominate: *Bahiopsis parishii*, *Nolina bigelovii*, *Pleuraphis rigida*, *Xylorhiza tortifolia*, *Pleurocoronis pluriseta*, *Simmondsia chinensis*, *Tetracoccus hallii*, and *Hyptis emoryi*. This variety highlights the weakness of this provisional association, which describes vegetation that did not comfortably align with any previously named mapping unit abutting the CMAGR. The simple rule for inclusion in this study is at least 2% cover of *Ephedra aspera* or *Bahiopsis parishii* or *Nolina bigelovii* over the MMA of 1 ha. The vegetation at such locations is diverse, with 15 to 29 perennial species found at each of the 15 sample sites.

A review of the DRECP final report (Reyes et. al., 2020) shows that the DRECP mapped the *Ephedra nevadensis*- *Lycium andersonii* - *Grayia spinosa* alliance in the Palen Mts, approximately 25 miles north of the CMAGR. However, this is a Mojave Desert alliance, and the CMAGR lacks both *Ephedra nevadensis*

and *Grayia spinosa*. A complicating factor is that without female cones, *E. nevadensis* and *E. aspera* are difficult to separate, raising the possibility that the *Ephedra* in the Palen Mts is actually *E. aspera*. Each cone in *E. nevadensis* has two seeds versus one in *E. aspera*.

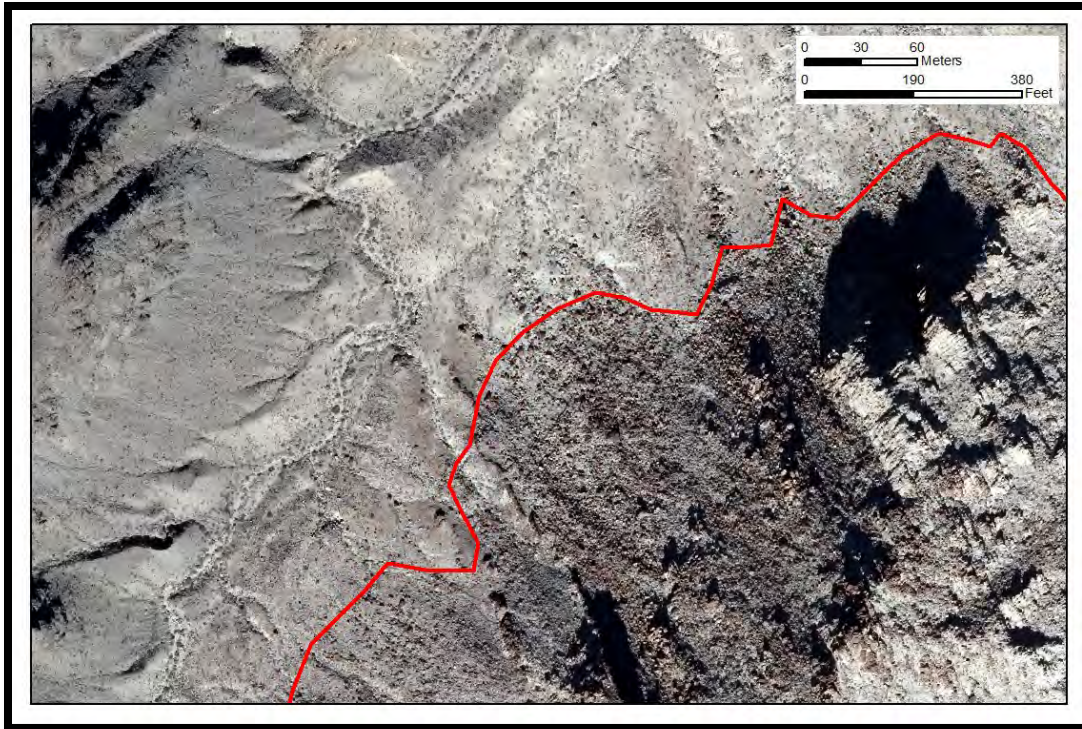
Most similar to this provisional association is the vegetation of the Barry M. Goldwater Range – West (BMGR-West) approximately 60 miles southeast in Arizona (Malusa and Sundt, 2015). The suite of dominant and co-dominants shared between the CMAGR and BMGR-West include *Ephedra aspera*, *Ambrosia dumosa*, and *Encelia farinosa*, as well as common associates *Nolina bigelovii*, *Pleurocoronis pluriseta*, *Sphaeralcea ambigua*, *Galium stellatum* and *Pleuraphis* (= *Hilaria*) *rigida*. The two locations differ in that the BMGR-West vegetation type holds *Agave deserti* as a co-dominant or common species in all 13 samples, yet this species is absent from the CMAGR (despite being common within Anza-Borrego State Park.) A further difference is the common presence in 11 of 15 CMAGR samples of *Xylorhiza tortifolia*, the wooly aster, which is absent from the BMGR-West.

In summary, both the CMAGR and BMGR-West vegetation could be considered part of the (1) NVC *Ephedra aspera* alliance (which includes an *Ambrosia dumosa* – *Ephedra* sp. association from the Grand Canyon that does not agree with the CMAGR vegetation; Kearsley et. al. 2015), the (2) Manual of California Vegetation *Ambrosia dumosa* alliance, the (3) NVC *Larrea tridentata* - *Fouquieria splendens* upper bajada alliance, or the (4) *Larrea tridentata* – *Ambrosia dumosa* – (*Ephedra nevadensis* – *Lycium andersonii*) association described from Lake Mead and Death Valley. Regarding the latter, *Larrea tridentata* is typically absent or rare within the CMAGR samples but can be common where colluvium has accumulated at the base of slopes.

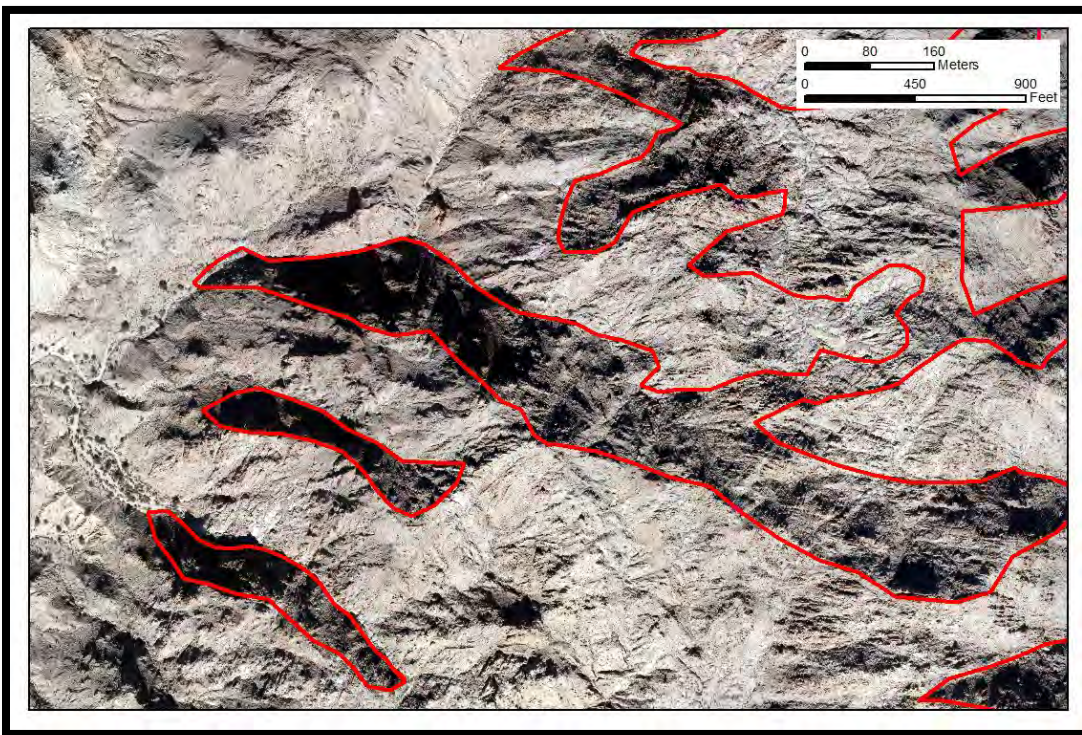
Setting: Elevations over 1700 ft (518 m), and usually on phaneritic igneous rocks, e.g., gabbro, diorite, and granite (12 of 15 sites). Two sites were on basalt/rhyolite (near Tabaseca Tank), and one was on schist. Twelve of the 15 sites were on very steep slopes of > 25 degrees, with little soil development. This unit was mapped at elevations ranging from 1700 – 3060 ft (518 - 933 m).

Image identification: All of the diagnostic species – *Ephedra aspera*, *Bahiopsis parishii*, and *Nolina bigelovii* – are rarely visible on imagery of steep rocky slopes. Mapping was based on field data showing a strong preference for granitic substrates, especially where spheroidal weathering results in boulders, as well as a preference for higher elevations/cooler aspects. See examples below.

Mapping Units with a similar appearance on imagery: The accuracy assessment could not reach this mapping unit in allotted time but review of the many photographs taken during hiking around the CMAGR shows that the more inclusive ***Ambrosia dumosa* alliance** appears very similar in imagery. It's likely that areas attributed to the *Ambrosia dumosa* – *Ephedra aspera* association are lacking *Ephedra aspera*.



Above, the *Ambrosia dumosa* – *Ephedra aspera* association is on the right, among granite boulders and outcrops. Image of landscape about 4 miles SW of Mount Barrow (see RA plot BM-4).



Above, the *Ambrosia dumosa* – *Ephedra aspera* association mapped in the cooler northern exposures as indicated by shadows.

FLORA AND VEGETATION OF THE CMAGR

Table of all taxa that had at least 1% cover in at least one sample site for:

***Ambrosia dumosa* - *Ephedra aspera* Association**

Number of Rapid Assessment Sites: 16

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Ambrosia dumosa</i> White bursage	16	4 (2-5)	6.8 (0.2-15)	0.3
<i>Ephedra aspera</i> Boundary ephedra	16	3 (3-5)	3.5 (0.2-10)	0.6
<i>Encelia farinosa</i> Brittlebush	15	3 (1-4)	2.5 (0.11-10)	0.5
<i>Pleuraphis rigida</i> Big galleta	14	3 (0-4)	2 (0-10)	0.6
<i>Xylorhiza tortifolia</i> Mojave woodyaster	11	3 (0-4)	<1 (0-7)	0.4
<i>Galium stellatum</i> Starry bedstraw	11	2 (0-3)	<1 (0-5)	0.3
<i>Pleurocoronis pluriseta</i> Bush arrowleaf	10	2 (0-4)	<1 (0-7)	0.4
<i>Fouquieria splendens</i> Ocotillo	10	1 (0-3)	<1 (0-7)	-
<i>Sphaeralcea ambigua</i> Desert globemallow	10	2 (0-3)	<1 (0-3)	0.5
<i>Larrea tridentata</i> Creosote	9	1 (0-5)	<1 (0-8)	1.2
<i>Trixis californica</i> American threefold	9	1 (0-3)	<1 (0-1)	-
<i>Tiquilia canescens</i> Woody crinklemat	8	0.5 (0-3)	<1 (0-3)	0.1
<i>Mirabilis bigelovii</i> Wishbone bush	8	0.5 (0-3)	<1 (0-3)	0.3
<i>Nolina bigelovii</i> Desert beargrass	8	0.5 (0-4)	<1 (0-10)	1.0
<i>Viguiera parishii</i> Parish's goldeneye	8	0.5 (0-4)	<1 (0-7)	0.7
<i>Simmondsia chinensis</i> Jojoba	7	0 (0-4)	<1 (0-7)	1.0
<i>Krameria grayi</i> White ratany	7	0 (0-3)	<1 (0-2.5)	0.7

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Eriogonum inflatum</i> Desert trumpet	7	0 (0-3)	<1 (0-7)	0.4
<i>Krameria erecta</i> Littleleaf ratany	7	0 (0-3)	<1 (0-2)	0.3
<i>Stephanomeria pauciflora</i> Brownplume wirelettuce	6	0 (0-3)	<1 (0-3)	-
<i>Lycium andersonii</i> Water jacket	5	0 (0-4)	<1 (0-7)	0.8
<i>Salazaria mexicana</i> Desert senna	5	0 (0-3)	<1 (0-1)	-
<i>Hyptis emoryi</i> Desert lavender	5	0 (0-4)	<1 (0-3)	1.2
<i>Lepidium fremontii</i> Desert pepperweed	4	0 (0-4)	<1 (0-7)	0.5
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	3	0 (0-4)	<1 (0-5)	0.7
<i>Acamptopappus sphaerocephalus</i> Rayless goldenhead	3	0 (0-3)	<1 (0-3)	0.4
<i>Ditaxis lanceolata</i> Silverbush	3	0 (0-3)	<1 (0-1)	0.6
<i>Fagonia pachyacantha</i> California fagonbush	2	0 (0-3)	<1 (0-2)	-
<i>Psorothamnus schottii</i> Schott's dalea	2	0 (0-3)	<1 (0-1)	1.0
<i>Thamnosma montana</i> Turpentinebroom	2	0 (0-3)	<1 (0-1)	0.5
<i>Baileya pauciradiata</i> Laxflower	1	0 (0-3)	<1 (0-3)	0.4

***Ambrosia salsola* - *Psorothamnus schottii* Association (provisional)**

Common name: Cheesebush – Schott’s dalea association

Most similar or equivalent mapping unit on adjacent lands: *Ambrosia salsola* - *Psorothamnus schottii* Association NECO

Most similar or equivalent NVC alliance: *Ambrosia salsola* - *Bebbia juncea* Alliance A4188

Acres (hectares) mapped on CMAGR: 492 (199)



Above: *Ambrosia salsola* and *Psorothamnus schottii* (mostly leafless) co-dominate this floodplain about 7 miles N of Camp Billy Machen, at 830 ft (253 m), with common associates *Parkinsonia florida* and *Encelia farinosa* (RA plot FNE-9).



Above: *Psorothamnus schottii*, fully leaved, dominates this steep alluvial fan with 16% cover, with *Encelia farinosa* the only other species with > 1% cover. *Ambrosia salsola* is uncommon at this site, 12 miles NW of Camp Billy Machen and 3 miles N of Siphon 17, at 950 ft (290 m) (RA plot FNW-9).

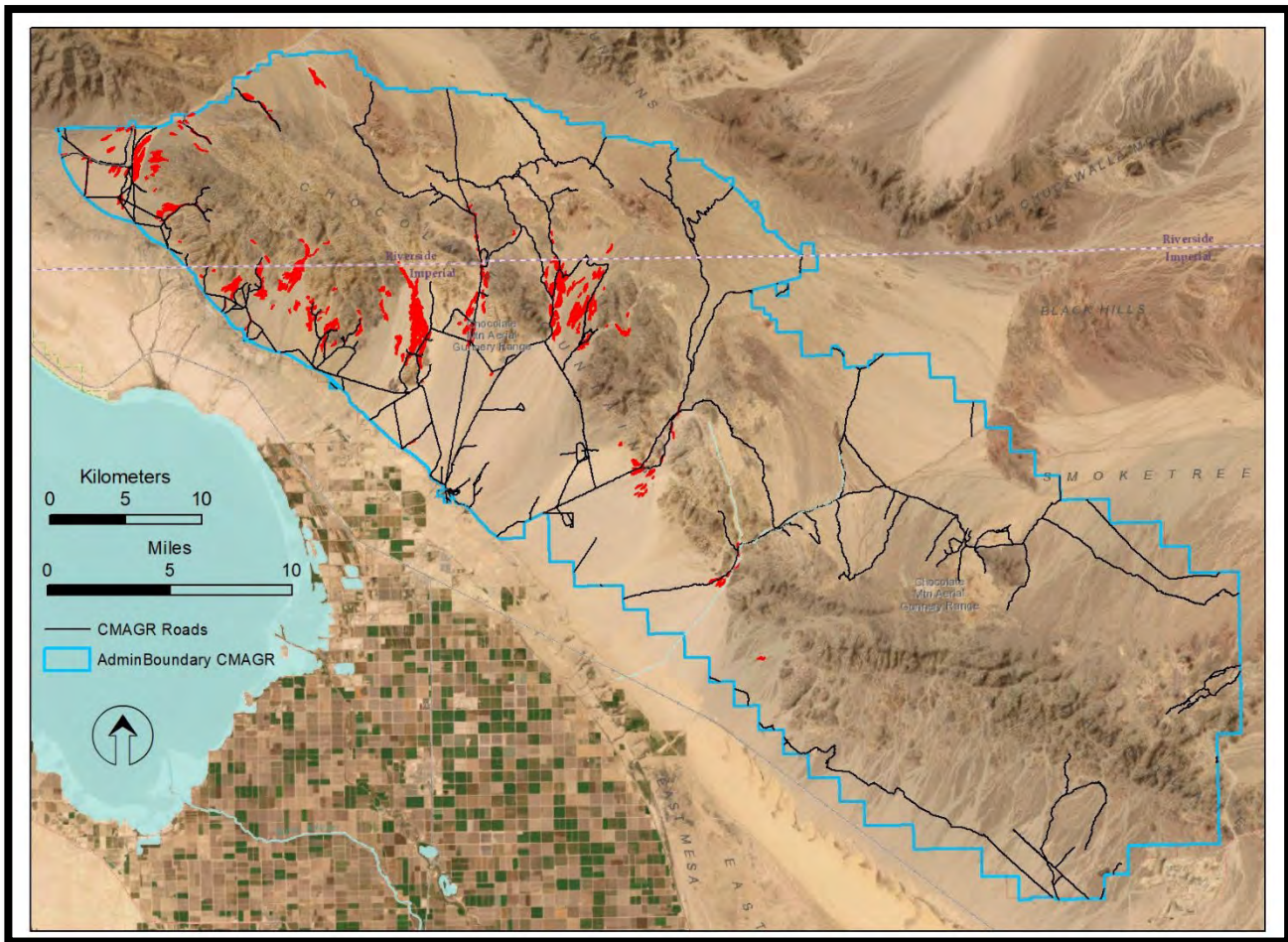


Above: *Ambrosia salsola* dominates this scoured watercourse along the Gasline Road, about 5 miles south of the Bradshaw Trail (RA plot IP-4), at 1850 ft (564 m). The only common associate with cover > 1% is *Ephedra californica*. *Psoralea schottii* is uncommon.



Above: *Ambrosia salsola* is the dominant on this floodplain, with 8 % cover, while *Psoralea schottii* is a common associate with 2% cover. Scattered *Hyptis emoryi* and *Olneya tesota* are common with about 1% cover. Located about 7 miles N of Camp Billy Machen at 810 ft (247 m) (RA plot FNE-8).

FLORA AND VEGETATION OF THE CMAGR



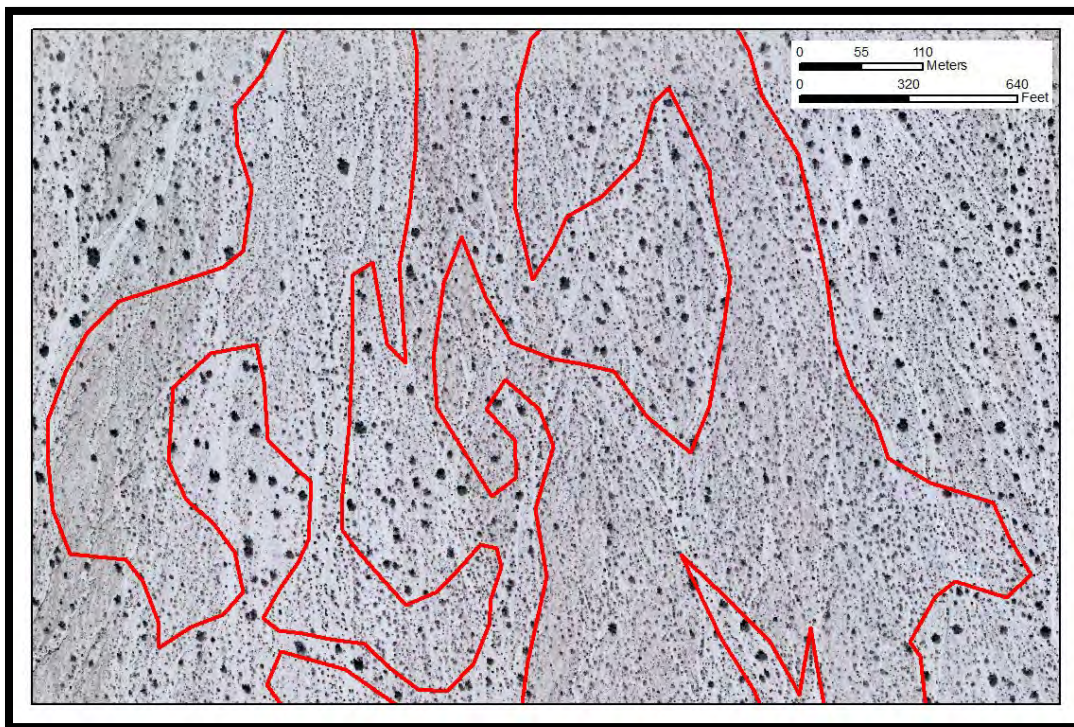
Above: Distribution of *Ambrosia salsola* – *Psoralea schottii* Association in red. Extent of vegetation polygons exaggerated for visibility.

Description: This association describes vegetation associated with watercourses that are dominated by either *Ambrosia salsola* and/or *Psoralea schottii*, yet tree coverage (*Parkinsonia florida*, *Olneya tesota*, *Psoralea schottii*, or *Chilopsis linearis*) is less than 3%. *Bebbia juncea* is occasionally common, rarely dominant. The lack of *Larrea tridentata* and *Ambrosia dumosa* distinguishes this mapping unit from the widespread *Larrea tridentata* – *Ambrosia dumosa* – *Olneya tesota* association that occurs on less-steep watercourses and bajadas. Ideally the *Ambrosia salsola* – *Psoralea schottii* association would be divided into an *Ambrosia salsola* association and *Psoralea schottii* association, but although *Psoralea schottii* is typically larger than *Ambrosia salsola* (1.5 m tall vs 0.9 m) it was apparently mostly leafless at the time of image capture and could not reliably be discerned from *Ambrosia salsola*. It can, however, be assumed that the lower ranges of this mapping unit are more likely dominated with *Psoralea schottii*. The example photos above are meant to show the entire range of mapped habitat.

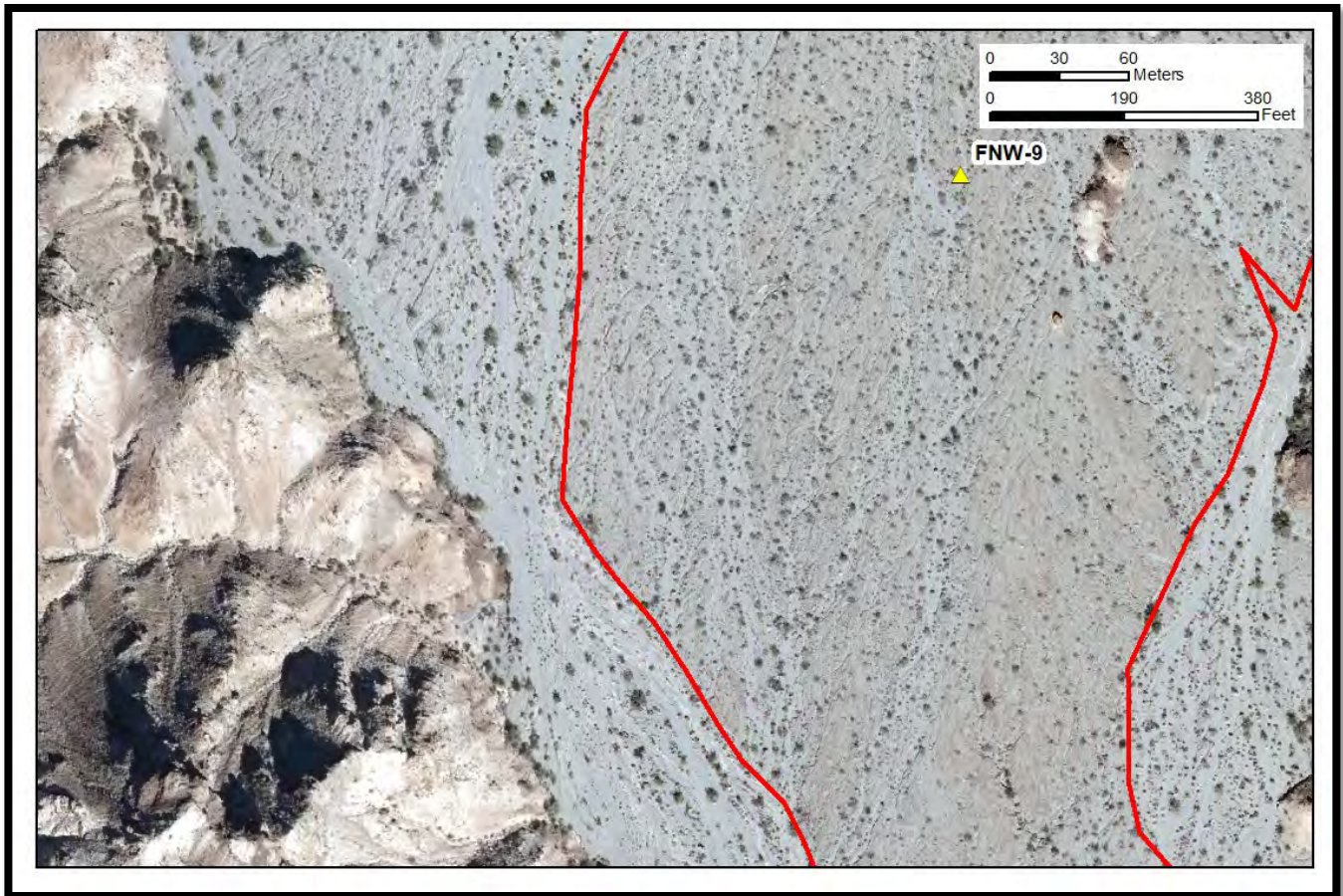
Setting: Sites are all affected by floods, from scoured sandy watercourses dominated by *Ambrosia salsola* to steep bajadas dominated by *Psoralea schottii* where large watercourses exit the mountains front and deposit gravel and cobbles fans on slopes exceeding 2 degrees. These steeper slopes are mostly at the northern end of the CMAGR due to faults/uplift. This unit was mapped at elevations ranging from 150 – 1950 ft (46 -594 m).

Image identification: The primary cues were (1) watercourses with less than 3% *Parkinsonia florida*, *Oleña tesota*, *Psoralea schottii*, or *Chilopsis linearis*; or (2) rubble fans lacking *Larrea tridentata*.

Mapping Units with a similar appearance on imagery: The *Encelia farinosa* – *Psoralea schottii* association is typically just downslope from the *Ambrosia salsola* – *Psoralea schottii* association, but is distinguished by the more readily visible *Encelia farinosa* and *Larrea tridentata*. Depending on the date of the last flood event, the **Unvegetated Wash Bottom and River Bottom mapping unit** could be mapped but using the clock function on Google Earth allows one to see that ‘unvegetated’ may be very temporary. Many watercourses that appeared unvegetated in the 2015 Canyon Air imagery were vegetated in 2012 Google Earth Imagery and were quickly revegetated in 2019 Google Earth imagery. Consequently, areas with sandy substrates in watercourses that lacked trees were mapped as the *Ambrosia salsola* – *Psoralea schottii* association or the *Psoralea spinosus* association.



Above, an example of the *Ambrosia salsola* – *Psoralea schottii* association mapped as areas lacking trees > 3% cover. Image shows lands about 7 miles north of Camp Billy Machen and less than a mile upslope from RA Plot FNE-9, with *Ambrosia salsola* and *Psoralea schottii* codominant.



Above, an example of the *Ambrosia salsola* – *Psoralea schottii* association mapped as areas lacking trees > 3% cover, with *Parkinsonia* – *Olneya* watercourses to either side. Image shows lands surveyed in RA Plot FNW-9, with *Psoralea schottii* dominant (see example of on-the-ground photo above).

Table of all taxa that had at least 1% cover in at least one sample site for:

***Ambrosia salsola* - *Psorothamnus schottii* Association**

Number of Rapid Assessment Sites: 4

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Ambrosia salsola</i> Cheesebush	4	4 (3-5)	5 (0.2 - 12)	0.9
<i>Psorothamnus schottii</i> Schott's dalea	3	3 (0-5)	3.3 (0-16)	1.5
<i>Hyptis emoryi</i> Desert lavender	3	3 (2-3)	<1 (0-1)	2.0
<i>Encelia farinosa</i> Brittlebush	3	3 (0-3)	1 (0-2.7)	1.0
<i>Funastrum hirtellum</i> Milkweed	2	3 (0-3)	0 (0-1.5)	-
<i>Olneya tesota</i> Ironwood	2	2 (0-3)	1 (0-1)	3.8
<i>Parkinsonia florida</i> Blue palo verde	3	2.5 (0-3)	<1 (0-0.2)	1.8
<i>Bebbia juncea</i> Sweetbush	1	0 (0-3)	<1 (0-0.2)	-
<i>Brassica tournefortii</i> Sahara mustard	1	0 (0-3)	<1 (0-7)	-
<i>Ephedra californica</i> California jointfir	1	0 (0-3)	<1 (0-3)	-

***Chilopsis linearis* Association**

Common name: Desert willow association

Most similar or equivalent mapping unit on adjacent lands: *Chilopsis linearis* Association DRECP 4224

Most similar or equivalent NVC alliance: *Chilopsis linearis* - *Psoralea argophylla* Alliance A1044

Acres (hectares) mapped on CMAGR: 828 (335)



Above: *Chilopsis linearis* is the dominant tree along a large arroyo one mile SW of Tabaseca Tank at an elevation of 2100 ft (640 m). *Senegalia greggii*, the large shrub visible at right foreground, is a common associate (RA plot EORC-9).



Above: *Chilopsis linearis* is mostly leafless in this image from flood scoured Salt Creek on the north end of the CMAGR, at 370 ft (113 m). The only other species with greater than 1% cover is *Psoralea argophylla*, smoketree. (RA plot FNW-2). Photo January 14, 2017. This area was hit by a flood sometime between 2012 and 2015. The many tire tracks are evidence of heavy RV use in Salt Creek.



Above: Distribution of *Chilopsis linearis* Association in red. Extent of vegetation polygons exaggerated for visibility. Except for a small area of Salvation Pass, the association is limited to the northern end of the CMAGR.

Description and setting: *Chilopsis linearis* is the dominant or co-dominant tree, averaging 10 ft (3 m) in height. *Psoralea argophylla*, smoketree, is a common associate, and typically occupies the flood channel while the *Chilopsis linearis* lines the sides of the arroyo. *Baccharis sarothroides* was a co-dominant species at one sample site, while *Senegalia greggii* (= *Acacia greggii*) and *Brickellia incana* were common at 2 of the 3 sample sites. This association was mapped at elevations from 370 to 2380 ft (113 – 725 m).

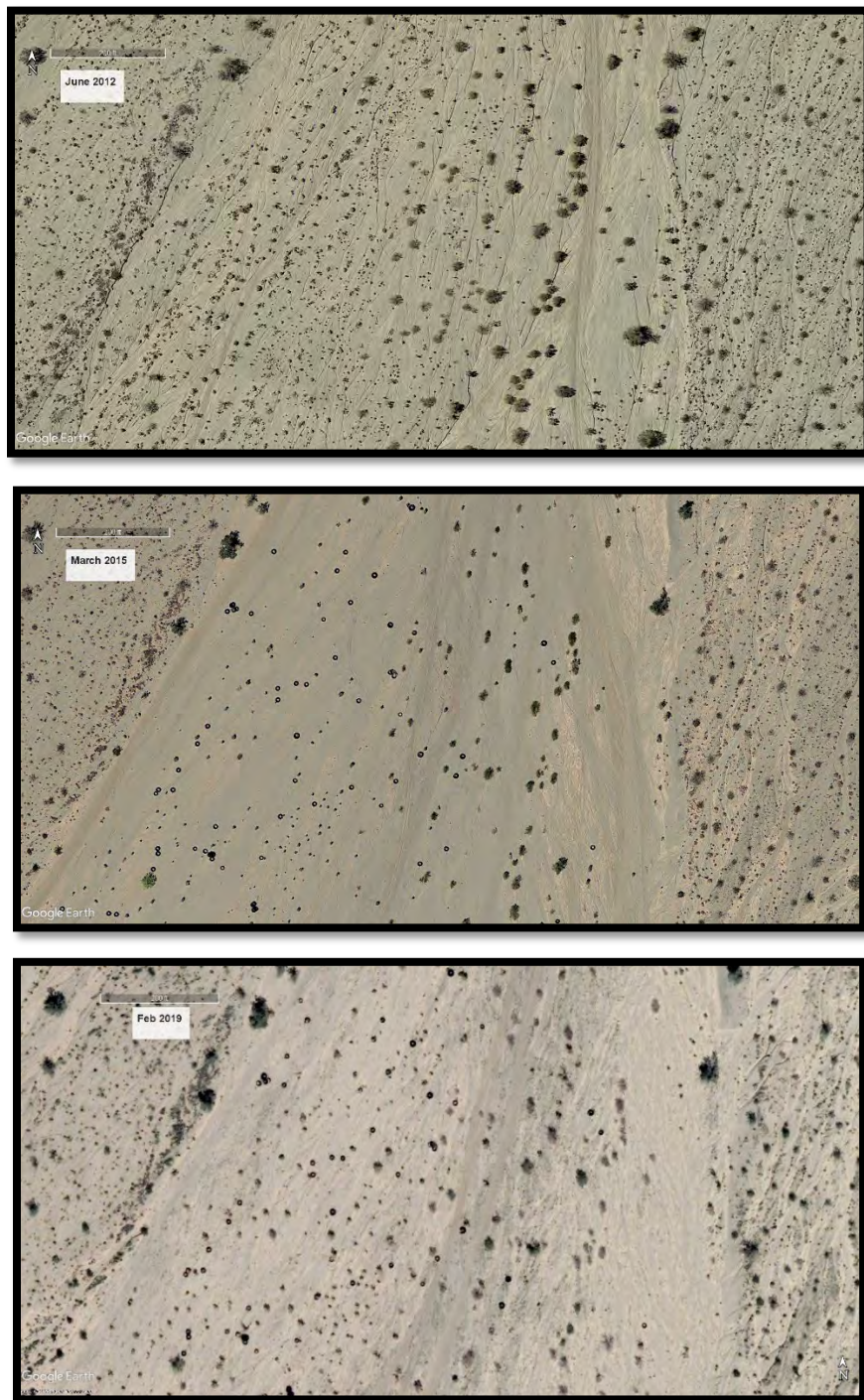
The *Chilopsis linearis* Association is limited to watercourses with large watersheds that provide occasional scouring floods. Although large watercourses are common in the south end of the CMAGR, the *Chilopsis linearis* Association is absent south of Salvation Pass. This may be due to decreased precipitation in the southern range.

Image identification: *Chilopsis linearis* could be identified by its habit of growing in long ellipsoid groups bordering an arroyo. *Senegalia greggii* will do the same, but typically is shorter than *Chilopsis linearis* and forms darker thickets.

Mapping Units with a similar appearance on imagery: If an arroyo has been flood-scoured within the last decade, the *Chilopsis linearis* will be small enough to mistake as the **Ambrosia salsola – Psoralea schottii association**. An example from Google Earth imagery between 2012 and 2019 demonstrates this (below), and a field visit is necessary to distinguish between the associations.



Above, an example of the *Chilopsis linearis* Association mapped along an arroyo one mile S of Tabaseca Tank at an elevation of 2100 ft (640 m). The *Chilopsis linearis* is bordered by the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance.



Above, a time-series example (2012, 2015, 2019) of the effects of flooding on the *Chilopsis linearis* Association in the main channel of Salt Creek, at the same location documented in RA plot FNW-2. Image area is about a ¼ mile wide. A flood hit sometime between 2012 and 2015, scouring much of the vegetation and leaving in its wake a scatter of giant earthmover tires (visible in 2015) that had previously been part of levee protecting the (defunct) Eagle Mt. Railway along Salt Creek. Note the recovery of *Chilopsis linearis* (and *Psoralea spinosus* vegetation), showing its resilience to flooding. Many of the tires are missing in 2019, indicating another flood occurred between 2015 and 2019.

FLORA AND VEGETATION OF THE CMAGR

Table of all taxa that had at least 1% cover in at least one sample site for:

***Chilopsis linearis* Association**

Number of Rapid Assessment Sites: 3

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Chilopsis linearis</i> Desert willow	3	5 (4-5)	18.1 (3.5-27.3)	3.0
<i>Psoralea argophylla</i> Smoketree	3	3 (3)	<1 (0.2-1.1)	1.5
<i>Larrea tridentata</i> Creosote	3	1 (1-3)	<1 (0.11-3.3)	1.9
<i>Senegalia greggii</i> Catclaw acacia	2	1.5 (0-3)	3.8 (0-9.3)	2.3
<i>Brickellia incana</i> Woolly brickellbush	2	3 (0-3)	1.2 (0-5)	-
<i>Ambrosia salsola</i> Cheesebush	2	2 (0-3)	<1 (0-1.2)	0.9
<i>Baccharis sarothroides</i> Desertbroom baccharis	1	0 (0-4)	<1 (0-25)	1.7
<i>Prunus fasciculata</i> Desert almond	1	0 (0-3)	<1 (0-1.7)	1.4
<i>Prosopis glandulosa</i> Honey mesquite	1	0 (0-2)	<1 (0-3)	-
<i>Senna armata</i> Desert senna	1	0 (0-2)	<1 (0-1)	-

***Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association (provisional)**

Common name: Desert pavements association

Most similar or equivalent mapping unit on adjacent lands: *Chorizanthe rigida* - *Geraea canescens* Alliance DRECP 6117

Most similar or equivalent NVC alliance: *Chorizanthe rigida* - *Geraea canescens* Alliance A4024

Acres (hectares) mapped on CMAGR: 47,195 (19,099)



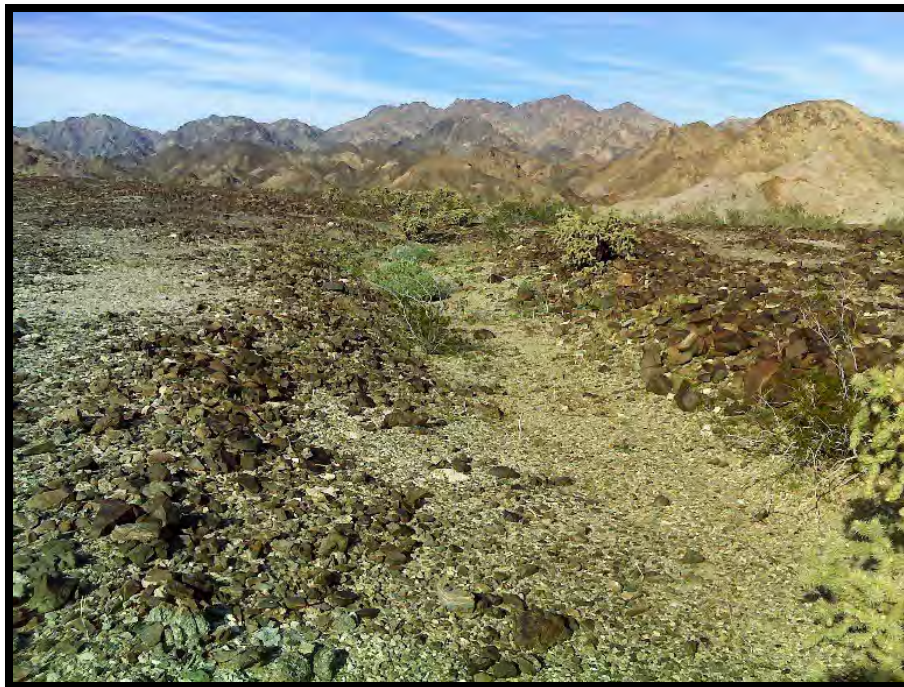
Above: The most common expression of a desert pavement, at 520 ft (158 m), about 7 miles NW of Glamis (RA plot EOA-9). It is not as barren as it appears, with *Larrea tridentata*, *Encelia farinosa*, and *Olneya tesota* each providing 1-2% cover.



Above: *Larrea tridentata* and *Olneya tesota* are the only species with > 1% cover on this pavement at 1040 ft (317 m) in the Little Mule Mts. about 4 miles NNW of Camp Burt. (RA plot LMM-12).



Above: *Ambrosia dumosa* is the only species with >1% cover on the pavements abutting Sawtooth Mt at 1420 ft (433 m) in the NE corner of the CMAGR, but *Larrea tridentata*, *Calliandra eriophylla*, and *Tiquila canescens* are common associates. *Olneya tesota* is absent. (RA plot MB-6).



Above: Close to the mountain front, fan deposits are comprised of younger cobbles and gravels with a bar-and-swale topography due to episodic debris flows. *Olneya tesota* is present but uncommon in this setting, where only *Larrea tridentata* and *Cylindropuntia munzii* have greater than 1% cover. (RA plot MW-14).

FLORA AND VEGETATION OF THE CMAGR

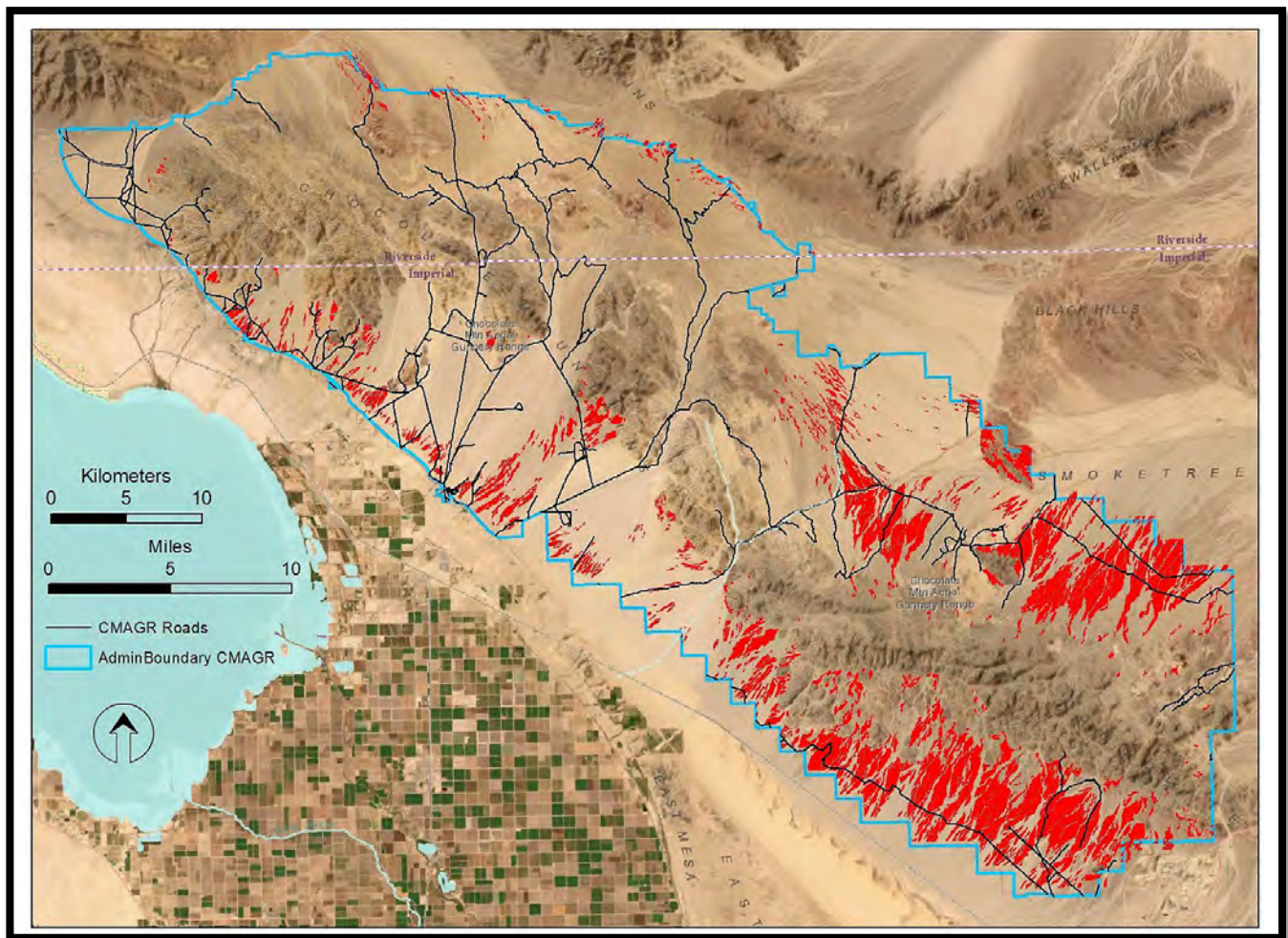


Above: Although not a true pavement, these barren hills have the same vegetation pattern of swaths of stones interrupted by small watercourses. *Larrea tridentata*, *Encelia farinosa*, and *Olneya tesota* are the only common perennials at this site at 635 ft (194 m) near Mammoth Wash (RA plot T-11).



Above: Another example of 'not a true pavement,' these old lake sediments near the Coachella Canal nonetheless had similar vegetation: barrens interrupted by swaths of *Larrea tridentata* and *Ambrosia dumosa*. *Olneya tesota* was present but rare. (RA plot IW-9).

FLORA AND VEGETATION OF THE CMAGR



Above: Distribution of *Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association in red.

Description and setting: The provisional *Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association is part of the well-established *Chorizanthe rigida* - *Geraea canescens* alliance. In the CMAGR, as well as in similar settings in southern Arizona, *Olneya tesota* is a characteristic species of pavements. *Olneya tesota* was present in 20 of 22 RA plots, with a median cover of 1.2%. *Larrea tridentata* is ubiquitous. *Ambrosia dumosa* (21 of 22 plots) and *Encelia farinosa* (18/22) are typically common, and occasionally dominant. This alliance was mapped at elevations between 100 and 2500 ft (30 – 762 m).

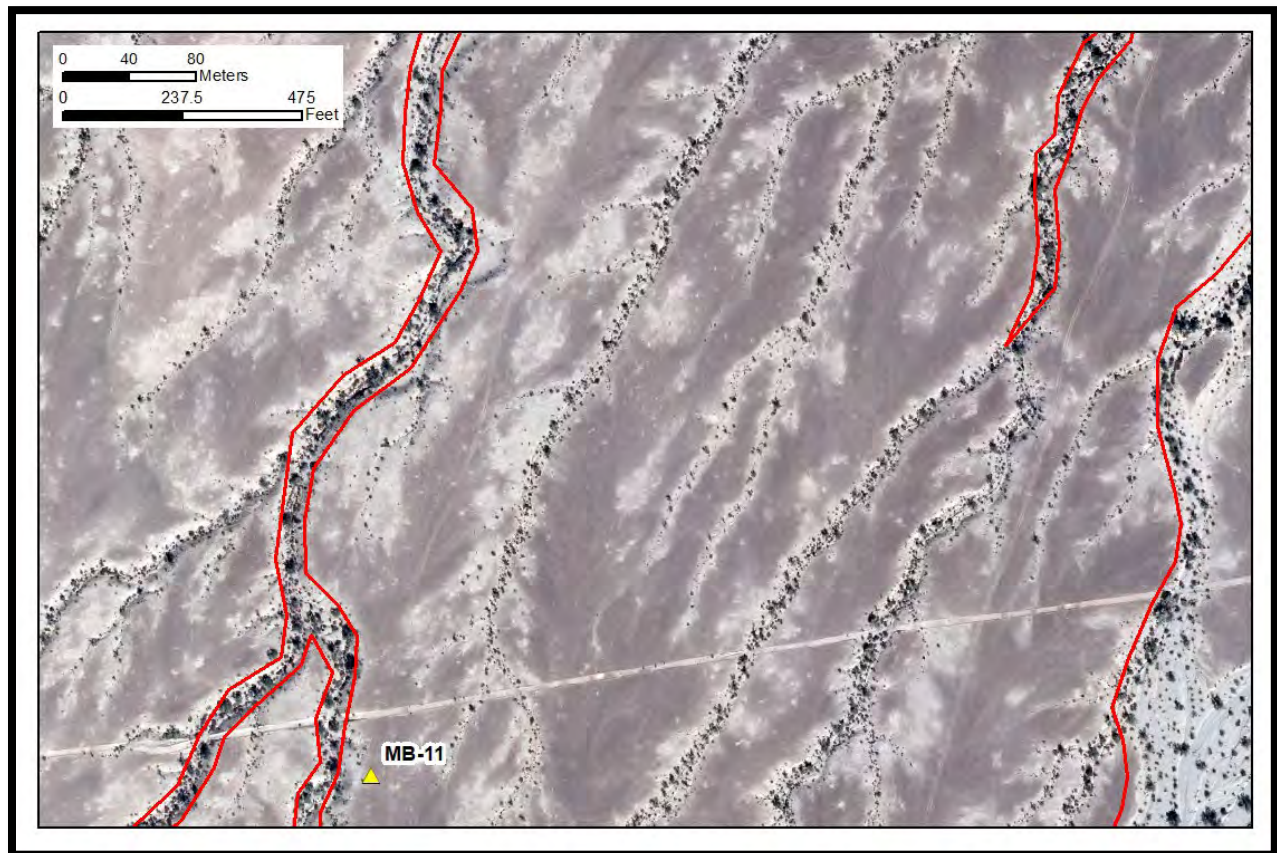
Pavements were mapped on alluvial fans throughout the CMAGR, but were far more common in the south, where less rain and milder slopes allow a desert surface to persist for the thousands of years required to develop a pavement (e.g., Frankel and Dolan 2007).

A strict definition of desert pavement (a veneer made of one or two layers of tightly packed gravels; McFadden et. al., 1987) would exclude some areas mapped as such in this study. The example photos

above are meant to show the range of landscapes mapped as pavements, which includes rolling barren hills and bar-and-swale topographies that exhibit the same vegetation pattern as ‘true’ pavements.

Image identification: Walking an imaginary line (or the road in the example below), you would cross barrens devoid of perennial vegetation of at least 10 m in width that make up at least 50% of the polygon. Small watercourses (<1-meter-wide open channel) between barren swathes may be densely vegetated, including scattered trees, but are mapped as part of the unit along with the adjacent barrens. Larger watercourses are typically mapped as the *Parkinsonia florida* - *Olneya tesota* alliance.

Mapping Units with a similar appearance on imagery: The **North American warm desert bedrock cliff and outcrop Group** can abut this association, but usually can be distinguished by a rougher texture because of much larger rocks. However, just NW of Camp Billy Machen the **Mud Hills sparsely vegetated ephemeral herbs Mapping Unit** gradually merges with this association and distinguishing the two was a matter of field visits.



Above, an example of the *Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association from the north side of the CMAGR, about 6 miles east of Camp Burt. The larger watercourses are mapped as *Parkinsonia florida* – *Olneya tesota*, while the smaller are included within the *Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association polygon.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association**

Number of Rapid Assessment Sites: 22

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	22	4 (2-5)	1.2 (0.2-4.3)	1.1
<i>Ambrosia dumosa</i> White bursage	21	3 (1-5)	<1 (0.11-3.0)	0.4
<i>Olneya tesota</i> Ironwood	20	3 (0-5)	1.2 (0-2.8)	2.8
<i>Encelia farinosa</i> Brittlebush	18	3 (0-5)	<1 (0-4.3)	0.7
<i>Fouquieria splendens</i> Ocotillo	14	2 (0-3)	<1 (0-2)	3.4
<i>Fagonia laevis</i> California fagonbush	13	2 (0-3)	<1 (0-1.1)	0.3
<i>Chorizanthe rigida</i> Rigid spineflower	9	2(0-3)	<1 (0-<1)	-
<i>Krameria erecta</i> Littleleaf ratany	8	0 (0-2)	<1 (0-0.2)	0.5
<i>Cylindropuntia munzii</i> Munz's cholla	6	0 (0-3)	<1 (0-1.3)	1.6
<i>Brassica tournefortii</i> Sahara mustard	6	0 (0-3)	<1 (0-10)	-
<i>Ambrosia salsola</i> Cheesebush	4	0 (0-3)	<1 (0-1.5)	0.9
<i>Calliandra eriophylla</i> Fairyduster	3	0 (0-4)	<1 (0-1)	0.6
<i>Cylindropuntia acanthocarpa</i> Buckhorn cholla	3	0 (0-3)	<1 (0-1)	0.9
<i>Geraea canescens</i> Desert sunflower	2	0 (0-3)	<1 (0-1)	-

***Cylindropuntia bigelovii* Alliance**

Common name: Teddy bear cholla alliance

Most similar or equivalent mapping unit on adjacent lands: *Cylindropuntia bigelovii* Alliance DRECP 4124

Most similar or equivalent NVC alliance: *Cylindropuntia bigelovii* Alliance A4024

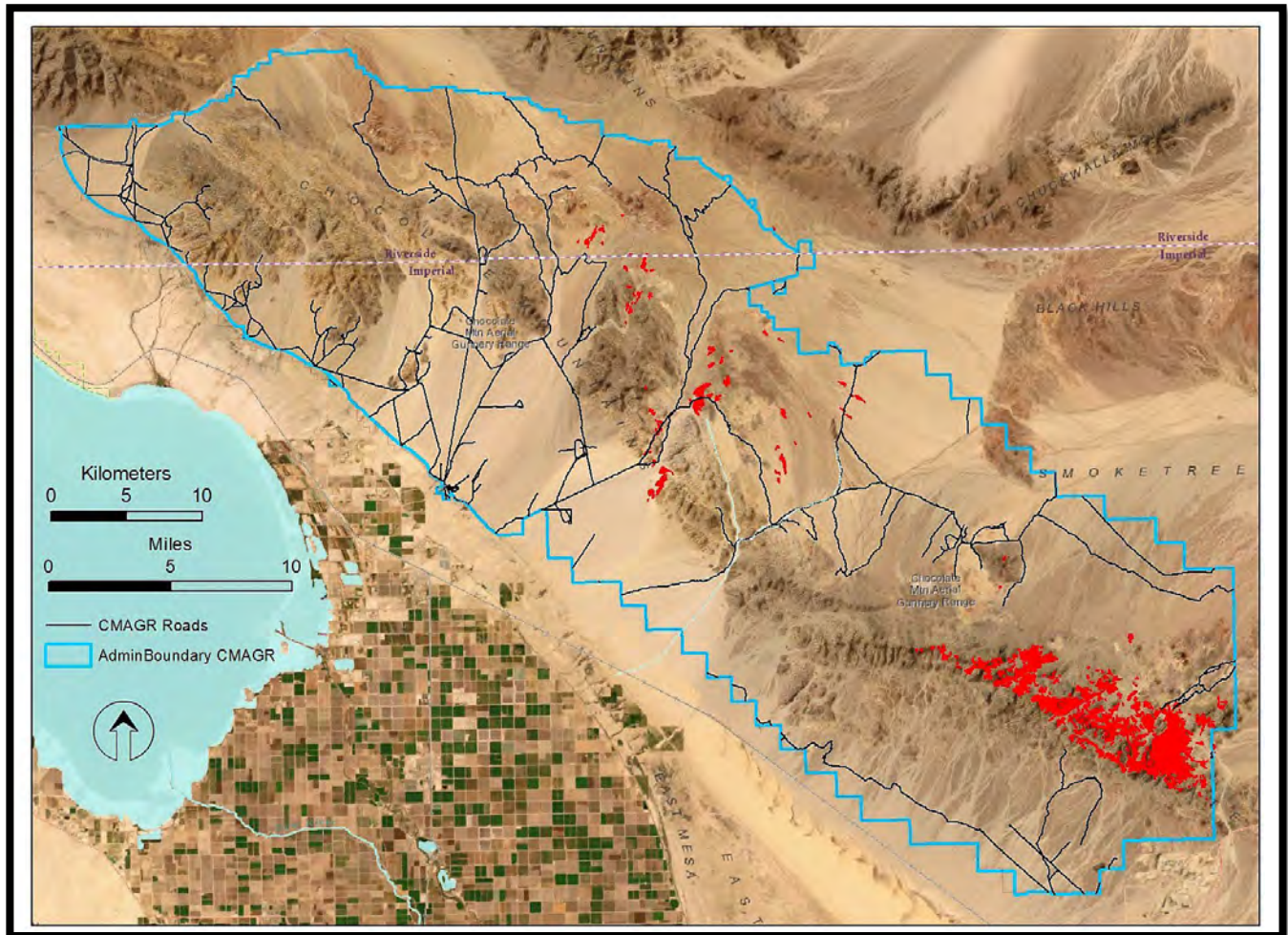
Acres (hectares) mapped on CMAGR: 7,648 (3,095)



Above: A portion of an exceptionally large *Cylindropuntia bigelovii* patch covering 1,806 acres (731 hectares) near the CMAGR boundary at Imperial Gables. *Cylindropuntia bigelovii* dominates the slopes in this image with an estimated 15% cover, with common associates *Ferocactus cylindraceus*, *Larrea tridentata*, *Ambrosia dumosa*, *Encelia farinosa*, and *Fouquieria splendens*. (RA plot MB-3, at 1680 feet (512 m)).



Above: *Cylindropuntia bigelovii* co-dominant with *Larrea tridentata*, each with 4% cover, about five miles N of Salvation Pass, at 1680 ft (512 m) (RA plot LHM-33).

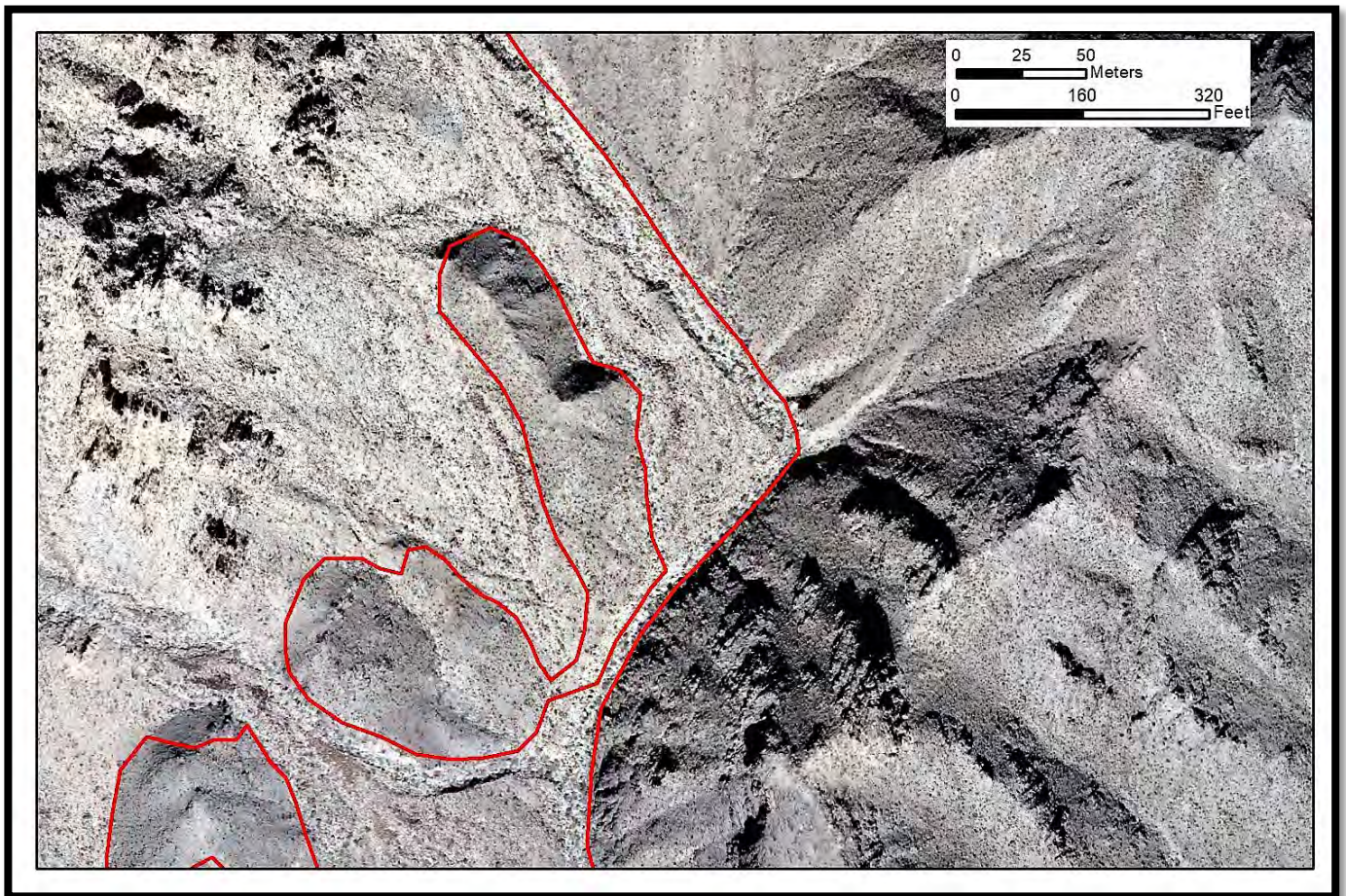


Above: Distribution of *Cylindropuntia bigelovii* Alliance in red.

Description and setting: *Cylindropuntia bigelovii* is dominant or co-dominant in this association, with a median cover of 4% in 8 RA plots. *Encelia farinosa*, *Larrea tridentata*, *Ambrosia dumosa*, and *Fouquieria splendens* are common associates (and occasionally co-dominant), each with a median cover of 1 to 2%. With the exception of the abundance of *Cylindropuntia bigelovii*, this vegetation is very similar to the *Larrea tridentata* – *Encelia farinosa* alliance. The *Cylindropuntia bigelovii* Alliance is widespread on steep slopes in the southern end of the CMAGR, especially on schist. In the central CMAGR, e.g., Surveyors Pass, it is more commonly on alluvial fans abutting the toe slopes. Occasionally the alliance is among braided floodplain channels in low energy watercourses. Mapped at elevations from 760 to 2630 ft (232 - 802 m)

Image identification: *Cylindropuntia bigelovii* at high cover values was apparent on the Canyon Air imagery supplied by the CMAGR (see below), and the November 2017 Google Earth imagery was a useful supplement because of the low sun angle.

Mapping Units with a similar appearance on imagery: The *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association abuts the *Cylindropuntia bigelovii* Alliance in and around Surveyors Pass, and the only clue on imagery is the height of the cactus (or rather the length of its shadow). *Cylindropuntia bigelovii* averaged 2.3 ft (0.7 m) in height, while the taller *Cylindropuntia munzii* averaged 5.2 ft (1.6 m).



Above, the *Cylindropuntia bigelovii* Alliance is apparent from the stubble on the darker schist, mostly on the right of the image. This is better seen on November 2017 imagery available on Google Earth. Granitic rocks are on the left side.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Cylindropuntia bigelovii* Alliance**

Number of Rapid Assessment Sites: 8

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Cylindropuntia bigelovii</i> Teddybear cholla	8	4.5 (4-5)	5 (4-15)	0.7
<i>Encelia farinosa</i> Brittlebush	8	3 (1-4)	2 (0.11-10)	0.4
<i>Ambrosia dumosa</i> White bursage	7	3 (0-4)	2 (0-5)	0.3
<i>Larrea tridentata</i> Creosote	7	3 (0-4)	1.5 (0-4)	1.2
<i>Fouquieria splendens</i> Ocotillo	7	3 (0-4)	1 (0-5)	2.6
<i>Ferocactus cylindraceus</i> California barrel cactus	6	2 (0-3)	<1 (0-3)	0.4
<i>Hibiscus denudatus</i> Paleface	5	2 (0-3)	<1 (0-3)	0.3
<i>Hyptis emoryi</i> Desert lavender	4	0.5 (0-2)	<1 (0-0.2)	-
<i>Cylindropuntia munzii</i> Munz's cholla	3	0 (0-4)	<1 (0-12)	-
<i>Ephedra aspera</i> Boundary ephedra	2	0 (0-3)	<1 (0-3)	5.0
<i>Olneya tesota</i> Desert ironwood	2	0 (0-3)	<1 (0-2)	-
<i>Fagonia laevis</i> California fagonbush	2	0 (0-3)	<1 (0-1)	-
<i>Senegalia greggii</i> Catclaw acacia	2	0 (0-2)	<1 (0-1.5)	-
<i>Parkinsonia florida</i> Blue paloverde	1	0 (0-3)	<1 (0)	-
<i>Galium stellatum</i> Starry bedstraw	1	0 (0-4)	<1 (0-3.5)	0.4

***Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association (provisional)**

Common name: Brittlebush – creosote – Schott’s dalea association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata*-*Encelia farinosa*-*Psoralea schottii* Association (Dos Palmas) OR *Encelia farinosa*--*Psoralea schottii*/*Parkinsonia florida* Association (Mecca/Orocopia)

Most similar or equivalent NVC alliance: *Larrea tridentata* - *Encelia farinosa* Alliance A3278

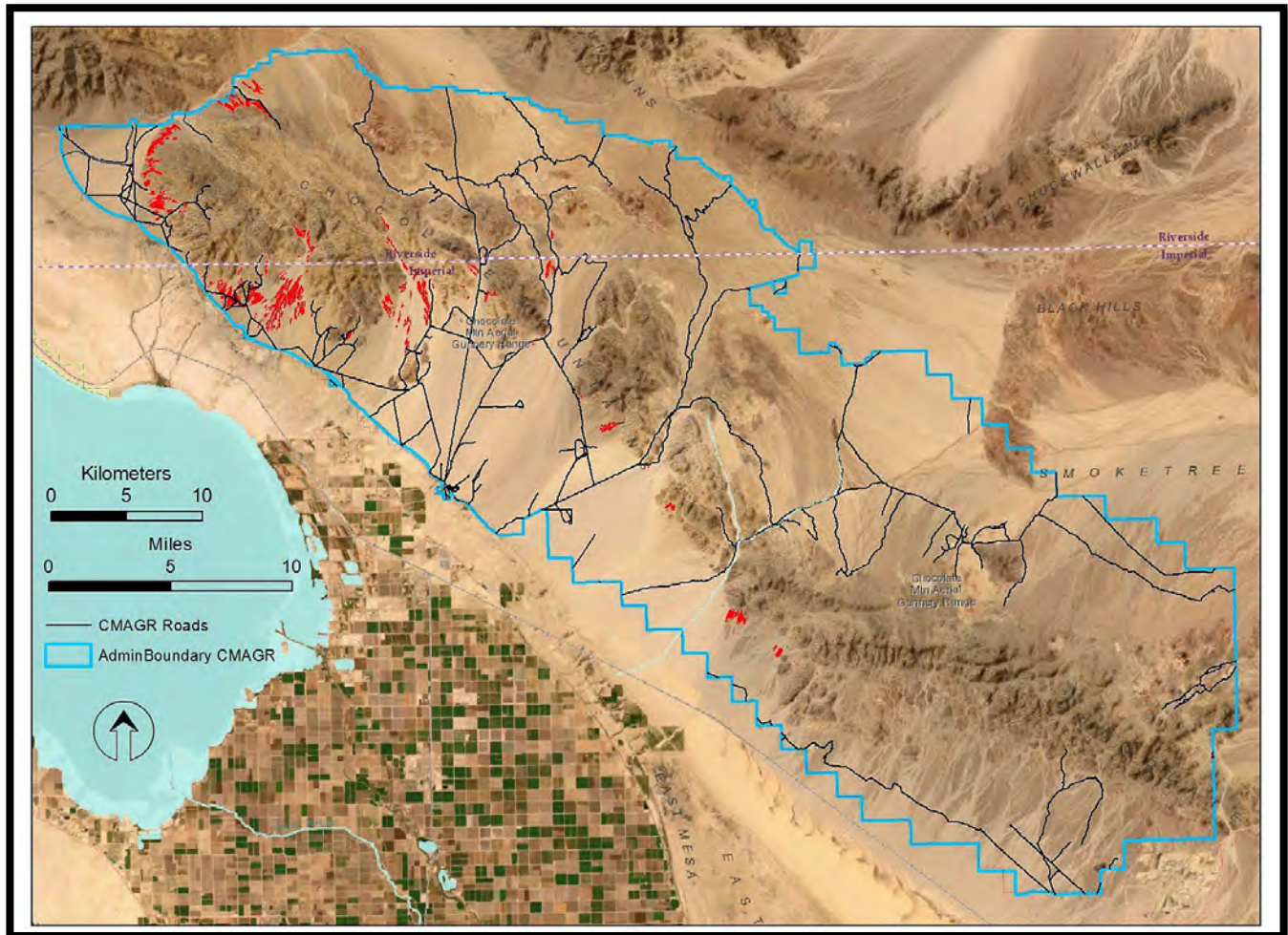
Acres (hectares) mapped on CMAGR: 3,605 (1,459)



Above: This steep alluvial fan (3 to 5 degrees) above Salt Creek is co-dominated by *Psoralea schottii*, *Encelia farinosa*, and *Larrea tridentata*, with *Parkinsonia florida* as a common associate. 370 ft (113 m) (RA plot FNW-1).



Above: *Encelia farinosa* and *Psoralea schottii*, each with 2% cover, at 760 ft (232 m) about two miles S of Salvation Pass (RA plot T-9). Common associates *Larrea tridentata* and *Cylindropuntia munzii* each contribute 1% cover. *Parkinsonia florida* is present but rare.



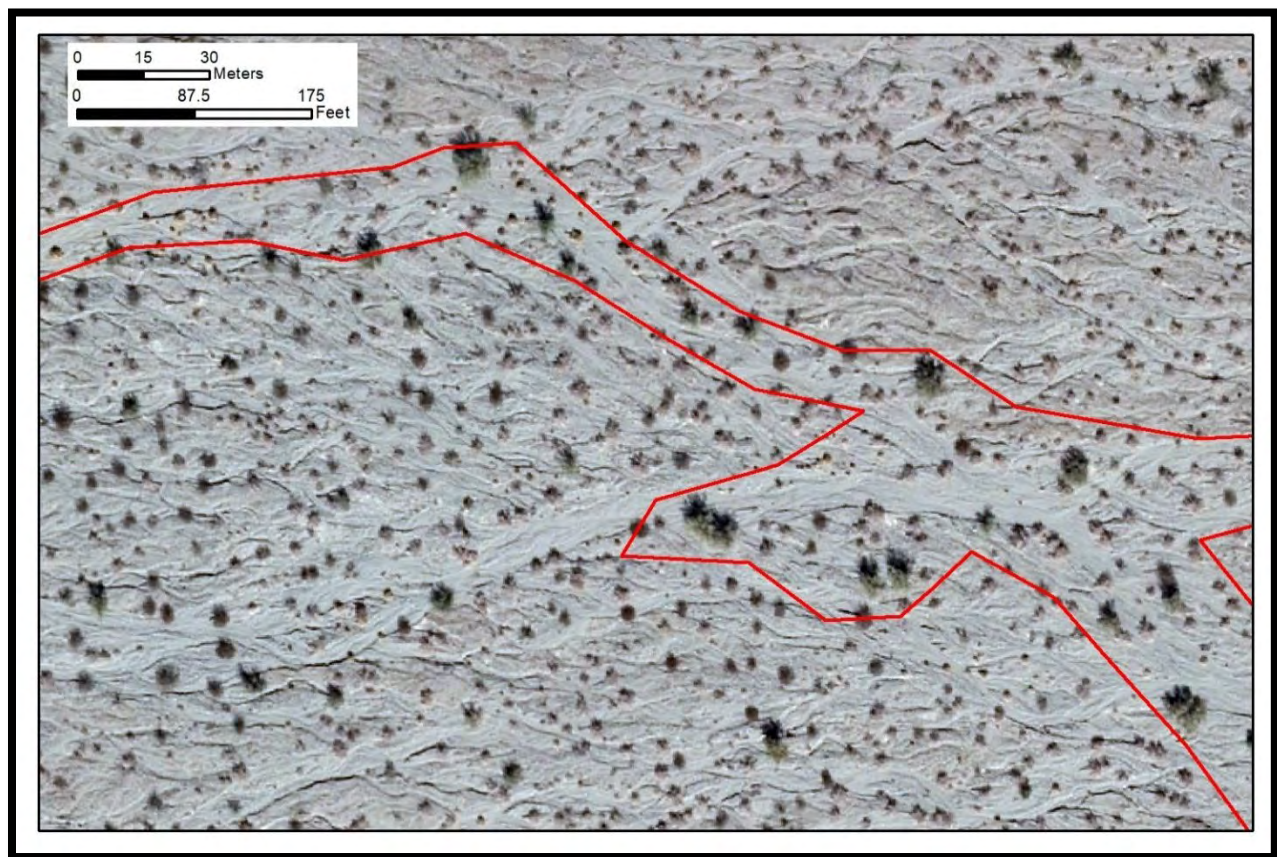
Above: Distribution of *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association in red.

Description and setting: The *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association occurs on steep and stony fans deposited by debris flows from large arroyos. *Psoralea schottii* and *Encelia farinosa* were consistently common or co-dominant at all 6 RA sites, with median cover of 2 to 3% cover. *Larrea tridentata*, and *Parkinsonia florida* were also present at all six RA sites, with widely varying abundance and a median cover of 1%.

The *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association often occurs just upslope from the *Larrea tridentata* – *Ambrosia dumosa* - *Psoralea schottii* Association. Comparing the sample data for both associations, the % surface cover of stones (25-60 cm) averaged 14 % for the former, and less than 1% for the latter, providing a clue for the relative abundance of *Encelia farinosa* on the stonier upper bajada. There are, however, plenty of stony upper bajadas throughout the CMAGR, so

the absence of this association in the southern half of the range is likely due to precipitation patterns such as diminished winter rains. Overall, the association was mapped at elevations from 100 to 2000 ft (30 – 610 m).

Image identification, and Mapping Units with a similar appearance on imagery: On the relatively open bajadas it was possible to distinguish *Psoralea schottii* from the similar sized *Larrea tridentata*, with the former having a pinkish cast and a more tousled silhouette. In the mountains, however, variation in the sun/slope angle made it impossible to reliably exploit this difference. Hence, a similar mix of species can occur on mountain slopes and foothills, but on such surfaces we could not reliably map its range. Such areas were instead mapped as the widespread *Larrea tridentata* – *Encelia farinosa* alliance.



Above, the *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association, just outside of the watercourse.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association**

Number of Rapid Assessment Sites: 6

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Psoralea schottii</i> Schott's dalea	6	3.5 (3-4)	3 (1.6-4.7)	1.3
<i>Encelia farinosa</i> Brittlebush	6	3 (3-4)	2 (1.6-3.8)	0.8
<i>Larrea tridentata</i> Creosote	6	3.5 (1-5)	1 (0.11-4.3)	1.5
<i>Parkinsonia florida</i> Blue paloverde	6	3 (1-3)	1 (0.11-1.8)	2.6
<i>Ambrosia salsola</i> Burrobush	5	1.5 (0-4)	<1 (0-4)	0.8
<i>Cylindropuntia ramosissima</i> Diamond cholla	5	2 (0-3)	<1 (0-2)	0.7
<i>Senegalia greggii</i> Catclaw acacia	3	0.5 (0-2)	<1 (0-0.2)	-
<i>Fouquieria splendens</i> Ocotillo	3	1.5 (0-4)	<1 (0-5.3)	3.1
<i>Fagonia pachyacantha</i> Sticky fagonbush	3	0.5 (0-3)	<1 (0-1.3)	0.2
<i>Fagonia laevis</i> California fagonbush	2	0 (0-3)	<1 (0-0.2)	0.1
<i>Hyptis emoryi</i> Desert lavender	2	0 (0-3)	<1 (0-3)	1.7
<i>Trixis californica</i> American threefold	2	0 (0-3)	<1 (0-1)	0.7
<i>Cylindropuntia munzii</i> Munz's cholla	1	0 (0-3)	<1 (0-1)	-

***Encelia farinosa* Alliance**

Common name: Brittlebush alliance

Most similar or equivalent mapping unit on adjacent lands: *Encelia farinosa* Alliance DRECP 4114

Most similar or equivalent NVC alliance: *Encelia farinosa* Alliance A4215

Acres (hectares) mapped on CMAGR: 45,359 (18,356)



Above: *Encelia farinosa*, mostly leafless, dominates this south facing slope at 1525 ft (465 m) about ten miles north of Camp Billy Machen. *Ambrosia dumosa* is the only other perennial managing over 1% cover (RA plot IP-14).



Above: *Encelia farinosa* and *Pleuraphis rigida* co-dominate, each with 12% cover, on this north facing slope at 1600 ft (488 m) about two miles north of Salvation Pass. *Ambrosia dumosa* is a close second, with 7 % cover, and *Fagonia laevis* adds another 3%. *Ephedra aspera* is present but uncommon. (RA plot LHM-9).



Above: Granite boulders amplify runoff at this site 2.5 miles north of Salvation Pass at 1530 ft (466 m). The co-dominants are *Encelia farinosa*, *Ambrosia dumosa*, *Senegalia greggii*, and *Psoralea schottii*. Adding to the diversity are *Bebbia juncea*, *Eriogonum inflatum*, *Krameria bicolor*, and *Senna armata*, each with about 3% cover (RA plot LHM-2).

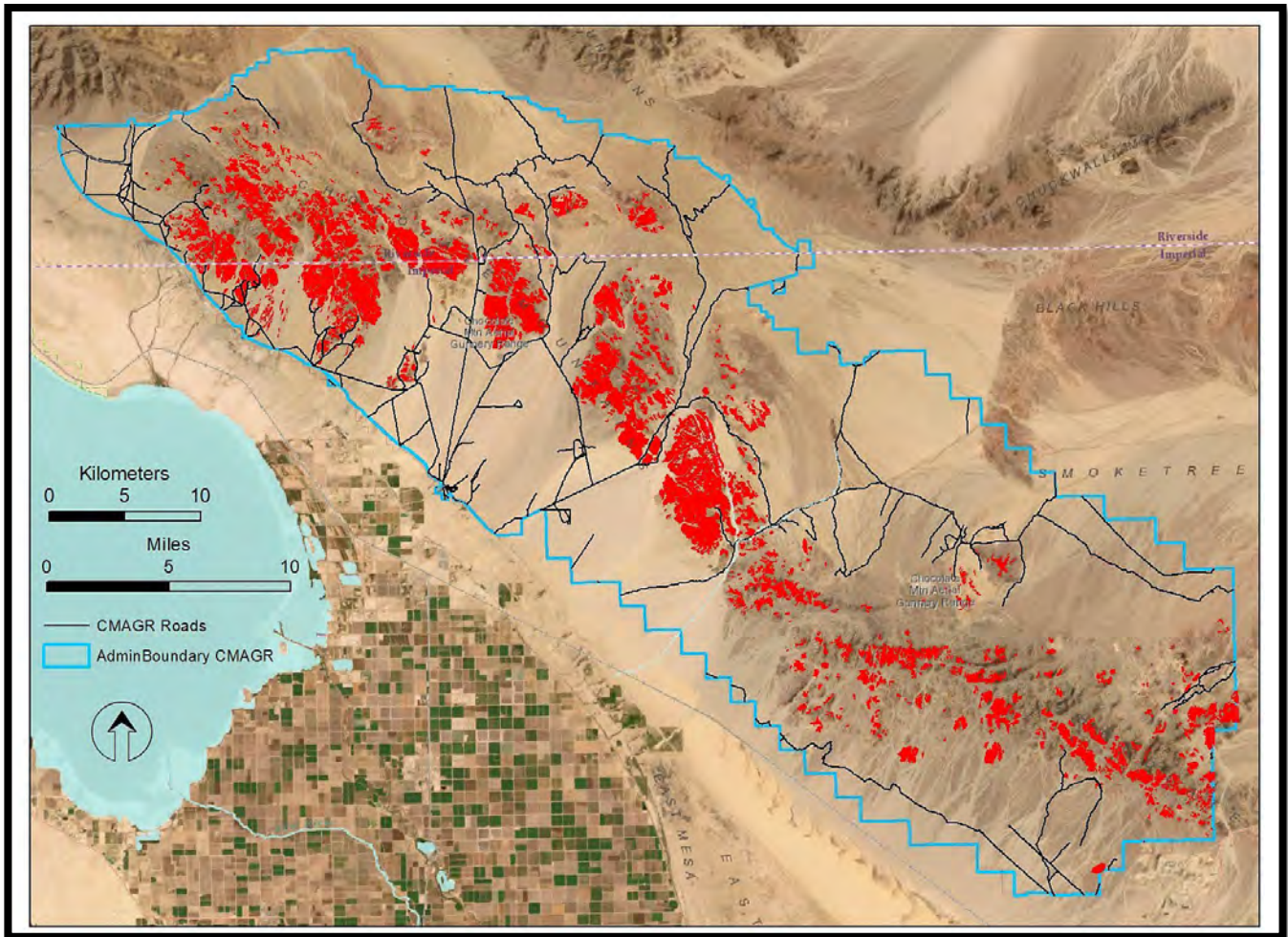


Above: An example of the simplest representative of the *Encelia farinosa* alliance: a south-facing slope on a hill about seven miles north of Camp Billy Machen, at 855 ft (261 m), with *Encelia farinosa* the only species with >1% cover (RA plot FNE-7). On other aspects of the same hill *Encelia farinosa* was abundant and the overall cover for all aspects for *Encelia farinosa* was 8.5%.

FLORA AND VEGETATION OF THE CMAGR



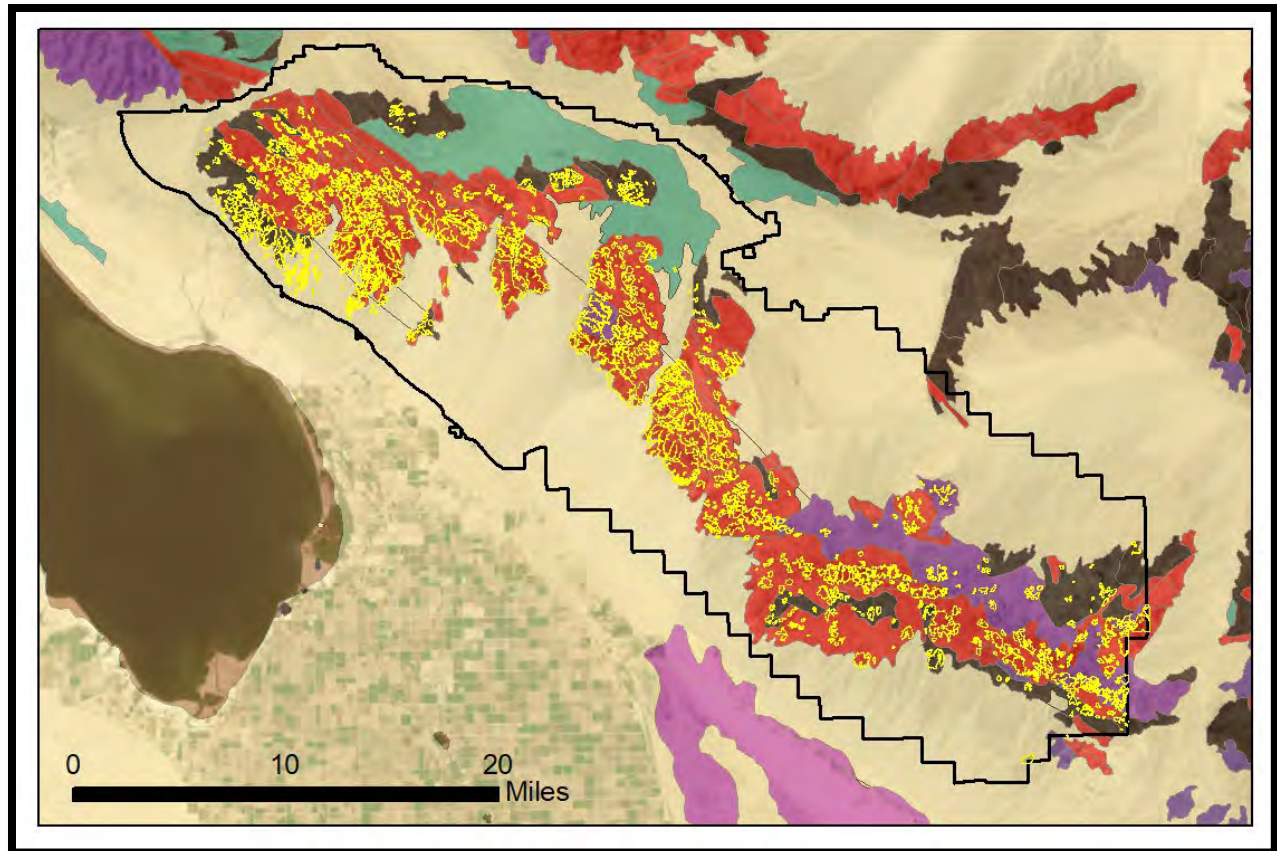
Above: Although mostly on mountain slopes, the *Encelia farinosa* alliance can also occur on steep fans. About eleven miles NW of Camp Billy Machen, on a 3-degree slope, *Encelia farinosa* is the dominant species with 5.2% cover. *Ambrosia salsola* is common at 2.8%, thus making this vegetation a candidate for the *Ambrosia salsola* - *Bebbia juncea* Shrubland Alliance, but the membership rules exclude this possibility. *Parkinsonia florida* is common but <2% cover in the mapped area; the higher density area in the background is mapped as the *Parkinsonia florida* association.



Above: Distribution of *Encelia farinosa* Alliance in red.

Description and setting: The *Encelia farinosa* alliance is widespread throughout the CMAGR, albeit more common in the northwestern range. The alliance is mostly found on rock and is more common on granite and gneiss than schist (see figure below). It also occurs on steep and stony alluvial fans at the north end of the CMAGR along the Salton Basin.

As can be seen in the example photos above, the *Encelia farinosa* alliance is broadly defined in this study. The data from the sample sites (below) reveal the diversity of the *Encelia farinosa* alliance. *Fagonia laevis*, *Fagonia pachyacantha*, *Senegalia greggii*, *Psoralea schottii* and *Pleuraphis rigida* can be co-dominants in this alliance. But none of these species could be reliably mapped in the steep mountains in this study, so they were lumped into the *Encelia farinosa* alliance.

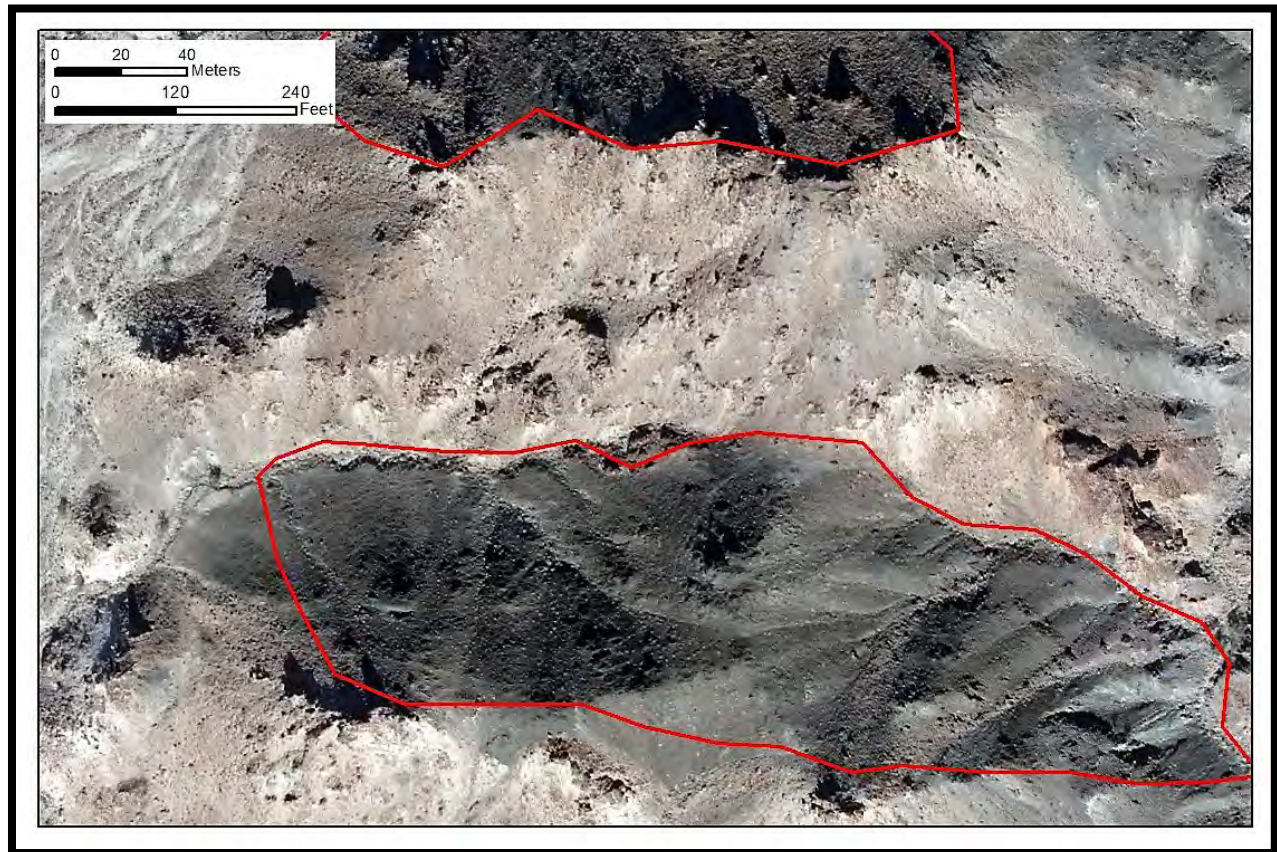


Above, the *Encelia farinosa* Alliance polygons in yellow, overlying a geologic map of the CMAGR, showing it to be more common on the granitoid rocks shown in red and extrusive basalts and rhyolite in black. The purple rocks at the south end of the range are schist mountains, and the green at the north end is a sandstone pediment. Beige-colored areas are recent, geologically speaking, alluvium.

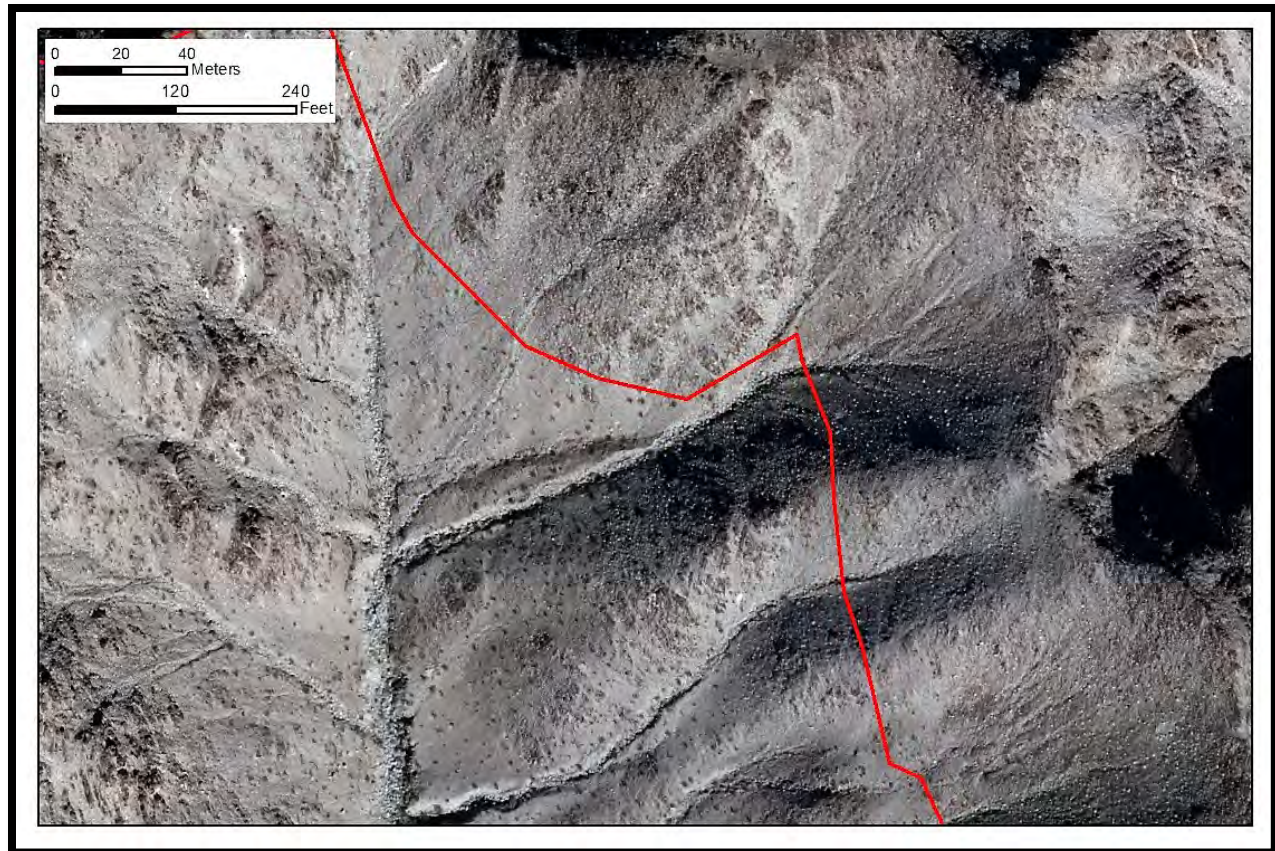
Image identification, and Mapping Units with a similar appearance on imagery:

The *Encelia farinosa* alliance is defined in the California Manual of Vegetation by simply the dominance of *Encelia farinosa* over other woody species, such as *Larrea tridentata* and *Ambrosia dumosa*. If *Ambrosia dumosa* is present, then *Encelia farinosa* must provide at least 30% of the total cover (Evens and Hartman 2007). This proved to be a difficult call in the CMAGR. The problem is detecting the relative coverage of *Encelia farinosa*, *Ambrosia dumosa*, and *Larrea tridentata* when the imagery and landscape makes it difficult to reliably detect the difference between *Encelia farinosa* and *Ambrosia dumosa* (though *Encelia farinosa* is typically larger), and equally difficult to appraise the relative cover of *Larrea tridentata* vs *Encelia farinosa*/*Ambrosia dumosa*. Because *Larrea tridentata* has the strongest signature on the imagery, the first couplet in the key that leads to the *Encelia farinosa* alliance is defined by *Larrea tridentata* <1% cover. Proceeding further, if the vegetation has >1% cover of *Encelia farinosa* it will be in this alliance unless (a) *Cylindropuntia munzii* or *Senegalia greggii* >1% cover; or (b) *Ephedra aspera*, *Nolina bigelovii*, *Bahiopsis parishii* have >2% cover; or (c) *Ambrosia dumosa* is judged to be the clear dominant (greater than 2x the cover of other species).

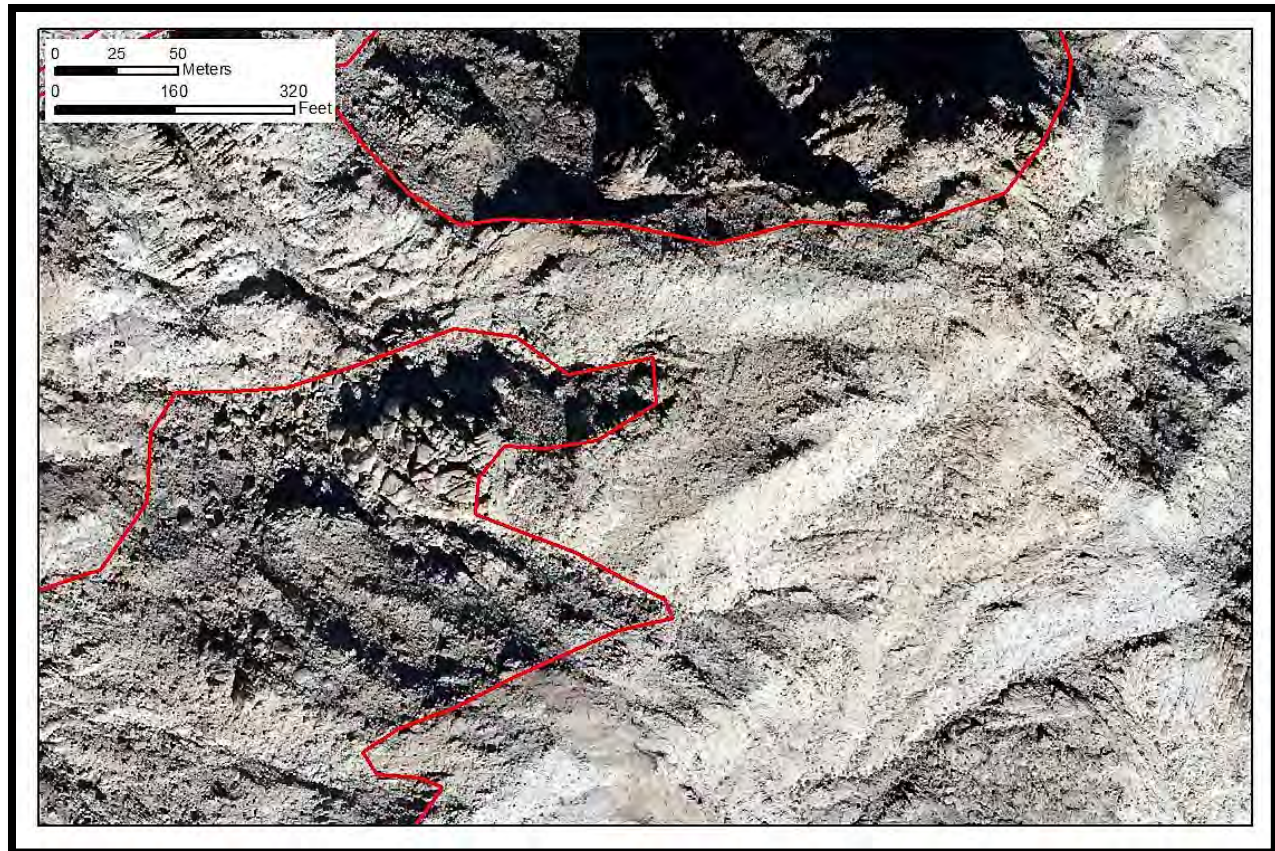
At the lower elevational range of the *Encelia farinosa* alliance, mapping from imagery focused on distinguishing the *Encelia farinosa* alliance from the **North American warm desert bedrock cliff and outcrop Group** and from the *Larrea tridentata* – *Encelia farinosa* alliance. See example images below. At the upper elevational range of the *Encelia farinosa* alliance, mapping was based on the assumption that both granitic rocks and cooler northern aspects favored the provisional ***Ambrosia dumosa* – *Ephedra aspera* association**. See example images below. It's likely the ***Ambrosia dumosa* alliance** was also mistaken for the *Encelia farinosa* alliance at high elevations.



Above, near Mammoth Wash, the *Encelia farinosa* Alliance circled in red on dark rock, with the silvery globes of *Encelia farinosa* distinguishing this mapping unit from the surrounding North American warm desert bedrock cliff and outcrop Group.



Above, on Blue Mountain, the *Encelia farinosa* Alliance on the right, and the *Larrea tridentata* – *Encelia farinosa* alliance on the left, with *Larrea tridentata* visible as black dots.



Above, near Lion Head Mountain, the *Encelia farinosa* alliance on the right, and the *Ambrosia dumosa* – *Ephedra aspera* association circled in red among the granite boulders on the north aspect.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Encelia farinosa* Alliance**

Number of Rapid Assessment Sites: 16

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Encelia farinosa</i> Brittlebush	16	4 (4-5)	5.6 (1.3-15)	0.6
<i>Ambrosia dumosa</i> White bursage	13	3 (0-4)	3 (0-10)	0.3
<i>Larrea tridentata</i> Creosote	13	2 (0-3)	<1 (0-2)	1.0
<i>Fagonia laevis</i> California fagonbush	9	2 (0-4)	<1 (0-10)	0.2
<i>Parkinsonia florida</i> Blue paloverde	9	1 (0-3)	<1 (0-1.8)	2.0
<i>Fouquieria splendens</i> Ocotillo	7	2 (0-3)	<1 (0-2)	-
<i>Fagonia pachyacantha</i> Sticky fagonbush	7	0 (0-4)	<1 (0-10)	0.2
<i>Psoralea schottii</i> Schott's dalea	6	0 (0-4)	<1 (0-3)	1.1
<i>Krameria bicolor</i> White ratany	6	0 (0-3)	<1 (0-3)	-
<i>Bebbia juncea</i> Sweetbush	5	0 (0-3)	<1 (0-3)	-
<i>Eriogonum inflatum</i> Desert trumpet	5	0 (0-3)	<1 (0-3)	0.4
<i>Pleuraphis rigida</i> Big galleta	4	0 (0-4)	<1 (0-12)	0.6
<i>Senna armata</i> Desert senna	4	0 (0-3)	<1 (0-3)	-
<i>Pleurocoronis pluriseta</i> Bush arrowleaf	4	0 (0-3)	<1 (0-2)	-
<i>Mirabilis bigelovii</i> Wishbone-bush	4	0 (0-2)	<1 (0-1)	0.3
<i>Trixis californica</i> American threefold	4	0 (0-3)	<1 (0-0.2)	0.2
<i>Brassica tournefortii</i>	4	0 (0-3)	<1 (0-1)	-

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
Sahara mustard				
<i>Xylorhiza tortifolia</i> Mojave-woolyaster	3	0 (0-3)	<1 (0-2)	0.2
<i>Ephedra aspera</i> Boundary ephedra	3	0 (0-3)	<1 (0-2)	0.5
<i>Atriplex hymenelytra</i> Desertholly saltbush	3	0 (0-3)	<1 (0-3.4)	0.6
<i>Ambrosia salsola</i> Burrobush	3	0 (0-3)	<1 (0-2.5)	0.6
<i>Senegalia greggii</i> Catclaw acacia	2	0 (0-4)	<1 (0-3)	1.6
<i>Nolina bigelovii</i> Bigelow's nolina	1	0 (0-1)	<1 (0-0.11)	0.9
<i>Ditaxis lanceolata</i> Silverbush	1	0 (0-3)	<1 (0-1)	-
<i>Acamptopappus sphaerocephalus</i> Rayless goldenhead	1	0 (0-3)	<1 (0-2)	-

Human Disturbance

Common name: Targets, quarries, levees, train tracks, bomb craters, wildcat roads

Most similar or equivalent mapping unit on adjacent lands: Anthropogenic areas of little or no vegetation DRECP 9320

Most similar or equivalent NVC alliance: Cultural vegetation

Acres (hectares) mapped on CMAGR: 9,612 (3,890)



Above: Target build near Invader Butte, November 2015.

Below: Heavily impacted soils at FARP Bull Attack, January 2017.





Above: Old bomb crater along road to ICM box above Iris Wash. January 2018.

Below: The edge of the rock levee protecting the Coachella Canal on the right, was mapped as Human Disturbance. The watercourse on the left side was mapped as a watercourse with a hydrologic modifier. January 2015.

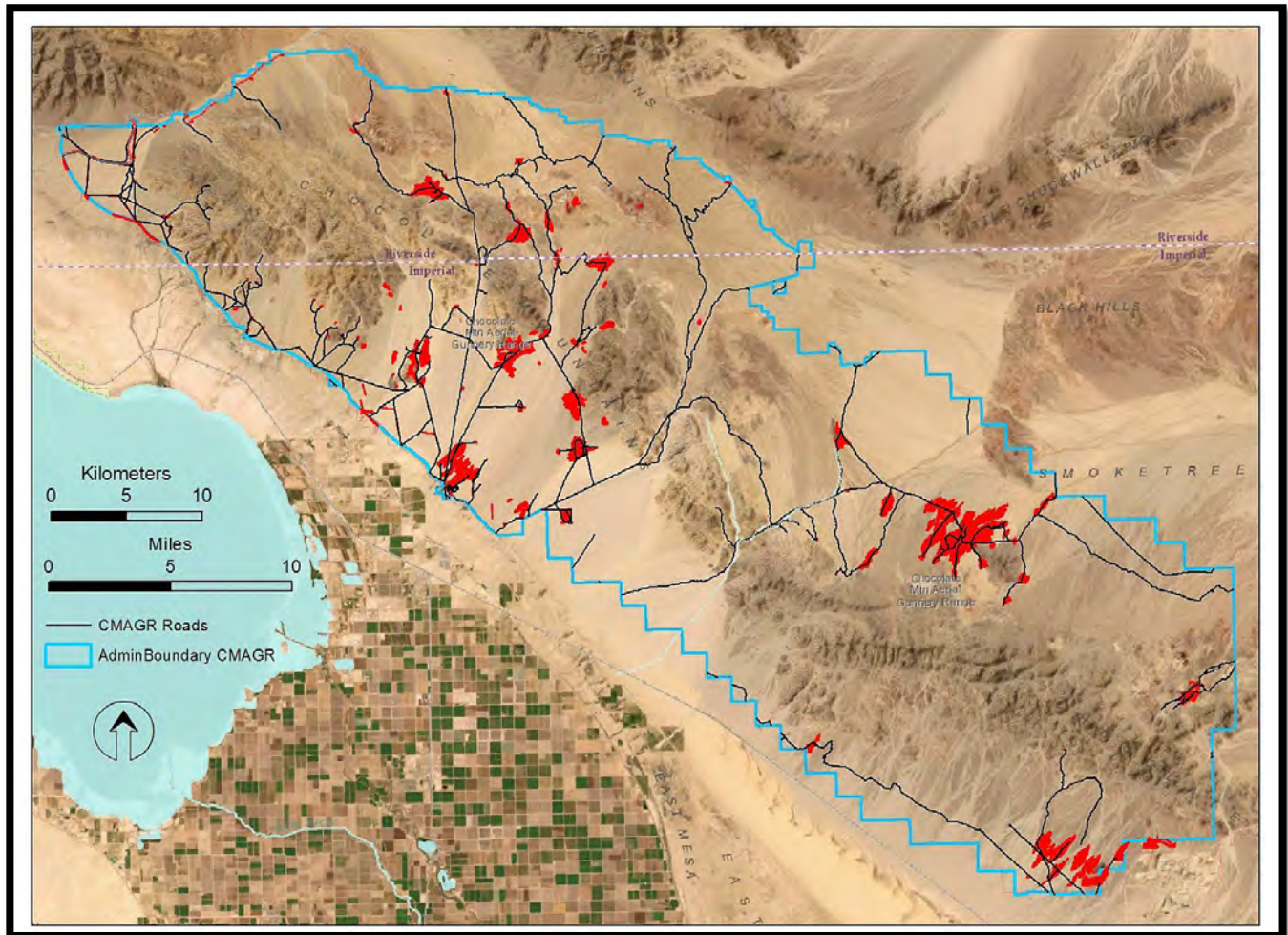




Above: Erosion along tracks from the Eagle Mountain Railway, near Salt Creek. January 2015.

Below: Abandoned quarry about 1.5 miles NNW of Siphon 17. March 2017.



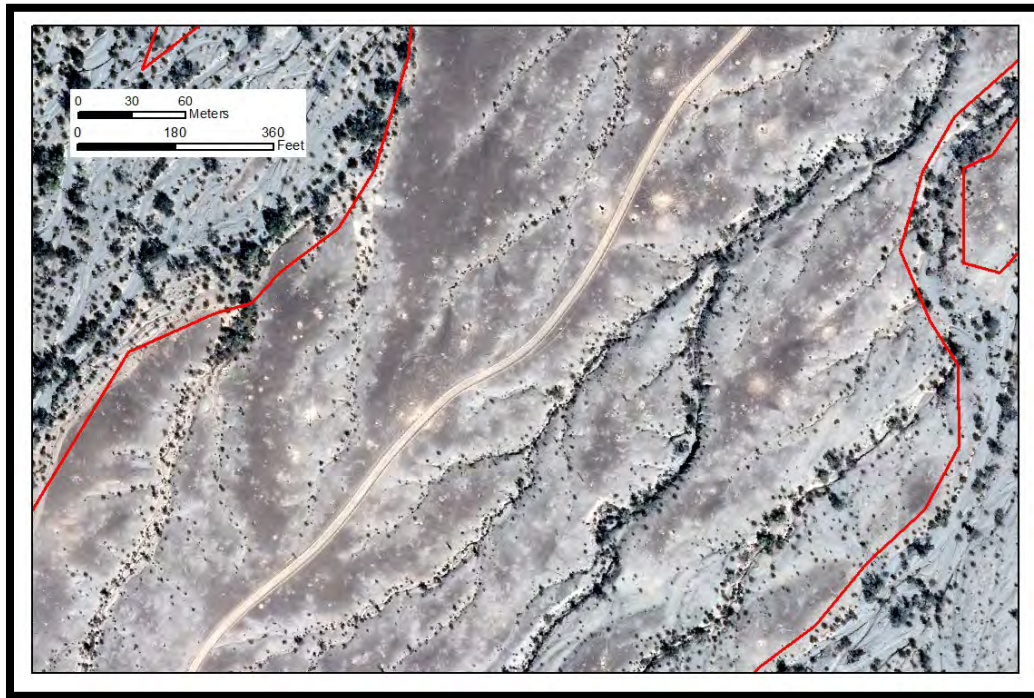


Above: Distribution of **Human disturbance** in red.

Description and setting: The mapped unit varies widely in the type and degree of impact. Some areas are denuded, some bombed, and some simply been driven over often enough to alter the surface soils. These areas may often retain vegetation, although it may no longer represent the pre-disturbance state, and may never regain this state because of invasive species like tamarix and Sahara mustard (*Brassica tournefortii*). For this reason this mapping unit is likely more inclusive and may not precisely match the DRECP study of adjacent lands, where they mapped “Anthropogenic areas of little or no vegetation”. In this study, the unit was mapped at elevations from 60 to 2,300 ft (18 – 701 m).

Image identification, and Mapping Units with a similar appearance on imagery: The mapped areas are where the vegetation has been altered through on-the-ground impacts (rather than, say, climate impacts). Some mapping units, like watercourses, are disturbed naturally through periodic flooding, and

have vegetation adapted to such disturbances. In contrast, ‘upland vegetation’ may take decades to recover. For this reason, the watercourses are generally excluded from the Human Disturbance mapping unit, except in cases where Google Earth imagery revealed that the watercourse is apparently a CMAGR target. See examples in imagery below. Such areas were mapped as Human Disturbance.



Above, SW of Camp Burt, a desert pavement pocked with small impact craters. To either side are watercourses that are not mapped as part of Human Disturbance mapping unit. **Below**: Iris Wash target, showing red circled area of desert willow destroyed by bombing in 2012 image on right, and undestroyed 2008 image on left. Subsequent imagery from 2015 shows continued bombing of this watercourse.



There was no attempt to document taxa for:

Human Disturbance

Number of Rapid Assessment Sites: 0

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)

***Hyptis emoryi* - *Nolina bigelovii* Association (provisional)**

Common name: Desert lavender-Bigelow's beargrass Association

Most similar or equivalent mapping unit on adjacent lands: *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance DRECP 4226

Most similar or equivalent NVC alliance: *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance A4187

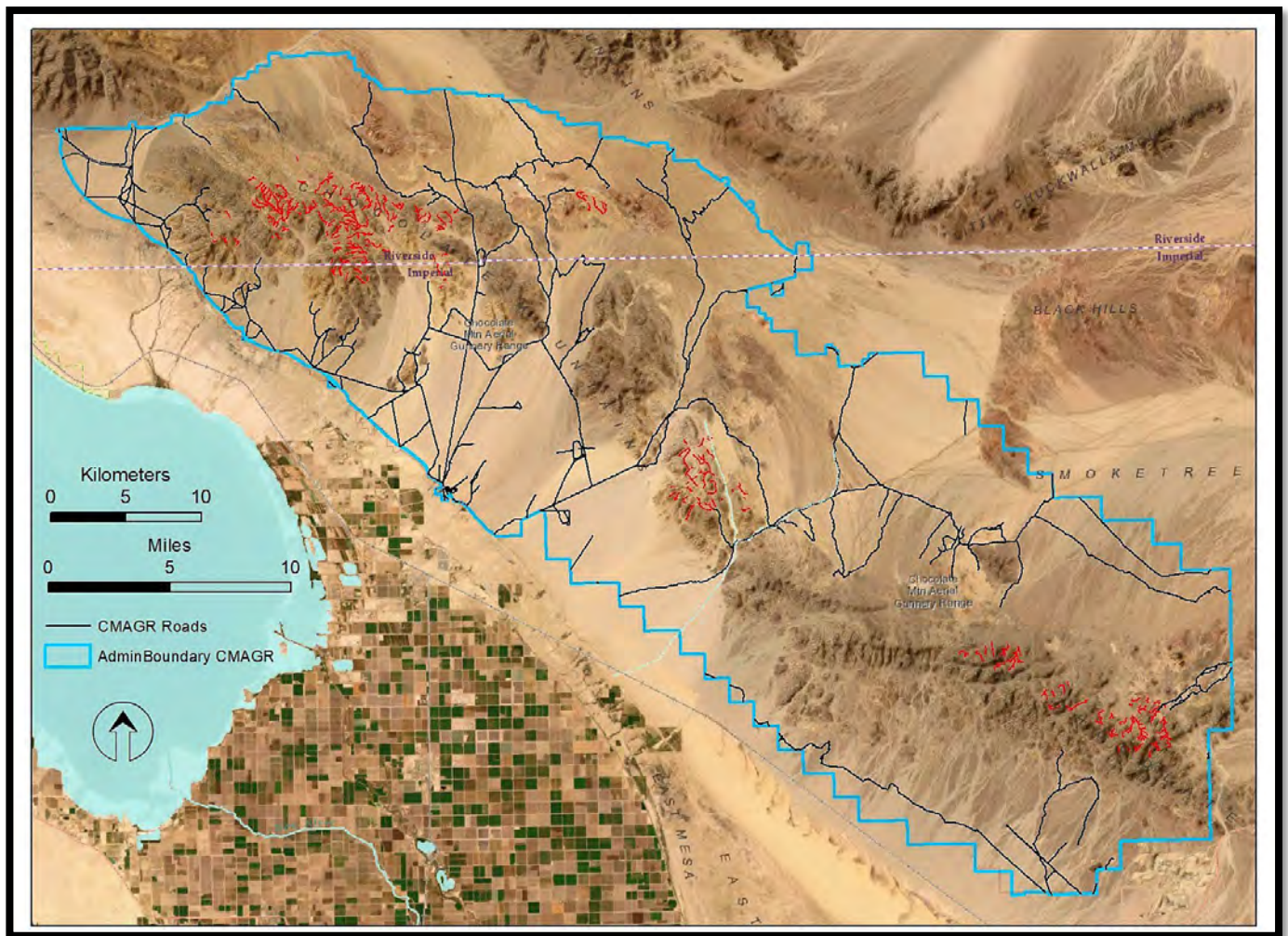
Acres (hectares) mapped on CMAGR: 554 (224)



Above: A steep rocky wash with *Hyptis emoryi* (desert lavender) dominant, but also with common *Ambrosia ilicifolia* (foreground, in flower) and *Nolina bigelovii* (left background, with tall flowering stalk) (RA plot LHM-52)



Above: *Nolina bigelovii* in bloom at 1780 ft (543 m) about 4 miles WSW of Mt Barrow (RA plot BM-5), with dominant *Hyptis* at right.



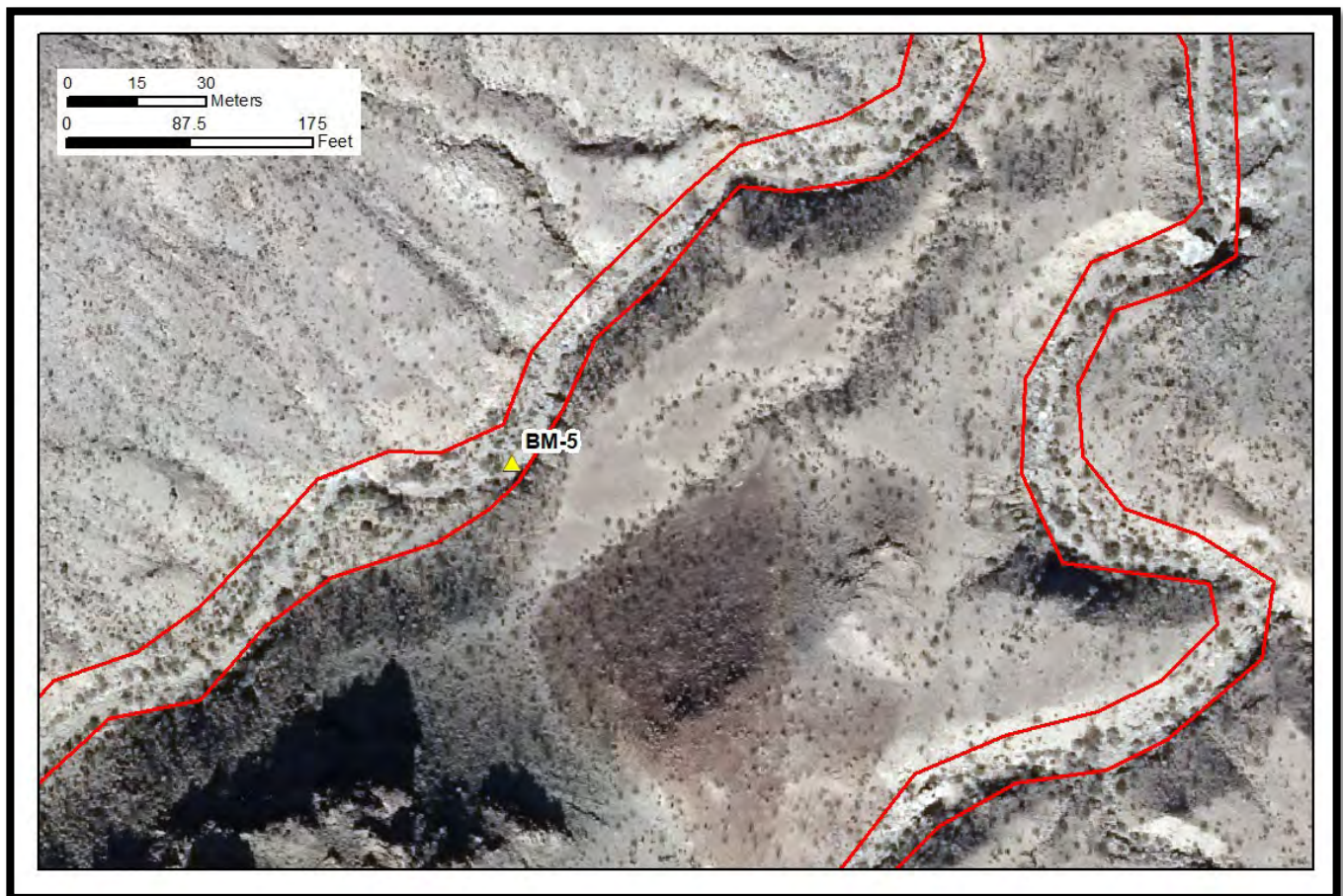
Above: Distribution of *Hyptis emoryi* - *Nolina bigelovii* Association in red.

Description and setting: This provisional association describes mountain watercourse vegetation mapped at 1200 – 3000 ft (366 – 914 m). It is characterized by the large clumps of *Nolina bigelovii* (average height 1.4 m, w/o flowering stalks) in rocky watercourses where desert lavender, *Hyptis emoryi*, is the dominant or co-dominant species. *Encelia farinosa* and *Pleuraphis rigida* are common associates. Catclaw, *Senegalia greggii*, was absent from three of six sample plots but common to co-dominant in the other three plots. Hollyleaf bursage, *Ambrosia ilicifolia*, was not known from the Chocolate Mountains before this survey, but was common in two samples between Lion Head Mt and Salvation Wash. This bursage is typical of *Hyptis emoryi* - *Ambrosia ilicifolia* described from the Barry M Goldwater Range in SW Arizona (Malusa and Sundt 2015).

Image identification: The *Hyptis emoryi* - *Nolina bigelovii* association could not be identified with imagery. It was mapped by using field observations, NECO sample data, and tortoise survey photos to identify similar nearby habitat. Watercourses are natural routes for surveyors of all stripes, and we

would note the highest and lowest occurrence of *Nolina bigelovii* and extend these observations to similar nearby watercourses.

Mapping Units with a similar appearance on imagery: At the top of its elevational range, the *Hyptis emoryi* - *Nolina bigelovii* association can extend beyond the edges of the watercourse onto the slopes and merge with the ***Ambrosia dumosa* – *Ephedra aspera* Association**. At the lower end of its range, this association merges with the ***Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance**.



Above, an example of the *Hyptis emoryi* - *Nolina bigelovii* Association mapped by extending the observations from RA plot BM-5.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Hyptis emoryi* - *Nolina bigelovii* Association (provisional)**

Number of Rapid Assessment Sites: 6

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Hyptis emoryi</i> Desert lavender	6	4.5 (4-5)	20 (10-21)	1.7
<i>Nolina bigelovii</i> Bigelow's nolina	6	3 (3)	4 (0.2-25)	1.4
<i>Encelia farinosa</i> Brittlebush	6	2.5 (1-3)	2 (0-3)	0.8
<i>Pleuraphis rigida</i> Big galleta	5	3 (0-3)	3 (0-9)	0.7
<i>Bebbia juncea</i> Sweetbush	5	2.5 (0-3)	<1 (0-6)	0.7
<i>Trixis californica</i> American threefold	5	2 (0-3)	<1 (0-1)	-
<i>Pleurocoronis pluriseta</i> Bush arrowleaf	5	1.5 (0-3)	<1 (0-5)	0.5
<i>Ephedra aspera</i> Mormon tea	4	1.5 (0-3)	0.5 (0-9)	0.6
<i>Sphaeralcea ambigua</i> Desert globemallow	4	1.5 (0-3)	<1 (0-2)	-
<i>Mirabilis bigelovii</i> Wishbone bush	4	1 (0-3)	<1 (0-2)	-
<i>Senegalia greggii</i> Catclaw acacia	3	2 (0-4)	5 (0-33)	1.9
<i>Ditaxis lanceolata</i> Silverbush	3	1.5 (0-3)	<1 (0-4)	-
<i>Lycium andersonii</i> Waterjacket	3	0.5 (0-3)	<1 (0-7)	1.0
<i>Asclepias albicans</i> Whitestem milkweed	3	0.5 (0-3)	<1 (0-1)	-
<i>Ziziphus obtusifolia</i> Lotebush	3	0.5 (0-3)	<1 (0-1)	1.4
<i>Krameria bicolor</i> White ratany	3	0.5 (0-2)	<1 (0-7)	-
<i>Aristida purpurea</i> Purple threeawn	2	0 (0-3)	<1 (0-6)	0.5
<i>Ambrosia ilicifolia</i> Hollyleaf bursage	2	0 (0-3)	<1 (0-5)	-

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Bahiopsis parishii</i> Parish's goldeneye	2	0 (0-3)	<1 (0-3)	-
<i>Ambrosia dumosa</i> White bursage	2	0 (0-2)	<1 (0-2)	-
<i>Eriogonum wrightii</i> Buckwheat	2	0 (0-2)	<1 (0-1)	-
<i>Funastrum hirtellum</i> Milkweed	1	0 (0-3)	<1 (0-5)	-
<i>Xylorhiza tortifolia</i> Mojave woodyaster	1	0 (0-3)	<1 (0-3)	0.5
<i>Atriplex hymenelytra</i> Desertholly saltbush	1	0 (0-3)	<1 (0-1)	-
<i>Simmondsia chinensis</i> Jojoba	1	0 (0-3)	<1 (0-1)	-
<i>Ephedra californica</i> California jointfir	1	0 (0-2)	<1 (0-3)	-
<i>Lycium californicum</i> Desert-thorn	1	0 (0-2)	<1 (0-3)	-
<i>Prosopis glandulosa</i> Honey mesquite	1	0 (0-2)	<1 (0-3)	-

***Larrea tridentata* Association**

Common name: Creosote monotype

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* Association DRECP 4119

Most similar or equivalent NVC alliance: *Larrea tridentata* – *Ambrosia dumosa* Alliance A3277

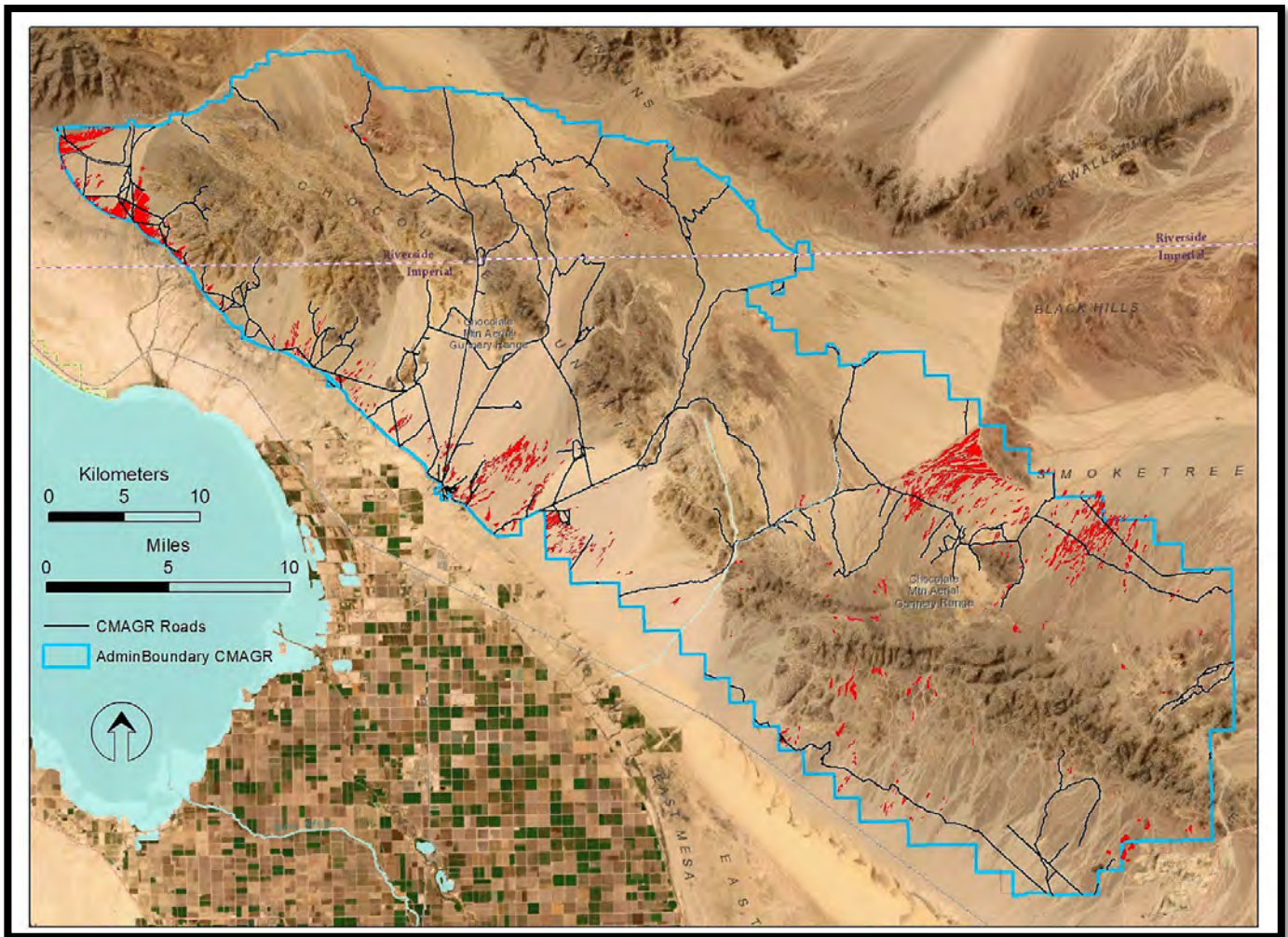
Acres (hectares) mapped on CMAGR: 9,247 (3,742)



Above: A rocky bajada with 3% cover of *Larrea tridentata* and no other common perennials, at 340 ft (104 m) near FARP Star. (RA plot T-2)



Above: A floodplain with 4% cover of *Larrea tridentata* and no other common perennials, at 1160 ft (354 m), on the west side of the Little Mule Mts near Camp Burt (RA plot LMM-3).



Above: Distribution of *Larrea tridentata* Association in red.

Description and setting: The *Larrea tridentata* Association is places where no other perennial exceeds 1% cover. Typically, such locations are species-poor, but some locations hold scattered *Olneya tesota*, *Psoralea schottii*, *Encelia farinosa*, *Ambrosia dumosa*, *Krameria bicolor* and various cacti include *Opuntia basilaris*, *Echinocactus polycephalus*, *Ferocactus cylindraceus* and several *Cylindropuntia* spp. It was most commonly found on floodplains just upslope of the Little Mule Mts, on the Salt Creek fan, and alongside pavements between Camp Bill Machen and Surveyors Pass, as well as NE of Blue Mt.

Image identification and Mapping Units with a similar appearance on imagery: The *Larrea tridentata* Association was identified by the lack of any species other than *Larrea tridentata*. This was straightforward on alluvial fans and valley bottoms but could be difficult on steep slopes of dark rock that mask the signature. In the latter case, the association could most easily be confused with the *Larrea tridentata* – *Encelia farinosa* Alliance.



Above, an example of the *Larrea tridentata* Association near the Little Mule Mts and Camp Burt. The areas outside the polygon are either the *Parkinsonia florida* – *Olneya tesota* alliance or the *Larrea tridentata* – *Ambrosia dumosa* alliance.



Above, an example of the *Larrea tridentata* Association on basalt near the Mesquite Gold Mine. The surrounding hills were judged to be part of the *Larrea tridentata* – *Encelia farinosa* Alliance, based on better Google Earth imagery showing the silvery globes of brittlebush.

FLORA AND VEGETATION OF THE CMAGR

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* Association**

Number of Rapid Assessment Sites: 6

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	6	5 (5)	3 (3-5.2)	1.2

***Larrea tridentata* - *Ambrosia dumosa* Alliance**

Common name: Creosote – white bursage alliance

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* - *Ambrosia dumosa* Alliance DRECP 4115

Most similar or equivalent NVC alliance: *Larrea tridentata* – *Ambrosia dumosa* Alliance A3277

Acres (hectares) mapped on CMAGR: 55,865 (22,608) – Does not include mapped associations within the alliance, e.g., *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association



Above: *Larrea tridentata* is the dominant, with 7% cover at this site along the northern boundary, about 4 miles north of Invader Butte at 1465 ft (447 m). *Ambrosia dumosa*, *Fouquieria splendens*, *Pleuraphis rigida*, and *Krameria bicolor* are all common associates, each with 1 to 2% cover (RA plot PW-14).



Above: A sparse expression of the alliance, with *Larrea tridentata* giving 2.8% cover, *Ambrosia dumosa* at 1%, and a few scattered *Olneya tesota*, less than a mile north of Camp Billy Machen, at 240 ft (73 m) (RA plot IW-12).



Above: *Larrea tridentata* is the easy dominant on the rolling ridges on the north end of the CMAGR, 1850 ft (564 m), two miles from Salt Creek. *Ambrosia dumosa*, *Fouquieria splendens*, and *Plir* each contribute another 1 to 3 % cover (RA plot EORC-10).



Above: A NW-facing slope at 2780 feet (847 m) with an unusually high density of *Larrea tridentata* and *Ambrosia dumosa*, each with about 15% cover. *Lycium andersonii* and *Spam* were common associates, each with 1% cover. The absence of *Encelia farinosa* is unusual on a steep rocky slope (RA plot AP-10).

FLORA AND VEGETATION OF THE CMAGR

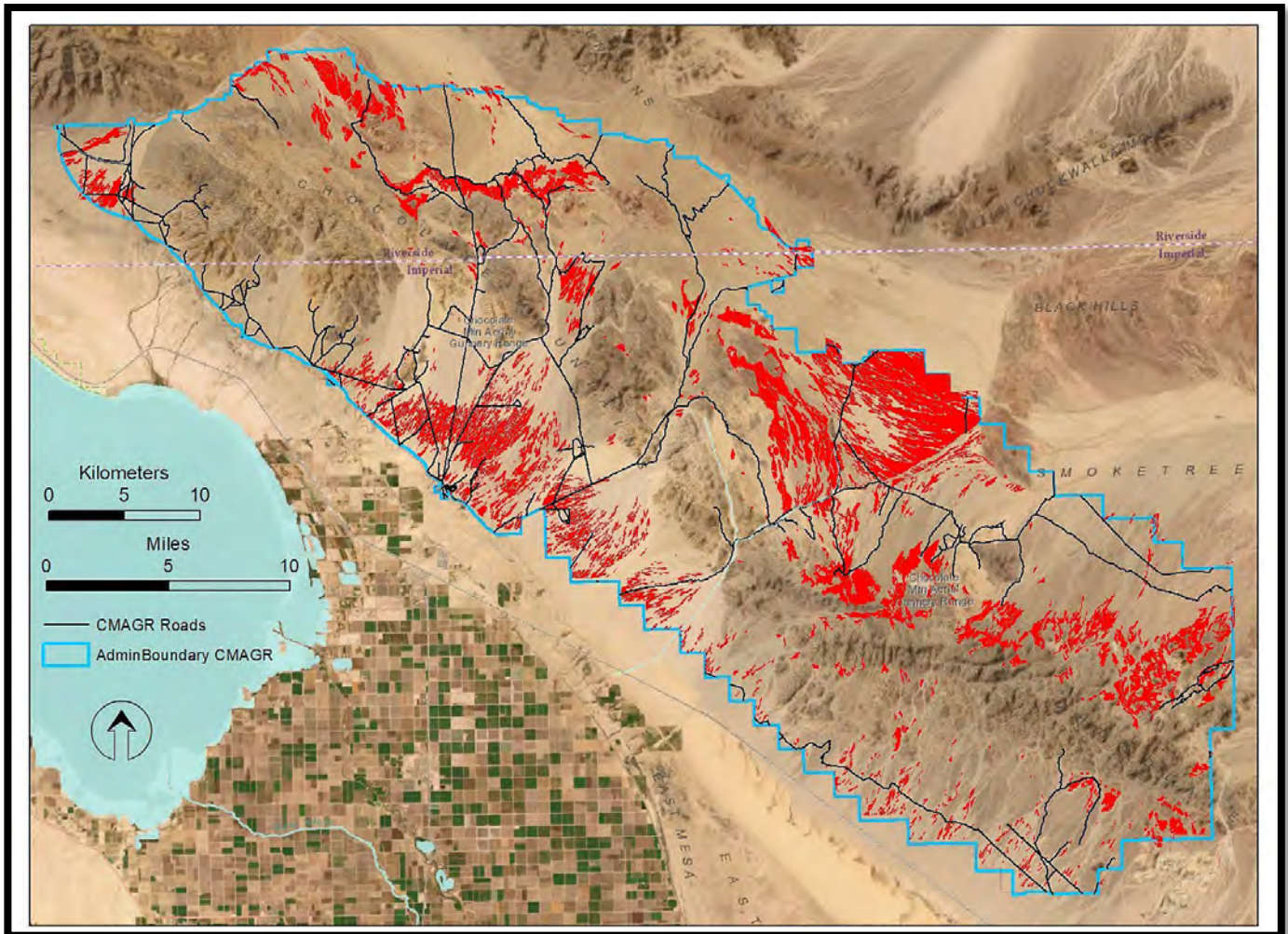


Above: *Larrea tridentata* and *Ambrosia dumosa* co-dominate this west-facing slope at 1860 ft (567 m) above Surveyors Pass. *Krameria erecta* and *Fouquieria splendens* are common associates, adding 3% and 6% cover respectively. *Encelia farinosa* is common but <1% cover (RA plot LHM-40).



Above: Deep sandy alluvium about a mile west of the Gas Line Road at 1840 ft (558 m) co-dominated by *Larrea tridentata*, *Ambrosia dumosa*, and *Cylindropuntia ramosissima*, with a supporting cast including *Senna armata* and *Ziziphus obtusifolia* for a total cover of about 25% (RA plot IP-23).

FLORA AND VEGETATION OF THE CMAGR



Above: Distribution of *Larrea tridentata* – *Ambrosia dumosa* Alliance in red. Not shown are the associations listed below.

Description and setting: This description is for those areas that were *not* mapped as one of the six associations that fall under the *Larrea tridentata* – *Ambrosia dumosa* Alliance:

- Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association
- Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association
- Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association
- Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association
- Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association
- Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association

The example photos above show that given enough time we could have mapped several more associations within this alliance, but the initial accuracy assessment showed we lacked the time and imagery to map, for example, the *Larrea tridentata* – *Ambrosia dumosa* – *Fouquieria splendens* association and the *Larrea tridentata* – *Ambrosia dumosa* – *Pleuraphis rigida* association.

Consequently, the mapped *Larrea tridentata* – *Ambrosia dumosa* Alliance are those areas that did not fit into one of six above associations yet satisfied the broad membership rule for this alliance: >1% cover of *Larrea tridentata* and *Ambrosia dumosa* and *Encelia farinosa* <1%. As can be seen in the data summary table below, *Fouquieria splendens* and *Cylindropuntia ramosissima* are the standout associates in the alliance, present at 23 of 28 samples, and occasionally the co-dominant species.

The *Larrea tridentata* – *Ambrosia dumosa* Alliance is rarely on slopes >25 degrees but can be common on rolling ridges and dissected alluvium on slopes of 5 to 25 degrees. Its most common expression is on bajadas where it borders braided *Parkinsonia florida* – *Olneya tesota* watercourses, pavements, or the *Larrea tridentata* monotype. It was mapped at elevations from 60 – 2800 ft (18 - 853 m).

Image identification and Mapping Units with a similar appearance on imagery: The *Larrea tridentata* – *Ambrosia dumosa* Alliance was identified by the lack of species with cover values beyond the thresholds identifying the six associations within this alliance: *Cylindropuntia munzii*, *Psoralea schottii*, *Calliandra eriophylla*, *Olneya tesota*, *Atriplex hymenelytra*, and *Yucca schidigera*. Further, *Encelia farinosa* should be <1% cover. *Encelia farinosa* is associated with certain features of bajadas, such as pavements, and *Encelia farinosa* is generally absent from valley fill. But on slope of 5-25 degrees *Encelia farinosa* is common and difficult to distinguish from *Ambrosia dumosa*. We relied on field visits, NECO data samples, and photos from the tortoise survey to help distinguish the *Larrea tridentata* – *Ambrosia dumosa* Alliance from the ***Larrea tridentata* – *Encelia farinosa* alliance**, but it's likely the two were confused in areas lacking such data.



Above, the area **below** the red polygon (which is the *Larrea tridentata* monotype) is an example of the ***Larrea tridentata* – *Ambrosia dumosa* Alliance** near the Little Mule Mts and Camp Burt. The tiny dots along the many minor watercourses are *Ambrosia dumosa*, situated among larger, darker *Larrea tridentata*.



Above, an example of the *Larrea tridentata* – *Ambrosia dumosa* Alliance on a slope below the red line, with the *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association above the line. The *Yucca* cast longer, thinner shadows. The location is just east of the Gas Line Road at about 2400 feet.

Table of all taxa that had at least 1% cover in at least one sample site for:

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

Number of Rapid Assessment Sites: 28

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	28	5 (3-5)	6 (1.9-17)	1.2
<i>Ambrosia dumosa</i> White bursage	28	3 (3-4)	1.5 (0.2-14)	0.4
<i>Fouquieria splendens</i> Ocotillo	23	3 (0-4)	1 (0-6.7)	2.7
<i>Cylindropuntia ramosissima</i> Diamond cholla	23	2 (0-4)	0.2 (0-6.4)	0.7
<i>Krameria bicolor</i> White ratany	22	2 (0-3)	0.2 (0-2)	0.6
<i>Psoralea schottii</i> Schott's dalea	15	1 (0-3)	0.11 (0-1)	1.2
<i>Cylindropuntia munzii</i> Munz's cholla	13	0 (0-3)	<1 (0-1)	1.3
<i>Olneya tesota</i> Desert ironwood	13	0 (0-3)	<1 (0-1)	1.5
<i>Pleuraphis rigida</i> Big galleta	11	0 (0-3)	<1 (0-2)	0.8
<i>Brassica tournefortii</i> Sahara mustard	10	0 (0-3)	<1 (0-2)	-
<i>Senna armata</i> Desert senna	9	0 (0-3)	<1 (0-1.6)	0.9
<i>Lycium andersonii</i> Water jacket	9	0 (0-3)	<1 (0-1.2)	1.0
<i>Fagonia laevis</i> California fagonbush	9	0 (0-3)	<1 (0-1)	0.2
<i>Hyptis emoryi</i> Desert lavender	9	0 (0-3)	<1 (0-1)	-
<i>Krameria erecta</i> Littleleaf ratany	7	0 (0-3)	<1 (0-3.1)	0.4
<i>Cylindropuntia bigelovii</i> Teddybear cholla	7	0 (0-3)	<1 (0-1.6)	0.9
<i>Parkinsonia florida</i> Blue paloverde	7	0 (0-2)	<1 (0-1)	-

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Sphaeralcea ambigua</i> Desert globemallow	7	0 (0-2)	<1 (0-1)	-
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	6	0 (0-3)	<1 (0-1.6)	0.6
<i>Ziziphus obtusifolia</i> Lotebush	5	0 (0-3)	<1 (0-1.2)	-
<i>Fagonia pachyacantha</i> Fagonbush	4	0 (0-3)	<1 (0-1.4)	0.2
<i>Atriplex canescens</i> Four-winged saltbush	1	0 (0-3)	<1 (0-1)	1.0

***Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association**

Common name: Creosote – white bursage – desert holly association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association OR *Atriplex hymenelytra* – *Larrea tridentata* association LAKE-DEVA-MOJA-CAMO Evens et al 2020

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277 OR *Atriplex hymenelytra* – *Larrea tridentata* Alliance A0872

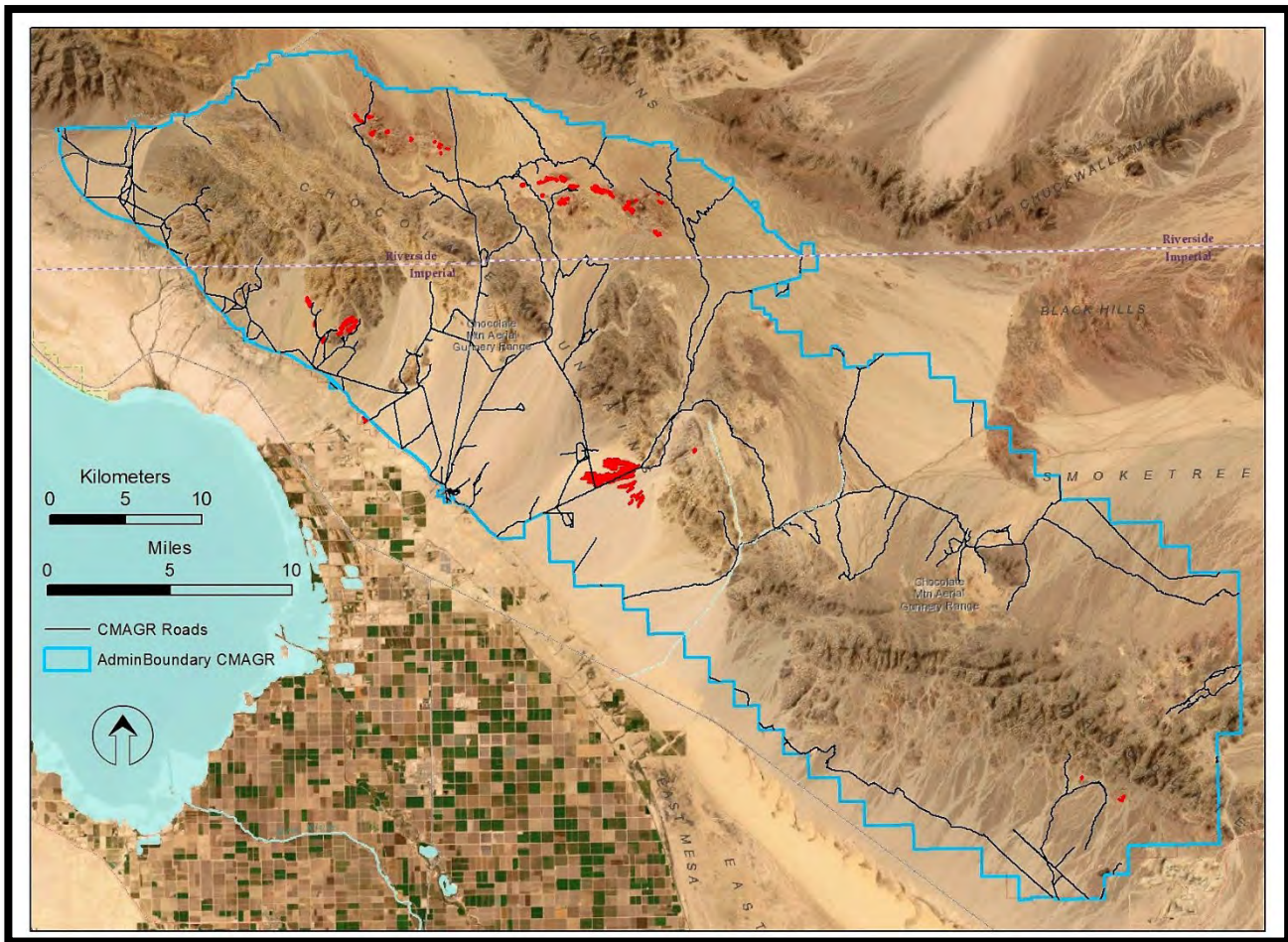
Acres (hectares) mapped on CMAGR: 932 (377)



Above: *Larrea tridentata*, *Ambrosia dumosa*, and *Atriplex hymenelytra* co-dominate this hillside of extrusive volcanics near Tabaseca Tank at 2000 ft (610 m), about two miles south of the Bradshaw Trail (RA plot EORC-3).



Above: *Atriplex hymenelytra* and *Encelia farinosa* co-dominate this alluvial fan along the road to Surveyors Pass, about 7 miles E of Camp Billy Machen. *Larrea tridentata*, *Ambrosia dumosa*, and *Olneya tesota* are common associates. (RA plot LHM-22).



Above: Distribution of *Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association in red. Extent of vegetation polygons exaggerated for visibility.

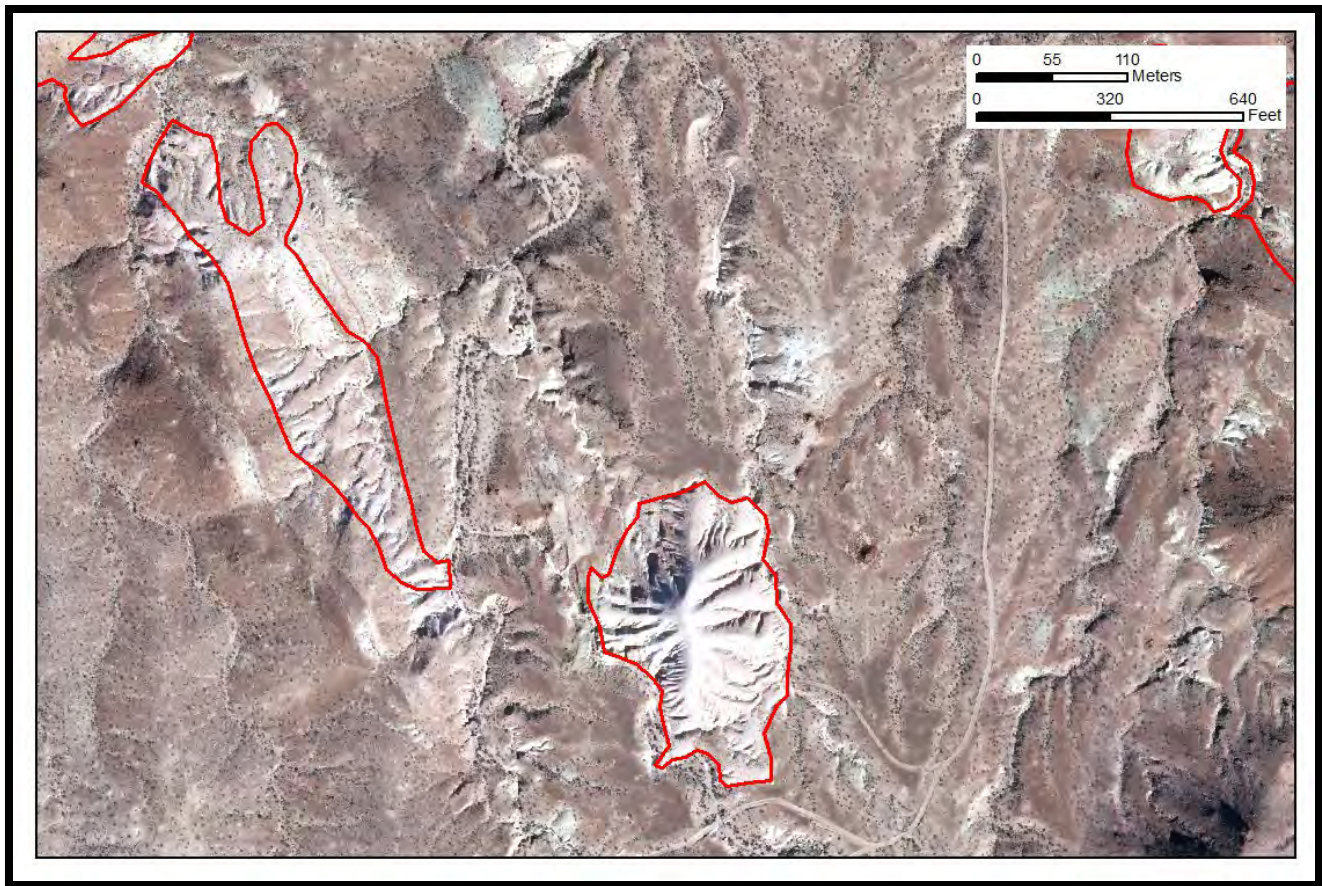
Description and setting: This association describes vegetation characterized by *Atriplex hymenelytra* and includes both alluvial fans and hillslopes. It's not clear that this association as presented on the CMAGR belongs wholly within the *Larrea tridentata* – *Ambrosia dumosa* alliance because *Encelia farinosa* is a common associate and exceeded 1% cover at 2 of 8 sample sites. Such sites may instead be a member of the *Atriplex hymenelytra* – *Larrea tridentata* alliance. *Larrea tridentata* was present at all samples, but cover was <1% at four of eight samples sites. There was no similar DRECP mapping unit.

The alluvial fans were on the south side of the Chocolate Mts on mixed alluvium, where the association was mapped wherever *Atriplex hymenelytra* was co-dominant or dominant, typically with *Larrea tridentata*, *Ambrosia dumosa*, *Fagonia laevis*, and *Encelia farinosa* as common associates. In contrast, the hillside occurrences were on the north side of the Choclates on extrusive volcanics at elevations ranging from 2000 – 2730 ft, where *Atriplex hymenelytra* could be joined by a host of higher elevation

species including *Ephedra aspera* and *Simmondsia chinensis* and, at one location 3 miles east of Iris Pass, *Lycium andersonii* at 4% cover on a steep NE facing slope.

Image identification: *Atriplex hymenelytra* was difficult to impossible to discern from *Ambrosia dumosa* on the hillside imagery. Mapping was based on field visits, then extrapolating to nearby areas that appeared similar. On alluvial fans it was possible to make out the faint coloration/shape of *Atriplex hymenelytra* for on Google Earth imagery from 2012 (which was superior to the Canyon Air imagery), and this was exploited to draw the polygons.

Mapping Units with a similar appearance on imagery: Four of the 8 samples sites have <1% cover of *Larrea tridentata*, which means that the ***Ambrosia dumosa* alliance** or ***Encelia farinosa* alliance** could be mistaken for this association.



Above, an example of the *Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association mapped on white hills near Tabaseca Tank.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association**

Number of Rapid Assessment Sites: 8

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Atriplex hymenelytra</i> Desertholly saltbush	8	4 (3-5)	3.5 (0.2-7)	0.7
<i>Larrea tridentata</i> Creosote	8	2.5 (2-4)	<1 (0.2-3)	1.0
<i>Encelia farinosa</i> Brittlebush	8	2.5 (1-4)	<1 (0.11-4)	0.6
<i>Ambrosia dumosa</i> White bursage	7	3 (0-5)	<1 (0-16)	0.3
<i>Fagonia laevis</i> California fagonbush	7	3 (0-4)	<1 (0-1)	0.2
<i>Simmondsia chinensis</i> Jojoba	4	1 (0-4)	<1 (0-1.2)	0.7
<i>Tiquilia canescens</i> Woody crinklemat	4	1 (0-4)	<1 (0-1)	0.1
<i>Ephedra aspera</i> Mormon tea	4	0.5 (0-4)	<1 (0-2.5)	0.5
<i>Pleuraphis rigida</i> Big galleta	3	0 (0-3)	<1 (0-2)	-
<i>Krameria erecta</i> White ratany	3	0 (0-3)	<1 (0-0.2)	-
<i>Lycium andersonii</i> Water jacket	2	0 (0-3)	<1 (0-4)	0.8
<i>Olneya tesota</i> Desert ironwood	2	0 (0-3)	<1 (0-1)	4.0
<i>Xylorhiza tortifolia</i> Mojave woodyaster	1	0 (0-4)	<1 (0-1)	0.2
<i>Fagonia pachyacantha</i> Fagonbush	1	0 (0-3)	<1 (0-1.5)	-
<i>Pleurocoronis pluriseta</i> Bush arrowleaf	1	0 (0-3)	<1 (0-1.2)	-

***Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association (provisional)**

Common name: Creosote – white bursage – fairy duster association

Most similar or equivalent mapping unit on adjacent lands: *Ambrosia dumosa*-*Olneya tesota*-*Calliandra eriophylla* Association NECO

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277

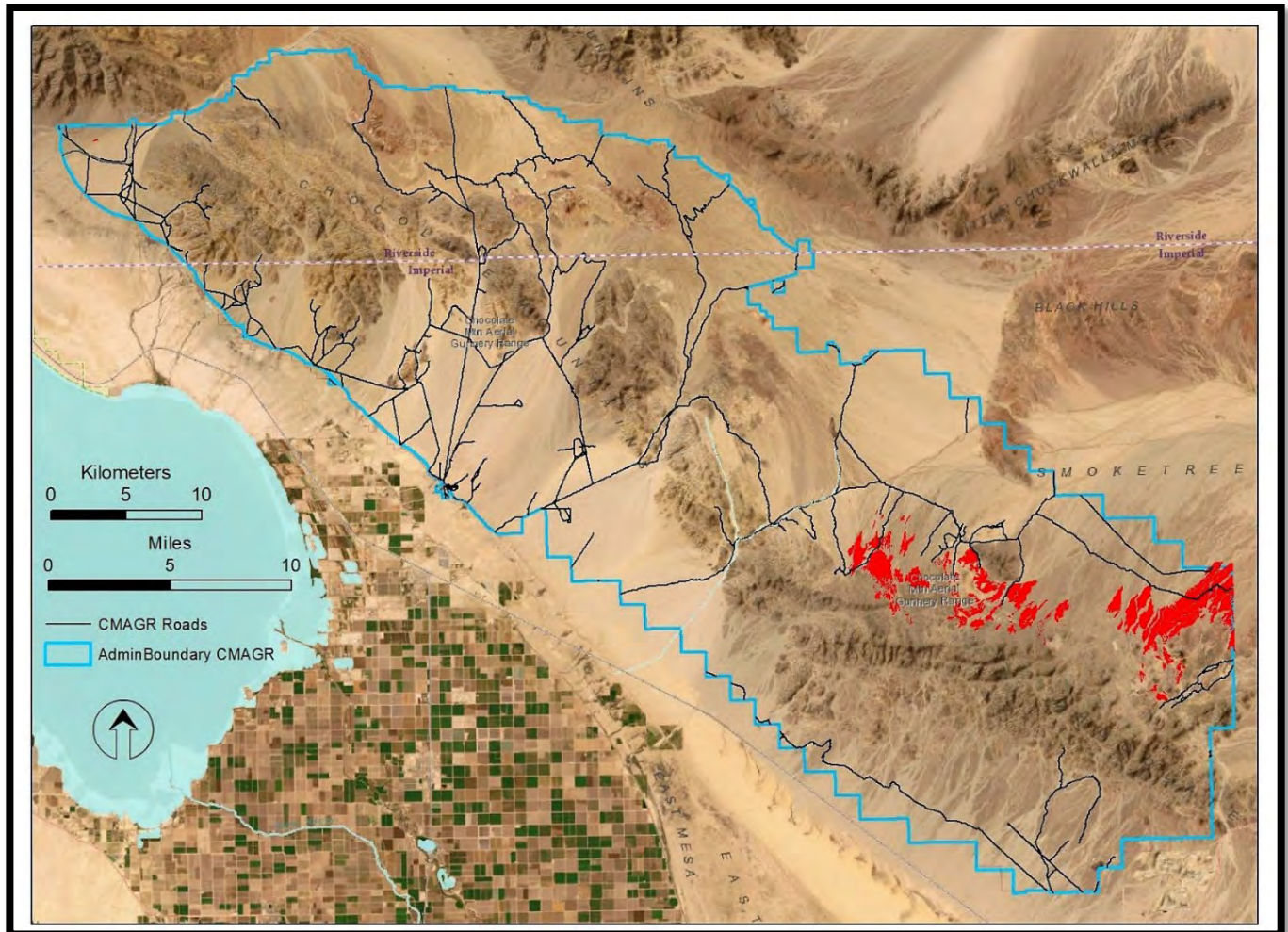
Acres (hectares) mapped on CMAGR: 9,014 (3,648)



Above: Blooming fairy duster, *Calliandra eriophylla*, along a watercourse about 4 miles SSW of Camp Burt. Typically about two feet high, fairy duster is an important browse species for desert tortoise (Van Devender et. al., 2002) as well as mule deer (Carrera et. al. 2015). It's also a nectar source for hummingbirds.



Above: Gravelly alluvium is typical habitat for the *Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association. *Larrea tridentata* dominates this site with about 5% cover, while *Ambrosia dumosa* and *Calliandra eriophylla* each add 1% cover overall, though mostly restricted to minor watercourses too small to map individually. The association was generally mapped to include watercourses and surrounding interfluvies (RA plot MB-13).

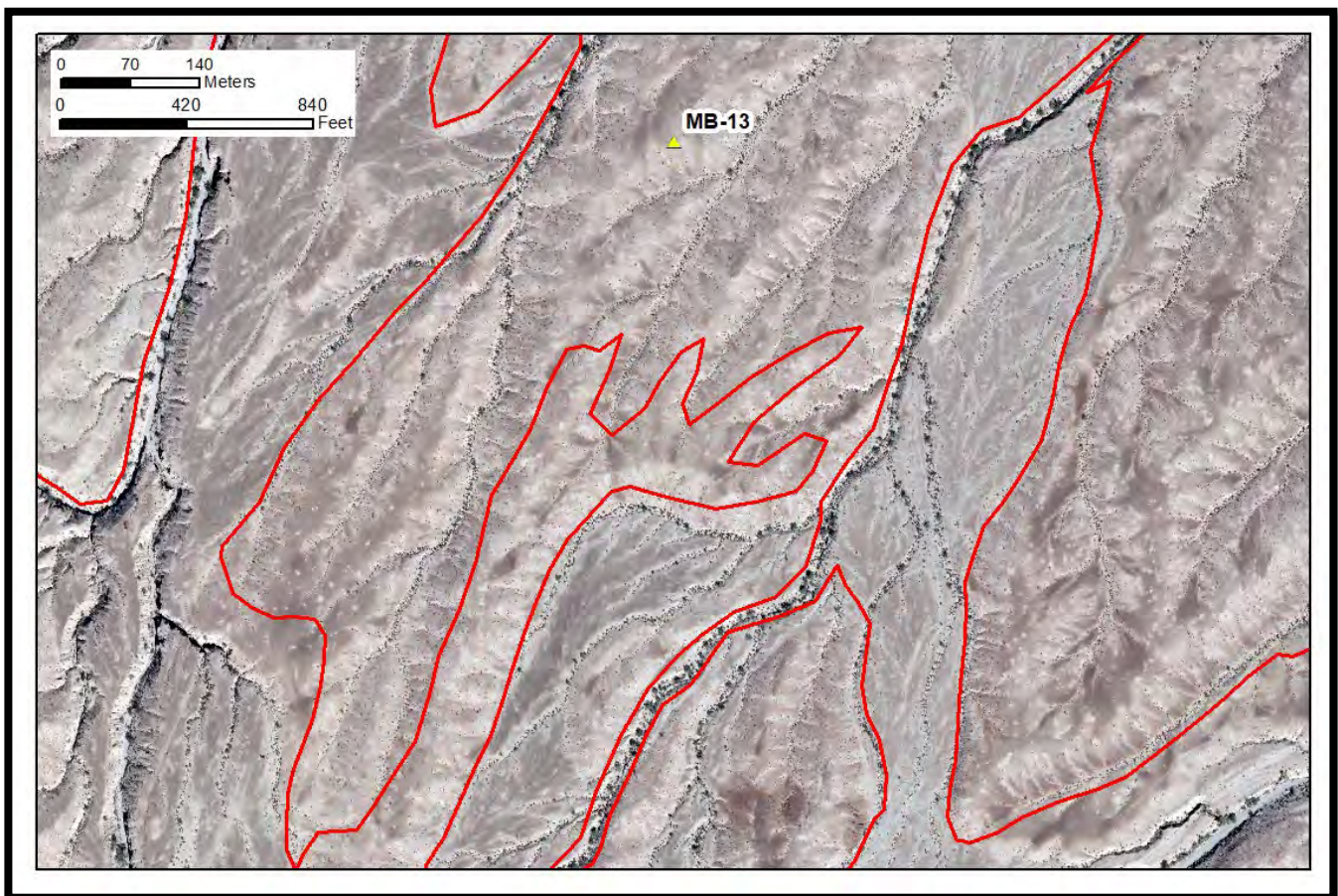


Above: Distribution of *Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association in red.

Description and setting: *Calliandra eriophylla* is typically at low densities in this association but nevertheless characteristic in both the mapped association as well as the mapped *Parkinsonia florida* – *Olneya tesota* watercourses within the *Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* association. The typical habitat is gravelly alluvium much incised by shallow watercourses holding the *Calliandra eriophylla*, although at one location on pale white rhyolite (MW-11) the species is common on hillslopes on all aspects. Overall, only seven species had greater than 1% cover in the 8 sample sites (see table below). NECO (2007) sample sites in the same NE corner of the CMA are classified in their scheme as the *Ambrosia dumosa*-*Olneya tesota*-*Calliandra eriophylla* association. Although their high % surface cover values for gravels indicates they included the hills surrounding the watercourses in the samples, the dominance of *Ambrosia dumosa* and consistent presence of *Olneya tesota* suggests their samples were restricted to the watercourses. Oddly, 3 of their 10 samples completely lack *Calliandra eriophylla*, and *Olneya tesota* exceeds 1% cover in only 3 of the ten samples.

The *Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* association in this study was mapped at 970 – 1700 ft (296 – 518 m).

Image identification and Mapping Units with a similar appearance on imagery: *Calliandra eriophylla* was visible, barely, as a tight dark dot that was larger than neighboring *Ambrosia dumosa* (0.6 m vs. 0.4 m). *Calliandra eriophylla* was strongly associated with small watercourses that occur so broadly that the MMU of 1 ha includes both the watercourses and interfluvies. However, the small difference in size between *Calliandra eriophylla* and *Ambrosia dumosa* makes it likely that small *Calliandra eriophylla* were confused with large *Ambrosia dumosa*, so it's probable that this association was mapped in locations that are actually the ***Larrea tridentata* – *Ambrosia dumosa* alliance**.



Above, an example (MB-13) of the *Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association about 4 miles north of Mt. Barrow. Adjacent polygons are either *Parkinsonia florida* – *Olneya tesota* alliance, *Larrea tridentata* – *Ambrosia dumosa* alliance, or pavements.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Ambrosia dumosa* - *Calliandra eriophylla* Association**

Number of Rapid Assessment Sites: 8

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	8	5 (2-5)	3.8 (0.2-6.2)	1.0
<i>Ambrosia dumosa</i> White bursage	8	3 (3-4)	2.1 (0.2-4)	0.4
<i>Calliandra eriophylla</i> Fairyduster	8	3 (3-4)	1.5 (0.2-5.3)	0.6
<i>Fouquieria splendens</i> Ocotillo	8	3 (2-4)	<1 (0.2-2.8)	3.1
<i>Krameria bicolor</i> White ratany	8	3 (1-3)	<1 (0.11-1)	0.5
<i>Cylindropuntia ramosissima</i> Diamond cholla	6	2 (0-3)	<1 (0-1.7)	0.5
<i>Fagonia pachyacantha</i> Fagonbush	4	1.5 (0-4)	<1 (0-4)	0.2

***Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association (provisional)**

Common name: Creosote – white bursage – Munz’s cholla association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata*-*Ambrosia dumosa* Alliance DRECP 4115

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277

Acres (hectares) mapped on CMAGR: 17,315 (7,007)



Above: *Larrea tridentata* and *Cylindropuntia munzii* co-dominate this site at 1370 ft (527 m) near Pegleg Well, above Salvation Pass, with common associates *Psoralea schottii* and *Encelia farinosa* (RA plot PW-11).



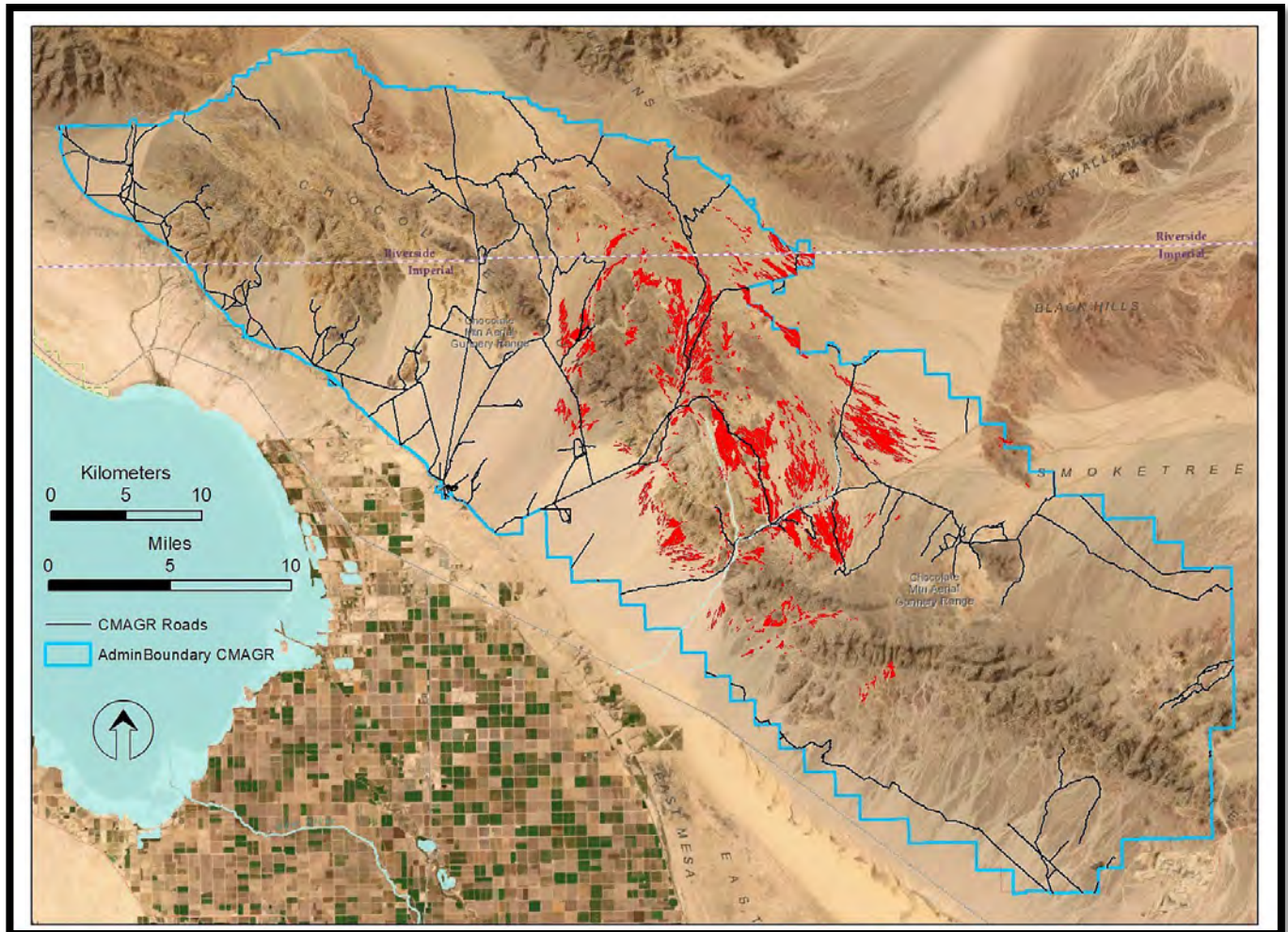
Above: *Cylindropuntia munzii* and *Psoralea schottii* are co-dominant on this cobble and gravel fan (though the latter species is not apparent in the photo). *Larrea tridentata* and *Ambrosia dumosa* are the only common associates (RA plot T-13).



Above: Although *Cylindropuntia munzii* was most common on alluvial fans with a slope < 5 degrees (9 of 16 sample sites), it could also inhabit steep slopes where the only other common species was *Larrea tridentata* (RA plot LHM-26).



Above: *Cylindropuntia munzii* and *Cylindropuntia bigelovii* are both common at this site at 1410 ft (430 m) 0.5 miles north of Beal Well, but *Cylindropuntia munzii* has greater coverage over the sample (RA plot LHM-24). As can be seen in the background, *Cylindropuntia munzii* is typically taller.

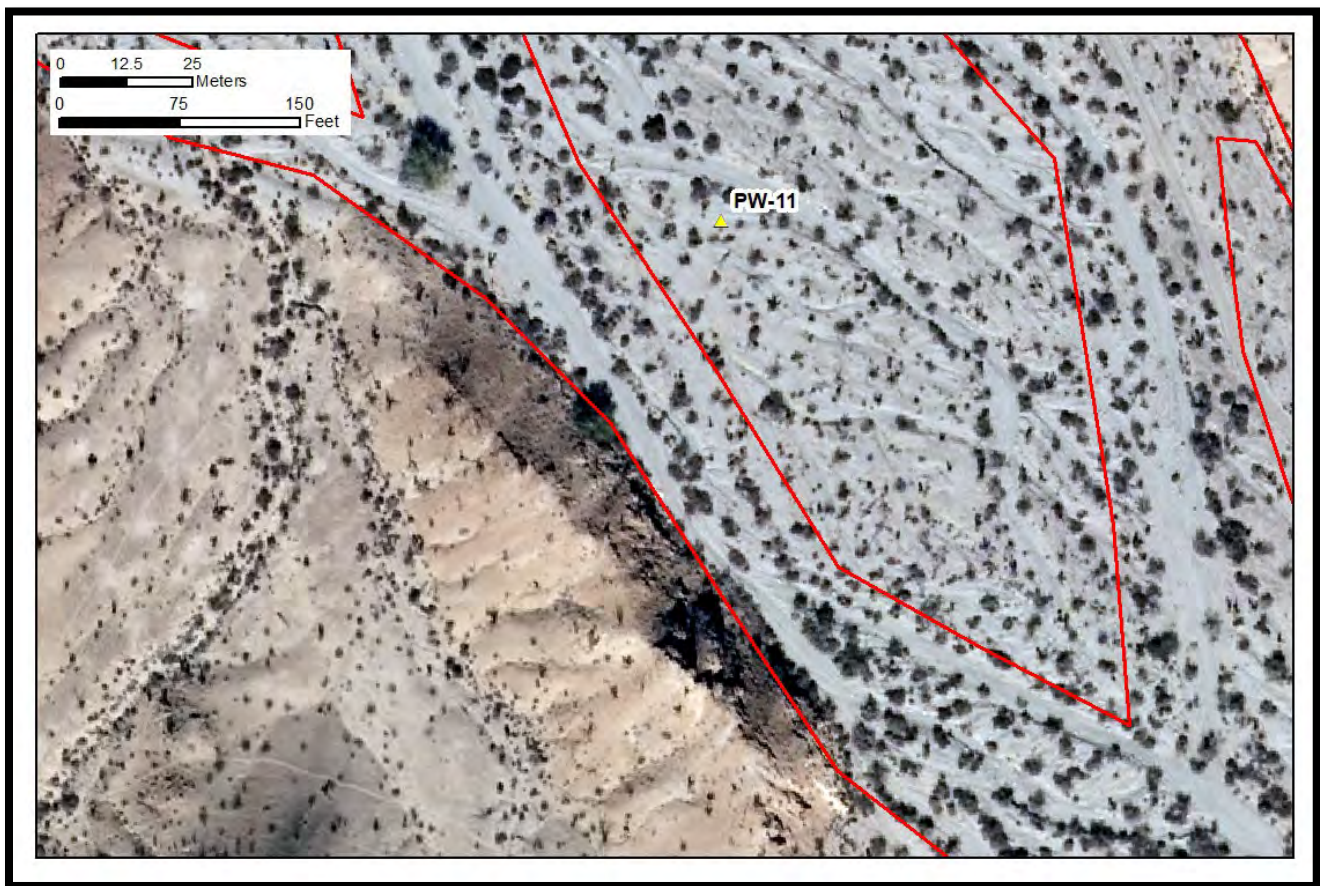


Above: Distribution of *Larrea tridentata* - *Ambrosia dumosa* - *Cyllindropuntia munzii* Association in red.

Description and setting: *Cyllindropuntia munzii* has a California Rare Plant Rank of 1B, which translates to: “Plants rare, threatened, or endangered in California and elsewhere”. However, its ‘threat rank’ is 3 (“Not very threatened in California”) and this study shows that is certainly true. *Cyllindropuntia munzii* occurs both along braided watercourses (the *Parkinsonia florida* - *Olneya tesota* - *Cyllindropuntia munzii* Association) and onto bajadas, ridges, and lower slopes of mountains. The latter area is represented by the *Larrea tridentata* - *Ambrosia dumosa* - *Cyllindropuntia munzii* Association, where *Cyllindropuntia munzii* has >1% cover. By this metric, there are 17,315 acres of the CMAGR mapped in this association. An additional 9,753 acres were mapped in the *Parkinsonia florida* - *Olneya tesota* - *Cyllindropuntia munzii* Association. The *Larrea tridentata* - *Ambrosia dumosa* - *Cyllindropuntia munzii* Association in this study was mapped at 500 – 2500 ft (152 - 762 m), suggesting a broad temperature tolerance. Both associations are restricted to the central CMAGR, suggesting that their presence on the range is relatively recent in evolutionary time, and they are expanding to similar habitat, a view supported by a recent plastome phylogeny of the *Cyllindropuntia* (Majure et. al. 2019).

All 16 of the sample sites held *Larrea tridentata*, *Ambrosia dumosa*, *Fouquieria splendens*, and *Cylindropuntia munzii*, and all four species had a median cover value greater than 1%. *Encelia farinosa* and *Psoralea schottii* could be common associates close to or on the mountain.

Image identification and Mapping Units with a similar appearance on imagery: The *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association was identified by the shadows of its namesake cactus, which was 1.6 m (5.25 ft) tall on average. The main difficulty in mapping was distinguishing *Cylindropuntia munzii* from the ***Cylindropuntia bigelovii* alliance**. Although the latter species is shorter (3.6 ft = 1.1 m) it's likely to have been mistaken for the *Cylindropuntia munzii* at some locations. On the north side of the CMAGR, the upper reaches of the *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association merges with ***Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association**. If *Cylindropuntia munzii* is more common than *Yucca schidigera*, it should be mapped as *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii*, but the two species can be confused on imagery of dense vegetation.



Above, an example of the *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association near Pegleg Well, above Salvation Pass. The association occupies both the hillslopes and the 'island' between the braided channels of the *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association. The latter is distinguished by at least 3% cover of *Parkinsonia florida* and/or *Olneya tesota*.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association**

Number of Rapid Assessment Sites: 16

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	16	4 (1-5)	3.5 (0.11-10.8)	1.2
<i>Cylindropuntia munzii</i> Munz's cholla	16	3 (3-5)	3 (1.4-8)	1.6
<i>Ambrosia dumosa</i> White bursage	16	3 (1-5)	1.5 (0.11-10)	0.4
<i>Fouquieria splendens</i> Ocotillo	16	3 (1-3)	1.2 (0.11-7)	3.3
<i>Psoralea schottii</i> Schott's dalea	13	3 (0-4)	<1 (0-3.3)	1.4
<i>Encelia farinosa</i> Brittlebush	12	2 (0-3)	<1 (0-3)	0.8
<i>Krameria bicolor</i> White ratany	11	1.5 (0-3)	<1 (0-3)	0.6
<i>Cylindropuntia ramosissima</i> Diamond cholla	11	1 (0-3)	<1 (0-2)	0.6
<i>Olneya tesota</i> Ironwood	8	0 (0-4)	<1 (0-2)	3.7
<i>Fagonia laevis</i> California fagonbush	6	0 (0-3)	<1 (0-1.1)	0.3
<i>Simmondsia chinensis</i> Jojoba	6	0 (0-3)	<1 (0-2)	1.2
<i>Cylindropuntia bigelovii</i> Teddybear cholla	5	0 (0-3)	<1 (0-1)	1.1
<i>Pleuraphis rigida</i> Big galleta	5	0 (0-3)	<1 (0-3)	-
<i>Senna armata</i> Desert senna	4	0 (0-3)	<1 (0-2)	-
<i>Tiquilia canescens</i> American threefold	1	0 (0-4)	<1 (0-3.7)	0.1

***Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association (provisional)**

Common name: Creosote – white bursage – ironwood association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association NECO

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277

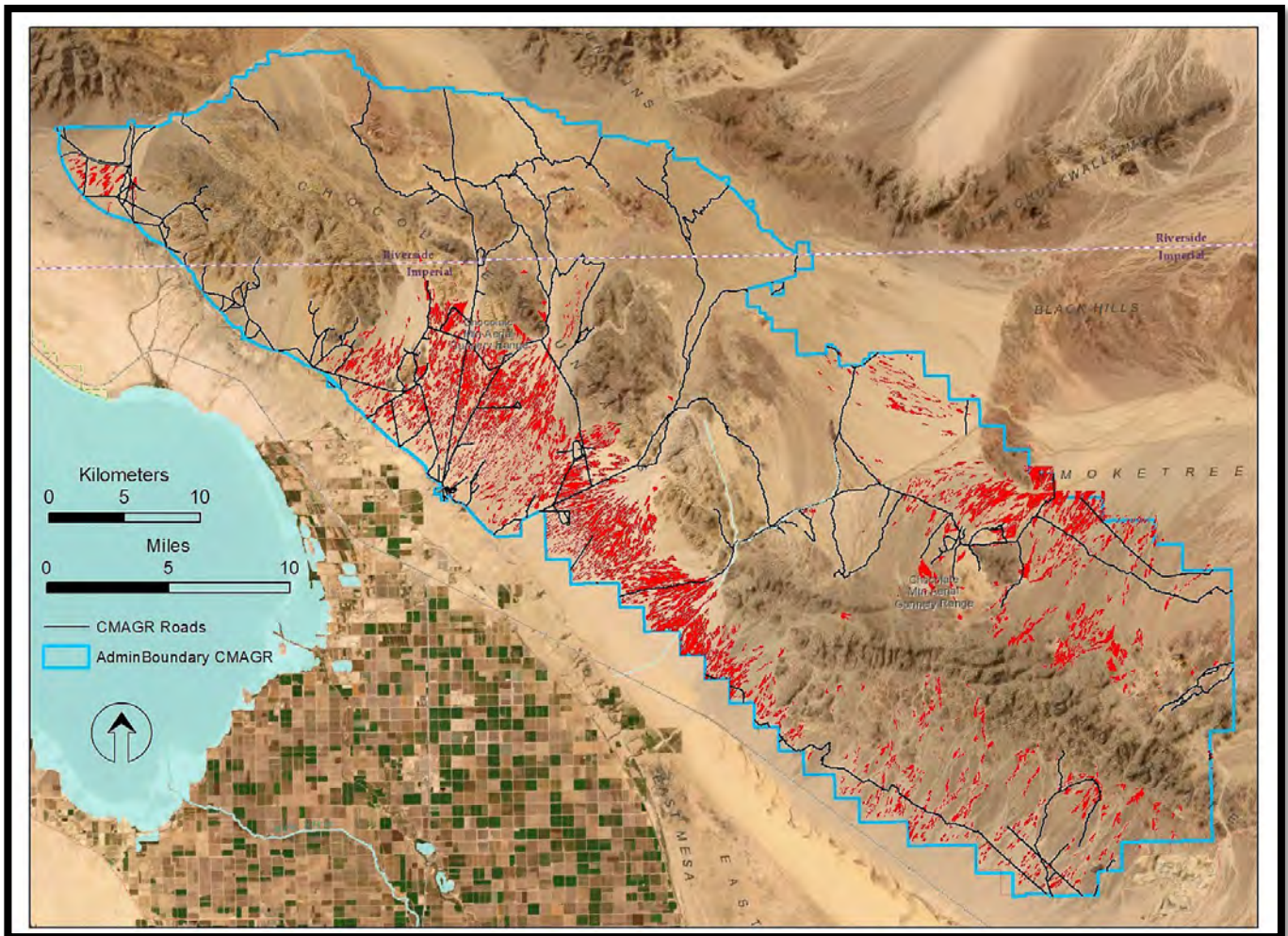
Acres (hectares) mapped on CMAGR: 31,526 (12,758)



Above: The most common expression of *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association is on alluvial outwash, where large arroyos exit the mountain front and fan over the landscape. *Larrea tridentata* dominates this site about 10 miles SE of Niland, with 2.7 % cover, while *Olneya tesota* adds another 1 %. No other species is common, but there is an occasional *Ambrosia salsola*, *Ambrosia dumosa*, and *Cylindropuntia ramosissima* (340 ft, 104 m) (RA plot T-1).



Above: Although the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association is most common on bajadas, it also occurs on hills where the transition from soil-mantled to bedrock hillslopes results in small watercourses holding *Olneya tesota*. At the site above, at 1350 ft (411 m) about five miles south of Blue Mountain, *Olneya tesota* and *Ambrosia dumosa* are co-dominant with 4 to 5% cover each, with common associates *Larrea tridentata*, *Tiquila canescens* and *Fagonia pachyacantha* all with at least 1% cover. (RA plot BM-7).



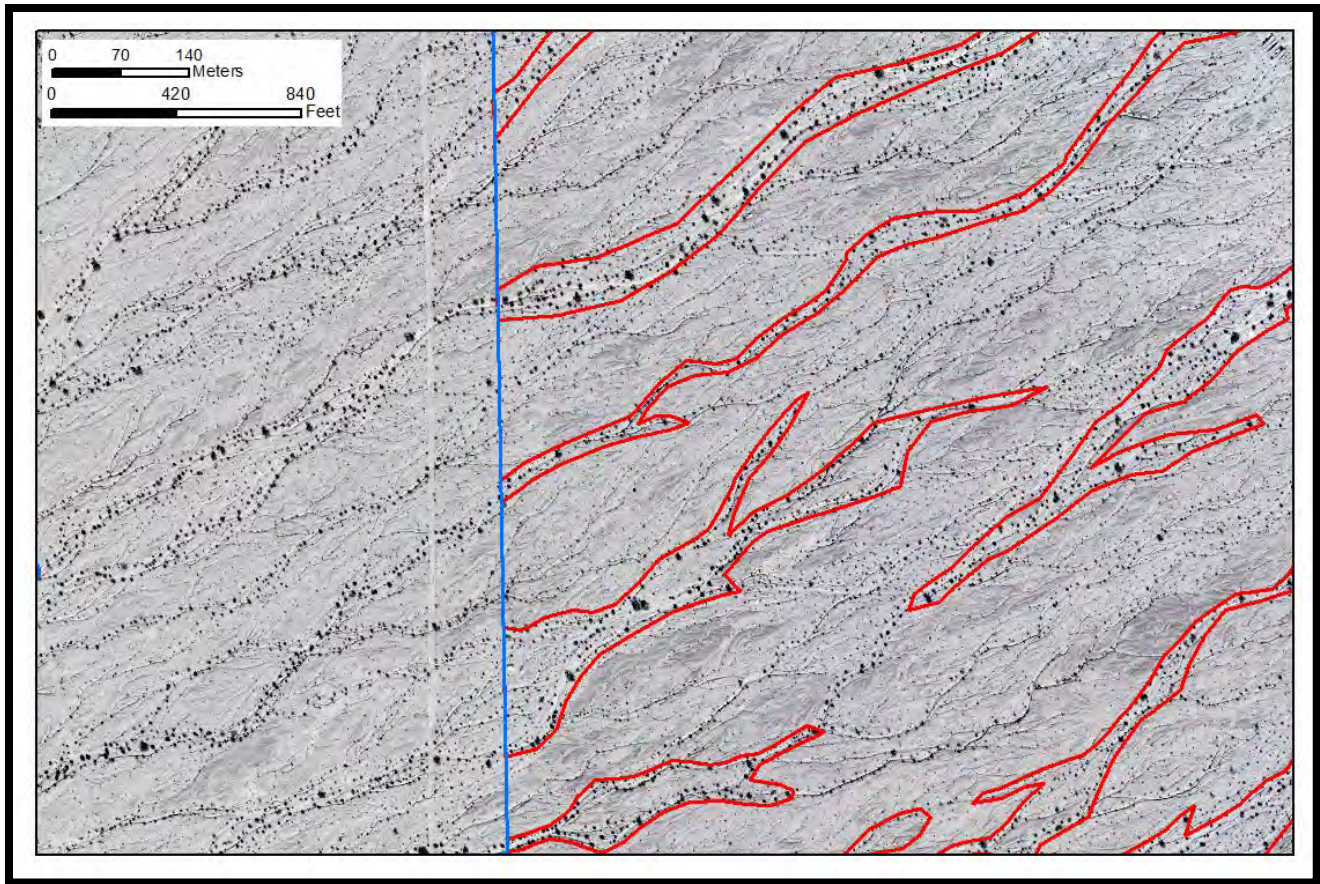
Above: Distribution of *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association in red.

Description and setting: The *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association describes lands with at least 1% cover of *Olneya tesota* that are within the *Larrea tridentata* – *Ambrosia dumosa* alliance, and not in the *Parkinsonia florida* – *Olneya tesota* Alliance. The distinction between the two is the relative abundance of *Olneya tesota* versus *Larrea tridentata* and/or *Psoralea schottii*. In the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association, *Larrea tridentata* and/or *Psoralea schottii* give greater cover than does *Olneya tesota*. The 1% cover cutoff is to distinguish this association from its neighbors, which is typically the *Larrea tridentata* - *Ambrosia dumosa* alliance (as described in this study). The difference between these mapping units can be seen in the stature of the *Olneya tesota*, which average 22 ft tall (6.7 m) in the *Parkinsonia florida* – *Olneya tesota* alliance, 13.1 ft (4 m) in the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association, and 5 ft (1.5 m) in the *Larrea tridentata* - *Ambrosia dumosa* alliance.

This *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association was mapped at elevations from 30 to 2300 ft (9 – 701 m).

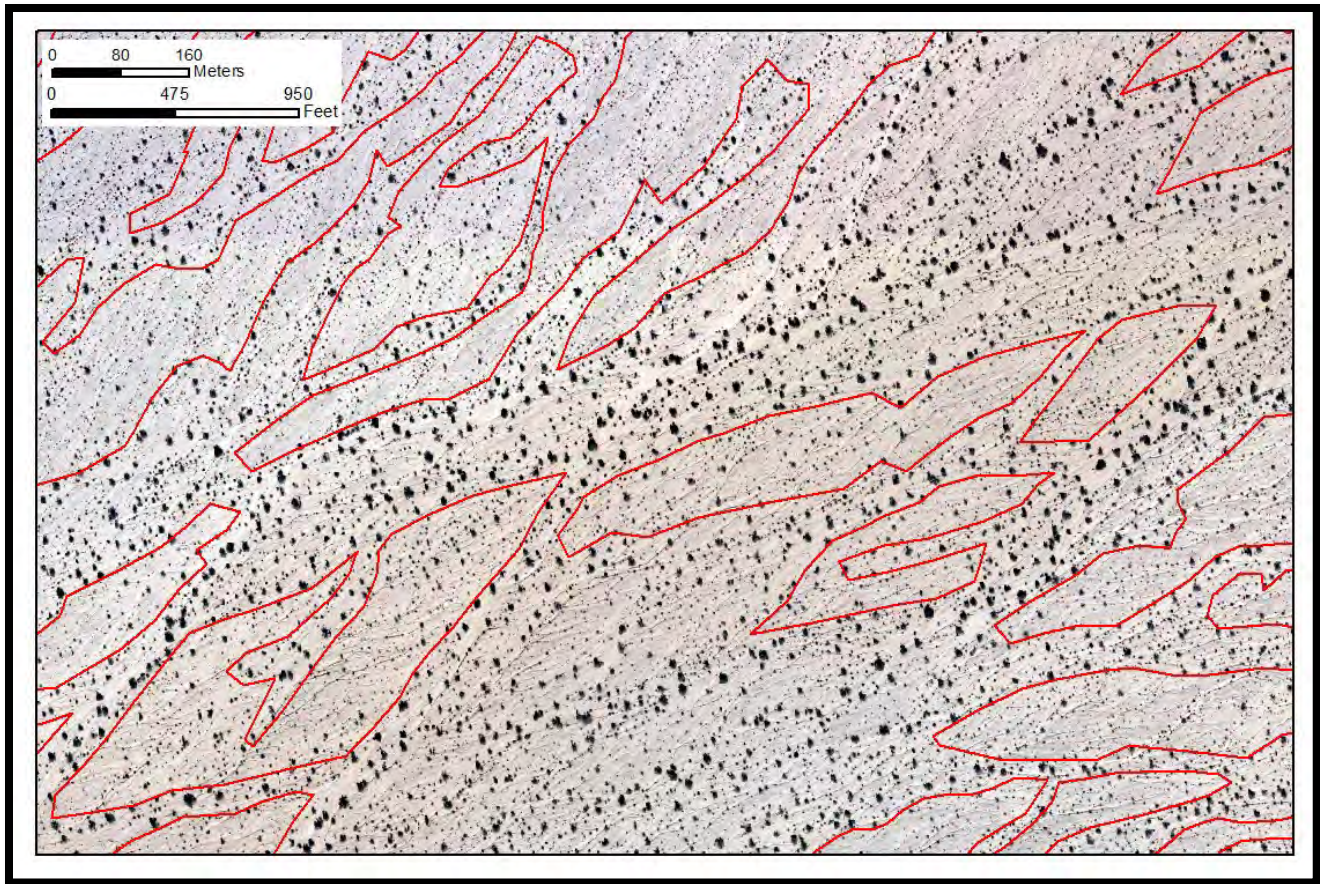
The DRECP (2020) effort also recognized the importance of *Olneya tesota*, but instead of creating a mapping unit they added a field to the attribute table called the **Ironwood – Blue Palo Verde Presence Modifier (OLNEYA TESOTA_PARKINSONIA FLORIDA)** which “denotes the consistent presence of ironwood (*Olneya tesota*) and/or blue paloverde (*Parkinsonia florida*) in mapped polygons within the study area... The modifier was added to represent the vast expanses of sparse ironwood and/or blue palo verde emerging from the canopy of creosote bush, white bursage, and brittle bush shrub types on broad alluvial fans and bajadas, as well as sparsely vegetated desert pavement dissected by small rivulets, where the vegetation type was not assigned to the *Parkinsonia florida*-*Olneya tesota* Alliance. 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.”

The DRECP solution is tailored to their Minimum Mapping Unit of 10 acres (4 hectares) for desert upland vegetation. This study’s MMU of 2.5 acres (1 ha) allowed more detailed mapping. Because the DRECP allows ‘trace amounts’ of *Olneya tesota* and/or *Parkinsonia florida* to be mapped, the Ironwood – Blue Palo Verde Presence Modifier includes lands that would not hold enough trees to be included in this study’s *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association. The difference can be seen where the two maps meet at the edge of the CMAGR (example below).



Above: on the left of the blue line is a single large DRECP polygon for the *Larrea tridentata* – *Ambrosia dumosa* alliance with the Ironwood – Blue Palo Verde Presence Modifier indicating “the consistent presence of ironwood (*Olneya tesota*) and/or blue palo verde (*Parkinsonia florida*).” On the right, in long red polygons, is the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association as mapped in this study.

Image identification: The *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association was identified by estimating the coverage of trees (> 2m tall, which were usually *Olneya tesota* but also included *Parkinsonia florida*) to be greater than 1% cover, and then judging the identity and cover of the surrounding vegetation to be the non-xeroriparian *Larrea tridentata* or *Psorothamnus schottii*. The example below shows how the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association can appear as ‘islands’ within braided channels of the *Parkinsonia florida* – *Olneya tesota* alliance.



Above: The polygons with a low cover of scattered trees are the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association, and the lands between are active watercourses with the *Parkinsonia florida* – *Olneya tesota* Alliance.

Mapping Units with a similar appearance on imagery: Large *Larrea tridentata* and small *Olneya tesota* can appear much the same on imagery, complicating the decision as to where the '1% cover' line should be drawn between the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association and the ***Larrea tridentata* - *Ambrosia dumosa* Alliance**. At higher tree densities, the distinction between the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association and ***Parkinsonia florida* – *Olneya tesota* Alliance** was based on the relative cover of *Larrea tridentata* and *Psoralea schottii* versus *Olneya tesota* and *Parkinsonia florida*. As can be seen in the example above, that is a difficult call.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association**

Number of Rapid Assessment Sites: 11

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	11	5 (3-5)	4 (1.4-22)	1.2
<i>Ambrosia dumosa</i> White bursage	11	3 (2-5)	0.5 (0-5.3)	0.4
<i>Olneya tesota</i> Desert ironwood	11	3 (2-4)	1.3 (1-4.8)	4.0
<i>Psoralea schottii</i> Schott's dalea	8	2 (0-3)	<1 (0-2.8)	1.2
<i>Lycium andersonii</i> Water jacket	7	1 (0-3)	<1 (0-1.4)	1.3
<i>Ambrosia salsola</i> Cheesebush	6	1 (0-3)	<1 (0-2.3)	0.9
<i>Fouquieria splendens</i> Ocotillo	5	0 (0-3)	<1 (0-1.6)	3.2
<i>Euphorbia polycarpa</i> Spurge	2	0 (0-3)	<1 (0-3)	0.5
<i>Cylindropuntia bigelovii</i> Teddybear cholla	2	0 (0-3)	<1 (0-1.8)	0.7
<i>Parkinsonia florida</i> Blue paloverde	2	0 (0-3)	<1 (0-1.7)	4.2
<i>Senna armata</i> Desert senna	1	0 (0-3)	<1 (0-3.5)	0.6
<i>Fagonia pachyacantha</i> Fagonbush	1	0 (0-3)	<1 (0-1)	-
<i>Tiquilia canescens</i> Woody crinklemat	1	0 (0-3)	<1 (0-1)	0.1

***Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association
(provisional)**

Common name: Creosote – white bursage – Schott’s dalea association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* - *Psoralea schottii* Association (Mecca/Orocopia) OR *Larrea tridentata*--*Ambrosia salsola*--*Psoralea schottii* Association (Dos Palmas)

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277

Acres (hectares) mapped on CMAGR: 3,341 (1,352)



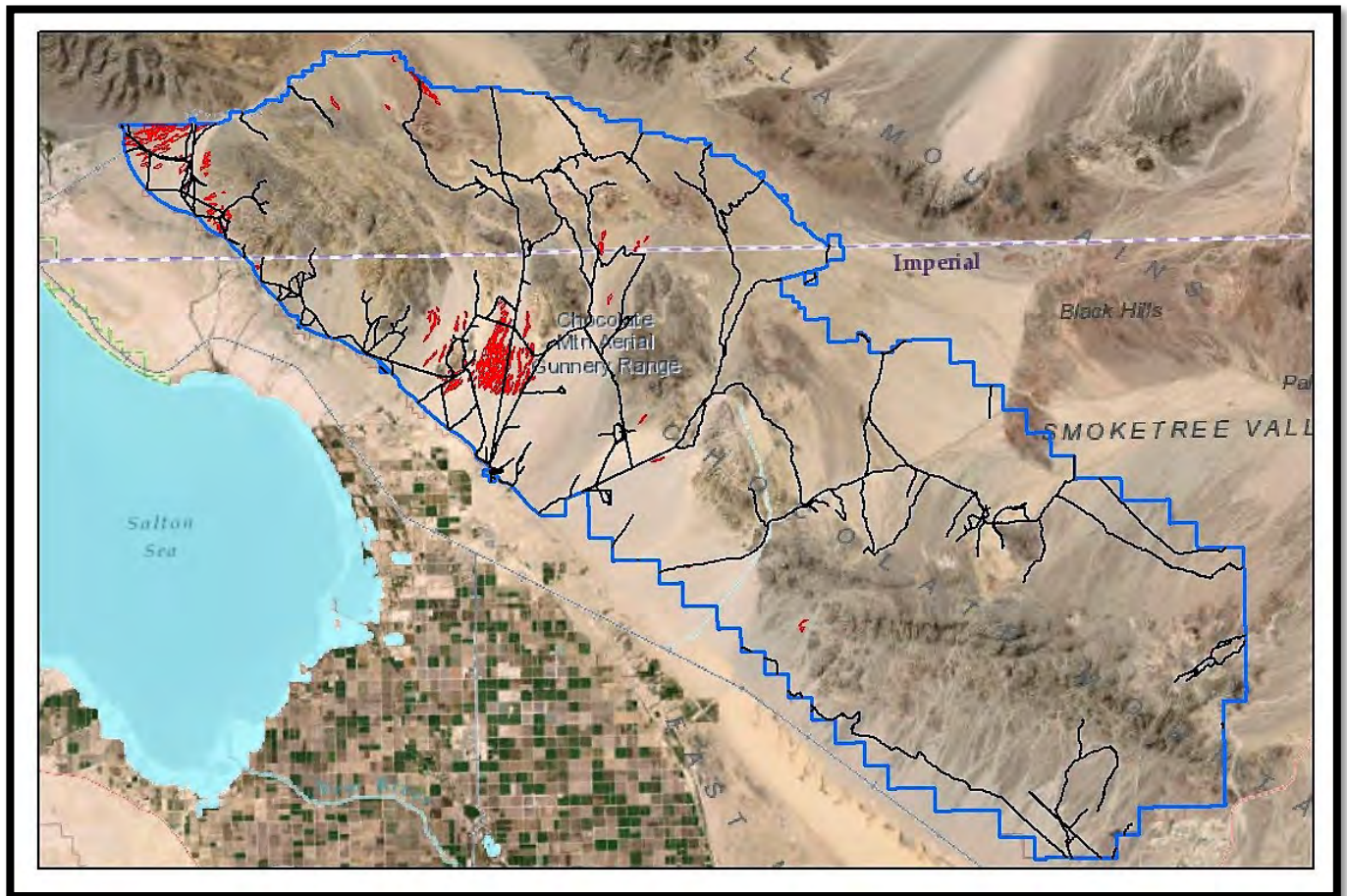
Above: *Larrea tridentata* is the clear dominant with 5% cover in this simple assemblage along the Gas Line Road, with *Psoralea schottii* and *Ambrosia dumosa* each contributing an additional 1 to 2% cover. 405 ft (123 m) (RA plot IW-13).



Above: *Ambrosia salsola* is common with 1.4% cover on the Salt Creek fan, but *Ambrosia dumosa* (2.8%) and *Psoralea schottii* (3.4%) co-dominate. *Larrea tridentata* is the only other common species with 1.2% cover. 360 ft (110 m) (RA plot FW-3).



Above: At 1900 ft (579 m), the upper end of its elevational range, the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association is much more diverse. *Larrea tridentata* and *Psoralea schottii* codominate this site near the Bradshaw Trail and Tabaseca Tank, with common associates *Ambrosia dumosa*, *Simmondsia chinensis*, and *Tetradlea hallii* each adding another 1 to 2% cover. (RA plot EORC-21).

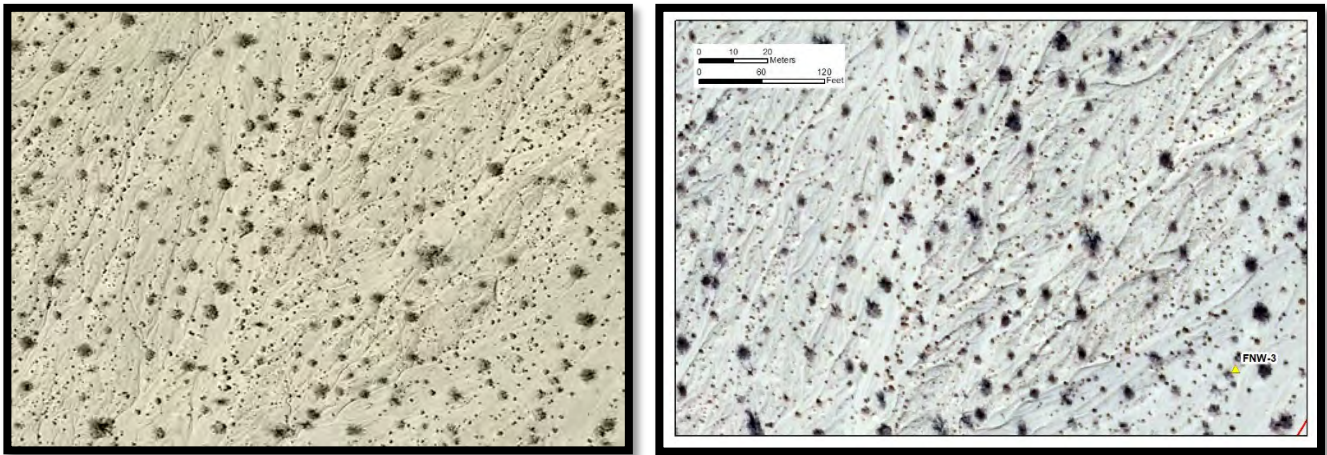


Above: Distribution of *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association in red.

FLORA AND VEGETATION OF THE CMAGR

Description and setting: The *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association is on fans subject to occasional sheet flooding. It is similar to the *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association, which often occurs just upslope from the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association. The key differences are the replacement of *Encelia farinosa* with *Ambrosia dumosa* in the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association. *Encelia farinosa* was common to codominant in all six sample sites for the *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association but does not reach even 1% cover in any of the five sample sites for the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association. Comparing the sample data for both associations, the % surface cover of stones (25-60 cm) averaged 14 % for the *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii*, and less than 1% for the *Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii*. This association was mapped from 70 to 1900 ft (21 – 579 m).

Image identification: On the relatively open bajadas it was possible to distinguish *Psoralea schottii* from the similar sized *Larrea tridentata*, with the former having a pinkish cast and a more tousled silhouette. The Canyon Air imagery was deficient in some areas such as Salt Creek, and Google Earth imagery from 2012 was substituted.



Above: Google Earth imagery from 2012 (left) versus Canyon Air 2015 (right) at RA Plot FNW-3.

Mapping Units with a similar appearance on imagery: *Psoralea spinosus* can appear very similar to *Larrea tridentata* on poor imagery, making it possible to map this association where it is actually the *Ambrosia salsola* – *Psoralea schottii* association.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Ambrosia dumosa* - *Psoralea schottii* Association**

Number of Rapid Assessment Sites: 5

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Larrea tridentata</i> Creosote	5	4 (3-5)	5.7 (1.2-8.1)	1.6
<i>Psoralea schottii</i> Schott's dalea	5	3 (3-4)	3.4 (1.6-6.0)	1.5
<i>Ambrosia dumosa</i> White bursage	4	3 (0-5)	1.8 (0-2.8)	0.5
<i>Brassica tournefortii</i> Sahara mustard	4	3 (0-3)	<1 (0-2)	-
<i>Ambrosia salsola</i> Cheesebush	4	2 (0-3)	<1 (0-1.4)	1.0
<i>Krameria bicolor</i> White ratany	2	0 (0-3)	<1 (0-1.4)	-
<i>Simmondsia chinensis</i> Jojoba	2	0(0-3)	<1 (0-1.1)	-
<i>Tetracoccus hallii</i> Hall's shrubby spurge	2	0 (0-3)	<1 (0-1.4)	-

***Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association**

Common name: Creosote – white bursage – Mojave yucca association

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association LAKE-DEVA-MOJA-CAMO Evens et al 2020

Most similar or equivalent NVC alliance: *Larrea tridentata*-*Ambrosia dumosa* Alliance A3277

Acres (hectares) mapped on CMAGR: 34,958 (14,147)



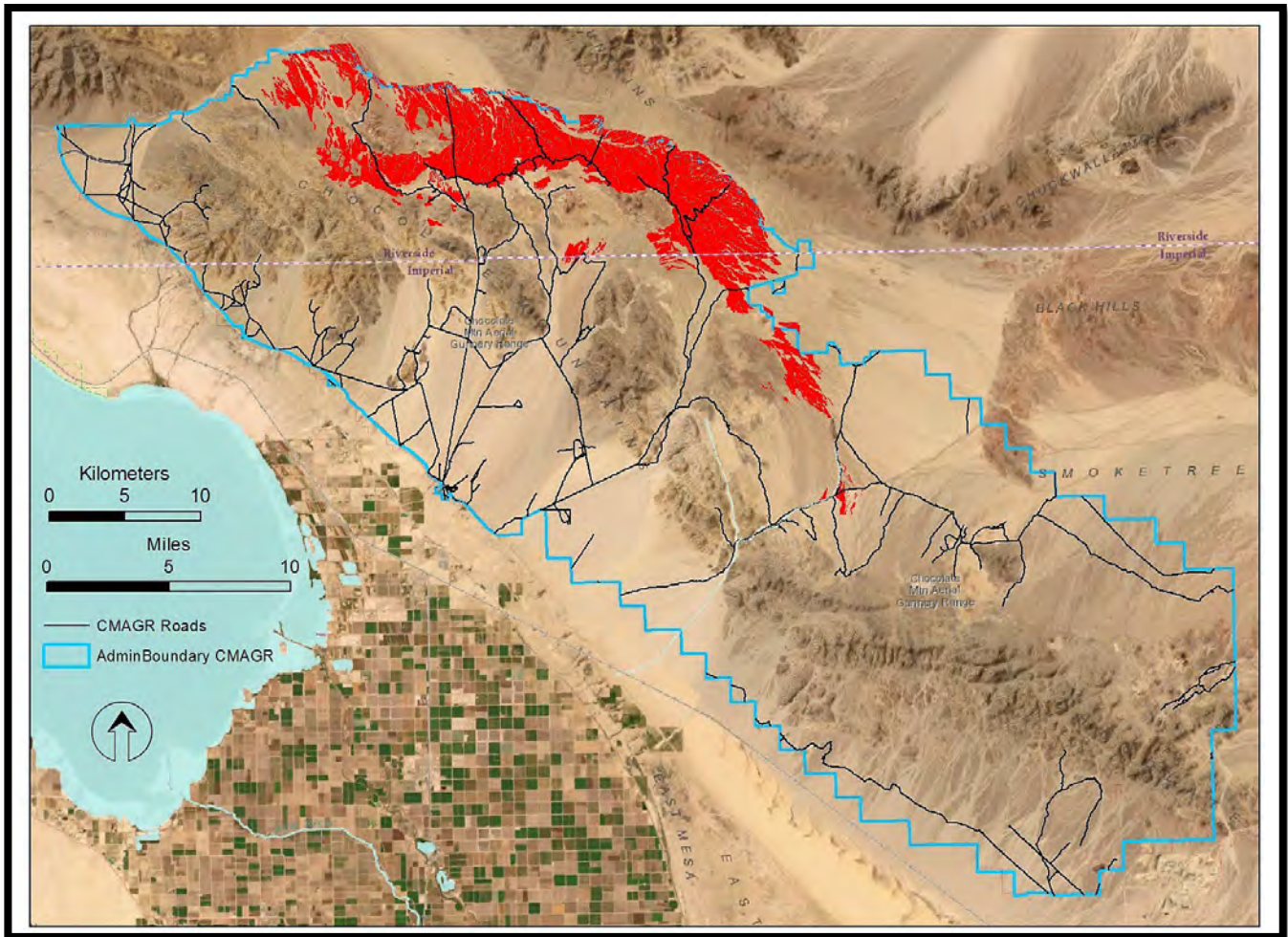
Above: At 2500 ft (762 m) about 2 miles S of the Bradshaw Trail and 2 miles E of Iris Pass, *Yucca schidigera* is a common associate with 2.2% cover, and *Larrea tridentata* and *Ambrosia dumosa* are co-dominants, each with 4 to 5% cover. Common associates *Ephedra californica*, *Krameria bicolor*, *Fouquieria splendens*, *Lycium andersonii*, and *Senegalia greggii* each contribute an additional 1 to 2% cover. (RA plot AP-11).



Above: This site, 3.5 miles S of Invader Butte, at 1360 ft (415 m), has gravelly interfluvies dominated by *Larrea tridentata* with 4.5% cover, and separated by swaths of *Ambrosia dumosa* and *Pleuraphis rigida*, with 1.3% and 2.7% cover respectively. Because both watercourses and interfluvies are part of the mapping unit, *Yucca schidigera* is <1% total cover but nonetheless characteristic of the minor watercourses. This is at the lower end of the mapped elevational range for the *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association (RA plot PW-9).



Above: The *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association occurs less commonly on mountain slopes. At this site *Larrea tridentata*, *Ambrosia dumosa* and *Fouquieria splendens* are co-dominant, with *Senna armata* and *Encelia farinosa* each adding 1 to 2 % cover. *Yucca schidigera* has <1% cover overall yet is common along minor watercourses. 2430 ft (741 m), 3 miles west of Tabaseca Tank (RA plot FNE-4).



Above: Distribution of *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association in red.

Description and setting: The *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association is exclusively on higher elevations on the northwest side of the CMAGR, and mapped where *Yucca schidigera* can be found with at least 10 clumps per hectare (the MMU). *Larrea tridentata* and/or *Ambrosia dumosa* are typically dominant or co-dominant and combine for a median cover of 10.3%, the highest cover for *Larrea tridentata* and *Ambrosia dumosa* of all associations within the *Larrea tridentata* – *Ambrosia dumosa* Alliance. *Fouquieria splendens* was present at 18 of 19 samples, with a median cover of 3.3%. *Ephedra californica*, *Simmondsia chinensis*, *Cylindropuntia ramosissima* and *Krameria bicolor* were common associates, all with a median cover <1% but ranging up to 3%. There were 26 species with at least 1% cover in at least one of the 19 sites. The association was mapped from 1330 to 2625 ft (405 – 800 m).

Image identification: The tall *Yucca schidigera* (1.5 m average) made it possible to detect the shadows of the species. See below.



Above: *Yucca schidigera* clumps circled in red, on RA Plot IP-31, near the Gas Line Road.

Mapping Units with a similar appearance on imagery: The main problem is detecting *Yucca schidigera* in areas of high overall coverage. In the example below, *Yucca schidigera* averages 1.5 m tall and is common enough to give 1% cover but it's difficult to make out among *Larrea tridentata* averaging 1.4 m, *Psoralea schottii* (1.4) and *Simmondsia chinensis* (1.3). In such cases of high overall coverage on the NW side of the CMAGR, the area was mapped as *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association but could very well have been simply ***Larrea tridentata* - *Ambrosia dumosa* Alliance.**



Above: *Yucca schidigera* gives 1% cover at this sample location but can be difficult to spot in areas with high cover such as this site at 2400 ft (731 m), 4 miles south of the Bradshaw Trail near the Gas Line Road. *Larrea tridentata* and *Ambrosia dumosa* combine for 17% cover, *Fouquieria splendens* adds 5%, and *Senna armata*, *Krameria bicolor*, *Simmondsia chinensis* and *Cylindropuntia ramosissima* each add another 1 to 2% (RA plot IP-30).

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association**

Number of Rapid Assessment Sites: 19

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Yucca schidigera</i> Mojave yucca	19	3 (2-3)	1 (0.2-3)	1.5
<i>Ambrosia dumosa</i> White bursage	19	3 (2-3)	3.3 (0.2-7.4)	0.5
<i>Larrea tridentata</i> Creosote	19	5 (3-5)	7 (3-10)	1.3
<i>Fouquieria splendens</i> Ocotillo	18	3 (0-3)	1.1 (0-5.3)	3.3
<i>Krameria bicolor</i> White ratany	18	3 (0-3)	0.2 (0-3)	0.6
<i>Cylindropuntia ramosissima</i> Diamond cholla	17	2 (0-3)	0.2 (0-1.3)	0.8
<i>Simmondsia chinensis</i> Jojoba	18	3 (0-3)	0.2 (0-3)	1.2
<i>Ephedra californica</i> Californica jointfir	16	3 (0-3)	0.2 (0-3)	0.9
<i>Senegalia greggii</i> Catclaw acacia	15	1.5 (0-3)	0.2 (0-2)	1.4
<i>Lycium andersonii</i> Water jacket	13	2 (0-3)	<1 (0-4)	0.9
<i>Senna armata</i> Desert senna	12	2 (0-3)	<1 (0-2.3)	0.8
<i>Pleuraphis rigida</i> Big galleta	11	1.5 (0-5)	0.2 (0-7)	0.8
<i>Psoralea schottii</i> Schott's dalea	11	1 (0-3)	<1 (0-3)	1.3
<i>Krameria erecta</i> Littleleaf ratany	9	0.5 (0-3)	<1 (0-1.6)	0.4
<i>Brassica tournefortii</i> Sahara mustard	9	0.5 (0-3)	<1 (0-1)	-
<i>Ambrosia salsola</i> Cheesebushy	8	0 (0-3)	<1 (0-3)	0.8
<i>Acamptopappus sphaerocephalus</i> Rayless goldenhead	7	0 (0-3)	<1 (0-3)	0.4

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Encelia farinosa</i> Brittlebush	7	0 (0-3)	<1 (0-0.2)	0.8
<i>Ziziphus obtusifolia</i> Lotebush	6	0 (0-3)	<1 (0-1.1)	-
<i>Cylindropuntia munzii</i> Munz's cholla	5	0 (0-3)	<1 (0-0.2)	2.0
<i>Parkinsonia florida</i> Blue paloverde	4	0 (0-3)	<1 (0-3)	2.6
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	4	0 (0-3)	<1 (0-3)	1.2
<i>Euphorbia eriantha</i> Spurge	1	0 (0-3)	<1 (0-3)	-
<i>Nolina bigelovii</i> Bigelow's nolina	1	0 (0-3)	<1 (0-1.6)	0.9
<i>Ephedra aspera</i> Boundary ephedra	1	0 (0-3)	<1 (0-1.1)	0.9
<i>Salvia columbariae</i> Desert chia	1	0 (0-3)	<1 (0-1)	-

***Larrea tridentata* - *Encelia farinosa* Alliance**

Common name: Creosote – brittlebush alliance

Most similar or equivalent mapping unit on adjacent lands: *Larrea tridentata* - *Encelia farinosa* Alliance DRECP

Most similar or equivalent NVC alliance: *Larrea tridentata* - *Fouquieria splendens* Upper Bajada & Rock Outcrop Desert Scrub Alliance A3278

Acres (hectares) mapped on CMAGR: 97,520 (39,465)



Above: *Larrea tridentata*, *Encelia farinosa*, and *Fagonia pachyacantha* each have about 2% cover on this south facing slope at 1425 ft (434 m) on Blue Mountain, south of Camp Burt. *Fouquieria splendens* is the only common associate (RA plot BM-12).



Above: *Larrea tridentata* is the dominant at this site at 2350 ft (716 m) two miles SW of Tabaseca Tank, with 12% cover. *Encelia farinosa*, *Ambrosia dumosa*, and *Krameria bicolor* are the only common associates, but there are scattered *Simmondsia chinensis* and *Yucca schidigera* (RA plot FNE-3).



Above: Although most commonly on slopes >5 degrees, the *Larrea tridentata* – *Encelia farinosa* Alliance also occurs on rocky bar-and-swale topography. At the SE corner of the range, 8 miles N of Glamis, *Larrea tridentata* is the dominant, with common associates *Ambrosia dumosa*, *Encelia farinosa* and *Cylindropuntia bigelovii* each contributing 1 to 2 % cover. 1060 ft (323 m) (RA plot EOA-5).

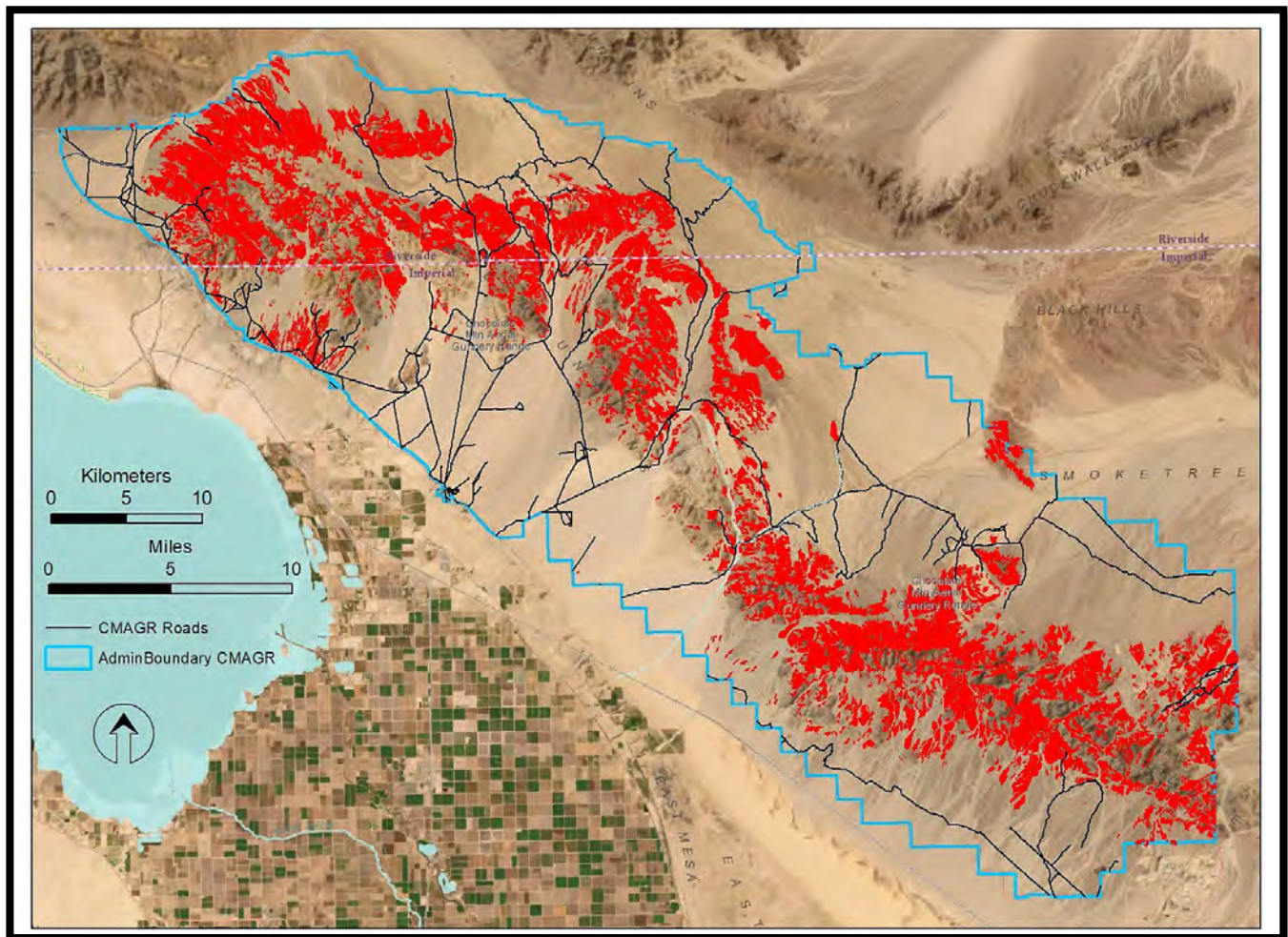
FLORA AND VEGETATION OF THE CMAGR



Above: *Psorothamnus schottii* was present in 19 of 41 sites sampled in the *Larrea/Encelia* alliance and was present at 2% or greater cover in only 2 of the 41 sites. One of those sites, above, on granitic hills at 2370 ft (722 m), held *Psorothamnus schottii* and *Ambrosia dumosa* as codominants, with common associates *Larrea tridentata*, *Encelia farinosa*, *Fouquieria splendens*, *Simmondsia chinensis*, *Senegalia greggii*, *Ephedra aspera*, *Bahiopsis parishii*, and *Xylorhiza tortifolia* each adding 1 to 3% cover (RA plot FNE-17).



Above: In contrast to the previous example, this site at 1560 ft (475 m) on Invader Butte is a simple assemblage of dominant *Encelia farinosa* and associated *Larrea tridentata*. The cactus is *Ferocactus cylindraceus* (RA plot PW-5).



Above: Distribution of *Larrea tridentata* - *Encelia farinosa* Alliance in red.

Description and setting: The *Larrea tridentata* - *Encelia farinosa* Alliance is the most extensive mapping unit in this study, reaching every corner of the CMAGR. The membership rule is simple - *Encelia farinosa* and *Larrea tridentata* each with >1% cover – and membership is consequently large. *Ambrosia dumosa* was present in 40 of 41 sample sites, with the same median coverage of 3% as *Larrea tridentata* and *Encelia farinosa*. There were 31 species that had at least 1% cover in at least one of the samples. The example photos above show locations that could certainly be classified as associations within this alliance, and in fact that are two such associations in this study: *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* association and the *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* association. The alliance was mapped from 90 to 2800 ft (27 – 853 m).

Image identification: Field experience showed that if *Larrea tridentata* is visible on the imagery, there is probably >1% cover, because there are always smaller wispy individuals that don't appear. Using this rule, we mapped places with *Larrea tridentata* that were on mountain slopes >5% degrees with the assumption that the smaller silver globes at the same locations were *Encelia farinosa*.



Above: *Larrea tridentata* - *Encelia farinosa* Alliance is at top, with the dark dots of *Larrea tridentata*. Area below red line is the *Encelia farinosa* Alliance.

Mapping Units with a similar appearance on imagery: If slopes were rocky and steeper than 5 degrees, it was usually mapped as the *Larrea tridentata* - *Encelia farinosa* Alliance, but the ***Larrea tridentata* – *Ambrosia dumosa* Alliance** appears very similar because of the difficulty in distinguishing *Encelia farinosa* from *Ambrosia dumosa*. In those cases where *Encelia farinosa* is absent from steep rocky hills, they were likely, and wrongly, mapped as *Larrea tridentata* - *Encelia farinosa* Alliance.

At the highest elevations in the CMAGR, *Encelia farinosa* and occasionally *Larrea tridentata* occur with *Ephedra aspera* and/or *Bahiopsis parishii* and or *Nolina bigelovii*, species that could not be identified on imagery. These latter species are characteristic of the provisional *Ambrosia dumosa* – *Ephedra aspera* association.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Encelia farinosa* Alliance**

Number of Rapid Assessment Sites: 41

NOTE: This association includes *Psoralea schottii* >2% that occasionally occurs on hills and mountains, and which was mapped as part of the *Larrea tridentata* - *Encelia farinosa* Alliance. For example, *Psoralea schottii* was present in 19 of 41 sites sampled in the Larrea/Encelia alliance but was present at 2% or greater cover in only 2 of the 41 sites.

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Encelia farinosa</i> Brittlebush	41	4 (3-4)	3 (0.2-7.5)	0.5
<i>Larrea tridentata</i> Creosote	41	4 (2-5)	3 (1-12.1)	1.1
<i>Ambrosia dumosa</i> White bursage	40	4 (0-5)	3 (0-7.6)	0.3
<i>Fouquieria splendens</i> Ocotillo	32	2 (0-5)	<1 (0-6.4)	2.9
<i>Krameria bicolor</i> White ratany	25	1 (0-3)	<1 (0-2.4)	0.5
<i>Fagonia laevis</i> California fagonbush	19	0 (0-3)	<1 (0-3)	0.2
<i>Psoralea schottii</i> Schott's dalea	19	0 (0-4)	<1 (0-6.7)	1.0
<i>Fagonia pachyacantha</i> Fagonbush	17	0 (0-4)	<1 (0-10)	0.2
<i>Eriogonum inflatum</i> Desert trumpet	17	0 (0-3)	<1 (0-2)	-
<i>Krameria bicolor</i> Littleleaf ratany	16	0 (0-3)	<1 (0-2)	0.3
<i>Pleuraphis rigida</i> Big galleta	13	0 (0-4)	<1 (0-5.3)	0.7
<i>Hyptis emoryi</i> Desert lavender	13	0 (0-3)	<1 (0-2.7)	1.0
<i>Hibiscus denudatus</i> Paleface	12	0 (0-3)	<1 (0-3)	0.7
<i>Sphaeralcea ambigua</i> Desert globemallow	13	0 (0-3)	<1 (0-3)	0.7

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Cylindropuntia bigelovii</i> Teddybear cholla	11	0 (0-3)	<1 (0-2)	0.8
<i>Ditaxis lanceolata</i> Silverbush	11	0 (0-3)	<1 (0-2)	0.4
<i>Simmondsia chinensis</i> Jojoba	12	0 (0-3)	<1 (0-1.7)	1.0
<i>Bebbia juncea</i> Sweetbush	12	0 (0-3)	<1 (0-1)	0.6
<i>Ferocactus cylindraceus</i> California barrel cactus	10	0 (0-3)	<1 (0-1)	-
<i>Pleurocoronis pluriseta</i> Bush arrowleaf	9	0 (0-4)	<1 (0-5)	0.5
<i>Echinocactus polycephalus</i> Cottontop cactus	9	0 (0-4)	<1 (0-1)	-
<i>Ephedra aspera</i> Mormon tea	9	0 (0-3)	<1 (0-1)	0.6
<i>Xylorhiza tortifolia</i> Mojave woodyaster	9	0 (0-3)	<1 (0-1)	0.4
<i>Lycium andersonii</i> Waterjacket	7	0 (0-3)	<1 (0-1)	1.0
<i>Olneya tesota</i> Desert ironwood	5	0 (0-3)	<1 (0-1)	-
<i>Euphorbia eriantha</i> Spurge	5	0 (0-3)	<1 (0-3)	0.1
<i>Senna armata</i> Desert senna	5	0 (0-3)	<1 (0-3)	-
<i>Brassica tournefortii</i> Sahara mustard	3	0 (0-3)	<1 (0-5)	-
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	4	0 (0-3)	<1 (0-1.7)	0.7
<i>Chaenactis stevioides</i> Desert pincushion	1	0 (0-3)	<1 (0-5)	-
<i>Atriplex hymenelytra</i> Desertholly saltbush	1	0 (0-3)	<1 (0-2)	-

***Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association (provisional)**

Common name: Orocopia sage association

Most similar or equivalent mapping unit on adjacent lands: *Encelia farinosa* - *Ambrosia dumosa* - *Salvia greatae* association (NECO) or *Larrea tridentata* - *Salvia greatae* association (Mecca/Orocopia) or *Encelia farinosa* - *Salvia greatae* association (Mecca/Orocopia)

Most similar or equivalent NVC alliance: *Larrea tridentata* - *Encelia farinosa* Alliance A4118

Acres (hectares) mapped on CMAGR: 403 (163)



Above: *Salvia greatae* is the pale mostly leafless shrub in the right foreground and left background. At this location, 950 ft (290 m) AMSL, above Salt Creek near the rail trestle, *Salvia greatae* has an estimated 3.2% cover. Associates *Larrea tridentata*, *Encelia farinosa*, and *Parkinsonia florida* each add 2 to 3% cover, while *Psoralea schottii* gave 1.3% (RA plot RC-1).

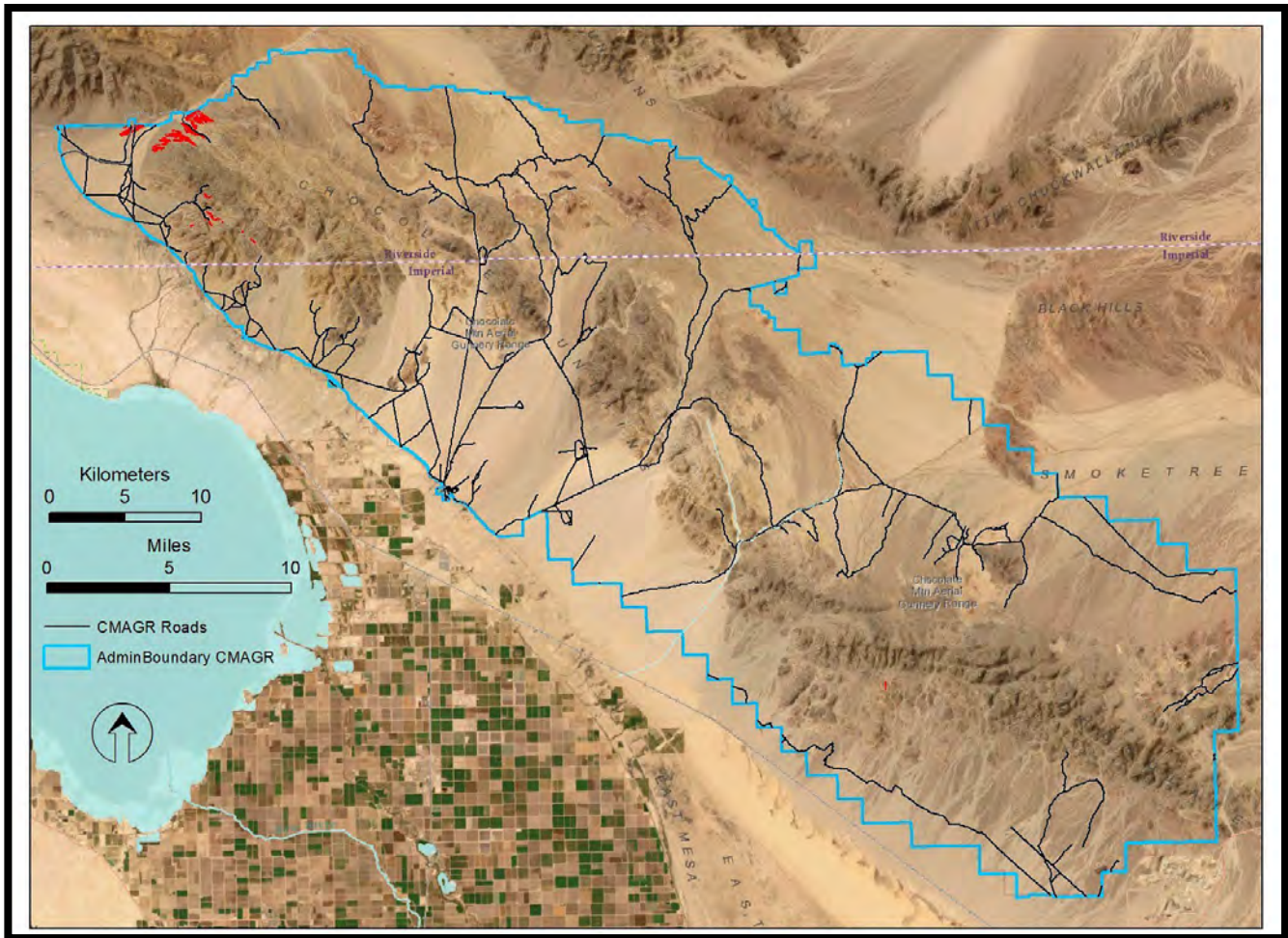


Above: *Salvia greatae* is the leafy green shrub in the left foreground, and common further back toward the bluffs, with an estimated 10% cover. It was only on the steep loose slope, and not on the bench above. This sample site is at 1500 ft (457 m), deep in the mountains at the north end of the CMAGR in a landscape very different from the Salt Creek populations. (RA plot FNW-11).



Above: *Salvia greatae* is the pale mostly leafless shrub in the middle ground, along the edge of the minor watercourse. *Larrea tridentata* is the dominant with 4.5% cover, while *Salvia greatae* is at 1.6%, *Ambrosia dumosa* at 1.1%, and *Psoralea schottii* at 1%. *Ambrosia salsola* is the only other common species. 580 ft (177 m), about two miles WSW of the rail trestle in Salt Creek (RA plot RC-2).

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Above: *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association in red. Extent of the vegetation polygons exaggerated for visibility.

Description and setting: Special status species listed in the CMAGR INRMP (2023) include the Orocopia Sage. As stated in the INRMP, Orocopia Sage (*Salvia greatae*) is “designated by CNPS as a List 1B.3 and a BLM sensitive species...is considered to be rare, threatened, or endangered in California and elsewhere, but not very threatened in California (low degree/immediacy of threats or no threats known).”

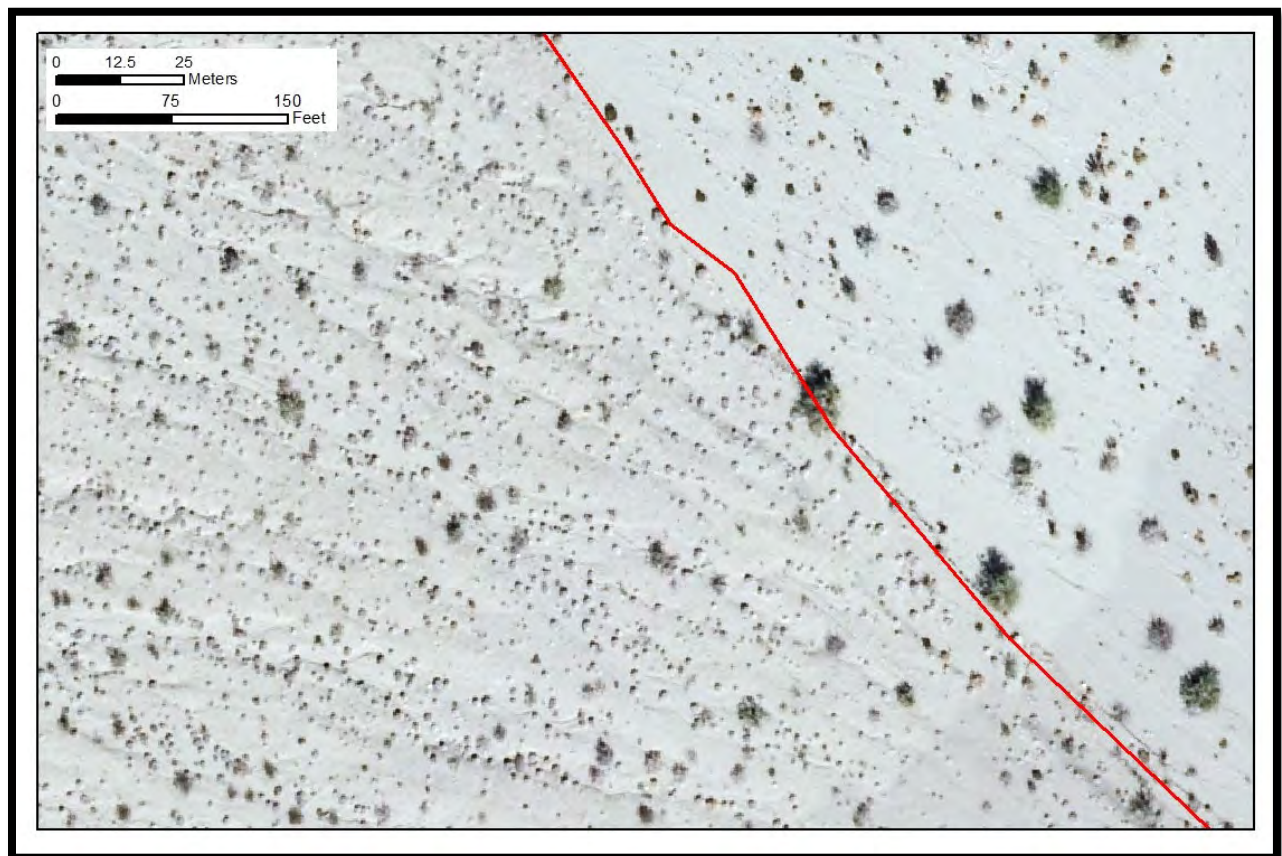
We estimate that the CMAGR population of Orocopia sage is in the 1000’s, but our confidence is weak because it’s hard to identify its preferred habitat (see example photos above). However, in the five sample sites there were 3 species that were always found with *Salvia greatae*: *Larrea tridentata*, *Encelia farinosa*, and *Psoralea schottii*. Median cover was at least 1% for these associates, suggesting that the provisional *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association belongs in the *Larrea tridentata*-*Encelia farinosa* alliance.

The association was mapped on from 470 to 1950 ft (143 – 594 m) in this study but has been found as low as 150 feet near Dos Palmas Spring. The field notes of Sanders describe typical habitat: *Shrubs to 1 m tall, on dry slopes of older alluvium (dissected alluvial fan). Mostly on E & NE-facing slopes of small side canyons above Salt Creek Wash, none seen in wash. Most plants in bud; fls. (very few) purple, small.*

Even fresh green plants with prickly leaves. Many dead twigs on most shrubs. Uncommon but widespread on slopes above the wash & below the RR, but large populations on hills to the south & SE above the RR.

Image identification: The white hemispheres of *Salvia greatae* can be seen on imagery, but unfortunately they are much the same size and color as *Encelia farinosa*. The association was mapped by personally discovering a population, then carefully expanding the perimeter to include similar habitat.

Mapping Units with a similar appearance on imagery: The *Encelia farinosa* - *Larrea tridentata* - *Psoralea schottii* Association is almost the same (except without *Salvia greatae*), and it occurs in the same areas.



Above: On the left of the red line, the *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association. The *Parkinsonia florida* association is to the right.



Above: The extent of the *Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association (in red) on old, dissected alluvium at RA Plot FNW-11 (see sample photos).

Table of all taxa that had at least 1% cover in at least one sample site for:

***Larrea tridentata* - *Encelia farinosa* - *Salvia greatae* Association**

Number of Rapid Assessment Sites: 5

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Salvia greatae</i> Orocopia sage	5	5 (3-5)	2.1 (1.6-10)	0.7
<i>Larrea tridentata</i> Creosote	5	3 (3-5)	4.5 (2-8.5)	1.4
<i>Psoralea schottii</i> Schott's dalea	5	3 (3)	1.3 (1-3)	1.4
<i>Encelia farinosa</i> Brittlebush	5	3 (1-3)	1 (0.11-3)	0.6
<i>Parkinsonia florida</i> Blue paloverde	4	3 (0-3)	1.5 (0-3)	2.1
<i>Lycium andersonii</i> Water jacket	3	2 (0-3)	0.2 (0-5)	-
<i>Senegalia greggii</i> Catclaw acacia	3	2 (0-3)	0.2 (0-2)	-
<i>Ambrosia dumosa</i> White bursage	3	1 (0-3)	0.11 (0-1.1)	0.6
<i>Fagonia laevis</i> California fagonbush	1	0 (0-3)	<1 (0-2)	-
<i>Fagonia pachyacantha</i> Fagonbush	1	0 (0-3)	<1 (0-2)	-

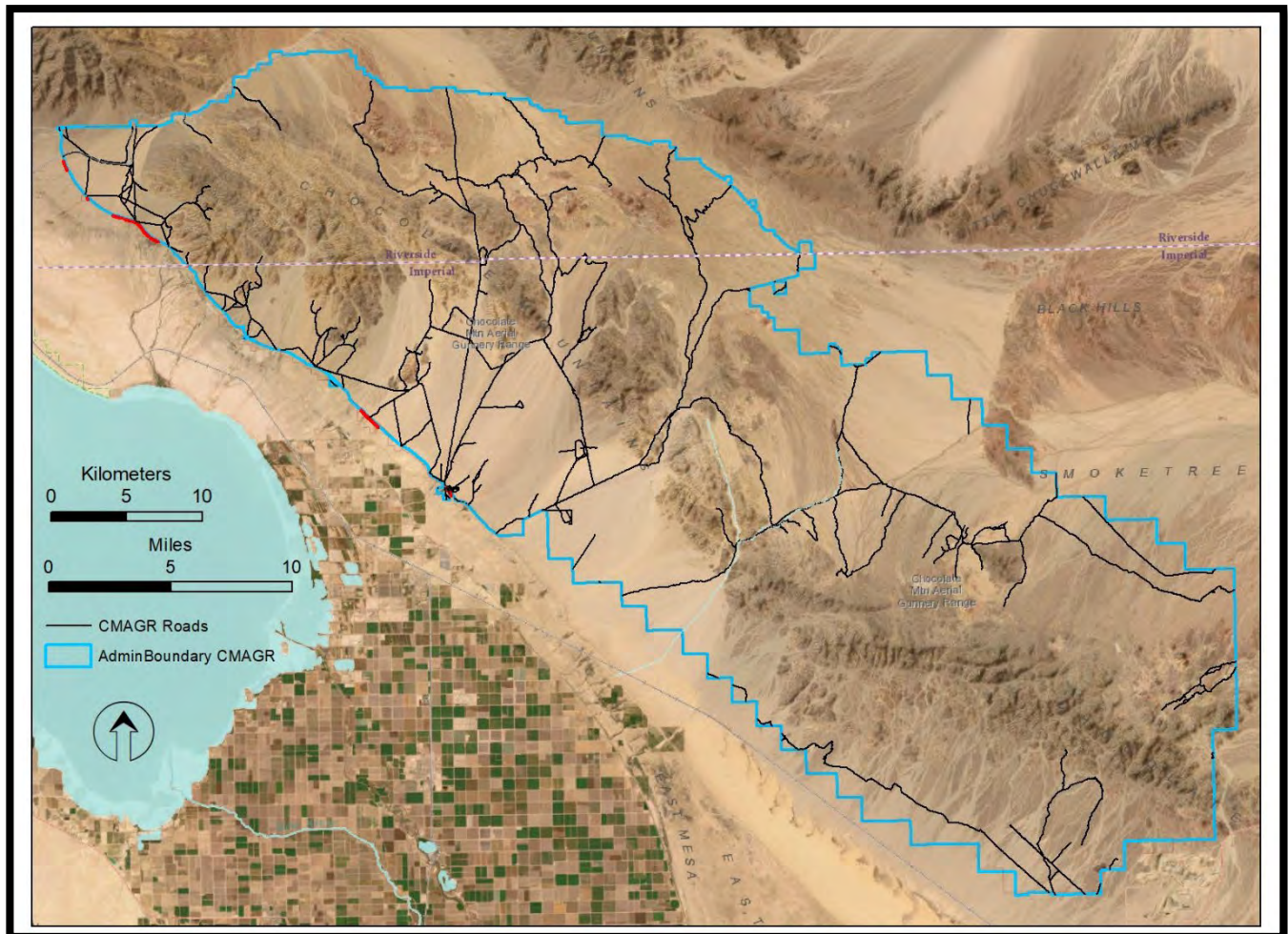
Major canals

Common name: Major Canal

Most similar or equivalent mapping unit on adjacent lands: Major Canals DRECP 9804

Most similar or equivalent NVC alliance: None

Acres (hectares) mapped on CMAGR: 49 (20)



Above: Distribution of **Major Canals** in red, scarcely visible along NW border of CMAGR between Salt Creek and Camp Billy Machen.

Description and setting: The “major canals’ in this case is the Coachella Canal. Only the current watery canal was mapped as a major canal, and not the parallel ditch of the old unlined canal. The latter was mapped as ‘human disturbance’.

Image identification: See below.



Above: The Coachella canal as mapped in red.

Mapping Units with a similar appearance on imagery: None

There was no attempt to document taxa for:

Major Canals

Number of Rapid Assessment Sites: 0

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit

Common name: Mud Hills

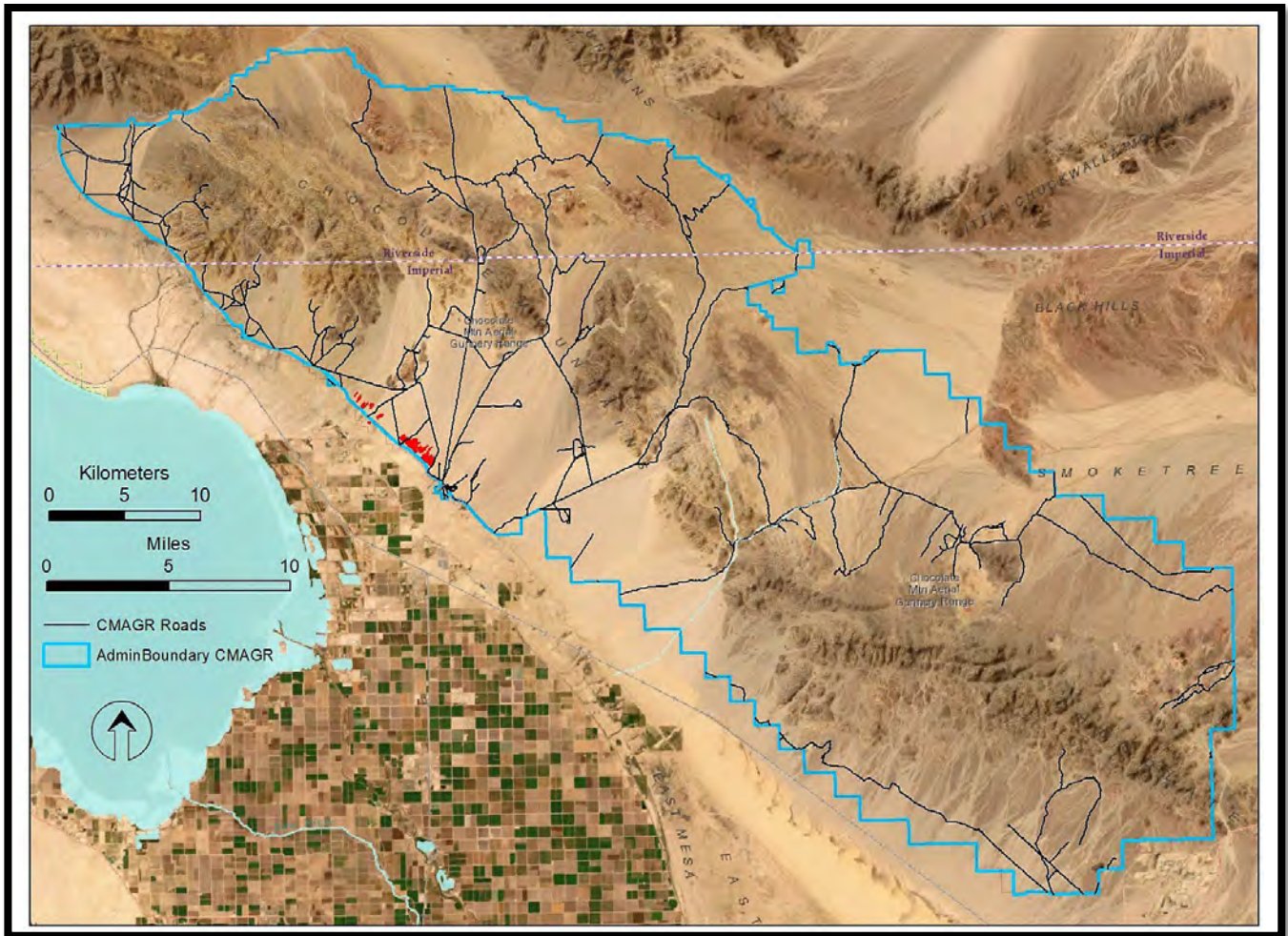
Most similar or equivalent mapping unit on adjacent lands: Mud Hills sparsely vegetated ephemeral herbs Mapping Unit DRECP 6113

Most similar or equivalent NVC alliance: None

Acres (hectares) mapped on CMAGR: 297 (120)



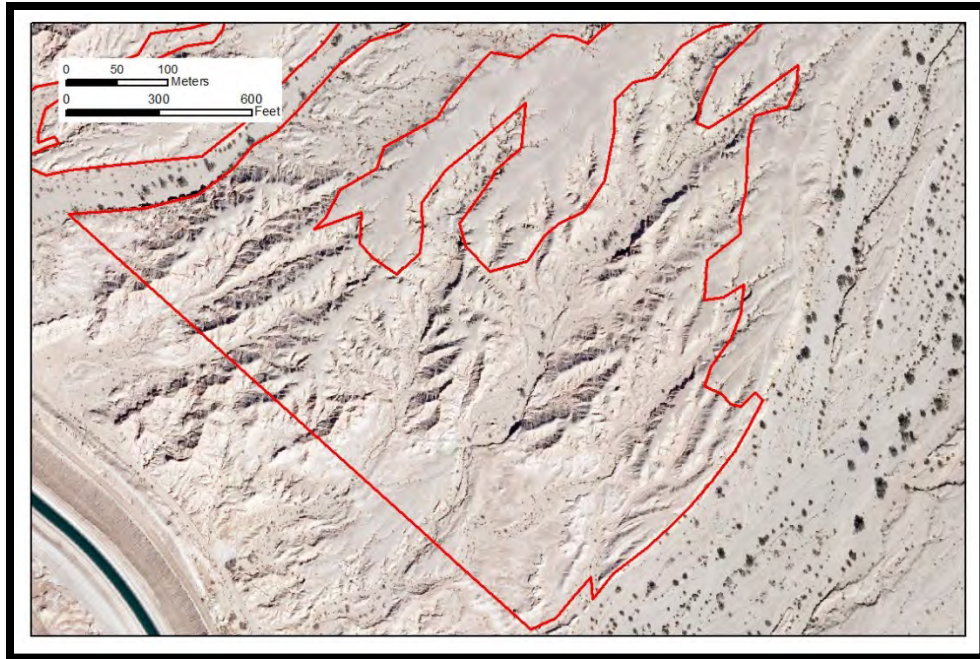
Above: *Atriplex canescens* (Four-winged saltbush) and *Suaeda nigra* (seablite) are the co-dominant species but neither exceeds 1 % cover over the mapping unit, which includes the eroded hills but not the more densely vegetated valley bottom. The latter was mapped as part of the *Suaeda moquinii* - *Atriplex canescens* Association. 100 ft (30 m), about a mile NW of Camp Billy Machen (RA plot W-5).



Above: Distribution of **Mud Hills sparsely vegetated ephemeral herbs Mapping Unit** in red.

Description and setting: The Mud Hills sparsely vegetated ephemeral herbs Mapping Unit are the ‘badlands’ of the CMAGR, an area of old lake sediments deeply eroded into nude hills and gullies. Two species, *Atriplex canescens* (Four-winged saltbush) and *Suaeda nigra* (seablite) were in both sample sites, but only the saltbush reached 1% cover. On less-saline soils within the unit, *Olneya tesota* and *Larrea tridentata* can be locally common.

Image identification: Landform was the signature. See gullies in image below.



Above: Mud Hills sparsely vegetated ephemeral herbs Mapping Unit, bounded by red lines. Flat barrens at middle top mapped as desert pavement. Straight line is the boundary with DRECP vegetation map.

Mapping Units with a similar appearance on imagery: This unit merges with the *Chorizanthe rigida* - *Geraea canescens* - *Olneya tesota* Association at its upper end. It was difficult to say where one mapping unit ended and the other began. See example photo below.



Above: An example of where the mud hills meet the desert pavements, on old lake sediments near the Coachella Canal. The example above was mapped as pavements, as it lacked saltbush and seablite (RA plot IW-9).

Table of all taxa in at least one sample site for:

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit

Number of Rapid Assessment Sites: 2

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Atriplex canescens</i> Four-winged saltbush	2	4 (4)	<1 (0-1)	0.8
<i>Suaeda nigra</i> Mojave seablite	2	4 (4)	<1 (0.2)	0.8
<i>Larrea tridentata</i> Creosote	1	2 (0-4)	<1 (0-1)	1.2
<i>Geraea canescens</i> Desert sunflower	1	1 (0-2)	<1 (0-0.2)	-
<i>Cylindropuntia echinocarpa</i> Silver cholla	1	1 (0-1)	<1 (0-0.11)	-
<i>Pleuraphis rigida</i> Big galleta grass	1	1 (0-1)	<1 (0-0.11)	-
<i>Olneya tesota</i> Ironwood	1	1 (0-2)	<1 (0-0.2)	-
<i>Ambrosia dumosa</i> White bursage	1	1 (0-4)	<1 (0-0.2)	0.5

North American warm desert bedrock cliff and outcrop Group

Common name: Cliffs and stone barrens

Most similar or equivalent mapping unit on adjacent lands: North American warm desert bedrock cliff and outcrop Group DRECP 6110

Most similar or equivalent NVC alliance: None

Acres (hectares) mapped on CMAGR: 6,042 (2,445)



Above: On this east-facing slope of shattered gneiss at 640 ft (195 m), no species manages to reach 1% cover. *Encelia farinosa* was the most common species but restricted mostly to northern aspects of this large polygon. Camera location about 2 miles N of Star FARP (RA plot MW-12).

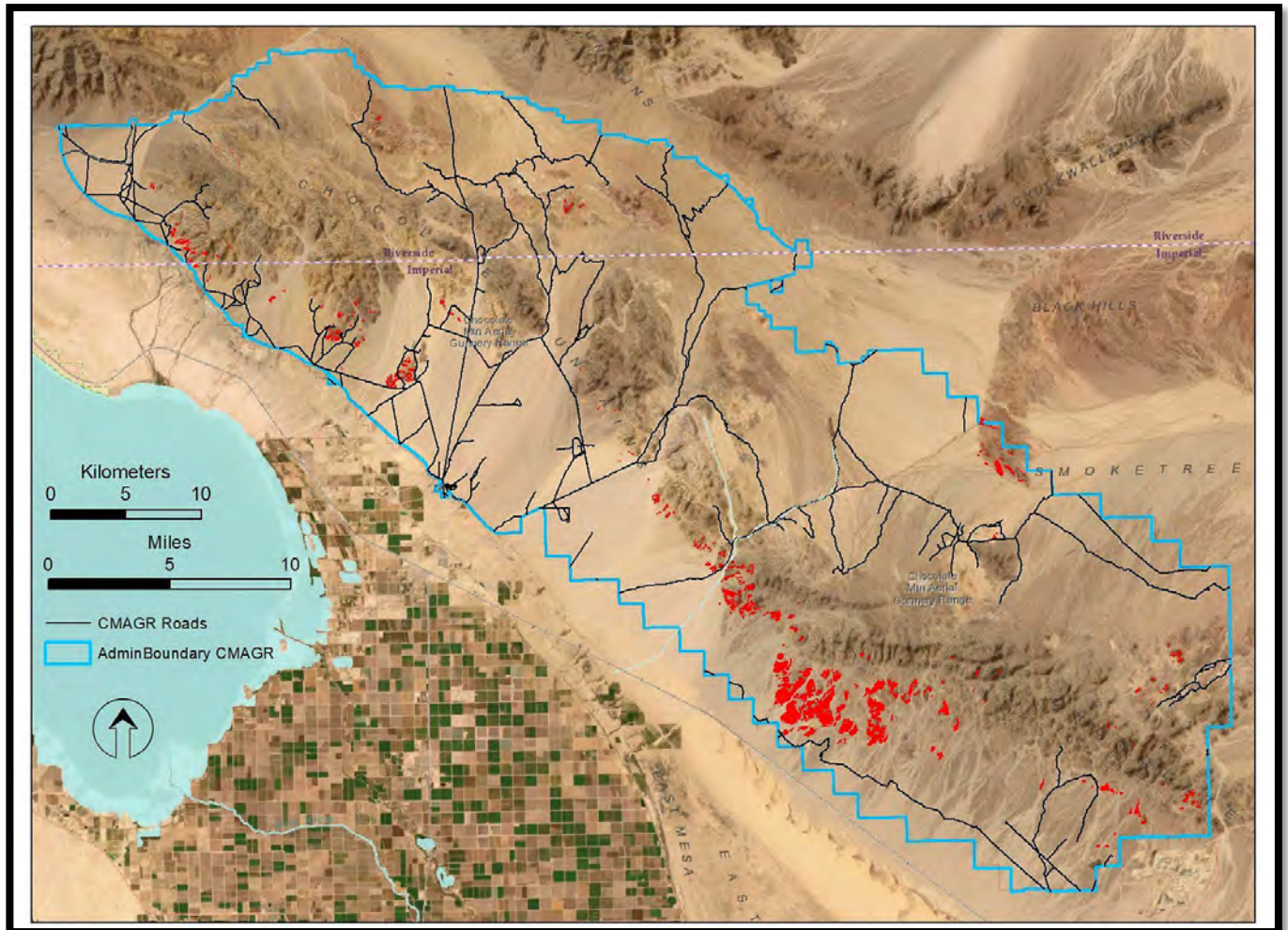


Above: Scattered *Larrea tridentata* give 1.3% cover to this rocky upper bajada at 300 ft (91 m) above the distant Salton Sea. *Fagonia pachyacantha* and *Encelia farinosa* were common associates but with cover <1% (RA plot FNW-14).



Above: Barren cliffs and talus about 1 mile NW of STAR FARP, at 345 ft (105 m), hold low densities of *Larrea tridentata*, *Ambrosia dumosa*, and *Encelia farinosa* (RA plot T-16).

FLORA AND VEGETATION OF THE CMAGR



Above: North American warm desert bedrock cliff and outcrop Group in red.

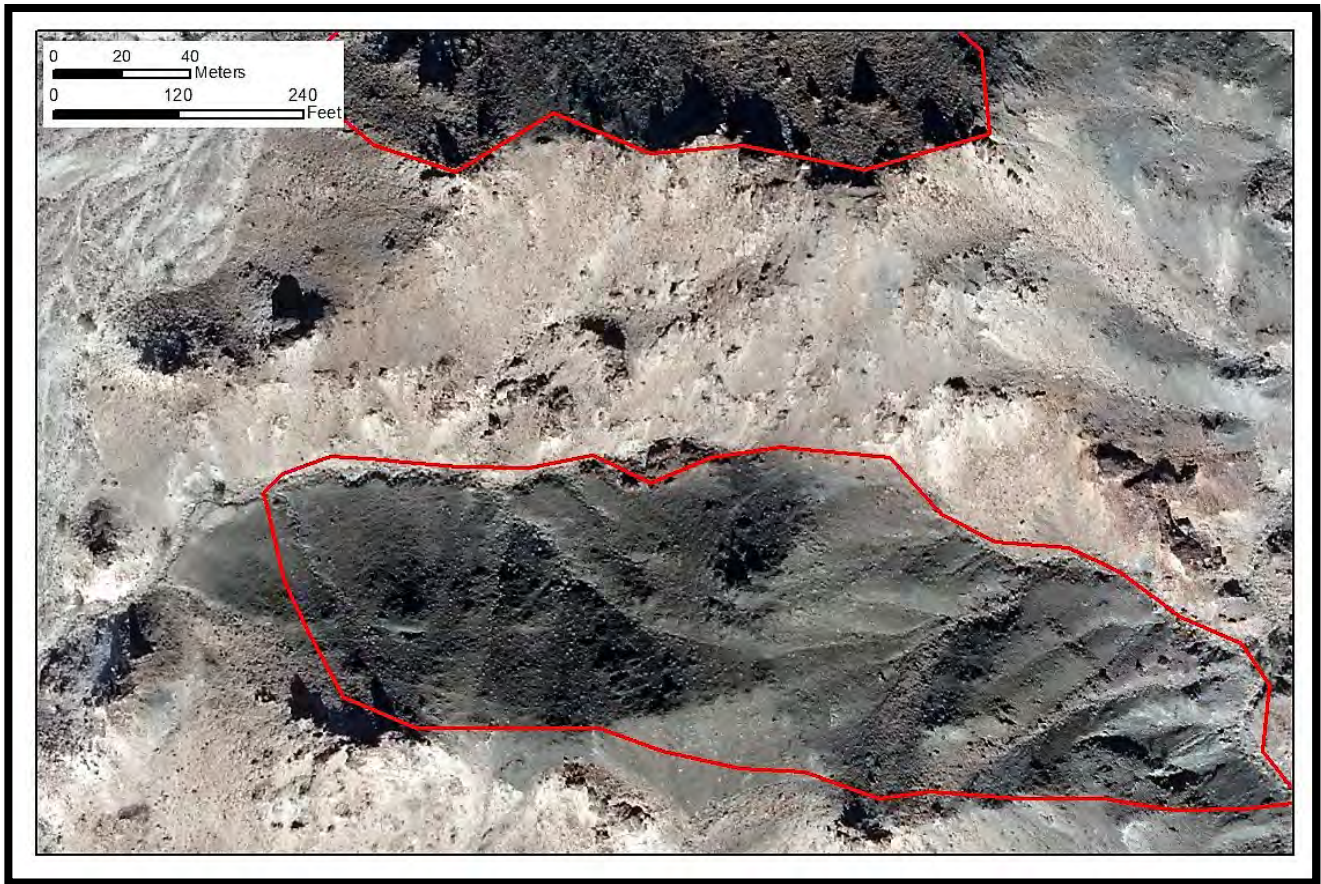
Description and setting: The North American warm desert bedrock cliff and outcrop Group holds <2% perennial vegetation. Three species were present at all four sample sites - *Larrea tridentata*, *Ambrosia dumosa*, and *Encelia farinosa*. None had a median cover over 1%. This unit was mapped largely along the south side of SMAGR, the hottest part, but there were a few exceptions on the north side, in the Little Mule Mts near Camp Burt, Sawtooth Mountain, and near Iris Pass. These were places of steep talus or simply bedrock. The unit was mapped at elevations from 200 to 2700 ft (61 – 823 m).



Above: A very steep talus slope and cliff near Iris Pass, showing the extent of the North American warm desert bedrock cliff and outcrop Group in red.

Image identification: The North American warm desert bedrock cliff and outcrop Group was identified by <2% cover of perennial species.

Mapping Units with a similar appearance on imagery: The North American warm desert bedrock cliff and outcrop Group is often bounded by the *Encelia farinosa* Alliance. If the sun angle is too high in the imagery, it can be difficult to make out the *Encelia farinosa*.



Above: The polygons are the *Encelia farinosa* Alliance, surrounded by the North American warm desert bedrock cliff and outcrop Group.

Table of all taxa for:

North American warm desert bedrock cliff and outcrop Group

Number of Rapid Assessment Sites: 4

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Encelia farinosa</i> Brittlebush	4	3 (3-5)	<1 (0.2)	0.5
<i>Larrea tridentata</i> Creosote	4	4.5 (2-5)	<1 (0.2-1.3)	1.0
<i>Ambrosia dumosa</i> White bursage	4	2.5 (1-4)	<1 (0.11-0.2)	0.4
<i>Fagonia laevis</i> California fagonbush	3	1.5 (0-4)	<1 (0-0.2)	0.2
<i>Brassica tournefortii</i> Sahara mustard	1	0 (0-3)	<1 (0-0.2)	-
<i>Chorizanthe rigida</i> Spineflower	1	0 (0-3)	<1 (0-0.2)	-
<i>Fagonia pachyacantha</i> Fagonbush	1	0 (0-3)	<1 (0-0.2)	0.3

***Parkinsonia florida* - *Olneya tesota* Alliance**

Common name: Blue palo verde and ironwood alliance

Most similar or equivalent mapping unit on adjacent lands: *Parkinsonia florida* - *Olneya tesota* Alliance DRECP 4227

Most similar or equivalent NVC alliance: *Parkinsonia florida* - *Olneya tesota* Alliance A0588

Acres (hectares) mapped on CMAGR: 44,825 (18,140)



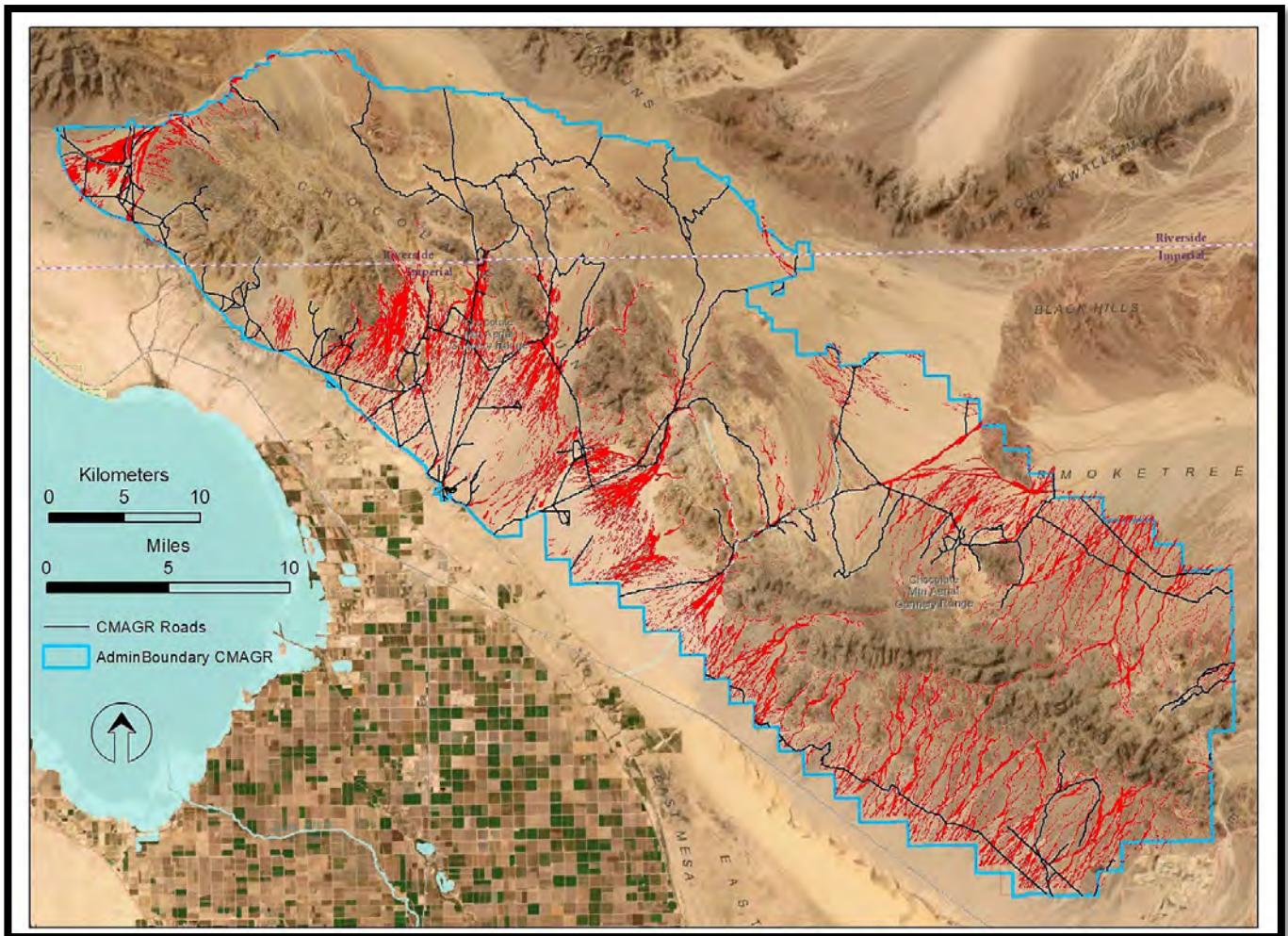
Above: A common expression of the *Parkinsonia florida* - *Olneya tesota* Alliance at 840 ft (256 m) at the mouth of Salvation Pass. *Parkinsonia florida* and *Olneya tesota* combine for 6% cover, and *Ambrosia salsola* adds another 3% (RA plot T-4). Algodones Dunes at left background.



Above: *Olneya tesota* is common along this narrow rocky watercourse, but *Hyptis emoryi* is the dominant. *Lycium andersonii* and *Ambrosia illicifolia* are also common. Just a few hundred meters upstream, the canyon narrows, *Olneya tesota* fades and *Nolina bigelovii* is common and this watercourse becomes the *Hyptis emoryi* – *Nolina bigelovii* association (RA plot LHM-8).



Above: At the lower end of the *Parkinsonia florida* – *Olneya tesota* Alliance, at 300 ft (91 m) about 6 miles SE of Camp Billy Machen. *Parkinsonia florida* and *Olneya tesota* for about 7% cover, with similar cover for *Larrea tridentata*, *Ambrosia dumosa*, and *Ambrosia salsola*. The left background was mapped as *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association.



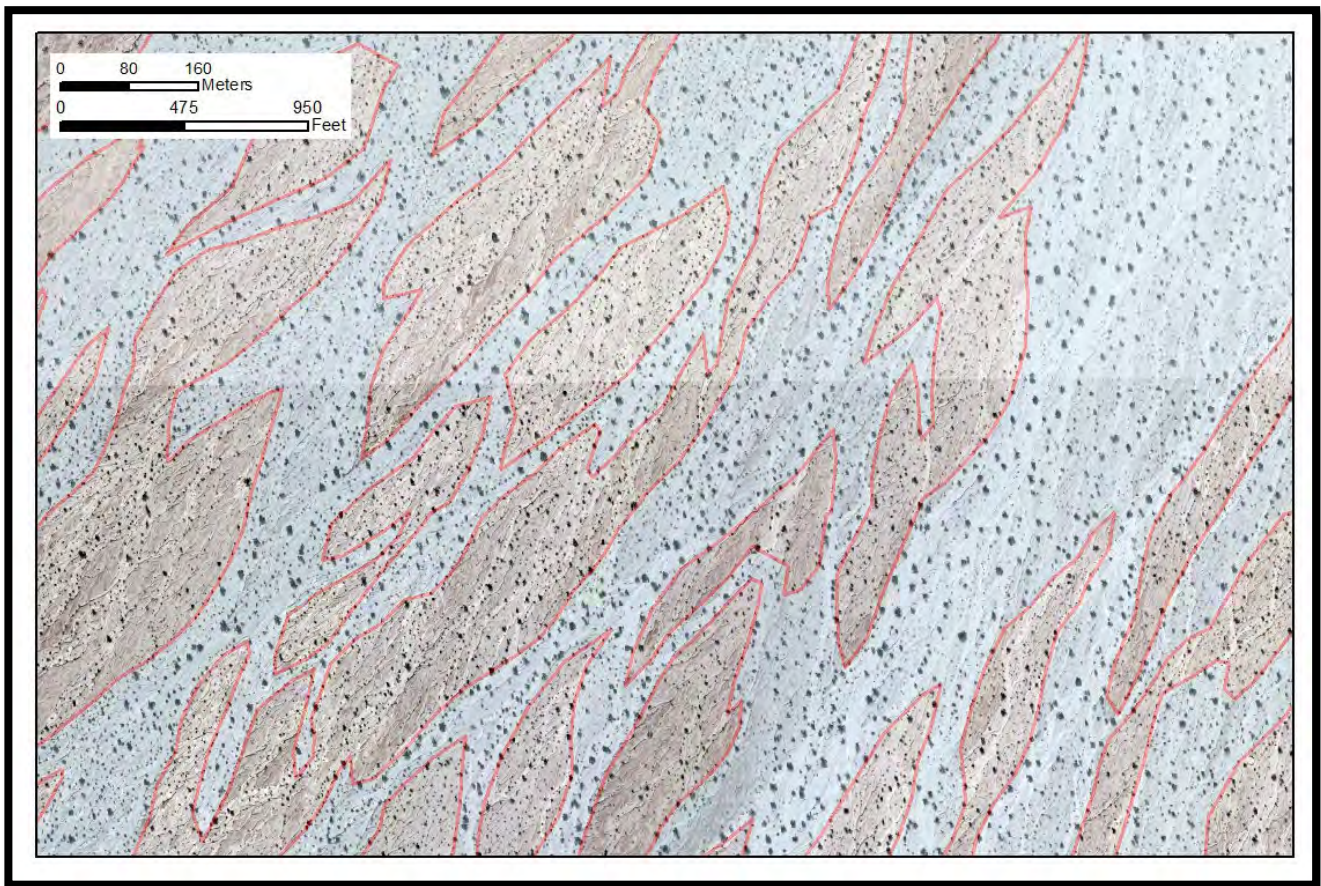
Above: *Parkinsonia florida* - *Olneya tesota* Alliance in red. Not shown is the *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association and the *Parkinsonia florida* association.

Description and setting: The *Parkinsonia florida* - *Olneya tesota* Alliance is distinguished by a greater than 3% cover of *Parkinsonia florida* and *Olneya tesota* AND give equal or greater cover than *Chilopsis linearis*, *Psoralea argophylla*, *Larrea tridentata* and *Psoralea schottii*. *Chilopsis linearis* and *Psoralea argophylla* each have their own associations. If the latter two species are more common, and *Olneya tesota* has at least 1% cover, it is mapped as the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association, a relatively xeric association. In contrast, the *Parkinsonia florida* - *Olneya tesota* Alliance hosts diverse xero-riparian species. Within the 20 sample sites, associates *Hyptis emoryi*, *Lycium andersonii*, and *Senecio greggii* all have a median cover >1%. There were 36 species that had at least 1% cover in at least one sample site. There were ten species that could be dominant or co-dominant, suggesting that this alliance holds several associations that could be mapped out with additional resources. For this study, we distinguished two associations within this alliance: the *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association and the *Parkinsonia florida* Association. Both are discussed in their respective mapping unit descriptions.

The *Parkinsonia florida* - *Olneya tesota* Alliance was mapped at elevations from 45 to 1900 ft (14 – 579 m). The *Parkinsonia florida* - *Olneya tesota* Alliance is absent from the NW quadrat of the CMAGR, likely due to freezes. More mysteriously, *Olneya tesota* is absent from a large area apparently suitable habitat between Salt Creek and Camp Billy Machen, where the only tree is *Parkinsonia florida*.

Image identification: The *Parkinsonia florida* - *Olneya tesota* Alliance was mapped by judging the density of dark dots that were presumably *Parkinsonia florida* or *Olneya tesota*. Active channels, as indicated by scoured substrates, are another good indicator of the alliance.

Mapping Units with a similar appearance on imagery: The *Parkinsonia florida* - *Olneya tesota* Alliance is most easily confused with the neighboring ***Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association**. The latter can also have >3% tree cover, but is distinguished by *Larrea tridentata* or *Psoralea schottii* having equal or greater cover than *Parkinsonia florida* or *Olneya tesota*. This is especially problematic when there are many ‘islands’ of areas with fewer trees between braided channels of the *Parkinsonia florida* - *Olneya tesota* Alliance. See example below.



Above: The blue polygons (color added) are the *Parkinsonia florida* - *Olneya tesota* Alliance, surrounded by either the *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association or the *Larrea tridentata* - *Ambrosia dumosa* alliance.

Table of all taxa that had at least 1% cover in at least one sample site for:
***Parkinsonia florida* - *Olneya tesota* Alliance**

Number of Rapid Assessment Sites: 20 (no species was in all 20)

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Olneya tesota</i> Desert ironwood	18	4 (0-5)	6.7 (0-33)	4.8
<i>Lycium andersonii</i> Water jacket	18	3 (0-4)	11 (0-36)	1.3
<i>Hyptis emoryi</i> Desert lavender	18	2.5 (0-5)	1.25 (0-51)	1.8
<i>Larrea tridentata</i> Creosote	18	2 (0-4)	0.2 (0-5)	1.5
<i>Parkinsonia florida</i> Blue paloverde	17	3 (0-4)	3.25 (0-27)	3.5
<i>Encelia farinosa</i> Brittlebush	16	2 (0-3)	<1 (0-4.7)	0.6
<i>Senegalia greggii</i> Catclaw acacia	15	3 (0-5)	1.6 (0-23)	2.0
<i>Ambrosia salsola</i> Cheesebush	15	2.5 (0-4)	<1 (0-8.3)	0.9
<i>Ambrosia dumosa</i> White bursage	11	0.5 (0-3)	<1 (0-3.3)	0.6
<i>Bebbia juncea</i> Sweetbush	10	1 (0-4)	<1 (0-20)	0.8
<i>Psoralea schottii</i> Schott's dalea	8	0 (0-8)	<1 (0-4.1)	1.3
<i>Krameria bicolor</i> White Ratany	8	0 (0-3)	<1 (0-5.2)	0.8
<i>Brassica tournefortii</i> Sahara mustard	7	0 (0-3)	<1 (0-13.3)	-
<i>Sphaeralcea ambigua</i> Desert globemallow	7	0 (0-3)	<1 (0-7)	0.8
<i>Stephanomeria pauciflora</i> Brownplume wirelettuce	7	0 (0-3)	<1 (0-5)	0.6
<i>Ditaxis lanceolata</i> Silverbush	6	0 (0-3)	<1 (0-8)	0.4
<i>Fagonia laevis</i> California fagonbush	6	0 (0-3)	<1 (0-4)	0.3
<i>Mirabilis bigelovii</i> Wishbone-bush	6	0 (0-3)	<1 (0-1)	-

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Psoralea argophylla</i> Smoketree	6	0 (0-3)	<1 (0-1)	2.2
<i>Cylindropuntia ramosissima</i> Diamond cholla	5	0 (0-3)	<1 (0-3)	-
<i>Funastrum hirtellum</i> Milkweed	5	0 (0-3)	<1 (0-3)	
<i>Brandegea bigelovii</i> Desert starvine	4	0 (0-4)	<1 (0-27)	-
<i>Adenophyllum porophylloides</i> San Felipe dogweed	4	0 (0-3)	<1 (0-1)	-
<i>Simmondsia chinensis</i> Jojoba	3	0 (0-3)	<1 (0-10)	1.5
<i>Pleuraphis rigida</i> Big galleta	3	0 (0-3)	<1 (0-6)	0.7
<i>Condalia globosa</i> Bittersweet snakeweed	3	0 (0-3)	<1 (0-22)	3.0
<i>Ziziphus obtusifolia</i> Lotebush	3	0 (0-2)	<1 (0-1.3)	-
<i>Funastrum cyanchoides</i> Milkweed	3	0 (0-2)	<1 (0-3)	-
<i>Calliandra eriophylla</i> Fairy duster	2	0 (0-3)	<1 (0-8.5)	0.7
<i>Euphorbia polycarpa</i> Spurge	2	0 (0-3)	<1 (0-1)	-
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	1	0 (0-4)	<1 (0-18)	1.4
<i>Phoradendron californicum</i> Mesquite mistletoe	1	0 (0-3)	<1 (0-1)	-
<i>Ambrosia ilicifolia</i> Hollyleaf bursage	1	0 (0-3)	<1 (0-20)	0.6
<i>Justicia californica</i> Beloperone	1	0 (0-3)	<1 (0-17)	1.1
<i>Porophyllum gracile</i> Odora	1	0 (0-2)	<1 (0-1.3)	-
<i>Prosopis glandulosa</i> Honey mesquite	1	0 (0-2)	<1 (0-3)	-

***Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association (provisional)**

Common name: Blue palo verde, ironwood, and Munz's cholla association

Most similar or equivalent mapping unit on adjacent lands: *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association NECO

Most similar or equivalent NVC alliance: *Parkinsonia florida* - *Olneya tesota* Alliance A0588

Acres (hectares) mapped on CMAGR: 9,753 (3,947)



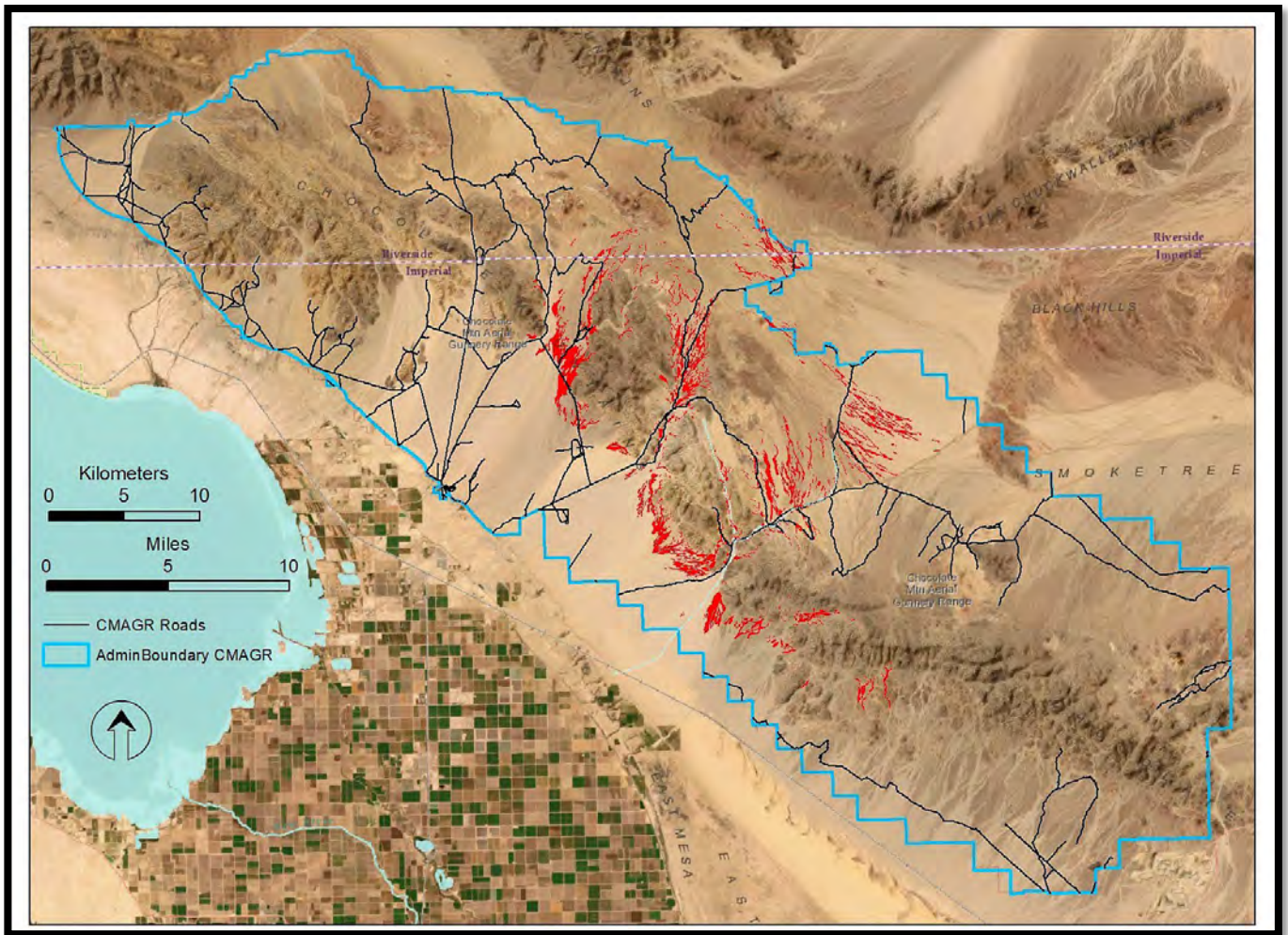
Above: *Cylindropuntia munzii*, *Olneya tesota*, and *Psoralea schottii* all have > 3% cover in this watercourse at 1400 ft (427 m) about ½ mile north of Beal Well in Salvation Pass. *Ambrosia salsola* and *Senecalia greggii* are the most common associates (RA plot LHM-23).



Above: Near the mouth of Salvation Pass, this vague watercourse/floodplain hosts six species that each have a least 3% cover: *Cylindropuntia munzii*, *Ambrosia salsola*, *Encelia farinosa*, *Olneya tesota*, *Hyptis emoryi*, and *Parkinsonia florida*. 720 ft (219 m) (RA plot T-10).



Above: *Olneya tesota*, *Cylindropuntia munzii* and *Larrea tridentata* each have 3% cover in this example of the *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association. Typical of this mapping unit, it's on an alluvial bench adjacent to a more active watercourse that was mapped as the *Parkinsonia florida* - *Olneya tesota* Alliance. Salvation Pass, 1080 ft (329 m) (RA plot LHM-13).



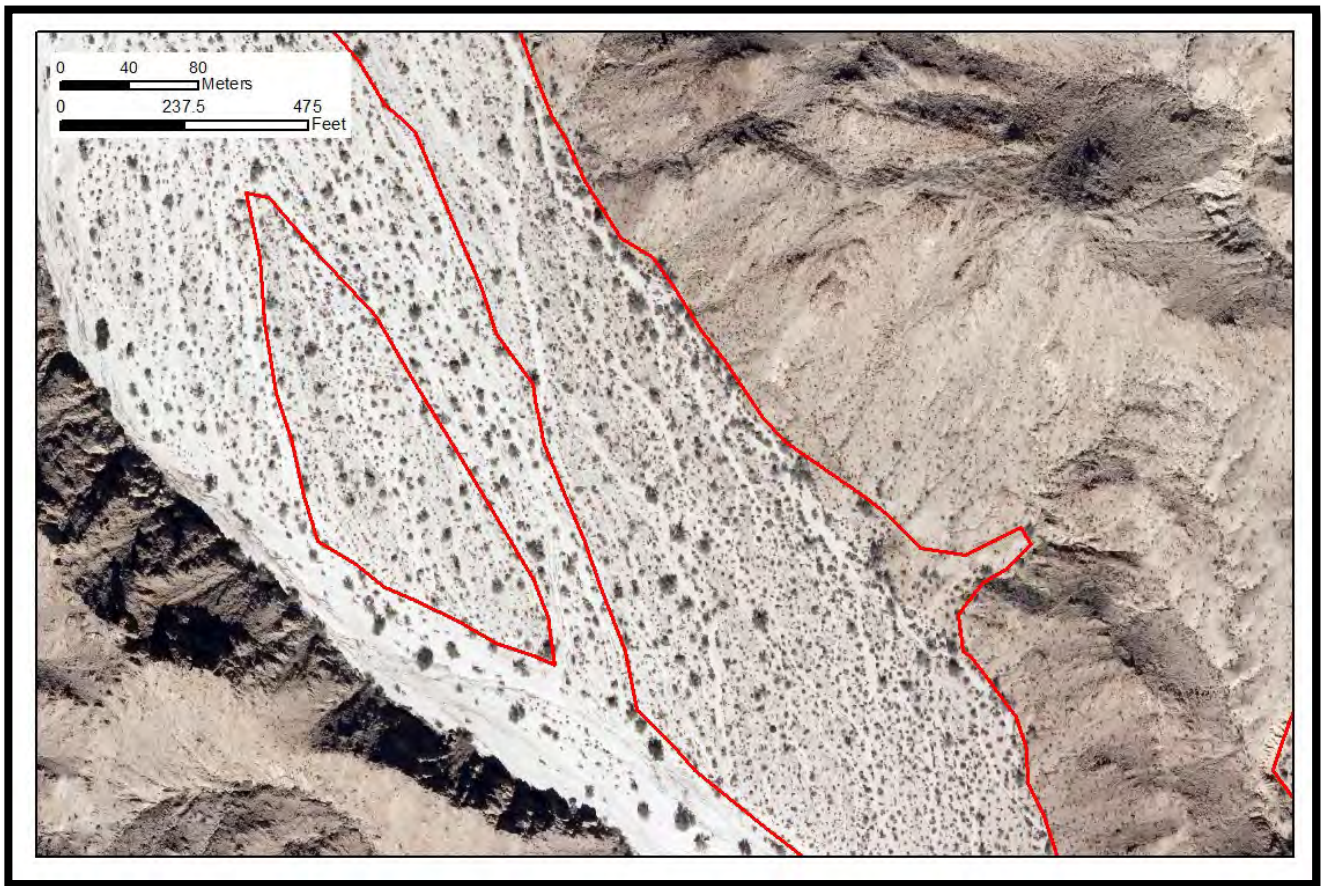
Above: *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association in red.

Description and setting: The *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association is distinguished by a greater than 3% cover of *Parkinsonia florida* and *Olneya tesota* AND *Cylindropuntia munzii* with at least 1% cover. It occurs on benches alongside active channels of *Parkinsonia florida* - *Olneya tesota* Alliance, where it appears infrequently flooding prevents broad establishment of the cholla. Similarly, it also occurs on broad deltaic floodplains where large watercourses exit the mountains and lose energy. See examples below.

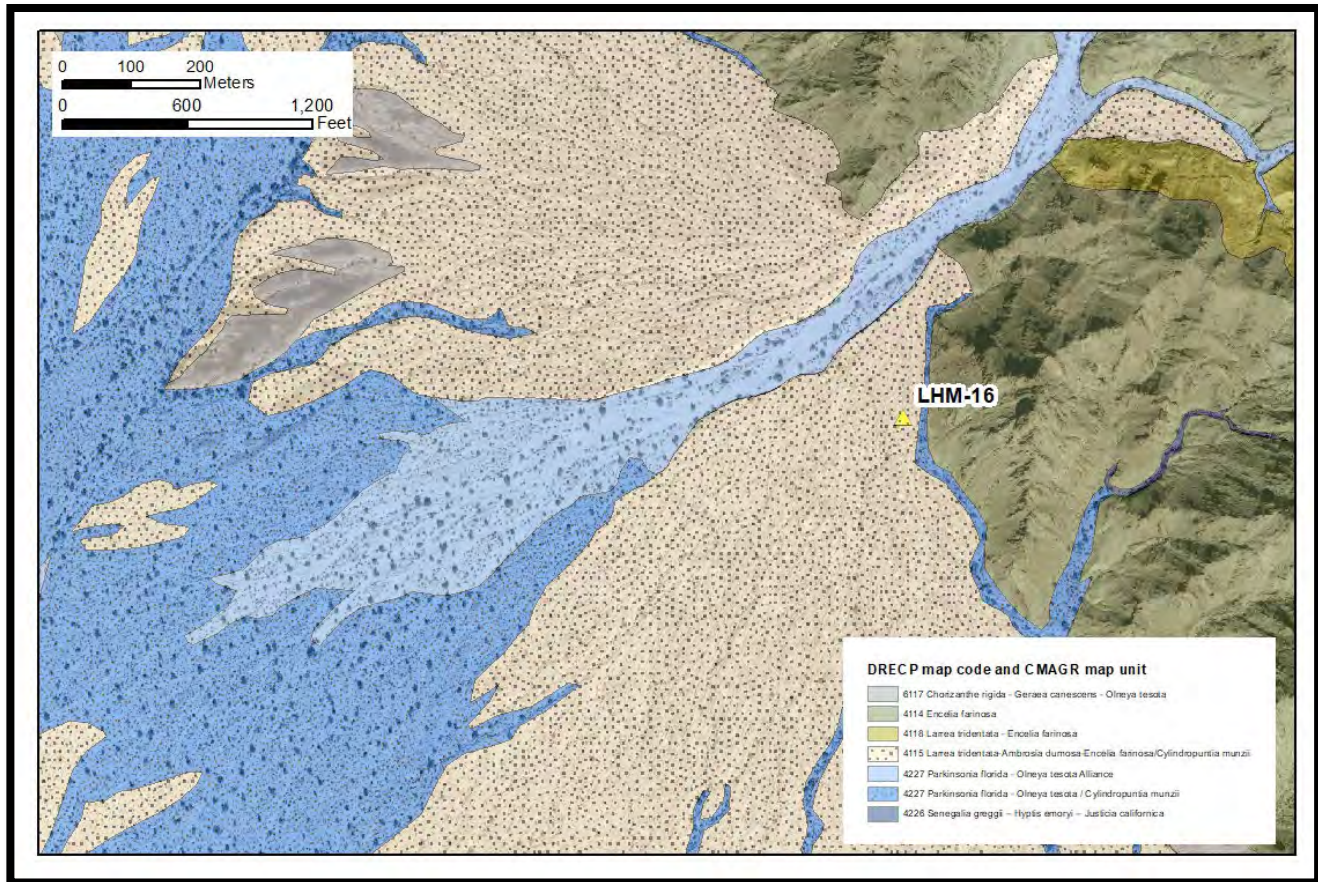
The *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association was mapped at elevations from 500 – 2430 ft (152 - 740 m), which is essentially the same as that of the *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association. This is not surprising because the latter usually borders the former. Both associations are restricted to the central CMAGR, suggesting that their presence on the range is relatively recent in evolutionary time, and they are expanding to similar habitat, a view supported by a recent plastome phylogeny of the *Cylindropuntia* (Majure et. al. 2019).

Image identification: The *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association was mapped by judging the density of large dark dots that were presumably *Parkinsonia florida* or *Olneya tesota*, and the presence of *Cylindropuntia munzii* at >1%. The latter can be detected by shadows. The *Cylindropuntia munzii* is especially tall in this association, averaging 1.8 m (5.9 ft), with many individuals 3 m (10 ft) tall.

Mapping Units with a similar appearance on imagery: The *Parkinsonia florida* - *Olneya tesota* Alliance borders this association, and estimating *Cylindropuntia munzii* cover is tricky where vegetation is dense and casting many shadows.



Above: The red polygons are the *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association, bordered by the *Parkinsonia florida* - *Olneya tesota* Alliance that lacks the cactus.



Above: An illustration of how *Cylindropuntia munzii* is distributed. The light blue *Parkinsonia florida* - *Olneya tesota* Alliance polygon fans out and into the darker blue *Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* Association. Both mapping units are flanked by the *Larrea tridentata* - *Ambrosia dumosa* - *Cylindropuntia munzii* Association, indicated by the polka-dotted polygon.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association**

Number of Rapid Assessment Sites: 4

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Cylindropuntia munzii</i> Munz's cholla	4	5 (3-5)	7 (3-9)	1.8
<i>Ambrosia salsola</i> Cheesebush	4	3 (3)	1.8 (0.2-7)	0.8
<i>Olneya tesota</i> Desert ironwood	4	3 (2-5)	3 (0.2-4)	4.3
<i>Parkinsonia florida</i> Blue paloverde	4	3 (2-3)	3 (0-3.7)	3.2
<i>Hyptis emoryi</i> Desert lavender	3	3 (0-3)	<1 (0-3)	1.6
<i>Larrea tridentata</i> Creosote	3	1.5 (0-3)	<1 (0-3)	1.2
<i>Senegalia greggii</i> Catclaw acacia	3	2 (0-3)	<1 (0-2.5)	1.7
<i>Encelia farinosa</i> Brittlebush	3	2 (0-3)	1 (0-5)	0.9
<i>Cylindropuntia bigelovii</i> Teddybear cholla	1	0 (0-2)	<1 (0-0.2)	0.9
<i>Psoralea schottii</i> Schott's dalea	2	1.5 (0-3)	<1 (0-3.3)	1.4
<i>Ambrosia dumosa</i> White bursage	2	1 (0-3)	<1 (0-1)	-
<i>Ziziphus obtusifolia</i> Lotebush	2	0.5 (0-2)	<1 (0-1.2)	1.6

***Parkinsonia florida* Association (provisional)**

Common name: Blue palo verde association

Most similar or equivalent mapping unit on adjacent lands: *Parkinsonia florida* Association NECO

Most similar or equivalent NVC alliance: *Parkinsonia florida* - *Olneya tesota* Alliance A0588

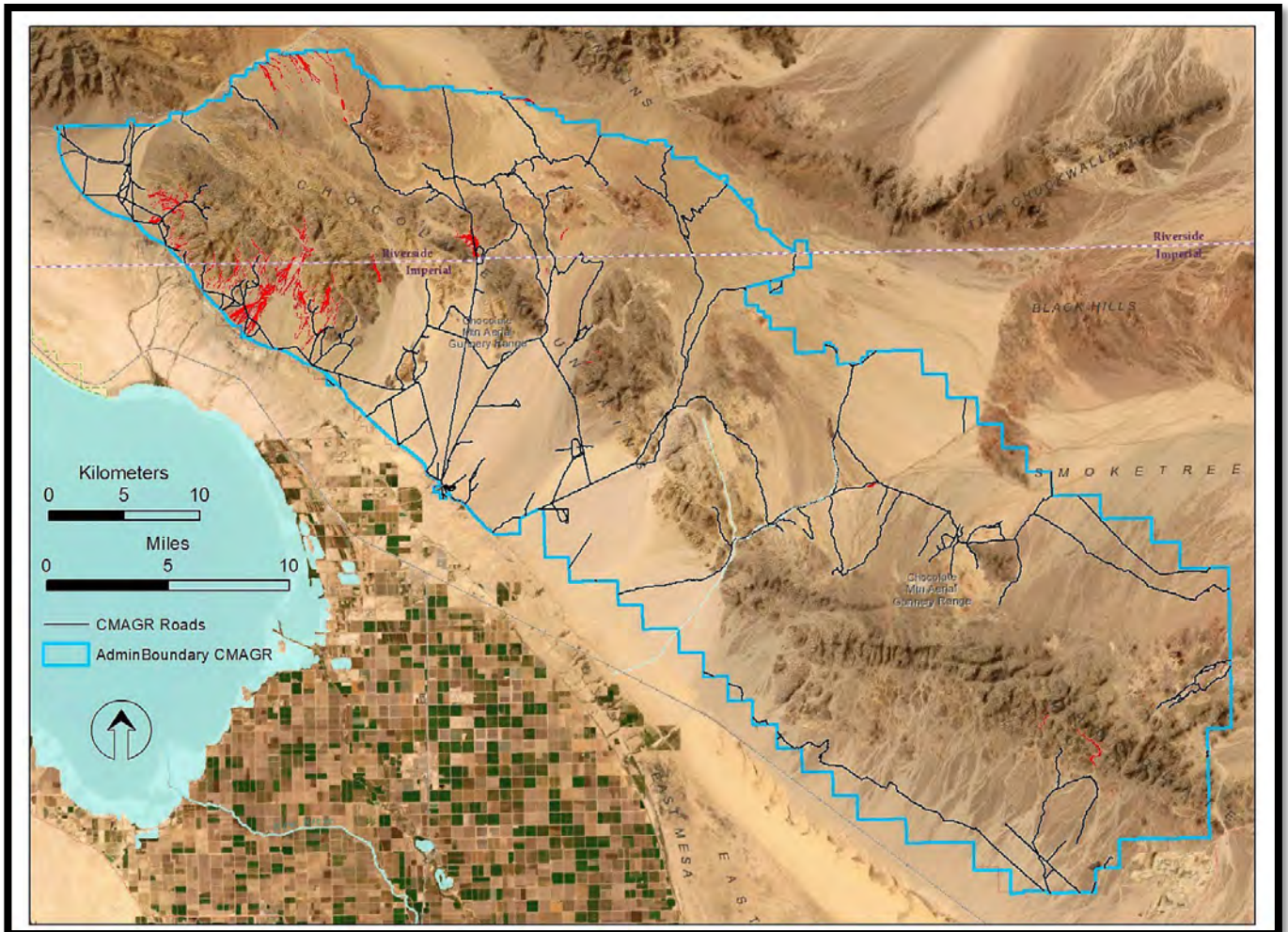
Acres (hectares) mapped on CMAGR: 3,324 (1,345)



Above: *Ambrosia salsola* is the dominant shrub with 8% cover, but *Parkinsonia florida* reaches the threshold 3% cover to place this sample site in the *Parkinsonia florida* Association about 1 mile SE of the junction of the Summit Road (Salt Creek) and the Bradshaw Trail. *Psoralea argophylla* and *Senecalia greggii* are common associates with 1 to 2% cover. 1600 ft (488 m) (RA plot EORC-18).



Above: *Encelia farinosa* is the dominant shrub with 6% cover, but *Parkinsonia florida* reaches the threshold 3% cover to place this sample site in the *Parkinsonia florida* Association along the CMAGR border just ½ mile north of Frink Hot Springs. *Ambrosia salsola*, *Psoralea schottii*, and *Larrea tridentata* are common associates with 1 to 3% cover. 100 ft (30 m) (RA plot FNW-13).



Above: *Parkinsonia florida* association in red.

Description and setting: The *Parkinsonia florida* association is distinguished by a greater than 3% cover of *Parkinsonia florida* and *Olneya tesota* either absent, rare, or uncommon. It's situated almost entirely in the northern CMA. The most common setting is elevations <1300 ft (300 m) on steep alluvial fans of 2 to 5 degrees slope between Salt Creek and Camp Billy Machen where it appears that *Olneya tesota* drops out due to a moisture deficit. It also occurs at elevations > 1300 ft in broad open watercourses draining into the upper reaches of Salt Creek at the NW corner of the CMA where it appears *Olneya tesota* drops out due to frost limits, because the *Parkinsonia florida* – *Olneya tesota* Alliance abuts its lower boundary.

In both settings, *Parkinsonia florida* barely musters a 3% median cover with an average height of 2.5 m, a full meter shorter than its 3.5 m average in the *Parkinsonia florida* – *Encelia farinosa* Alliance. *Lycium andersonii* is a dominant shrub in the *Parkinsonia florida* – *Encelia farinosa* Alliance with a median cover of 11% but is only present in 2 of 7 sample sites and never reaches 1% cover in the *Parkinsonia florida* association. The only common associate species with at least 1% median cover are *Senegalia greggii* and *Ambrosia salsola*.

Image identification: The *Parkinsonia florida* Association was mapped first by field surveys that identified areas lacking *Olneya tesota* (generally the only other species > 2 m stature), and then trying to figure out their respective signature on the images. Using Google Earth imagery of various dates between 2012 and 2017, this could be possible in some locations, due to the ‘greener’ appearance of *Parkinsonia florida*. But in general we relied on field surveys to determine areas where *Olneya tesota* was absent, and if trees >2m tall were present (and not *Chilopsis linearis* or *Psorothamnus spinosus*) at > 3% cover they were mapped as the *Parkinsonia florida* Association.

Mapping Units with a similar appearance on imagery: The *Parkinsonia florida* – *Olneya tesota* Alliance is easily confused with this association where it’s hard to identify the tree species. The ***Encelia farinosa* - *Larrea tridentata* - *Psorothamnus schottii* Association** often abutted the *Parkinsonia florida* association at elevations < 1300 feet, and because both associations have characteristic *Parkinsonia florida* it was a matter of estimating % cover.



Above: The red polygons are the *Parkinsonia florida* Association, bordered by ‘islands’ of the *Encelia farinosa* - *Larrea tridentata* - *Psorothamnus schottii* Association with fewer *Parkinsonia florida*. The straight lines are a levee built to divert flood flows to protect the Coachella Canal. Flow is from right to left in this image, and it is surprising how little difference the levee makes in this location, at least regarding the abundance of *Parkinsonia florida*. Either they are long lived (the levees were built in the 1940s) or they rely on subsurface water.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Parkinsonia florida* Association**

Number of Rapid Assessment Sites: 7

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Parkinsonia florida</i> Blue paloverde	7	3 (3-4)	3 (3-10)	2.5
<i>Senegalia greggii</i> Catclaw acacia	7	3 (1-5)	1 (0.11-7.5)	1.9
<i>Ambrosia salsola</i> Cheesebush	6	3 (0-5)	3 (0.2-12)	1.0
<i>Bebbia juncea</i> Sweetbush	6	3 (0-3)	<1 (0-2)	0.4
<i>Encelia farinosa</i> Brittlebush	5	2 (0-5)	<1 (0.2-6.2)	0.4
<i>Larrea tridentata</i> Creosote	5	2 (0-3)	<1 (0-5)	1.5
<i>Ambrosia dumosa</i> White bursage	3	0 (0-3)	<1 (0-2)	-
<i>Brassica tournefortii</i> Sahara mustard	3	0 (0-3)	<1 (0-15)	-
<i>Ephedra californica</i> California jointfir	3	0 (0-3)	<1 (0.11-5)	1.7
<i>Hyptis emoryi</i> Desert lavender	3	0 (0-3)	<1 (0-1.5)	1.7
<i>Krameria bicolor</i> White ratany	3	0 (0-3)	<1 (0-1)	-
<i>Psoralea schottii</i> Schott's dalea	3	0 (0-3)	<1 (0-1.2)	1.3
<i>Psoralea spinosa</i> Smoketree	3	0 (0-3)	<1 (0-1.5)	1.8
<i>Pleuraphis rigida</i> Big galleta	2	0 (0-4)	<1 (0-15)	0.9
<i>Isomeris arborea</i> Alkali goldenbush	2	0 (0-3)	<1 (0-2)	1.7
<i>Senna armata</i> Desert senna	2	0 (0-3)	<1 (0-7)	-

***Pleuraphis rigida* Alliance**

Common name: Big galleta grass alliance

Most similar or equivalent mapping unit on adjacent lands: *Pleuraphis rigida* Alliance DRECP 4122

Most similar or equivalent NVC alliance: *Pleuraphis rigida* Alliance A3170

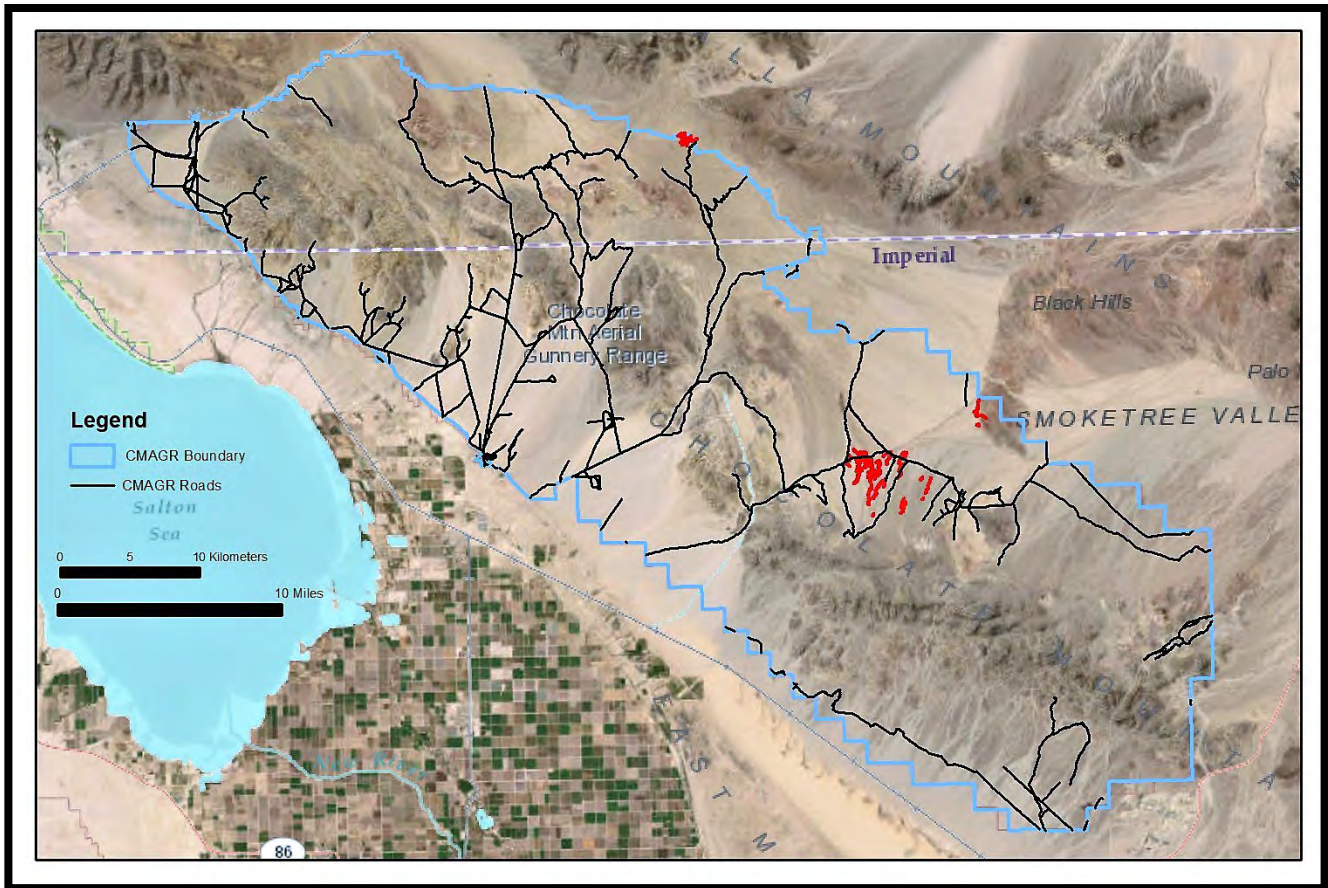
Acres (hectares) mapped on CMAGR: 188 (76)



Above: *Pleuraphis rigida* dominates this site at 2440 ft (744 m) along the Bradshaw Trail with an estimated 60% cover. *Yucca schidigera*, *Larrea tridentata*, *Krameria bicolor*, *Ziziphus obtusifolia*, and *Lycium brevipes* each add 2 to 5% cover. Site is on the divide between Salt Creek and Arroyo Seco watersheds (RA plot AP-20).



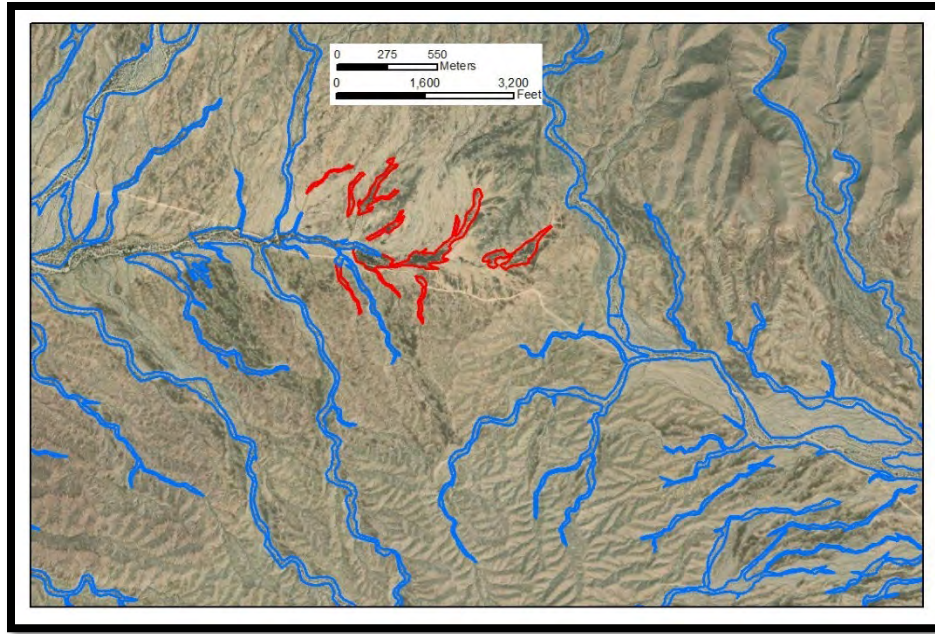
Above: *Pleuraphis rigida* with about 35% cover and another grass, *Aristida purpurea*, adding another 7% cover. The climbing milkweed, *Funastrum cynanchoides*, adds another 4%, as does desert straw, *Stephanomeria pauciflora*. Site is on the divide between Salvation Pass and Arroyo Seco watersheds. 1380 ft (421 m) (RA plot PW-3).



Above: *Pleuraphis rigida* Alliance in red. Extent of vegetation polygons exaggerated for visibility.

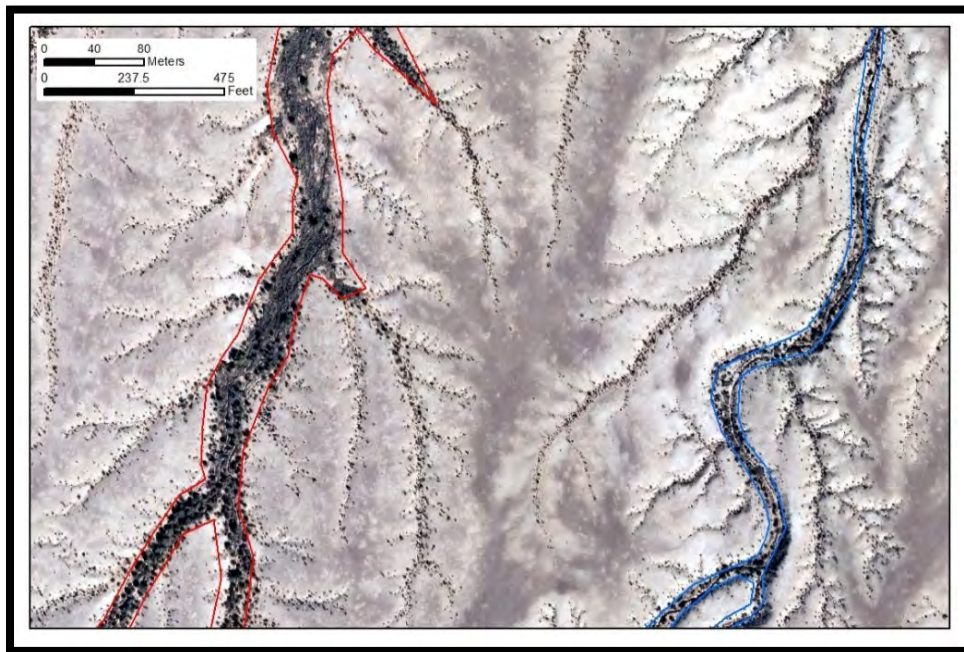
Description and setting: As can be seen in the example photos and data table, *Pleuraphis rigida* is the strong dominant in *Pleuraphis rigida* Alliance. *Larrea tridentata* and *Ambrosia dumosa* are common associates with uncommonly tall average heights: 2.0 m and 0.5 m respectively. Unusual associates include *Lycium brevipes* and *Sporobolus airoides*, with the latter unique to this alliance on the CMAGR. Also unusual: this alliance is found almost exclusively on major watershed divides. The example below is from the divide between Salt Creek and Arroyo Seco, which is the saddle between the Chocolate and the Chuckwalla Mts.

This alliance was mapped at elevations from 1150 to 2500 ft (351 – 762 m), exclusively on the north side of the CMAGR.



Above: The typical location for the *Pleuraphis rigida* Alliance (in red) is the divide between two watersheds, as can be seen by the blue polygons of the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance. The Bradshaw Trail can be seen running east-west through the image.

Image identification and Mapping Units with a similar appearance on imagery: The *Pleuraphis rigida* Alliance was mapped by vegetation density, as can be seen in the image below. This alliance abuts the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance, which is distinguished by a lower plant density.



Above: The red polygon is the *Pleuraphis rigida* Alliance, while the blue is *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Pleuraphis rigida* Alliance**

Number of Rapid Assessment Sites: 3

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Pleuraphis rigida</i> Big galleta	3	5 (5)	40 (35-60)	0.9
<i>Ambrosia dumosa</i> White bursage	3	3 (3)	2 (1-2)	0.5
<i>Larrea tridentata</i> Creosote	3	3 (3)	15 (5-19)	2.0
<i>Sphaeralcea ambigua</i> Desert globemallow	3	3 (3)	0.2 (0.2-2)	0.7
<i>Yucca schidigera</i> Mojave yucca	3	2 (2-3)	0.2 (0.2-3)	2.6
<i>Senegalia greggii</i> Catclaw acacia	2	3 (0-3)	3 (0-15)	2.0
<i>Lycium brevipes</i> Desert-thorn	2	3 (0-3)	2 (0-5)	1.0
<i>Krameria bicolor</i> White ratany	2	3 (0-3)	1 (0-3)	1.0
<i>Ephedra californica</i> California jointfir	2	3 (0-3)	1 (0-1)	-
<i>Lycium andersonii</i> Water jacket	2	3 (0-3)	1 (0-1)	1.1
<i>Stephanomeria pauciflora</i> Brownplume wirelettuce	2	2 (0-3)	0.2 (0-4)	-
<i>Ziziphus obtusifolia</i> Lotebush	2	0 (0-3)	<1 (0-2)	-
<i>Aristida purpurea</i> Purple threeawn	1	0 (0-3)	<1 (0-7)	0.6
<i>Funastrum cynanchoides</i> Milkweed	1	0 (0-3)	<1 (0-4)	-
<i>Encelia frutescens</i> Button brittlebush	1	0 (0-3)	<1 (0-3)	-
<i>Prosopis glandulosa</i> Honey mesquite	1	0 (0-3)	<1 (0-2)	4.5
<i>Sporobolus airoides</i> Alkali sacaton	1	0 (0-3)	<1 (0-10)	1.2

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Krameria erecta</i> Littleleaf ratany	1	0 (0-3)	<1 (0-1)	-
<i>Parkinsonia florida</i> Blue paloverde	1	0 (0-2)	<1 (0-1)	-

***Prosopis glandulosa* Association**

Common name: Honey mesquite association

Most similar or equivalent mapping unit on adjacent lands: *Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens* Alliance DRECP 4222

Most similar or equivalent NVC alliance: *Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens* Alliance A3877

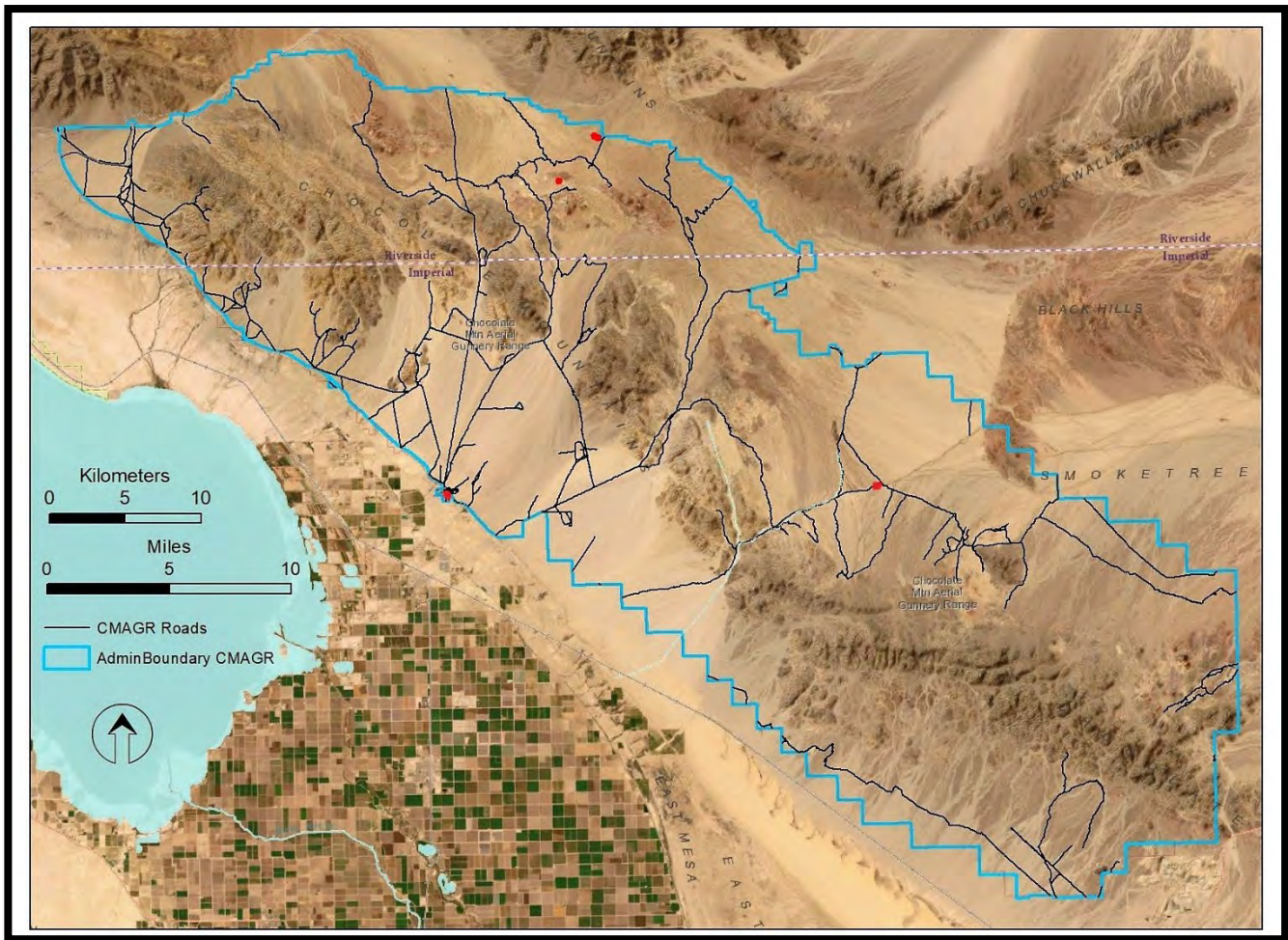
Acres (hectares) mapped on CMAGR: 5 (2)



Above: *Prosopis glandulosa* has an estimated 70% cover in this thicket at 95 ft (29 m) just south of Camp Billy Machen, where the Coachella Canal has blocked natural drainage. *Olnya tesota* is a common associate, though not visible, with 15% cover (RA plot IW-10).



Above: A 'natural' occurrence of the *Prosopis glandulosa* Association, at the head of Arroyo Seco at 1350 ft (411 m). Here the mesquite dominates the banks with >80% cover. *Lycium andersonii* is common in the understory, but no other species exceeded 1 % cover, an odd lack of diversity (RA plot PW-2).



Above: *Prosopis glandulosa* Association in red. Extent of the 4 vegetation polygons exaggerated for visibility.

Description and setting: *Prosopis glandulosa* was recorded at 12 sample sites, yet in only four locations was it common enough to be mapped as the *Prosopis glandulosa* Association, where *Prosopis glandulosa* has > 25% cover and is dominant or codominant. One of the sites is the result of human disturbances causing pooling of water, and the other 3 are where *Prosopis glandulosa* dominates a natural stream bank. This association was mapped at elevations from 90 to 2400 ft (27 – 732 m), with no apparent pattern of distribution.



Above: The *Prosopis glandulosa* Association (in red) near Camp Billy Machen in a depression modified by human activity. The dense vegetation to the north is mostly *Tamarix*.

Image identification and Mapping Units with a similar appearance on imagery: All mapped locations were those discovered in the field because the *Prosopis glandulosa* Association could not be reliably distinguished from the *Parkinsonia florida* – *Olneya tesota* alliance on imagery.



Above: The red polygon is the *Prosopis glandulosa* Association, below a small gorge in white rhyolite near Iris Pass.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Prosopis glandulosa* Association**

Number of Rapid Assessment Sites: 3

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Prosopis glandulosa</i> Honey mesquite	3	5 (4-5)	70 (20-83)	3.4
<i>Olneya tesota</i> Desert ironwood	2	3 (0-3)	10 (0-15)	6.0
<i>Tamaris ramosissima</i> Salt-cedar	2	2 (0-4)	<1 (0.2-20)	-
<i>Parkinsonia florida</i> Blue paloverde	2	1 (0-4)	0.11 (0-20)	-
<i>Lycium andersonii</i> Water jacket	1	0 (0-3)	<1 (0-34)	1.5
<i>Brassica tournefortii</i> Sahara mustard	1	0 (0-3)	<1 (0-1)	-
<i>Larrea tridentata</i> Creosote	1	0 (0-3)	<1 (0-1)	-

***Psorothamnus spinosus* Association**

Common name: Smoketree association

Most similar or equivalent mapping unit on adjacent lands: *Psorothamnus spinosus* Association
DRECP 4225

Most similar or equivalent NVC alliance: *Chilopsis linearis* - *Psorothamnus spinosus* Alliance A1044

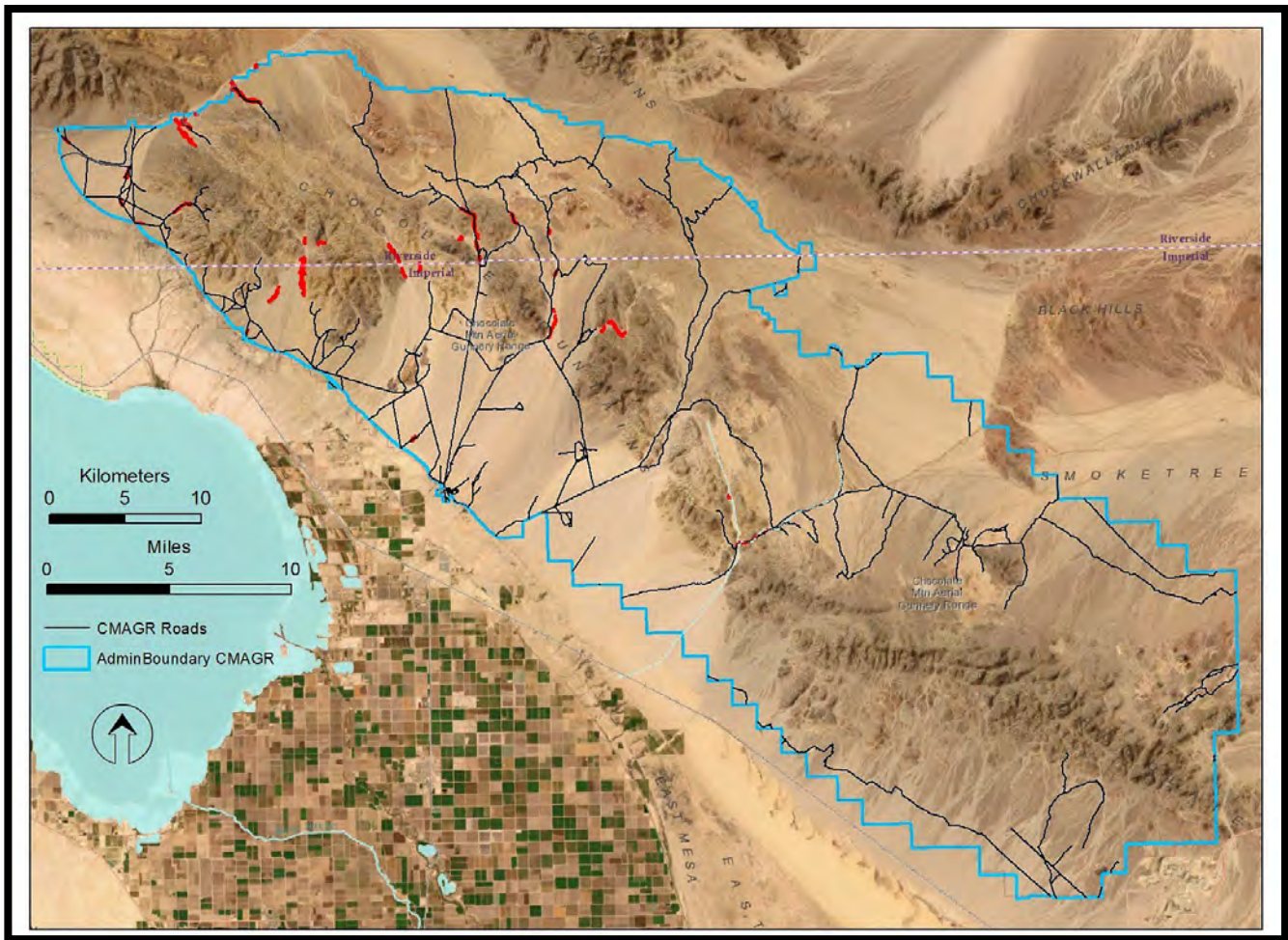
Acres (hectares) mapped on CMAGR: 403 (163)



Above: *Psorothamnus spinosus* has an estimated 15% cover on this steep braided watercourse at 1050 ft (317 m) on a bajada one mile south of the Salt Creek rail trestle. *Parkinsonia florida*, *Hyptis emoryi*, *Ambrosia salsola*, and *Bebbia juncea* each add 5 to 15% cover (RA plot RC-4).



Above: *Hyptis emoryi* and *Ambrosia salsola* are more common than *Psorothamnus spinosus* at along this wash at 1780 ft (543 m) near the Gas Line Road, yet it was mapped as part of the *Psorothamnus spinosus* Association because the *Psorothamnus spinosus* cover (3%) was greater than other 'trees', which for this study were *Parkinsonia florida*, *Olneya tesota*, and *Chilopsis linearis* (RA plot IP-22).



Above: *Psorothamnus spinosus* Association in red. Extent of the vegetation polygons exaggerated for visibility.

Description and setting: The *Psorothamnus spinosus* Association occupies high-energy watercourses, which might explain its setting in the north end of the CMAGR, where the gradient is steeper and there is more rain. *Psorothamnus spinosus* shares these watercourses with other flood adapted species, most commonly *Ambrosia salsola* and *Hyptis emoryi*. These two species are generally considered shrubs, but our samples showed *Hyptis emoryi* to be 0.5 m taller than *Psorothamnus spinosus* on average. Nevertheless, we mapped areas as the *Psorothamnus spinosus* Association based on our reading of the membership rule for the *Psorothamnus spinosus* Association, (according to the California Manual of vegetation): “*Psorothamnus spinosus* > 2% absolute cover in the small tree or tall shrub canopy and dominant in the overstory; smaller shrubs such as *Ambrosia salsola* or *Larrea tridentata* may have up to two times the cover of the *Psorothamnus*”.

Despite our broad interpretation of the membership rule, and despite the fact that *Psorothamnus spinosus* was a common species on the CMAGR (recorded at 26 of our samples), only 403 acres were mapped, all between the elevations of 80 to 2040 ft (24 – 622 m).

Image identification: *Psorothamnus spinosus* over 2 m tall cast a distinctive spiky shadow. This was easiest to see on the Google Earth imagery from 2012.

Mapping Units with a similar appearance on imagery: The *Ambrosia salsola* – *Psorothamnus schottii* association also occupies high-energy watercourses, and tall *Psorothamnus schottii* can appear much like *Psorothamnus spinosus*.



Above: The *Psorothamnus spinosus* Association (in red) along the scoured channel. The *Parkinsonia florida* association is to the left.



Above: Google Earth 2012 imagery zoomed in on the lower half of the example above, illustrating the spiky signature of *Psorothamnus spinosus* along the scoured watercourse on the right.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Psorothamnus spinosus* Association**

Number of Rapid Assessment Sites: 3

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Psorothamnus spinosus</i> Smoketree	3	4 (3-5)	11.7 (3-15)	1.8
<i>Ambrosia salsola</i> Cheesebush	3	3 (1-3)	5 (0.11-5)	1.1
<i>Hyptis emoryi</i> Desert lavender	3	3 (3-5)	2 (1.3-15)	2.3
<i>Parkinsonia florida</i> Blue paloverde	3	3 (3)	2 (0.2-10)	4.2
<i>Senegalia greggii</i> Catclaw acacia	3	3 (3)	2 (0.2-3)	-
<i>Bebbia juncea</i> Sweetbush	2	2 (0-4)	<1 (0-15)	0.7
<i>Encelia farinosa</i> Brittlebush	2	2 (0-2)	<1 (0-0.2)	-
<i>Lycium andersonii</i> Water jacket	1	0 (0-3)	<1 (0-4)	1.3
<i>Brassica tournefortii</i> Sahara mustard	1	0 (0-3)	<1 (0-1)	-
<i>Krameria bicolor</i> White Ratany	1	0 (0-3)	<1 (0-1)	-

***Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance**

Common name: Catclaw – desert lavender – chuparosa alliance

Most similar or equivalent mapping unit on adjacent lands: *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance DRECP 4226

Most similar or equivalent NVC alliance: *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance A4187

Acres (hectares) mapped on CMAGR: 10,037 (4,062)



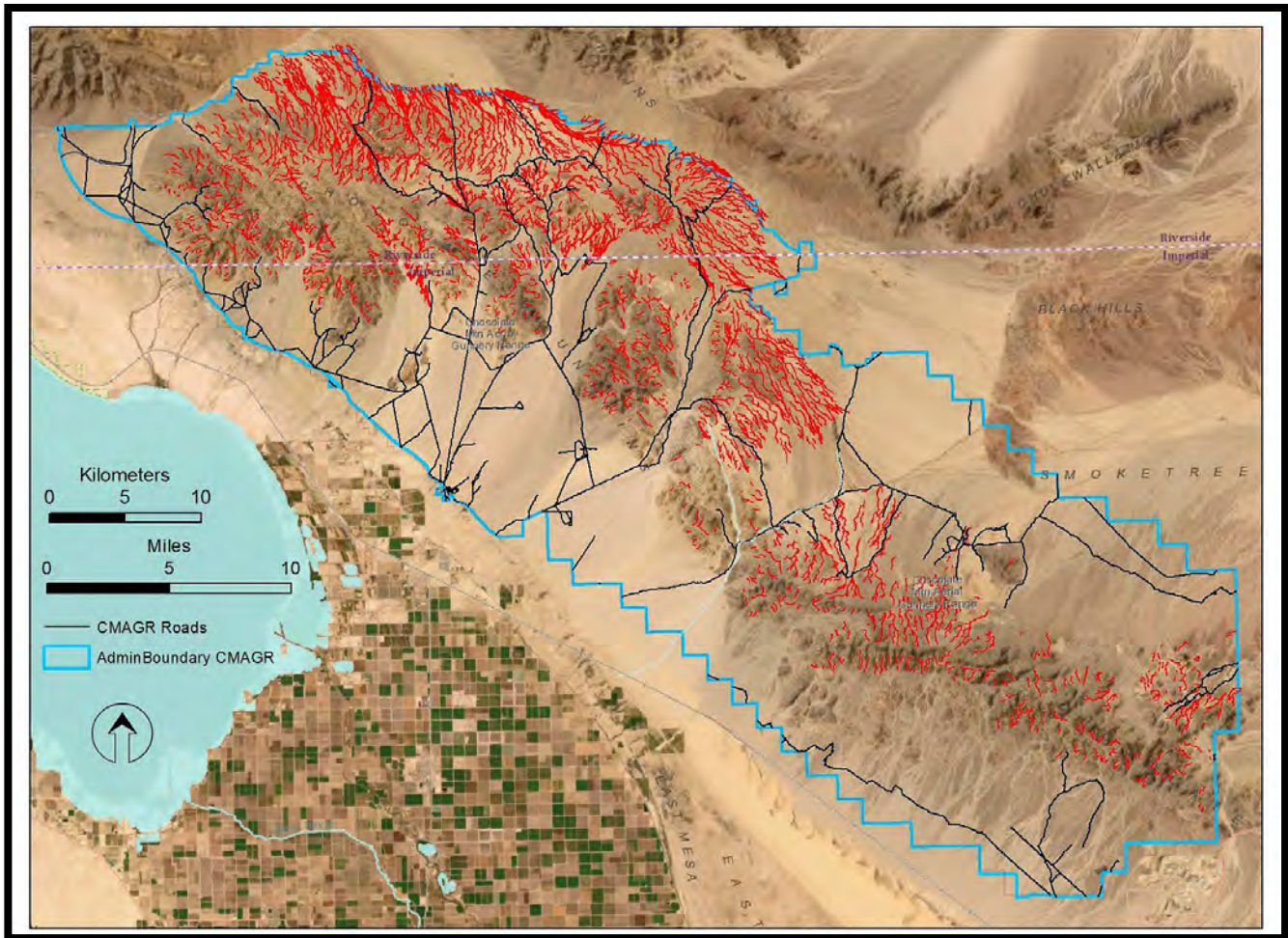
Above: *Senegalia greggii* is codominant in this watercourse, along with *Ambrosia salsola*, *Lycium andersonii*, and *Senna armata*, each with around 8% cover. *Hyptis emoryi* is absent from this location at 2085 ft (636 m) near the intersection of the Gas Line Road and the Bradshaw Trail (RA plot RCC-7).



Above: At the low end of the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance at 1260 ft (384 m), *Hyptis emoryi* (tall shrub, middle background) is dominant, with common associates *Senegalia greggii*, *Encelia farinosa*, and *Bebbia juncea*. *Parkinsonia florida* is common but with less than 2% cover. Site is 5 miles SW of Mt. Barrow (RA plot BM-6).



Above: *Hyptis emoryi*, with 20% cover, dominates the center background of this narrow rocky watercourse near the Gas Line Road at 1905 ft (581 m). On the right bank are the two most common associates, *Senegalia greggii* and *Tetracoccus hallii* (RA plot IP-26).



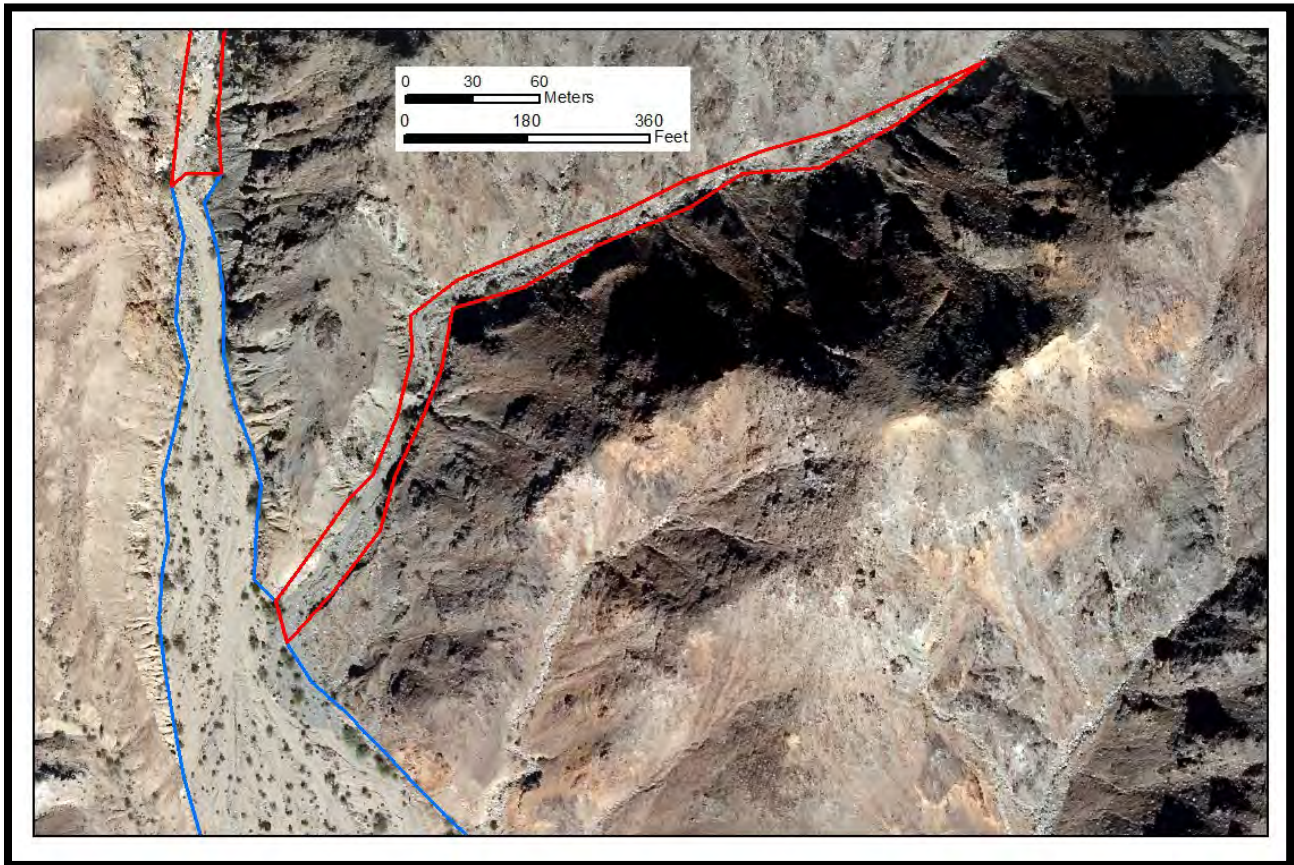
Above: *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance in red. Extent of the vegetation polygons exaggerated for visibility.

Description and setting: The *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance is widespread in the CMA in part because of its broad membership rules for this study. It encompasses all watercourses that lack threshold values of desert willow (*Chilopsis linearis*), smoketree (*Psoralea arguta*), *Nolina bigelovii*, and paloverde/ironwood (*Parkinsonia florida* and/or *Olneya tesota*). Among the 16 sample sites, *Senegalia greggii* had a 8% median cover value, and *Hyptis emoryi* was at 9%. No other species had a median cover greater than 1%, yet 8 other species could be dominant or codominant at any single location.

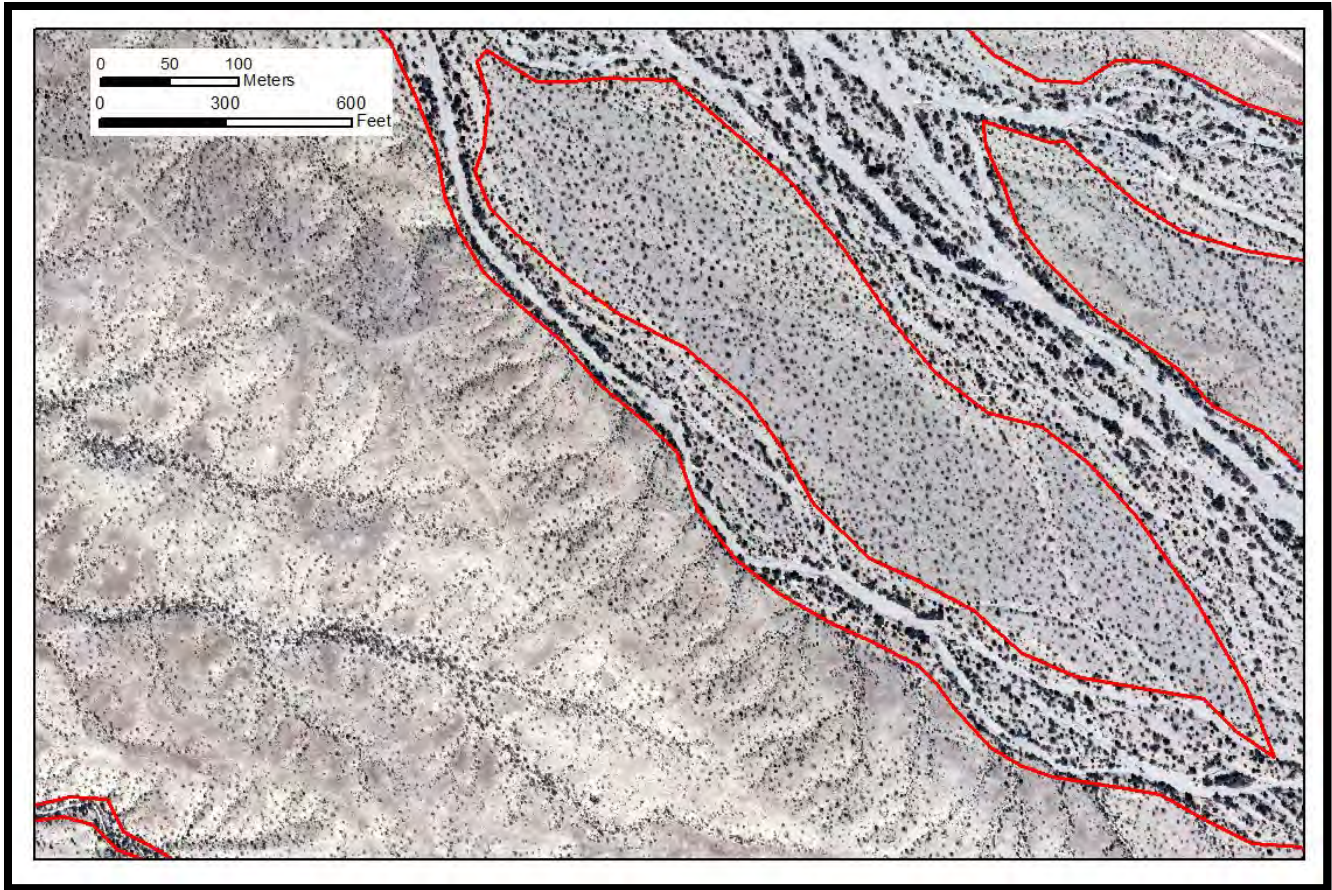
This alliance was mapped from 300 to 2800 ft (91 – 853 m). At lower elevations along the south slope of the CMA mapped areas are typically dominated by *Hyptis emoryi* in steep rubble chutes leading down to the *Parkinsonia florida* – *Olneya tesota* Alliance. A similar vegetation occurs in the mountains on the Barry M. Goldwater Range in SW Arizona (Malusa and Sundt 2015). At higher elevations on the north side of the CMA the vegetation is typically dominated by *Senegalia greggii*.

Image identification: At lower elevations the key was *Olneya tesota* and *Parkinsonia florida* cover < 3%, as shown in the example below. At higher elevations, the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance often occurs as a braided watercourse on flatter terrain. See example below.

Mapping Units with a similar appearance on imagery: The *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance has *Yucca schidigera* in 7 of 16 samples, and it can be difficult to decide where to draw the line between this alliance and the *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association.



Above: The red polygons are the *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* alliance, while the blue polygon is the *Parkinsonia florida* – *Olneya tesota* alliance.



Above: The *Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* alliance (in red) bounded by the *Larrea tridentata* - *Ambrosia dumosa* - *Yucca schidigera* Association on both the hills and a large 'island' in the braided watercourse.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Senegalia greggii* - *Hyptis emoryi* - *Justicia californica* Alliance**

Number of Rapid Assessment Sites: 16

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Senegalia greggii</i> Catclaw acacia	15	3 (0-4)	8 (2-20)	1.9
<i>Hyptis emoryi</i> Desert lavender	11	3.5 (0-5)	9 (0-33)	1.8
<i>Ambrosia dumosa</i> White bursage	15	2 (0-3)	<1 (0-3)	0.4
<i>Encelia farinosa</i> Brittlebush	12	3 (0-4)	<1 (0-10)	0.8
<i>Sphaeralcea ambigua</i> Desert globemallow	12	3 (0-3)	<1 (0-3)	0.7
<i>Krameria bicolor</i> White Ratany	12	2.5 (0-3)	<1 (0-8)	2.6
<i>Lycium andersonii</i> Water jacket	11	3 (0-5)	<1 (0-20)	1.1
<i>Bebbia juncea</i> Sweetbush	11	2 (0-3)	<1 (0-13)	0.9
<i>Stephanomeria pauciflora</i> Brownplume wirelettuce	11	1 (0-3)	<1 (0-7)	0.8
<i>Simmondsia chinensis</i> Jojoba	11	1 (0-3)	<1 (0-4)	1.7
<i>Pleuraphis rigida</i> Big galleta	10	1 (0-5)	<1 (0-20)	0.8
<i>Larrea tridentata</i> Creosote	9	1 (0-5)	<1 (0-9)	1.7
<i>Tetracoccus hallii</i> Hall's shrubby-spurge	9	0.5 (0-5)	<1 (0-14.3)	6.7
<i>Porophyllum gracile</i> Slender poreleaf	9	0.5 (0-3)	<1 (0-2)	0.4
<i>Mirabilis bigelovii</i> Wishbone-bush	9	0.5 (0-3)	<1 (0-1)	-
<i>Ambrosia salsola</i> Cheesebush	8	0.5 (0-4)	<1 (0-10)	1.0
<i>Parkinsonia florida</i> Blue paloverde	7	0 (0-3)	<1 (0-5)	3.8

<i>Taxon</i>	<i>Sites</i>	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Psorothamnus schottii</i> Schott's dalea	7	0 (0-3)	<1 (0-4)	1.6
<i>Yucca schidigera</i> Mojave yucca	7	0 (0-3)	<1 (0-3)	0.1
<i>Ephedra californica</i> California jointfir	6	0 (0-3)	<1 (0-6)	1.0
<i>Ziziphus obtusifolia</i> Lotebush	6	0 (0-3)	<1 (0-3)	2.1
<i>Senna armata</i> Desert senna	5	0 (0-4)	<1 (0-8)	0.9
<i>Brassica tournefortii</i> Sahara mustard	5	0 (0-3)	<1 (0-9)	-
<i>Salazaria mexicana</i> Mexican bladdersage	5	0 (0-3)	<1 (0-2)	1.0
<i>Trixis californica</i> American threefold	5	0 (0-3)	<1 (0-1)	0.5
<i>Cylindropuntia munzii</i> Munz's cholla	4	0 (0-3)	<1 (0-1)	-
<i>Ephedra aspera</i> Boundary ephedra	4	0 (0-3)	<1 (0-3)	0.7
<i>Aristida purpurea</i> Purple threeawn	3	0 (0-3)	<1 (0-1.7)	0.4
<i>Encelia frutescens</i> Button brittlebush	3	0 (0-3)	<1 (0-1)	0.9
<i>Fagonia laevis</i> California fagonbush	2	0 (0-3)	<1 (0-1)	0.4
<i>Fagonia pachyacantha</i> Fagonbush	2	0 (0-3)	<1 (0-1)	-
<i>Bahiopsis parishii</i> Parish's goldeneye	2	0 (0-3)	<1 (0-4)	0.9
<i>Aristida adscensionis</i> Six-weeks three-awn	1	0 (0-3)	<1 (0-3)	-
<i>Lycium species</i> Desert-thorn	1	0 (0-3)	<1 (0-3)	-
<i>Baccharis sarothroides</i> Desertbroom baccharis	1	0 (0-3)	<1 (0-2)	1.5

***Suaeda moquinii* - *Atriplex canescens* Association**

Common name: Sea blite – four-winged saltbush association

Most similar or equivalent mapping unit on adjacent lands: *Suaeda moquinii* – *Atriplex canescens* Association (Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument) DRECP 5111

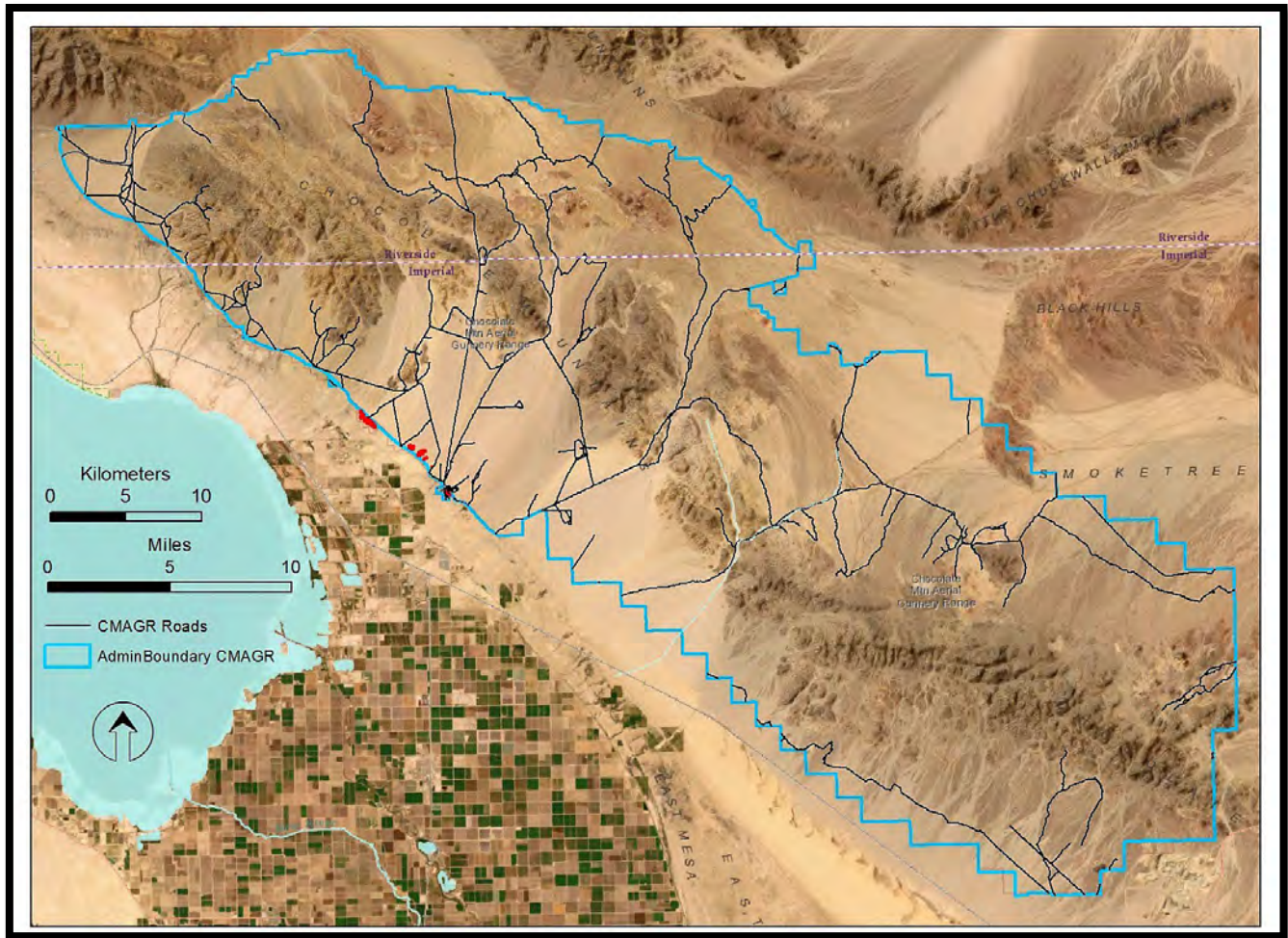
Most similar or equivalent NVC alliance: *Suaeda moquinii* Alliance A3880

Acres (hectares) mapped on CMAGR: 69 (28)



Above: This location at 100 ft (30 m) elevation and a ¼ mile west of Camp Billy Machen is co-dominated by *Atriplex canescens* and *Larrea tridentata*. Sea blite, *Suaeda moquinii*, is the low dark shrub at right (RA plot W-4). The Coachella canal is near the power lines. **Below:** *Suaeda moquinii* and *Atriplex canescens* co-dominate this site about a mile NW of Camp Billy, at 100 ft (30 m) (RA plot W-6).





Above: *Suaeda moquinii* – *Atriplex canescens* Association in red. Extent of the vegetation polygons exaggerated for visibility.

Description and setting: The *Suaeda moquinii* – *Atriplex canescens* Association is only found on saline soils both above and below but always nearby the Coachella Canal. Common associates include *Larrea tridentata* and *Ambrosia dumosa*. It is closely associated with the same ancient lake sediments that make up the nearby Mud Hills mapping unit. This alliance was mapped from 70 to 150 ft (21 – 46 m).

Image identification: Locations were mostly mapped based on field visits, but the image below shows the appearance of the mapping unit.

Mapping Units with a similar appearance on imagery: The **Mud Hills mapping unit** blended into this unit, with fingers of saltbush reaching into the mud hills. Both mapping units have saltbush and sea-blite, so the line between is based mainly on landform.



Above: The red polygon is the *Suaeda moquinii* – *Atriplex canescens* Association, alongside a *Parkinsonia florida* – *Olneya tesota* watercourse. The polygon is cutoff on the bottom where it adjoins the neighboring vegetation map. The Coachella Canal is at top right.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Suaeda moquinii* - *Atriplex canescens* Association**

Number of Rapid Assessment Sites: 2

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Atriplex canescens</i> Four-wing saltbush	2	4.5 (4-5)	7.3 (7-7.7)	0.9
<i>Larrea tridentata</i> Creosote	2	3 (2-4)	3.9 (0.2-7.7)	1.2
<i>Suaeda nigra</i> Mojave seablite	2	2.5 (2-3)	1.6 (0.2-3)	0.9
<i>Chorizanthe rigida</i> Devil's spineflower	2	2.5 (2-3)	0.6 (0.2-1)	-
<i>Ambrosia dumosa</i> White bursage	1	1.5 (0-3)	1 (0-2)	0.4

***Tamarix* spp. Alliance**

Common name: Tamarix alliance

Most similar or equivalent mapping unit on adjacent lands: *Tamarix* spp. Alliance DRECP 1432

Most similar or equivalent NVC alliance: *Tamarix* spp. Alliance A0842

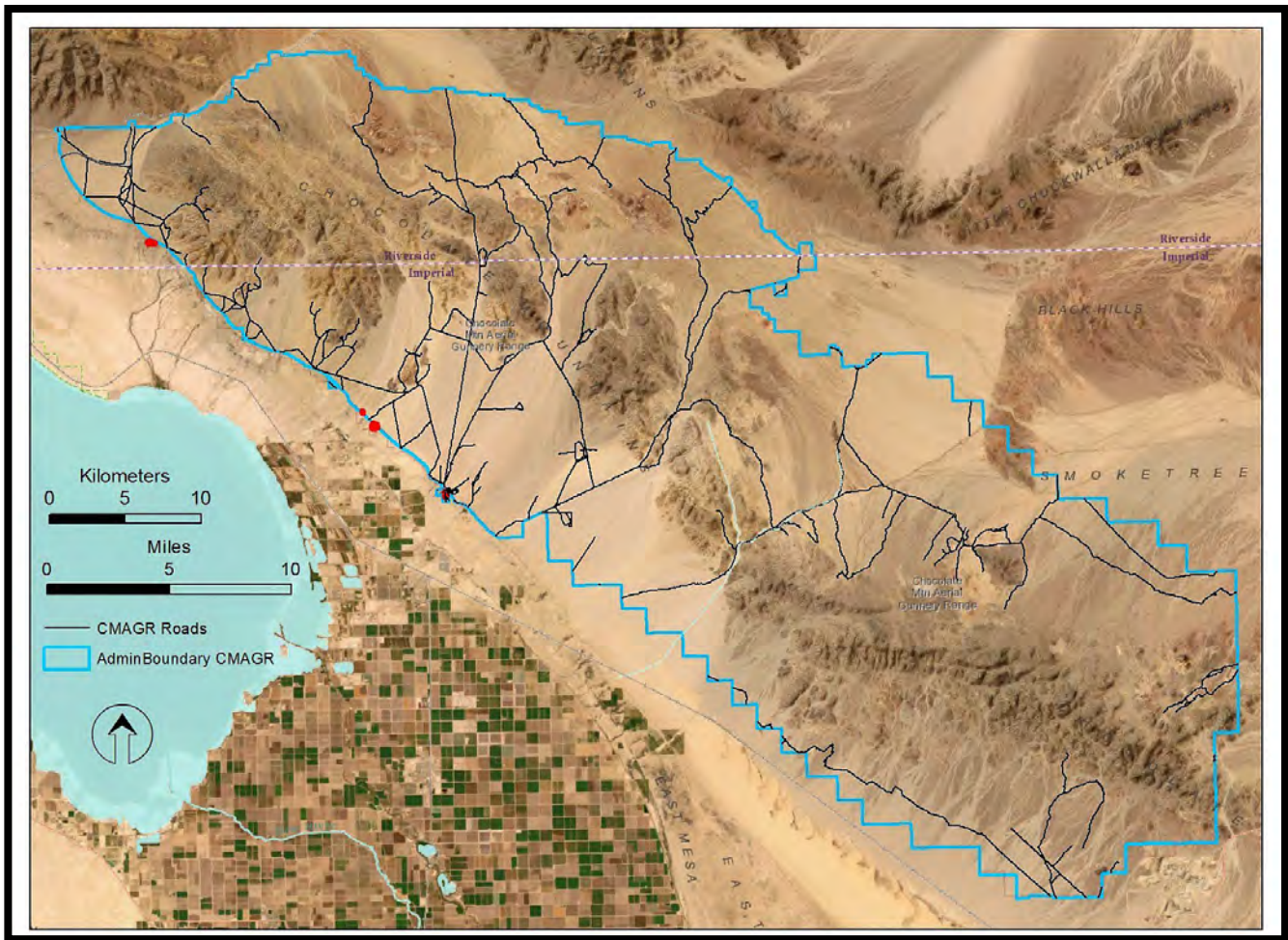
Acres (hectares) mapped on CMAGR: 22 (9)



Above: *Tamarix ramosissima* is the smaller gold-tinged plant at center and right foreground, while *Tamarix aphylla* is the larger tree in the background. Both species combine to give 30% cover. Located about 2.5 miles SE of Camp Bill Machen along the canal, at 90 ft (27 m) (RA plot IW-8).



Above: *Tamarix ramosissima* completely dominates this site a ¼ mile west of Camp Billy Machen at 90 ft (27 m). A patch of arrow-weed, *Pluchea sericea* is in the foreground (RA plot W-3).



Above: *Tamarix spp.* Alliance in red. Extent of the vegetation polygons exaggerated for visibility.

Description and setting: The *Tamarix spp.* Alliance is restricted to a few patches in hydrologically altered setting along Coachella Canal. It varies from impenetrable thickets to more open and diverse settings, with common xero-riparian associates like *Olneya tesota*, *Parkinsonia florida*, and *Prosopis glandulosa*, and uncommon (for the CMAGR) species such as date palm (*Phoenix dactylifera*), arrowweed (*Pluchea sericea*) and alkali goldenbush (*Isocoma acradenia*). This alliance was mapped from 30 to 90 ft (9 – 27 m).

Image identification: All locations were mapped based on field visits, but the image below shows the dense appearance of *Tamarix* thickets.

Mapping Units with a similar appearance on imagery: The *Prosopis glandulosa* association and the *Parkinsonia florida* – *Olneya tesota* Alliance have vegetation of similar height, but typically not as dense as *Tamarix*.



Above: The red polygon is the *Tamarix spp.* Alliance. The Coachella Canal is at center, and Camp Billy Machen on right.

Table of all taxa that had at least 1% cover in at least one sample site for:

***Tamarix* spp. Alliance**

Number of Rapid Assessment Sites: 2

<i>Taxon</i>	Sites	Median Prominence (Range) 5 = dominant 4 = codominant 3 = common 2 = uncommon 1 = rare	Median % Cover (Range)	Avg Height (m)
<i>Tamarix ramosissima</i> Salt-cedar	2	4.5 (4-5)	47.5 (15-80)	6.5
<i>Prosopis glandulosa</i> Honey mesquite	2	3.5 (3-4)	8.5 (2-15)	3.3
<i>Ambrosia dumosa</i> White bursage	2	2 (3-1)	2.8 (0.11-5)	0.7
<i>Larrea tridentata</i> Creosote	2	3 (2-4)	7.6 (0.2-15)	1.9
<i>Parkinsonia florida</i> Blue paloverde	2	2.5 (2-3)	1.1 (0.2-2)	4.8
<i>Atriplex canescens</i> Fourwing saltbush	2	3 (3)	2.5 (2-3)	0.9
<i>Tamarix aphylla</i> Athel tamarisk	1	2 (0-4)	7.5 (0-15)	5.5
<i>Olneya tesota</i> Desert ironwood	1	1.5 (0-3)	1 (0-2)	-
<i>Pulchea sericea</i> Arrow-weed	1	1.5 (0-3)	1 (0-2)	1.5
<i>Phalaris minor</i> Canary grass	1	1.5 (0-3)	10 (0-20)	-

Unvegetated wash and river bottom Mapping Unit

Common name: Bedrock or scoured watercourse

Most similar or equivalent mapping unit on adjacent lands: Unvegetated wash and river bottom Mapping Unit DRECP 6114

Most similar or equivalent NVC alliance: None

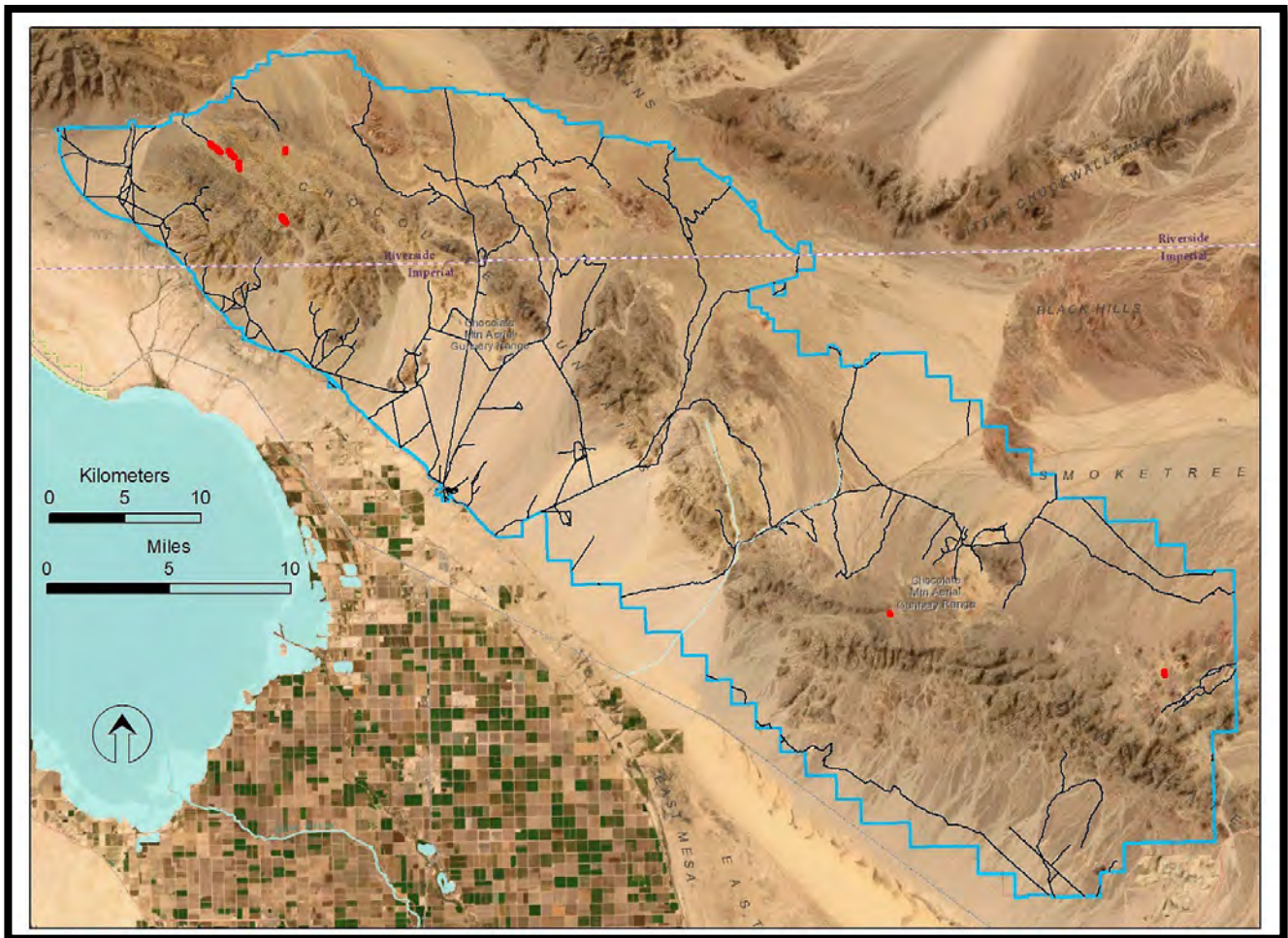
Acres (hectares) mapped on CMAGR: 2 (1)



Above: Unvegetated wash and river bottom Mapping Unit at bottom left near Sawtooth Mt in the eastern CMAGR.



Above: The narrows of upper Mammoth Wash. Clipboard in photo is atop a 5-foot-long walking stick.



Above: Unvegetated wash and river bottom Mapping Unit in red. Extent of the polygons exaggerated for visibility.

Description and setting: The Unvegetated wash and river bottom Mapping Unit Urban mapping unit was mapped only where rock prevented the establishment of vegetation. Scoured sandy watercourses were not mapped as part of this unit because time series available on Google Earth imagery showed rapid regeneration of watercourse species within 5 to 10 years.

Image identification: Bedrock is apparent in the imagery.

Mapping Units with a similar appearance on imagery: The *Ambrosia salsola* - *Psoralea schottii* Association could appear much the same after a recent flood, but Google Earth imagery from 2012 to showed rapid recovery.



Above: The red polygon is an example of the Unvegetated wash and river bottom Mapping Unit, near Sawtooth Mountain.

No attempt was made to collect vegetation data for:

Unvegetated wash and river bottom Mapping Unit

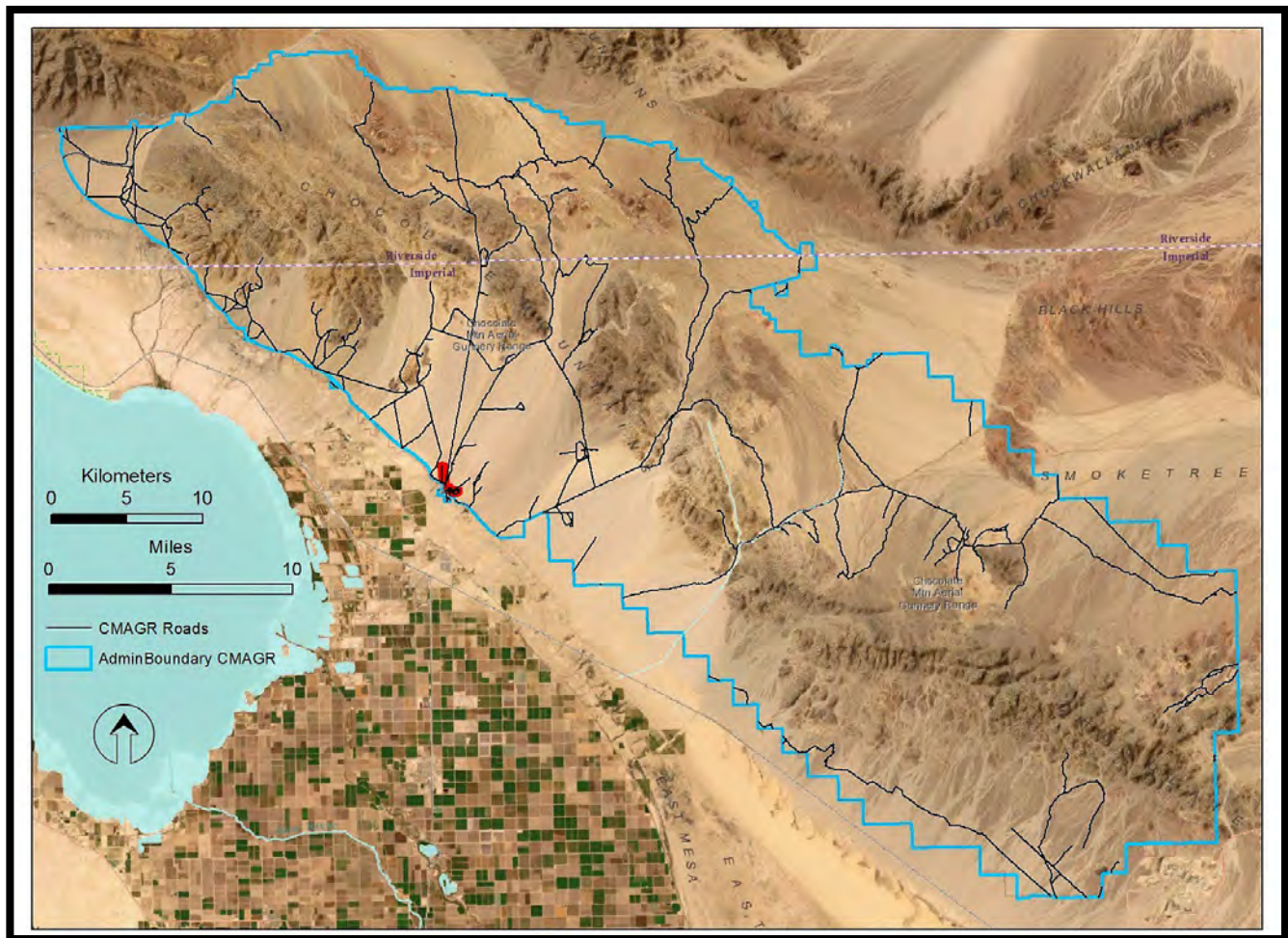
Urban

Common name: Urban

Most similar or equivalent mapping unit on adjacent lands: Urban DRECP 9300

Most similar or equivalent NVC alliance: None

Acres (hectares) mapped on CMAGR: 89 (36)



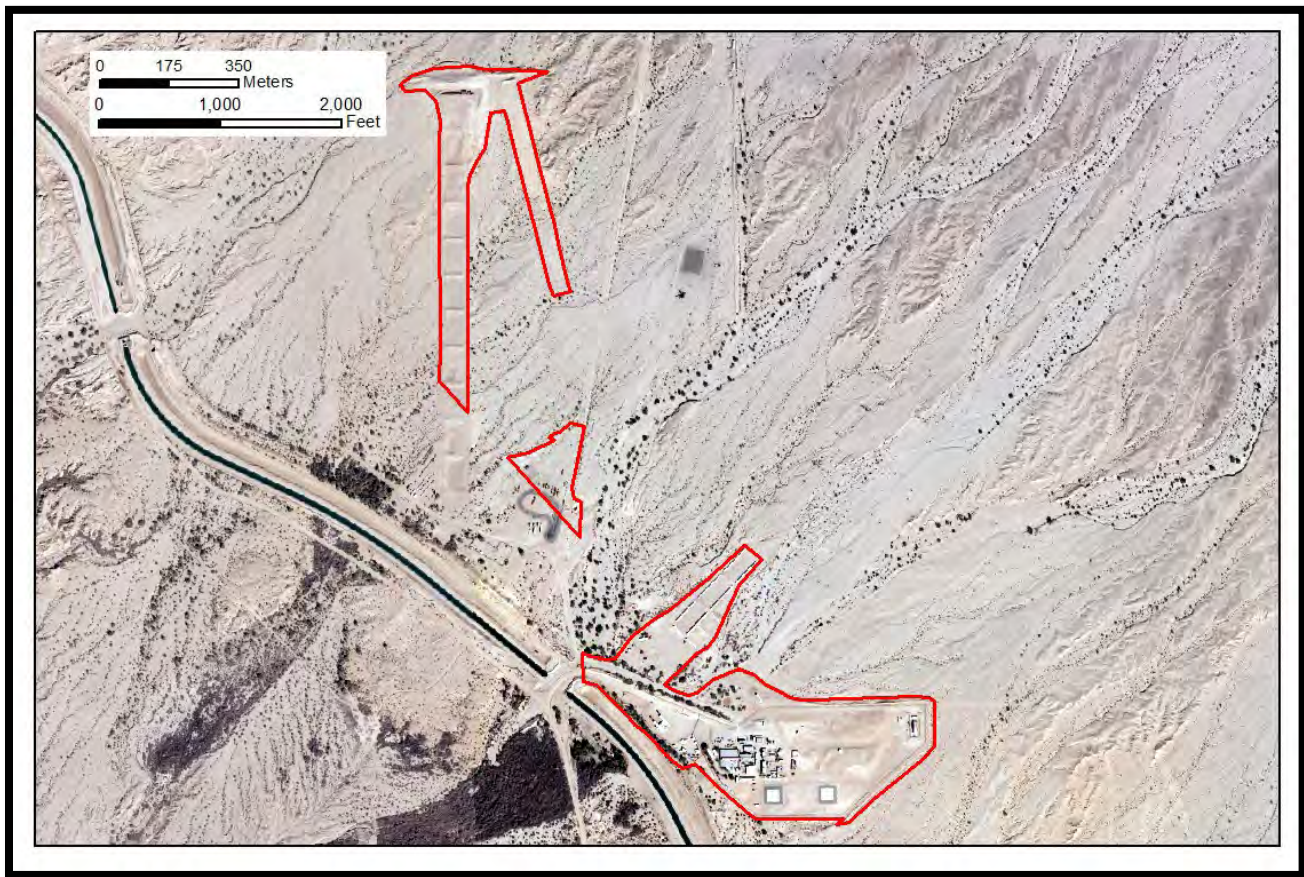
Above: **Urban** mapping unit in red. Extent of the polygons exaggerated for visibility.

FLORA AND VEGETATION OF THE CMAGR

Description and setting: The Urban mapping unit is Camp Billy Machen. Unlike the Human Disturbance mapping unit, the urban mapping unit has permanent structures and/or is maintained in a non-natural condition. In the CMAGR this includes Camp Billy Machen structures and parking lots, as well as the shooting range. The unit was mapped from 95 to 145 ft (29 – 44 m).

Image identification: See below

Mapping Units with a similar appearance on imagery: The **Human Disturbance** mapping unit.



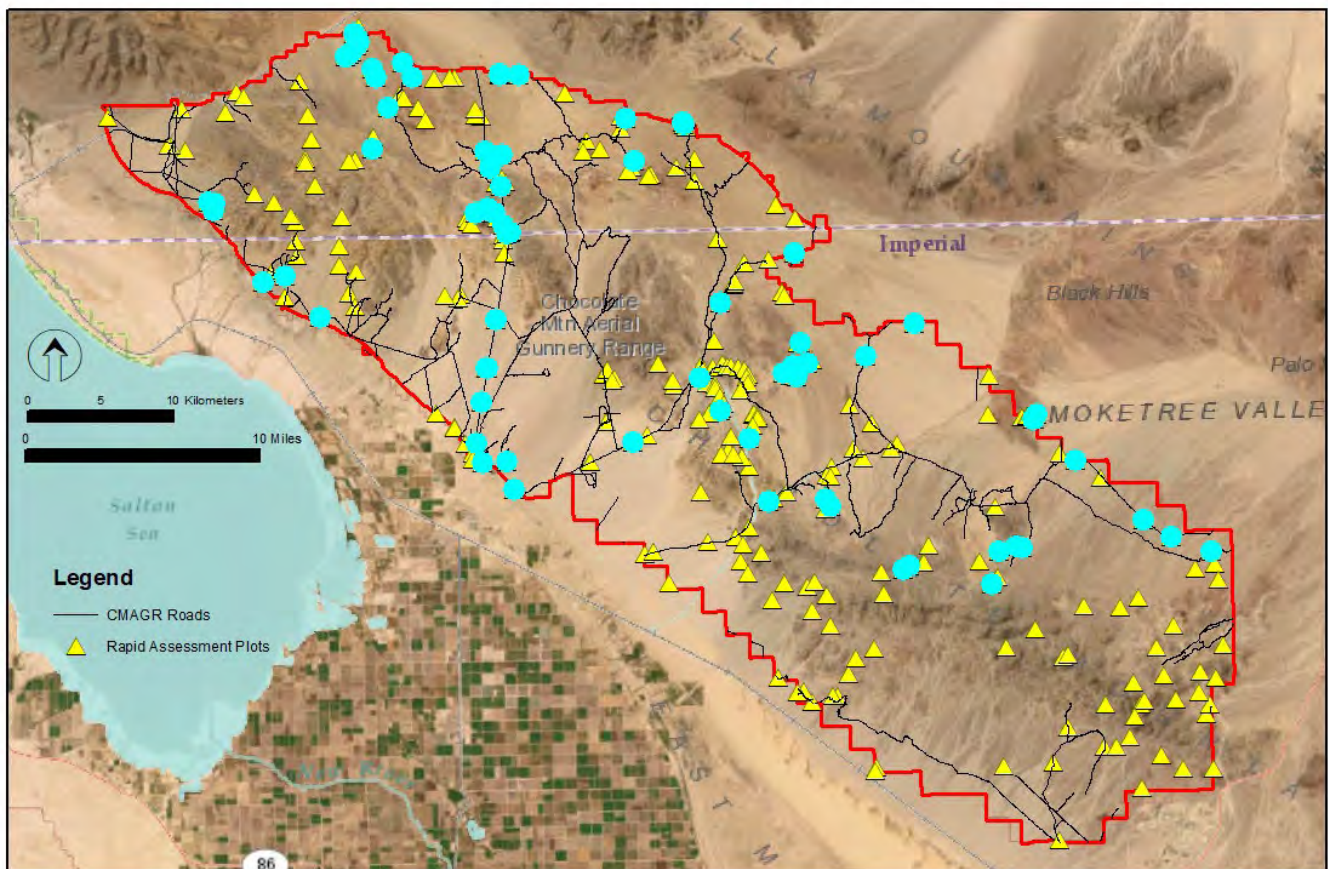
Above: The red polygons are the Urban mapping unit. The polygons are cut-off at the boundary with the DRECP vegetation map, which did not precisely follow the boundary of the CMAGR.

No attempt was made to collect vegetation data for:

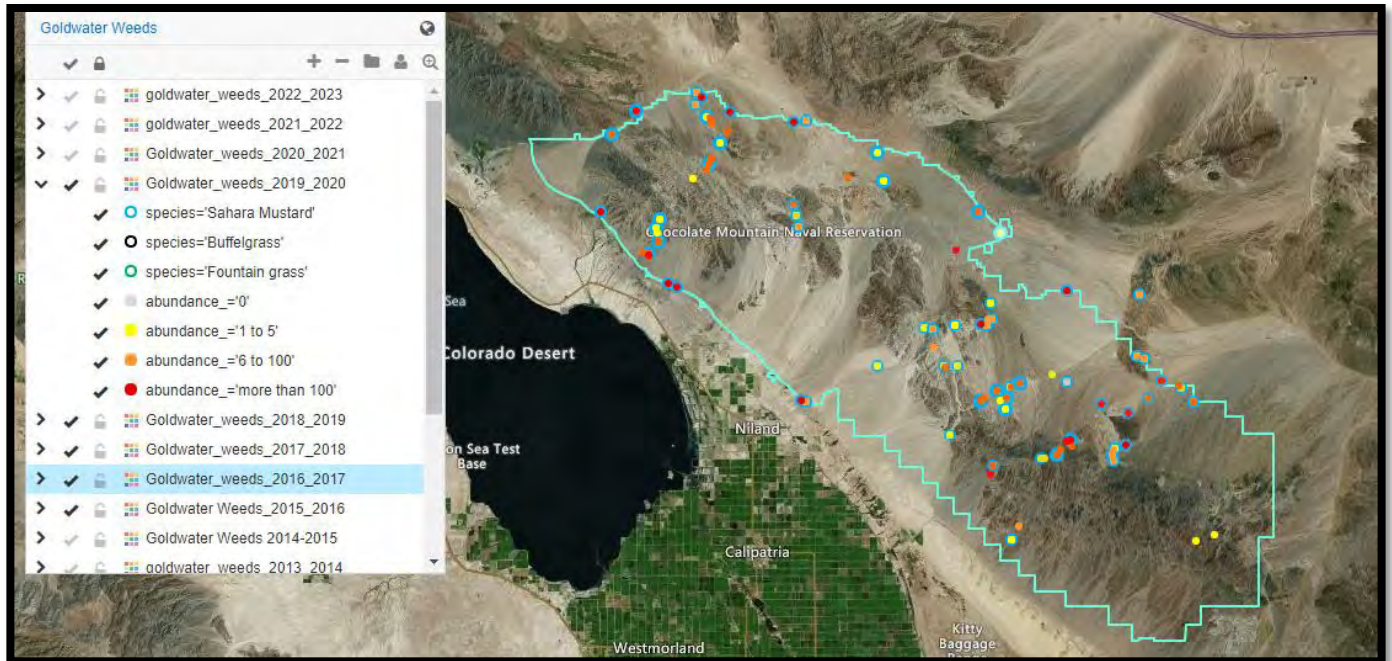
Urban

Invasive species

Invasive plant species were recorded in two ways. First, they might be present in a Rapid Assessment plot, in which case they were noted in the plot data and recorded in the database. Second, if encountered elsewhere on the CMAGR, they may be recorded on a phone app and later uploaded onto a GISCloud map. Examples of both are below:



Above: The blue dots are the 74 Rapid Assessment plots where Sahara mustard (*Brassica tournefortii*) was recorded as present. The yellow triangles are all 303 Rapid Assessment plots.



Above: The GISCloud map showing 146 invasive species locations recorded from 2015 to 2019 that were NOT on Rapid Assessment plots. The dots with a blue perimeter are Sahara mustard, the vast majority of records (130 of 146, or 89%). This species has been an aggressive invasive on the BMGR-West since at least 2002 (Malusa, J. et. al., 2003).

As stated in section 3.4.2 in the 2023 INRMP for the CMAGR:

“A 2014 INRMP working group identified **11 invasive plant species** of concern for the CMAGR: Sahara mustard (*Brassica tournefortii*), red brome (*Bromus madritensis* ssp. *rubens*), Lehmann lovegrass (*Eragrostis lehmanniana*), Arabian grass (*Schismus arabicus*), Russian thistle (*Salsola tragus*), buffelgrass (*Pennisetum ciliare*), storksbill (*Erodium cicutarium*), tamarisk (*Tamarix* spp.), Mediterranean splitgrass (*Schismus barbatus*), tansy mustard (*Descurainia pinnata*), and flaxweed (*Descurainia sophia*).”

A) **One of the 11** species listed above is not invasive: tansy mustard (*Descurainia pinnata*). It’s a native species, common on the CMAGR. It was likely listed as invasive because the invasive flaxweed (*Descurainia sophia*) is very similar in appearance to *Descurainia pinnata*.

B) We documented **four of the 11** species listed above to be entirely absent from the CMAGR: Lehman lovegrass, buffelgrass, Mediterranean splitgrass, and flaxweed.

C) **Three of the 11** were rarely encountered: red brome, Russian thistle, and storksbill. These species have long been present in southeastern California, and their rarity on the range is likely because of aridity.

D) **Three of the 11** were widespread over the CMAGR: Sahara mustard, Arabian grass, and tamarisk.

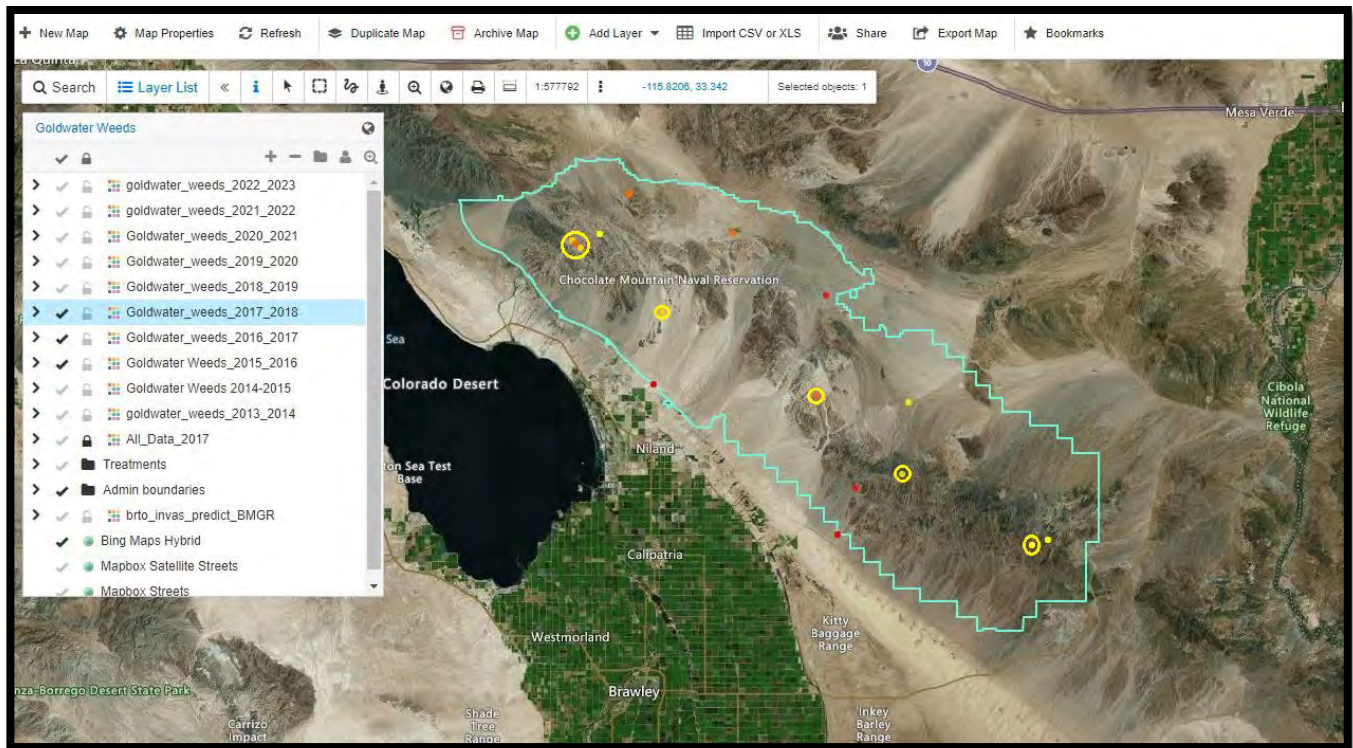
As stated in the 2023 INRMP for the CMAGR:

“Arabian grass is a widespread and common annual weed in open sandy soils. Throughout the range. It is easily confused with Mediterranean splitgrass, which is widely naturalized on the coastal slope of southern California but uncommon in the desert and which was not found during surveys despite making many *Schismus* collections. Arabian grass is introduced from North Africa and the Middle East, with the earliest California record from 1935 in Fresno County; however, the first Imperial County record was not made until 1973. On the CMAGR, it can be considered a naturalized species that occurs in so many places that it is beyond human control.

“There are two species of tamarisk on the CMAGR, *Tamarix aphylla* and *T. ramosissima*.

“*T. aphylla* is commonly called athel and is a tree introduced from North Africa and the Middle East. This species is often planted in the California deserts because it is more tolerant of heat, drought, and soil salinity than any other available shade tree. Malusa and Sanders (this study) found this species only twice, both times on roadsides, so they may have been persisting from old plantings, though there was no direct evidence of that. When planted it is often in a row, as a windbreak or to shade a building, but these were both solitary plants in places where it was not obvious that shade would be wanted or needed. This species is not as successful in naturalizing as its weedy congener *T. ramosissima* but will do so occasionally usually along washes.

“*T. ramosissima*, known as salt cedar, is an introduced weedy shrub, locally common in alkaline clay soil near the Coachella Canal and occasionally along washes elsewhere. Formerly it was common before the canal was concrete lined, when water leaked at numerous points, but many of those thickets are now dead. The light, fluffy seeds are wind dispersed and so the species can appear anywhere surface moisture remains long enough to germinate and grow seedlings, even far from established plants and in places where the species cannot last more than a year or two. It was occasionally found in remote canyons where seasonal water allowed it to grow, but in such cases, it was an uncommon and struggling species.”



Above: The yellow circles are records for *T. ramosissima*, all in remote canyons.

“Sahara mustard is an occasionally abundant spring annual weed in sandy soil throughout the range. Especially common on wash edges, sandy alluvial slopes, and along roadsides, it is also occasionally found on rocky slopes, suggesting that it has been present in the CMAGR long enough to disperse from disturbed areas. During dry winters, it is mostly absent from the CMAGR, as are most spring annuals; this is especially so on the southeast of the range, where winter rains are less common than at the northwest end of the range. It is native to North Africa and the Middle East but was introduced to California (probably with potted date palms) in the early 20th century (Minnich and Sanders 2000). This species has been proven to have negative effects on native flora and fauna such as fringe-toed lizards and Coachella Valley milkvetch (Barrows and Murphy 2017) and can reach densities allowing the spread of fire (Malusa 2018). However, although it was widespread in the CMAGR and documented in 74 of the 303 rapid assessment plots for the vegetation survey, it was rarely a dominant or codominant species. Of the 74 plots holding Sahara mustard, it was at 2 percent or greater ground cover in only 11 plots; of these 11, only 3 held the mustard at 10 to 15 percent cover. Of these three plots, two were close to the Coachella Canal and had moderate levels of road disturbance, but one was far more remote.

“This was near the “narrows” of upper Mammoth Wash, a popular area of trespass for people riding all-terrain vehicles. These vehicles have forged a new path up a steep slope out of the wash just above the narrows, and the resulting disturbance is associated with numerous patches of Sahara mustard. This area needs more frequent patrols by Conservation Law Enforcement Officers to prevent the further spread of Sahara mustard.

“Because the Sahara mustard is an invasive of special concern, Malusa and Sanders utilized a smartphone application called GISCloud to record locations outside of the vegetation mapping rapid assessment plots. This method was pioneered on the Barry M. Goldwater Range – West and allows anyone with the application on a cell phone to rapidly take georeferenced photographs and data. Once within cell range, the data are automatically uploaded on a Web map at www.portal.GISCloud.com (Search maps for Goldwater).”

Additional invasive species

We all recorded the presence of eight invasive species not anticipated in the 2014 INRMP. All are uncommon.

- Canary grass (*Phalaris minor*)
- Bermuda grass (*Cynodon dactylon*)
- Sudan grass (*Sorghum sudanense*)
- Ravenna grass (*Saccharum ravennae*)
- Foxtail barley (*Hordeum murinum*)
- Rabbitsfoot grass (*Polypogon monspeliensis*)
- Prickly sow thistle (*Sonchus asper*)
- Common sow thistle (*S. oleraceus*)

Canary grass is thinly scattered in relatively moist sites such as wash edges, roadside ditches and depressions. Common in irrigated fields and along drains in the Imperial Valley agricultural zone a few miles from the range boundary, which is doubtless a seed source.

Bermuda grass was found only once, which illustrates this species’ requirement for summer moisture to be successful. It is frequent in irrigated areas nearby and would doubtless have colonized the area more extensively if conditions were favorable.

Sudan grass was found only once, and that was dead remnants in a wash west of Camp Burt; identification necessarily uncertain because the species was never found again. Plant was certainly a waif, seeds perhaps carried here by birds or moved accidentally by equipment. From what was left of it, it may have been the cultivar called “Sudan grass” which is grown for forage in the Imperial Valley.

Ravenna grass is a tall, clump-forming, reed-like, perennial grass, mostly 1.5-2 m tall here, but reported to reach 4 m tall elsewhere. It was found only in wet or moist areas near the Coachella Canal on edge of CMAGR; between Siphons 16 & 17, near Frink Springs; along canal at Siphon 10 [Camp Billy Machan]; Hot Mineral Spa Rd. 1 km from range boundary. This species is becoming common in permanently moist areas, especially along canals and drainage ditches on the eastern side of the Imperial Valley. Probably

cannot be successful in the interior of the CMAGR as conditions are too dry. With the recent (c. 2005) lining of the canal, it may not continue to survive in the places where it has recently been.

Foxtail barley is an annual weedy grass that is active in winter and spring, after the winter rains; found only once on this survey (near Siphon 10, edge of Camp Billy Machan), at the edge of a road beside an ephemeral muddy pond. This EurSahara weed is common in disturbed loam soil in the Salton Basin, such as at the edges of roads and agricultural fields. All barley species are tolerant of moderately salty soil and so can be prominent in areas of saline/alkaline soil. Also naturalized in many other places in California and the western U.S, especially where the soil has been disturbed by human activity.

Rabbitsfoot grass is a scarce annual weed in moist and wet areas, seen in places such as near the Coachella Canal and at Tabaseca Tank. Seldom found because little suitable habitat exists in the CMAGR.

Prickly sow thistle in the CMAGR is very scarce and almost entirely found on wash margins. It is doubtful whether this species is more than a waif locally. It was once seen to have been cropped by deer near Salvation Pass.

Common sow thistle is the more common species of *Sonchus* in the Chocolate Mountains, but it is still very infrequent here. It is also by far the more common of the two species as an urban and agricultural weed in southern California. Our best guess is that the wind dispersed seeds blow into the Gunnery Range regularly, but that the plants germinated are too few to sustain a population on their own. Without the continuing seed rain from the Imperial Valley this species would probably cease to be present.

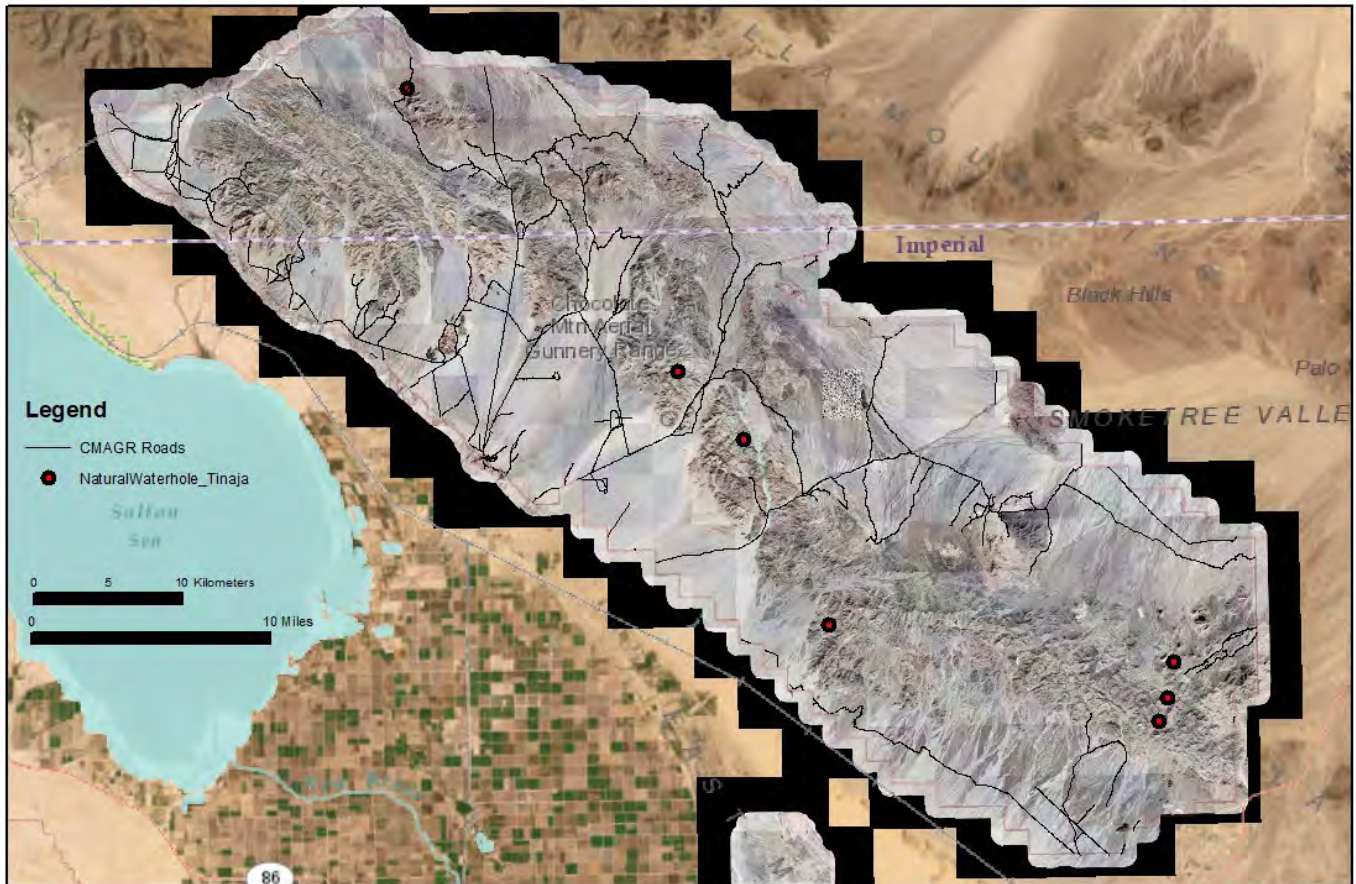
All these invasive species were collected and curated, with the exception of sorghum, which was in poor condition, and rabbitsfoot grass. The records can be found in Consortium of California Herbaria at <http://ucjeps.berkeley.edu/consortium>. When these data are combined with the vegetation map and flora, range management will be able to focus control efforts, if any, on areas known to be at high risk of invasion, a metric which can vary with the dispersal capabilities of the invasive species (Brooks and Berry 2006).

Tinajas, or natural waterholes

We documented the locations of seven natural waterholes. One is the well-known Tabaseca Tank, but the other six are obscure, or at least not on known maps. To be included in this tally the waterhole had to be capable of holding at least 500 gallons. A GIS feature class called CMAGR_NaturalWaterholes is included in the geodatabase.



Above: A tinaja in a canyon about 4 miles SW of Barrow. Walking stick is 1.5 m tall (5 ft).



ABOVE: Locations of seasonal waterholes. Tabaseca Tank is the northernmost.

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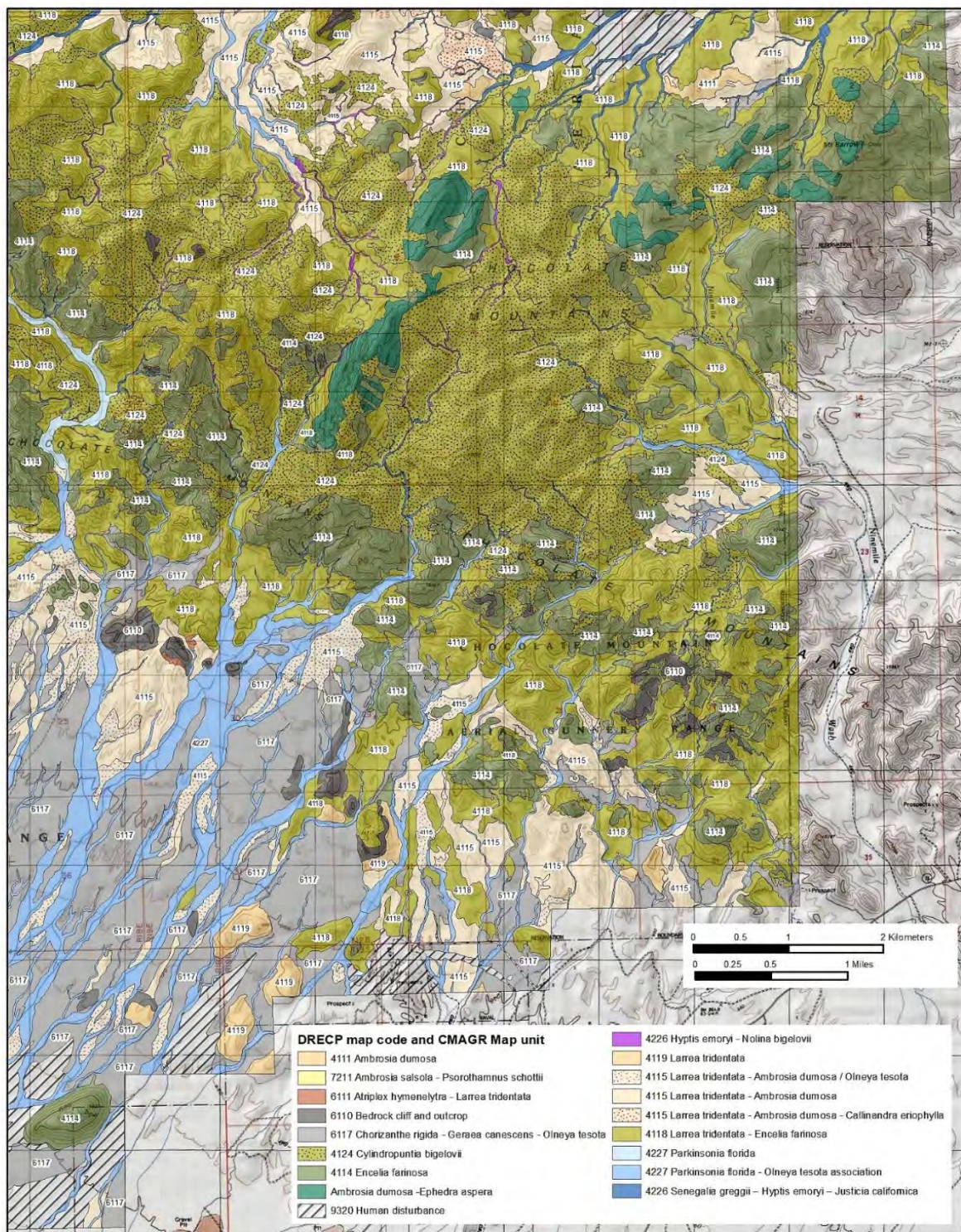
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Appendix B – Vegetation maps of selected areas within the CMAGR

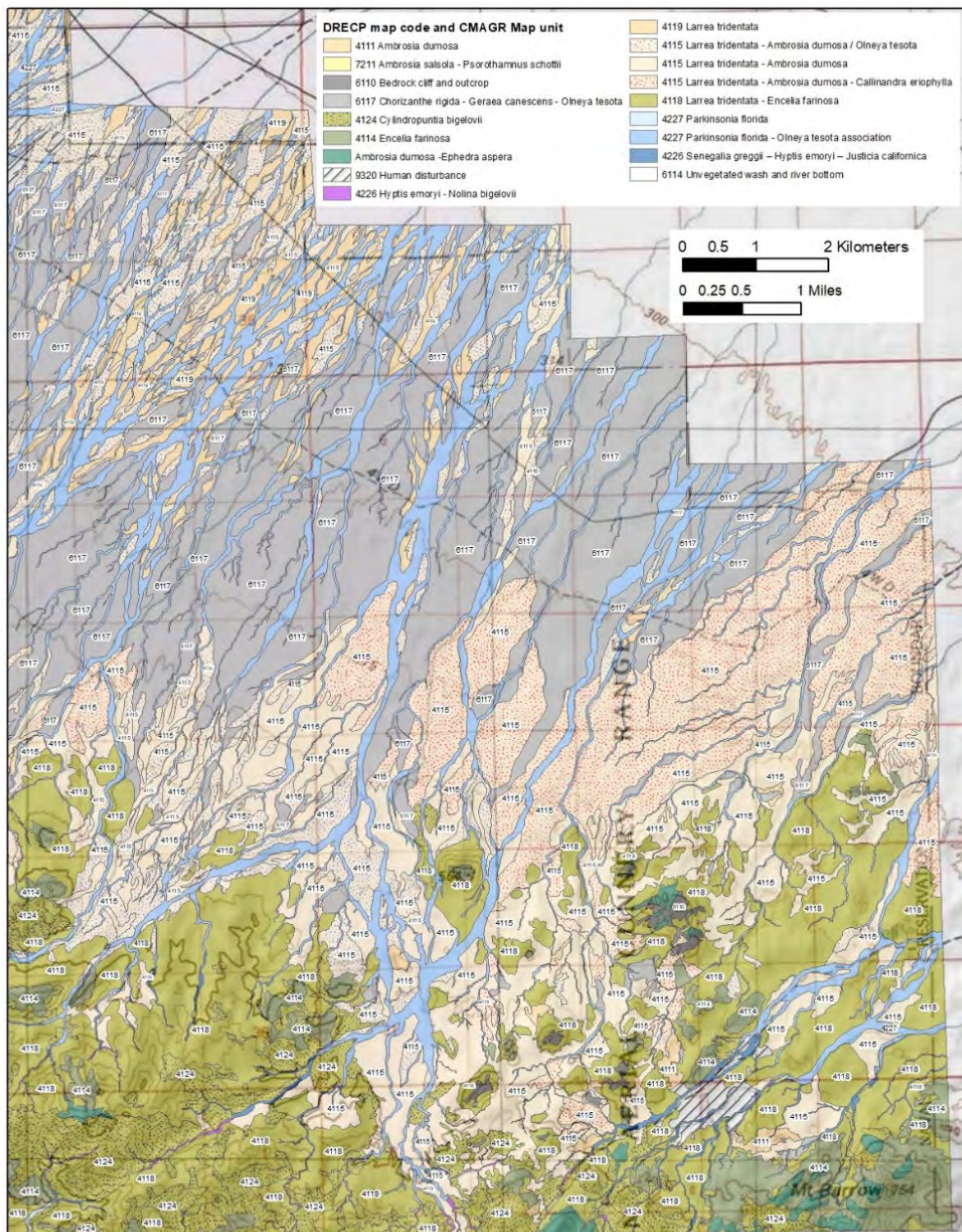
Below are images of the vegetation maps of the same areas described in the introduction under “A Tour of the CMAGR.” Large polygons are labeled with the map units from this report as well as the map code from the most similar mapping unit in the DRECP (Desert Renewable Energy Conservation Plan). Note that the DRECP mapping units are at the broader alliance level, and a single alliance code may apply to several of the more detailed association level map units of this report.



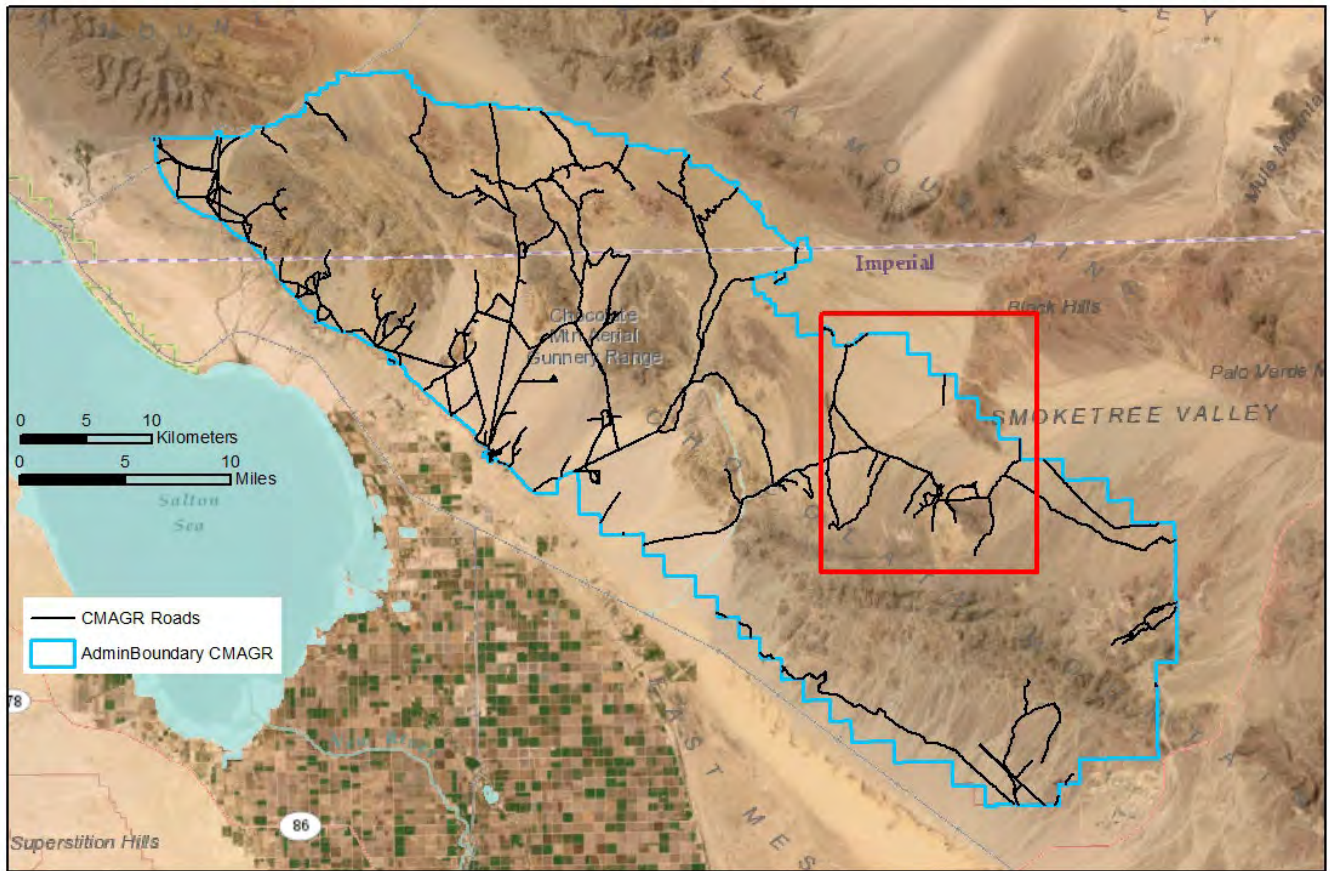
South of Mount Barrow: Imperial Gables, Mesquite Gold Mine



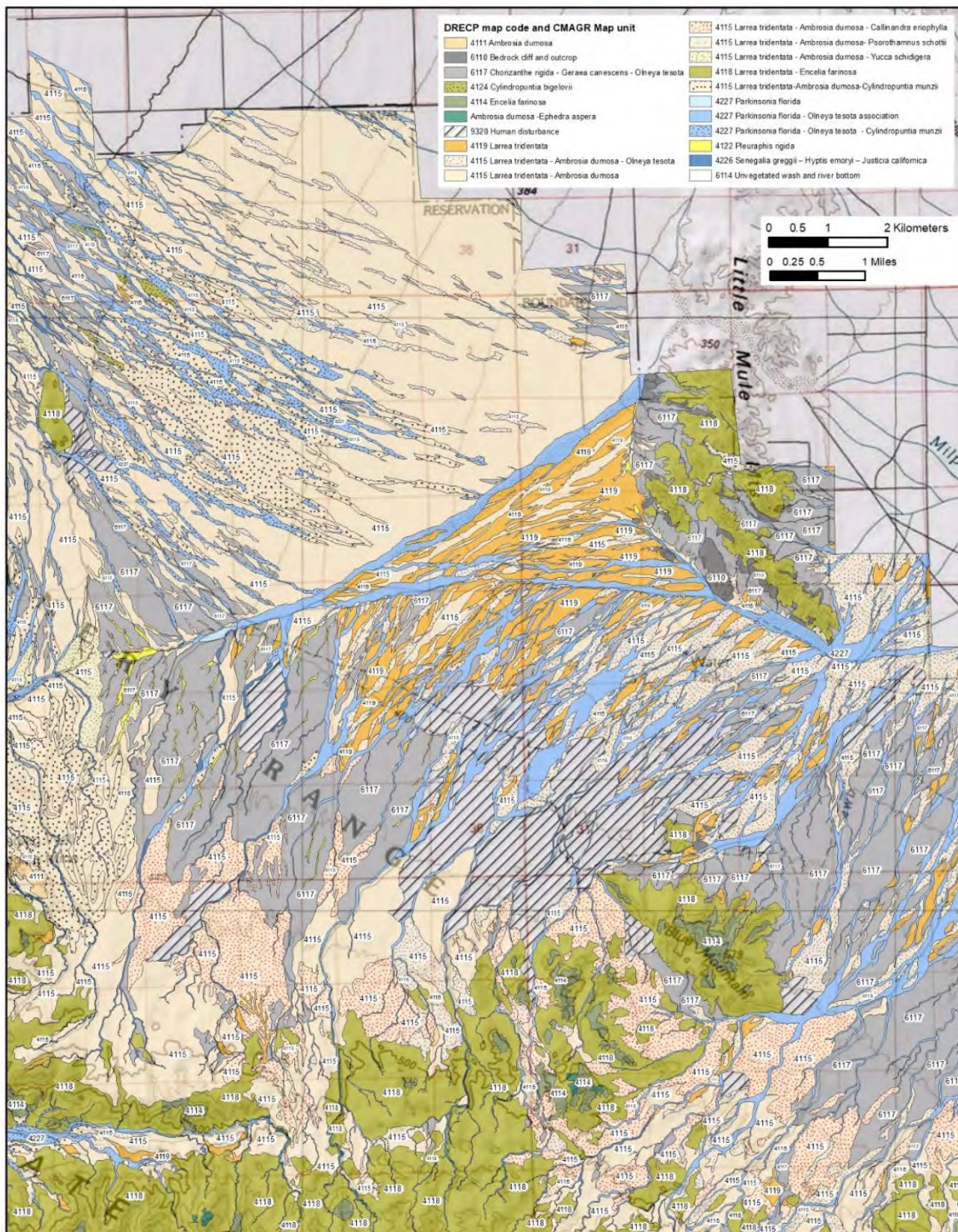
South of Mount Barrow: Imperial Gables, Mesquite Gold Mine



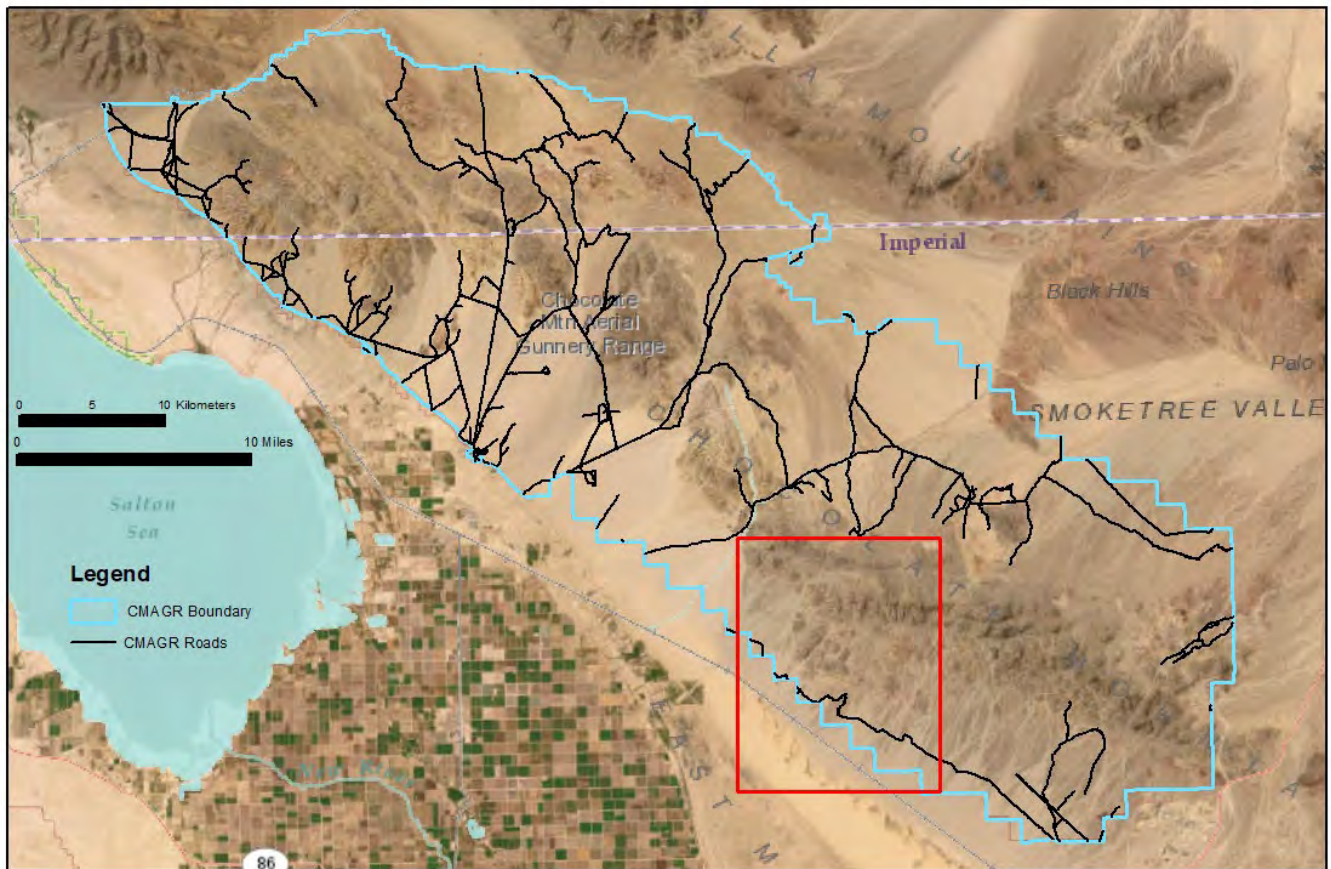
North of Mount Barrow: Sawtooth Mountain



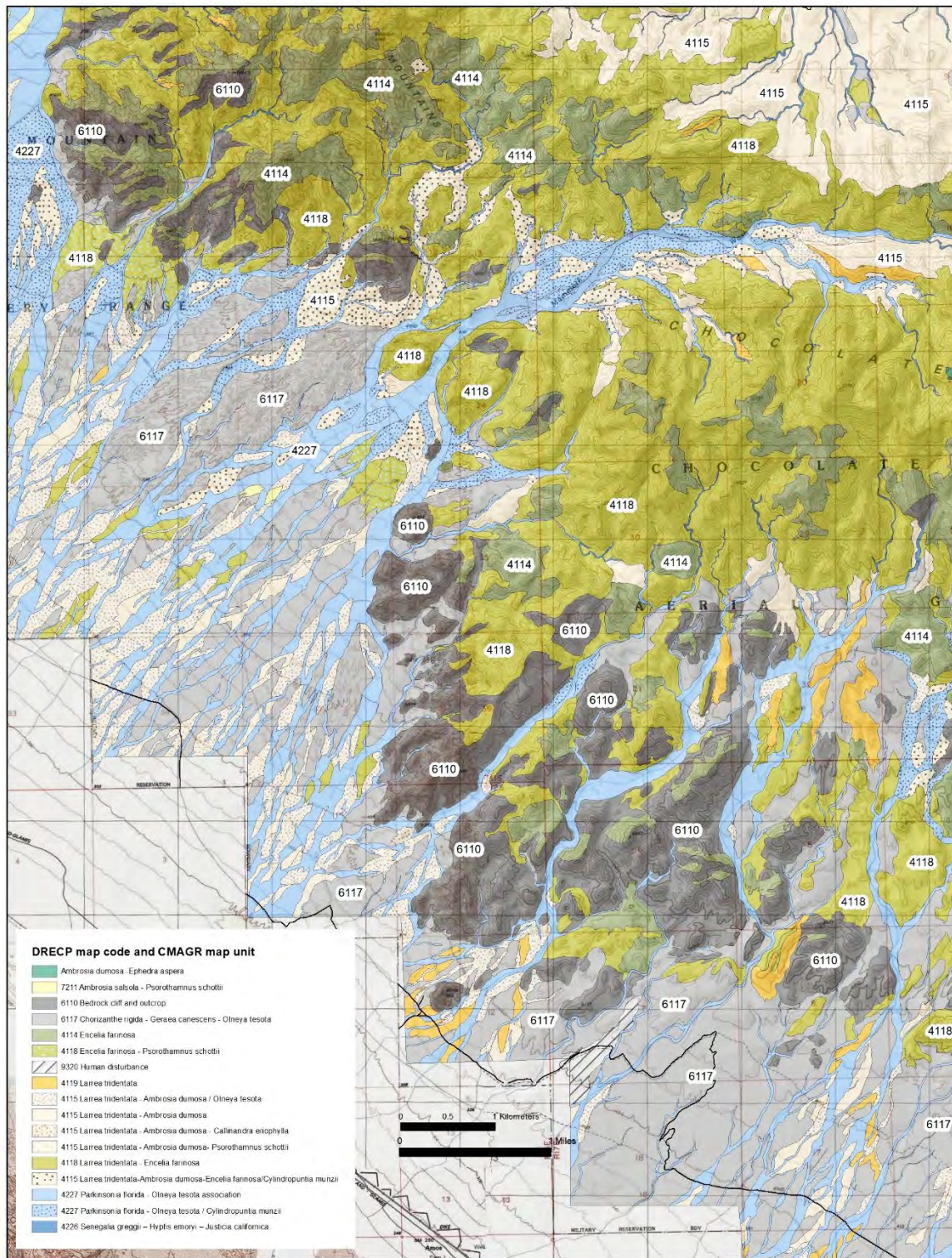
Camp Burt, Blue Mountain, and the Little Mule Mountains



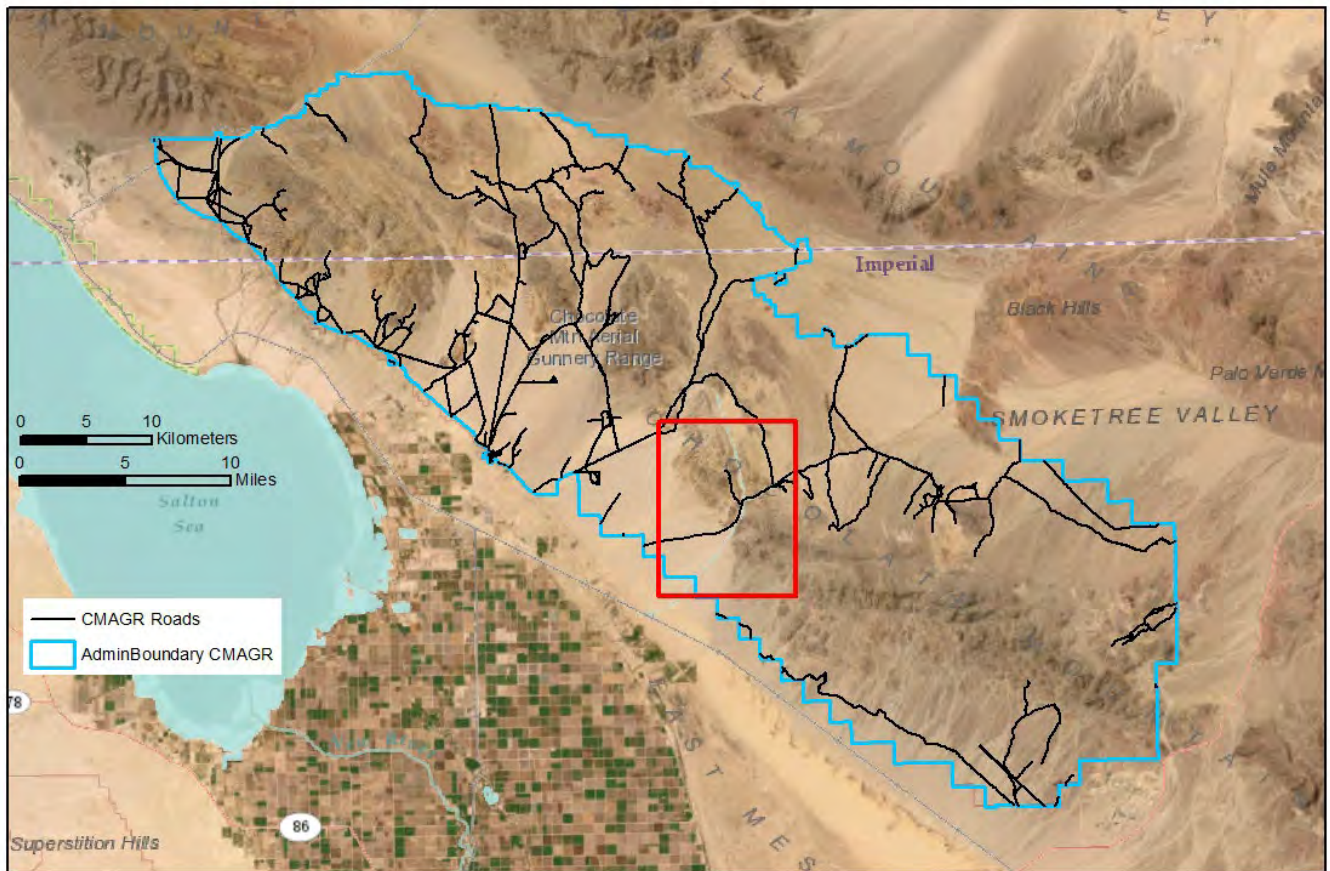
Camp Burt, Blue Mountain, and the Little Mule Mountains



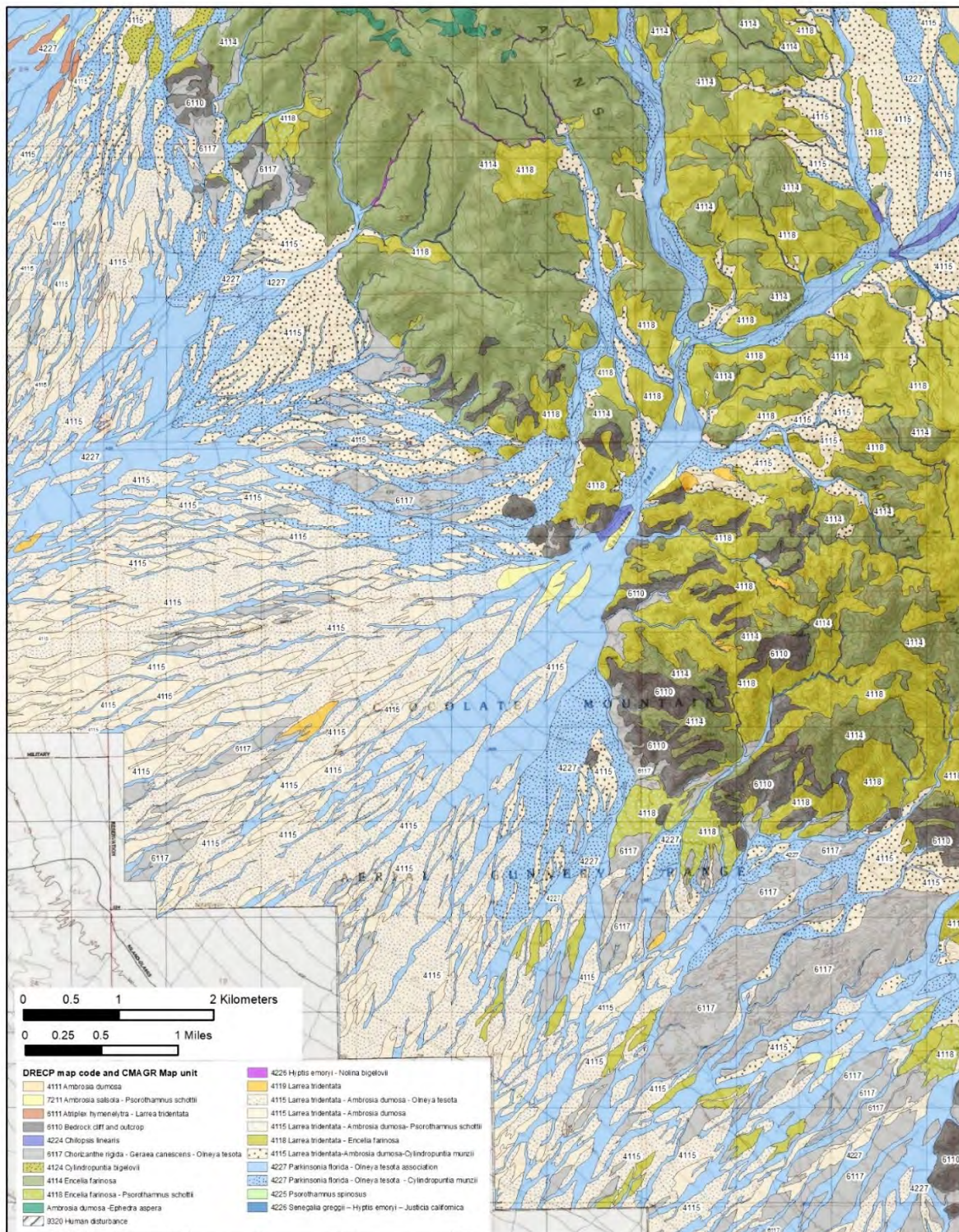
Mammoth Wash



Mammoth Wash

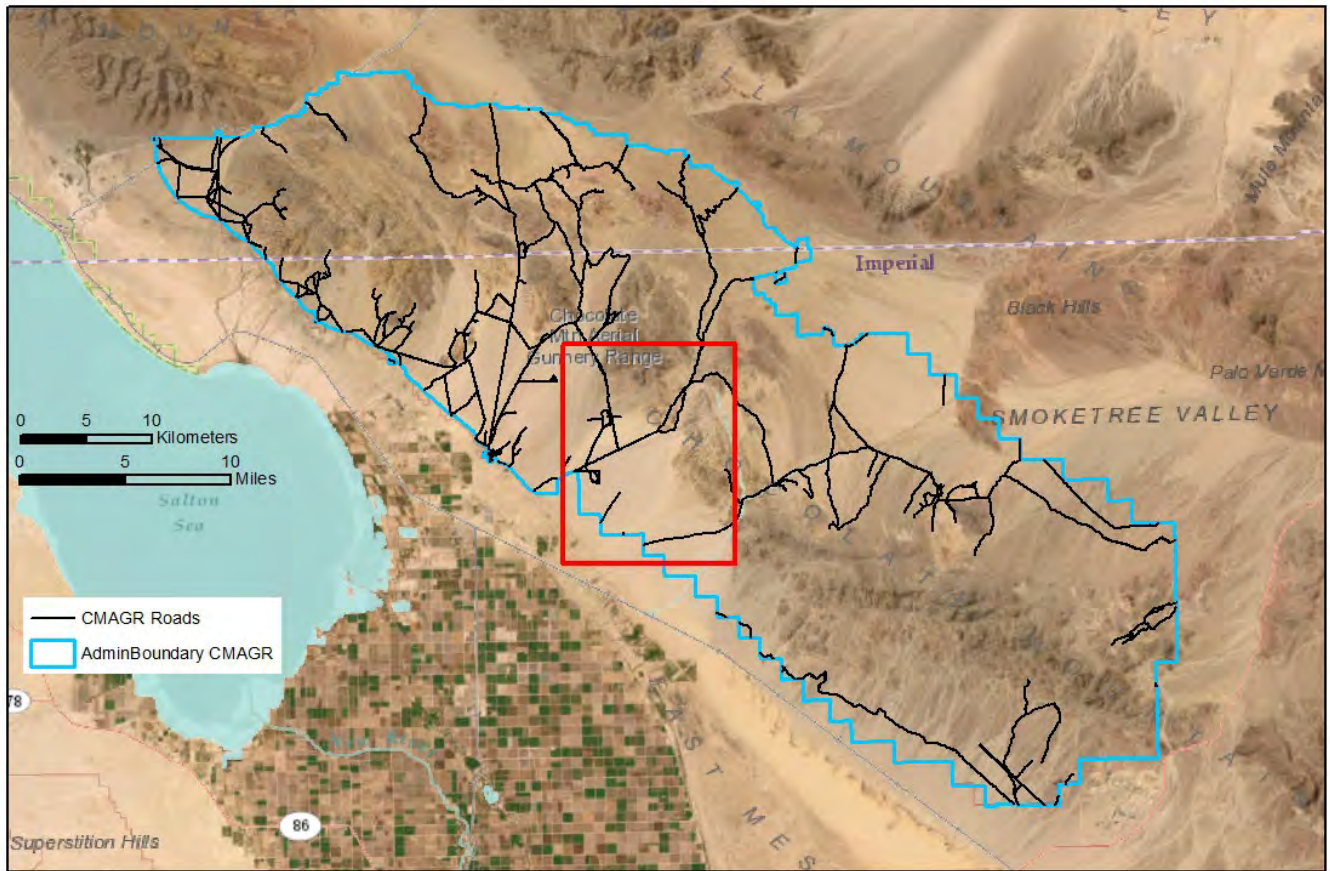


Salvation Pass



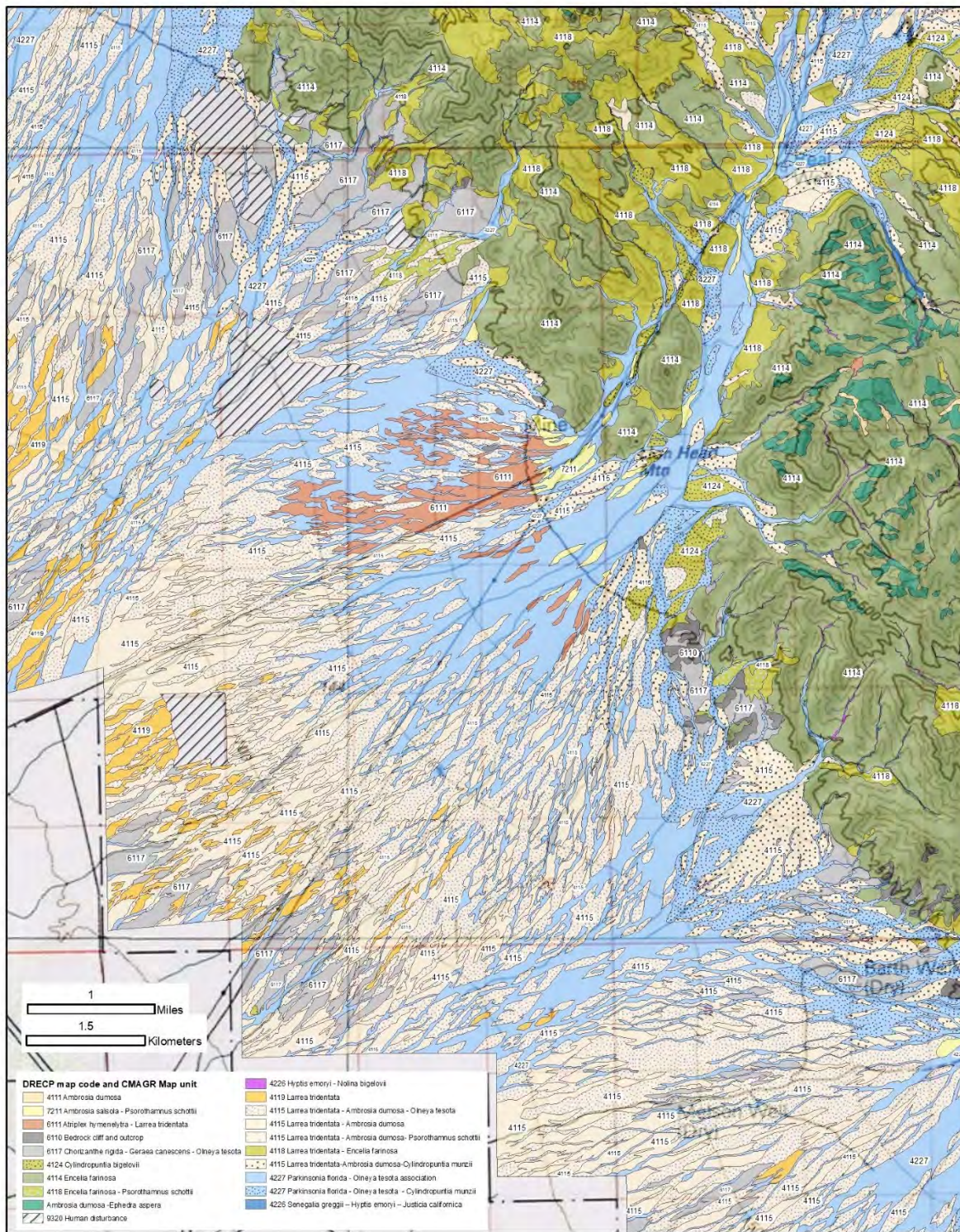
Salvation Pass

FLORA AND VEGETATION OF THE CMAGR



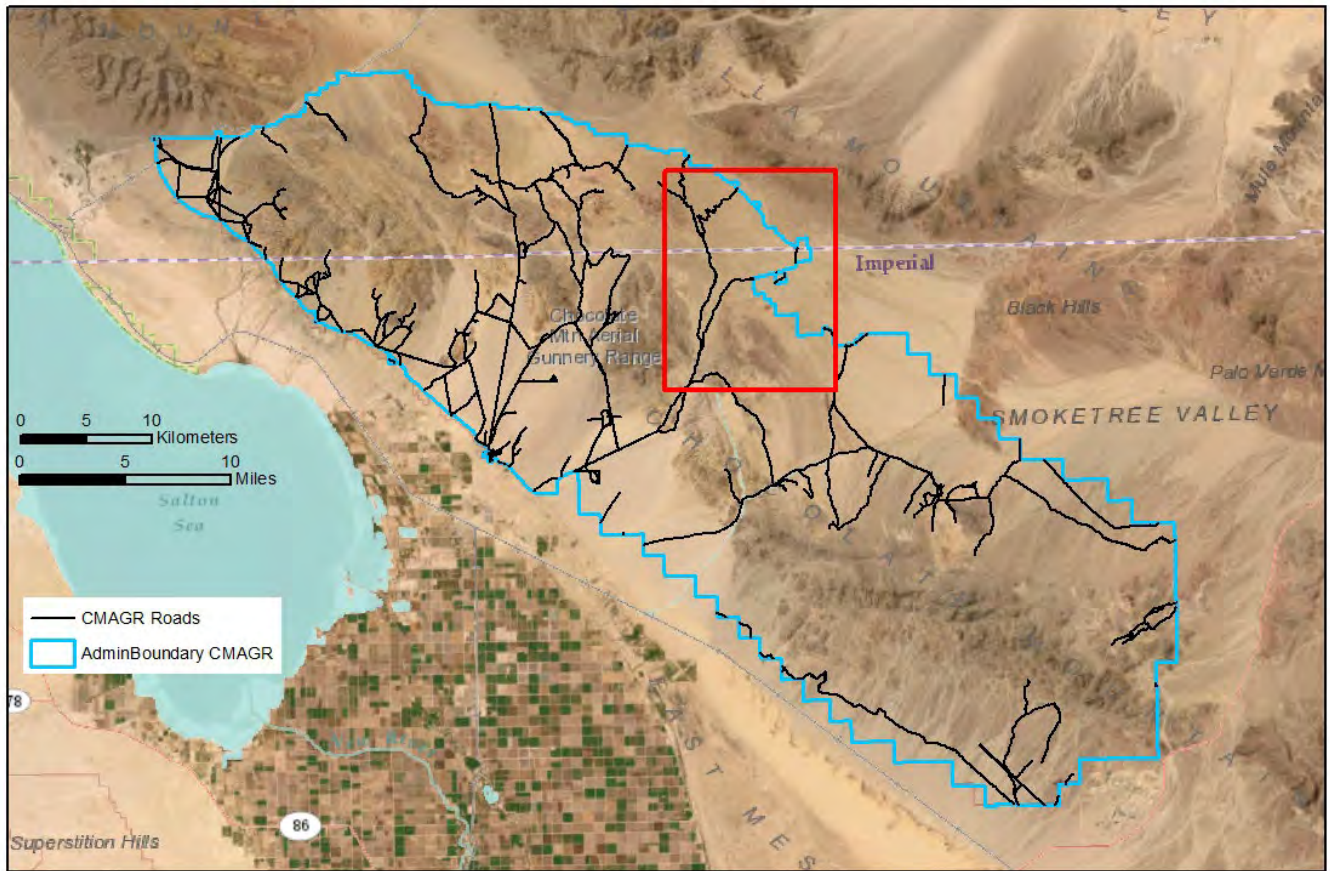
Lower Surveyors Pass

FLORA AND VEGETATION OF THE CMAGR



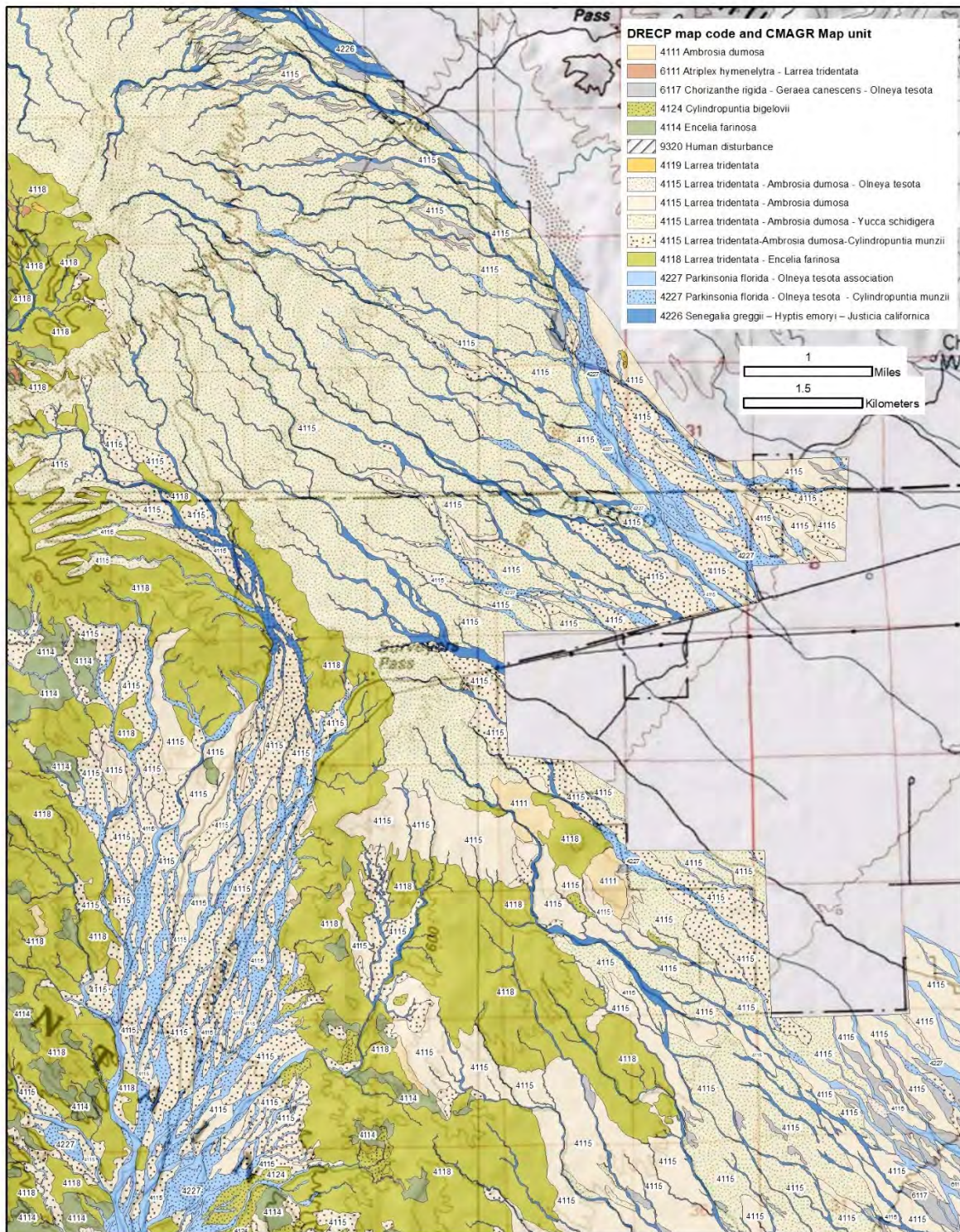
Lower Surveyors Pass

FLORA AND VEGETATION OF THE CMAGR



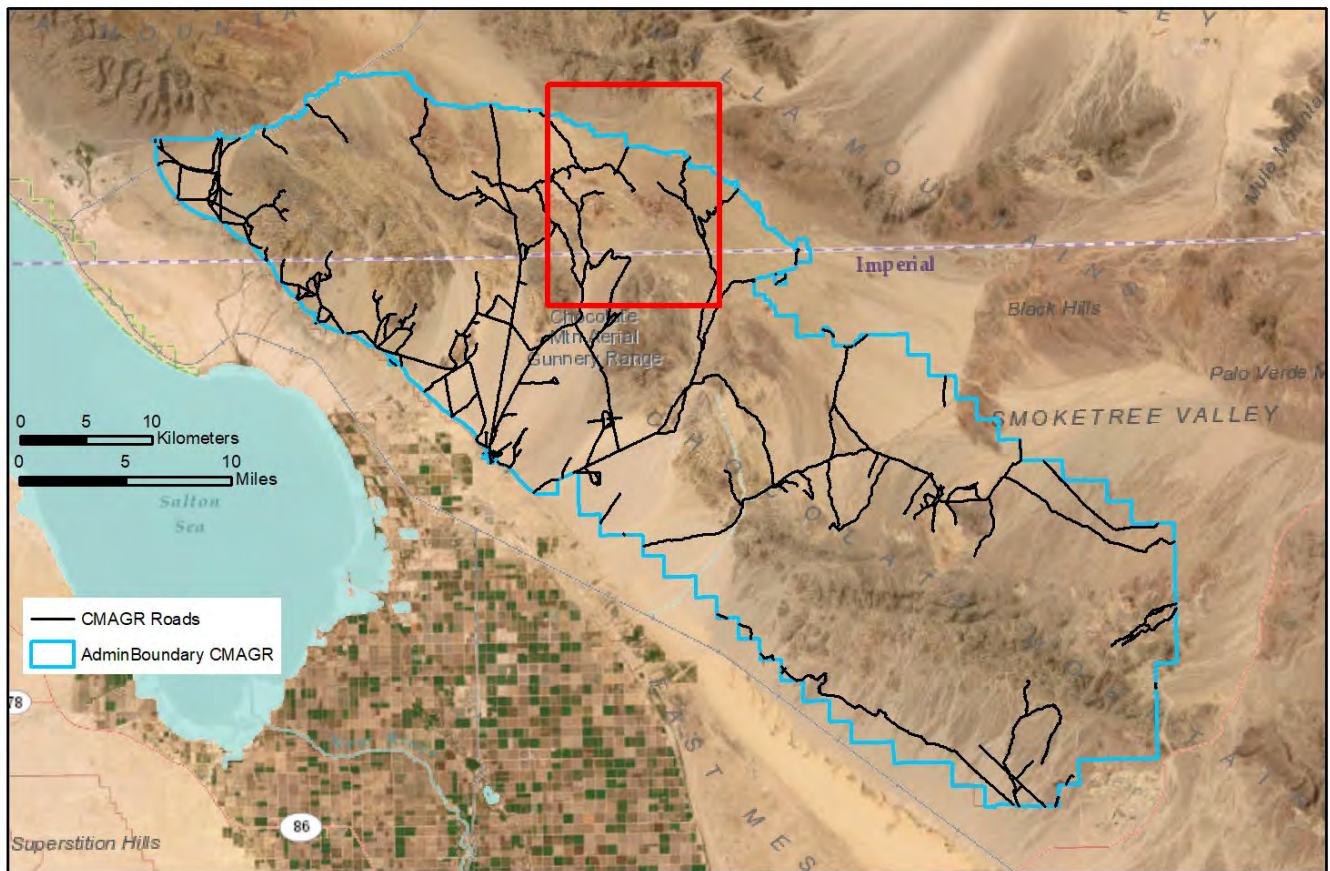
Upper Surveyors Pass

FLORA AND VEGETATION OF THE CMAGR

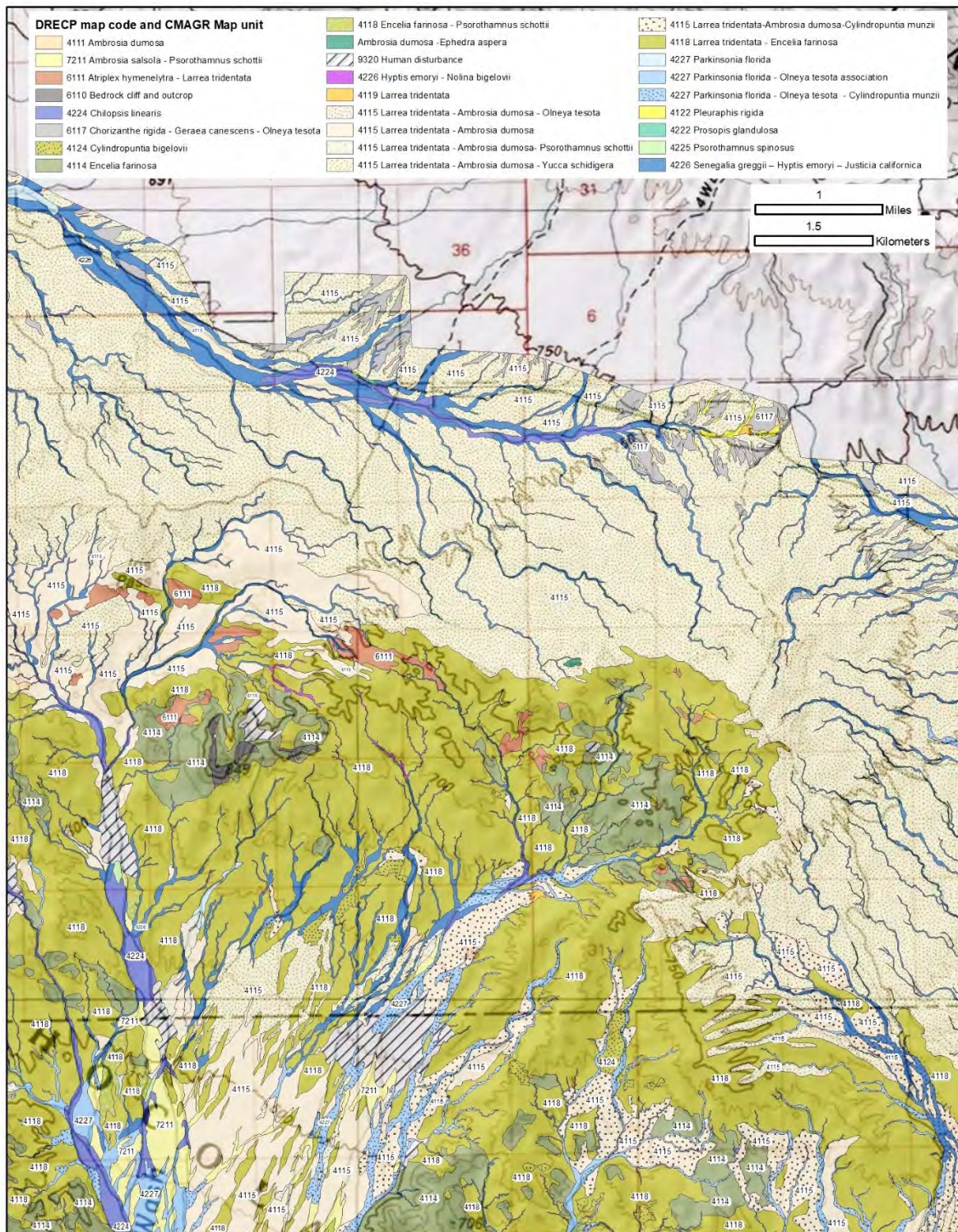


Upper Surveyors Pass

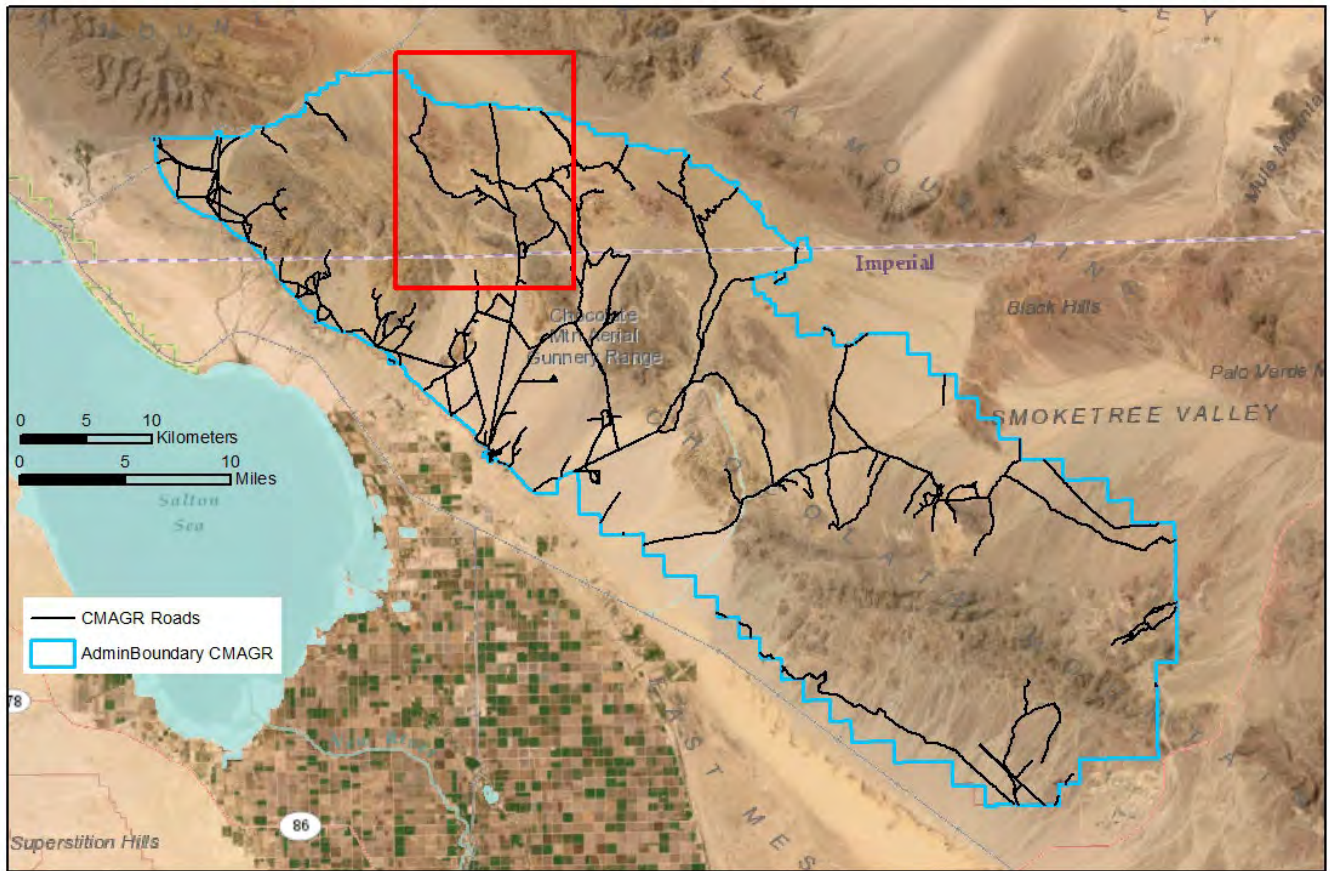
FLORA AND VEGETATION OF THE CMAGR



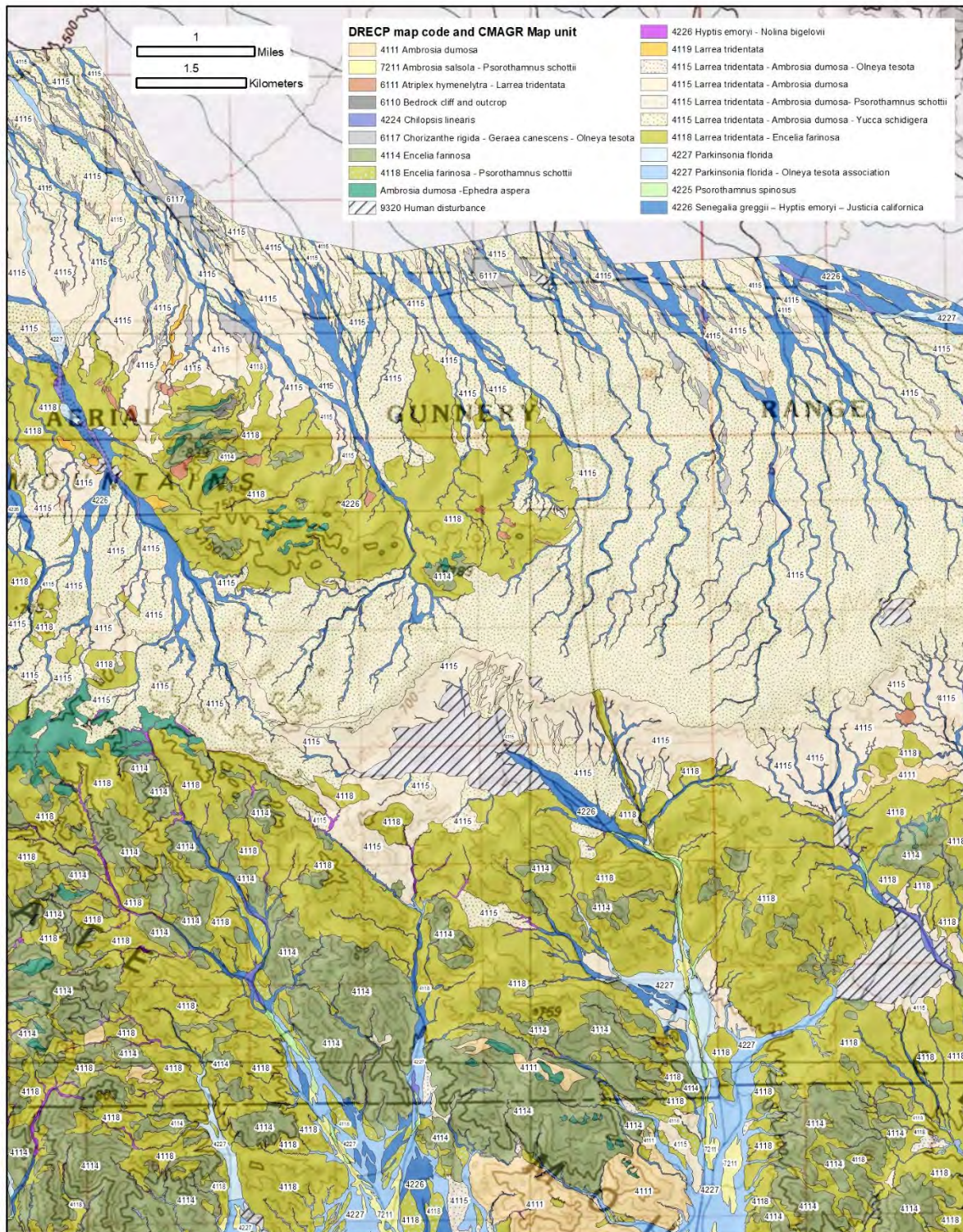
Bradshaw Trail and Iris Pass



Bradshaw Trail and Iris Pass

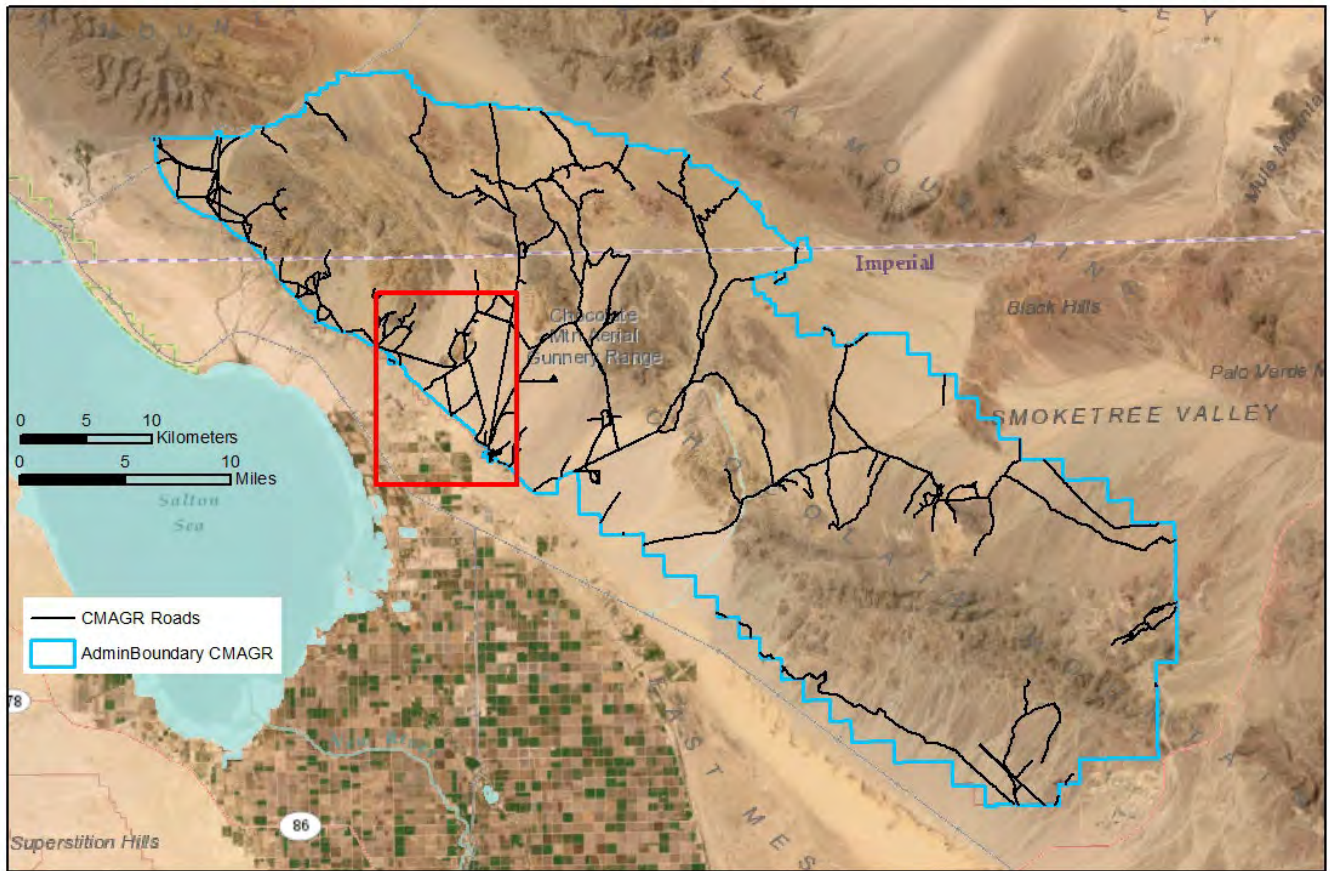


Upper Gas Line Road and Bradshaw Trail



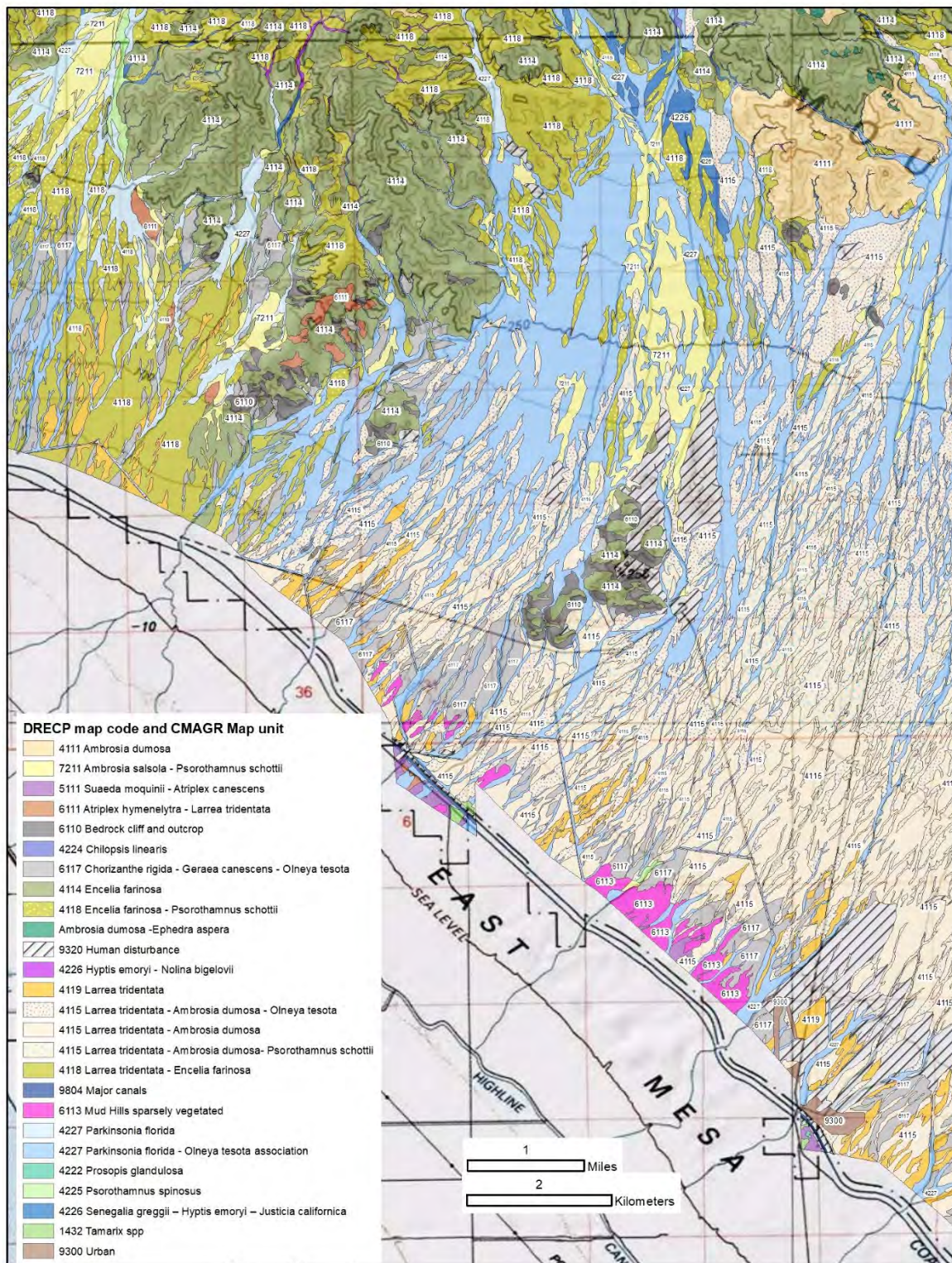
Upper Gas Line Road and Bradshaw Trail

FLORA AND VEGETATION OF THE CMAGR



Lower Gas Line Road

FLORA AND VEGETATION OF THE CMAGR

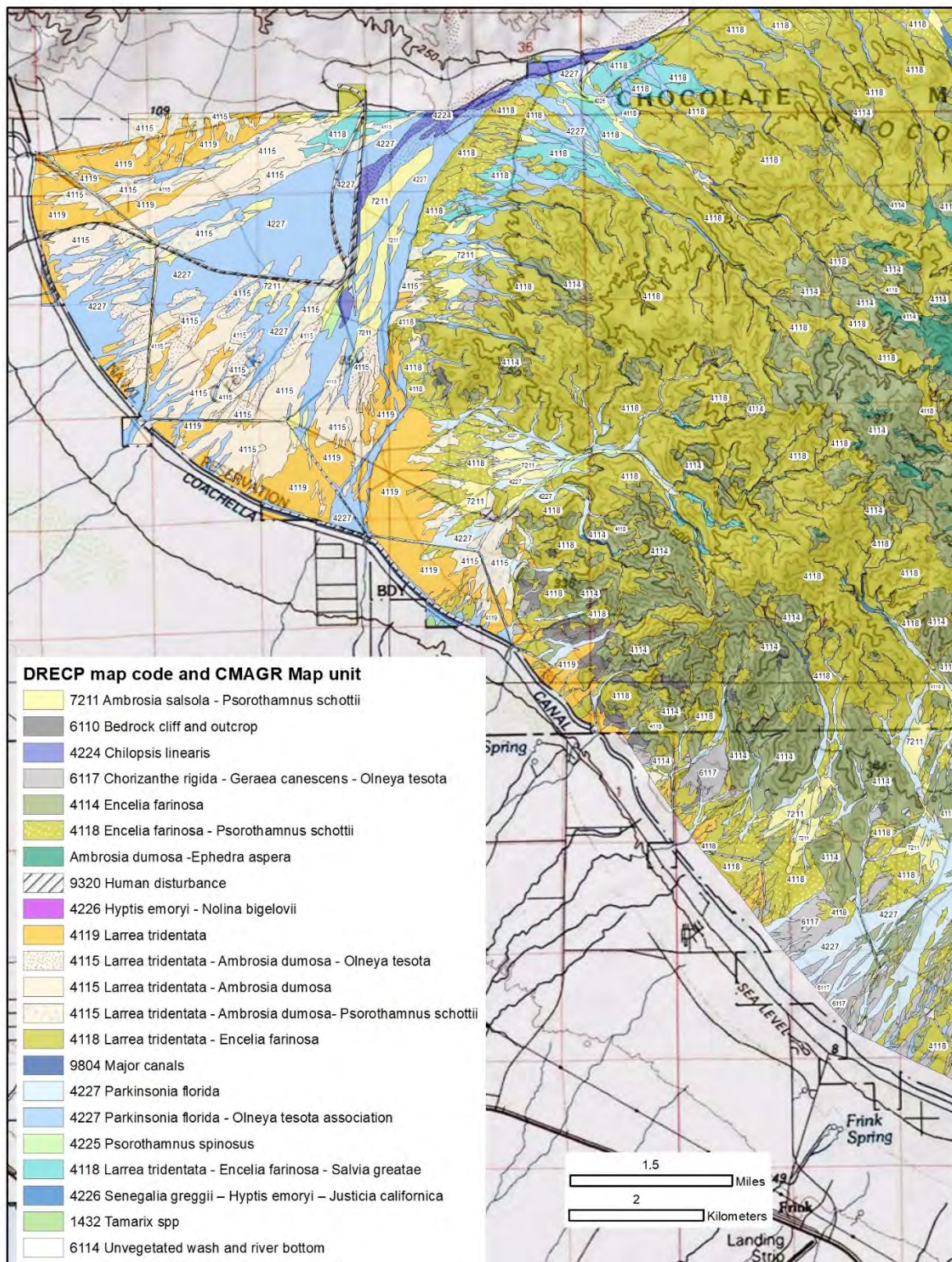


Lower Gas Line Road

FLORA AND VEGETATION OF THE CMAGR

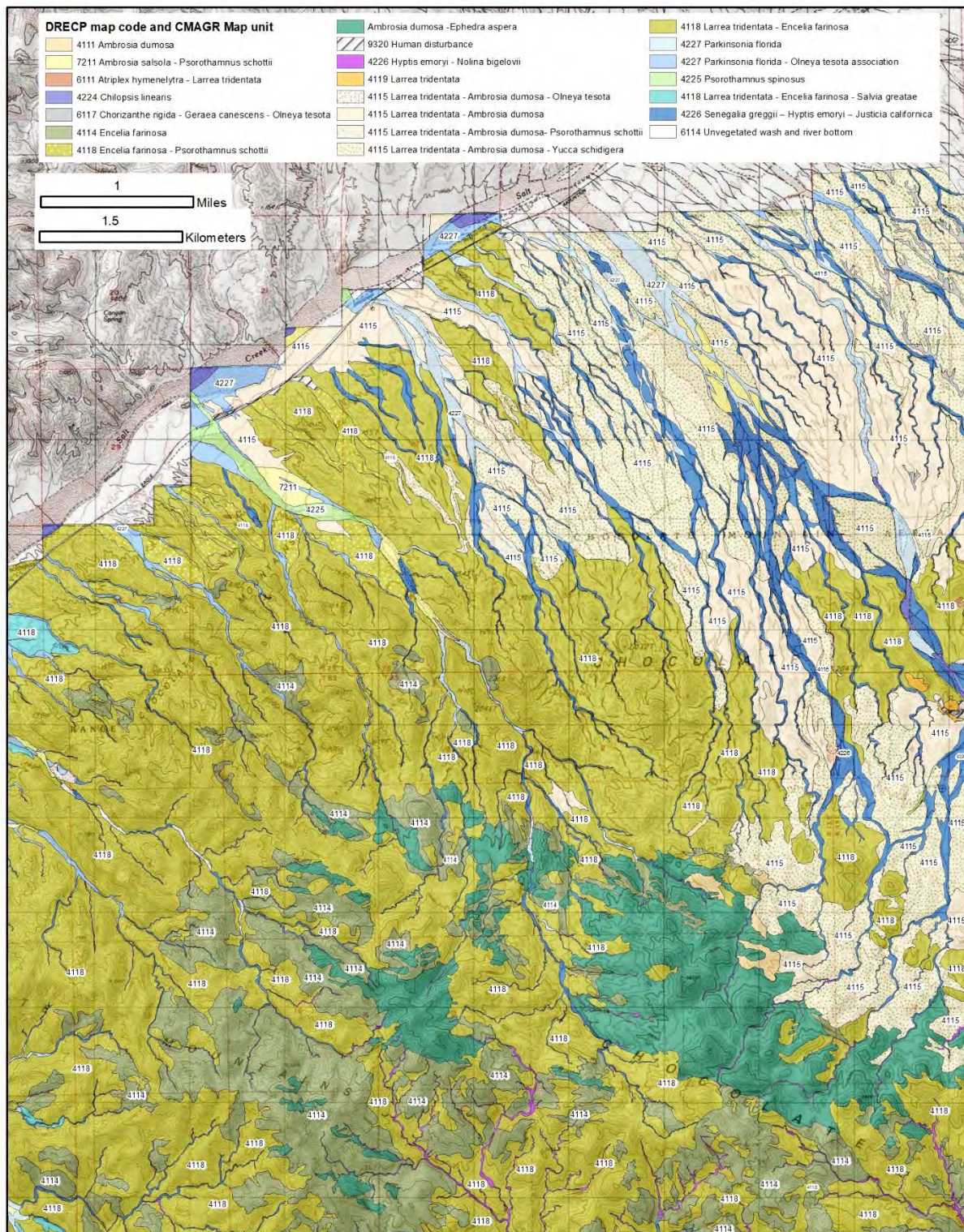


Lower Salt Creek



Lower Salt Creek

FLORA AND VEGETATION OF THE CMAGR



Upper Salt Creek

Appendix C: Accuracy Assessment contingency table

Field_assocn	Ambrosia dumosa Association	Ambrosia salsola - Psorothamnus schottii Association	Suaeda moquinii - Atriplex canescens Association	Atriplex hymenelytra - Larrea tridentata Association	Bedrock cliff and outcrop	Chilopsis linearis Association	Chorizanthe rigida - Gersea canescens - Olneya tesota Association	Cylindropuntia bigelovii alliance	Encelia farinosa Alliance	Encelia farinosa - Larrea tridentata - Psorothamnus schottii Association	Ambrosia dumosa - Ephedra aspera association	Hyptis emoryi - Nolina bigelovii Association	Larrea tridentata Association	Larrea tridentata - Ambrosia dumosa - Calliandra eriophylla Association	Larrea tridentata - Ambrosia dumosa - Fouquieria splendens Association	Larrea tridentata - Ambrosia dumosa - Olneya tesota Association	Larrea tridentata - Ambrosia dumosa - Psorothamnus schottii Association	Larrea tridentata - Ambrosia dumosa - Yucca schidigera Association	Larrea tridentata - Encelia farinosa Alliance	Larrea tridentata - Ambrosia dumosa - Cylindropuntia munzii Association	Mud Hills sparsely vegetated	Parkinsonia florida Association	Parkinsonia florida - Olneya tesota Alliance	Parkinsonia florida - Olneya tesota / Cylindropuntia munzii	Parkinsonia florida - Olneya tesota / Hyptis emoryi Association	Encelia rigida Alliance	Prosopis glandulosa Association	Psorothamnus spinosus Association	Salvia greatae Association	Senegalia greggii - (Bebbia juncea - Hyptis emoryi) Alliance	Tamarix spp Alliance
Ambrosia dumosa Association	2																														
Ambrosia salsola - Psorothamnus schottii Association		2																													
Suaeda moquinii - Atriplex canescens Association			2																												
Atriplex hymenelytra - Larrea tridentata Association				1																											
Bedrock cliff and outcrop					3																										
Chilopsis linearis Association						4																									
Chorizanthe rigida - Gersea canescens - Olneya tesota Association							10																								
Cylindropuntia bigelovii alliance									5																						
Encelia farinosa Alliance	1																														
Encelia farinosa - Larrea tridentata - Psorothamnus schottii Association										2																					
Ambrosia dumosa - Ephedra aspera association																															
Hyptis emoryi - Nolina bigelovii Association																															
Larrea tridentata Association													2																		
Larrea tridentata - Ambrosia dumosa Association													6																		
Larrea tridentata - Ambrosia dumosa - Calliandra eriophylla Association																															
Larrea tridentata - Ambrosia dumosa - Fouquieria splendens Association																															
Larrea tridentata - Ambrosia dumosa - Olneya tesota Association																															
Larrea tridentata - Ambrosia dumosa - Psorothamnus schottii Association			1																												
Larrea tridentata - Ambrosia dumosa - Yucca schidigera Association																															
Larrea tridentata - Encelia farinosa Alliance	1																														
Larrea tridentata - Ambrosia dumosa - Cylindropuntia munzii Association																															
Mud Hills sparsely vegetated																															
Parkinsonia florida Association																															
Parkinsonia florida - Olneya tesota Alliance																															
Parkinsonia florida - Olneya tesota / Cylindropuntia munzii																															
Parkinsonia florida - Olneya tesota / Hyptis emoryi Association																															
Pleuraphis rigida Alliance																															
Prosopis glandulosa Association																															
Psorothamnus spinosus Association																															
Salvia greatae Association																															
Senegalia greggii - (Bebbia juncea - Hyptis emoryi) Alliance																															
Tamarix spp Alliance																															

Map Unit CMAGR	BMGR alliance (code)	BMGR association (code)	BMGR subassociation (code)
Ambrosia dumosa Alliance	Ambrosia Alliance (2)	No equivalent (new 20)	No equivalent (new 200)
Ambrosia dumosa - Ephedra aspera association	Ephedra Alliance (4)	No equivalent (new 42)	No equivalent (new 420)
Ambrosia salsola - Psoralea schottii Association	No equivalent	No equivalent	No equivalent
Chilopsis linearis Association	No equivalent, but most similar to the watercourse alliance (8)	No equivalent	No equivalent
Chorizanthe rigida - Geraea canescens - Olneya tesota Association	Larrea Alliance (1)	Creosote – white bursage – paloverde/ironwood (17)	Creosote – white bursage/paloverde-ironwood pavements (171)
Cylindropuntia bigelovii Alliance	Larrea Alliance (1)	Creosote - teddy bear cholla (14)	Creosote - white bursage – teddy bear cholla (141)
Encelia farinosa - Larrea tridentata - Psoralea schottii Association	Encelia farinosa Alliance (6)	No equivalent but most similar to Brittlebush-Creosote-WhiteBursage (68)	No equivalent, but similar to Brittlebush-Creosote-WhiteBursage on fans (681) and Creosote – white bursage/ yellow paloverde-ironwood on bar/swale fans (175)
Encelia farinosa Alliance	Encelia farinosa Alliance (6)	No equivalent but most similar to Brittlebush-Creosote (67)	No equivalent but most similar to Brittlebush-Creosote on dark rocks (670)
Human disturbance	Disturbed (5)	Disturbed (50)	Disturbed (500)
Hyptis emoryi - Nolana bigelovii Association	Watercourse (8)	Most similar to Lavender/Hollyleaf bursage (83)	Most similar to Lavender/Hollyleaf bursage – Brittlebush (830)
Larrea tridentata - Ambrosia dumosa - Atriplex hymenelytra Association	Atriplex alliance (7)	Atriplex hymenelytra - Ambrosia dumosa (71)	No equivalent (new 711)
Larrea tridentata - Ambrosia dumosa - Calliandra eriophylla Association	Larrea Alliance (1)	Larrea tridentata - Ambrosia dumosa (11)	No equivalent (new 112)
Larrea tridentata - Ambrosia dumosa - Cylindropuntia munzii Association	Larrea Alliance (1)	Larrea tridentata - teddy bear cholla (14)	No equivalent (new 142)
Larrea tridentata - Ambrosia dumosa - Olneya tesota Association	Larrea Alliance (1)	Creosote – bursage – paloverde/ironwood (17)	Creosote – white bursage/ironwood-blue paloverde (176)
Larrea tridentata - Ambrosia dumosa - Psoralea schottii Association	Larrea Alliance (1)	Larrea tridentata - Ambrosia dumosa (11)	No equivalent (new 118)
Larrea tridentata - Ambrosia dumosa - Yucca schidigera Association	Larrea Alliance (1)	Larrea tridentata - Ambrosia dumosa (11)	No equivalent (new 119)
Larrea tridentata - Ambrosia dumosa Alliance	Larrea Alliance (1)	Larrea tridentata - Ambrosia dumosa (11)	Larrea tridentata - Ambrosia dumosa (110)
Larrea tridentata - Encelia farinosa Alliance	Encelia Alliance (6)	Brittlebush-Creosote (67)	Most similar to Brittlebush-Creosote on dark rocks, but the CMAGR has more Ambrosia dumosa. (new 671)
Larrea tridentata - Encelia farinosa - Salvia greatae association	Larrea Alliance (1)	No equivalent	No equivalent
Larrea tridentata Association	Larrea Alliance (1)	Larrea tridentata monotype (10)	Larrea tridentata monotype (100)
Major canals	Disturbed (5)	Disturbed (50)	Disturbed (500)
Mud Hills sparsely vegetated ephemeral herbs Mapping Unit	No equivalent, but most similar to 'barrens' on BMGR, code (0)	barrens (00)	barrens (000)
North American warm desert bedrock cliff and outcrop Group	No equivalent, but most similar to 'barrens' on BMGR, code (0)	barrens (00)	barrens (000)
Parkinsonia florida - Olneya tesota - Cylindropuntia munzii Association	Watercourse (8)	Wolfberry (Lycium) (81)	Most similar to Ironwood/Brittlebush-Wolfberry-Cheesebush (811), but should recognize CMAGR as new (814)
Parkinsonia florida - Olneya tesota Alliance	Watercourse (8)	Wolfberry (Lycium) (81)	Most similar to Ironwood/Brittlebush-Wolfberry-Cheesebush (811), but should recognize CMAGR as new (815)
Parkinsonia florida Association	Watercourse (8)	No equivalent (new 82)	No equivalent (new 820)
Pleuraphis rigida Alliance	No equivalent	No equivalent, but most similar to creosote floodplain (15)	No equivalent
Prosopis glandulosa Association	Watercourse (8)	Mesquite (80)	Mesquite bosque (800)
Psoralea spinosa Association	Watercourse (8)	Most similar to Wolfberry (81)	Most similar to BMGR-East Wolfberry-Canyon Ragweed-Smokedtree-Catclaw (813) - should call the this new 815
Senegalia greggii - Hyptis emoryi - Justicia californica Alliance	Watercourse (8)	No equivalent, but most similar to Lavender/Hollyleaf bursage (83)	No equivalent but most similar to Lavender/Hollyleaf bursage – Brittlebush (830)
Suaeda moquinii - Atriplex canescens Association	Atriplex Alliance (7)	No equivalent (new 76)	No equivalent - (new 762) (761 is from BMGR-E and Cabeza Prieta)
Tamarix spp. Alliance	Watercourse (8)	No equivalent (new 86)	No equivalent - (new 860)
Unvegetated wash and river bottom Mapping Unit	Barrens (0)	Barrens (00)	Barrens (000)
Urban	Disturbed (5)	Disturbed (50)	Disturbed (500)

Appendix D: Vegetation Crosswalk between CMAGR (California) and Barry M. Goldwater Range, Arizona

FLORA AND VEGETATION OF THE CMAGR

Appendix E – Key to mapping units of the CMAGR

Preliminary Notes

(1) Estimates of dominance and co-dominance are based on minimum mapping unit (= MMU) of one hectare. In other words, a 50 x 50 m patch of dominant teddy bear cholla (*Cylindropuntia bigelovii*) is not sufficient to map the cholla mapping unit – it must be at least 100 x 100 m.

(2) A **tree** in the CMAGR is one of six species: paloverde (*Parkinsonia florida*); ironwood (*Olneya tesota*); desert willow (*Chilopsis linearis*); tamarix (*Tamarix aphylla*); mesquite (*Prosopis glandulosa*), and smoketree (*Psoralea argyrea*). When estimating cover of these species, only include ironwood (*Olneya*) at least 2 m height. This is because it was not possible to distinguish short *Olneya* from tall *Larrea* on imagery.

(3) Cover is canopy cover and includes all stems/branches that are standing – as if you draped a sheet over a plant and included all space under the sheet as part of the canopy. Dead branches still on the plant count but fallen branches don't count. Cover measurements for upland landforms were generally made by the step-point method, with transects ranging from 100 to 1000 m. For very steep terrain, including cliffs, estimates are ocular. For narrow watercourses (<5 m open channel), cover is based on walking 100 paces (= 70 m) along a single bank and counting a hit for each species falling on a line perpendicular to the bank, within 2 meters of the bank. For broad arroyos ≥5 m wide with multiple channels, and floodplain, cover measurements are similar to upland landforms, and include the bank and vegetation between banks, zig-zagging between banks for at least 100 paces. This includes lands with scattered *Olneya* that are along vague and intermittently active watercourses on alluvial fans; in such cases, the resulting *Olneya* cover estimate is for the mapped polygon area.

(4) Dominance is usually when a species has at least ≥ 2X the cover of any other species. When this rule is broken, mention will be made in the key.

(5) Roads were not mapped in this study, but available as a separate layer from Range Management.

Key to Physiognomic/Ecological Levels

1. Sites characterized by disturbance within the last century, usually as obvious as buildings, communication installations, or targets, but also including earth works (=levees) meant to protect the Coachella canal, retain water for animals, or clearings for developments that now are in the process of returning to nature. Does NOT include roads, either active or inactive, which are another layer. **Key I – Disturbance features**

1'. Not as above. Vegetation occurs on natural landforms..... 2

2. ≥25% cover of **mesquite** and/or **tamarix** and/or **big galleta grass** (*Hilaria*=*Pleuraphis*), usually with little or no gradient and no open channel. Mesquite and tamarix typically associated with a diversion or earthwork such as a road, canal, or dike, while big galleta grass is in natural watercourses. **Key II - ≥25% cover of *Prosopis glandulosa* and/or *Tamarix sp.* and/or *Pleuraphis rigida***

2') Not as above – **Key III - Watercourses and uplands**

Key I. Disturbance Features

Camp Billy Machen = **Urban** map unit

Coachella Canal = **Major Canals** map unit

Targets, cleared areas, craters; levees to protect the canal; abandoned train tracks – all can be decades old = **Human disturbance** map unit

Note: A series of levees protecting the canal typically extend one mile upslope, diverting floodwaters to canal siphons. Lands between the canal and levees are deprived of upslope runoff. They are nevertheless mapped not as disturbed but instead as any other watercourse or upland vegetation in the CMAGR and noted as 'Affected' in a separate field called 'hydrologic modification'. An example of such lands is shown below (Fig. 1), with the levees to the right of the Coachella Canal.



Figure 1. Example of lands 'hydrologically affected' by the levees extending upslope (to the right) from the Coachella canal.

Key II. $\geq 25\%$ cover of *Prosopis glandulosa* and/or *Tamarix sp.* and/or *Pleuraphis rigida*

1) Big Galleta Grass (*Pleuraphis rigida*) with $\geq 25\%$ cover. Only on the north side of the Chocolate Mts. May be relatively long and narrow (5 m wide) strips of dominant big galleta grass with yucca common. Uncommon. Restricted to the summit of the Bradshaw Trail, and the valley south of Invader Butte.

Big Galleta (*Pleuraphis rigida*) Alliance

1') *Prosopis glandulosa* and/or *Tamarix* spp. at $25 \geq\%$ cover2

2) *Tamarix* strongly dominant in the overstory, with $\geq 2x$ cover of any other tree. Uncommon. Restricted to a few patches near Coachella Canal.

***Tamarix* spp. Alliance**

2') *Prosopis glandulosa* spp. dominant or co-dominant in the overstory. Uncommon, found only in three scattered watercourses, and one location near the Coachella canal.

***Prosopis glandulosa* Association**

Key III: Watercourses and uplands

1) Barren hills, mountains, and fans with < 2% perennial vegetation OR desert pavements (barrens interrupted by strips of vegetation, often dense, including scattered trees) – 2

1') Not as above – 4

2) Desert pavements, defined as follows: walking perpendicular to the watercourses, more than 50% of your path is swaths of small stones (pavements) or simply bare earth, in swaths at least 10 meters wide, devoid of perennial vegetation. Small watercourses (<1-meter-wide open channel) between barren swaths may be densely vegetated, including scattered trees, but are mapped as part of the unit along with the adjacent pavements. Includes rolling hills (uncommon) as well as more typical valley floors. Overall perennial vegetation coverage of mapping unit can be $\geq 2\%$.

***Chorizanthe rigida* – *Geraea canescens* – *Olneya tesota* association**

2') Not as above – 3

3) Ancient lake sediments resembling badlands, found only NW of Camp Billy Machen, above Coachella Canal

Mud Hills sparsely vegetated mapping unit

3') Barren slopes or hills and mountains, including bedrock cliffs

North American warm desert bedrock cliff and outcrop Group

4) INDICATOR SPECIES are dominant or co-dominant within the Minimum Mapping Unit of 1 hectare (= 2.4 acres), in which case the mapping unit is named thusly:

Cylindropuntia bigelovii

***Cylindropuntia bigelovii* Alliance**

Atriplex canescens and/or *Suaeda nigra*

***Suaeda moquinii* - *Atriplex canescens* Association**

Atriplex hymenelytra

***Larrea tridentata* – *Ambrosia dumosa* - *Atriplex hymenelytra* Association**

4') No indicator species as above - 5

5) Watercourses and floodplains, braided or single, with $\geq 2\%$ cover of one or more species: ironwood (*Olneya tesota*), palo verde (*Parkinsonia florida*), desert willow (*Chilopsis linearis*), smoketree (*Psoralea argyrea*), catclaw (*Senegalia greggii*), desert lavender (*Hyptis emoryi*), cheesebush (*Ambrosia salicifolia*), Schott's dalea (*Psoralea schottii*) – 6

5') Not as above, i.e., upland vegetation – 12

6) Desert willow, *Chilopsis linearis*, with $\geq 2\%$ cover and is the dominant tree, or codominant with smoketree.

***Chilopsis linearis* Association**

6') Smoketree, *Psoralea argophylla*, with $\geq 2\%$ cover and is the dominant tree, or co-dominant with *Parkinsonia* or *Olneya*. *Ambrosia salsola* and/or *Hyptis emoryi* can be more abundant than smoketree.

***Psoralea argophylla* Association**

6'') *Cylindropuntia munzii* with $\geq 1\%$ cover among braided channels - 7

6''') Not as above – 8

7) *Cylindropuntia munzii* with $\geq 1\%$ cover. Typical associates include ironwood and/or paloverde, but occasionally reaches higher into watercourses dominated by *Senegalia* and/or *Hyptis*. If *Yucca schidigera* present, the *Cylindropuntia munzii* has greater cover than *Yucca schidigera*.

***Parkinsonia florida* - *Olneya tesota* - *Cylindropuntia munzii* association**

7') *Cylindropuntia munzii* with $\geq 1\%$ cover. Typical associates include *Senegalia* and/or *Hyptis*. If *Yucca schidigera* present, the *Yucca* has greater cover than *Cylindropuntia munzii*.

***Senegalia greggii* – (*Bebbia juncea* – *Hyptis emoryi*) alliance**

8) $\geq 3\%$ cover of desert ironwood (*Olneya tesota*) and/or blue palo verde (*Parkinsonia florida*) of tree height ($\geq 2\text{m}$). Shrub cover, including *Ambrosia salsola*, *Psoralea argophylla* and *Atriplex hymenelytra*, can exceed tree cover – 9

8') Not as above, i.e., watercourses with $< 3\%$ *Parkinsonia florida* and/or *Olneya tesota* of tree height – 10

9) *Olneya tesota* absent or nearly so (you would have to search for one) -

***Parkinsonia florida* Association**

9') *Larrea tridentata* and/or *Ambrosia dumosa* and/or *Psoralea argophylla* with equal or greater cover than *Olneya* (and rarely *Parkinsonia*), with the trees widely scattered among minor watercourses. Typical xero-riparian species (*Lycium*, *Ambrosia salsola*, *Bebbia*, and *Hyptis*) are absent or rare. Typically, no more than 5% tree cover within the unit, which is usually on alluvial fans (see figure below for example) but occasionally on incised hillslopes.

***Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association**

9'') *Olneya* and *Parkinsonia* present and visible from any point in the unit, although one species can be the overwhelming dominant. This association can include abundant *Ambrosia salsola*, *Atriplex hymenelytra*, *Bebbia juncea*, *Lycium andersonii* and *Psoralea argophylla* at cover values greater than the trees.

***Parkinsonia florida* - *Olneya tesota* Alliance**



Figure 2. Examples of *Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* association.

10) *Senegalia greggii* and/or *Hyptis emoryi* and/or *Tetracoccus hallii* with $\geq 2\%$ cover, typically along narrow watercourses in mountains at all elevations or in many-braided channels at elevations over 1900 feet. Shrubs including *Ambrosia salsola*, *A. dumosa*, *Lycium andersonii*, *Larrea tridentata*, *Encelia farinosa*, and *Pleuraphis rigida* can equal cover of *Senegalia*, *Hyptis*, or *Tetracoccus* – 11

10') *Ambrosia salsola*, *Psoralea schottii*, or *Bebbia juncea* dominant, or co-dominant with *Encelia farinosa*. Typically occupies flood-scoured watercourses and alluvial fans.

***Ambrosia salsola* – *Psoralea schottii* Association**

11) *Nolina bigelovii* is a common associate, visible without searching. Mountain canyons above 1400 ft (420 m), especially on granites.

***Hyptis emoryi* – *Nolina bigelovii* Association**

11') Not as above. Occurs in steep narrow canyons on relatively barren slopes below 1800 feet, and above 1800 feet on many-braided channels on alluvial outwash with jojoba (*Simmondsia chinensis*) and *Yucca schidigera*. Widespread.

***Senegalia greggii* – (*Bebbia juncea* – *Hyptis emoryi*) Alliance**

12) Upland landform with *Larrea tridentata* $< 1\%$ cover - 13

12') Upland landform with *Larrea tridentata* $\geq 1\%$ – 18

13) *Ephedra aspera* or *Bahiopsis* (= *Viguiera*) *parishii* or *Nolina bigelovii* with at least 2% cover. Restricted to cooler aspects typically above 1700 feet, usually on granitoid rocks.

***Ambrosia dumosa* - *Ephedra aspera* association**

13') Not as above – 14

14) *Cylindropuntia munzii* $\geq 1\%$ cover

***Larrea tridentata*-*Ambrosia dumosa*-*Cylindropuntia munzii* Association**

14') Not as above - 15

15) *Ambrosia dumosa* $\geq 1\%$ cover and at least twice the cover of any other perennial. *Encelia farinosa* typically $< 1\%$.

***Ambrosia dumosa* Association**

15') *Encelia farinosa* $\geq 1\%$, *Ambrosia dumosa* may be absent or present – 16

16) *Calliandra eriophylla* (fairy duster) $\geq 1\%$ cover in small watercourses among rolling hills or bajadas that are included within the association mapping unit, so overall cover of *Calliandra* is $< 1\%$. Restricted to

the NE section of the range.

***Larrea tridentata* – *Ambrosia dumosa* – *Calliandra eriophylla* association.**

16') Not as above - 17

17) *Psoralea schottii* $\geq 2\%$. *Parkinsonia florida* and/or *Larrea tridentata* can be equal or exceed cover of *Encelia*.

***Encelia farinosa*-*Psoralea schottii* association**

17') Not as above – most commonly on steep mountain slopes but can also occur on fans

***Encelia farinosa* alliance**

Below: ***Encelia farinosa* alliance on fan – FNE 13**



18) *Encelia farinosa* $<1\%$ - 19

18') *Encelia farinosa* $\geq 1\%$ - 20

19) *Ambrosia dumosa* $<1\%$ - 23

19') *Ambrosia dumosa* $\geq 1\%$ - 26

20) *Cylindropuntia munzii* ≥1% cover

***Larrea tridentata*-*Ambrosia dumosa*-*Cylindropuntia munzii* Association**

20') *Ephedra aspera* or *Bahiopsis* (= *Viguiera*) *parishii* or *Nolina bigelovii* with at least 2% cover. Restricted to cooler aspects typically above 1700 feet, usually on granite.

***Ambrosia dumosa* - *Ephedra aspera* Association**

20'') *Salvia greatae* ≥1% -

***Salvia greatae* Association** (only near Salt Creek or less commonly in mountain canyons within 5 miles SE of Salt Creek)

20''') Not as above – 21

21) *Psoralea schottii* ≥2% and *Oenothera tesota* <1%, on alluvial fans. NOTE: This association does not include *Psoralea schottii* >2% that occasionally occurs on hills and mountains, and which was mapped as part of the *Larrea tridentata* - *Encelia farinosa* Alliance.

***Encelia farinosa* - *Psoralea schottii* association.**

21') Not as above – 22

22) *Oenothera tesota* ≥1%, typically scattered among vague watercourses (Can include *Psoralea schottii* ≥2%).

***Larrea tridentata* - *Ambrosia dumosa* - *Oenothera tesota* Association**

22') Not as above.

***Larrea tridentata*-*Encelia farinosa* Alliance**

23) *Cylindropuntia munzii* ≥1% cover

***Larrea tridentata*-*Ambrosia dumosa*-*Cylindropuntia munzii* Association**

23') Not as above – 24

24) *Oenothera tesota* ≥1%, typically scattered among vague watercourses. Can include common *Psoralea schottii*.

***Larrea tridentata* - *Ambrosia dumosa* - *Oenothera tesota* Association**

24') Not as above – 25

25) *Psoralea schottii* ≥2%

***Larrea tridentata* – *Ambrosia dumosa* – *Psoralea schottii* association**

25') Not as above

***Larrea tridentata* Association**

26) *Yucca schidigera* is present with at least ten individuals/clumps within a hectare. Includes the rolling hills/ridges dominated by *Latr/Amdu*, where *Yucca* is mostly in small watercourses which are mapped along with the hills/ridges between as a single mapping unit – 27

26') Not as above – 28

27) *Cylindropuntia munzii* is present at $\geq 1\%$, and more common than the *Yucca*.

***Larrea tridentata*-*Ambrosia dumosa*-*Cylindropuntia munzii* Association**

27') Not as above. Widespread on rolling hills/small watercourse in northwestern CMAGR.

***Larrea tridentata* - *Ambrosia dumosa* – *Yucca schidigera* Association**

28) *Cylindropuntia munzii* is present at $\geq 1\%$

***Larrea tridentata*-*Ambrosia dumosa*-*Cylindropuntia munzii* Association**

28') Not as above - 29

29) *Calliandra eriophylla* (fairy duster) $\geq 1\%$ cover in small watercourses among rolling hills or bajadas that are included within the association mapping unit, so overall cover of *Calliandra* is often $< 1\%$. Restricted to the northeastern CMAGR.

***Larrea tridentata* – *Ambrosia dumosa* – *Calliandra eriophylla* Association**

29') Not as above – 30

30) *Ephedra aspera* or *Bahiopsis* (= *Viguiera*) *parishii* or *Nolina bigelovii* with at least 2% cover. Restricted to cooler aspects typically above 1700 feet, usually on granite.

***Ambrosia dumosa* - *Ephedra aspera* Association**

30') Not as above – 31

31) *Salvia greatae* $\geq 1\%$

***Salvia greatae* Association** (only near Salt Creek or mountains within 5 miles SE of Salt Creek)

31') Not as above – 32

32) *Olneya* (and occasionally *Parkinsonia*) $\geq 1\%$, with the trees widely scattered among minor watercourses. *Psoralea schottii* can be common. Usually on alluvial fans but occasionally on incised hillslopes. Widespread.

***Larrea tridentata* - *Ambrosia dumosa* - *Olneya tesota* Association**

32') Not as above – 33

33) *Psoralea schottii* $\geq 2\%$

***Larrea tridentata* – *Ambrosia dumosa* – *Psoralea schottii* Association**

33') Not as above. Widespread throughout the CMAGR.

***Larrea tridentata* – *Ambrosia dumosa* Association**

EXAMPLE IMAGES

Below is an example of narrow channel (LHM-8), where cover is measured only along bank.

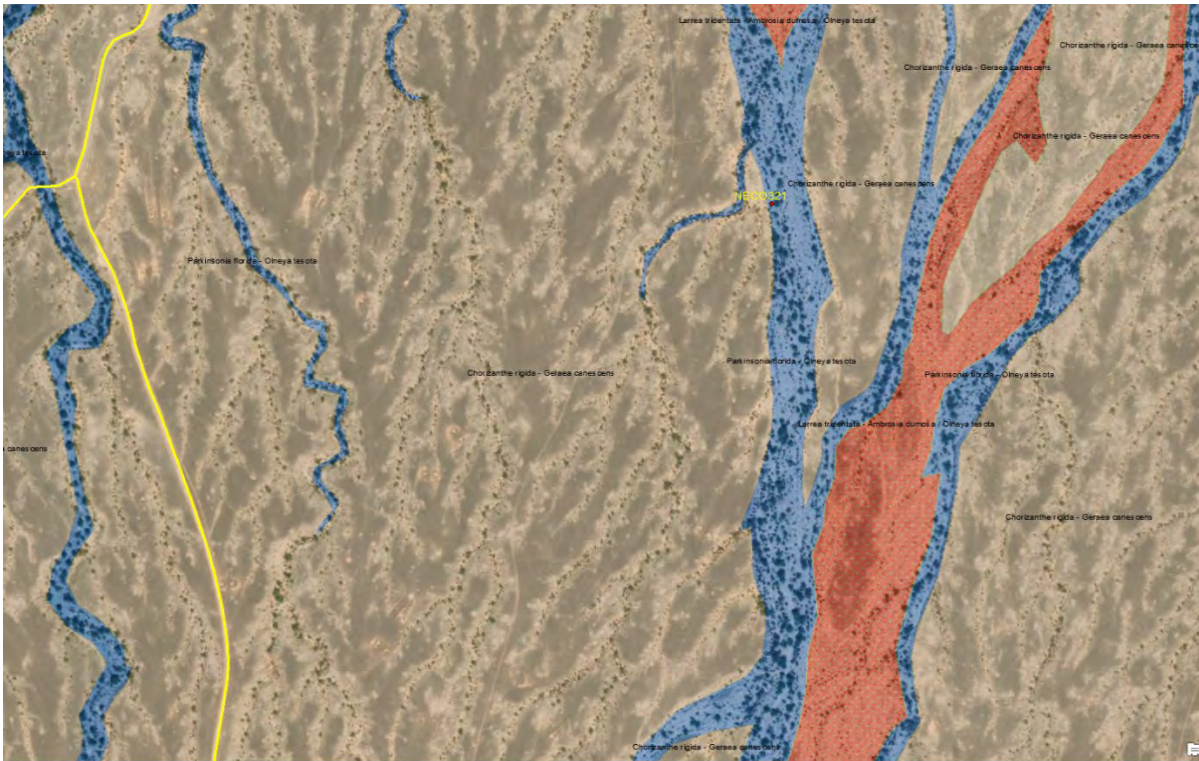


Below, example of broad channel (LHM-13), where the bank is not clear and cover values includes plants between banks.



Pavements: Image below is one mile wide. Yellow line is road. Many small arroyos about 1 meter wide are mapped as part of the larger pavement association (*C. rigida*-*G. canescens*). Larger arroyos are mapped as *Pafil/Olte* arroyos (blue). Red is mapped as creosote and scattered trees (*Larrea tridentata*-*Ambrosia dumosa*-*Olneya tesota*).





***Latr/Amdu/Yusc* association.** Example below from near Invader Butte, showing in the background the ridges with scant vegetation that are mapped as part of this association, because each hidden (in this view) watercourse holds *Yucca* with at least 10 clumps/hectare.





View above is 500 meters across. The lands between PW-9a and PW-9b are part of the *Latr-Amdu-Yusc* association, with *Yucca* common in the watercourses. Desert pavements, mapped separately, are to the right of image.

Below: ***Larrea tridentata* – *Ambrosia dumosa* – *Calliandra eriophylla* association.** *Calliandra* blooming pink in the watercourse. Ocotillo common here, but association is defined instead by the *Calliandra*.



Appendix F: Flora of the Chocolate Mountain Aerial Gunnery Range

Introduction

The highest point of the Chocolate Mountains is 3060 ft., and the lowest elevation within the CMAGR is c. -70 ft., thus there is an elevation range of c. 3130 ft. for the area. This is not huge but is enough to influence the presence or absence of some species because the upper elevations are necessarily cooler and moister than the lower.

Scientific names generally follow the Jepson Manual (2012) and alternative names are given in brackets following the name used, including cases where a well-known name not used in the Jepson Manual is used here and or where such names that are not used in the Jepson Manual.

The total number of taxa, including subspecies and varieties, accepted here is 316.

For brevity only one specimen is cited per accepted taxon, because cumulative records can be accessed in the Consortium of California Herbaria (<https://www.cch2.org/portal/index.php>), which makes long printed lists of specimen citations unnecessary. The few exceptions to this are cases, mostly involving cacti, where the making of specimens is sufficiently difficult that not many were made, and in those cases the limited number of collected specimens are supplemented by observation reports.

Historically there has been little botanical inventory work conducted within what is now the CMAGR because of the restricted access to the area since WWII. There were a few collectors who conducted at least limited inventories prior to the war, but most were just working along the Niland to Blythe Rd., or occasionally elsewhere.

The early collections are often rather indefinite as to locality and sometimes one cannot determine whether a particular collection was made within the boundaries of the modern CMAGR or just somewhere in the region. For example, Edmund C. Jaeger made collections in the Chocolate Mountains between 1921 & 1939 but some of these are just reported from “north base” or the “east base” though one with the same date as some of these vague “north base” ones also specifies “Salvation Wash” and another specifies “Arroyo Seco”.

Other early collections appear to give a locality, but it could just be of the 'closest named place' type – for example “Beal's Well” is a frequently cited locality but it's likely that those plants were just taken somewhere in the vicinity of Beal's Well along the Niland-Blythe Rd. and not necessarily at it. It was the closest named place known to the collector. This idea is supported by the shortage of early localities described as “5 miles NE of Beal's Well” or “2 miles west of Beal's Well”, or similar constructions. If the collectors had been concerned with that level of precision, and were keeping a road log of localities, they would probably have said something like that more often.

Earlier collectors seem to have frequently had different concepts of locations than we do currently. An example of a specimen taken elsewhere in the region but with Chocolate Mountains mentioned in the locality, based on a broader locality concept than is used today:

J.T. Howell in 1928 says "Hidden Spring Canyon at Hidden Spring, 13 miles se. of Mecca, Chocolate Mts." Hidden Spring is in the western Orocopia Mountains according to today's concepts. At one time the Chocolate and Orocopia Mountains were treated as one range it seems.

Even today the hills east of Hwy 78 in the Picacho Peak area, trending toward the Colorado River, are considered part of the Chocolate Mountains, though outside of the gunnery range and mostly of different geological origin. Searching on "Chocolate" as locality in Imperial County will yield a number of those records. This expansive delimitation of the Chocolate Mountains is used on the AAA Imperial County Map.

Sometimes place names have changed in their designation: a Roxana S. Ferris 1918 collection location is given as "Shaver's Well, Chocolate Mts - Mecca-Blythe Road" but that area is not now considered part of the Chocolate Mountains, but either the Orocopia Mtns. or the Mecca Hills.

Records like these had to be eliminated in compiling the list of plant species known from the Chocolate Mountains.

Plant distribution information is taken from CCH2 (Consortium of California Herbaria-2, <https://cch2.org/portal/collections/index.php>) and SEINet (<https://swbiodiversity.org/seinet/>) online databases of California plant specimens).

CCH2 lists only 174 collection records from before 1940 which mention "Chocolate" in the locality, and some of those are duplicate specimens. But some records from the area do not mention the Chocolate Mountains in general, but only some specific localities such as Beal Well, Mammoth Wash or M. Tank, or Salvation Spring and so will not be found in a search for the more inclusive term. The more specific terms needed to be used in searching.

All species which we accepted as present based either on our or earlier collections are listed in the main catalog. We attempted to document every species encountered with a voucher specimen.

There was only one previous effort to systematically survey the flora of the range (NAVFAC 1977) and that only covered the south half of the present CMAGR. In addition, the person doing the survey, Lorraine Pritchett, was only given one month to accomplish the field work and that was in the middle of summer (July) when many plants would have been dead or otherwise in poor condition. But, fortunately 1977 followed a year in which a hurricane had struck during fall (Hurricane Kathleen, September 1976) and brought heavy rains to the SE deserts of California. Because of this fortuitous circumstance, many plants would have been in better condition than would be expected in a more normal year. Unfortunately, no voucher specimens were preserved in this survey effort, making the species reports uncertain and subject to interpretation.

Format of specimen citations: county of collection, brief version of location, elevation in meters and equivalent in (feet), collector and collection number (usually Sanders and a sequential number, but occasionally s.n. (without number) or some other collector's number. Full record details can be found in CCH2 by searching on collector name and collection number for numbered collections. Unnumbered collections require at least collector name, plant name, and date.

Doubtful and excluded species

Ammobroma sonorae

There are records of this within a couple of miles of the range boundary, but in deep windblown sand of which there is none inside the CMAGR. Locally this is an Algodones Dunes specialist. Not reported in NAVFAC (1977).

Astragalus magdalenae* var. *peirsonii

Grows in deep windblown sand of the Algodones Dunes, but there are no records in the CMAGR and no suitable habitat. There is a record a couple of miles west of the boundary in the Algodones Dunes. This plant was not reported in NAVFAC (1977).

Astragalus tricarinatus

There are a number of records of this plant in the Chuckwalla Mountains north of the CMAGR, but none in or near the Chocolate Mountains. Not reported in NAVFAC (1977).

Atriplex torreyi

Reported by NAVFAC (1977) but we never found it and since it's similar to *A. lentiformis*, which we did find, and there is no voucher available, we are discounting this report.

Ayenia compacta

"California ayenia"

There are a number of records to the north in the Chuckwalla Mountains, but we found none during our surveys. We are not listing this even though there is potentially suitable habitat present. Not reported by NAVFAC (1977).

Colubrina californica

"Las Animas colubrina"

There are many records of this in the Chuckwalla Mountains (Corn Springs area) north of the CMAGR and a few in the canyons feeding toward the Colorado River east of Hwy 78 in the Picacho Peak area of the eastern Chocolate Mountains, but none close to the CMAGR and we did not find it. Often associated with seeps and springs in canyons, and the CMAGR may have too few of those to maintain populations of this species. Not reported in NAVFAC (1977).

Croton wigginsii

There are records of this from the dunes within a couple of miles of the range boundary, but in deep windblown sand of which there is none inside the CMAGR. Not reported in NAVFAC (1977).

Dicoria canescens

Reported from Mammoth Wash and the Salvation Pass area by NAVFAC (1977), and certainly possible in the area since it occurs on the Algodones Dunes, but we suspect these observations were from down in the loose sand outside the CMAGR boundary. The specimens closest to the range clearly specify that they were from dunes/sand probably on the west side of Ted Kipf Rd., but this species does occur elsewhere in sand deposits that are not strictly speaking dunes.

Distichlis spicata

This grass was reported (as *D. stricta*) from numerous places by NAVFAC (1977), but we strongly suspect that these records are in error as there is very little, if any, suitable habitat within the CMAGR for this halophyte of saline, high water table, areas. Grass identification presents many difficulties, and we feel certain that some other grass was mistaken for this. *Cynodon dactylon* is scattered in moist spots and is vegetatively similar to *Distichlis*, so is our best guess as to what was seen. *Cynodon* is unreported in NAVFAC 1977.

Ditaxis claryana

“glandular ditaxis”

There are no records within the CMAGR, but there are records to the east near the Colorado River in the Picacho Peak area. Possibly present but very unlikely. It is unreported in NAVFAC 1977.

Eriogonum deserticola

Reported from the Salvation Pass area by NAVFAC (1977) but we doubt that this observation was from within the CMAGR as this species is another sand obligate species and we suspect it was observed on the edges of the Algodones Dunes. The lowest end of the Salvation Pass Road would be a possibility, but since that is not a generally sandy area it was likely observed beyond the range boundary.

Euphorbia glyptosperma

This is a very rare plant, yet NAVFAC (1977) reported it from numerous places in the vicinity of the CMAGR. None of the other similar *Euphorbia* species was reported, including the very common, almost ubiquitous, *Euphorbia polycarpa*. There are only 21 records of this plant in CCH2, but NAVFAC placed it in 12 spots in and around the range. We are confident in saying that all reports of *E. glyptosperma* from the range actually pertain to *E. polycarpa* (or occasionally to some other prostrate spurge).

Helianthus niveus* var. *tephrodes

“Algodones sunflower”

This grows in deep windblown sand of the Algodones Dunes, and there is no suitable habitat within the CMAGR. This species was not found in the NAVFAC (1977) survey but was listed by them for consideration.

Ipomopsis tenuifolia

This species is reported from the area based on some serious error in data transmission. There are voucher specimens, but with serious errors.

Evelyn Gray s.n., 1 Apr 1928, Imperial County, Chocolate Mountains, Colorado Desert, Mammoth Wash, near Indio. And also as "California, Imperial, Mammoth Wash; between Niland and Ogilby"

Either the collector was deeply confused as to where she was or, more likely, problems occurred during the labeling of specimens. This plant has never otherwise been collected anywhere near Mammoth Wash and there is no suitable habitat within the CMAGR. Gray "reported" this plant from other implausible locations as well. And Mammoth Wash is not "near Indio" according to usual word usage, nor is Indio in Imperial County. *Ipomopsis tenuifolia* is a rare plant known in California only from the hills on the US/Mexico border in eastern San Diego County. It is certainly not present in the CMAGR.

Mammillaria microcarpa

[= *M. grahamii*, *M. milleri*]

This small cactus was reported by NAVFAC (1977), but the record is likely the result of a misidentification of *M. tetrancistra*. This plant is known in California only from the extreme eastern lobe of the state in the Whipple Mountains area of San Bernardino County.

Mortonia utahensis

This shrub is known only from the eastern and northern Mojave Desert in California, where it is strongly associated with limestone substrates. It also occurs in southern Nevada and extreme NW Arizona, and the SW corner of Utah. There is no suitable limestone habitat for this plant in the Chocolate Mtns, and even if there were it is so far from established locations that it would have little chance of reaching the area. Some other plant was mistaken for this species in the NAVFAC (1977) report.

Nemacaulis denudata* var. *gracilis

There are no records of this in the vicinity of the CMAGR. Closest locations are near Blythe and Mecca. It grows in loose sand, of which there is little in the CMAGR. It might be expected in the Algodones Dunes, but has never been found there. There is only a single collection (two specimens made) from Imperial County, and that was on the far western edge of the county. Perhaps this plant needs a cooler climate or more winter rain. Though, it grows in the Coachella Valley of Riverside County, which is climatically like Algodones, so the excluding factor is not obvious.

Nolina parryi

This was listed in the NAVFAC (1977) report, but this is undoubtedly based on a misidentification of *N. bigelovii* which is present at scattered location in CMAGR, especially at higher elevations, but which is unreported by NAVFAC.

Oenothera deltoides

This common spring annual of dunes and other sandy sites across the California desert is present in the Algodones dunes but there is scant sand habitat within the CMAGR. We never saw this plant and suspect the report in NAVFAC (1977) is based on plants growing outside the range boundaries. This species could be present at the edge of the range, perhaps in a sand accumulation above Ted Kipf Rd., or elsewhere along the SW edge of the range, but we did not find it and there are no specimens that suggest this. The closest is 2 miles SE of Regina siding along the RR right of way, but that is still outside of the range.

Palafoxia arida* var. *gigantea

“giant Spanish needle”

This grows in deep windblown sand of the Algodones dunes, but there is apparently no suitable habitat within the CMAGR boundaries. However, the earlier CMAGR survey (NAVFAC, 1977) reported it (as *P. linearis gigantea*) from “Acolita Wash”, which may be outside the range boundary within the dunes, or the plant may have been misidentified. Perhaps the common *P. arida arida* was seen. The area within the range near Acolita consists of rocky/gravelly alluvial slopes which is unsuitable habitat for this plant, but somewhat tolerable for *P. arida arida*.

Phacelia calthifolia

This annual is not expected on the low desert because it has been exclusively found in the greater Death Valley region of the Mojave Desert. It is not known from south of San Bernardino County. It was reported by NAVFAC (1977) but since the common and somewhat similar *Phacelia crenulata* was not, we are sure that dead dried plants (inventory in July, remember) of that were misidentified.

Collection History of CMAGR and Vicinity

The earliest collectors in the area were the Parish brothers, Samuel B. & Wm. F. They collected in 1881 & 1882 at Mammoth Tank and Mesquite Canyon.

E. E. Schellenger was the most active early worker documenting the flora of the vicinity. He passed by the range on various dates from 1894 to 1920, while traveling between the Coachella Valley and the Palo Verde area near Blythe. His route most frequently was along the old Bradshaw Trail ("Ehrenberg Road") up Salt Creek wash and across the Chuckwalla Bench. This route skirts the northern edge of the CMAGR for a number of miles in the vicinity of Canyon Springs, Red Canyon, and Arroyo Seco.

His locations include: Ehrenberg ("Eherenberg") Road near Red Cañon, 1894; Chuckwalla Bench, Colorado Desert, 1894, 1895, 1903, 1904, 1920; 15 mi e Salton; Canyon Springs, 1904

Unfortunately, his location descriptions are often not very specific, with a simple "Chuckwalla Bench" being by far his most frequent site description.

H.M. Hall made over 100 collections in 1905 around Salvation Spring, on Chuckwalla Bench and at Canyon Spring, as well as elsewhere in the broader region. His collection of *Erigeron divergens* remains the only Chocolate Mountains record.

Next in chronological sequence was Edmund C. Jaeger, who collected several significant specimens in and around the Chocolate Mtns. in the 1920s and again in 1939.

Around the same time as Jaeger (March-May, 1927) a few collections were made by Ethel Rockwell, mostly around Mammoth Wash and Calipatria.

Flora of the Chocolate Mountain Aerial Gunnery Range

CRYPTOGAMS

PTERIDACEAE

Cheilanthes parryi (D.C. Eat.) Domin

[*Myriopteris parryi* (D.C.Eaton) Grusz & Windham]

“Parry's lip fern”

An inconspicuous and uncommon xerophytic perennial fern, always found in rock crevices or in the shade of overhanging boulders. Does not occur on alluvial slopes/bajadas but only among bedrock outcrops of the mountain face. Still, it is easily the most common fern in the Chocolate Mountain Aerial Gunnery Range (hereafter, CMAGR) and it is widespread on rocky slopes.

This species has only been collected inside the range c. 11 times in history, 7 of those on this survey.

General distribution is southern California, Arizona, and adjacent Clark Co., NV in the U.S.; plus, the state of Baja California in Mexico.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, *Sanders & Malusa 41286* (UCR, SD).

Notholaena californica D. C. Eat.

“California cloak fern”

A very scarce and inconspicuous xerophytic fern of crevices and shady places around boulders. Like *Cheilanthes p.*, it does not occur on alluvial slopes/bajadas but only among bedrock outcrops of the mountains. However, this species is restricted to the uppermost parts of slopes and is not found near the mountain's foot.

This plant has only been collected inside the range c. 4 times in history, 3 of those by this survey. It is very scarce indeed, and among the less frequently encountered members of the CMAGR flora.

Largely endemic to the southern California and Baja California region, with just a few records in Arizona and Sonora.

Representative voucher specimen: Imperial County, 1.5 miles WNW of Beal Well, *Sanders & Malusa 41986* (UCR).

GYMNOSPERMS

EPHEDRACEAE

***Ephedra aspera* Engelm. ex S. Wats.**

“rough jointfir”

A widespread dioecious shrub on rocky hillsides and wash margins; it was collected 8 times on these surveys, but because it is typically found at higher elevations, far from roads, there is only one other collection known from the CMAGR. In addition, it was recorded 46 times on the vegetation plots (15% frequency), at elevations ranging from 308-884 m (1010-2900 ft.). The stems of this plant are distinctly gray-green and have two leaves per node. Fertile female plants can be conclusively identified by the presence of only one seed per cone.

A low, intricately branched shrub of the rocky hills in and bordering the Sonoran Desert, from southern California to the cape region of Baja California, and east to southern Nevada, Arizona, and then sparingly reported east to the Big Bend Region of Texas. This species is closely related to, and easily confused with, *Ephedra nevadensis*, and further study of their relationship is doubtless warranted. In southern California *E. nevadensis* is the dominant *Ephedra* of the western and central Mojave Desert while *E. aspera* occurs more frequently in the eastern and southern parts of the deserts. I suspect that the biogeographic pattern seen by mapping Consortium of California Herbaria (hereafter, CCH2) records is muddled by misidentifications of these two taxa, unless they are just not clearly separated by the standard characters.

Representative voucher specimen: Imperial County, side canyon west of north fork of Salvation Wash, *Sanders & Malusa 41328* (UCR, CAS).

***Ephedra californica* S. Wats.**

“California jointfir”

An uncommon dioecious shrub, mostly growing on wash margins. This was found on 37 of 303 vegetation samples (12.2% frequency) at elevations from 1170-2500 ft. (357-762m).

Widespread in interior California. In parts of its range, it occurs on open hillsides, but in desert habitats it is mostly wash associated. Records in or near the CMAGR are mostly toward the north and on the Chuckwalla Bench to the east. Records in the lowlands of Imperial County are few in number and this is probably not entirely due to collection bias but to a genuine lack of plants.

Easily recognized by the combination of distinctly green stems and three scale-like leaves per node. The only other three-leaved species locally is *E. trifurca*, which is a much larger plant, with grayer stems, and much longer leaves.

Representative voucher specimen: Imperial County, 2.1 km SW of Surveyors Pass, *Sanders & Malusa 42300* (UCR, CAS).

***Ephedra nevadensis* S. Wats.**

“Nevada jointfir”

Hypothetical (reported with vouchers, but reports doubted). There is a specimen of a male plant that is purported to be this species, but we seriously doubt that the identification is correct, though we have seen an image of the duplicate at SD and it is not obviously wrong. *E. nevadensis* is a plant of higher elevations, mostly of the western Mojave Desert in California, and there are very few reports of it from the Sonoran Desert. *E. aspera* is the expected species in this habitat zone. *E. nevadensis* seems to be separated ecologically from *E. aspera* by, perhaps, a tolerance for colder winters. Reports of *E. nevadensis* in the Sonoran Desert are mostly older collections from the days when *E. aspera* was considered a variety of *E. nevadensis* (e.g., Alexander & Kellogg 1989, from 1941, Beal Well Basin; UC, GH, CAS). I am sure most or all Sonoran Desert reports pertain to *E. aspera*. Even the more recent records are dubious since, without female cones, *E. nevadensis* and *E. aspera* are difficult to separate. Each cone in *E. nevadensis* has two seeds versus one in *E. aspera*.

Representative voucher specimen: Imperial County, east side of range at end of Imperial Gables Rd, André 23825 (RSA, SD)

***Ephedra trifurca* Torr. ex S. Wats.**

“longleaf jointfir”

This, the largest of the Californian *Ephedra* species, barely enters the CMAGR on localized sandy substrates around the edges of the range. It is common on the vast sand fields of the Algodones Dunes and on the sandy flats of East Mesa. Though it is sometimes among the dominant shrubs in these places, it is unable to tolerate rocky slopes, benches and wash margins which are predominant landscape features within the CMAGR. It requires loose, well-aerated soils, specifically wind-blown sand.

This species is vegetatively distinctive in possessing three leaves per node and these leaves are relatively long and silvery/papery.

Representative voucher specimen: Imperial County, Coachella Canal between siphons 10 and 11, 17 Feb 2005, Chet McGaugh s.n. (UCR).

ANGIOSPERMS

EUDICOTYLEDONS

ACANTHACEAE

***Justicia californica* (Benth.) D. Gibson**

“chuparosa”

Very locally common shrub along washes in the Sonoran Desert, but apparently absent across most of the CMAGR, except the extreme southeast corner. It is common on the west side of the Salton Basin and populations extend east from the Coachella Valley to the Chuckwalla Valley along the south side of the Little San Bernardino/Eagle Mountains axis. Other populations extend along the Colorado River Valley and connect to those in the SE corner of the CMAGR. This plant was only encountered on one of the vegetation sample plots but was collected five times in the Mt. Barrow and Paymaster Mine area. All collections and observations were from between 308 and 412m (1010-1350 ft.) on alluvial slopes and along washes.

Overall, the range of the species in southern CA is a bit difficult to explain and may reflect a geologically recent expansion into the area by a species which has not yet fully occupied suitable habitat. Strongly wash associated, and often found under and around larger plants, such as *Olneya* trees and *Lycium* shrubs. While most commonly about 1 m tall, in well-watered washes where it is supported by larger plants it can grow surprisingly tall – up to 3 or 3.5 m. Oddly, there is a population on the coastal slope in the interior of San Diego County at Lakeside.

The red bilaterally symmetrical flowers are frequently visited, and doubtless predominantly pollinated, by hummingbirds, especially Costa's Hb. (*Calypte costae*). The capsules contain 2 relatively large seeds which are distributed partially by being thrown forcefully by the explosive dehiscence of the capsule. The flowers are edible and taste like cucumber.

A widespread shrub of the Sonoran Desert in southern California, Arizona, the entire Baja California peninsula, and coastal Sonora, Mexico.

Representative voucher specimen: Imperial County, 1 km NE of Paymaster Mine, *Sanders & Malusa 43467* (UCR, BRIT, US, CAS).

AIZOACEAE

Mesembryanthemum crystallinum L.

“common ice plant”

A very scarce succulent annual with broad flat leaves that normally occurs in disturbed and usually saline soils. Found once on disturbed roadside of Gasline Road on fine-grained and clay-rich lake sediments near Camp Billy Machan. Found only in this one place and not common there, but does occur sparingly elsewhere in Salton Basin, as at North Shore.

Introduced and naturalized, from southern Africa. In California this is a common plant on the immediate coast on clay flats, headlands, and disturbed but not yet urbanized ground behind the beach. It is very scarce in inland California and especially so in the deserts, where it is seldom seen.

Representative voucher specimen: Imperial County, Coachella Canal near Siphon 10, edge of Camp Billy Machan, *Sanders & Malusa 43467* (UCR, AWC).

Mesembryanthemum nodiflorum L.

“slenderleaf ice plant”

This succulent annual with terete fleshy leaves was found only in two neighboring places during this survey, both near Camp Billy Machan and growing on clay soil of the bed of former Lake Cahuilla. This has also been found at other localities in the Salton Basin outside the CMAGR, notably on dried lake sediments near Wister, Frink, and Red Hill.

Introduced and naturalized, from southern Africa. In California, this plant is widely scattered on seasonally moist flats with saline/alkaline soils at low elevations from the coast to the interior. Regularly seen around alkaline vernal pools in the interior coastal slope valleys of southern California (e.g., Hemet area).

Representative voucher specimen: Imperial County, Camp Billy Machan, just outside “quarterdeck,” near siphon 10 of the Coachella Canal, *Sanders & Malusa* 43514 (UCR, AWC)

***Sesuvium verrucosum* Raf.**

“western sea-purslane”

A native succulent perennial herb from a deep, often fleshy, root. Stems \pm prostrate and bearing pink to purplish flowers toward the tip. Very infrequent on alkaline flats along the western edge of the CMAGR, on alkaline clay-rich lake sediments.

Not actually found during this survey, but a recent collection exists from the range boundary along the Coachella Canal, and others exist from the Imperial Valley in the vicinity of Wister.

Widespread in dry lake margins and similar seasonally wet alkaline places in the arid valleys of western North America from California to Texas and south through Mexico.

Representative voucher specimen: Imperial County, Coachella Canal right-of-way, between siphons 9 and 10 [near Camp Billy Machan, NW of Slab City], *John F. Green s.n.*, 10 Mar. 2005 (UCR).

AMARANTHACEAE

***Amaranthus fimbriatus* (Torr.) Benth. ex S. Wats.**

“fringed amaranth”

A slender erect native annual appearing only after heavy summer rains. It was collected only once during this survey, at the northern edge of the range, but was observed twice on the vegetation plots and was collected in 2012 by ACS on the Chuckwalla Bench just east of the CMAGR, and also 30 years ago near Tabaseca Tank. Recorded at elevations of 2200 to 2360 feet. Only 6 separate records of this species exist in CCH2 for all of Imperial County, and on some labels the collectors specifically noted that the plant was scarce where collected.

This is a widespread species on the deserts of the southwestern U.S. and northern Mexico. It is common on the Mojave Desert but infrequent in the low hot desert of Imperial County, perhaps because of insufficient summer rains. However, populations appear equally sparse in the higher elevation Riverside County portion of the CMAGR where summer rainfall is more frequent.

This plant occurs from southern Nevada to the cape region of Baja California and then east to the vicinity of El Paso, Texas. In California it is conspicuously more abundant along the east side of the Peninsular Range and on the Mojave Desert, especially near the Transverse Ranges, where orographic lift results in much more regular and heavy summer rainfall.

Representative voucher specimen: Riverside County, 1.75 km (airline) south of Tabaseca Tank, *Sanders* 9508, in Sept. 1989 (UCR).

***Tidestromia suffruticosa* (Torr.) Standl. var. *oblongifolia* (S. Watson) S    . Pino & Flores Olv.**

“honeysweet”

An infrequent decumbent or sprawling native perennial. Reported to have very rapid photosynthesis, the fastest that had been recorded for any plant as of the 1970s. [Olle Björkman, Robert W. Pearcy, A. Tyrone Harrison and Harold Mooney, 1972; Science, Vol. 175, No. 4023, pp. 786-789, "Photosynthetic Adaptation to High Temperatures: A Field Study in Death Valley, California"]

Widespread in the deserts of the SW U.S., including Arizona, southeastern California, southern Nevada, and then extending southeast to Nuevo Leon, Mexico.

Representative voucher specimen: Imperial County, Skyline Dr., 3.25 miles west of the wash at the western foot of the Little Mule Mountains, *Sanders & Malusa 41814* (UCR, SD).

APOCYNACEAE

Amsonia tomentosa Torr. & Frem.

"woolly bluestar"

Very scarce perennial herb found only in one canyon in the northern part of the range, though very locally common there along wash edges and on protected alluvial canyon slopes and benches. This species comes in two forms, a tomentose form with white foliage, and a glabrous form with green leaves. The local plants are the glabrous form. The site found by this survey is the southernmost locality where the species is known, most other California populations being located within the Mojave Desert.

Amsonia occurs from the vicinity of the Mojave River Forks near Hesperia (where common) on the southern Mojave Desert northeast through the central and eastern Mojave Desert, then across southern Nevada and northern Arizona. The closest other locations to this new site are in the Orocopia and Chuckwalla mountains about 25 km NW and NE respectively.

Representative voucher specimen: Riverside County, 4.65 km SW of Tabaseca Tank, 744m (2440 ft.), *Sanders & Malusa 43341* (UCR, CDA).

Asclepias albicans S. Wats.

"whitestem milkweed"

Widely scattered but usually infrequent shrub, found on 19 of 303 vegetation sample plots (6.25%) at elevations ranging from 110-832m (350-2730 ft). It has long whip-like stems, often 2-3 m tall, and relatively few branches from the base of the plant. Usually found on rocky hillsides and canyon walls but may also be seen crowning rocky ridges. Very scarce along washes on the upper bajadas, apparently absent from the lowest alluvial slopes, and never seen on saline lake sediments. Prefers well-drained rocky sites that are warm to hot all year. Its lack of leaves would seem to make it a poor host for the larvae of the queen butterfly, but we did find them feeding on flowers and buds on one occasion.

Whitestem milkweed occurs widely in the Sonoran Desert part of the California desert, extending from the cape region of Baja California to the deserts of SE California and then up the Colorado River Valley to the margin of southern Nevada, and into the western portion of Arizona. It also occurs on Isla Tiburon in the Gulf of California and at scattered localities on the coast of Sonora, Mexico.

Representative voucher specimen: Imperial County, side canyon west of north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41326* (UCR).

***Asclepias erosa* Torr.**

“desert milkweed”

We found this in the CMAGR at only one location on the SE side of the range, on an alluvial slope cut by shallow washes and with cover of paloverde/ironwood woodland. This species is characteristic of roadsides on the Mojave Desert, especially the eastern Mojave, and this location on the Sonoran Desert of California is unusual, though there are a few other collections in the region, notably one made by Rebman near Milpitas Wash. NAVFAC (1977) reported seeing it in five locations in and around the CNAGR: Paymaster Mine, McKinney area, Salvation Pass area, Surveyor Pass area, Indian Well area (which may be c. 3.5 miles outside the range boundary). The location of the McKinney area” is unknown.

This species is widespread in the California deserts, especially on the Mojave, but also extends into the southern San Joaquin Valley. Outside of California it occurs in western Arizona, southern and central Nevada, and south through the northern half of the Baja California peninsula.

Representative voucher specimen: Imperial County, 1.5 miles north of Dietz Rd./Camp Burt, SE of Little Mule Mtns., 307m (1007 ft.), *Sanders & Malusa 41815* (UCR, SD).

***Asclepias subulata* Decne.**

“rush milkweed”

Uncommon perennial with many leafless stems from base, scattered along gravel bars in washes and on wash banks; leaves narrow and early deciduous. Found on 14 of the 303 vegetation plots (4.6% frequency), at a range of elevations from 41 to 658m (136 to 2160 feet). Stems mostly 1-1.75 m tall, clustered with many from base of plant; bleeds milky latex when cut. General form reminiscent of a petite version of *A. albicans* but with many more stems and with elongated white hoods in the flowers. Petals greenish white.

Widespread on the California deserts and extending south to the tip of Baja California, barely into southern Nevada, and scattered in southwestern Arizona.

Representative voucher specimen: Imperial County, wash crossing near road jct. to Salvation Pass, 401m (1315 ft.), *Sanders & Malusa 41807* (UCR, SD, CAS).

***Funastrum cynanchoides* (Decne.) Schltr.**

[*Sarcostemma cynanchoides* Dcne.]

“climbing milkweed”

Flowers are white and purple, not particularly showy though more prominent than the greenish flowers of *F. hirtellum*. The leaves are conspicuous and lanceolate, usually with cordate blade bases. Plants form large tangles and in favorable seasons can climb high in trees. Stems develop thick corky bark in age, and always have a milky latex and foliage with a distinctly disagreeable odor. This is a major food plant of the larvae of the queen butterfly

(*Danaus gilippus*) and the adults can often be seen flying around the plants, especially in the summer and fall of seasons with summer rainstorms.

This common vine occurs throughout southern California on both the coastal and desert slopes of the mountains and extends south throughout the Baja California peninsula. To the east it occurs throughout the Sonoran Desert of southern and western Arizona, and populations continue east into Texas, where it thrives in the subtropical Rio Grande Valley. It thrives so well that it is a problem in citrus orchards with the vines sometimes covering the trees.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, *Sanders & Malusa 41293* (UCR, SD, AWC, CAS, SBBG).

***Funastrum hirtellum* (A. Gray) Schltr.**

[*Sarcostemma hirtellum* (A. Gray) R. Holm]

“hairy twinevine”

A climbing vine forming large tangles on the edges of washes, often in shrub thickets, but also forming long braids lying on the ground among rocks. Tolerant of disturbance by flooding and often lining the large and active washes of the area. Foliage pubescent and with milky latex and an unpleasant odor. Flowers are dull, greenish-white and the leaves are narrow and inconspicuous. This is perhaps the most common member of the genus in the CMAGR, though *F. cynanchoides* is close. This is a major food plant of the larvae of the queen butterfly (*Danaus gilippus*).

A Sonoran and Mojave Desert endemic species that is restricted to the most arid parts of the desert in southern California, southern Nevada, western Arizona, and the northern half of Baja California.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, *Sanders & Malusa 41295* (UCR, SD, CAS, RSA).

***Funastrum utahense* (Engelm.) Liede & Meve**

[*Cynanchum utahense* (Engelm.) Woodson]

“Utah vine milkweed”

California Rare Plant Rank: 4.2 (limited distribution).

Scarce perennial vine of small washes and draws. Rhizomatous, with thickened roots. Not actually found within the CMAGR but has been collected on the Chuckwalla Bench just a mile or so to the east, toward Rainey’s Well, and so is certainly present within the range. Until the last few years, this species was almost unknown from Imperial County and there are still only four known records from the county, though the first record for Imperial Co. seems to have been taken in 1959 near the Colorado River by Tom Fuller. Unlike its two local congeners, this species has yellow flowers, these ageing to orange. The plants are diminutive compared to the other two local *Funastrum* species and, except when flowering, are very inconspicuous. While doubtless an acceptable food plant for *Danaus* larvae, whether this plant is often large enough to support the complete development of one or more larvae is unknown to me. I have not seen adults frequenting it, which suggests it is not an important host in any event.

This species is more common to the north and east, with the largest populations in the eastern Mojave Desert of San Bernardino County, California; also present in southern Nevada, western Arizona, and SW Utah. There are no known populations outside of the U.S.

Representative voucher specimen: Riverside County, Chuckwalla Bench along Bradshaw Trail, *Sanders 40823*, in May 2013 (UCR).

***Matelea parvifolia* (Torr.) Woodson**

“spear-leaf matelea”

California Rare Plant Rank: 2B.3 (rare, threatened, or endangered in CA; common elsewhere).

Very infrequent perennial vine with milky latex, usually found growing up through shrubs on the sides of small washes, notably on *Tetradloccus* along the Bradshaw Trail on the Chuckwalla Bench. Also occurs at Tabaseca Tank in the same region. Very inconspicuous among the branches of its host shrubs and some populations have certainly been overlooked.

This is doubtless a species of Baja Californian origin with limited extensions into the southwestern U.S., though most collections are from southern California. In California it occurs on both sides of the Salton Basin. It is also found in Arizona and in the Newberry Mountains of southern Nevada.

Representative voucher specimen: Riverside County, 0.3 mile SE of Tabaseca Tank, *J. Malusa s.n.* (UCR).

ASTERACEAE

***Acamptopappus sphaerocephalus* (Harv. & A. Gray) A. Gray**

“rayless goldenhead”

Small compact shrubs with yellow flowers in rounded heads. The heads in bud regularly abort and remain on the plants through the dormant season as compact balls at the tips of twigs, which is a useful identification feature during field work of this otherwise somewhat generic shrub. Uncommon to scarce on slopes throughout the CMAGR, observed on 23 of the 303 vegetation sample plots (7.6%), but more common toward the north, and at the upper elevations of between 1170 and 2680 feet.

There are 2 named varieties of this species, which differ in the presence or absence of short rough hairs on the leaves. But the forms do not have distinct ranges and it appears that they are little more than two genotypes of one entity. In the eastern Mojave Desert this plant intergrades with *A. shockleyi*, a related plant with well-developed ray flowers which has always been treated as a separate species even though, apart from the presence or absence of rays, the plants are remarkably similar.

Predominantly a plant of the Mojave Desert but occurring at some favorable sites within the Sonoran Desert as well. Its range extends from southern California to SW Utah, including much of Arizona and the southernmost tip of Nevada.

Representative voucher specimen: Imperial County, between Beal Well and Surveyors Pass, *Sanders & Malusa 42286* (UCR, SD, RSA).

***Adenophyllum porophylloides* (A. Gray) Strother**

“San Felipe dyssodia”

A small, often rather ragged, subshrub with a powerful scent. Usually growing under or inside larger shrubs on rocky slopes, and in gullies and among rocks. Generally inconspicuous apart from the scent of the foliage and frequently discovered olfactorily by brushing against or stepping on the plants while hiking up a hill. Seldom a dominant element of the flora of a site but often present at elevations ranging from 366 to 884m (1200 - 2900 ft.) and recorded in 27 of the 303 vegetation sample plots (8.9%).

A remarkably tough plant that even flowers during drought years when many other species cannot: it probably has deep roots. The flowers are a distinctive burnt-orange and the leaves are deeply incised with acute lobe tips.

The range of this plant extends across the desert of southern California into central Arizona and slightly into southern Nevada, from California it is spread south through the arid hills to central Baja California, Mexico.

Representative voucher specimen: Imperial County, Salvation Pass, *Sanders & Malusa 41345* (UCR, SD, AWC, CAS).

***Ambrosia dumosa* (A. Gray) Payne**

“white bursage”

An extremely common, often dominant, small compact shrub on alluvial slopes and rocky hillsides in the CMAGR, from the upper edge of the old lake sediments to the highest peaks in the range: present on 265 of the 303 vegetation sample plots (87.5%) at elevations from 85 to 2900 feet. Always a pale green/whitish in color, which contributes substantially to the overall appearance of the landscape in many places. Along with its common associate creosote bush (*Larrea*) this is a characteristic vegetation element across the much of the Sonoran and Mojave deserts.

A wind pollinated shrub with inconspicuous unisexual heads: the male heads are clustered in racemes at the ends of twigs and produce abundant yellow pollen which is carried on the wind. Female flowers are enclosed in enlarged phyllaries with spinescent tips, which mature to form burs.

This plant has a general range focused on the deserts of southern California, but it extends southward the length of the Baja California peninsula, and eastward through the deserts of Arizona, southern Nevada, and southwestern Utah.

Representative voucher specimen: Imperial County, along old Niland-Blythe Rd., *Sanders & Malusa 42174* (UCR, SD).

***Ambrosia ilicifolia* (A. Gray) W. Payne**

“hollyleaf bursage”

This odd holly-like shrub was not known from the Chocolate Mountains before this survey but has long been known from a few scattered locations on the Sonoran Desert of California including at Corn Springs in the

Chuckwalla Mountains, the next range north of the CMAGR. It seems to prefer soils composed of decomposed granite and is associated with wash margins where water can accumulate at depth in the porous soil.

Known in the Chocolate Mountains only from a few limited areas on Salvation Wash and toward Surveyors Pass at elevations of 1365 to 1525 feet, but should be looked for in other areas of similar habitat. Encountered on only three (1%) of the vegetation sample plots.

The overall distribution of this Sonoran Desert endemic species is distinctly spotty which suggests it is relictual from a formerly larger and more contiguous one. But populations are clearly broadly associated with the head of the Gulf of California including its extensions into the Salton Basin and the lower Colorado River Valley. This includes parts of SE California, SW Arizona, extreme northwest Sonora, as well as the gulf coast of northern Baja California and several islands in the gulf.

This is an interesting example of a species that clearly evolved under pressure from large mammalian herbivores, probably during the Pliocene or earlier. Its rigid, spiny-margined leaves are unambiguously adapted to discourage browsing by animals that naturally take large bites of vegetation, such as camels and other ungulates. Such features are of limited value in warding off insect or fungal threats. The modern populations of mule deer that inhabit this area are seen to leave this plant alone and nibble on other things instead, which supports this suggestion.

Female heads are bur-like and seed dispersal is clearly via “hitch-hiking” on the fur of passing animals, including those that will not eat the plant.

Representative voucher specimen: Imperial County, upper north fork of Salvation Wash, *Sanders & Malusa 41296* (UCR, SD, AWC, CAS).

***Ambrosia salsola* (T & G) Strother & Baldwin**

“cheesebush”

A dominant shrub in the vegetation along most washes and on sandy outwash plains in the CMAGR, but also regular on gravelly benches and rocky north-facing slopes well up into the mountains. Recorded on 87 of the 303 vegetation sample plots (28.7%) at elevations of 30 to 732m (100 to 2400 feet). Like other species of *Ambrosia* there are separate male and female heads, but in this species the phyllary tips in female heads do not form hooks or spines but rather are flattened into wings and serve for wind dispersal.

This is a widespread shrub on the deserts of southwestern North America, including southern California, southern and central Nevada, western and central Arizona, western Sonora, and most of the peninsula of Baja California. In California it ranges from the arid southern San Joaquin Valley across all the deserts to the Arizona and Nevada borders and then east of the Sierra Nevada north into Mono County.

The common name is reputed to be because the crushed foliage smells like cheese, but what type of cheese has never been specified and the resemblance has never been obvious to anyone known to us.

Representative voucher specimen: Imperial County, Salvation Pass, *Sanders & Malusa 41268* (UCR).

***Atrichoseris platyphylla* (A. Gray) A. Gray**

“parachute plant”

A distinctive annual herb mainly growing on desert pavement and other gentle rocky slopes, but also often appearing in adjacent washes and on alluvial fans. Its wide flat leaves with dark blotches are distinctive and are the largest among local desert annuals. The plants grow as a flat rosette of leaves through the winter growing (rainy) season and then send up a long naked inflorescence in early spring. Most plants flower in March.

The common name relates to the fact that the white flowered heads on slender peduncles look a bit like a group of parachutists descending.

An endemic of the southwestern United States with populations concentrated in SE California, southern Nevada, and western Arizona. As of 2022 there are no records from Mexico in CCH2 or SEINet.

Representative voucher specimen: Imperial County, 12 km [c. 7.5 miles] NE of Bombay Beach, overlooking Frink, 226 m (740 ft.), *Sanders & Malusa 43096* (UCR).

***Baccharis brachyphylla* A. Gray**

“shortleaf baccharis”

A nondescript 1-1.5 m tall shrub of rocky hillsides, gullies, and wash margins, found from 308-786m (1010-2580 ft.) elevation and on 11 (3.6%) of the vegetation sample plots. Densely and intricately branched, but otherwise distinctive in its lack of distinctive features. Unlike most *Baccharis* species this plant is not strongly associated with seasonally or permanently wet sites but rather is often found on dry hillsides, though also at the edges of ephemeral washes in canyons.

Not common in the CMAGR with only 6 collections made over the 5 years of the survey, and 3 of those were of plants that were past flowering and fruiting and just had dried remnants of reproductive parts remaining. This at least illustrates the fact that we tried to document the species. A plant in flower was found in September 2017 and another in November 2016: the flowers were dull white. Two collections were made earlier, so there are now eight collections from within or at the edge of the range. In addition to the collections, this was recorded 12 times on the vegetation plots.

More common on the Mojave Desert than the Sonoran, but its range extends from southern California and southern Nevada SE to the vicinity of El Paso Texas and south to central Baja California Mexico.

Representative voucher specimen: Imperial County, large north-draining wash south of Blue Mountain, 415-427m (1360-1400 ft.), *Sanders, Malusa & Sobol 43904* (UCR, BRIT, UTC, DES).

***Baccharis sarothroides* A. Gray**

“broom baccharis”

An uncommon broom-like shrub which we always found on wash margins. The ascending to erect, photosynthetic stems bear small narrow leaves that are inconspicuous, and deciduous when the plants become drought stressed. Widely but thinly scattered in the range but prominent along the Bradshaw Trail on the Chuckwalla Bench at the northern edge. Local and spotty elsewhere, even in its favored habitat. Only found three times in the vegetation samples (1% frequency), all between 396 and 725m (1300-2380 ft.) elevation.

This shrub occurs from southern California and southern Nevada south throughout the Baja California peninsula and east at least to the region of El Paso, Texas. It is widespread in western Sonora, Mexico, even to the southern edge of the state.

Representative voucher specimen: Imperial County, upper Mammoth Wash, 447m (1467 ft.), *Sanders & Malusa 42090* (UCR).

***Bahiopsis parishii* (Greene) E.E. Schill. & Panero**

[*Viguiera parishii* Greene]

“Parish goldeneye”

Widespread and often locally common 0.4-1.2 m shrubs on peaks, high ridges, north-facing slopes, and wash margins, but recorded at only 25 of the vegetation sample sites (8.25%). Elevations recorded by us are 335-884m (1100-2900 feet), indicating that much of the CMAGR is too low and dry for this species.

This plant ranges widely from the deserts of southern California to central Arizona and south to central Baja California. Reports of this in CCH2 from southern Baja California are probably *Bahiopsis deltoidea*.

Representative voucher specimen: Imperial County, 1.6 miles WNW of Beal Well, 549m (1800 ft.), *Sanders & Malusa 41985* (UCR, AWC, SD).

***Baileya pauciradiata* Harvey & A. Gray ex A. Gray**

“Colorado desert marigold”

A sand-loving annual that barely reaches the margin of the range near the Algodones Dunes. Not found on this survey, but a specimen exists that documents its occurrence at the edge of the range. Always in loose sand, usually wind-blown, and known to be much more common further west within the Algodones Dunes sand field.

Representative voucher specimen: Imperial County, 2 miles SSE of Regina [old RR siding, c. 245 ft.], *Thorne 52159*, in May 1978 (RSA). Specimen not seen; data accessed via CCH2.

***Baileya pleniradiata* Harvey & A. Gray ex A. Gray**

“woolly desert marigold”

An annual or short-lived perennial known in the immediate area from locations on the southwestern edge of the range in sandy soil near the Algodones Dunes. There are many collections from the vicinity of Glamis/Hwy 78 and north along the RR frontage road to the Mammoth Wash/Regina area. There are also locations to the east and northeast of the CMAGR, which illustrates the extent of the species in the general area.

Widely scattered across the California deserts and through the deserts of SW North America from central Nevada south to central Baja California, and then east across Arizona to at least the vicinity of El Paso, Texas. This species has more generalized habitat requirements than *B. pauciradiata* and so occurs in many more places. It does well on alluvial slopes and wash margins and does not require blow sand.

Representative voucher specimen: Imperial County, Mammoth Wash area, along Ted Kipf Rd., 70 m (230 ft.), *Sanders & Malusa* 42108 (UCR).

***Bebbia juncea* (Benth.) Greene var. *aspera* Greene**

“sweetbush”

Common and widespread in the CMAGR in habitats ranging from low elevation sand flats at c. 100 ft. (30m) to rocky hillsides on the highest peaks at 2800 ft. (855m). Recorded on 82 of 303 vegetation sample sites (27%). Especially common on wash edges and disturbed sites with loose sandy or gravelly soil. All alluvial fans in the CMAGR have this plant in at least moderate abundance. The seedlings germinate readily following rainfall making this plant a quick colonist of disturbed sites such as outwash fans, roadsides, quarry pits and bomb craters. The flowers are yellow-orange and are sweetly scented, perfuming the air around them, and giving the plant its common name.

Widespread in southern California; primarily occurs in the deserts but also present on the coastal side of the mountains. Elsewhere, it occurs through the northern half or two-thirds of Baja California, in western Arizona, and at least sparingly through the Sonoran Desert in Sonora.

Representative voucher specimen: Imperial County, NE of Amos, 122-152m (400-500 ft.), *Sanders & Malusa* 43760 (UCR, DES).

***Brickellia desertorum* Coville**

“desert brickellbush”

An infrequent shrub of rocky slopes at the higher northern end of the range, including the highest peak of the mountains. Often growing from small cracks or large fissures in the sides or tops of boulders or in rocky canyon walls. Even from a distance, if one sees a shrub growing out of the top of a large rock rather than from the base, one can safely predict that it will be this species.

Desert brickellbush occurs mostly in southern California, but also extends into southern Nevada, western Arizona, and northern Baja California. In southern California it grows on both the coastal and desert sides of the Peninsular and Transverse Ranges but may be most common in the granitic hills of the interior of the coastal slope, perhaps because growing in rock crevices is a difficult way to make a living in the more arid desert areas. When it does appear in the desert it is usually at higher, cooler, and seasonally moister sites. Not recorded on any of the 303 vegetation samples.

Representative voucher specimen: Riverside County, 3.5 km ESE of Iris Pass, 671-701m (2200-2300 ft.), *Sanders & Malusa* 42979 (UCR).

***Brickellia incana* A. Gray**

“woolly brickellbush”

This attractive small shrub with white woolly foliage is typical of washes on the upper alluvial slopes, at 451-728m (1480-2390 ft.) elevation, but is very local and not commonly encountered. Only seen on 5 of 303 vegetation survey plots (1.6%), and we only collected it twice during these surveys, both times in the northern part of the range in Riverside County. It is never seen away from sandy wash habitats or the sandy soil of roadside berms, usually growing in decomposed granite soil.

This southwestern North American endemic species has its center of abundance is the eastern Mojave Desert of San Bernardino County, adjacent southern Nevada, and northwestern Arizona. However, there is also a substantial population centered on Joshua Tree National Park and specifically the range of mountains including the Cottonwood and Eagle Mountains.

Representative voucher specimen: Riverside County, Salt Creek Canyon, along Summit Road, 433m (1420 ft.), *Sanders & Malusa 41848* (UCR, SD, AWC).

***Calycoseris wrightii* A. Gray**

“white tackstem”

An uncommon stiffly erect annual of loose soils and washes. Widely scattered but infrequent: never among the dominant annuals. It was collected 20 times on this survey, but usually described as uncommon or scarce at any one site.

In California, this species is absent from most of the Mojave Desert, except for the Death Valley region. It is widespread from the Owens Valley of eastern California to southern Nevada and then southeast through southern New Mexico to El Paso, Texas. It is common on the Sonoran Desert of California and south from there through Sonora and northern Baja California, Mexico.

This is one of several spring annuals that are, contrary to expectation, common in the summer wet parts of the California deserts but absent from the winter wet western Mojave Desert.

Representative voucher specimen: Imperial County, between Beal Well and Surveyors Pass, 599m (1965 ft.), *Sanders & Malusa 42313* (UCR, UTC).

Chaenactis carphoclinia* A. Gray var. *carphoclinia

“pebble pincushion”

An abundant, erect, spring annual in the CMAGR that occurs on desert pavement and rocky hillsides where there is limited shrub competition for soil moisture. Also found in adjacent washes due to frequent seed dispersal from rocky slopes, but these populations may be dependent on abundant seed rain from neighboring rocky uplands to maintain themselves. This is among the last of the spring annuals to flower and, due to deep roots and a specialized habitat, plants keep flowering after most other spring annuals have dried. Flowers white.

Its overall range is around the head of the Gulf of California and northward to the eastern Sierra Nevada of Mono County including all the desert area of southern California, as well as southern Nevada and western Arizona. It barely reaches the southwestern corner of Utah.

Representative voucher specimen: Imperial County, Hayden Well on Mammoth Wash, 284m (930 ft.), *Sanders & Malusa 42023* (UCR, AWC).

***Chaenactis fremontii* A. Gray**

“Fremont pincushion”

A very scarce annual in the Chocolate Mountains, barely reaching this area from its typical habitat in southern California along the western edge of the Sonoran Desert, though also occurring farther north on the Mojave Desert and in Arizona to the east of the Colorado River.

Immature plants with typical thick fleshy leaves and scant pubescence were found in January 2017 but mature plants were never encountered anywhere. The only known Imperial County records are along the foot of the Peninsular Range, and there are very few Riverside County records from south of the I-10 Freeway, leaving the southeastern corner of California devoid of this plant.

Representative voucher specimen: Riverside County, Salt Creek Wash at bend in old Kaiser RR tracks, 6 miles east of Dos Palmas, 119m (390 ft.), *Sanders & Malusa 42662* (UCR).

***Chaenactis stevioides* Hook. & Arn.**

“desert pincushion”

A common, erect, spring annual of open and generally sandy soils with sparse shrub cover. Widespread on wash banks and gravel bars in washes on its preferred habitat of alluvial fans. Scarce or absent on desert pavements and rocky bedrock slopes unless sand deposits are present. Flowers white.

A widespread species in the arid parts of southern California including the San Joaquin Valley and Inner Coast Range, from there it occurs south through the deserts of Baja California into Baja California Sur, and it also is present in northwestern Sonora, and east to southern New Mexico and north to Nevada and Utah.

Representative voucher specimen: Imperial County, near Camp Burt, Skyline Dr., 0.45 km north of Dietz Rd., 320 m (1048 ft.), *Sanders & Malusa 42144* (UCR, AWC).

Encelia farinosa* A. Gray ex Torr. var. *farinosa

“brittlebush”

This shrub has brittle easily broken branches, hence the common name. It is common on both alluvial and bedrock slopes throughout the CMAGR, from sea level to over 2500 feet elevation and is especially prominent on hot south-facing slopes where other shrubs struggle to survive. It is almost the only shrub present in some places but is absent from fine alkaline/saline clay of old lake sediments. Recorded on 77% of vegetation sample plots (233 of 303).

A common and widespread shrub throughout much of the Sonoran Desert and southwestern North America. Occurs from southern Nevada through Arizona and southern California, then south through Baja California and the coastal

region of Sonora, Mexico. In southern California it also occurs west of the deserts in the dry foothills of the Transverse and Peninsular ranges.

Representative voucher specimen: Imperial County, Salvation Pass, 366m (1200 ft.), *Sanders & Malusa 41259* (UCR).

***Encelia farinosa* var. *phenicodonta* (Blake) Jtn.**

“maroon-disked brittlebush”

This plant is probably merely a geographical variant or local genotype, and it is not recognized as a distinct taxon in the Jepson Manual, but is visually distinctive due to its purple disk flowers and it has a describable range. In most of the California desert *Encelia farinosa* has yellow disk flowers but in the eastern Colorado Desert this variant occurs. In the Chocolate Mountains, the edge between the eastern and western Colorado desert, this is known only from one area near Beal Well and only the normal yellow flowered type was seen everywhere else.

Representative voucher specimen: Imperial County, 1 km SW of Beal Well, 395m (1295 ft.), *Sanders & Malusa 43029* (UCR, CDA).

***Encelia frutescens* (A. Gray) A. Gray**

“button brittlebush”

Infrequent 0.6-1m tall shrubs usually in open sandy places ranging from the old shoreline of ancient Lake Cahuilla at 24m (80 ft.) to washes in the mountains at 762m (2500 feet). Only observed at 11 of the 303 vegetation sample locations (3.6%).

This grows largely in southern California, but its range extends from the head of the Gulf of California in Baja California and Sonora, through western Arizona to southern Nevada.

Representative voucher specimen: Imperial County, Salvation Wash east of Salvation Pass, 373m (1225), *Sanders & Malusa 42854* (UCR).

***Ericameria paniculata* (A. Gray) Rydb.**

“black-banded rabbitbrush”

A large shrub typically associated with active washes, even being successful in areas subject to severe scouring floods. In the Chocolate Mountains this was found to be common along Salt Creek Wash, but it was not recorded elsewhere in the range, and it was not found on any of our vegetation sample plots. There are only 4 specimens in the online databases which have come from in or near the CMAGR, and three of those are from Salt Creek Wash. One of those was collected on this survey. The fourth is an old (1904) and vague locality given simply as “Chuckwalla Bench, Riverside County”, which certainly refers again to the Salt Creek area, presumably the upper part near the Chuckwalla Mountains.

The common name of this plant comes from the fact that the plants have at least a few dark bands on the twigs caused by a fungus or some other organism.

Endemic to SW North America, being found in southern California, western Arizona, southern Nevada, and SW Utah.

Representative voucher specimen: Riverside County, Salt Creek wash below Red Canyon confluence, 367m (1205 ft.), *Sanders & Malusa 42667* (UCR).

***Erigeron canadensis* L.**

[*Conyza canadensis* (L.) Cronq.]

“horseweed”

A very scarce annual, found only once on the range and that solitary plant on a wash edge was clearly drought stressed. When conditions are good these plants will grow to 3 m tall and flower in late summer and fall. Conditions are seldom good for this plant in the CMAGR.

This is a common weed in agricultural areas of the Imperial Valley, where it occupies field edges and ditch banks. It is native to North America but whether it is native to California is subject to dispute.

Representative voucher specimen: Imperial County, wash crossing near road junction to Salvation Pass, 401 m, *Sanders & Malusa 41806* (UCR).

***Erigeron divergens* Torr. & A. Gray**

“spreading fleabane”

This is a scarce native annual collected within the current CMAGR only once, in 1905. It has not been reported here since. There is also a collection from the Cargo Muchacho Mtns., about 10-15 miles SE of the range but in a habitat like some in the Chocolate Mtns. That specimen was taken in 1932, though that is still 90 years since it was last recorded in the vicinity. Other broadly regional records are from Blythe (in 1965) and Hayfield Dry Lake near the Chuckwalla Mtns in 1922.

The species is more typical of the foothills of the Peninsular and Transverse Mountain ranges and is infrequent on the deserts.

Representative voucher specimen: Imperial County, Salvation Spring, H.M. Hall 5881, Apr. 1905 (CAS, UC).

***Eriophyllum lanosum* (A. Gray) A. Gray**

“white woolly daisy”

A widespread but spotty and uncommon spring-flowering annual of wash edges, benches, shallow draws, rocky slopes, and edges of shrub clumps. Perhaps most common on low gravelly/sandy benches along washes where it often occupies open spaces between shrubs.

This species is widespread in southwestern North America, ranging from southern California south through the northern half of the Baja California peninsula, and east through the hot deserts of western Arizona, and north to southern Nevada. In California it is most frequent in the eastern Mojave Desert of San Bernardino County, and it is notably sparse in the western Mojave. This illustrates a peculiarity of its distribution and ecology: even though it is a spring annual, dependent on winter rains, it is part of the group of spring annuals that is most common in areas with regular summer rain and limited winter rainfall.

Representative voucher specimen: Imperial County, 0.8 km NE of Beal Well, 427-442m (1400-1450 ft.), *Sanders & Malusa 42226* (UCR, AWC).

***Geraea canescens* Torr. & A. Gray**

“desert sunflower”

Infrequent but widely scattered in the range, often associated with desert pavement, rocky slopes, or dry fine-grained sedimentary deposits with little vegetation. Five collections were made during these surveys.

Widespread on both deserts in California and extending south to the head of the Gulf of California in Sonora and Baja California. Also common in the Death Valley area and north into southern Nevada but does not reach the Utah section of the Mojave Desert, nor does it occur on the western Mojave Desert of Los Angeles and Kern counties. It often occupies the most barren and difficult sites and perhaps because there it has limited competition from other plants. It also does well on roadsides. This species is responsive to late summer and early winter rains, when the soil is still warm, and so often germinates well ahead of other normally spring flowering winter annuals that germinate under cool soil conditions. Some years there is massive flowering as early as December in parts of the desert.

Representative voucher specimen: Riverside County, Salt Creek Wash watershed, 1.85 km SE of intersection of Bradshaw Trail and Summit Rd., 488m (about 1600 ft), *Sanders & Malusa 43992* (UCR).

***Gutierrezia microcephala* (DC.) A. Gray**

“threadleaf snakeweed”

In the CMAGR this perennial/subshrub appears very scarce, but it is inconspicuous and late flowering and so populations may have been overlooked. Only one collection was made, and no other plants were recorded. There are no specimens of this species from Imperial County in CCH2 and so this record is near the southern edge of the species known range in this region.

Widespread in southwestern North America from northern Baja California through much of interior southern California, and east through Arizona and New Mexico and north to the southern parts of Nevada and Utah. Populations barely edge into western Texas and northern Sonora.

Representative voucher specimen: Riverside County, c. 10 miles north of Camp Billy Machan and just north of the Imperial County line on Gas Line Road, 581m (c. 1900 ft), *Sanders & Malusa 44124* (UCR, SD).

***Isocoma acradenia* (Greene) Greene**

“alkali goldenbush”

Scarce shrubs on old sediments of Lake Cahuilla along the western edge of the range, but only recorded twice in the vegetation sample plots. It was found on a disturbed roadside along the Coachella Canal, but this species does not require disturbance. Its yellow flowers appear in the fall.

Widespread in deserts of southern California, and on dry slopes in the San Joaquin Valley north to about Stanislaus County. Its range also extends east through Arizona and north into southern Nevada. Southward it grows in northern Baja California and Sonora, Mexico.

Representative voucher specimen: Imperial County, Coachella Canal, between siphons 9 & 10, 29m (c. 95 ft.), *Sanders & Malusa 41835* (UCR, SD, AWC).

***Lactuca serriola* L.**

“prickly lettuce”

Scarce weedy annual in the Chocolate Mountains, probably infrequent because it has a long growing season and typically flowers toward fall, by which time dryness and heat will have killed most plants. None of the three collections made was from a mature plant though two showed the beginnings of an inflorescence. The lack of old skeletons was specifically noted and recorded as evidence that the species here consists of waifs growing from airborne seeds drifting in from the Imperial Valley, because it cannot regularly mature seeds locally.

An introduced weed from Europe, and the wild ancestor of cultivated lettuce. Now a worldwide weed in temperate zones.

Representative voucher specimen: Imperial County, Mammoth Wash near Hayden Well, 284m (932 ft.), *Sanders & Malusa 42781* (UCR, SD).

***Logfia depressa* (A. Gray) Holub.**

[*Filago depressa* A. Gray]

“hierba limpia”

Scarce native annual in the CMAGR, though widespread elsewhere on the deserts of California, especially the Mojave. We have only two collection records from in or near the range; one made by us, and one made along the Coachella canal earlier by John Green. There are only 5 records total from Imperial County, with none of these from east of the Salton Sea and most clustered along the foot of the Peninsular Range. Similarly, Riverside County records are predominantly from the western edge of the Coachella Valley with only two from near the CMAGR.

East of California this plant is uncommon in Arizona and Nevada and there are a few collections from New Mexico, but none from farther east. There is one collection from southern Utah. South of the United States this occurs in the state of Baja California and sparingly in Sonora.

Representative voucher specimen: Riverside County, Arroyo Seco, c. 4 km south of Augustine Pass, 652m (932 ft.), *Sanders & Malusa 43015* (UCR).

***Malacothrix coulteri* A. Gray**

“snake's head”

A very scarce annual in the CMAGR with only one population found, and that at a relatively high elevation in a canyon in the northern part of the range. This location represents the southeastern edge of the species known range in California: there are no records at all from Imperial County.

A widespread spring annual in the California Floristic Province, from the San Francisco Bay Area south in the inner Coast Ranges and San Joaquin Valley to the western Mojave Desert and further south into northern Baja California. The species does also occur in Arizona (rarely) and southern Nevada (commonly) but does not reach Utah.

Representative voucher specimen: Riverside County, c 3.5 km ESE of Iris Pass, 736m (2415 ft.), *Sanders & Malusa 42980* (UCR, CDA).

***Malacothrix glabrata* A. Gray**

“desert dandelion”

In the CMAGR this plant was collected 9 times, but seven of those were in Riverside County, which supports the idea that this has a more northerly distribution and is not common in the lowest and hottest parts of the desert.

This is a common spring annual on the Mojave Desert in California but also grows sparingly across the northern Colorado Desert. From the Mojave Desert its range extends northward all the way to eastern Oregon, including southern and western Nevada. Specific areas in California occupied include the drier parts of the San Joaquin Valley and the Owens Valley and other places in the rain shadow of the Sierra Nevada. From southern California it also extends to western Arizona, and just barely into southern Utah.

Representative voucher specimen: Imperial County, dirt track (Skyline Dr.) on range boundary, 445m (1460 ft.), *Sanders & Malusa 43822* (UCR).

***Malacothrix stebbinsii* W.S. Davis & Raven**

“Stebbins' desert dandelion”

Small and inconspicuous annuals found scattered on a steep north-facing granitic slope, sometimes also in the shade of trees and large shrubs. The collection reported here is the first for both the Chocolate Mountains and Imperial County and provides a slight range extension south from the Chuckwalla and Orocopia Mountains of Riverside County.

This species is infrequent but widely scattered in the deserts from southern California to western Arizona and southern Nevada. There are also scattered records as far north as Oregon, east to El Paso, Texas, and south into Baja California.

Representative voucher specimen: Imperial County, hill 175-500m SW of Beal Well, 412-427m, *Sanders & Malusa 42781* (UCR, US).

***Microseris lindleyi* (DC.) A. Gray**[*Uropappus lindleyi* (DC.) Nutt.]

“silver-puffs”

In the CMAGR this spring annual is very scarce, and we managed to find it at only one location on the northern boundary, in an open and seasonally moist site where water accumulates.

A common spring annual of coastal sage scrub and chaparral habitats on the coastal slope of California. Widespread on the west coast from Baja California to Oregon, and occurs east to Arizona, Nevada, and New Mexico. This is not common in the California deserts but does appear regularly toward the western edges and at higher elevations, especially on the western Mojave.

Representative voucher specimen: Riverside County, Bradshaw Trail at “perched playa” 1 km west of Dupont Rd., 741-745m (2430-2445 ft.), *Sanders & Malusa* 44018 (UCR, SD, RSA).

***Monoptilon bellioides* (A. Gray) H.M. Hall**

“desert star”

A common low annual on alluvial slopes including desert pavement, wash beds and benches, and occasionally appearing on rocky hillsides. Often in coarse sand in openings between shrubs.

Widespread from the head of the Gulf of California in Baja California and Sonora to western Arizona and southern Nevada. In California it covers a vast area of the desert from the Mexican border to Inyo County east of the Sierra Nevada, but never occurs on the coastal side of the mountains nor does it occur west of Hinkley on the Mojave Desert. It is partially replaced on the western Mojave by *M. bellidifforme*, except in the westernmost/least arid part: west of a line from about Palmdale to the town of Mojave the genus is entirely absent.

Representative voucher specimen: Imperial County, head of Mammoth Wash, 488m (1600 ft.), *Sanders & Malusa* 42064 (UCR, AWC).

Palafoxia arida* B.L. Turner & M. Morris var. *arida

“Spanish needle”

Annual or short-lived perennial, uncommon but widely scattered in sandy soil either at the fringe of the Algodones Dunes, in sand accumulations around trees (often dead ones) on lower outwash plains, or at wash edges elsewhere on alluvial slopes. Absent from the core of the mountains and found only on alluvium below the canyons, but present on both sides of the range where sand has accumulated on gentle slopes and flats.

The large-headed and shrubby var. *gigantea*, a rare endemic of the Algodones Dune system, occurs on the dunes near Glamis and elsewhere in loose blow sand, but has not been found in or near the CMAGR.

Spanish needle occurs widely in southwestern North America from Baja California to Inyo County and east to Arizona, southern Nevada, and the southwestern corner of Utah.

Representative voucher specimen: Imperial County, Mammoth Wash along Ted Kipf Rd., 83m (271 ft.), *Sanders & Malusa* 42107 (UCR, AWC, SD).

Pectis papposa* Harvey & A. Gray var. *papposa

“chinchweed”

An abundant summer annual, appearing quickly following substantial summer storms and within two weeks making carpets of yellow flowers. Occurs virtually everywhere on the alluvial slopes during wet summer periods, sometimes coloring large areas yellow. The foliage is strongly scented.

Widespread across the Sonoran, Mojave, and Great Basin deserts, from the Cape Region of Baja California and southern Sonora to central Nevada and east to Utah, Arizona, New Mexico, and western Texas.

Representative voucher specimen: Imperial County, west side of the Little Mule Mountains, 355m (1163 ft.), *Sanders & Malusa 41827* (UCR, AWC).

***Perityle emoryi* Torr.**

“Emory's rockdaisy”

Common annual on rocky slopes and ledges, along washes, and under shrubs and trees. Commonly in shaded places, but also in full sun on gravel bars in washes, etc. Full sun may only be tolerable to this plant when ample moisture is available in the sand of a wash. Rocky south-facing hillsides are poor habitat for it.

Frequently found on both the Sonoran and Mojave deserts, from the southern Baja California north to Inyo County, California. Mostly occurs on the desert side of the mountains but there are significant populations on the immediate coast of southern California, including the Channel Islands, and occasional small populations in dry places east of the Peninsular Range (e.g., Lake Elsinore).

Representative voucher specimen: Imperial County, Dietz Rd. 1.6 km east of Skyline Dr., 313m (1027 ft.), *Sanders & Malusa, 43433* (UCR, CAS, CDA, TEX).

***Perityle* sp. (yellow-rayed form)**

“yellow rockdaisy”

This plant is closely related to the common *Perityle emoryi* of the California deserts, but the yellow rays suggest introgression, perhaps from *P. californica* or another of the northern Mexican species. Both the ray and disk flowers are yellow, often strongly so. But plants intermediate toward typical *P. emoryi* and apparently pure *P. emoryi* are also present here. Yellow rayed plants have never been found in California before this study but what they represent is currently unknown. These plants are under study by Isaac Marck.

Representative voucher specimen: Imperial County, Mammoth Wash, 439m (1440 ft.), *Sanders & Malusa 42073* (UCR).

***Peucephyllum schottii* A. Gray**

“desert fir”

A widely scattered and often common shrub over the entire range, from Hwy 78 to Salt Creek; 1-2.5 m tall, sometimes from a thick woody trunk. May be tree-like in form, though resembling a juniper more than a fir, because usually rounded and shrubby. Often along washes, even on gravel bars in the center of regularly scoured ones, and on rubble accumulations at wash heads. But also can be found clinging to steep rocky slopes and cliffs and famously (among southwestern botanists) is an early colonist of road cuts along highways. Found on 32 of 303 vegetation sample sites, or about 10.5% of them.

Occurs from Baja California north through the deserts of southern California to the Death Valley region and from there east through southern Nevada and just entering the SW corner of Utah. Present in western Arizona and the Grand Canyon region. Often occupies particularly harsh parts of the desert subject to extremely high temperatures and extended periods without rainfall.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 401m (1315 ft.), *Sanders & Malusa* 41292 (UCR, SD, RSA).

***Pleurocoronis pluriseta* (A. Gray) King & H.E. Robins.**

“bush arrowleaf”

A weak-stemmed small subshrub or shrub, 10-50cm tall, that always grows in rocky places, often rooted in crevices in cliffs or under overhanging boulders. Always in partial shade and never on open alluvial slopes, on exposed south-facing hillsides, or in washes. Widespread in the mountains and probably present in every canyon, but never common and always easily overlooked because of its small stature, small leaves, and flowers that are not remotely eye-catching. Found on 30 of the 303 vegetation plots (10 %), which clearly shows it is fairly common locally.

The general range of this plant is from the gulf coast of central Baja California to the lower Colorado River Valley at the junction of Sonora, Baja California, and California, then northward along the east side of the Peninsular Range and through the Mojave Desert to Inyo County, then east across southern Nevada and into NW Arizona.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa* 41329 (UCR, SD).

Pluchea odorata* (L.) Cass. var. *odorata

“saltmarsh fleabane”

A scarce native perennial of permanently wet areas associated with springs and alkaline streams on the west edge of the CMAGR. Perhaps no longer persisting locally, at least not as close to the range as formerly, following the lining of the Coachella Canal with concrete and cessation of seepage. Not found in any of our vegetation samples.

Widespread in warm wet places from California to Florida and southward to South America. In California it is most common on the coastal slope, especially associated with salt marshes, semi-permanent streams including the Santa Ana River, and low-elevation springs. On the California desert it is most associated with wet places in the Salton Basin, such as along various drainage ditches around the Salton Sea.

Representative voucher specimen: Imperial County, Hot Mineral Spa Road, 1 km from CMAGR, -20m (-66 *ft.*), *Sanders 9524*, in 1989 (UCR).

***Pluchea sericea* (Nutt.) Cov.**

“arrowweed”

Abundant over much of the Salton Basin, wherever there is a high water table, which in practice usually also means saline soils, of which this species is tolerant. Formerly common along the western edge of the CMAGR below the leaking Coachella Canal, but the concrete lining of the canal, together with dredging and other landscape modification, has eliminated most populations. A few persist, and it was found in 3 of the 303 vegetation sample plots.

A widespread plant of stream margins, ditch banks and other permanently damp places in southwestern North America. Known from Southern California, Arizona, New Mexico, Texas, Sonora, and northern Baja California.

Representative voucher specimen: Imperial County, canal road 2 miles north of Frink, 28m (91 *ft.*), *Sanders & Malusa 43522* (UCR, CAS, AWC).

***Porophyllum gracile* Benth.**

“odora”

A widely scattered subshrub with ascending stems, 20-50 cm high, most commonly around 35 cm, on dry open slopes in canyons and on hillsides. It was recorded from 256 to 876m (840 to 2875 *ft.*) elevation. This was found on 16.5% of vegetation sample plots, or 50 total. Strongly scented and prominently gland-dotted foliage and involucre; glabrous and of a peculiar purplish or blue-green color. Flowers dull white, flowering includes at least the January-March period.

Plants spread widely across the Sonoran Desert region from the cape of Baja California north through both coastal and desert slopes of southern California and continuing north through the Mojave Desert to southern Nevada. Widespread on the western deserts of Arizona, and east and south from there through New Mexico, western Texas, Sonora, and Chihuahua, and barely reaching the northern edge of Sinaloa.

Representative voucher specimen: Imperial County, upper Mammoth Wash, 317-457m (1040-1500 *ft.*), *Sanders & Malusa 42097* (UCR, CDA, DES).

***Prenanthes exiguus* (A. Gray) Rydb.**

“brightwhite”

Uncommon and easily overlooked small annual from a basal rosette of leaves. Found along washes and on adjacent sandy benches as well as on rocky slopes, at 284-787m elevation. Mostly in bud in March, but once found flowering that month. Due to the peculiarities of access (mostly just March during the spring season), all our few (5) collections of this were made in mid to late March, but it is certain that flowering is mostly in April in this area.

Widespread in western North American and present in every state of the U.S. southwest, and it is even present in Idaho. In Mexico it is recorded only in the northwestern states of Sonora and Baja California.

Representative voucher specimen: Riverside County, 2.3 miles east of Iris Pass, 765-787m (2510-2580 ft.), *Sanders & Malusa 42895* (UCR, DES).

***Psathyrotes ramosissima* (Torr.) A. Gray**

“turtleback”

An infrequent native perennial of open alluvial slopes and barren hills (desert pavement) in the lower parts of the CMAGR. Seldom seen and only 3 collections were made, despite our being very conscious of this plant. The highest collection is from 1128 ft. while one is from the lowest part of the CMAGR near Frink Spring at 70 ft. below sea level. Always recorded as scarce or solitary in the few places it was seen.

Widespread in the hot deserts of southern California, western Arizona, and southern Nevada, and continuing south into northern Baja California along the alluvial slopes leading down to the Gulf of California from the Peninsular Range.

Representative voucher specimen: Imperial County, hills near Mammoth Wash, 1.12 km west of Hayden Well, 255m (837 ft.), *Sanders & Malusa 42105* (UCR, AWC).

***Psilostrophe cooperi* (A. Gray) Greene**

“Cooper's paper daisy”

An uncommon perennial herb or subshrub, typically seen among shrubs and *Hilaria* along small washes on alluvial slopes and flats on the north and east sides of the range along and near the Bradshaw Trail. All our specimens and observations are from Riverside County at elevations of 2100 to 2560 ft.

This is a plant of the summer rain regions of SW North America, Arizona in particular, and populations are localized in California because such rains are less regular. Here it is restricted to the higher and wetter areas of the eastern Mojave Desert (especially), plus Joshua Tree National Park, and the Chocolate Mountains region. Substantial populations also occur in southern Nevada between those of eastern California and the extensive Arizona populations. The other main area of occurrence is Baja California, where populations occur the length of the peninsula.

This is one of the small group of sunflowers with rays that remain on the plant and turn papery after anthesis.

Representative voucher specimen: Riverside County, Bradshaw Trail at border of CMAGR, 2.25 miles east of Gasline Rd., 646m (2120 ft.), *Sanders 41868* (UCR, SD, AWC).

***Rafinesquia neomexicana* A. Gray**

“desert chicory”

Widely scattered and fairly common native annual throughout the CMAGR usually growing through shrubs and barely able to stand on its own when in the open. It benefits from the support of other plants. Frequently provides a

crown of white flowers on an otherwise drab *Ambrosia dumosa* or other shrub. It occurs both in canyons and on alluvial slopes with sandy and gravelly soil, especially in the lower parts of the alluvial fans bordering the mountains.

The southern California deserts represent the northwestern edge of this species' range, from here it extends south through the northern half of Baja California and east through Arizona and New Mexico as far as western Texas. It occurs north to central Nevada and south on the Mexican mainland to Sonora and Chihuahua.

Representative voucher specimen: Imperial County, large N-draining wash south of Blue Mountain, 415-427m (1360-1400 ft.), *Sanders & Malusa 43931* (UCR, DES).

***Senecio mohavensis* A. Gray**

“Mojave ragwort”

Infrequent to locally common native annual, usually occurring in rocky rubble, gullies, crevices, on ledges on cliffs, etc., though occasionally found in adjacent washes. Most commonly in partial to full shade, but much more commonly shade of rock than of shrubs. Largely absent from open flats and valley bottoms. In California, this plant is associated with rocky desert mountains from the Mexican border to the Death Valley region of Inyo County, but mostly in the eastern zone and entirely absent from the western Mojave Desert. The abaxial surfaces of the leaves are purple and the flowers are yellow.

East of California, this is common in western Arizona and southern Nevada. It is also widespread in Baja California especially on the eastern slopes of the Peninsular Range. There is a lone record from the gulf coast of Sonora.

Surprisingly, this is most closely related genetically to *Senecio flavus* (Decne.) Schultz-Bip. of North Africa and the Middle East; these two species, separated by thousands of miles and the Atlantic Ocean, are closest relatives and differ in only a small number of genes, one chromosome doubling, and small morphological differences. [Aaron Liston, Loren H. Rieseberg and Thomas S. Elias, 1989, *American Journal of Botany*, Vol. 76, No. 3 (Mar, 1989), pp. 383-388.]

Representative voucher specimen: Imperial County, Salvation Pass, 354m (1160 ft.), *Sanders & Malusa 41341* (UCR, AWC).

Sonchus asper* (L.) Hill ssp. *asper

“prickly sow-thistle”

A common weed of wildlands in California, and less common in irrigated areas in urban or rural settings. It is usually especially common along minor drainages where supplemental water is regularly available and is often more common in such places than *S. oleraceus*. In the CMAGR it is very scarce and almost entirely found on wash margins. It is doubtful whether this species is more than a waif locally. It was once seen to have been cropped by deer near Salvation Pass.

A Eurasian weed that is now naturalized in many places including much of North America.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well, 398m (1305 ft.), *Sanders & Malusa 42120* (UCR, AWC, SD).

***Sonchus oleraceus* L.**

“common sow-thistle”

Consistent with its common name, this is the more common species of *Sonchus* in the Chocolate Mountains, but conversely it is still very infrequent here. It is also by far the more common of the two species as an urban and agricultural weed in southern California. Our best guess is that the wind dispersed seeds blow into the Gunnery Range regularly, but that the plants germinated are too few to sustain a population on their own. Without the continuing seed rain from the Imperial Valley this species would probably cease to be present.

Like *S. asper*, this is Eurasian weed that is now naturalized in many places including much of North America.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well, 398m (1305 ft.), *Sanders & Malusa 42121* (UCR, AWC)

***Stephanomeria pauciflora* (Torr.) Nutt.**

“desert straw”

Common weak subshrub or perennial that only lives a few years. It forms rounded tumbleweed-like clumps or twiggy bushes on hillsides, road edges, beside washes, and in other open places. It is a quick invader following any kind of disturbance but appears to be a poor competitor that needs full sun, and so is not usually found among dense shrubs. This is a nearly ubiquitous plant of the California desert and was found very widely in the CMAGR from 24-876m (80-2875 ft.) elevation, and on 84 of the 303 vegetation sample plots (27.7% frequency).

Found throughout the deserts of southwestern North America including the U.S. states of California, Arizona, Nevada, Utah, New Mexico, western Texas, and Colorado. In Mexico it is present in Chihuahua, Sonora and throughout the Baja California peninsula.

Representative voucher specimen: Riverside County, along south side of Bradshaw Trail at large wash crossing, 680m (2230 ft.), *Sanders & Malusa 43353* (UCR, DES).

***Stylocline micropoides* A. Gray**

“woollyhead neststraw”

This is one of those peculiar spring annuals that is most successful in areas of substantial summer rainfall even though it does not grow during the summer rainy season. In California it is most common in the eastern Mojave Desert toward the Nevada state line, the most summer-wet part of the California desert, and is completely absent from the western Mojave Desert, the driest part of the desert in summer. The eastern foot of the Peninsular Range, which is another relatively wet area in late summer, almost serves as a natural control because despite its position at the western edge of the desert (similar to the western Mojave in that respect) it does support this plant. This is doubtless because it catches the Arizona monsoon more strongly than the western Mojave which has a more Mediterranean climate.

This is a small, low, and spreading spring annual that occurs from southern California through Arizona, southern Nevada, southwestern Utah, New Mexico, and western Texas. It is most frequent in the vicinity of the junction of California, Nevada, and Arizona. South of the U.S. it occurs in Baja California, Sonora, and Chihuahua.

Representative voucher specimen: Imperial County, German Diggins Wash below Pegleg Mine, 419m, (1373 ft.), Sanders & *Malusa* 42836 (UCR, SD). Only four collections were made and at each location the species was recorded as scarce or solitary.

***Trichoptilium incisum* A. Gray**

“yellowhead”

A small deep-rooted perennial that grows on barren rocky hillsides of various slope exposures and on alluvial slopes covered by desert pavement. Can be found on the bars of bar and swale surfaces. Seldom seen along washes, and very infrequent here in any habitat.

It occurs on hot desert slopes from central Baja California north to southern Nevada and east through western Arizona, and NW Sonora. Has not been recorded north of San Bernardino County in California even though other species with superficially similar habitat requirements extend north to Death Valley. Some non-obvious factor must be at work. Perhaps it is intolerant of winter cold.

Representative voucher specimen: Riverside County, Summit Rd. at Salt Creek Wash, 1480m (1480 ft.), Sanders & *Malusa* 44002 (UCR).

***Trixis californica* Kellogg**

“American threefold”

A frequently encountered shrub c. 0.5-1.5 m tall, lining the beds of small washes and gullies, occupying the edges of larger more active washes, and growing among rocks on boulder strewn slopes. Sometimes in light shade under ironwood or paloverde on wash banks. Flowers are bright yellow, and the lanceolate leaves are glossy green. Found at elevations from 41 to 783 m (136-2570 ft.) and in 73 of the 303 vegetation sample plots (24.1 %).

Very widespread in the arid parts of southern North America from Baja California (throughout the peninsula) to southern California, Arizona, and Texas and southeast through the Chihuahuan Desert to the vicinity of San Luis Potosi. On the Pacific coast it ranges from Sonora to Sinaloa.

In California, this plant occurs most commonly in the warmer Colorado Desert and is uncommon and local on the colder Mojave, which seems of eco-physiological importance until one realizes that in both Arizona and New Mexico it ranges into the northern parts of the state. It has never been found on the coastal slope of southern California.

An interesting shrub and one of only three members of the Tribe Mutisieae that reaches California. The tribe is species rich in South America and several species reach Mexico and a few others reach the United States. The tribe is unique in Asteraceae in possessing two-lipped corollas.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 421m (1380 ft.), Sanders & *Malusa* 41309 (UCR, SD, RSA).

Xylorhiza tortifolia* (T. & G) Greene var. *tortifolia[*Machaeranthera tortifolia* (T. & G.) Cronq. & Keck]

“Mojave-aster”

Uncommon to locally common perennial or subshrub from a thick woody root, on open slopes at higher elevations, 447-884 m (1400-2900 ft.) elevation. Often growing among other shrubs but sometimes in almost barren areas. Found on 38 of the 303 vegetation sample plots (12.5%).

In California this is widespread on the Mojave Desert, and it also occupies higher elevations in and around the Colorado Desert, as here. It does not occur in the lowest hottest habitats and thus it is absent from the Salton Basin, and it does not occur closer to the Mexican border in California than the Chocolate Mountains. It does extend north from southern California through the Owens Valley to the vicinity of Bishop. To the north and east it is present in western Arizona, southern Nevada, and southern Utah, with a different variety of the species present in central Utah.

Representative voucher specimen: Imperial County, 2.1 km SW of Surveyors Pass, 598m (1960 ft.), *Sanders & Malusa* 42298 (UCR, AWC).

BIGNONIACEAE***Chilopsis linearis* (Cav.) Sweet ssp. *arcuata* (Fosberg) Henrickson**

“desert willow”

With adequate water this can make a tree 10 m tall, but in the more arid parts of the desert, it usually exists as a large shrub or small tree c. 3-6m tall. In the southern California desert it occurs from the southwestern border through Death Valley (sparingly), but more commonly toward the east where summer rain is more frequent. While mostly growing on the desert, this plant also occurs at scattered favorable sites in the interior coastal valleys of California, as near San Jacinto. This species is always associated either with large sandy washes or dune fields, both of which are habitats that retain water at depth through the dry season. A large population exists along Salt Creek at the northern edge of the range, and smaller populations occur at other favorable sites such as near Iris Pass and along Salvation Wash. Found at elevations from 113 to 728m (370-2390 ft.) but only on 7 of the 303 vegetation sample sites (2.3%).

The large showy pink flowers are visited by a variety of bees and by hummingbirds; the trees themselves are important in providing cover and shelter for desert wildlife. The winged seeds are borne in long slender pods that split open at maturity and release the seeds to be dispersed by the wind.

Outside of California it occurs in northern Baja California, much of southern and western Arizona, southern Nevada, SW Utah, New Mexico, and in northernmost Sonora. The nominate subspecies occurs in Texas and north-central Mexico.

Representative voucher specimen: Riverside County, 1.5 km west of Tabaseca Tank, 602m (1975 ft.), *Sanders & Malusa* 43347 (UCR).

BORAGINACEAE

***Amsinckia intermedia* Fisch. & C.A. Mey.**

“common fiddleneck”

A spring annual usually found in sand accumulations in shrub clumps (especially where the shrub is dead) or on wash margins, and other sites where moisture accumulates.

This is usually thought of as the species common on the coastal side of the mountains in California, but we found it to be quite widespread in the Chocolate Mountains. There are other records from the California deserts, so our observation is not unique, and it is common in open habitats in western North America north to Canada: this includes the entire Baja California peninsula, most of Arizona, plus parts of Nevada and Utah. Scattered individuals may appear almost anywhere, all the way to the eastern U.S. and it has become a common weed in parts of Australia.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42123* (UCR, AWC).

Amsinckia tessellata* A. Gray var. *tessellata

“devil's lettuce”

An uncommon to locally common spring annual, usually on wash edges and on shrub hummock sand accumulations, but also on roadside berms and elsewhere with loose sandy soil. We made fewer collections (5) of this common desert native than we did of the less expected *A. intermedia* (12), probably because it was of less inherent interest and because it is pricklier. Our sampling of this species seems to have been strongly biased and this is probably reflected in the fact that our collections are predominantly from the northern parts of the range. However, there are few collections of this species by others from anywhere in the vicinity of the range, for example along CA Highway 78, so it is possible that the lack of records partly reflects a genuine scarcity in this part of the desert. Or, just that no one likes the prickly trichomes.

This species occurs from northern Sonora and Baja California north through California, Arizona and Nevada to Oregon, and Idaho.

Representative voucher specimen: Imperial County, between Beal Well and Surveyors Pass, 599m, (1965 ft.), *Sanders & Malusa 42309* (UCR).

***Cryptantha angustifolia* (Torr.) Greene**

[*Johnstonella angustifolia* (Torr.) Hasenstab & M.G.Simpson]

“bristlelobe cryptantha”

Common and widespread spring annual on alluvial slopes, especially in washes, their edges, and on included gravel bars. A total of 18 collections were made throughout the range on this project, but mostly on the sandy bajadas on the southwestern side.

The range of this species takes in much of the lowland southwestern deserts from southernmost Baja California through southern California, Arizona, and New Mexico, plus the southern parts of Nevada and Utah, and east to Texas, and to south into Sonora, Chihuahua and Coahuila in northern Mexico.

This plant occurs in two forms which differ in corolla size and foliage pubescence -- the larger corollas are associated with denser trichomes and thus a whiter appearance to the foliage. These forms have never been formally named at any level.

Representative voucher specimen: Imperial County, Niland-Blythe Rd., NE of Siphon 8 on the Coachella Canal, and of Slab City, 51m (168 ft.), *Sanders & Malusa 42167*, (UCR, SBBG, RSA).

Cryptantha barbiger* (A. Gray) Greene var. *barbiger

“bearded cryptantha”

In the Chocolate Mountains this spring annual is characteristic of sandy soil on wash edges and shrub clumps. It often grows around the edges of shrubs and trees, but also can be found away from cover on gravel bars of open washes. It is frequently seen on the sand accumulation that built up around a now dead shrub, or around a live one.

This grows from southern Baja California north through southern California and continuing north to central Nevada and Utah. From California it ranges eastward to Texas and south to Sonora and Chihuahua. This widespread spring annual has characteristically softly hairy inflorescences and wide blunt-tipped leaves. The corollas are of small diameter compared to *C. angustifolia*.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42124*, (UCR, ARIZ).

***Cryptantha decipiens* (M.E. Jones) Heller**

“gravel cryptantha”

All our collections (4) from the Chocolate Mtns. were made along the Bradshaw Trail on the northern edge of the range within Riverside County, at some of the higher elevations in the range (2000-2450 ft.). We did not record it anywhere else.

In parallel with our observations, there are no other collections of this species east of the Salton Basin in Imperial County by anyone. Southern California specimens mostly hug the desert side of the Peninsular Range snaking along the foot of the mountains but also with substantial outlying populations at moderate elevations in the eastern Mojave Desert and the Death Valley area of the northern Mojave Desert. The population from the eastern Peninsular Range continues north and then west around the Transverse Range and along the western edge of the Mojave Desert. The range of this species forks in the Tehachapi area with an eastern branch hugging the east side of the Sierra Nevada and extending as far north as Big Pine, while the western branch follows the coast range north to Mt. Diablo. Based on what I can see in CCH, the coast range branch is mostly in the (arid) inner coast range. Most of these populations are either in the zone of descending air on the edge of either the desert or of the San

Joaquin Valley. Those away from the descending air zone are at slightly higher elevations within the desert itself, as at the north end of the Chocolate Mountains.

Outside California this species occurs in southern Nevada, scattered through Arizona (especially NW), and in northern Baja California. The southern Nevada populations link those of the eastern and northern Mojave in California.

Representative voucher specimen: Riverside County, “perched playa” on Bradshaw Trail 1 km west of Dupont Rd., 741m, (2430 ft.), *Sanders & Malusa 44021* (UCR, SD).

***Cryptantha dumetorum* (Greene ex A. Gray) Greene**

“bushloving cryptantha”

As in the case of *C. decipiens*, we found this infrequently (3 times) and only along the Bradshaw Trail at the northern edge of the CMAGR. It is a cryptic species that usually grows inside, and clambers on, various shrubs and so it can easily be overlooked.

Unlike *C. decipiens*, this plant is widespread across Mojave Desert of California, and it is also common in southern Nevada (Clark and Nye Counties), but it barely enters Arizona where there are only about a half dozen separate collections. It seems to have been barely successful in crossing the Colorado River. It has also been mostly unsuccessful in the Colorado Desert in California where there are only a few records in the northern part, including those found by this survey. There are a few collections from the southwestern corner of Utah in the Mojave Desert portion of that state. The vast majority of plants of this species occur in California and it is close to being endemic to the state.

Representative voucher specimen: Riverside County, Bradshaw Trail, 11 km east of Gas Line Rd., *Sanders & Malusa 42952* (UCR, CDA, SD).

***Cryptantha holoptera* (A. Gray) Macbr.**

[*Johnstonella holoptera* (A. Gray) Hasenstab & M.G. Simpson]

“narrow-wing cat's-eye”

This species, uncommon in California, was found only twice by these surveys, one of those as seedlings in January 2020. Its preferred habitat is rocky slopes, often steep, and it was not found in washes on this survey though plants have been found in washes elsewhere -- those doubtless waifs from nearby hillside populations. This species can perennate under favorable conditions and will then form small sub-woody shrublets.

It ranges from the head of the Gulf of California, especially on the east slope of Baja California, through the hot deserts of southern California to the Death Valley area. On the eastern side of the Gulf it has been found twice in the Pinacate region in NW Sonora but is probably more extensive there. It occurs around the Salton Sink and up the Colorado River Valley to southern Nevada and further up through the Grand Canyon. Aside from the upper Colorado River it is very local in Arizona, mostly just in the Yuma area of southwestern Arizona. Populations reported in CCH2 on the western Mojave Desert and Santa Ana Mountains of California are in error. The type was supposedly collected at St. George, Utah, where no one has found it since.

Representative voucher specimen: Imperial County, hill emergent from alluvial slope, NE of Ted Kipf Rd., 2.5 km north of Amos, 119m (390 ft.), *Sanders & Malusa 43777* (UCR).

Cryptantha maritima (Greene) Greene

This species has two varieties in the California desert, both of which occur in the Chocolate Mountains. In size and stature, they are similar, but they differ in the pubescence of the inflorescence. *C. m. pilosa* plants have tufts of soft white hairs covering the calyx while *C. m. m.* has scattered stout trichomes and a consequently green calyx. Typical plants are easy to separate even at several feet distance, but unfortunately not all plants are typical and there may be some introgression between the taxa, as would be expected for varieties. In the last printed edition of the Jepson Manual (Baldwin et al, 2012), the two forms were not recognized but subsequent work by Simpson & Rebman, 2021 [Phytotaxa 509 (2): 185–210 <https://doi.org/10.11646/phytotaxa.509.2.3> “Research in Boraginaceae: A new variety of *Cryptantha maritima*, *Cryptantha pondii* resurrected, and *Johnstonella echinosepala* transferred back to *Cryptantha*”] argued for their validity, and they are now at least tentatively accepted. That said, there are several specimens from the Chocolate Mountains and vicinity which we cannot identify with confidence and some of those we did identify are open to question. This is particularly so for specimens collected during the annual January open period (EOD sweeps) when the plants were just beginning to flower and the inflorescence indumentum characteristics were not yet well developed.

The range of the species overall is from southern Baja California north to central Nevada and from the coast of southern California, including the Channel Islands, east to the Phoenix area in central Arizona. It is primarily a species of the deserts, but there are scattered populations in particularly arid locations along the California coast.

Cryptantha maritima (Greene) Greene var. *maritima*

“*Guadalupe cryptantha*”

A common small annual of alluvial slopes and hillsides, mostly in sandy soil. All our collections were from plants growing in or beside washes. In Arizona, this variety is much less common than var. *pilosa* based on records reported in SEINet and CCH2, and on specimens in the UCR Herbarium. At UCR there is only one Arizona *C. m. maritima* specimen versus seven *C. m. pilosa*. On our surveys we collected the two about equally frequently in the CMAGR (14 *maritima* vs. 11 *pilosa*) based on a review of the specimens just completed.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42125* (UCR).

Cryptantha maritima (Greene) Greene var. *pilosa* I.M. Johnston

“tufted haired cryptantha”

A common small annual that grows on alluvial slopes and among rocks on slopes, mostly in sandy soil. All collections we made were from plants growing along washes.

This taxon is widespread in the California deserts where it is often mixed with variety *maritima*. In Arizona this is the predominant form based on records reported in SEINet and CCH2 and on specimens in the UCR Herbarium; it

seems to largely replace variety *maritima* in that state. On our surveys we found the two to be about equally common in the CMAGR.

Representative voucher specimen: Imperial County, Hayden Well on Mammoth Wash, 284m, (930 ft.), *Sanders & Malusa 42015* (UCR).

Cryptantha micrantha* (Torr.) Jtn. var. *micrantha

[*Eremocarya micrantha* var. *micrantha*]

“greater alley cat's-eye”

A scarce annual that we found only once in a wash near the Bradshaw Trail. This is a widespread annual on open sandy flats over much of the California Desert and so its scarcity here is surprising.

Globally it occurs from Baja California north across both southern California deserts to the Owens Valley in eastern California, then it is spread east through southern Nevada and across the southern edge of Utah. To the south it is widespread in Arizona and then in small numbers east through New Mexico to western Texas.

Representative voucher specimen: Riverside County, Bradshaw Trail, c. 11 km SE of Gasline Rd., 729m (2390 ft.), *Sanders & Malusa 42985* (UCR, CDA, HSU).

Cryptantha nevadensis* A. Nels. & Kennedy var. *nevadensis

“Nevada catseye”

This is a common annual on the Mojave Desert in California, but in the CMAGR it is infrequent and in low numbers, with most observations in the northern and higher elevation parts of the range. Seven collections were made and four of those are from Riverside County. Apart from one small population (waifs?) collected in lower Salt Creek Wash at 145 ft., all collections were made above 1300 ft. elevation. The plants were recorded as solitary or scarce everywhere they were found. It is strongly associated with shrub clumps and wash margins, usually both. It has elongated arching stems and tends to clamber through shrub branches or over debris accumulations on wash margins. It is incapable of standing on its own and in open areas, mid-wash, the plants are usually fallen over.

Outside of southern California, this plant occurs through Nevada, Utah, northern Arizona, and barely reaches western New Mexico. There are a few records in Sonora and Chihuahua, Mexico but it appears uncommon in Mexico, as expected. Most common in deserts of southern California, Arizona, and southern Nevada.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42130* (UCR).

***Cryptantha pterocarya* var. *cycloptera* (Greene) J.F. Macbr.**

[*Cryptantha cycloptera* (Greene) Greene]

“Tucson cryptantha”

A common annual in the CMAGR, mostly found along washes and in other places of seasonal water accumulation but also on rocky hillsides at upper elevations. This is the common representative of the *C. pterocarya* group in the lowland parts of the eastern deserts of southern California: it is absent from the Mojave Desert west of Victorville and Barstow. These are stiffly erect annuals with white flowers and enlarged fruiting calyces to accommodate the prominently winged seeds. Eighteen collections were made from throughout the range, but mostly in the northern half.

Widespread on deserts from southern Baja California to central Nevada, and then eastward through Arizona to southern New Mexico and El Paso Texas. There are isolated collections in Utah and Colorado as well.

Representative voucher specimen: Imperial County, west side of Surveyors Pass, 663m (2175 ft.), *Sanders & Malusa* 42326 (UCR, AWC).

***Cryptantha racemosa* (S. Wats.) Greene**

[*Johnstonella racemosa* (S. Watson ex A. Gray) Brand]

“bushy cryptantha”

A rock-loving perennial, only found once by us among granite boulders on a hill along the Niland-Blythe Road west of Beal Well. However, there is an old collection from Beal Well (Alexander & Kellogg, in 1941), and the type locality is at the south end of the Chocolate Mtns. near the Mesquite Mine (Parish, in 1881), so it has long been known from the vicinity though it appears to be scarce locally. It always grows under overhanging boulders, in rock crevices on cliffs, and in similar places. It is not found on alluvial slopes or fine-grained soils except perhaps as a rare waif.

Occurs from around the head of the Gulf of California in Baja California and Sonora, north through the California deserts to Death Valley and the White Mountains, and along the Colorado River Valley to the Grand Canyon area of northern Arizona and adjacent areas of southern Nevada and Utah.

Representative voucher specimen: Imperial County, 1 km SW of Beal Well, 392m (1287 ft.), *Sanders & Malusa* 44068 (UCR, SD, RSA, ARIZ, CAS, DES, AWC).

***Cryptantha utahensis* (A. Gray) Greene**

“Scented cryptantha”

We found this erect annual in the CMAGR only once, at the northern end near Salt Creek Canyon.

Despite its specific epithet, this plant is uncommon in Utah, being restricted to the SW corner around St. George, and the bulk of its distribution is in California. But it is also common in southern Nevada and NW Arizona. It is scarce in the Sonoran Desert with few records from eastern Riverside County and none from Imperial County.

Representative voucher specimen: Riverside County, large canyon 4 km SSE of the confluence of Red Canyon and Salt Creek, 518m (1700 ft.), *Sanders & Malusa* 43171 (UCR, AWC, CDA).

***Pectocarya anisocarpa* Veno**

“unequal-fruited pectocarya”

We found this species in the CMAGR only twice, once at Beal Well and once at the northern end of the range. This is not a conspicuous species and other populations were undoubtedly overlooked.

The exact details of the general distribution of this recently described species are still to be worked out, but its range clearly includes the deserts of southern California and the arid west side of the San Joaquin Valley/Inner Coast Range as far north as the latitude of Fresno. There are a few records in NW Arizona, and it definitely occurs in northern Baja California.

Representative voucher specimen: Imperial County, Beal’s Well, 412m (1351 ft.), *Sanders & Malusa 41958* (UCR).

***Pectocarya heterocarpa* (Jtn.) Jtn.**

“chuckwalla combseed”

Common annual with seeds curved forward, not recurved as in most other *Pectocarya* species. Perhaps the most common *Pectocarya* locally. It occurs on wash edges, adjacent benches, and gravelly slopes.

Overall, it ranges through the Sonoran Desert from Baja California and Sonora, though southern California and then through the Mojave Desert to the fringe of the Great Basin in eastern California and central and southern Nevada, also western Arizona and adjacent SW Utah. In California it also occurs from the arid western San Joaquin Valley and Inner Coast Range to the coastal slope of southern California.

Representative voucher specimen: Imperial County, west side of Surveyors Pass, 663m (2175 ft.), *Sanders & Malusa 42324* (UCR, SD).

***Pectocarya penicillata* (H. & A.) A. DC.**

“winged combseed”

A low annual which we found only once in the CMAGR, in a silty depression among sparse grasses on a bench above a wash.

In California this is widespread in dry open places the length of the state, including the Mojave Desert, Sierra Nevada, and around the San Joaquin and Sacramento valleys. Common on the coastal slope of southern California, often in mixed populations with *P. linearis*. Outside California this appears to be quite scarce but has been recorded from Oregon, Nevada, and Arizona, plus Baja California and Sonora in Mexico.

Representative voucher specimen: Riverside County, 1.85 km SE of intersection of Bradshaw Trail and Summit Rd., 488m (1600 ft.), *Sanders & Malusa 43953* (UCR, AWC).

***Pectocarya peninsularis* I.M.Johnst.**

“baja pectocarya”

Hypothetical. This occurs along the Coachella Canal at the mouth of Salt Creek near Dos Palmas Oasis and to be expected further up Salt Creek or farther south on the alluvial slopes along the Coachella Canal. This recently described species is still poorly known with respect to the outline of its range.

We are having trouble separating this from *P. heterocarpa*, its close relative. It may well be that some of our specimens scored as *P. heterocarpa* are this.

Representative voucher specimen: none

***Pectocarya platycarpa* (Munz & Jtn.) Munz & Jtn.**

“broadfruit combseed”

A common spring annual on wash margins, gravel bars, adjacent alluvial benches, and less commonly on open slopes on hillsides. The largest and most conspicuous of local *Pectocarya* species.

Throughout the southwestern deserts from central Baja California north to the Owens Valley near Big Pine in eastern California, east through southern Nevada, the SW corner of Utah, the deserts of Arizona, and south into Sonora. Absent from the NE quarter of Arizona. Eastward, populations extend through New Mexico to El Paso, Texas.

Representative voucher specimen: Riverside County, 2.3 miles east of Iris Pass, 765-787m (2510-2580 ft.), *Sanders & Malusa 42899* (UCR).

***Pectocarya recurvata* Jtn.**

“curvenut combseed”

This is a common and widespread spring annual in the Chocolate mountains, with 16 records in CCH, 14 of them collected by us, but all these records are on the eastern side of the crest not on the steeper western side above the Salton Basin. Mostly found on wash edges, but also on benches, hillside slopes, and even ridgetops.

Deserts from southern Baja California north to the Owens Valley of California and east through southern Nevada, Arizona, SW New Mexico, and Sonora. Like *P. platycarpa*, this plant is absent from the NE quarter of Arizona.

Representative voucher specimen: Imperial County, Salvation Wash and NE of German Diggins Wash, 404m (1325 ft.), *Sanders & Malusa 42825* (UCR, SD).

***Plagiobothrys jonesii* A. Gray**

“Mojave popcornflower”

An uncommon but not rare spring annual, often on steep rocky slopes of ridges, commonly east or north facing ones, and seldom south-facing ones, or more usually on wash margins at the foot of such slopes.

It occurs from the Gulf of California to the hills of Mono County, California. Widespread in the deserts of western Arizona, southern Nevada, and SW Utah.

The relationship of this plant to the other species placed in *Plagiobothrys* is not obvious and superficially it seems closer to *Amsinckia*, except that it has white flowers.

Representative voucher specimen: Imperial County, 0.85 km NNE of Beal Well, 434m (1423 ft.), *Sanders & Malusa 42254* (UCR, AWC, SD).

***Tiquilia canescens* var. *pulchella* (I.M. Johnston) A. Richards.**

“woody crinklemat”

California Rare Plant Rank: 3.2

A low spreading/prostrate shrub on rocky slopes and ridges the entire length of the range. Always among bedrock outcrops and never seen in washes or on alluvial slopes except in shallow alluvium over bedrock. Root crown and stems are strongly woody, and the plant forms a low gray mat of vegetation.

This is the only form of *Tiquilia canescens* we found in the Chocolate Mountains, and we believe that all the plants present are of this moderately rare taxon.

Representative voucher specimen: Imperial County, between Beal Well and Surveyors Pass, 599m (1965 ft.), *Sanders & Malusa 42307* (UCR).

***Tiquilia plicata* (Torr.) A. Richardson**

“fanleaf crinklemat”

A scarce perennial in sandy soil mostly at low elevations on the SW edge of the range. It was collected only twice by us but was collected at Beal Well by Jaeger in 1922, and there are many records around the Algodones Dunes outside the CMAGR boundary but nearby.

Sandy desert flats around the head of the Gulf of California and north through both deserts of southern California to the Death Valley region of Inyo County.

Representative voucher specimen: Imperial County, Ted Kipf Rd. north of Tortuga Siding, 88m (290 ft.). *Sanders & Malusa 42792* (UCR, RSA, SD).

BRASSICACEAE

***Brassica geniculata* (Desf.) Benth.**

[*Hirschfeldia incana* (L.) Lagr.-Foss.]

“short-podded mustard”

Only found once on this project. A scarce weed, probably behaving as a spring annual here though capable of perennating elsewhere in southern California. May well just be a waif in this area as the habitat is distinctly marginal and the solitary plant we collected had not yet matured and probably never would have. Common on the coastal slope of southern California and extending a bit into the desert on roadsides and other sites receiving extra water from runoff. Native to the Mediterranean Basin.

Representative voucher specimen: Riverside County, lower Salt Creek on the illegal OHV road from the Coachella Canal to the trestle, 44m (145 ft.), *Sanders & Malusa 43134* (UCR).

***Brassica tournefortii* Gouan**

“Sahara mustard”

An abundant spring annual weed in sandy soil throughout the range. Especially common on wash edges and sandy alluvial slopes, but also occasionally on rocky slopes.

Native to North Africa and the Middle East but introduced to California (probably with potted date palms) in the early 20th century. [Minnich, R.A. and A.C. Sanders. 2000. *Brassica tournefortii* Gouan. In: Bossard, C.C., J.M. Randall, and M.C. Hoshovsky. eds. Invasive Plants of California's Wildlands. University of California Press]

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 326m (1070 ft.), *Sanders & Malusa 41297* (UCR, AWC).

***Caulanthus cooperi* (S. Wats.) Payson**

“Cooper's wild cabbage”

Locally a very scarce native spring annual, found by us only once at the edge of a dried (moist) pool near Salt Creek. This plant has only been collected twice in the Chocolate Mountains, both times at the northern edge. There are very few records from southeastern California in general: for example, there are only 4 records from Imperial County recorded in CCH2 and 2 of those are at the foot of the Peninsular Range west of the Imperial Valley. In an adjacent area of similar habitat to Imperial County, there are no records in Yuma County in SW Arizona, according to SEINet (excluding two that are in error and should have been recorded as Mohave County). This species clearly does not do well in low elevation hot deserts.

This plant occurs in the Peninsular Range in northern Baja California and then north through the deserts of southern California to the Owens Valley. It is most common on the Mojave Desert, including NW Arizona, southern Nevada, and the SW corner of Utah. It appears that c. 95% of the population of this plant occurs in the Mojave Desert of California and southern Nevada.

This plant typically grows from under shrubs and its elongated main stem climbs up through the branches of the host, almost becoming vine-like.

Representative voucher specimen: Riverside County, Summit Rd. at Salt Creek Wash, 451m (1480 ft.), *Sanders & Malusa 44001* (UCR).

***Caulanthus lasiophyllus* (Hook. & Arn.) Payson**

“California mustard”

A common spring annual along washes and in the shade of trees, shrubs, and rock outcrops. Delicate, erect, and white flowered; probably pollinated by moths at night. Sometimes forms large stands in favorable spots.

Widespread spring annual of the southwestern deserts and the dry hills of California, occurring from southern Baja California north to Inyo County in eastern California and throughout the coastal range of the coast of California north to at least Arcata. From the Owens Valley it occurs east across southern Nevada and north to about Reno, and just slightly into SW Utah. Farther south it can be found in western Arizona and western Sonora, Mexico.

Representative voucher specimen: Imperial County, Salvation Pass, 366m (1200 ft.), *Sanders & Malusa 41265* (UCR, AWC).

***Descurainia pinnata* (Walt.) Britt.**

“western tansymustard”

A common and widespread spring annual of wash edges, sandy benches, on the margins of tree and shrub canopies, and often in the shade beneath trees or shrubs. We saw this throughout the range, and it is commonly encountered in all surrounding areas. This was historically an important food plant for various Native American groups [e.g., Bean, Lowell John and Katherine Siva Saubel, 1972, Temalpakh (From the Earth): Cahuilla Indian Knowledge and Usage of Plants, Banning, CA. Malki Museum Press, page 66].

Common throughout western North America from central Mexico to northern Canada and it also has populations on the east coast, especially in the Southeast.

Representative voucher specimen: Imperial County, 1 mile west of Beal Well, 415-473m (1360-1550 ft.), *Sanders & Malusa 41962* (UCR, AWC, SD).

***Dithyrea californica* Harv.**

“spectacle pod”

An uncommon to scarce annual of sandy soil accumulations along wash margins here, and on dunes outside the range where those are present (e.g., Algodones). The flowers are white, open at night, and give off a strong fragrance similar to jasmine. This syndrome strongly suggests the flowers are pollinated by nocturnal moths.

We only collected this plant three times and found that locally it occurs on lower alluvial slopes at elevations of 290-1460 ft. In California overall it is characteristic of sandy areas in both the Sonoran and Mojave deserts but does not leave the arid lands of the interior. It occurs from the Mexican border to as far north as the vicinity of Bishop in Inyo County. Toward the coast it is replaced by a perennial but otherwise similar relative (*C. maritima*) which occupies coastal dunes.

Outside of California this plant is found in western Arizona and southernmost Nevada. In Mexico it is widespread in the Baja California peninsula and along the Gulf of California coast in northern Sonora.

Representative voucher specimen: Imperial County, Gas Line Rd., 5.7 km above the Coachella Canal, 125m (410 ft.), *Sanders & Malusa 44113* (UCR).

***Draba cuneifolia* Nutt. ex T. & G.**

“wedgeleaf draba”

This is a widespread annual in the CMAGR, but it is usually not numerous. We usually found it present only as scattered individuals along washes, but also among rocks on slopes. In both settings it frequently appears in sites with partial shade. Elevations where we found it range from 900 to 2390 ft., always in well-drained upland areas and never on fine-grained alkaline soils of the Salton Basin. We collected it 14 times from scattered points, and we have records the length of the range though with a significant concentration in the central part.

This plant is widespread in southern California on both the coastal and desert sides of the mountains, and it is very early to flower in the spring but this may also cause it to be missed during surveys which often take place later in the spring, and this is particularly true on the coastal slope where this plant is infrequently seen. We found it in February and March.

It is readily recognized by its short stature, strong basal rosette of leaves, and relatively large bright white flowers. When not flowering the plants are inconspicuous, though the flattened pods aid in detection.

Outside of California *Draba cuneifolia* grows in much of western North America from the Pacific Coast east to Missouri and Mississippi, and from Oregon and Utah south to northern Mexico (Zacatecas and Baja California Sur).

Representative voucher specimen: Imperial County, Salvation Pass, 354m (1160 ft.), *Sanders & Malusa* 41337 (AWC, UCR).

***Lepidium fremontii* S. Wats.**

“desert alyssum”

An uncommon subshrub, often from a thick woody base, that occurs mostly at higher elevations, from 366-884m (1200-2900 ft.) and which was found at only 5 of 303 vegetation sample sites (1.65%). Six collections have been made over the years at scattered localities in CMAGR, five of those by us on these surveys.

This plant occurs in various habitats including wash edges, openings between shrubs on alluvial slopes, crevices and ledges on cliffs, canyon bottoms, among boulders on rocky slopes, etc.

In California this plant is most common on the Mojave Desert, but populations trickle onto the Sonoran Desert at higher elevations, mostly in Riverside County. There are only c. 10 separate collections (plus 4 duplicates) from Imperial County reported in CCH2. Populations extend north from the Mojave Desert on the east side of the Sierra Nevada to Mono County.

Outside California this is found in western and northern Arizona, western Nevada almost to the Oregon border, and in southwestern Utah.

Representative voucher specimen: Imperial County, north fork of Salvation wash, 427-457m (1400-1500 ft.), *Sanders & Malusa* 41324 (AWC, UCR).

Lepidium lasiocarpum* Nutt. ex Torr & A. Gray ssp. *lasiocarpum

“shaggyfruit peppergrass”

A common and almost universal spring annual in the CMAGR; low in stature with stems decumbent to ascending and the plants are not conspicuous unless particularly large or abundant at some site. Most frequent along washes or between shrubs on sandy alluvial slopes, and always in open sites that are not heavily shaded. The flowers are small and individually hardly noticeable; the species has virtually 100% fruit set which suggests self-pollination or asexual seed production.

Widespread in SW North America from Utah to California and from southern Baja California to Arizona and Texas; also occurs south to central Mexico.

Representative voucher specimen: Imperial County, north fork of Salvation wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41320* (UCR, SD, AWC).

***Physaria tenella* (A. Nelson) O'Kane & Al-Shehbaz**

“slender bladderpod”

A common spring annual with decumbent stems, when growing in the open, and conspicuous yellow flowers. However, this is often seen growing in shrub clumps and the stems then usually ascending through, and clambering over, the host's branches. Many of our records were of plants in shallow low-gradient drainages rather than larger active washes.

Widespread on the deserts of Arizona, and southern Nevada. More localized in California where it is mostly found in the eastern Mojave Desert, Joshua Tree National Park, and the eastern Colorado Desert in the Chocolate Mountains area. This is another spring annual that seems to do best in areas of abundant summer rain and to be absent from those parts of the desert that receive almost none (e.g., western Mojave Desert). It has not colonized the western side of the Salton Basin despite the relatively high frequency of summer rains near the foot of the Peninsular Range.

Representative voucher specimen: Imperial County, head of Mammoth Wash, 506m (1660 ft.), *Sanders & Malusa 42773* (UCR, SD).

***Sisymbrium irio* L.**

“London rocket”

A common weed in California, mostly at lower elevations and in the south. Frequently a weed of agricultural fields on the desert, but more common as a roadside, vacant lot, and yard weed in urban California. Over recent decades it seems to have spread into or at least multiplied in distinctly desert habitats and other wildlands. In the CMAGR we found it at scattered locations, mostly disturbed sites and wash margins.

Introduced from Europe, but now common across the western U.S. and north to Canada to a limited degree, and also occurs south through much of upland Mexico.

Representative voucher specimen: Imperial County, Pegleg Well near Pegleg Mine, 424 meters (1391ft), *Sanders & Malusa 42838* (UCR).

***Streptanthella longirostris* (S. Wats.) Rydb.**

“longbeaked twist-flower”

A scarce erect annual of sandy soils, especially frequent on dunes. We only found this species once in the range, in a sand hummock accumulated around an ironwood tree on the lower alluvial slopes on the outer fringe of the Algodones Dune system. The species is widespread in the deserts of southern California

Outside California it is widespread in western North America wherever there are sand accumulations, including Nevada, Utah, eastern Oregon, New Mexico, Colorado, Wyoming, Montana, and Idaho. Oddly, it does not reach the extensive dunes of western Texas. In Mexico it is known from northern Baja California, and northwestern Sonora.

Representative voucher specimen: Imperial County, above Ted Kipf Rd., between Amos and Acolita, just inside CMAGR boundary, 87m (285 ft.), *Sanders & Malusa 43744* (UCR, AWC).

BURSERACEAE

Bursera microphylla A. Gray

“elephant tree”

Our discovery of this constitutes the first record of this species in California on the east side of the Salton Basin. It is well-known in California from several locations in and near Anza-Borrego State Park in the Peninsular Range west of the basin. Those are in a summer wet zone and are contiguous with the extensive populations in Baja California. Other populations occur in Arizona, and it is possible that this new population, of a single plant, is related to those more closely than to the known Californian populations, though we have other cases of plants “jumping” across the Salton Basin from the mountains of Baja California to the Chocolate Mountains. The distance from the Chocolate Mountains to the *Bursera* populations near Yuma is not much greater than to those in Anza-Borrego. There could easily be other plants of this species in the area that we did not find.

Fairly common thick-stemmed shrub or small tree of rocky granite slopes in the Sonoran Desert. Most populations are in Mexico around the Gulf of California from the cape region of Baja California north to the U.S. border, on most of the islands in the gulf, and along the coast of Sonora south almost to the Sinaloa border. In Arizona this occurs from Phoenix to Tucson and Yuma.

Representative voucher specimen: Imperial County, 1.48 km SE of Beal Well, 505m (1655 ft.), *Sanders & Malusa 44086* (AWC, SD, RSA).

CACTACEAE

Carnegiea gigantea (Engelm.) Britton & Rose

“saguaro”

A very scarce columnar cactus, with perhaps only one native individual in the area. We have a photograph we took of one of these at Midway Well, but that is about 3 miles outside the range boundaries, and we strongly suspect that this individual was planted. In addition, one of us (Malusa) photographed a saguaro off Dietz Rd. on the range boundary in 1991, but subsequent searches in 2020 could not relocate the specimen. It was a large mature (10 m) saguaro with two arms, and has likely died in the intervening 3 decades.

Representative voucher specimen: Imperial County, 2.5 mi E of Mt. Barrow, 1 mi N of Imperial Gables Road, and 1/2 mi NW of Lowe Rd., *Stephen Ingram 2103*, in 2011 (SD, RSA). This specimen and image were taken outside the range boundaries, but not far outside. It is a large mature individual and has been growing there for decades and so cannot have been planted.

Cylindropuntia acanthocarpa* (Engelm. & J. M. Bigelow) F. M. Knuth var. *acanthocarpa

“buckhorn cholla”

Local colonies exist only at the extreme southeastern end of the CMAGR on dry slopes with rocky soils and much desert pavement. But the plants are not as numerous or as large as in the eastern Mojave Desert, and they are much less numerous than the associated populations of *C. bigelovii*. In California this plant occurs in the eastern Mojave Desert, the Whipple Mountains area, and the southeastern part of Imperial County. The C.B. Wolf specimen from the northern end of the Chocolate Mountains (in CCH2) is clearly mis-mapped.

Recorded on 16 of 303 vegetation sample plots (5.3%) at elevations of 250-680m (820-2230 ft.)

The general range of the taxon also includes western Arizona and southern Nevada. It has not been recorded outside these three southwestern states.

Representative voucher specimen: Imperial County, 2.25 km SW of Paymaster Mine, 356m (1168ft), *Sanders & Malusa 43469* (UCR, AWC, SD).

***Cylindropuntia bigelovii* (Engelm.) F.M. Knuth**

“jumping cholla”

Huge populations of this exist in the southeastern part of the Chocolate Mountains (e.g., Imperial Gables), near Lion Head Mountain, along Salvation Wash, at “Invader” target, around Beal Well, in Mammoth Wash near Hayden Well, in the vicinity of Surveyors Pass, along the cutoff road between Bradshaw Trail and the old Niland-Blythe Rd., and at many other places on alluvial slopes and stony hillsides. Extremely spiny and difficult to even be around, hence we did not make as many specimens from multiple locations as we should have, but fortunately we had Marc Baker along on a few trips and he made a half dozen vouchers. It is doubtless under-collected in general. The species is especially common on schist bedrock.

This plant is mostly sterile and produces few viable seeds. Reproduction is predominantly asexual via dropped stem joints.

Found at 54 of 303 vegetation sample locations (17.8%) at elevations ranging from 197-823m (645-2700 ft.).

In California overall this is a common member of many desert plant communities especially at the eastern foot of the Peninsular Range, in Joshua Tree National Park, and in the eastern Colorado and Mojave Deserts. This species is absent from the western and northern Mojave Desert.

Representative voucher specimen: Imperial County, 5.5 km east-southeast of Lion Head Mountain, 434m (1425 ft.), *Baker 18468* (UCR, ASU).

***Cylindropuntia chuckwallensis* M.A. Baker & M.A. Cloud-Hughes**

“chuckwalla cholla”

A very recently described species [M.A. Baker & M.A. Cloud-Hughes. 2014. *Madroño* 61(2): 231-243.] for which more distributional information is certainly needed. It is a Californian endemic known from Chocolate Mountains and northwest from there through the Chuckwalla and Cottonwood mountains to the vicinity of Twentynine Palms. Most of our few records in the CMAGR are in the northeastern part of the range. Found on only 3 of 303 sample plots (1%) and at elevations ranging from 474-658m (1555-2160 ft.).

Representative voucher specimen: Imperial County, 2.8 km east of Surveyors Pass, 610m (2000 ft.), *Sanders & Malusa 43026* (UCR).

***Cylindropuntia echinocarpa* (Engelm. & J. M. Bigelow) F. M. Knuth**

[*Opuntia echinocarpa* Engelm & J. Bigel.]

“silver cholla”

A common and widespread shrubby cactus in the CMAGR on alluvial slopes and ridges, observed at Gasline Rd. near OP Slats, Iris Pass, head of Mammoth Wash, 10.3 miles NNE (5°) of Niland, 4.3 miles NE of Frink, Bradshaw Trail at “perched playa” 1 km west of Dupont Rd., and elsewhere at elevations ranging from 420-2410 ft. Like most *Cylindropuntia* species this plant is extremely prickly and difficult to handle and so was not collected often. This is one of the more drought tolerant *Cylindropuntia* species and consequently can be found lower on the alluvial fans than the others. Found in 73 of 303 vegetation samples (24.1%) at elevations from 26-876m (85-2875 ft.)

A widespread species of the desert Southwest from southern California to southern Nevada, southwestern Utah and throughout western Arizona. It also occurs in northern Baja California and NW Sonora in Mexico.

Representative voucher specimen: Imperial County, 1 mile above site of Melson Well along the Niland-Pegleg Well Rd., 198m (650 ft.), *Sanders & Malusa 41355* (UCR, AWC).

***Cylindropuntia munzii* (C.B. Wolf) Backeb.**

[*Opuntia munzii* C.B. Wolf]

“Munz's cholla”

California Rare Plant Rank: 1B.3

A commonly encountered large cholla, of wash margins, gravelly benches, and alluvial slopes. With an average height of 5 to 6 feet, and mature adults usually around 10 to 12 feet, it is taller than any other cholla in California. As a result of these surveys, it is now known to be much more widely distributed in the range than was formerly understood. It is abundant in the central CMAGR, from Salvation Pass to Iris Pass. This plant is very subject to being undermined and toppled by flood waters, probably because its height makes it a bit top heavy, and so the plants are not found on the beds of active washes but can be very common on the edges or more often on associated alluvial benches. We saw many plants that had been knocked over by floodwaters because they grew on low benches which were washed over in unusually large floods. Still, the species is closely linked to large alluvial

outwash surfaces, as well as the toe slopes of adjacent mountains. Observed at 75 of 303 sample locations (24.8%) at elevations of 41-823m (136-2700 ft.)

In California and the U.S., the Chocolate Mountains support the only known populations and it was long thought to be endemic to the Chocolate Mountains, from which place it was originally described. This is now known not to be so restricted. This cholla has recently been found to occur on the eastern slopes of the Peninsular Range above the coast of the Gulf of California in Baja California, c. 80km south of the closest California populations. The Baja California populations range for over 150km down the coast and undoubtedly represent the most extensive stand of this species.

Representative voucher specimen: Imperial County, between Amos and Acolita, 87m (285 ft.), *Sanders & Malusa 43745* (UCR).

***Cylindropuntia ramosissima* (Engelm.) F.M. Kunth**

“pencil cholla”

A common shrubby succulent in a variety of open habitats including alluvial slopes and benches, gullies, wash margins, and gravelly hillsides. Like most *Cylindropuntia* species this one was not collected frequently and so observations are reported below to supplement the specimen records in CCH2. It was observed at 142 of the 303 Rapid Assessment Plots for vegetation mapping.

Observed at Gasline Road near OP Slats; Skyline Dr., 3.25 miles west of Little Mule Mountains; 7.8 miles NE of Niland, Pegleg Well Rd.; 14km ESE of Niland; Pegleg Well Rd (Salvation Pass Rd) above Niland; Pegleg Well Rd., 18.25km east (92°) of Niland; 8.7km NE of Siphon 8 on the Coachella Canal, NE of Slab City; Gasline Road 15km due north of Slab City; head of Mammoth Wash; NE of German Diggins Wash. Elevations of observation range from 320-2370 ft.

Representative voucher specimen: Imperial County, 14km northeast of Niland, 196m (644 ft.), *Baker 18486* (UCR, ASU, AWC).

***Echinocactus polycephalus* Engelm. & Bigelow**

“cotton-top cactus”

Widely scattered clump-forming barrel cactus, on alluvial slopes, rocky hillsides, and benches with desert pavement. Not present in active washes, except on raised bars and benches. Occurs throughout the California deserts from San Diego and Imperial counties to Inyo County, except absent from the western Mojave Desert of Los Angeles and Kern counties.

Globally it is widespread from northern Baja California to Nevada, Arizona, and east to Sonora but does not reach Utah or New Mexico. There are old (19th century) vague records from southwestern Utah, but they are probably erroneous since these reports have not been confirmed in the past 150 years.

Representative voucher specimen: Riverside County, dirt road near Iris Pass, 1 km south of Bradshaw Trail, 734m (2407 ft.), *Sanders & Malusa 41882* (UCR, SD)

Echinocereus engelmannii* (Parry ex Engelm.) Lem. var. *engelmannii

“calico cactus”

Uncommon but widespread in the CMAGR though only collected twice because of the inherent difficulties of making cactus specimens. It was present in 80 of the 303 Rapid Assessment Plots of the vegetation survey. Observed at Gasline Road near OP Slats, 2.1 km SW of Surveyors Pass, and 1 km due east of Beal Well.

The general range of this species is from southern Baja California through southern Nevada, western Arizona, southern and western Utah. In northern Mexico it also occurs in the state of Sonora, south almost to the Sinaloa border. The populations are mostly concentrated in the deserts of southern California (east of the Mojave River/Barstow), western Arizona and southern Nevada, but it is notably absent from the western Mojave Desert.

Representative voucher specimen: Imperial County, 0.8 km NE of Beal Well, 427-442m (1400-1450 ft.), *Sanders & Malusa 42231* (UCR, AWC).

***Ferocactus cylindraceus* (Engelm.) Orcutt**

“California barrel cactus”

Widespread on rocky ridges and alluvial slopes from the southeastern end of the range to the northernmost end in Riverside County. Occurs on granite, schist and volcanics, as well as mixed alluvium along washes and on upper alluvial fans. Usually growing among rocks or rocky alluvium rather than sand and never seen on alkaline lake sediments.

It occurs from Baja California and western Sonora through the deserts of Arizona and California to the extreme SW corner of Utah. It is absent from the entire western half of the Mojave Desert in California but is present in the northern Mojave (Panamint Mtns.).

Representative voucher specimen: Imperial County, 5 km NW of Blue Mountain, 397m (1300 ft.), *Sanders & Malusa 42118* (UCR, AWC).

***Mammillaria tetrancistra* Engelm.**

“common fishhook cactus”

Not a common or conspicuous species, but widespread on rocky slopes and alluvial benches throughout the Chocolate Mountains, though there are no specimens or recorded observations from the Riverside County portion of the range.

This small sub-globular cactus is most conspicuous when bearing its bright red cylindrical fruits.

Widespread in the southwestern deserts, especially in southeastern California and the western half Arizona but absent from the western Mojave Desert of California. Also occurs into the SW corner of Utah, as well as northern Baja California and NW Sonora in Mexico. Usually present as scattered individuals rather than substantial populations, often just one or two seen at a location.

Representative voucher specimen: Imperial County, 0.8 km NE of Beal Well, 427-442 m (1400-1450 ft.), *Sanders & Malusa 42191* (UCR, AWC).

***Opuntia basilaris* Engelm. & Bigel.**

“beavertail cactus”

A common succulent on alluvial slopes and rocky hillsides in the CMAGR and surrounding areas. Observed at 73 of the vegetation sample sites. Very conspicuous when bearing its large deep pink to purple or magenta flowers.

Widespread in southern California, western Arizona and southern Nevada and extending well into southwestern Utah. Occurs even to the western edge of the Mojave Desert in California, where cacti are otherwise scarce. A few locations have been recorded in northwestern Sonora, and none in Baja California (which seems like a data deficiency rather than a description of reality).

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41312* (UCR, AWC).

CAMPANULACEAE***Nemacladus glanduliferus* Jeps.**

A small and inconspicuous annual of wash margins and alluvial slopes, growing in sandy and gravelly soil. We collected this only four times, despite being alert for small annuals, which suggests it is quite uncommon in the CMAGR, or was during the period of our surveys. Because of recent taxonomic revisions, particularly the separation of *N. orientalis* from this species, it is difficult to use the online plant data sites to work out the distribution of this plant in detail since many records have not been revised to align with N. Morin’s recent work. Despite that, we can at least say that it is a plant of the desert Southwest, including California, Arizona, and NW Mexico in the states of Baja California and Sonora.

Among the threadplants of the CMAGR this species is marked by having unmarked white, sub-radially symmetrical flowers.

Representative voucher specimen: Imperial County, 12 km NE (53°) of Bombay Beach, 226 m (740 ft.), *Sanders & Malusa 43090* (UCR). Determination by Nancy Morin.

***Nemacladus orientalis* (McVaugh) Morin**

“eastern glandular threadplant”

This minute thin-stemmed annual occurs throughout the range, with collections made at both the northern and southern ends. Mostly found along washes, but also on a south-facing volcanic slope and other rocky/gravelly hillsides. Sometimes thousands of plants are present, but still nearly invisible if not flowering, and not too obvious even then.

Occurs from Nevada and Utah south through the deserts of California and into central Baja California and east through Arizona, southern New Mexico, extreme western Texas, and Sonora.

Representative voucher specimen: Imperial County, west side of Surveyors Pass, 663m (2175 ft.), *Sanders & Malusa 42331* (UCR, CAS). Determination by Nancy Morin.

***Nemacladus ramosissimus* Nutt.**

“smallflower threadplant”

We found this delicate annual only a single time, along a wash on an alluvial slope.

This plant is most common on the coastal slope of southern California, but there are a few scattered records on the California deserts, with an even smaller number of reports east to southern Nevada and western Arizona (though these extra-Californian reports need to be verified). There are several verified records from northern Baja California, Mexico.

Representative voucher specimen: Imperial County, 0.8 km NE of Beal Well, 427-442m (1400-1450 ft.), *Sanders & Malusa 42228* (UCR). Determination by Nancy Morin, 2018.

***Nemacladus rubescens* E.L. Greene**

“desert threadplant”

We did not find this minute spring annual, but there are specimens from c. 2.5 miles east of the range boundary on the Chuckwalla Bench, near Rainey Well; and near Red Canyon in Salt Creek Canyon just north of the range boundary.

This plant is widespread across the California deserts from the Mexican border to Death Valley but has only been collected in Imperial County east of the Salton Basin a few times.

It has also been recorded from western Arizona and southern Nevada. There is a single questionable specimen (possibly *N. tenuis*, without having seen it) from northern Baja California, but the species is expected to be there too.

Representative voucher specimen: Imperial County, Arroyo Seco, 0.8 km southwest of Rainey Well, 527-534m (1730-1750 ft.), *Salvato 7318*, in 2013 (UCR). Determined by N. Morin, 2018.

***Nemacladus tenuis* (McVaugh) Morin var. *aliformis* Morin**

“desert threadplant”

An uncommon annual overall in the CMAGR, but sometimes locally abundant, mostly along washes and adjacent rocky or sandy benches, but occasionally on hillsides.

Widespread on the eastern deserts of California, but apparently absent from the Mojave Desert west of Barstow. This is another spring annual that is present mostly or entirely in regions that receive significant amounts of summer rainfall, including the eastern slopes of the Peninsular Range and the desert mountains from Joshua Tree National Park north to Death Valley, but in this case also mostly absent from the eastern Mojave Desert despite heavy summer rainfall there. This species is unrecorded east of California in either Nevada or Arizona.

Representative voucher specimen: Riverside County, vicinity of Clemons Well, 284-314m (930-1030 ft.), *Sanders & Malusa 43138* (UCR, CAS, CDA).

CAPPARIDACEAE

Cleomella arborea (Nutt.) Roalson & J.C.Hall

[*Isomeris arborea* Nutt., *Cleome isomeris* Greene; *Peritoma arborea* (Nutt.) Iltis]

“bladderpod”

Uncommon and local shrub along washes in the central and northern parts of the CMAGR. There are numerous older collections from the vicinity of Beal Well.

This drought tolerant shrub is absent from the states of Arizona and Nevada, and from anywhere else east of California, except for a few plants escaped from cultivation in Phoenix, AZ. It is native from southern California, including dry slopes bordering the San Joaquin Valley, south through the northern half of the Baja California peninsula to the Vizcaíno Desert. In California it occurs on both the coastal slope and on the desert, at elevations below c. 1200m. On the desert this species flowers opportunistically through the winter and spring from October to May, even when conditions are dry and most other plants are dormant.

Representative voucher specimen: Riverside County, Gas Line Rd. just north of Imperial Co. line, 449m (1474 ft.), *Sanders & Malusa 43505* (UCR).

CARYOPHYLLACEAE

Achyronychia cooperi T. & G.

“frost-mat”

A scarce spring annual of open sandy flats and dunes. Found only three times by us, on sandy flats near the edge of the Algodones Dunes on the western border of the range, and along lower Salt Creek. The highest elevation where it was found was only 290 ft. (88m).

In California it occurs on the central and eastern Mojave Desert from Death Valley south to the Mexican border, and then southward through the Baja California peninsula. It also occurs in southernmost Nevada, western Arizona, and western Sonora as far south as Guaymas.

Representative voucher specimen: Riverside County, lower Salt Creek, 44m (145 ft.), *Sanders & Malusa 43131* (UCR, AWC).

Spergularia marina (L.) Griseb.

“salt sandspurry”

Found only once by us, on sand on the bed of Tabaseca Tank below a then dry waterfall.

A widespread annual across North America, including south to Baja California and Sonora. Grows from Seattle, WA to Maine, Florida, and southern California. Occurs the length of California, especially in the deserts and on the immediate coast.

Representative voucher specimen: Riverside County, eastern canyon at Tabaseca Tank, 611m, (2005 ft.) Sanders & *Malusa* 41383 (UCR).

CHENOPODIACEAE

Allenrolfea occidentalis (S. Wats.) Kuntze

“iodine bush”

A scarce shrub within the range, restricted to fine alkaline clay soil on the bed of ancient Lake Cahuilla. Widespread in the Salton Basin, but there is little suitable habitat within the CMAGR. A single small colony of c. 20 plants found around an old borrow pit on the western edge.

Widespread in saline basins and shores in western North America. Baja California, coastal Sonora, California, Nevada, Arizona, Utah, New Mexico, Texas, Coahuila, Chihuahua

Representative voucher specimen: Imperial County, Coachella Canal Rd. near intersection with Frink Rd., *Sanders & Malusa* 43802 (UCR, AWC).

Atriplex sp.

“saltbush”

A solitary unidentified small shrub was found on old lake deposits on the western edge of the range. We suspect it is an introduction because it was on disturbed soil near the Coachella Canal and because we cannot match it to known California species. It may be of Australian origin.

Representative voucher specimen: Imperial County, Coachella Canal 350 m west of Siphon 15, 28m (92 ft.), *Sanders & Malusa* 43795 (UCR, AWC).

Atriplex canescens (Pursh) Nutt. ssp. *canescens*

“four-winged saltbush”

A medium-sized shrub about 1.5 m tall, associated with wash margins at low elevations of 78 to 1315 ft. We made only two specimens of this taxon, because it is uncommon and because we were often not around it during periods when the plants were fertile: it was only recorded at 8 of the 303 vegetation sample sites. There is some uncertainty about the identity of these plants, they may be ssp. *laciniata*, as neither of the specimens collected had mature fruits.

Representative voucher specimen: Imperial County, Coachella Canal at edge of Chocolate Mountains Aerial Gunnery Range, near siphon 13, 24m (78 ft.), *Sanders & Malusa* 41840 (UCR, CAS, SBBG, AWC).

***Atriplex canescens* (Pursh) Nutt. var. *macilenta* Jepson**

“Salton saltbush”

This low shrub or subshrub only just enters the CMAGR on alkaline clay on the bed of former Lake Cahuilla, at elevation of c. 100 feet. It can be separated from its relative *A. c. ssp. canescens* quite effectively by habitat – this plant occurs only on fine-grained lake deposits, while *ssp. canescens* almost never does, preferring gravelly alluvial soils above the former high-water line of Lake Cahuilla. *A. c. macilenta* is also a much smaller plant, woody only for a short distance above the ground, in comparison to the large woody stemmed *canescens* varieties.

This plant is poorly known and has been ignored in most treatments of the California flora since it was described by Jepson. However, it is known to occur around Palen and Ford dry lakes and at the Salton Sea in southern California, and northeast from these places to the border of Nevada near Primm. In the Salton Basin it is the most common shrubby saltbush on the former lake bottom, and it is so conspicuous that when actively growing and in flower it can be identified even while driving along Hwy 111. As far as currently known it may be endemic to southern California.

Representative voucher specimen: Imperial County, beside Coachella Canal just inside CMAGR, NW of Slab City between Siphons 11 & 12, 30m (100 ft.), *Sanders & Malusa 43787* (US, MO, DES, AWC).

***Atriplex elegans* (Moq.) D. Dietr.**

“wheelscale saltbush”

We only found this species once, on old clay lake deposits at the western edge of the CMAGR near Slab City and Siphon 8: it appears to be very scarce here.

This interesting annual with distinctive fruits is widespread in the southwestern United States from southern California to Texas. It is common in Arizona and extends into southernmost Nevada and Utah. In Mexico it is found in Sonora and Chihuahua, with a single specimen known from the cape region of the Baja California peninsula. It typically occurs in alkaline clay soils around the seasonally wet edges of dry lakes, but also can be found in sandy soils around dunes and basalt flows.

Representative voucher specimen: Imperial County, Coachella Canal at Siphon 8, near Slab City, 29m (95 ft.), *Sanders & Malusa 44088* (UCR).

***Atriplex hymenelytra* (Torr.) S. Wats.**

“desert holly”

This compact small to medium-sized shrub is widespread, found at 22 of the 303 vegetation sample sites, from the extreme southeastern end of the CMAGR near Imperial Gables to the northern end in Riverside County at Tabaseca Tank. Populations are highly localized but it grows in a variety of difficult environments ranging from alkaline lake deposits to dry exposed rocky hillsides, but also on wash edges and other more favorable sites. Its broad ecological amplitude is illustrated by the range of elevations it occupies. It occurs in the lowest hottest areas, such as at –61m

(–200 ft.) at Obsidian Butte beside the Salton Sea, but also up to at least 1325m (4340 ft.) in Inyo County; within the CMAGR we found it between 90 and 2730 ft.

It occurs from northern Baja California to both deserts of southern California, western Arizona, southern Nevada in the Las Vegas area, and the southwestern corner of Utah. It does not occur on the western Mojave Desert west of Iron Mountain in the Barstow area.

Representative voucher specimen: Riverside County, Tabaseca Tank, 610m (2000 ft.), *Sanders & Malusa 41370* (UCR, SD).

***Atriplex lentiformis* (Torr.) S. Wats.**

“quail bush”

Scarce shrub within the CMAGR and we only found it once, on old lake deposits at low elevation on the western edge near the Coachella Canal. This species is sometimes large and rounded and is more common in areas with fine soils and a high water table. It is frequent in the Imperial Valley especially in untended areas along canal banks and drains.

This is a widespread species in the southwestern United States ranging from the Sacramento Valley in northern California to the cape region of Baja California, though there are very few records in Baja California. East from California it ranges through Arizona, southern Nevada, SW Utah, New Mexico, and the Big Bend region of Texas, though it is very scarce in the latter two states.

Representative voucher specimen: Imperial County, Coachella Canal at Siphon 8, near Slab City, 29m (95 ft.), *Sanders & Malusa 44087* (UCR, AWC).

***Atriplex polycarpa* (Torr.) S. Wats.**

“cattle spinach”

Locally common shrubs, mostly along washes here but also on dredge spoil and fill along the Coachella Canal. Not seen often (only about five times), but plants can be numerous where present. Elevations where it was observed in the CMAGR ranged from c. 71 ft. at the mouth of Salt Creek to 2150 ft. near Surveyors Pass.

This plant is widespread in the dry hills of the Coast Ranges from San Benito and Glenn counties in California south to southern Baja California. East of the Gulf of California it is common on the coast of Sonora south to about Ciudad Obregon. As implied above, it is widespread across the deserts of southern California, including the Owens Valley, and from there it occurs across southern Nevada to southwestern Utah. Southward it occupies much of lowland Arizona and continues sparingly east into New Mexico.

Representative voucher specimen: Riverside County, Salt Creek at Clemons Well, 284-314m (930-1030 ft.), *Sanders & Malusa 43136* (UCR, US, CDA, AWC).

***Chenopodium murale* L.**

[*Chenopodiastrum murale* (L.) S. Fuentes, Uotila & Borsch]

“nettle-leaved goosefoot”

This common annual weed of the Imperial Valley, and other cultivated ground in California, is widespread but only locally common within the CMAGR. It occurs on wash edges and particularly in the sand accumulations around ironwood trees (especially dead ones) on the lower alluvial slopes. When present it generally forms local colonies of dozens or hundreds of individuals.

This erect herb is native to Eurasia and especially southern Europe, North Africa, and the Middle East, but is also probably native eastward to at least India. It is now naturalized over much of the world as an agricultural and urban weed.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 326m (1070 ft.), *Sanders & Malusa* 41304 (UCR, SD).

***Salsola tragus* L.**

“tumbleweed”

An infrequent annual but observed at a few locations along washes and roadsides. Collected twice. The area may be too dry (especially in summer) and insufficiently disturbed to support this summer active weed of Eurasian origin. It was introduced to North America in about 1875 as a contaminant in flax seed sent to South Dakota and has spread widely since then. Disturbed ground along the Coachella Canal service road may be its chief habitat locally.

Representative voucher specimen: Riverside County, Iris Pass, floor of canyon c. 100m below white tuff outcrops, 659m (2160 ft.), *Sanders & Malusa* 41879 (UCR).

***Suaeda nigra* (Raf.) J.F. Macbr.**

“Mojave sea-blite”

An uncommon perennial or subshrub restricted to alkaline lake sediments along the Coachella Canal based on 2 collections and on experience elsewhere in the Imperial Valley. This is not expected on alluvial slopes or rocky hillsides with coarse sandy and gravelly soil. This is an ill-smelling plant without showy flowers that is certainly collected much less frequently than its abundance would permit.

Widespread in arid and alkaline/saline basins and seashores in western North America from Mexico City to Oregon and from California to Colorado and Wyoming.

Representative voucher specimen: Imperial County, Coachella Canal SE of Siphon 12, 30m (99 ft.), *Sanders & Malusa* 41837 (UCR, SD, AWC, CAS).

CUCURBITACEAE

***Brandegea bigelovii* (S. Wats.) Cogn.**

“desert starvine”

Common fast growing summer vine, many seedlings appear following heavy summer rains, but many other stems also appear from buried tubers from the previous year's crop. All above ground parts of the plants die at the end of the summer growing season and the plants survive the dormant season as buried tubers in the soil. Abundant along washes and in depressions that accumulate water, especially with sandy or silty soil, but not on saline lake sediments. Climbing on trees and shrubs and forming large tangles and hanging festoons among the branches. Present in every sizable wash and depression, especially on the alluvial slopes surrounding the main mountain mass. It occurs regionally from 45 up to 2390 feet.

It occurs in the Colorado Desert of southern California and south to the cape region of Baja California and eastward into central Arizona (Phoenix area) and south from Arizona down the west coast of Sonora to Guaymas. In California, this plant is restricted to the Colorado Desert and the southern fringe of the Mojave Desert, probably because of poor cold tolerance by the over-wintering tubers.

Representative voucher specimen: Riverside County, south of Bradshaw Trail at major wash, 726m (2380 ft.), *Sanders & Malusa 41880* (UCR, AWC, SBBG).

***Cucurbita palmata* S. Wats.**

“coyote melon”

Very scarce perennial vine with prostrate stems, not found during current surveys. One historical collection exists from just inside the range boundary, but a few others exist in the general vicinity indicating at least a thinly spread population in the region. In addition, NAVFAC 1977 reported observations near Salvation Pass, Indian Well and the Little Mule Mountains. These observations are highly likely to be correct and can be relied on, as this species is certainly expected in these places. The timing of the NAVFAC survey may have been optimal for this species since it followed the high intensity rains of Hurricane Kathleen which doubtless germinated seedlings of this long-lived perennial.

This is a widespread species in the desert Southwest, known from numerous collections in southern California and dozens more from western Arizona, southern Nevada, and northern Baja California.

Representative voucher specimen: Imperial County, c. 1 mile east of Coachella Canal and west of Melson Well, *R. F. Thorne 52129*, in 1978 (RSA).

EUPHORBIACEAE

***Ditaxis lanceolata* (Benth.) Pax & Hoffm.**

“narrowleaf silverbush”

A common subshrub or small shrub on wash edges and among rocks on protected slopes. Often growing between and under larger shrubs on wash edges. It occurs the full length of the Chocolate Mountains range from Hwy 78 to Salt Creek.

Common in the Sonoran Desert of southeastern California and southwestern Arizona, and south the length of the Baja California peninsula and throughout coastal Sonora south to near Cd. Obregon.

In 1954 Louis Wheeler reported that these plants were “palatable to rodents” at a site in the Palo Verde Mountains northeast of the CMAGR. Not just rodents: this plant is frequently browsed by bighorn sheep where those are present. Locally, plants in open areas are sometimes severely hedged by deer and <20 cm tall, while nearby plants protected inside shrubs may be 75cm, but with any tips projecting outside the shrub canopy clipped off. Is this a frequent food for wildlife partly because it is common, or is it common despite being a food plant for many wildlife species?

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 326m (1010 ft.), *Sanders & Malusa 41306* (UCR, SD).

***Ditaxis serrata* (Torrey) Müll. Arg.**

[including *Ditaxis neomexicana* (Müll. Arg.) A. Heller, following the Integrated Taxonomic Information System of USGS & Smithsonian]

“saw-toothed ditaxis”

Common annual or short-lived perennial. Collected 11 times on this project, always in or adjacent to washes. Often on low sand or gravel bars in or beside a wash. Germinates following summer rains but commonly persists until the following spring and can live for over one year in favorable sites.

Occurs in deserts of southeastern California, always east of Newberry Springs/Barstow (absent from western Mojave Desert); western and southern Arizona, southern New Mexico, southern Nevada. Sonoran Desert of Sonora and the Baja California peninsula, across Texas almost to the Gulf of Mexico. In Mexico south to the Isthmus of Tehuantepec, and south on the Pacific Coast into Sinaloa as far as Culiacan.

Representative voucher specimen: Imperial County, Gas Line Road along Coachella Canal, at Siphon 16, 46m (150 ft.), *Sanders & Malusa 43799* (UCR).

***Euphorbia abramsiana* L.C. Wheeler**

“Abrams' spurge”

California Rare Plant Rank: 2B.2

Prostrate summer annual of the eastern Colorado Desert in California. It was little known and had been considered rare, but a recent convergence of events, heavy summer rain and groups of biologists conducting surveys in the region where this grows, have shown that it is much more common and widespread than formerly understood. But, it is still not a commonly found species and all our records are on the edge or a short distance outside the range boundaries, but this species is undoubtedly more widespread than we now know within the CMAGR. To find it one must visit the right spots and time visits correctly following summer rain. Its favored habitat is on relatively level sites rather than hillsides.

Ranges from SE California to southern Arizona, western Sonora, the Baja California peninsula almost to cape region, SW New Mexico, and in the Big Bend region of Texas.

Representative voucher specimen: Riverside County, Bradshaw Trail, [“perched playa”] 0.9 km west of Dupont Rd., Sanders 40513, in Nov. 2012 (UCR).

***Euphorbia eriantha* Benth.**

“desert poinsettia”

Erect annual or short-lived perennial. Germinates primarily or entirely in the late summer and fall after summer rains, but plants commonly persist through the winter and may still be flowering the next spring. Usually grows along washes and in other seasonally wet spots, often in dense vegetation, even sometimes in light shade under trees.

It is widespread in the Chocolate Mountains though most of our records are toward the north at higher elevations. Perhaps this result is simply a sampling error, but alternatively it could be the species is more successful with increased summer rainfall at higher elevations in the north.

This plant occurs through the Colorado Desert of southeastern California, east from the foot of the Peninsular Range to southern Arizona, and then south through the desert in western Sonora. West of the Gulf of California it occupies the length of the Baja California peninsula. It also occurs in the Big Bend region of Texas and southeast into Coahuila, Mexico. It is absent from the Mojave Desert and the farthest north California location known to us is 10 miles south of Needles in the Colorado River drainage.

Representative voucher specimen: Imperial County, foot of west side of the Little Mule Mountains, 355m (1163 ft.), *Sanders & Malusa* 41826 (UCR, SD).

***Euphorbia micromera* Boiss. ex Engelm.**

“Sonoran sandmat”

Prostrate summer annual, with a minute, barely visible, petaloid appendage on the gland of the cyathium. The most consistently prostrate of the local spurges with little tendency for stems to ascend or form cushion-like mats. It is also the species least likely to over-winter and survive into spring. Our only collections within the CMAGR were in the northern, Riverside County, portion but we also collected it in the Midway Well area. Other people have collected it at a variety of localities on the western and southeastern sides of the range, and also inside the range at Lion Head Mountain and at target “Runway.”

Occurs from eastern California east to Utah and Texas and south to the Chihuahuan Desert of northern Mexico. Particularly common on the deserts of southern California, southern Nevada, Arizona, New Mexico, Sonora, and the entire peninsula of Baja California. This plant does not occur on the coastal slope of southern California, nor does it enter the Great Basin.

Representative voucher specimen: Riverside County, Red Canyon at Salt Creek wash, 390m (1280 ft.), *Sanders & Malusa* 41842 (UCR).

***Euphorbia pediculifera* Engelm.**

“Carrizo mountain sandmat”

Hypothetical. We never found this low perennial within the CMAGR, but there is an old record (22 Mar. 1932) from Midway Well which is only about 3-4 miles east of the range, if the imprecise location description is accurate. There is another even more indefinite locality (6 Apr. 1932) from “20 miles northeast of Ogilby” which could be near the modern intersection of Ogilby Rd. and Hwy 78 and thus approaching the SE corner of the CMAGR. It is not certain these two vague locations are different but there are several other collections east and northeast of the range in the Indian Pass and Palo Verde Mountains areas, so it is certain that this species does occur near the southeastern end of the range.

This species is distributed through the entire length of the Baja California peninsula, in the southwestern corner of Arizona and all along the coast of Sonora. The California populations represent the northwestern corner of the species’ range.

Representative voucher specimen: Imperial County, 20 miles NE of Ogilby, *P. Munz 12155* (RSA).

***Euphorbia polycarpa* Benth. var. *hirtella* Boiss.**

“smallseed sandmat”

The most common prostrate spurge on the California desert. Perennial, but many young plants appear following summer rains and many of these flower and set fruit but not to survive beyond their first season, thus functionally are annuals. Older plants may have a thick sub-woody root-crown and the branches then often form a low mound. It is very widespread in the CMAGR in a variety of habitats, but most common along washes and on sandy outwash plains. Tolerant of disturbance, because of rapid germination and abundant seedling establishment when competition is reduced, and so often present on roadsides and other human altered areas.

It occurs from central California east to Utah and Texas and south to central Mexico. Particularly common on the deserts of southern California, southern Nevada, Arizona, Sonora, and along the entire peninsula of Baja California. This plant does also occur on the coastal slope of southern California, but does not enter the Great Basin. It is scarce in the western Mojave Desert. The two named varieties often grow intermixed and may not be separable.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 457m (1500 ft.), *Sanders & Malusa 41276* (UCR, AWC).

***Euphorbia setiloba* Engelm. ex Torr.**

“Yuma sandmat”

A common summer annual, appearing widely on sandy flats and wash margins following rains. The plants regularly persist into the following spring if weather conditions are mild and sufficient residual soil moisture is available. Old plants, that have plainly been around for months, in washes with flowers and fruits in March are a common sight.

This occurs from southern California east to Utah and Texas and south to north-central Mexico (Chihuahuan Desert), plus Sonora, and the entire peninsula of Baja California. In the Southwestern U.S. it is strongly restricted to the deserts of southern California, southern Nevada, Arizona, and does not occur on the coastal slopes of California.

Representative voucher specimen: Imperial County, Salvation Pass, 366m (1200 ft.), *Sanders & Malusa* 41251 (UCR, AWC)

***Stillingia linearifolia* S. Wats.**

“queen's-root”

A scarce, slender-stemmed, small shrub usually on dry rocky slopes or wash margins. We found this only twice in rocky hills in the northern part of the range, one of those at the edge of a stony wash.

It occurs on both the coast and desert slopes of southern California from the Mexican border north to the arid Inner Coast Ranges Fresno in County. In the desert it occurs from the border to Ridgecrest and Shoshone.

It has also been found in southernmost Nevada and western Arizona. In Mexico this occurs throughout Baja California and at a few spots on the coast of Sonora and on the Arizona border in the Pinacate region. Reports from Texas and Coahuila are some other species based on provided images in SEINet..

Representative voucher specimen: Riverside County, Gasline Road at major wash crossing 1.9 miles south of Bradshaw Trail, 671-686m (2200-2250 ft.), *Sanders & Malusa* 41359 (UCR, SD, AWC).

***Stillingia spinulosa* Torr.**

“annual toothleaf”

A scarce native annual, found only once in the CMAGR in low wind-blown sand deposits on an alluvial slope along the old Blythe-Niland Road. Typically found in dunes, such as the nearby Algodones Dunes.

Mostly associated with low elevation sites around the head of the Gulf of California in Sonora and Baja California and the Salton Basin in California, but also in western Arizona and southern Nevada. Absent from the western Mojave Desert, west of Victorville and Barstow, but widely scattered on the eastern Mojave Desert. Endemic to this described region.

Representative voucher specimen: Imperial County, 1.92 km NE of Siphon 8 on the Coachella Canal, NE of Slab City, 51m (168 ft.), *Sanders & Malusa* 42169 (UCR).

FABACEAE

***Acmispon maritimus* (Torr. & A. Gray) D.D. Sokoloff var. *brevivexillus* (Ottley) Brouillet**

“desert coastal lotus”

This small native annual is mostly encountered along washes where it is neither conspicuous nor common, but it is widespread and was found in gravelly uplands as well as on wash margins, gravel bars, and alluvial benches.

It appears to be a distinct species from the coastal slope plant called *A. maritimus* var. *maritimus*, but they are similar, and it appears they are confused by some collectors. The locations on the coast of southern California reported in CCH2 are very unlikely to be *brevivexillus*, despite what it says there. One specimen from southern

Nevada identified as this and imaged in SEINet is clearly *Acmispon strigosus*, illustrating the difficulties of identification in *Acmispon* in general.

This plant is almost endemic to the Sonoran Desert except for limited occurrences on the southern edge of the Mojave Desert and in the Death Valley region. It is restricted to southeastern California, western Arizona, northern Baja California, and the coast of Sonora. In addition, its range extends slightly into Nevada along the Colorado River. It is absent from the western Mojave Desert and is clearly more common in the eastern parts of its range.

Representative voucher specimen: Imperial County, west of large N-draining wash south of Blue Mountain, 415-427m (1360-1400 ft.), *Sanders & Malusa 43906* (UCR).

***Acmispon strigosus* (Nutt.) Brouillet**

[*Lotus strigosus* var. *tomentellus* (Greene) Isely; *Lotus tomentellus* Greene]

“hairy lotus”

A scarce native spring annual with thick sub-fleshy leaves and prostrate to ascending stems. It occurs on gravelly slopes, wash margins, and road edges throughout the Chocolate Mountains.

The range of this plant in the online databases is confused by the fact that it is not separated from coastal slope *Acmispon strigosus*, but it is still clear that it occurs in both the Sonoran and Mojave Deserts of California and across southern Arizona to southern New Mexico and north into southern Nevada.

This is clearly a distinct species from *Acmispon strigosus*, but it has no species name in *Acmispon* except *A. strigosus*, so that is what we are calling it here. It was previously recognized as a separate taxon under *Lotus* by various authors, frequently as a separate species.

Representative voucher specimen: Imperial County, Coachella Canal at Siphon 8, near Slab City, 29m (95 ft.), *Sanders & Malusa 44091* (UCR).

***Astragalus crotalariae* (Benth) A. Gray**

***Astragalus insularis* var. *harwoodii* Munz & McBurney ex Munz**

“Harwood's milkvetch”

A scarce native spring annual which we did not find but which has been collected near the CMAGR twice, once each on the north and west edges of the range.

Fairly widespread but uncommon in the southeastern Colorado Desert of southern California, mostly in Riverside, Imperial and San Diego counties. Usually on sandy plains and wash margins, generally in the valleys between the mountains. Often on dunes or low sand accumulations, but not obligately so.

Representative voucher specimen: Imperial County, NE side of the Coachella Canal right-of-way, between siphons 12 and 13, c. 4 miles east of Wister, 29m (96 ft.), *Green s.n.*, in 2005 (UCR).

Astragalus lentiginos* Dougl. ex Hook.**Astragalus nuttallianus* DC.**

“Small-flowered milkvetch”

A diminutive and very scarce native spring annual which we only found once, as a young plant just beginning to flower associated with a few other individuals that were still vegetative.

Fairly widespread but only locally common across the deserts of southeastern California, from the Death Valley area to the Mexican border, except apparently absent from the western Mojave Desert. Usually found on sandy plains and wash margins. The population we found was on a sandy wash bench.

Representative voucher specimen: Riverside County, 2.3 miles east of Iris Pass, *Sanders & Malusa 42901* (UCR).

***Calliandra eriophylla* Benth.**

“pink fairy-duster”

A common low shrub of wash margins and the beds of smaller tributary washes. It is largely absent from major washes where it would be subject to scouring floods, but also absent from upland areas which never receive supplemental water flows. This plant requires regular (\pm annual) flows but relatively gentle ones which do not wash away these shallowly rooted plants. The roots, while shallow, spread widely. When present along major washes plants are found mostly along the edges, where protected by other shrubs or rocks. Plants flower predominantly in March and April, but also, infrequently, in the fall following summer rains.

Occurs on the Colorado Desert in California from the Mexican border north along the eastern foot of the Peninsular Range and east of the Salton Sea in the hills toward the Colorado River. The species barely reaches the southern edge of Riverside County, and all except a few California records are from Imperial and San Diego counties. Eastward from California the species is widespread in southern Arizona and then into southwestern New Mexico and through southern Texas. It is very widespread in Mexico and occurs as far south as the state of Chiapas.

Representative voucher specimen: Imperial County, upper Mammoth Wash, *Sanders & Malusa 42087* (ARIZ, DES, UCR).

***Dalea mollis* Benth.**

“sand silk dalea”

Scarce native annual in sandy areas, especially wind-blown sand. This species can be quite reliably separated from the next simply by habitat/substrate.

We did not find this species during our surveys but there are recent collections in or near the range by other people, all of them along the western edge and thus near the Algodones Dunes sand fields.

Representative voucher specimens: all Imperial County; Coachella Canal just above Siphon 16 [near Frink Spring], *J. Green s.n.*, Mar. 2006, (UCR); same, between Siphons 10 & 11 [c. 1/2-mile NW of Camp Billy Machan], *J. Green s.n.*, Mar. 2005 (UCR); near Melson Well, in 1978, *Thorne 52124* (RSA).

***Dalea mollissima* (Rydb.) Munz**

“gravel silk dalea”

A short-lived native perennial usually found on gravelly alluvial fans below the mountains: it is widespread and regularly encountered though not abundant.

Occurs on the Colorado and Mojave deserts of California from the Mexican border to Death Valley. Eastward from there across southern Nevada, south across much of lowland Arizona, and to northwestern Sonora and the north half of the peninsula of Baja California.

Representative voucher specimen: Imperial County, 3.15 km NE (47°) of Amos, 122-152m (400-500 ft.), *Sanders & Malusa 43756* (UCR).

***Hoffmannseggia microphylla* Torr.**

[*Caesalpinia virgata* Fisher]

“wand holdback”

Very scarce perennial with slender stems ascending from the plant base, a bit like a reduced and unarmed version of an ocotillo. Only found once on this survey on a bajada in the southern part of the range. However, it has been collected several times in the Salt Creek drainage just north of the CMAGR and so could occur in intervening areas in the center of the CMAGR.

The overall range of this species is restricted to the head of the Gulf of California, including the Coachella and Imperial valleys and the lower Colorado River Valley.

In California it is most prominent in the western Colorado Desert and along the eastern foot of the Peninsular Range.

Representative voucher specimen: Imperial County 7 miles NE of Glamis, 323m (1060 ft.), *Malusa s.n.*, 31 Oct 2017, (UCR).

***Hoffmannseggia peninsularis* Wiggins**

“peninsular holdback”

A low perennial with spreading branches from a deep root. Forming loose mats, but branches not rooting in contact with the soil. Scarce local colonies near the mouth of Salvation Wash, on rocky almost barren slopes and ridgetops on both sides of the canyon. Not seen on alluvial slopes below but only on bedrock. Found only in this one area.

This is a new species for the flora of the United States, and a range extension of about 120km NNE from the Sierra de los Cucapah on the west side of the Gulf of California in Baja California. This plant was totally unexpected and not one we would have put on a list of taxa potentially present. Its presence illustrates the continuing need for basic

botanical exploration even in California and other “well known” areas. It is particularly noteworthy that it was found on the opposite side of the Salton Trough and the San Andreas Fault from the previously known populations.

Representative voucher specimen: Imperial County, hill west of the mouth of Salvation Wash, *Sanders & Malusa 41923* (UCR, AWC, RSA)

***Leucaena leucocephala* (Lam.) DeWit**

“guaje”

Hypothetical. This erect shrub or small tree occurs outside western edge of CMAGR, along East Highline Canal at Flowing Well, east of Niland. Hypothetical inside range as it certainly needs more water than is available except in a very few spots. Locally common at Flowing Wells and naturalized in other wet places in southern California.

Introduced from Mexico and Central America and planted for shade and occasionally as food for livestock and people. More widely used in its countries of origin.

Representative voucher specimen: Imperial County, bank of canal at Flowing Well, -11m (-36 ft.), *Sanders & Malusa 41356* (UCR, SD, RSA).

***Lupinus arizonicus* (S. Wats.) S. Wats.**

“Arizona lupine”

Common annual on exposed rocky and sandy slopes, wash margins, and sand bars and alluvial benches in and along washes. It is particularly common on upper, broad, sandy, outwash plains where habitat is extensive and runoff from rocky slopes frequent. This is a regular element of the roadside flora, again because of extra moisture from runoff, in this case from pavement or packed dirt rather than rocky hillsides.

This is one of the most common and conspicuous spring annuals on the Colorado and eastern Mojave deserts in California. It does not occur west of Barstow on the Mojave Desert, and the Parish collection mapped from NE of Cantil in CCH2 was mislocated – it is from Mesquite Canyon (= Ninemile Wash?) on the south side of the Chocolate Mountains in Imperial County. Some other anomalous records probably represent the closely related *L. sparsiflorus*.

Outside of California this is widespread in western Arizona, and it extends up the Colorado River valley into southern Nevada and the Grand Canyon area of northern Arizona. In Mexico it occurs the full length of the Baja California peninsula and throughout the Sonoran Desert portion of the state of Sonora.

Some plants in the Chocolate Mountains were, based on appearance, hybridized with *L. sparsiflorus*.

Representative voucher specimen: Imperial County, below Lion Head Mountain, 17km NE of Niland, 293- 314m (960-1030 ft.), *Sanders & Malusa 41994* (UCR, AWC).

***Lupinus sparsiflorus* Benth.**

“Coulter's lupine”

This common annual has a range that is broadly similar to that of *L. arizonicus*, but it is also extensive on the coastal slope of southern California where *L. arizonicus* is absent. Where the two species occupy the same area, *L. sparsiflorus* sites will usually be higher in elevation and closer to the mountain front, while *L. arizonicus* occupies lower elevations on the alluvial fans and sites on the valley bottoms.

The species are closely related and hybridize when they come into contact, usually on the upper alluvial fans, which makes identification difficult at times. In their "pure" forms *L. arizonicus* has distinctly broader and less hairy leaflets and the flowers of *L. sparsiflorus* are bluer, while those of *L. arizonicus* are purplish to pink.

Representative voucher specimen: Riverside County, dirt track over hills from Bradshaw Trail toward Beal Well, 793-823m (2600-2700 ft.), *Sanders & Malusa 44030* (UCR).

***Marina parryi* (T. & G.) Barneby**

“Parry's false prairie-clover”

A common and widespread short-lived perennial on alluvial slopes, usually on wash margins, gravel bars, or low sandy benches. Found widely on the range on the lower alluvial slopes, but not on steep bedrock slopes.

It occurs mostly in the Sonoran Desert of California, Arizona, Sonora, and the peninsula of Baja California, but with some extension into the eastern Mojave Desert of California, southern Nevada, and NW Arizona.

Notable for its combination of somewhat inconspicuous foliage and intensely colored violet-purple flowers.

Representative voucher specimen: Riverside County, Salt Creek wash, c. 6 miles east of Dos Palmas, 119m (390 ft.), *Sanders & Malusa 42663* (UCR).

***Olneya tesota* A. Gray**

“ironwood”

The dominant tree throughout the range, especially on the extensive bajadas on the east side where it forms a woodland focused on the drainages between desert pavement surfaces. It predominantly occurs along washes either on alluvial fans or in canyons, but also occasionally is seen on hillsides. It has heavy dense wood that decays slowly, and so long-dead trees can be seen still standing in places that are no longer capable of supporting living trees, as on certain benches above down-cut arroyos.

Extensive stands of this tree occur on the Sonoran Desert and continue southward in tropical dry forest to near the Sinaloa border. Its distribution is restricted by excessive aridity, soil salinity, and winter cold. It is characteristic of low elevation hot places, but is absent from the Mojave Desert, where freezing weather is regular in winter, and is also missing from the west side of the Coachella Valley below the San Jacinto Mountains, perhaps because of cold air drainage from the high peaks. It does occur at the foot of the Peninsular Range from about Borrego Springs south, perhaps because the mountains in that area are lower and thus less cold.

It flowers in late spring and early summer after temperatures have become elevated, from late April to the beginning of June. Its wood was at one time used commercially as fuel, especially in bakeries, because of its high energy content and long-burning properties.

Representative voucher specimen: Imperial County, 10 miles NNE of Niland, 250 m (820 ft.), *Sanders & Malusa 43498* (UCR).

***Parkinsonia florida* (Benth. ex A. Gray) S. Wats.**

“blue palo verde”

This is the other common tree of the area, but it is less regular than ironwood, probably because it requires more water and so cannot survive on some of the smaller washes that ironwood occupies. However, it is a common or dominant tree along all larger washes on the alluvial slopes and in some canyons. It's also more frost-tolerant than ironwood, and extends well upslope of ironwood. It is fast-growing and consequently has relatively light wood that decays and becomes termite riddled much more quickly than the dense wood of *Olneya*.

Its range is more extensive overall than that of *Olneya*, and it is the dominant tree on the west side of the Coachella Valley in the Palm Springs and Palm Desert region, the slopes where *Olneya* is absent. It also occurs in northeastern Mexico which *Olneya* does not. It is primarily a plant of the Sonoran Desert but can survive in parts of the Mojave Desert if planted there; the scattered records in CCH2 from the central Mojave Desert in San Bernardino County are mostly or entirely roadside plantings.

Representative voucher specimen: Imperial County, 5.5 miles due west of the south end of the Little Mule Mountains, 401m (1315 ft.), *Sanders & Malusa 41802* (UCR, AWC)

***Prosopis glandulosa* Torr. ssp. *torreyana* (L. Benson) E. Murray**

“honey mesquite”

This, the native local mesquite, has long roots that usually reach deeply for ground water, but they are sometimes exposed on wash banks where they may be seen to have spread laterally rather than vertically in some cases. Root architecture is doubtless controlled by local moisture distribution.

Uncommon large shrubs 2-3 m tall and up to about 15 m broad, always along washes or in canyons. Sometimes forming extensive stands, but more commonly present as solitary large individuals or as scattered plants.

Widely native in southwestern North America from California to Texas and from the southern edge of Colorado to central Mexico, including the Sonoran Desert, the entire Baja California peninsula, and the Pacific coast south to Sinaloa.

Representative voucher specimen: Imperial County, 5.5 miles due west of the south end of the Little Mule Mountains, 401m (1315 ft.), *Sanders & Malusa 41801* (UCR, AWC).

***Prosopis juliflora* (Sw.) DC.**

“mesquite”

This exotic species was planted to provide food and cover for wildlife near several wildlife guzzlers: Hayden, Pegleg Well, Salvation Pass Well. It seems to be the tropical nominate subspecies, which is common on the coast of western Mexico. It is most easily separated from the native mesquite trees by its exceptionally large spines.

The taxonomy of the mesquites is a bit confused, with different books using different names for the same plant or including multiple plants under one name. This makes relying on the online databases an uncertain undertaking since one cannot tell what treatment was being followed for a particular identification.

Representative voucher specimen: Imperial County, Pegleg Well near Pegleg Mine, 424m (1390 ft.), *Sanders & Malusa* 42837 (UCR, SD).

***Psorothamnus arborescens* var. *simplicifolius* (Parish) Barneby**

“California indigobush”

This shrub with intense violet-colored flowers is endemic to Riverside and San Bernardino counties in southern California and is most common on the western edge of the Colorado Desert and on the southwestern Mojave Desert, in the Palm Springs to Twentynine Palms area. The plants in the Chocolate Mountains are among those farthest into the desert and form the southeastern edge of the range of the species. It does also occur to a limited degree along washes in the dry interior valleys of the coastal slope of southern California, such as at Bautista Canyon near Hemet.

Found by us only once in the northernmost part of the CMAGR, and that record is the only one for the Chocolate Mountains. The closest other collections are from around Cottonwood Spring at the south entrance to Joshua Tree National Park, about 35-40km northwest.

Representative voucher specimen: Riverside County, canyon 3.35 km SW of Tabaseca Tank, 693m (2272 ft.), *Sanders & Malusa* 43342 (UCR).

***Psorothamnus emoryi* (A. Gray) Rydb.**

“dyebush”

A scarce subshrub of sandy soil. During these surveys it was found only once, on a stabilized dune on the western edge of the range.

An endemic of the southwestern part of North America including the entire Baja California peninsula; the deserts of SE California; southwestern Arizona; and Sonora, especially toward the coast of the Gulf of California. It does not reach Nevada or Utah.

A point of interest concerning this plant is that it is the main host plant of the parasitic flowering plant *Pilostyles thurberi*. Commonly known as “Thurber’s stemsucker”, this tiny (less than a centimeter) parasite’s stems grow inside those of the host in a way similar to fungal hyphae and then at flowering the buds rupture the epidermis of the host and the flowers emerge.

Representative voucher specimen: Imperial County, just outside Camp Billy Machen and SW of the Coachella Canal, near intersection of Coachella Canal Rd. and Gas Line Rd., 26m (86 ft.), *Sanders & Malusa 43485* (UCR, AWC, CAS).

***Psorothamnus polydenius* (Torr. ex S. Wats.) Rydb.**

“Nevada indigobush”

A very local perennial on rocky & sandy hills at the northern end of the CMAGR in the vicinity of Iris Pass. It was found at multiple spots in this small area. These are the southernmost known localities for this species, except for a population in the Coyote Mountains NW of Ocotillo in SW Imperial County. This plant is more commonly encountered in the cold desert of the Owens Valley area and north to Mono Lake and then through western Nevada to the Oregon border. From the Chocolate Mountains, populations straggle north through the central Mojave Desert from Joshua Tree National Park to the Bullion Mountains and then Barstow and on northward toward the Owens Valley.

Most populations of this plant are in eastern California and western Nevada with just isolated reports from Arizona, Oregon, and Utah.

Representative voucher specimen: Riverside County, south of Bradshaw Trail at large wash crossing, 689m (2260 ft.), *Sanders & Malusa 43360* (UCR, RSA, DES).

***Psorothamnus schottii* (Torr.) Barneby**

“Schott's indigo bush”

Widespread and common shrub on well-drained alluvial or bedrock slopes, often beside washes. It was documented in 138 of the 303 vegetation mapping plots, at elevations as low as 70 feet above sea level near the Coachella Canal, but not seen on fine-grained alkaline lake sediments. Often present on coarse sand and cobbles on upper slopes of alluvial fans.

Its distribution is centered on the Salton Basin of southern California and the head of the Gulf of California in NW Baja California, but extends east across the low desert of California to the Colorado River Valley. The only reliable Arizona records are two from near the Colorado River in Mohave County.

Representative voucher specimen: Imperial County, old Niland-Blythe Rd. between Beal Well and Surveyors Pass, 561m (1840 ft.), *Sanders & Malusa 42287* (UCR, AWC).

***Psorothamnus spinosus* (A. Gray) Barneby**

“smoketree”

Widespread erect shrub or small tree along active washes, usually located in the zone subject to scouring floods because seed coat abrasion is required for seed germination. It is common only in washes with a large watershed, and a sure sign of episodic floodwaters. Always rooted in loose wash sand and absent from rocky hillsides, bedrock areas, desert pavement and other stable dry slopes.

This plant is widespread on the southeastern deserts of California in Imperial, San Diego, Riverside and San Bernardino Counties. It is likewise widespread in western Arizona west of Phoenix. In Mexico it is present only in NW Sonora and NE Baja California.

Only collected once but observed at many localities: Imperial County -- 0.42 km north of Beal Well along old Niland-Blythe Rd.; Beal's Well; Riverside County -- south of Bradshaw Trail, c. 11 km SE of Gasline Rd.; Gas Line Rd. c. 0.8 mile north of the Imperial Co. Line; canyon 1.5 km west of Tabaseca Tank; 1.35 km SW of Tabaseca Tank; 6 miles east of Dos Palmas; Salt Creek wash below Red Canyon confluence; Red Canyon at Salt Creek wash; 21.5 km due north of Slab City; Gasline Road at major wash crossing 1.9 miles south of Bradshaw Trail.

Representative voucher specimen: Imperial County, 0.8 km NE of Beal Well, 427-442m (1400- 1450 ft.), *Sanders & Malusa* 42212 (UCR, AWC).

***Senegalia greggii* (A. Gray) Britton & Rose**

[*Acacia greggii* A. Gray]

“catclaw acacia”

One of the more common and widespread shrubs in the CMAGR, collected from the extreme south end at Imperial Gables (Nine Mile) wash to Salt Creek wash in Riverside County. Present along virtually every wash (even small ones), and hillside gully, but also on rocky slopes and benches in canyons. Observed in 114 of the 303 vegetation sample plots and at elevations ranging from 100 to 2875 ft.

Widespread from the southern California deserts east to southern Nevada, southwestern Utah, Arizona, New Mexico, and Texas; and south in Mexico to southern Baja California, Sonora, Zacatecas & Tamaulipas. Largely absent from California north of the I-15 corridor, based on data presented by CCH2 and SEINet.

Winter deciduous 2-3 m tall spiny shrubs that are usually among the last of the deciduous species in the California deserts to leaf out in the spring. The large flat pods are conspicuous and are often produced in large numbers such that they are major targets of seed-eating rodents. It is common to see pods hanging from the shrubs with holes chewed into their sides at each seed bulge.

Representative voucher specimen: Imperial County, Gables Wash, near mouth of canyon above Hwy 78, 334m (1095 ft.), *Sanders & Malusa* 41832 (UCR, AWC).

***Senna armata* (S. Wats.) Irwin & Barneby**

“desert senna”

Uncommon subshrub, or sometimes locally common, on granitic slopes or mixed alluvium at moderate to high elevations, with all observations and collections from between 357 m and 762 m (1170 ft to 2500 ft). None were from the lowest elevations or on old lake sediments. Most frequent on alluvium along washes but occasionally growing from bedrock crevices in cliffs of canyon walls.

Mostly a plant of the southern California deserts, especially the Mojave Desert, but also occurring commonly in southern Nevada (Clark County) and slightly into western Arizona (mostly Mojave County). Smaller populations exist on the eastern slopes of the Peninsular Range of NE Baja California.

Representative voucher specimen: Riverside County, Bradshaw Trail, 0.85-mile SE of its junction with Summit Rd., 480m (1575 ft.), *Sanders & Malusa* 41855 (UCR, SD, AWC, CAS).

***Senna covesii* (A. Gray) I. & B.**

“Coues' senna”

California Rare Plant Rank: 2B.2

Scarce small shrub or perennial herb, not common anywhere in California, and we only found it once, on a berm along the side of the Bradshaw Trail. More common in Arizona, probably because it benefits from summer rainfall which is more frequent there.

In California this has been known only from the Peninsular Range of Riverside and San Diego counties, the Turtle and Whipple mountains of SE San Bernardino County, the Chuckwalla Mountains of Riverside County, and a single vague old location somewhere around Needles in San Bernardino Co. Our Bradshaw Trail location is from the Chuckwalla Bench just south of the Chuckwalla Mountains and can be considered a part of that population.

This plant is very widespread in western and southern Arizona, with an adjacent sizeable population in southern Nevada. In Mexico it is widespread with many records in both Sonora and the Baja California peninsula, and there are records from Chihuahua, Coahuila, Tamaulipas, Aguascalientes, Zacatecas, and Hidalgo but they are very few and the species must be rare in those states, or just poorly collected or reported.

Representative voucher specimen: Riverside County, along the Bradshaw Trail, 739m (2425ft.), *Sanders & Malusa* 42988 (UCR, AWC, ARIZ).

FOUQUIERIACEAE

Fouquieria splendens* Engelm. ssp. *splendens

“ocotillo”

A tall tree-like shrub with long whiplike branches clothed in sharp spines formed from the midribs of the primary leaves on new growth. Axillary leaves are drought deciduous and do not form spines. Common on rocky slopes and benches along washes throughout the range; very characteristic of alluvial fans with washes separating islands of desert pavement, but also common on rocky mountain sides, ridge tops and elsewhere in the uplands. Absent from fine and alkaline soils of former lakebed and infrequent on the beds of active washes where they tend to be swept away by floods.

The roots are shallow and spread widely around the plant gathering any moisture that falls, but this may also contribute to vulnerability to flood damage because there is no deep anchorage. The stems are covered with corky and waxy tissues and are highly resistant to loss of hard-won moisture. Cut stems will remain alive for months when in storage and can even flower though not rooted to the ground or receiving new moisture. However, normally leaf and flower production are stimulated by moist soil following rainfall and that is normally the trigger for flowering.

Flowers are red and produce copious nectar and are visited by birds, particularly Costa's Hummingbirds, but by other nectar consumers as well.

In California, this species is characteristic of the Sonoran Desert but absent from the Mojave Desert, except in the eastern parts toward or in the Colorado River Valley, probably because it is intolerant of cold, and that area is warmer. It may also be more successful in the eastern Mojave Desert partially because of higher rainfall there. This species is very widespread in the Sonoran and Chihuahuan deserts, south into central Mexico. In the Chihuahuan Desert it usually occupies soils derived from limestone.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 489m (1605 ft.), *Sanders & Malusa 41307* (UCR, AWC).

GERANIACEAE

Erodium cicutarium (L.) L'Her. ex Ait.

“redstem filaree”

An introduced weedy spring annual, widespread in California at low elevations especially in annual grassland, coastal sage scrub, and disturbed areas on the coastal slope. This is an uncommon species on the Colorado Desert, except in a few particularly favorable sites. It is more common in the Mojave Desert where rainfall is greater, and temperatures are lower. We found little of it: of nine CMAGR collections we made, four were of solitary individuals, and at four other locations the species was judged to be scarce.

Representative voucher specimen: Imperial County, Niland-Blythe Rd. between Beal Well and Surveyors Pass, 599m (1965 ft.), *Sanders & Malusa 42302* (UCR, AWC).

Erodium texanum A. Gray

“Texas storks-bill”

A fairly common native spring annual, widely scattered on alluvial slopes but more common between the stones of desert pavement than in washes.

Flowering must be very ephemeral and the petals quickly deciduous as 6 of our 12 collections were noted as having both buds and fruit but no open flowers. Those plants were plainly in the middle of their flowering period, but the precise timing of collection missed anthesis. Four other plants were past flower and had fruit but neither buds nor flowers.

Widespread in the southwestern desert in the states of California, Arizona, New Mexico and Texas, plus southernmost Nevada and Utah. In Mexico it occurs across the northern tier of states from Baja California to Sonora, Chihuahua, and Nuevo Leon.

Representative voucher specimen: Imperial County, head of Mammoth Wash, above “slot” canyon, 488m (1600 ft.), *Sanders & Malusa 42062* (UCR, AWC).

HYDROPHYLLACEAE [included in Boraginaceae in some recent treatments]

***Eucrypta micrantha* (Torr.) Heller**

“dainty desert hideseed”

Native spring annual that usually grows in shade, either of shrubs, boulders, wash banks, or just on steep north-facing slopes. Very widespread and sometimes locally common under woody plant canopies. Very infrequent in full sun. This plant is a typical inhabitant of shady places throughout the range and was seen at elevations ranging from 900 to 2800 ft., but not on low elevation lake sediments.

Native to southwestern North America with populations extending from the deserts of southern California through Arizona to southern New Mexico and western Texas, and then north through central Nevada and Utah (to about the latitude of Ely, NV). In Mexico it is widespread in both states of Baja California and throughout the desert parts of Sonora and from there east into Chihuahua to a limited degree.

Representative voucher specimen: Imperial County, ENE of Hayden Well on Mammoth Wash, 291m (956 ft.), *Sanders & Malusa 42032* (UCR, AWC).

Nama demissa* A. Gray var. *demissa

[in family Namaceae in some recent treatments]

“purplemat”

A native spring annual that is widespread in the CMAGR, as shown by the fact that 16 collections were made from all parts of the range. A low spreading plant with prostrate branches that usually grows on open sand, most commonly in washes or on adjacent sandy benches. Not observed on rocky slopes or old lake sediments.

Occurs on deserts of southern California and western Arizona, and then eastward to New Mexico, and north to southern Nevada, and SW Utah. In Mexico it is recorded from the state of Sonora and throughout the peninsula of Baja California.

Representative voucher specimen: Riverside County, vicinity of Clemons Well site, 284-314m (930-1030 ft.), *Sanders & Malusa 43151* (UCR, CDA).

***Nama hispida* A. Gray var. *spathulata* (Torr.) C. Hitchc.**

[in family Namaceae in some recent treatments]

“hispid nama”

Native spring annual that is widespread in the Sonoran Desert, but which we found to be scarce in the CMAGR. Only collected once and that at the northern end of the range. Unlike its congener *N. demissa*, this plant has branches that are decumbent to (usually) ascending, rather than prostrate.

Widespread in the arid zone on both sides of the Mexican border from southern California to Texas and Oklahoma, including also all or parts of the US states of Nevada, Arizona, New Mexico, and Utah; in Mexico states of occurrence include Baja California, Baja California Sur, Sonora, Sinaloa, Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, and Zacatecas.

Despite its broad range and obvious ecological adaptability this plant is much less common in California than is the similar *Nama demissa*.

Representative voucher specimen: Riverside County, wash south of Bradshaw Trail, c. 11km SE of Gasline Rd., 729m (2390 ft.), *Sanders & Malusa 42957* (UCR, AWC).

***Phacelia crenulata* Torr. ex. S. Wats. var. *ambigua* (M. Jones) Macbr.**

“notch-leaf wild heliotrope”

Common along washes and on sandy alluvial slopes, but also on exposed rocky slopes, dissected alluvial fans, and desert pavement. Plants on south-facing slopes may flower as early as February, and mass germination was once seen at such a site in January. Flowering normally begins in early March and is over by the first of April. The purple flowers with white centers are both fairly large and relatively numerous so that the plant makes a conspicuous wildflower display at times.

A native spring annual that is often common in deserts of southeastern California and adjacent western Arizona, but also extending into southern Nevada and the southwestern corner of Utah. In Mexico it occurs in Sonora and on the Baja California peninsula.

This plant causes severe dermatitis in some people, due to an oily glandular exudate on the leaves and stems. Perhaps this should be treated as a full species, *Phacelia ambigua* M.E. Jones, separate from the plants in Utah and the Intermountain Region.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41316* (UCR, AWC).

***Phacelia distans* Benth.**

“distant scorpionweed”

A common native spring annual that usually grows under and inside shrub clumps with its branches leaning on and clambering over host limbs. Also common under the canopy of trees lining washes. The elongate stems (to 75cm) often raise the flowers above the canopy of the host shrub’s foliage, especially with shorter hosts such as *Ambrosia dumosa*. Occasional in open areas, but then unable to support itself and the main stem usually falls over. The largest populations are along the sides of washes, often growing in the tangles of driftwood that accumulates there.

This species is very widespread in southern California, being conspicuous in many habitats on both the coastal and desert sides of the mountains. On the coastal slope it follows the coast range north to the San Francisco area, and on the southern deserts it grows from the Mexican border to Owens Valley and north to about Mono Lake.

Representative voucher specimen: Imperial County, along German Diggins Wash below Pegleg Mine, 390-404m (1280-1325 ft.), *Sanders & Malusa 42834* (UCR).

***Phacelia minutiflora* J. Voss**

[*Phacelia crenulata* var. *minutiflora* (J. Voss) Jeps.]

“cleftleaf wildheliotrope”

A native spring annual that was locally common at the southern end of the range in the Imperial Gables area, and nearby at the mouth of Ninemile Wash, but was seen by us only one other place. The plants were often on old alluvial fans with a gravelly surface. Many recent authors have treated this as a variety of *P. crenulata* but judging by the differences from *P. crenulata ambigua* in the same region these seem more like distinct biological species.

This plant is not recognized at any level in *Arizona Flora* by T.H. Kearney and R.H. Peebles, 1964, and so this name has not been used much in Arizona and is not well represented in the SEINet database. It is hard to know if the lack of records is because of lack of plants or just lack of awareness.

Representative voucher specimen: Imperial County, mouth of Ninemile Canyon just above Hwy 78, 308-314m (1010-1030 ft.), *Sanders & Malusa 42750* (UCR).

***Phacelia neglecta* M.E. Jones**

“neglected scorpionweed”

A small, compact, native spring annual almost always seen growing from between the stones of desert pavement or rocky slopes, except rarely as waifs in adjacent washes or gullies. The taproot is thickened like a tiny white carrot. Widespread and collected from both the north and south ends of the range.

Most common in the southeastern parts of the California deserts, but also present on the west side of the Imperial Valley and extending north to the Nopah Range in the NE Mojave Desert. Also common in southwestern Arizona (west of Phoenix and south of Prescott) and scattered in southernmost Nevada. Absent from the western Mojave Desert and Owens Valley of California.

Representative voucher specimen: Imperial County, SE end of range above Imperial Gables, 390m (1280 ft.), *Sanders & Malusa 42706* (UCR, SD).

***Phacelia pedicellata* A. Gray**

“specter phacelia”

Hypothetical. We never found this plant in or near the CMAGR, but it has been collected north of the range in the Orocopia and Chuckwalla mountains and to the SE near Picacho Peak. Native spring annual usually on shaded rocky slopes. Foliage with a strong foul odor.

Representative voucher specimen: none

KOEBERLINIACEAE

***Koeberlinia spinosa* ssp. *tenuispina* (K. & P.) E. Murray**

“crown of thorns”

California Rare Plant Rank: 2B.2 (rare, threatened, or endangered in CA; common elsewhere)

A native shrub that for many years was little known in California. There was one old (15 Jan. 1939) collection by Jaeger from "Chocolate Mts. - along gullies, north base" [= upper Arroyo Seco? Salvation Wash?] but it was not reported in any California flora until the Supplement to A California Flora [pg. 16, P.A. Munz, 1968, Univ. of California Press] and then in 1980 it was confirmed as present by a collection from "Salvation Pass, Chocolate Mountains" by H.L. Ferguson. In recent years this has been found several times in the Chocolate Mountains and on the Chuckwalla Bench just to the east, and in 2010 and 2011 a small population of 1-4 individuals was discovered near the Eagle Mountains north of Desert Center in Riverside County, though that population may have since been eliminated by solar farm development. These are all the known occurrences in California and represent the western edge of its known range.

Outside of California this is known from Arizona, New Mexico, Texas; and then south into the Mexican states of Baja California, Baja California Sur, Sonora, Chihuahua, Coahuila, Durango, Zacatecas, Nuevo Leon, and Tamaulipas.

Representative voucher specimen: Imperial County, major tributary of Salvation Wash 0.15 km NNW of the well near Salvation Pass, 1.1 km west of confluence with German Diggins Wash, 356m (1167 ft.), *Sanders & Malusa* 42866 (UCR, RSA, SD).

KRAMERIACEAE

Krameria bicolor S. Watson

[*K. grayi* Rose & Painter]

"white ratany"

A common low and often spreading shrub on alluvial slopes and hillsides, usually reported to be either 3-7dm (Munz, 1974) or <1m (Baldwin, Jepson Manual, 2012) tall, but in favorable sites on the CMAGR we found (rarely) plants up to 2m tall, which is similar to the stature of this species in southern Sonora, Mexico. But even here 50cm to 1m is usual.

This species is common on the deserts of southern California, except it is absent from the Mojave Desert west of Barstow. In the U.S. outside of California this plant occurs from Arizona to Texas, plus southern Nevada, and SW Utah. In Mexico it can be found the length of the peninsula of Baja California, all along the arid coast of Sonora from the Arizona border south to beyond Navojoa, and in the states of Chihuahua, Durango, and Coahuila.

Representative voucher specimen: Imperial County, south of Bradshaw Trail on dirt road toward Surveyors Pass, 677m (2222 ft.), *Sanders & Malusa* 43366 (UCR).

Krameria erecta Willd. ex Schult.

"littleleaf ratany"

A fairly common low shrub with sparse narrow leaves and intricately branched stems. Generally occurs at higher elevations than *K. bicolor*, but with considerable overlap. This is also more regular on north-facing slopes.

Widespread in California from the Mexican border to Death Valley, except absent from the western Mojave Desert. Most common in the eastern parts of the desert, but also conspicuous along the desert slopes of the Peninsular Range.

Elsewhere in the U.S. it occurs in southern Nevada, barely reaches the SW corner of Utah, is widespread in southern Arizona, and extends through southern New Mexico, and western Texas.

In Mexico, it occurs throughout the Baja California peninsula, in western Sonora, and through the Chihuahuan Desert and central plateau south to Zacatecas.

Representative voucher specimen: Imperial County, hills near Mammoth Wash, 1.17 km WNW of Hayden Well, 246m (808 ft.), *Sanders & Malusa 42103* (UCR, AWC, SD).

LAMIACEAE

Hyptis emoryi Torr.

[*Condea emoryi* (Torr.) Harley & J.F.B. Pastore]

“desert lavender”

A common 1-3.5m shrub along washes on alluvial slopes, its primary habitat, but also on raised alluvial benches, in canyon gullies, and occasionally on protected (usually north-facing) slopes. Very widespread and probably present along every significant wash, and many insignificant ones, in the CMAGR.

In California this is widespread on the Sonoran (Colorado) Desert and in the southeastern Mojave Desert, but it is absent from the western, central, and northern parts of Mojave Desert. There appear to be no records of this from north of the I-40 Freeway, except in the Dead Mountains on the edge of the Colorado River Valley. It clearly does poorly in areas with colder winters.

Desert lavender is widespread in the Sonoran Desert of western and southern Arizona, and to some degree in southeastern Arizona. It does not occur in New Mexico or Texas and the Texas location reported in SEINet is a mistake for Carrizo Creek in California. In Nevada this only occurs in the southernmost part of Clark County in the Colorado River Valley adjacent to California and Arizona.

In Mexico this is widespread on the Baja California peninsula, through much of Sonora, and south through Sinaloa to Mazatlan.

Representative voucher specimen: Imperial County, Salvation Pass, edge of Salvation Wash, 366m (1200 ft.), *Sanders & Malusa 41260* (UCR, SD).

Salvia columbariae Benth.

“desert chia”

A common and widely distributed native spring annual. Usually found along washes and associated sandy benches but also on slopes ranging from gentle and sandy to steep and rocky. Seems to prefer sandy south-facing sites, but has broad ecological amplitude and even present on shaded talus on steep slopes.

Widespread in the arid Southwest in California, Nevada, Utah, Arizona, New Mexico, Sonora, and Baja California. In California this is common on both sides of the mountains, as well as in the mountains themselves. The desert and coastal populations differ in subtle ways morphologically and appear to be evolutionarily divergent.

This was a particularly important food plant for Native Americans in the Southwest and seed caches have been found in hidden clay jars. Like most plants with small seeds the seeds were harvested by pulling entire plants at maturity and piling them on blankets or flat baskets until they dry and then beating out the seeds and winnowing the results.

Representative voucher specimen: Imperial County, 0.42 km north of Beal Well, 423m (423 ft.), *Sanders & Malusa 42187* (UCR, AWC).

***Salvia greatae* Brandeg.**

“Orocopia sage”

California Rare Plant Rank: 1B.3

A locally common rounded shrub with holly-like leaves, on alluvial slopes and hillsides at the northwest end of the CMAGR. Previously only known within the CMAGR on the slopes leading down to Salt Creek at the extreme northern end of the range at elevations from 30 to 100 m (100 to 1000 ft), but we observed it in mountain canyons on deeply cut alluvium and colluvium fringing arroyos as high as 594 m (1950 ft). It is reportedly much more common on the slopes of the Orocopia mountains on the NW side of Salt Creek wash, but we did not visit that area. The species is commonly reported from Salt Creek wash itself, but plants in the wash are doubtless mere waifs and the main populations are on the slopes above. We never saw it in the wash so it must be very scarce there.

This plant is endemic to the Salt Creek area and northern Chocolate Mountains of southern California. Most records are from Riverside County but there are a few (3) from immediately adjacent areas of Imperial County.

Representative voucher specimen: Riverside County, vicinity of Clemons Well site, between wash and old Kaiser RR, 284-314m (930-1030 ft.), *Sanders & Malusa 43141* (UCR, AWC, CAS, CDA).

***Scutellaria mexicana* Torr.) A.J. Paton**

[*Salazaria mexicana* Torr.]

“paperbag bush”

An uncommon shrub in the CMAGR but more common at higher elevations and in the northern part of the range. This is primarily a wash inhabiting species at this dry margin of its range and all seven of our collections were made along washes.

In addition to the collections, it was observed c. 6 km SE of Lion Head Mountain (Imperial Co.); along Gasline Road at junction with road to Observation Point Slats; narrows of Iris Pass; SW (227°) of Surveyors Pass (Imperial). In California, this species is widespread and common across the Mojave Desert, including the western Mojave, but it is most common close to the mountains at the western and southern edges.

Outside of California it is uncommon in Arizona and is present, but apparently uncommon, in the Big Bend region of Texas. In Mexico it occurs in northern and central Baja California, Sonora, and Coahuila.

Representative voucher specimen: Riverside County, Tabaseca Tank, 610m (2000 ft.), *Sanders & Malusa 41377* (UCR).

LOASACEAE

Mentzelia desertorum (Davidson) H. Thompson & J. Roberts

“desert blazingstar”

A common native spring annual. Among the most common and widespread *Mentzelia* species in the Chocolate Mountains, often growing up through shrubs or in accumulations of loose plant material/branches deposited beside washes by running water. Stems distinctly elongate and clambering through other vegetation.

Identification is uncertain for some specimens as this is in a taxonomically difficult species group and we were unable to get many specimens with mature capsules and seeds because of the timing of our visits. For this species it would have been better if we had been able to survey in April because March had mostly flowers and young fruit.

Representative voucher specimen: Imperial County, 1 km due east of Beal Well, 411m (1347 ft.), *Sanders & Malusa 44061* (UCR).

Mentzelia involucrata S. Wats.

A common native spring annual that is present here as two very distinct taxa that appear to have such different microhabitats that we never saw them growing together or even in close proximity. There is a strong possibility that the two forms are distinct species, even though they have often been synonymized and not even treated as separate infraspecific taxa.

Most populations of this species in the broad sense are in the deserts of California from the Gulf coast in northern Baja California north to the Death Valley area, but also east into Arizona as far as Phoenix and to the southernmost tip of Nevada.

In the field separation of the two forms is usually simple and any given site usually only has one or the other. We did not notice any intergradation between them. However, in the herbarium with specimens from numerous places and often various deficiencies (no flowers, etc.) it is sometimes not currently possible to say which name should be applied to some particular specimen. Many specimens in herbaria have not yet been identified beyond *M. involucrata* based on the information presented in CCH2 and SEINet and the two taxa are not distinguished in CCH2 in any event, making analysis of geographic differences too difficult for present purposes.

Neither variety grows in shade under trees or on north-facing hillsides.

Mentzelia involucrata S. Wats. var. *involucrata*

“whitebract blazingstar”

This is the small-flowered taxon in the *M. involucrata* taxon pair and was the less common of the two in the CMAGR. As habitat it seems to prefer relatively stable hillsides of alluvial gravel, alluvial fan surfaces, and hilltops. Because of its infrequency and relative novelty, it was collected at a higher percentage of observed population sites than was var. *megalantha* so the specimen number difference is much less than the true population number difference.

Representative voucher specimen: Imperial County, Mammoth Wash area, along dirt road to Hayden Well, 201m (658 ft.), *Sanders & Malusa 42007* (UCR, AWC, SD).

***Mentzelia involucrata* var. *megalantha* I.M. Johnston**

“sand blazingstar”

A native spring annual. This is the large-flowered and more common taxon in the *Mentzelia involucrata* complex within the CMAGR. We usually found it in sandy washes, but occasionally on steep, eroding, , usually south or west-facing alluvial hillsides. This is often among the early flowering taxa on these exposed sunny sites and frequently grows mixed with *Phacelia crenulata ambigua*. The plants were commonly larger in stature compared to the nominate variety and, given the other character differences, a careful review of their taxonomic status is warranted.

In California records of this variety are concentrated on the south and east sides of Joshua Tree National Park, but with an isolated cluster of reports in the Ricardo area at the edge between the southern Sierra Nevada and the Mojave Desert. These Ricardo specimens should be checked for ID, but the whole species complex needs review. The varietal information that exists in the online databases is not reliable because of the numerous specimens misidentified or not fully identified.

Representative voucher specimen: Riverside County, 2.3 miles east of Iris Pass, 765-787m (2510 –2580 ft.), *Sanders & Malusa 42932* (UCR).

***Mentzelia longiloba* Darl.**

“many flowered mentzelia”

A biennial or short-lived perennial that was found only once on the west edge of the range in loose sand near the Algodones Dunes. The species is strongly associated with dunes and other sand accumulations, mostly in eastern parts of the California Desert from the Algodones Dunes to the Kelso Dunes in San Bernardino County. The largest California concentration is around the Algodones Dunes, but many major dune systems have the plant.

Occurs widely in Arizona, and is also present in New Mexico, western Texas, and Utah. In Mexico this occurs in northern Baja California, Sonora, Chihuahua, and Coahuila.

Representative voucher specimen: Imperial County, above Ted Kipf Rd., north of Tortuga Siding, 88m (290 ft.), *Sanders & Malusa 42790* (UCR, SD)

***Mentzelia puberula* J. Darl.**

“Darlington's blazingstar”

Scarce perennial in rocky places. We did not find this plant during our work, but it has been collected on the edge of the range in recent years. It usually grows among boulders on hillsides or from bedrock in canyons, rarely on coarse alluvium on a canyon floor.

Most common in the Death Valley region of Inyo County and adjacent Clark County in southern Nevada, but scattered populations also occur through the southern California deserts, in western Arizona, northwestern Sonora and northern Baja California. Commonly on limestone in Death Valley region and southern Nevada, but on granitic rock here and in many other places as well.

Representative voucher specimen: Imperial County, at the end of Imperial Gables Rd east of Hwy 98 at the base of the Chocolate Mtns., 420m (1377 ft.) A. Swanson 182, in 2011 (RSA)

***Petalonyx linearis* Greene**

“long-leaved sandpaper plant”

A scarce small shrub in rocky washes and canyons. We did not find this species, but it has been collected twice at the northwestern edge of the CMAGR.

In California this occurs mostly along the eastern foot of the Peninsular Range in San Diego and Riverside counties, with its range extending into the Little San Bernardino Mountains in Joshua Tree National Park, and it also occurs near the Colorado River in the southeastern corner of Imperial County, and up the Colorado to the Parker area of San Bernardino County.

Outside of California this occurs through much of the Baja California peninsula, in the Pinacate region of northwestern Sonora, and on Isla Tiburon. In Arizona it occurs in Yuma (fairly common) and Pima (scarce) counties.

Representative voucher specimen: Riverside County, canyon bottom near Pope Hot Mineral Springs [Bashford's Hot Mineral Spa], 61m (200 ft.), J.C. Roos 4150, in 1949 (UCR).

***Petalonyx thurberi* A. Gray**

“common sandpaper plant”

An infrequent many stemmed subshrub that occurs along washes and in other sandy places. We have four collections from the Chocolate Mountains, but only three of those were by us and the other one was taken earlier.

Widespread on the deserts of southern California, especially along major washes feeding out of the mountains and carrying large loads of eroded sand. Many collections have been made at the foot of the Peninsular and Transverse ranges.

Outside of California it occurs in Baja California, northwestern Sonora, and through western Arizona and southernmost Nevada.

Representative voucher specimen: Imperial County, 15 km due north of Slab City, 305m (1000 ft.), Sanders & Malusa 42386 (UCR, SD, CAS).

MALVACEAE

Eremalche exilis (A. Gray) Greene

“white mallow”

A very scarce low annual, found only once during this survey.

Overall, it is widespread on open sandy soils from the central part of the Baja California peninsula north to the vicinity of Reno, Nevada and from interior southern California east through central Arizona. It also occurs in southern Nevada and southwestern Utah.

Representative voucher specimen: Riverside County, large wash south of Bradshaw Trail, c. 11 km SE of Gasline Rd., 729m (2390 ft.), *Sanders & Malusa 42955* (UCR).

Eremalche rotundifolia (A. Gray) Greene

“desert five-spot”

A common native spring annual, often seen on alluvial slopes either on desert pavement or among stones on hillsides, but also regularly appears along adjacent washes.

Widespread on the eastern deserts of California from the Mexican border to the Death Valley region of Inyo County. It also occurs in the Colorado River Valley in western Arizona (Yuma, La Paz & Mohave counties) and southern Nevada (Clark, Nye & Esmeralda counties). In both the latter states it essentially hugs the California border. In Mexico it occurs a few places in northeastern Baja California. This plant is close to being endemic to southeastern California despite being common there, even near the borders. In Mexico it is very local in northeastern Baja California.

Representative voucher specimen: Imperial County, upper Ninemile Wash, 409m (1343 ft.), *Sanders & Malusa 42711* (UCR, AWC).

Hibiscus denudatus Benth.

“rock hibiscus”

A small multi-stemmed native shrub of rocky slopes and canyons, especially smaller side canyons not subject to scouring floods, but it occurs on all wash edges to varying degrees. Very widespread but usually not present in large numbers. It prefers low elevation hot areas and is probably not tolerant of frost.

Widespread in all the states of the Southwest from the Sonoran Desert of southeastern California through western Texas, including large areas of southern Arizona and southern New Mexico. There are a few records in the southern part of Nevada associated with the Colorado River Valley, and these extend upriver into the Grand Canyon of Arizona.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41314* (UCR, SD, AWC, CAS).

***Horsfordia newberryi* (S. Wats.) A. Gray**

“Newberry's velvet-mallow”

CA Rare Plant Rank: 4.3

Uncommon in California and mostly present along the eastern foot of the Peninsular Range from San Diego County to about the mouth of Martinez Canyon in Riverside County. There are isolated smaller populations farther east, beyond the Salton Basin, notably in western Arizona. In Mexico it is common in Baja California, Baja California Sur, northwestern Sonora and south along the coast to Guaymas region. It is absent from Nevada and New Mexico. Its global population is centered on the Baja California peninsula and the Peninsular Range extension into southern California, and secondarily on western Arizona.

Representative voucher specimen: Imperial County, Chocolate Mountains north of Pope, 122m (400 ft.) *J.C. Roos 4151* (RSA).

***Sphaeralcea ambigua* A. Gray**

“common globe mallow”

A common subshrub above 300 m (1000 ft) elevation on rocky slopes, alluvial fans, and especially wash margins. Absent from alkaline lake deposits. It has many fibrous short-lived stems from a woody root-crown and is conspicuous when in flower because of the display of red-orange flowers on the many branch tips. Because it is so showy when in flower it has been the subject of interest among native plant growers.

Widespread on the California deserts from north of Mono Lake south to the Mexican border and from the Arizona and Nevada borders west to the Peninsular Range, Transverse Range, and the Sierra Nevada. Absent from the coastal side of the California mountains, except for a few waifs escaping from cultivation and scattered reports based on misidentification of other mallows.

Outside of California this is widespread in southwestern North America being common in Arizona, Nevada, and Utah, as well as the length of the Baja California peninsula and western Sonora in Mexico.

Representative voucher specimen: Imperial County, Salvation Pass, 354m (1160 ft.), *Sanders & Malusa 41343* (UCR, AWC).

***Sphaeralcea coulteri* (S. Wats.) A. Gray**

“Coulter's globemallow”

An attractive, orange-flowered, desert annual, active after winter rains (flowering in about March), though mostly germinating following summer rains. It is uncommon overall in the CMAGR, but locally common in the vicinity of Hayden's Well at Mammoth Wash, where a side wash holds water for prolonged periods, and abundant in an old borrow pit on the edge of the range NW of Amos siding. This plant may have a longer period of vegetative growth before flowering than other desert annuals.

This native annual is almost endemic to the Sonoran Desert, except for limited extensions into adjacent arid habitats on the Pacific slope of Baja California and the coastal thorn scrub of southern Sonora. In California it is restricted to the southeastern corner of the state in Imperial County, but it is widespread in Arizona.

Representative voucher specimen: Imperial County, 2 miles NW of site of Amos Siding, 82m (270 ft.), *Sanders & Malusa 43475* (UCR, AWC, CAS, ARIZ, CDA, SD).

***Sphaeralcea emoryi* Torr. ex A. Gray**

“Emory's globemallow”

Hypothetical. We did not find this uncommon subshrub, but it is hypothetical based on occurrences along eastern side of the Algodones Dunes and near Wister, some only 1-2 miles outside the range boundary. This seems to occur primarily on sediments on the bottom and edges of the Salton Basin and so there is limited habitat within the range, with what there is being mostly along the western edge. It is not expected on the slopes of bedrock or coarse alluvium that form the core of the range.

Representative voucher specimen: Imperial, 16.5 air miles southeast of Niland., Amos 7.5' Q., 60m (196ft.), *D. Bell 4355* (RSA).

MARTYNIACEAE

***Proboscidea althaeifolia* (Benth.) Dcne.**

“desert unicorn-plant or devil's claw”

An uncommon herbaceous perennial appearing from buried roots following substantial summer rains. Typically found in sandy soil on alluvial slopes, often near small low-gradient washes. The peculiar fruits with their long-hooked tips reveal the presence of the plant during the winter and spring when there are no leaves or flowers present. The tops of the plants die back and rapidly disintegrate at the end of the growing season, but the dried woody fruits remain visible for months.

The fruits are clearly modified to hook on the hooves of ungulates and perissodactyls and thereby be dispersed. Most of the effective dispersers (horses, camels, bison) are now gone, but the plants still manage to reproduce even if not able to readily colonize new areas. Perhaps deer, despite their slender legs, are adequate dispersal agents. The black capsule fibers were used in basketry by the native peoples.

This species is most common on the flats dissected by shallow washes on the Chuckwalla Bench just northeast of the range but there is some habitat within the CMAGR and we managed to find the plant once.

Representative voucher specimen: Imperial County, foot of west side of the Little Mule Mountains, 355m (1163 ft.), *Sanders & Malusa 41828* (UCR, AWC).

MOLLUGINACEAE

***Mollugo cerviana* (L.) Ser.**

“threadstem carpetweed”

A globally widespread annual, present on most continents with warm arid zones, but we did not find it during these surveys, though one of us found it nearby c. 2-3 years before the surveys began. That 2012 collection is the only one reported for Imperial County in CCH2, though it is undoubtedly (at least by ACS) more widely present.

It is frequently asserted that this is a weed and introduced in North America, but this seems very unlikely as it is not at all weedy in its habits. It barely tolerates disturbed areas for example. It seems both native to California and with a moderately specialized habitat. It prefers sandy alluvial soils but can also occur on gravelly hillsides and only grows following summer rains, which are uncommon in California. While widespread and locally common in California deserts, it can be difficult to find because of its slender stems, lack of showy flowers and a habitat not strongly associated with areas of human activity. Plus, few collectors visit the desert during the summer months. This is a species which spread around the world many years ago and not via recent human dispersal. See also *Oligomeris*, which was also of disputed nativity but has been shown to have dispersed to North America millennia ago [S. Martín-Bravo et al. 2009].

Occurs from California south to southern Baja California and east through Arizona, New Mexico, and Texas. It has a general distribution just like several other plants native to the southwestern deserts.

Representative voucher specimen: Imperial County, Arroyo Seco on Chuckwalla Bench c. 1.5 miles east of the eastern boundary of the CMAGR, 566m (1855 ft.), *Sanders 40496*, in 2012, (UCR).

MONTIACEAE

***Calandrinia ambigua* (S. Wats.) Howell**

[*Cistanthe ambigua* (S.Wats.) Hershkovitz]

“dead-man’s fingers”

A very scarce succulent annual, with thick finger-like leaves. It grows in fine soil that is seasonally saturated with water but is otherwise dry, and may also be be salty and alkaline. Found on dry lakebeds or in silt between stones in desert pavement. We only found this once on a desert pavement inside the western boundary of the range. Not a common plant in California, spotty and irregular in distribution, but can be locally common in some locations: apparently most common in the Salton Basin and the Borrego Valley but populations occur through the central Mojave Desert to Death Valley. Absent from the Owens Valley and western Mojave Desert. Despite its infrequency, most of the global population of this species is in southern California.

In Arizona, this species is known from the Colorado River Valley, mostly close to Yuma but also from La Paz and Mohave counties. The two reports from Tucson are certainly both of something else – the one that has been imaged is *Calandrinia ciliata*, as is another collection from Pinal County. There is only one Mexican collection of this species, from NW Sonora also close to Yuma.

Representative voucher specimen: Imperial County, 10 miles NW of Glamis, north of the RR & Ted Kipf Rd., between Amos and Acolita, 96m (315 ft.), *Sanders & Malusa 42757* (UCR).

NYCTAGINACEAE

Abronia villosa* S. Wats. var. *villosa

“sand verbena”

A common spring annual on sand dunes, sandy plains, and other sand accumulations in the desert, but there is little such habitat in the CMAGR, and we only found this species once. While in a favorable year, following a wet winter, there are innumerable plants to the west on the Algodones Dunes, the limited habitat within the CMAGR means that populations are necessarily limited. We found the plants to be scarce at one site in a sand accumulation on the edge of a wash.

In California this is widespread on the deserts wherever there is sandy soil, especially accumulations of wind-blown sand. It ranges from the Mexican border north to the Death Valley area, and perhaps even farther north if some questionable identifications are correct. It occurs on both sides of the Peninsular Range, but plants from the coastal slope and mountains are a different variety, with larger flowers and a tendency to perennate. These are currently called variety *aurita*, but there is some nomenclatural confusion and names may not be applied correctly.

Outside of California this is common and widespread in western Arizona, from Phoenix westward, and extends into southern Nevada and even southwestern Utah. In Mexico it occurs around the head of the Gulf of California in Sonora and Baja California.

Representative voucher specimen: Imperial County, north of Tortuga Siding, 88m (290 ft.), *Sanders & Malusa 42791* (UCR, SD).

***Allionia incarnata* L.**

“trailing windmills”

A common and very widespread prostrate annual or (usually) short-lived perennial on rocky slopes, alluvial fans, and other open places above the alkaline lake deposits. Recorded at elevations of 1365 to 2090 ft. The plants are most active following summer rains but will continue to grow and flower into the following spring if soil moisture is adequate. The stems are several or many from a thickened root and can become 1m or more long under favorable conditions, forming large diffuse mats. These plants are always strictly prostrate and do not climb or clamber on other vegetation.

Widespread across southwestern North America from the cape region of Baja California to Death Valley, but missing from the western Mojave Desert as are so many species benefited by summer rain.

In the U.S. outside of California, it occurs in Arizona, Nevada, Utah, New Mexico, and western Texas. It is also present in the dry northern Mexican states of Baja California, Sonora, Chihuahua & Durango.

Representative voucher specimen: Riverside County, Summit Road c. 1.5 miles above mouth of Red Canyon, 433 m (1420 ft.), *Sanders & Malusa 41846* (UCR, AWC).

***Boerhavia coccinea* P. Mill.**

“scarlet spiderling”

A widespread but uncommon short-lived perennial in California, ranging as far north as the San Joaquin Valley. It has weedy tendencies and becomes established on roadsides and other disturbed sites, but it is not common in the CMAGR though it is native in the region. We did not find it at all during these surveys, but it was found here previously.

Occurs also in Arizona (widely), southern Nevada, southern New Mexico, Texas, and across the southern US to North Carolina and Florida. Widespread in southern North America and Central America, including all of Mexico, and to northern South America.

Naturalized in Australia and Hawaii.

Representative voucher specimen: Riverside County, 1.75 km (airline) south of Tabaseca Tank, *Sanders 9510*, in 1989 (UCR, RSA, SBBG, SD).

***Boerhavia coulteri* (Hook.f.) S.Wats. var. *palmeri* (S. Wats.) Spellenberg**

“Coulter's spiderling”

We did not find this usually common plant, but that may be because of problems with access in late summer after suitable rains. There are many collections to the north in the Orocopia and Chuckwalla Mountains and along the I-10 corridor in similar habitat to some in the CMAGR, and it was also collected once a few miles SW of the range near Glamis. But, there are few collections of this from the SE corner of California (south of the I-10) in general and so this may reflect a real distribution anomaly. The Glamis collection is the only one reported in CCH from Imperial County.

In general, this is a Southwestern endemic with substantial populations from the southern California deserts through southern and western Arizona, and southern New Mexico, and slightly into southern Nevada, southwestern Utah, and western Texas. In Mexico it occurs in Baja California, Baja California Sur, Sonora, and Chihuahua.

Representative voucher specimen: none.

***Boerhavia triquetra* S. Wats var. *intermedia* (M.E. Jones) Spellenberg**

[*Boerhavia intermedia* M.E. Jones; *B. erecta* L. var. *intermedia* (M. E. Jones) Kearney & Peebles]

“slender spiderling”

A common erect annual that appears only following summer rain and can be difficult to locate except in the late summer and fall. It occupies open exposed sites on rocky hillsides, alluvial slopes, or along washes, and it also occurs at the edges of tree and shrub canopies, but not in deep shade. A very widespread plant in the southwest, especially in regions with regular summer rainfall. Occurs from eastern California into southernmost Nevada, widely through the SW half of Arizona, southern New Mexico, and into western Texas. In Mexico it occurs throughout the Baja California peninsula and through the Sonoran Desert of Sonora, and at least into northern Sinaloa. In the Chihuahuan Desert it occurs from the Texas border south to the vicinity of Torreón.

In California it is common in the eastern deserts from the Kingson Mountains region in northeastern San Bernardino County to the Mexican border, but it is absent from the Mojave Desert west of Barstow where summer rain is infrequent. This is also locally common at the eastern foot of the Peninsular Range in San Diego County, an area that gets regular summer rain.

This is the most common species of *Boerhavia* in the vicinity of the range and sometimes forms populations large enough to support the larvae of the white-lined sphinx moth, *Hyles lineata* (Clerio l.). But, we found little of it, probably because of the timing of our visits. Populations are highly variable and strongly affected by quantity and spacing of rains in the July through September period and we may have just had poor luck. Like some other species of *Boerhavia* this plant shows conspicuous sticky bands on the stems, which certainly discourages ants and other small climbing insects from bringing aphids or otherwise attacking the foliage.

Representative voucher specimen: Imperial County, foot of west side of the Little Mule Mountains, 355m (1163 ft.), Sanders & Malusa 41822 (UCR, AWC).

***Boerhavia wrightii* A. Gray**

“largebract spiderling”

A common erect annual, usually with taller and thicker stems than *B. triquetra*, but this larger stature may require more soil moisture thus restricting its geographic and temporal distribution. We found this plant twice vs. four times for *B. triquetra* but also found it two additional times on public land just east of the range in September of 2021, but *B. triquetra* was also located twice in these areas. A distinctive species because the stems are very glandular-hairy.

This has a very similar distribution in California to that of *B. triquetra*: it is common in the eastern deserts from the Death Valley region to the Mexican border, is absent from the summer dry part of the Mojave Desert. This is also locally common at the eastern foot of the Peninsular Range in San Diego County, an area that gets regular summer rain. The distribution of the two common desert *Boerhavia* species is probably an indication of where summer rainfall is regular.

In Mexico, despite the regularity of summer rains there, this is apparently uncommon and found only in Baja California, Baja California Sur, Sonora, Chihuahua, and Coahuila.

Representative voucher specimen: Riverside County, Bradshaw Trail, 0.85 mile SE of its junction with Summit Rd. in Salt Creek Canyon, 480m (1575 ft.), Sanders & Malusa 41867 (UCR, SD, AWC, CAS)

***Mirabilis laevis* (Benth.) Curran**

(*Mirabilis bigelovii* A. Gray var. *aspera* (Greene) Munz)

“wishbone bush” or “desert four-o'clock”

This common perennial exists in two forms in the Sonoran Desert of California and around the Chocolate Mountains.

Both forms are common in the California deserts overall, on rocky slopes and on upper alluvial fans, growing among boulders, in rocky talus, and between and under larger shrubs. They appear to intergrade, as would be expected since they are varieties. If there were strong barriers to crossing between them, they would probably be treated as separate full species. The presence of many intermediate plants makes species level separation difficult.

Both forms have pale, white or pinkish flowers and are pollinated at night by moths or other such insects, and the flowers close in early morning.

var. *retrorsa* (Heller) Jepson

This form is characterized by spherical fruits and foliage with short, rough, reflexed pubescence. While common all across the desert, we have only seen one specimen from the vicinity of the Chocolate Mountains that represented “pure” *retrorsa* and that was from the northwest edge of the range at the mouth of Salt Creek between the Chocolate and Orocopia Mountains.

Representative voucher specimen: Riverside County, 2 miles west of Clemens Well, 229m (750 ft.), *Prigge 7856* (UCR, LA).

var. *villosa* (Kell.) Spellb.

This is by far the more common form of this species locally, but many plants appear to be introgressed by var. *retrorsa*. Variety *villosa* is characterized by longer, soft, conspicuously glandular hairs on stems and leaves and by elongated, egg-shaped, fruits.

Almost all of the plants we collected in the CMAGR were either clearly var. *villosa* or at least had strong tendencies in that direction based on foliage pubescence. Where fruits were available they were elongate, like *villosa*, except in the one case.

The distinction between the two taxa is not always clear, especially if no mature fruits are available. It may be that moths do not notice a difference in the flowers of the two and will move pollen from one taxon to the other if they grow in proximity -- the moths thereby promote rampant hybridity.

There was no obvious difference in the habitat preferences of the two plants but based on our observations and on the examination of specimens in the UCR Herbarium it can be hypothesized that var. *villosa* may be more competitive at higher elevations and along washes while var. *retrorsa* is more tolerant of dry exposed sites. These ideas are merely informed speculations and should be tested by further observation.

Representative voucher specimen: Imperial County, near the foot of Blue Mountain, *Sanders & Malusa 42114* (UCR, AWC, ARIZ, SD).

ONAGRACEAE

***Chylismia arenaria* A. Nelson**

[*Camissonia arenaria* (A. Nelson) Raven]

“Fortuna Range suncup”

California Rare Plant Rank: 2B.2 (rare, threatened, or endangered in CA; common elsewhere).

Very scarce and localized perennial, primarily an inhabitant of rocky crests and steep mountain sides, but also found along washes, where it is probably a waif. The largest populations we found were in steep places that the numerous burro mule deer (*Odocoileus hemionus eremicus*) of the alluvial slopes cannot easily reach.

In California this is restricted to the southeastern corner of the state in Imperial County and adjacent Riverside County in the Chocolate, Chuckwalla, Palo Verde and Orocopia mountains. The specimen from west of Chiriaco

Summit was misidentified and the old specimen reported from Oasis, on the west side of the Salton Basin, by Marcus Jones is probably mislocated, as a disturbingly large number of his specimens were.

Present in the Colorado River Valley in California and Arizona from Yuma to Topock and eastward into western Arizona near Hwy 93 south of Wikiup and north to the Black Mountains near Oatman. A major population center is the range of dry rocky hills running from Yuma SE to the international boundary near Cerro Pinto, including the Fortuna Hills from which this plants' common name is derived.

This species is restricted to the California-Arizona border region of the southwest, with just minor incursions into Mexico or into the two states away from their immediate border region.

Representative voucher specimen: Riverside County, canyon on Gas Line Rd., 15km above the Coachella Canal, 366m (1200 ft.), *Sanders & Malusa 44121* (UCR, SD).

***Chylismia brevipes* (A. Gray) Small ssp. *arizonica* (P.H. Raven) W.L. Wagner & Hoch**

[*Camissonia brevipes* ssp. *arizonica* Raven]

“Arizona sun cup”

A scarce spring annual which we only collected 3 times. Seems to be primarily associated with gravelly alluvium and desert pavement, but also found in adjacent washes. This taxon may have sometimes been overlooked among the more numerous populations of *C. brevipes brevipes*, but it is certainly not common in the CMAGR.

Endemic to southwestern Arizona and southeastern California with most populations in the general region of the lower Colorado River Valley. Known in California from Imperial, Riverside and San Bernardino counties. A report from Inyo County needs to be confirmed. In Arizona this is most prominent in the Yuma region, but it occurs both north and east of there including a hybridized plant (with *C. claviformis*) at Sentinel, western Maricopa County.

Representative voucher specimen: Imperial County, Mammoth Wash near Hayden Well, 284m, (940 ft.), *Sanders & Malusa 42784* (UCR, SD)

Chylismia brevipes* (A. Gray) Small ssp. *brevipes

[*Camissonia brevipes* (A. Gray) Raven ssp. *brevipes*]

“Mojave suncup”

A prominent, yellow-flowered, spring annual, occurring widely and in a variety of habitats including washes, steep rocky slopes, gravelly hills, desert pavement depressions, and older alluvium. Plants were found on both north and south facing slopes at elevations ranging from 200 to 2200 ft.

Widespread on the California deserts from the Mexican border north to the Death Valley region. It also occurs in western Arizona, southern Nevada, southwestern Utah, but not in other southwestern states. Frequently hybridizes with *C. claviformis* and it is possible that all yellow-flowered forms of that species are the products of introgression (either recent or ancient) of genes for yellow flower colors from this species.

This plant has never been recorded in Mexico. The two putative Mexican specimens in CCH2 and SEINet were both misidentified and the records are being corrected.

Representative voucher specimen: Riverside County, Gasline Road south of road to Observation Point Slats, c. 3.9 miles south of the Bradshaw Trail, 674m (2210 ft.), *Sanders & Malusa 41399* (UCR, AWC).

***Chylismia cardiophylla* (Torr.) Small**

[*Camissonia cardiophylla* (Torr.) Raven]

“heartleaf suncup”

Scarce spring-flowering annual or short-lived perennial on steep rocky slopes or in sandy washes.

We did not find this species during our surveys, but there are two older collections from the north end of the range which document its presence. Also found in the general vicinity north, south, and east of the CMAGR, so presumably more widespread than now known. Widespread in the California deserts from the Mexican border to the Death Valley region, except absent from the western Mojave Desert.

Outside of California it occurs in western Arizona from Yuma to the Kingman area, mostly in or near the Colorado River Valley. Its range does not reach Nevada or Utah. However, it is widespread on the Baja California peninsula and also in the Pinacate Region of northwestern Sonora.

Representative voucher specimen: Riverside County, Gas Line Road in major wash system west of Iris Wash drainage, 570m (1870ft.), *Boyd 11290*, in 2004 (RSA).

***Chylismia claviformis* (Torr. & Frem.) A. Heller ssp. *aurantiaca* (Munz) W.L. Wagner & Hoch**

[*Camissonia claviformis* (Torr. & Frem.) Raven ssp. *aurantiaca* (Wats.) Raven]

“pinnate brown-eyed primrose”

A common spring annual along washes and on sandy alluvial slopes throughout the CMAGR, except largely or completely absent from rocky hillsides. The white flowers with brown centers are open well into daylight hours, at least during cool weather. These plants are more sensitive to dry conditions than other local annuals and many were seen to have died during a February dry spell when no other annuals appeared significantly affected. Survivors of that event were in shade or moist soil.

This plant is widespread on the California deserts from the Mexican border north to the Death Valley region. It is also common in the southwestern half of Arizona and the population extends into southern Nevada and slightly into SW Utah.

Representative voucher specimen: Imperial County, mouth of canyon below Lion Head Mountain, 293-314m (960-1030 ft.), *Sanders & Malusa 41990* (UCR, AWC)

***Chylismia claviformis* (Torr. & Frem.) A. Heller ssp. *yumae* (P.H. Raven) W.L. Wagner & Hoch**

[*Camissonia claviformis* (Torr. & Frem.) Raven ssp. *yumae* (Raven) Raven]

“Yuma brown-eyed primrose

A scarce annual we only collected twice within the CMAGR, both times along wide sandy washes.

In California this is most common on the sandy flats of the East Mesa, between El Centro and Yuma, AZ, but smaller populations extend northward to the Coachella Valley and Interstate 10 corridor and westward to the foot of the Peninsular Range. Reports from the Mojave Desert north of the Little San Bernardino Mountains should be carefully checked as they may well represent hybrids between *C. claviformis* and *C. brevipes*.

Outside of California this species is reported from western Arizona, and northwestern Sonora and northern Baja California in Mexico.

Representative voucher specimen: Riverside County, Gasline road 21.5km due north of Slab City, 538m (1765 ft.) *Sanders & Malusa 42365* (UCR).

***Eremothera boothii* (Dougl.) W.L. Wagner & Hoch ssp. *condensata* (Munz) W.L. Wagner & Hoch**

[*Camissonia boothii* (Dougl.) Raven ssp. *condensata* (Munz) Raven]

“woody bottle-washer”

Common and widespread annual on alluvial slopes, but absent from fine-grained sedimentary beds, especially where those are saline or alkaline. The white flowers are open at night and are doubtless moth pollinated. The axis of the inflorescence is spikelike and becomes lignified in fruit, then persists for several years with its attached fruit remnants. This structure gives rise to the usual common name.

Common on the deserts of southern California from the Mexican border to the Death Valley region except absent from the western Mojave Desert and the Imperial Valley. The absence from the Imperial Valley is certainly due to adverse soil conditions.

Representative voucher specimen: Imperial County, head of Mammoth Wash, above “slot” canyon, 488m (1600 ft.), *Sanders & Malusa 42066* (UCR, AWC).

***Eremothera chamaenerioides* (A. Gray) W.L. Wagner & Hoch**

[*Camissonia chamaenerioides* (A. Gray) Raven]

“long fruit suncup”

An uncommon and very inconspicuous spring annual. The flowers are both small and nocturnal, withering soon after the sun comes up, making the plants particularly difficult to find. It usually grows along wash margins, but also occurs on rocky hillsides. Four of our five collections were from the northern (Riverside County) part of the range, and all were from elevations of 2000 ft. or above.

This is a very widespread plant in the desert Southwest with its range extending from Mexico to central Nevada and Utah and east to New Mexico and western Texas. In Mexico it occurs only in the northwestern states of Baja California, Baja California Sur, Sonora, and Chihuahua.

Representative voucher specimen: Riverside County, Bradshaw Trail, c. 11km SE of Gasline Rd., 729m (2390 ft.), *Sanders & Malusa 42956* (UCR, AWC).

***Eremothera refracta* (S. Watson) W.L. Wagner & Hoch**

[*Camissonia refracta* (S. Wats.) Raven]

“narrowleaf suncup”

A common annual along washes (especially on gravel bars and low benches), on open alluvial slopes between washes, and on poorly consolidated eroding alluvial hillsides. Similar to *E. chamaenerioides* but with larger and more easily visible flowers that remain open until mid to late morning.

In California this occurs on the deserts from the hills north of Yuma, AZ to the vicinity of Death Valley, generally in the eastern parts of the deserts except in the Anza-Borrego area near the Peninsular Range. Elsewhere it ranges widely through western Arizona and north into central Nevada. It occupies the Beaver Dam Slope of SW Utah, but is otherwise largely unknown from that state except for one or two old and questionable records. There are no reports from Mexico.

Representative voucher specimen: Imperial County, Hayden Well on Mammoth Wash, 285m (936 ft.), *Sanders & Malusa 42024* (UCR, AWC, SD).

OROBANCHACEAE

***Orobanche cooperi* (A. Gray) Heller**

[*Aphyllon cooperi* A. Gray]

“desert broomrape”

Hypothetical. We did not find this species during our surveys and there are no older records from within the range boundaries of which we are aware, but there are several records in the vicinity. The closest are near Dos Palmas Spring at the mouth of Salt Creek wash, NW of the range boundary; a recent collection from the Orocopia Mountains in the same region; and a collection from near Mesquite Siding, between the RR and the Algodones Dunes on the west side of the range.

In California this is widespread on the deserts from the Mexican border to the northern part of the Death Valley region. Usually parasitic on composite shrubs such as *Ambrosia salsola* and *A. dumosa*.

In North America overall this ranges from Central Mexico and the cape region of Baja California north through central Utah and Nevada and east through Arizona, New Mexico, and western Texas.

Representative voucher specimen: Riverside County, Salt Creek Wash, near Dos Palms, *E. Jaeger s.n.*, in 1926 (SBBG).

PAPAVERACEAE

***Argemone munita* Dur. & Hilg. ssp. *argentea* G.B. Ownbey**

“prickly poppy”

An uncommon to locally common erect perennial herb mostly along washes, most prominent locally in the large wash near Beal Well. More common on the Chuckwalla Bench just east of the range. Recorded on only one of the vegetation sample plots, but has been collected in the area six times since 2012 at elevations of 1300 to 1775 feet.

The Jepson Manual does not recognize the subspecies and CCH2 likewise synonymizes it with the species and treats all forms of *A. munita* as equivalent. The type of ssp. *argentea* was taken 1/2 mile southwest of Beal Well. The species is widespread in California, but the subspecies, if accepted, is restricted to the desert.

Elsewhere in western North America this species occurs in Arizona, Nevada, Utah, Oregon, Wyoming.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 401m (1315 ft.), *Sanders & Malusa 41291* (UCR, SD, AWC).

***Eschscholzia glyptosperma* Greene**

“desert gold poppy”

An uncommon but widely scattered, stemless, spring annual on wash benches and gravelly alluvial slopes. Eight collections were made. Restricted to flats and gentle slopes and absent from steep rocky slopes.

Common on the Mojave Desert in California, and occasional but much less frequent on the Colorado/Sonoran Desert. Its overall range extends commonly into western Arizona and southern Nevada, and barely into SW Utah.

Representative voucher specimen: Imperial County, near head of Mammoth Wash, 506m (1660 ft.), *Sanders & Malusa 42772* (UCR).

***Eschscholzia minutiflora* S. Wats.**

“little gold poppy”

A common and widespread spring annual, mostly occurring along washes but also on open sandy flats. Populations variable and plants may be few or locally common at any particular site, but usually present in at least small number in any suitable habitat. Often grows in large numbers on sandy outwash fans such as that along the road below Lion Head Mountain. Apparently requires non-salty coarse-grained soil, and so is absent entirely from the bottom of the Imperial Valley, though regular on the alluvial slopes feeding into it.

Widespread in the southern California deserts, and also occurring on the coastal slope in the dry interior.

Widespread in western Arizona and southern Nevada, and slightly into extreme SW Utah. In Mexico it is common only around the head of the Gulf of California, in the states of Baja California and Sonora.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 457m (1500 ft.), *Sanders & Malusa 41287* (UCR).

***Eschscholzia papastillii* Shannon Still**

“cryptic desert golden-poppy”

A recently described and still poorly known spring annual endemic to California from the central Mojave Desert to the Chocolate Mountains. This has not been found in any neighboring state and its range even within California is quite circumscribed. Occupies gentle alluvial slopes composed of sand and gravel.

May easily be confused with the following species to which it is closely similar, and we are not sure we have all specimens identified correctly.

Representative voucher specimen: Imperial County, mouth of canyon below Lion Head Mountain, 293-314m (960-1030 ft.), *Sanders & Malusa 41988* (UCR, AWC, SD).

***Eschscholzia parishii* Greene**

“Parish's poppy”

As presently understood, this plant occurs in the deserts of southern California from the Mexican border to the central Mojave Desert, except that its absent from the Salton Basin, apart from the surrounding alluvial slopes. With recent revision of the genus *Eschscholzia* the online botanical databases have been made nearly unusable for these taxa because most specimens have not yet been updated. This species is one where many specimens formerly included here are now placed elsewhere. We have 19 CMAGR specimens attributed to this species, but some may be other taxa.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 326m (1070 ft.), *Sanders & Malusa 41299* (UCR, SD, RSA).

PHRYMACEAE

***Diplacus bigelovii* (A.Gray) G.L.Nesom**

[*Mimulus bigelovii* (A. Gray) A. Gray var. *bigelovii*]

An uncommon spring annual of open sandy slopes, typically along washes or on adjacent sand bars and alluvial benches. Always grows in loose sandy soil. Usually found as small populations, but occasionally locally common following favorable rainfall.

Widespread in southern California deserts and in western Arizona, southern Nevada, and on the Beaver Dam Slope in southwestern Utah. It has not been collected in Mexico and currently appears to be endemic to the southwestern United States.

Representative voucher specimen: Imperial County, mouth of canyon below Lion Head Mountain, 293-314m (960-1030 ft.), *Sanders & Malusa 41989* (UCR, AWC).

PICODENDRACEAE

***Tetracoccus hallii* Brandegees**

“purple bush”

Common shrub along washes in at least the northern 2/3 of the range, from the vicinity of Mount Barrow west to the Bradshaw Trail, ranging from 1320 ft to 2470 ft. We have no records of the species farther south than Mammoth Wash nor are there specimens from farther south in Imperial County collected by anyone. Any

populations in the far southern part of the range remain to be discovered. Most common and successful along smaller and low-gradient washes not subject to regular severe scouring floods.

It is somewhat local and patchy, but often common where found. This species occurs from the southern edge of the Mojave Desert to the Colorado Desert subdivision of the Sonoran Desert, in southeastern California, northeastern Baja California, western Arizona, and the southernmost tip of Nevada. There are only four records for the Baja California portion of its range, so it may be rare there.

Representative voucher specimen: Imperial County, 1 mile west of Beal Well, 415-473m (1360 ft.-1550 ft.), *Sanders & Malusa 41968* (UCR, AWC).

PLANTAGINACEAE

Antirrhinum filipes A. Gray

[*Neogaerrhinum filipes* (A.Gray) Rothm.]

“yellow twining snapdragon”

An uncommon to scarce annual vine that climbs on shrubs along washes using its twining stems, often among the branches of *Ambrosia dumosa* or *A. salsola*. Does well on dead shrub skeletons - perhaps because less shade and reduced competition for moisture? Not common but thinly scattered over the area, though never more than a few plants were seen at one place. The flowers are bright yellow and make this thin-stemmed plant more readily visible when they are present.

Most common in southeastern California, but also common in southern Nevada (Clark, Nye & Lincoln counties), SW Utah, and western Arizona. In Mexico this is known from scattered localities throughout the Baja California peninsula and from northwestern Sonora.

Representative voucher specimen: Imperial County, 3.5 km NE of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42122* (UCR, AWC, SD).

Mohavea confertiflora (Benth.) Heller

[*Antirrhinum confertiflorum* Benth. ex A. DC.]

“ghost flower”

Fairly common annual along gravelly washes, and similar open exposed sites at lower elevations of 205-1600 ft. Sometimes present on rocky hillsides composed of coarse alluvium, but most frequent along washes in sand. Intolerant of saline or fine-grained soils and so is absent from the Imperial Valley, except on the alluvial slopes on the sides.

In California this is found in the south-central and southeastern Mojave Desert but is not present in the more northern and colder parts of that desert. It generally occurs south of the I-40 corridor and east of Barstow. It is widespread in the Colorado Desert subdivision of the Sonoran Desert and has spread farther north in the low elevation Colorado River Valley than elsewhere, extending into the Las Vegas area in southern Nevada. Common

in the low hot areas of western Arizona, and around the head of the Gulf of California in Baja California and Sonora, Mexico.

Representative voucher specimen: Imperial County, 0.85 km NNE of Beal Well, 434m (1423 ft.), *Sanders & Malusa 42256* (UCR, AWC).

***Plantago ovata* Forsskal**

“desert Indianwheat”

A spring annual species that is common on flats and slopes, including desert pavement, being most common in open sunny places. The flowers are wind pollinated and so lack colorful parts and thus the plants resemble grasses. Claimed to be introduced, but probably just an example of a transcontinental native, as has been demonstrated for other plants. This species has been used for temporary soil stabilization on the costal slope of southern California because it establishes quickly from seed but does not persist for long whereas its close relative *Plantago erecta* reproduces well in the same areas. Populations of desert indianwheat cannot be sustained on the coastal slope, which is very un-weedlike behavior, and is the thing that makes it attractive for temporary ground cover in natural areas where only plants native to the site are desired for the long term.

This plant is abundant across the desert flats of California, southern Nevada, and western Arizona. It is also scattered across southern New Mexico and western Texas.

In Mexico this occurs the full length of the Baja California peninsula, in western Sonora, and in Chihuahua and Coahuila

Representative voucher specimen: Imperial County, Salvation Pass, 354m (1160 ft.), *Sanders & Malusa 41346* (UCR, SD).

***Stemodia durantifolia* (L.) Sw.**

“whitewoolly twintip”

A widespread perennial herb in open wet areas in tropical and subtropical America from the southwestern U.S. through South America (Brazil). Quite common and widespread on riverbanks and in seasonal arroyos in Mexico.

Historically scarce in California with only scattered populations on the coastal slope of San Diego County and a former location in Palm Canyon near Palm Springs. The collection on this project, 1.2 miles SW of Mount Barrow, is the first for Imperial County and the first for anywhere in the California desert since 1948.

Representative voucher specimen: Imperial County, 1.21 miles SW (237°) of Mount Barrow, 470m (1540 ft.), *Malusa s.n.* (RSA) <https://cch2.org/portal/collections/individual/index.php?occid=1226798>

POLEMONIACEAE

Aliciella latifolia* (S. Wats.) J.M. Porter ssp. *latifolia

“broad-leaved gilia”

An uncommon but widespread spring annual along washes, sandy or steep rocky slopes, around desert pavement, and on silty alluvium near the north end of the Salton Sea outside the range. Grows mostly at low to middle elevations of the range; observed at elevations of 205-1500 ft. in hot dry areas. The lowest elevation where it is recorded in the general area is minus 230 ft. near the Salton Sea.

In California this is widespread across both deserts but is noticeably more common to the east, and infrequent to the west, except locally common at the eastern foot of the Peninsular Range at the southwestern edge of the desert. Common in the Death Valley area, but scarce or absent in most of the Imperial Valley.

Common across the Southwest in western Arizona, southern Nevada, and southern Utah almost to the Colorado border. In Mexico this is limited to the area around the head of the Gulf of California in northern Baja California and northwestern Sonora.

Representative voucher specimen: Imperial County, upper Mammoth Wash above Hayden Well, 317-457m (1040-1500 ft.), *Sanders & Malusa 42099* (UCR).

***Eriastrum eremicum* (Jeps.) H. Mason**

“desert woollystar”

An annual that flowers in late spring, about April and May, which was consequently only collected once by us because spring range access was in March and it seldom flowers as early as March. We have four collections of this from the CMAGR at UCR, only one of which was made on the current surveys.

Over most of the California deserts, absent only from the extreme western Mojave and the Imperial Valley. From California it occurs east through southern Nevada, southwestern Utah, and south to western Arizona. In Mexico, it is limited to northern Baja California and is unrecorded from Sonora.

Representative voucher specimen: Imperial County, c. 1 mile SW of Surveyors Pass, 599m (1965 ft.), *Sanders & Malusa 42303* (UCR, AWC).

***Gilia scopulorum* M.E. Jones**

“rock gilia”

We only found this species once on these surveys but on the California deserts it is a widespread annual though not particularly common. However, there are only four collections from Imperial County, and this is the only one from the county east of the Salton Basin. The site where we found it was geologically “Quaternary older alluvium, cut by gullies with sand and gravel.” Outside of the CMAGR It is usually found on rocky hillsides, often in the shelter of boulders or cliffs. It may be that the regional climate is too arid for this species to be more common.

Common on the deserts of Arizona, SW Utah, southern Nevada. It occurs sparingly in the northern parts of Baja California and Sonora in Mexico.

Representative voucher specimen: Imperial, 4.5 km NW (318°) of basalt hill with “Invader” target, 540m (1770 ft.), *Sanders & Malusa 43886* (UCR).

***Gilia stellata* A. Heller**

“star gilia”

A common, nearly ubiquitous, spring annual in the range, occurs along all washes on the alluvial fans, in rocky gullies in the mountains, on steep slopes of various exposures at high elevations, on rocky hillsides, on open gravel on old alluvial surfaces, and elsewhere. Not a particularly noticeable species but usually present.

Distribution is centered on the deserts of southern California, but also common in western Arizona, southern Nevada and the Gulf coast of Baja California, Mexico.

Representative voucher specimen: Imperial County, west side of Surveyors Pass, 663m (2175 ft.), *Sanders & Malusa 42328* (UCR, AWC).

Langloisia setosissima* (T. & G.) Greene ssp. *setosissima

“bristly calico”

An uncommon or scarce annual on alluvial slopes, but mostly flowering after our March surveys and so only collected twice, with that weak record supplemented by a collection from Iris Pass in 1988. A low spreading but compact annual in washes or on gentle sandy slopes.

Widespread in the eastern deserts of California but absent from the central and western Mojave Desert. Common near the Colorado River Valley and on both sides of the Salton Basin, but absent from the Salton Basin itself. But, with populations occurring in the hills all around it of which the Chocolate Mountains populations are a part. The populations in the eastern Mojave Desert are connected to those in the Death Valley Region.

Representative voucher specimen: Imperial County, mouth of the canyon of Salvation Wash, 20.45 km due east (90°) of Niland, 262m (860 ft.), *Sanders & Malusa 42817* (UCR, SD).

***Linanthus jonesii* (A. Gray) Greene**

“Jones' linanthus”

A night-blooming spring annual that is quite difficult to see because of the combination of very slender stems and leaves and lack of open flowers during daylight. Flowers open at dusk and the plants then become easy to find and are often revealed to be quite common. Plants were found more often on gravelly benches, old alluvial slopes, and desert pavement than in washes, though certainly common along washes as well.

Common on the eastern deserts of California from near Yuma to Death Valley but very scarce west of Barstow.

Occurs in the southwestern U.S. in western Arizona, southern Nevada, and barely reaching southwestern Utah. Unrecorded from New Mexico and Texas. In Mexico it occurs in the northern half of the Baja California peninsula and in arid areas of Sonora.

Representative voucher specimen: Imperial County, Salvation Pass, 366m (1200 ft.), *Sanders & Malusa 41257* (UCR).

***Loeseliastrum schottii* (Torr.) Timbrook**

A very scarce spring annual which we found only once in the course of these surveys.

Representative voucher specimen: Riverside County, large wash south of Bradshaw Trail, c. 11 km SE of Gasline Rd., 729m (2390 ft.), *Sanders & Malusa 42986* (UCR).

POLYGONACEAE***Chorizanthe brevicornu* Torr. var. *brevicornu***

“brittle spineflower”

Widespread and common annual on rocky hillsides, disturbed sites, wash edges, alluvial plains, and other non-saline habitats. Not present on old lake sediments at the western edge of the range in the Salton Basin. Collected in the mountains has high as 2800 ft.

Widely distributed across the California deserts from the Mexican border north to the vicinity of Mono Lake, but not present on the coastal slope because there is no suitable habitat.

Elsewhere in the West this is found in SW Utah, through southern and western Nevada and into eastern Oregon. In Mexico this is uncommon around the head of the Gulf of California in the Sonoran Desert of both Baja California and Sonora.

Representative voucher specimen: Imperial County, head of Mammoth Wash, 488m (1600 ft.), *Sanders & Malusa 42063* (UCR, AWC).

***Chorizanthe corrugata* (Torr.) Torr. & A. Gray**

“wrinkled spineflower”

Uncommon and always in very dry open sites, often in desert pavement developed on alluvial deposits, or otherwise nearly barren areas. Scarce in washes.

Localized in southern California, southern Nevada, and western Arizona within the U.S. and in northern Baja California and northwestern Sonora in Mexico.

Representative voucher specimen: Imperial County, near edge of range at end of Imperial Gables Rd., 396m (1300 ft.), *Sanders & Malusa 42704* (UCR, SD).

***Chorizanthe rigida* (Torr.) Torr. & A. Gray**

“rigid spiny herb”

Annual mostly on rocky slopes, stable gravel bars in washes, raised benches between washes, and most common on desert pavements. It seems most successful on stable surfaces such as pavements as opposed to wash beds, probably because of its peculiar slow release of seeds and eventual release of them right around the mother plant. It seems adapted to holding onto a suitable patch of ground rather than dispersing to another one.

Common on the California deserts from the international boundary to Death Valley and the Bishop area. It also occurs in southern Nevada and is widely distributed in Arizona west of Phoenix. In Mexico this is uncommon in the northern half of the Baja California peninsula and in northwestern Sonora.

Representative voucher specimen: Imperial County, south of Salvation Wash and NE of German Diggins Wash, 404m (1325 ft.), *Sanders & Malusa 42827* (UCR).

***Eriogonum deflexum* Torr.**

“flat-top buckwheat”

A fairly common annual in open areas along washes, on steep rocky hillsides, in desert pavement, and on roadside berms and other disturbed sites. Widely scattered in open habitats and sometimes locally common. Usually in places with little competing perennial vegetation. Plants germinate with other spring annuals in the winter but only begin to flower in late spring after most other annuals have died from lack of water. These plants are very deep rooted and tap into moisture below the layers used by other spring annuals.

Common on both southern California deserts, and throughout much of Nevada, Utah, and Arizona; extending slightly into New Mexico and Colorado. Reported in 1884 from El Paso, Texas but collector is unreliable, specimen label is poor and imprecise, and locality probably wrong. Otherwise, unreported from Texas or anywhere else within 200 miles of El Paso. More recent intense collecting has not found it there.

Representative voucher specimen: Riverside County, Iris Pass, gorge of canyon, 663m (2175 ft.), *Sanders & Malusa 41875* (UCR).

***Eriogonum inflatum* Torr. & Frem.**

“desert trumpet”

Widespread on rocky slopes at all elevations in the CMAGR. There are two forms of this species in the area, but they seem not to remain distinct and are usually treated as one taxon. They are var. *deflatum* I.M. Johnston with stems that are not inflated toward the apex of the internodes and the nominate var. *inflatum* with stems that are usually strongly inflated toward the apex of the internodes. The nominate variety is more common locally, though the inflated types are usually more common at higher elevations and toward the Mojave Desert while the “deflated” plants are usually found on the low desert in hotter dryer sites.

Found all across the California deserts from the Mexican border to the Death Valley region; also occurs in the Inner Coast Range on the west side of the San Joaquin Valley.

Outside California this grows on all the warmer deserts of the Southwest including in Nevada, western Arizona, Utah, western Colorado, and New Mexico. In Mexico this is found almost the full length of the Baja California peninsula and quite widely in western, especially northwestern, Sonora.

Representative voucher specimen: Imperial County, dirt road from E.O.D. Camp Burt toward target “Invader,” at north foot of Blue Mountain, 375m (1230 ft.), *Sanders & Malusa 42115* (UCR, ARIZ, SD, AWC).

***Eriogonum nidularium* Cov.**

“birdnest buckwheat”

A scarce annual which has only been found in the range three times, all in the northern part in Riverside County. We only found it only once during the current surveys, which suggests it is very uncommon. The three Chocolate Mountains specimens are the southernmost records for the species.

This is a plant that is mainly distributed in the Intermountain Region. In California it occurs from Riverside County north to Mono County through the Mojave Desert and Eastern Sierra Nevada. Elsewhere in the West it occurs in Arizona (mostly northwestern, Mohave and Yavapai counties), Nevada, southern Utah, eastern Oregon, and southern Idaho. Unrecorded in Mexico.

Representative voucher specimen: Riverside County, 3.35 km SW of Tabaseca Tank, 693m (2272 ft.), *Sanders & Malusa 43343* (UCR).

***Eriogonum reniforme* Torr. & Frem.**

“kidney-leaf buckwheat”

A very scarce annual which we did not find at all but for which there is one earlier collection within the range and two others outside the range but nearby. Two of these three records are from Riverside County, and the third is from northern Imperial County near the county line. Elevations of collection range from 1470-1870 ft., and washes with sandy beds are the most favored habitat, especially on the Sonoran Desert.

Common on the California deserts from the Mexican border north to Bishop area.

Elsewhere in the Southwest this is found in southern and central Nevada, southwestern Utah, western Arizona (Yuma, La Paz, Mohave counties, and Pima to a limited degree.) Also reported from Apache County, but that should be checked.

In Mexico this is limited to northern Baja California on the eastern slope of the Peninsular Range and NW Sonora near the Arizona border.

Representative voucher specimen: Riverside County, Gas Line Road in major wash system west of Iris Wash, 570m (1870 ft.), *Boyd 11294* (UCR, RSA).

***Eriogonum thomasi* Torr.**

“Thomas' buckwheat”

A common annual in the CMAGR in most locations and many habitat types: open, sandy, outwash plains; along all sandy and gravelly washes; steep sandy slopes; rocky-gravelly alluvial hills; steep volcanic slopes; disturbed bedrock slopes/quarries; exposed rocky slopes, desert pavements, etc.

In California this is virtually universal in open, low elevation, desert habitats, ranging from the Mexican border to Death Valley, except missing from the western Mojave Desert. Also common in southern and western Arizona, southern Nevada, and southwestern to east-central Utah. In Mexico this occurs around the head of the Gulf of California in Baja California and Sonora.

Representative voucher specimen: Imperial County, Mammoth Wash area, along dirt road to Hayden Well, 201m (658 ft.), *Sanders & Malusa 42010* (UCR, AWC).

Eriogonum trichopes* Torr. var. *trichopes

“little desert trumpet”

A locally common annual with inflated distal sections of internodes, like a small version of *E. inflatum*. We found it to be thinly scattered except at higher elevations, such as around Iris Pass and Surveyors Pass where it was more common. Widespread on California deserts, except on the floor of the Imperial Valley as expected due to salinity. There is also a lack of records on the sandy mesas (East Mesa, Algodones Dunes, etc.) east of the Imperial Valley, which is surprising. It may be that this species is favored by higher elevations and so not successful in continuously warm areas.

Common on the California deserts, in western and southern Arizona, southern New Mexico, southern Nevada, southwestern Utah, and western Texas. In Mexico this occurs in Baja California and northwestern Sonora.

Representative voucher specimen: Imperial County, 0.42 km north of Beal Well along old Niland-Blythe Rd., 423m (1386 ft.), *Sanders & Malusa 42190* (UCR, AWC).

***Eriogonum viridescens* Heller**

“bright green buckwheat”

A very scarce annual that we did not find during our surveys. There is one older (1989) specimen from near Tabaseca Tank in the northern part of the range, cited below. This is primarily a species of the Mojave Desert and the record from the Chocolate Mountains is the southernmost location for the species. This location is 100km disjunct to the SE from the Twentynine Palms area and the identification therefore could be questioned except that it was confirmed by James Reveal in 2005.

This species is endemic to the deserts of southern California, mostly the western and northern Mojave Desert, but also is widespread in the Inner Coast Range on the western side of the San Joaquin Valley.

Representative voucher specimen: Riverside County, 1 km south of Tabaseca Tank, 700m (2296 ft.), *B. Pitzer 1295* (UCR).

***Eriogonum wrightii* Torr. ex Benth. var. *nodosum* (Small) Reveal**

“knotty buckwheat”

This perennial was found in just one location at relatively high elevation in the northern part of the range, near Tabaseca Tank.

The overall distribution of this variety is muddled by misidentifications and changes of classification in the online databases, but it is reasonably clear that this plant is common in the Peninsular Range north to the eastern end of the San Bernardino Mountains and then east through Joshua Tree National Park to the Coxcomb Mountains, with a substantial disjunct population in the Whipple Mountains of SE San Bernardino County. The Chocolate Mountains population is closest to the plants in Joshua Tree National Park.

Representative voucher specimen: Riverside County, canyon 5 km SW of Tabaseca Tank, 767m (2515 ft.), *Sanders & Malusa 43337* (UCR,

***Pterostegia drymarioides* F. & M.**

“granny’s hairnet”

An infrequent sprawling or clambering annual that we found three times, all in the vicinity of Salvation Wash and Salvation Well. Always seen in the shade of rocks, wash banks, and shrubs, and on decomposed granite soil.

A common plant on the coastal slope of California from the Mexican border north to Mendocino County. Present on the California desert, but mostly the Mojave Desert and the three specimens we made on this project appear to represent a significant fraction of California Sonoran Desert specimens, especially of those from east of the Salton Basin.

Outside California in the SW United States this occurs widely in western Arizona and southern Nevada, and barely enters Utah in the SW corner. The report in SEINet from New Mexico is based on a misidentification. In Mexico this occurs in the northern half of the Baja California peninsula. There are no records from Sonora, even though there are records in Arizona that are virtually on the international boundary.

Representative voucher specimen: Imperial County, lower part of north fork of Salvation Wash, 326m (1070 ft.), *Sanders & Malusa 41303* (UCR, AWC).

RESEDACEAE

***Oligomeris linifolia* (Vahl) J.F. Macbr.**

“lineleaf whitepuff”

A fairly common spring annual of open sunny places in the CMAGR on many different substrates. Most common along washes, but also on south-facing rocky slopes, around dried seasonal pools, on gravelly benches, disturbed flats, etc. Somewhat salt-tolerant and plants occur in old lake sediments near the Salton Sea and along the western edge of the range. Plants widely scattered and sometimes locally common.

Very widespread in Southern California from the Mexican Border north to the Death Valley region and the San Joaquin Valley.

In North America this occurs from southern California to western Texas and then down the Rio Grande River valley to Starr County. Common in western Arizona and the deserts of SE California. In Mexico it occurs across the arid northern states from Baja California and Baja California Sur to Sonora, Chihuahua, Durango, Coahuila, and Nuevo Leon.

This plant has been shown to be native to both the Old and New Worlds with dispersal between them predating possible human intervention. [Is *Oligomeris* (Resedaceae) indigenous to North America? Molecular evidence for a

natural colonization from the Old World, Santiago Martín-Bravo, Pablo Vargas and Modesto Luceño, *American Journal of Botany*, Vol. 96, No. 2 (February 2009), pp. 507-518].

Representative voucher specimen: Imperial County, lower Salvation Wash below confluence of E and N forks, *Sanders & Malusa 41910* (UCR, AWC, SD).

RHAMNACEAE

***Condalia globosa* var. *pubescens* I.M. Johnston**

“spiny abrojo”

A widely scattered but generally uncommon large shrub or tree (2-4 m tall, crowns often to 4-5 m broad) of wash edges. Most plants are hundreds or perhaps thousands of years old with thick gnarled trunks. Only a few young plants (saplings and young adults) were ever seen, and no seedlings were found. It is clear that this species is barely reproducing under present environmental conditions but, because it is tough and long-lived, it remains widespread here. Fruits with seeds are produced annually and in abundance and flowering plants are heavily visited by bees and wasps, so the problem this species has is seedling establishment and not pollination or seed production. Noticeably more common on the extensive and gradual alluvial fans on the east side of the range than on the shorter and steeper slopes to the west.

In California this plant is restricted to the low hot Colorado Desert from the Yuma area northwest to Salt Creek wash near the Orocopia Mountains. Most localities are in Imperial County with only the northernmost being in Riverside County, and none are as far north as the I-10 corridor.

In Mexico this is widespread in the Sonoran Desert: the full length of the Baja California peninsula and from the Arizona border to the Sinaloa border in Sonora.

Representative voucher specimen: Imperial County, near Salvation Pass, edge of Salvation Wash, 361m (1185 ft.), *Sanders & Malusa 41247B* (UCR, SD, AWC).

***Ziziphus obtusifolia* (T. & G.) A. Gray**

“gray-leaved abrojo or gray thorn”

A common 2-3 m tall shrub forming spiny thickets along many washes throughout the range, but strictly wash associated and absent from areas not receiving supplemental water as runoff. It occurs both in canyons and on alluvial fans. May be associated with springs and seeps, where those are present. Found as low as 250 m (830 ft) all the way up to 870 M (2500 ft).

In California this grows mostly in the Colorado Desert east of the Salton Basin in Imperial and eastern Riverside counties, but there are also populations in southeastern San Bernardino County in the Whipple and Turtle Mountains. An isolated disjunct (relictual?) population occurs at a spring in a canyon in the Avawatz Mtns. in the southern part of the Death Valley region.

Flowers following summer rains (c. September) and fruit ripens the following spring (c. April). The bark on younger stems was often seen to have been nibbled by rodents (*Neotoma*/pack rats?), perhaps as a moisture source.

Representative voucher specimen: Riverside County, junction with Summit Rd. in Salt Creek Canyon, 480m (1575 ft.), *Sanders & Malusa 41854* (UCR, SD, AWC).

ROSACEAE

Prunus fasciculata (Torr.) A. Gray

“desert almond”

Scarce or locally common shrub along washes, collected only twice by us and only common at the higher (2200 ft. elevation) site at the north end of the range. Sometimes forming thickets on wash edges at upper elevations, all known CMAGR collections are at 1300-2250 ft. Besides our two collections there are two others which bear on the status of this species here – one along the Bradshaw Trail and one in a canyon far above Siphon 21 in the NW part of the CMAGR, at 1350 ft. Three of the four known collections are from Riverside County, which emphasizes the northern and high elevation distribution of this species.

In California, this species is typical of the Mojave Desert, mostly at higher elevations than are present in the CMAGR, often 3000-5000 ft. Many collections are in mountainous areas of the Mojave Desert or along the edges where the Mojave Desert meets the Transverse Range or Sierra Nevada. But it also occurs in the Peninsular Range and the southernmost California populations are in the Peninsular Range in Anza-Borrego State Park. The northernmost California populations are in the Death Valley region.

Outside of California this species is widespread in the Southwest, but mostly in the extra-Californian parts of the Mojave Desert (Nevada and Utah) and in isolated mountains with a similar climate. In western Arizona it occurs mostly in the north and northwest, but also in isolated higher elevation sites within the Sonoran Desert, such as the Kofa Mountains. It is also widespread in southern and central Nevada and southwestern Utah. In Mexico it is restricted to the slopes of the higher mountains of northern Baja California.

Representative voucher specimen: Riverside County, along Gasline Road at major wash crossing 1.9 miles south of Bradshaw Trail, 671-686m (2200-2250 ft.), *Sanders & Malusa 41366* (UCR, SD, AWC).

RUBIACEAE

Galium stellatum Kellogg

“desert bedstraw”

In the CMAGR this is a commonly encountered subshrub or small shrub normally growing among boulders or in cracks in bedrock on cliffs or steep mountain slopes, at elevations above 1400 ft., usually in shaded or partially shaded places. Found occasionally on canyon bottoms, even in places subject to periodic scouring flooding, or at wash edges and benches at the foot of canyon walls or cliffs. May occur in rocky alluvium in canyons, but never present on lower alluvial slopes with fine or sandy soil.

In the California deserts this is present in every mountain range from the Mexican border to the Death Valley region, but does not occur in valleys or other areas without mountains or rock outcrops, such as the western Mojave Desert.

Outside of California this plant can be found in western Arizona, southern Nevada, and southwestern Utah. It also occurs in northwestern Mexico, but only in western Sonora and the northern half of the Baja California peninsula.

Representative voucher specimen: Imperial County, upper Mammoth Wash, below “slot” canyon, 439m (1440 ft.), *Sanders & Malusa 42082* (UCR, SD, AWC).

RUTACEAE

Thamnosma montana Torr. & Frem.

“turpentine broom”

An uncommon subshrub found at the upper elevations of the range, on rocky slopes, rounded ridges, mountain tops, gullies, and wash banks at 1800-2700 ft. Usually growing in coarse soil of disintegrating granite scree, stony volcanic alluvium, or among rounded water-washed stones composing an ancient alluvial surface.

In California this occurs throughout the deserts from the Mexican border to the Death Valley region, except not present in the Imperial Valley nor on the windy and summer dry western Mojave Desert. Elsewhere in the Southwest it follows the Mojave Desert climatic zone into western Arizona, southern Nevada, and southwestern Utah. There are three records for this in New Mexico.

In Mexico this plant grows only in northern Baja California and northwestern Sonora.

Representative voucher specimen: Imperial County, SW slope near summit of Mt. Barrow, 579 –686m (1900-2250 ft.), *Sanders & Malusa 42740* (UCR, AWC, CDA).

SIMAROUBACEAE

Castela emoryi (A. Gray) Moran & Felger

“Emory's crucifixion-thorn”

CNPS: 2B.2

State Rank: S2S3

A rare shrub found only once on this survey, and that a single plant. Earlier, in 2012 another lone plant was found on the Chuckwalla Bench c. 15km north of this site by one of us, which combined with this record, reinforces the impression that this is a rare plant locally. If large populations exist, they have not been found.

In California, this plant is scattered with a few large populations but more often as single plants or small colonies. Elsewhere this is fairly common in the Sonoran Desert of southwestern Arizona and in the dry coastal desert of western Sonora, Mexico. It would be expected in northeastern Baja California, since the largest known population in California is only c. 5 km north of the border, and a recently found population farther west is only c. 1 km north, but any such Mexican populations have not been documented.

Representative voucher specimen: Imperial County, upper end of Salvation Pass road, between Salvation Pass and Arroyo Seco drainages, “perched playa,” 410m (1345 ft.), *Sanders & Malusa 41810* (UCR).

SIMMONDSIACEAE

Simmondsia chinensis (Link) C. Schneider

“goatnut”

Large evergreen shrubs with thick leathery leaves. Usually on wash margins but also found on sandy, or desert pavement covered, alluvial slopes; rounded hilltops; and rocky hillsides. When growing in desert pavement this usually occupies minor draws or depressions. Most frequent at higher elevations and absent from the lowest hottest sites and old lake sediments.

Occurs in California in the southeastern part of the state in both the desert (widely) and onto the coastal slope in more limited areas in Riverside and San Diego counties. In San Diego County it is common on the coastal plain and the lower slopes of the Peninsular Range. Goatnut is not successful in areas with temperature extremes, either constant high temperatures during the summer or regular hard freezes during the winter. There is an anomalous report of this from the southern Sierra Nevada of Kern County, but this needs confirmation as it is both ecologically and geographically out of place. This species barely reaches the southern Mojave Desert and this site from the Sierra Nevada above the desert is very unexpected.

Outside of California this plant is widespread in Arizona, especially the southern part of the state. In Mexico it occurs throughout the Baja California peninsula and along the coast of Sonora within the Sonoran Desert. Reports from the foothills in eastern Sonora appear to be mapping errors.

Representative voucher specimen: Riverside County, Gasline Road at major wash crossing 1.9 miles south of Bradshaw Trail, 671-686m (2200-2250 ft.), *Sanders & Malusa 41360* (UCR, AWC).

SOLANACEAE

Datura discolor Bernh.

“desert thorn-apple”

A common native annual, germinating commonly following summer storms but plants sometimes persist into the spring. Populations often follow washes and are absent from adjacent uplands with desert pavement. Always on alluvium and not seen on rocky hillsides or mountain slopes. Flowering is nocturnal and pollination is by hawkmoths, which also use this as a larval food plant. Flowers wilt in the morning when the sun gets intense. The foliage and fruit are toxic to people and may be so to rabbits or deer as well as we observed foliage which has been cropped and discarded before much was consumed.

In California this is common on the Sonoran Desert of Riverside, Imperial, and San Diego counties and slightly enters San Bernardino County (1 or 2 collections) along the Colorado River. There are no collections from southern Nevada. Very widespread in Mexico from Yucatan and Oaxaca to Sonora and the entire Baja California peninsula. Based on records in SEINet it is most common along the west coast of Mexico.

Representative voucher specimen: Imperial County, Mammoth Wash area on dirt road toward Hayden Well, 122m (400 ft.), *Sanders & Malusa 42106* (UCR, AWC, ARIZ, SD).

***Datura wrightii* Regel**

“jimson weed”

A scarce native perennial with deep and rather fleshy roots. We found this only in sand along the large wash along Salt Creek in the northern part of the range and this restriction reflects the fact that this plant requires more water over a longer period of the year than is present in other parts of the CMAGR. Rocky hillsides do not hold enough water to sustain this plant through the dry season.

In California this is widespread on the coastal side of the mountains from the Mexican border north to Shasta County. Much less common on the deserts but still widely scattered in favorable sites such as washes, disturbed areas, and roadsides irrigated by runoff from the pavement. Even less common on the Sonoran Desert than on the Mojave because of the greater aridity.

Representative voucher specimen: Riverside County, along Salt Creek at edge of Navy Aerial Gunnery Range, vicinity of Clemons Well site, 284-314m (930-1030 ft.), *Sanders & Malusa 43135* (UCR, CDA, AWC).

***Lycium andersonii* A. Gray**

“Anderson boxthorn”

A very common and widespread thorny shrub, 1-2 m tall, in a variety of habitats from alluvial lower fans to rocky hillsides and mountain tops. Particularly common on wash edges where it often forms small thickets, usually around and under ironwood trees lining the wash. Small red berries are conspicuous in late spring, but are not sweet though presumably of interest to birds. This is one of the most characteristic elements of the local flora.

In California this is widespread on both deserts from the Mexican border to Death Valley, and is present in small, scattered populations on the coastal slope. Outside of California this occurs commonly in southern and western Arizona. It is also present in southern and central Nevada, is widespread in Utah, and is present though apparently scarce east to New Mexico and western Texas.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 441m (1445 ft.), *Sanders & Malusa 41902* (UCR, AWC, SD).

***Lycium brevipes* Benth.**

“frutilla”

An uncommon but widespread shrub, almost exclusively associated with wash margins and other relatively moist sites. Not present on dry rocky hillsides, probably because it requires a high water table. This was only collected five times during our surveys, in contrast to *L. andersonii* which was collected a dozen times and documented in vegetation plots at over 100 locations. The berries of this shrub are much larger than those of *L. andersonii*, as are the leaves. The leaves are bright green and in general it presents the appearance of a more mesophilic species than *L. andersonii*. Unlike the bland berries of the other species, the berries of this plant are sweet and taste like apples to the human palate.

This is primarily a species of the Gulf of California in Baja California and coastal Sonora and Sinaloa, but its range extends into southern California in the Salton Basin and also on the dry coastal terraces of San Diego County. It has not been found growing wild in Arizona.

Representative voucher specimen: Imperial County, upper Mammoth Wash, below "slot" canyon, 439m (1440 ft.), *Sanders & Malusa 42083* (UCR, AWC).

***Nicotiana obtusifolia* Mart. & Gal.**

"desert tobacco"

A very widespread perennial growing along washes, at bases of cliffs, and among boulders on rocky slopes, in shade under trees, etc. Not usually common but scattered individuals appear in a variety of places and are regularly encountered. Plants live for several years and flower opportunistically whenever sufficient moisture is available, from January through May and also in the fall after summer rains.

In California this occurs in all the desert mountains from the Mexican border to Death Valley and is only missing from the Imperial Valley and the western Mojave Desert.

Extremely widespread in North America from Texas to Utah, Nevada, and California. Occurs virtually throughout Mexico from the U.S. border to Oaxaca, and especially along the western coast from Baja California to Sonora and Sinaloa.

Representative voucher specimen: Imperial County, Hayden Well on Mammoth Wash, 284m (930 ft.), *Sanders & Malusa 42056* (UCR, AWC).

***Physalis crassifolia* Benth.**

"thick-leaf ground-cherry"

A moderately common perennial herb with a thickened root, usually growing among rocks on hillsides or along wash margins, but also colonizing disturbed ground. Usually only a few individuals were seen at any one site, but we have 14 specimen-based observations from in and around the range, including two from before our surveys began.

In California this is primarily a desert species, but it occasionally occurs on hillsides in the dry interior cismontane valleys and dry marine terraces of the immediate coast. It is very widespread on the deserts, but mostly toward the east and is completely absent from the western Mojave Desert. The lack of summer rain may be a problem for this species, at least in hot desert environments.

Outside of California this is fairly common in western and southern Arizona and southern Nevada. In Mexico it is frequent on the entire Baja California peninsula and is also regular on the Gulf of California coast of Sonora.

Representative voucher specimen: Imperial County, Niland to Blythe road on the upper alluvial fan in mouth of canyon below Lion Head Mountain, 17km NE of Niland, 293-314m (960-1030 ft.), *Sanders & Malusa 41991* (UCR, AWC).

TAMARICACEAE

Tamarix aphylla (L.) Karsten

“athel”

A tree introduced from North Africa and the Middle East. This species is often planted in the California deserts because it is more tolerant of heat, drought, and soil salinity than any other available shade tree.

We found this only twice, both times on roadsides and so they may have been persisting from old plantings, though there was no direct evidence of that. When planted it is often in a row, as a windbreak or to shade a building, and these were both solitary plants in places where it was not obvious that shade would be wanted or needed. This species is not as successful in naturalizing as its weedy congener *T. ramosissima*, but will do so occasionally usually along washes.

Representative voucher specimen: Imperial County, along Coachella Canal at edge of CMAGR, between siphons 12 & 13, elev. 28m (92 ft.), *Sanders & Malusa 41838* (UCR, AWC).

Tamarix ramosissima Ledeb.

“salt cedar”

An introduced weedy shrub. Locally common in alkaline clay soil near the Coachella Canal and occasionally along washes elsewhere. Formerly common before the canal was concrete lined, when water leaked at numerous points, but many of those thickets are now dead. The light fluffy seeds are wind dispersed and so the species can appear anywhere that there is surface moisture long enough to germinate and grow seedlings, even far from established plants and in places where the species cannot last more than a year or two.

Representative voucher specimen: Imperial County, outward lobe of CMAGR near siphon 13, elev. 20m (65 ft.), *Sanders & Malusa 41839* (UCR, AWC).

URTICACEAE

Parietaria hespera Hinton var. *hespera*

“rillita pellitory”

An uncommon annual in shaded places usually under shrubs but sometimes beside cliffs, wash banks, or under overhanging boulders. Widely scattered but infrequent and inconspicuous. This was never seen growing in full sun.

A widespread plant in southwestern North America from central California (both coastal and desert sides of mountains) south through all of Baja California and along the coast and foothills of Sonora. Present on most islands in the Gulf and off the Pacific coast. Widely scattered in Arizona and present in southern Nevada.

Representative voucher specimen: Imperial County, ENE of Hayden Well on Mammoth Wash, 291m (956 ft.), *Sanders & Malusa 42031* (UCR, AWC).

VISCACEAE

Phoradendron californicum Nutt.

“desert mistletoe”

A common hemi-parasitic shrub on woody plants, particularly legumes such as ironwood, catclaw and mesquite, but seldom found on paloverde. Occasional on plants of other families including *Larrea* and *Condalia*. Present in virtually all ironwood trees and on the majority of catclaw.

Widespread on the California deserts from the Mexican border to Death Valley. Not recorded on the western Mojave Desert, probably because the major hosts have been excluded by environmental conditions.

Widely spread across southern and western Arizona, as well as southern Nevada. Presumably mostly parasitic on mesquite and catclaw in Nevada because ironwood is not present there. Common around the head of the Gulf of California in Baja California, Baja California Sur, and Sonora on the same three hosts most used in the Chocolate Mountains.

Representative voucher specimen: Imperial County, lower Salvation Wash below confluence of E and N forks, 263m (862 ft.), *Sanders & Malusa 41922* (UCR, AWC).

ZYGOPHYLLACEAE

Fagonia densa Johnston

“dense fagonbush”

This species is here recorded from within the United States for the first time. It was formerly known only from the Baja California peninsula and the northwestern corner of Sonora (Pinacate region), but we found this at the north end of the CMAGR at the uppermost elevations of the mountains, and then later discovered two earlier collections in the UCR Herbarium (with duplicates at RSA) that had been misidentified. These two were also from the northern Chocolate Mountains in Riverside County.

Representative voucher specimen: Riverside County, on highest peak of range, 16 miles north of Niland, 877m (2875 ft.), *Sanders & Malusa 43526* (UCR, RSA, AWC).

Fagonia laevis Standl.

“California fagonbush”

A common subshrub on bedrock slopes, gravelly hillsides, and alluvial fans; virtually universal in open rocky sites with well-drained soils. Does not occur on fine-grained lake sediments or saline soils. Except when flowering, these plants are easy to overlook as they are neither large conspicuously leafy. The leaflets are small and deciduous during times of drought so that only the twigs and stipules are present most of the year.

In California this is mostly in the southeastern deserts. It is primarily recorded south of the I-40 and east of the Peninsular Range, but there are also a few collections from the Death Valley region. Common in western Arizona and southern Nevada but does not reach southwestern Utah. In Mexico this is widespread in the Gulf of California region, including the full length of the Baja California peninsula and the coast of Sonora south to Guaymas.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41317* (UCR, AWC).

***Fagonia pachyacantha* Rydb.**

“Sticky fagonbush”

A widespread and moderately common subshrub on exposed bedrock slopes, wash margins, roadsides, rocky benches, alluvial rubble, etc. Found from 70 ft. below sea level to 2700 feet above and on both north and south exposed slopes. It is much more conspicuous than *F. laevis* because the leaflets are larger and the plants are larger and more widely branched.

In California this is restricted to the southeastern corner of the state, roughly the area south of the I-10 corridor and east of the Salton Basin. In the broader Southwest this occurs from southwestern Arizona south into Sonora and Baja California. Mexican populations are located around the Gulf of California, including on most of the islands.

Representative voucher specimen: Riverside County, Gasline Road south of junction with road to Observation Point Slats, c. 3.9 miles south of the Bradshaw Trail, 674m (2210 ft.), *Sanders & Malusa 41400* (UCR, AWC, SD).

***Kallstroemia californica* (S. Wats.) Vail**

“California caltrop”

Hypothetical. We never found this summer annual during our surveys but there are two recent records within 2 miles of the CMAGR boundary and the closest of those is cited below; another location is northeast of the range on the Chuckwalla Bench.

This prostrate plant only germinates following summer rain and the dried remains do not persist well, thus making the temporal window for detection narrow. This plant occurs primarily in areas that are both sunny and subject to runoff water accumulation, including especially low-gradient washes and roadside pools. It cannot grow on steep or shaded slopes but instead is found on alluvial surfaces with sandy soil. It is possible that the washes within the CMAGR are simply too steep and active for this species and so it is restricted to the undulating terrain of the Chuckwalla Bench and the “ponded area” above the Algodones Dunes along Ted Kipf Rd., respectively on the east and west sides of the range. Being prostrate it is subject to being washed away by strong water flows.

In California this is widespread on the Sonoran Desert and eastern Mojave Desert south of the I-15 corridor and east of the Peninsular and Transverse ranges. There are significant concentrations of collection records in the Chuckwalla Valley, Algodones Dunes, and Yuma areas in southeastern California.

This species is common in southern and western Arizona, New Mexico, and southern and western Texas and is widely distributed from Mexico southward to Central America.

Representative voucher specimen: Imperial County, [1.6 miles SW of the CMAGR boundary] along Ted Kipf Rd., 91m (299ft.) *Conocchioli* 82 (RSA).

***Larrea tridentata* (Sesse & Moc. ex DC.) Cov.**

“creosote bush”

This is certainly the most common and widespread shrub of the CMAGR, and is also among the most abundant shrubs in the California deserts, above the zones of old lake sediments and alkaline-saline deposits in various basins. It was documented in 270 of the 303 vegetation survey plots. This species is not tolerant of saline soils but does well most everywhere else, especially in dry, rocky, sun-blasted sites. It's uncommon, rare, or absent on steep north-facing slopes at elevations above 2500 feet.

In California it occurs on the deserts from the Mexican border north to the vicinity of Bishop in Inyo County, and from the Arizona and Nevada borders west to the Sierra Nevada, Transverse Ranges, and Peninsular Range. Historically there were also a few scattered populations in dry interior valleys on the coastal slope, such as near Hemet.

Representative voucher specimen: Imperial County, Pegleg Well Rd (Salvation Pass Rd) above Niland, 98m (320 ft.), *Sanders & Malusa* 41889 (UCR, AWC).

ANGIOSPERMS

MONOCOTYLEDONS

ARECACEAE

***Phoenix dactylifera* L.**

“date palm”

Dioecious trees native to the Middle East and North Africa but that they have been cultivated in California since the late 1800s and early 1900s. The fruits are known to be spread by coyotes and doubtless by other means, so that spontaneous populations have developed wherever surface water is available on the low desert. One found in a deep canyon 3.5 miles west of Mt. Barrow was the only one found on this survey in unmodified natural conditions. A few more exist around the edges of the CMAGR along canals, but now that the Coachella Canal has been lined with concrete there is less seepage and so less palm habitat. The date palms in formerly wet areas are clearly in decline. Representative voucher specimen: Imperial County, just outside Camp Billy Machen and SW of the Coachella Canal, 26m (86 ft.), *Sanders & Malusa* 43482 (UCR, SD, AWC, RSA).

***Washingtonia filifera* (Lindl.) Wendl.**

“California fan palm”

This is the native palm of the California deserts, but it is certainly not native within the CMAGR, though it spread there after water was introduced via the Coachella Canal; there is also a native stand nearby at Dos Palmas Oasis at the mouth of Salt Creek. The populations dependent on canal leakage are clearly struggling and will eventually cease to exist.

The native range of the species includes southern California and southwestern Arizona, along with northern Baja California. The exact historical range of the species is a bit difficult to track because the species has been expanding in range under the influence of human dispersal of seeds and the spread of irrigation water into formerly dry areas, leading to formation of new springs even as historical springs are drying. It appears that this species was also spread prehistorically by native people who used it as a source of food, construction material, and fiber. It is certain that historically it occupied the major permanent springs and creeks along the eastern slope of the Peninsular Range. To the south in Baja California, it occupies the same habitat of permanent water sources along the eastern side of the Peninsular Range as in California. In the California deserts away from the Peninsular Range it occurs in scattered native stands, some of long duration, at permanent springs, and some of these are doubtless the product of pre-Columbian dispersal by native people. This includes groves such as those at Corn Springs, Cottonwood Springs, Fortynine Palms, and Twentynine Palms. There is a single natural isolated population in the Kofa Mountains of Arizona.

Representative voucher specimen: Imperial County, intersection of Coachella Canal Road and Frink Rd., 2.2 km NNE of Frink, 6m (20 ft.), *Sanders & Malusa 43803* (UCR, AWC).

ASPARAGACEAE

Hesperocallis undulata A. Gray

“desert lily”

A showy perennial over 1 m tall under good conditions, this species occurs exclusively in loose sand, usually in wind-blown accumulations as dunes, hummocks around shrub groups, or beside washes. We found this plant only once, on the fringe of the Algodones Dunes system.

Widespread in sandy deserts of southeastern California, generally southeast of Barstow. There is a single record from the edge of Kern County near Boron on the western Mojave Desert, but that isolated record needs review.

The desert lily is endemic to southwestern North America: it is common in southwestern Arizona, east as far as the vicinity of Phoenix, and barely reaches southernmost Nevada in the Colorado River Valley. It is also common in northwestern Sonora and northeastern Baja California in Mexico, around the head of the Gulf of California.

Representative voucher specimen: Imperial County, above Ted Kipf Rd., north of Tortuga Siding, 88m (290 ft.), *Sanders & Malusa 42793* (UCR, AWC).

Nolina bigelovii (Torr.) S. Wats.

“Bigelow's beargrass”

Locally common on granitic slopes and canyons at higher elevations, including the vicinity of Salvation Pass and near the Bradshaw Trail. Always associated with cliffs, ridges, canyon slopes, wash edges, and other sites with either exposed or near surface bedrock.

As presently understood, this species occurs through the northern half of Baja California, in all the higher southeastern desert ranges of California, across western Arizona, and into southernmost Nevada.

There is some question about whether the plants that go under this name in California and Arizona are the same. Plants from SW Arizona (Yuma County) are often reported to have trunks to 5 m tall, while California plants are trunkless, as are at least some of those from NW Arizona. Unfortunately, many collectors do not include notes on stature on their labels. Further study is needed.

Representative voucher specimen: Riverside County, just south of Bradshaw Trail, c. 2.4 km west of the Dupont Rd. Junction, 749m (2458 ft.), *Sanders & Malusa 41883* (UCR, AWC).

***Yucca schidigera* Roezl ex Ortega**

“Mojave yucca”

A common arborescent yucca on upper alluvial slopes, ridge tops, rolling hills, rocky canyons, sandy alluvial plains, wash edges, edges of barren desert pavement, etc. Often in stony or gravelly soil. Observed at 1370-to-2700-foot elevations.

Common from central Baja California north to southern Nevada. Scarce in Arizona, except common in the northwest corner of the state in the Mojave Desert region.

It occurs on both sides, coastal and desert, of the mountains in California and is not restricted to the desert, though localized on the coastal plain and foothills in San Diego County and to arid slopes in the interior valleys and foothills of Riverside and San Bernardino counties.

Representative voucher specimen: Imperial County, c. 3.6 km NE (68°) of Salvation Pass well site, 398m (1305 ft.), *Sanders & Malusa 42142* (UCR, AWC, SD, DES).

LILIACEAE

***Calochortus flexuosus* S. Wats.**

“winding mariposa lily”

Found in only one area at the north end of the range, common at this 2700 ft site, and a new species for the Chocolate Mountains and a range extension about 100km southwest from the Whipple Mountains in southeastern San Bernardino County. In California this is usually found in the Mojave Desert, especially the eastern Mojave. This is a peculiar and unexpected plant for the locality because the species is centered in the area where Arizona, Nevada and Utah come together, with populations straggling east as far as Colorado and New Mexico. However, it is widespread in Arizona including the Sonoran Desert and there are even a few records in northwestern Baja California.

This species has long twisting stems that climb up through shrubs or may lie on the ground if no support shrubs are available.

Representative voucher specimen: Riverside County, c. 2.3 miles east of Iris Pass, (2510-2580 ft.), *Sanders & Malusa 42909* (UCR, CDA, AWC)

POACEAE

Aristida adscensionis L.

“six-weeks three-awn”

A common and widespread annual, recorded at 400 to 2360 feet elevation, that germinates after summer rains, but then may persist through the winter and into spring. Plants seldom survive the early summer dry period and so all will have died by the time any late summer rains arrive again. All our collections, including those from previous surveys, are in the March-May or September-January periods. The February gap is due to access issues and provides no information about flowering times. If there is a real gap it should be around June through August.

Widespread in North America from the Great Plains west to the Pacific and from Kansas and Colorado south to Guatemala in Central America. There are also scattered records in eastern North America and South America.

Representative voucher specimen: Imperial County, lower Salvation Wash below confluence of E and N forks, 267 (875 ft.) *Sanders & Malusa 41913* (UCR, AWC).

Aristida purpurea Nutt.

“purple three-awn”

A caespitose perennial that was found several times but was not common; recorded on 13 of the 303 vegetation samples. It was usually observed growing between rocks or in fissures of boulders along washes, but was also scattered among rocks on bedrock slopes up to the highest peaks. Presumably it benefits from the extra moisture provided by a wash but also needs the protection from scouring floods provided by immovable rocks. Found at middle and upper elevations of 1230 to 2875 feet.

A common plant in most of western North America from the Canadian border south to southern Mexico and from the Great Plains west to California. In California it occurs widely in southern California from the Mexican border north to the White Mountains area in Mono County, but it is absent from the northwestern 2/3 of the state.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 427-457m (1400-1500 ft.), *Sanders & Malusa 41323* (UCR, SD, AWC).

Bouteloua aristidoides (HBK) Griseb.

“needle grama”

Like its congener *B. barbata*, this is a locally common summer annual, germinating quickly and typically in large numbers following the arrival of heavy summer rains. Recorded from 1163 up to 2030 ft., but doubtless could be found as high as 2800 ft. or as low as 60 ft. based on other regional southern California collections. Due to the vagaries of summer rain and the timing of our visits, we only found this species four times. The two annual *Bouteloua* species were found to be common in many of the same places, doubtless due to locally favorable rainfall prior to our visits. We have three collections of this species from the CMAGR, one of them from before these surveys began, plus one observation on a vegetation plot. This is a short-lived annual that does not persist over the winter.

In the United States this occurs in open desert in southern and eastern California, southern Nevada, southern Utah, Colorado, New Mexico, and western Texas. In Mexico this is found from Michoacan north to the United States border, including the entire Pacific Coast and Baja California peninsula, and the rest of the Sonoran Desert.

Representative voucher specimen: Imperial County, foot of west side of the Little Mule Mountains, 355m (1163 ft.), *Sanders & Malusa 41830* (UCR).

Bouteloua barbata* Lag. var. *barbata

“six-weeks grama”

A locally common summer annual, with local observations the same as for *B. aristidoides*. Three collections were made on these surveys, along with two observations on vegetation plots.

In the United States this occurs in open desert in southern and eastern California, the southern 2/3 of Nevada, southern Utah, Colorado (both sides of, but not in, the Rocky Mountains), New Mexico, the dry parts of southern and western Texas. In Mexico this is found from Puebla north to the United States border, including the entire Baja California peninsula, from U.S. border to cape, and the rest of the Sonoran Desert. 400-2030 ft.

Representative voucher specimen: Imperial County, foot of west side of the Little Mule Mountains, 355m (1163 ft.), *Sanders & Malusa 41825* (UCR, AWC).

***Bromus arizonicus* (Shear) Stebbins**

“Arizona brome”

Native spring annual that we found only at one location at the north edge of the range in a seasonally wet depression among dense herbs. Locally common in this one spot.

This plant is related to and has been confused with *Bromus carinatus*, a perennial of variable habit. Arizona brome certainly occurs in southern California, western Arizona, and the northern half of the Baja California peninsula, but because of taxonomic change and confusion, we do not trust many of the reported records presented on the botanical websites. A careful review of this species group is needed.

Representative voucher specimen: Riverside County, Bradshaw Trail at “perched playa” 1 km by road west of intersection with Dupont Rd., 741-745m (2430-2445 ft.), *Sanders & Malusa 44023* (UCR, AWC, SD, SBBG).

***Bromus berterioanus* Colla**[*Bromus trinii* Desv.]

“Chilean chess”

An inconspicuous native annual grass that usually grows inside shrub clumps with its inflorescences sticking out above the shrub’s foliage. This is a fairly specialized habitat. Only seen once by us, as dead plants at Tabaseca Tank, Riverside County. We wish now that we had preserved even as old fragments, but at the time anticipated that better material would be found. The closest known specimen is from c. 30km northwest at Cottonwood Spring, which is similar habitat and in the same general region, but there are no previous reports from the Chocolate Mountains and likewise none from adjacent Imperial County.

This plant’s status as a native has been disputed by various authors, but in our view it is native in California based on its ecological behavior and post 1860 history. It was collected by the earliest botanical collectors in California, 19 years before the known weedy grass *B. rubens* was found here. Weeds typically behave very differently from long established natives: over time their ranges tend to expand as new areas are colonized and they seldom have specialized habitats, except for preferring disturbance. Conversely, native plants may decline over time in the face of competition from new invaders. The new weeds usually occupy, at least initially, disturbed habitats and seldom are specialized to a peculiar niche, such as always growing inside native shrub clumps. The range of *B. berterioanus* appears to have contracted as time has gone along, especially on the coastal slope of southern California.

Bromus berterioanus appears to be an amphitropical disjunct – it is one of several species that occur naturally in California and western South America in the shared Mediterranean climate. This rare and peculiar distribution pattern is what has caused some people to think it was introduced from South America.

Representative voucher specimen: none.

***Bromus rubens* L.**[*B. madritensis* . subsp. *rubens* (L.) Husn.]

“red brome”

This spring annual is a scarce weed in the CMAGR and was only seen twice by us. It is of Mediterranean European origin and is much less successful on the deserts of southern California, especially the Sonoran Desert, than on the coastal slope where it is a dominant species and is displacing the native flora in many areas. Besides the locality cited below, this was also seen near Tabaseca Tank (dead plants, not collected).

This species was first recorded in California in 1879 at Eagle Lake by J.G. Lemmon and first observed in southern California by S.B. Parish in Reche Canyon near Colton in 1889. After that it seems to have moved slowly and did not become common for several decades, until about the 1920s.

Representative voucher specimen: Riverside County, Bradshaw Trail at “perched playa” 1 km west of Dupont Rd., 741-745m (2430-2445 ft.), *Sanders & Malusa 44016* (UCR, AWC, SD, SBBG, DES).

***Cynodon dactylon* (L.) Pers.**

“Bermuda grass”

Scarce rhizomatous perennial weed in the CMAGR and we only found it once, which illustrates this species' requirement for summer moisture to be successful. It is frequent in irrigated areas nearby and would doubtless have colonized the area more extensively if conditions were favorable.

A common agricultural and garden weed in California, but also grown for hay in the Imperial Valley. Originally from Africa but now naturalized in warm climates everywhere in the world.

Representative voucher specimen: Imperial County, Mammoth Wash, 0.9 km SSW (197°) of Hayden Well, 347m (810 ft.), *Sanders & Malusa 42045* (UCR, AWC).

***Dasyochloa pulchella*(Kunth) Willd. ex Rydb.**

[*Erioneuron pulchellum* (Kunth) Tateoka]

“fluff grass”

Uncommon short-lived perennial, actively growing after summer rains. Active plants exude thin strands of hair-like material from glands on the leaves which give the plants a fluffy appearance. This material is apparently water-soluble, and plants placed in a plastic bag with moisture or just heightened humidity soon lose these strands: they seemingly dissolve. The strands are also lost with environmental exposure so that plants not actively growing and producing them do not show them.

This plant is widespread in rocky hills on both deserts in California and from central Mexico north to Utah and Colorado, including Texas, southern California, and Nevada.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 457m (1500 ft.), *Sanders & Malusa 41272* (UCR, AWC).

***Festuca octoflora* Walt.**

[*Vulpia octoflora* (Walt.) Rydb.]

“six-weeks fescue”

Widespread but small and inconspicuous native spring annual grass: slender and erect. It was collected 12 times during these surveys virtually always in the shade of shrubs, wash banks, or boulders. Active in spring when the soil is moist and completes its life cycle when the upper layers of the soil begin to dry.

Widespread in temperate North America from coast to coast and from the Canadian border to central Mexico.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 457m (1500 ft.), *Sanders & Malusa 41283* (UCR, AWC).

***Hilaria rigida* (Thurb.) Scribn.**

[*Pleuraphis rigida* Thurb.]

“big galleta grass”

Common shrubby perennial along washes on alluvial slopes and in canyons, also on rocky slopes among boulders and in loose sand; extends low on the alluvial fans in sandy soil but absent from alkaline clay. Unlike other grasses this plant has solid, not hollow, stems and their woodiness and branched character make this plant essentially a shrub or at least a subshrub. Responds vigorously to summer rains.

This is an important forage plant for livestock on grazing lands where it occurs, and the common name in Spanish means cracker or biscuit grass referring to this importance. It was seen by us to be browsed by mule deer.

Common around the head of the Gulf of California in western Sonora and northeastern Baja California; equally so on the deserts of southern California and western Arizona, extending to southern Nevada and the SW corner of Utah. Endemic to SW North America.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, 457m (1500 ft.), *Sanders & Malusa 41275* (UCR, AWC).

***Hordeum murinum* L.**

“foxtail barley”

An annual weedy grass that is active in winter and spring, after the winter rains; found only once on this survey, at the edge of a road beside an ephemeral muddy pond. This Eurasian weed is common in disturbed loam soil in the Salton Basin, such as at the edges of roads and agricultural fields. All barley species are tolerant of moderately salty soil and so can be prominent in areas of saline/alkaline soil. Also naturalized in many other places in California and the western U.S, especially where the soil has been disturbed by human activity.

Representative voucher specimen: Imperial County, near Siphon 10, edge of Camp Billy Machan, 35m (114 ft.), *Sanders & Malusa 44093* (UCR, SD, AWC).

***Muhlenbergia microsperma* (DC.) Kunth.**

“six-weeks muhley”

Uncommon but widespread native annual that appears following either summer or winter rains.

Coastal slope and desert areas of central and southern California, except notably absent from the western Mojave Desert; in eastern California deserts from Mexican border north to Death Valley region. Also in Arizona, the Big Bend region and Davis Mountains of western Texas, southwestern Utah, Colorado, Wyoming, Nebraska. There is only a single old (1851) vague record from New Mexico. Widespread in Mexico as far south as Oaxaca, and common on the Baja California peninsula and in Sonora.

Representative voucher specimen: Riverside County, Gasline Road 1.9 miles south of Bradshaw Trail, 671-686m (2200-2250 ft.), *Sanders & Malusa 41361* (UCR, SD, AWC).

***Muhlenbergia porteri* Scribn. ex Beal**

“bush muhley”

A very scarce perennial grass in this area, we found it only once in the northern part of the area and there are no other known collections of it from the Chocolate Mountains, nor any by anyone from Imperial County. This plant is more typical of summer wet areas, such as the eastern Mojave Desert. There is one collection from the Orocopia Mountains which is the closest locality to the CMAGR and in similar habitat.

“Scarce perennial with long wiry stems clambering through shrubs -- these from *Lycium*. Up to 1 m tall, but stems at least twice that long.” -- from field notes.

Representative voucher specimen: Riverside County, Bradshaw Trail, 2.25 miles east of Gasline Rd., 646m (2120 ft.), *Sanders 41869* (UCR, SD, AWC).

***Phalaris minor* Retz.**

“small-seeded canary grass”

An introduced weed, thinly scattered in relatively moist sites such as wash edges, roadside ditches and depressions. Common in irrigated fields and along drains in the Imperial Valley agricultural zone a few miles from the range boundary, which is doubtless a seed source.

A widespread introduced weed of agriculture and other damp areas in western North America north to Oregon and Colorado. A worldwide weed that infests several crops but is especially troublesome in wheat. Naturalized in wildlands in riparian areas and on lake margins.

Representative voucher specimen: Imperial County, old borrow pit at edge of range, c. 2 miles NW of site of Amos Siding of SPRR, 82m (270 ft.), *Sanders & Malusa 43474* (UCR, CAS, ARIZ, CDA).

***Phragmites australis* (Cav.) Steud.**

“common reed”

Dead plants on western edge of CMAGR, on dredge spoil beside formerly unlined Coachella Canal; live plants along canals and other wet places a short distance outside the range (Flowing Well, Frink, etc.)

This species is widespread in California with populations the entire length of the state in permanently wet areas. Common in the Imperial Valley along canals and especially drains, including saline areas near the Salton Sea. Elsewhere, it is nearly universal in permanently wet places in the United States and extends to southern Canada and northern South America.

Representative voucher specimen: none

***Polypogon monspeliensis* (L.) Desf.**

“rabbitsfoot grass”

Scarce annual weed in moist and wet areas, seen in places such as near the Coachella Canal and at Tabaseca Tank. Seldom found because little suitable habitat exists in the CMAGR.

Native to Europe but widely introduced in temperate and Mediterranean climate zones.

Representative voucher specimen: Imperial County, beside muddy pool at edge of Camp Billy Machan, *Sanders & Malusa 44094* (UCR).

***Saccharum ravennae* (L.) Murr.**

[=*Tripidium ravennae* (L.) H. Scholz.]

“Ravenna grass”

A tall, clump-forming, reed-like, perennial grass, mostly 1.5-2 m tall here, but reported to reach 4 m tall elsewhere. Wet or moist areas near the Coachella Canal on edge of CMAGR; between Siphons 16 & 17, near Frink Springs; along canal at Siphon 10 [Camp Billy Machan]; Hot Mineral Spa Rd. 1 km from range boundary. Becoming common in permanently moist areas, especially along canals and drainage ditches on the eastern side of the Imperial Valley. Probably cannot be successful in the interior of the CMAGR as conditions are too dry. With the recent (c. 2005) lining of the canal, it may not continue to survive in the places where it has recently been.

Introduced in California, native to the Mediterranean region including southern Europe and North Africa.

Representative voucher specimen: Imperial County, near Frink Springs between Coachella Canal and C. Canal Road, *Sanders 15891*, in 1994 (UCR).

***Schismus arabicus* Nees**

“abu mashi”

Widespread and common annual weed in open sandy soils, throughout the range. Easily confused with *Schismus barbatus* which is widely naturalized on the coastal slope of southern California but uncommon in the desert and which we did not find during our surveys despite making many *Schismus* collections.

Introduced from North Africa and the Middle East, with the earliest California record from 1935 in Fresno County, but the first Imperial County record not being until 1973.

Representative voucher specimen: Imperial County, north fork of Salvation Wash, *Sanders & Malusa 41285* (UCR).

***Sorghum bicolor* (L.) Moench**

“sorghum”

Dead remnants in a wash west of Camp Burt; identification necessarily uncertain because the species was never found again. Plant was certainly a waif, seeds perhaps carried here by birds or moved accidentally by equipment. From what was left of it, it may have been the cultivar called “Sudan grass” which is grown for forage in the Imperial Valley.

Representative voucher specimen: none.

***Sporobolus airoides* (Torr.) Torr.**

“alkali sacaton”

Very locally common at one location only, the “perched playa” along the Bradshaw Trail on the north edge of the CMAGR. This is an area subject to shallow ponding during periods of heavy rainfall. The vegetation of the site looks much like a stand of mesquite grassland, sans mesquite, as it appears in Arizona, if visited during a wet summer.

In addition, there is a single historical collection from Salvation Springs, Imperial Co., *H. M. Hall* 5885, Apr 24 1905 reported in CCH2.

On the California desert this species tends to be local around springs and along seasonal streams, usually at least moderately alkaline ones. It is not common in the desert overall but may be very locally so in favorable spots. It is more widespread on the coastal slope of southern California where it occupies the saline fringe of many coastal and interior valley streams and springs.

Widespread in western North America from Missouri to California, and from Montana and North Dakota south to Mexico (Aguascalientes), including all the Baja California peninsula.

Representative voucher specimen: Bradshaw Trail at “perched playa” 1 km west of Dupont Rd., *Sanders & Malusa* 44019 (UCR).

***Stipa speciosa* Trin. & Rupr.**

“desert needlegrass”

A scarce cespitose native perennial grass restricted to higher elevations and representing a Mojave Desert element in the local flora. Found only six times between 1500 ft and 2800 ft in vegetation plots.

Range overall: California south to central Baja California (southernmost location: Volcan las Tres Vírgenes), in California east of the Sierra north to vicinity of Reno, and across central and northern Nevada. Scarce in eastern Oregon. Widespread in Arizona and southern Utah. Reported in western Texas but the image in SEINet shows some other species. Also occurs in northern New Mexico and southwestern Colorado. Present in Mexico in northwestern Sonora, in the vicinity of the Pinacate peaks.

Representative voucher specimen: Riverside County, narrows of Iris Pass, 854m (2800 ft.), *Sanders & Malusa* 44019 (UCR).

***Tridens muticus* (Torr.) Nash**

“slim tridens”

Scarce tufted perennial herb with erect culms. Found only on rocky slopes at Mt. Barrow during these surveys, and this is the only specimen of the species from Imperial County in the UCR Herbarium and CCH2. The population is

disjunct c. 60km SE from populations in the Chuckwalla Mountains of Riverside County, according to CCH2 records.

A widespread species in the southwestern U.S. from California to Texas, and northeast to Colorado, especially in places with limestone substrates of either bedrock or alluvium. In California this is most frequent in the Eastern Mojave Desert of San Bernardino County and the limestone ranges of Inyo County. Common south into northern Mexico.

Representative voucher specimen: 2.5 miles SW (240°) of Mount Barrow, *J. Malusa s.n.* (UCR)

<https://cch2.org/portal/collections/individual/index.php?occid=1693650>